

## 2009 Rio Grande Riparian Stabilization Project – Phase 4

Final Report prepared for CWCB - December 2014



### Colorado Rio Grande Restoration Foundation Rio Grande Headwaters Restoration Project



*The Mission of the Rio Grande Headwaters Restoration Project is to restore and conserve the historical functions and vitality of the Rio Grande in Colorado for improved water quality, agricultural water use, riparian health, wildlife and aquatic species habitat, recreation, and community safety while meeting the requirements of the Rio Grande Compact.*

## **Final Report Executive Summary**

### **Project Title: 2009 Rio Grande Riparian Stabilization Project – Phase 4**

CWCB WSRA Grant Contract Number: C150486

CDPHE CO NPS Grant Contract Number: 11 FAA 30432

**Project Start Date:** April 15, 2011

**Project Completion Date:** December 15, 2014

#### **FUNDING**

Total CO NPS Grant - Cash	\$218,117.69
Total CWCB WSRA - Cash	\$148,000.00
Local/Private - Cash	\$112,596.05
Subtotal Cash	\$478,713.74
In-kind Contributions	\$19,386.80
Subtotal In-kind	\$19,386.80
<b>TOTAL FUNDING</b>	<b>\$498,100.54</b>

#### **EXPENDITURES**

Expenditures of CO NPS (EPA) Funds	\$218,117.69
Expenditures of CWCB WSRA Funds	\$148,000.00
Other Expenditures	\$131,982.85
<b>TOTAL EXPENDITURES</b>	<b>\$498,100.54</b>

### **Summary Accomplishments**

The 2009 Rio Grande Riparian Stabilization Project – Phase 4 (Phase 4) was a riparian restoration and stabilization Project completed by the Rio Grande Headwaters Restoration Project (RGHRP) in 2014. The Goal of Phase 4 was to improve riparian health, floodplain function, and water quality by reducing erosion within the project boundaries. Through Phase 4, streambank stabilization was completed on 1.75 miles of riparian areas on 5 privately owned sites. Based on estimated erosion rates, the reduction in sediment loading from these efforts is 16,120 cubic feet per year. Aggressive revegetation efforts were implemented on Project sites to further stabilize the streambanks and improve riparian habitat. Volunteers and crews from the Southwest Conservation Corps worked to increase streambank vegetation, contributing 100 volunteer hours. The RGHRP gave tours and provided updates to local newspapers and community groups as part of outreach and education. Monitoring has shown Project efforts were successful. The RGHRP will continue long-term monitoring, with help from the Colorado Measurable Results Program. Phase 4 reduced sediment loading by stabilizing the streambanks, improved the riparian and upland habitat by increasing willow and riparian vegetation cover, and enhanced the fishery. Additionally, the capacity of the Rio Grande to transport sediment that has entered the system from upstream reaches was increased. Finally, improvements to riparian habitat and floodplain function improved the condition of wetlands located throughout the riparian areas within the project boundary.

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## 1.0 Introduction

The Colorado Rio Grande Restoration Foundation (Foundation) is the fiscal agent for the Rio Grande Headwaters Restoration Project (RGHRP). The RGHRP was formed to implement the recommendations of the 2001 Study. The 2001 Study was prompted by a group of citizens who were concerned that the river had been impaired. The 2001 Study, sponsored by the San Luis Valley Water Conservancy District and funded by the Colorado Water Conservation Board, analyzed 91 miles of the Rio Grande from South Fork to the Alamosa/Conejos County line. This reach was identified as the portion of the Rio Grande in Colorado that has been most impacted by human intervention in the past 100 years. The 2001 Study analyzed the current vegetation, human impact, agricultural disturbance, geomorphology, hydrology, wildlife habitat, and aquatic habitat of the 91-mile reach. The 2001 Study determined that a major cause of the deterioration in river function was the continual increase in sediment loading caused by unstable and eroding streambanks. Sediment input degrades the Rio Grande by reducing water quality and sediment transport capacity. Reduced water quality negatively impacts the fisheries, wetlands, critical wildlife habitat, historic agriculture communities, and recreation economy: all of which rely on high quality water supplied by the Rio Grande. Furthermore, lowered sediment transport capacity inhibits the ability of the Rio Grande to supply water to the ecosystems and economies that depend on it.

Since 2001, the RGHRP has worked to improve the function of the Rio Grande in Colorado. The Rio Grande Riparian Stabilization Project – Phase 4 (Phase 4) continued these efforts. The primary Goal of Phase 4 was to improve water quality by reducing sediment entering the river within the project boundaries.

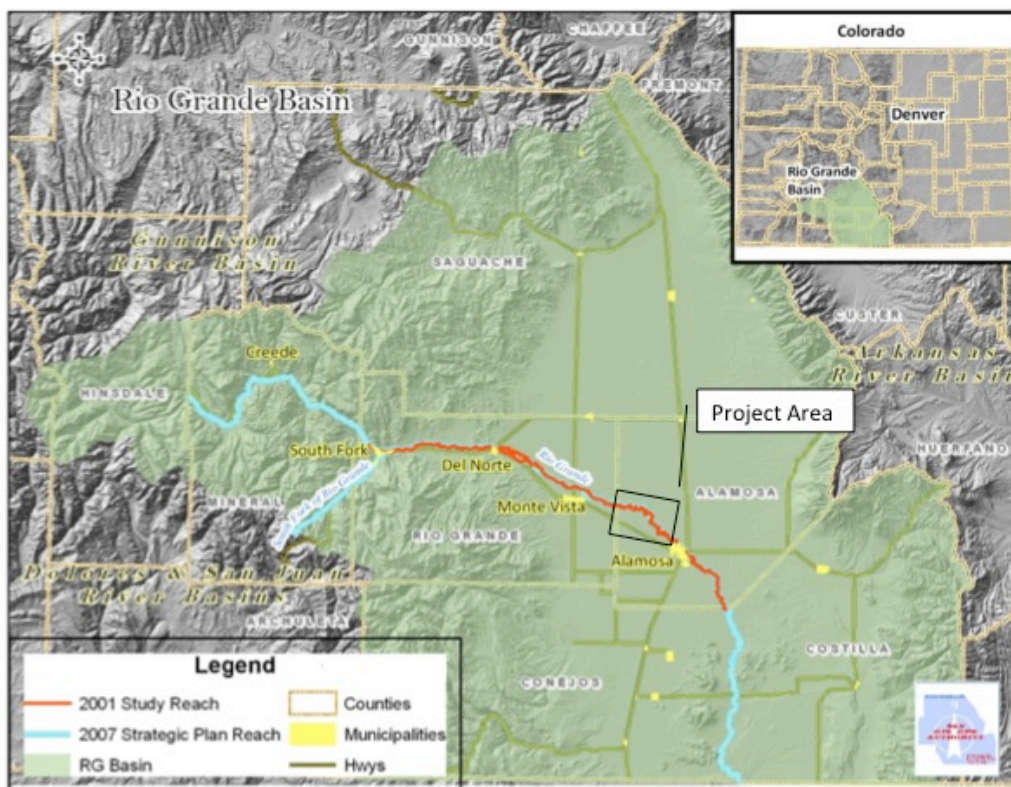


Figure 1. Location of Phase 4 Project Area within the Rio Grande Watershed.



