RECLAIMING URBAN STREAMS: A STUDY OF THE FLAT CREEK CORRIDOR IN JACKSON, WYOMING

by

SARA HOFFMAN

(Under the Direction of Marianne Cramer)

ABSTRACT

Urban streams face a multitude of challenges, such as careless development and polluted runoff. However, with careful consideration and thoughtful design, these streams can become valued amenities. That can only be accomplished by treating riparian corridors with respect, and recognizing them as dynamic natural features that can add to the richness of the city. This project focuses on Flat Creek and its relationship to the town of Jackson, Wyoming, taking into account the history of the area as well as a thorough study of existing conditions. Several cities, including San Luis Obispo, CA, Boulder, CO and Breckenridge, CO have already accomplished similar stream restorations and can be used as examples to learn from. A design proposal and recommendations offer a new vision for the creek corridor, showing that there is a great deal of potential for making it a more visible and celebrated feature of the community.

INDEX WORDS: Flat Creek, urban streams, Jackson, Wyoming, stream restorations, riparian corridors, Boulder, San Luis Obispo, Breckenridge

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DEDICATION

For Jason, my favorite companion in adventure.  Let the new adventure begin.

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# CHAPTER 1

# INTRODUCTION

*"Water is a source of life, power, comfort, and delight, a universal symbol of purification and renewal. Like a primordial magnet, water pulls at a primitive and deeply rooted part of human nature. More than any other element besides trees and gardens, water has the greatest potential to forge an emotional link between man and nature in the city."*

-Anne Whiston Spirn

Water is essential for survival, and throughout history an adequate supply of fresh drinking water has been a main concern for all cities. The availability of potable water has generally determined the geographical location of settlements and has often been a key factor in both military security and health. Over time, cities have relied upon urban waterways for a variety of uses, including drinking, cooking, transportation, bathing, food preparation, irrigation, and recreation. The need for fresh water has even inspired the construction of some of the most impressive examples of architecture and engineering, such as the Roman aqueducts (Spirn, 1984).

Despite the on-going fascination with water, human cultures have not always treated waterways with respect. Quite often they have been used as dumping grounds, with sewage treatment plants emptying inadequately treated wastewater into local rivers, and pipes discharging industrial waste from nearby factories. In other cases, dams are built which obstruct

the normal flow of a river and destroy its continuity, or a once mighty river is reduced to a trickle by excessive water withdrawals. Streams are especially vulnerable in urban settings and are often neglected and degraded within the city. For example, urban streams are regularly buried underground in dark culverts, or confined to concrete channels and denied the ability to meander as nature intended. Examples such as these are directly related to the lack of understanding that is so common today in relation to water issues. Only 25% of Americans know where their drinking water comes from and thirty million Americans believe that the ocean is the leading source of drinking water. Less than 1% of Americans can define a watershed (Source: NEETF Roper ASW annual surveys of American's Environmental Knowledge, Attitudes and Behavior).

Compared to their more rural counterparts, urban streams face a unique set of challenges. Some of these challenges include high amounts of impervious cover, altered hydrology, altered channels, sedimentation, contaminants and poor in-stream habitat quality. The amount of impervious cover in a watershed has a direct effect on stream health and is one of the key differences between urban streams and those located in forested, rural, or agricultural areas. As little as 10% impervious cover in watershed can cause stream degradation, with the damage becoming more severe as the percentage of impervious cover increases (Schueler, 1995). Impervious cover, such as rooftops and pavement, impacts urban streams by dramatically increasing surface runoff during storm events (Federal Interagency Stream Restoration Working Group, 1995).

Flat Creek in Jackson, Wyoming offers a classic example of an urban stream suffering from many of the aforementioned problems. Jackson is a beautiful town in a spectacular setting and yet the main creek flowing through the center of town is suffering, like many other urban streams, from neglect and polluted runoff. Other cities have faced similar situations and have

used these underappreciated streams as an opportunity for change. By focusing positive attention and creative design approaches on their local creeks, these cities have re-claimed their local waterways as treasured community resources. The accomplishments of these other communities can serve as inspiration in the effort to restore Flat Creek.

The following thesis focuses on restoring the ecological balance of Flat Creek while at the same time re-claiming the creek as a valued amenity in town. The next chapter, Chapter Two, sets the stage for the project by providing a history of the area. The chapter starts with an overview of the striking natural features of the valley of Jackson Hole and continues with an account of human inhabitants of the area, beginning with the early Native Americans. Next it describes westward expansion and establishment of the town of Jackson, water issues of the area, and changes during the 20th century, including modifications to Flat Creek and its tributaries.

Chapter Three provides a detailed study of existing conditions in the design area along Flat Creek. The chapter begins with a discussion of western riparian ecosystems in general and continues with a description of Flat Creek and an overview of the design site. A series of specific site inventories follows in the form of both maps and text, including topography, vegetation, wildlife habitat, hydrology, impervious surfaces, crossing points, building uses, and property ownership.

The chapter after that, Chapter Four, focuses in depth on three different examples of cities which have used carefully considered design approaches to embrace urban stream corridors as valuable green space, while at the same time improving the ecological health of their local waterways. The specific projects included in this chapter as case studies are the San Luis Creek Walk in San Luis Obispo, California, the Boulder Creek Greenway in Boulder, Colorado, and the

Blue River Walkway in Breckenridge, Colorado. The chapter finishes with a summary of the results and an analysis of lessons which can be applied to Flat Creek in Jackson, Wyoming.

In Chapter Five, all of the previously mentioned studies are taken into account and used to create a comprehensive design proposal for a specific area of the Flat Creek corridor in Jackson. This chapter includes a Master Plan of the entire design site, as well as a more detailed plan of a specific portion of the area In addition to illustrations, the chapter also includes written recommendations for improving both the ecological health of the creek and the pedestrian experience of that area.

Chapter Six, the conclusion, ties everything together and offers recommendations for enhancing and protecting the Flat Creek Corridor. These suggestions include strategies for future expansion of the greenway trail and techniques for reducing runoff throughout the town. Overall, the goal of the project is to offer a vision of what the area *could* be like with careful planning and a commitment to preserving the ecological integrity of the creek.

# CHAPTER 2

# HISTORY

*"The story of this valley is really the story of the American West in miniature. Across its sagebrush flats, along its rolling rivers, and beneath its snow-capped peaks have traveled and settled many of those remarkable characters who made the West what it was and is. Indians and trappers, gold seekers and surveyors, cattlemen and farmers, moviemakers and tourists, have all been eyewitnesses to the spellbinding beauty and the exciting history of Jackson Hole."*

-David Saylor

## Overview

Situated in the northwest corner of Wyoming, Jackson Hole lies just west of the Continental Divide, just south of Yellowstone, just east of Idaho and just north of the Snake River Canyon (Betts, 1978). Over the years, countless writers, artists, and photographers have attempted to convey the extraordinary beauty of the area, yet many have found it next to impossible to truly capture the immensity and magnificence of this landscape in something as simple as words or images. Large spaces are a way of life out west, yet even so, this is big country, with the Tetons and the valley together occupying more than six hundred square miles, or an area about half the size of Rhode Island (Betts, 1978). It is also high country, even by Rocky Mountain standards, with most of the lower elevations in the valley still lying more than a mile above sea level (Betts, 1978).

Despite the high elevation of the entire area, the Tetons still tower over the valley and dominate the view as they rise abruptly out of the ground. The tallest peak, Grand Teton, soars a mile and a quarter above the valley floor, with a height of 13,766 feet. Although there are many taller mountains in the world, what makes the Tetons unique is that there are no foothills to soften them- they rise against the sky with a rugged sharpness that has a tremendous visual impact. As Saylor comments, "With its deep glacier-carved cleavages, robes of fir and pine, and six sparkling gemlike lakes at its feet, the Teton Range is one of the most scenic mountain groups in the world" (Saylor, 1970).

Jackson Hole was named after an otherwise relatively undistinguished local trapper, David E. Jackson, in 1829. In the terminology of the early West, a "hole" was a "large, open valley encircled by high mountains" (Betts, 1978). The valley was therefore called Jackson's Hole for many decades, until about the turn of the century, when local officials decided to slightly modify the name, justifying the change on the grounds that, "The term Jackson's Hole gives rise to ribald remarks not in keeping with the dignity of this beautiful valley" (Hough, 1956). From then on the area has simply been


*Figure 2.1 Map showing location of Jackson Hole area in Northwest Wyoming (www.world66.com)*

called Jackson Hole. It is not surprising that visitors are often confused about the difference between "Jackson" and "Jackson Hole." In fact, the area called Jackson Hole is actually the entire valley, while the town itself is called Jackson, and encloses a much smaller space.

Early Human Inhabitants

*"The feeling of emptiness one gets in Wyoming- the ache of vastness and solitude- is not because it has no past. It is rather because the signs and monuments of the past are so meager and so few. The characters in its cavalcade- the Indians, the trappers, the miners, the scouts, the bullwhackers, the mule skinners, and the cowboys- left hardly a trace in their passing. They came, they did, and they went. The decaying logs of an old fur press, rotting sluice boxes, the stone abutments of a railroad trestle, a rusty beaver trap lying in the weeds along a river, a broken arrowhead kicked up in a field- these are the relics of Wyoming's history. Nearly everything else is scenery, emptiness, and the ever-enduring grass."*

-Hamilton Basso

It is estimated that prehistoric people began using the valley approximately 11,000 years ago during the last ice age (Jackson Hole Historical Society, 2003). While it is not known precisely when or by what exact route they arrived, there is no doubt that the Early Hunters- as they are often called- arrived in time to see the Tetons while the canyons still contained the last withdrawing traces of Pleistocene ice (Betts, 1978). Because they had no written language, there is no written history of their time here. However, as Betts comments, "they were human in the fullest sense of the word. They lived and roamed in small family units, were intelligent, spoke a language, used tools and had a command of fire" (Betts, 1978, 23). Evidence of their presence

consists of arrowheads, grinding stones, cook pots, obsidian tools, and other artifacts, as well as traces of their camps and hunting sites. Because of the harsh winters, it is thought that none of the tribes lived in the area permanently. However, many of them migrated through the valley in the warmer months to hunt antelope, buffalo, and elk. Some of the tribes who spent time in the valley were the Blackfoot, Gros Ventre, Flathead and Shoshone (Teton County Wyoming, 2003).

Westward Expansion and Settlement

*"Eastward I go only by force; but westward I go free… I should not lay so much stress on this fact if I did not believe that something like this is the prevailing tendency of my countrymen. I must walk toward Oregon… And that way the nation is moving…"*

-Henry David Thoreau

It is thought that John Colter was the first white man to enter the valley when he arrived there in 1807. A guide with the Lewis and Clark expedition, he had left that group to explore the area of Jackson Hole as an emissary of the fur trade. For the next 45 years, Indians and trappers often met in the valley for the Rendezvous, an event which gave them a chance to socialize and trade the season's pelts for essential supplies needed to sustain them during the year. The life of a trapper was mostly solitary and yet full of danger. For the most part, they were young, poor, men who were physically able to endure all sorts of hardships. They also needed to be able to adapt to an environment completely unlike anything they had ever experienced before, including a variety of unfamiliar wildlife such as grizzlies and other bears.

The story of these rugged people, often referred to as "mountain men," began with a small group of trappers who went into the Rocky Mountains in search of beavers' pelts. In the

early decades of the 1800's there was a large demand for beaver fur, as it had become extremely fashionable for use in men's hats. In their quest for these pelts, the mountain men explored the West much more thoroughly than anyone else had done before. They also established the trails that would eventually lead waves of pioneers out as far as Oregon and California. As Betts points out, "It is no exaggeration to say that more than any other driving force the pelts of fur-bearing animals, especially the beaver, moved men to explore the unknown parts of North America, caused empires to wage bloody colonial wars and, along with the never-to-be-satisfied hunger for land, lured the frontier inexorably toward the Pacific Ocean" (Betts, 1978, 55). The fur trade declined around 1840 when beaver hats fell out of fashion, and almost nothing appears in the historical record again about the valley until people began to settle there later in the 1800's (Jackson Hole Historical Society, 2003).

The first homesteaders in the valley were John and Millie Carnes and John Holland, who arrived in 1884. Although Jackson Hole was settled later than many other parts of the West, much of its early development occurred under the Homestead Act of 1862, which allowed people to acquire land at the cost of improving it (Jackson Hole Historical Society, 2003). By 1889, the

*Figure 2.2 First known photograph of Jackson, taken June 1, 1907 (Huidekoper, 1978)*

population of Jackson had grown to 64 people (Teton County Wyoming, 2003). With a number of families now living in the valley, during the 1890's the residents established a small school, a post office and a church. The town of Jackson itself was laid out in 1897, with only four buildings on the site at the time (Teton County Wyoming, 2003). Back then, "Pap Deloney's general store was considered the heart of the town, offering everything from horse collars to wash tubs" (Teton County Wyoming, 2003). Built in 1906, the building is still on the corner of Glenwood and Deloney and is currently the Jackson Hole Museum.

Many of the early pioneers, however, were unprepared for the severe winters and harsh climate. The very short growing season proved to be a hardship and some of the homesteaders chose to sell out. Some of the other settlers who stayed in the area were able to purchase these lands and consolidate them into large ranches, raising hay, oats and beef cattle as cash crops and feeding their families off of wild game and produce from their own gardens (Jackson Hole Historical Society, 2003). Attempts to mine precious metals in the area were unsuccessful and many of the settlers barely subsisted (Jackson Hole Historical Society, 2003). The remoteness of Jackson Hole also attracted fringe elements such as poachers, elk

*Figure 2.3 The Hotel Jackson and dirt streets, circa 1905 (Huidekoper, 1978)*

tuskers (who killed elk for their two ivory teeth and left the meat to waste), horse thieves, and other outlaws (Jackson Hole Historical Society, 2003). Big game hunting and sport fishing eventually became major attractions in the valley, and faced with a meager existence, many families turned to outfitting and guiding as a way of earning extra money.

Although cattle ranching was the first significant business in the valley, it was not always profitable, and "as wealthy eastern visitors traveled to the valley, some ranchers determined that wrangling dudes was easier and more profitable than wrangling cows" (Jackson Hole Historical Society, 2003). The heyday of the "Dude" ranches spanned from approximately 1915 to 1930, with early ranches such as the Bar BC and Triangle X becoming nationally known (Teton County Wyoming, 2003). Even today, the tradition of dude ranches continues, with travelers from all over the world coming to Jackson Hole to experience life on a ranch while enjoying the natural beauty of the area. While both cattle and dude ranching were continuing to evolve in the early 1900's, the town of Jackson was growing as well and like other typical frontier towns, it now had mercantile stores, a post office, a school, cafes, saloons, a rodeo, churches, hotels, a playhouse, and a jail (Jackson Hole Historical Society, 2003).

Also during the late 1800's and early 1900's wealthy and influential visitors to Jackson Hole began to argue for the permanent protection and preservation of the magnificent natural beauty of the valley. As a result, a number of federal lands were designated, including Grand Teton Park, Yellowstone National Park, Bridger-Teton National Forest, and the Elk Refuge. The designation of these lands had a huge impact on the future of the area, not only changing the character and landscape of the valley forever, but guiding as well both the economic and social future of Jackson Hole. The new parks also gave rise to a different type of tourism, and have been attracting people to the area ever since.


*Figure 2.4 Map showing national parks and national forests near the town of Jackson (www.gorp.away.com)*

Water Issues

"*The preservation of Jackson Hole's unique lakes and streams should be of primary concern, and the agricultural productivity of certain parts of Jackson Hole and Idaho- that productivity being valuable but not unique- should be of secondary importance.*"

-David Saylor

Over time, numerous attempts to dam Jackson Hole's lakes and streams have threatened the natural beauty of the valley. In the early 1900's, the development of agriculture in nearby semi-arid areas of Idaho was limited by a lack of water. In response to this problem, the federal government in 1906 constructed a rock-filled, log-crib dam at the outlet of Jackson Lake to regulate the seasonal flow of water into the Snake River. After the original crude structure

was washed away in 1910, a much sturdier reinforced concrete dam was erected in its place and remains there to this day (Saylor, 1970). Although the dam did have some agricultural benefits, it was controversial for a number of reasons. As Saylor says, "First, it added a touch of unnaturalness to one of the most beautiful lakes in the world. Second, the resulting reservoir backed up water over a considerable portion of historically and ethnologically significant land. The reservoir covered the ancient Indian and trapper trail leading to Conant Pass and washed away artifacts and other scientifically valuable evidence of Indian campgrounds along the original northern shore of Jackson Lake" (Saylor, 1970, 155). The raised waters also killed large numbers of trees along the shoreline, leaving their bare skeletons to edge the lake in a dramatic visual reminder of the ecological damage.

The struggle between conservationists and development interests extended to other lakes and streams in the area as well. Another controversy involved the Cheyenne-based Teton Irrigation Company. In 1910 and 1912 they were able to secure damming privileges on Spread Creek as well as both the Buffalo and Gros Ventre Rivers under the provisions of the federal Carey Land Act of 1894 (Saylor, 1970). This act allowed federally owned arid lands to be donated to the state on the condition that the state would encourage the lands to be reclaimed and settled. Wyoming accepted the land donation and then allowed the Teton Irrigation Company to sell water to settlers in the dry northeastern portion of Jackson Hole. However, through a series of unethical and possibly illegal maneuvers, the company ended up hoarding most of the water to sell at much higher prices to agricultural interests in Idaho (Saylor, 1970). As a result, settlers who had been drawn by the promise of irrigated farmland found the soil unfit for agricultural use and most eventually abandoned their homesteads (Saylor, 1970). Conservationists in Jackson Hole were angry and felt that the irrigation company had deceived the state into allotting

worthless land for settlement, yet it wasn't until the 1930's that officials finally ended the firm's operations in the valley (Saylor, 1970).

Irrigation and water rights were often contentious issues in Jackson Hole and there were other private companies which, like the Teton Irrigation Company, used land reclamation laws in ways that threatened to destroy the natural beauty of the valley. According to Saylor, "The Osgood Land and Livestock Company of Idaho and the Utah-Idaho Sugar Company held similar water-storage and irrigation privileges on Emma Matilda and Two Ocean lakes. The dams the two firms built were not removed until the 1950's when Emma Matilda and Two Ocean were included in the national park system" (Saylor, 1970, 156- 157).

Yet another company considered a project which would have destroyed the untouched beauty of Jenny and Leigh Lakes, but these plans were fortunately halted by the state in response to pressure from both the park service and local dude ranchers. Overall, the government in Jackson Hole has had to carefully balance agricultural and commercial water use with conservation and the protection of natural areas. Dude ranchers, outfitters, guides, and other residents whose livelihoods depended on the natural splendor of Jackson Hole have long opposed the damming of the valley's lakes and streams and have been vocal advocates for the preservation of Jackson Hole's natural water features.

Changes During the 20th Century

"*Change occurs so rapidly that it is important that Jackson Hole maintains a sense of its past and its values. The community needs to understand and remember the effects of the evolution of the valley on the human spirit over time, particularly as it defines its future."*

-Jackson Hole Historical Society

Attempts to change the natural flow of local waterways have extended into downtown Jackson as well. In the 1970's, a significant portion of Cache Creek- a tributary to Flat Creek- was put into a culvert as it runs through downtown. This was done in an effort to prevent flooding from spring snow melt. Although one of the major streets in town is named after Cache Creek, it can only be seen or heard in the downtown area through the storm drains, and it has effectively become nothing more than a storm sewer in this area, collecting runoff from the streets and carrying it to Flat Creek.

Flat Creek itself has also faced a number of ecological challenges resulting from dubious or misguided plans. For example, in the 1960's some of the property owners along one section of the creek decided to try to "straighten it out" by moving it up against the butte and filling the low land between the creek and the highway as it runs past the Jackson Hole Lodge (Krummer, 2004). The stretch they were focusing on began where Broadway currently crosses Flat Creek and extended from there approximately 200 yards upstream. As historian Larry Krummer comments, "For a distance of about 200 yards, and going upstream, a dike was built with earth scraped off the side of the butte, and the creek moved up against the side of the butte. This was done in conjunction with the construction of a new and slightly relocated bridge, by the Wyoming Department of Transportation- the old bridge being made of wood" (Krummer, 2004).

The new bridge for the Broadway Avenue crossing now sits slightly to the south of where the old bridge was.

The character of Jackson Hole continues to change and evolve as the area grows rapidly. With its majestic setting, world-class skiing, and opportunities for a wide variety of outdoor activities, the area attracts people from around the world, who come to the beautiful valley both as visitors and new residents. Up to three million tourists come to Jackson Hole every year to experience the romance of the American West and to enjoy the natural features of the area. The Historical Society also points out that "Teton County at the recent turn of the century had the highest construction expenditure per capita than any of the other 3,800 counties in the United States and the third highest number of construction jobs per capita" (Jackson Hole Historical Society, 2003). Even though 97% of the land in Teton County is publicly owned, it is crucial that the community effectively manage the remaining privately owned land in order to protect natural resources for future generations.

# CHAPTER 3

# EXISTING CONDITIONS

## Western Riparian Ecosystems

Riparian environments are a critical part of any landscape, and in the western United States they are even more important since in that arid region they are often the only areas wet enough to support trees. Typically defined as ecotones or corridors along the bank of a natural course of water, riparian landscapes provide key physical and biological linkages between terrestrial and aquatic environments (Busch and Scott, nd). Because of this, these areas are essential habitat for many wildlife species. Many western streamside landscapes, including those in the valley of Jackson Hole, are characterized by a mix of cottonwood (*Populus deltoides*) and willow (*Salix gooddingii*) trees. Also, two of Wyoming's threatened species, Ute Ladies'-Tresses (*Spiranthes diluvialis*) and Colorado Butterfly Plant (*Gaura neomexicana coloradensis*), are found in riparian areas (Bureau of Land Management WY, 2004).

Like riparian corridors, wetlands are also extremely important ecological areas. Not only do they serve as summering and breeding grounds for many bird species, wetlands also prevent soil loss and filter impurities. Almost two million acres of wetlands occur in Wyoming (Bureau of Land Management WY, 2004). These areas are critical in times of high precipitation or snowmelt, since they provide space for the storage of floodwaters. There are several wetland areas adjacent to Flat Creek, including those at the north end of town on the National Elk Refuge and also those in Karns Meadow, close to downtown Jackson.

Human activity in the west has often centered around scarce water resources such as streams and rivers. Often these human influences have resulted in changes to the water flow or other modifications that damage riparian ecosystems. Some of the major threats to riparian areas include water impoundment and diversion, groundwater pumping from aquifers, mining, livestock grazing, land clearing for agriculture, road development, heavy recreational demand, the elimination of native species or the introduction of exotics, and overall watershed degradation (Stromberg, 1993).

Flat Creek

Flat Creek begins with several springs in the Teton National Forest at an elevation of approximately 8700 feet, flowing north and west from there out of the mountains and into the National Elk Refuge, which sits directly north of the town of Jackson (Daly, 2001). Upstream of Jackson, the drainage area for the creek encompasses roughly 120 square miles. Once it reaches Jackson, Flat Creek then flows mostly south through town until finally emptying into the Snake River.

Like many urban streams today, Flat Creek is in trouble. Although it runs right through the heart of town, access to the creek is limited and it is so hidden that many people do not even notice it. As newspaper reporter Bill Curran comments in a recent article about downtown and the creek, "on the National Elk Refuge north of town, the creek is a blue-ribbon fishery, but in town it serves as a gutter" (Curran, 2003). Referring to a degraded section of the creek behind several downtown businesses, Mayor Mark Barron adds, "This looks more like a drainage ditch than Flat Creek" (Curran, 2003). The town is currently struggling to alleviate the impacts of

decades of inappropriate streamside development and reclaim the creek as celebrated feature of the community.

Overview of Design Site

The design site and most of the inventory maps focus on the Flat Creek corridor starting upstream at the Meadowbrook Village condominiums and ending downstream at the point where Flat Creek flows out of Karns Meadow. For mapping purposes, the overall design area has been divided into Site A, which looks at a densely developed commercial area along Broadway Avenue, and Site B, which is Karns Meadow and is located south of Broadway (Figure 3.1). Site A focuses on the creek as it runs between the condominiums and several downtown businesses on one side and a steep slope on the other side. Site B includes Flat Creek as it flows through Karns Meadow, 41 acres of key open space which the town of Jackson is currently in the process of acquiring and which is designated to be a park.

