SECTION 319 NONPOINT SOURCE POLLUTION CONTROL PROGRAM

WATERSHED PROJECT FINAL REPORT

Lefthand OHV Area Restoration Project
Phase II

By
Colleen Williams
James Creek Watershed Initiative

October 18, 2011

This project was conducted in cooperation with the State of Colorado and the United States Environmental Protection Agency, Region 8.

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ACKNOWLEDGMENTS

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Restoration Team

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319 Grant Partners

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Wildlands Restoration Volunteers
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James Creek Watershed Initiative
Lefthand Water District
Lefthand Watershed Oversight Group

Project Funders

State of Colorado 319 Non Point Source Grant
James Creek Watershed Initiative

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EXECUTIVE SUMMARY

PROJECT TITLE: Lefthand OHV Area Restoration Project: Phase II

PROJECT START DATE: February 1, 2008
PROJECT COMPLETION DATE: September 30, 2011

FUNDING:	TOTAL BUDGET	$ 250,000.00
	TOTAL EPA GRANT	$ 150,000.00
	TOTAL EXPENDITURES OF EPA FUNDS	$ 149,981.48
	TOTAL SECTION 319 MATCH ACCRUED	$ 135,207.30
	FEDERAL AGENCY INKIND MATCH	$ 103,096.14
	BUDGET REVISIONS	$ 0
	TOTAL EXPENDITURES	$ 388,284.92

SUMMARY ACCOMPLISHMENTS

The Lefthand OHV Area Restoration Project Phase 2 was a collaborative effort among partners, stakeholders, and agencies to implement remediation actions to improve the water quality of Lefthand Creek. During Phase 2 (February 1, 2009 – September 30, 2011), project partners worked together with the Boulder Ranger District implementing on-the-ground restoration activities. Phase 2 restoration projects involved over 389 volunteers contributing 4,370 hours, construction of 3,262 feet of post and cable fencing, installed 12 rolling dips, installed 350 feet of erosion control matting, restored 4,300 feet of stream, planted 3,055 shrubs, obliteration of 15,243 feet of roadway, and the restoration of 7.5 acres. The completed restoration project reduced the amount of sediment entering Lefthand Creek from the project area by approximately 2,534 tons over the 3 year project period or over 844 tons annually.

Project partners participated on the Monitoring Team and developed a Sampling and Analysis Plan to monitor water quality improvements in Lefthand Creek from the implementation of restoration activities. Baseline water quality data was generated with the use of in-stream turbidimeters to continuously monitor sediment loading from the project site.

I. INTRODUCTION

The Lefthand OHV Area Restoration Project focuses on the restoration of forest lands that are contributing sediment loads into Lefthand Creek. Lefthand Creek is a source of drinking water for the Left Hand Water District. Funded by the State of Colorado's 319 Non-point Source Grant Program, this project engages stakeholders and partners in the reclamation of the Lefthand Off Highway Vehicle (OHV) Area (Fig. 1). The overall goal of this project is to reduce the amount of sediment loading sites into Lefthand Creek from the Lefthand OHV Area by 75%. The long-term goal is to improve the water quality of Lefthand Creek for drinking water and aquatic life.

The Restoration Project is a multi-phase project with this report covering Phase Two: February 2009 to September 2011. During Phase One, 25% of the Best Management Practices identified in the Restoration Plan were implemented. Phase Two resulted in 70% of the BMPs implemented and a completion of the Restoration Plan. A small area of the project site was not accessible, therefore 5% of the project BMPs were not completed.

A. Watershed Location

The Lefthand Creek Watershed lies in north central Colorado on the east slope of the Front Range of the Rocky Mountains. It is part of the St. Vrain Creek basin (HUC 10190005), tributary to the South Platte River. The watershed comprises about 12,000 acres and is approximately 10 air miles northwest of the city of Boulder. The Lefthand OHV Area is located on the north-east portion of the U.S. Forest Service Boulder Ranger District on the east side of the Continental Divide in Boulder County, Colorado in Township 2 N, R 71 W, Sections 15, 16, 17, 20, 21, 22, 27, 28, and 29.

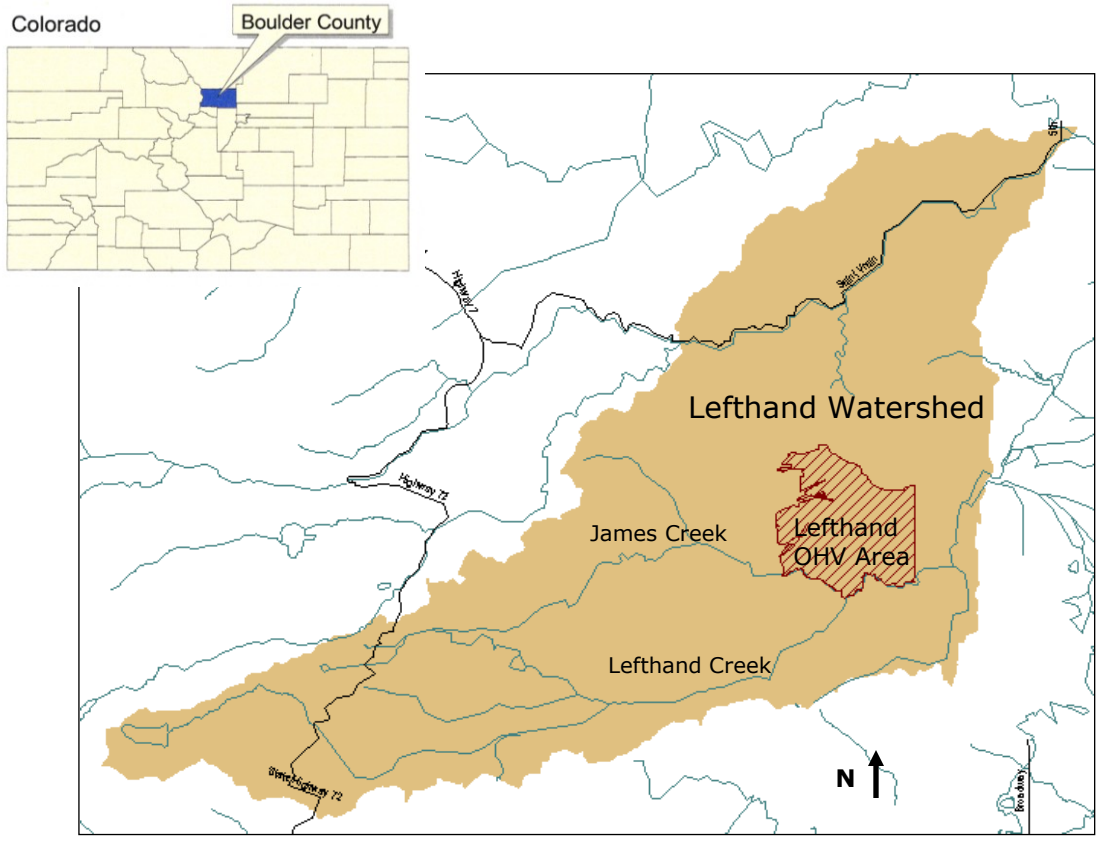

Figure 1. Lefthand Creek watershed and OHV area location map

B. Identify Waterbody

Lefthand Creek originates in glacial and snow melt waters in the Indian Peaks Wilderness area near the Continental Divide, approximately 5 km west of Highway 72 and the town of Ward, Colorado. Lefthand Creek, James Creek, and Little James Creek are the primary streams in the watershed. These three streams are fed by numerous intermittent tributary channels. The streams drain approximately 54,400 acres of land area, ranging in elevation from nearly 4,300 m at the Continental Divide to about 1,500 m on the eastern plains. Lefthand Creek is a second-order headwater mountain stream.

Average Lefthand Creek stream flows from 1929 to 1980, recorded at a United States Geological Survey (USGS) staff gage at 40°07'32" north latitude and 105°18'12" west longitude (USGS, 2004). Peak flows occur in June, corresponding to snowmelt in the high-elevation peaks at the watershed headwaters at the Continental Divide. Annual stream flows for Lefthand Creek averaged approximately 985 Ls-1, varying by about 24% between the 11 years for which complete data exists. The basin discharges an average of about 36,000,000 m3 annually, but in wet years such as 1995 it may discharge nearly 50,000,000 m3.

