Rogers Park Restoration Project Final Report

Initiated and Implemented By

Boulder Flycasters, a Chapter of Trout Unlimited

February, 2006 – July, 2009

Authored By:

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Roger Svendsen, Project Manager. Boulder Flycasters

Note: The project committee has determined that a second project phase should be established to enhance the public education opportunities of the project area as well as designing and installing public awareness and education signs. This second phase is targeted for completion in the spring of 2010, assuming sufficient funding can be obtained.

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Project Summary:

The Board of Directors of Boulder Flycasters, BFC, a chapter of Trout Unlimited, TU, initiated a project to restore a 0.4 mile section of Middle Boulder Creek in the winter of 2006. The project committee was approached by Ecological Resource Consultants, ERC, to consider a partnership for this project. After an in-depth study of completed ERC projects and investigation of other similar companies, the committee decided to partner with ERC with the assumption it would be a design & build relationship. Boulder Flycasters did not have the experience or resources to assemble a formal Request for Proposal for a separate design and build methodology. It was decided that BFC would assure construction costs in the ERC construction contract were competitive.

The conceptual design of the project was initiated in the spring of 2006 and was completed in the fall of that year. This work contained the necessary elements for the committee to seek grant money. A detailed design with construction drawings was completed in the summer of 2008. The estimated total cost of the project was $235,000, which included the desired level of volunteer labor.

Following the completion of the conceptual design, grant money was requested from the Fishing is Fun Program, Great Outdoors Colorado, The Trout and Salmon Foundation, Fish America, TU Embrace a Stream Program, Colorado Department of Wildlife Habitat Stamp Grant Program, 5 Star Program, the Colorado Watershed Restoration Grant Program, and Boulder County Parks and Open Space. Grant funds were obtained from Fishing is Fun, $129K; Trout and Salmon Foundation, $4K; Colorado Water Conservation Board, $30K; and Boulder County, $20K; Colorado Trout Unlimited, $1K. Boulder Flycasters greatly appreciates all the financial support from the above organizations. Several events were held by BFC to raise money for the project. A film festival, a special dinner, and several auctions were dedicated to the Rogers Park Project. The balance of required funding came from individual members of BFC and the BFC treasury.

The detailed design and permitting effort began in February, 2008 and was completed in April, 2009. This effort required much more time than anticipated and caused the in-stream construction phase to slip from the planned fall of 2008 until the spring of 2009. The delay was due largely to the Boulder County permitting process. (This type of project was unusual within the County and required learning on the part of County personnel as well as ERC and BFC. The County had little experience with stream restoration and with funding coming from “private” sources.)

The in-stream work began in late April 2009 and was completed on May 4, 2009. Only minor changes were required between the project final design and the completed in-stream construction. The changes were the elimination of one riffle/pool/glide sequence, the addition of two cascades, and the placement of boulders for an education venue at the west end of the project area. These changes were made by ERC at no additional cost.

Background:

At a Boulder Flycasters Board of Directors meeting in the winter of 2006, a discussion developed as to why the chapter had been unable to establish an environmental restoration project since the completion of Boulder Flycasters Park on Middle Boulder Creek in 2003. It was determined that the chapter needed to discuss options, then focus on a single "flagship" project and dedicate all the resources necessary to make that project successful. A number of options were discussed, with the conclusion that the chapter should focus on close-by waters. After much discussion, the Board decided to make the restoration of a half mile section of Middle Boulder Creek located in the area called Platt Rogers Memorial Park the "flagship" project. This creek section has, over the years, been damaged by a sawmill, the construction of Highway 119, floods and pollution from the highway, which have severely degraded this section as trout habitat and which severely eliminates this stream reach as trout holding area due to freezing from the surface to the bottom.

A project committee was quickly formed and regular project meetings were initiated.

Project Approach and Implementation:

A project committee was formed at the project outset consisting of approximately ten members, in the spring of 2006. A broad range of skills were represented, however there was not sufficient expertise to allow the generation of a high quality bid proposal package for use in the development of a conceptual design. One committee member, a new member of the BFC chapter, represented a consulting firm with significant experience in stream restoration, offered an option to begin our project. His firm is Ecological Resource Consultants, ERC, with offices in Boulder and Evergreen Colorado. In return for a very significant discount to their normal fees for the development of a conceptual design, BFC would work toward a combined Design/Build project with his company. The normal fee for this work was $20,000 and would be discounted to $5,000. He provided a number of references for projects his company had completed along the Colorado Front Range. Members of the committee interviewed most of these references in detail and did not find anyone that was dissatisfied with the work performed. We agreed to go forward with a conceptual design with the understanding that we would review cost estimates at the beginning of the construction phase to assure they were competitive. BFC had the option to select another company for the construction phase and pay the full conceptual design fee of $20,000. A very significant and positive offering by ERC was the promised assistance in finding sources of grant funding and the inclusion of obtaining necessary building permits from the various government agencies. These tasks were not offered by other companies performing stream restoration. A significant cost saving was implemented using a design/build concept due to the avoidance of some detailed design effort which would have been required in a "Request for Proposal" for the construction phase. The committee agreed we could learn from this project and perhaps choose to perform some tasks ourselves on future projects.

