

Trinidad / Purgatoire River  
Reach 3 Aquatic Habitat Enhancement Project

*A Project of the*

*Purgatoire River Water Conservancy District,  
the City of Trinidad, Colorado,  
& Purgatoire River Anglers Chapter – Trout Unlimited,*

Final Report



Prepared by:  
Pete Gallagher, Fin-Up Habitat Consultants, Inc.  
May, 2014

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**Background:**

The Purgatoire River is a major headwater tributary of the Arkansas River, draining a large portion of southeastern Colorado. From the headwaters on the eastern slopes of the Culebra Range, the river flows east for approximately 50 miles to the City of Trinidad, Colorado. The City of Trinidad has through its history been plagued by several damaging flood events. Significant flooding occurred in 1905, and again in the 1920's and 1930's. In 1958, the US Congress authorized construction of the Trinidad Dam and Reservoir (Trinidad Project) under the Flood Control Act of 1958. The primary purpose of the project was to provide flood control, as well as storage for irrigation and recreational use. Construction of the dam began in 1971, and was completed by 1976. Filling of the reservoir began following construction, and the reservoir began operations in 1979.

The Trinidad Project dam and reservoir have dramatically altered the natural flow regime of the Purgatoire River. The pre-project river hydrology was principally snow-melt driven, with additional influence from high-intensity, short duration storm events during the summer monsoon season. Prior to construction of the reservoir, the Purgatoire River typically experienced peak flows during the snow melt run-off in May and June, with additional storm driven peaks in July and August. Base flows typically occurred from mid-September through early April. Reservoir operations have flattened out the annual hydrograph, limiting the peak run-off flows below the dam, and significantly extending the period of higher than natural flows beginning earlier in the spring through the late summer into fall. Releases from the dam correspond to a designated irrigation season, and flows during the non-irrigation season are limited, with the only flow in the river downstream of the dam coming from Raton Creek and a few other intermittent tributaries.

In 2010, the Purgatoire River Anglers Chapter of Trout Unlimited contracted with Fin-Up Habitat Consultants, Inc. to conduct an assessment of existing aquatic habitat conditions and a feasibility study for a cold water habitat improvement project on a segment of the Purgatoire River within the City of Trinidad, Colorado. Funding for the assessment came from a Trout Unlimited Embrace-A-Stream grant, as well as a small contribution from the Cheyenne Mountain Chapter of TU in Colorado Springs. The purpose of this assessment was to evaluate the existing condition of the river, including available habitat for resident trout, to identify segments of the stream for restoration, and to develop a planning document for future projects.

The assessment was completed during the summer of 2011. The results of the assessment indicated that the severely reduced winter flows below Trinidad Dam are likely to limit the potential fishery in the Purgatoire River through the City of Trinidad, Colorado. Interviews with long time residents and local fisherman, did indicate that a remnant population of trout does persist in the study reaches, and many of the river's stakeholders in the region are convinced that the creation of an urban recreational fishery is in the best economic and social interests of the community. Although a self-sustaining population of trout might be difficult to establish, there was an opportunity to create a seasonal "put-and take" fishery within the city limits of Trinidad, which would provide recreation

enhancements including easier and more controlled access to the river corridor for residents. While an enhancement project of this nature could not address the limited flow issue, the work would provide velocity shelter and in-channel holding cover for stocked fish during the sustained higher flow period. A project could provide seasonal fishing opportunities from April through October each year, and would address many of the access, dispersed recreation, and bank stability issues. Following this enhancement concept, the assessment analyzed the potential of each reach for a project of this type. Concept plans for Reach 3, 4 and 5, in the central downtown area of the City of Trinidad were developed, and funding was sought for the first demonstration project, in Reach 4 in the center of the City.



Map 1: Purgatoire River Reach 3 Aquatic Enhancement Project Location.

## **Stakeholders & Project Development**

The stakeholders for the Trinidad / Purgatoire River effort include a diverse mix of business leaders, local, state & federal government agencies, non-governmental organizations, and private individuals. Without the efforts of these groups and individuals, a project of this scope would be impossible. Stakeholders for the Purgatoire River effort include:

- The Purgatoire River Water Conservancy District
- The City of Trinidad, Colorado
- Purgatoire River Anglers – Trout Unlimited
- Colorado Dept. of Parks & Wildlife
- The Trinidad Community Foundation
- Pioneer Natural Resources Company

The project stakeholders agreed that Reach 4, located in the heart of the City downtown business district, would be the first priority, and would be used as a demonstration project to assess the value of creating a “put-and-take” fishery in the heart of downtown Trinidad, CO. Planning for implementation of the project began in the summer of 2011. Funding for the project was secured through the Arkansas River Roundtable, Colorado Water Conservation Board, and the individual stakeholders. The Purgatoire River Water Conservancy District agreed to be the fiscal agent for the project, and Fin-Up Habitat Consultants, Inc. was selected to complete the final design, obtain the necessary permits, and to supervise construction of the in-channel habitat and river bank stabilization features outlined in the final design. The Reach 4 project was completed in the spring of 2012. In addition to the in-stream habitat enhancement work, construction of a handicapped accessible trail and three fishing sites within the project reach was completed by crews from Pioneer Natural Resources Company, following a trail design developed by Wildland Landscapes LLC..

The Reach 4 Demonstration Project was completed under-budget due to unanticipated savings in the cost of boulders & heavy equipment. The stakeholders sought to apply the remaining funds to implement the next phase downstream in Reach 3 the following year.

The proposed enhancement in Reach 3 was of a relatively smaller scope and scale compared to the efforts in Reach 4, and the stakeholders believed there were adequate funds available to quickly implement additional enhancement work. One aspect of the Reach 3 plan included removal of 150 feet of obsolete steel jetty-jacks that had failed, and were in the process of collapsing into the river. An inquiry to the US Army Corps of Engineers indicated that a “Letter



Photo 1: Reach 4 Demo Project 2012

of No Objection” from the Levy Safety Branch would be required in order to remove these structures and replace them with boulder J-Hook vanes. After reviewing the proposed project, the Levy Safety Branch determined that the jetty-jacks could be removed, but only with a significant modification to the proposed enhancement plan. Specifically, they would require Bendway weirs in lieu of boulder J-Hook vanes, and boulder revetment up to the high water line between each weir. This requirement increased the cost of the project from \$40,000 to \$112,000, postponing the effort until some other solution could be found for the jetty jacks segment of the project.



Photo 2: Example of Bendway Weirs & River Bank Revetment

In the fall of 2013, the stakeholders approached the US Corps of Engineers with an alternate proposal for the area surrounding the jetty-jacks. The contractor selected for the work had suggested to the stakeholders that he could install boulder J-Hook vanes underneath, around, and through the jetty jack cables without disturbing the structures. The Corps concurred that a Letter of No Objection would not be required if the jetty-jacks were left in place and undisturbed. A revised plan was submitted to the Corps, and a Regional General Permit 12 for aquatic enhancement was issued by the Southern Colorado Regulatory Office in December 2013.