C. Land Ownership and Use

Ownership of the land in the watershed is a combination of U. S. Forest Service (70%), private owners (22%), agricultural 1%, County 2%, State (less than 1%), unknown (4%). The densest concentration of residences in the upper watershed are in the towns of Jamestown, Ward, and the Bar-K subdivision located along the north central boundary of the watershed. The remainder of the upper watershed is sparsely populated with scattered residences.

Ownership of land within the Lefthand OHV Area Restoration Project Area includes both public lands managed by the U.S. Forest Service Boulder Ranger District and private land tracts (Fig. 2). All restoration activities implemented during this project were done on the public lands identified within the “fee area” on the Base Map. This designated fee area is the area that is open for public use as indicated in the Lefthand OHV Area Travel Management Plan. This map also identifies the main water bodies and road systems within the project area.

The primary uses of land within the watershed presently include: municipal water supply for the Lefthand Water District serving Niwot, the City of Boulder, and the Town of Jamestown; residential, dispersed recreation (motorized, hiking, fishing, mountain biking), wildlife habitat, and aquatic habitat.

The public land within the Lefthand OHV Area is designated multiple use as described in the 1997 Arapaho and Roosevelt National Forests and Pawnee National Grasslands Land and Resource Management Plan or Forest Plan. Multiple use is a management framework that the Forest Service uses to manage the land and all of its resources. Multiple use management implies “the greatest good for the greatest number and the greatest good for the resources managed.” The Lefthand OHV Area is currently used for motorized recreation, hiking, equestrians, mountain biking, and camping. The upper part of the Lefthand OHV Area around Fairview Peak is closed to public use due to the impact from the Overland Fire of October 2003 and the lack of legal access over private property.

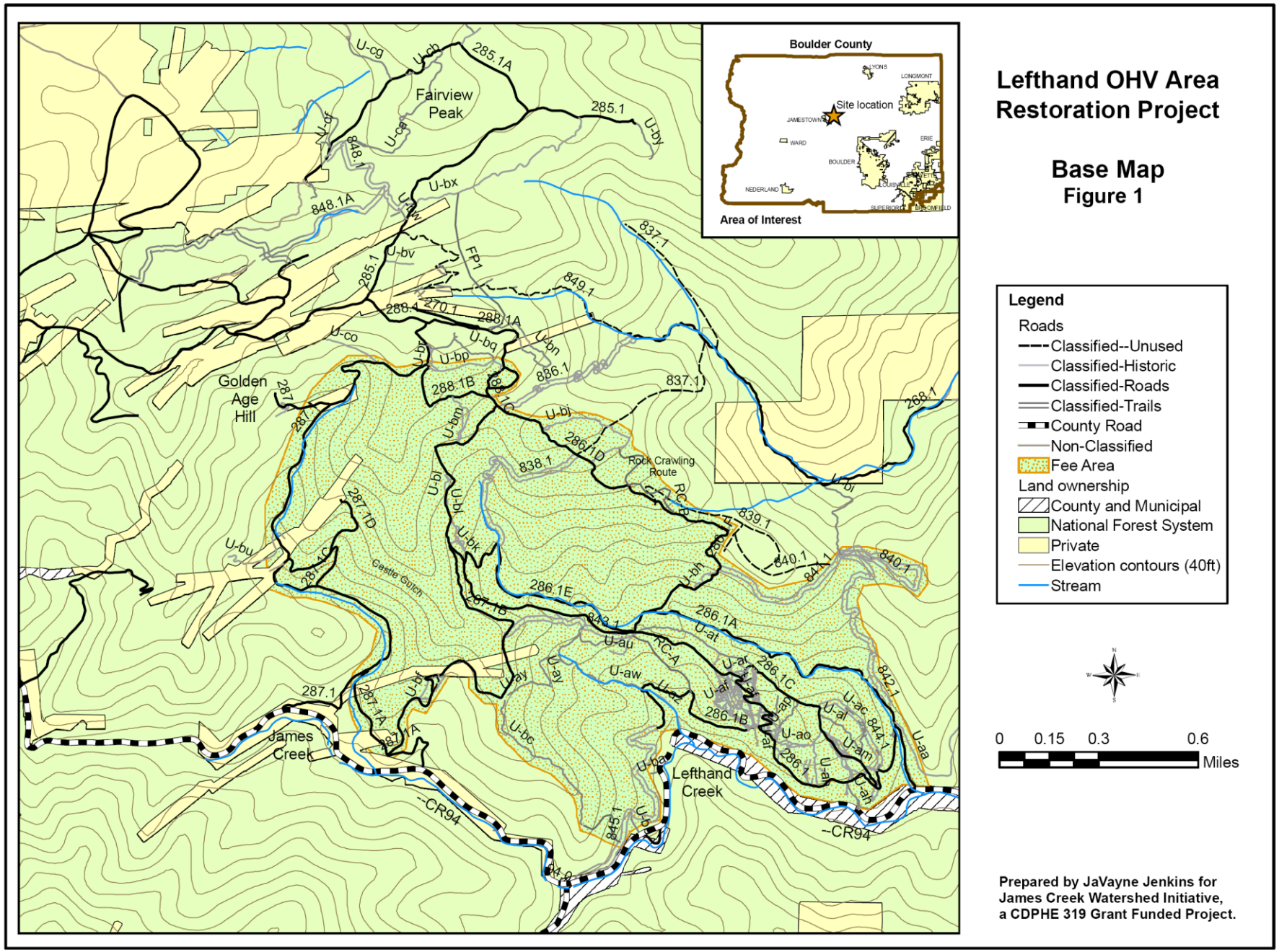

Figure 2. Lefthand OHV Area Restoration Project base map

D. Water Quality Priority

Lefthand Creek is on the Priority List #1 in the Colorado Unified Watershed Assessment and is identified under the State's Water Body Identification as COSPSV04 with beneficial uses of: Cold Water Aquatic Life - Class 1, Recreation Class 1 - Primary Contact, Domestic Water Supply, and Agriculture. Under Tier 2, Antidegradation Policy of the Clean Water Act the waters are protected as "High Quality" waters. The Colorado Water Quality Control Division resource prioritization indicates a final priority of "High" for these segments. The project area includes the upland areas that drain into both James and Lefthand Creek near their confluence.

E. State of Colorado's NPS Management Program

The Lefthand OHV Area Restoration Project is consistent with the overall State Nonpoint Source Program goal *"to strive to restore to full use those waters, both surface and ground water, impaired by nonpoint sources, and to prevent future impairments to Colorado's waters, by using an effective, efficient and open process that fully involves the public and brings together the necessary regulatory and non-regulatory authorities, agencies and programs."*

Specifically, this project addresses the goals of the 2005-2010 NPS Action Plan by:

- Focusing on remediation actions and water quality improvements in the Lefthand Creek watershed (Action 1.2)
- Building long-term partnerships to enhance cooperation between environmental groups and government in restoration of lands (Action 1.4)
- Implementing the Lefthand Watershed plan and on-the-ground water quality restoration and protection measures (Action 4.1)
- Securing maintenance agreement with public land managers for on the ground restoration activities and assure long-term operation and maintenance of NPS funded best management practices and continuance of protection accomplished by the work (Action 4.2)
- Developing evaluation tools for the remediation/restoration program and the appropriate tools for developing water quality improvements (Action 5.1)
- Developing a standard sample and analysis plan (Action 5.3)

This project is located within the delineated Source Water Assessment and Protection (SWAP) Area identified in the Left Hand Water District SWAP report. The SWAP report identified forest lands as a potential source of contaminants to Lefthand Creek, a drinking water source for the Left Hand Water District. The Left Hand Water District completed their Source Water Protection Plan (SWPP) for their drinking water source in December 2010. The SWPP identifies the Left Hand OHV Area as the main source of sediment loading in the watershed.

The 2010 State of Colorado 303(d) list includes segments of Lefthand Creek watershed as impaired with a medium-high priority ranking. The segment of Lefthand Creek from Highway 72 to its confluence with James Creek is impaired for pH, copper, and zinc and is listed as a medium priority. The segment of Lefthand Creek from the James Creek confluence downstream is impaired for copper and arsenic and is listed as a high priority. The Little James Creek segment, located 5.5 miles upstream of the project area, is listed as impaired for copper and lead with a medium priority. The CDPHE Water Quality Control Division is developing Total Maximum Daily Load (TMDL) guidelines in Lefthand Creek for pH, copper, and zinc. The impairment listing and development of TMDLs is for the metals problem in the streams and does not address the sediment problem that currently exists.