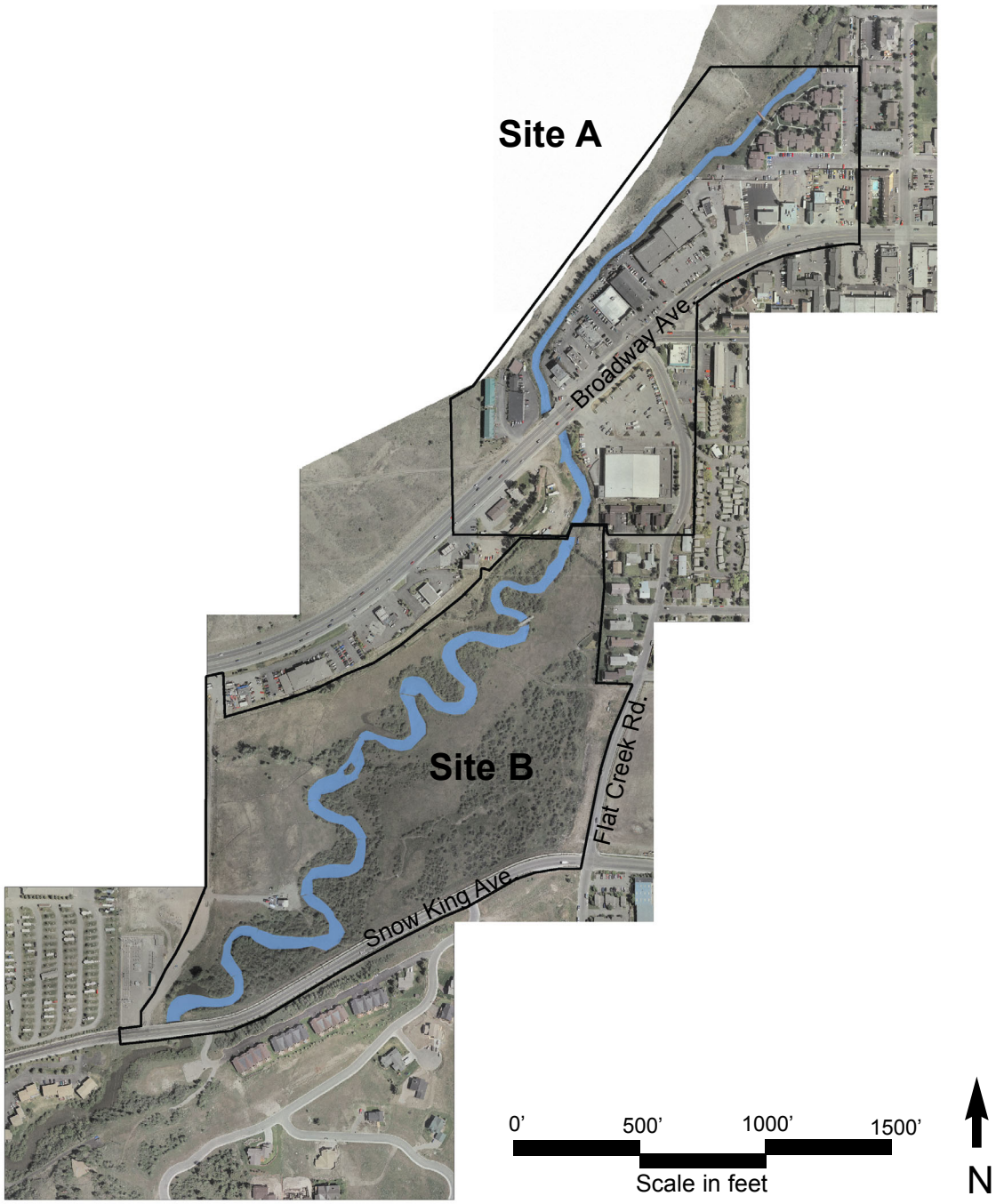


*Figure 3.1 Overview of design site*

Explanation of Inventory and Site Analysis

The following sections of this chapter focus on existing conditions in the design area. A combination of maps and text provide an inventory and analysis for a variety of key features. This study of existing conditions will then form the basis for the design in Chapter Seven. Site inventories included are topography, vegetation, wildlife habitat, hydrology (divided into watershed boundary, water use in town, ice and flooding problems, water quality, and aquatic habitat), impervious surfaces, crossings and access points, building uses, and property ownership.

*Figure 3.2 Area of severe erosion on the east side of Gros Ventre Butte in Site A*

Topography

As can be seen in digital elevation model in Figure 3.3, much of the design area is relatively flat, except for a large and very steep slope on the northwest side of the creek in Site A. There is an area of severe erosion on the slope, shown in Figure 3.2 above. Because of the unstable character of this hillside and the danger of rockslides, it could be dangerous to locate a

pathway on this side of the creek, unless it was covered to protect pedestrians from falling rocks. The slope is actually one side of a local land formation called Gros Ventre Butte, named after one of the Native American tribes that used to occupy the area. The steepness there could present a design challenge for any plans to create a pathway along that section of the creek.

Site B, or Karns Meadow, is by comparison much flatter, with few steep areas. Most of the significant slopes in Site B occur along the edge of Snow King Avenue, and Flat Creek Road, as well as at the point where Broadway crosses the creek, and these are all relatively short slopes. The riparian and wetland areas in Karns Meadow flood periodically and act as a flood plain that reduces flooding damage downstream (Segerstrum, 2003).

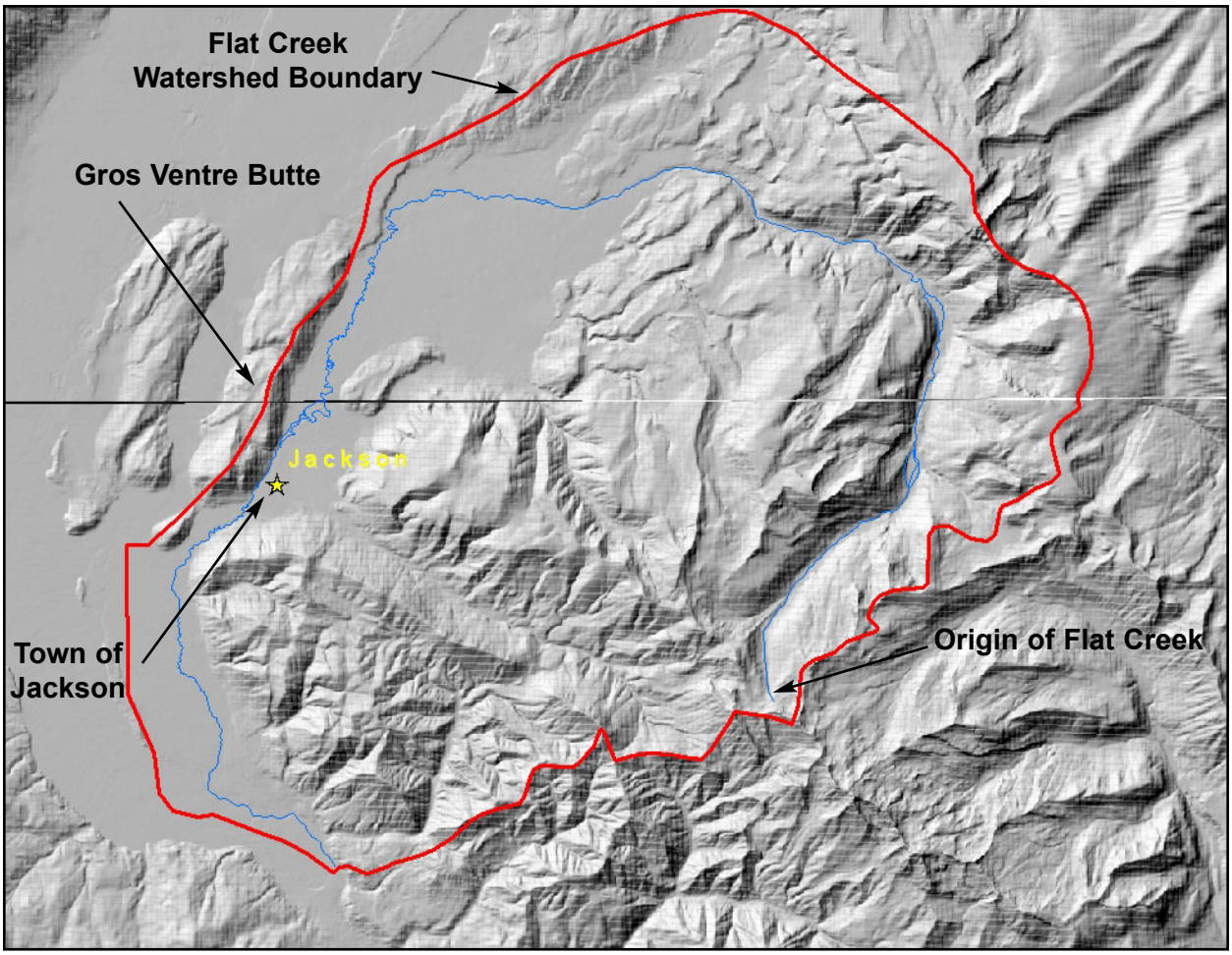


*Figure 3.3 Map showing topography of area with Flat Creek watershed boundary in red (Courtesy of Teton Conservation District)*


*Figure 3.4* *Map showing topography of Site A with arrows indicating water flow*

Key

- Streambed
- Extremely Steep (>25% Slope)
- Moderately Steep (10-25% Slope)
- Less Steep (0-10% Slope)

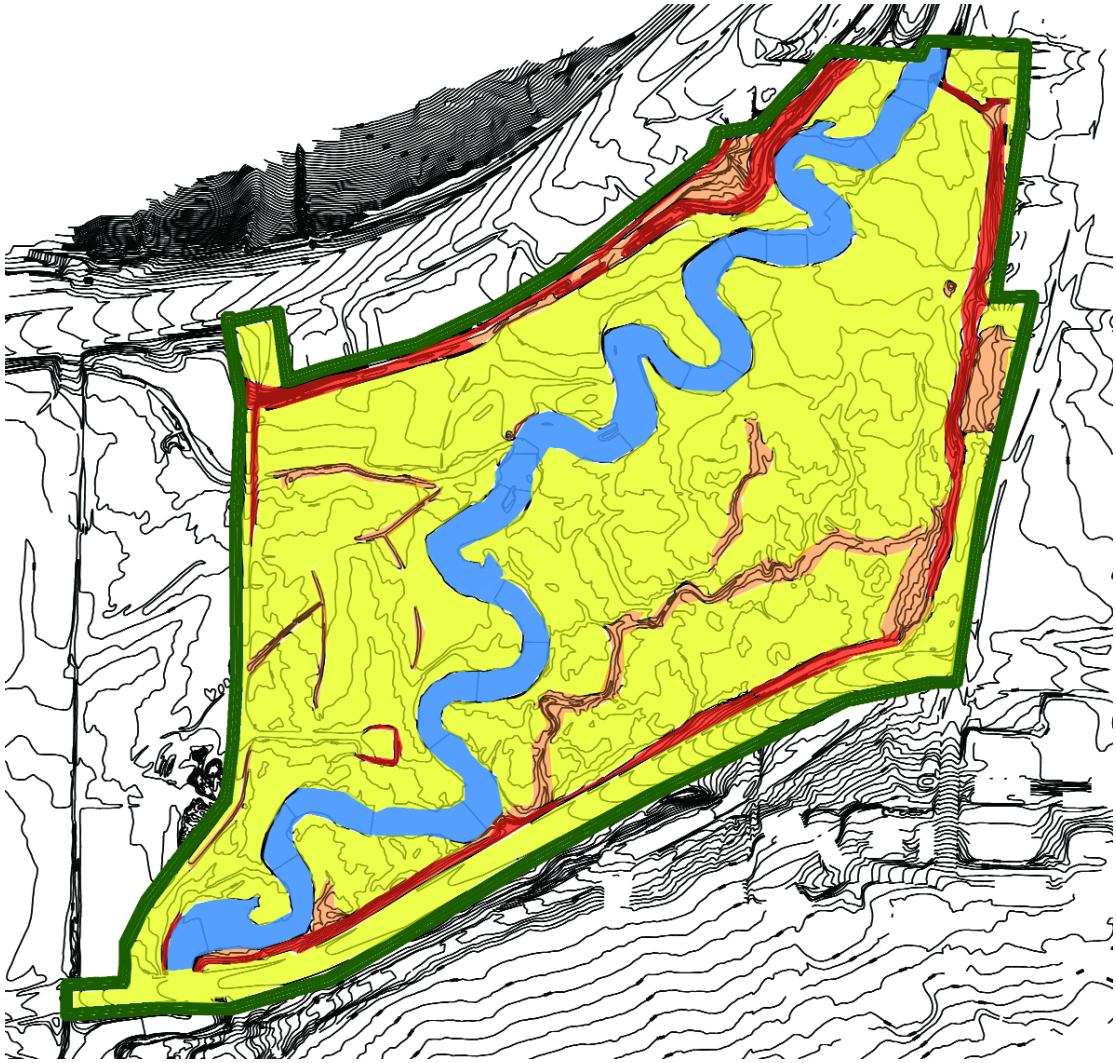

*Figure 3.5 Map showing topography of Site B*

Vegetation

Site A is largely developed and has only small areas of vegetation lining the creek. The existing vegetation consists mostly of a mix of willow species directly adjacent to the water, and disturbed areas at the edges of the parking lots. There are also some bare areas of exposed soil on the steep side of the creek, where the hillside has eroded. It would be useful to study the native plant species remaining in Site B to create a list of appropriate plant species for future landscaping and restoration projects in the disturbed areas of Site A.

Site B has two primary types of plant communities, in addition to disturbed areas with roads. In his Natural Resources Inventory of Karns Meadow, biologist Tom Segerstrum says, "The plant communities are: 1) Palustrine Shrub-Scrub (PSS), with an understory of grasses, which has historically experienced seasonal flooding, and 2) Agricultural Meadows, into which domestic grasses have been inter-seeded or introduced at various locations" (Segerstrum, 2003). The PSS community is dominated by a variety of willow species (*Salix spp*.), with other shrubs such as glandular birch (*Betula occidentalis*) and alder (*Alnus spp*.) also present (Segerstrum, 2003). Wetland plants found in the low-lying areas of Site B include sedges (*Carex spp*.) and rushes (*Juncus spp*.). Some of the native grass species found on the site are Redtop *(Agrostis stolenifera),* western wheatgrass *(Agropyron* smithii), slender wheatgrass (*Agropyron tachycauluim*), blue grass (*Poa pratensis*), and Idaho fescue (*Festuca idahoensis*). Invasive exotics, found so far only in the disturbed areas at the edges of the property, include spotted knapweed (*Centaura maculosa*), common tansy (*Tanacetum vulgare*), and curly dock (*Rumex crispus*) (Segerstrum, 2003).


*Figure 3.6 Map showing types of vegetation in Site A*


*Figure 3.7* *Map showing types of vegetation in Site B*
*Courtesy of Jackson Hole Land Trust (Segerstrum, 2003)*

Wildlife

With its high amount of impervious cover and confined stream channel, Site A provides little space for wildlife habitat. However, some birds and small mammals do use the remnant riparian vegetation for food and cover. Bird species found in Site A and Site B include the American Robin (*Turdus migratorius*), black-capped chickadees (*Poecile atricapillus*), house wrens (*Troglodyte aedon*), mountain chickadees (*Poecile gambeli*), northern flickers (*Colaptes auratus*), the western wood peewee (*Contopus sordidulus*), yellow warblers (*Dendroica petechia*), warbling vireo (*Vireo gilvus*), and ruby crowned kinglets (*Regulus calendula*), as well as waterfowl such as ducks (*Aix sponsa*) and mallards (*Anas platyrhunchos*) (Segerstrum, 2003).

A wide variety of animal species can be found at different times of the year in Site B, including quite a few species which are listed as threatened or endangered, such as bald eagles (*Haliaeetus leucocephalus*), osprey (*Pandion halieatetus*), and moose (*Alces alces*). Other species which use Karns Meadow include mule deer (*Odocioleus hemoinus*), hawks (*Accipiter cooperii*), owls (*Asio flammeus*), trumpeter swans (*Cygnus buccinator*), coyotes (*Cucurbita palmate*), and river otters (*Lutra canadensis*). Also, the central location of the property acts a corridor for wildlife movement between East Gros Ventre Butte (the steep slope seen in Site A) and Snow King Mountain, an area of undeveloped land to the south of Karns Meadow (Segerstrum, 2003). It is also important to note the ecological impacts that can be seen when certain native species are removed. As Segerstrum points out, "The absence of beaver (*Castor canadensis*), due to their physical removal over decades, has affected the character of Flat Creek and the riparian vegetation dramatically. Recent proposals for fishery and hydrologic improvements on Flat Creek by the Teton Conservation District largely replicate the effects of beaver, using man-made structures and excavations" (Segerstrum, 2003).

Hydrology

**The Watershed**

The map below shows the watershed boundary for Flat Creek. The creek itself is 26 miles long, yet the straight distance on land between the start of the creek and the end of the creek is only eight miles. As can be seen later in this chapter in the property ownership maps, two thirds of the watershed is actually public land. However, the biggest impact on the creek comes from the section that flows through town.

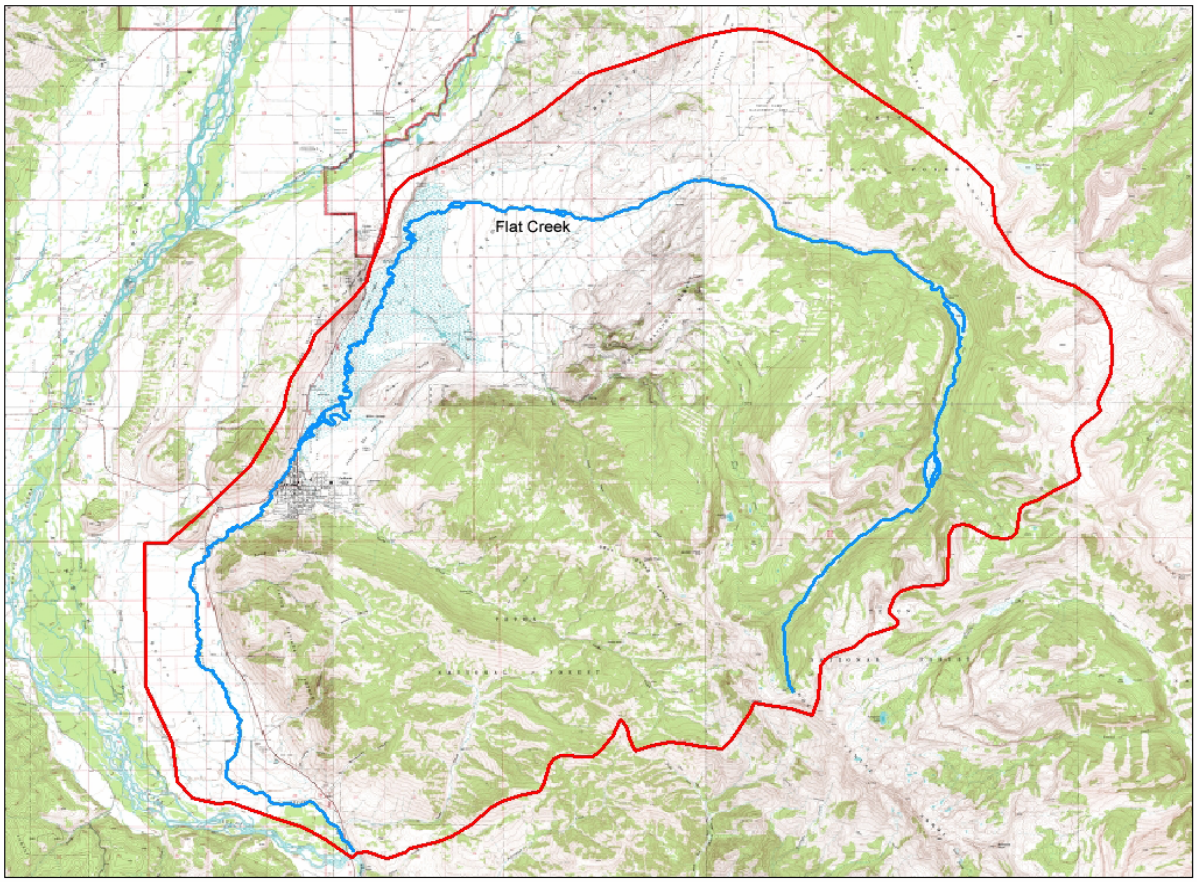


*Figure 3.8 Map showing watershed boundary for Flat Creek in red*

**Water Use in Town**

Jackson pumps its drinking water from underground aquifers, using a total of seven wells placed at various locations throughout the town. Three of the wells are located north of town on the National Elk Refuge, one is in Karns Meadow near downtown, and the other three are south of town. Water use varies widely throughout the year, largely in relation to the number of visitors in town. At the height of the summer tourist season, the town uses approximately seven and a half million gallons/day, while a typical day in the quieter winter season averages closer to three million gallons/day. In addition to drinking water, a large amount of water is used for irrigation as well, especially in the summer and for cattle. The water from the irrigation either evaporates, flows into the town's storm water drainage system, or soaks back into the ground. Therefore, on the peak day, only 2.5 million gallons out of the original 7.5 million actually reaches the treatment plant. Despite the multiple uses however, groundwater levels are not severely impacted by the town's level of use and instead tend to fluctuate according to patterns of drought, precipitation, and snowmelt.

After circulating through the community, the water travels to a sophisticated sewage treatment plant south of town. At the plant, the used water then moves through a series of eight ponds and aeration lagoons, as well as constructed wetlands and a UV clarification system, before being ultimately released into the Snake River. According to Town Engineer Shawn O'Malley, the water leaving the treatment plant is clean enough to drink, and some officials have even drunk it in the past to prove how well the plant works. The Snake River is also a major recreational area for the town, and is extremely popular with kayakers and rafters in the summer. Therefore, many people have an interest in protecting the water quality of the river.

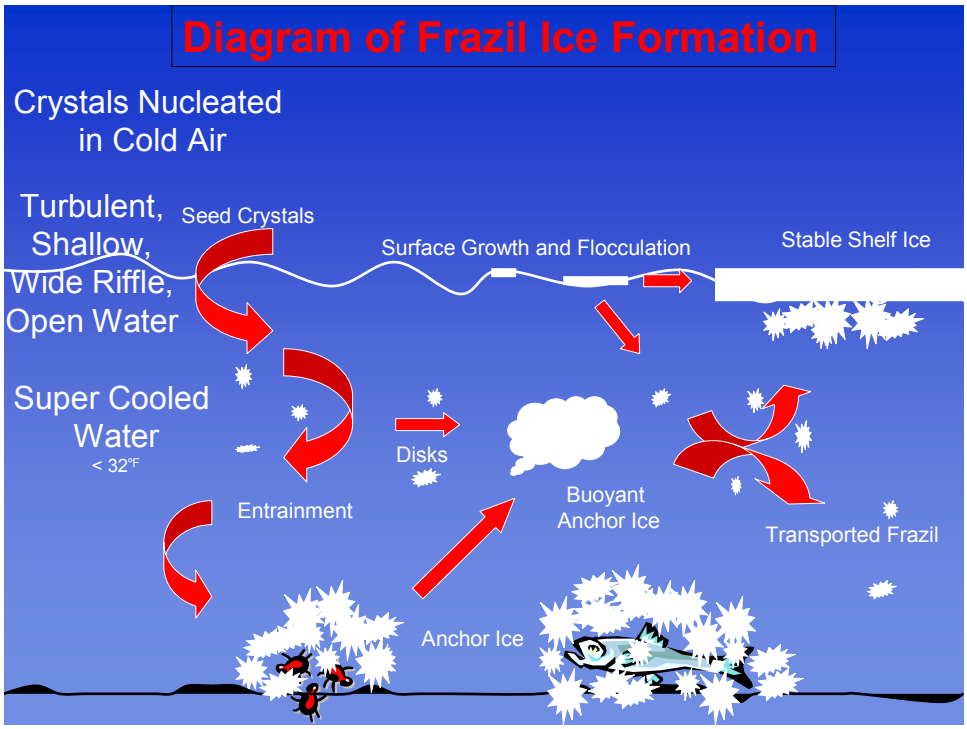


*Figure 3.9 Diagram showing formation of anchor ice (Remlinger, 2003)*

**Ice and Flooding Problems**

For years the town of Jackson has had to deal with wintertime flooding of Flat Creek caused by a specific type of ice called anchor ice, which forms large masses on the bottom of the creek bed and pushes the water out and over the banks. This ice problem is actually one of the main issues which initially drew attention to the creek and has since been the catalyst for other restoration efforts. Anchor ice forms from frazil ice crystals deposited on the channel bottom. These crystals occur during cold periods when the water in the creek, becomes super-cooled (Daly, 2003). Super-cooled water is water that is slightly below 32 degrees Fahrenheit, yet is still liquid. Flooding caused by anchor ice in urban areas is rare in North America, and this is an unusual problem that the town faces.

Anchor ice tends to form in fast, shallow, turbulent streams located in cold climates. The fast flow, shallow depths, and super-cooled water of Flat Creek therefore create ideal conditions for the formation of anchor ice. The problem has been exacerbated by the loss of insulating riparian vegetation, which would help prevent the water in the creek from becoming super-cooled.

**Water Quality**

Stormwater runoff is a major issue for Flat Creek, since it receives most of the runoff from the entire town. Like many old agricultural towns in the west, Jackson developed over time with few restrictions on stormwater runoff. As a result, Flat Creek has become the main stormwater collection point in the area. Presently in Karns Meadow there are also two large stormwater drainage pipes emptying directly into the creek. All of this runoff into the creek is threatening fish habitat, and has inspired the town to try some new methods in order to protect water quality. The town of Jackson is currently working with the Teton County Conservation District on installing new stormwater separators at the output end of some of the drainage pipes to soak up oil and heavy metals before the water enters the creek.

**Aquatic Habitat**

Tom Wesche, a stream restoration consultant hired by the town of Jackson to evaluate Flat Creek, points out some of the key ecological issues for the creek in a presentation he gave in the winter of 2003. In addition to solving the ice and flooding problems, another major goal of restoration efforts is to improve trout habitat. According to Wesche, positive features of the creek's current state include an adequate flow regime, a stable channel, water quality that is

mostly supportive of aquatic life, some remnants of riparian corridor remaining, no fish passage problems, and some spawning gravels remaining (Wesche, 2003). Perhaps the greatest strengths are the dedicated people working to protect the creek and the fact that there are many opportunities for improvement. Ecological problems that need to be addressed along the creek include winter icing and flooding, confinement and channelization, homogenous habitat (too many riffles), a lack of complex pools, scarce woody debris, a channel that is too wide and shallow, stormwater runoff, and turbid conditions (Wesche, 2003).