### **Reach 3 River Enhancement**

Construction of the Trinidad / Purgatoire River Reach 3 Habitat Enhancement Project began on February 20, 2014. Heavy construction equipment services for the river channel and bank stabilization portion of the project were provided by Chaparral Construction, LLC, of La Veta, Colorado. Chaparral provided a John Deere 160D LC excavator and a JD TC62H loader for the project, as well as tandem dump truck for transport of boulders to the project site. The project began with the stockpiling of 300 tons of boulders at a designated site upstream of the Linden Street bridge, near the downstream boundary of the reach. Boulders were then distributed to the individual habitat feature locations within the river channel by a loader. Acquisition and distribution of boulder was completed by February 24, and construction of the in-channel habitat features began that week.

Construction began at the downstream boundary of the reach, under the Linden Street bridge, and worked upstream to the low head dam at the Picketwire Ditch diversion. Construction of the J-Hook vanes through the existing jetty-jack structures proved to be every bit as challenging as we expected. The equipment operators deserve credit for devising innovated techniques to place boulders in and around the structures without disturbing them. These included using equipment with quick coupling buckets, which allowed the operators, at times, to disconnect the bucket and balance boulders on just the



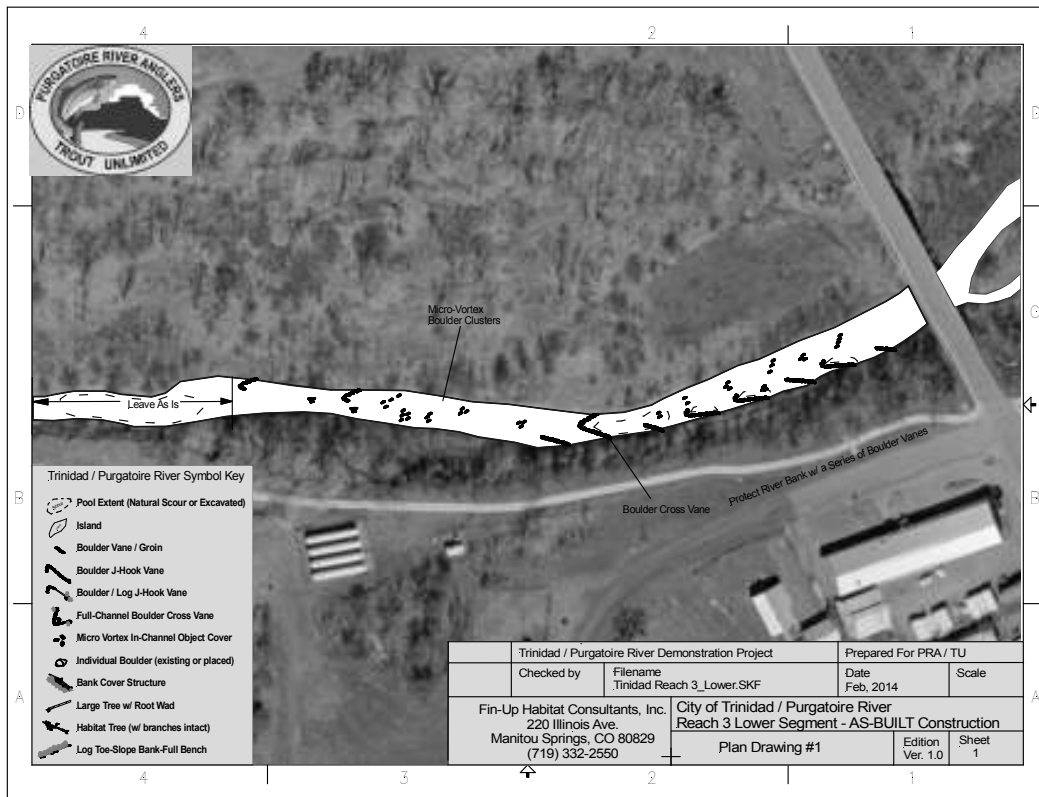
Photo 3: Utilizing innovative techniques to install vanes around the existing Jetty Jacks.

excavator thumb. The boulder could then be threaded through the heavy steel cables and embedded into the river bank. Final adjustments could then be made by reaching underneath the cables with the excavator arm completely extended. Heavy equipment construction of all the in-channel habitat and stream-bank stabilization features was completed by Friday, February 28, 2014.

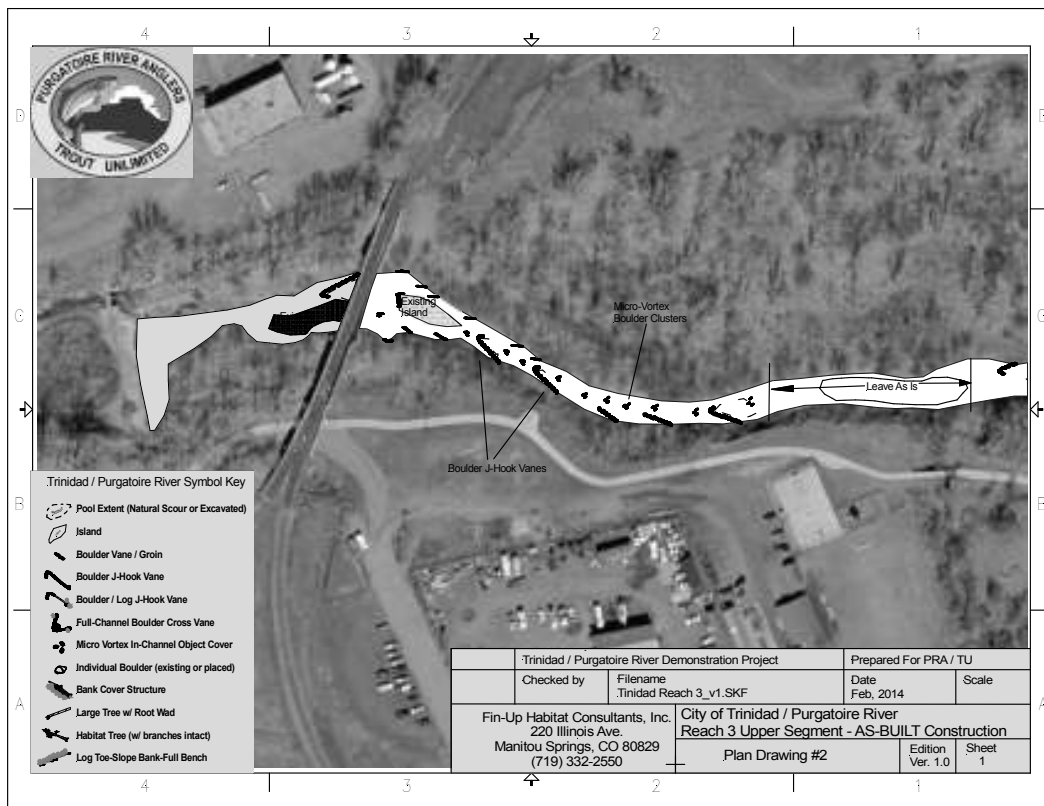
As-Built drawings of the project reach are shown in the drawings on the following page. A total of one full-channel cross-vane, 9 boulder J-Hook vanes, 13 short vanes / groins, and 24 boulder clusters were constructed along 2,000 feet of river. Additionally, three motorized access routes into the river were closed and rehabilitated. Construction generally followed the finalized plan, with a few minor adjustments and additions that were identified as necessary during the course of construction. Additions to the original plan included more boulder cluster/micro-vortex habitats, an additional J-Hook vane upstream of the railroad bridge, and additional boulder vanes or bank groins to protect river banks and create velocity shelter.