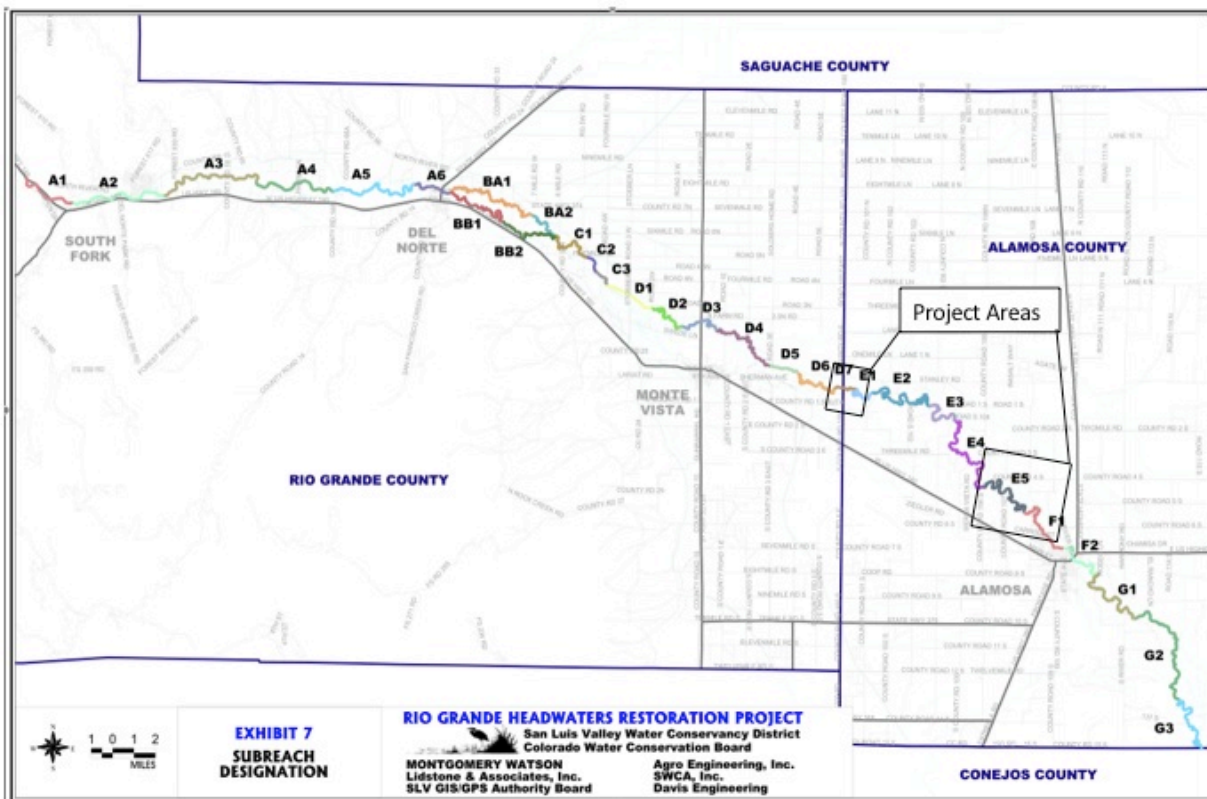


Figure 2. Location of Phase 4 Project Area within the 2001 Study Reach.

In Phase 4, five (5) sites underwent streambank stabilization and riparian restoration; actions reduced sediment loading and improved water quality by stabilizing the streambanks, improved the riparian and upland habitat by increasing willow and riparian vegetation cover, and enhanced the fishery. Additionally, the capacity of the Rio Grande to transport sediment that has entered the system from upstream reaches was increased. Finally, improvements to riparian habitat and floodplain function improved the condition of wetlands located throughout the riparian areas within the project boundary.



Figure 3. Location of Phase 4 Project Sites within Project Area, relative to Phase 3 Project Sites.

## 2.0 Project Goals, Objectives, and Activities

### 2.1 Planned Goals and Objectives, and Actual Activities and Products

Planned Phase 4 Environmental Goal - Improve the function of the Rio Grande by reducing sediment loading by 8,900 cubic feet per year in Alamosa County, Colorado.

Objective 1 – Improve water quality, reduce sediment loading, and enhance sediment transport by stabilizing streambanks and reconfiguring the stream channel on the Rio Grande.

Completed Task 1 Activities – Streambank Stabilization: The RGHRP hired third party engineering firm, Riverbend Engineering, and restoration contractors, Robins Construction, to design and implement streambank stabilization methods on 1.75 miles of riparian area. The methods utilized included sloping and shaping banks, building floodplain benches, reconfiguring the channel to move the thalweg away from the bank, and installing rock barbs to move water away from and stabilize the streambanks. Based on erosion rates calculated in the 2001 Study, the estimated reduction in sediment loading from these efforts is 16,120 cubic feet per year. These efforts resulted in improved water quality, reduced erosion, increased sediment transport capacity, increased quality of riparian areas and habitat, and proper functioning floodplains.

Products – Stabilized streambanks, annual sediment loading reduced by 16,120 cubic feet, and reconfigured stream channel on 5 sites. This was 7,220 cubic feet per year of sediment reduction and 1 site more than initially planned.



*Shaping Streambanks and Piling Topsoil to Spread on Finished Benches and Streambanks.*



*Rock Barb Installation.*



*Rock Barb Installation and Topsoiling.*

Figure 4. Streambank Stabilization Techniques.



Table 1. Phase 4 - Task 1 Accomplishments				
Site	2001 Study Subreach	Feet of Streambank Stabilized	Rock Barbs Installed	Estimated Cubic Feet of Sediment Reduced Annually
1 - Outcalt	D7	3,000	17	4,230
2 - Chefas	E5	2,650	15	5,090
3 - Hrehovcsik	E5	1,000	7	1,920
4 - Colwell	E5	1,010	9	1,940
5 - Chefas	F1	1,400	10	2,940
<b>TOTAL</b>		<b>9,060</b>	<b>58</b>	<b>16,120</b>

Completed Task 2 Activities – Bioengineering: The RGHRP hired Riverbend Engineering and Robins Construction to design and implement bioengineering techniques in order to further stabilize the streambanks following construction in Task 1. Techniques used in the riparian areas included, mechanically planting 830 willow clumps and reseeding 11 acres of riparian areas with grasses and forbs through hydromulching. Upland areas disturbed during onsite activities were reseeded with appropriate species through drill seeding. The RGHRP organized 2 volunteer revegetation events: in August 2013, 7 volunteers from the community and the Southwest Conservation Corps trimmed willow clumps to increase vigor. In October 2013, 9 volunteers trimmed remaining willow clumps. In June 2014, a crew of 8 young adults planted 1,050 willow bundles in the project area.

Products – Reestablished riparian vegetation, increased streambank stability, and reduced erosion. Three community events, through which groups of volunteers, community organizations, and a crew from the Southwest Conservation Corps completed revegetation efforts at the Project sites.



*Robins Construction Planting Willow Clumps.*



*Applying Hydromulch.*



*Southwest Conservation Corps Planting Willow Bundles.*

**Figure 5. Bioengineering Methods.**

Planned Phase 4 Programmatic Goal 1 - Reduce streambank erosion and protect the riparian area after streambank stabilization with improved grazing techniques, where applicable.

Objective 2 – Identify and implement grazing best management practices (BMPs) to reduce sediment input and enhance riparian areas on sites where livestock grazing occurs.

Completed Task 3 Activities – Grazing Management: Riparian fencing was completed on all project sites. Only one of the owners currently graze livestock on their property. Fencing will help protect the riparian areas from overgrazing while vegetation becomes established. Because the potential for grazing in the future exists, the other riparian areas were also protected from overuse through fencing. Furthermore, two of five sites receive use from public recreators as the landowner allows public access. As such, the fencing will protect riparian areas from overuse by walkers, runners, and ATV users.

Products - Improved riparian zones through grazing BMP implementation and fencing.



*Before: Fence Hanging in River.*

*After: Completed Riparian Fencing.*

Figure 6. Grazing Best Management Practice, Fencing, Implemented at Site 5.