Impervious Surfaces

The maps on the next pages show various types of impervious cover along the Flat Creek corridor, including rooftops, roads, and parking, as well as total impervious cover. As can be seen in the maps, there is a dramatic contrast between Site A and Site B in terms of impervious cover. Site A has a high amount of impervious surfaces on the Southeast side of the creek, with many of the parking lots extending all the way to water's edge. The commercial buildings close to Broadway Ave. are all surrounded by large parking areas, with no attempt to prevent runoff from spilling into the creek. This is a serious problem for water quality, and needs to be addressed as part of an overall restoration effort. A closer examination of the parking lots shows pavement

*Figure 3.10 Pavement crumbling into Flat Creek*

literally crumbling into the creek in some places. The steep northwest side of the creek is Site A is less developed. Most likely the steepness of the hillside on the northwest side of the creek has protected that portion of land from being developed, which is fortunate, since water falling on that slope drains directly into the creek.

By contrast, Site B has almost no impervious cover, except for Snow King Avenue to the south and a dirt road running along the western edge. This lack of impervious cover is a result of the fact that the meadow has been mostly protected from development. Areas of impervious cover close to the site include commercial buildings and parking lots along Broadway, and several roads, including Broadway Avenue and Flat Creek Road. It is also interesting to note the difference in the shape of the stream channel in Site A versus Site B. As the creek flows through Site A it is forced into a straight channel between the steep slope and the built area. By contrast, the creek in Site B has an intact floodplain, and with space to meander it has taken on a much more natural and sinuous form that is typical of an undisturbed stream.


*Figure 3.11 Map showing types of impervious cover in Site A*

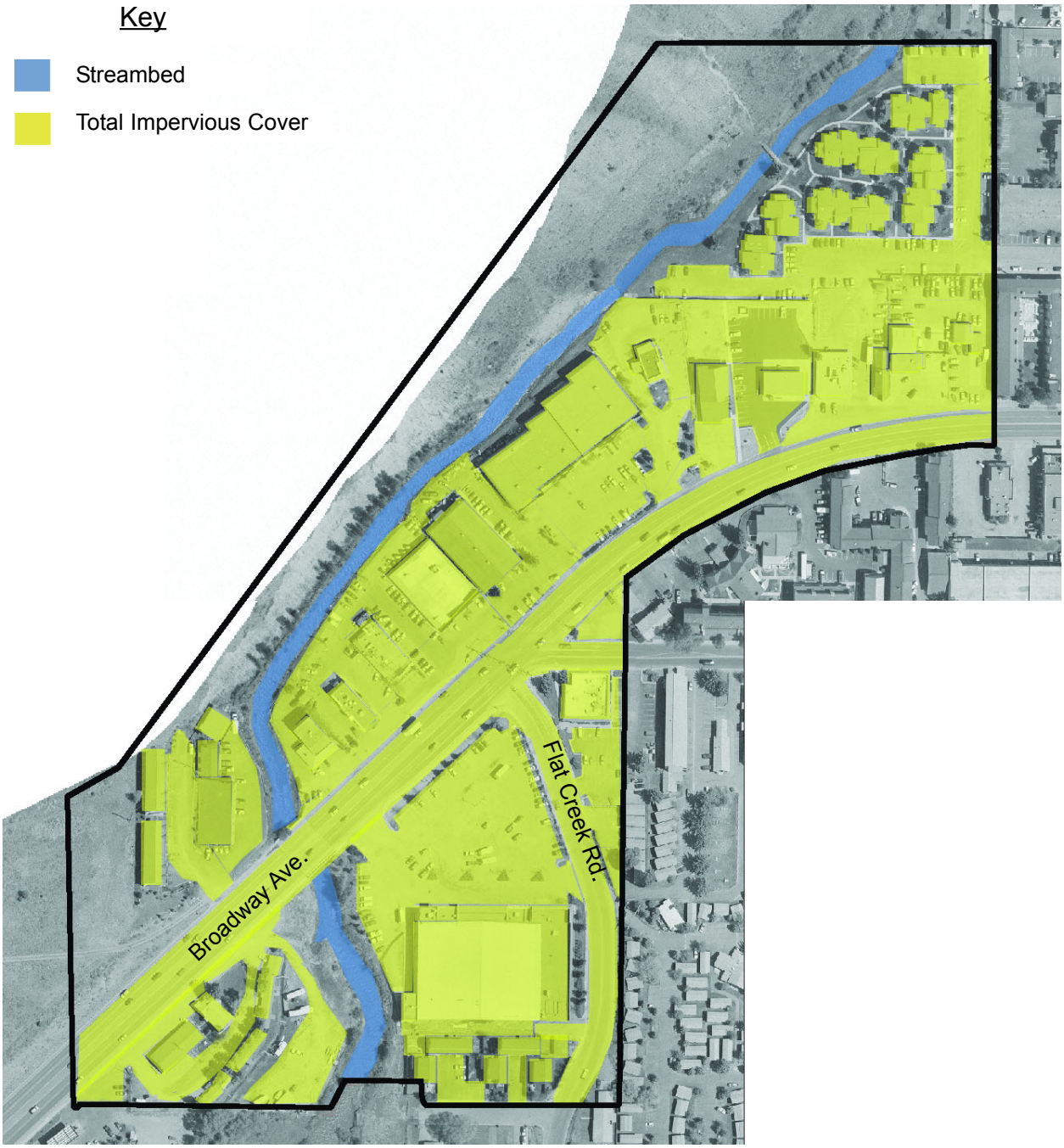


*Figure 3.12 Map showing total impervious cover in Site A*


*Figure 3.13 Map showing types of impervious cover in Site B*

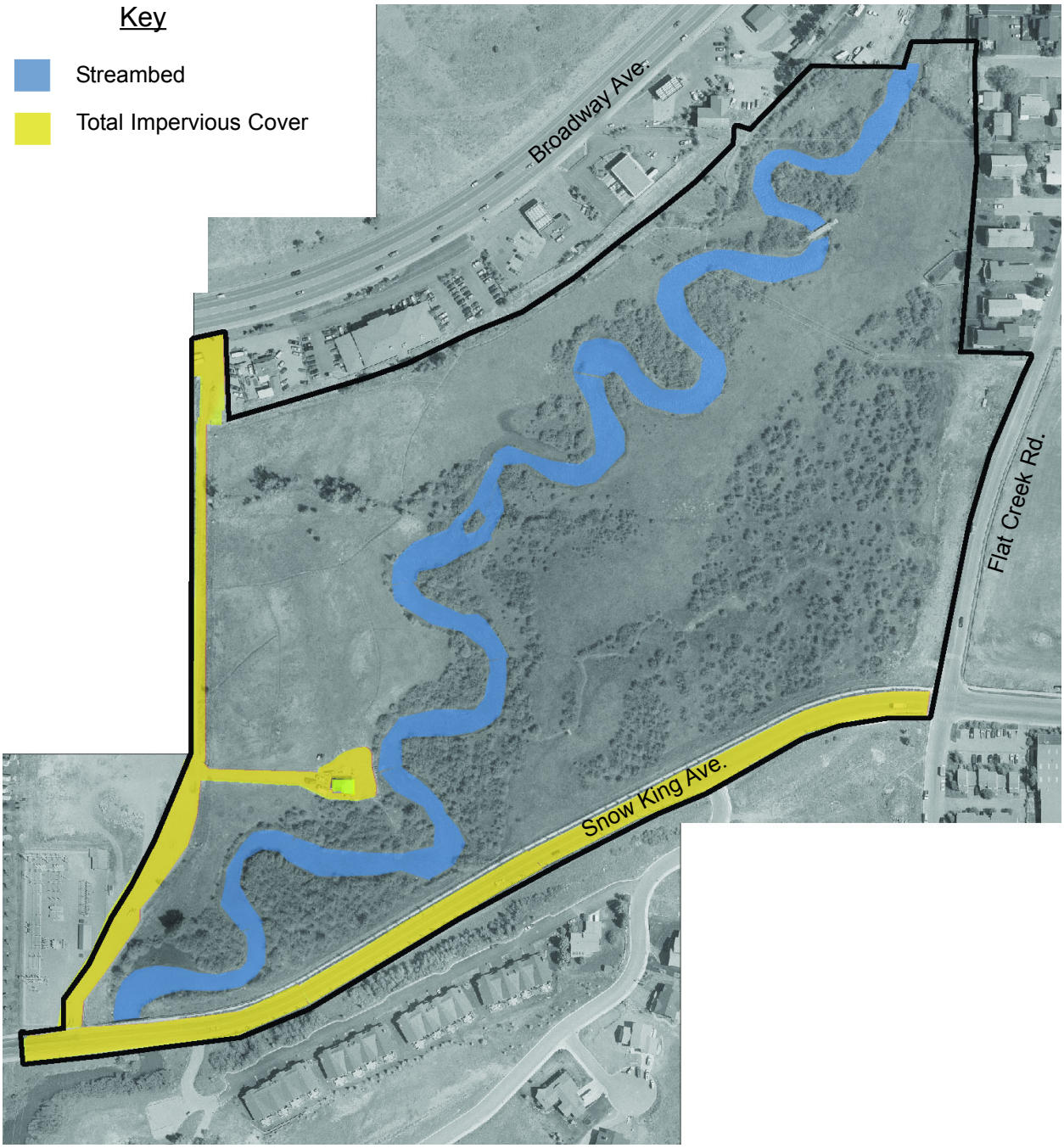


*Figure 3.14 Map showing total impervious cover in Site B*

Crossings and Access Points

Crossing points for Site A include the major road crossing of Broadway Avenue, and a smaller pedestrian bridge leading from the condominiums to a private playground across the creek. Several other bridges upstream of the design area are extremely low, presenting a safety hazard for anyone trying to float down Flat Creek. Local residents sometimes take advantage of the creek on hot summer days by wading in it or by floating downstream on inner tubes. However, low-hanging bridges, shallow water and other obstructions in the creek are currently limiting the appeal and practicality of recreational activities such as tubing.

There is one pedestrian bridge on Site B, located in the northern half of the site near Broadway. That bridge can currently be accessed from the adjacent residential neighborhood. The only other crossings are the vehicle crossings where Snow King Avenue and Broadway Avenue pass over the creek. Both of those major road crossings are potential access points to the new park being planned for the site.

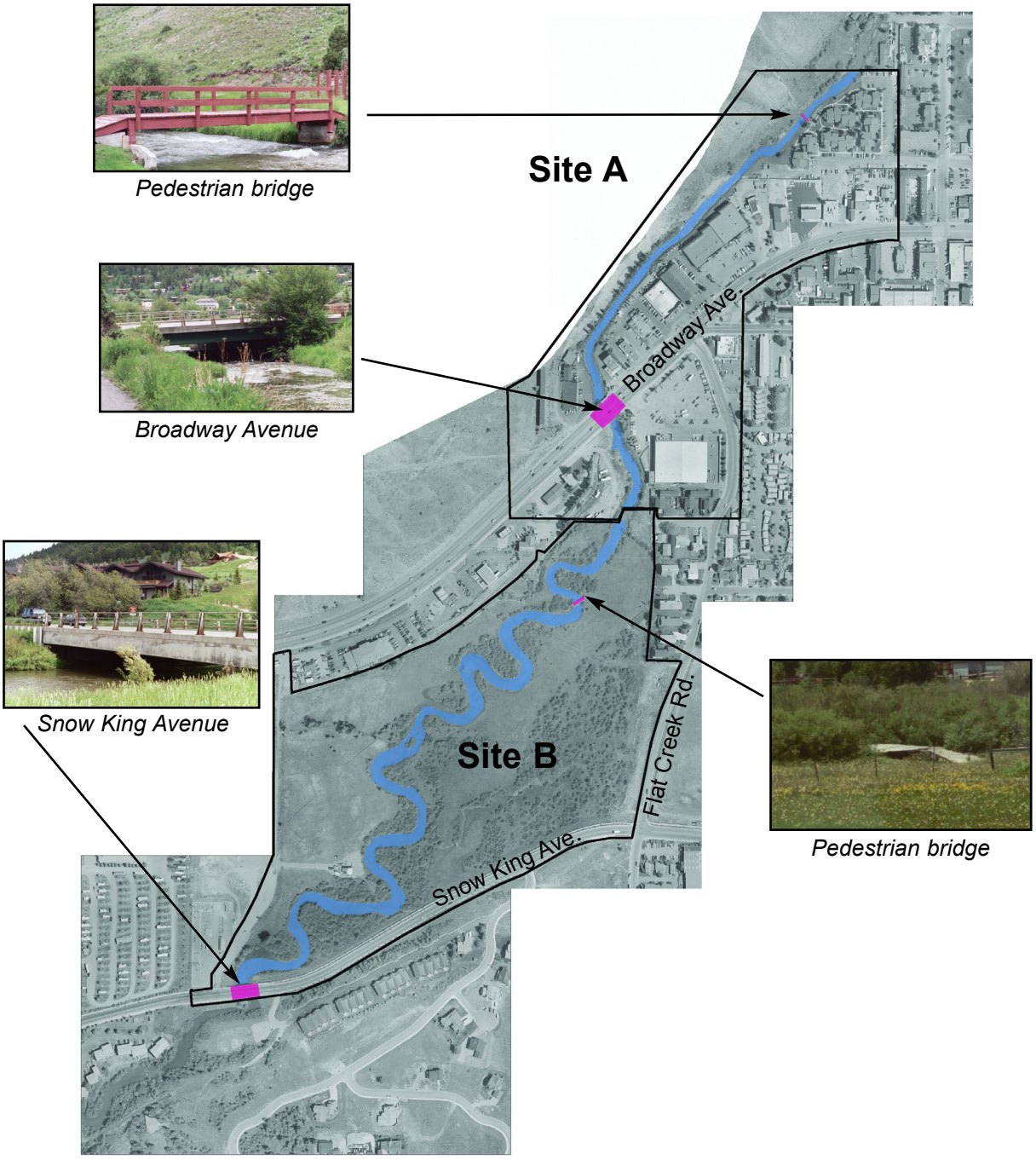


*Figure 3.15 Map showing crossing points*

Built Features and Building Uses

The map of Site A (Figure 3.16) shows a mostly commercial area, except for a group of condominiums to the north and a small row of townhouses towards the southern end. Site B is currently undeveloped. The only currently existing building is a town well site, used both for irrigation and as a thaw well in winter. Thaw wells are one approach to dealing with the problem of anchor ice, and they work by pumping warmer groundwater into the creek to prevent ice formation. However, it is likely that the town will phase out the use of the thaw wells, since they are expensive and there are some other options that may be more ecologically sound. Existing buildings surrounding Site B include businesses along Broadway Avenue and residential neighborhoods to the east. There is also a power substation immediately to the west of the site, and a row of power lines that cross the northern end of the meadow.

The small municipal building associated with the thaw well is the only building on Site B. Therefore, the inventory map for Site B in this category shows other built features of the site, rather than building uses. Although Karns Meadow has remained largely free of buildings, it has not been immune to human impact, as the inventory map shows. Examples of human impacts shown on the map include power lines, fences, irrigation ditches, and stormwater outlets.

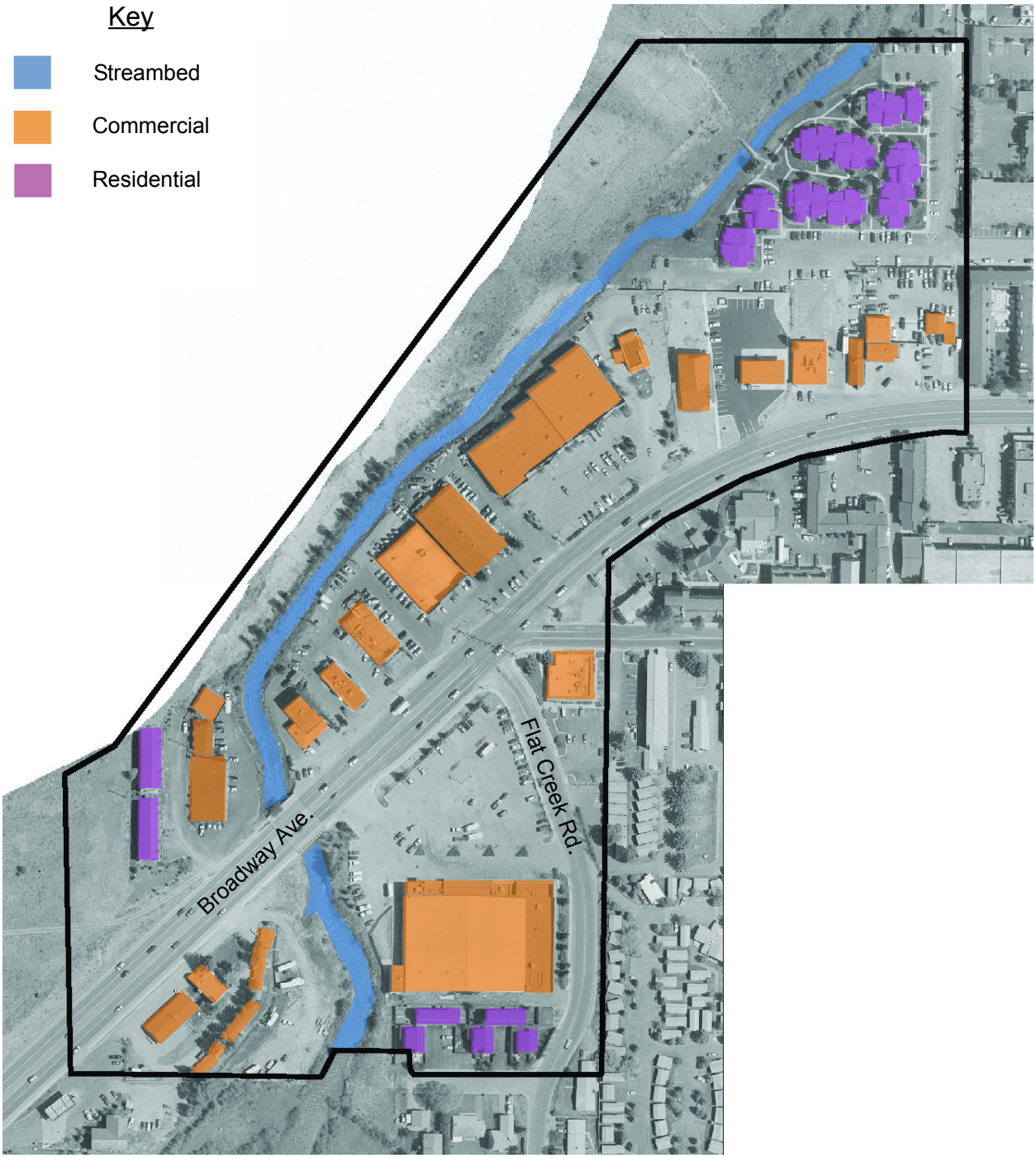


*Figure 3.16 Map showing building use in Site A*

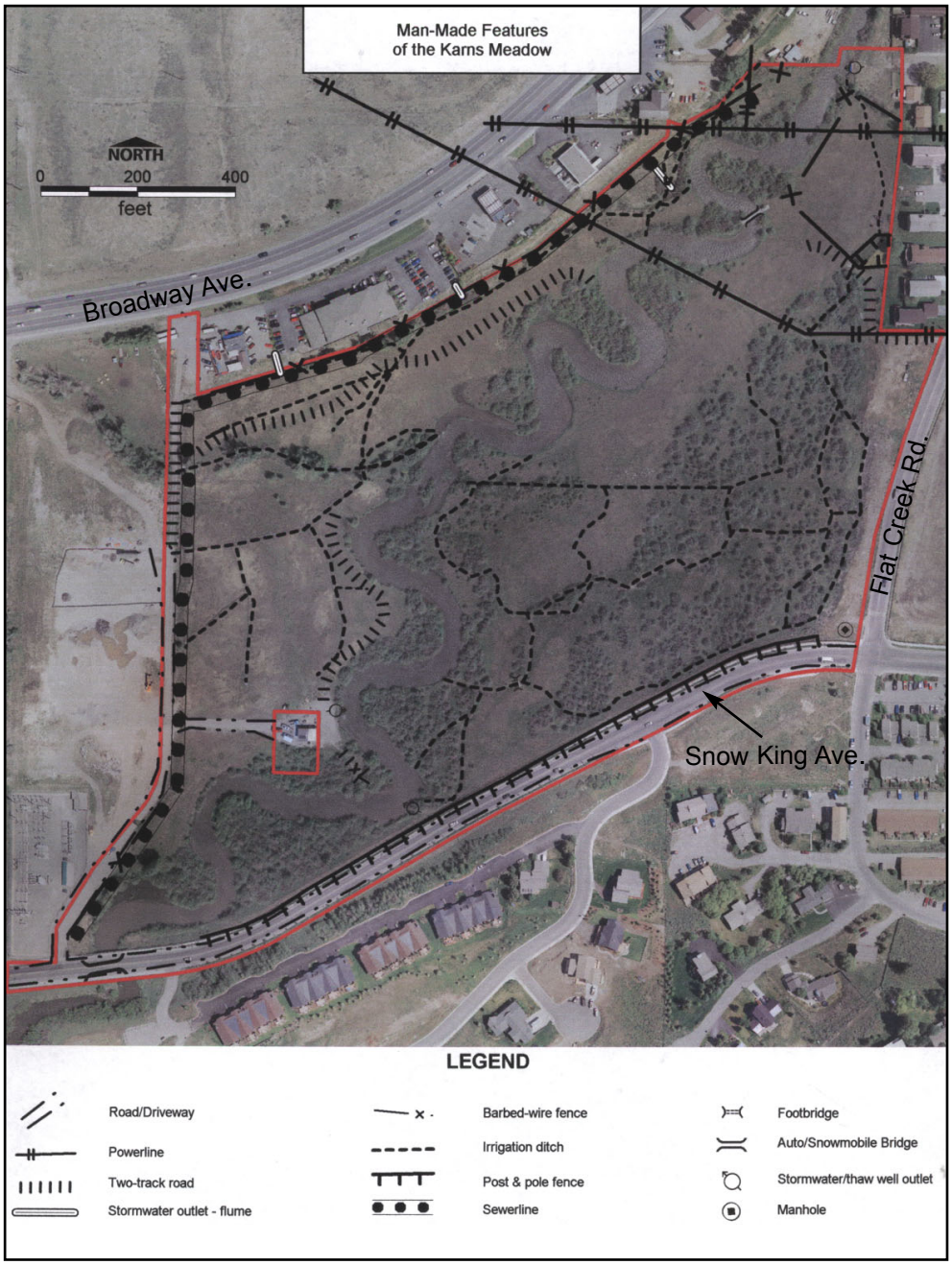


*Figure 3.17 Map showing built features of Site B*
*Courtesy Jackson Hole Land Trust (Segerstrum, 2003)*

Property Ownership

The land on either side of Flat Creek in Site A is mostly privately owned, except for a small area on the steep side of the creek which is owned by the town. This could be a challenge when trying to create a pathway along that section of the creek, although it may be possible to persuade the businesses to give easements for a pathway, since increased pedestrian access would most likely lead to increased sales. The property ownership maps on the next pages show land ownership for both the entire Flat Creek watershed and design area.

Site B consists of mostly public land, since Karns Meadow is in the process of being purchased by the town in a complex arrangement over the course of several years. Surrounding the site, there is a commercial district along Broadway Avenue and residential neighborhoods to the south and east. Karns Meadow represents the last undeveloped portion of Peter Hansen Karns 1890's homestead, and is significant since it had been one of the few remaining large, privately owned, undeveloped land parcels in town. Both the Karns family and the Town of Jackson were eager to preserve the land as a park. In a newspaper article about the purchase, Pete Karns said, "We've resisted selling the property for years for other purposes. It's been the desire of the Karns family to preserve it as a park" (Curran, 2003). Currently, the town has purchased only part of the property and will be buying rest of the land in a staggered purchase agreement over a period of five years. With interest, the total purchase cost for the 41 acre parcel will be $5.6 million, with the Jackson Hole Land Trust contributing $1 million of that amount (Curran, 2003).

Part of the land is categorized as a wetland, and this had offered some protection from development for the land. Despite this label, much of the area is no longer a true wetland since years of withdrawals have led to reduced water levels there. In fact, it is estimated that the size

of the wetlands has been reduced to only about eight acres. Therefore, this means that the development restrictions that currently protect the land could be challenged soon. This is one reason why the town was eager to buy the land and ensure that it could be protected from inappropriate development.

In addition to the wetland areas, there are numerous other deed restrictions on the property and these must be taken into account as part of the design process for this land parcel. In exchange for their financial contribution, the Jackson Hole Land Trust specified a conservation easement and several other deed restrictions for the property. For the most part, these restrictions reflect the fact that the area is significant as wildlife habitat. The previous owner, Pete Karns, also had a vision of what he wanted and did not want to happen with the land. Therefore, he also included certain specifications and restrictions in the sale agreement. Overall, the town will need to determine how to best use the site while still focusing on the protection and enhancement of wildlife habitat.