The committee was very pleased with the conceptual design work products and project costs were deemed reasonable. BFC proceeded with a detailed design contract that included ERC obtaining all the required permits. A Corp of Engineers 404 Permit, a Boulder County Permit, and a General Use Permit from the Colorado Department of Transportation were required. By far, the most difficult permit was Boulder County. The permit was initiated in June of 2008 and was not completed until April, 2009. A construction contract was signed in late April, 2009. The construction costs did not change between the conceptual design phase and the construction contract. The construction phase of the project began in late April and all in-stream work was completed on May 4, 2009. Extensive bank restoration was performed, largely on the north side of the creek, and new native vegetation was required. ERC generated a list of plant species and had it approved by Boulder County. (The vegetation effort took place on July 18, 2009.)

Budget:

The final budget reflecting all work performed on this project is shown below:

Item	Description	Unit Unit	Cost	Quantity	Subtotal	ERC	BFC
1	Channel Grading and Shaping (Low Flow Channel)	Cubic Yard	$2 4.00	1670	$40,080.00	$40,080.00	
2	Riffle-Pool-Glide Sequences	Each	$2,500.00	10	$25,000.00	$25,000.00	
3	Major Bank Stabilization (Boulder Toe)-Shrub Install by others (1)	Linear Feet	$50.00	1125	$56,250.00	$46,250.00	$10,000.00
4	Minor Bank Stabilization (Cobble Toe)-Shrub/Plug Install by others	Linear Feet	$20.00	230	$4,600.00	$4,600.00	
5	Instream Habitat Features	Each	$300.00	10	$3,000.00	$3,000.00	
6	Import Boulders/Rock (Instream Features) (2)	Ton	$40.00	500	$20,000.00	$10,000.00	$10,000.00
7	Improved Public Acess (1-General & 1-Handicap)	Each	$3,000.00	2	$ 6,000.00	$6,000.00	
8	Signs	Each	$175.00	2	$350.00		$350.00
9	Erosion Protection (5)	Square Yards	$3.25	800	$2,600.00	$1,300.00	$1,300.00
10	#5 Riparian Shrubs (Installed) (4) (5)	Each	$34.00	450	$15,300.00		$15,300.00
11	10cc Grass Plugs (Installed) (4) (5)	Each	$1.80	3000	$5,400.00		$5,400.00
12	Construction BMPs and Water Control	Lump Sum	$5,000.00	1	$5,000.00		$5,000.00
13	Preliminary Evaluation, Concept Plan, Costs	Lump Sum	$5,000.00	1	$5,000.00		$5,000.00
14	Final Design/Build Drawings	Lump Sum	$8,000.00	1	$8,000.00		$8,000.00
15	Construction and Design Permits	Lump Sum	$10,000.00	1	$10,000.00		$10,000.00
16	Construction Design Build Coordination and Surveying	Lump Sum	$20,000.00	1	$20,000.00	$20,000.00	
17	Mobilization/Demobilization	Lump Sum	$5,000.00	1	$5,000.00	$5,000.00	
18	Public Educational Brochure (Moved to Phase II)	Lump Sum	$3,000.00	1			
	Total Project				**$231,580**	**$161,230**	**$70,350**

Notes:
1 BFC Boulder Donation 250 tons @ $40 per ton
2 BFC Riprap donation 250tons @ $40 per ton
3 ERC will seed and install erosion control fabric on all ingress/egress points and construction staging disturbance
4 BFC will be responsible for all plantings (purchase/install) as well as volunteer coordination
5 Quantities subject to change prior to 7/18/09

Construction Approach and Implementation:

To satisfy requirements for the Fishing is Fun grant, as well as the desires of all those concerned, the in-stream rehabilitation was designed and constructed to withstand naturally occurring events for 25 years. Water forces experienced during the extreme differences in stream flow make the requirements very challenging. Many projects such as this one fail or change in unsatisfactory ways due to inappropriate design and construction techniques. ERC, together with their construction partner, Tezak Construction, have a great deal of experience in work identical to this. Though the project has only undergone one high flow season, none of the stream features changed.

Several of the key techniques used in the design and construction are as follows:

A proper technical evaluation and design are imperative to the success of stream habitat restoration work. Successful habitat restoration requires input from a variety of technical specialties to ensure the design is consistent with physical constraints and parameters (geomorphology), is structurally competent (engineering), provides the desired environmental benefits (biology and hydrology) and can be implemented in a cost effective manner (construction cost estimating and value engineering).

This restoration project was developed on the fundamental principles of fluvial morphology and aquatic biology. A stable channel is morphologically defined as a river that has the ability to maintain its dimension, pattern and profile over time while conveying flows and sediment load without aggrading or degrading. While natural channels are continually changing in response to flow regime and sediment loads, they are in a state of dynamic equilibrium. ERC conducted a detailed field and technical evaluation as part of design development.