Planned Phase 4 Programmatic Goal 2 - Track the progress of Phase 4 activities and long-term site condition with evaluation and monitoring.

Objective 3 – Ensure Project design is implemented accurately. Monitor sites to track long-term condition and evaluate overall success of reaching Goals and Objectives.

Completed Task 4 Activities – Monitoring: The RGHRP and Riverbend Engineering characterized sites before on-site work to establish baseline condition. RGHRP and Riverbend Engineering monitored on-site activities to ensure on-the-ground efforts were consistent with Project design and monitored sites after construction in accordance with the SAPP. RGHRP personnel, with cooperation from the Colorado Measurable Results Program, will continue to monitor sites according to the Phase 4 SAPP to ensure proper function and determine that Projects successfully attain Goals and Objectives.

Products - Monitoring Reports that can be compared to determine the success of riparian stabilization, ensure the desired results have been achieved, and develop lessons learned for future Projects.



Planned Phase 4 Programmatic Goal 3 - Promote community awareness of and involvement in non-point source pollution and water quality related issues through Outreach and Education.

Objective 4 – Promote community participation and increase understanding of water quality issues and encourage involvement in Phase 4 by reaching out to the community with presentations, tours, and volunteer events.

Completed Task 5 Activities – Outreach and Education: The RGHRP developed visual aids about Phase 4; spoke at public meetings, local schools, and conferences about the importance of water quality and healthy rivers; submitted articles to local newspapers with Project information and updates; organized volunteer revegetation efforts and tours for members of the public.

Products - A well-informed community regarding water quality issues in the watershed, the activities of the RGHRP, and the importance of healthy rivers. Increased community involvement in riparian stabilization Projects; three revegetation efforts. Finally, community tours of completed Projects were given to interested community groups and individuals.



Figure 7. Outreach and Education - Public Tour During Construction, Fall 2012.

Planned Phase 4 Programmatic Goal 4 - Determine most cost efficient and effective riparian stabilization methods for implementation at the four Project sites.

Objective 5 – Facilitate discussions with the Technical Advisory Team, a multi-discipline team of expert advisors, to identify the most cost efficient and effective riparian stabilization methods for implementation at each site.

Completed Task 6 Activities – The RGHRP organized four meetings of members of the Technical Advisory Team. The Technical Advisory Team visited sites before design and construction to discuss suitable methods to address the causes of reduced riparian function. Using lessons learned from previous projects and the best available science, the Technical Advisory Team determined the most effective and cost-efficient methods for implementation at each site. The technical team will visit the sites in summer 2015 to review the results of onsite work and develop "lessons learned" for future efforts.

Products - A team of professionals committed to selecting the most technically and cost effective mitigation measures to be implemented at each Project site. A detailed look at the completed sites to determine how future efforts can be improved.



Figure 8. Technical Advisory Team Pre-Construction Site Visit, March 2012.



Planned Phase 4 Programmatic Goal 5 – Administer Phase 4 efficiently, within budgeted costs and Project timelines, and in accordance with Project Goals, Objectives, and Tasks.

Objective 6 – Administer Phase 4 efficiently, within budgeted costs and timelines, and in accordance with Project Goals, Objectives, and Tasks. Complete all necessary contracts, status reports, and internal and external documents. Ensure Tasks are completed within approved costs and timelines.

Completed Task 7 Activities – The RGHRP administered Phase 4. This included completing contracts with the CDPHE, CWCB, landowners, third party engineers, and contractors; obtaining the necessary environmental permits; managing budgets and reimbursement requests; and completing semi-annual and final reports. Additionally, RGHRP performed Project oversight; making certain project design and implementation were timely and accurate. The RGHRP organized outreach and education efforts and completed site monitoring in accordance the Phase 4 SAPP.

Products – All appropriate contracts, external and internal reports, and on-site Project activities completed within anticipated costs and timelines.

## *2.2 Evaluation of Goal Achievement and Relationship to the State NPS Management Plan*

The actions taken in Phase 4 to reduce sediment input and improve river function are consistent with the recommendations of the 2001 Study and the 2007 Rio Grande Watershed Strategic Plan, and with the Stream Restoration guidelines outlined in the Colorado Non Point Source (CO NPS) Management Plan. The CO NPS Management Plan states that partners should approach Projects at a watershed scale, identify impacted areas and rehabilitation priorities, and define expected condition; this evaluation should be completed by examining the hydraulic processes, stream geomorphology, channel condition, and riparian vegetation of the stream. The 2001 Study and 2007 Strategic Plan were completed in accordance with this recommended approach. The CO NPS Plan highlights the importance of restoring and rehabilitating streams to improve sediment conveyance and water flow, which was one of the primary goals of Phase 4. Finally, the CO NPS Plan describes the importance of a rigorous scientific approach and application of sound scientific principles and engineering techniques in a timely and cost-efficient manner. The RGHRP has been managing riparian stabilization Projects since 2001. Through these efforts, and with the guidance of the Technical Advisory Team, the RGHRP has used sound science to select the most effective and cost efficient treatments for implementation. Long-term monitoring of these sites has allowed the RGHRP to determine which methods are most successful and applicable to future efforts. By combining these “lessons learned” with the best available science, the RGHRP strives to implement the mitigation measures with the highest success at greatest cost efficiency.

Table 2. Project Milestones: 2009 Rio Grande Riparian Stabilization Project - Phase 4																
Task Description	Year 1 - 2011				Year 2 - 2012				Year 3 - 2013				Year 4 - 2014			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
<b>Task 1 - Streambank Stabilization</b>																
Complete Project Design and Planning																
Project Construction																
<b>Task 2 - Bioengineering</b>																
Use Bioengineering techniques during Project construction: including planting willow clumps and reseeding disturbed areas.																
Implement Bioengineering techniques through volunteers events and with crews from the Southwest Conservation Corps.																
<b>Task 3 - Implement Grazing BMPs</b>																
Take necessary measures to promote improved grazing and recreation management in the riparian areas.																
<b>Task 4 - Site Evaluation and Monitoring</b>																
Monitor site before, during, and after construction and onsite mitigation measures.																
<b>Task 5 - Outreach and Education</b>																
Develop visual aids. Give presentations to local stakeholder and community groups. Submit status updates to newspapers and radio stations.																
<b>Task 6 - Establish Technical Team</b>																
Organize Technical Team; Visit sites before site design and after construction.																
<b>Task 7 - Project Administration</b>																
Approval of PIP by CDPHE and EPA																
Execute EPA 319 Contract with CDPHE																
Execute CWCBC Contract																
Maintain Financial Records; submit reimbursement reports.																
Execute Agreements with Project Landowners																
Execute Contract with 3rd Party Engineer, Riverbend Engineering																
Obtain USACE 404 Permits																
Obtain Cultural Clearance Surveys																
Select and Execute Contract with Contractor																
Oversee Project Construction and Monitoring																
Phase 4 Final Reporting																

### **Section 3.0 Best Management Practices Developed and/or Revised**

Streambank Stabilization was completed on 1.75 miles of riparian areas on 5 privately owned sites. The methods utilized included sloping and shaping banks, building floodplain benches, reconfiguring the channel to move the thalweg away from the bank, and installing rock barbs and root wads to move water away from and stabilize the streambanks. Based on erosion rates calculated in the 2001 Study, the estimated reduction in sediment loading from these efforts is 16,120 cubic feet per year.