Photo 4: Completed J-Hook & Boulder Vanes adjacent to the Jetty-Jacks.



Drawing #1: As-Built Drawing - Lower Segment of Purgatoire River Reach 3.



Drawing #2: As-Built Drawing - Upper Segment of Purgatoire River Reach 3.



### **Trout Unlimited Volunteer Workday and Other Activities**

Following the heavy construction activities in the river the Purgatoire River Anglers chapter of Trout Unlimited will organize a volunteer workday in the project reach this spring. Volunteers will clean up the boulder stockpile sites, reseed disturbed areas, harvest willow cuttings, and plant willow and sedge as necessary where the newly constructed habitat features tie into the river bank. We estimate that approximately 80 hours of volunteer effort will be necessary to put the finishing touches on the river work. An addendum to this report may be submitted to account for this “In-Kind” contribution to the effort. In early May, members of Trout Unlimited will complete the final phase of the project, stocking catchable brown trout throughout the project reach. Later in the summer, Colorado Parks & Wildlife is expected to stock catchable rainbow trout into Reach 4 & 3 as well.



Photo 5: Closing and Rehabilitating a Motorized Access Route to the River.

### **Budget:**

The total project cost was \$43,250.00, not including in-kind contributions from the partners and stakeholders, which will be determined following the volunteer workday. Funding for the project consisted of \$25,250.00 from the CWCB, \$9,000.00 from the Purgatoire River Water Conservancy District, and \$9,000.00 from the City of Trinidad. Cash expenditures included such costs as construction management, heavy equipment, materials acquisition, and post-project follow-up. The final budget of the Trinidad / Purgatoire River Reach 4 Demonstration Project, including a breakdown of costs by task, is shown in the table on the following page.

<b>Trinidad / Purgatoire River Reach 3 Aquatic Enhancement Project</b>					
<b>Final Budget - May 2014</b>					
<b>Task</b>	<b>Description</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit Cost</b>	<b>Total Cost</b>
<b>1</b>	<b>Pre-Project Prep., Surveys, Permits</b>	<b>ls</b>		\$ 3,500.00	\$ 3,500.00
<b>2</b>	<b>Project Oversight &amp; Management</b>	<b>ls</b>		\$ 8,750.00	\$ 8,750.00
<b>3</b>	<b>Heavy Equipment</b>	<b>ls</b>		\$ 23,880.00	\$ 16,600.00
<b>4</b>	<b>Boulders</b>	<b>tons</b>	300	\$ 38.00	\$ 11,400.00
<b>9</b>	<b>Trout Unlimited Volunteer Workday April 15, 2012</b>	<b>hours</b>	TBD	\$ 21.79	\$ -
<b>10</b>	<b>Final Report, As-Built Drawings, and Permit Close-out</b>	<b>ls</b>		\$ 3,000.00	\$ 3,000.00
Total Project:					\$ 43,250.00
Project Cash Expense:					\$ 43,250.00

### **Project Goals/Objectives and Post Project Monitoring:**

Project goals and objectives were principally focused on providing exceptional recreation and fishing opportunity within an urban setting. To this end, the project provides for adequate suitable habitat to sustain a stocked fishery during the summer months. The reach will benefit from improved velocity shelter, cover, and additional useable habitat through the selective placement of in-channel structure. Holding cover and velocity shelter in the low gradient riffles is substantially improved, with 47 new habitat structures installed in the reach. These features will create depth and scour and should be self cleaning of sediment. The boulder vanes and J-Hook structures installed along the failing jetty-jacks should help to stabilize eroding banks and limit further damage to these structures.

Following construction of the project, Fin-Up Habitat Consultants, Inc. personnel established photo-points of the work to assist in post project monitoring of the project. In addition, the Purgatoire River Anglers chapter is regularly monitoring the river for any indication that reduced flows may strand stocked fish. To date, this has yet to become an issue. We recommend that a comprehensive post-project monitoring assessment be conducted within the next three to five years following project construction to evaluate whether the original goals and objectives are being met, and to identify any unexpected issues or consequences that may arise. This assessment should include repetition of the photo-points for comparison, an assessment of structure function, and a re-survey of the longitudinal profile to assess the effectiveness of scour in the new pool habitats. An informal creel survey may also be considered to evaluate the recreational use in the project area.

## APPENDIX

BUDGET & TIMELINE

PROJECT “AS BUILT” DRAWINGS

STRUCTURE PLAN & PROFILE (Typical) DRAWINGS

PROJECT PHOTOGRAPHS

USACE RGP12 PERMIT



## Task 1 - Project Management

[illegible]

Description	Target Start Date	Target Completion Date	Quantity (tons or Equipment)	Unit Cost	CWCBC Funds	Other Funding	Other Funding In-	Total
						Cash*	Kind*	
Equipment Mobilization	12/15/2013	2/28/2014	2	\$ 800.00		\$ 1,600.00		\$ 1,600.00
Boulders	12/15/2013	2/28/2014	180	\$ 38.00		\$ 6,840.00		\$ 6,840.00
Installation (Excavator & Loader)	12/15/2013	2/28/2014	LS	\$ 7,500.00	\$ 7,500.00			\$ 7,500.00
Total J-Hook / Boulder Vane Installation - TASK 2								\$ 15,940.00

[illegible]

Description	Target Start Date	Target Completion Date	Quantity (hrs)	Unit Cost/Hr	CWCB Funds	Other Funding Cash*	Other Funding In-Kind*	Total
Project Prep & Supervision	TBD	TBD	-	\$ 20.00			\$ -	\$ -
Project Volunteers (10 persons @ 6 hrs)	TBD	TBD	-	\$ 20.00			\$ -	\$ -
Total Other Channel Habitat Installation - TASK 3								\$ -

Description	Target Start Date	Target Completion Date	Total Cash Funds	CWCB Funds	Other Funding Cash*	Other Funding In-Kind*	Total
Purgatoire River Reach 3 Project	12/15/2013	3/31/2014	\$ 43,250.00	\$ 25,250.00	\$ 18,000.00	\$ -	\$ 43,250.00
TASKS 1-4							\$ 43,250.00