Flow data was analyzed and flow frequency curves were generated to quantify flow ranges incorporated into the design. Available gage data was also analyzed to define seasonal flow variations, average flow conditions and extreme high and low flow scenarios. All of this data was used as the baseline for defining a stable channel configuration for improvement features. A sediment transport model was generated and run in conjunction with the hydraulic model to evaluate material transport through the project reach. This model was used to define the channel maintenance flow and determine the flow rate and corresponding frequency at which boulders of different sizes are transported, both of which are important parameters required for enhancement design. This information was used to ensure that the proposed improvements are appropriate for the river type and will remain stable over time. As a result of the fieldwork and sediment modeling, the stable channel geometry was defined for different stretches of the project.

Specific trout habitat features incorporated into the project were based on a limiting factor analysis. Habitat improvement projects require a thorough analysis of limiting (habitat) and non-limiting factors related to the trout habitat suitability index (HSI) prepared by the U.S. Fish and Wildlife Service (1984). 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 1984). These specific habitat requirements were the basis for the restoration project.

The main project component consisted of natural enhancement activities to a 2,000 linear foot reach of Middle Boulder Creek. The enhancement approach was to establish a stream channel geometry that is balanced with the current flow regime. This creates a stream that is stable under bankfull and flood events yet maximizes aquatic habitat during the more typical low flow conditions. The enhancement activities reshaped the typical channel profile and cross section. The new channel section was built at a bankfull

width that is in balance with the current annual hydrograph (which accounts for the effects of the upstream Barker Reservoir) and with a concentrated low flow area that provides trout habitat for minimum low flow conditions that are often observed. The project also restored the bedform of the channel to a more natural state. Long riffle sections dominated the former channel with only minimal pool habitat required for over-wintering and trout refuge. The project reestablishes the predominate riffle, pool and glide sequences typical of a natural stream system. These bedforms are natural morphologic occurrences and provide structural variety needed for optimal trout habitat. By establishing banks at the appropriate width, providing instream cover and reconfiguring the channel to better accommodate lower flows, the project restores the health of the Creek and trout habitat, as well as improves angling opportunities and the aesthetic value of the stream.

Construction implementation generally progressed from upstream to downstream. Imported material was first staged in the river with the use of an off-road haul truck and loader. Instream grading and rock placement was completed with a large track-excavator working within the active channel. In order to achieve the instream enhancements described above, site grading was required to reconfigure the channel. Approximately 1,670 cubic yards of the cobbles and boulders from the existing channel were repositioned in the channel to help achieve a stable longitudinal profile/cross section and instream habitat features. Approximately 620 tons (435 cubic yards) of locally native boulders (3 foot diameter) were imported and placed within the main channel below the ordinary high water mark to stabilize the banks and provide instream aquatic habitat. Approximately 420 tons (315 cubic yards) of angular rip rap (12 inch diameter) was imported and placed within the main channel below the ordinary high water mark in order to create stable and long term features.

Above and below the project site, creek conditions were near optimal. Construction at each end of the project was carefully blended into the two end points so as to eliminate any visual discontinuities.

Re-Vegetation Effort:

The list of native plants used to bring the rehabilitated area to a natural state is shown below. This list was originally compiled by ERC, then was rigorously reviewed by Boulder County Parks and Recreation personnel.

As specified in the design plans the following #5 shrubs* will be provided.

Quantity	Scientific Name	Common Name	Size
75	*Acer glabrum*	Rocky Mountain maple	#5
75	*Alnus incana ssp. tenuifolia*	thinleaf alder	#5
75	*Prunus virginiana*	chokecherry	tree band
75	*Rosa woodsii*	Wood's rose	#5
75	*Salix exigua*	coyote willow	#5
75	*Salix monticola*	Rocky Mountain willow	tree band

***** Size #5 chokecherry and Rocky Mountain willow were not available, therefore #1 (tree band) sizes were substituted.

Three-thousand grass plugs were also installed along the creek banks.

1000	*Carex lanuginosa*	wooly sedge	10 cu in
679	*Pascopyrum smithii*	western wheatgrass	10 cu in
321	*Calamagrostis canadensis*	bluejoint reedgrass	10 cu in
1,000	*Poa palustris*	fowl bluegrass	10 cu in

There was a discussion prior to ordering materials relative to the numbers needed. The numbers recommended by ERC were considered overly large by one project committee expert. ERC assumed the area should look natural and well vegetated in a short time. Significant plant mortality was also assumed. Boulder County had approved the plant species and quantity design prior to the project start and required a detailed review if quantities were changed. Therefore, the original plan was utilized to avoid delays. As it turned out, planting was reasonable dense, but not overly so.

Planting soil conditions were very difficult. At least 80% of the area to be planted consisted of cobble. ERC recommended topsoil be used around each plant. A project committee member with equal experience to ERC and long term experience with front range re-vegetation recommended using native soil in close proximity to the newly planted materials. He felt top soil would largely wash away during high water, leading to unwanted silt deposits downstream. After some discussion, the decision was made to use native soil around each new shrub.