Bioengineering techniques were implemented on 11 acres of riparian areas in order to further stabilize the streambanks and improve riparian habitat. Techniques used in the riparian areas included stockpiling and spreading topsoil, willow clump plantings, and grass and forb seeding through hydromulching. The decision to stockpile and spread topsoil was derived from a lesson learned in Phase 3. This action greatly increased organic matter and willow propagules. Additionally, the Technical Advisory Team recommended hydroseeding to further increase organic matter and seed coverage. Upland areas disturbed during onsite activities were reseeded with appropriate species by drill seeding. Additional upland areas were treated for a severe Russian knapweed infestation. As such, a total of 80 upland areas were reseeded.

## Section 4.0 Monitoring Results

In accordance with the Phase 4 SAPP, monitoring includes channel cross section transects, photo points, Stream Visual Assessment Protocol, and Grazing BMP compliance. The following tables and photos show the improvements in streambank stability and riparian condition as a result of Phase 4 activities.

Site 1 (Outcalt): Construction Fall 2014

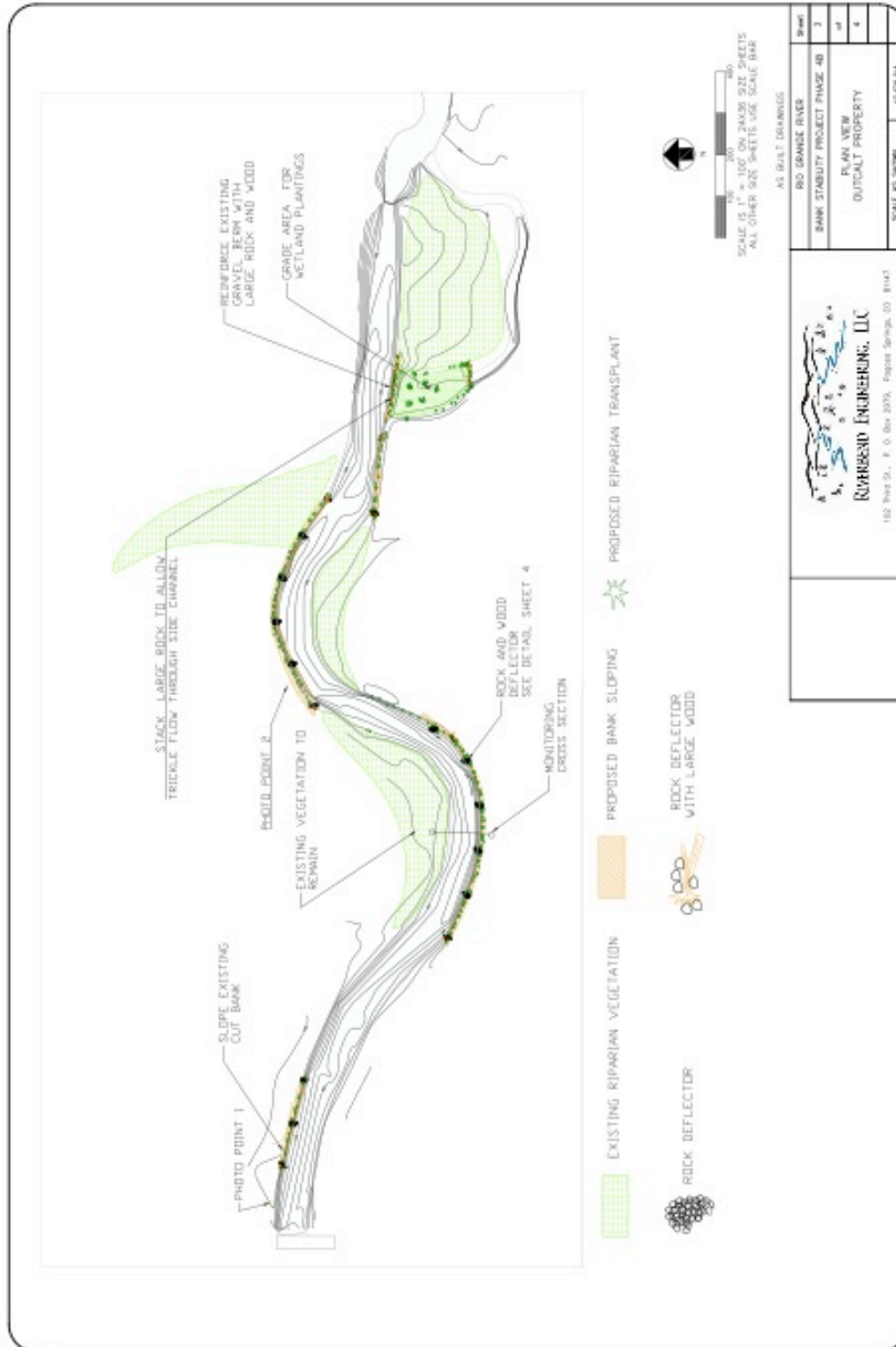


Figure 9. Site 1 Design, Cross Section Location, and Photopoint Locations.





Before - October 2014



After - December 2014

Figure 10. Site 1 (Upper) Photos Before and After Construction.



Before - October 2014



After - December 2014

Figure 11. Site 1 (Lower) Photos Before and After Construction.

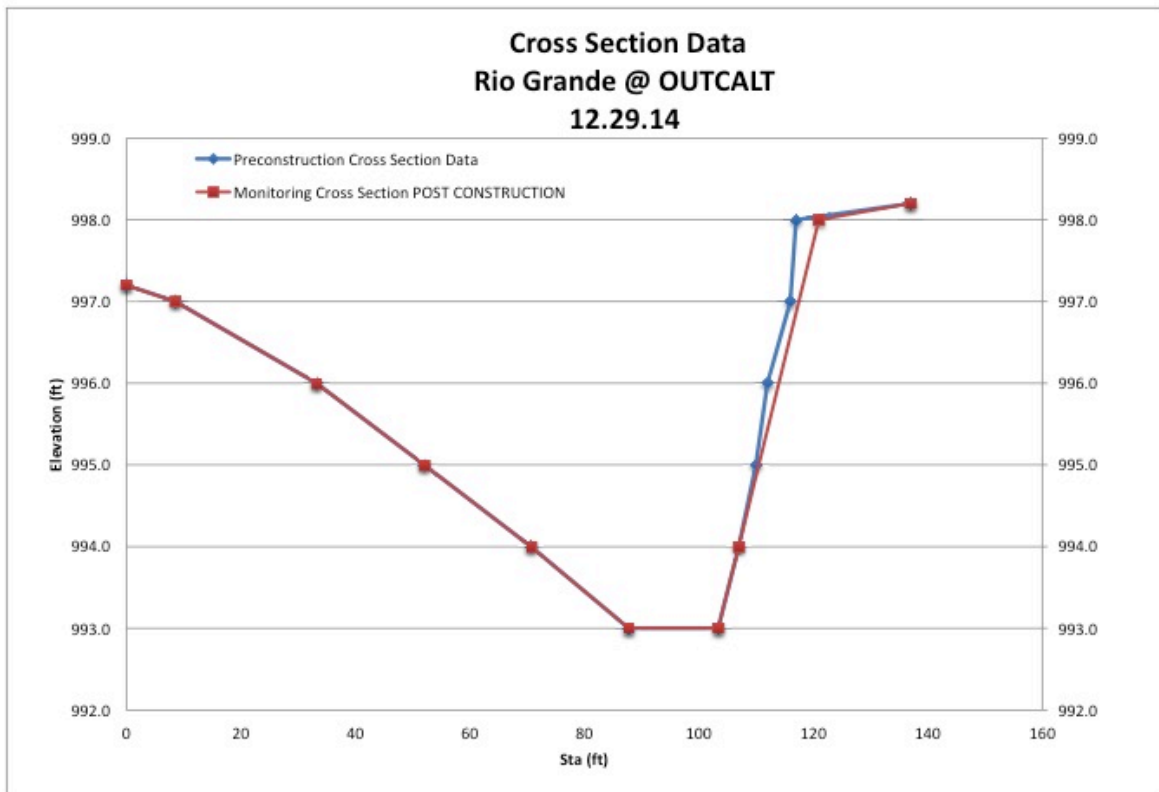


Figure 12. Site 1 Cross Section Data Before and After Construction.