F. Water Quality Problem

Lefthand Creek is a source of drinking water for the Left Hand Water District and the City of Boulder. The Left Hand Water District (LHWD) serves a population of more than 18,500. In the winter months, Lefthand Creek is the sole supply of water for their customers. The LHWD experiences ongoing problems with sediment deposition at its water intake on Lefthand Creek. This district has recently spent thousands of dollars on efforts to mitigate the impacts of these sediments, and annually expends man and equipment hours removing sediment from intake structures. In 2004 the LHWD installed a turbidity meter at the Haldi water intake in order to monitor increases in sediment loading and prevent uptake of this sediment into the water treatment system.

The Lefthand Watershed Plan, completed in 2005, has identified sediment as a water quality concern and the Lefthand OHV Area as the main sediment loading site in the watershed. Motorized recreation use in this area has dramatically increased in the past several decades because it is easily accessible from Denver and the surrounding Front Range communities. Forest Service budgets and management have not been able to keep pace with this growing trend of use, and as a result, the majority of OHV activity has gone unmanaged. This has led to extreme resource damage and watershed degradation. This problem is documented by the Boulder Ranger District in their 2005 Environmental Assessment (EA) of the Lefthand Canyon OHV Area Travel Management Plan. The EA identifies impacts of concern to include: degradation of riparian and aquatic ecosystems, erosion and compaction of soils, and degradation of watershed health in both James and Lefthand Creeks. The EA also identifies the future direction of management for this area to be “pro-active recreation management while protecting natural resources”.

In the past decade numerous agencies have collected environmental and health data related to the Lefthand Creek watershed. The main focus has been on the impact of metals within the watershed. Although sedimentation has been identified as a water quality problem, there is not much data to show the impact to the creeks from the Lefthand OHV area. From 2007 - 2011 we have been gathering data to document the impact of sediment generated from the project area.

Stormwater events have been photographed over a few years prior to the implementation of this project, documenting massive amounts of muddy water entering Lefthand and James Creeks from the upland Lefthand OHV area. The Forest Service estimates that based on the size of gullies and eroded areas, there has been 18,207 tons of soil loss in the OHV area over the last 10 years or an average of 1,820 tons annually.

Figure 3. A rainstorm event over the Lefthand OHV Area resulting in sediment loading into Lefthand Creek.

Figure 4. Nonpoint source pollution from the Lefthand OHV Area entering Lefthand Creek via a culvert under County Road 94.

II. PROJECT GOALS, OBJECTIVES, AND ACTIVITIES

A. Overall Project Goal

Reduce the amount of sediment loading sites into Lefthand Creek from the Lefthand OHV Area by 75%, thereby improving the water quality of Lefthand Creek for drinking water and aquatic life.

B. Specific Project Goals and Objectives

Goal 1: Provide comprehensive communication and planning toward achieving remediation objectives.

Objective 1: Provide Project Planning, Coordination, and Outreach

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Task 1: In order to facilitate involvement and information sharing, stakeholders will be kept informed of project progress.

Products: Public outreach activities were successful in educating and involving the community and user groups in the restoration projects. These included:

- Monthly reports to stakeholders at the Boulder Ranger District's OHV meetings;
- Presentations to the Jamestown Town Board in May 2010, January 2011, February 2011, and April 2011;
- Quarterly reports to the Lefthand Watershed Oversight Group Board of Directors;
- Project information and volunteer opportunities were posted on the Wildlands Restoration Volunteers website and provided to WRV's volunteers via their email list;
- Project information and volunteer opportunities were posted on the Jamestown community electronic bulletin board and on an information board located at the entrance to the Lefthand OHV Area;
- Presentation of the project at the Colorado Watershed Assembly event in October 2009;
- Articles about the project were included in newsletters of the Lefthand Watershed Oversight Group and Boulder Ranger District;
- Field trip to the project on August 12, 2011 with JCWI and CDPHE.

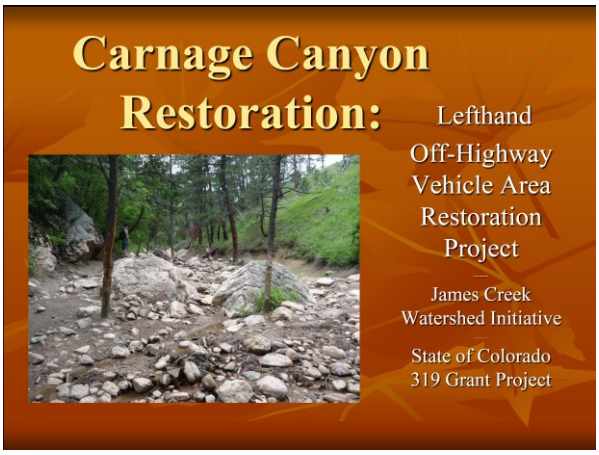

Figure 5. Carnage Canyon Presentation. Project partners, Boulder Ranger District and Walsh Environmental presented information on the Carnage Canyon Restoration Project at the October 2009 Colorado Watershed Assembly in Vail, Colorado.

Task 2: Develop site-specific construction plans and prepare the sites for restoration work. Project partners will assist with developing plans for projects to be implemented during Phase 2 of the restoration project. Site preparation will include: delineate work zone, develop strategy for accessing sites, and preparing staging areas. Volunteers will be recruited and trained by Wildlands Restoration Volunteers to complete the hands-on restoration activities at each site.

Products: The Restoration Team participated in project planning and field trips to the project sites (Fig. 6). Construction design plans were developed, restoration sites were prepared, and a schedule of work was completed prior to project implementation. Project and treatment areas were GPS mapped. Section lines and project areas were staked within the project corridor. Volunteers were recruited and trained prior to the 2009, 2010, and 2011 projects by Wildlands Restoration Volunteers. There were 389 volunteers who contributed 4,370 hours to Phase 2 projects. Tools and supplies were staged at central work zone sites (Fig. 7).

PHOTO: BRIAN RASMUSSSEN

Figure 6. Restoration Team members participated in a field trip to Carnage Canyon project site to develop construction plans.

PHOTO: BRIAN RASMUSSEN

Figure 7. Trailridge Runners 4WD Club volunteers helped with hauling supplies up to the staging sites.

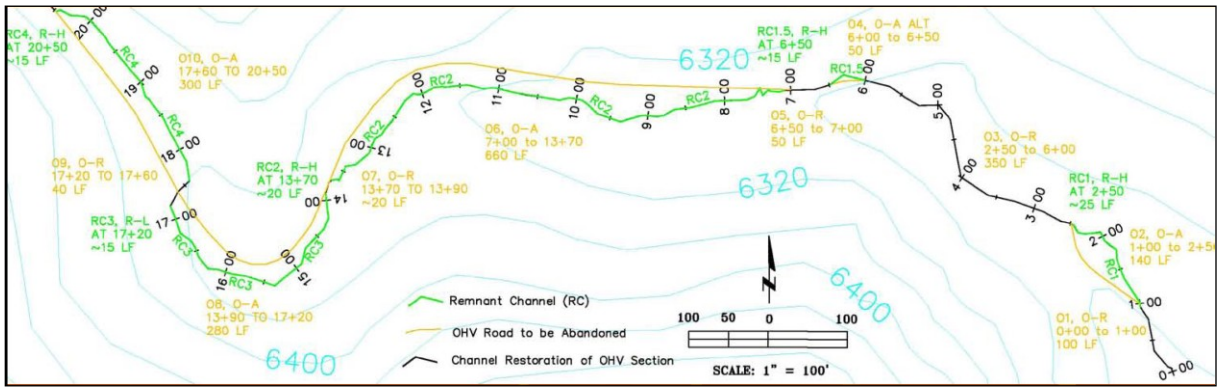

Figure 8. Walsh Environmental Engineers designed a stream restoration plan for the Carnage Canyon corridor.

Goal 2: Reduce sediment loading to waterways from the site.