The planting effort along the banks of the project was non-trivial. Originally, it was thought Boulder Flycasters could enlist plenty of volunteers from within chapter membership. The project manager became concerned about that approach and seriously entertained engaging the Wildland Restoration Volunteer, WRV, organization to assist in the effort. This would have required the expenditure of $3,000. to partially cover WRV expenses. The BFC board of directors decided that the chapter needed to depend on chapter membership to test their level of commitment. It was ultimately decided to open the project to chapter members and the general public in the Boulder area. This was a very successful approach. Chapter spouses stepped up and assembled a continental breakfast and a substantial lunch for the volunteers that ultimately numbered over 100.

A BFC chapter member organized the overall volunteer effort and was assisted by the Boulder County Volunteer Coordinator, Matt Bruce, who promoted the re-veg event through standard County publications

and news outlets. Boulder County provided vans and drivers to transport volunteers to the project site. Boulder County provided planting tools for the volunteers which included forestry shovels, pick mattocks, trowels, brushes, pulaskis, rock bars, dibbles, rubber boots, buckets for watering and gloves for the volunteers were donated by McGuckin's Hardware in Boulder.

All volunteers reported to the County Justice Center parking lot on Canyon Blvd., approximately ten miles east of the project site, at 8 AM on July 18. They were transported in the County vans which were driven by members of the Boulder County Youth Corp. Volunteers included members of BFC, a local Boy Scout troop, Boulder County employees, members of the foreign students club at CU and volunteers from the Boulder area.

The date for re-vegetation was set based on historical flow data on Middle Boulder Creek. July 18, 2009 appeared to be a safe date where flow would not be at a low point, but would be low enough to allow safe working conditions along the stream banks. Crossing the stream at the anticipated flow would also be safe for experienced personnel with appropriate wading equipment (waders and felt or studded wading boots). As it turned out, flows on the 18th were very acceptable.

Plants were obtained from Mountain Native Plant Nursery. They were delivered on July 15th and 16th and were staged above and below the project site by volunteers and representatives from Boulder County. The condition of the plants was judged to be excellent. The grass plugs were slightly root bound, however that was not a serious problem. Some #5 plants were trimmed to approximately three feet high to allow easier handling and reduced planting shock. Some of the #5 alders and maples were six to eight feet tall as delivered. The project site was divided into nine sections with two sections on the south side of the creek. A team leader was assigned to each section and the leaders were trained on planting techniques on July 17.

Generally, holes were dug slightly larger in diameter than the plant root balls and sufficiently deep to make the planted shrub soil level equal to the bank surface. Local soil was backfilled around each plant and lightly compressed. Plants were watered immediately after planting. In some areas on the hillsides, where wild roses were planted, a watering basin was built. This was a good idea. Where no basins were built, the roses and other plants did not do well over the course of the summer due to inadequate water retention near the root ball. Basins were built around these plants later in the summer and most plants survived. With the approximately 100 volunteers that actually did the planting, 450 plants and 3000 grass plugs were in the ground by about 3:30 PM. (The lunch break was about 45 minutes) The weather was perfect with no afternoon rain. The day was an unqualified success.

A watering team was assembled in early August. The coordinator arranged for teams of two BFC volunteers to water plants approximately once per week. Watering was suspended for a few days when summer rains were deemed sufficient. The last half of the summer was fairly dry, so watering was performed almost every week. As of late October, the plant survival rate is estimated to be 95%+ for the plants and 60%+ for the grass plugs.

Lessons Learned:

The Rogers Park Restoration Project on Middle Boulder Creek was the first project of this type to be undertaken by Boulder Flycasters since the mid-1980's. The dedicated committee members on this project learned a great deal as the project un-folded. We believe the following points should be considered by the team that undertakes the next BFC project:

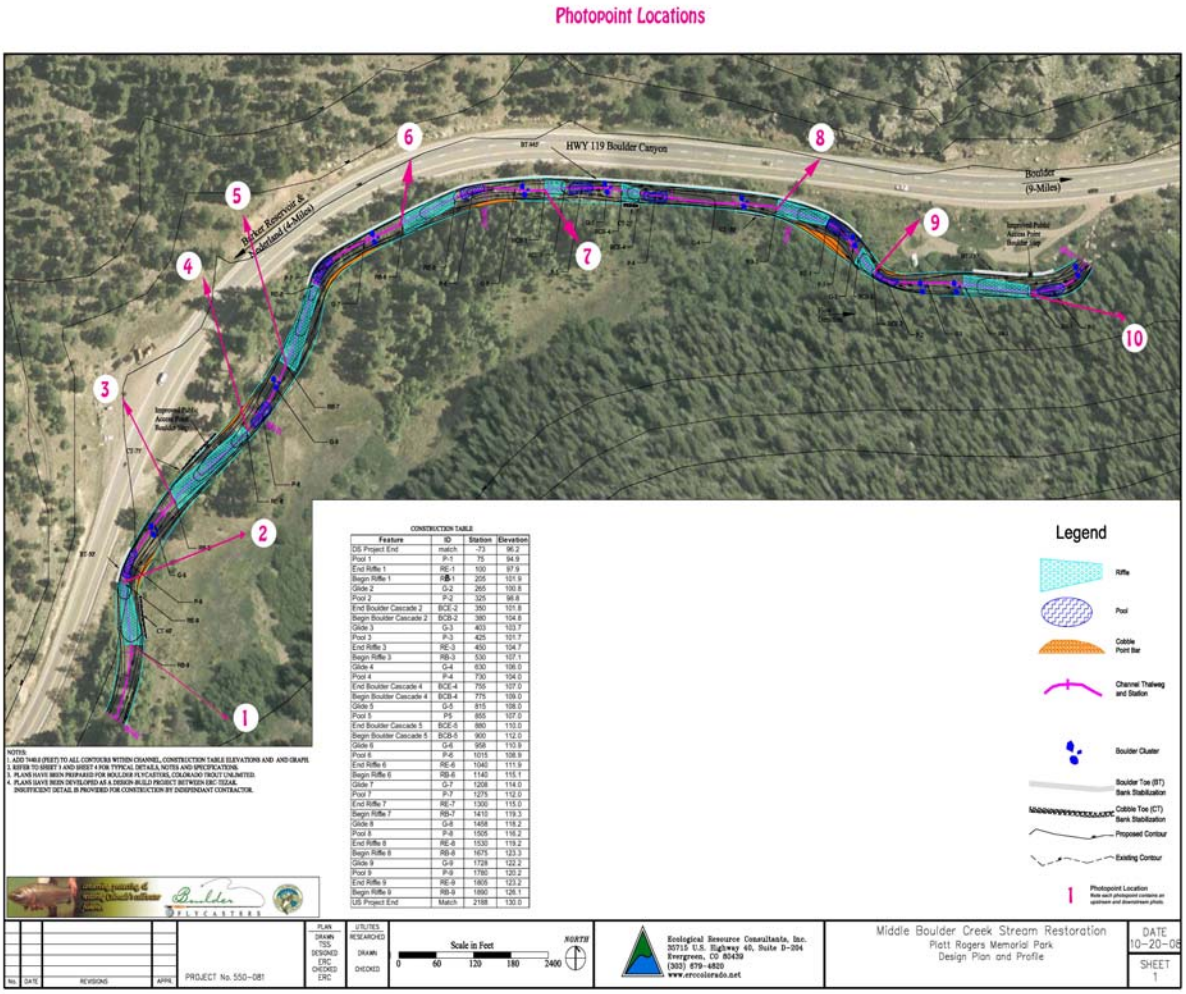
- A design/build approach with the project contractor is a very helpful and labor saving methodology. It is critical that the selected contractor be thoroughly researched and is trustworthy. Boulder Flycasters is very satisfied with the performance of ERC, however a rigorous review of available companies experienced in this type of work should be considered on the next project.
- Permitting is a very non-trivial process, especially in Boulder County. This was another benefit in contracting with ERC, since they assembled all permitting materials. It is critical that the BFC project manager stay very close to the many steps in the process. Otherwise, other County projects take priority over the BFC project and valuable time will be lost.
- Funding a project such as this must be done through grants. Fundraising activities on this project did not yield meaningful returns vs. the effort required to organize and conduct them. ERC committed to assist with identifying funding sources and assisting with grant applications in the early stages. This was very helpful.
- Coordinating volunteer activities such as the re-vegetation effort is non-trivial. Without the support of Boulder County Parks and Open Space, plus some warning from the Wildland Restoration Volunteer organization, the re-vegetation effort would not have been as successful.

Conclusion:

The Rogers Park Restoration Project resulted in a major improvement to over 2000 feet of Middle Boulder Creek. The fish habitat is now suitable for trout spawning. Fish survival during winters with minimum flows is now highly probable. Recreational activities in this area are significantly improved. Angler access is much improved in all areas, especially at the lower end of the stream section. Though it is much too soon to assess the increase in angler activity to be experienced over the long term, it is conservatively estimated that current activity in this area is ten times what it was prior to the restoration. Boulder Flycasters plans to implement a phase II of the project to provide education opportunities to local and out of town visitors to the site. Ideally, this section of Middle Boulder Creek will be designated as a "flies and lures only" fishery and perhaps also a "catch and release" area. Extensive fishing pressure over the summer of 2009 seems to have removed most of the larger fish. Many small trout are easily visible however, indicating the habitat to be healthy and highly desirable from a trout's "point of view"!!

Appendix

The following are representative pictures showing “Before & After” shots of the project. Pictures do not do justice to the work that was performed, however an attempt was made to show the changes as accurately as possible. A red reference flag was placed on each photo to assist the viewer to more easily identify changes. Flows in April and August are reasonably equal. The flow in May was approaching the season maximum, perhaps 10X the earlier and later flows, making newly implemented features nearly impossible to see. Several pictures are included to show high flow conditions.