Owner's Name: Outcalt  
Stream Name: Rio Grande  
Reach Location: D7 \*

Table 3. Site 1 Stream Visual Assessment Scores		
Assessment Category	Preconstruction October-14	2014 Monitoring December-14
Channel Condition	3	9
Hydrologic Alteration	5	7
Riparian Zone	2	7
Bank Stability	2	7
Water Appearance	5	6
Nutrient Enrichment	8	8
Barriers to Fish Movement	10	10
Instream Fish Cover	4	7
Pools	3	6
Invertebrate Habitat	5	9
Canopy Cover	3	4
Manure Presence	N/A	N/A
Salinity	N/A	N/A
Riffle Embeddedness	4	4
Macroinvertebrates Observed	N/A	N/A
<b>Overall Score</b>	<b>4.50</b>	<b>7.00</b>

< 6.0 Poor  
6.1-7.4 Fair  
7.5-8.9 Good  
> 9.0 Excellent

\* As designated in the 2001 Study

Site 2 (Chefas): Construction in Fall 2012.

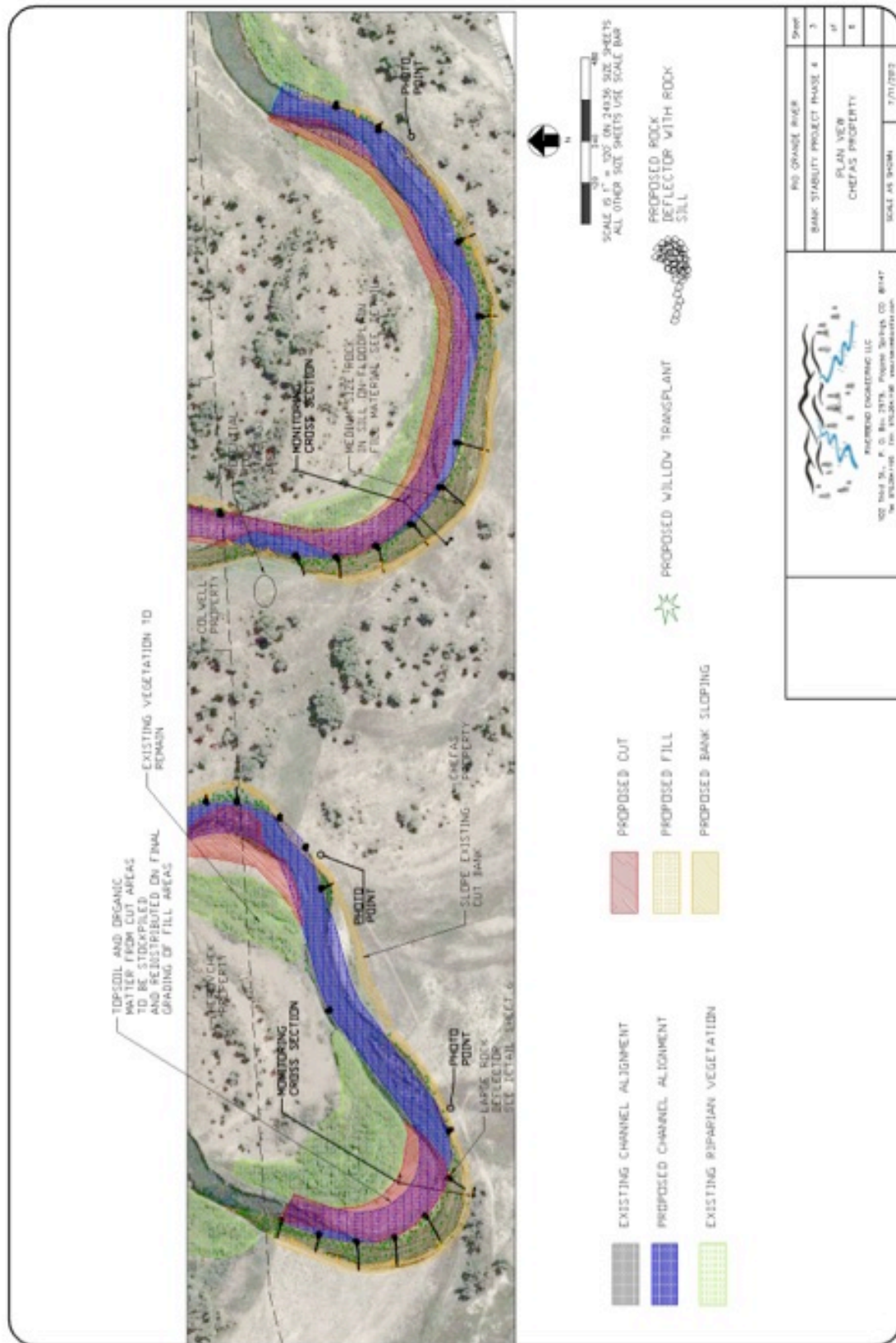


Figure 13. Site 2 Design (Including Site 5), Cross Section Location, and Photopoint Locations.





Before - October 2012



After - October 2014

Figure 14. Site 2 (Upper) Photos Before and After Construction.



Before - October 2012



After - October 2014

Figure 15. Site 2 (Lower) Photos Before and After Construction.





Figure 16. Site 2 Cross Section Data Before and After Construction.

Owner's Name: Chefas  
Stream Name: Rio Grande  
Reach Location: E5 \*

Table 4. Site 2 Stream Visual Assessment Scores		
Assessment Category	Preconstruction August-12	2014 Monitoring August-14
Channel Condition	1	8
Hydrologic Alteration	1	7
Riparian Zone	3	8
Bank Stability	1	9
Water Appearance	6	8
Nutrient Enrichment	7	8
Barriers to Fish Movement	10	10
Instream Fish Cover	3	5
Pools	7	2
Invertebrate Habitat	3	6
Canopy Cover	1	3
Manure Presence	N/A	N/A
Salinity	N/A	N/A
Riffle Embeddedness	3	4
Macroinvertebrates Observed	N/A	N/A
<b>Overall Score</b>	<b>3.83</b>	<b>6.50</b>

< 6.0 Poor  
6.1-7.4 Fair  
7.5-8.9 Good  
> 9.0 Excellent

\* As designated in the 2001 Study

Site 3 (Hrehovcsik): Construction in Fall 2012.



Figure 17. Site 3 Design, Cross Section Location, and Photopoint Location.



Before - October 2012



After - August 2013

Figure 18. Site 3 Photos Before and After Construction.



Figure 19. Site 3 Cross Section Data Before/After Construction.

Owner's Name: Hrehovcsik  
Stream Name: Rio Grande  
Reach Location: E5 \*

Table 5. Site 3 Stream Visual Assessment Scores		
Assessment Category	Preconstruction August-12	2014 Monitoring August-14
Channel Condition	1	8
Hydrologic Alteration	1	7
Riparian Zone	3	8
Bank Stability	1	9
Water Appearance	7	8
Nutrient Enrichment	7	8
Barriers to Fish Movement	10	10
Instream Fish Cover	3	5
Pools	6	3
Invertebrate Habitat	3	6
Canopy Cover	1	1
Manure Presence	N/A	N/A
Salinity	N/A	N/A
Riffle Embeddedness	3	4
Macroinvertebrates Observed	N/A	N/A
<b>Overall Score</b>	3.83	6.42

< 6.0 Poor  
6.1-7.4 Fair  
7.5-8.9 Good  
> 9.0 Excellent

\* As designated in the 2001 Study



Site 4 (Colwell): Construction in Fall 2012.

