From: Friends of the Yampa, Inc.
To: Julie Franklin, City Clerk
Re: Response to RFP Re: Accommodations Tax
Date: January 10, 2013

FRIENDS OF THE YAMPA

Dear Committee:

The Yampa River is one most important natural resources, signature landscapes and recreational facilities that we have here in Northwest Colorado. This beautiful river navigates into everything we do here in Steamboat Springs. The Yampa brings a tremendous amount of direct and indirect revenue to our community via the jobs, activities and pleasure for locals and tourists alike.

Like other recreational facilities, the Yampa requires annual maintenance and upkeep. Yes it functions naturally but still requires tweaking, cleaning and restoration like all other facilities. Beyond Howelsen Hill, when you think about the amount of people who spend time in and around the river during the summer months, this natural facility handles more people than any other City maintained facility at a fraction of the cost.

Over the past decade, we have worked diligently as a partner with the City in efforts to promote the Yampa as a key recreational component of Steamboat Springs. We've helped enhance river features, built fisheries habitat and access points along with leveraging donated monies and in-kind efforts to make the Yampa what it is today. The recent investments that the City has made thru GOCO, the Rivers Corridor Initiative and the America's Great Outdoors provide this proposal with a backbone to move forward. A little bit of money annually directed towards the Yampa will be leveraged multiple times and give the river the nudge toward being the well maintained recreational resource that it needs to be.

The Friends of the Yampa, Inc. is excited to provide the following response to the City's request for proposal concerning how to spend future accommodations tax revenue. We appreciate this opportunity and hope you find this proposal sufficient for future funding.

Sincerely,

The Friends of the Yampa Board of Directors

Adam Mayo
Eugene Buchanan
Greg Henion
Peter Van De Carr
Ken Brenner
Kent Vertrees
Soren Jespersen
Charlie Preston-Townsend
John St. John
John Saunders
Danny Tebbenkamp

Description of project:

a. The projects are contained in the *Yampa River Structural Master Plan* (2008) ["YRSMP"]. The YRSMP includes over $4 million of specific projects that address public access, riparian habitat, river clean up, bank stabilization and recreational features. There was a coordinated public process and analysis by professional consultants funded by the City to engage all the various user groups. The community went through a ten-year process to develop consensus of the user groups about what should be done and where. The Yampa River is the cornerstone of the local summer economy and no other amenity has received such a thorough public vetting and professional analysis.

b. The City would be the primary entity involved with the development of this project. The U.S. Army Corps of Engineers (COE) would be responsible for issuing the necessary permits to allow the project to proceed. The CO Division of Wildlife (DOW) has historically provided input through the permitting process at the COE. The general public has already been involved with the development of the YRSMP. Most of the projects contained in the YRSMP occur on property already owned by the City. Inasmuch as, the YRSMP addresses improvements on privately held land, such landowners would either be involved, or such portions of the YRSMP could be eliminated if cooperation were not obtainable.

c. The projects consist of in-stream and riverside improvements along the Yampa River within the city limits of Steamboat Springs. The City would continue to own the project and be responsible for any limited management needs. The projects contained within the YRSMP dovetail perfectly with current City plans for Yampa Street revitalization, Bear River, and Fournier.

d. Implementing just the portions of the plan that are contained between Fetcher Park (Staples) and the new skate park (Bear River Park) is estimated to cost about $2.1 million. Implementing the plan from Fetcher Park to the D hole (Elk Park) is estimated to cost about $1.3 million. Overall, the plan anticipates approximately $4 million worth of improvements. These capital costs estimates are taken directly from the YRSMP. See **APPENDIX E** of YRSMP(2007). In 2012, Friends of the Yampa obtained a $25,000 grant from the city to begin implementing a portion of the YRSMP. Friends of the Yampa was able to leverage that $25,000 into $100,000 by obtaining additional grants that required matching funds. Friends of the Yampa hopes to use whatever monies may be earmarked from the Accommodations Tax as leverage to receive matching grants from other sources. If $50,000-$100,000 per year were allocated to implementing the YRSMP, Friends of the Yampa believes that considerable progress could be made over time.

e. The projects contained within the YRSMP can be phased over a number of years. Some of the projects can only be completed during the low water seasons, while others may be performed year-round. The phasing of these projects is extremely flexible, depending on how funds are allocated. Multiple projects could be addressed simultaneously.

f. New infrastructure would <u>not</u> be necessary to complete the projects detailed in the YRSMP.

g. No future capital needs are anticipated. The projects contained in the YRSMP are intended to be permanent.

h. While data is somewhat limited, please see attached economic study related solely to the creation of the C hole and the Recreation In-channel Diversion associated therewith. Note, this study does not address the benefits of improved access along the river for floaters, fisherpersons, and wildlife observers. See attached "Potential Beneficial Values of Waters Diverted in the Yampa River for the Steamboat Springs Boating Park" (2005).

i. As suggested above in (d), it is possible to select certain line item improvements from the YRSMP for implementation. However, Friends of the Yampa would suggest completing projects within the high-use areas of the river, at least in between Fetcher Park and the D hole (Elk Park). This would give the City the most bang for its buck. This portion of the river is most visited by tourists for fishing, floating, and wildlife viewing.

Maps

See **APPENDIX D** of the YRSMP(2007).

How the project meets the criteria of the ballot question:

Promote Tourism: Both users and admirers of the Yampa come to SS for the experience of the Yampa's wild and natural river qualities. An improved river corridor will draw from the thousands of river recreation enthusiasts throughout the state and region. The core trail ensures easy access for both active participants and those there simply to enjoy the view shed.

Enhance the vitality of Steamboat Springs as a destination resort: Unlike every other resort community, Steamboat has a large free-flowing river gushing directly through downtown providing exceptional fishing, floating and viewing opportunities. Improving on this amenity would set Steamboat apart from most other resort communities. The free-spirited nature of the Yampa is the exact sort of things tourists seek when planning a Rocky Mountain vacation.

Enhance the community identity of Steamboat Springs: When people think of Steamboat, they should imagine snow-capped mountains in the winter, and a lush, green river valley in the summer. Improving on the river corridor through town will highlight the uniqueness of this wonderful valley. The river corridor is the center-piece for many of our community's summer activities. Among competing river communities, Steamboat stands out has having the only free-flowing river.

Enhance the environmental desirability of Steamboat Springs: Many of the projects included in the YRSMP anticipate removing the randomly placed concrete rip-rap that has been dumped into the river. Removing the unnatural debris that has been deposited in the river over the years will create a more natural environment for people to enjoy. The YRSMP anticipates repairing much of the riparian habitat that has been damaged.

Enhance the economic health of Steamboat Springs: An improved river corridor will provide a boom to the local fishing, wildlife viewing, and floating industries. For instance, the City currently lacks a single boat ramp capable of launching drift boats and larger rafts. The economic study performed in 2005 found that river users could create as much as $7,000,000 annually to the Steamboat economy. See *The Potential Beneficial Values of Waters Diverted in the Yampa River for the Steamboat Springs Boating Park*, Robert S. Raucher, PhD. et al., 2005. In increase in use could also potentially create jobs in the river-related industries.

Stratus Consulting

3

The Potential Beneficial Values of Waters Diverted in the Yampa River for the Steamboat Springs Boating Park

Draft Report

Prepared for:

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April 19, 2005
SC10613

Ex. 64

The Potential Beneficial Values of Waters Diverted in the Yampa River for the Steamboat Springs Boating Park

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Introduction and Summary

This report describes our investigation of the economic benefits associated with waters diverted in the Yampa River to support recreation in the boating park in Steamboat Springs. Order of magnitude estimates of the potential economic benefits are derived.

While the benefits estimates derived here are preliminary (e.g., we anticipate updating this report with boater visitation data collected in 2005), our results are indicative of the types of potential economic values derived by users of the boating park, and also the potential economic values realized by spectators and the greater community. These findings are based on a review of available information and published economic literature.

This report is organized as follows:

- Chapter 1 examines the economic stimulus to the local region from the boating park. It addresses employment and tax revenues from recreation to Routt County. It considers both direct and indirect impacts associated with boating park users, special event spectators, and their potential economic stimulus to the economy.

- Chapter 2 provides an overview of the river structures comprising the boating park; the types of uses (rafting, whitewater kayaking and canoeing, and tubing); and a preliminary discussion concerning levels of use.

- Chapter 3 describes the value of the course to those engaged in kayaking and related whitewater activities. We estimate direct expenditures made by users. We also summarize estimates of the user value (consumer surplus) of a kayak-related recreational outing. These consumer surplus results — derived from the published economics literature — are applied in a "benefits transfer" to estimate direct use values for the boating park. This chapter also addresses the potential benefits associated with special events, such as the Yampa River Festival.

- Chapter 4 shows a summary of potential future benefits generated from the Steamboat Springs boating park. The benefits will be revised when new information on boater use is collected in 2005.

Our results demonstrate that waters diverted in the Steamboat Springs boating park can generate considerable economic benefit. We estimate that the future annual monetary benefits potentially derived from the boating park are greater than $7.2 million. When capitalized over 20 years at 7%, the present value of benefits are greater than $81.4 million. This estimate will be refined when actual boater visitation data are collected for 2005. The estimate does not include several

benefits that could not be quantified or valued within the present study's constraints, leading to an underestimation of total benefits. Details are shown in Table 1.

Table 1. Estimated value of future beneficial uses of waters diverted in the Steamboat Springs' boating park (in 2005 dollars)

Beneficial use category	Level of use	Monetary unit value	Beneficial value[d]
Kayakers and canoers[a]	13,700		
Expenditures (locals and nonlocals)		$69	$945,300
Expenditures (nonlocals)[b]		$150	$1,027,500
Consumer surplus		$41	$561,700
Economic stimulus to community[c]			$1,346,025
Increase in rafters	>0	>$0	+
Increase in tubers	40,000	$23	$1,310,000[e]
Special event (Yampa River Festival)[f]	22,000		
Expenditures			$1,137,182
Economic stimulus to community[c]			$852,887
Nonevent spectators	>0	>$0	+
Increase in property values			+
Community identity, quality of life			+
Option value			+
Total beneficial use values per year			**>$7.2 million**
Total beneficial use values over 20 years[g]			**>$81.4 million**

a. Based on estimate documented for Golden. Steamboat-based estimates are anticipated via 2005 use survey.
b. Nonlocal boaters equal 25% of total boaters and include one companion.
c. 0.75 times out-of-pocket expenditures (excluding the value of travel time).
d. "+" indicates positive benefits that could not be quantified or monetized using readily available data.
e. Includes economic stimulus of 0.75 times out-of-pocket expenditures.
f. Potential special event spectators based on 100% of 2004 Teva event in Vail.
g. Over a time horizon of 20 years and a discount rate of 7%.

1. Economic Stimulus to the Local Region

1.1 Value of Recreation and Tourism in Colorado

Outdoor recreation is an important activity nationwide. Approximately 142 million Americans, or 68% of Americans 16 years of age and over, participated in a "human powered" recreation activity in 2003. Participation by Americans in at least one outdoor activity is up 8% over 1998, far outpacing the impact of natural population growth in the United States (Outdoor Industry Association, 2004). Recreation is particularly popular in Colorado, and as detailed below, plays a key role in the state and local economies.

1.1.1 Employment

The importance of recreation-related tourism to employment in Routt County is highlighted in Figure 1.1. These results are based on a Colorado Tourism Office (in the Office of Economic Development and International Trade) study conducted by Dean Runyan Associates (2004). The Dean Runyan study found that in 2003, jobs generated by visitors traveling to and within Colorado made up 4.5% of all jobs in the state of Colorado.[1] These tourism-generated jobs are much more important, however, to Colorado's mountain resort areas. In 2003, travel-generated jobs accounted for 27% of all jobs in Routt County (not including tourism-related jobs generated in the real estate and construction sectors).

1. Dean Runyan Associates (2004) uses the results of a Colorado visitor survey to estimate spending by travelers. Spending on air travel in Colorado was estimated using data from the Bureau of Transportation Statistics. Spending by visitors staying in hotels, motels, resorts, and private campgrounds was estimated using a ratio of total travel spending to spending on lodging, where total spending on lodging is estimated using applicable state and local tax receipts. Spending by visitors to public campgrounds and private homes is estimated using survey results on daily spending by visitors in each category. Spending by visitors to vacation homes is based on an "inventory of vacation homes (2000 U.S. Census) expenditure survey data of vacation home visitors that made trips of 30 days or less."

Once total travel spending is estimated, travel earnings are estimated using payroll-to-receipts ratios derived from the 1997 Economic Census and earnings data from the Bureau of Economic Analysis; and travel employment is estimated using wage data from the Colorado Department of Labor and the Bureau of Economic Analysis. Local tax receipts generated by travel are estimated as a percentage of "local lodging taxes, sales taxes, and other local taxes applicable to traveler purchases (e.g., automobile rentals)." State tax receipts generated by travel are estimated as a percentage of "state sales taxes, gasoline taxes, and income taxes on travel-generate earnings and business income."

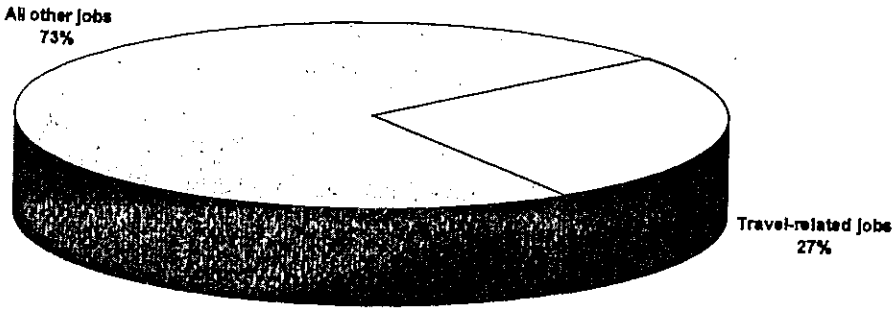

Figure 1.1. Tourism-related jobs as a percentage of all jobs: Routt County.

Sources: Dean Runyan Associates (2004), Colorado Department of Labor and Employment (2005).

1.1.2 Impacts on earnings, tax revennes, and employment

Recreation and tourism-related impacts on the state and local economies of Colorado extend beyond direct impacts on employment. Earnings and tax receipts are among the other important economic parameters that are boosted by recreation-related spending in Colorado's resort communities.

Further detail on the economic value of tourism-related spending is provided in Table 1.1, based on data from the Colorado Tourism Office report prepared by Dean Runyan Associates (2004). The spending categories are defined as follows:

- **Employment.** All employment associated with travel and recreation spending, including wage and salary workers and proprietors, and full- and part-time positions.
- **Earnings.** The wage and salary disbursements, earned benefits, and proprietor income of employees that receive travel expenditures; includes only the earnings that are attributed to travel expenditures.
- **Travel spending.** All purchases by travelers during their trip, including lodging taxes and other applicable local and state taxes paid by the traveler at the point of sale.

Table 1.1. Recreation and tourism-generated impacts on the economies of Colorado, and Routt County: 1999-2003 (spending in current dollars)

	1999	2000	2001	2002	2003
Colorado					
Employment (thousand jobs)	121	120	111	108	105
(% of all Colorado jobs)	5.5%	5.2%	4.8%	4.7%	4.5%
Earnings ($M)	2,527	2,660	2,597	2,556	2,488
Travel spending ($M)	7,486	7,884	7,639	7,534	7,533
Recreation spending ($M)	1,129	1,171	1,138	1,133	1,125
(% of travel spending)	15.1%	14.9%	14.9%	15.0%	14.9%
Local taxes ($M)	259	281	271	267	262
State taxes ($M)	276	279	265	262	258
Routt County					
Employment (jobs)	3,620	3,570	3,520	3,390	3,260
(% of all Routt County jobs)	33.2%	31.7%	30.2%	28.2%	27.0%
Earnings ($M)	93.5	98	101.4	103.8	101.6
Spending ($M)	212.4	223.4	229.2	233.9	230.6
Local taxes ($M)	7.5	8.0	8.3	8.3	8.2
State taxes ($M)	5.8	6.0	6.1	6.1	6.0

Sources: Dean Runyan Associates, 2004; Colorado Department of Labor and Employment, 2005.

Note: Excludes tourism-related jobs created in the real estate and construction sectors.

- **Recreation spending.** Spending on entertainment and recreation, such as admissions to tourist attractions or artistic events; does not include accommodations, eating and drinking, food, transportation, or retail sales.

- **Local taxes.** Tax receipts collected by counties and municipalities, as levied on applicable travel-related purchases, includes lodging taxes, local sales taxes, and other local use taxes (e.g., auto rental taxes), but not property taxes.

- **State taxes.** State sales taxes, gasoline taxes, and income taxes on individuals and businesses.

As shown in Table 1.1, in 2003, the tourism-related travel industry statewide provided 105,000 jobs to the Colorado economy. Earnings for these jobs totaled almost $2.5 billion. Total travel-related spending in Colorado in 2000 was just over $7.5 billion. In addition, travel

spending contributed significantly to state and local taxes. Of these travel-generated taxes, a large share of the receipts accrued to local governments. In 2003, 50.4% went to local taxes, 26.7% went to state sales tax, 14.2% went to the state gas tax, and 8.6% went to state income taxes (Dean Runyan Associates, 2004).

It is important to note that these results reflect only "direct" spending effects and do not include the multiplier effect of travel spending that occurs when money spent by travelers is recirculated throughout the local economy. As detailed in Section 1.4, these multiplier effects can be significant.

1.2 Kayaking as an Emerging Recreational Asset

The Outdoor Industry Association's (2004) report on participation in outdoor recreation highlights the continuing popularity of kayaking. The report presents the results of a 2003 survey of 4,000 people (as a representative sample of the U.S. population), in which participants were asked about their participation in 21 "human-powered outdoor recreation" activities, including kayaking.

Kayaking has been experiencing strong growth in participation in recent years. Participant and enthusiast levels for kayakers have more than doubled since the first year of the survey, which was 1998 (Outdoor Industry Association, 2004). The survey divided kayakers into three types – sea kayakers, recreation/sit-on-top kayakers, and whitewater kayakers.[2] Whitewater kayakers were estimated to total 1.8 million people in the United States in 2003. Of these whitewater kayaking participants, 879,000 were considered "enthusiasts" — defined as people who participated 3 or more times in 2003 as whitewater kayakers (equivalent to the top 15% of participation in the category).

Several other results from the study show that kayaking holds great potential for boosting local tourism spending in Colorado. In addition to being relatively young, kayakers tend to be among the most wealthy participant populations (Outdoor Industry Association, 2004). Fifty percent of whitewater kayakers are under 35 years of age. The mean household income reported by whitewater kayakers was $76,000, with 26% reporting household incomes of $80,000 or more. Finally, kayakers also tend to enjoy a variety of activities that Colorado has to offer — 73% of whitewater kayakers also bike on paved roads, 72% hike, 47% canoe, and 45% bike on dirt paths and roads (Outdoor Industry Association, 2004).

2. Due to the change in categorization starting in 2001 in which all kayakers are divided into sea kayakers, recreation/sit-on-top kayakers, and whitewater kayakers, a direct comparison of whitewater kayaking participation in 1998 compared to 2003 was not possible. Whitewater kayaking outings were reported to be 8 million in 2001, 14 million in 2002, and 5 million in 2003.

→ 03 = 02 = drought year

1.3 The Value of Recreation and Tourism in Steamboat Springs

As discussed in Section 1.1, travel spending is an important component of the Colorado economy. It is even more important to Colorado's mountain resort towns. Table 1.1 highlights the importance of recreation and tourism-related travel to Routt County. In 2003, tourism accounted for 27% of all jobs in Routt County. In 2003, travel spending of over $230 million provided $101.6 million in earnings to Routt County. Significant levels of local tax receipts are also generated by tourist spending. Routt County and its cities collected an estimated $8.2 million in 2003 from taxes generated by travel spending (Dean Runyan Associates, 2004).

1.4 The Economic Benefit of Kayaking and Other Boating Uses for the Local Economies

As detailed above, recreation and related tourism is a vital element of the economic well-being of Colorado's resort communities. The provision of quality boating opportunities through the construction of the boating course in Steamboat Springs is intended to fill an important niche in the overall tourism-related economies of the town.

Not only are kayaking and related boating activities among the fastest growing recreational activities in the nation over the last 6 years, but they also provide an excellent seasonal fit for resort communities like Steamboat Springs. The primary attraction for kayakers is relatively high stream flows, which typically occur in the late spring and early summer. The boating parks, by attracting recreational users in late spring and early summer, fill an important shoulder season for these resort towns, which have considerable tourism-related infrastructure in place that would otherwise be relatively idle at that time of year. And, to a lesser extent, the kayakers coming to the site in the latter half of the summer are a good supplement to that season's tourism base.

Tubing is a major activity during the summer months. In previous years the number of tubers has exceeded 20,000.

Increased expenditures on a recreational activity generate an economic stimulus for the community. The regional economy will be affected through a multiplier effect. The multiplier is a factor that when multiplied by new or increased expenditures (or reductions in expenditures) yields the benefits (or reductions in benefits) to the region. While we do not have precise estimates of the multiplier for kayaking and other boating uses in Steamboat Springs, some related published literature provides guidance.

Cordell et al. (1990) estimated regional economic multipliers of 2.00 and 2.03 for the total economic effects of water-based recreation expenditures on local economies. Norton et al. (1981) estimated a range of multipliers from 2.03 to 2.88 in an analysis of the total economic value of

recreational fishing. State of Colorado agencies also use similar or larger multipliers for estimating the total economic impacts of spending activities in one sector (e.g., housing or aeronautics) to the broader economy of the relevant local community or the state as a whole (e.g., airport construction-related economic impacts have been projected that imply a multiplier of slightly over 3.0).

In our calculations, we use a relatively conservative economic multiplier of 1.75, although higher multipliers could be justified.

2. River Structures and Levels of Use

2.1 Background Description of the River Structures

The Yampa River runs through the heart of the City of Steamboat Springs (City). It is an integral element of the community, adding to its year-round appeal. The importance of the Yampa River to the City is described in the Yampa River Management Plan (2003).

In October 2001, the City constructed a hydraulic feature in the Yampa River to attract and improve the experience of recreational water uses (e.g., kayaking, canoeing, rafting, tubing). This structure is commonly referred to as "D Hole" and is just below the 13th Street Bridge. In April 2003, the City constructed another hydraulic feature called "Charlie's Hole" or "C Hole" just above the 13th Street Bridge. At this same time, improvements were made to D Hole.

These two in-channel diversion structures have attracted many users. This boating park (C and D Holes) is one of the premiere spots in the country for whitewater kayakers and canoers to perform rodeo-like acrobatic maneuvers in their boats. This type of boating is becoming more popular and becoming a more important component of the recreation economy. The structures also enrich rafting and tubing opportunities.

2.2 Types and Levels of Use

We interviewed four people knowledgeable about the City boating park. The persons interviewed are listed in Table 2.1. The interviews were conducted via telephone between March 10 and March 14, 2005.

Summary of types of boater use

The boating park is used by a variety of users. In the Spring and early Summer, flows can be high enough to support rafting, kayaking, and canoeing. In Summer and early Fall, tubing is very popular on the river given the right conditions.

Rafting user days

Commercial rafting occurs on the stretch going through the City and the boating park when flows are sufficient. Based on City records summarized in Table 2.2, rafting has been generally increasing over the 5 years spanning 2000 through 2004. In 2002, water flows were extremely low and rafting (and all boating activities) was greatly limited. In 2004, the two companies

Table 2.1. Interviewees for Steamboat Springs boating park

Person	Comment
Eugene Buchanan Publisher/Editor-in-Chief of Paddler Magazine Tele: (970) 870-1579	Expert kayaker that used the park about 40 times and visited the park another 40 times during 2004. Very familiar with river flows in cfs. Higher flows provide a better experience. One of best spots in state at high flows. Estimates 75% local and 25% out-of-town boaters. More out-of-town boaters at higher flows.
Peter Van de Carr Owner of Backdoor Sports Tele: (970) 879-6240	Expert kayaker that used the park about 30 times and visited the park another 30 times during 2004. Very familiar with river flows in cfs and posts daily values in his store. Higher flows provide a better experience. Did C&D holes at over 4000 cfs in 2003 and loved it. Estimates about 80% local and 20% out-of-town boaters. More out-of-towners on weekends. His store rents tubes for people to float river. Notes the C&D structures attract people that cycle through the structures many times per day. C&D holes add to the experience, especially those looking for more action.
Kent Vertrees Manager of Blue Sky West Tele: (970) 871-4260	Expert kayaker that used park about 25 times and visited the park another 10 times in 2004. Very familiar with river flows in cfs. Higher flows provide a better experience. Estimates about 60% local and 40% out-of-town boaters. More boaters on weekends and when flows are higher. His store rents tubes for people to float the river. Notes C&D structures are popular and people cycle through structures multiple times. His store runs raft trips through town. The C&D structures are the "big event" on the run. Professional pictures are taken at this spot and sold to clients. C&D structures are what clients talk about, that in turn, brings in more customers.
Barry Smith Owner of Mountain Sports Kayak School Tele: (970) 879-8747	Expert kayaker that used park about 100 times and visited the park another 25 times in 2004. Very familiar with cfs. Higher flows provide a better experience, up to about 2000 cfs. He runs kayak instruction lessons. About 25% of his business relates to some use of C&D structures.

reporting raft clients (i.e., Blue Sky West and Bucking Rainbow) ran about 436 guests through this stretch in May and June 2004. In looking at the Yampa River flows measured at the USGS 09239500 gauge, flows dropped below 400 after June 23, cutting the rafting season short.

Table 2.2. Rafting guest counts

Year	Period	Number of guests		
		Blue Sky West	Bucking Rainbow Oufitters	Totals
2000	Total	0	0	0
2001	May	0	2	2
	June	46	15	61
	July	0	0	0
	August	0	0	0
	Total	46	17	63
2002	May	0	0	0
	June	0	4	4
	July	0	0	0
	August	0	0	0
	Total	0	4	4
2003	May	Na	4	40
	June	Na	16	52
	July	0	0	36
	August	0	0	36
	Total	144	20	164
2004	May	7	59	7
	June	297	73[a]	297
	July	0	0	0
	August	0	0	0
	Total	304	132	436

a. 2004 values for Bucking Rainbow need to be estimated given data were in dollars not number of guests. Given Blue Sky West charged $34.30 per rafter in 2004 (revenue/# of guests), we estimate the May 25-29 count to be 59 ($2,027.68/$34.30) and the June count to be ($2,519.05/$34.30) 73 guests.

Source: City of Steamboat Springs.

Kayaking and canoeing user days

Whitewater kayaking and canoeing is a major use of the boating park. Boater use varies with flow, day of week, and time of day, among other factors.

We do not have historic data on the number of boaters using the boating park. It is our current plan to have such data collected during the 2005 boating season.

Although we do not have such data yet, it is clear from our interviews with people knowledgeable about the boating park that:

- The number of boaters in the boating park increases with flow, holding all other factors constant. Use also tends to increase on the weekends and holidays, and during warm weather, among other factors.
- The increase in boaters resulting from increased flow comes both from more intensive use by local boaters and from an influx of out-of-town boaters attracted to the features of the boating park. Out-of-town boaters (e.g., from the Colorado front range) have multiple options in selecting where to boat (i.e., substitutes). They are more likely to travel to the Steamboat Springs boating park when flows are higher.
- Higher flows provide boaters with higher-value experiences. Higher flows increase the types and magnitudes of rodeo-like maneuvers that boaters can perform.
- Higher flows provide spectators with higher-value experiences.

These observations are not only consistent with the four people interviewed, but are consistent with previous findings concerning other Colorado boating parks. Previously, we analyzed the use of new boating parks in Golden (Stratus Consulting, 2000) and in the Town of Breckenridge and the Town of Vail (Stratus Consulting, 2002). These studies all showed the number of boaters increased with increasing flows within the claimed amounts.

The Golden study estimated that the number of boaters using their boating park ranged from 13,170 to 13,709 per year. The boater use estimates for Steamboat Springs are likely to be similar. Steamboat has flows that are similar in magnitude to Golden, substantially higher than those experienced with the Breckenridge and Vail boating parks.

Spectator use

The boating park provides benefits beyond the direct benefits to boaters. The park is located along the Yampa River corridor and is highly visible to spectators. In fact, the boaters interviewed commented that many spectators stop and watch boaters perform at the park. This type of entertainment adds to the ambiance of Steamboat Springs as a premium outdoor recreation area. Tourism is an important element of the Steamboat Springs economy, and the boating park adds to the draw of Steamboat Springs as a destination for visitors.

The Yampa River Festival, for example, has potential to bring in a large number of out-of-town guests. This annual festival is held on a weekend in early June and includes a variety of events. The boating park is central to this festival, including the whitewater rodeo that receives the

biggest draw of spectators. We do not have data, and we do not know of an evaluation quantifying the impact of the Yampa River Festival on the Steamboat Springs economy.

We do have, however, data on the Teva Whitewater Festival/Mountain Games in Vail that includes kayakers competing in a rodeo event. This event has been held on Memorial Day weekend and in early June. This event helps the Vail economy during a non-peak period. Steamboat Springs has the potential to leverage its boating park into a similar type of event in the future.

40% for TEVA

The number of spectators estimated at the Teva event in 2001 was 2,300 (Stratus Consulting, 2002). The number of spectators has grown significantly and was estimated to be 22,000 in 2004 (Untraditional Marketing, 2004).

Key findings from detailed intercept surveys conducted for the 2004 Teva event show:

- 40% of spectators come to Vail specifically for the Teva event
- 80% go out after the event in Vail for drinks, dining, and shopping
- $109 is the average spent on lodging per out-of-town spectator
- $52 is the average spent on dining per spectator
- $45 is the average spent on shopping and activities per spectator
- $89,000 is the median household income of spectator
- 37.1 is the average age of a spectator
- 65% said the event has a very positive influence for them to return to Vail in future
- $1,137,182 is the direct expenditures from the mix of day and overnight spectators incremental to the Town of Vail.

Tubing user days

Tubing is a major use of the Yampa River in Steamboat Springs. Table 2.3 shows commercial tubing counts from 1998 through 2004.

Table 2.3. Tubing guest counts

Year	Period	BackDoor Sports/ Rock & Roll	Blue Sky West (Buggywhips)	Lockhart	One Stop Ski Shop	High Adventure/ Bucking Rainbow	Total
1998	**Total**	**12,983**	**4,352**	**5,902**	**1,873**	**855**	**26,366**
1999	**Total**	**10,337**	**4,268**	**4,239**	**1,493**	**545**	**21,226**
2000	June	509	190	269	na	55	1,023
	July	5,595	3,292	5,211	1,009	1,343	16,450
	August	na	841	1,369	445	91	2,746
	Total	**6,104**	**4,323**	**6,849**	**1,454**	**1,489**	**20,219**
2001	June	1,300	0	128	89	234	1,751
	July	4,711	1,528	2,023	1,008	590	9,860
	August	2,542	862	774	630	252	5,060
	September	113	0	0	0	0	113
	Total	**8,666**	**3,262**	**2,925**	**1,727**	**1,076**	**17,656**
2002	June	922	142	40	272	115	922
	July	0	0	0	0	0	0
	August	0	0	0	0	0	0
	September	0	0	0	0	0	0
	Total	**922**	**142**	**40**	**272**	**115**	**1,491**
2003	June	125	8	0	13	0	146
	July	6,523	1,378	979	1,302	384	10,566
	August	2,029	484	51	558	10	3,132
	Total	**8,677**	**1,870**	**1,030**	**1,873**	**394**	**13,844**
2004	June	195	34	0	0	na	229
	July	5,882	1,325	323	1,164	na	8,694
	August	587	103	0	150	0	840
	Total	**6,664**	**1,462**	**323**	**1,314**	**na**	**8126[a]**

a. 2004 total is an underestimate given Bucking Rainbow did not provide number of tubes.

Tubers used to put into the river at Rotary Park and float down to various takeouts above the James Brown Bridge. In 2001, the City forced all commercial tubers to put in below the 5th Street Bridge. This greatly decreased the length of the run and also the visibility of commercial tubing to visitors (e.g., eliminated run through Weiss Park). This has led to a drop in the number of commercial tubers. This drop in tubing was exacerbated by very low water flows in 2002.

The addition of the C and D Holes in the boating park has enhanced the remaining section of the tubing section of the river. The boating park is just above the half-way point between the 5th Street and James Brown Bridges. The C and D Holes provide the most active water features on the run. Many people tube through the C and D Holes, walk back upriver, and then run the C and D Holes again. They certainly enhance the experience and have increased tubing during a difficult period of decreased tubing for commercial outfitters.

With the addition of the boating park, we believe the commercial tubing numbers can be increased back to and exceed pre-2001 levels in the future. Without the boating park, this would be unlikely. The addition of the boating park mitigates the change in the tubing section to a shorter and less visible section. With better recognition and knowledge of the public to the change, it is reasonable to believe the number of tubers will increase.

The City estimates that the number of commercial tubers could reach 40,000 to 50,000 per year. This is based on commercial tubing companies meeting their regulated capacity limits (Yampa River Plan, 2003). In our calculations, we assume the potential number of tubers related to the existence of the boater park is 40,000. Some of these tubers may not be incremental to the boating park. Hence, this might be an overestimate. However, we note that this section of river did not receive much tubing use prior to 2001. It is only when the City pushed tubing to this lower section and added the structures that tubing increased in this section. In addition, we do not include private tubers in our calculations. The City estimates that the number of commercial to private tubes is approximately two to one. Therefore, 40,000 commercial tubers translates into 20,000 private tubers for a total of 60,000 tubers. These estimates may be refined based upon data expected to be collected in 2005.

2.3 Conclusions

The boating park is used by a variety of users and spectators. They can be divided into three groups:

- Rafting
- Kayaking and canoeing
- Tubing.

Commercial rafting occurs when flows exceed 400 cfs for 12-foot rafts. When flows exceed 800 cfs, 14-foot rafts are also permitted. Rafting is a growing business on this section of river. A total of 436 paying customers were reported to the City in 2004.

Kayaking and canoeing are major users of the boating park. The number of participants using the park is unknown. We expect the total number of boater days in the future to compare to Golden

— about 13,700. We anticipate collecting data in 2005 to get a more precise understanding of use.

Special events have the potential to generate a large number of out-of-town visitors during the May and June non-peak season (i.e., this is a shoulder season between the high use winter skiing and summer tourism seasons). The Teva event held in Vail is reported to generate up to 22,000 spectators. These spectators tend to be affluent and spend up to $206 per day per spectator on lodging, dining, shopping, and activities. The total direct expenditures of spectators incremental to the Town of Vail were estimated to be $1,137,182 in 2004. These are direct out-of-pocket expenditures and do not include any economic multiplier effect.

Commercial tubing has seen a general decline in use since 2001, largely related to a major change in the section of the river that can be run, and also to less than ideal flows especially in 2002. The boating park is a major feature in the revised and shortened stretch used for commercial tubing. The potential increase in tubing in this section could be as high as 40,000 tubers per year.

3. Value of Boating Park to Users and Spectators

Instream recreational uses of water can be highly valuable. These instream values accrue not only to those engaged in recreational activities, but also provide value to spectators and for the local and regional economy. This chapter looks at benefits derived from the Steamboat Springs boating park to specific user and spectator groups. The next chapter calculates their aggregate role in the larger economy.

The total value of the boating park to users has two components: (1) what people actually pay in going to the park (e.g., equipment costs), and (2) what they would be willing to pay over and above what they currently pay. The first component of value can be represented simply by the expenditures incurred. The second component requires more explanation. Consumers purchase products in the marketplace because they are better off with the products than they were with the money needed to obtain the products (or whatever else they would have purchased with the money). If that were not true, goods and services would not be exchanged through free will in the marketplace. Similarly, recreational site visits cost money and time, and recreationalists would not undertake visits unless the visits yielded net benefits. Those net benefits are referred to by economists as "consumer surplus," and are measured as willingness to pay (WTP).

This chapter is divided into four subsections. In Section 3.1, an estimate of user expenditures is developed. Our figures account for kayak equipment and other costs. In Section 3.2, we show WTP "unit values" obtained from the peer reviewed economics literature. In Section 3.3, we summarize the estimated use of the boating park (from Chapter 2) and combine this information with the valuation estimates to calculate the value of this use to boaters and others who use the Steamboat Springs boating park. In Section 3.4, we also quantify the potential impacts from spectator events (i.e., Yampa River Festival), based on inferences from the Teva Whitewater Festival/Mountain Games in Vail.

3.1 Direct Expenditures

We conducted a preliminary assessment of the costs that might be typically incurred by a kayaker visiting the boating park. We considered three cost items: kayak equipment, automobile, and travel time.

Table 3.1 shows our cost calculation for kayak equipment. We estimate the cost of purchasing a typical set of new kayak equipment to be about $2,000. This estimate is based on a detailed review of prices including a kayak, paddle, helmet, dry top, life jacket, spray skirt, booties, gloves, and throw rope (Stratus Consulting, 2000; personal communication with Barry Smith who runs a store in Steamboat Springs selling kayaks). We amortize the equipment costs over three to five years and assume the equipment is used on average 15 to 20 days per year. This leads to an average equipment cost ranging between $20 and $44 per user day. The midpoint of this range is $32 per user day that we use for our calculations.