CONSTRUCTION TABLE

Feature	ID	Station	Elevation
DS Project End	match	-73	96.2
Pool 1	P-1	75	94.9
End Riffle 1	RE-1	100	97.9
Begin Riffle 1	RB-1	205	101.9
Glide 2	G-2	265	100.8
Pool 2	P-2	325	98.8
End Boulder Cascade 2	BCE-2	350	101.8
Begin Boulder Cascade 2	BCB-2	380	104.8
Glide 3	G-3	403	103.1
Pool 3	P-3	425	101.7
End Riffle 3	RE-3	450	104.7
Begin Riffle 3	RB-3	530	107.1
Glide 4	G-4	630	106.0
Pool 4	P-4	730	104.0
End Boulder Cascade 4	BCE-4	755	107.0
Begin Boulder Cascade 4	BCB-4	775	109.0
Glide 5	G-5	815	108.0
Pool 5	P-5	855	107.0
End Boulder Cascade 5	BCE-5	880	110.0
Begin Boulder Cascade 5	BCB-5	900	112.0
Glide 6	G-6	958	110.9
Pool 6	P-6	1015	108.9
End Riffle 6	RE-6	1040	111.9
Begin Riffle 6	RB-6	1140	115.1
Glide 7	G-7	1208	114.0
Pool 7	P-7	1275	112.0
End Riffle 7	RE-7	1300	115.0
Begin Riffle 7	RB-7	1410	119.3
Glide 8	G-8	1458	118.2
Pool 8	P-8	1505	116.2
End Riffle 8	RE-8	1530	119.2
Begin Riffle 8	RB-8	1675	123.3
Glide 9	G-9	1728	122.2
Pool 9	P-9	1780	120.2
End Riffle 9	RE-9	1805	123.2
Begin Riffle 9	RB-9	1890	126.1
US Project End	Match	2188	130.0