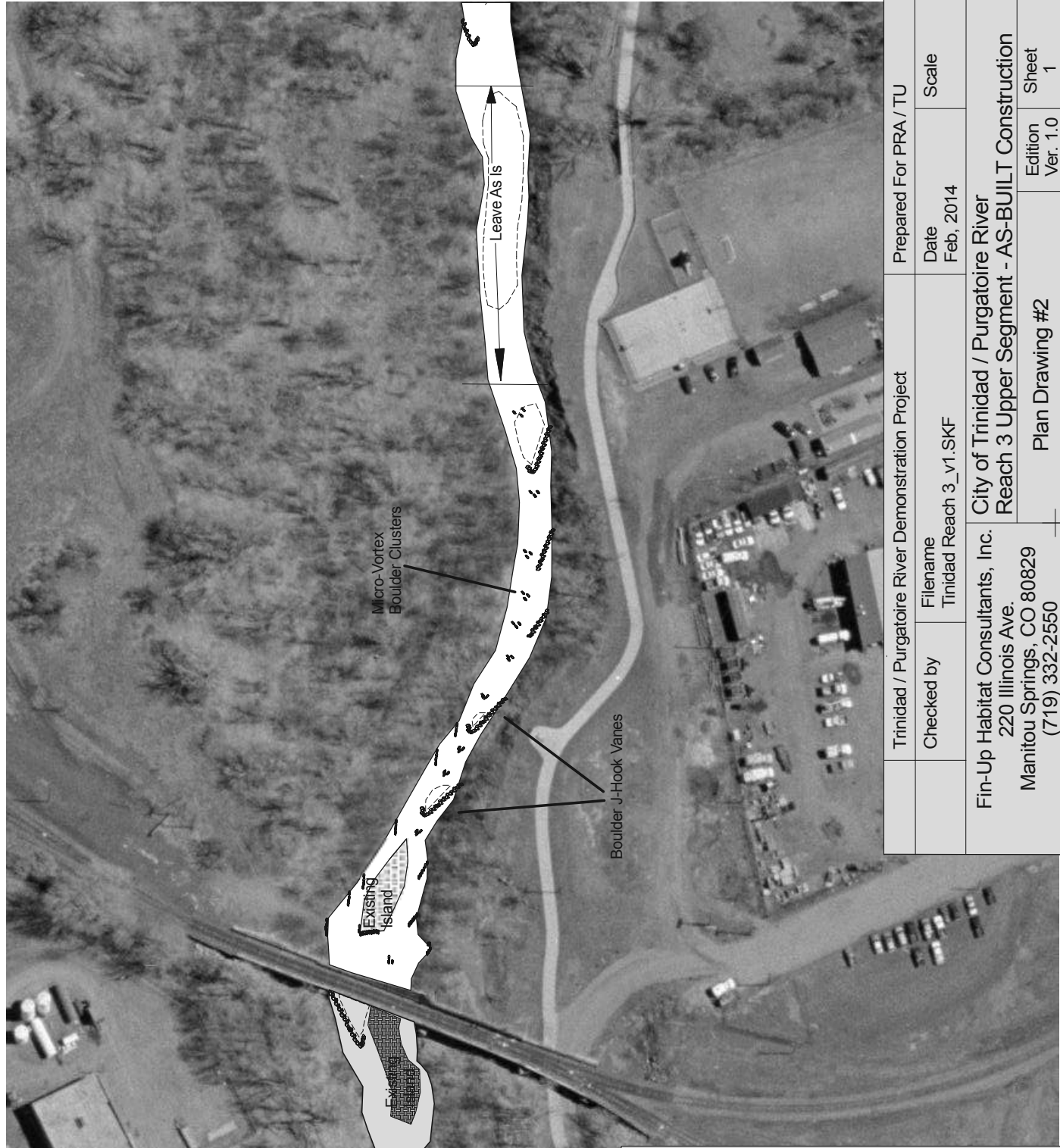
Trinidad / Purgatoire River Symbol Key	
	Pool Extent (Natural Scour or Excavated)
	Island
	Boulder Vane / Groin
	Boulder J-Hook Vane
	Boulder / Log J-Hook Vane
	Full-Channel Boulder Cross Vane
	Micro Vortex In-Channel Object Cover
	Individual Boulder (existing or placed)
	Bank Cover Structure
	Large Tree w/ Root Wad
	Habitat Tree (w/ branches intact)
	Log Toe-Slope Bank-Full Bench



Trinidad / Purgatoire River Demonstration Project		Prepared For PRA / TU	
Checked by	Filename	Date	Scale
	Trinidad Reach 3_Lower.SKF	Feb, 2014	
Fin-Up Habitat Consultants, Inc. 220 Illinois Ave. Manitou Springs, CO 80829 (719) 332-2550		City of Trinidad / Purgatoire River Reach 3 Lower Segment - AS-BUILT Construction	
Plan Drawing #1		Edition Ver. 1.0	Sheet 1