Table 3.1. Cost of kayaking equipment (2005$)

Kayak gear purchase cost	Useful life (years)	Average user days/year	Gear days over useful life	Kayak gear cost per user day
$2,000	5	20	100	$20
$2,000	4	20	80	$25
$2,000	3	20	60	$33
$2,000	5	15	75	$27
$2,000	4	15	60	$33
$2,000	3	15	45	$44

The other two cost components we considered relate to travel costs. Table 3.2 shows automobile costs for roundtrip distances of 20, 65, and 200 miles using the federal reimbursement rate of $0.375 per mile. We assume 75% of the boaters using the boating park are local to Routt County with an average roundtrip travel distance of 20 miles. We assume 25% are outside Routt County with an average roundtrip travel distance of 200 miles. The 75%/25% split between locals and out-of-town boaters is consistent with the results of our interviews of four people knowledgeable about the boating park, and also consistent with results derived from our research of Vail and Breckenridge boating parks. The 200 mile estimate for out-of-town boaters considers most boaters will come from the front range (about 300 miles roundtrip from Denver to Steamboat Springs). The composite average roundtrip travel distance for all users is estimated to be about 65 miles.

Table 3.2. Automobile costs to travel to kayak course (2005$)

Average round trip miles to whitewater courses	Auto cost per mile[a]	Auto cost[b]
20	$0.375	$7.50
65	$0.375	$24.38
200	$0.375	$75.00

a. Equals the federal reimbursement rate as of January 1, 2004.
b. Equals round trip miles multiplied by the cost per mile.

Studies of recreational expenditures and travel costs also typically include the opportunity cost (value) of travel time in the estimation process (time spent on site also might be included). Assuming an average 50 miles per hour travel rate (including stop signs, etc.), the average travel time given a 65 mile round trip is 1.3 hours. We use a $10 per hour value to reflect this travel time cost, which translates into a $13 travel time cost per visit. The total cost from the kayak equipment, automobile, and travel time cost components is about $69 per visit ($32.00 + $24.38 + $13.00).

Tubing expenditures consist of $13 for a tube rental. We do not include travel expenditures for people that tube as tubing is not always the primary reason people visit Steamboat Springs.

3.2 Consumer Surplus

The method of "benefits transfer" is a standard practice used by resource economists to obtain quick approximations of value when there is no opportunity to undertake primary research by administering a new survey or econometric model. Benefits transfer is conducted by obtaining values per unit of use for similar types of activities from studies conducted in similar locations. Then, those unit values are multiplied by the amount of use. A unit value typically might be the consumer surplus value for an activity such as a fishing day or a hiking trip.

We conducted a benefits transfer using recent, peer-reviewed recreational valuation literature. One set of unit values per day of kayaking was obtained from a 1999 database compiled by John Loomis, a professor of economics at Colorado State University and an expert in valuing environmental amenities. This database is a "meta-analysis," which is an amalgamation of many individual studies to develop an estimate of central tendency. Meta-analysis is used to exploit and combine the strengths of multiple studies that use different valuation methods, and to avoid being misled by a single potential outlier study. These user day values reflect the availability of substitute sites for the recreationalists.

Typically, two types of valuation methods are used in the literature, and in the Loomis database: (1) revealed preference (RP) methods such as travel cost models, which use observed recreational behavior to infer values; and (2) stated preference (SP) methods such as contingent valuation, which ask people to state their values or their willingness to trade off different resource commodities. Carson et al. (1996) demonstrated that estimates of use values do not vary substantively whether RP or SP methods are used.

The Loomis database reports values for five regions of the United States. The values used in this report are taken from the values listed for the "Intermountain" region because they apply directly to Colorado. This region had six studies on floatboating, which includes kayaking, rafting, and

sailing. The mean value per person per day for the "Intermountain" region is $43.22, in 2005 dollars. For comparison, Loomis found the national average to be $35.80, in 2005 dollars.[1]

The recreation values summarized in the Loomis database are generally consistent with summary values obtained in other analyses, such as Walsh et al. (1980). This study, using the contingent valuation method, found kayaking values on the Crystal, Roaring Fork, and Yampa rivers (all in Colorado) to be $38.58 in 2005 dollars per person per day. In the same study, rafting on these same rivers was valued at $33.37 per person per day. Thus, we may deduce that, in general, kayaking is a more highly valued activity than rafting. Accordingly, the Loomis value for floatboating may be an underestimate, since it includes kayaking and rafting together. Nonetheless, the Loomis estimate is used as an upper bound in our analysis.

Another study focused on kayaking in the West found that the average user day value for kayaking on the Colorado River is $72.83, in 2005 dollars (Bishop et al., 1989). However, we do not apply this value to the Steamboat Springs boating park because the Colorado River is considered to be a unique resource in the United States and, thus, values for use of this special amenity may be higher than those for similar activities at other sites.

Therefore, for the purposes of this study, we use a range of $38.58 to $43.22 per person, per activity day, as the value of kayaking (in 2005 dollars). The midpoint of this range is about $41 that we use in our calculations.

We note that this consumer surplus serves as an average estimate. Based on our interviews and previous research, consumer surplus increases with increases in flow. Boaters are more likely to come from longer distances more frequently when higher flows improve the experience.

We do not have any specific studies on tubing. In this analysis, we use a consumer surplus value of $10. This is likely a conservative (low) estimate, given the higher values found in the available empirical literature for other water-based recreational activities (e.g., for swimming or floatboating).

3.3 Total Use Values

As described in Chapter 2, we anticipate obtaining data on boater use for the 2005 season. At this point, we make an estimate of possible use based on experiences at Golden. We focus on kayakers and canoers using the boating parks. Rafting is growing in its importance and the C and

1. Values updated to 2005 dollars using Consumer Price Index, U.S. Department of Labor, Bureau of Labor Statistics.

D Holes add to the demand for this service. In a similar manner, the C and D Holes also have a positive impact on tubing.

For the Steamboat Springs boating park, we use 13,700 kayakers and canoers per year. This estimate represents boaters that come exclusively or primarily to the boating park to paddle. We anticipate that a more precise figure will be generated when actual observations in 2005 become available.

To obtain the recreational use value of the boating parks, the user days are multiplied by the sum of expenditures and consumer surplus.

For kayakers and canoers, we use the average estimate of $69 per person for daily expenditures, which reflects kayak, automobile, and travel time costs. Added to this is the consumer surplus realized by each kayaker of $41 per outing. Thus, the total willingness to pay recreational value per outing is $110 (2005 dollars). Multiplying the estimated number of boater days by the value per outing yields a total recreational beneficial use of $1,507,000 per year.

For tubing, we use an average estimate of $13 per daily expenditures and $10 for consumer surplus. Thus, the total willingness to pay is $23. Multiplying the estimated number of tubing days by the value per outing yields a total recreational beneficial use of $920,000.

These values do not include benefits to spectators.

3.4 Beneficial Value of Special Events

Special events held at boating parks can generate other economic benefits besides ones that accrue to participants. The Yampa River Festival has potential to bring in a large number of out-of-town guests. This annual festival has historically been held in early June and includes a variety of events. The boating park is central to this festival, including the whitewater rodeo that receives the biggest draw of spectators. We do not have data and we do not know of an evaluation quantifying the impact of the Yampa River Festival on the Steamboat Springs economy.

To illustrate the upside potential of special events, we can look at the Teva Whitewater Festival / Mountain Games in Vail that includes kayakers competing in a rodeo event. It can be argued that the Steamboat boating park is similar if not superior to the Vail boating park for performing rodeo moves.

The Teva event has been held on Memorial Day weekend and in early June. The main rodeo event is held in Vail's boating park that is located near the center of town. The boating park consists of three control structures along approximately 300 feet of the existing channel. The

structures were constructed in October and November 2000. Twenty professional kayakers competed in the feature events of the TEVA 2001 Whitewater Festival. Of these 20, five were Colorado residents — one was a Vail resident and four came from other Colorado towns. Ten competitors traveled to Vail from other U.S. states, including California, Montana, New Mexico, North Carolina, Oregon, Utah, and Washington. There were five international competitors — three from Canada, one from England, and one from Costa Rica. The spectator audience was estimated to be 2,300.

According to a survey of 2001 Teva spectators conducted on behalf of the Vail Valley Tourism and Convention Bureau by RRC and Associates:

- 67% came to Vail specifically for the Teva Whitewater Festival.
- 47% came from outside Eagle County, and 26% of these visitors spent at least one night in the area.
- Those staying overnight stayed an average of 3 days, and 30% stayed 4 nights or more.
- The average Saturday spectator spent a total of $133 for food, lodging, and shopping. Therefore, the festival generated over $305,000 in spending by spectators alone at the Saturday competition alone.

The 2001 boating festival provided valuable regional and national exposure to Vail. The event was marketed heavily in Colorado's print and electronic media and had several promotional tie-ins with local businesses. In addition, radio station Q106.5 in the Quad Cities (of Iowa and Illinois) highlighted the festival and conducted a contest to win a Vail rafting trip. The biggest exposure, however, was provided by FOX Net Sports, which prepared a one-hour program on the kayaking competition. This program was aired a confirmed 13 times in seven of Fox's major markets across the United States (Detroit, Pittsburgh, Midwest, Los Angeles, San Francisco Bay Area, Rocky Mountain Region, and Florida).

The Teva event has expanded and grown over time and now includes professional and amateur athletes competing in six sports and ten disciplines including: freestyle and extreme kayaking, kayak and raft paddlecross, bouldering, speed and dyno climbing, mountain bike trials, cross country racing and the Vail Hill Climb, trail running championships, and the GNC adventure sprint race. Kayaking is the center of the event including the Dagger Kayak PaddleCross – where boaters race against the clocks down class IV rapids, to the most skilled boaters competing in the Paddler Magazine Extreme Creek Race. Additionally kayakers compete in the "8" Ball which is comparable to "American Gladiators" – boaters sprint 200 meters down river while over coming human obstacles. The Teva Pro Kayak Rodeo is another event where boaters get to show off their moves in front of both the judges and the crowd. Lastly, is the East vs West Amateur Kayak

Rodeo that places top male and female boaters from the Golden and Vail rodeos against each for the "Battle of Water Rights."

This event helps the Vail economy during a non-peak period. The number of spectators estimated at the Teva event in 2004 was 22,000 (Untraditional Marketing, 2004). Key findings from detailed intercept surveys conducted of spectators of the 2004 Teva event show:

- 40% of spectators come to Vail specifically for the Teva event
- 80% go out after the event in Vail for drinks, dining, and shopping
- $109 is the average spent on lodging per out-of-town spectator
- $52 in the average spent on dining per spectator
- $45 is the average spent on shopping and activities per spectator
- $89,000 is the median household income of spectator
- 37.1 is the average age of a spectator
- 65% have say event has a very positive influence for them to return to Vail in future.

A study of the Teva event calculates that the direct expenditures from the mix of day and overnight spectators incremental to the Town of Vail for the Teva event in 2004 was over $1.1 million. When a 1.75 economic multiplier effect is taken into consideration, the value is $1.9 million per year.

4. Preliminary Estimate of the Beneficial Value of the Steamboat Springs Boating Park

Table 1 in the Introduction and Summary shows a summary of potential future benefits generated from the Steamboat Springs boating park. The benefits will be revised when new information on boater use is collected in 2005.

Annual direct expenditures from equipment, automobiles, and travel time for kayakers and canoers are $945,300. The direct expenditures related to nonlocals staying in Steamboat Springs is estimated to be $1,027,500; we use a $150 per day per person estimate that is below typical values estimated for mountain resort communities.

Applying the multiplier of 1.75 to the out-of-pocket expenditures of $56 per boater day (excluding the value of travel time) and nonlocal expenditures related to lodging, dining, and shopping, we obtain an incremental economic stimulus value of $1,346,025 per year. The net impact on the local economy beyond direct expenditures is obtained by reducing the multipliers by 1.0 (to 0.5 and 1.00).

Direct expenditures related to tube rentals can potentially be $520,000. Consumer surplus values would be $400,000. The indirect economic stimulus would be $390,000. Total economic impacts from tubing would be $1,310,000.

We do not quantify any additions related to the increase in rafting from the boating park. The contribution from this growing activity could be significant in the future.

We do estimate a range of values related to the potential use of the boating park for special events. We assume Steamboat Springs can produce an event equal in magnitude to the 2004 Teva event in Vail. Given Steamboat Springs has the infrastructure and boating park, it is not unreasonable that Steamboat Springs can develop a special event generating spectator interest of this magnitude in the future.

The total potential benefits of the boating park are over $7.2 million per year. When capitalized over 20 years at 7%, the present value of benefits are greater than $81.4 million.

Other economic and nonpecuniary benefits can be generated in Steamboat Springs and surrounding vicinities because of the waters diverted in the boating park. These likely benefits include nonevent spectators, enhancement of local property values, improved community identity and quality of life, and option values.

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November
2008

Yampa River Structural Master Plan

Ecological Resource Consultants, Inc.

City of Steamboat Springs
Parks, Open Space and Recreational Services

Executive Summary

The Yampa River Structural Master Plan was created in a combined effort between Ecological Resource Consultants, Inc. (ERC), the City of Steamboat Springs (City) and the general public. It provides a framework for instream and riparian area improvements that will optimize the recreational benefits of the river while protecting its ecological integrity. The area that was used includes approximately 34,000 linear feet (6.4 miles) of the Yampa River located on City property from the Chuck Lewis Wildlife Management Area to the Fournier Open Space. The plan prioritizes the recommended improvements and provides budgetary cost estimates for City implementation. The study area consists of approximately 6.4 miles of river and riparian corridor located along City owned property.

Resident interest and comment was encouraged throughout the study process and was primarily received during three public meetings. This input, combined with river reconnaissance performed by ERC and the results of past studies, allowed "areas of interest" (AOIs) to be identified and recommended improvements to be given for each. These areas were grouped into three categories based on the nature of their issue(s): river rehabilitation, recreational use and water rights. River rehabilitation AOIs were defined as areas where the stream channel and adjacent riparian corridor have been degraded and natural aquatic habitat is limited. This category was further broken down into smaller categories including bank stabilization, vegetation and riparian buffer, channel form and aquatic habitat. Recreational use included AOIs were active and passive recreational opportunities exist and require improvement or areas where they are desired. The water rights category addressed the need for the construction of a gage that will ensure that Steamboat Springs receives flows required for its recreational demands. These flows were decreed by the Recreational in Channel Diversion Steamboat Springs received in March of 2006. Community input and reconnaissance also facilitated the ranking of each AOI based on its severity.

The culmination of the study was an easily understood and usable master plan, including detailed costs and mapping, which will help the City in planning future river improvements.

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I. INTRODUCTION

A. Project Description

The City of Steamboat Springs (the City) is developing a structural master plan that will provide a framework for instream and riparian area improvements on City owned lengths of the Yampa River. These improvements will optimize the recreational benefits of the Yampa River (the River) while protecting its ecological integrity. The Yampa River Structural Master Plan (the Plan) is intended to prioritize these improvements and to provide budgetary cost estimates for City implementation.

The Plan is the result of a collaboration between the City, Ecological Resource Consultants, Inc. (ERC), and the general public..

B. Project Area

Within the project area the Yampa River flows through both urban and natural settings including parks and downtown Steamboat Springs. The project area includes approximately 34,000 linear feet (6.4 miles) of the Yampa River from the Chuck Lewis Wildlife Management Area to the Fournier Open Space. Throughout a significant portion of the project area, the river generally flows from south to north with a railroad on its western bank and the City on its eastern bank. There are 6 main tributaries to the Yampa within the study area and include: Walton Creek, Fish Creek, Spring Creek, Soda Creek, Butcher Knife Creek and Burgess Creek. The land adjacent to the River is held in both public and private ownership and there is development, existing or planned, on many of the river's borders within the study area. City owned properties were analyzed as part of this Plan. Some other adjacent areas that were identified as areas of interest by the City that are not on City property were also evaluated.

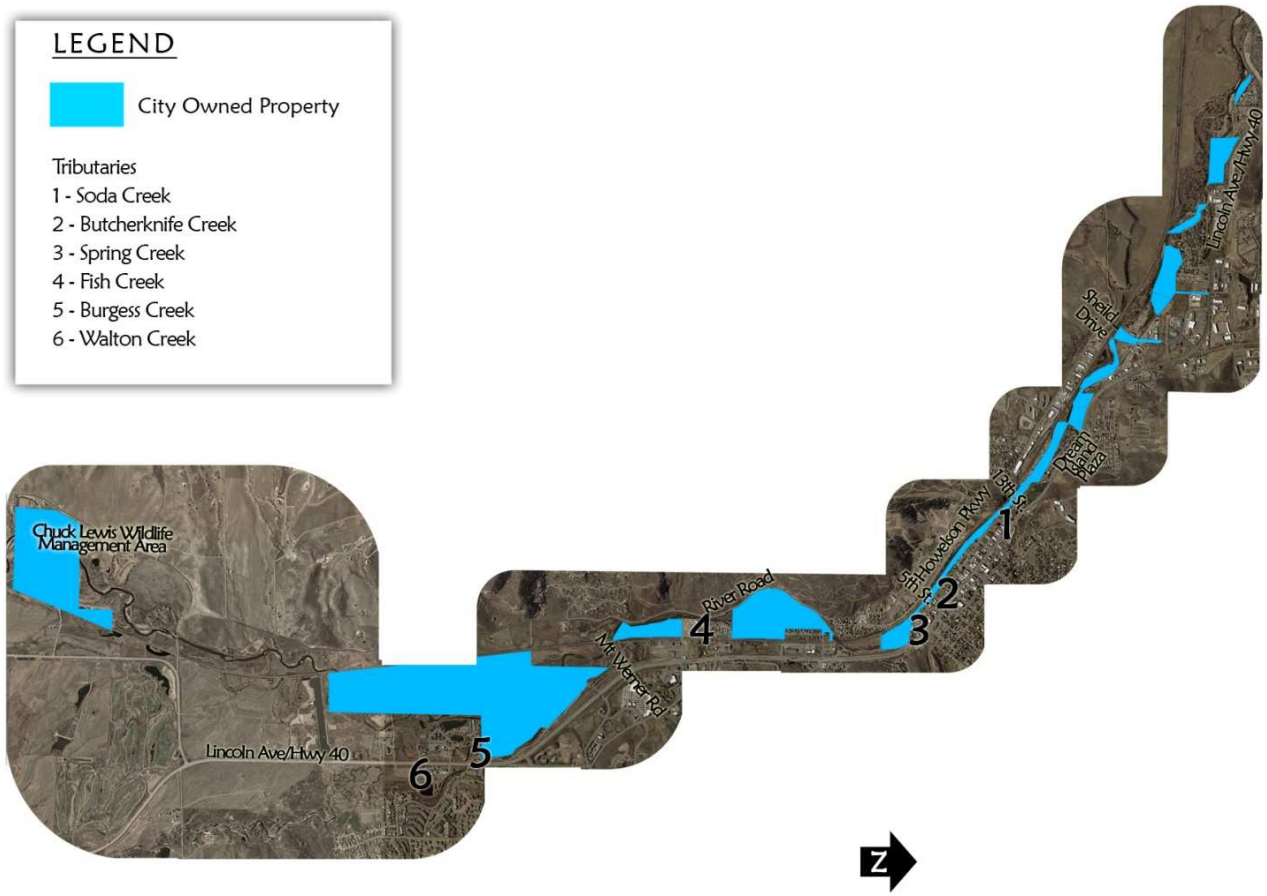


Figure 1 - City Owned Parcels

C. Project Approach

Residents of the City are very interested in protecting and improving the Yampa River. Because of this, citizens' input was solicited in public meetings that took place during each of the three phases of the project and used throughout the creation of the Plan. Phase 1 consisted of gathering existing information, including mapping and past studies of the River, as well as a river reconnaissance by ERC. Public meeting #1 introduced the project and ERC to the community and provided a forum where stakeholders raised the main issues they see affecting the River. In Phase 2 ERC performed additional river reconnaissance and more closely observed those areas that had received comments in Phase 1. During this phase ERC identified areas of interest based on the River assessments and community comments. This phase also included public meeting #2 where ERC presented its areas of interest and asked the community to identify additional areas they perceived as areas of interest. Phase 3 included the completion of a draft Plan and public meeting #3 where ERC showed the community its draft recommendations for the River. It also allowed the community to provide input on the Plan before it was finalized.

Please note that all report figures can be found in a larger size in Appendix A. A figure showing photo locations can also be found in Appendix A.

D. Data Collection, Mapping and Surveys

Project sponsors provided information and records during the course of the study. The information included copies of previous related studies, aerial topographic data and aerial photographs. The City provided all mapping. M.J. Harden Associates, Inc. processed and prepared the aerial topography with a 2' contour interval in August of 2007 based on 1994 contour data. Aerial photographs were created by Pixxures, Inc. in July of 2007.

E. Previous Studies

In 2001, the City collaborated with Aquatic and Wetland Company (AWC) of Boulder, Colorado and completed the Yampa River Studies. It provided a river management plan for approximately 4 miles of the Yampa River from the Walton Creek-Yampa River confluence to the James Brown Bridge. Phase 1 and phase 2 of a planned 5 phase study, including a water quality and macroinvertebrate analysis and a river user survey, were completed. Phases 3-5 which included baseline map development, policy development and a river management plan were not completed.

In 2003, the City collaborated with EDAW of Denver, Colorado to produce the Yampa River Management Plan (YRMP). This plan divided the Yampa River Corridor into 5 River Management Areas (RMAs) based on their land and aquatic habitats, land uses and recreational amenities. It also defined recreational uses, access points and seasons of use along the corridor. Recreational uses included tubing, paddling (kayaking and rafting) and fishing. It also provided a river management and monitoring plan. The recreational uses, seasonal use and access point information from this plan were used to define specific improvements in the Plan that will enhance the recreational use of the river.

II. BACKGROUND

A. Community Amenity

The Yampa River corridor is one of the most important amenities to the City of Steamboat Springs. From its value as an ecological resource to its economic impact on the community from activities associated with stream related recreation to the beauty and character it provides, the Yampa corridor is vital to the City. The community appreciates how important a resource it is and has worked hard to protect and improve the area.

Use of the corridor by the public is encouraged by the multitude of parks and trails that the City has developed. Parks located along the River include: Dr. Rich Weiss Park, River Creek Park, Rotary Park, Fetcher Park, Emerald Park, Little Toots Park, West Lincoln Park, Howelsen Park and the Stockbridge Multi-Modal Center. Wildlife Management Areas (WMAs) like the Chuck Lewis WMA and public open space also exist along the River. Connecting the parks and neighborhood trails is the Yampa River Core Trail. This trail follows the river from Walton Creek Road and Highway 40 to the James Brown Bridge on Shield Drive and provides access to the river. The trail is highly used and there are plans to extend the trail South and West along the river corridor.

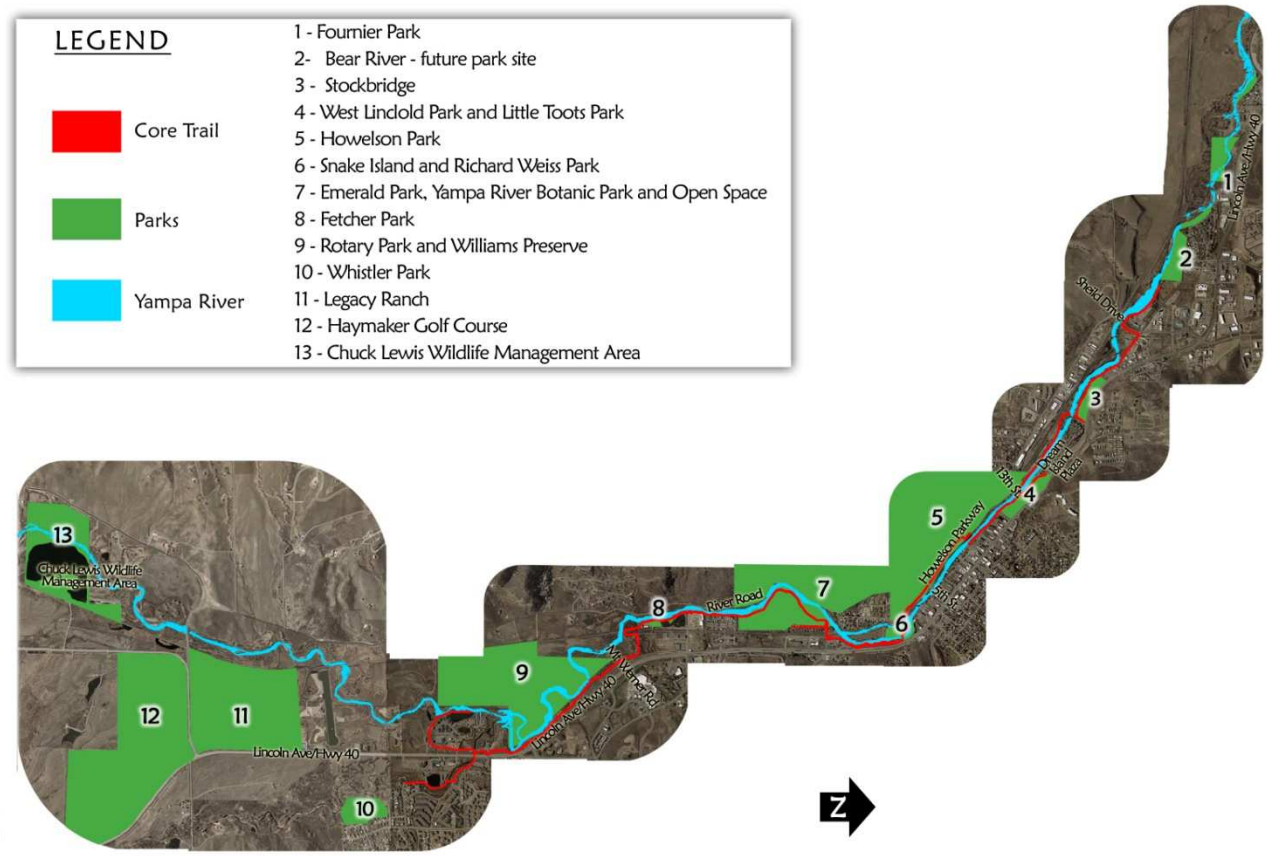


Figure 2 - Parks, WMA's and the Core Trail provide easy access to the River

The parks, WMAs, open space and trail offer easy river access which has led to an increase in recreational demands on the river. This increase has occurred with some impacts to the resource. Creation of informal access points along the banks of the river, loss of vegetation and bank erosion, user conflicts and increased trash are all results of the high level of use this area receives. ERC anticipates that as the City implements improvements presented in this Plan, more use will follow. We recommend that the necessary level of regulation, monitoring and maintenance is implemented to ensure the resource retains its character and value.

B. Yampa River Hydrology

Daily flow data from the United States Geologic Survey (USGS) database for the Yampa River at Steamboat was retrieved from October 1, 1904 to July 1, 2007 (USGS Station No. 09239500). The data was analyzed and statistics of observed daily flows were determined.

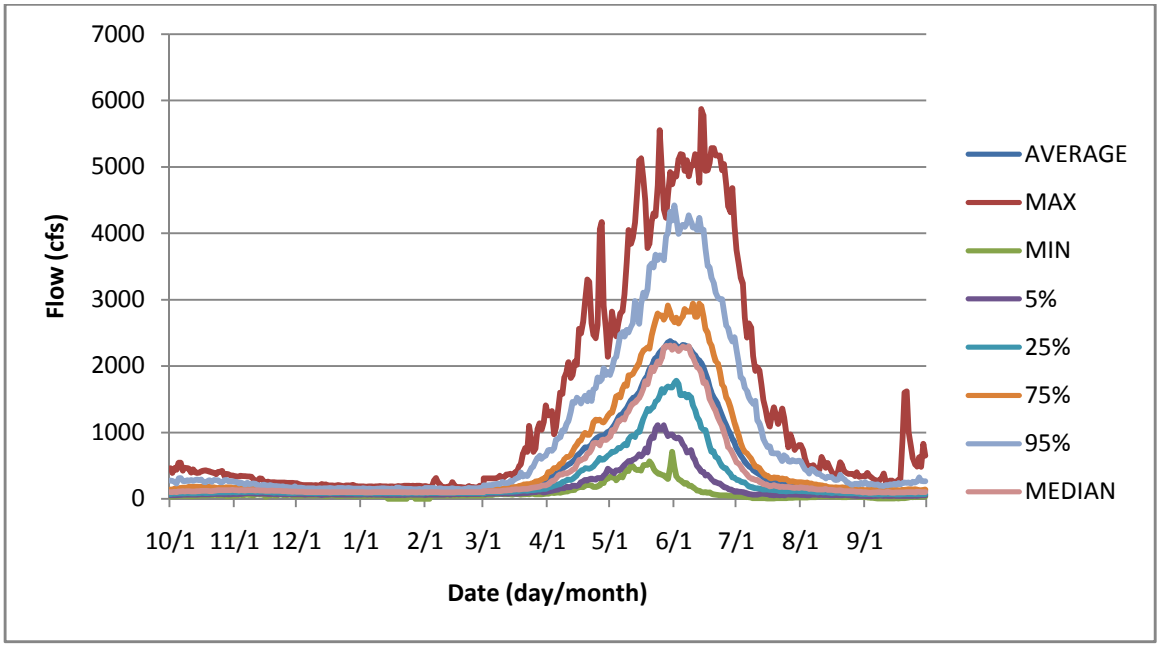


Figure 3 - Flows on the Yampa River

This graph shows the average, minimum, maximum, median and varying percentile daily flows on the Yampa River. Percentile flows describe how one flow relates to other observed flows. For example, the 95% daily flow value is the value below which 95% of the observed flows for that day during the years that measurements were taken have occurred.

Historically, lower flows occur during the months of October through March with the lowest flows occurring during January or February. Flows begin to increase in March from snowmelt and reach their peaks during May and June. The flows decrease during July through October. These flows coincide with the recreational use seasons on the river specified in the YRMP; with recreational use occurring from April to November and peaking in July and August.

In an average year, flows peak in early June at a flow rate of approximately 2940 cfs. Average flows through the critical late summer months of August and September when air and water temperatures peak are approximately 256 cfs and 189 cfs, respectively. Average flows through the lowest flow month of January are approximately 114 cfs.

The bankfull, or channel maintenance discharge, is the flow that generally controls the channel shape. Regionally the bankfull flow can be defined as the flood flow that occurs on an average of once every 1.5- to 2- years. Bankfull flow is an important parameter in stream improvement projects as any proposed channel modifications need to take this parameter into account so as to not adversely impact major sediment transport requirements. Based on review of the available flow data the bankfull flow for the Yampa River at Station No. 09239500 is approximately 2,700 cfs.

C. Existing Channel Character

The character of the River changes along the project reach. The upstream and downstream most portions have been impacted the least by encroachment and development and are slightly entrenched, have natural meander patterns and relatively low slopes. The riparian buffer in these sections of the River is typically wider than through the downtown area. The downtown area, through the more developed reaches along the river, is more entrenched, has less sinuosity and steeper slopes. The riparian buffer in this portion is narrow or non-existent due to development on its eastern bank and the location of the railroad on its western bank. In some areas, development has occurred adjacent to the river bank and little to no buffer is present.

The channel within the project reach was classified by ERC according to the Rosgen Classification System, level 1 (Rosgen, 1996). Using this system, stream channels are given a classification based on the general geometry of the channel and floodplain. The Rosgen classification system was used as a tool to describe the existing state of the River in the study area. The channel classification system was not used to determine rehabilitation methods; rather, each area of interest was viewed as unique and received improvements tailored to its issue(s).

A majority of the stream was classified as a Type C stream. Type C streams are riffle/pool streams with well developed meanders, pointbars and a broad well defined floodplain. They are wide streams with a width to depth ratio (W/D) greater than 12, are slightly entrenched and usually have slopes less than 2%. Prior to human impacts we believe the Yampa River, through the entire project area, would have classified as a Type C stream.

In areas where the stream has been straightened and encroachment into the natural floodplain has occurred with development of the City and railroad, the channel is no longer in a natural state. The straightening of the channel reduced sinuosity and increased channel gradients. The channel banks have been built up to minimize flooding and have resulted in increased entrenchment. Using the Rosgen method, the decreased sinuosity and increased entrenchment result in a Type F classification. Type F streams are riffle/pool streams that are deeply entrenched with a W/D ratio greater than 12. They are often meandering, have little to no floodplain and low slopes.

Other isolated sections of the project area have braided flows most likely resulting from an increase in deposition. These areas classify as D stream types. Type D streams are braided streams characterized by moderate to high bank erosion rates, depositional features such as longitudinal and transverse bars and a frequent shift in bed forms. They are very wide channels, are slightly entrenched and have slopes of less than 4%. The results of ERC's level 1 classification are shown below.

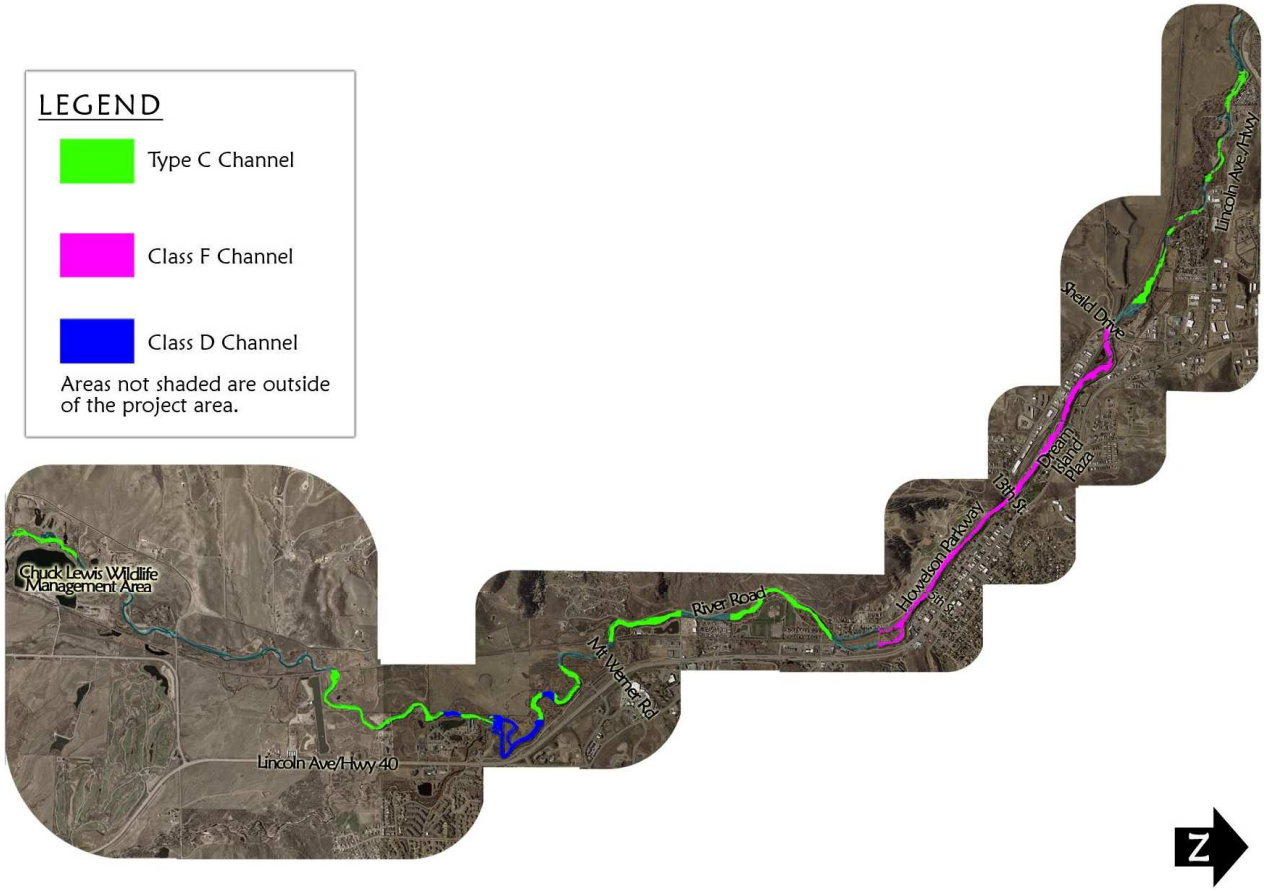


Figure 4 – Level I Rosgen Channel Classification

This classification system was established for natural rivers. Many portions of the River through the project reach have been modified from their natural state through straightening and encroachment. Classifications therefore may not be completely accurate.

D. Defined River Use

Due to the quality of the resource there are many competing interests for its use. The Yampa River Management Plan (EDAW, 2003) identified river users and the times of years they used the river.

***Private Tubing **Commercial Tubing**

Figure 5 - Optimal Use Periods by Recreation Activity (EDAW, 2003)

In addition to the time of year the river is used, the Yampa River Management Plan established the locations along the river where different uses are allowed/recommended. The River was divided into five distinct River Management Areas (RMAs) and major uses within each RMA were defined.

River Management Area	Main Recreational Uses
RMA - 1	Wildlife viewing, fishing and kayaking
RMA - 2	Fishing, kayaking and private tubing
RMA - 3	Fishing, kayaking, swimming and private tubing
RMA - 4	Fishing, kayaking and tubing
RMA - 5	Kayaking and commercial tubing
*RMA – 6	Wildlife viewing and fishing
*RMA – 7	Wildlife viewing and fishing

*RMA created by ERC for this report. It was not part of the EDAW report. Recommended uses for these areas were provided by the City.