Objective 2: Implement Phase 2 of the Restoration Plan to mitigate the sources of sediment loading from 25% of the project area, yielding a reduction in loading of an additional 450 tons/year. Practices that will be used to achieve this objective will include road maintenance, obliterating roads, restoring vegetation, and preventing further erosion. All techniques will be selected based on their sustainable long-term operation and maintenance.

Task 3: Mitigate storm water runoff on the current road system within the project area by disconnecting disturbed areas of the road. Water bars will be constructed on the roads to effectively collect and disperse surface water runoff onto vegetative buffer areas and prevent further soil erosion. Other BMPs that may be used include: grading, check dams, outlet protection, and revegetation.

Products: During August 2009, water bars were placed along system routes, road/water crossings were repaired and stabilized using backhoe and boulders, and gullies were filled in. Regular road maintenance on the system routes was implemented to improve "travelability" and reduce resource damage. During the September 2010 Big Mother Hill Restoration Project, 12 water bars were constructed on the roadway to disconnect the disturbed areas of the road and to: 1) collect surface water runoff, 2) trap and settle sediment, 3) promote infiltration, 4) disperse energy, and 5) redirect runoff onto vegetated buffer areas. The implementation of this BMP resulted in a decrease of sediment movement into waterways. All Phase 2 backhoe work was completed by Budhoe Backhoe.

PHOTO: WILDLANDS RESTORATION VOLUNTEERS

Figure 9. System route prior to regular road maintenance and grading by Budhoe Backhoe.

PHOTO: COLLEEN WILLIAMS

Figure 10. Water bars were constructed at locations on the roadway based on elevation and drainage need.

Task 4: Obliterate roads and restore vegetation within 25% of the project area. Revegetation will help to slow the velocity of runoff, filter sediment, and decrease soil erosion. Bioengineering techniques will be incorporated using rock, native seed, erosion control matting, and certified weed-free straw mulching.

Products: Six restoration projects to obliterate roads and restore vegetation were completed between summer 2009 and fall 2011 as illustrated in Table 1 and on map in Fig. 11. The projects resulted in a reduction of soil erosion, improvement of riparian habitat, and a reduction of sediment loading into Lefthand Creek. A photo log of each restoration site and Bioengineering Treatments used is included in the Attachments to this report.

Task 5: Construct a system of post and rail fencing to keep recreational vehicles on the system routes to prevent further erosion and protect project BMPs.

Product: During Phase 2 of the project we constructed 3,262 feet of post and rail fencing to protect restored lands and riparian corridors. Each post hole was drilled with a special auger attachment and steel posts were secured inside the post-holes with concrete. Wire cable obtained from recycled oil/gas well drilling operations was used to connect the posts. The fence is proving to be an effective barrier.

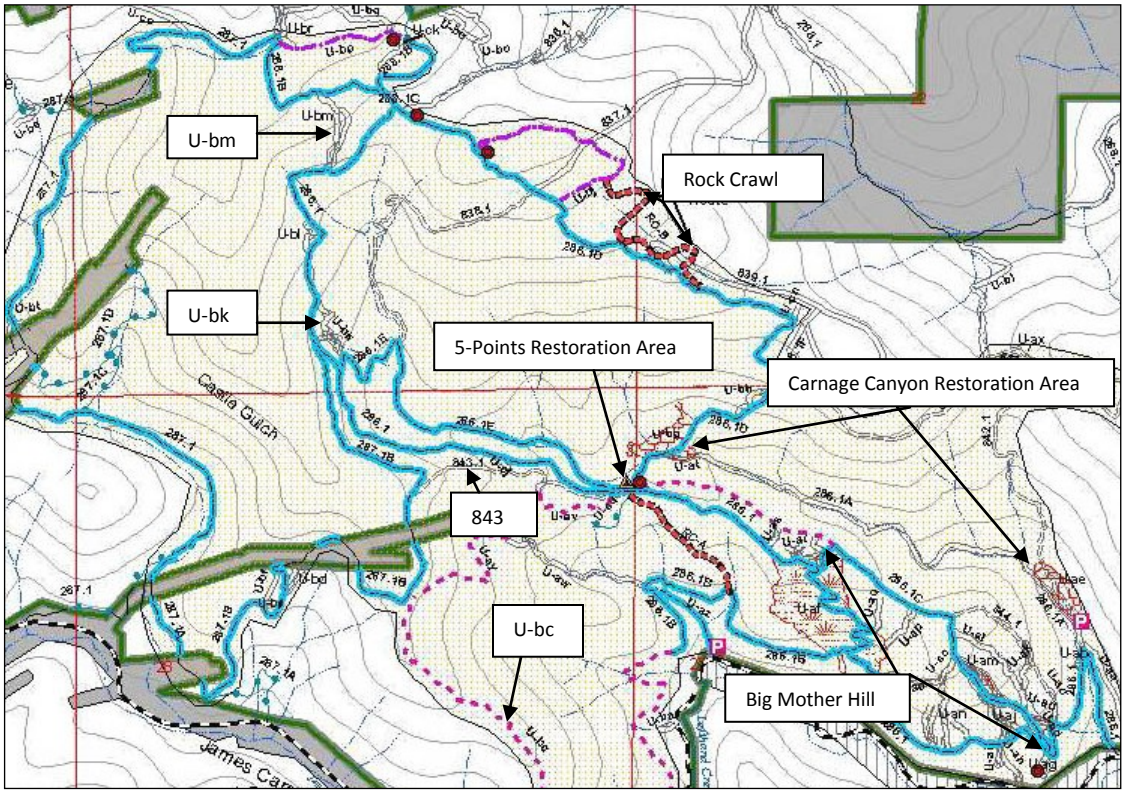

Figure 11. Map of Phase 2 Restoration Sites

Table 1. Restoration Accomplishments

Date	Project Area	Restoration Accomplishments
Summer 2009	5-Points Restoration Project	Project consisted of site grading to mitigate runoff over deep eroded gullies, obliterating and restoring 0.6 acres of roadway with seed and straw mulch, and constructing 1,200 feet of post and cable fencing.
	U-bc Single Track	Project consists of converting a 0.6 mile road into a single track route and installing post and cable fencing to create a trailhead and prevent vehicle usage.
	Rock Crawl	Project consisted of installing 350 feet of post and cable fencing to keep vehicles on designated routes and out of riparian corridor.
Fall 2009	Carnage Canyon Restoration Project	Project consisted of stream channel hydrology, road obliteration and restoration. A stream hydrologic analysis, survey, and stream channel engineering design was completed prior to restoring 4,300 feet of stream. Backhoe operator obliterated 4,900 feet of roadway within the riparian corridor. Volunteers restored vegetation with seed and mulch on 165,000 square feet of riparian corridor and planted 490 native shrubs.
Spring 2010	Carnage Canyon Shrub Planting: 1	Volunteers planted over 1,400 native shrubs at key points along the riparian corridor. The planting of these shrubs will accelerate the re-establishment of native vegetation and provide critical stabilization to vulnerable stretches of the newly created stream bank.
Fall 2010	Big Mother Hill	Project consisted of restoring about 39,300 square feet of eroded steep hillsides. Approximately 2,300 feet of road was obliterated using back hoe equipment to scarify the hillside and install 12 water bars to direct stormwater off the road onto vegetated areas. Eroded areas were reseeded and covered with either erosion control matting or weed free straw by the volunteers. Volunteers installed post and cable fencing over 1,400 feet of roadway to keep OHV's on system routes and off of revegetated areas.
Spring 2011	Carnage Canyon Shrub Planting: 2	Project consisted planting 1,015 native shrubs (700 chokecherry and 315 Oregon grape root) grown from seed collected on-site at the restoration area and grown into 2-year plants. AmeriCorps volunteers also helped with this project.
Fall 2011	U-bk, 843, U-bm	Project consisted of grading and scarifying 2,875 feet of roadway, restoring 96,220 ft^2 of roadway, applying 100 feet of erosion control matting, planting 70 shrubs, and constructing 300 feet of post and cable fencing.

PHOTO: WILDLANDS RESTORATION VOLUNTEERS

Figure 12. Volunteers constructing fencing.

PHOTO: WILDLANDS RESTORATION VOLUNTEERS

Figure 13. Volunteers restoring upland areas with erosion control matting, seed, and straw.

Goal 3: Assess the impacts and reduction of sediment loading from the project site.