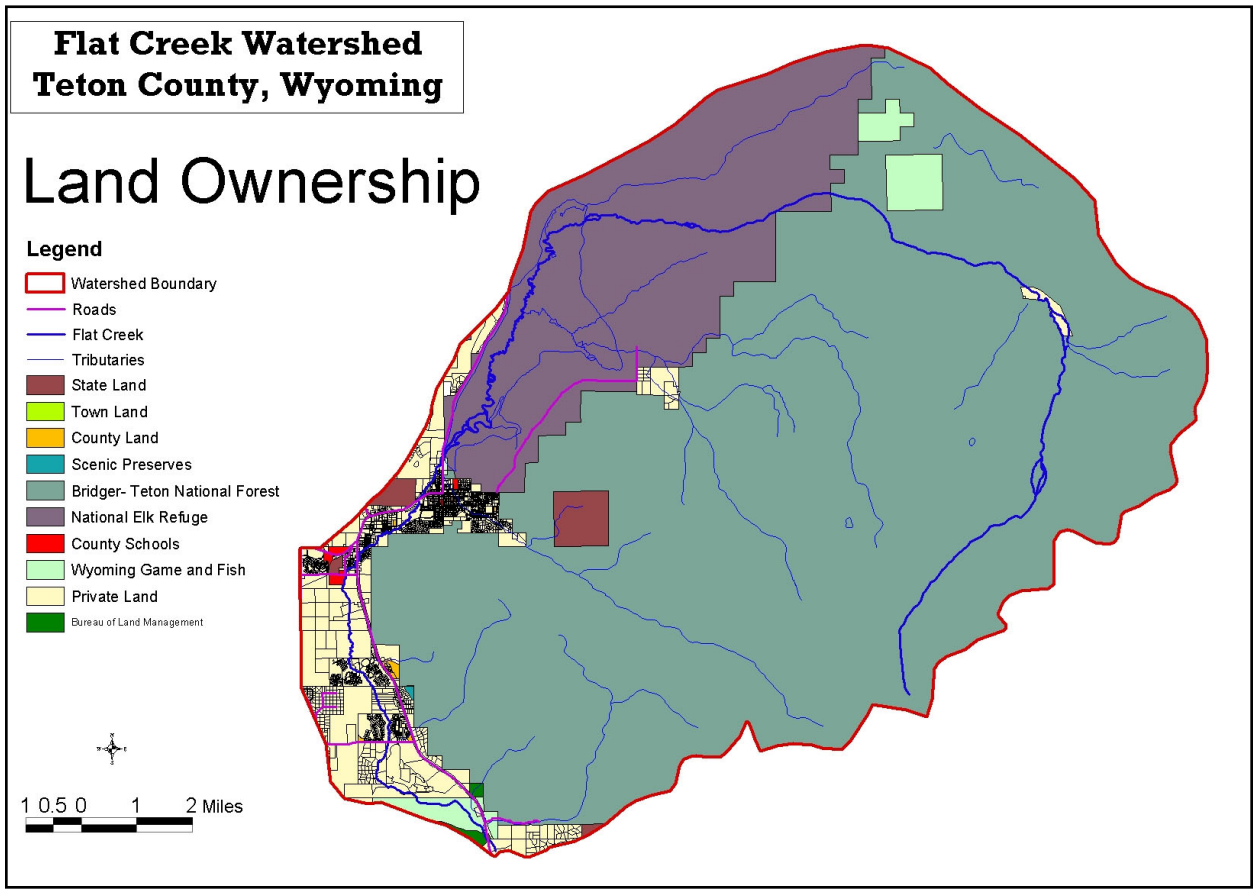


*Figure 3.18 Map showing property ownership in Flat Creek watershed (Teton County, 2003)*

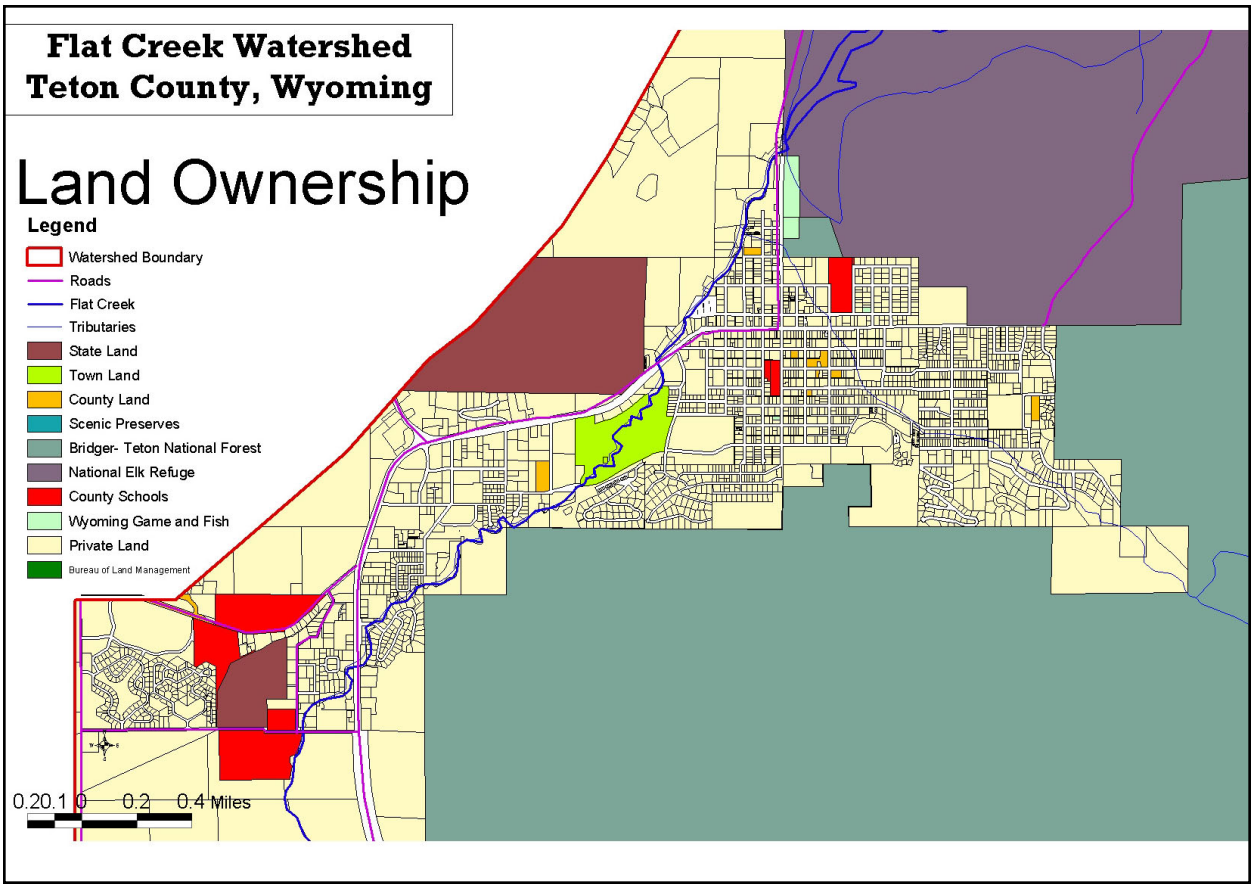


*Figure 3.19 Map showing property ownership in Jackson, WY (Teton County, 2003)*

Composite Analysis

The following pages provide a visual summary of existing conditions in the design area. First, a photo survey of Site A gives a sense of what it is like to walk through the site in its current state. This is significant since Site A will be the focus of a detailed design in Chapter Five. Next there is a composite analysis for each of the two sites, highlighting key elements in each area. These analyses, as well as the other information presented in this chapter, will serve as a basis for guiding many of the design proposals and recommendations.

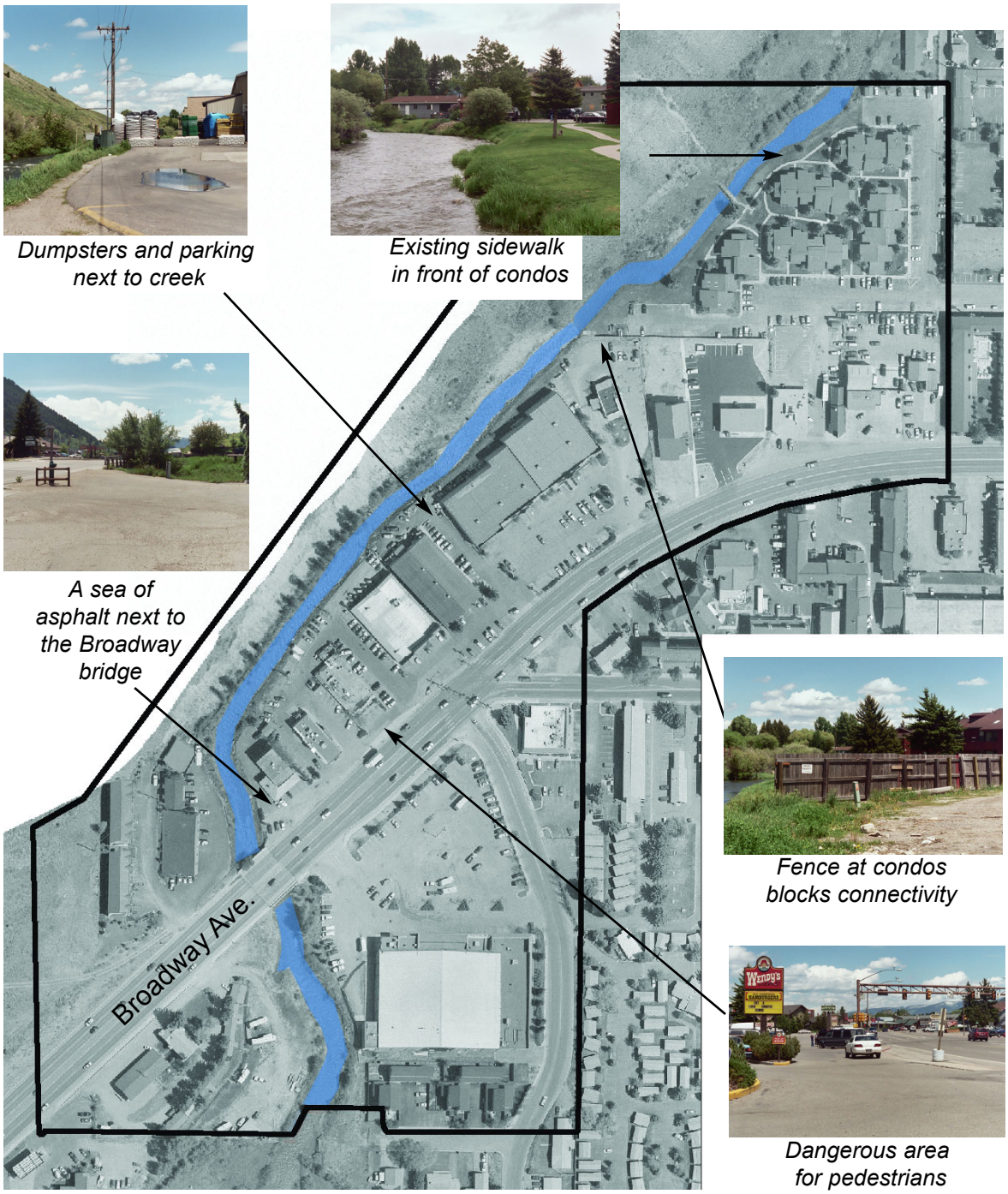


*Figure 3.20 Photo survey of existing views in Site A*

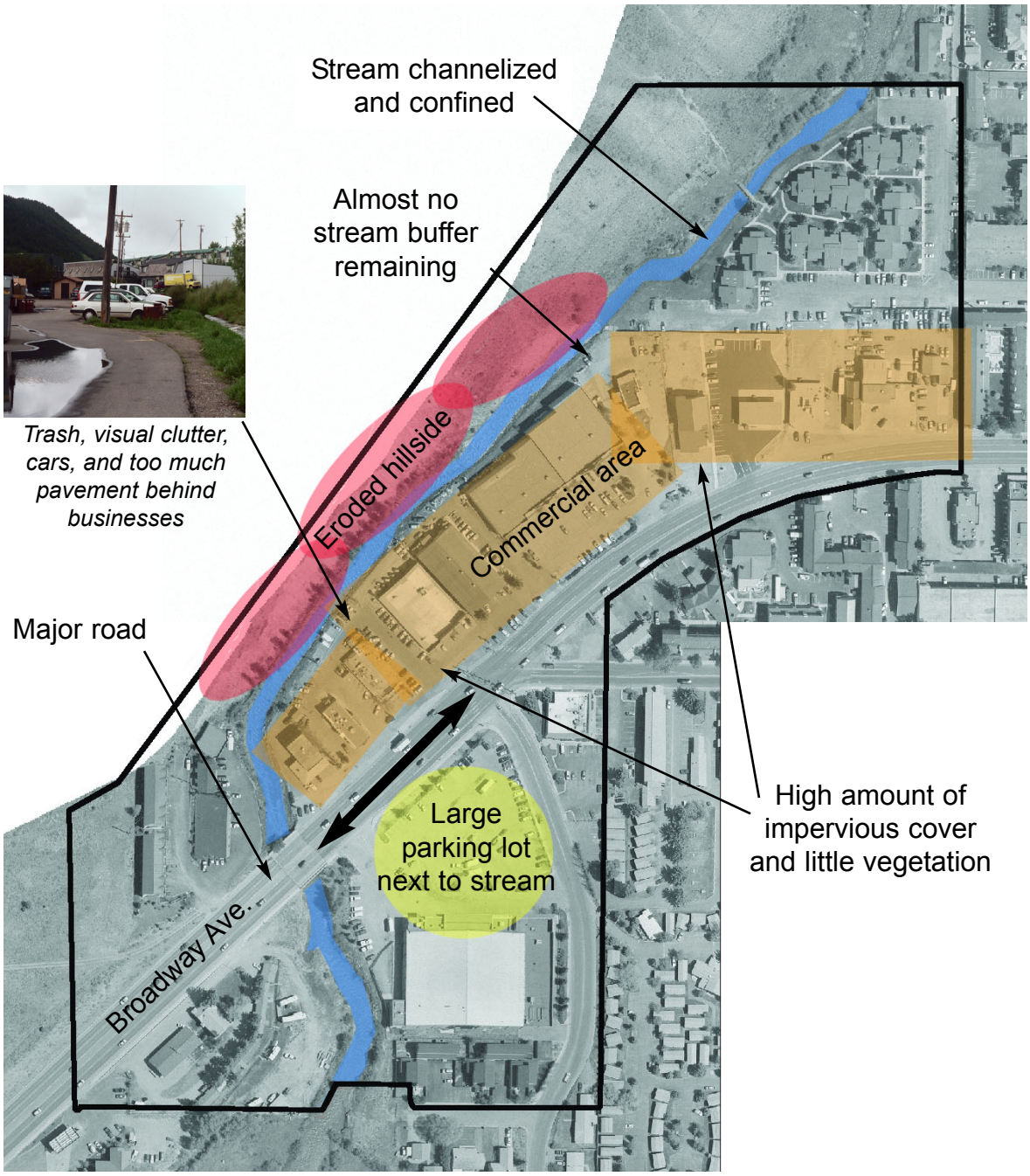


*Figure 3.21 Map showing composite analysis of Site A*

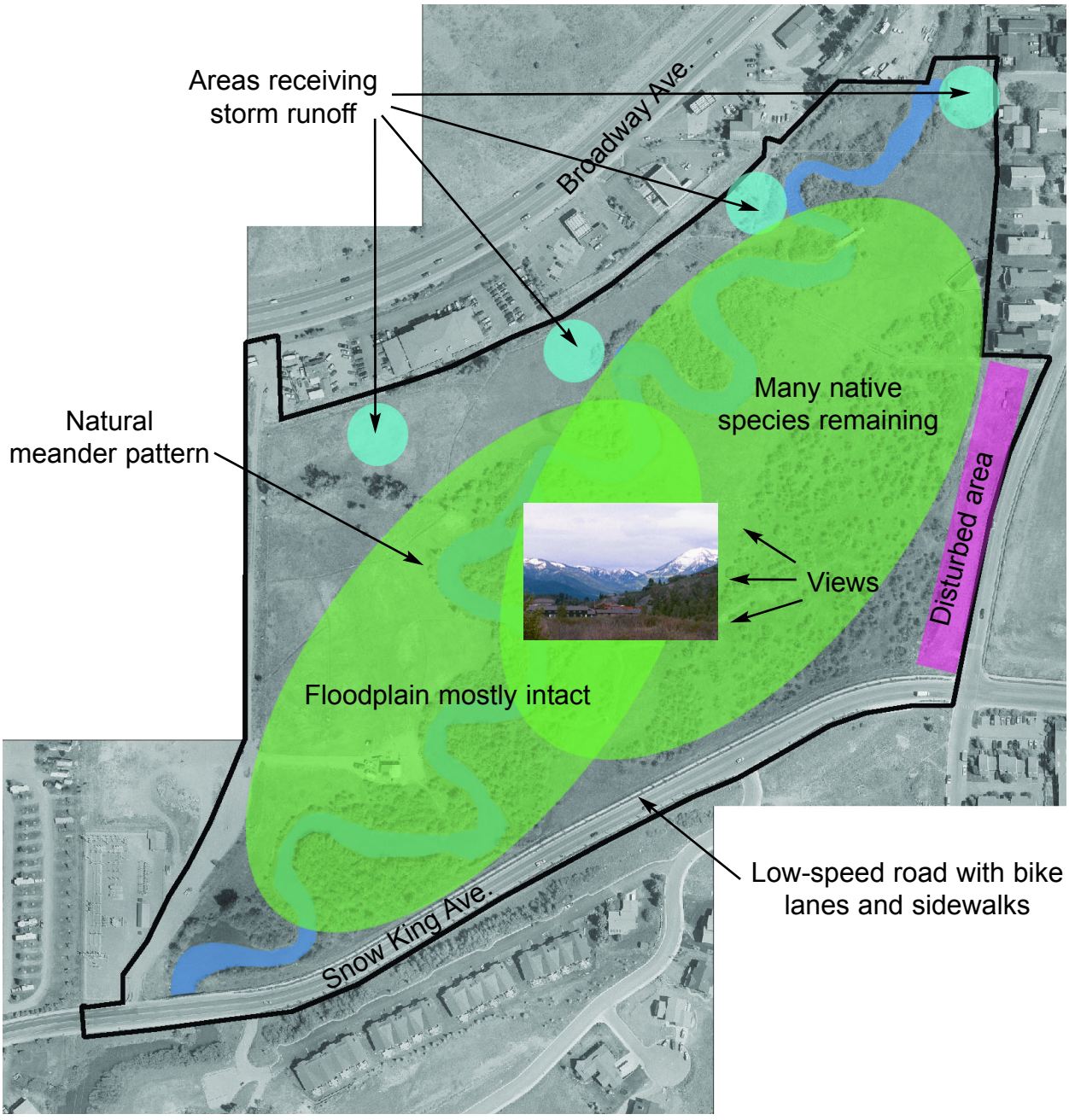


*Figure 3.22 Map showing composite analysis of Site B*

# CHAPTER 4

## CASE STUDIES OF SUCCESSFUL URBAN STREAM DESIGNS

This chapter focuses on three case studies: San Luis Creek in San Luis Obispo, California, The Boulder Creek Greenway in Boulder, Colorado, and The Blue River Walkway in Breckenridge, Colorado. These three projects were chosen because each of them had different key similarities to Flat Creek and also because they show positive examples of cities that have successfully reclaimed their urban waterways both as living ecosystems and as a vibrant part of community life. The creek walk along San Luis Creek runs through the heart of downtown and includes many restaurants, a thriving retail district, and a creative use of outdoor art installations, while the Boulder Creek Greenway is highly successful as both a paved recreational trail and a link between multiple areas of the city. The Blue River Walkway project includes a significant amount of ecological restoration and has now become both a cultural and recreational focal point for the city, with an award-winning performing arts venue and an urban whitewater park.

The following evaluation criteria were used for each case study:

- Similarities to Flat Creek
- How they addressed public access and visibility
- How they approached commercial areas
- How they handled recreation
- How they improved habitat and water quality
- How they addressed the bank
- How they dealt with property ownership issues
- How they secured funding and support for the project
- Long-term success of the restoration effort

## Case Study #1: San Luis Creek in San Luis Obispo, CA

*"For a planner, SLO (the local nickname) seems almost too good to be true. Consider these features: a downtown geared to pedestrians, a compact urban form, a strong university, clean and safe streets, free city bus service to the campus, a wonderful climate with an abundance of trees and flowers, and, just outside of town, a thriving viticulture industry."*

-William Siembieda

San Luis Obispo is located approximately halfway between San Francisco and Los Angeles, in a valley nine miles from the Pacific Ocean. Due at least partly to this relatively isolated location, it is a sort of "middle kingdom," where the old California lifestyle can still be found (Siembieda, 1998). The original settlements in California centered around 21 Spanish missions. Like other California towns, the city of San Luis Obispo grew up around the mission, which was at one time the centerpiece of the community. The mission building is approximately 200 years old and was constructed out of adobe bricks made by the local Chumash Indians for Father Junipo Serra (Siembieda, 1998).

San Luis Creek, which runs through downtown San Luis Obispo, CA, has become something of an icon for streams as they run through cities. It is interesting to note, however, that the project did not start out as a stream restoration. In fact, the project began with a controversial proposal to close the street in front of the historic Mission San Luis Obispo de Tolosa in order to create a pedestrian plaza there. In the debate over whether to close the street, the creek running along one side of the plaza was just a side issue. However, after the street was

*Figure 4.1 Fountain in Mission Plaza, with the historic mission on the right*

closed and Mission Plaza was created, pathways were eventually added along the creek to enhance the pedestrian experience. The walkway along San Luis Creek has now become a focal point for the city as well as a favorite gathering place for both tourists and residents.

Similarities to Flat Creek

San Luis Creek is similar in many ways to the current situation facing Flat Creek in Jackson, WY. Like Flat Creek, San Luis Creek was lined with a number of commercial properties, but the businesses were oriented with their back to the creek. In general, the creek was neglected, and as in the case of Flat Creek, it was so hidden that many people did not even realize it was there. The story of San Luis Creek is particularly useful as it provides an excellent example of how to successfully re-orient an existing commercial corridor in order to take advantage of its location adjacent to the creek.

Public Access and Visibility

The creek walk can be accessed either from Mission Plaza, or downtown from entrances along Broad St. or Nipomo St., two streets under which the creek flows. The walkway is popular

with both visitors and locals, providing an opportunity to stroll alongside the creek and discover the many art pieces, shops, galleries, and restaurants located along the water's edge.

San Luis Obispo has a vibrant, pedestrian-oriented downtown and the creek walk now provides a welcome space for play and relaxation in the heart of the city. The area is easily accessed either by car or by foot, and numerous bicycles as well can be seen resting along the walkway. Plenty of metered on-street parking and several nearby public parking lots accommodate cars without disrupting the pedestrian focus of the space.

*Figure 4.2 Paved walkway along San Luis Creek*

Like Flat Creek, the stream corridor here is not entirely commercial, since it does run past a small residential area close to the business district. Here planners chose to place the walkway on the far side of the creek from the homes. The houses along that section of the creek are very close to the water. Having the pathway on the other side of the creek at that point allows the residents to maintain their privacy while still enjoying close proximity to a major local amenity.

Commercial Areas

A variety of retail businesses and numerous restaurants line the creek. Some examples of the businesses that line the creek include a coffee shop, a gourmet kitchen supplies store, a candy shop, an art gallery, a toy store, a florist, and a shoe store. Not all of the businesses can be entered from the creek side, however. Some stores use the creek side door as an emergency exit only and still have their main entrance on the street. Yet these businesses still benefit from the extra visibility by having signage at the back, which provides a second place to advertise the store. Given the high number of people who use the pathway every day, it is likely that the creation of the creek walk has had a positive impact on businesses adjacent to the creek.

*Figure 4.3 Retail area with walkway extending out over creek*

In most areas, the pathway runs along both sides of the creek, providing maximum access to area businesses. Apartments and offices located above shops embrace concepts of mixed-use spaces and increase the number of potential customers for these commercial establishments. Other amenities such as pay phones and benches, some of which are built directly into the railing, make the space more appealing and convenient to use. Public restrooms located at

Mission Plaza are a good addition which is helpful for both tourists as well as retailers, since it means that businesses are no longer the only source of restrooms in the area.

Of all the businesses located along the creek, the restaurants make perhaps the most creative use of their ideal location. Many of the dining establishments have patios overlooking the creek and in some places, these patios, like the walkway itself, literally hover over the water's edge for a dramatic effect. The mild climate in the city makes dining outside appealing and practical. At least one restaurant has taken advantage of the topography by creating an attractive multi-level terrace full of outdoor tables for dining. Colorful umbrellas shading tables at some restaurants are reminiscent of the famous San Antonio Riverwalk.

*Figure 4.4 Outdoor cafe*

Recreation

The water in the creek is primarily an aesthetic amenity, offering visual relief from the urban environment as well as providing a relaxing sound backdrop. In some areas the steepness of the banks, as well as railings along the walk's edge, prevent direct access to the water In these areas, the creek offers more passive forms of recreation, such as wildlife observation. It is still enjoyable, however, and children eagerly lean over the gracefully arching pedestrian bridge to feed the fish. Several small, scattered areas of grass provide space for sunbathing and lounging. These tiny pocket lawns contrast well with the carefully landscaped planting beds and rocks

along the path. The walkways are too crowded to accommodate bikes and rollerblades; relatively narrow, curving paths, steps and high usage mean that the space is designed for pedestrians. Many people use bikes to get to the creek walk, but then they park them and walk once they have arrived. The pathway also provides connections between local points of interest, such as the San Luis Obispo Children's Museum, the Art Center, and downtown shopping. Interactive art, such as the spinning, round bronze sculpture entitled "Web of Life," creates places of discovery and opportunities for play.

Further upstream towards Mission Plaza, the water is more accessible and can be reached along a small stretch of sand, as well as from a path that is right next to the water as opposed to high above it, like the other walkway downstream. Large stepping stones placed in the creek allow a much closer experience with the water and introduce an element of exploration and challenge for children as well as adults. However, despite the tempting availability of the water here, signs along the creek advise users to avoid contact with it, citing elevated levels of bacteria from wildlife use as well as urban and agricultural runoff. The signs, combined with the inviting design of the water's edge, create a confusing situation and send a

*Figure 4.5 Children spinning the "Web of Life" sculpture*

mixed message. Despite the warnings, many people do wade in the creek and the decision whether to have contact with the water is left mostly to the discretion of the user. Perhaps if the city continues to focus attention on the creek, one day it will be clean enough that the signs will not be necessary.