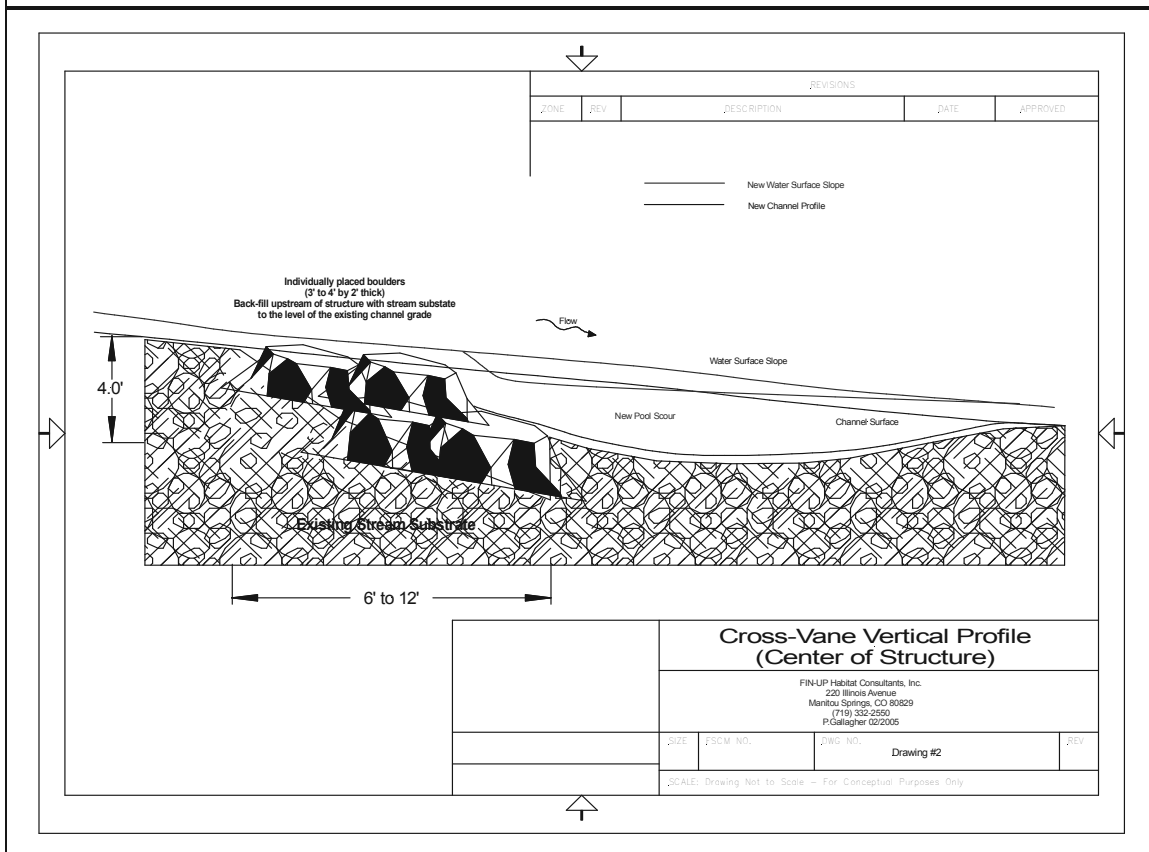
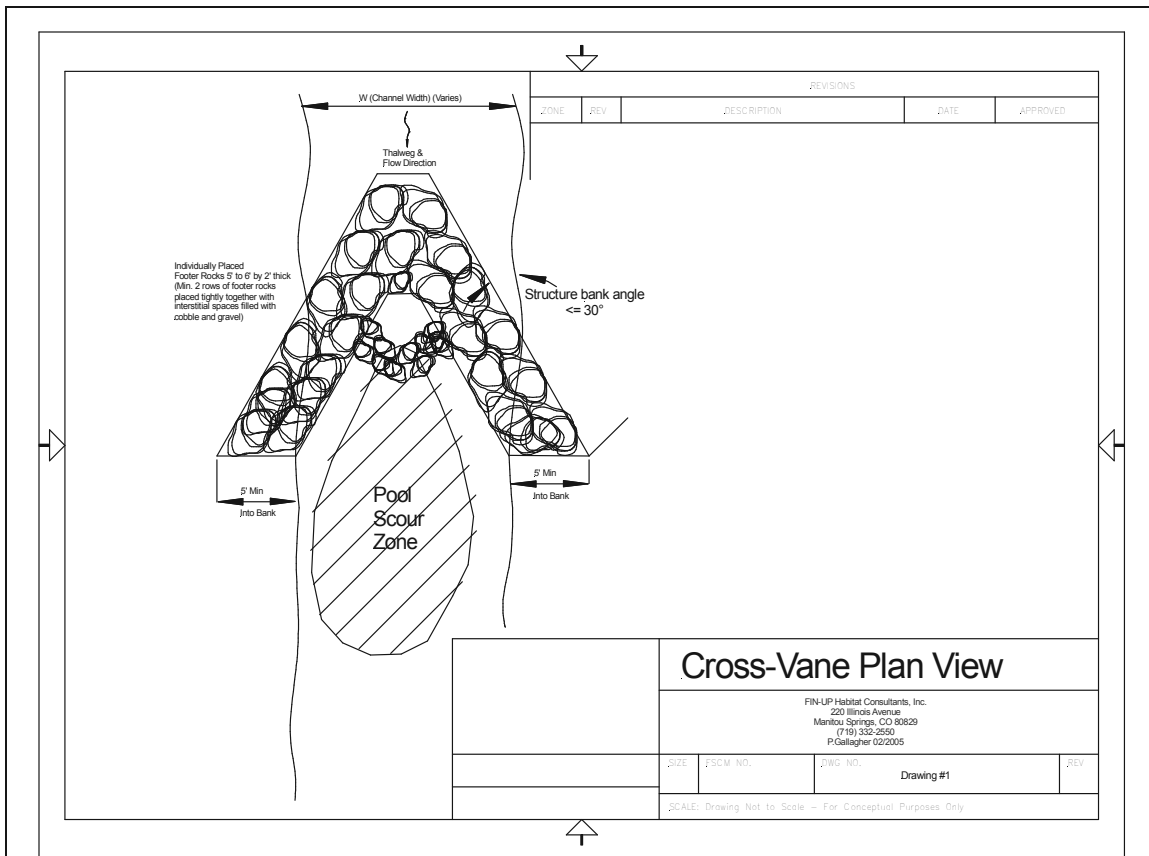
Trinidad / Purgatoire River Symbol Key	
	Pool Extent (Natural Scour or Excavated)
	Island
	Boulder Vane / Groin
	Boulder J-Hook Vane
	Boulder / Log J-Hook Vane
	Full-Channel Boulder Cross Vane
	Micro Vortex In-Channel Object Cover
	Individual Boulder (existing or placed)
	Bank Cover Structure
	Large Tree w/ Root Wad
	Habitat Tree (w/ branches intact)
	Log Toe-Slope Bank-Full Bench

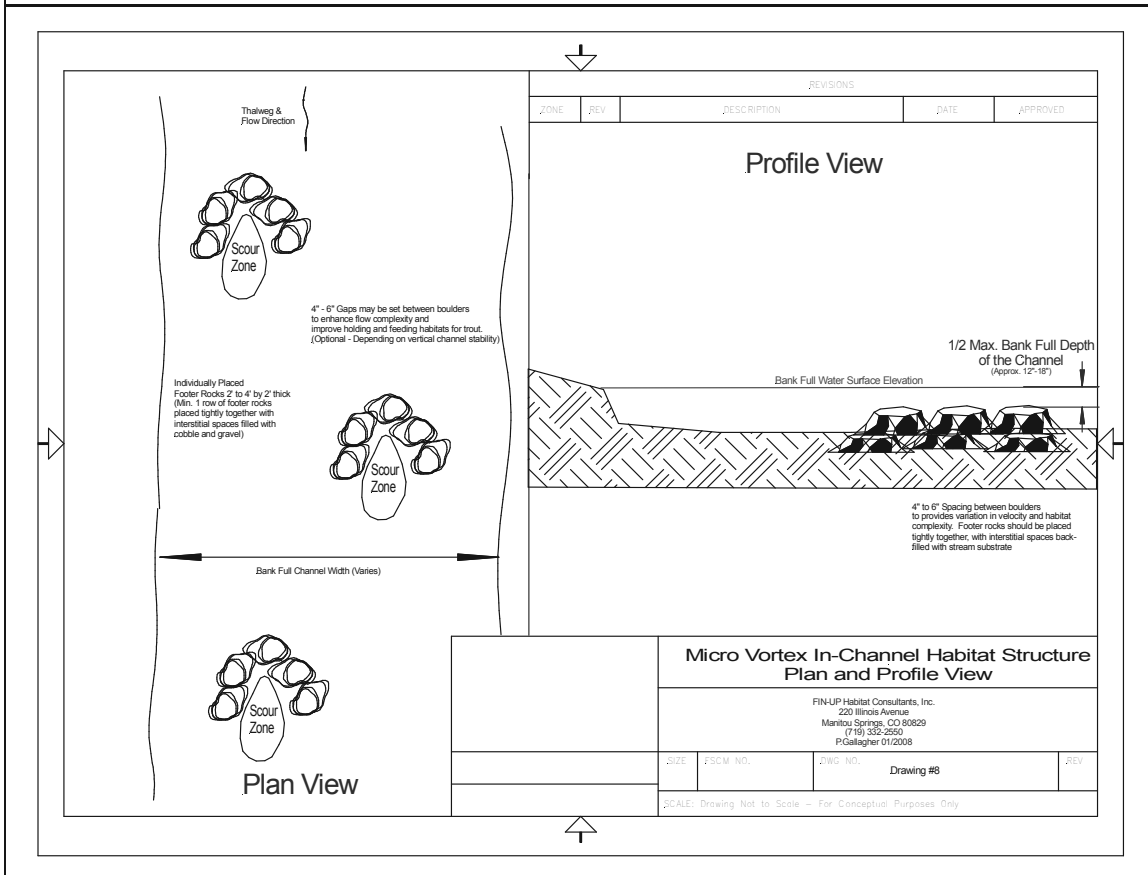
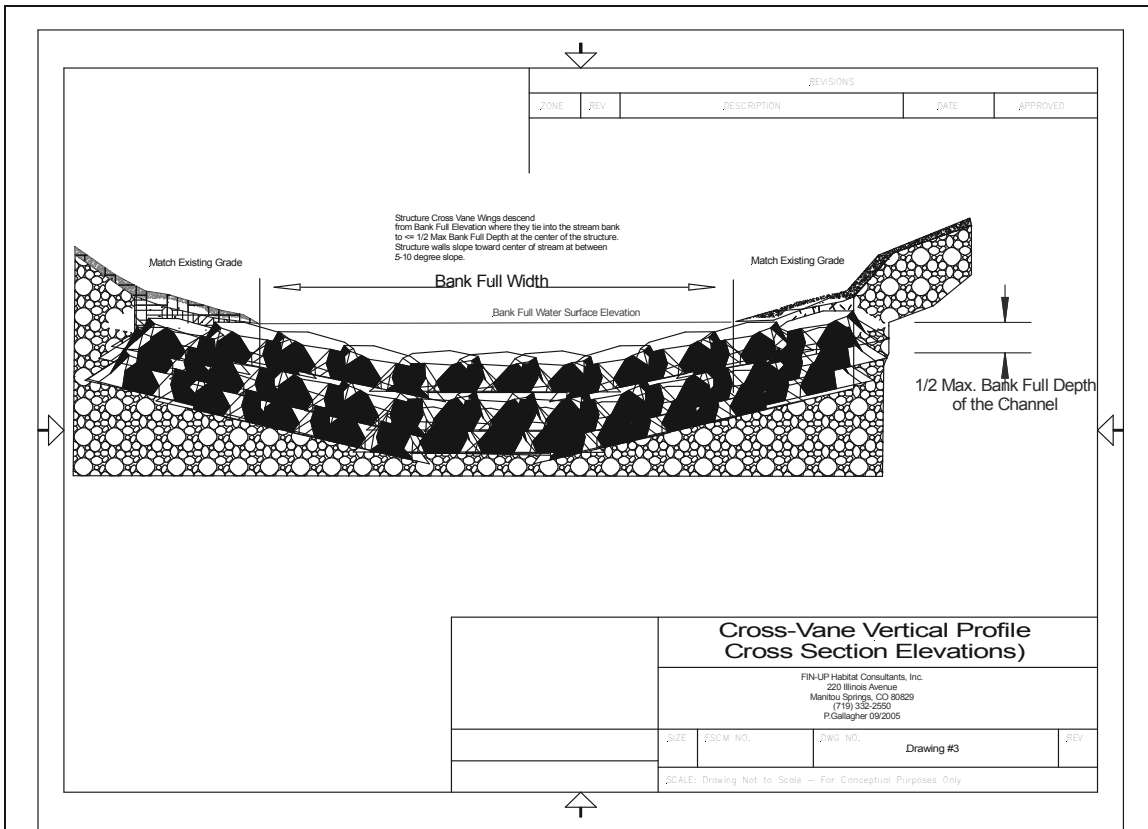