Objective 3: Conduct monitoring plans to evaluate success of restoration activities

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Task 6: Implement monitoring plans for both water quality and restoration activities. Monitoring will be done before, during and after project implementation.

Products: A Water Quality Monitoring Team of technical advisors formed during Phase 1 met during Spring 2009 to review the Sample and Analysis Plan. Project partners implemented the water quality monitoring plan for turbidity in Lefthand Creek during late spring and summer months of 2009, 2010, and 2011. Daily rainfall data was collected at 3 local weather stations near the project area. Photographic documentation of each restoration site was completed with a chronology of each project, maps, detailed observations and records of measures performed. Results of monitoring is provided in Section 4: Monitoring Results.

Goal 4: Project management accountability and evaluation

Task 7: Evaluate how well the project goals, objectives and tasks have been met. Restoration Team will help to determine if the restoration measures have achieved the desired results. The Boulder Ranger District will continue with assessment and follow-up mitigation efforts (if needed) after project completion. Project manager will provide semi-annual progress reports, final report, match requirements and reporting, and accurate timely reimbursement requests to the Colorado Department of Public Health & Environment, Water Quality Control Division (CDPHE-WQCD).

Products: The James Creek Watershed Initiative successfully completed all of the Phase 2 projects, objectives, and tasks. The restoration goal of reducing the sediment loading into Lefthand Creek by 460 tons per year was exceeded with 844 tons annually reduced instead over the three year project. The plantings of vegetative cover on the eroded landscape is successfully growing in.

The semi-annual reports and final report was provided to the Colorado Department of Public Health and Environment Water Quality Control Division on time as required. The match requirement for the grant funding was obtained. Project partners will continue to assess the effectiveness of each treatment site and implement future restoration projects in the area as needed and funding is made available.

C. Planned / Actual Milestones, Products, and Completion Dates

Table 2. Project Objectives, Products, and Completion Dates

OBJECTIVES & TASKS	PRODUCTS	COMPLETION DATES
OBJECTIVE #1 Task 1 – Information Sharing	26 verbal progress reports at Boulder Ranger District meetings, LWOG meetings, and Jamestown Town Board meetings; 5 project postings on WRV website and 3 on the Jamestown electronic bulletin board.	September 2011
Task 2 – Coordination / Preparation	Construction plans with BMP's developed for 8 project sites; maps of restoration areas developed; 389 volunteers were recruited and trained.	August 2011
OBJECTIVE #2 Task 3 – Mitigate storm water runoff	Road maintenance over 4.2 miles of forest routes including: grading and rolling dips; 12 water bars were constructed.	September 2010
Task 4 – Obliterate Roads / Restore Vegetation	Realigned 4,300 feet of stream bed; restored 165,000 ft^2 (3.79 acres) of riparian corridor; restored 326,656 ft^2 (7.50 acres) of eroded lands; obliterated 15,243 feet of roadway.	September 2011
Task 5 – Construct Fencing	Constructed 3,262 feet of post and cable fencing.	September 2011
OBJECTIVE #3 Task 6 – Implement Monitoring Plan	4 people participated on the Monitoring Team; water quality monitoring conducted over 3 summers; photos of each restoration site taken before, during, and after restoration.	September 2011
Task 7 – Evaluate Project	Effective restoration strategies, management techniques, and project reporting.	September 2011

D. Evaluation of Goals and Achievements in Relationship to the States NPS Management Plan

This project adheres to the primary goal of Colorado's NPS program by restoring waters that are impaired by nonpoint sources of pollution and preventing future impairments. It uses an effective open process that fully involves the public and brings together the necessary regulatory and non-regulatory authorities, agencies, and programs.

The Lefthand OHV Area Restoration Project restores waters impaired by non-point sources of sediment pollution and prevents future sediment impairment. Specifically, this project addresses the objectives and action items listed in the NPS Management program by:

1) Stakeholder support – The project is sponsored by the James Creek Watershed Initiative, whose organization consists of active and involved concerned citizens who work toward protecting and restoring watersheds. These stakeholders/project partners assisted with developed construction plans, obtained additional funding for restoration projects, and implement the remediation actions. Our group has built long-term partnerships between federal land managers, restoration organizations, public water providers, OHV recreationists, university educators and students, government agencies, and local citizens. We have collaborated, coordinated, and cooperated with these stakeholders for this on-the-ground restoration project.

2) Monitoring and Evaluation – This project developed a strategic approach to monitoring, evaluation, and planning activities.

3) Watershed Plan – This project is included in the watershed plan for the Lefthand Watershed.

4) Restoration – This project implements a watershed plan for restoration activities and incorporates long-term operation and maintenance of the restoration actions to improve water quality.

5) Evaluation and Monitoring for Success – This project collected and evaluated data to document the water quality of Lefthand Creek and the effectiveness of the BMPs implemented through the restoration work.

The James Creek Restoration Project contributed to controlling NPS pollution as part of a watershed-wide approach by working collaboratively with the Lefthand Watershed Oversight Group (LWOG) to take on the bigger picture of addressing water quality issues for water users downstream. Beginning at the headwaters and working in an upstream to downstream approach, the James Creek Watershed Initiative completed the following projects to reduce sediment pollution in the Lefthand Watershed:

- James Creek Restoration Project (2003 – 2006)
- Overland Fire Mulch Project (2005 - 2006)
- Lefthand OHV Area Restoration Project: Phase 1 (2006 - 2008)
- Lefthand OHV Area Restoration Project: Phase 2 (2009 - 2011)

The James Creek Watershed Initiative is also currently working on their first mine land reclamation project on Little James Creek, the Porphyry Waste Rock Restoration Project (2010 – 2012).

III. BEST MANAGEMENT PRACTICES DEVELOPED AND OR REVISED

The main challenge of mitigating the stormwater runoff over forest routes within the project area was to disconnect the disturbed areas of the system road network with water bars in order to disperse sediment onto vegetated buffer areas (Objective 2, Task 3). The location of each water bar was determined by Forest Service hydrologists according to the slope of the road, natural contours, and best area to direct the drainage over vegetated areas. Other road BMPs used to prevent sediment from being delivered from the road system to Lefthand Creek included: grading to re-contour road, culvert placement, and check dams in drainage areas.

The non-system routes were obliterated by scarification with a back hoe and revegetated using native seed and mulch. Erosion control matting was applied to the steepest slopes after seed was applied. Table 3 illustrates the project areas that BMPs were used and measurable results of each project area. Illustrations and details of treatments used are included in the Attachments of this report.

Table 3. Project BMPs with Measurable Results

Route/ Project	Rolling Dips or Water Bars	Grading or scarification	Roads Obliterated (feet)	Erosion Control Matting (feet)	Stream restored	Trees or shrubs planted	Acres Restored (Seed/mulch) (sq.ft.)	Post and Cable Fencing (feet)
5-Points Project		x	2,000 ft. (0.6 acres)				26,136 ft^2	1,200
U-bc Single Track			3,168 ft. (.6 mi) road converted to single track					12
Rock Crawl								350
Carnage Canyon		x	4,900 ft.	130 ft.	4,300 ft.	490	165,000 ft^2	
Carnage Canyon Shrub Planting I						1,400		
Big Mother Hill	12	x	2,300 ft.	120 ft.		80	39,300 ft^2	1,400
Carnage Canyon Shrub Planting 2						1,015		
U-bk,843,U-bm		x	2,875 ft.	100 ft.		70	96,220 ft^2	300
Total number of project BMPs	12	4 sites	15,243 ft.	350 ft.	4,300 ft.	3,055	326,656 ft^2 (7.5 acres)	3,262 ft.

SOURCE: WILDLANDS RESTORATION VOLUNTEERS AND U.S. FOREST SERVICE BOULDER RANGER DISTRICT * 1 acre = 43,560 square feet

Restoration Accomplishments

The goal of Phase 2 of this project was to reduce the amount of sediment loading sites into Lefthand Creek from the Lefthand OHV Area by 75% was accomplished. The goal of reducing sediment loading by 450 tons/year was exceeded, with a reduction of 844 tons/year achieved. It is estimated that the total amount of eroded land that was restored during Phase 2 which covered a 3 year period was 7.5 acres (Table 3). Quantitative estimations of soil loss were made from volumetric calculations. The Water Erosion Prediction Project (WEPP) Model was used to estimate expected annual rates of soil erosion and sedimentation on both undisturbed and roaded hill-slopes within the Lefthand OHV Area. WEPP modeling indicates that hill-slope erosion from undisturbed/forested hill-slopes would likely range from 0-1 tons/acre/year. For hill-slopes with roads, erosion rates increase to 8-15 tons/acre/year (Eric Schroeder, Soil Scientist, Arapaho and Roosevelt National Forest, 2011). Phase 2 resulted in a reduction of 2,534 tons over the 3-year project. The soil loss rates for each of the Phase 2 project sites is included in Table 4.