*Figure 4.6 People playing music and enjoying the creek on a spring afternoon*

Habitat and Water Quality

This is an area which could have been better addressed in this project. The emphasis of the project focused more on integrating the creek into the urban environment and providing a local amenity for the community, rather than truly restoring the ecology of the creek. The designers were constrained, in part, by the fact that the stream channel was already relatively confined through the commercial corridor. With numerous buildings already located right next

to the edge, they faced a limited number of options. The commercial section of Flat Creek is limited by many of these same constraints. Habitat and water quality improvement is therefore not the greatest strength of the San Luis Creek project, although it is worth mentioning that simply by focusing more attention on the creek, the city has likely raised awareness of the local waterways in general.

However, the city of San Luis Obispo is committed to caring for its creek in other ways, and has established several programs which together work to protect the health of the creek. These programs focus primarily on greenbelt protection, land stewardship, natural history education, and environmental restoration. The city has even created a free brochure about caring for and restoring creeks, entitled "San Luis Obispo Creek Care." Such programs and publications encourage community members to become involved in caring for their local streams and serve to raise awareness of water quality issues.

One major obstacle standing in the way of habitat improvement is the fact that only a small portion of the creek is day-lighted as it runs through downtown. The day-lighted section extends approximately two blocks, while much of the rest of the creek is hidden in culverts as it moves through the rest of downtown. If less of the creek were underground, not only would habitat be improved, but the walkway itself could extend for a longer distance and create more useable green space in the city. The creek is also quite shallow in some areas, with some sections only a few inches deep. Despite these challenges, small fish and even ducks can be observed in the creek. Much of the art along the creek is also nature-oriented and pays tribute to local flora and fauna. One brushed stainless steel mobile for example, represents two types of fish found in San Luis Creek, including a threatened local native trout species.

Addressing the Bank

For a significant portion of the creek walk, railings separate users from the steep slopes leading down to the water. In addition to defining the pedestrian space, the railings are needed for safety as well, since they keep pedestrians from falling down into the creek. In some places the water is about 15 or 20 feet below the level of the walkway. The steepness of the banks is likely the result of years of erosion. A wide variety of bank treatments have been used in the design, including vertical concrete walls, stone walls, gabions, and the natural stream edge. The steeper walls are less than ideal ecologically, since they do not allow the creek to meander as it would in nature, however, the designers were constrained by the existing buildings. Green erosion control matting and brown natural fiber matting have been used on some of the landscaped slopes that line the creek. The materials used along the bank of this creek are not always as visually appealing as they could be. For example, green chain-link fencing is used on one slope. Overall, the area could benefit from a more unified approach to the banks.

*Figure 4.7 Stone wall and café along the bank*

Property Ownership

Most creeks in California are not public, and the creek bed is often considered private property. In this particular situation, creating public access can be a challenge. Generally, in order to construct a pathway along a creek in California, it is necessary to first either buy the rights or get

easements in order to construct the project. In the case of San Luis Creek, the city was able to obtain an eight-foot easement from adjacent property owners that allowed them to build pedestrian pathways along the creek. This could be a potential strategy for Flat Creek and may be something that the town of Jackson should investigate.

Funding and Support for the Project

The realization of this vibrant and successful pedestrian space is largely due to the work of Kenneth Schwartz, a former architecture professor at California Polytechnic State University. He is well-known for his role in reviving the city's downtown, now considered one of the best small downtowns in California (Fulton, 1997). In the 1960's, at the time of the controversy over the street closure, the downtown area of San Luis Obispo had become neglected and shabby. The creation of Mission Plaza and subsequent creek restoration ultimately served as a catalyst for economic revival in the downtown.

Ironically, the people who had the most to gain from the creation of Mission Plaza were originally the most vocal opponents of the project. Downtown merchants strongly opposed the street closure, worried that it would adversely affect their businesses if cars could not park directly in front of their establishments. However, Schwartz, who was a city planning commissioner at that time, organized a popular movement in favor of the street closure. The debate culminated

*Figure 4.8 View showing where street was closed*

in a still-famous meeting at which members of the city council changed their minds and voted to close the street (Fulton, 1997). As Schwartz recalls, "It was amazing to see. The next day they closed the street" (Fulton, 1997). Schwartz later led a volunteer movement to clean up the creek and to begin landscaping the area. As can be seen today in the lively shopping district lining the creek, the fears of the merchants never materialized and the area is now a strong commercial space. Following the success of that initiative, Kenneth Schwartz was then elected Mayor in 1969, ultimately serving five terms, during which time he continued to improve the city's already strong pedestrian orientation.

Long-term Success

It is useful to look at the San Luis Creek project within the larger context of the entire community. Just as the creek restoration itself grew out of the original plan to close the street and create Mission Plaza, the efforts with both the plaza and the creek later led to other significant improvements aimed at making the city more pedestrian-friendly and more livable in general. Some of the city's other actions included burying utility wires, planting street trees, and establishing a sign-control ordinance to reduce overly large or visually distracting signs. Ultimately, by closing the street and enhancing the creek corridor, the city government demonstrated its commitment to maintaining a viable downtown. As a result, the city has been fortunate enough to avoid much of the urban sprawl that plagues the majority of communities today.

## Case Study #2: Boulder Creek Greenway in Boulder, Colorado

*"A sports mecca, Boulder is one city in the United States where the number of bicycles and the number of residents are roughly the same (93,000)."*

- Doug Rennie

Numerous publications have recognized Boulder recently as a great place to live. *Outside* magazine ranked them the number-one sports town in America, *USA Today* named them number one on their list of America's "50 Healthiest Places to Live," and *Money* magazine called Boulder the "Best Medium-Sized U.S. City" (Rennie, 2004). All of this recognition and praise is due in part to the city's approach to open space and recreation. Many people are attracted to Boulder for the high quality of life there. The city's extensive trail system and dedication to protecting natural resources plays a large role in creating this quality of life. A haven for outdoor enthusiasts, Boulder is one city in the United States where the number of bicycles and the number of residents are roughly the same: 93,000 (Rennie, 2004).

Boulder, Colorado lies just to the east of the Rocky Mountains. With such a striking backdrop, it is difficult to imagine that this city would be facing environmental problems such as declining wildlife populations and degraded water quality; yet it is. The city of Boulder has experienced a dramatic increase in population- from 20,000 in 1950 to 90,000 today; and this has strained the region's natural resources ("Boulder, CO Case Study," nd). In an effort to ameliorate the situation, the city has established an extensive open space protection program and begun to focus a significant amount of attention on protecting water resources as well. With

regard to water quality, the three main areas city officials have been working to improve are: buffering riparian corridors in rangeland, restoring Boulder Creek, and improving flood control.

The Boulder Creek Corridor Project, completed in 1987, created a continuous path along the entire length of Boulder Creek. This path was originally designed to serve as a flood mitigation measure, as well as a linear urban park and a transportation route. The Boulder Creek Greenway follows Middle Boulder Creek from Four Mile Canyon on the western end to Arapahoe Road on the east, providing connections to several city parks, a kayak slalom course, fishing ponds, a sculpture garden, the public library, Colorado University, a fish observatory and classic cottonwood groves along its seven-mile stretch. As a result of its immense popularity, the trail can sometimes be congested, and speed limits for bikers are posted in certain areas. Other key elements of the project included restoration and enhancement of wetlands and wildlife habitat (Noble, nd).

Similarities to Flat Creek

Like Jackson, Wyoming, the city of Boulder is located at the base of a majestic mountain range and hosts a resident population that is extremely active. Both cities are tourist destinations and attract people who enjoy a wide variety of outdoor activities. Geographically, the two communities are similar in that both are relatively high-altitude western towns. Another important similarity is that one of the goals of the Boulder Creek Restoration was to improve trout habitat, which is one of the major concerns facing the Flat Creek as well.

Public Access and Visibility

Beginning at Eben G. Fine Park at the base of Boulder Canyon, the Boulder Creek Greenway runs seven miles along the creek all the way to Fifty-fifth Street on the east side of town. A network of other paths connects to this main trail, allowing for easy access from most parts of the town (Casewit and Raney, 2003). On the west side of the city, the trail follows Boulder Creek part of the way up Boulder Canyon, becoming a dirt path before it ends.

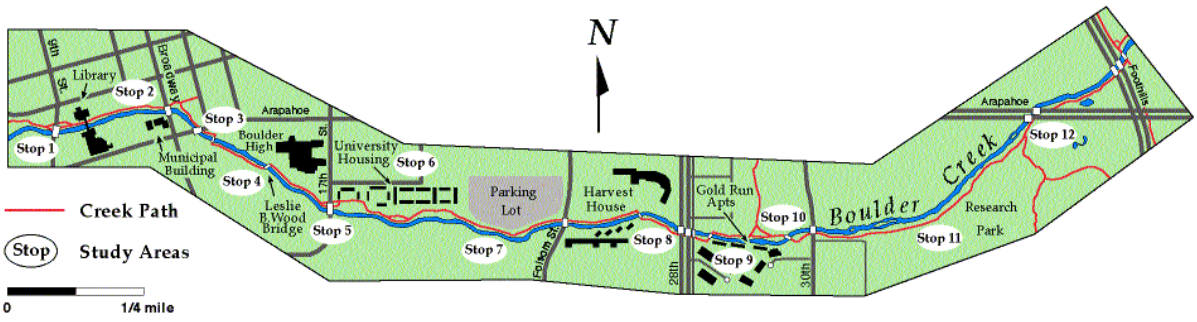


*Figure 4.9 Map showing Boulder Creek Greenway through town (www.colorado.edu)*

All along the Boulder Creek Greenway, unusual design details reflect the unique heritage of the site. One example is the statue of Chief Niwot, a tribute to the Arapahoe Chief who welcomed the white pioneers in 1859, who were astonished when he greeted them in English, offering them cigars and a peace pipe. Noel comments that "his hospitality was poorly repaid: he and some of his tribe were slaughtered five years later at the Sand Creek Massacre" (Noel, 2004). Another highlight is a series of four plazas featuring nature-inspired details such as leaf benches in one of the plazas, placed to take advantage of views of the creek. The third plaza in the series draws its inspiration from a nearby pond, incorporating impressions of lily pads and native cottonwoods into the pavement.

Commercial Areas

Although the Boulder Creek Greenway is a large project that goes through several different types of neighborhoods, the trail does not incorporate a distinct commercial district as is the case in other cities such as San Luis Obispo. The focus of this peaceful, wooded pathway is more on recreation rather than retail. However, it does provide connections between numerous points of interest in Boulder, such as Eben G. Fine Park and the Boulder Public Library. It also links up to an entire network of smaller greenway trails that follow the tributaries to Boulder Creek, offering an opportunity for people to take advantage of it as a corridor for alternative transportation such as biking and walking.

Recreation

The Boulder Creek Greenway is ideally suited for a variety of recreational activities, including biking, walking, jogging, and rollerblading. Underpasses at every intersection allow users to enjoy the path without interruption since they do not have to stop for road crossings (Casewit and Raney, 2003). This design feature adds to the safety of the trail by minimizing conflicts between automobiles and pedestrians. It also creates a more visually satisfying experience by distancing the trail user from the noise and distraction of passing cars. Other highlights of the greenway trail include xeriscape gardens, a trout observatory, and a fishing pond created specifically for children.


*Figure 4.10 Sign for trout observatory (www.colorado.edu)*

Habitat and Water Quality

Development along Boulder Creek had degraded riparian and aquatic habitat, in addition to seriously altering the flow of the creek by restricting its channel. In an effort to mitigate these problems, the new greenway includes structures designed to reproduce the natural pattern of riffles and pools. The city also narrowed and deepened the channel, which allows it to flow more quickly and carry more sediment ("Boulder, CO Case Study," nd). As a result of restoration efforts, trout populations in the creek have increased and wildlife habitat in general has improved ("Boulder, CO Case Study," nd).

*Figure 4.11 Steps leading down to trout observatory (www.colorado.edu)*

Outside the city, another major issue facing Boulder Creek was the ecological damage caused by livestock grazing, since the creek passes through the center of several ranches. Livestock can cause significant stream bank erosion and stream bed disturbance if they are allowed regular access to streams. Fortunately, Boulder imposes guidelines on ranchers who lease rangeland space from the city ("Boulder, CO Case Study," nd). These regulations are intended to protect water resources by keeping the animals away from riparian vegetation and the steep slopes associated with streams. Another ecological problem associated with

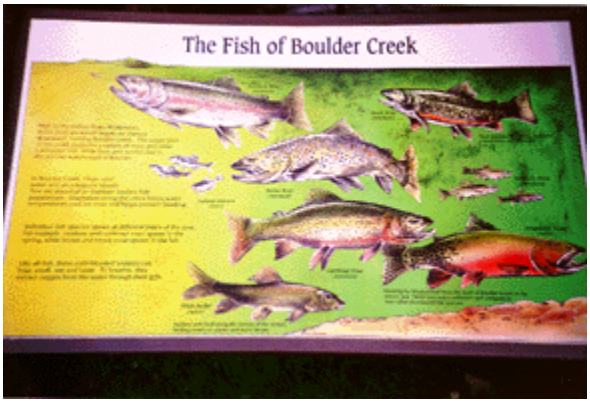


*Figure 4.12 Educational signage (www.colorado.edu)*

livestock grazing is the introduction of invasive plant species, such as Canadian thistle, knapweed, and cheat grass. The city encourages practices that mimic the grazing patterns of bison, which were the area's original occupants, in order to prevent overgrazing and discourage exotic species ("Boulder, CO Case Study," nd).

How they Addressed the Bank

Within town, uncontrolled recreation along the creek had also been causing erosion and damage to the banks. The city was able to solve this problem by concentrating recreation on paved bicycle paths which are set back from the stream's banks. These paved pathways are now ideal for many forms of recreation, including biking, rollerblading, jogging, and walking.

Stream restoration efforts in Boulder were not limited to the downtown area only. The city has also spent more than $1.4 million so far on efforts to improve water quality in the 15.5 mile section of the creek downstream from the city (US EPA, 1992). This stretch of water was suffering from degraded physical habitat, high water temperature, high pH, and ammonia toxicity problems stemming from the municipal wastewater treatment plant. The restoration techniques used in this case reduced potential wastewater treatment costs significantly, since the other, more expensive alternative would have been to build a nitrification tower at the plant.

*Figure 4.13 Paved bike trail along the Boulder Creek Greenway (www.ci.boulder.co.us)*

The city's engineers and scientists realized that plant upgrades alone would not return the creek to a viable biological condition, and therefore included plans to restore the stream's physical integrity as a major component of their program. The restoration treatments they used for Boulder Creek included stream bank stabilization, restoration of riparian vegetation, development of pool habitat, narrowing/deepening the channel, returning natural sinuosity, restoring wetlands habitat, and re-routing irrigation return flows through developed wetlands (US EPA, 1992). Many of these techniques could be useful for restoring the ecological health of Flat Creek as well.

Property Ownership

Future goals of the Greenways Program include creating more paths along the tributaries to Boulder Creek and providing additional connections to on-street bicycle routes. The Master Plan for the program takes into account strategies for land acquisition, which include easements and right-of-way purchases (Noble, nd).

As is the case with Flat Creek in Jackson, Boulder Creek caused property damage and became a nuisance when it flooded. The city of Boulder took a radical approach to solving this problem by actually purchasing and removing forty-seven buildings that were located in the floodplain. Having the buildings gone will allow the city to lower the flood plain in that area by two to three feet, which will increase its capacity to hold water during a flood ("Boulder, CO Case Study," nd). Since the stream will normally remain in its banks the majority of the time, this additional open space can simply be used for recreation at times when it is not flooded. By re-creating the floodplain, and allowing for the natural flood storage capacity of the landscape, the city has gone to the root of the problem and found an effective way to prevent future damage.

Funding and Support for the Project

The Boulder Creek Greenway is maintained jointly by both the City Public Works Department and the Parks and Recreation Department. For any greenway, it is important to know from the beginning who will be responsible for maintaining the trail. As can be seen in the case of Boulder Creek, greenways often have numerous economic benefits for communities, including job creation and maintenance expenditures that contribute to local economies. For example, landscape maintenance carried out on the greenway by the Parks and Recreation Department in Boulder generates annual expenditures of $6,000 for salaries and $3,000 for services and supplies *per mile* of the trail (National Park Service, nd). The managing agency for a greenway has the opportunity to support the local or regional economy when purchasing the supplies and services needed to develop, maintain, and operate the pathway. The community in which the greenway is located generally benefits most when supplies and services are purchased from local businesses.

Long-term Success

With carefully considered designs, the city of Boulder has used greenways to enhance water quality while at the same time providing recreational opportunities and improving wildlife habitat. It is interesting to note that not all of the restored land is publicly owned- some of the restoration projects occur on land protected by easements ("Boulder, CO Case Study," nd). The county is also encouraging private landowners to manage their riparian areas in a similar way in order to protect the creek. The Boulder Creek Greenway contributes significantly to the quality of life in the city by offering a convenient and attractive corridor for recreation, in addition to providing an unusual and educational way for visitors to explore Boulder.

## Case Study #3: Blue River Walkway in Breckenridge, Colorado

*"The entire area had been mined, and the fines washed downstream. It was mined so much; it was like a big sieve. It just wouldn't hold water."*

-Bill Wenk

Breckenridge was founded during the Gold Rush of the mid 1800's and is one of Colorado's oldest towns. The community was established in 1859 when a group of miners first discovered gold in the area and Breckenridge grew quickly as other miners came in the hopes of striking it rich. At the height of the mining, more than $30 million in gold was taken out of the region (Casewit and Rainey, 2003). The mines eventually played out and resourceful community members later found a new gold mine in the form of tourism, when the county's first ski area opened in 1961. Even today, many of the ski slopes are still named after old mines, reflecting the significance of the town's colorful history. Community pride runs high in this city, with many locals fondly referring to their town as the "Kingdom of Breckenridge" (Robinson, 2002).

Unfortunately, the gold mining that gave Breckenridge its ambitious start also wreaked havoc on natural resources of the area. Techniques such as placer and lode mining resulted in huge piles of rubble which accumulated along the Blue River and other local waterways. These processes eventually came to a halt in 1942, but by that time, fifty years of dredging had not only left unsightly piles of rock in downtown Breckenridge, it had also caused the disturbed river bottom to become so porous that almost all of the water in the Blue River seeped below the river

bed, except during spring runoff. In essence, the river running through the center of downtown had sunk out of sight.

All of this changed in 1993, when work began on the Blue River Walkway. The project began as a continuation of a reclamation project completed three years earlier on a different section of the river further downstream. The first reclamation project had been such a success and had received such a positive response from both residents and visitors that the town decided to reclaim the river as it ran through the heart of downtown. The design approach for the new Riverwalk was much more urban than the earlier downstream reclamation project, and the town sought out the expertise of Denver-based firm Wenk Associates, Inc to guide them through the restoration process.

*Figure 4.14 The Blue River in downtown Breckenridge BEFORE restoration (Courtesy of Wenk Associates)*

*Figure 4.15 The Blue River in downtown Breckenridge AFTER restoration (Courtesy of Wenk Asssociates)*

Similarities to Flat Creek

The Blue River site in Breckenridge, Colorado shares several features with Flat Creek in Jackson, Wyoming. Like Flat Creek, the Blue River was neglected by the town, despite the fact that it ran through the heart of downtown. Another important similarity is that the river in Breckenridge runs behind the main street, with commercial buildings backing onto the waterway, as they do along Flat Creek in Jackson as well. Also, although the waterway in Breckenridge is called the Blue River, it is actually relatively small compared to other rivers and therefore is not vastly different in size from Flat Creek. The Blue River, like Flat Creek, is a valued fishing resource. Despite the damage from years of mining and population growth, the Blue River is still prized as a gold medal trout stream.

Jackson, Wyoming and Breckenridge, Colorado are similar in that both communities are high-altitude western towns with thriving tourism industries. Both towns are prime destinations for skiing and other snow-related sports in the winter. In the summer, Breckenridge, like Jackson, attracts visitors looking to explore an Old West frontier town in a beautiful setting. Both communities are also fortunate enough to have a resident population that tends to be very involved in community affairs, such as environmental resource protection and preserving the unique local heritage.

*Figure 4.16 A rollerblader trains for ski season along the Blue River (Courtesy of Wenk Associates)*

Public Access and Visibility

One of the main focal points of the Blue River Walkway is the Riverwalk Center, an award-winning performing arts venue used for events such as the Breckenridge Music Festival. This 800-seat, radiantly heated amphitheatre is covered in the summer by a tent structure and is surrounded by a landscape design featuring native plants. The seasonal tent structure- reminiscent of the Denver International Airport with its sweeping, twin-peaked form- is erected each spring and then dismantled in the fall. An adjacent outdoor terrace and 9,500 square foot permanent building provide additional space. The area is popular with both visitors and residents as a beautiful setting for picnics, special events, or simply relaxing along the banks of the river. In addition to the Riverwalk Center, the area also includes a park and a downtown river walk. The walkway not only gives pedestrians access to the Blue River, it is also the southernmost extension of a 40-mile paved trail connecting the towns of Breckenridge and Vail (DeWall, nd).

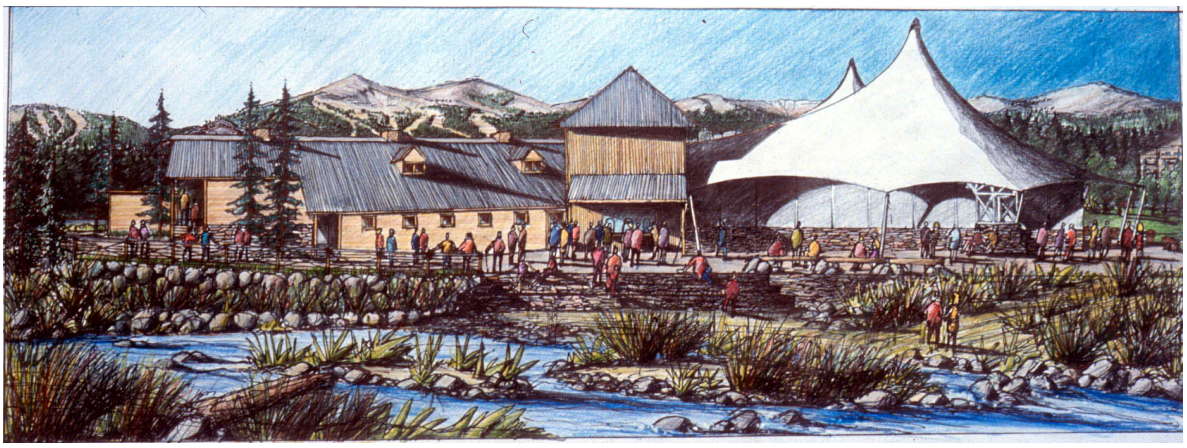

*Figure 4.17 Design drawing showing new Riverwalk Center (Courtesy of Wenk Associates)*

Commercial Areas

The Blue River runs parallel to Highway 9 through Breckenridge, and also the town business district. Fred A. Mueller, a stone supplier involved from the earliest stages of the project, comments that "when the town of Breckenridge approved its dynamic plans for revision and expansion, the priority item of their plan for the downtown area was the Blue River" (Robinson, 2002). He goes on to add that "the Blue River was determined to be central to the downtown plan, so enhancing its attractiveness, as well as controlling its erosion capability required serious consideration, technical engineering skill, and proper timing" (Robinson, 2002).

*Figure 4.18 Downtown retail district next to the Blue River (Courtesy of Wenk Associates)*

The river runs through the heart of the commercial district, with shops, grocery stores and even a post office along its banks. Before the restoration project, the banks had a slope of 1:1, which created a dangerous situation for anyone trying to get down to the river's edge. Since the river runs through such a busy commercial area, safety was a top concern and the planners took this into account when they re-designed the area to be more accessible to people. Most of the Blue River Walkway was also

*Figure 4.19 Relaxing on the stream bank next to the Riverwalk Center (Courtesy of Wenk Associates)*

finished in about six months- just one construction season- thereby minimizing any disruption to the surrounding business district.

Recreation

Another innovative highlight of the Blue River is an urban whitewater park which opened in the spring of 2001. This playground for kayakers is similar in concept to other popular whitewater parks in Colorado, such as ones in Boulder, Vail, and Golden. At 1,800 feet, the park is now the longest whitewater kayak park in the state and is open free of charge roughly from April to August (DeWall, nd). Colorado-based designer and builder Gary Lacy used scores of boulders up to six feet in diameter to cerate a series of formations intended to mimic features found in free-flowing rivers, such as holes, drops, and waves (Berwyn, 2001). Paddlers can then use the current to stand their boats on end, surf, or do other maneuvers. The park provides a safe and convenient location for boaters of all levels to learn kayaking skills.

*Figure 4.20 Children playing on rocks at the Riverwalk Plaza (Courtesy of Wenk Associates)*

Kayaking and rafting are one of the fastest-growing segments of the outdoor recreation business and have the potential to boost local economies. As an example, a recent study of the urban whitewater park in Golden, Colorado found that the park, built at a cost of $165,000, pumps between $1.4 million and $2 million into the local economy each year as a result of equipment sales and other factors (Berwyn, 2001). Enjoyment of parks such as this is hardly

limited just to paddlers, however. As Lacy points out, "a lot of the action is on the riverbanks. It creates access and becomes a place for people to sit and have picnics" (Berwyn, 2001).

Habitat and Water Quality

Efforts to restore the Blue River actually began in 1985 with a reclamation project downstream of Breckenridge. A main component of this earlier project consisted of removing the dredge materials that had accumulated in the channel during years of mining in the past. In addition, wetlands were incorporated wherever possible and the shape of the river channel was adjusted and stabilized. Both residents and visitors reacted positively to the project and the Town was so pleased with the results downstream of the city that they next decided to reclaim the river in the heart of downtown, which is how the Blue River Walkway project got its start in 1993.