Photo Point 3
Looking Downstream

Before

After

Photo Point 4
Looking Upstream

Before

After

Photo Point 6
Looking Downstream

Before

After

Photo Point 7
Looking Downstream

Before

After

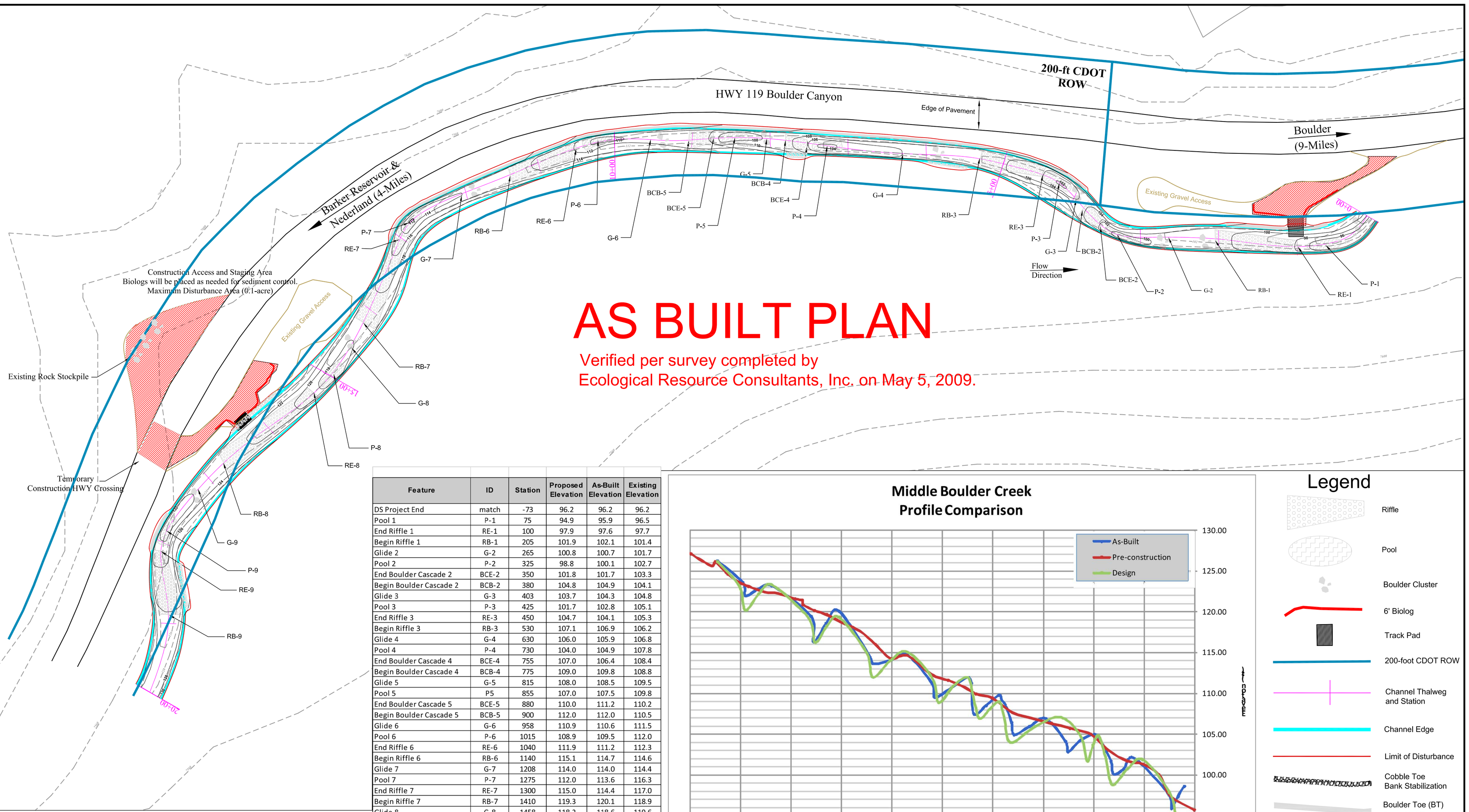
Photo Point 10
Looking Upstream

Before

After

Photo Point 10
Looking Upstream

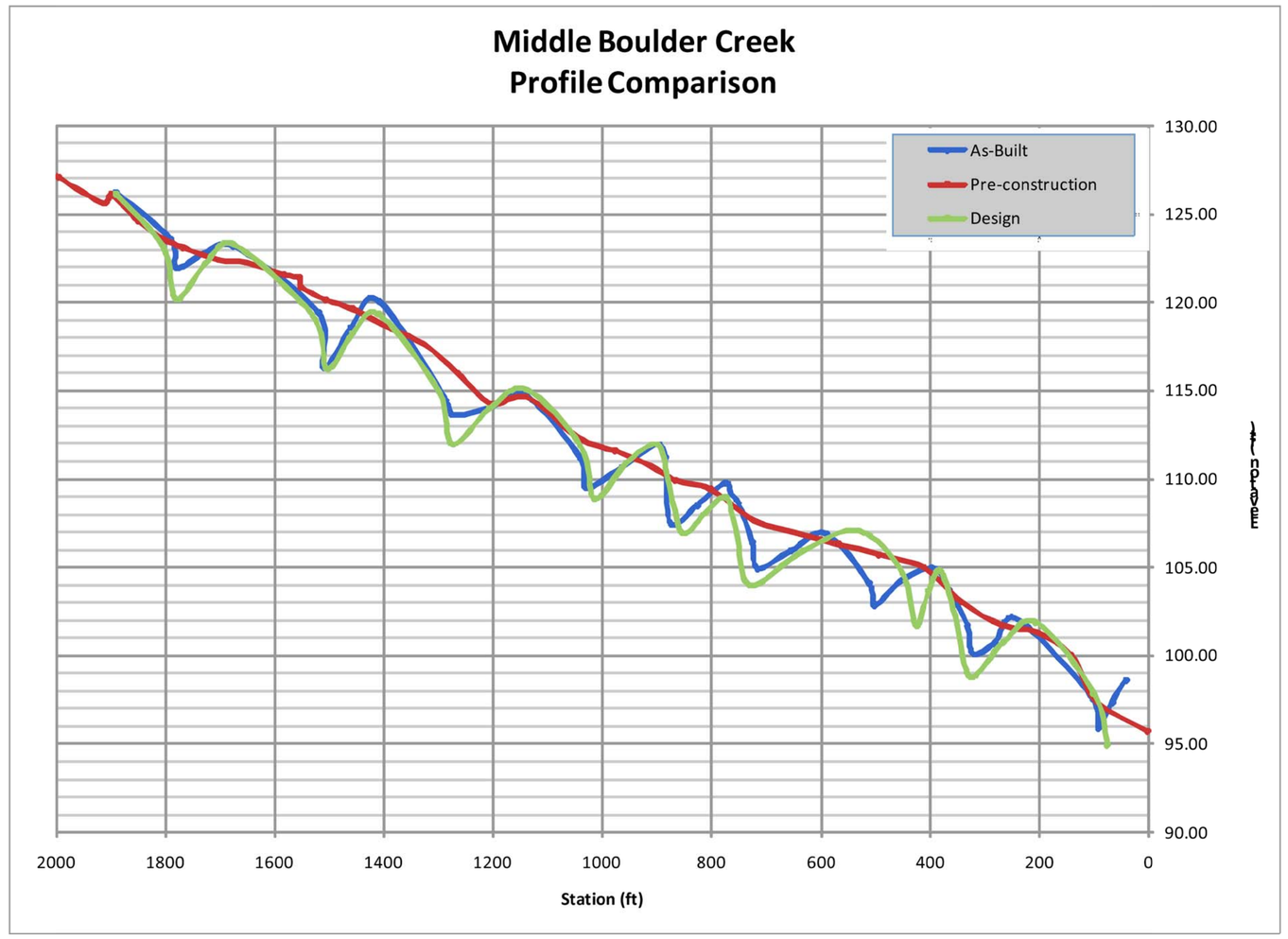
After – At High Water in Late May

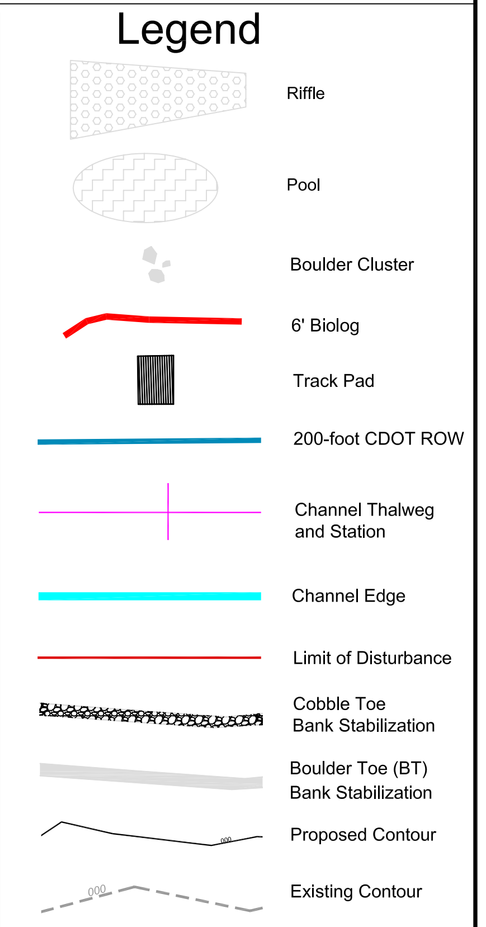


AS BUILT PLAN

Verified per survey completed by
Ecological Resource Consultants, Inc. on May 5, 2009.

Feature	ID	Station	Proposed Elevation	As-Built Elevation	Existing Elevation
DS Project End	match	-73	96.2	96.2	96.2
Pool 1	P-1	75	94.9	95.9	96.5
End Riffle 1	RE-1	100	97.9	97.6	97.7
Begin Riffle 1	RB-1	205	101.9	102.1	101.4
Glide 2	G-2	265	100.8	100.7	101.7
Pool 2	P-2	325	98.8	100.1	102.7
End Boulder Cascade 2	BCE-2	350	101.8	101.7	103.3
Begin Boulder Cascade 2	BCB-2	380	104.8	104.9	104.1
Glide 3	G-3	403	103.7	104.3	104.8
Pool 3	P-3	425	101.7	102.8	105.1
End Riffle 3	RE-3	450	104.7	104.1	105.3
Begin Riffle 3	RB-3	530	107.1	106.9	106.2
Glide 4	G-4	630	106.0	105.9	106.8
Pool 4	P-4	730	104.0	104.9	107.8
End Boulder Cascade 4	BCE-4	755	107.0	106.4	108.4
Begin Boulder Cascade 4	BCB-4	775	109.0	109.8	108.8
Glide 5	G-5	815	108.0	108.5	109.5
Pool 5	P5	855	107.0	107.5	109.8
End Boulder Cascade 5	BCE-5	880	110.0	111.2	110.2
Begin Boulder Cascade 5	BCB-5	900	112.0	112.0	110.5
Glide 6	G-6	958	110.9	110.6	111.5