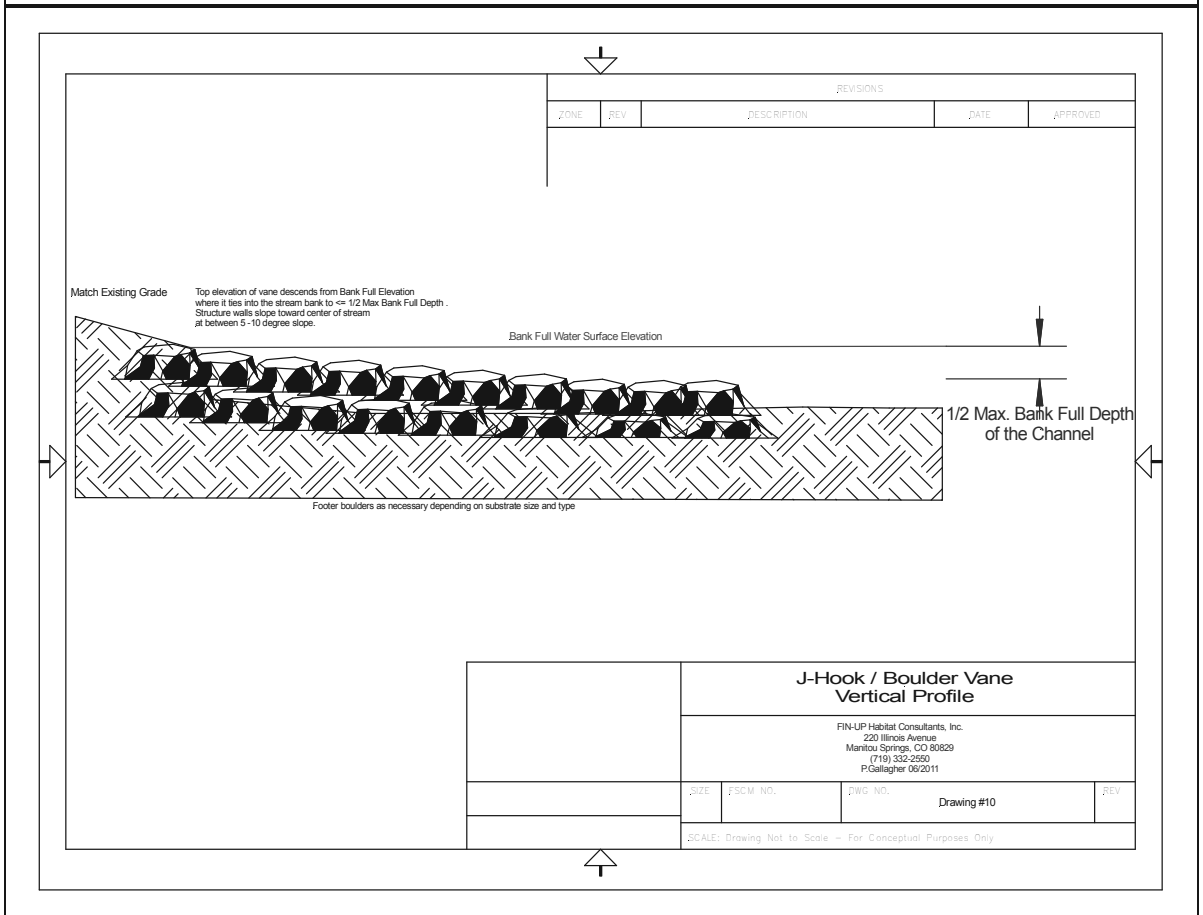
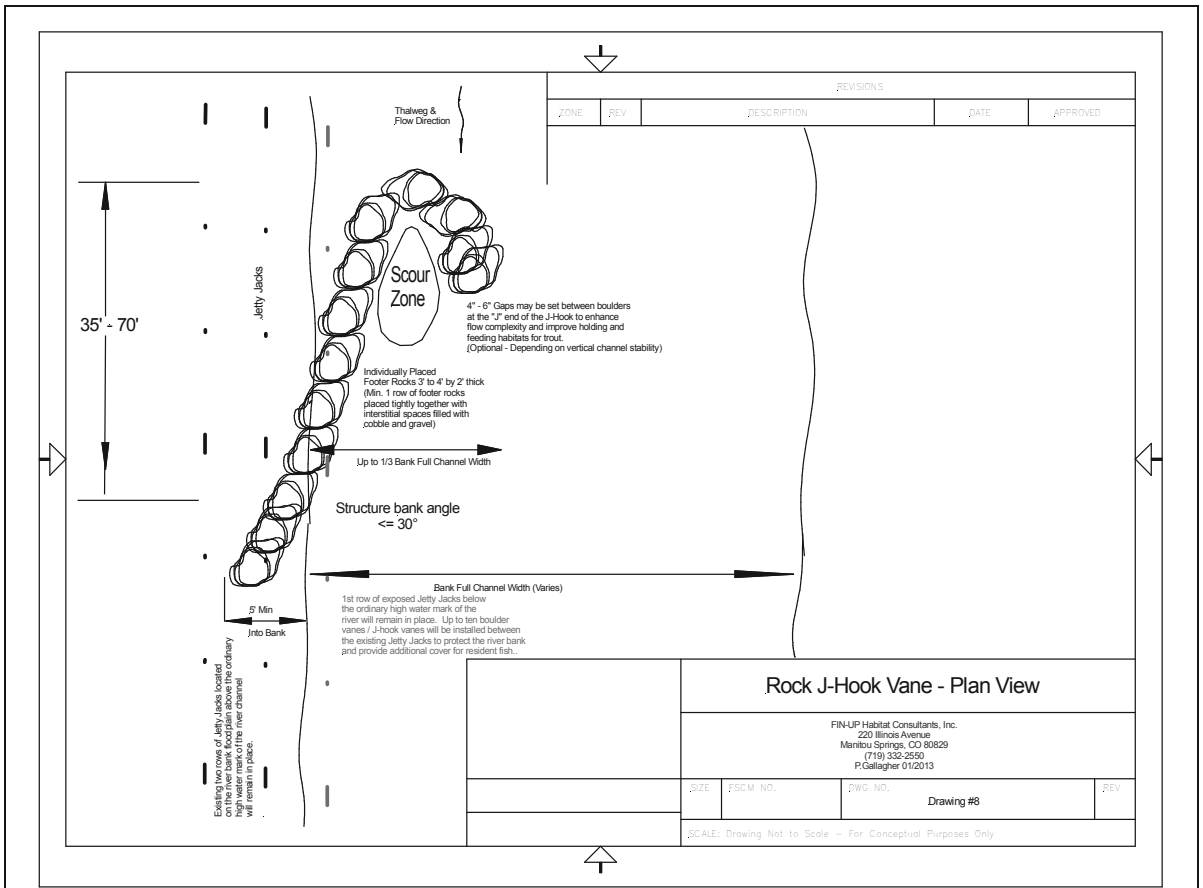
Trinidad / Purgatoire River Demonstration Project		Prepared For PRA / TU	
Checked by	Filename Trinidad Reach 3_v1.SKF	Date Feb, 2014	Scale
Fin-Up Habitat Consultants, Inc. 220 Illinois Ave. Manitou Springs, CO 80829 (719) 332-2550		City of Trinidad / Purgatoire River Reach 3 Upper Segment - AS-BUILT Construction	
Plan Drawing #2		Edition Ver. 1.0	Sheet 1