The Riverwalk project has transformed what was once a heavily degraded portion of the Blue River into a living river system. The restored vegetation along the river's edge, in addition to improvements within the channel itself, has helped to re-establish habitat for wildlife, including birds, trout, beavers, and other native species (National Urban River Awards, 1997). Work on the Blue River continues today with a multi-agency team that is focusing on improving habitat conditions for fish. One of their main goals is to develop and maintain spawning beds, resting areas, and places which offer cover from predators.

How they Addressed the Bank

Although erosion control was part of the overall plan, the project actually went well beyond that since the designers also had to deal with the unusual problem of a river that had

*Figure 4.21 Local stone was used to improve bank stabilization and access (Courtesy of Wenk Associates)*

simply sunk out of sight in all the rubble. Bill Wenk comments that "the Breckenridge project goes beyond erosion control, in that the river was a ditch that disappeared in the mined-out cobble through town" (Robinson, 2002). Former City Engineer Don Nilsson compared the river to a bathtub filled with marbles and described the water as being visible for only a short time each year, typically after the mountain snow melted (Robinson, 2002). Before beginning the restoration, the city had to get a permit for stream stabilization from the Army Corps of Engineers. Next they literally raised the river to the surface by installing a PVC liner in the portion of the river that ran through downtown. Because the PVC liner was installed under dry conditions, they had to re-route the stream around the work during construction of the project.

Once the channel was lined, crews were able to start work on the rest of the Blue River Walkway. The stretch of river running through town had been eroding its banks for a long time. Therefore, retaining walls and rock slabs were used to strengthen the banks and prevent erosion. The designers chose the materials carefully so that they would enhance the aesthetics of the space in addition to their practical purpose, going well beyond traditional riprap techniques. The lined portion of the channel is about a quarter of a mile long and includes a large, open town square where the river widens to about 300 feet. In other areas, it narrows to 75-100 feet as it flows between existing properties in the commercial district (Robinson, 2002). The main area,

within and around the Riverwalk Center, was actually just a parking lot before the project began. It is now one of the highlights of downtown Breckenridge.

Other significant points of interest relating to the banks include the benches and step areas, which were widened to provide better access to the river and a more natural view of the stream (Robinson, 2002). Rock slabs of various sizes- some weighing up to eight tons- were set in place meticulously using a hydro-excavator with a thumb attachment. Fred Mueller of Siloam Stone says, "It was determined that the Dakota formation sandstone found in south central Colorado was best suited for the project. Large slabs approximately eight feet by six feet by eight inches were dry stacked to the predetermined height. This offered the desired natural decorative effect, solved the erosion problem, and furnished the retaining wall requirements for the future building construction plans along the now-extremely-attractive waterway" (Robinson, 2002). He also adds that the dry-stacked sandstone slabs have the further benefit of permitting runoff from melting snow and rain to filter through the stone slabs without disturbing the wall (Robinson, 2002).

Property Ownership

At least eighty percent of the lands in the Blue River watershed are publicly owned and administered, including lands managed by the US Forest Service, the Bureau of Land Management, Summit County, and the Towns of Blue River, Dillon, Frisco, Silverthorne, Kremmling and Breckenridge (Finn, nd). However, the Blue River also flows through the fastest growing region of Colorado- a region growing at twice the rate of the state as a whole- and because of this, the river has been physically degraded over time and is currently the focus of on-going restoration efforts aimed at improving wildlife habitat and water quality (Finn, nd).

Funding and Support for the Project

The Blue River Walkway was funded primarily by the city as part of its plans to improve the downtown area. The Riverwalk Center cost approximately $3 million to build and opened for its first season in 1993 (DeWall, nd). The inspiration for the whitewater park came from members of the local paddling community, who approached town officials with their idea. After the project was pushed through the planning process in record time, the town spent $170,000 to plan and build the park (Berwyn, 2001). The habitat restoration projects both within and outside of town, however, are the result of a collaboration between numerous governmental and non-profit agencies. Some of the agencies participating in the Blue River Restoration Project include six municipal governments, two county governments, the Bureau of Land Management and the White River National Forest (Finn, nd). As is the case in Jackson, the local Trout Unlimited chapter and an area land trust are also involved in restoration efforts along the river.

The Town of Breckenridge chose to support a regional business by purchasing all of the boulders and rock materials used in the construction of the Blue River Walkway from Siloam Stone, which is based in Canon City, Colorado. Not only did this reduce transportation costs involved in shipping the stone, it also provides an example of how greenway development can contribute to the local economy. Even the choice of rock, a type of sandstone found in south central Colorado, shows a commitment to creating a river walk that is uniquely "of the place."

Long-term Success

Uncovering the Blue River and creating the river walk was a major undertaking, yet it appears to have been well worth the effort. The Town of Breckenridge has made a commitment to supporting a vibrant downtown area and also to protecting their ecological resources. This is evident in the fact that they were willing to spend approximately $6.5 million to restore the downtown portion of the river and also to create the Blue River Walkway and adjacent Riverwalk Center. This area has now become a focal point for the city, offering both recreational and cultural opportunities, as well as being an enjoyable space for people to gather in. By making the river accessible to pedestrians, they have also raised awareness of water quality issues and the value of protecting local water resources.

*Figure 4.22 The Riverwalk Center draws crowds on a beautiful summer day (Courtesy of Wenk Associates)*

Summary of Case Studies

The case studies explored in the previous chapter- all widely different in approach- offer many useful insights for dealing with the issue of Flat Creek in Jackson, Wyoming. Based on the evaluation criteria, some projects were stronger in certain areas than other projects. The following summary highlights selected ideas and principles from these projects which can be

applied the site in Wyoming, while the matrix below shows which cities offer the best examples of successful approaches in each category.

*Figure 4.13 Matrix showing which cities offer the best examples of successful approaches in each category*

| | BOULDER | BRECKENRIDGE | SAN LUIS OBISPO |
|---|---|---|---|
| Public access and visibility | ● | ● | ● |
| Commercial areas | ● | | |
| Recreation | ● | ● | |
| Habitat and water quality | ● | ● | |
| Addressing the bank | | ● | |
| Property ownership | ● | | ● |
| Funding and support | | ● | ● |

**Public Access and Visibility**

All three of the projects excelled in this area. In Boulder, an extensive network of connections and tributary greenways provides bike and pedestrian links to many areas of the city. This is a concept that would be useful to keep in mind for Jackson, since a large number of residents enjoy biking there, especially in the summer, and the relatively flat topography also helps make it a viable transportation option. In particular, the focus in Jackson should include strengthening and expanding connections between existing bike and pedestrian trails.

One of the greatest strengths of the San Luis Creek Walk is as a space for people. The fact that the pathway can be easily accessed from many road crossings is something to strive for

in Jackson, as well, with Flat Creek. Also their imaginative use of nature-inspired outdoor sculptures gives character to the space and raises awareness of local ecology. Art such as this would be a positive addition to a creek pathway in Jackson too.

The Blue River Walkway project succeeded in re-designing the river's edge so that it was no longer a steep, hazardous slope and instead made it accessible for people to enjoy. This is an area which needs to be addressed for Flat Creek as well. Although not all of the banks along Flat Creek are steep, access to the creek is very limited at the moment and prevents people from enjoying it as a valued natural resource. Also, the incorporation of a performing arts facility and outdoor gathering space at the Blue River Walkway is an interesting concept which could be pursued on a smaller scale for Flat Creek. Most likely, a simple plaza for outdoor events would be a more practical option there, rather than a large performance facility, given the lack of available space.

**Commercial Areas**

Many towns have historically grown in such a way that a main retail street runs in front of the local stream or river- this is a fairly common orientation seen in many communities and is certainly the case in both San Luis Obispo and Breckenridge. Of the three case studies, San Luis Obispo perhaps has the most to offer as far as lessons in re-orienting an existing commercial district in order to take advantage of the creek. Many of the businesses there have added a second entrance which can be accessed from the creek walk. This means that they have increased their pool of potential customers by drawing people into their shop or restaurant from both the front and back of the building. Even the stores that do not have a true entrance on the creek side of the building have taken advantage of the location to advertise with signage and

direct customers to the front entrance. All of the concepts could easily be applied to the commercial district along Flat Creek, providing additional customers and strengthening businesses. It is also useful to examine the way the restaurants have capitalized on their ideal location by creating shaded patios, dramatic overhangs, and even multi-level terraces overlooking the creek. These strategies not only provide them with extra outdoor seating space, they also give the dining establishment a unique feature that makes them stand out from other restaurants downtown. The small restaurants and delis along Flat Creek could also benefit from incorporating outdoor patios and taking advantage of their unique and scenic location along the creek.

**Recreation**

The urban whitewater park in Breckenridge is an innovative feature that expands the recreational potential of the river by creating a space for activities that occur *on* the water, rather than simply just next to it on the banks. Many urban greenways consist of only a trail running alongside the water's edge, yet areas which incorporate some type of water-based recreation such as this create additional opportunities for people to enjoy and appreciate the local waterway. In Jackson, this concept of water-based recreation could be applied to tubing, rather than kayaking, since Flat Creek is smaller than the Blue River. Many people already enjoy floating down Flat Creek in the summer, but conditions along the creek could definitely be improved to make tubing both safer and more enjoyable.

In Boulder, the paved pathways are ideal for biking and this approach would be useful in Jackson starting in the area of Karns Meadow. A pathway along the businesses downtown might be too compact and full of people to allow bikes, but as the trail moves away from downtown, it

would be good to establish a link to existing pathways and bike routes, just as the city of Boulder has done. In this way, the town of Jackson could follow Boulder's example by creating an extensive network for alternative transportation options.

**Property Ownership**

In dealing with the issue of property ownership, it is useful to look at how the city of San Luis Obispo was able to create their creek walk in the midst of privately owned commercial buildings. Primarily, they were able to create the walkway by obtaining an eight foot easement from the property owners which allowed the city to construct and maintain a pathway along the bank. This was accomplished partly by convincing the business owners that the pathway would draw people to the space and ultimately increase their business. That strategy was very successful in San Luis Obispo, and could be a good approach for Flat Creek too, since the creek in Jackson flows past mostly private properties as it moves through downtown.

The city of Boulder also employed some interesting techniques in their efforts to improve the water quality of Boulder Creek. Most notably, they made a decisive and highly effective move to prevent damaging floods by purchasing and getting rid of 47 buildings that were in the floodplain. In essence, they were acknowledging that previous development had been misguided and located in the wrong place, but unlike most other cities today, they actually took action to correct these mistakes rather than simply accepting the current situation. This is a useful concept that could definitely be applied to Flat Creek, particularly in the downtown area where commercial development years ago was allowed to encroach within several feet of the water, since it was built before the stream buffer regulations of today were in effect. Specifically, this might mean finding creative ways to adjust existing parking lots and other development so that

the impervious areas are moved farther from the creek. In addition, all of the cities have worked with private land owners on water quality issues in general, and this will also be an important strategy to include as part of the overall plan for Flat Creek.

**Habitat and Water Quality**

The Blue River Restoration Project incorporates many techniques which can also be applied to Flat Creek. Like Flat Creek, the Blue River is prized for trout fishing, so improving fish habitat has been a top priority. Some of the methods they have employed along the Blue River include restoring native vegetation along the banks, adjusting the river channel itself, and including important features for fish such as spawning beds, resting areas, and cover from predators. It is also significant to note that this extensive project is not being carried out by just one agency; rather it is the joint effort of several different governmental and non-profit organizations. Fortunately, in Jackson, there are also a number of different agencies involved in the protection of Flat Creek, ranging from Trout Unlimited and the Land Trust to the Town of Jackson, and this attitude of cooperation will be essential to accomplishing any habitat restoration goals along the creek.

**Funding and Support for the Project**

In all three cases, most of the funding for the projects came from the city governments. However, critical support for the initiatives came from a variety of sources. For example, in Breckenridge it was members of the local paddling community who went to the town council with their request for an urban whitewater park. In San Luis Obispo, the movement to create Mission Plaza- and subsequently the creek walk itself- came largely from one passionate and

inspired community leader. Former architecture professor Kenneth Schwartz, sometimes called the "Father of Mission Plaza," is famous for his role in getting the project started. All of this means that involved citizens can have a tremendous positive impact on their communities, and that by including their voices in the discussions, residents can help decided the physical form of their own cities.

Additionally, as was demonstrated in the case of Boulder, greenways can benefit local economies both through job creation and as a result of money spent on maintenance, supplies, and services or purchases related to recreational activities. Using local businesses for construction whenever possible, as in the case of Breckenridge, where the stone supplier was from the same region, puts money back into the local economy and contributes to community pride. For Flat Creek, this means that although much of the funding for the project may come from the town, it will be crucial to have significant community support and involvement on the project in order for it to succeed. By collaborating with local non-profit agencies and focusing on benefits to local businesses as well as residents, a pathway along Flat Creek can become a successful addition to the town.

**How they Addressed the Bank**

In Breckenridge the design team was able to modify the bank for both safety and access. These issues are also important for Flat Creek, where access is currently limited and could be improved by creative design treatments along the bank. It is also interesting to note how the stone in Breckenridge was stacked in such a way as to accommodate runoff while at the same time being an attractive and useful retaining wall featuring local stone. Boulder also provides a positive example, by carefully locating the paved trial far enough from the bank so that it would

minimize any damage to riparian vegetation. Despite the steep walls along the bank in San Luis Obispo, it is admirable what the city has been able to accomplish within such a restricted space. One of the most unusual and creative features are the restaurant patios which, at times, actually hover above the water on patios which project out from existing buildings. The lesson there is that even in a small space, it is often possible to still take advantage of the creekside location through the use of creative spatial arrangements and innovative design solutions. Specifically, many of the restaurants and inns along Flat Creek could also enhance their appeal by adding patios or decks facing the creek.

# CHAPTER 5

# DESIGN PROPOSAL AND RECOMMENDATIONS

This chapter offers a new vision for Flat Creek, beginning first with a Master Plan for the entire area covered by both sites, and then focusing in detail on the commercial area north of Broadway Avenue. A combination of drawings and written recommendations show how it is possible to improve and protect the ecological integrity of the creek while at the same time creating a much more functional and enjoyable space for people. The guiding principles listed below provide a framework for the design proposal that follows.

## Design Guiding Principles

### Site A: Commercial Area along Broadway Avenue

1. Provide safe access to businesses for pedestrians
2. Protect water quality of the creek and improve ecological health of the riparian zone
3. Increase stream buffer
4. Reduce total amount of impervious cover in the area
5. Enhance pedestrian connectivity to downtown
6. Improve visual appeal of the area, as one of the main gateways to the town
7. Safely accommodate cars and provide clear routes for them to follow
8. Provide opportunities for outdoor seating at restaurants
9. Increase visibility and appreciation of Flat Creek

**Site B: Karns Meadow**

1. Allow for recreational use of the meadow with minimal disturbance of natural areas
2. Enhance and protect habitat
3. Provide opportunities for biking, walking, wildlife viewing, tubing and environmental education
4. Filter and treat stormwater
5. Provide parking that is ecologically sensitive and can serve as a model demonstration site for parking areas that create little or no runoff
6. Serve as a key bike and pedestrian link to other trails and other areas of town

Master Plan

The Master Plan on the next page presents a concept for the entire area, including both Site A and Site B. Some of the key features highlighted in the plan include connections to surrounding residential areas, potential links to other trails, stormwater treatment, environmental protection, and recreational opportunities. An explanation of the design, along with written recommendations, follows the Master Plan.

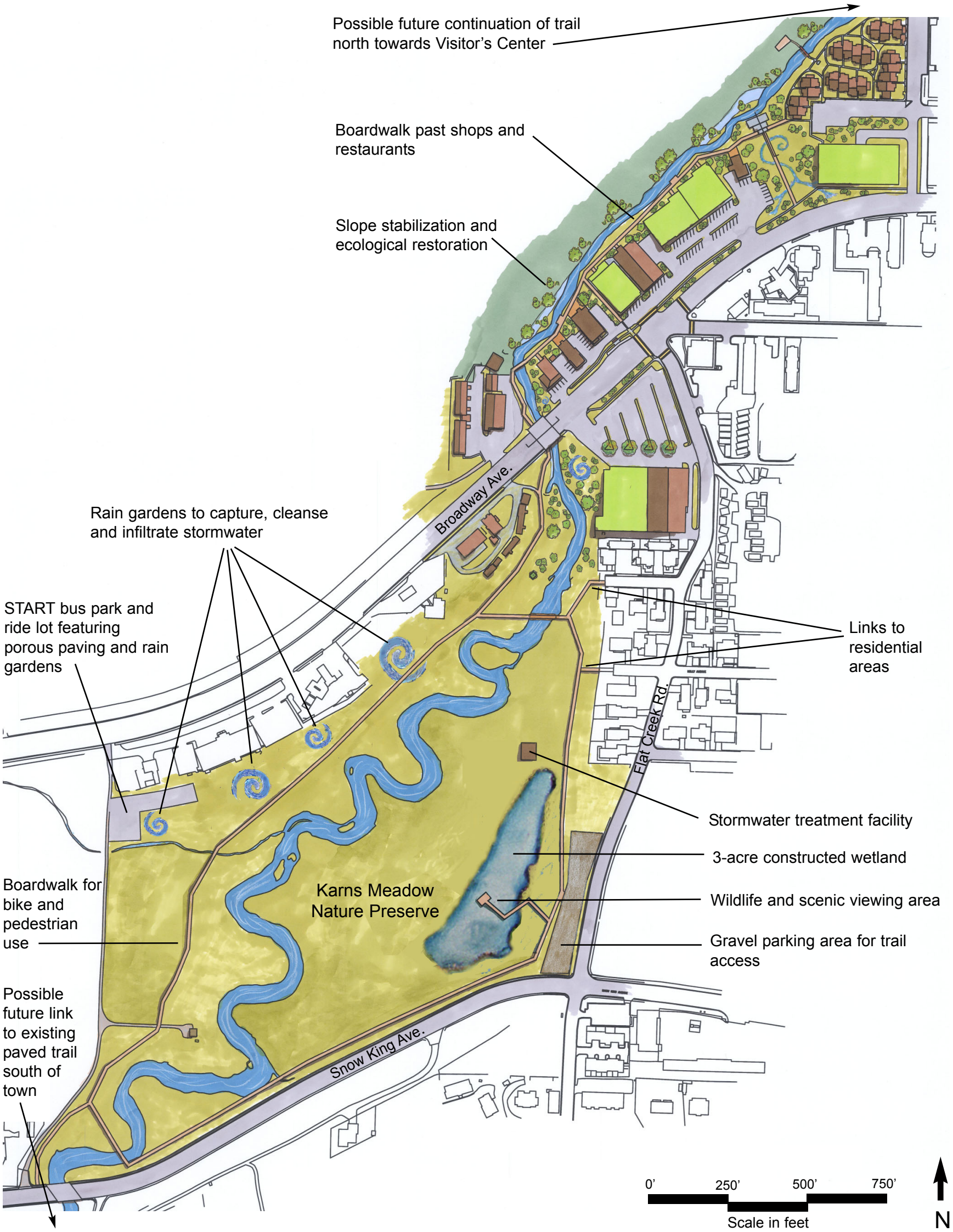


*Figure 5.1 Master plan showing entire area*

**Greenway**

The recent purchase of Karns Meadow by the town of Jackson and the Jackson Hole Land Trust presents a unique opportunity to create a nature preserve and low-impact recreational area right in the heart of town. Compared to the heavily paved commercial district in Site A, Karns Meadow is relatively undisturbed and any new construction undertaken there should make use of environmentally sensitive methods and materials in order to protect this important habitat. This space, shown in the Master Plan as the Karns Meadow Nature Preserve, includes as one of its main elements The Flat Creek Greenway, in the form of a boardwalk that roughly follows the perimeter. In this portion of the greenway, the boardwalk is intended to accommodate bicycles as well as pedestrians, since this section is less crowded than the commercial area. Painted lanes on the boardwalk would keep bicycles separate from pedestrians. However, once the walkway reaches Broadway Avenue at the north end of the Preserve, posted signs will instruct bikers to dismount and walk their bikes through the retail district in order to avoid collisions with people as they stroll past the stores.

Using a boardwalk instead of pavement for the pathway will help minimize the environmental impact by still allowing for infiltration to occur. The boardwalk in Karns Meadow should be built in such a way so that it does not impede wildlife movements, meaning that it should be high enough that small animals can pass beneath it, and yet low enough that large mammals such as deer and moose can go over it. Also for this reason, the boardwalk in Karns Meadow should be built without a railing wherever possible, except in areas where height issues would present a safety hazard. For winter use, the section of boardwalk north of Karns Meadow should ideally be kept clear of snow. Some of the options for snow removal include a small tractor with a snow plow attached, snow shovels, or electric snow blowers. Electric snow

blowers would be an option in the commercial district. They are preferable to gasoline-powered blowers since they do not produce exhaust which would cause pollution and detract from the user experience of the walkway. In Karns Meadow, another interesting option for winter maintenance would be to *not* clear the snow from that section and to have the boardwalk become a cross-country skiing path in the winter. To do this, the boards should be laid relatively close together in order to allow for enough snow compaction to support skiing. Either way, with some planning and maintenance, it is fully possible for the path to be enjoyed year-round.

**Stormwater Runoff and Treatment**

Stormwater treatment is another major focus of the Master Plan. Within the Karns Meadow Nature Preserve, there will be a stormwater treatment facility and three acres have also been set aside for an artificial wetland. Once the water has been cleaned at the treatment facility, it will then move into the adjacent wetland for additional cleansing. This area corresponds to a low point in the topography and as a wetland it will also provide habitat for migrating birds and other wildlife.

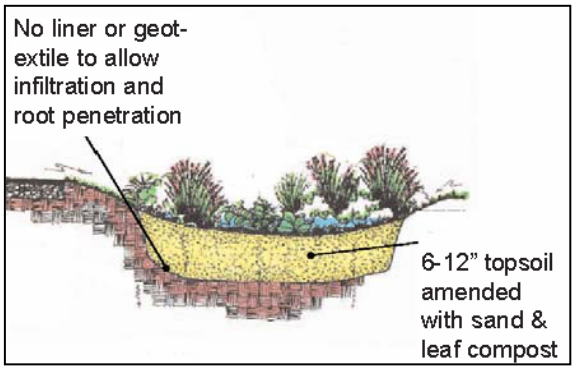


*Figure 5.2 Diagram showing typical rain garden construction (Conservation Design Forum, 2003)*

Another important strategy to help improve water quality is the use of rain gardens, or a series of smaller infiltration areas. These are shown on the plan behind some gas stations and other businesses along Broadway Avenue. They are located downhill from the road, with their placement corresponding to existing storm drainage

outlets. A rain garden generally consists of a shallow depression which combines layers of porous soil with a variety of water-tolerant plants, as shown in figure 5.2 below. The purpose is to create an area that captures rainwater and allows it to soak into the ground, thereby filtering the most contaminated "first flush" of stormwater. It is best to use native plants for the rain gardens and to choose species which can tolerate significant variations in moisture levels. An expert should be consulted for more specific design details.

The benefits of rain gardens are numerous. Most notably, by encouraging infiltration, they help prevent a surge of contaminated runoff from rushing into a stream after a storm, while also recharging ground water supplies which are critical for maintaining stream base flows. As the water soaks into the ground, the soil acts as a filtering mechanism. That is especially important for this part of Karns Meadow, considering that the runoff is coming from a busy road, a gas station, and other polluted areas.

**Aquatic Habitat Improvements**

Where necessary, some simple modifications could improve the aquatic habitat of Flat Creek. In general, creating more complex pools, narrowing and deepening the channel (in certain areas only) and adding some large woody debris are all ways to encourage the presence of native cut-throat steelhead trout. Narrowing and deepening the channel will also help prevent troublesome frazil ice from forming, thereby providing a lower-impact and much less costly alternative to the expensive thaw wells currently being considered. The portion of Flat Creek which flows through Karns Meadow offers an ideal opportunity for aquatic habitat restoration, since the banks of the stream are not constrained by development and the entire meadow is now permanently protected as public green space. Therefore, the focus in this area should be on

maintaining a high-quality aquatic habitat. A professional stream restoration consultant should be hired to design and supervise any modifications to the creek.

**Parking**

As part of the original land-purchase agreement for Karns Meadow, a portion of the land was set aside to be used as a park and ride facility for the local bus system, which is the called START bus. Because this parcel is so close to the creek, it is especially important that the parking area be designed to have the least environmental impact possible. As is highlighted in the Master Plan, the design of the lot allows for maximum infiltration, using a combination of rain gardens and porous paving. By eliminating concrete curbs and instead allowing any extra water to flow into infiltration areas, it should be possible to handle most or all of the runoff on-site. Another benefit of this approach is that the park and ride lot can actually serve as a model demonstration area showcasing environmentally sensitive techniques for parking. A sign posted at the lot could explain the methods and materials used to achieve this goal. This type of positive visibility would not only look good for the town administration, but would also educate private business owners about strategies they could use in their own parking lots to help protect local water quality. The other parking area shown on the plan is a small gravel lot designed for trail users. This lot is located along Flat Creek Road, and is designed as a gravel lot, since pavement is not necessary here and the gravel will encourage infiltration. As in the other parking lot, environmentally responsible techniques should be used here as well to protect water quality.

**Recreation**

One of the best features of the Karns Meadow Nature Preserve is that it will provide a variety of low-impact recreational opportunities that will allow people to experience and enjoy Flat Creek up close, thereby gaining a deeper appreciation of this important natural resource. Some of these activities include wildlife viewing and photography, biking, walking, tubing, and fishing for children. In order to protect fish populations, the town of Jackson has a policy that allows fishing in Flat Creek only for children fourteen and younger. Now that there will finally be public access to the creek, this will give children a chance to spend time in nature and learn about local trout, yet will still protect fish stocks because the town's policy effectively limits the overall number of people who will be fishing.