Table 1 - RMA's and Their Main Recreational Use

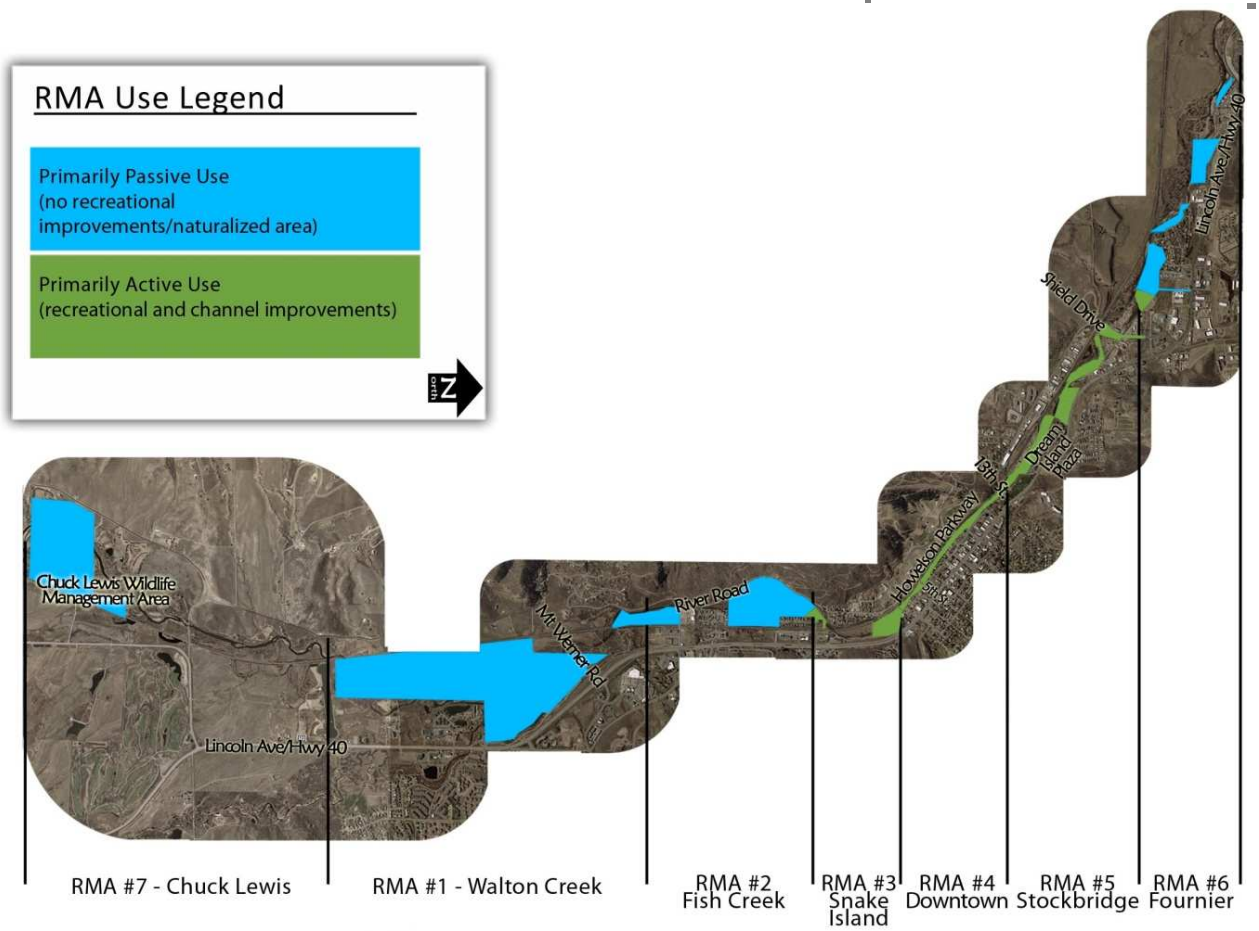


Figure 6 –RMAs and Their Recreational Use

The Plan includes Fournier Park, an area recently acquired by the City, and the Chuck Lewis WMA. These areas were not included in the 2003 YRMP. Per direction from the City, uses in Fournier Open Space and the Chuck Lewis WMA will emphasize wildlife viewing and fishing.

The recommended improvements presented in this Plan will reflect these use patterns. Heaviest "park and play" boating kayak uses occur from downstream of the Fifth Street Bridge to the "D Hole" downstream of the 13th Street Bridge. The approach in this reach will be to recommend improvements that improve/optimize its recreational utility while a more natural, less structural approach is recommended in other areas to protect and promote the natural character of the stream.

E. Public Input

Community input was received throughout the Plan development process with specific input obtained during the first two public meetings. At the first public meeting recreational use improvements requested included increased and more user-friendly River access, new kayak holes and play areas and the reconstruction of existing play structures. The installation of a gage for RICD rights and agricultural diversion repair were other requests. The need for strict regulation and enforcement to protect the resource was also a main concern raised at the first public meeting. During the second public meeting,

when ERC's initial assessment of areas of interest was presented, river health concerns were more prominent with channel stabilization and minimizing and controlling River access being more vocal concerns. Community comments from public meeting #1 and #2 can be found in Appendix B.

F. Past Improvements

The Yampa River has historically been a popular place for fishing, rafting, swimming, tubing and kayaking and, because of this, the community has been committed to improving the health and recreational use of the river. Improvements have included the addition of boating play structures, rock vanes and boulder clusters, revegetation and bank stabilization measures. Many of these improvements still exist today. Dates and scope of prior stream projects known to ERC are provided in Appendix C.

III. EXISTING CONDITIONS ASSESSMENT

As part of ERC's assessment of existing conditions, the entire project area was walked and the condition of the channel, banks and vegetation were evaluated. Input was also received from the City and public on problems along the project reach. Based on our observations and input from others, areas of interest (AOIs) were defined. These AOIs were the basis for ERC's recommended improvements.

Areas of interest were grouped into two major categories: river rehabilitation and recreational use. River rehabilitation AOIs were defined by ERC as areas where the stream channel and adjacent riparian corridor have been degraded to a point where they are functioning well below their potential, considering current conditions and constraints. Included in this category are areas where the channel form is degraded (poor width/depth ratio, low sinuosity, etc) and natural aquatic habitat is limited. It also includes areas lacking a healthy riparian corridor (stable, vegetated banks with riparian terraces and connected floodplains where possible). Recreational use AOIs included areas where active and passive recreational opportunities exist and are desired.

A third category was included in ERC's assessment for water rights. Ensuring that maximum flows continue through this reach is of importance to the health of the river system and recreational uses alike.

To understand the basis for ERC's assessment, the sections below describe types of problems that were noted and why these issues are concerns to the overall integrity of the system. Specific areas along the project reach where each type of problem was identified are presented in Appendix D.

A. River Rehabilitation

1. Bank Stabilization

Bank stability affects channel shape, aquatic habitat and water quality. Eroding banks can cause the river to widen, migrate laterally or create a new bend. The sediment from an eroding bank can fill in pools and other areas that fish use for refuge and, by increasing the amount of suspended solids, it can decrease water quality. Bank instability results from a lack of sufficient natural armoring.

Bank stability problems can be found in many locations along the River and vary from minor surface erosion to mass wasting and undercutting. In some locations the undercutting is stabilized by existing vegetation and provides aquatic habitat. In others, vegetation is not well established or does not sufficiently stabilize the bank. Existing revetments, i.e. forms of structural bank stabilization, include large placed boulders and logs and riprap. Many of these structures are locally effective and have been placed on an as needed basis.

Steep bank angles and sparse surface protection, both vegetative and structural, are closely correlated with bank instability in severely eroded sections of the River. These steep banks may have formed as either a result of channel incision or of the River adjusting to past channel modifications and encroachment. In areas that have been straightened and confined the River has tried to reestablish its equilibrium by becoming erosive. These changes, combined with the River's inability to access its historic floodplain, have increased shear stresses and caused bank erosion to be more prevalent.

New areas of bank instability may develop over time in sections that are not identified in this report and areas that received a low ranking in this report may develop into more immediate problems if corrective measures are not taken, particularly as existing revetments degrade with age.

Photo 1- Existing Bank Stabilization AOI example

Photo 2 - Existing revetment

Areas where bank stabilization was observed are depicted on Drawings 1 – 11 in Appendix D. A description of the specific issues noted at the individual AOIs is presented in Appendix E.

2. Vegetation and Riparian Buffer

Healthy and viable vegetation in the riparian corridor is very important. It has many functions including: stabilizing riverbanks and resisting erosion, filtering suspended solids, nutrients and other pollutants, supporting riverine and riparian fish and wildlife species and helping to moderate the climate of the riparian system. It also protects and buffers the river from adverse impacts such as stormwater runoff.

Vegetative quality is a subjective indicator of observed vegetation characteristics. These characteristics include the presence and density of overstory, midstory and understory vegetation, amount of hardscape present, complexity of the vegetation structure, amount of non-native species present and the presence and width of the riparian buffer. A table of recommended native plant species and non-native species is located in Appendix F.

Higher vegetative quality is found in the upstream and downstream reaches where less development is present. In many of these areas the amount of vegetation could be increased but is sufficient and, since there is very little development on the banks of the river, buffer width is adequate. This is primarily true along the eastern bank of the river.

In many locations in the middle reaches, the railroad track or road lies along the top of the western bank and little to no buffer is present. The middle portion, through downtown, has lower vegetative quality with little to no buffer and less vegetation along the banks. In areas where bank instability has necessitated the installation of bank armoring little to no vegetation is present. The lack of riparian vegetation in these areas affects the overall health and function of the channel.

Photo 3- Lack of Riparian buffer and Vegetation Example

Photo 4 - Lack of Riparian buffer and Vegetation Example

Areas where concerns with the vegetation and riparian buffer were observed are depicted on Drawings 1 – 11 in Appendix D. A description of the specific issues noted at the individual AOIs is presented in Appendix E.

3. Channel Form

In its natural state the Yampa River through the project area was an alluvial or unconstrained river. This means that its beds, banks and floodplain were composed of materials deposited by the river and, since these materials were constantly being moved, the bed and banks were moveable boundaries. Thus, the floodplain was constantly being reworked as the river removed sediment from one bank and deposited

the material in a sandbar on the opposite bank. Channel stability occurred when the removal and deposition of this material was equal.

As previously described, the River channel was naturally a Rosgen Type C channel through the project reach prior to human impacts. Areas less affected by development and where braiding has not occurred are typical of this type of alluvial rivers. During flood events they are able to access their floodplains and they have meanders and point bars.

Areas where past human activities have straightened the channel, built up its banks to prevent flood flows from leaving the main channel and encroached within the natural floodplain, the natural stream balance has been upset and the River is no longer in a natural state. In these areas natural meanders have been lost as the river has been straightened, the channel has become incised due to the heightened banks and the natural floodplain has been lost to railroads, roads and development. These activities have combined to result in a channel that is no longer functioning as a natural system.

It is natural for a river to change its morphology in response to a disturbance. Following a channel altering disturbance the river typically undergoes a period of recovery in which the equilibrium of the channel is reestablished. For example, a channel that widens and straightens in response to a flood will narrow and regain sinuosity through revegetation and sediment transport. In the case of the River through much of the project reach, the degree of human impact is so great that the system is not capable of adapting to the forced changes. This is indicative of areas on the River where the channel is wide, straight and shallow with little or no pronounced thalweg.

Photo 5 - Overly wide and shallow channel

Photo 6 - Slackwater and braiding

Given the development that has occurred in these areas, true channel restoration is not possible. ERC believes the goals for these areas should be to provide a level of channel equilibrium that is obtainable given current land constraints. Minor improvements can regain some of the natural function of the stream system which will lead to improved aquatic and riparian function and recreational opportunities.

The main, fixable problem observed within the River is the absence of a defined low flow channel. This impacts both the ecological and recreational function of the channel. Ecologically, a low flow channel is important because during times of low flow it provides deeper water and higher quality habitats, less evaporation losses by decreasing the water surface area and lower water temperatures. Recreationally, a low flow channel extends the time during the year when boating can occur as a result of the confined, deeper water.

In the past the City has constructed vanes from the bank into the channel in an attempt to remedy this problem. In some locations vanes have been constructed along both the right and left bank. In other locations vanes have been constructed in an alternating fashion with one on the left bank followed by a downstream vane on the right bank followed by a downstream vane on the left bank, etc.

Photo 7 – Vanes have been used previously in an effort to create meanders and low flow water depths

ERC believes that the installation of vanes has benefited the stream by creating deeper water in some areas. However, in most cases the vanes as constructed have further aggravated the unnatural form of the channel.

Natural channels have a thread of the deepest water, called the thalweg, on the outside bend and shallower areas and bars on the inside of bends. This follows the natural stream process where channel material is eroded from an outside bend and deposited on an inside bend. In locations where vanes have been constructed along both banks the vanes are fighting this natural process and instead trying to structurally force flows down the center of the channel. This is generally not an optimal solution as the vanes further force the channel into a straight alignment and they are susceptible to failure as the natural forces of the channel are working against them.

Installing vanes on alternating banks, as has been done in other locations, is a more natural approach as it allows the stream to meander from one bank to the other. The problem ERC has observed with these installations, however, is the meandering pattern they force the stream to take.

A degree of variability exists in the shape of meanders that form but the meander wavelength in rivers is generally between 10 and 14 times the width of the channel (Leopold, 1992). One meander wavelength includes a left and a right meander; therefore a single meander should occur approximately once every five to seven channel widths. The width of the river through a majority of the straightened sections is typically between 70 and 90 feet, meaning that each meander should be between 350 and 630 feet apart and that total meander wavelengths should be between approximately 700 and 1260 feet. Alternating meanders that have been installed on the River through the project reach have much shorter wavelengths and distances between meanders. Single meanders spaced as close as 50 feet apart

(100 foot meander wavelength) have resulted based on the vane spacing. These extremely short constructed meanders are fighting the natural tendency of the river and creating an unnatural, structural control that is impacting the health and function of the stream.

Areas where the form of the channel could be modified to improve the overall health and function of the stream are depicted on Drawings 1 – 11 in Appendix D. A description of the specific issues noted at the individual AOIs is presented in Appendix E.

4. Aquatic Habitat

Aquatic habitat is affected by hydraulic variability, bed material, flow velocity, nutrient availability, water quality and water temperature. Hydraulic variability ensures the presence of an array of microhabitats for various riverine species. Given that this reach of river is of such importance as a trout fishery, the aquatic habitat was judged based on requirements for a healthy trout population and managed as a cold water fishery.

Quality habitat requires that varying flow velocity, depth and flow patterns exist in the channel through a range of flows. Hydraulic variability is a result of varying gradients (channel slopes), thalwegs and instream features. A natural river of this type with hydraulic variability will have riffles (shallow fast moving water) and pools (deep, slower moving water). High flow channels can improve aquatic habitat by providing added diversity. Many factors contribute to the quality of the aquatic environment. During times of the year, water quality (temperature, pH, dissolved oxygen and suspended solids) can be the most influential component. Physical habitat conditions also limit the aquatic habitat of a significant amount of the project reach with average water depth and overwintering pool habitat the two primary limiting physical habitat factors.

An optimal trout fishery requires a variety of specific habitat features. In general, optimal trout riverine habitat can be characterized by clear, cold water; a silt-free rocky substrate in riffle-run areas; an approximately 1:1 pool-to-riffle ratio, with areas of slow, deep water; well-vegetated stream banks; abundant instream cover; and relatively stable water flow, temperature regimes, and stream banks (Raleigh and Duff 1980).

Photo 8 - Lack of aquatic habitat

Photo 9 - Lack of aquatic habitat

There are many areas along the River where aquatic habitat is well below optimal. Overall a majority of the channel is dominated by low gradient riffles with limited deeper pools. Habitat variety is minimal through most of the project reach. In other areas little or no instream habitat exists.

Areas where aquatic habitat was limited were identified as part of the site assessment and are depicted on Drawings 1 – 11 in Appendix D. A description of the specific issues noted at the individual AOIs is presented in Appendix E.

B. Recreational Use

Recreational values gained by the river system are of high importance to the City, its citizens and visitors to the community. Recreation takes many forms along and adjacent to the river including wildlife viewing, walking/running/biking the trail, boating (tubing, rafting and kayaking) and angling. These varying uses require different types of amenities and direct access to the river.

As part of ERC's assessment of existing conditions, a specific assessment was completed to evaluate river access and boating. Wildlife viewing was incorporated indirectly as part of the evaluation of vegetation and riparian buffer presented above. Quality angling is related to channel form and aquatic habitat and is therefore addressed indirectly through those categories. Access, which is a requirement of many uses and boating are addressed as part of this section.

1. Access

Access to the river is required to support a number of different active and passive recreational activities. Quality access allows the specific users to enter the river setting in a safe and secure manner. Good access points should direct users to a specific location thereby limiting impacts on adjacent slopes and vegetation.

Photo 10 - Eroding access point at "The Beach" in Dr. Rich Weiss Park

Photo 11 – Eroding Informal Access Point

As part of our investigation, existing access points to the stream were evaluated. Areas where the access was either difficult to use, unsafe, in a state of disrepair, poorly defined and/or where access was clearly impacting surrounding areas were identified and are depicted on Drawings 1 – 11 in Appendix D. A description of the specific issues noted at the individual AOIs is presented in Appendix E.

2. Boating

Boating is a major use of the Yampa River. Boating takes on many forms including rafting, tubing and kayaking. Boating uses are further split into those who put in the water at one location and float downstream (top to bottom users) and those whose recreation is focused on one specific location (park and play). Use by top to bottom boaters is dominated by tubing (EDAW, 2003) however, kayaking and rafting are still important uses of the area. Park and play use is typically limited to kayaks.

The section of the River flowing through the downtown corridor provides a world class resource to experienced and amateur kayakers alike. The many instream boating structures offer both park and play and top to bottom boating opportunities. The community has been heavily involved with the creation and maintenance of these structures.

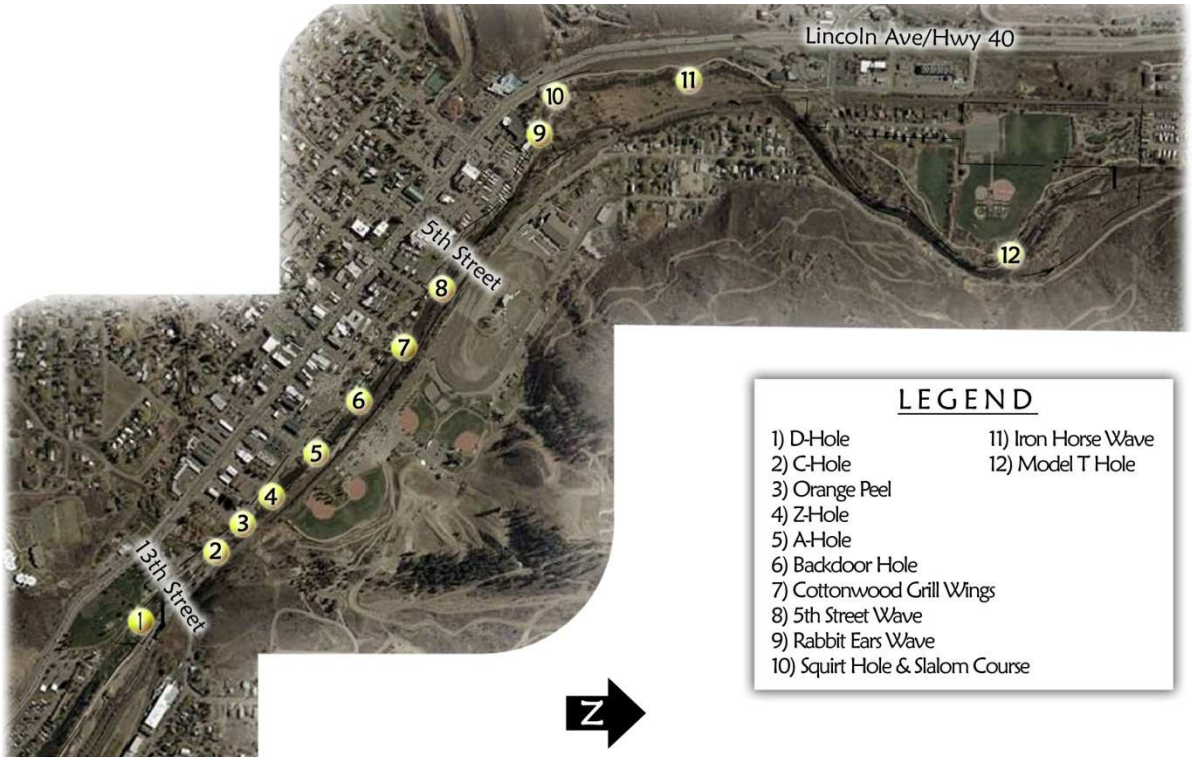


Figure 7 - Play Structures in the Project Area

In order to function as a quality amenity, boating features should function over a range of time and flow conditions and they should provide a variety of opportunities for enjoyment for differing ability levels. Any boating feature should provide safe passage for novice users.

ERC's evaluation of existing boating features found that a significant number of structures have been built for this purpose. Despite the high number of features available, discussions with the boating community indicated that two specific features, Charlie's Hole and the D-Hole receive far more use than any of the other structures. Other features typically only function well under a small range of flows or do not function as intended altogether. This results in underutilization of most of the boating features and crowding at the most popular locations. Concerns with channel form discussed above are generally areas where the overall channel shape limits the top to bottom boater.

ERC's assessment of the river, which included significant input from the public, identified improvements that could be made to better the area for recreational boating. Areas where boating features are poorly designed or are in a state of disrepair were identified and are depicted on Drawings 1 – 11 in Appendix D. A description of the specific issues noted at the individual AOIs is presented in Appendix E.

C. Water Rights

To ensure that the River within City limits receives flows required for its recreational demands, the City obtained a Boating Park Recreational in Channel Diversion (RICD) in March of 2006. Before this right can be administered the City must install gages required to calculate average daily flow in 1 of 2 locations:

on Butcher Knife Creek near its confluence with the River and on Soda Creek near its confluence with the River; or at or near the 13th Street Bridge. As part of ERC's assessment of existing conditions, the need to perfect this water right by installation of the required gage(s) was identified. The City installed a gage at the 13th Street Bridge in the summer of 2008.

IV. MASTER PLAN IMPROVEMENTS

The City's stated objectives for this project were to define master plan improvements:

- To enhance/preserve the natural character of the River through river rehabilitation improvements
- To enhance the value of the River as a community amenity through access points and recreational use opportunities

After ERC completed its evaluation of the stream system through site assessment, review of background data and public input, recommended improvements were defined. Improvements presented herein are intended to address problems identified in a consistent manner establishing a roadmap for future implementation. Improvements presented include all items identified as part of this Plan evaluation. It is envisioned that recommended improvements could be phased in and it is likely that some improvements may never be implemented. It is also likely that as areas which are outside the scope of this study are evaluated, other related improvements may be undertaken and incorporated into this Plan.

Recommended improvements presented in this Plan are described at a conceptual level of detail. Prior to implementation, a more detailed site specific investigation and design will need to be conducted to verify the appropriateness and suitability of a technique for a given area and refine the improvements made in this report.

The sections below describe the typical improvement techniques that were considered as part of the Plan improvements. Possible treatments are broken out below to correspond to the categories of problems observed and discussed above. For each treatment method, means of implementing the treatment along with pros and cons are discussed. Where appropriate, a graphical example of the typical treatment is presented. Locations within the project reach where specific Plan improvements are recommended are shown on Drawings 1 – 11 in Appendix G.

A. River Rehabilitation Improvements

1. Bank Stabilization

Bank stabilization is recommended in locations throughout the project reach where instabilities were noted.

- Improvement techniques
  a) Vegetate

Figure 8 - Improvement Example, Vegetate

- Description
  - Remove non-native species
  - Revegetate with native species
  - Vegetation may either be along the slope, the top of bank or both
- Where appropriate
  - Where banks are stable and erosion is not a serious problem
  - Widely recommended where structural reinforcement is unnecessary
- Implementation
  - Area is vegetated with a variety of native species.
  - Revegetation should include under-, mid- and overstory.
- Advantages
  - Relatively inexpensive
  - Uses natural materials ensuring a long-lasting effectiveness with generalized habitat benefits.
  - Attractive
  - Improves water quality by decreasing turbidity
  - Improves aquatic habitat through overhead cover
  - Decreases water temperature due to shading
- Disadvantages
  - Only feasible in areas with stable slopes and easy access
  - Maintenance and irrigation may be necessary

b) Vegetate existing stabilization feature

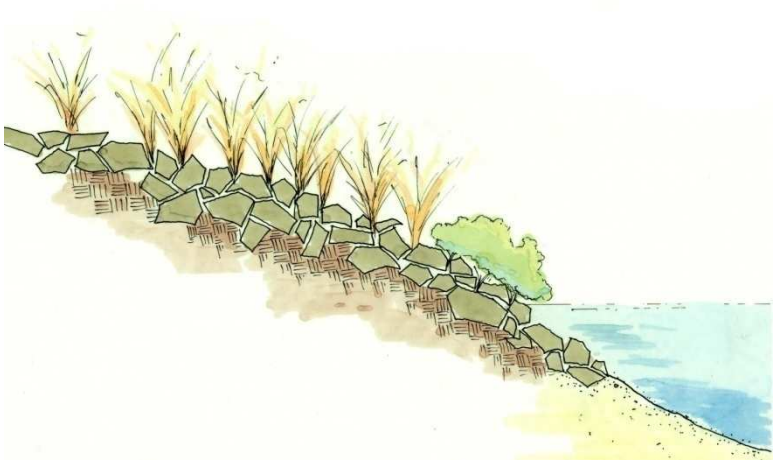


Figure 9 - Improvement Example, Vegetate Existing Stabilization Feature

- Description
  - Existing bank structure remains and is revegetated with native and varied species
- Where Appropriate
  - In areas where the existing feature is effective and in good condition and revegetation is possible
- Implementation
  - Create planting zones with required planting soils
  - Plant appropriate native vegetation
- Advantages
  - Makes structural bank stabilization more natural looking
  - Improves water quality by decreasing turbidity
  - Improves aquatic habitat through overhead cover
  - Decreases water temperature due to shading
- Disadvantages
  - May be difficult to establish planting zones through some existing structural revetment
  - Maintenance and irrigation may be required

c) Regrade and replant

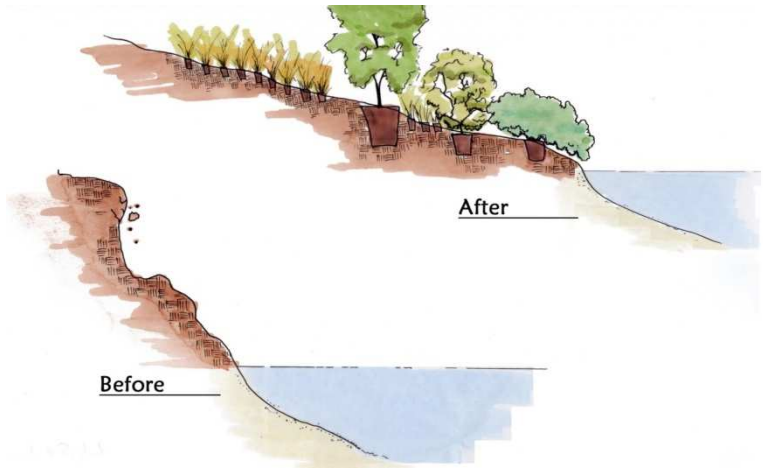


Figure 10 - Improvement Example, Regrade and Replant

- Description
  - Existing steep banks are regarded to a maximum 3:1 bank slope
  - Area is replanted with native and varied plant species
- Where Appropriate
  - Where the room exists to regrade and the access is good
  - Along lower banks where water velocities are sufficiently low
  - Where regrading is necessary for vegetation establishment and vegetation is desired
- Implementation
  - Regrade banks without altering the toe of the existing slope
  - Vegetate with native and varied plant species
- Advantages
  - Plant growth will maintain bank stability
  - Aesthetically pleasing
  - Improves water quality by decreasing turbidity
  - Improves aquatic habitat through overhead cover
  - Decreases water temperature due to shading
- Disadvantages
  - Can have a significant lag time between implementation and improved bank stability
  - Disturbs soil and existing plants
  - Maintenance and irrigation may be required

d) Boulder Terrace

Figure 11 - Improvement Example, Boulder Terrace

- Description
  - Bank is stabilized by the creation of one or more vegetated terraces (wide benches cut into the river bank)
- Where Appropriate
  - Where space is limited so that a stable soil slope is not feasible
  - Where riprap is not required
- Implementation
  - Grade terraces
  - Install boulders for vertical face of terrace
  - Provide planting areas in flat sections behind boulders
  - Seed and plant flat sections with native and varied species
- Advantages
  - More aesthetically pleasing than riprapped slopes
  - Long lasting, solid armoring
  - Improves water quality by decreasing turbidity
  - Improves aquatic habitat through overhead cover
  - Decreases water temperature due to shading
- Disadvantages
  - May be more costly than riprap
  - Maintenance and irrigation may be necessary

e) Boulder Wall

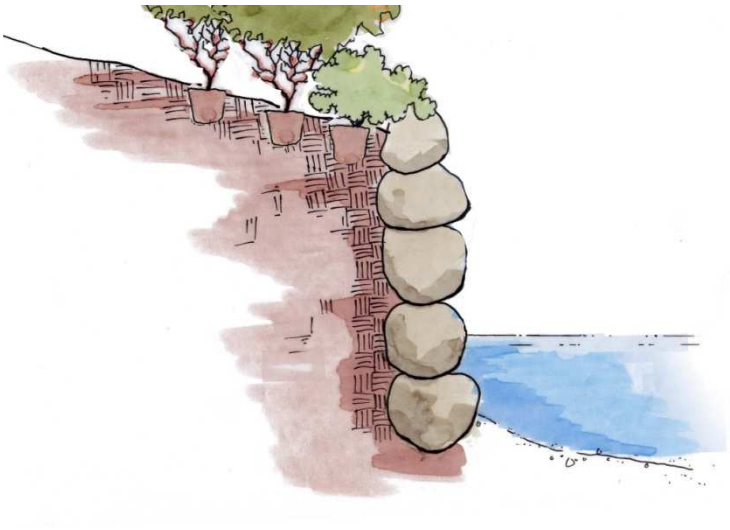


Figure 12 - Improvement Example, Boulder Wall

- Description
  - Bank is stabilized by construction of near vertical wall
- Where Appropriate
  - Where a distinct buffer is required between the river and adjacent areas and sufficient room does not exist for other treatment methods
- Implementation
  - Regrade bank to facilitate construction of wall
  - Wall typically constructed of boulders or similar materials
  - May use wall to move existing toe of slope
  - Top of wall can be vegetated, if room exists
- Advantages
  - Distinct break between riverine and urban environments
  - Structures are stable under high shear stresses
- Disadvantages
  - Costly to construct
  - Unnatural in appearance

f) Boulder Toe

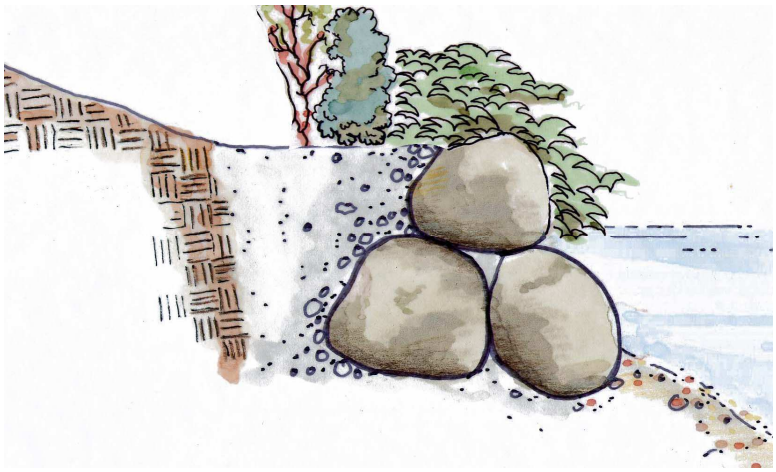


Figure 13 - Improvement Example, Boulder Toe

- Description
  - Protect toe with sufficiently large rocks
  - Include revegetation above the rocks
- Where Appropriate
  - Where erosion is pronounced at the toe
- Implementation
  - Bank graded for stability
  - Boulders placed at toe of bank
- Advantages
  - Prevents further erosion at toe of bank
- Disadvantages
  - Can be costly and labor intensive
  - Does not allow for naturally occurring bank undercutting or other natural bank variation

2. Vegetation and Riparian Buffer

Vegetation and riparian buffer improvements were recommended at locations throughout the project reach as determined necessary.

- Improvement techniques
  a) Supplement existing vegetation
    - Description
      - Remove non native vegetation
      - Add plantings to vegetated areas
    - Where appropriate

        - Areas where vegetative quality is good but could improve with the placement of additional vegetation and removal of non native species
    - Advantages
        - Increases vegetative quality
        - Plant growth will maintain bank stability
        - Aesthetically pleasing
        - Improves water quality by decreasing turbidity
        - Improves aquatic habitat through overhead cover
        - Decreases water temperature due to shading
    - Disadvantages
        - Some cost and labor
        - Maintenance and irrigation may be necessary

b) Revegetation
    - Description
        - A currently non-vegetated or sparsely vegetated area is planted with native species. Non native species are removed.
    - Where appropriate
        - Areas where minimal or no vegetation exists
    - Advantages
        - Increases vegetative quality
        - Plant growth will maintain bank stability
        - Aesthetically pleasing
        - Improves water quality by decreasing turbidity
        - Improves aquatic habitat through overhead cover
        - Decreases water temperature due to shading
    - Disadvantages
        - Some cost and labor
        - Maintenance and irrigation may be necessary

3. Channel Form

Channel form improvements were recommended at many locations along the project reach. In general channel form improvements were not recommended in areas through the heart of downtown where existing boating structures are prevalent as reshaping the channel in this manner would likely be detrimental to some boating recreation.

- Improvement Techniques
    a) Create meander and thalweg

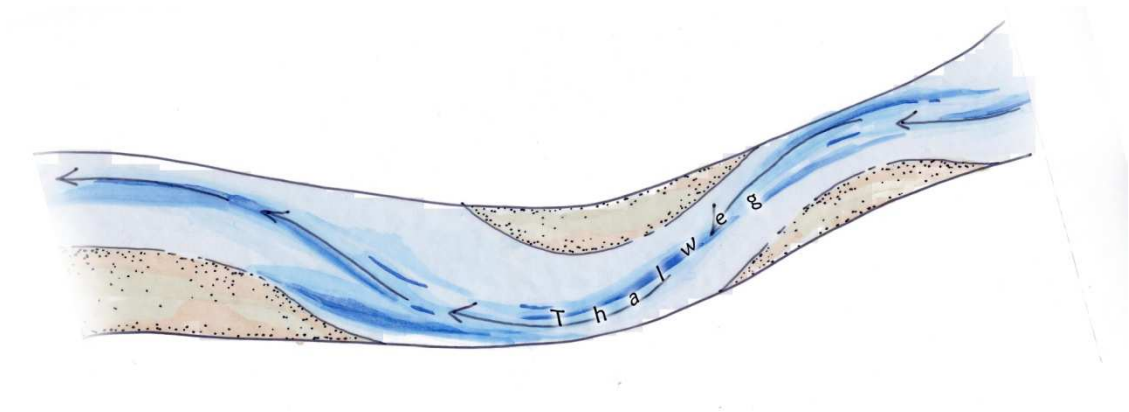


Figure 14 - Improvement Example, Create Meander and Thalweg

- Description
    - A meander is created at the appropriate spacing
- Where Appropriate
    - Areas where no low flow channel exists
    - Straight channel sections
    - Areas where a meander exists, but is spaced improperly
- Implementation
    - Excavate a meandering low flow channel
    - Move excavated material to opposite side of channel to create bars
    - Typically done in combination with longitudinal channel modification.
- Advantages
    - Increases depth of water at low flows which results in better aquatic habitat and more boatable water
    - Decreases water temperature
    - Reduces evaporative losses
    - Reestablishes meander pattern of natural channel – if spaced correctly
    - Eliminates improperly spaced meanders that fight natural forces of the stream
- Disadvantages
    - Temporarily disrupts streambed

b) Create High Flow Channel

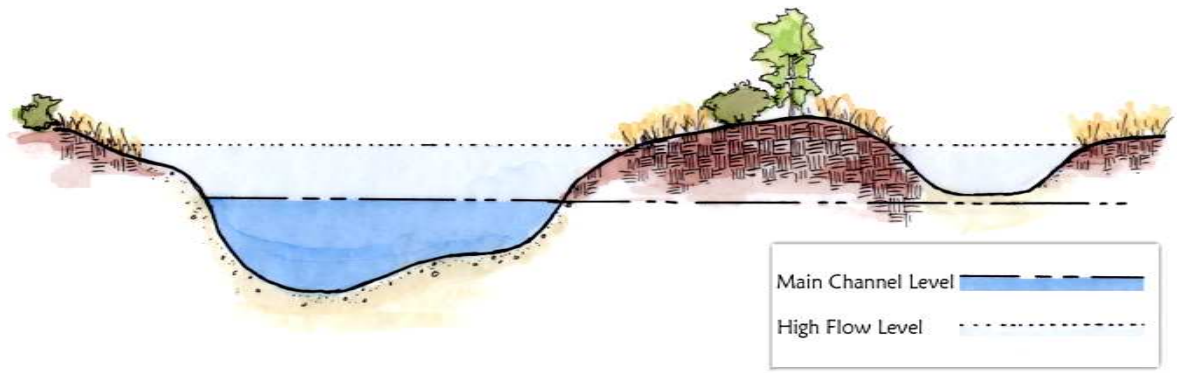


Figure 15 - Improvement Example, Create High Flow Channel

- Description
  - A high flow channel is created within the channel
- Where Appropriate
  - Areas that require a high flow channel to avoid flooding
- Implementation
  - A high flow channel is graded into the stream channel
- Advantages
  - Contains high flows in channel banks
- Disadvantages
  - Disrupts channel banks and streambed

c) Remove boulder vanes

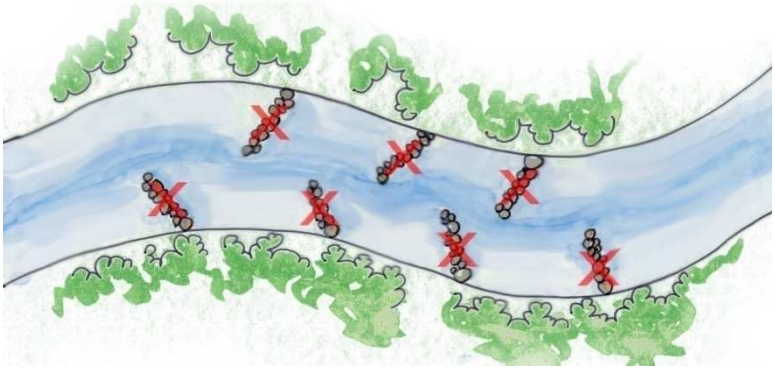


Figure 16 - Improvement Example, Remove Boulder Vanes

- Description
  - Existing boulder vanes are removed from the channel
- Where Appropriate
  - Areas where boulder vanes are fighting the natural form of the channel or are causing bank erosion
- Implementation
  - Boulder vanes are removed from the channel
- Advantages
  - Allows the channel to follow a natural erosion and deposition process
  - Reduces bank erosion caused by the vane structure
- Disadvantages
  - Disrupts channel banks and streambed

4. Aquatic Habitat

Aquatic habitat improvements were recommended in locations where existing habitat is limited. Locations for these improvements were generally not recommended in locations where use by boaters is highest.