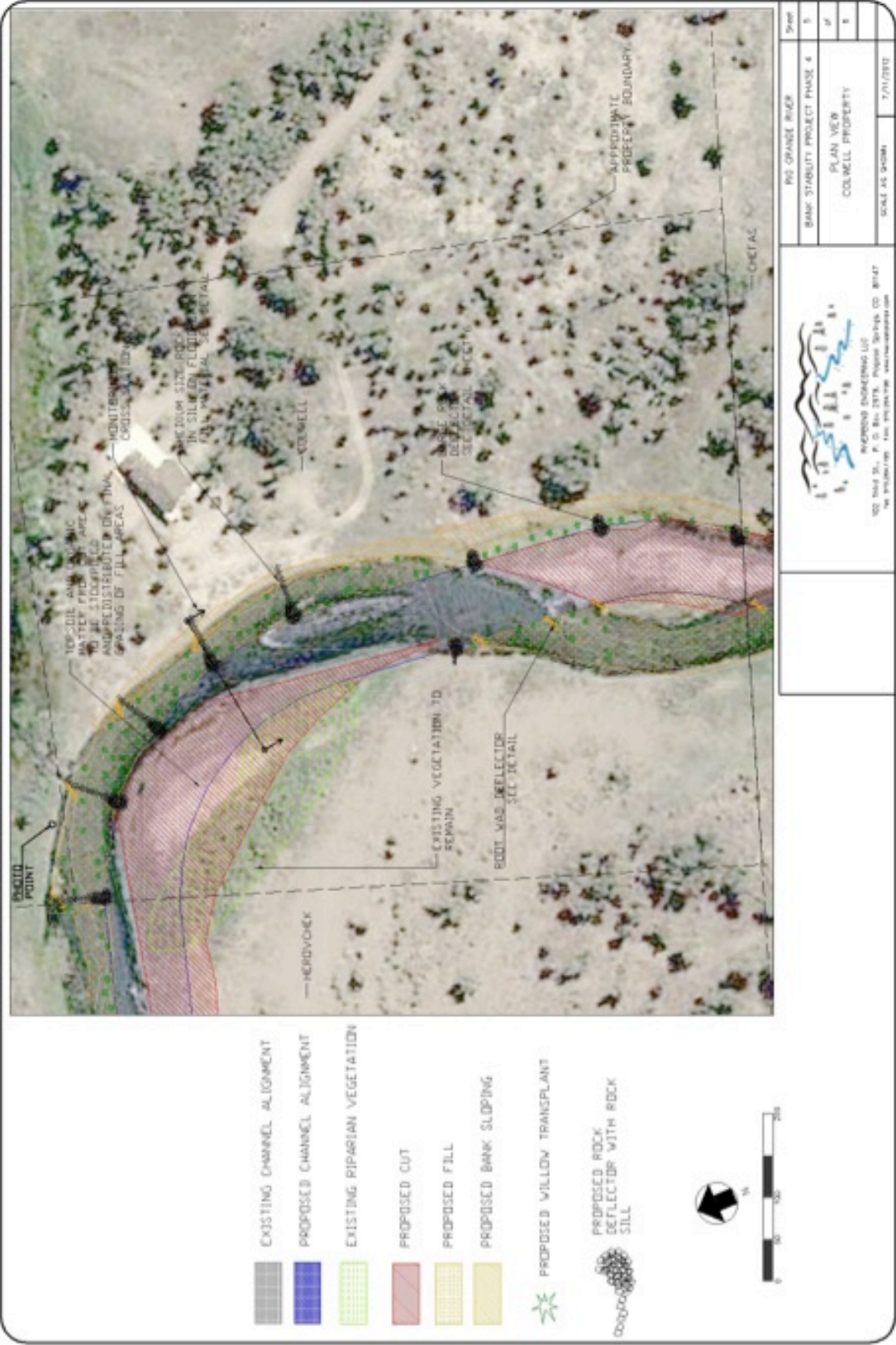


Figure 20. Site 4 Design, Cross Section Location, and Photopoint Location.



Before - October 2012



After - August 2013

Figure 21. Site 4 Photos Before and After Construction.

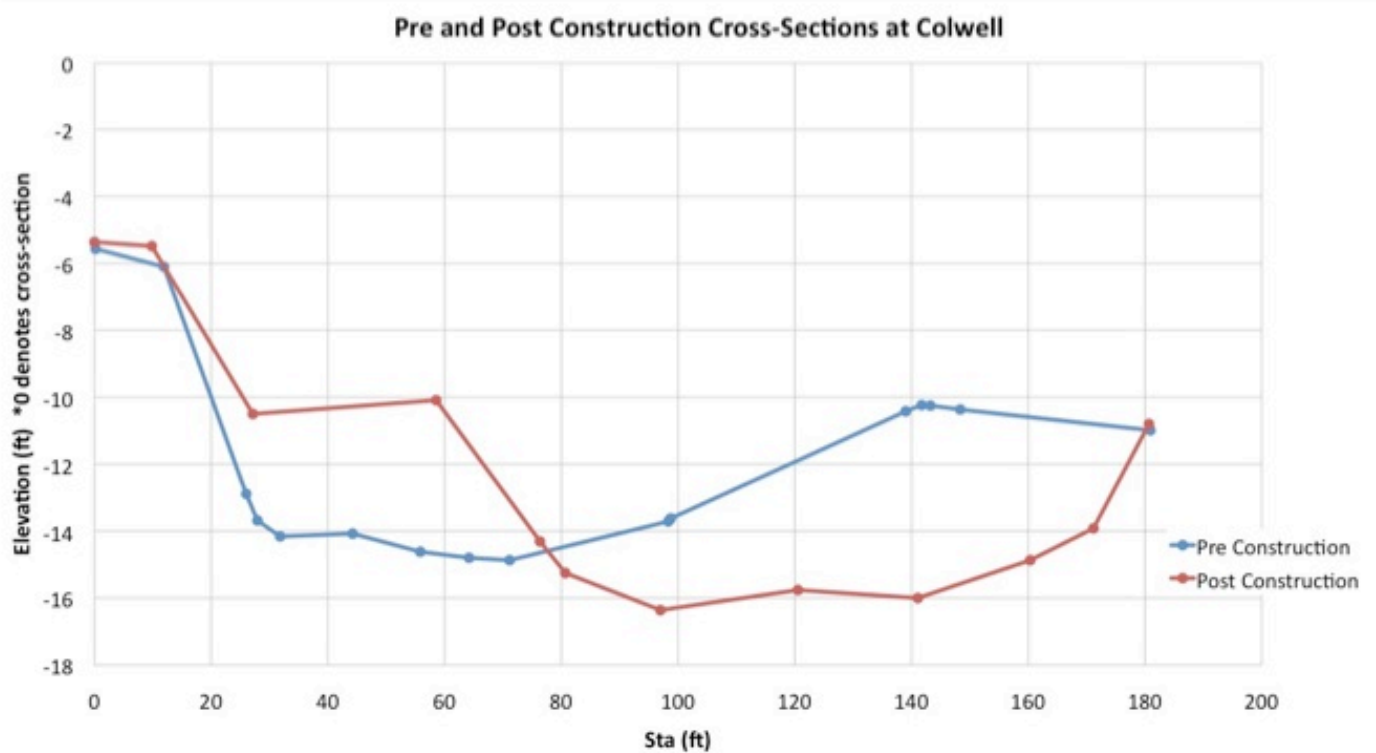


Figure 22. Site 4 Cross Section Data Before/After Construction.