# Drawings of Treatment Types (Typicals)











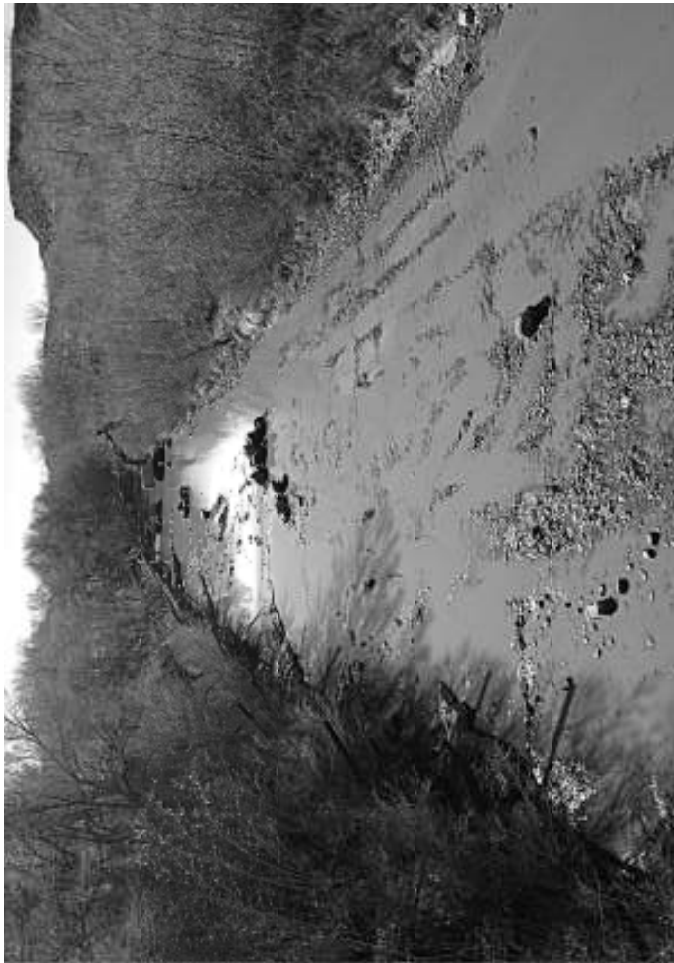
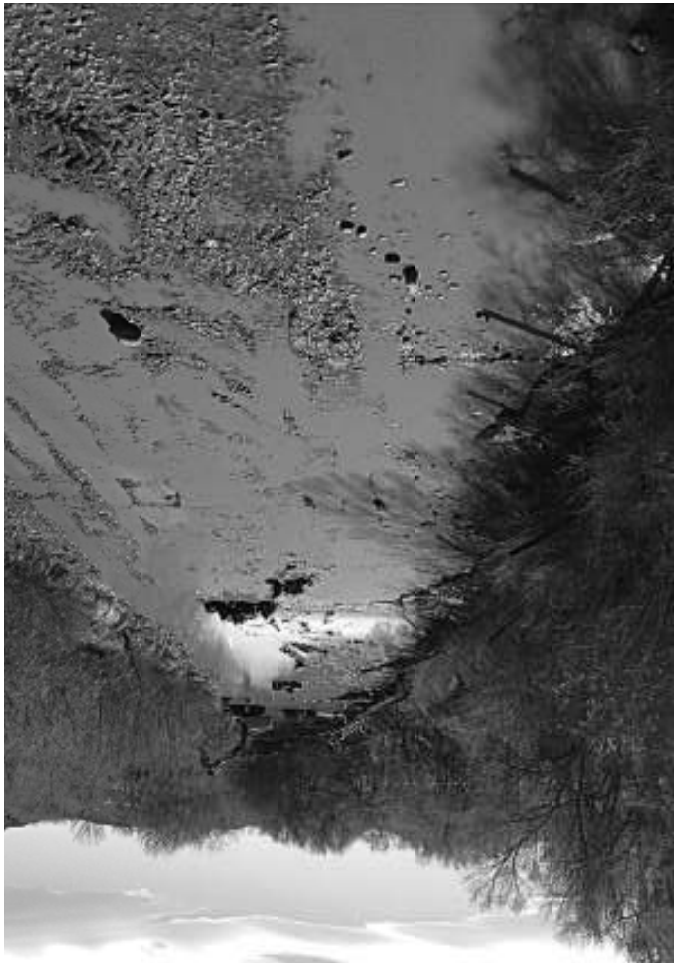