- Improvement Techniques

a) Create riffle/pool/glide sequences

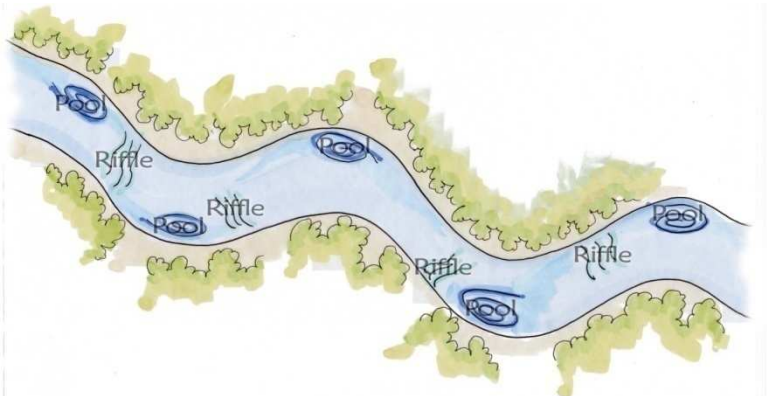


Figure 17 - Improvement Example, Create Riffle/pool/glide Sequences

- Description
  - Riffle/pool/glide sequences are created within the channel
- Where Appropriate
  - Areas that lack aquatic habitat diversity and have sufficient longitudinal gradient for riffles.
- Implementation
  - The streambed is graded to have steep and shallow sections (riffles), depressions (pools) and transition areas (glides)
  - Done in combination with longitudinal grading discussed above.
- Advantages
  - Provides habitat variety needed for various flow conditions and trout life cycles.
  - Establishes deep overwintering pool habitat.
  - Improves experience for angling
  - Creates instant habitat improvements.
- Disadvantages
  - Temporarily disrupts stream bed

b) Install boulder habitat clusters

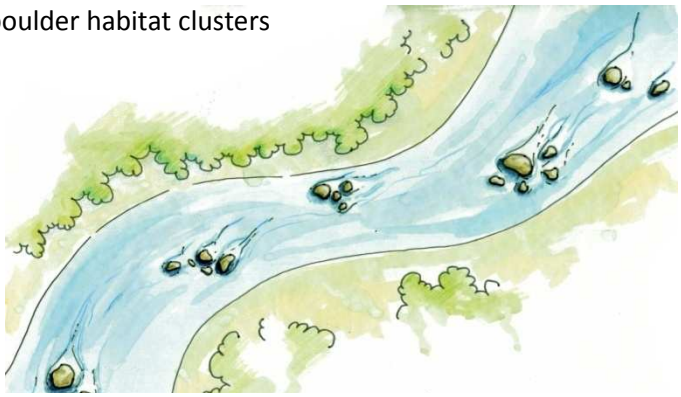


Figure 18 - Improvement Example, Install Boulder Habitat Clusters

- Description
  - Boulders are placed within the stream to create micro aquatic habitat
- Where Appropriate
  - Areas with insufficient instream aquatic habitat
  - Areas with inadequate hydraulic diversity
- Implementation
  - Boulders are placed within the stream in clusters to provide hiding/resting areas for trout. Instream habitat creates quality feeding lanes and increase holding capacity.
- Advantages
  - Improved habitat
  - Can generally be completed using material that is already in the stream.
- Disadvantages
  - If placed in pool locations may increase erosion downstream or create a backwater issue upstream

c) Install natural habitat feature

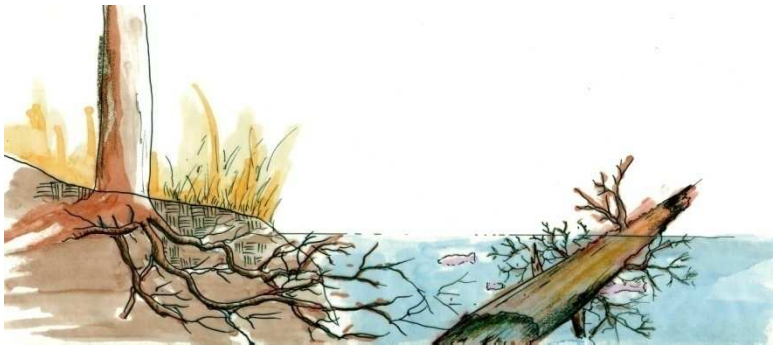


Figure 19 - Improvement Example, Install Natural Habitat Feature

- Description
  - Instream cover features such as rootwads, submerged vegetation and logs are installed
- Where Appropriate
  - Areas with inadequate instream cover
  - Particularly successful in areas with low flow velocities and shear stresses
- Implementation
  - Add logs, rootwads or similar natural material to the stream bed and banks
- Advantages
  - In-stream cover gives fish and macro-invertebrates shelter from predators, competitors and river current and offers areas for feeding and reproduction
- Disadvantages
  - Often susceptible to being dislodged
  - Can result in sediment accumulation if placed incorrectly

d) Remove debris
- Description
  - Debris and other items are removed and disposed of
- Where Appropriate
  - Areas with a large amount of debris or debris that presents a safety concern
- Implementation
  - Debris is removed and disposed of
- Advantages
  - Improves aquatic habitat health
  - Improves user safety

- Disadvantages
  - May be labor intensive

e) Convert open water to wetland

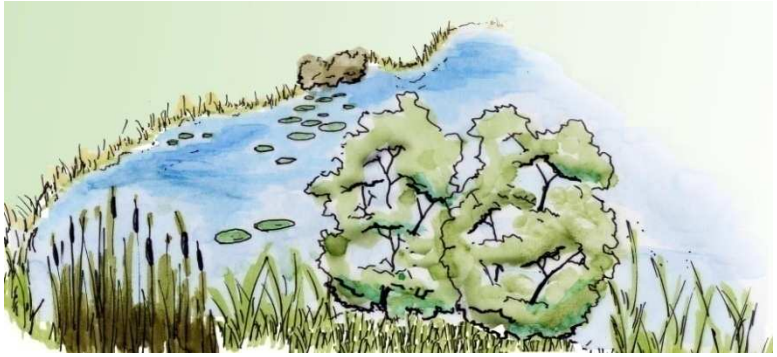


Figure 20 - Improvement Example, Convert Open Water to Wetland

- Description
  - Converts a section of land that is currently open water to wetland habitat
- Where Appropriate
  - In locations where stagnant, open water exists and the riparian area would be improved by the creation of wetlands
- Implementation
  - Import channel material to establish proper ground elevation.
  - Add suitable planting matrix, if necessary
  - Vegetate with wetland species
- Advantages
  - Wetlands filter runoff prior to it reaching the river, increasing water quality
  - Wetlands add variety and high quality habitat to the stream system
  - Possible to use material from other portions of the channel improvements to create wetlands thereby eliminating or reducing costs associated with hauling and disposing excavated material.
- Disadvantages
  - Costly if fill material must be purchased and imported.
  - Chance for failure if not set at correct elevations related to river.

B. Recreational Use Improvements

1. Access

Access improvements were recommended in locations throughout the project.

- Improvement Techniques
  a) Formalize access point

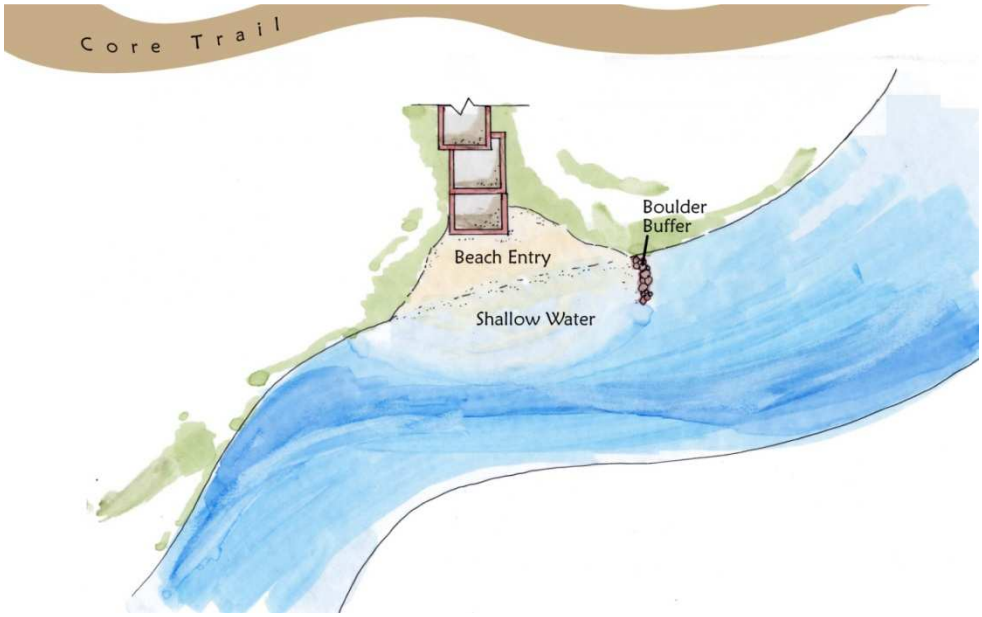


Figure 21 - Improvement Example, Formalize Access Point

- Description
  - User created access point is formalized
- Where Appropriate
  - Areas where additional access is desired and a user created access point exists
- Implementation
  - Boulder terrace similar is installed
  - Slope is graded and stabilized
- Advantages
  - Increases river access
  - Lessens need to user created access point
  - Improves bank stability/reduces erosion and vegetation impacts at access point
- Disadvantages
  - Increases river access
  - Places unnatural structure along river bank

b) Create formalized access point
- Description
  - A formalized access point is installed
- Where Appropriate
  - Areas where additional access is desired and a user created access point does not exist

- Implementation
  - Boulder terrace is installed
  - Slope is graded and stabilized with concrete
- Advantages
  - Increases river access
  - Lessens need to user created access point
  - Ensures bank stability at access point
- Disadvantages
  - Increases river access
  - Places unnatural structure along river bank

2. Boating

Boating improvements were generally recommended for portions of the project reach that are already heavily used for boating. Additional boating features were not recommended in areas that are currently more natural to reduce impacts on these areas that come with heavy boating use.

- Improvement Techniques
  a) Repair/enhance existing boating structure
    - Description
      - Repairs or enhancements are made to an existing boating structure to increase its recreational usability and/or safety
    - Where Appropriate
      - In areas where a boating feature exists, but is functioning in a sub-optimal manor or a safety concern exists
    - Implementation
      - Feature(s) is repaired by moving boulders, grading, extending hole, adding or removing boulders.
    - Advantages
      - Less costly than replacing boating feature
      - Extends lifetime of existing boating features
      - Decreases user pressure at existing high quality boating features
    - Disadvantages
      - Inherent uncertainty as to how feature will function

  b) Remove and/or replace boating structure
    - Description
      - Existing boating structure is removed and replaced, if appropriate
    - Where Appropriate
      - In areas where the boating structure has become unsafe and/or ineffective and cannot be improved through repair or enhancement

        - Areas where the existing structure requires more than minor modifications to function properly
    - Implementation
        - Existing boating structure is removed
        - If appropriate, a new boating structure is constructed in its general location
    - Advantages
        - Ineffective and/or unsafe boating structures are removed
        - Higher quality feature can be implemented
        - Increases the recreational usability of the river
        - Decreases user pressure at existing high quality boating features
    - Disadvantages
        - May be costly
        - Possible floodplain and/or 404 permit issues
        - Inherent uncertainty as to how feature will function

c) Install new boating structure
    - Description
        - A boating structure such as a hole or wave is installed where currently no feature exists
    - Where Appropriate
        - In areas where a boating structure is desired, channel grade is sufficient and it will not have a negative impact on the river
    - Implementation
        - Desired boating structure is designed and installed
    - Advantages
        - The recreational usability of the river is increased
        - Decreases user pressure at existing high quality boating features
    - Disadvantages
        - Adds boating use pressure to new section of the river
        - May be costly
        - Possible floodplain and/or 404 permit issues
        - Inherent uncertainty as to how feature will function

C. Water Rights Improvements

a) Install gage for RICD rights
    - Description
        - A streamflow gage(s) is installed to allow the City to exercise its RICD water rights
    - Where Appropriate

    - At the 13th Street bridge
- Implementation
    - Install streamflow gage(s) with recording device to continually measure stream flows
- Advantages
    - The City will be able to make a call on the River for the RICD
- Disadvantages
    - Costly
    - Must be operated and maintained by the City or by a contractor
    - Water right may be so junior that it does not result in any "wet water"

V. PRIORITIZATION OF AREAS OF INTEREST

Areas of interest were categorized based on their need for improvements. Their characteristic rating was based on a matrix developed by ERC in conjunction with input from the community. Each individual proposed treatment was ranked on a scale of 1 (least critical) to 3 (most critical). Criteria used to rank the individual components are shown below.

Criterion/Rank	3	2	1
Aquatic Habitat	Existing aquatic habitat is poor. Little to no diversity exists in channel and instream cover is lacking. During low flow periods problems are extreme.	Existing aquatic habitat is limited. Some diversity and instream cover exists, but area is well below optimal conditions.	Overall aquatic habitat is moderate; however minor improvements would increase carrying capacity of the channel.
Channel Form	Channel is out of balance with natural equilibrium. Width, lack of low flow channel and sinuosity are disturbed and affecting health of the stream. Longitudinal profile and plan form require modification.	Channel is in transition between impacted and natural state. Work is required to achieve a natural state, but less work needed than areas ranking as a 3	Channel has characteristics of a natural stream form, but could be improved with minor grading and/or shaping.
Vegetation/ Riparian Buffer	No or limited vegetation on banks and/or in the riparian buffer, non-native species are in high numbers and should be removed. Vegetation will provide habitat, and water quality benefits.	Existing vegetation is sparse and/or non-native vegetation is present and should be removed. Minor habitat and water quality benefits exist, but could be greatly improved with more plantings and/or increased diversity.	Existing vegetation looks good, non-native species are not significant. Additional vegetation would help but is not required.

Criterion/Rank	3	2	1
Bank Stabilization	Visible, extensive bank erosion, bank undercutting, and/or mass wasting. Erosion appears to be on-going in this location and likely to become a greater problem if not addressed. Stabilization is an immediate concern.	Visible erosion and bank undercutting occurring but is localized problem. These areas may develop into larger problems in the future.	Minor localized erosion.
Recreational Use Boating*	Boating structure does not exist or no longer functions as intended, enhancement or improvement is needed for feature to function near optimal condition.	Existing boating structure function is moderate. It provides quality use for a limited amount of time but duration of time it functions well is limited. Modifications or enhancements are expected to significantly improve recreational opportunities.	Existing boating structure functions reasonably well. Improvements could be obtained with minor modifications, but feature currently provides quality recreational experience.
Recreational Use Passive	No formal access points, trails, picnic areas or opportunities for wildlife observation or existing amenities are unusable	Few formal access points, trails, picnic areas and/or opportunities for wildlife observation - none currently needed but may be needed in the future, or existing features in decent condition but need work	Sufficient access points, trails, picnic areas and opportunities for wildlife observation and all in good condition
Water Rights Improvements	Installation of stream gages will allow the City to make calls on the river that result in a significant increase in streamflows through the town. Recreational uses and ecological benefits of resulting from additional water will be significant.	Installation of stream gages will allow the City to make calls on the river that result in an increase in streamflows through the town. Recreational uses and ecological benefits resulting from additional water will be notable.	Installation of stream gages will allow the City to make calls on the river that result in a minor increase in streamflows through the town. Amount or timing of additional water results in minor recreational and ecological benefits.

*Boating includes kayaking, rafting and tubing

Table 2 - Area of Interest Categories and Ranking Criteria

VI. IMPROVEMENT COSTS

Cost estimates were developed for the individual Plan improvements. As the improvements presented herein are conceptual in nature, all costs should be considered budgetary level costs. More detailed costs can be developed as part of the final design for improvements as they occur.

Costs contained in this Plan are based on 2008 prices. Estimates were generated from known material costs, cost data provided by the City, costs for completed river improvement projects and engineering judgment.

Unit construction costs (per linear foot, per square foot, per each, etc) were prepared for each specific Plan improvement. Estimated costs to implement any specific improvement can be determined by scaling the unit cost to the number or size of a particular problem area. A table summarizing unit costs for each improvement type is shown below. An itemized breakout that includes all individual items and costs used to generate unit costs is presented in Appendix H.

ERC took the approach that any improvements to be made would be done in the highest quality manner. As an example, areas requiring revegetation were assumed to planted at very high densities and include seeding, grass plugs, shrubs and trees. As a result, the unit costs for improvements are high. If desired the City could scale back many of the treatments and obtain cost savings over the values derived by ERC.

Category	Improvement	Unit	Unit Cost
Bank Stabilization			
	Vegetate	SF	6.67
	Vegetate existing feature	SF	6.67
	Regrade and replant	SF	7.09
	Boulder Terrace	SF	57.89
	Boulder Wall	LF	350.40
	Boulder Toe	LF	55.85
	Pipe Repair and Bank stabilization	*LS	4,500.00
Vegetation and Riparian Buffer			
	Supplement existing vegetation/riparian buffer	SF	1.62
	Revegetation	SF	6.40
	Remove vehicle	EA	1,000.00
Channel Form			
	Create meander and thalweg	LF	73.80
	Create high flow channel	LF	16.40
	Remove boulder vane structures	EA	1,000.00

Category	Improvement	Unit	Unit Cost
Aquatic Habitat			
	Create riffle/pool/glide sequences	EA	3,000.00
	Install boulder habitat clusters	EA	670.00
	Install natural habitat feature	EA	1,250.00
	Remove debris	*LS	2,000.00
	Convert open water to wetland	SF	6.78
Recreational Use			
Boating			
	Repair/enhance boating structure	EA	10,000.00
	Remove boating structure	EA	8,000.00
	Install boating structure	EA	40,000.00
	Diversion structure at James Brown Bridge	LS	5,000.00
Access			
	Formalize access point	EA	2,000.00
	Create formalized access point	EA	5,000.00
	Create formalized access point with ADA access and trail connection	EA	15,000.00
Water Rights			
	Install gage for RICD rights	EA	30,000.00
Other			
	Temporary Fencing	LF	3.00
Per Cost Total			
	Construction Management	LS	8% of total cost
	Contingency	LS	10% of total cost
	Design & Permitting	LS	10% total cost
	Mobilization/Demobilization	LS	5% of total cost
	Sediment Control	LS	2% of total cost

***LS = Lump Sum**

Table 3 - Improvement Unit Cost

Total costs were then defined for each AOI and can be found in Appendix H. A detailed cost breakdown is provided in Appendix H. For the total cost estimate, final design and permitting was assumed to cost 10% of the total, construction management was assumed to cost 8% of the total, mobilization/demobilization was assumed to cost 5% of the total, sediment control was assumed to cost 2% of the total and contingency was added at a cost of 10% of the total.

The overall cost for all improvements presented in the plan, including design and permitting, construction management, mobilization/demobilization and contingencies is $5,116,440.61

Costs were evaluated based on AOI rankings. It is anticipated that AOIs ranking most critical will require a majority of the total cost. The ranking of the installation of the RICD gages was ranked uncertain because the effect of the streamflow increase gained by the instream flow right is unknown to ERC.

Ranking	Cost	Percent of total
3 (most critical)	$2,917,227.47	76%
2 (medium)	$669,215.12	18%
1 (least critical)	$260,505.23	7%
Total	$3,846,947.82	100%

Table 4 - Cost per Ranking

Costs were also evaluated based on the type of improvement recommended. Due to the amount of overlap, aquatic and channel form improvements were combined. Vegetation and riparian buffer, which often are recommended in conjunction with bank stabilization, are similarly grouped together.

Improvement Category	Cost	Percent of Total
Aquatic Habitat and Channel Form	$1,530,946.10	40%
Vegetation/Riparian Buffer and Bank Stabilization	$2,059,001.72	54%
Recreational Use - Boating	$179,000.00	5%
Recreational Use - Access	$48,000.00	1%
Water Rights (RICD)	$30,000.00	1%
Total	$3,846,847.82	100%

Table 5 - Cost per Category

VII. PRIORITIZATION OF IMPROVEMENTS

Given the high cost to implement the recommended improvements, the recommendations within this Plan will need to be prioritized. Final prioritization should factor in the relative need for the improvement (ranking presented above), desires of the community and available financial resources.

VIII. REFERENCES

Aquatic and Wetland Company. (2002). Preliminary Report – Yamp River Studies. AWC.

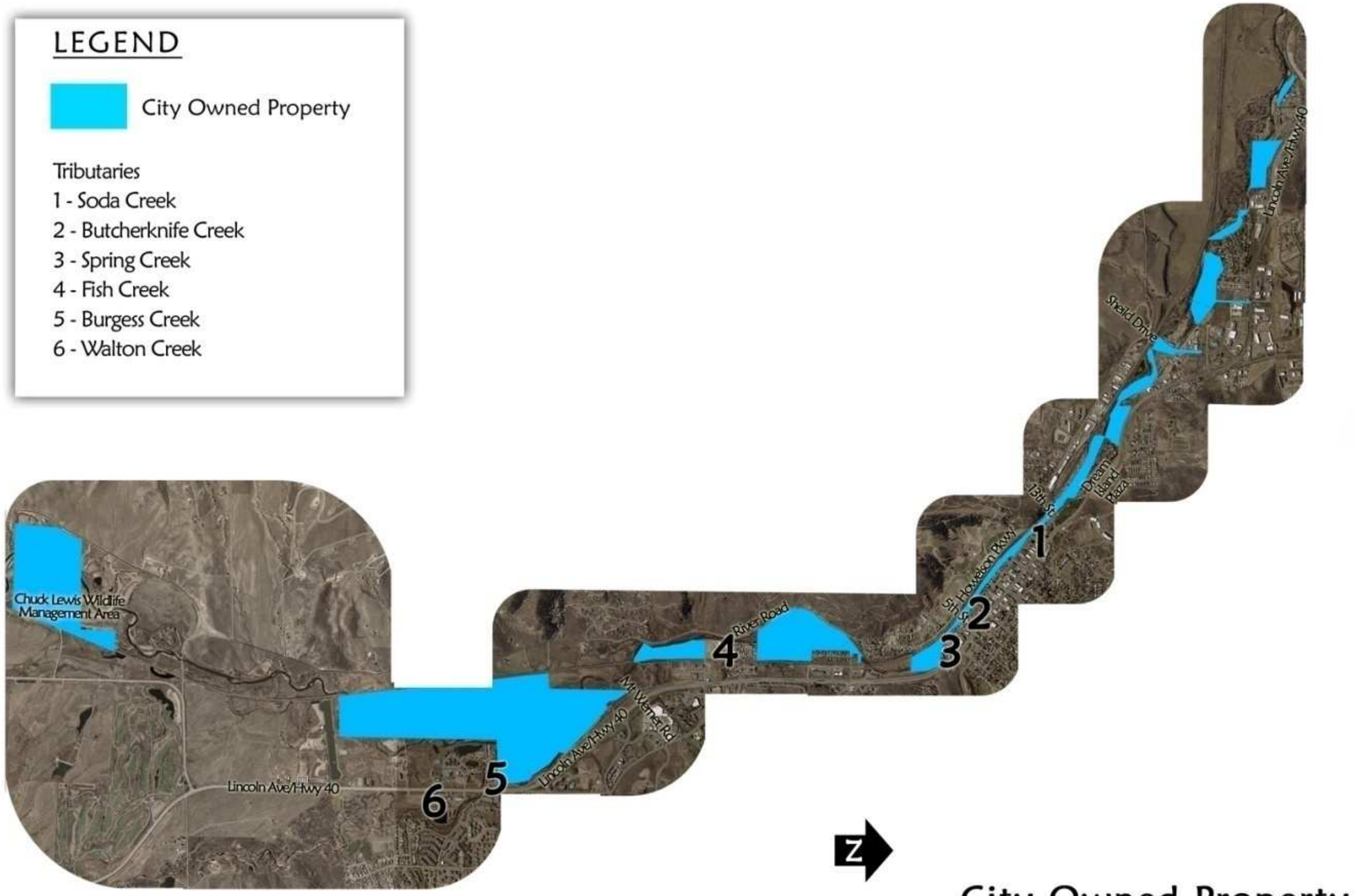
EDAW. (2003). *Yampa River Management Plan.* EDAW.

Leopold, L. (1992). A View of the River. Harvard Univerity Press

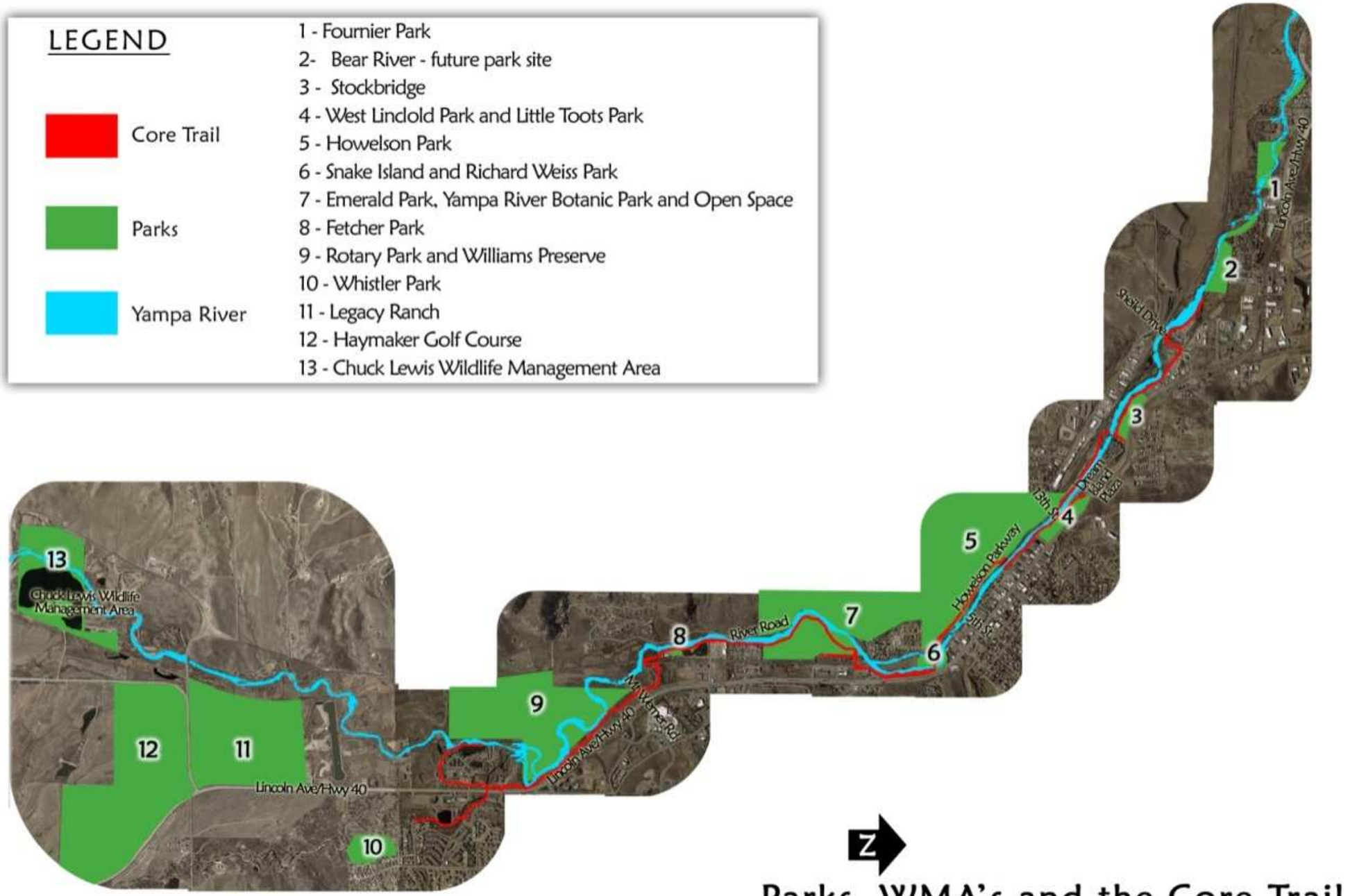
Leopold, L, et al., (1992). Fluvial Processes in Geomorphology. Dover Publications, Inc.

Rosgen, D. (1996). *Applied River Morphology.* Pagosa Springs: Hilton Lee Silvey.

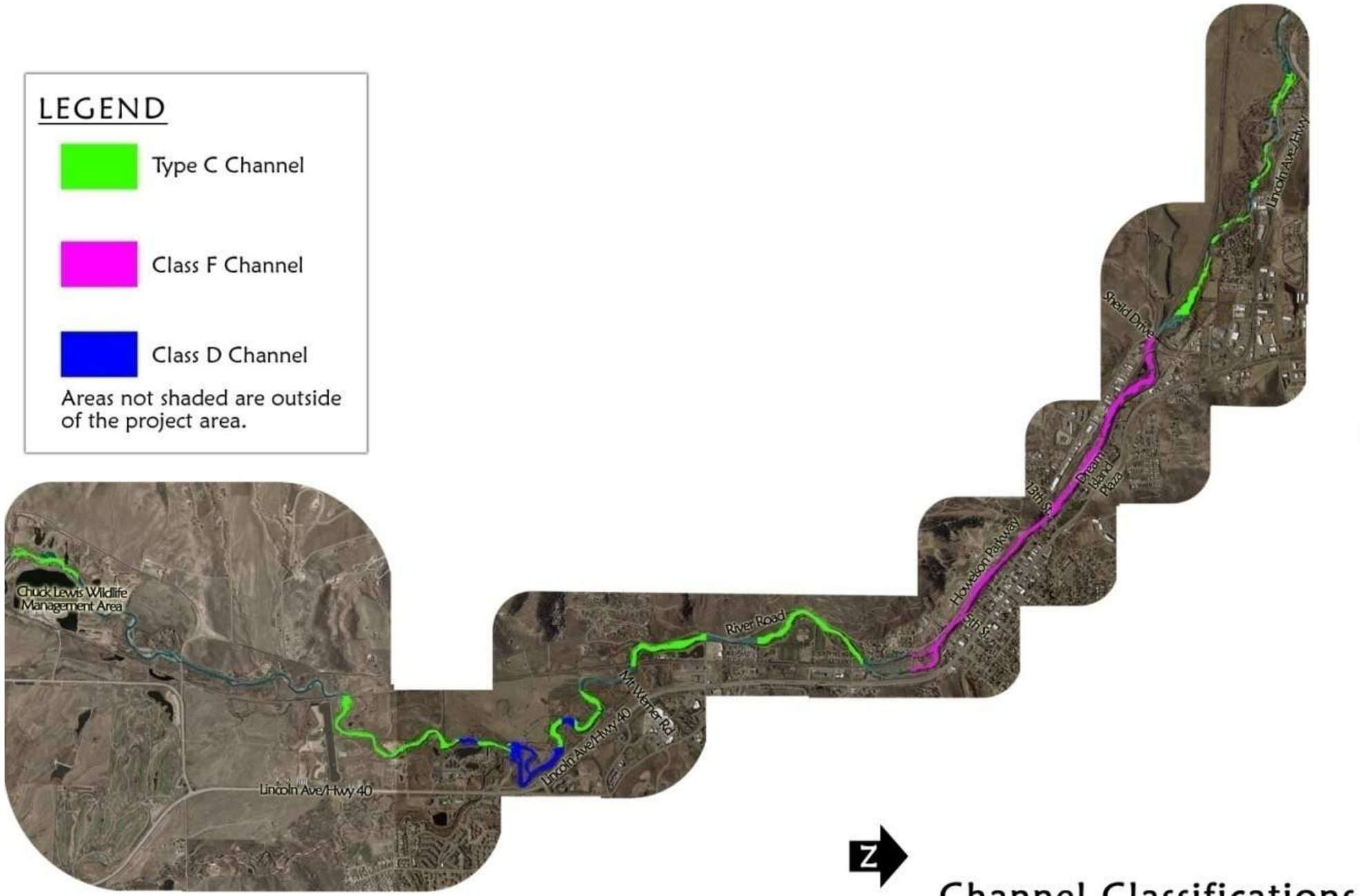
Appendix A - Report figures 11x17



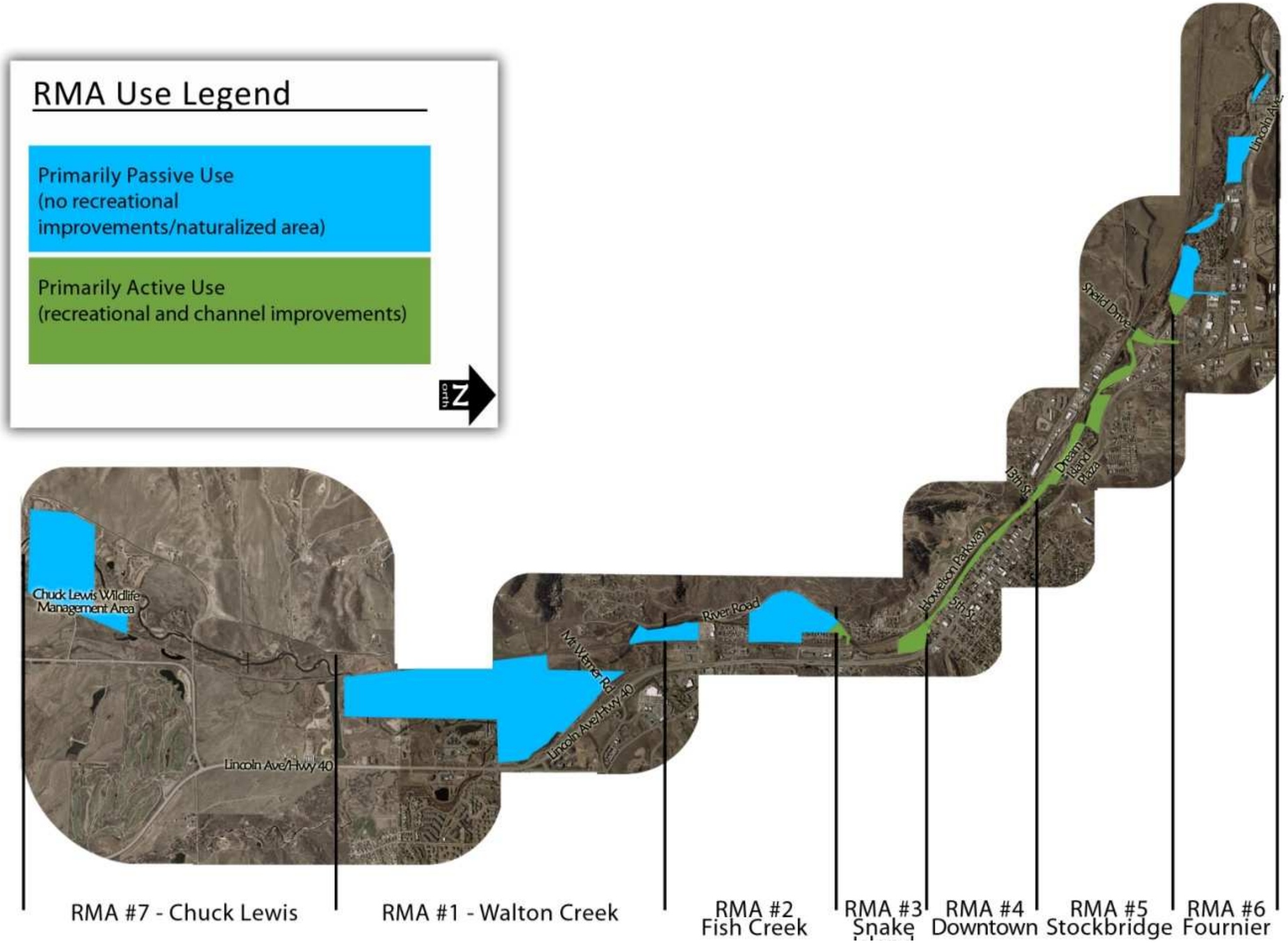
City Owned Property

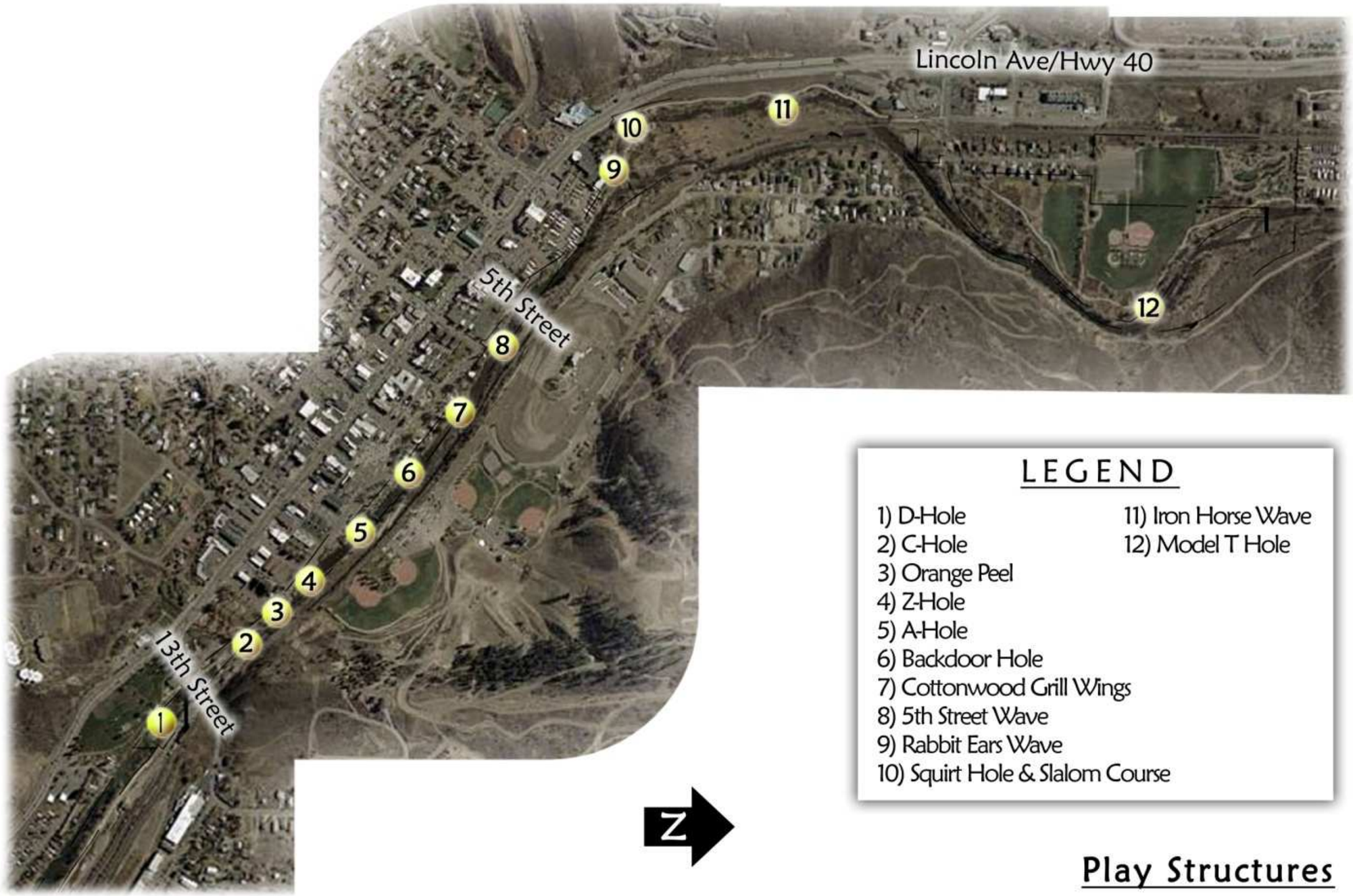


Parks, WMA's and the Core Trail



Channel Classifications


RMA Use Legend
Primarily Passive Use
(no recreational
improvements/naturalized area)
Primarily Active Use
(recreational and channel improvements)
N
Chuck Lewis Wildlife
Management Area
Lincoln Ave/Hwy 40
Mc Werner Rd
Lincoln Ave/Hwy 40
River Road
Howelson Parkway
Sheid Drive
Lincoln Ave
Dream
Island
Plaza
RMA #7 - Chuck Lewis
RMA #1 - Walton Creek
RMA #2
Fish Creek
RMA #3
Snake
RMA #4
Downtown
RMA #5
Stockbridge
RMA #6
Fournier