Pool 6	P-6	1015	108.9	109.5	112.0
End Riffle 6	RE-6	1040	111.9	111.2	112.3
Begin Riffle 6	RB-6	1140	115.1	114.7	114.6
Glide 7	G-7	1208	114.0	114.0	114.4
Pool 7	P-7	1275	112.0	113.6	116.3
End Riffle 7	RE-7	1300	115.0	114.4	117.0
Begin Riffle 7	RB-7	1410	119.3	120.1	118.9
Glide 8	G-8	1458	118.2	118.6	119.6
Pool 8	P-8	1505	116.2	116.3	120.1
End Riffle 8	RE-8	1530	119.2	119.4	120.5
Begin Riffle 8	RB-8	1675	123.3	123.2	122.3
Glide 9	G-9	1728	122.2	122.8	122.7
Pool 9	P-9	1780	120.2	121.9	123.3
End Riffle 9	RE-9	1805	123.2	123.6	123.6
Begin Riffle 9	RB-9	1890	126.1	126.2	125.8
US Project End	Match	2188	130.0	130.0	130.0





NOTES:
1. ADD 7440.0 (FEET) TO ALL CONTOURS WITHIN CHANNEL, CONSTRUCTION TABLE ELEVATIONS AND GRAPH.
2. REFER TO SHEETS 2, 3 AND 4 FOR CROSS SECTIONS AND TYPICAL DETAILS .
3. PLANS HAVE BEEN PREPARED FOR BOULDER FLYCASTERS, COLORADO TROUT UNLIMITED.
4. PLANS HAVE BEEN DEVELOPED AS A DESIGN-BUILD PROJECT BETWEEN ERC-TEZAK.
INSUFFICIENT DETAIL IS PROVIDED FOR CONSTRUCTION BY INDEPENDENT CONTRACTOR.

No.	DATE	REVISIONS	APPR.

PROJECT No. 550-081

PLAN
DRAWN TSS
DESIGNED ERC
CHECKED ERC

UTILITIES
RESEARCHED
DRAWN
CHECKED

Scale in Feet
0 60 120 180 240

NORTH

Ecological Resource Consultants, Inc.
35715 U.S. Highway 40, Suite D-204
Evergreen, CO 80439
(303) 679-4820
www.erccolorado.net

Middle Boulder Creek Stream Restoration
Platt Rogers Memorial Park
Grading Plan

DATE
3-10-09

SHEET
1