Tubing (floating downstream using a rubber inner tube) in Flat Creek has traditionally been another popular summer pastime, although limited public access and several low-hanging bridges have made it a challenge in the past. However, now that Karns Meadow is open to the public, people will be able to park at the gravel lot and easily access the creek for tubing. This is a fun activity that allows people to experience the creek in a much more personal way than by simply looking at it from the bank, and therefore has great potential to inspire citizens to appreciate and care for Flat Creek. The concept is similar to the very successful urban whitewater parks in Colorado which were discussed in the Case Studies chapter. To facilitate tubing, it is crucial that bridges within the tubing area be high enough to allow people to safely pass underneath them in the water. This means that the several new bridges proposed in the plan- two in Karns Meadow and one just north of Broadway- should be high enough to allow a person to safely float under them. Existing bridges that are too low should be modified and

made higher so that people can safely and conveniently enjoy Flat Creek from *on* the water as well as next to it.

Wildlife viewing is another recreational activity that people will be able to enjoy in the Karns Meadow Nature Preserve. Therefore, the Master Plan features a wildlife viewing deck that extends out over the constructed wetland, allowing for bird-watching as well as scenic views of snow-capped mountains in the distance. The entrance to the boardwalk from the gravel lot would also be an excellent place to locate educational signage highlighting some of the native plants and animals of the area and explaining the ecological importance of Flat Creek. Several other educational signs focusing on the ecology and natural history of Karns Meadow could be located at other entrances to the walkway.

**Links to Other Trails and Neighborhoods**

The central location of Karns Meadow in town offers a unique opportunity to provide connections between different trails and between different areas of town. As indicated in the Master Plan, the proposed boardwalk will offer a safe and scenic pedestrian link between several residential neighborhoods and the businesses along Broadway Avenue. Continuing the trail underneath Broadway allows pedestrians to easily move between the Nature Preserve and the retail area without having to cross a busy and dangerous road. The Master Plan also indicates future extensions of the trail which could be implemented as a next stage in the greenway plan. To the north, if the trail were to be continued along the creek it could eventually lead to the Visitor's Center, about a mile north of where the map ends. At the southern end, if the trail were to continue in the future, it could link to the Jackson Hole Community Pathways Paved Trail, which begins about a half mile away. That trail continues for several miles into the countryside south of town and is extremely popular with bikers and other outdoor enthusiasts.

Detailed Design Area Plan

The detailed design area covers Site A, which is the commercial area along Broadway Avenue. As was seen in the Existing Conditions chapter, this area currently has a very high amount of impervious cover, poor pedestrian access, and little visual appeal. The plan in Figure 5.5 offers an alternative to this situation. To provide some background, a labeled aerial photograph on the next page shows the current layout of the area as it is now. After the aerial photo, a concept diagram shows the early stages of the design process and the major decisions that were made before the plan was refined into greater detail. Following the plan is an

explanation of the design and a series of recommendations, organized by topic. Two section drawings and a series of "before and after" PhotoShop images are also included.


*Figure 5.3* *Aerial photo showing detailed design area as it is now, as well as location of various businesses*

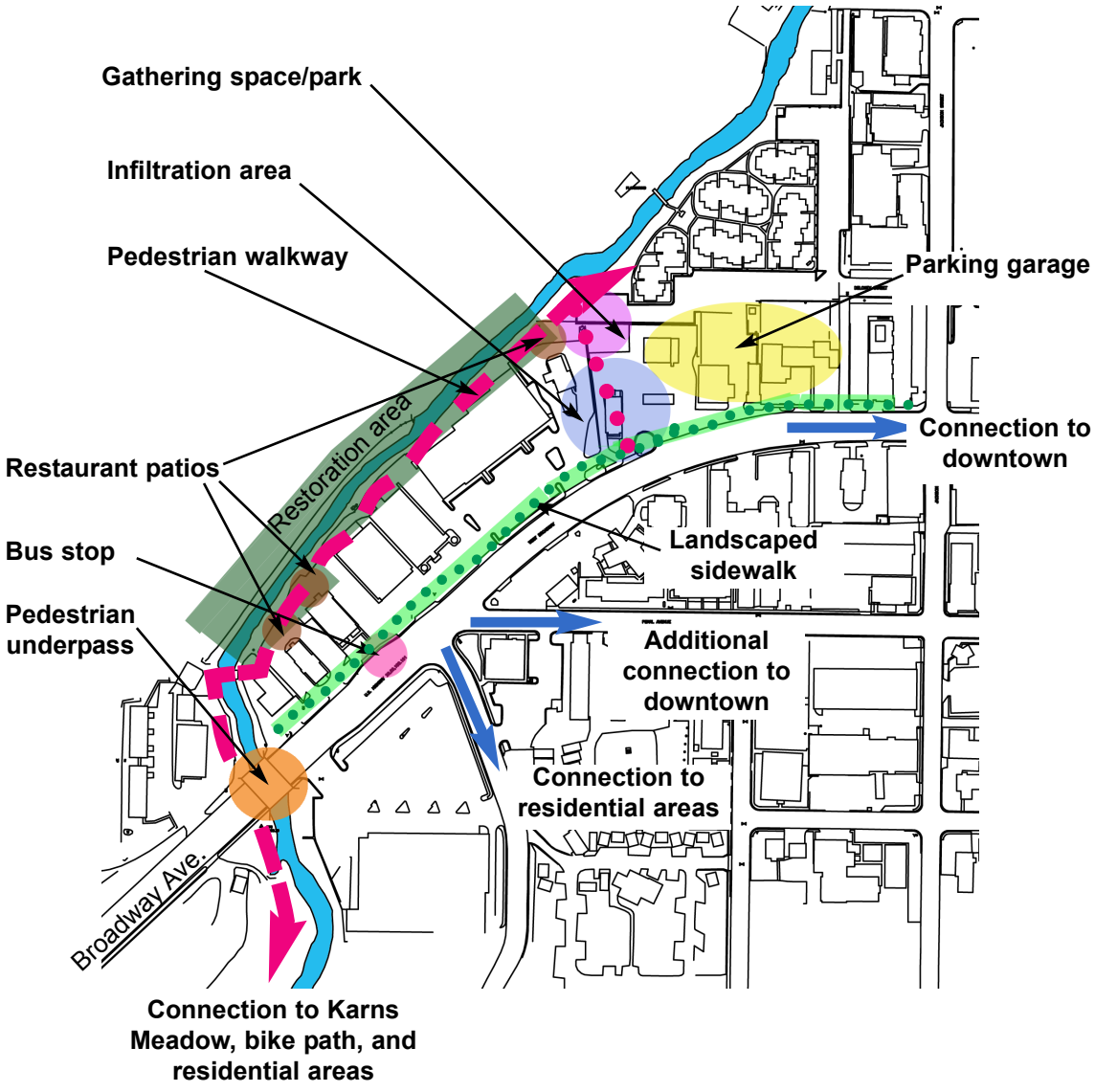


*Figure 5.4 Concept diagram for detailed design area*

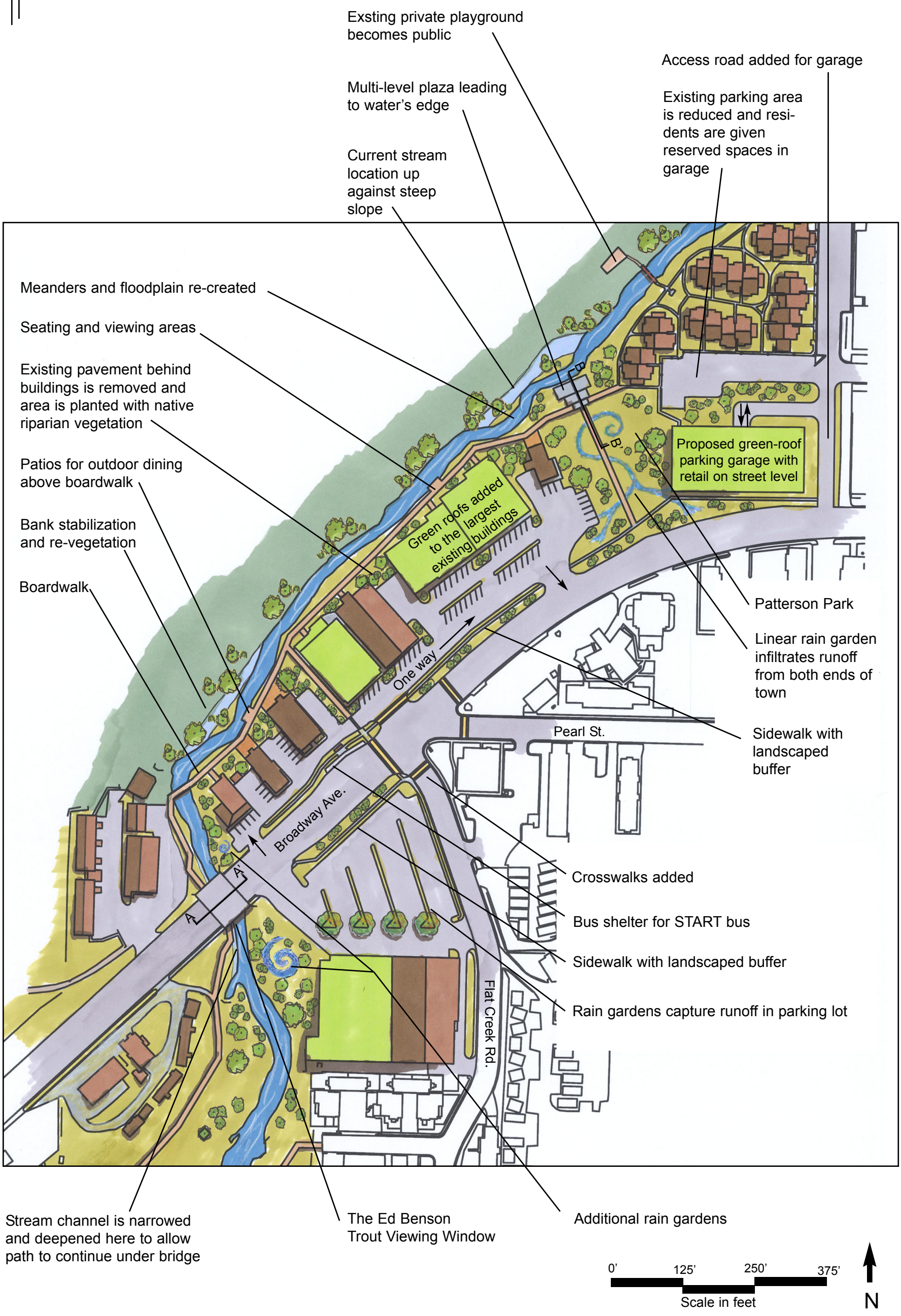


*Figure 5.5 Plan showing detail of commercial area*

Detailed Design Area Written Recommendations

**Parking and Vehicular Circulation**

One of the main elements of the Detailed Design Area Plan is a proposal for a new parking garage that would consolidate many of the parking spaces into one garage, thereby reducing the need for surface parking in the congested commercial area. The garage is located in an area that is presently occupied by several small businesses, each of which is currently surrounded by a large parking lot. This proposal suggests combining all of those elements- and more- into one single, beautiful and ecologically designed structure. The proposed garage is three stories high, and features a green roof that would absorb rainfall and could even serve as an additional public garden if desired. The first floor would be reserved for retail spaces, including especially the businesses that currently occupy that land. Architecturally, the style should fit in with the traditional building styles of the town. A sidewalk in front of the retail level links the garage structure to the other businesses just west of the building, as well as to downtown Jackson, to the east. The second and third levels of the structure would be for parking. Based on the building dimensions of 120 by 240 feet, the garage would provide approximately 152 parking spaces. This number of spaces would more than make up for the surface parking spaces that have been removed as part of the design proposal, and would actually offer more parking overall than currently exists. A new road connecting from existing streets all the way through to Broadway provides access to the garage. For pedestrian safety and to preserve the visual appeal of the retail front, the garage entrance/exit is located at the rear of the building. Trees and shrubs soften and screen this view from the nearby condominiums.

The concept of the new garage is significant, since it allows surface parking spaces to be removed from several different areas, including from behind many of the businesses as well as

from the parking lot for Meadowbrook Village Condominiums. Currently in these areas, as was shown in the Existing Conditions chapter, there are parking lots and pavement extending literally to the edge of the creek. To make up for the lost spaces in the condominium lot, residents would be offered reserved spaces in the garage instead. Given the harsh winter weather in Jackson, it is likely that the condominium residents would be happy to trade in their exposed parking spaces for indoor ones. The aerial photo also shows how that parking lot is presently located right next to the edge of the creek, which undoubtedly has a negative impact on water quality. The garage solution moves the parking away from the edge of the creek, while at the same time opening up opportunities to create enjoyable spaces for *people*, rather than cars, in the Detailed Plan.

As is indicated in the plan, a smaller number of parking spaces do remain in front of the commercial buildings. Some of these spaces will need to be set aside for disabled patrons, while others can be for general use that supplements the nearby garage. Angled parking and a one-way traffic flow simplify the vehicular circulation in this area. Also in the design, there are just three connections to Broadway, which is in contrast to the current situation in which almost every business has its own entrance to Broadway. These changes, combined with the landscaped sidewalk area that defines the space, will provide a clear route for cars. This will eliminate the dangerous vehicular free-for-all that exists now, and by slowing the cars in front of the businesses, it will also improve pedestrian safety and access.

**Stores and Restaurants**

Another main component of the Detailed Plan is the boardwalk which runs behind the businesses in the commercial area and then continues south under Broadway into Karns Meadow. Like the creek walk in San Luis Obispo, this portion of the Flat Creek Greenway is intended to be a vibrant and interesting shopping area. Two seating areas along the boardwalk provide places to stop and rest or simply take in the scene. The design also shows all three of the restaurants in the area taking advantage of their scenic creek-side location by extending decks off the back of the buildings toward the boardwalk. As can be seen in the drawing, outdoor patios are added to Wendy's, to Bubba's Barbeque, and to Taco Bell. These patios are set a few feet above the rest of the boardwalk, which defines those spaces as distinct and offers a better view of the water. The "before and after" comparison in Figure 5.6 offers a suggestion of what one of these outdoor dining areas might look like.

In order to fully realize the potential of this area as a walkable commercial district, there are other important features that should be added as well. These features include new entrances from the boardwalk into the stores, as well as new display windows and signage facing the walkway. An example of this type of transformation can be seen in Figure 5.7, which shows the back of Gart Sports as it is now, and then as it could be. Landscaping is of course another important element, and the plan shows a mix of native trees, shrubs, and other plants growing alongside the boardwalk. This vegetation will also help create a buffer between the boardwalk and the parking areas in front of the stores. As the design indicates, the existing pavement there would be removed in order to recreate as much of the floodplain as possible. Also, by moving the dumpsters from the backs of the buildings to the sides instead, this will prevent the trash from blowing into the creek, which is currently a problem. Placing wooden screens around the

dumpsters will also help contain the debris and make those areas more attractive. There is space reserved in the plan for dumpsters and deliveries along the sides of most of the buildings.

In order to create space for the Greenway in the plan, the drive-through windows behind Wendy's and Taco Bell have been removed. This is a key change that will reduce traffic congestion in the parking lots and increase pedestrian safety. Drive-through fast food windows contribute to air pollution while cars sit in line with their engines idling, and they also add to litter, as people toss the resulting trash out of their cars. For these reasons, some communities such as San Luis Obispo have actually banned all drive-through fast food windows from their towns. In the case of Flat Creek especially, the area under consideration would benefit both visually and functionally by removing these windows and replacing them with outdoor patios instead.

South of Broadway, nest to the large Staples store, the parking area is also reduced and the edge of the pavement is moved further from the creek. The resulting green space is planted with native vegetation and includes a rain garden to capture and infiltrate runoff from the lot before it reaches the creek. Another small rain garden next to Jackson Hole Family Health captures runoff from that end of the other surface lot north of Broadway, although the majority of runoff in that lot will be directed to the larger rain garden in the park at the other end. Linear rain gardens in the Staples parking lot, doubling as row dividers, also capture runoff from that parking area. The same strategy of linear rain gardens is used in the other lot as well. Additionally, in the Detailed Plan green roofs are added to four of the largest existing commercial buildings in the area, further contributing to an overall reduction in runoff and consequently better water quality for Flat Creek.

*The space behind Bubba's as it is now, with cars, trash, and too much pavement.*


*The space behind Bubba's as it could be, with a patio overlooking the boardwalk and the creek. New signage advertises the restaurant to people walking along the Greenway.*

*Figure 5.6 "Before and After" comparison of area behind Bubba's restaurant*

*The space behind Gart Sports as it is now, with little access to the creek.*


*The space behind Gart Sports as it could be, with signage and a new entrance from the Flat Creek Greenway. A child tests a fishing pole from the store as other people stroll by.*

*Figure 5.7 "Before and After" comparison of area behind Gart Sports*

**Erosion**

As was shown in the Existing Conditions chapter, there are several areas of severe erosion on the steep side of the creek across from the businesses. Much of this erosion is a result of the stream being channelized and pushed up against that steep slope in the past. Ultimately, the best way to correct the erosion problem would be to restore the stream's natural meander pattern. However, given the extent of streamside development that already exists in that area, it probably wouldn't be possible to restore all of the original meanders. Therefore, the focus should instead be on re-creating some sinuosity wherever there is space to do so, and then simply restoring as much of the floodplain as possible. The plan indicates two areas where the meanders are re-created and the stream pulled away from the base of the hillside to increase the size of the floodplain. Building the path as a boardwalk rather than a paved trail helps in this effort by allowing plants to go beneath it and by permitting infiltration.

Bank stabilization and re-vegetation is also recommended for the most severe area of erosion. To restore the bank, it would be wise to research various approaches and then experiment first with several different strategies to see which one works best. Considering that the slope is much too steep for grading, the restoration strategy would most likely need to focus on retaining the fine sediments that are currently washing down the hillside. One possible way to accomplish this is by installing log cribbing at the base of the slope, using long, large diameter logs. As the log structure captures the soil, this will provide a place for plants to grow, ultimately stabilizing the hill. Overall, any stabilization structures installed should be carefully designed to be aesthetically pleasing, preferably with a rustic and natural style that will complement the rest of the surroundings.

**The Ed Benson Trout Viewing Window**

Flat Creek Greenway users will find a fun surprise in the form of the Ed Benson Trout Viewing Window located under Broadway Avenue. The concept is based on the popular Trout Observatory located in Boulder, Colorado along the Boulder Creek Greenway. Native cut-throat trout play a central role in the aquatic life of Flat Creek, and as the boardwalk passes under the road, this presents a unique opportunity to allow people a glimpse of them in their own habitat. Educational signage on the back wall and in front of the viewing window would teach people about the trout and their importance in this area.

To create the viewing window, the stream channel would need to be narrowed and deepened as it flows under the bridge so that there is enough space for the viewing area. This is a modification that would be helpful anyway, as it will improve habitat and help prevent frazil ice formation. The walkway itself would need to ramp down to this lowered area and then ramp back up on the other side. Using a ramping system is preferable to steps, so that it can be accessible to disabled users as well as people who may be walking their bikes through the short tunnel. A light installed underwater will help illuminate the scene so that people can actually see the trout. Also, an overflow drainage system should be engineered and installed in case there are any unusually high water flows. There will also need to be drains to keep rainwater from collecting on the floor of the viewing area, since that will be a low area. The section drawing in Figure 5.8 illustrates how the trout window would work. Also, a plaque on the wall should tell the story of how the window was named, a tale which is recounted below.

The trout viewing window is named after one of the many eccentric and colorful local characters from Jackson's history. Ed Benson brought his family to Jackson after becoming enamored with the area on a hunting trip in 1919. Searching for a way to make a living in the

town, he eventually decided to supply the town with its first electricity by building a house and two small turbines over Cache Creek, one of the main tributaries to Flat Creek. As Cache Creek flowed through the basement of his house, it turned the turbines, and also created one of the most unusual problems ever to confront the Game and Fish Commission. Historian Robert Betts tells the story as follows:

> *"Finding that the trout of Cache Creek gathered in the pool of his basement, during the winter Ed would excuse himself when company came, take his fishing pole, and go downstairs, shortly to return to the amazement of his guests with fresh trout for dinner. When this was brought to the attention of the Game and Fish Commission, Ed was accused of fishing out of season, a charge he boldly countered by ordering the state 'to keep their silly trout out of his basement.' Then, blatantly defying the authorities, he cut a hole in the kitchen floor above the basement, lengthened his line and brought the flapping fish directly to the frying pan. Again accused of breaking the law, Ed now told the state to keep the confounded fish out of his kitchen, citing their presence in the upstairs part of his house as an invasion of his constitutional right to privacy. No one knew what to do, so no one did anything. Ed went on serving fresh trout, a man admired with amusement throughout the valley for standing up for his rights"* (Betts, 1978, 219-220).

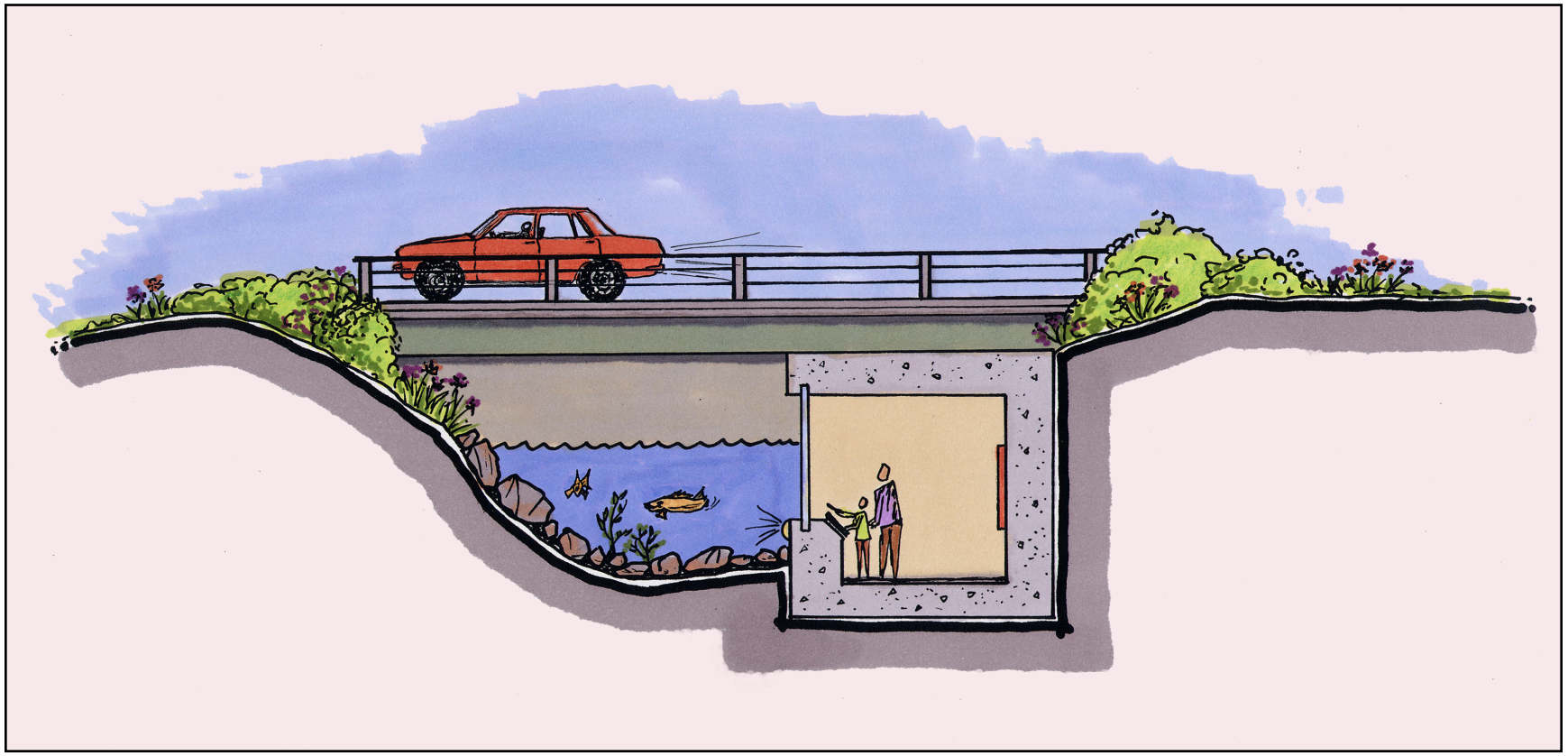

*Figure 5.8* *Section/elevation showing the Ed Benson Trout Viewing Window below Broadway Avenue*

**Patterson Park**

Another famous and widely admired local character from the pages of Jackson Hole's rich history is Cissy Patterson, also known as the "Countess of Flat Creek." The informal title referred to the fact that she was a Polish countess by marriage and had a ranch which was located near the headwaters of Flat Creek. An heiress of a huge newspaper fortune, she came to Jackson Hole as a part-time resident seeking peace and quiet after leaving her unhappy marriage to the count. Throughout her life, she kept returning to the valley and was once quoted as saying, "I have seen taller mountains and larger lakes, but the people here I love" (Betts, 1978). She was unconventional and outspoken, during a time when such independent women were often looked down upon in other parts of the country. However, people in Jackson Hole admired her spirit and they loved the bold Countess as much as she loved them. Strong women have always played a central role in the life of this town, and it is therefore in tribute to her and the other women that the new park featured in the design has been named Patterson Park.