LEGEND

1) D-Hole
2) C-Hole
3) Orange Peel
4) Z-Hole
5) A-Hole
6) Backdoor Hole
7) Cottonwood Grill Wings
8) 5th Street Wave
9) Rabbit Ears Wave
10) Squirt Hole & Slalom Course
11) Iron Horse Wave
12) Model T Hole

Play Structures

Report Photos Locator Map

Appendix B: Community Comments from Public Meetings

Comments from Yampa River Structural Master Plan

August 2, 2007 Public Workshop

From notepads

- Need to preserve wetlands and streambanks for wild habitat. Ospreys have recently been seen around Steamboat. Need to preserve habitat and water quality for birds and small river animals.
- Consider erecting nest platforms for Osprey.
- This fishing is a great resource for this community. Overall use impacts needs to be better monitored. Tools need to be available to city departments.
- Canoe and Kayak Access
    - Most access is by unimproved, narrow footpaths
        - Wider, more solid footpaths would make access easier and could reduce erosion.
        - Clear sections along the banks at access points are needed to get into and out of boats.
            - Need to be non-muddy.
- RMA maps
    - For the next meeting, please note a couple of landmarks (e.g. street names) to help orient people.
- River Health should be our first priority. Let's help Mother Nature do what needs to be done.
    - Bank stabilization where needed.
    - Meander to slow the river down.
    - Protection for riparian areas.
- But we need to help private landowners with trespass issues.
- Keep trash out of river.
- Educate users (maybe through signage or enforcement).
- Seems like the river is getting overused by private tubers in the upper section. Would like to see additional enforcement of the alcohol rules for tubers.

- Improve access for kayakers at Fetcher Park.
- I enjoy running down a river and stopping to play briefly at many spots along the way. Many of the good play ledges do not have good eddies alongside to feed into the hole from. Strategically placed eddies would help.
- More individual park 'n' play holes AND some design overall that encourages boating runs from upper to lower.
- Put a kayak/canoe rack on a shuttle bus to encourage top to bottom boating.
- More shelves and beaches.
- More public access.
- City Parks and Recreation should have authority to close river and enforce.
- River education kiosk and live programs.
- In depth signage of rules and regulations at put-in along the river (i.e., signs now on highways and interstate giving info per weather, closures (the new highlighted signs)).
- Maybe: fines doubled for alcohol on river.
- To protect the river environment, restrict future development to only (2) two "water features", the Library and the Depot. If the City wants another water feature, require the removal of one of the two existing features. It is now time to concentrate on water quality and the health of the river. – John Armiger
- All kayak features should be below rabbit ears. Everything should begin at 5th St. More flow = more fun.
- D-hole should be pinched to create a low flow hole and a wave when it's high.
- Z-hole and 5th St. need to be pinched/rebuilt riverwide.
- All features need a maintenance plan. Fixing concrete, trimming bushes.
- Lights at C-hole, permanent.
- Webcam on C-hole for promotion.
- New feature in Milner below Elk. – crossed out
- More holes like C and D at 5th St. /Double Z.
- A low-water feature, 300-cfs, channeled to 6 feet wide
- Concrete slabs in upper Yampa near the soccer fields should be cleaned up.

- Wave could be put in above Soda below ZZ. Water is channelized and would be a great spot. Gradient/naturally pinched.
- Raise the elevation of the pinch at C-hole.
- Remove sediment below Soda Creek confluence.
- New play spot adjacent to the new "River Walk" project. – Jim Cook, old trailer park

RMA#1- Walton Creek

- Enforce parking/alcohol restrictions.
- Not much swimming occurs here.
- Use needs to be controlled.
- City departments need more tools to implement/enforce regulations and use.
- Pike habitat exists at head of rich – could this be reduced?
- Excellent fishing habitat, could there be more fishing habitat?
- Not much paddling features, but great for beginners/int paddlers.
- Works good for rafting put-in and great for float through.
- Take out/put-in at Rotary Park needs work for ability to put in rafts, some rocks in water need to be moved just at the water surface.
- Some erosion occurring in select areas.
- How is cottonwood recruitment doing…i.e. riparian habitat

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- Not much swimming occurs here.
- Use needs to be controlled.
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- Some erosion occurring in select areas.
- How is cottonwood recruitment doing…i.e. riparian habitat

RMA#2 – Fish Creek

- Enforce access – parking/alcohol.
- Pool at Fish Creek is very important as area for fish at low water.
- Area on east bank of river adjacent and downstream from trailer park is circled. Old construction cleanup. Barbed wire and metal in the water. Trash build up area.
- Kayak launch eroding bank – rocks not placed well. Lots of kayaking and access. Consolidate access and rouge tracks, many trails spurring off into riparian.

RMA#3 – Snake Island

- Second most swimming beyond C-hole at hot spring.
- Could more fish habitat be placed?
- Iron Horse Hole – need to be fixed. This hole fell over and is not functioning.
- Not many high play waves.
- Problem with erosion above Iron Horse Hole at bird statue on river right – take out bench or rebuild.
- Some minor bank erosion below features along reach.
- Rich Weiss Park is very, very important as lots of use, great access, as head of boating park. Will see increased use in the future. Currently needs lot of work. Needs bathroom.
- Rocks have moved at Iron Horse Hole and it is dangerous.
- Rocks just about 5th Street need to be reconfigured.

RMA#4 – Downtown

- Water quality #1 issue
    - Water temperature – no porous surface
    - Non source point pollution
    - DO
    - Flows

        - RICD – need to implement

- If we address water quality and volume many issued are resolved.
- Rebuild A-hole. Lots of erosion on river. Great access…bad for tubing @ low water.
- Reexamine all river features for effectiveness in this area for all recreation.
- Excellent location for feature above and below 5th Street (possible surf wave at higher water). Work with new developers to maximize efficiencies.
- Major work at Rabbit Ears/Rich Weiss – needs help with erosion issues.
- This is most important reach of the entire river from recreational standpoint – most use – great fishery, most important kayak/tubing area.
- Great fish habitat. Riffles. Pools. Access.
- Need to help educate developers about the rivers needs. More native/riparian habitat.
- Access is all over. Need to fence/limit some trails.
- Access at Lions Park needs help – major erosion.
- Work with landowners to rebuild certain banks if possible.
- Fix diversion to Wolf Ranch for tubing/kayaking/fishing. Build solid structure.
- Need erosion control upstream of Z-hole.
- Area upstream of 13th Street Bridge circled – pinch to make deeper pocket at water levels of 300 – 700 cfs.

RMA#5 – Stockbridge

- Around the bus barn (Multimodal center) there is a nice area for kids to wade.
- Area on left bank upstream and adjacent to James Brown Bridge circled– Dangerous objects from railroad in water and on the banks.
- Area on left bank downstream and adjacent to James Brown Bridge circled– Need permanent (not giant boulders) diversion structure at current tube take out to protect agricultural senior water rights.

Project Area: Fournier Open Space

- Help stop trespassing onto private property.
- Old meander that should probably be restored.
- Do not puncture another neighborhood.

Existing assets of the Yampa River

- Education – Produce DVD education/infomercial for cable channel 6, 10 minutes.

Channel Shape

- Rock vanes seem to work well for 1. maintaining a deep center channel and 2. creating fish habitat.
    - They do not work well as play features for kayaks and canoes because the flow on the downstream side flushed the boater back into the center channel.
    - Would a J-shaped feature work for 1 and 2 above?
    - It could create a nice play feature at the end of a rock vane.

Comments from Yampa River Structural Master Plan

November 7, 2007 Public Workshop

Sheet	Reference #	Category	Description	Comments				
Sheet 1	1a	VEG/RB	lacking vegetation			Riverside Park - fix damage done by sewer line repair		
	1b	AH	lacking aquatic habitat diversity					
	1c	VEG/RB	lacking vegetation	allow for water inundation				
	1d	BS	eroding bank		future tube take out			
	1e	RU	formalized access needed					
	1f	VEG/RB	lacking vegetation					
	1g	BS	eroding bank					
Sheet 2	2a	OTHER	existing diversion structure	very dangerous diversion structure, needs mitigation				
	2b	RU	tubing take out					
	2c	BS	unstable slope					
	2d	VEG/RB	lacking riparian buffer		eroding bank of right bank			
Sheet 3	3a	VEG/RB	lacking riparian buffer		move channel to left bank through new newly deposited cobble, involve planners with the Bear River Parcel options			
	3b	AH	poor aquatic habitat			improve habitat		
	3c	RU	need to formalize access					
	3d	VEG/RB	lacking vegetation					
	3e	VEG/RB	encroachment/buffer management					
	3f	BS	eroding bank					
	3g	RU	D Hole - limited pool and drop	requires dredging				
Sheet 4	4a	OTHER	need for flow gage	artificial buffer, more meandering	Very important, needed to implement water rights			
	4b	RU	eroding access point					
	4c	RU	C Hole - functioning well		needs riparian habitat/focus human impact			
	4d	VEG/RB	lacking riparian buffer					
	4e	RU	non utilized gradient in boating reach					
	4f	VEG/RB	existing rubble - safety concern					
	4g	RU	Orange Peel Hole - ineffective		could go away	very ineffective		
	4h	RU	Z Hole - sub optimal function		too wide	build with 2 outlets (large boulders in the middle, very wide channel right now)		
	4i	BS	eroding bank	add fencing				
	4j	RU	improve access point					
	4k	RU	A Hole - sub optimal function	high priority restructuring, somewhat dangerous	Take pressure off of riparian buffer (N.) access needed on south side of river + by foot bridge near tunnel	Rebuild		

Sheet	Reference #	Category	Description	Comments				
Sheet 5	5a	BS	eroding bank					
	5b	RU	Backdoor Hole - sub optimal function			built to divert water to city snowmaking inlet		
	5c	BS	eroding bank	add fencing				
	5d	RU	Boating wave - sub optimal function			could go away		
	5e	RU	Cottonwood Hole - sub optimal function			could go away		
	5f	AH	lacking aquatic habitat diversity					
	5g	VEG/RB	encroachment/buffer management					
	5h	OTHER	degraded Butcherknife Creek confluence					
	5i	BS	eroding bank					
	5j	RU	eroding access point					
	5k	RU	5th Street Wave - sub optimal function			potential for Charlie's Hole quality structure		
	5l	BS	eroding bank	good fishing area, reorient structures US				
	5m	BS	eroding bank	DO NOT TOUCH!				
	5n	RU	ineffective boating area	don't change this	great trout habitat, deep, cool, shelters	great fish habitat - don't change!		
	5o	OTHER	future daylight of Spring Creek		rebuild			
	5p	RU	Rabbit Ears Wave - sub optimal function					
	5q	BS	eroding bank					
	5r	RU	Squirt Hole - functioning well					
	5s	RU	existing slalom kayak course					
	5t	RU	Iron Horse Wave - functioning well					
	5u	RU	eroding access point					
Sheet 6	6a	VEG/RB	river against toe of slope and unvegetated					
	6b	AH	lacking aquatic habitat diversity	riparian buffer				
	6c	RU	Model T Hole - sub optimal function		rebuild for optimum function			
Sheet 7	7a	VEG/RB	river against toe of slope and unvegetated	vegetative diversity				
	7b	BS	eroding bank		not necessary DS of drain	DS limit of 7b - river eroding bankside of structure		
	7c	OTHER	Pond outfall					
	7d	BS	eroding pipe outfall and bank		fix before road slumps!			
	7e	BS	eroding bank					
	7f	AH	lacking aquatic habitat diversity					
	7g	VEG/RB	lacking riparian buffer					

Sheet	Reference #	Category	Description	Comments				
Sheet 8	8a	BS	eroding bank	allow for river meandering				
	8b	VEG/RB	lacking riparian buffer					
	8c	AH	lacking aquatic habitat diversity		good invertebrate habitat			
	8d	AH	lacking aquatic habitat diversity			not necessary to improve	is stream too wide? River left	
	8e	VEG/RB	lacking riparian buffer			good trout habitat		
	8f	BS	eroding bank		important spawning area	yes, but good gravel bottom for natural reproduction		
Sheet 9	9a	AH	lacking aquatic habitat diversity	close off backwater + wetland creation	point source pollution, vegetative diversity, interactive areas	great habitat for frogs, ducks, pike, snakes	block slough first, then examine effect on 9A + 9B and design accordingly	better aquatic habitat
	9b	BS	lacking riparian buffer					
	9c	BS	lacking riparian buffer					
	9d	BS	eroding bank					
	9e	BS	lacking riparian buffer					
	9f	BS	lacking riparian buffer					
	9g	BS	eroding bank					
	9h	BS	eroding bank					
	9i	BS	eroding bank					
	9j	BS	eroding bank					
	9k	BS	eroding bank					
	9l	BS	eroding bank					
Sheet 10	10a	VEG/RB	debris - vehicles		US wetland areas, vegetative diversity	included phase III of Chuck Lewis Project that is currently being worked on	pulling vehicles - replace with vegetation	
	10b	BS	eroding bank	not that bad, point bar is revegging				
	10c	BS	eroding bank					
	10d	BS	eroding bank					
Sheet 11	11a	AH	lacking aquatic habitat diversity	shoud be another reference between 11a + 11b	diversity of flow, multiple uses	add boulders, deepen channel	large slack water area between 11A + 11B is the biggest problem area	
	11b	AH	lacking aquatic habitat diversity	to address large backwater (gravel pit) on river left		add boulders - not necessary though		

Appendix C: Past Yampa Corridor Improvements known to ERC

1980

- Slalom Course construction

1981

- Downtown improvements – Rabbit Ears to Backdoor Sports

1982

- Continued downtown improvements – Rabbit Ears to Backdoor Sports

1985

- Yampa River Kayak Course Improvements
- Yampa River Fish Habitat Improvements

1986

- Dr Rich Weiss Park (formerly known as Yampa River Park)

1987

- Stockbridge Road (Depot) Riverbank Landscaping

1988

- Yampa River Park

1989

- 5th Street to 13th Street, 1989
    - Created fish habitat in slow moving water
    - River wide kayaking structure below 5th Street
    - Installed wing structures at Bear River Center
    - A-hole wings by library
- Stockbridge Riverbank
- Yampa River Improvements

1990

- 5th Street to 13th Street, 1990
    - Moved 5th Street hole to put in at Lions Club Park
    - Made a channel on river left of A-hole
    - Moved rocks at library to create more of a kayaking feature

1991

- Phases 4 & 5 of Yampa River Channel Improvements,

1992

- Phase 6 of Yampa River Channel Improvements

1993

- River Improvements
- Xeriscape Corridor/River Road/Trail

1994

- Yampa River Kayak Course
- Yampa River Stream Improvements

1996

- Yampa River Cottonwood Grove/River Improvements

1997

- Yampa Stream improvement Vermeer Tree Spade
- Yampa River Habitat Improvement

1998

- The "Yampa River Improvement Project," 1998
    - Changed all DS wings built in 1989 to US wings
    - Built Z-hole
    - Habitat work above Z-hole, random rock placement
- Friends of the Yampa – Kayak Course

1999

- YV Stream Improvement – River Management Plan

2001

- Rivers and Trails Committee

2002

- D-hole
- Rivers and Trails Committee

2003

- Charlie's Hole (C-hole)
- Additional work to D-hole
- Yampa Valley Stream Improvement – Tree Planting
- Friends of the Yampa River – Hydraulic Feature

2004

- Repaired C-hole
- Friends of the Yampa – River Improvements

2005

- Friends of the Yampa – Yampa River and Fetcher Pond ADA Access

2006

- Chuck Lewis State Wildlife Park, 2006
    - Installed vane structures
    - Removed Detroit rip rap
- YVSICT – Yampa River Channel Stabilization

Appendix D: Areas of Interest Drawings

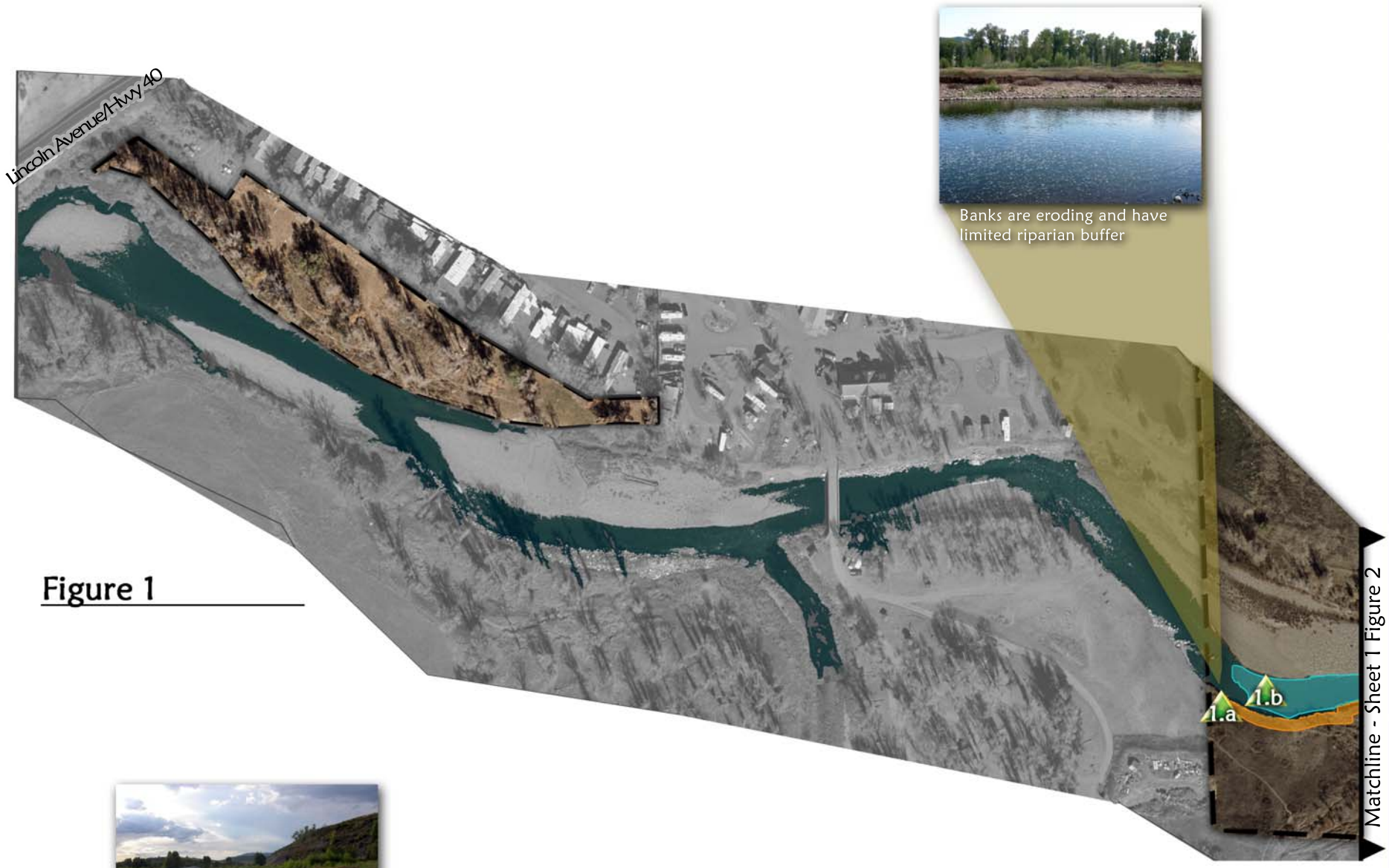


Figure 1

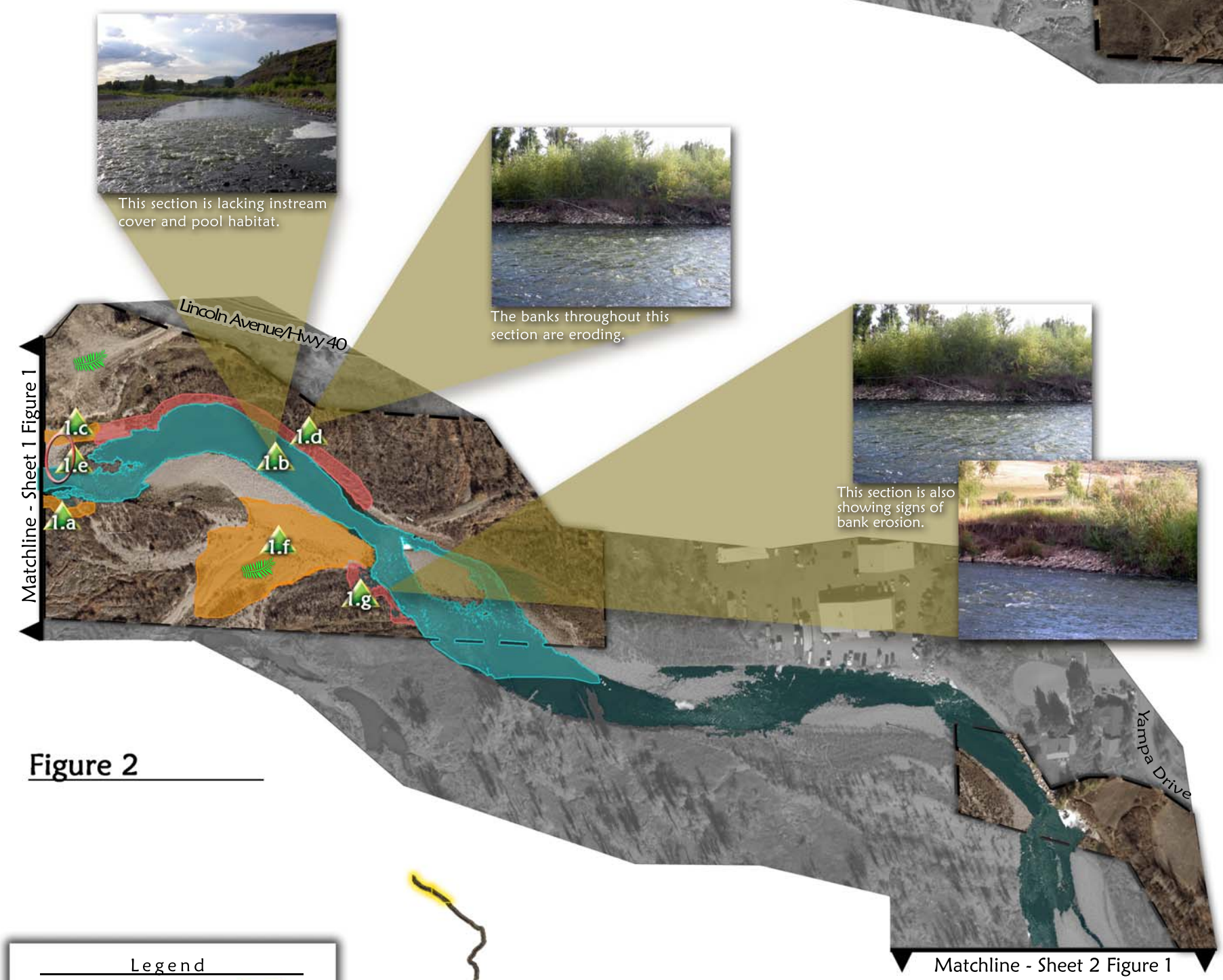
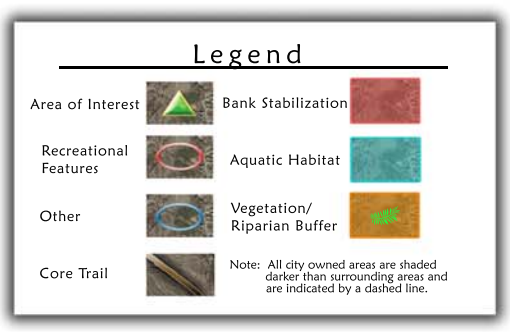


Figure 2



City of Steamboat Springs
Parks, Open Space and Recreational Services

Ecological Resource Consultants, Inc.

Yampa River Master Plan Site Assessment

Steamboat Springs, Colorado

November 2008

N

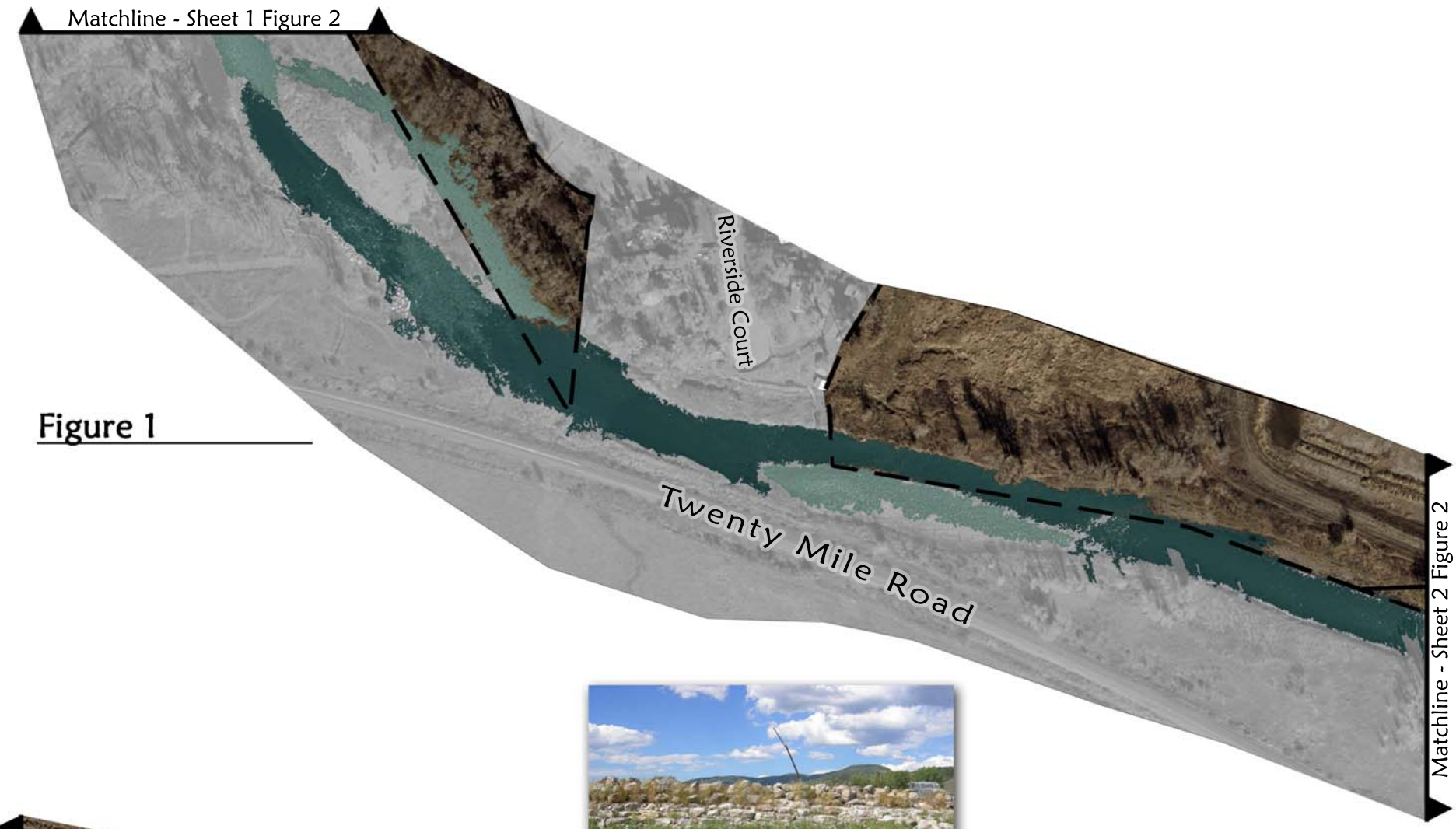


Figure 1

The bank is stable but is lacking in riparian vegetation

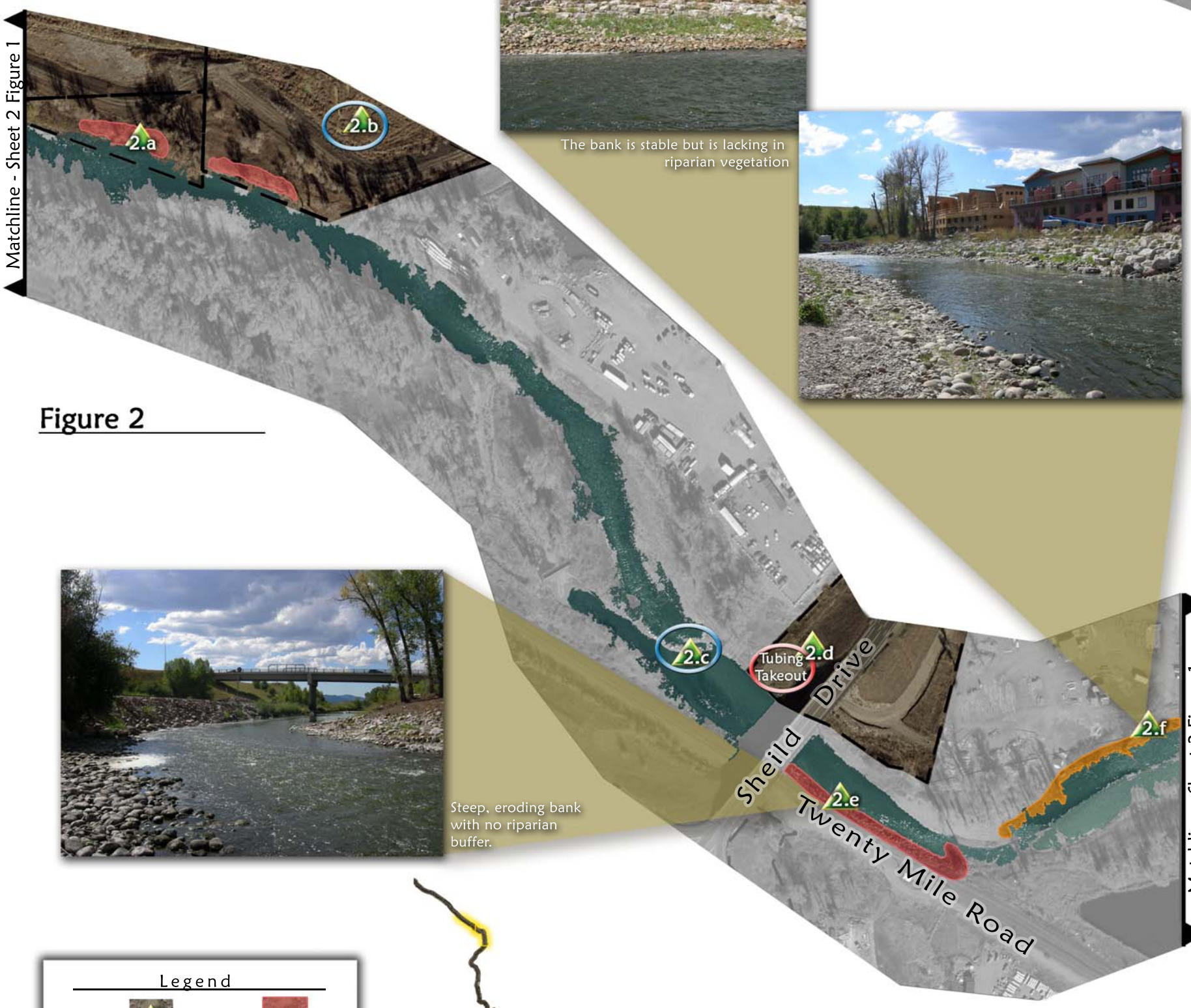


Figure 2

Steep, eroding bank with no riparian buffer.

Legend

Area of Interest		Bank Stabilization	
Recreational Features		Aquatic Habitat	
Other		Vegetation/ Riparian Buffer	
Core Trail			

Note: All city owned areas are shaded darker than surrounding areas and are indicated by a dashed line.