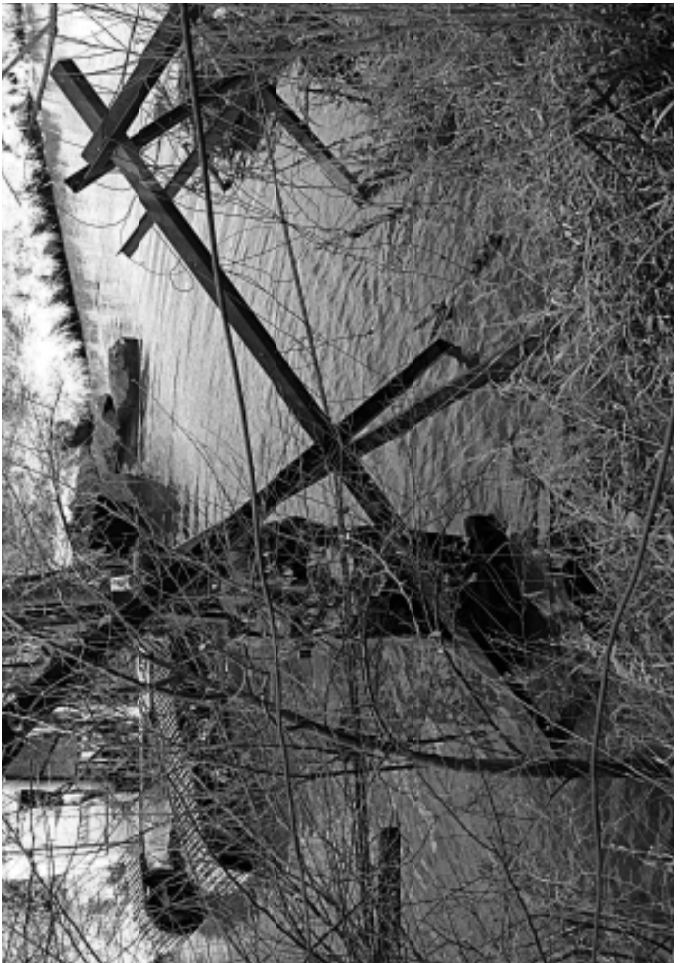
































REPLY TO  
ATTENTION OF

**DEPARTMENT OF THE ARMY**  
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS  
SOUTHERN COLORADO REGULATORY OFFICE  
200 SOUTH SANTA FE AVENUE, SUITE 301  
PUEBLO, COLORADO 81003-4270

November 5, 2013

Regulatory Division

**SUBJECT: Regional General Permit Verification – Action No. SPA-2013-00493-SCO, City of Trinidad Purgatoire River Reach 3 Habitat Improvement Project**

Pete Gallagher  
FIN-UP Habitat Consultants, Inc.  
220 Illinois Avenue  
Manitou Springs, Colorado 80829-1627

Mr. Gallagher:

I am writing this letter in response to your request for a permit verification for the proposed City of Trinidad Purgatoire River Reach 3 Habitat Improvement Project located between Linden Avenue and the Picketwire Ditch diversion structure in Las Animas County, Colorado. The work, as described in your letter, will involve construct a series of habitat improvement structures such as boulder clusters and J-Hooks in the Purgatoire River. We have assigned Action No. SPA-2013-00493-SCO to this project. Please reference this number in all future correspondence concerning the project.

Based on the information provided, we have determined that the project will be authorized by Regional General Permit (RGP) No. 12 for Aquatic Habitat Improvement for Stream Channels in Colorado. A summary of RGP 12 is available on our website at <http://www.spa.usace.army.mil/reg/rgp>. To use this permit, you must ensure that the work complies with the terms and conditions of the permit.

This permit verification is valid until November 5, 2015 unless the RGP is modified, suspended, revoked or reissued prior to that date. Continued confirmation that an activity complies with the terms and conditions, and any changes to the RGP, is the responsibility of the permittee. Activities that have commenced, or are under contract to commence, in reliance on the RGP will remain authorized provided the activity is completed within 12 months of the date of permit expiration, modification, or revocation.

In accordance with General Condition (GC) 5, the permittee must submit a set of as-built drawings to this office within 90 days following project completion. Drawings shall contain enough detail to compare post-construction conditions to baseline conditions. Furthermore, the

permittee shall monitor all completed work in accordance with the stated project goals and objectives. The permittee must submit a monitoring report for evaluation of objectives and effectiveness by December 31 of the third year after project completion. Monitoring reports shall include, at a minimum, the following information:

- a. Permit number and a location map;
- b. A description of the successes, failures, and potential problem areas;
- c. A description of the recommendations for maintenance or remedial efforts that the permittee feels should be implemented to support the success of the project;
- d. Documentation of any remedial activities that were completed during the monitoring period;
- e. Maps and drawings as needed for illustration; and
- f. Photos taken from the same points and bearings as pre-construction photos to be compared to preexisting site conditions. Photos should include labels with time, date, bearing, and a general description of the site.

Our review of this project also addressed its effects on threatened and endangered species and historic properties in accordance with GCs 13, 14, and 15. Based on the information provided, we have determined that this project will not affect any species listed as threatened or endangered by the U.S. Fish and Wildlife Service within the permit area. We have also determined that this project will not affect historic properties listed, or eligible for listing, in the National Register of Historic Places. However, please note that you are responsible for meeting the requirements of GC 13 for endangered species and GCs 14 and 15 for historic properties.

This letter does not constitute approval of the project design features, nor does it imply that the construction is adequate for its intended purpose. This permit does not authorize any injury to property or invasion of rights or any infringement of federal, state or local laws or regulations. The permittee and/or any contractors acting on behalf of the permittee must possess the authority and any other approvals required by law, including property rights, in order to undertake the proposed work.

The landowner must allow Corps representatives to inspect the authorized activity at any time deemed necessary to ensure that it is being, or has been, accomplished in accordance with the terms and conditions of the permit.

I am forwarding copies of this letter to Louis Fineburg, City of Trinidad, 135 N. Animas St., Trinidad, Colorado 81082, and Jeris Danielson, Purgatoire River Water Conservancy District, 314 W. Main St., Trinidad, Colorado 81082. If you have any questions, please contact me at (719) 543-6914 or by e-mail at [Joshua.G.Carpenter@usace.army.mil](mailto:Joshua.G.Carpenter@usace.army.mil). At your convenience, please complete a Customer Service Survey on-line available at <http://per2.nwp.usace.army.mil/survey.html>.

Sincerely,

A handwritten signature in black ink, appearing to read "Joshua G. Carpenter". The signature is fluid and cursive, with the first name "Joshua" being more prominent.

Joshua G. Carpenter  
Senior Project Manager