Table 4. Rates of Soil Erosion and Soil Loss

Year of Project	Route/ Project	Rates of Soil Erosion and Soil Loss
Summer 2009	5-Points Project	Rates of soil erosion prior to the restoration project were very high due to expansion of impacts off designated routes and heavy vehicular scouring into deep and seasonally wet soils. Increased overland flow and high rates of sediment delivery to Carnage Creek were observed. Prior to the project, rates of soil loss were very high and increasing with time. Volumetric estimation of soil loss over 0.6 acres is 255 tons (based on estimated average of 0.25 feet of soil loss). Currently, the risk for soil loss from the restored/protected area is minimal and the risk for soil loss from the designated route through Five Points is moderate.
Summer 2009	U-bc Single Track	Rates of soil erosion prior to the restoration project were high due to steep slopes and widening of the designated route. Prior to the project, rates of soil loss were high and increasing with time. Currently, the risk for soil loss from the restored/protected area is minimal and the risk for soil loss from the designated route is moderate. Volumetric estimation of soil loss over 0.4 acres is 51 tons (based on estimated average of 1 inch of soil loss)
Summer 2009	Rock Crawl (RC-B)	Construction of Rock Crawl Route is likely to reduce displaced activities and associated impacts.
Fall 2009	Carnage Canyon	Rates of soil erosion prior to the restoration project were very high due to expanded impacts off of designated routes and extreme vehicular scouring within an intermittent stream channel. Increased in-channel flows and high rates of sediment delivery to Carnage and Lefthand Creeks was observed. Prior to the project, rates of soil loss were very high and increasing with time. Currently, soil loss from the restored/protected area is low. Sediment delivery from the project area is expected to stabilize to natural levels within a few years. Volumetric estimation of soil loss over 2.25 acres is 1,911 tons (based on estimated average of 0.50 feet of soil loss)
Spring 2010	Carnage Canyon Shrub Planting I	Shrub planting within the riparian zone is complimenting and completing the 2009 Carnage Canyon Restoration project by lowering stream bank erosion and increasing channel stability
Fall 2010	Big Mother Hill	Rates of soil erosion prior to the restoration project were very high due the very steep slope and expansion of impacts off the designated route. In places vehicular traffic had scoured to bedrock. Because the route is still actively used, increased overland flow and sediment delivery to Lefthand Canyon Drive/Lefthand Creek continue. Prior to the project, rates of soil loss were very high and increasing with time. Currently, soil loss from the restored/protected area is minimal and soil loss from the designated route is moderate to high. Volumetric Estimation of soil loss over 0.5 acres is 224 tons (based on estimated average of 0.25 feet inch of soil loss)
Spring 2011	Carnage Canyon Shrub Planting II	Shrub planting within the riparian zone is complimenting and completing the 2009 Carnage Canyon Restoration Project and 2010 Carnage Creek Shrub Planting by lowering stream bank erosion and increasing channel stability
Fall 2011	U-bk,843,U-bm	Rates of soil erosion prior to the restoration project were high due to expanded impacts off of designated routes. Prior to the project, rates of soil loss were very high and increasing with time. Currently, the risk for soil loss from the restored/protected areas is minimal. Volumetric estimation of soil loss over 0.6 acres is 93 tons (based on estimated average of 1 inch of soil loss)

SOURCE: ARAPAHO AND ROOSEVELT NATIONAL FOREST SOIL SCIENTIST, ERIC SCHROEDER

IV. MONITORING RESULTS

A. Water Quality Monitoring Strategy

The James Creek Watershed Initiative continued to implement a Sampling and Analysis Plan developed in Phase 1. The purpose of monitoring is to document the water quality of the stream before, during, and after the restoration activities to evaluate the effects of BMPs success in the reduction of sediment loading into Lefthand Creek while continuing to monitor overall creek health. Monitoring sites are identified in Fig. 14 below.

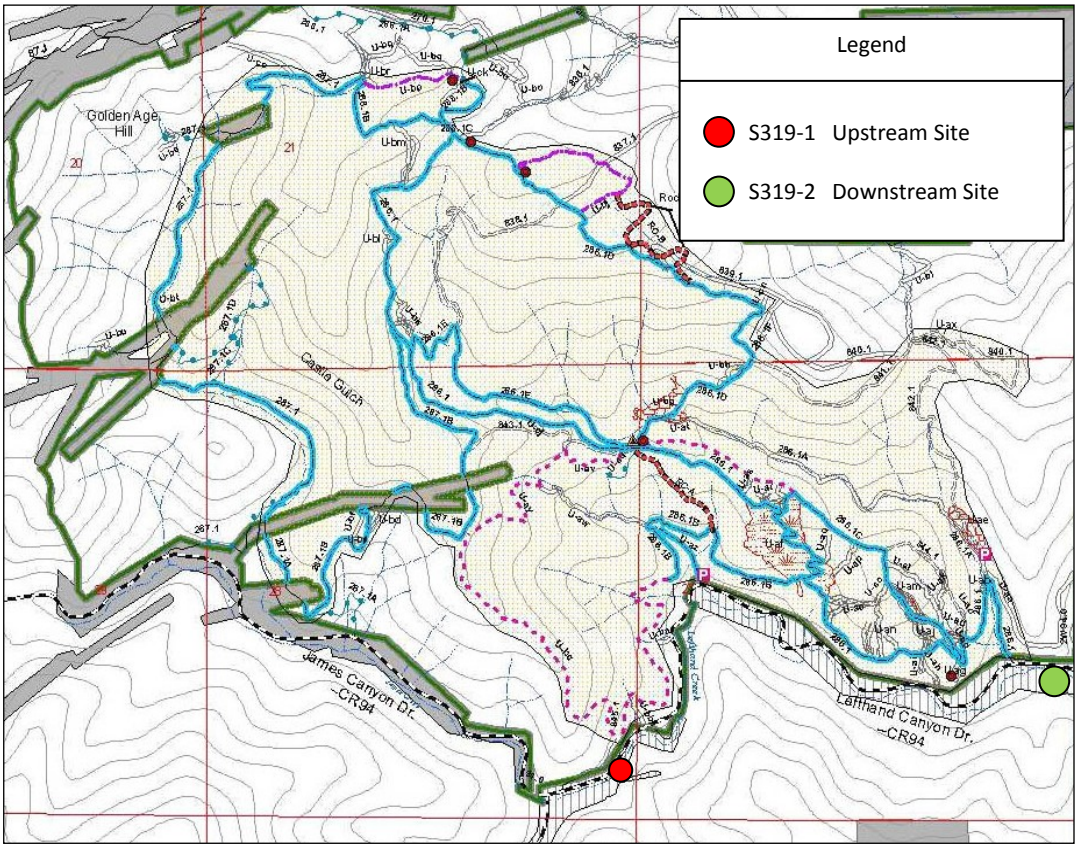

Figure 14. Map of water quality monitoring sites

Table 5. Monitoring Sites Information and Sampling Activity

Site ID#	Description	Latitude/Longitude	Rationale	Elevation	Sampling Activity
S319-1	Lefthand Creek upstream of Lefthand OHV Area	40^0 5' 20.3" 105^0 20' 11.9"	Background reference	6730 ft.	Continuous for both turbidimeters: 5/09 – 9/09 5/10 – 9/10 6/11 – 9/11
S319-2	Lefthand Creek downstream of Lefthand OHV Area	40^0 05' 29.5" 105^0 29' 10.6"	Sedimentation from vehicular travel & long term changes in the OHV area	6129 ft.	

B. Sampling Activities

During May 2009 through September 2011, we conducted water quality monitoring to help determine the effectiveness of sediment control treatments applied in the Lefthand OHV Area. The main tributary draining this area is Carnage Creek. An overall summary of the sampling activities is provided in Table 5.