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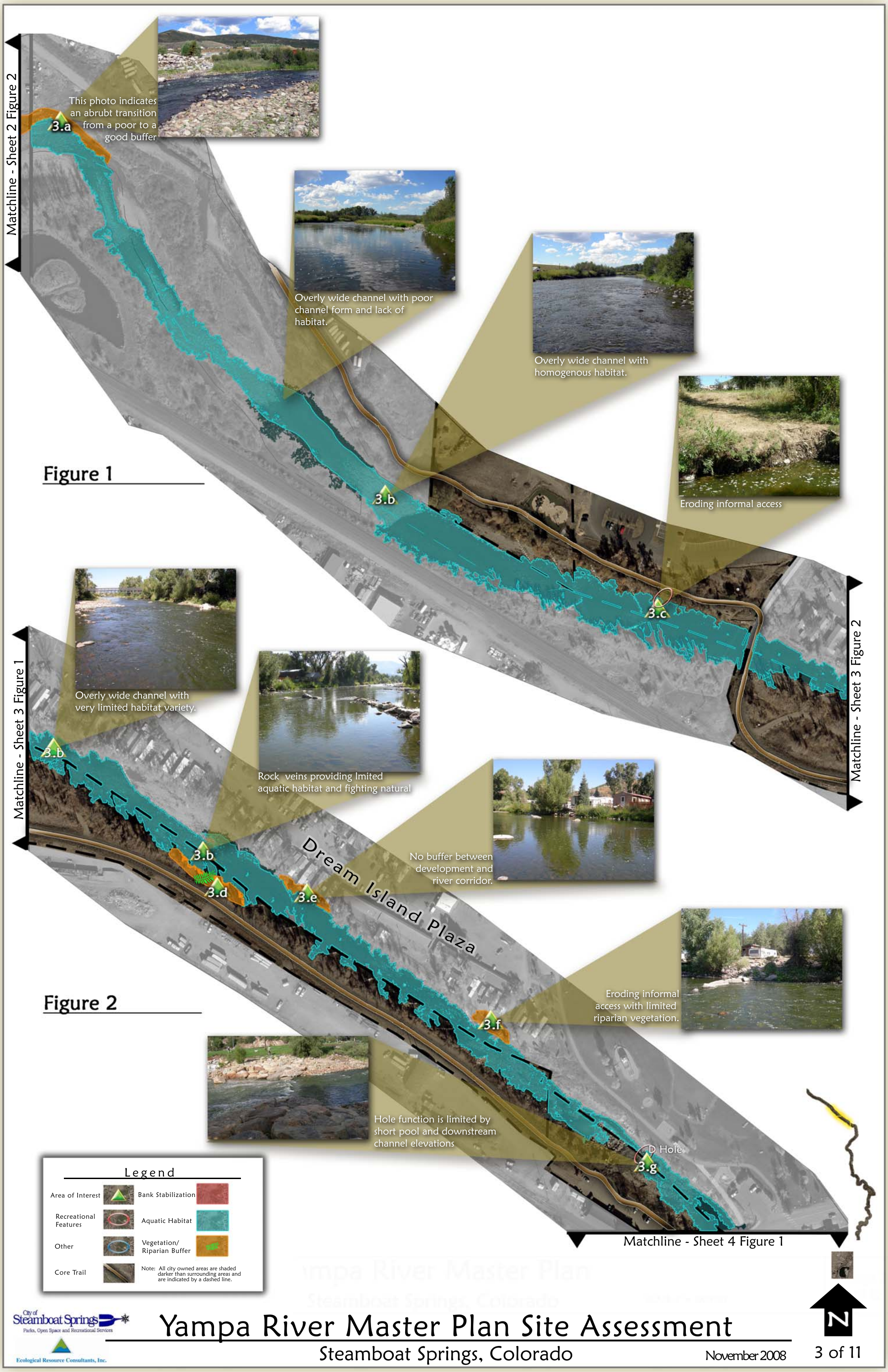

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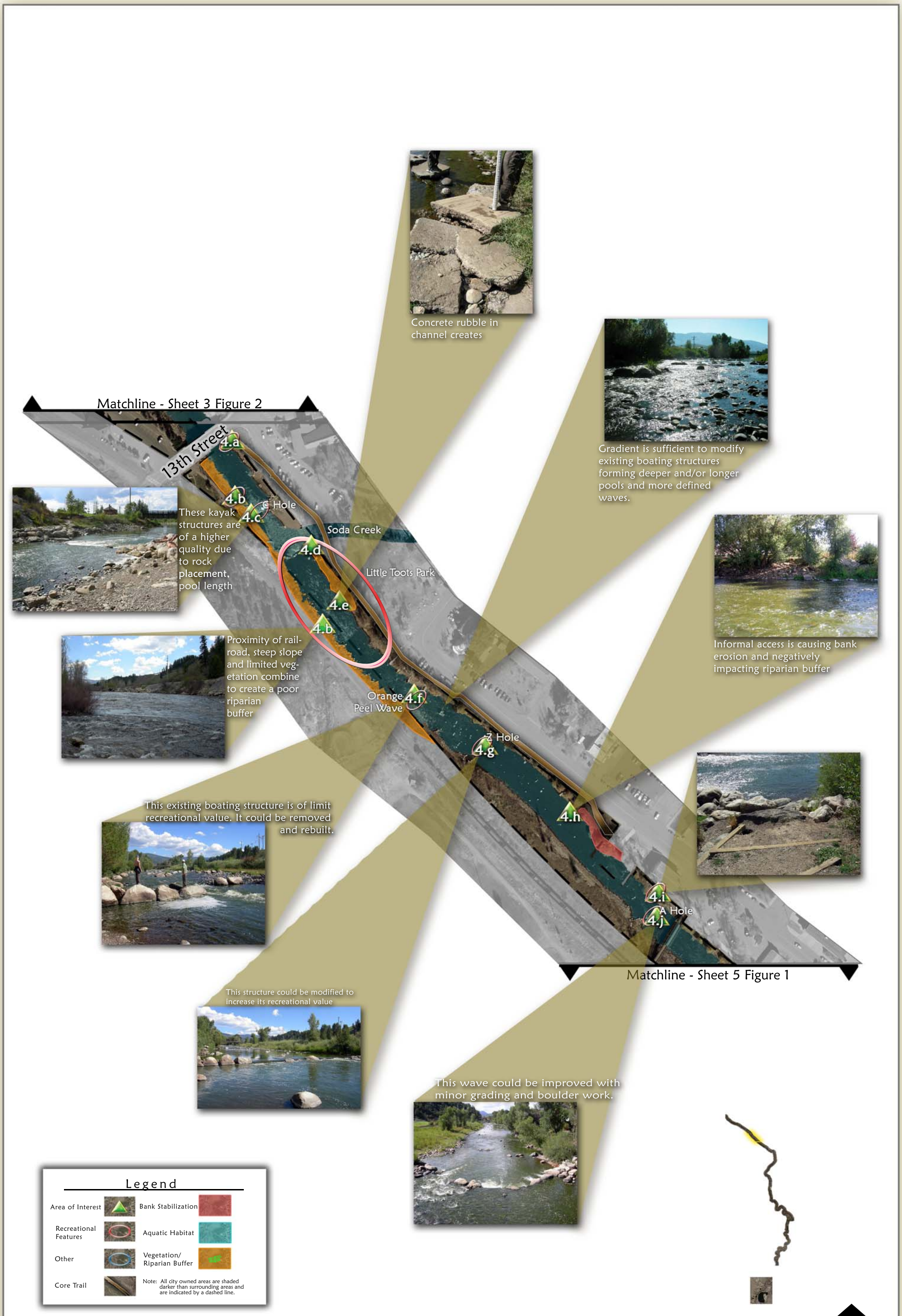
Steamboat Springs, Colorado

November 2008



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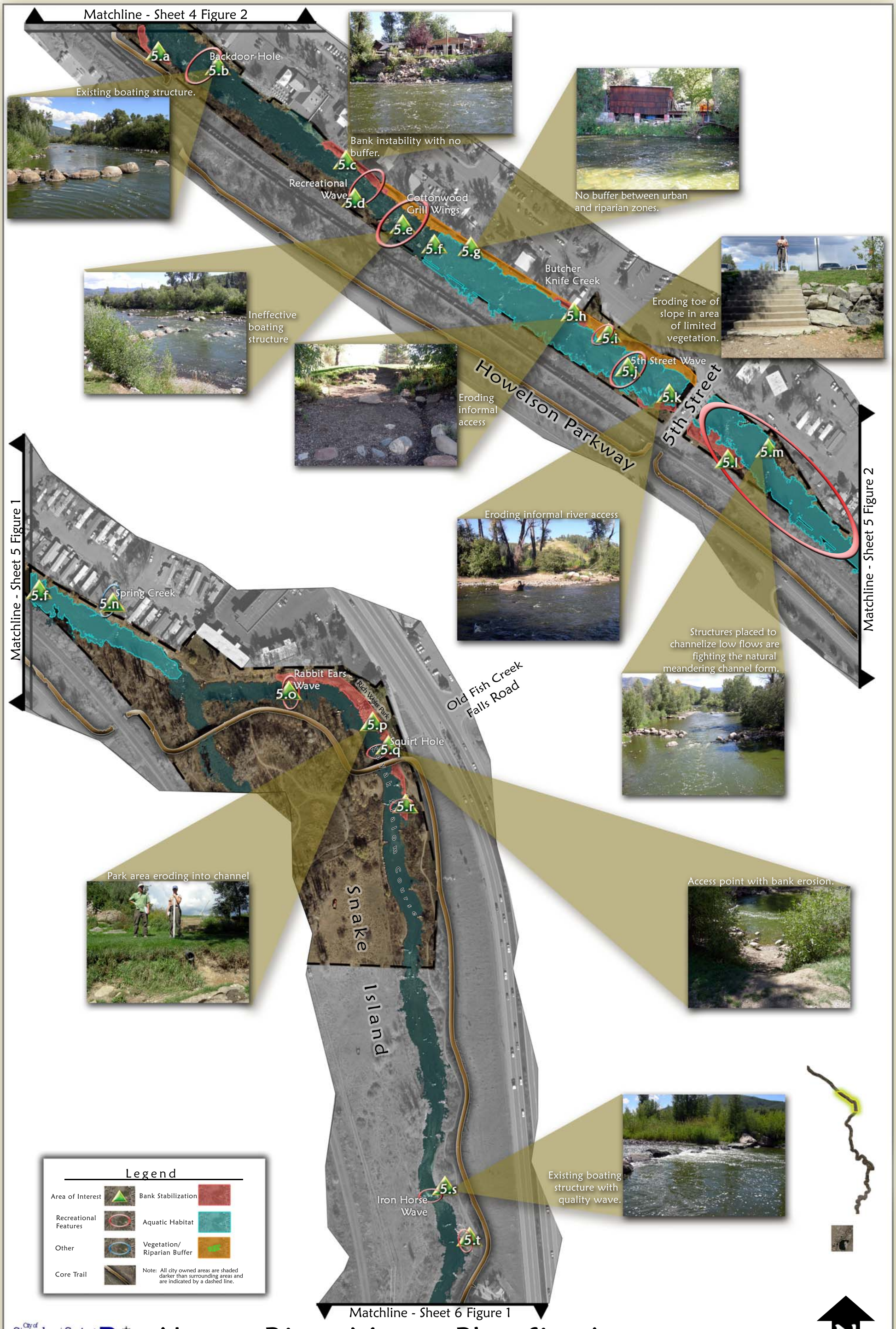
Yampa River Master Plan Site Assessment

Steamboat Springs, Colorado

November 2008



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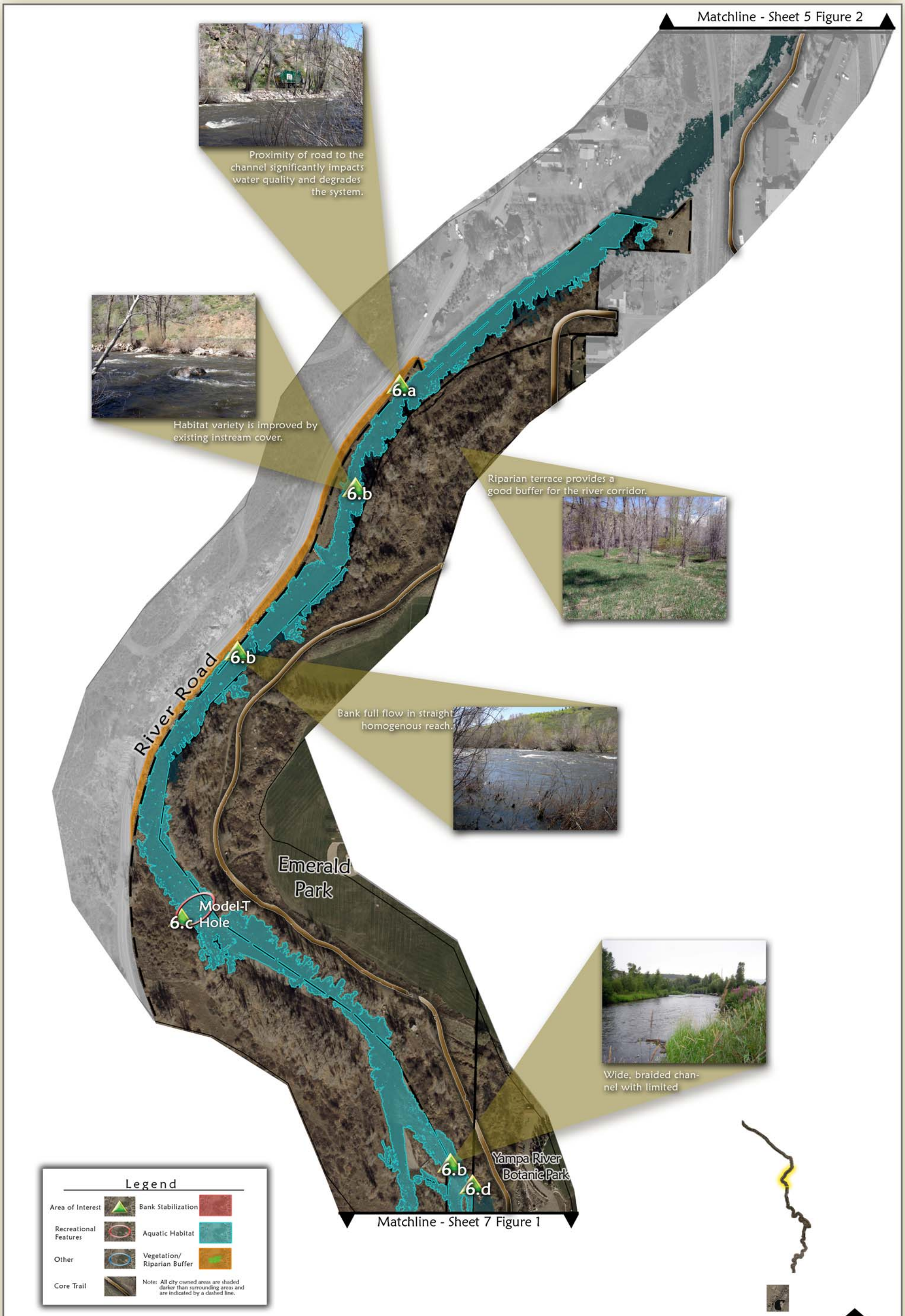

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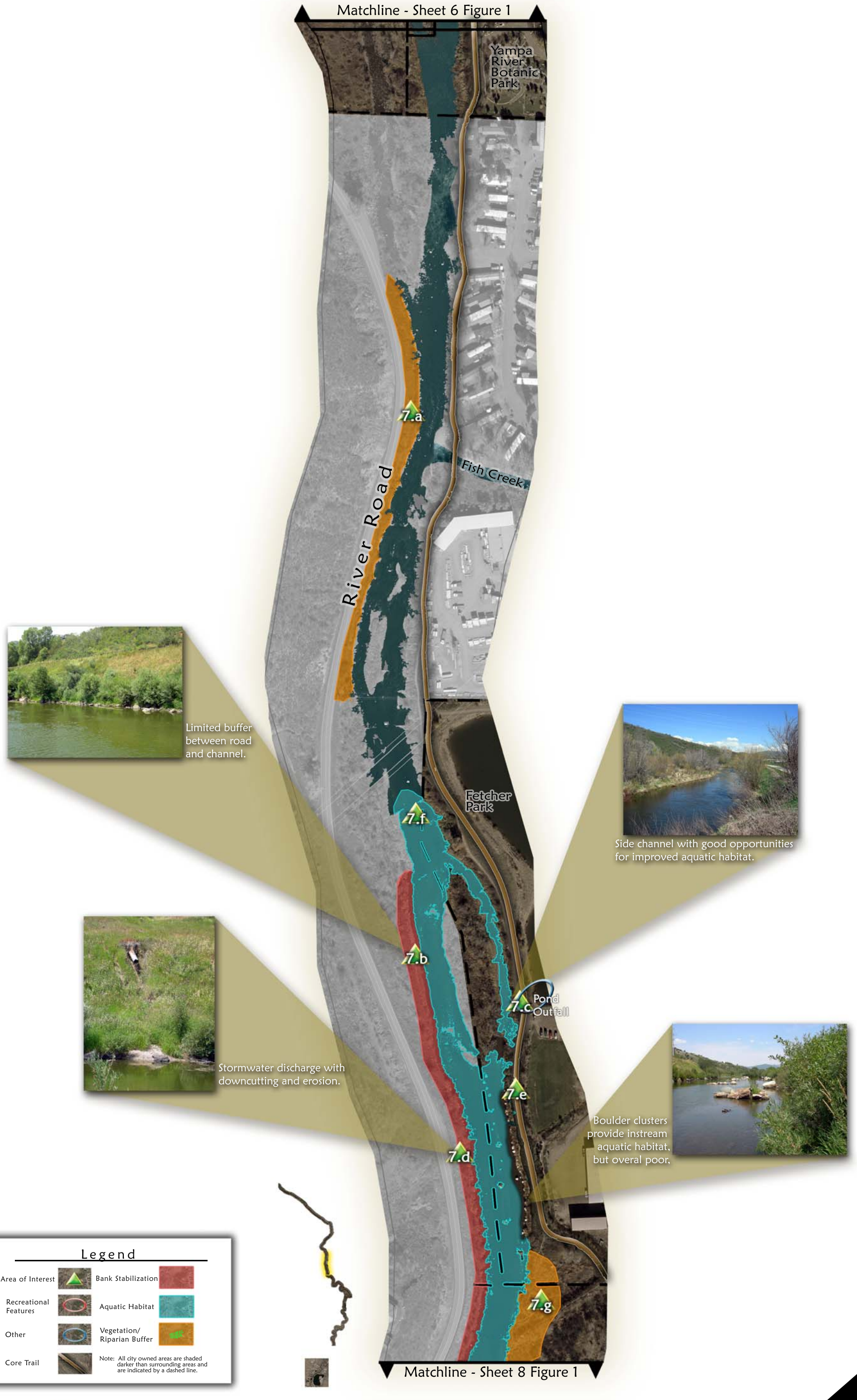

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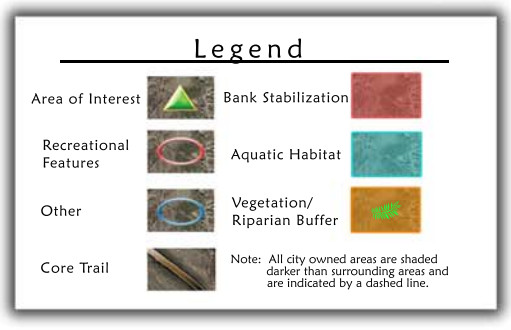

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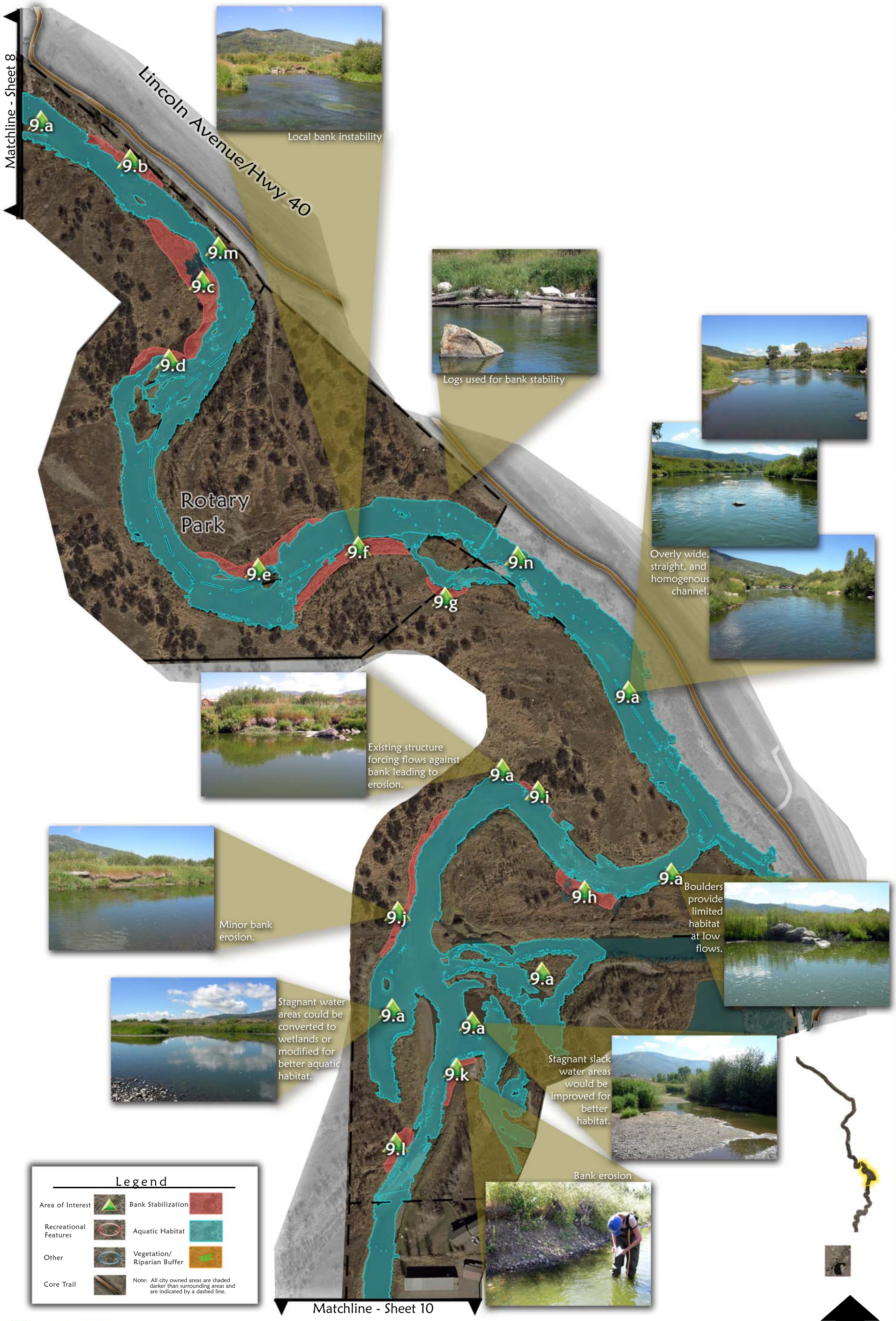

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Matchline - Sheet 9

Bank erosion and debris

10.a

10.b

10.c

10.d

Lateral channel migration.

Bank erosion and lmited riparian vegetation ersulting in channel migration.

Stable banks near infiltration gallery.

Legend

Area of Interest		Bank Stabilization	
Recreational Features		Aquatic Habitat	
Other		Vegetation/ Riparian Buffer	
Core Trail			

Note: All city owned areas are shaded darker than surrounding areas and are indicated by a dashed line.

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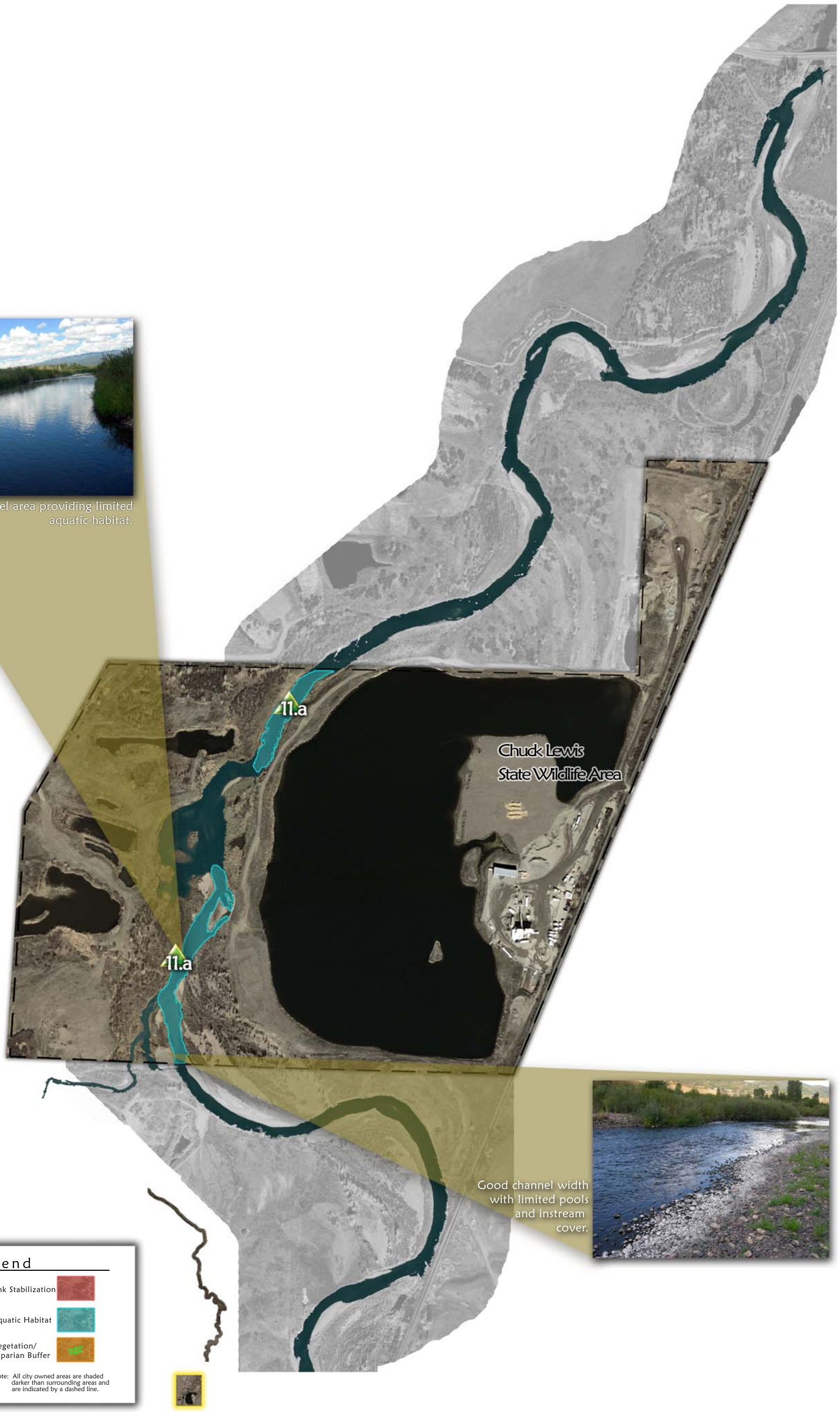
Stagnant channel area providing limited aquatic habitat.



Good channel width with limited pools and instream cover.

Legend

Area of Interest		Bank Stabilization	
Recreational Features		Aquatic Habitat	
Other		Vegetation/ Riparian Buffer	
Core Trail			

Note: All city owned areas are shaded darker than surrounding areas and are indicated by a dashed line.

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Appendix E: Area of Interest Descriptions, Rankings and Cost

AOI	AOI Category	AOI Description	AOI Rating	Improvement	Improvement Cost
1a	VEG/RB, BS	Active bank erosion is occurring and there is limited existing vegetation. Bank should be regraded to a stable slope, the toe of the slope stabilized and vegetation should be added.	3	Regrade and replant	31,561.58
1b	AH, CF	Some riffles and point bars present. Limited instream cover and instream aquatic habitat features exist. The channel has good meander shape, but low flow should be better defined.	2	Create high flow channel Create meander and thalweg Create riffle/pool/glide sequences Install boulder habitat clusters	44,953.90
1c	VEG/RB, BS	Little to no vegetation is present. Area expected to be used as parking lot area, but vegetation buffer should be implemented to restore other areas.	3	Regrade and replant	10,711.92
1d	VEG/RB, BS	Active bank erosion is occurring and there is limited existing vegetation. Bank should be regraded to a stable slope, the toe of the slope stabilized and vegetation should be added.	3	Regrade and replant	63,081.78
1e	RU - Access	This area is used as an informal access point. There is sparse vegetation present which may lead to bank erosion. A formal access point needs to be placed here if the vehicle access remains and is used.	3	Create formalized access point	5,000.00
1f	VEG/RB, BS	Limited vegetation exists in this area. Creation of riparian area will provide quality habitat, reduce future erosion and water quality impacts and improve the stream system.	2	Supplement existing vegetation/riparian buffer	40,265.25
1g	VEG/RB, BS	Active bank erosion is occurring and there is limited existing vegetation. Bank should be regraded to a stable slope, the toe of the slope stabilized and vegetation should be added.	3	Regrade and replant	2,700.00
2a	VEG/RB, BS	The bank is actively eroding and bank undercutting is present. There are no space constraints so regrading is possible.	3	Regrade and replant	42,516.55
2b	RU - Access	A formalized river access point is being constructed in this area. It will be ADA accessible and connect to the Yampa Core Trail.	1	Create formalized access point with ADA access and trail connection	15,000.00

AOI	AOI Category	AOI Description	AOI Rating	Improvement	Improvement Cost
2c	RU - Boating	A way for the tubers to safely pass the structure is needed. It also needs to function well as a diversion structure for agricultural water rights.	3	Diversion structure at James Brown Bridge	$5,000.00
2d	RU - Access	Area is heavily used as a tube take-out. Area is not in a bad state but its condition will deteriorate as it is used if nothing is done.	2	Formalize access point	$2,000.00
2e	VEG/RB, BS	Slope has been recently built up by dumping riprap. Due to the steep slope, rock is sliding into the River. The bank will continue to degrade if nothing is done, however solutions in this area are limited due to space constraints. Addition of vegetation would be helpful, but it is likely that bank erosion will continue and more riprap will be added by the railroad. Area is severely degraded, but options are limited. Not on City property.	1	Vegetate existing feature	$45,369.59
2f	VEG/RB, BS	The bank has been stabilized with a boulder wall and rock. It appears effective in terms of stabilization and has allowed some vegetative growth. Aesthetics and riparian function could be improved with additional of native vegetation. Not on City property.	1	Supplement existing vegetation/riparian buffer	$10,950.29
3a	VEG/RB, BS	The bank has been stabilized with a boulder wall and rock. It appears effective in terms of stabilization and has allowed some vegetative growth. Aesthetics of riparian function could be improved with the addition of native vegetation. Abrupt transition from wall to vegetation.	1	Supplement existing vegetation/riparian buffer	$9,003.08
3b	AH, CF	The channel is very wide and shallow. Rock vanes have been constructed in many places but are spaced in a manner that is against natural stream tendency. Rock clusters have been placed within the channel, but appear to be minimally effective at low flow conditions. There is limited instream cover and more instream aquatic habitat diversity is recommended. No meanders or point bars are present.	3	Create meander and thalweg Create riffle/pool/glide sequences Install boulder habitat clusters Remove boulder vane structures	$312,080.00

AOI	AOI Category	AOI Description	AOI Rating	Improvement	Improvement Cost
3c	RU - Access	Informal access is eroding and falling into the channel. Vegetation along travel path is gone. Undercutting of the bank has occurred.	3	Formalize access point	$2,000.00
3d	VEG/RB, BS	Area is lacking in vegetation.	1	Supplement existing vegetation/riparian buffer	$8,570.63
3e	VEG/RB, BS	There is little to no buffer between the Dream Island development and the River. In some locations decks and/or houses are placed on the banks. Informal access points exist throughout the area. Area is on private property, so land owner input needed.	3	Boulder Terrace	$129,395.62
3f	VEG/RB, BS	There is little to no buffer between the Dream Island development and the River. In some locations decks and/or houses are placed on the banks. Informal access points exist throughout the area. Area is on private property, so land owner input needed.	3	Boulder Terrace	$145,426.06
3g	RU - Boating	The structure has a limited pool which appears to be limiting its function. The structure itself is in good condition, so work would focus on grading downstream. It is expected that the D Hole could function as well as the C Hole with these improvements.	2	Repair/enhance boating structure	$10,000.00
4a	WATER RIGHTS	A gage needs to be installed for the RICD implementation. The gage on the Yampa near 13th Street bridge will be installed. Actual amount of water that would be received by perfecting this water right is unknown therefore ranking is uncertain.	1	Install gage for RICD rights	$30,000.00
4b	VEG/RB, BS	Rock has been placed along the bank for stabilization. There is sparse vegetation present. The access point is heavily used by swimmers and boaters. Success of any treatment at this location is dependent on O&M activities of the railroad.	3	Vegetate existing feature	$92,125.80
4c	RU - Boating	C-Hole. Boating structure functions well. No modifications recommended.	1	Repair/enhance boating structure	$10,000.00

AOI	AOI Category	AOI Description	AOI Rating	Improvement	Improvement Cost
4d	RU - Boating	An additional boating structure could be placed here as there is sufficient space and channel gradient to accommodate it. This would reduce high level of use at other play features. Improvement is not needed, but would improve overall recreational benefits.	2	Install boating structure	$40,000.00
4e	VEG/RB, BS	There concrete debris scattered in the channel and along the right bank in this location. It is a safety concern and aesthetic detriment.	3	Remove debris	$2,000.00
4f	RU - Boating	This boating structure is not effective. Although it does provide some good rapids and drop, it has limited recreational value.	3	Repair/enhance boating structure	$10,000.00
4g	RU - Boating	Also called the Double Z wave and Rock 'n' Roll wave. It is minimally effective and traps sediment. It could be improved by continuing the hold downstream and could reshape the structure.	3	Repair/enhance boating structure	$10,000.00
4h	RU - Access	Bank is eroding and is being used for River access. Rocks have been placed along the bank for stabilization and are effective at the toe. There is some vegetation including shrubs.	2	Create formalized access point Regrade and replant	$24,323.84
4i	RU - Access	Boulders have been placed along the bank for stabilization and railroad ties have been used to provide steps to the channel. The informal access is bare earth with no vegetation.	2	Create formalized access point	$5,000.00
4j	RU - Boating	A-hole. Boating feature is functioning sub-optimally. It would function better if rebuilt with curve in opposite direction.	3	Repair/enhance boating structure	$10,000.00
5a	VEG/RB, BS	Bank is eroding and there is little vegetation. It may be being used as an informal access point.	1	Regrade and replant	$9,931.92
5b	RU - Boating	Backdoor Hole. Boating feature is effective but could use some enhancement.	1	Repair/enhance boating structure	$10,000.00
5c	VEG/RB, BS	A rock wall was constructed to stabilize the bank and has fallen into the channel. Some vegetation exists along the bank but it could be increased.	3	Boulder Wall Revegetation	$65,498.26

AOI	AOI Category	AOI Description	AOI Rating	Improvement	Improvement Cost
5d	RU - Boating	Boating feature is functioning sub-optimally. It could be removed.	1	Repair/enhance boating structure	$10,000.00
5e	RU - Boating	Boating feature is function sub-optimally. River right works well but River left does not.	3	Remove boating structure	$8,000.00
5f	VEG/RB, BS	The channel is very wide and shallow. Rock vanes have been constructed in many places but are spaced in a manner that is against natural stream tendency. Rock clusters have been placed within the channel, but appear to be minimally effective at low flow conditions. There is limited instream cover and more instream aquatic habitat diversity is recommended. No meanders or point bars are present.	3	Create meander and thalweg Create riffle/pool/glide sequences Install boulder habitat clusters Remove boulder vane structures	$138,120.00
5g	VEG/RB, BS	There is little no buffer between development and the River. In some locations decks and/or houses are placed on the banks. Informal access points exist throughout the area.	3	Boulder Wall Revegetation	$321,461.71
5h	RU - Access	Bank is eroding due to the creation of an informal access. Some rocks are present along the access path but are not effectively stabilizing the banks. The access path is primarily gravel and sand. It is eroding almost up to the Core Trail.	3	Create formalized access point Regrade and replant	$14,163.31
5i	RU - Access	Access point consists of concrete steps and boulders. Beyond the concrete steps no armoring exists and erosion can be seen. Upstream stabilization consists of a boulder wall.	2	Boulder Wall Regrade and replant	$49,022.99
5j	RU - Boating	5th Street Wave. This area receives less use as a park and play structure and this portion of the channel could be converted to a more natural state.	3	Remove boating structure	$8,000.00
5k	VEG/RB, BS	During high flows there is no bank armoring. During low flows there are cobbles along the banks. It may be being used as an informal access.	2	Create formalized access point Regrade and replant	$15,610.53
5l	VEG/RB, BS	Bank stabilization consists of vegetation and some rocks. The bank is steep. It appears to be stable but will need work in the future.	1	Regrade and replant	$13,353.11