Owner's Name: Colwell  
Stream Name: Rio Grande  
Reach Location: E5 \*

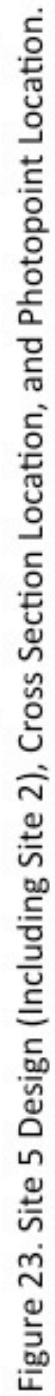
Table 6. Site 4 Stream Visual Assessment Scores		
Assessment Category	Preconstruction August-12	2014 Monitoring August-14
Channel Condition	1	8
Hydrologic Alteration	1	7
Riparian Zone	3	8
Bank Stability	1	9
Water Appearance	7	8
Nutrient Enrichment	7	8
Barriers to Fish Movement	10	10
Instream Fish Cover	3	5
Pools	5	3
Invertebrate Habitat	3	6
Canopy Cover	1	1
Manure Presence	N/A	N/A
Salinity	N/A	N/A
Riffle Embedddness	3	4
Macroinvertebrates Observed	N/A	N/A
<b>Overall Score</b>	3.75	6.42

< 6.0 Poor  
6.1-7.4 Fair  
7.5-8.9 Good  
> 9.0 Excellent

\* As designated in the 2001 Study



28





Before - October 2012



After - October 2014

Figure 24. Site 5 Photos Before and After Construction.

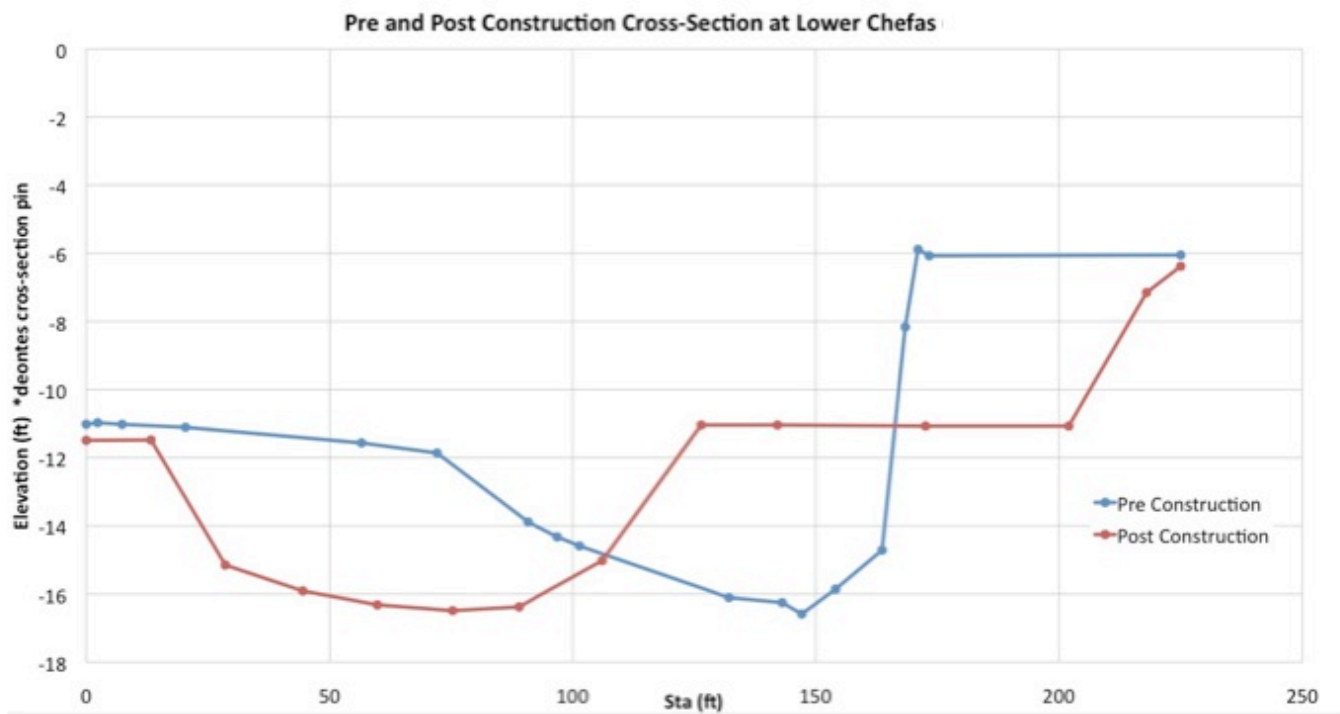


Figure 25. Site 5 Cross Section Data Before/After Construction.



Owner's Name: Chefas  
Stream Name: Rio Grande  
Reach Location: F1 \*

Table 7. Site 5 Stream Visual Assessment Scores		
Assessment Category	Preconstruction August-12	2014 Monitoring August-14
Channel Condition	1	8
Hydrologic Alteration	1	7
Riparian Zone	3	8
Bank Stability	1	9
Water Appearance	7	8
Nutrient Enrichment	7	8
Barriers to Fish Movement	10	10
Instream Fish Cover	3	5
Pools	6	3
Invertebrate Habitat	3	6
Canopy Cover	1	1
Manure Presence	N/A	N/A
Salinity	N/A	N/A
Riffle Embeddness	3	4
Macroinvertebrates Observed	N/A	N/A
<b>Overall Score</b>	<b>3.83</b>	<b>6.42</b>

< 6.0 Poor  
6.1-7.4 Fair  
7.5-8.9 Good  
> 9.0 Excellent

\* As designated in the 2001 Study

Table 8. Phase 4 Grazing BMP Monitoring - August/December 2014		
Site	Implementing Grazing BMPs	Comments
1 - Outcalt	Yes	<i>Cattle are grazed on the property. Fencing was completed to protect riparian areas from overgrazing.</i>
2 - Chefas	N/A	<i>Livestock are not currently grazed on the property. However, fencing was completed to protect riparian areas from any future grazing and from public users.</i>
3 - Hrehovcsik	N/A	<i>Livestock are not grazed on the property.</i>
4 - Colwell	N/A	<i>Livestock are not grazed on the property.</i>
5 - Chefas	N/A	<i>See 2.</i>

#### *4.1 TMDL Implementation Effectiveness*

At the Project inception, a TMDL was in place for aquatic life (provisional) in this reach. The TMDL has since been removed. The efforts of the Project improved aquatic habitat for fish and macroinvertebrates. The in-stream rock barbs and root wads provide cover and resting locations, while revegetation of woody riparian species over time will provide shading and reduced water temperature. Additionally, conditions are improved by reduced turbidity and increased water quality as a result of lower sediment erosion.

#### *4.2 BMP Effectiveness Evaluations*

- Streambank stabilization: The methods utilized have proven effective in meeting the goals of reducing sediment input. Bank shaping and rock barb installation has stopped excessive erosion. Cross section monitoring and photo points show the banks are stable.
- Bioengineering: The methods utilized have been successful in revegetating restoration sites. Photopoint and SVAP monitoring has shown that growth on all sites has been good.
- Grazing Management: Livestock grazing occurs on Site 1; Project areas are protected from overgrazing with riparian fencing. The other landowners do not graze livestock on their property; this has been verified with grazing BMP monitoring.

#### *4.3 Surface Water Improvements*

Physical and Habitat: Phase 4 resulted in significant reductions in sediment input in the Rio Grande. The Project sites are located in sub reaches D7, E5, and F1, as defined by the 2001 Study. The "erosion potential index" developed in the 2001 Study for the subreaches can be multiplied by the feet of streambank affected at each project site to calculate the average annual volume of sediment deposited. The Project stabilized the streambanks and dramatically slowed erosion. The estimated reduction in sediment input is 16,120 cubic feet per year. This improves water quality, aquatic habitat, and water conveyance. The slowed erosion has been documented with monitoring cross sections, which document the channel profile. Continued monitoring will document the channel profile, streambank stability, and erosion over time.