Water quality sondes (HACH, Hydrolab MS 5) continuously measured instream turbidity at two locations upstream and downstream of the restoration area. Each sonde was secured in a perforated polyvinylchloride pipe at the edge of the stream at a depth of 10-30 cm below the water surface and about 20 cm above the stream bottom. The sondes recorded time, turbidity, and water temperature at intervals of 5 minutes. Once a week, data was downloaded from the sondes to a data logger (Hydrolab, Surveyor 4a)or laptop computer. Weekly maintenance of the sondes included cleaning, calibration, battery change, and wipers replaced as per manufacturer's instructions.

C. Analysis and Data Summary

Turbidity records from all three summers will be addressed in this section. Since installation of sediment control measures was not complete until the 2011 season, emphasis will be placed on records from 2011. When considering turbidity records covering the whole season, it is advisable to use log-mean values of the data, to account for the large variation observed in turbidity values. Shorter records, covering a few days, may be analyzed with regular arithmetic mean values. Looking at the entire turbidity record for the three seasons, the annual log-mean turbidity values for the upstream station were consistently higher than the log-mean turbidity values for the downstream station (Fig. 15).

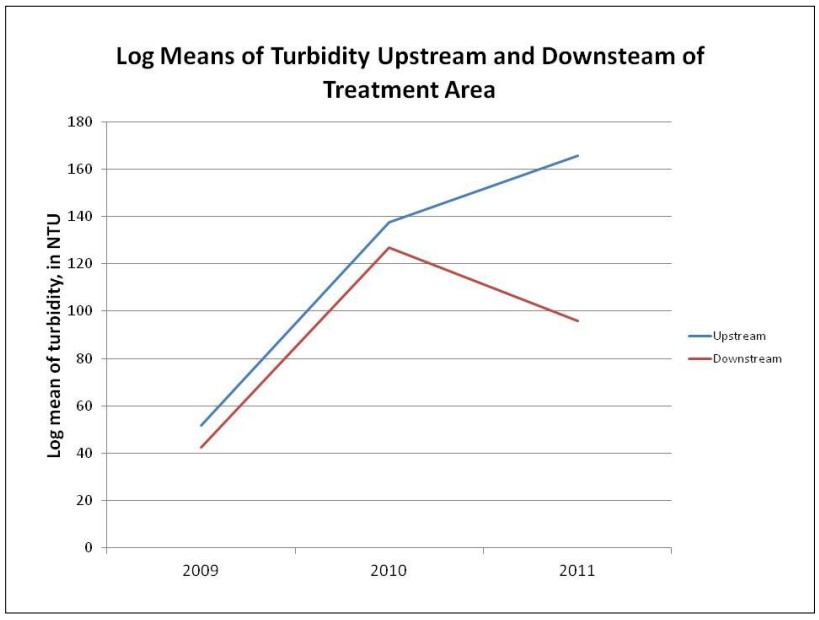

Figure 15. Annual log means of turbidity upstream and downstream of treatment area, 2009-11

This pattern indicates that the flow from Carnage Creek tended to dilute, rather than add to, the concentration of suspended sediment in Left Hand Creek. This would be an indication that the installed sediment control measures were effectively reducing concentrations of suspended sediment in Carnage Creek. Prior to installation of these sediment control measures, Carnage Creek tended to add to, rather than dilute, the suspended sediment concentrations in Left Hand Creek, owing to the mobilization of sediment by vehicular traffic on steep slopes unprotected by vegetation.

Logs of 5-minute turbidity values for 2009 are presented in Fig. 16. This graph demonstrates the typical variability inherent in the turbidity record. In general, turbidity values are similar for the upstream and downstream stations, but there are more times when the upstream value was greater than the downstream value, than vice-versa.

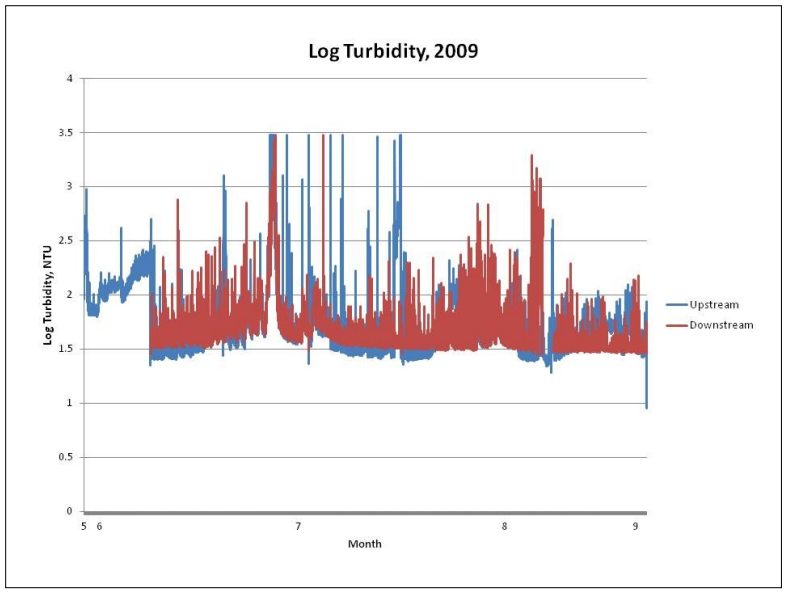

Figure 16. Logs of 5-minute turbidity values for summer 2009.

Looking at the log-mean turbidity trends by month for all three years (Fig. 17), it can be seen that in 2009 the upstream and downstream values were relatively low and similar to each other, with the downstream values being slightly lower than the upstream values. In 2010, there was slightly more variability in the data, and in some months the downstream station had higher log-mean turbidity values than the upstream station. In 2011, when installation of the sediment control measures was complete, the downstream station had consistently lower log mean values than the upstream station, even during the storms and high flows that brought high turbidity values to both stations late in the season.

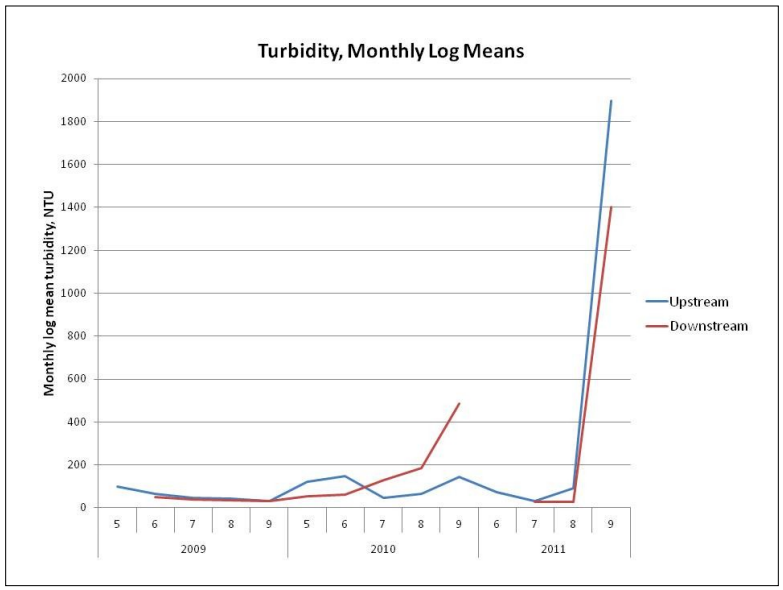

Figure 17. Monthly log mean turbidity values, 2009-11.

A typical period of record influenced by a rainstorm and high flows is presented in Fig. 18. This graph shows 5-minute turbidity values for the period September 6-8, 2011. During this time the sediment control measures were in place, and a significant rainstorm, widespread over the area, brought high flows to the creek. Rainfall totals at the Fairview precipitation gage were 0.54 inches on September 6 and 0.95 inches on September 7. Volunteer precipitation monitoring stations in the mountainous part of Boulder County registered in the range of 0.7 inches on September 7 and 0.3 inches on September 8.