AOI	AOI Category	AOI Description	AOI Rating	Improvement	Improvement Cost
5m	RU - Boating	This area receives less use as a park and play structure and this portion of the channel could be converted to a more natural state. Existing boating structure and vanes should be removed.	3	Remove boating structure	$8,000.00
5n	OTHER	This area will likely need to be addressed in the future, however until plans for realignment of Spring Creek are completed the appropriate improvements for this area are unknown.	1	No action	$0.00
5o	RU - Boating	Rabbit Ears Wave. Boating feature is functioning sub-optimally. It is located at the downstream end of a kayak course.	1	Repair/enhance boating structure	$10,000.00
5p	VEG/RB, BS	This area is heavily used and is known as "the Beach." Mass wasting is present and outfall pipes have been exposed. Banks are in need of immediate repair as ongoing erosion is evident and due to high use is only expected to worsen.	3	Boulder Terrace Revegetation	$83,009.33
5q	RU - Access	Informal access is eroding and falling into the channel. Vegetation along travel path is gone and the access path is steep. This access is heavily used.	3	Formalize access point	$2,000.00
5r	RU - Boating	Squirt Hole and Slalom Course. Existing features are functioning well. Minor improvements or resetting of rocks could be made, however are receives limited use	1	Repair/enhance boating structure	$10,000.00
5s	RU - Boating	Iron Horse Wave. The boating feature functions well. It is not located on City property.	1	Repair/enhance boating structure	$10,000.00
5t	RU - Access	This access point is eroding and appears to be unsafe. It is not located on City property.	2	Formalize access point	$2,000.00
6a	VEG/RB, BS	In this area there is very little space between the road and the river. Area would be greatly improved by moving toe of the slope further away from road, stabilizing with boulder toe and vegetating area between toe and road.	3	Boulder Toe	$65,340.90
6b	AH, CF	The channel is somewhat wide and shallow, however some natural characteristics exist. Rock clusters have been placed within the channel, providing some habitat. There is limited instream diversity and majority of area is low gradient riffle.	2	Create meander and thalweg Create riffle/pool/glide sequences Install boulder habitat clusters	$232,320.00

AOI	AOI Category	AOI Description	AOI Rating	Improvement	Improvement Cost
6c	RU - Boating	Model T Hole. The feature is performing sub-optimally.	2	Repair/enhance boating structure	$10,000.00
6d	AH	There is approximately 90 LF of concrete debris scattered along the channel in this location. It is a safety concern and aesthetic detriment.	3	Remove debris	$2,000.00
7a	VEG/RB, BS	In this area there is very little space between the road and the river. Area would be greatly improved by moving toe of the slope further away from road, stabilizing with boulder toe and vegetating area between toe and road.	3	Boulder Toe	$46,352.95
7b	VEG/RB, BS	Minimal buffer is present due to the proximity of River road. In some areas the roadway is on the River bank. Vegetation is present but could be improved.	2	Regrade and replant	$73,936.48
7c	OTHER	Pond outfall from Fetcher Park.	1	No action	$0.00
7d	VEG/RB, BS	Area surrounding a stormwater outfall is eroding. Undercutting is occurring beneath the pipe and may compromise its integrity.	3	Pipe Repair and Bank stabilization	$4,812.00
7e	VEG/RB, BS	Bank is eroding and mass wasting and undercutting is present.	3	Regrade and replant	$42,190.72
7f	AH, CF	Boulder clusters exist in the main channel and some vanes have been placed in the side channel. Both provide poor low flow aquatic habitat. The channel is straight and no point bars or thalweg are presents	3	Create high flow channel Create meander and thalweg Create riffle/pool/glide sequences Install boulder habitat clusters	$103,754.00
7g	VEG/RB, BS	Vegetation is sparse. Many informal pathways and access points exist in this area.	2	Supplement existing vegetation/riparian buffer	$23,840.79
8a	VEG/RB, BS	See 7b	2	Regrade and replant	$12,736.36
8b	VEG/RB, BS	See 7g	3	Supplement existing vegetation/riparian buffer	$22,244.83
8c	AH, CF	See 7f	3	Create meander and thalweg Create riffle/pool/glide sequences	$38,350.20

AOI	AOI Category	AOI Description	AOI Rating	Improvement	Improvement Cost
8d	AH, CF	Overall channel form and aquatic habitat are poor. Meander pattern exists, but no low flow thalweg is present. Aquatic habitat diversity is limited and boulders that have been placed in the channel are generally not providing quality habitat, particularly at low flows.	3	Create high flow channel Create meander and thalweg Create riffle/pool/glide sequences Install boulder habitat clusters	$57,580.00
8e	VEG/RB, BS	There is sparse vegetation along the point bar and along the banks.	1	Supplement existing vegetation/riparian buffer	$18,768.13
8f	VEG/RB, BS	The bank is actively eroding and bank undercutting is present. There are no space constraints so regrading is possible.	3	Regrade and replant	$12,417.75
9a	AH, CF	Overall channel form and aquatic habitat are poor. Meander pattern exists, but no low flow thalweg is present. Aquatic habitat diversity is limited and boulders that have been placed in the channel are generally not providing quality habitat, particularly at low flows.	3	Convert open water to wetland Create high flow channel Create meander and thalweg Create riffle/pool/glide sequences Install boulder habitat clusters Install natural habitat feature	$556,146.40
9b	VEG/RB, BS	Vegetation is sparse.	1	Vegetate	$29,834.19
9c	VEG/RB, BS	Vegetation is sparse.	1	Supplement existing vegetation/riparian buffer	$21,667.00
9d	VEG/RB, BS	Bank is eroding and vegetation is sparse.	2	Supplement existing vegetation/riparian buffer	$5,256.38
9e	VEG/RB, BS	Vegetation is sparse.	1	Supplement existing vegetation/riparian buffer	$10,722.75
9f	VEG/RB, BS	Vegetation is sparse.	1	Supplement existing vegetation/riparian buffer	$13,334.54
9g	VEG/RB, BS	Bank is eroding along this side channel. Formalize channel into a high flow channel.	2	Supplement existing vegetation/riparian buffer	$3,036.88
9h	VEG/RB, BS	Existing feature is forcing flows towards the bank and causing local erosion. Bank is eroding and needs to be stabilized.	2	Boulder Toe	$10,610.92

AOI	AOI Category	AOI Description	AOI Rating	Improvement	Improvement Cost
9i	VEG/RB, BS	Existing feature is forcing flows towards the bank and causing erosion.	2	Boulder Toe	$12,286.32
9j	VEG/RB, BS	Bank has eroded and become destabilized. Undercutting has occurred with vegetation holding the bank together above the high flow line. This could provide aquatic habitat during high flows but it may cause the bank to fall into the River if the erosion keeps occurring.	3	Regrade and replant	$33,278.80
9k	VEG/RB, BS	Bank is eroding and no vegetation exists below the high flow line. Undercutting is not occurring.	2	Regrade and replant	$18,585.23
9l	VEG/RB, BS	Bank is eroding at the toe and vegetation is sparse.	2	Regrade and replant	$16,988.01
9m	VEG/RB, BS	Area is eroding due to flows hitting bank.	2	Boulder Toe	$2,039.27
9n	VEG/RB, BS	Area is eroding due to flows hitting bank.	2	Boulder Toe	$1,402.00
10a	VEG/RB, BS	Two vehicles were left here and are rusting.	1	Remove vehicle	$2,000.00
10b	VEG/RB, BS	Bank has eroded and become destabilized. Undercutting has occurred with vegetation holding the bank together above the high flow line. This could provide aquatic habitat during high flows but it may cause the bank to fall into the River if the erosion keeps occurring.	3	Regrade and replant	$18,056.62
10c	VEG/RB, BS	Mass wasting has occurred and the bank is vertical. There is no vegetation along the bank helping to stabilize it.	3	Boulder Terrace	$69,473.31
10d	VEG/RB, BS	Mass wasting has occurred and the bank is vertical. There is no vegetation along the bank helping to stabilize it. Bank erosion has caused the exposure of a PVC outfall pipe.	3	Boulder Terrace	$254,735.47
11a	AH, CF	The channel leading into and out of the pond area has limited aquatic habitat and would benefit from additional instream variety and features. The pond area is stagnant water that could be partially converted to wetlands with the remainder improved by habitat features.	3	Convert open water to wetland Create riffle/pool/glide sequences Install boulder habitat clusters Install natural habitat feature	$43,641.60

Appendix F: Steamboat Springs, Routt County, Yampa River Riparian Corridor Commercially Available Native Plants Appropriate for Ecological Restoration

Trees & Shrubs	
Scientific Name	**Common Name**
Acer glabrum	Rocky Mountain Maple
Alnus incana	thinleaf alder
Amelanchier alnifolia	Saskatoon serviceberry
Betula glandulosa	bog birch
Lonicera involucrata	twinberry
Picea pungens	Colorado blue spruce
Populus angustifolia	narrowleaf cottonwood
Prunus americana	American plum
Prunus virginiana	choke cherry
Ribes spp.	currants
Rose woodii	woods rose
Salix spp.	willows

Grasses & Grasslike Species	
Scientific Name	**Common Name**
Beckmannia syzigachne	American sloughgrass
Bromus marginatus	mountain brome
Calamagrostis canadensis	bluejoint reedgrass
Carex spp.	sedges
Deschampsia cespitosa	tufted hairgrass
Eleocharis spp.	spikerush
Elymus lanceolatus	streambank wheatgrass
Elymus trachycaulus	slender wheatgrass
Festuca arizonica	Arizona fescue

Grasses & Grasslike Species	
Scientific Name	**Common Name**
Glyceria grandis	American mannagrass
Glyceria striata	fowl mannagrass
Juncus spp	rushes
Pascopyron smithii	western wheatgrass
Poa palustris	fowl bluegrass

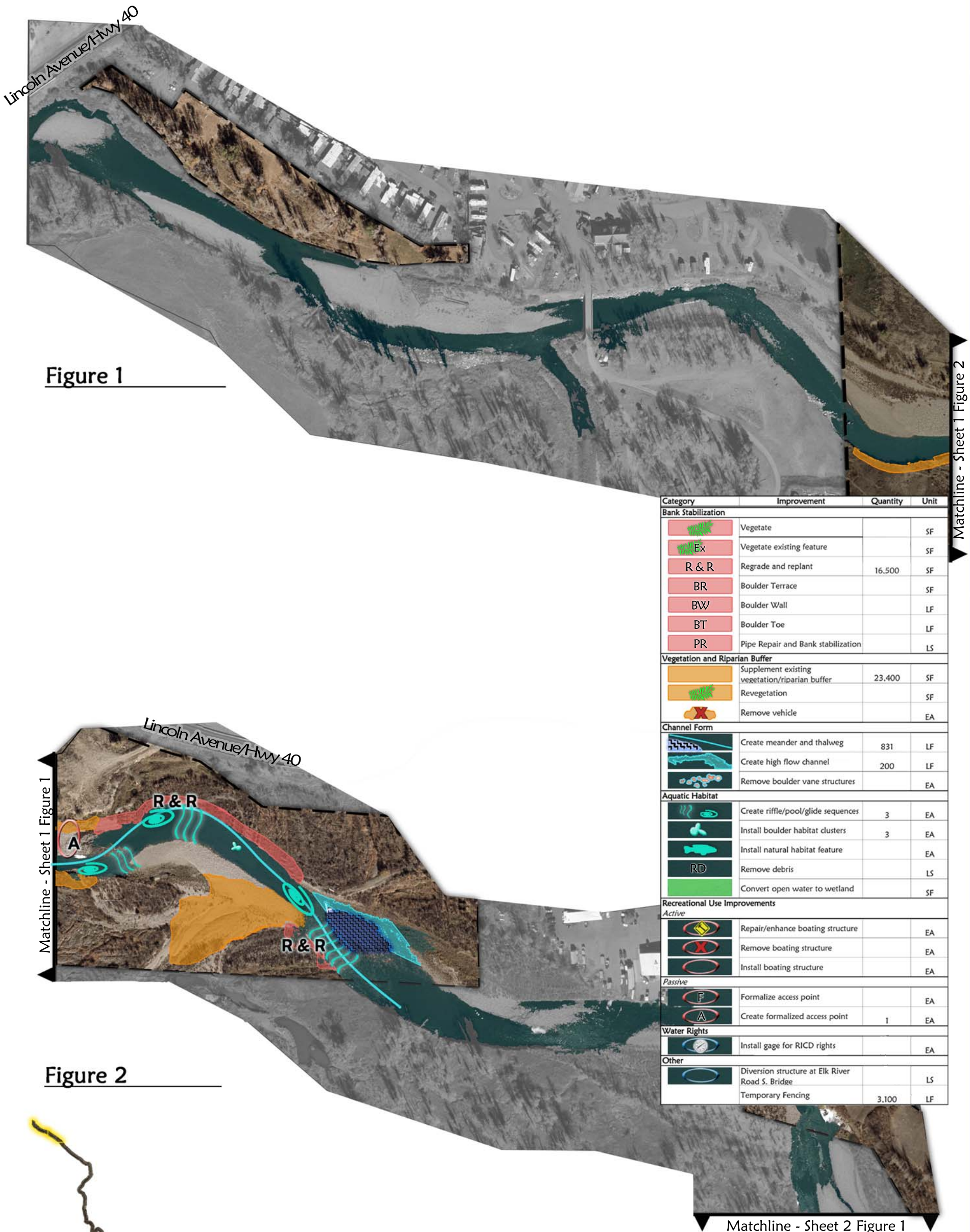
Noxious/ do not plant species	
Scientific Name	**Common Name**
Abutilon theophrasti	velvetleaf
Acroptilon repens	Russian knapweed
Aegilops cylindrica	jointed goatgrass
Agropyron cristatum	crested wheatgrass
Alhagi pseudalhagi	camelthorn
Anoda cristata	spurred anoda
Anthemis arvensis	corn chamomile
Anthemis cotula	mayweed chamomile
Arctium minus	common burdock
Artemisia absinthium	absinth wormwood
Bromus inermis	smooth brome
Bromus tectorum	downy brome/cheatgrass
Cardaria draba	whitetop/ hoary cress
Carduus acanthoides	plumeless thistle
Carduus nutans	musk thistle

Noxious/ do not plant species	
Scientific Name	**Common Name**
Carum carvi	wild caraway
Centaurea diffusa	diffuse knapweed
Centaurea maculosa	spotted knapweed
Centaurea pratensis	meadow knapweed
Centaurea solstitialis	yellow starthistle
Centaurea virgata	squarrose knapweed
Chondrilla juncea	rush skeletonweed
Chrysanthemum leucanthemum	oxeye daisy
Cichorium intybus	chicory
Cirsium arvense	Canada thistle
Cirsium vulgare	bull thistle
Clematis orientalis	Chinese clematis
Conium maculatum	poison hemlock
Convolvulus arvensis	field bindweed
Crupina vulgaris	common crupina
Cynoglossum officinal	houndstongue
Cyperus esculentus	yellow nutsedge
Dipsacus fullonum	common teasel
Dipsacus laciniatus	cutleaf teasel
Elaeagnus angustifolia	Russian olive
Elytrigia repens	quackgrass
Erodium cicutarium	redstem filaree
Euphorbia cyparissias	cypress spurge
Euphorbia esula	leafy spurge

Noxious/ do not plant species	
Scientific Name	**Common Name**
Euphorbia myrsinites	myrtle spurge
Halogeton glomeratus	halogeton
Hesperis matronalis	Dame's rocket
Hibiscus trionum	Venice mallow
Hieracium aurantiacum	orange hawkweed
Hydrilla verticillata	hydrilla
Hyoscyamus niger	black henbane
Hypericum perforatum	common St. Johnswort
Isatis tinctoria	Dyer's woad
Lepidium latifolium	perennial pepperweed
Lespedeza cuneata	sericea lespedeza
Linaria dalmatica	Dalmatian toadflax
Linaria vulgaris	yellow toadflax
Lythrum salicaria	purple loosestrife
Matricaria perforata	scentless chamomile
Myriophyllum spicatum	Eurasian watermilfoil
Onopordum acanthium	scotch thistle
Panicum miliaceum	wild proso millet
Peganum harmala	African rue
Phalaris arundinacea	reed canary grass
Potentilla recta	Sulfur cinquefoil
Salvia aethiopis	Mediterranean sage
Salvinia molesta	giant salvinia
Saponaria officinalis	bouncingbet

Noxious/ do not plant species	
Scientific Name	**Common Name**
Senecio jacobaea	tansy ragwort
Sonchus arvensis	perennial sowthistle
Sorghum halepense	johnsongrass
Taeniatherum caput-medusae	medusahead
Tamarix sp.	tamarisk
Tanacetum vulgare	common tansy
Tribulus terrestris	puncturevine
Typha sp.	cattails
Verbascum blattaria	moth mullein
Verbascum Thapsus	common mullein

Appendix G: Recommended Improvements Drawings



Category	Improvement	Quantity	Unit
Bank Stabilization			
	Vegetate		SF
Ex	Vegetate existing feature		SF
R & R	Regrade and replant	16,500	SF
BR	Boulder Terrace		SF
BW	Boulder Wall		LF
BT	Boulder Toe		LF
PR	Pipe Repair and Bank stabilization		LS
Vegetation and Riparian Buffer			
	Supplement existing vegetation/riparian buffer	23,400	SF
	Revegetation		SF
	Remove vehicle		EA
Channel Form			
	Create meander and thalweg	831	LF
	Create high flow channel	200	LF
	Remove boulder vane structures		EA
Aquatic Habitat			
	Create riffle/pool/glide sequences	3	EA
	Install boulder habitat clusters	3	EA
	Install natural habitat feature		EA
RD	Remove debris		LS
	Convert open water to wetland		SF
Recreational Use Improvements			
Active			
	Repair/enhance boating structure		EA
	Remove boating structure		EA
	Install boating structure		EA
Passive			
F	Formalize access point		EA
A	Create formalized access point	1	EA
Water Rights			
	Install gage for RICD rights		EA
Other			
	Diversion structure at Elk River Road S. Bridge		LS
	Temporary Fencing	3,100	LF

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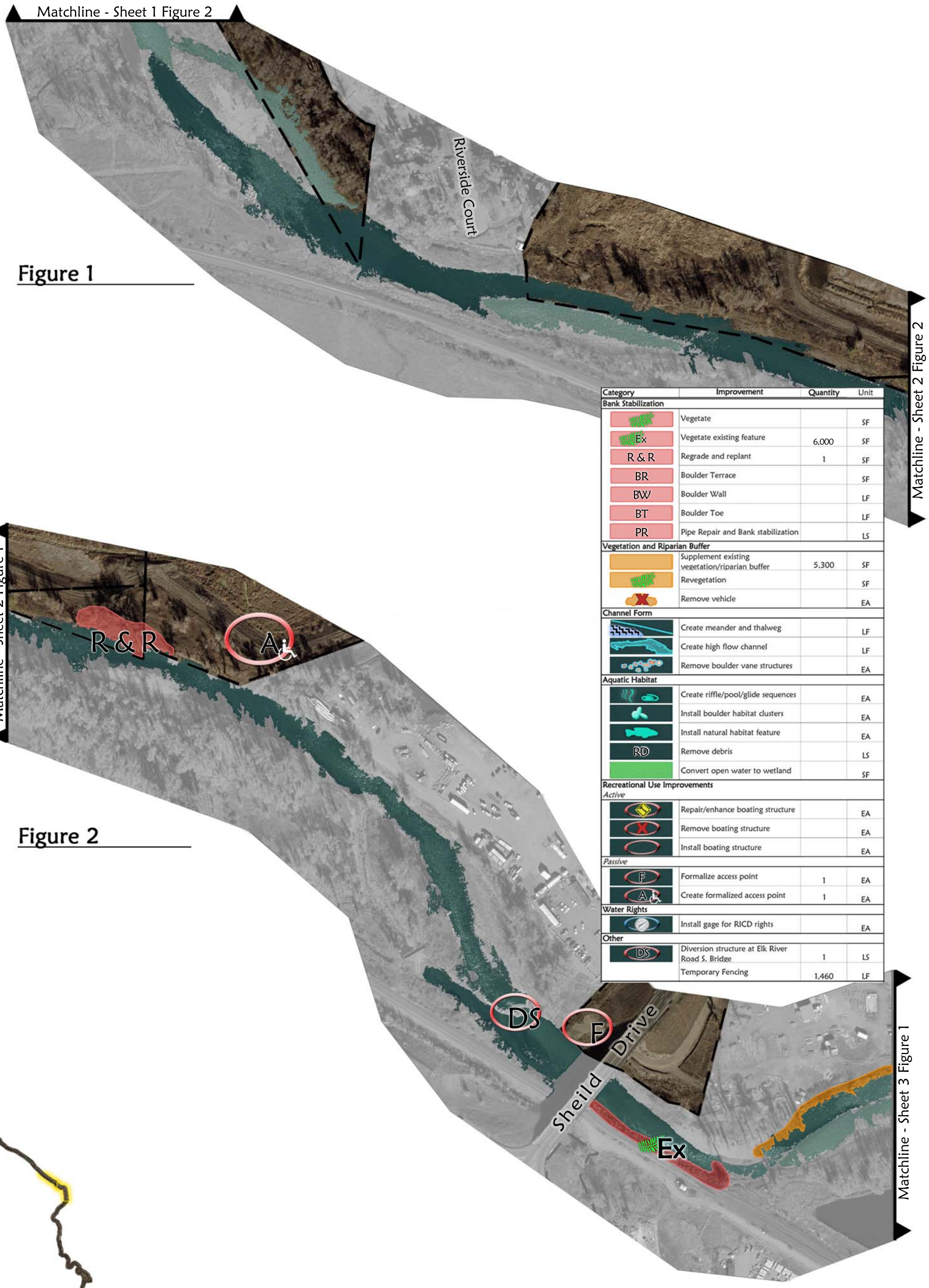

Category	Improvement	Quantity	Unit
Bank Stabilization			
	Vegetate		SF
Ex	Vegetate existing feature	6,000	SF
R & R	Regrade and replant	1	SF
BR	Boulder Terrace		SF
BW	Boulder Wall		LF
BT	Boulder Toe		LF
PR	Pipe Repair and Bank stabilization		LS
Vegetation and Riparian Buffer			
	Supplement existing vegetation/riparian buffer	5,300	SF
	Revegetation		SF
	Remove vehicle		EA
Channel Form			
	Create meander and thalweg		LF
	Create high flow channel		LF
	Remove boulder vane structures		EA
Aquatic Habitat			
	Create riffle/pool/glide sequences		EA
	Install boulder habitat clusters		EA
	Install natural habitat feature		EA
RD	Remove debris		LS
	Convert open water to wetland		SF
Recreational Use Improvements			
Active			
	Repair/enhance boating structure		EA
	Remove boating structure		EA
	Install boating structure		EA
Passive			
F	Formalize access point	1	EA
A	Create formalized access point	1	EA
Water Rights			
	Install gage for RICD rights		EA
Other			
DS	Diversion structure at Elk River Road S. Bridge	1	LS
	Temporary Fencing	1,460	LF

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Matchline - Sheet 2 Figure 2

Figure 1

Category	Improvement	Quantity	Unit
Bank Stabilization			
	Vegetate		SF
Ex	Vegetate existing feature		SF
R & R	Regrade and replant		SF
BR	Boulder Terrace	4,720	SF
BW	Boulder Wall		LF
BT	Boulder Toe		LF
PR	Pipe Repair and Bank stabilization		LS
Vegetation and Riparian Buffer			
	Supplement existing vegetation/riparian buffer	9,100	SF
	Revegetation		SF
X	Remove vehicle		EA
Channel Form			
	Create meander and thalweg	3,300	LF
	Create high flow channel		LF
	Remove boulder vane structures	6	EA
Aquatic Habitat			
	Create riffle/pool/glide sequences	9	EA
	Install boulder habitat clusters	20	EA
	Install natural habitat feature		EA
RD	Remove debris		LS
	Convert open water to wetland		SF
Recreational Use Improvements			
Active			
	Repair/enhance boating structure	1	EA
	Remove boating structure		EA
	Install boating structure		EA
Passive			
F	Formalize access point	1	EA
A	Create formalized access point		EA
Water Rights			
	Install gage for RICD rights		EA
Other			
DS	Diversion structure at Elk River Road S. Bridge		LS
	Temporary Fencing	1,450	LF

F

Matchline - Sheet 3 Figure 2

Matchline - Sheet 3 Figure 1

Figure 2

Dream Island Plaza

BR

BR

D Hole

Matchline - Sheet 4 Figure 1

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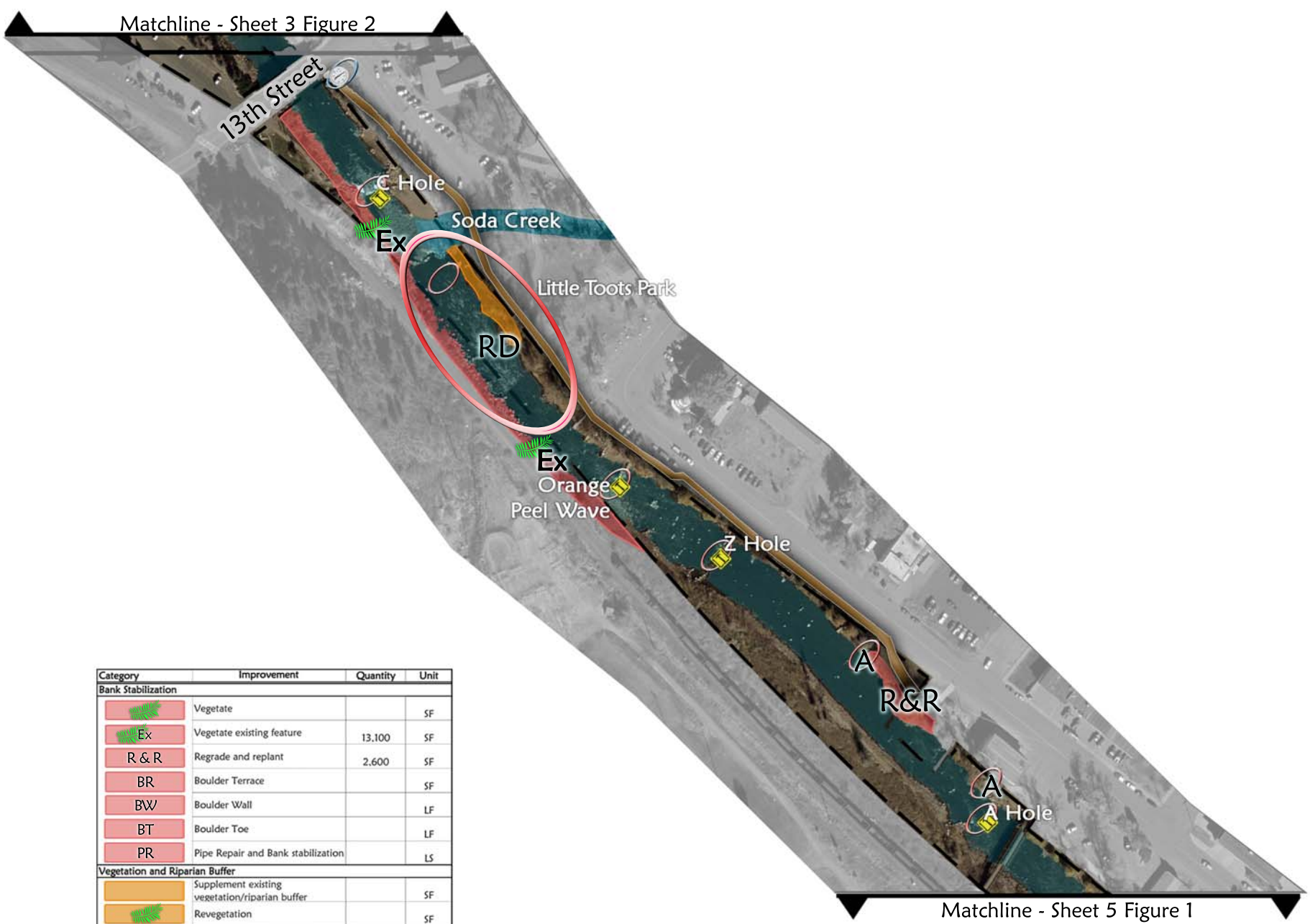

Category	Improvement	Quantity	Unit
Bank Stabilization			
	Vegetate		SF
Ex	Vegetate existing feature	13,100	SF
R & R	Regrade and replant	2,600	SF
BR	Boulder Terrace		SF
BW	Boulder Wall		LF
BT	Boulder Toe		LF
PR	Pipe Repair and Bank stabilization		LS
Vegetation and Riparian Buffer			
	Supplement existing vegetation/riparian buffer		SF
	Revegetation		SF
	Remove vehicle		EA
Channel Form			
	Create meander and thalweg		LF
	Create high flow channel		LF
	Remove boulder vane structures		EA
Aquatic Habitat			
	Create riffle/pool/glide sequences		EA
	Install boulder habitat clusters		EA
	Install natural habitat feature		EA
RD	Remove debris	1	LS
	Convert open water to wetland		SF
Recreational Use Improvements			
Active			
	Repair/enhance boating structure	3	EA
	Remove boating structure		EA
	Install boating structure	1	EA
Passive			
F	Formalize access point		EA
A	Create formalized access point	3	EA
Water Rights			
	Install gage for RICD rights	1	EA
Other			
	Diversion structure at Elk River Road S. Bridge		LS
	Temporary Fencing	1,900	LF

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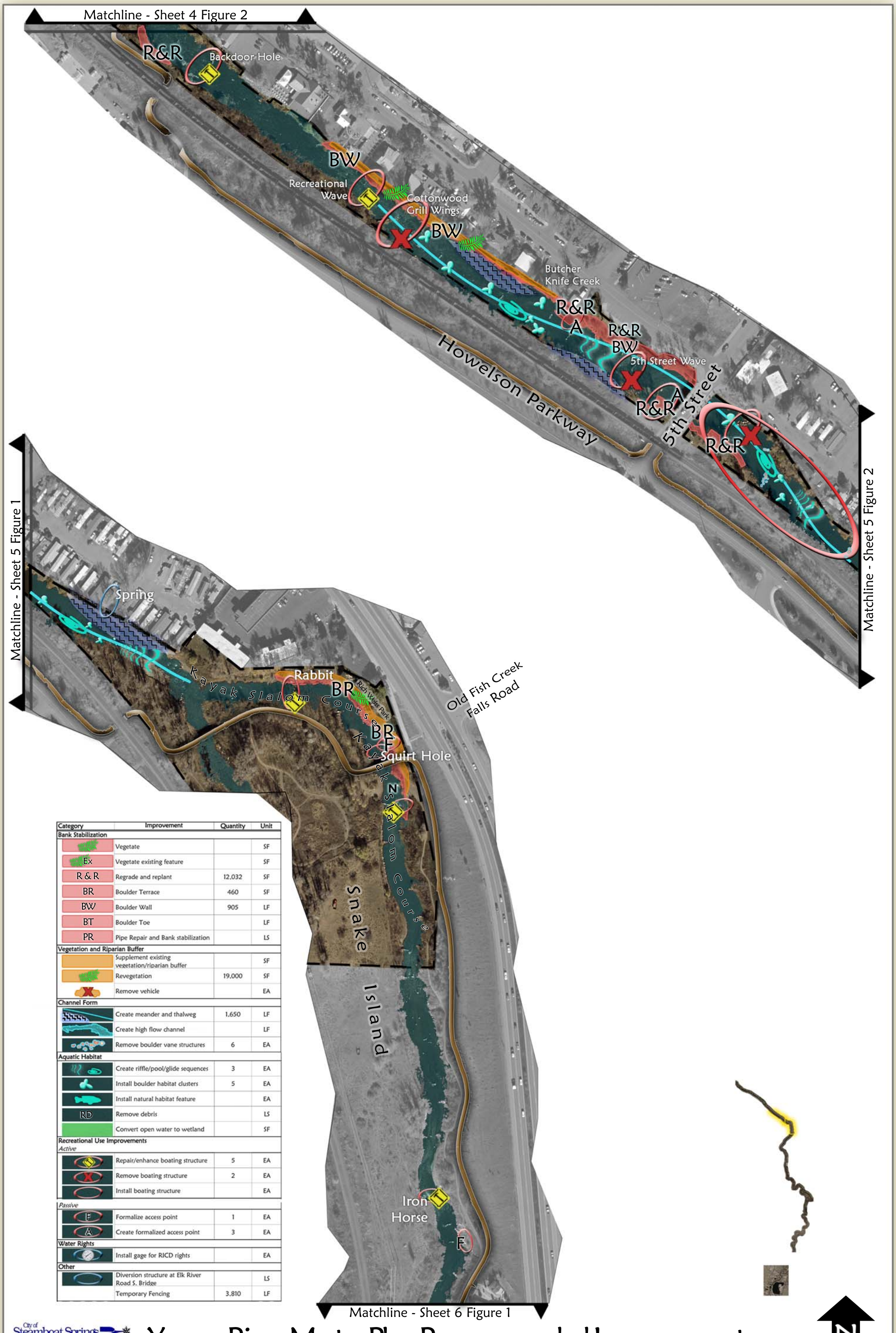

Category	Improvement	Quantity	Unit
Bank Stabilization			
	Vegetate		SF
Ex	Vegetate existing feature		SF
R & R	Regrade and replant	12,032	SF
BR	Boulder Terrace	460	SF
BW	Boulder Wall	905	LF
BT	Boulder Toe		LF
PR	Pipe Repair and Bank stabilization		LS
Vegetation and Riparian Buffer			
	Supplement existing vegetation/riparian buffer		SF
	Revegetation	19,000	SF
X	Remove vehicle		EA
Channel Form			
	Create meander and thalweg	1,650	LF
	Create high flow channel		LF
	Remove boulder vane structures	6	EA
Aquatic Habitat			
	Create riffle/pool/glide sequences	3	EA
	Install boulder habitat clusters	5	EA
	Install natural habitat feature		EA
RD	Remove debris		LS
	Convert open water to wetland		SF
Recreational Use Improvements			
Active			
	Repair/enhance boating structure	5	EA
	Remove boating structure	2	EA
	Install boating structure		EA
Passive			
F	Formalize access point	1	EA
A	Create formalized access point	3	EA
Water Rights			
	Install gage for RICD rights		EA
Other			
	Diversion structure at Elk River Road S. Bridge		LS
	Temporary Fencing	3,810	LF

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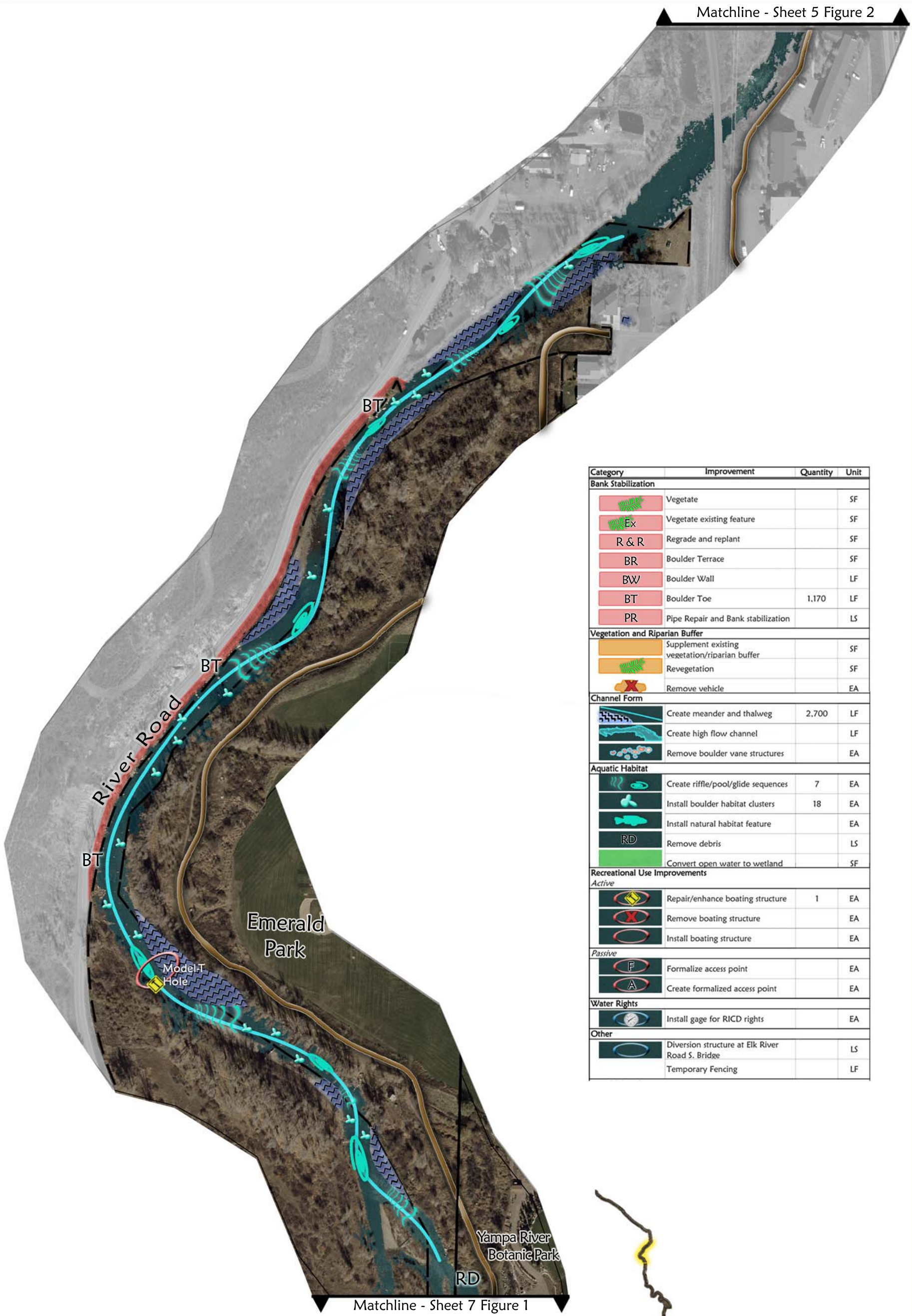