Overall, the park is designed as a gathering space that joins multiple parts of town. One of the main features of Patterson Park is a linear rain garden with branches that collect the runoff from two different directions and then join into a single rain garden that spirals through the park. One of the problems with the current state of the commercial area of Site A is that it is cut off from the popular and visually appealing downtown area. It is not distance, however, that is causing this separation, but rather the lack of a safe and attractive pedestrian route between that commercial area and the famous town center a few blocks away. The creation of the park and the addition of new sidewalks with landscaped buffers will help join these two areas and bring pedestrians to these businesses.

The long, curving rain garden symbolizes the bridging of this rift as it receives water from the surface lot to the west and from Broadway Avenue to the east. The location of the western branch that captures water from the parking lot corresponds to the location of existing storm drain outlets in that area. Additionally, any extra water that is not absorbed by the green roof of the parking garage will be directed to this rain garden as well. The garden is lined with large rocks and water-tolerant native plants to slow the water and give it time to soak into the ground. Most of the time, the spiral rain garden will look like a relatively narrow dry creek bed that is full of a mix of beautiful plants. A boardwalk connects from the sidewalk to the multi-level plaza and the main walkway along the creek, with small bridges crossing over the rain garden along the way. The plaza itself leads to the water's edge and provides an area where people can experience the creek up close. It could also be used for smaller public events, as well as simply being a place for local residents to come and relax. A section drawing in Figure 5.9 shows the boardwalk and the stepped plaza leading down to the water.

Another key element in the success of the plan is the removal of the fence currently separating Meadowbrook Village Condominiums from the commercial area. Taking into account the dumpsters, debris, parked cars and other clutter that currently occupies that space, it is not the surprising that the residents chose to build a fence to block the ugly view. However, with the creation of Patterson Park, there will longer be a need for the fence. By removing it, the residents will then be able to take advantage of their new scenic and tranquil view. Removing the fence will also allow the new Flat Creek Greenway to connect to the sidewalks that already exist in that area. This will provide convenient access to the greenway for residents and could even be a link for a future extension of the trail northward through town. Also, there is an existing playground across the creek from the condominiums. This playground is currently

*Figure 5.9 Section/elevation showing the boardwalk, rain garden, and stepped plaza at Patterson Park*

marked as private property for the use of condominium residents only, however, it is recommended that it somehow be transferred to the town or otherwise made open to the public so that all trail users can enjoy it. As a result, it could be one of the highlights along the greenway and contribute to the overall vibrant life of the area.

**Bus shelter and sidewalk**

Another feature of the Detailed Design is a bus shelter which has been added in front of the commercial area. A bus stop currently exists there, but with no shelter and nothing but a crooked sign to designate it, it is currently rather forlorn and not very welcoming for users. In the plan a covered shelter with sides makes riding the local START bus more appealing and comfortable in the often chilly weather of Jackson Hole. For safety and comfort the bus shelter is set back slightly from the road, and there is a pull-out so that the small bus can stop for passengers without blocking traffic. This area has also been lacking a decent sidewalk, and in the plan sidewalks with landscaped buffers have been added. The vegetated buffer provides extra separation from the cars and is important since there is such heavy traffic on Broadway. New crosswalks at the major intersection of several streets encourage pedestrians to come to the retail area by making crossing it safer to cross the street. A photo illustration in Figure 5.10 shows how the new bus shelter and sidewalk changes would improve the experience of being in that space.

*The existing bus stop and commercial area, lacking a safe sidewalk.*

*Pedestrian access to the front of the commercial area as it could be, showing the new sidewalk with a landscaped buffer of native wildflowers and a bus shelter featuring images of trout.*

*Figure 5.10 "Before and After" comparison of bus stop and sidewalk*

**Planting Suggestions**

Native plants appropriate to the specific ecosystem should preferably be used for all landscaping in this area. Some of the native plants which are already growing in Karns Meadow can also be used as a guide for determining plants which would be appropriate to use along Flat Creek. Choosing native plants has multiple benefits. Not only does it prevent the introduction of invasive exotics, it also creates a landscape that visually complements the surroundings and is ultimately easier to care for because it is well-adapted to the regional growing conditions. The following plant lists offer suggestions of possible plants that could be used to implement the design (Source: "Creating Native Landscapes in the Northern Great Plains and Rocky Mountains," a brochure published by the USDA Natural Resources Conservation Service).

TREES
*Betula papyrifera* (paper birch)
*Celtis occidentalis* (common hackberry)
*Fraxinus pennsylvanica* (green ash)
*Gleditsia triacanthos* (honeylocust)
*Populus angustifolia* (narrowleaf cottonwood)
*Populus balsamsifera ssp. trichocarpa* (black cottonwood)
*Populus deltoides spp. monilifera* (plains cottonwood)
*Populus tremuloides* (quaking aspen)
*Quercus macrocarpa* (bur oak)
*Sorbus sitchensis* (western mountain ash)

SHRUBS
*Amelanchier alnifolia* (serviceberry)
*Artemesia tridentata* (big sagebrush)
*Atriplex X aptera* (flowering saltbush)
*Cerocarpus ledifolius* (curlleaf mt. mahogany)
*Cornus sericea spp.sericea* (redosier dogwood)
*Dasiphora floribunda* (shrubby cinquefoil)
*Elaeagnus commutata* (silverberry)
*Juniperus communis* (common juniper)
*Juniperus scopulorum* (Rocky Mountain juniper)
*Krascheninnikovia lanata* (winterfat)

*Philadelphus lewisii* (Lewis' mockorange)
*Physocarpus malvaceus* (mallow ninebark)
*Prunus americana* (American plum)
*Prunus pumila var. besseyi* (western sandcherry)
*Prunus virginiana* (chokecherry)
*Rhus trilobata* (skunkbush sumac)
*Rhus typhina* (staghorn sumac)
*Ribes aureum* (golden currant)
*Rosa woodsii* (Woods' rose)
*Shepherdia argentea* (silver buffaloberry)
*Shepherdia canadensis* (Canada buffaloberry)
*Symphoricarpos albus* (common snowberry)

COOL-SEASON ACCENT GRASSES
*Achnatherum hymeniodes* (Indian ricegrass)
*Koeleria macrantha* (prairie junegrass)
*Leymus cinereus* (basin wildrye)
*Pseudoroegneria spicata* (bluebunch wheatgrass)

WARM-SEASON ACCENT GRASSES
*Andropogon gerardii* (big bluestem)
*Bouteloua curtipendula* (sideoats grama)
*Bouteloua gracilis* (blue grama)
*Calamovilfa longifolia* (prairie sandreed)
*Panicum virgatum* (switchgrass)
*Schizachyrium scoparium* (little bluestem)
*Sorghastrum nutans* (Indiangrass)

WILDFLOWERS
*Achilea millefolium* (common yarrow)
*Anaphalis margaritacea* (western pearly everlasting)
*Antennaria microhphylla* (littleleaf pussytoes)
*Dalea candida* (white prairieclover)
*Dalea purpurea* (purple prairieclover)
*Echinacea angustifolia* (blacksampson echinacea)
*Erigonum umbellatum* (sulphur-flower buckwheat)
*Gaillardia aristata* (blanket flower)
*Geranium viscosissimum* (sticky geranium)
*Hedysarum boreale* (boreale sweetvetch)
*Helianthus maximiliani* (Maximilian sunflower)
*Heliomeris multiflora* (showy goldeneye)
*Liatris punctata* (dotted gayfeather)
*Linum lewisii* (Lewis flax)

*Lupinus* (lupine)
*Monarda fistulosa* (wild bergamot beebalm)
*Opuntia polyacantha* (plains pricklypear)
*Penstemon* (beardtongue)
*Phacelia hastata* (silverleaf phacelia)
*Phlox hoodii* (spiny phlox)
*Potentilla hippiana* (woolly cinquefoil)
*Ratibida columnifera* (prairie coneflower)
*Sphaeralcea coccinea* (scarlet globemallow)
*Symphyotrichum laevae* (smooth blue aster)
*Thermopsis rhombifolia* (prairie thermopsis)
*Vicia americana* (American vetch)
*Yucca glauca* (soapweed yucca)

# CHAPTER 6

# CONCLUSION

*"Water is the most critical resource issue of our lifetime and our children's lifetime. The health of our waters is the principle measure of how we live on the land."*

-Luna Leopold

There is an urgent need to address the problems along Flat Creek. Because Jackson relies on the splendor of its natural resources to attract visitors, protecting these features is vital to the continued well-being of the local economy. The case study of San Luis Creek in California showed that reducing automobile traffic and establishing a compact, beautiful, and walkable retail district along the creek actually improved business by drawing people to the area. The same result is clearly possible for the retail area next to Flat Creek, which was highlighted in the Detailed Design.

The town of Jackson has been fortunate to have largely escaped the urban sprawl that plagues most other communities in the country. This is because the town is bounded on several sides by steep mountains and protected public land. However, there are still some edges of town which are not protected by these factors and which are still vulnerable to urban sprawl. In particular, the area southwest of downtown has begun to have a problem with sprawl (Figure 6.1) and this will only continue to get worse unless pro-active planning strategies are enacted. The design proposal and recommendations included in this document are meant to become part of the overall solution, starting by re-envisioning the section of this haphazard area that is closest to

downtown. As a result, the design would link these existing buildings to the compact, charming, and pedestrian-friendly downtown just a few blocks away.

There is also a great deal of public support in Jackson for the creation of more bike and pedestrian trails, which would be another way to bridge the gaps between different areas of town. Broadway Avenue, in particular, is currently too dangerous for biking, as it is completely lacking bike lanes. Figures 6.2 and 6.3 show the results of a household survey that indicates Teton County residents place a high value on alternative transportation and are in favor of building more pathways.

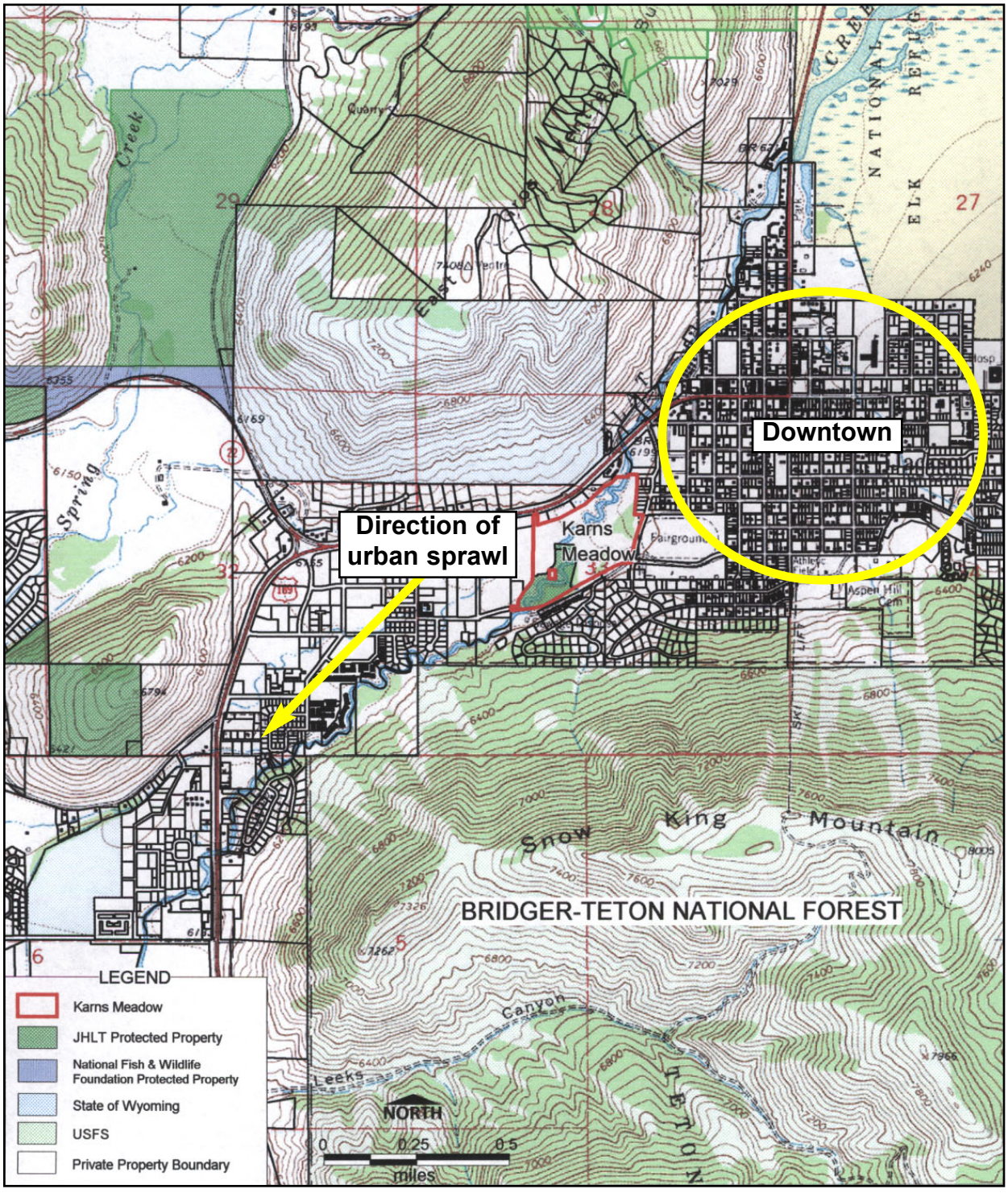


*Figure 6.1* *Map showing direction of urban sprawl in Jackson (background image courtesy of Jackson Hole Land Trust, 2004)*

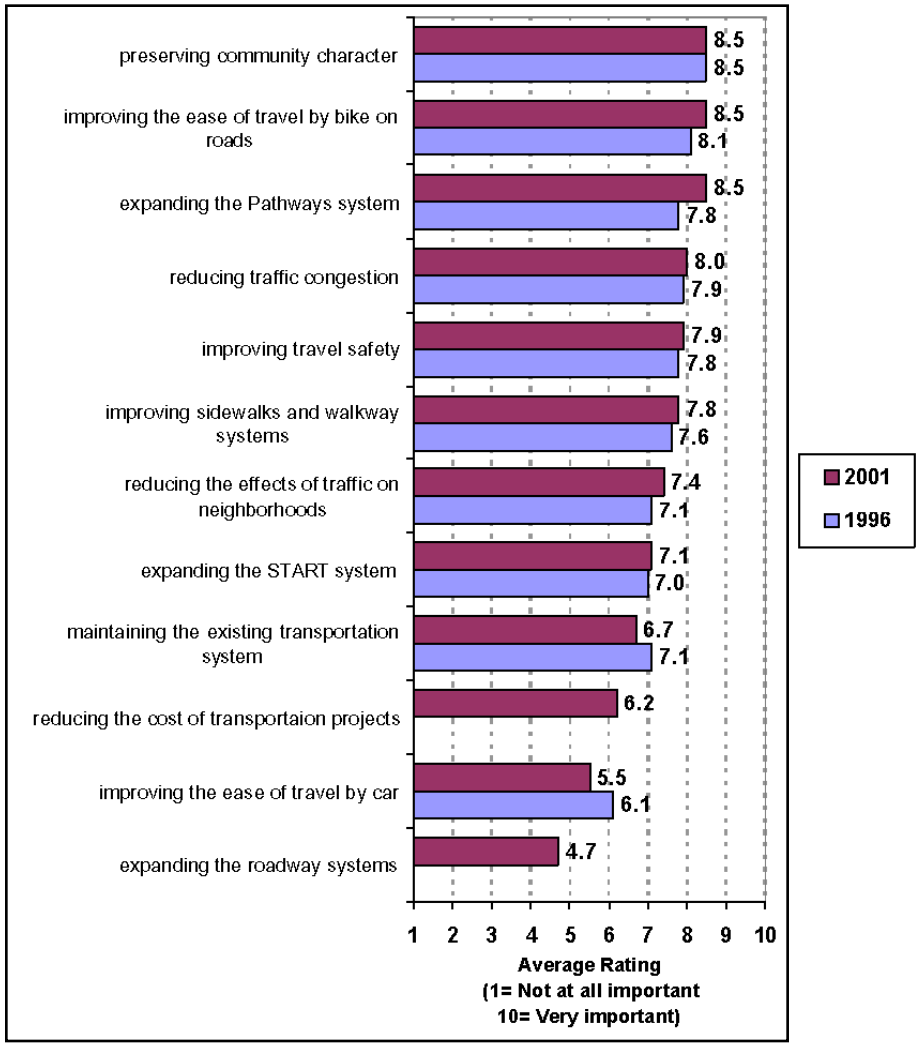


*Figure 6.2 Graph showing average importance ratings of transportation issues based on a household survey of Jackson Hole residents (Teton County Travel Study, 2001)*

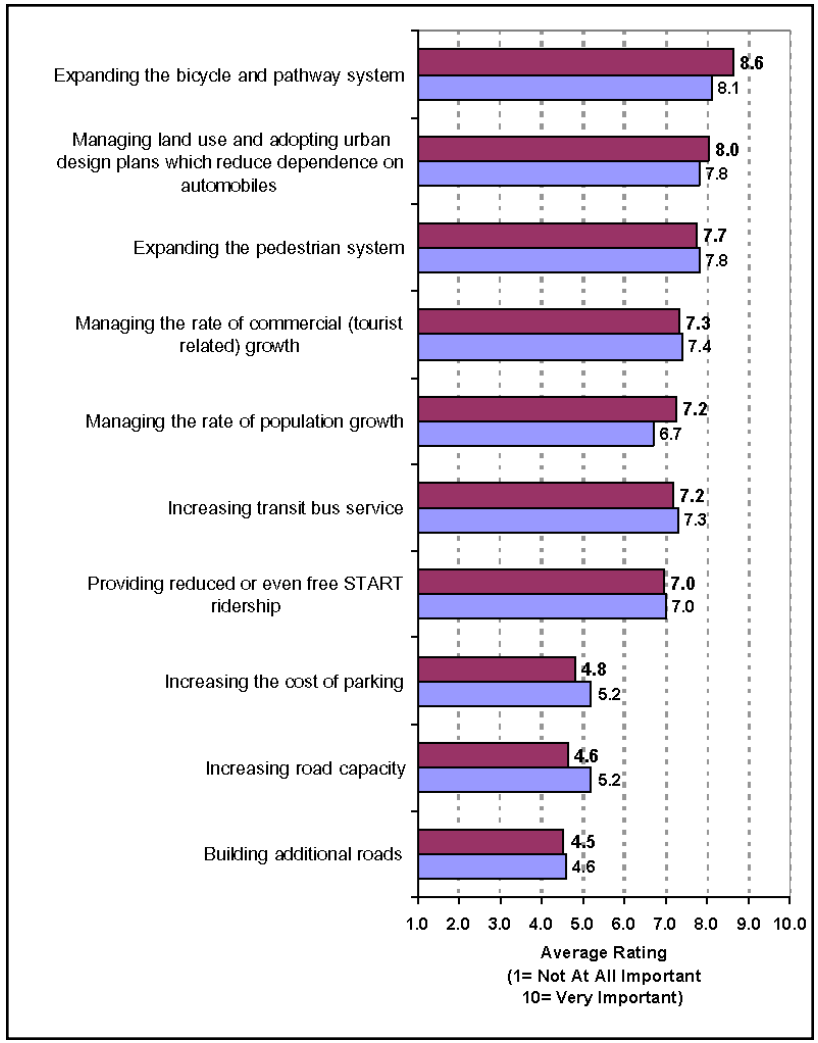


*Figure 6.3 Graph showing support for potential Teton County Transportation Plan projects based on a household survey of Jackson Hole residents (Teton County Travel Study, 2001)*

In order to implement the design, it is crucial to have a plan of action. A three-part strategy for making this proposal a reality includes: enlisting cooperation, controlling runoff, and creating links. Enlisting the cooperation of business owners, residents, community organizations, government agencies, and citizens of the town is the first logical step in the creation of the new Flat Creek Greenway. Potential funding sources for the project include private foundations, individual donations, and local funds such as impact fees or bond referendums. Some more options are grants from either the state or federal government. Examples include Federal Surface Transportation Funds, Community Development Block Grants, and state programs designed to encourage recreation conservation, or water quality. Also, if the town owned the parking garage they could raise money for the greenway by leasing the retail space on the first level of the garage.

Perhaps the most striking element highlighted in the survey of existing conditions is the high amount of impervious cover that currently exists in Site A. This is undoubtedly having a negative impact on water quality and urgently needs to be addressed as part of an overall plan to restore and improve the creek corridor. However, since almost all storm runoff and snow melt in town eventually ends up in Flat Creek, it is essential that a comprehensive water quality protection plan be pursued not only in the areas directly adjacent to Flat Creek, but throughout the entire town as well. The goal everywhere in Jackson should be to capture and infiltrate all stormwater on site, using techniques such as green roofs, porous paving, and rain gardens. The Visitor's Center at the north entrance to town already sets a positive example of this by having a green roof which is planted with native grasses.

Since one of the main goals of this project is to raise awareness of the creek, the new greenway should therefore be easily accessible to as many people as possible. The design

proposal already indicates several connections to nearby neighborhoods, and more links should be created in the future whenever there is an opportunity to do so. Also, an extension of the trail to the north could eventually connect to the Visitor's Center and the Forest Service Headquarters. The map in Figure 6.4 shows the location of existing trails and pathways in the area. In particular, there is already an excellent network of trails outside of town and on the edges of town. The trails south of Jackson, especially, are close enough that in the future they could be linked to the greenway. This could become a second phase in the overall implementation of the plan. Hopefully one day the network will extend through the heart of town, starting with the Flat Creek Greenway.

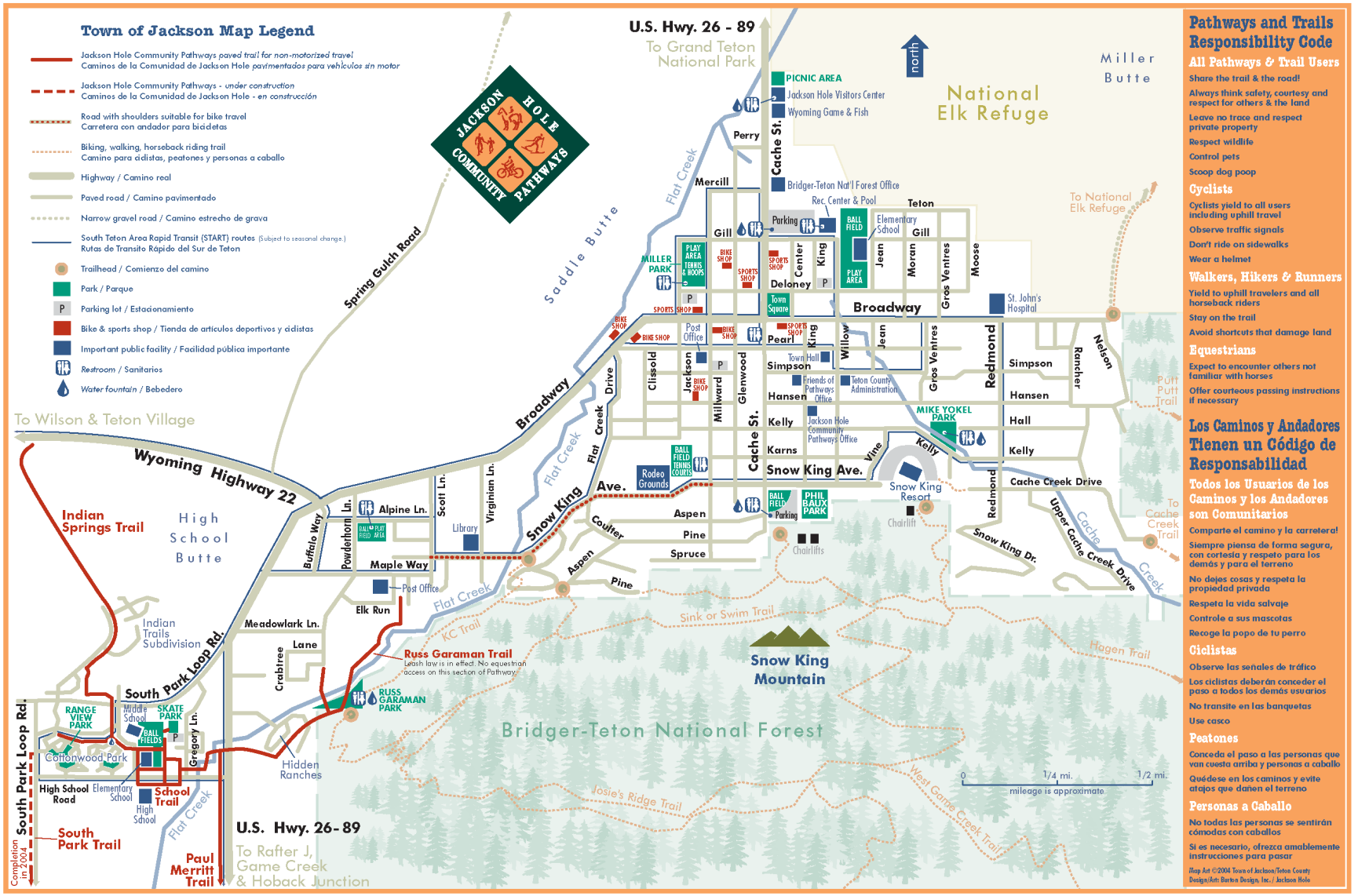


*Figure 6.4 Map showing existing recreational trails and pathways in Jackson (Courtesy of Friends of Pathways, 2004)*

In conclusion, there is a great deal of potential for re-claiming Flat Creek. Although it suffers from many of the same problems that face other urban streams today, Flat Creek does have one major advantage that will play a key role in its future existence, and that is the extraordinary dedication of the local residents. Fortunately, the creek is located in Jackson, Wyoming, a town which has a great deal of political will and public support for environmental responsibility. It is fully possible that with a commitment to action, Jackson can have a thriving commercial area, a greenway trail for recreation, *and* a healthy creek.

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