#### *4.4 Quality Assurance Reporting*

The RGHRP is following the approved SAPP, as evidenced by the included data and photos. Project sponsors can be assured these activities will continue as the RGHRP has partnered with the Colorado Measurable Results Program (MRP) to continue to monitor projects long-term.

#### *4.5 Results of BMP Operation and Maintenance Reviews*

Through monitoring and site visits, the RGHRP has reviewed the implemented BMPs and recorded the following observations:

- Bank shaping and channel configuration are stable, no movement or sagging has occurred.
- Rock barbs and root wads are in good, stable condition; limited rock movement occurred and was addressed.
- Waterline vegetation, including willows and shrubs, has experienced good growth; volunteer vegetation has colonized streambanks, further stabilizing the toe of the slope. All willow clumps were planted with roots in the water table and survival is above 90%.

- Upland areas disturbed during construction of Phase 4 sites were seeded with an upland seed mix. The RGHRP will continue to monitor these sites to ensure appropriate revegetation success occurs.

## **Section 5.0 Coordination Efforts**

### *5.1 Coordination From State Agencies*

The following State Agencies participated in Phase 4: The Colorado Non Point Source Program (CO NPS), Colorado Water Conservation Board (CWCB), Colorado State Forest Service (CSFS), and Colorado Parks and Wildlife (CPW). CO NPS provided grant monies for streambank stabilization and technical assistance. CWCB provided matching funds through the Water Supply Reserve Account (WSRA). CWCB personnel also provided technical assistance through the technical advisory team. CSFS provided technical assistance for revegetation efforts and weed management on the sites. CPW gave guidance during technical advisory team meetings.

### *5.2 Other State Environmental Program Coordination*

RGHRP is working with the Colorado Measurable Results Program (MRP), sponsored by, CO NPS, the Colorado Watershed Assembly, and CWCB, to coordinate long-term monitoring of Project sites. RGHRP will continue to monitor sites until 2015 when MRP staff will help RGHRP transition to long-term monitoring.

### *5.3 Federal Coordination*

Two engineers and one biologist from the Natural Resources Conservation Service (NRCS) participated in the technical advisory team. This included site visits, BMP suggestions, and design review.

### *5.4 Accomplishments of Agency Coordination Meetings*

Personnel from agencies participated in meetings of the Technical Advisory Team. The Technical Advisory Team determined the most effective and cost-efficient methods for implementation at each site. The Team will reconvene in 2015 and visit the sites to review the final results of on-site work and develop "lessons learned" for future efforts.

## 5.5 Sources of Funds by Task

Table 9. Final Cash and In-kind Expenditures of the Rio Grande Riparian Stabilization Project - Phase 4 by Source and Task									
Task	Description	Cash Sources of Funds				In-kind Match			
		CO Non Point Source Program (CO NPS)	Colorado Water Conservation Board (CWCB) Water Supply Reserve Account	Landowners	RGHRP	Technical Team	Volunteers	RGHRP	TOTAL
Task 1	Streambank Stabilization	\$ 146,094.55	\$ 144,612.00	\$ 67,932.55	\$ -	\$ -	\$ -	\$ -	\$ 358,639.10
Task 2	Bioengineering	\$ 38,183.14	\$ 3,388.00	\$ 15,000.00	\$ 12,400.00	\$ -	\$ 6,180.00	\$ -	\$ 75,151.14
Task 3	Grazing Management	\$ 2,840.00	\$ -	\$ 8,903.50	\$ -	\$ -	\$ -	\$ -	\$ 11,743.50
Task 4	Monitoring	\$ 10,000.00	\$ -	\$ 2,000.00	\$ -	\$ -	\$ -	\$ -	\$ 12,000.00
Task 5	Outreach and Education	\$ -	\$ -	\$ 500.00	\$ -	\$ -	\$ -	\$ 1,550.00	\$ 2,050.00
Task 6	Technical Team	\$ -	\$ -	\$ -	\$ -	\$ 1,656.80	\$ -	\$ -	\$ 1,656.80
Task 7	Administration	\$ 21,000.00	\$ -	\$ 5,860.00	\$ -	\$ -	\$ -	\$ 10,000.00	\$ 36,860.00
<b>TOTAL</b>		<b>\$ 218,117.69</b>	<b>\$ 148,000.00</b>	<b>\$ 100,196.05</b>	<b>\$ 12,400.00</b>	<b>\$ 1,656.80</b>	<b>\$ 6,180.00</b>	<b>\$ 11,550.00</b>	<b>\$ 498,100.54</b>
<i>Percent of Project Funds</i>		43.8%	29.7%	20.1%	2.5%	0.3%	1.2%	2.3%	



## **Section 6.0 Summary of Public Participation**

The public was involved in Phase 4 through participation by site landowners, educational opportunities including presentations and tours, and volunteer revegetation events. As part of the Outreach and Education Program, visual aids including information about Phase 4 were developed showing the specific sites before, during, and after treatments. Presentations about Phase 4 were made at the Rio Grande Inter-basin Roundtable; Quarterly Board Meetings of the Rio Grande Water Conservation District; Board Meetings of the San Luis Valley Water Conservancy District; Local schools and civic groups; visiting college classes; and public meetings. Interviews and status reports were given on local radio stations. Newspaper articles about the project were printed in the Valley Courier and Pueblo Chieftain. The RGHRP organized site tours to demonstrate the applied techniques. The presentations and tours communicated the importance of water quality, riparian health, and non point source programs. Finally, members of the public participated in two volunteer events.

## **Section 7.0 Aspects of the Project That Did Not Work Well**

Monitoring showed an area of scour within Site 2 approximately one year after project completion. The Project engineer, contractor, and RGHRP reviewed the problem and determined a rock barb was installed such that it pushed the flow upstream, forming an erosive eddy. The contractor hauled additional rock and rebuilt the poorly functioning barb, adding more rock to the footer and toe of the slope. The fix appears to be holding and will be monitored annually.

## **Section 8.0 Future Activity Recommendations**

The RGHRP is continuing to implement the recommendations of the 2001 Study, 2007 Watershed Strategic Plan, and the CO NPS Management Plan by administering additional streambank stabilization and riparian restoration efforts. The “lessons learned” in Phase 4 and other RGHRP Projects include:

- Determine Project areas by selecting highest priority reaches identified in guiding studies and reports.
- Continue to utilize the Technical Advisory Team to develop and review the designs to ensure methods have the greatest potential for success and are cost effective.
- Hire contractors with experience in river restoration and streambank stabilization projects; ensure they understand the techniques included in the design and have engineers supervise the initial technique implementation to provide needed guidance and training.
- Provide daily project management; ensure Project representatives are available during business hours and visit the site daily to observe progress and address concerns.
- Purchase a set number of rocks individually in needed sizes, rather than purchasing cubic yards or tons; this provides easier verification of accurate rock delivery and installation.
- Stockpile topsoil when moving earth and spread on finished streambanks; do not seed directly on subsoil as revegetation will be slow due to low organic matter.
- Plant willow clumps into the water table. Trim willows after planting so the majority of energy is sent to roots rather than shoots and leaves.
- Seed in periods of adequate moisture and water seeded areas with pumps if needed (an augmentation plan is required).
- When performing annual monitoring, ensure permanent markers are present each year and replace if necessary using well-documented location information.
- Continue to organize tours and volunteer events to provide opportunities for community involvement and ownership in Projects.
- Track all project timelines and complete needed reports in advance of deadlines.



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