Category	Improvement	Quantity	Unit
Bank Stabilization			
	Vegetate		SF
Ex	Vegetate existing feature		SF
R & R	Regrade and replant		SF
BR	Boulder Terrace		SF
BW	Boulder Wall		LF
BT	Boulder Toe	1,170	LF
PR	Pipe Repair and Bank stabilization		LS
Vegetation and Riparian Buffer			
	Supplement existing vegetation/riparian buffer		SF
	Revegetation		SF
X	Remove vehicle		EA
Channel Form			
	Create meander and thalweg	2,700	LF
	Create high flow channel		LF
	Remove boulder vane structures		EA
Aquatic Habitat			
	Create riffle/pool/glide sequences	7	EA
	Install boulder habitat clusters	18	EA
	Install natural habitat feature		EA
RD	Remove debris		LS
	Convert open water to wetland		SF
Recreational Use Improvements			
Active			
	Repair/enhance boating structure	1	EA
X	Remove boating structure		EA
	Install boating structure		EA
Passive			
F	Formalize access point		EA
A	Create formalized access point		EA
Water Rights			
	Install gage for RICD rights		EA
Other			
	Diversion structure at Elk River Road S. Bridge		LS
	Temporary Fencing		LF

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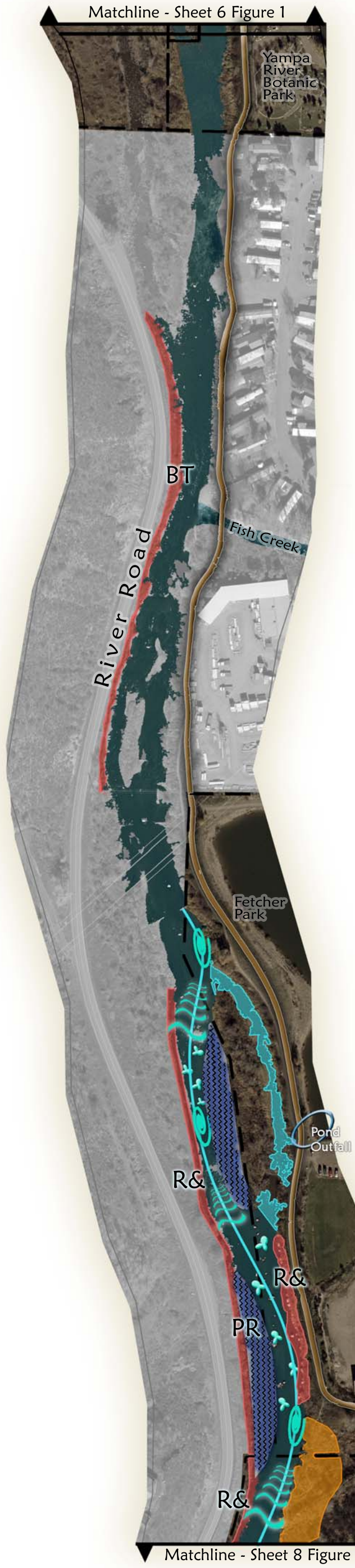

Category	Improvement	Quantity	Unit
Bank Stabilization			
	Vegetate		SF
Ex	Vegetate existing feature		SF
R & R	Regrade and replant	15,300	SF
BR	Boulder Terrace		SF
BW	Boulder Wall		LF
BT	Boulder Toe	830	LF
PR	Pipe Repair and Bank stabilization	1	LS
Vegetation and Riparian Buffer			
	Supplement existing vegetation/riparian buffer	13,700	SF
	Revegetation		SF
	Remove vehicle		EA
Channel Form			
	Create meander and thalweg	1,100	LF
	Create high flow channel	460	LF
	Remove boulder vane structures		EA
Aquatic Habitat			
	Create riffle/pool/glide sequences	3	EA
	Install boulder habitat clusters	9	EA
	Install natural habitat feature		EA
RD	Remove debris		LS
	Convert open water to wetland		SF
Recreational Use Improvements			
Active			
	Repair/enhance boating structure		EA
	Remove boating structure		EA
	Install boating structure		EA
Passive			
F	Formalize access point		EA
A	Create formalized access point		EA
Water Rights			
	Install gage for RICD rights		EA
Other			
	Diversion structure at Elk River Road S. Bridge		LS
	Temporary Fencing	3,202	LF

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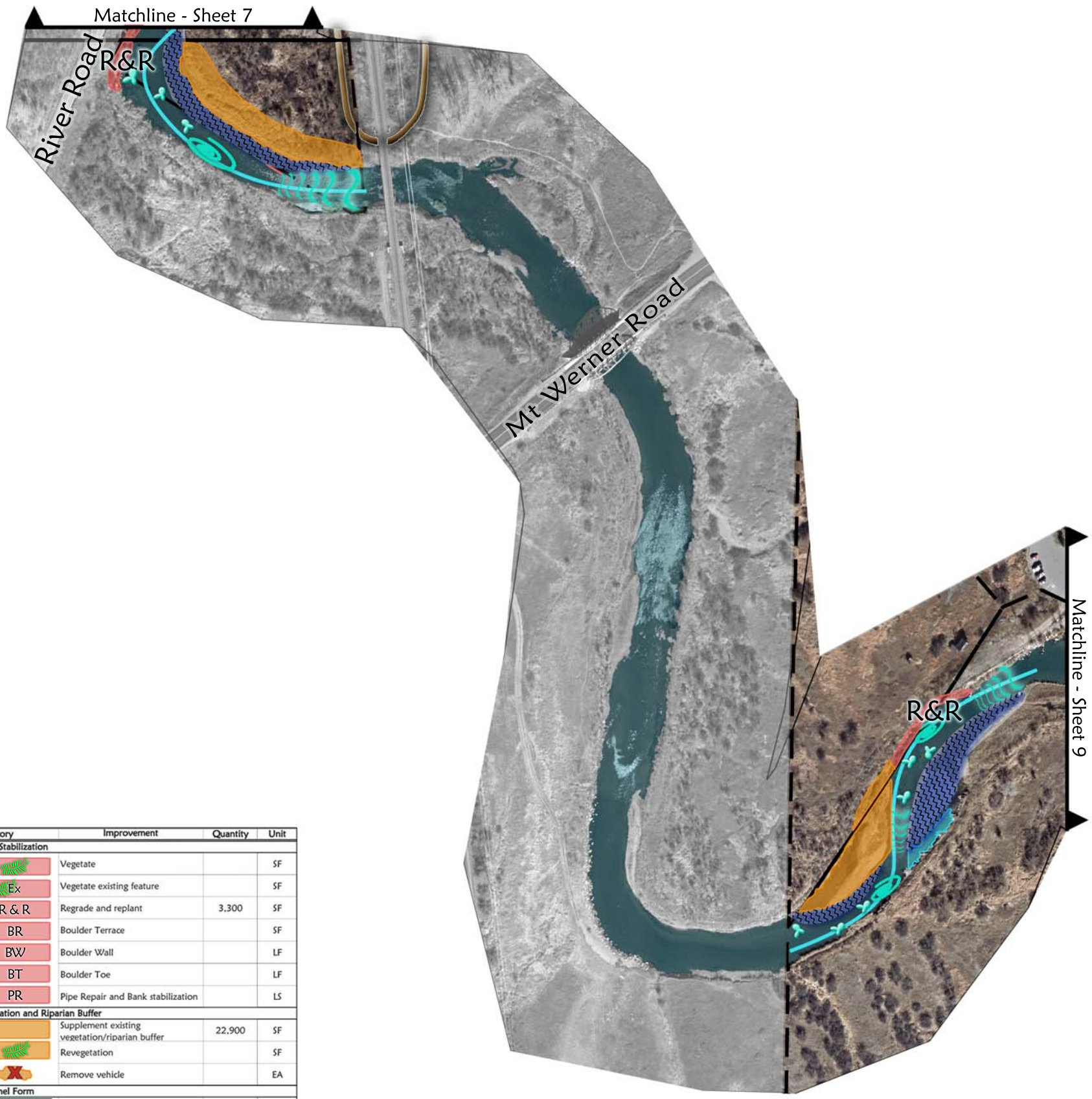

Category	Improvement	Quantity	Unit
Bank Stabilization			
	Vegetate		SF
Ex	Vegetate existing feature		SF
R & R	Regrade and replant	3,300	SF
BR	Boulder Terrace		SF
BW	Boulder Wall		LF
BT	Boulder Toe		LF
PR	Pipe Repair and Bank stabilization		LS
Vegetation and Riparian Buffer			
	Supplement existing vegetation/riparian buffer	22,900	SF
	Revegetation		SF
	Remove vehicle		EA
Channel Form			
	Create meander and thalweg	1,079	LF
	Create high flow channel	200	LF
	Remove boulder vane structures		EA
Aquatic Habitat			
	Create riffle/pool/glide sequences	3	EA
	Install boulder habitat clusters	6	EA
	Install natural habitat feature		EA
RD	Remove debris		LS
	Convert open water to wetland		SF
Recreational Use Improvements			
Active			
	Repair/enhance boating structure		EA
	Remove boating structure		EA
	Install boating structure		EA
Passive			
F	Formalize access point		EA
A	Create formalized access point		EA
Water Rights			
	Install gage for RICD rights		EA
Other			
	Diversion structure at Elk River Road S. Bridge		LS
	Temporary Fencing	1,860	LF

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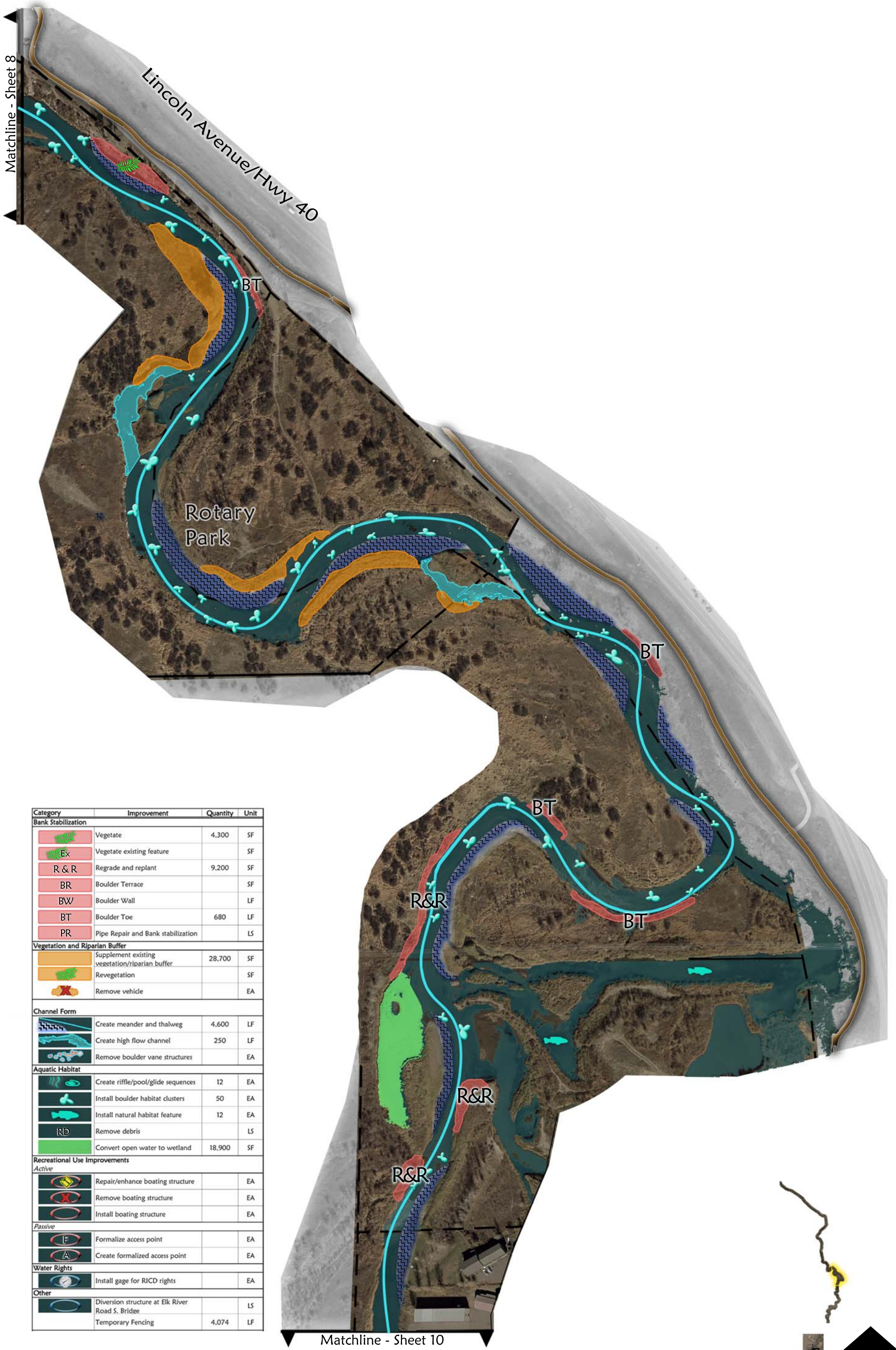

Category	Improvement	Quantity	Unit
Bank Stabilization			
	Vegetate	4,300	SF
Ex	Vegetate existing feature		SF
R & R	Regrade and replant	9,200	SF
BR	Boulder Terrace		SF
BW	Boulder Wall		LF
BT	Boulder Toe	680	LF
PR	Pipe Repair and Bank stabilization		LS
Vegetation and Riparian Buffer			
	Supplement existing vegetation/riparian buffer	28,700	SF
	Revegetation		SF
	Remove vehicle		EA
Channel Form			
	Create meander and thalweg	4,600	LF
	Create high flow channel	250	LF
	Remove boulder vane structures		EA
Aquatic Habitat			
	Create riffle/pool/glide sequences	12	EA
	Install boulder habitat clusters	50	EA
	Install natural habitat feature	12	EA
RD	Remove debris		LS
	Convert open water to wetland	18,900	SF
Recreational Use Improvements			
Active			
	Repair/enhance boating structure		EA
	Remove boating structure		EA
	Install boating structure		EA
Passive			
F	Formalize access point		EA
A	Create formalized access point		EA
Water Rights			
	Install gage for RICD rights		EA
Other			
	Diversion structure at Elk River Road S. Bridge		LS
	Temporary Fencing	4,074	LF

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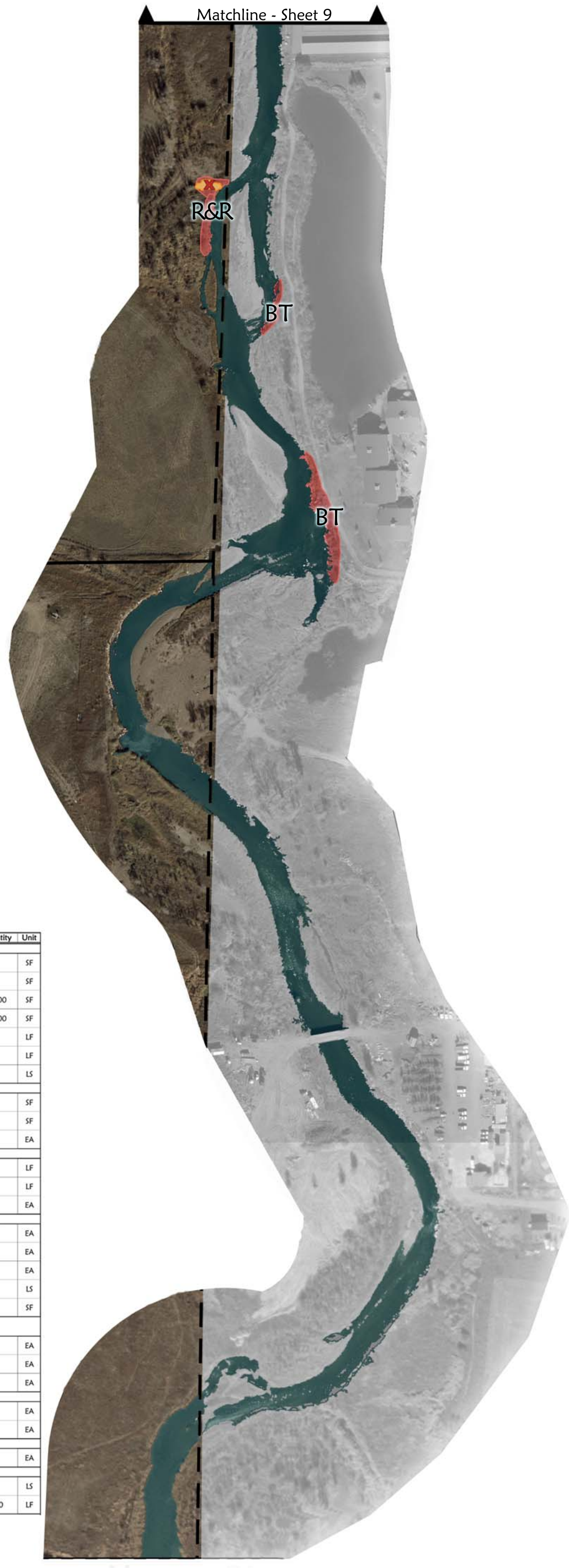

Category	Improvement	Quantity	Unit
Bank Stabilization			
	Vegetate		SF
Ex	Vegetate existing feature		SF
R & R	Regrade and replant	2,400	SF
BR	Boulder Terrace	5,600	SF
BW	Boulder Wall		LF
BT	Boulder Toe		LF
PR	Pipe Repair and Bank stabilization		LS
Vegetation and Riparian Buffer			
	Supplement existing vegetation/riparian buffer		SF
	Revegetation		SF
	Remove vehicle	2	EA
Channel Form			
	Create meander and thalweg		LF
	Create high flow channel		LF
	Remove boulder vane structures		EA
Aquatic Habitat			
	Create riffle/pool/glide sequences		EA
	Install boulder habitat clusters		EA
	Install natural habitat feature		EA
RD	Remove debris		LS
	Convert open water to wetland		SF
Recreational Use Improvements			
Active			
	Repair/enhance boating structure		EA
	Remove boating structure		EA
	Install boating structure		EA
Passive			
F	Formalize access point		EA
A	Create formalized access point		EA
Water Rights			
	Install gage for RICD rights		EA
Other			
	Diversion structure at Elk River Road S. Bridge		LS
	Temporary Fencing	350	LF

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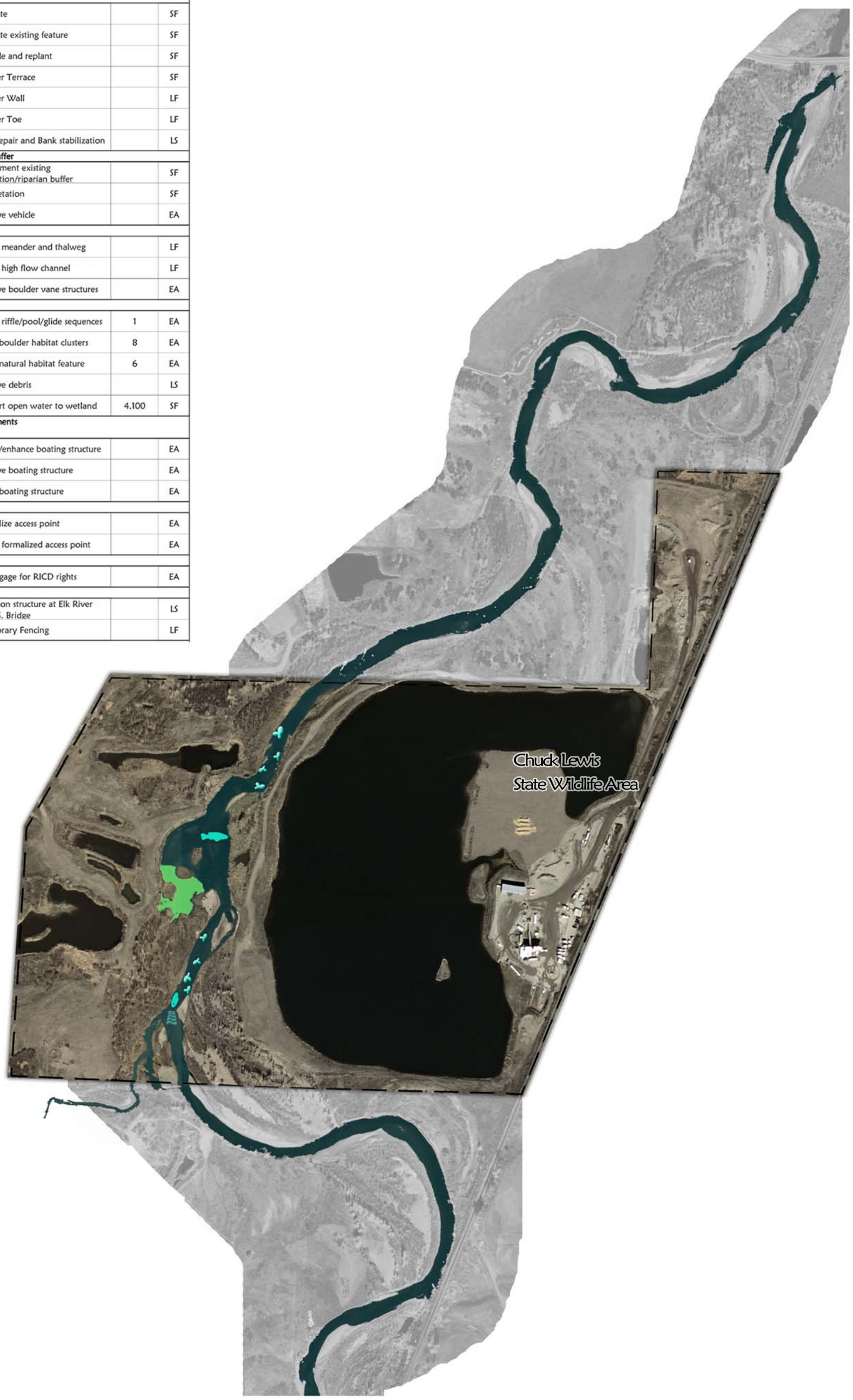
Category	Improvement	Quantity	Unit
Bank Stabilization			
	Vegetate		SF
Ex	Vegetate existing feature		SF
R & R	Regrade and replant		SF
BR	Boulder Terrace		SF
BW	Boulder Wall		LF
BT	Boulder Toe		LF
PR	Pipe Repair and Bank stabilization		LS
Vegetation and Riparian Buffer			
	Supplement existing vegetation/riparian buffer		SF
	Revegetation		SF
	Remove vehicle		EA
Channel Form			
	Create meander and thalweg		LF
	Create high flow channel		LF
	Remove boulder vane structures		EA
Aquatic Habitat			
	Create riffle/pool/glide sequences	1	EA
	Install boulder habitat clusters	8	EA
	Install natural habitat feature	6	EA
RD	Remove debris		LS
	Convert open water to wetland	4,100	SF
Recreational Use Improvements			
Active			
	Repair/enhance boating structure		EA
	Remove boating structure		EA
	Install boating structure		EA
Passive			
F	Formalize access point		EA
A	Create formalized access point		EA
Water Rights			
	Install gage for RICD rights		EA
Other			
	Diversion structure at Elk River Road S. Bridge		LS
	Temporary Fencing		LF



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Appendix H: Cost Background Information

Improvement Breakdown by Category

Category	Improvement	Improvement break down	Unit	Cost/Unit	Quantity	Cost/Improvement Unit
	No action					
		No action	-	0.00	-	0.00
Bank Stabilization	**Vegetate**		SF		1	6.67
		Non-native species removal	SF	0.25	1.0000	0.25
		Planting Soil	CY	24.00	0.0370	0.89
		Upland Seed Mix	SF	0.05	1.0000	0.05
		Riparian Seed Mix	SF	0.05	1.0000	0.05
		Trees	EA	750.00	0.0025	1.88
		Fence protection (trees)	EA	30.00	0.0025	0.08
		Shrubs (5 gallon) area treatment	EA	34.00	0.0278	0.94
		Wetland/Riparian plugs	EA	2.00	1.0000	2.00
		Hay mulch	AC	1,600.00	0.000023	0.04
		Stabilization blanket	SY	3.20	0.0550	0.18
		Monitoring & Irrigation	LS	5% of total cost	1.0000	0.32
Bank Stabilization	**Vegetate existing feature**		SF			6.67
		Non-native species removal	SF	0.25	1.0000	0.25
		Planting Soil	CY	24.00	0.0370	0.89
		Upland Seed Mix	SF	0.05	1.0000	0.05
		Riparian Seed Mix	SF	0.05	1.0000	0.05
		Trees	EA	750.00	0.0025	1.88
		Fence protection (trees)	EA	30.00	0.0025	0.08
		Shrubs (5 gallon) area treatment	EA	34.00	0.0278	0.94
		Wetland/Riparian plugs	EA	2.00	1.0000	2.00
		Hay mulch	AC	1,600.00	0.000023	0.04
		Stabilization blanket	SY	3.20	0.0550	0.18
		Monitoring & Irrigation	LS	5% of total cost	1.0000	0.32

Category	Improvement	Improvement break down	Unit	Cost/Unit	Quantity	Cost/Improvement Unit
Bank Stabilization	**Regrade and replant**		SF			7.09
		Bank grading	CY	10.00	0.0400	0.40
		Non-native species removal	SF	0.25	1.0000	0.25
		Planting Soil	CY	24.00	0.0370	0.89
		Upland Seed Mix	SF	0.05	1.0000	0.05
		Riparian Seed Mix	SF	0.05	1.0000	0.05
		Trees	EA	750.00	0.0025	1.88
		Fence protection (trees)	EA	30.00	0.0025	0.08
		Shrubs (5 gallon) area treatment	EA	34.00	0.0278	0.94
		Wetland/Riparian plugs	EA	2.00	1.0000	2.00
		Hay mulch	AC	1,600.00	0.000023	0.04
		Stabilization blanket	SY	3.20	0.0550	0.18
		Monitoring & Irrigation	LS	5% of total cost	1.0000	0.34
Bank Stabilization	**Pipe Repair and Bank stabilization**		LS			4,500.00
		Pipe repair	LS	4,500.00	1.0000	4500.00
Bank Stabilization	**Boulder Terrace**		SF			57.89
		Boulder import	TON	70.00	0.5000	35.00
		Non-native species removal	SF	0.25	1.0000	0.25
		Planting Soil	CY	24.00	0.0370	0.89
		Upland Seed Mix	SF	0.05	1.0000	0.05
		Filter Fabric	SF	3.00	1.0000	3.00
		Riparian Seed Mix	SF	0.05	1.0000	0.05
		Trees	EA	750.00	0.0025	1.88
		Fence protection (trees)	EA	30.00	0.0025	0.08
		Shrubs (5 gallon) linear treatment	EA	34.00	0.3333	11.33
		Wetland/Riparian plugs	EA	2.00	1.0000	2.00
		Hay mulch	AC	1,600.00	0.000023	0.04
		Bank grading	CY	10.00	0.0400	0.40
		Stabilization blanket	SY	3.20	0.0550	0.18
		Monitoring & Irrigation	LS	5% of total cost	1.0000	2.76

Category	Improvement	Improvement break down	Unit	Cost/Unit	Quantity	Cost/Improvement Unit
Bank Stabilization	**Boulder Wall**		LF	AVG. HEIGHT	6	350.40
		Boulder import	TON	70.00	0.5000	35.00
		Wall construction	LF	20.00	1.0000	20.00
		Filter Fabric	SF	3.00	1.0000	3.00
		Bank grading	CY	10.00	0.0400	0.40
Bank Stabilization	**Boulder Toe**		LF			55.85
		Boulder import	TON	70.00	0.5000	35.00
		Bank grading	CY	10.00	0.0400	0.40
		Non-native species removal	SF	0.25	1.0000	0.25
		Planting Soil	CY	24.00	0.0370	0.89
		Filter Fabric	SF	3.00	1.0000	3.00
		Upland Seed Mix	SF	0.05	1.0000	0.05
		Riparian Seed Mix	SF	0.05	1.0000	0.05
		Shrubs (5 gallon) linear treatment	EA	34.00	0.3333	11.33
		Wetland/Riparian plugs	EA	2.00	1.0000	2.00
		Hay mulch	AC	1,600.00	0.0000	0.04
		Stabilization blanket	SY	3.20	0.0550	0.18
		Monitoring & Irrigation	LS	5% of total cost	1.0000	2.66
Vegetation and Riparian Buffer	**Supplement existing vegetation/riparian buffer**		SF			1.62
		Upland Seed Mix	SF	0.05	1.0000	0.05
		Riparian Seed Mix	SF	0.05	1.0000	0.05
		Trees area supplement	EA	750.00	0.0013	0.94
		Fence protection (trees area supplement)	EA	30.00	0.0013	0.04
		Shrubs (5 gallon) area supplement	EA	34.00	0.0139	0.47
		Wetland/Riparian plugs supplement	EA	2.00	0.0000	0.00
		Monitoring & Irrigation	LS	5% of total cost	1.0000	0.08

Category	Improvement	Improvement break down	Unit	Cost/Unit	Quantity	Cost/Improvement Unit
Vegetation and Riparian Buffer	**Revegetation**		SF			6.40
		Planting Soil	CY	24.00	0.0370	0.89
		Upland Seed Mix	SF	0.05	1.0000	0.05
		Riparian Seed Mix	SF	0.05	1.0000	0.05
		Trees	EA	750.00	0.0025	1.88
		Fence protection (trees)	EA	30.00	0.0025	0.08
		Shrubs (5 gallon) area treatment	EA	34.00	0.0278	0.94
		Wetland/Riparian plugs	EA	2.00	1.0000	2.00
		Hay mulch	AC	1,600.00	0.000023	0.04
		Stabilization blanket	SY	3.20	0.0550	0.18
		Monitoring & Irrigation	LS	5% of total cost	1.0000	0.30
Vegetation and Riparian Buffer	**Remove vehicle**		EA			1,000.00
		Remove vehicle	EA	1,000.00	1.0000	1,000.00
Channel Form	**Create meander and thalweg**		LF	AVERAGE WIDTH	90	73.80
		Channel excavation - meander	CY	25.00	0.0200	0.50
		Channel grading - meander	CY	16.00	0.0200	0.32
Channel Form	**Create high flow channel**		LF	AVERAGE WIDTH	20	16.40
		Channel excavation and grading	CY	25.00	0.0200	0.50
		Channel grading	CY	16.00	0.0200	0.32
Channel Form	**Remove boulder vane structures**		EA			1,000.00
		Remove boulder vane	EA	1,000.00	1.0000	1,000.00
Aquatic Habitat	**Create riffle/pool/glide sequences**		EA			3,000.00
		Riffle/Pool/Glide Sequences	EA	3,000.00	1.0000	3,000.00
Aquatic Habitat	**Install boulder habitat clusters**		EA			670.00
		Boulder import	TON	70.00	6.0000	420.00
		Boulder placement	LS	250.00	1.0000	250.00
Aquatic Habitat	**Install natural habitat feature**		EA			1,250.00
		Import natural feature	EA	500.00	1.0000	500.00
		Install Instream natural habitat feature	EA	750.00	1.0000	750.00
Aquatic Habitat	**Remove debris**		LS			2,000.00
		Remove debris	LS	2,000.00	1.0000	2,000.00

Category	Improvement	Improvement break down	Unit	Cost/Unit	Quantity	Cost/Improvement Unit
Aquatic Habitat	**Convert open water to wetland**		SF			6.78
		Wetland Seed Mix	SF	0.10	1.0000	0.10
		Planting Soil	CY	24.00	0.0370	0.89
		Shrubs (5 gallon) area treatment	EA	34.00	0.0278	0.94
		Wetland/Riparian plugs	EA	2.00	1.0000	2.00
		Channel grading	CY	16.00	0.0200	0.32
		Import fill from on-site supply	CY	20.00	0.1100	2.20
		Monitoring & Irrigation	LS	5% of total cost	1.0000	0.32
Recreational Use - Active	**Repair/enhance boating structure**		EA			10,000.00
		Repair/Enhance boating structure	EA	10,000.00	1.0000	10,000.00
Recreational Use - Active	**Remove boating structure**		EA			8,000.00
		Remove boating structure	EA	8,000.00	1.0000	8,000.00
Recreational Use - Active	**Install boating structure**		EA			40,000.00
		Install boating structure	EA	40,000.00	1.0000	40,000.00
Recreational Use - Passive	**Formalize access point**		EA			2,000.00
		Formalize Access	EA	2,000.00	1.0000	2,000.00
Recreational Use - Passive	**Create formalized access point**		EA			5,000.00
		Install formalized access	EA	5,000.00	1.0000	5,000.00
Recreational Use - Passive	**Create formalized access point with ADA access and trail connection**		EA			15,000.00
		Install formalized access with ADA access and trail connection	EA	15,000.00	1.0000	15,000.00
Water Rights	**Install gage for RICD rights**		EA			30,000.00
		Install streamflow gage	EA	30,000.00	1.0000	30,000.00
Other	**Diversion structure at James Brown Bridge**		LS			5,000.00
		Diversion Structure	EA	5,000.00	1.0000	5,000.00
Other	**Construction Management**		LS			8% of total cost
		Construction Management	LS	8% of total cost	1.0000	

Category	Improvement	Improvement break down	Unit	Cost/Unit	Quantity	Cost/Improvement Unit
Other	**Contingency**		LS			10% of total cost
		Contingency	LS	10% of total cost	1.0000	
Other	**Design & Permitting**		LS			10% total cost
		Design & Permitting	LS	10% total cost	1.0000	
Other	**Mobilization/Demobilization**		LS			5% of total cost
		Mobilization/Demobilization	LS	5% of total cost	1.0000	
Other	**Temporary Fencing**		LF			3.00
		Temporary fencing	LF	3.00	1.0000	3.00
Other	**Sediment Control**		LS			2% of total cost
		Sediment Control	LS	2% of total cost	1.0000	

Unit Cost

Item	Unit	Unit Cost	Cost/Improvement Unit
Bank excavation	CY	15.00	0.04
Bank grading	CY	10.00	0.04
Boulder import	TON	70.00	0.50
Boulder placement	LS	250.00	1.00
Boulder removal	TON	10.00	0.30
Channel excavation - meander	CY	25.00	0.02
Channel grading - meander	CY	16.00	0.02
Channel excavation and grading	CY	25.00	0.02
Channel grading	CY	16.00	0.02
Construction Management	LS	8% of total cost	1
Contingency	LS	10% of total cost	1
Design & Permitting	LS	10% total cost	1
Diversion Structure	EA	5,000.00	1.0000
Fence protection (trees area supplement)	EA	30.00	0.0013
Fence protection (trees)	EA	30.00	0.0025
Filter Fabric	SF	3.00	1.0000
Formalize Access	EA	2,000.00	1.00
Hay mulch	AC	1,600.00	0.000023
Import fill from on-site supply	CY	20.00	0.11
Import natural feature	EA	500.00	1.00
Install streamflow gage	EA	30,000.00	1.00
Install boating structure	EA	40,000.00	1.00
Install formalized access	EA	5,000.00	1.00
Install formalized access with ADA access and trail connection	EA	15,000.00	1.00
Install Instream natural habitat feature	EA	750.00	1.00
Mobilization/Demobilization	LS	5% of total cost	1.00
Monitoring & Irrigation	LS	5% of total cost	1.00
No action	-	0.00	1.00
Non-native species removal	SF	0.25	1.00
Pipe repair	LS	4,500.00	1.00
Planting Soil	CY	24.00	0.04
Planting soil placement and grading	CY	15.00	0.04
Quarried rock	TON	50.00	0.30
Remove boating structure	EA	8,000.00	1.00

Item	Unit	Unit Cost	Cost/Improvement Unit
Remove boulder vane	EA	1,000.00	1.00
Remove debris	LS	2,000.00	1
Remove informal access	EA	2,000.00	1.00
Remove vehicle	EA	1000	1
Repair/Enhance boating structure	EA	10,000.00	1.00
Reset rock	SF	10.00	1.00
Revetment removal	EA	5,000.00	1.00
Riffle/Pool/Glide Sequences	EA	3,000.00	1.00
Rip Rap	SF	7.22	1.00
Riparian Seed Mix	SF	0.05	1.00
Sediment Control	LS	2% of total cost	1
Shrubs (5 gallon) area supplement	EA	34.00	0.0139
Shrubs (5 gallon) area treatment	EA	34.00	0.02778
Shrubs (5 gallon) linear treatment	EA	34.00	0.3333
Stabilization blanket	SY	3.20	0.06
Temporary fencing	LF	3.00	1.00
Trees	EA	750.00	0.0025
Trees area supplement	EA	750.00	0.0013
Upland Seed Mix	SF	0.05	1.00
Wall construction	LF	20.00	1.00
Wetland Seed Mix	SF	0.10	1.00
Wetland/Riparian plugs	EA	2.00	1.00
Wetland/Riparian plugs supplement	EA	2.00	0.00