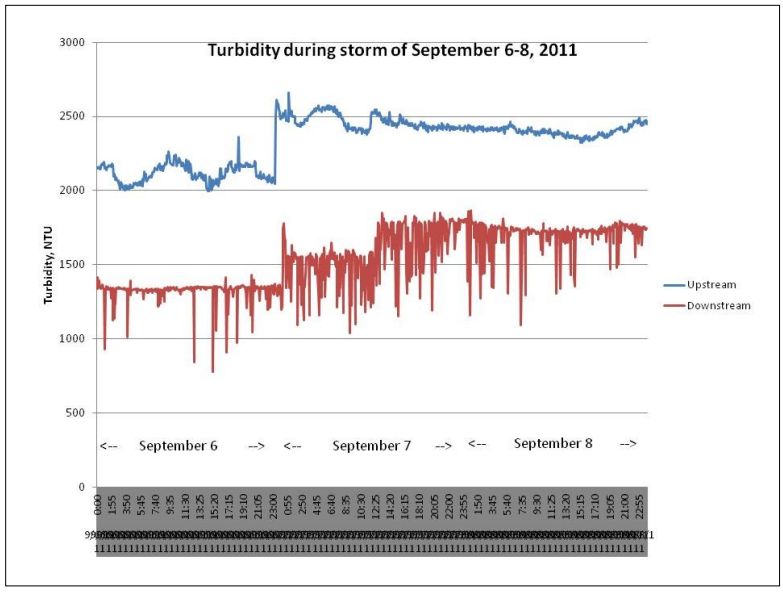

Figure 18. 5-minute turbidity values during the storm of September 6-8, 2011.

During this storm, turbidity values were elevated at both stations, but the upstream station had consistently higher values than the downstream station.

From these data, it can be concluded that the sediment control measures implemented during 2009-11 were successful in reducing turbidities, and hence suspended sediment concentrations, in Left Hand Creek downstream from Carnage Creek, the tributary that drains the area where the sediment control measures were installed. Lefthand Watershed Oversight Group's Director, Glenn Patterson, provided the data analysis included in this report .

D. BMP Effectiveness Evaluation

We used implementation monitoring to evaluate whether our restoration measures were done correctly and if they achieve the desired results. Overall, all of the restoration measures we constructed were according to specifications and are achieving the desired results as planned. The completed restoration project reduced the amount of sediment entering Lefthand Creek from this corridor by approximately 844 tons annually.

The construction of water bars along system routes within the project area were the most effective road BMP we used in the restoration project to decrease the nonpoint source sediment pollution from entering Lefthand Creek. The water bars disconnected the normal runoff pathways, decreased the volume and velocity of the runoff at any one site, thus decreasing the potential for sediment delivery and transport along the road. The drainage was dispersed onto vegetative buffers where sediment could be trapped and infiltration could occur.

The use of mulching, native seed, erosion control matting, and planting shrubs on the obliterated roads and along the restored Carnage Canyon Creek were the most effective BMP we used to decrease soil loss and erosion. We observed the erosion control matting to be intact and over 90% of the vegetation thriving. The photo-log of the restoration sites included in this report documents the effectiveness of the treatments.

E. Surface Water Improvements
The data analysis shows that the sediment control measures implemented during 2009-11 were successful in reducing turbidities, and hence suspended sediment concentrations, in Left Hand Creek downstream from Carnage Creek, the tributary that drains the area where the sediment control measures were installed.

F. QA Reporting
The monitoring was consistent with the SAP in the sampling collection procedures and schedule, data analysis and validation, and data recording. We collected replicate samples in the field and compared turbidity field grab samples with in-stream turbidimeter readings. We also made sure to follow manufacturer guidelines for maintaining and calibrating equipment.

G. Operation and Maintenance
During the projects operation the heavy equipment operator was provided specific plans for road grading and scarification BMPs and was monitored on site during construction to ensure that the proper design plans were implemented. During the restoration workdays project partners were on site with the volunteer crews to provide guidance and ensure restoration techniques were implemented according to the plan. After restoration work was completed we inspected each site quarterly to document BMP effectiveness. We will continue inspecting the vegetation and replanting when needed during 2012.

V. COORDINATION EFFORTS

This project was the result of various agencies and entities working to improve the source waters for the Lefthand Water District. The diverse group of project partners provided technical expertise and in-kind services.

A. Coordination from Other State Agencies
There were no other State agencies other than CDPHE involved with this project.

B. Other State Environmental Program Coordination
The Colorado Department of Public Health and Environment Water Quality Control Division provided project guidance, funding, and began gathering water quality data to determine total maximum daily load reductions.

C. Federal Coordination
The U. S. Forest Service Boulder Ranger District provided technical assistance for restoration activities and water quality monitoring, equipment and supplies, volunteer coordination, and funding for this project.

D. USDA Programs
There were no USDA programs involved with this project.

E. Accomplishments of Agency Coordination Meetings

The coordination of this project involved meeting with the members of the Restoration Team and Monitoring Teams individually and in groups over the duration of the project. The members of the Restoration Team assisted with providing the project vision, objectives, goals, restoration designs and plans, timeline for implementing the project, volunteer coordination, monitoring strategies, and technical advice. They were especially helpful with troubleshooting problems that arose and assisting with adaptive management. The list of participants is included in the Acknowledgments of this report.

F. Resources/Coordination from Federal Land Management Agencies

The U.S. Forest Service played a major role in this project that was completed entirely on public lands they manage. Their contribution is addressed above in "C. Federal Coordination."

G. Other Sources of Funds

The James Creek Watershed Initiative was successful in bringing together a diverse group of partners who provided in-kind match to this project (Table 6).

Table 6. Project Partners and Matching Funds

Project Partner	In-Kind contribution	Type of Service Provided
University of Colorado		Technical assistance - water quality data
Wildlands Restoration Volunteers*	$ 116,109.95	Volunteer coordination, technical assistance, restoration management
James Creek Watershed Initiative	$ 9,807.35	Project management, secretary, accounting
Boulder County Health Department	$ 720.00	Technical assistance – water quality monitoring
Left Hand Water District	$ 420.00	Technical assistance - planning
Lefthand Watershed Oversight Group	$ 935.00	Technical assistance - data analysis
HACH Environmental	$ 5,345.00	Monitoring equipment repair
Trailridge Runners 4WD Club	$ 1,870.00	Restoration volunteers, hauling supplies
Total Non-federal Match	$ 135,207.30	
U.S. Forest Service Total Federal Match	$ 103,096.14	Technical assistance, equipment & supplies, volunteer coordination, and funds

*Wildlands Restoration Volunteer's match includes contributions by National Forest Foundation grant funding, Walsh Environmental Scientists, Budhoe Backhoe, Einstein Bagels, Le Peep Restaurant, Left Hand Brewing, Woodstraw, Moes Bagels, Amante Coffee, Boulder Beer, and the restoration design assistance of Alan Carpenter.

VI. SUMMARY OF PUBLIC PARTICIPATION

The public participated in this restoration project by attending meetings, providing additional funding for the project, and volunteering to help with the restoration work. Restoration projects involved 389 volunteers contributing 4,370 hours.

Project information has been shared with stakeholders through the following:

- Monthly reports to stakeholders at the Boulder Ranger District's OHV meetings;
- Presentations to the Jamestown Town Board in May 2010, January 2011, February 2011, and April 2011;
- Quarterly reports to the Lefthand Watershed Oversight Group Board of Directors;
- Project information and volunteer opportunities were posted on the Wildlands Restoration Volunteers website and provided to WRV's volunteers via their email list;

- Project information and volunteer opportunities were posted on the Jamestown community electronic bulletin board and on an information board located at the entrance to the Lefthand OHV Area;
- Presentation of the project at the Colorado Watershed Assembly event in October 2009;
- Articles about the project were included in newsletters of the Lefthand Watershed Oversight Group and Boulder Ranger District;
- Field trip to the project are on August 12, 2011 with JCWI and CDPHE.

VII. ASPECTS OF THE PROJECT THAT DID NOT WORK WELL

Aspects of the project that created challenges include water quality monitoring problems, wildland fires within the project area, and partnership match projections. Water quality monitoring involved continuous in-stream monitoring with turbidimeters. During 2010 and 2011 the turbidimeters had problems with water getting into the battery compartment. The turbidimeters were serviced by HACH during both years and HACH donated the cost of repair in 2011 to JCWI. Therefore, there are some data gaps.

There were three wildland fires within the project area during Phase 2. The Maxwell Fire which started on June 26, 2011 burned 65 acres and required emergency restoration treatments to prevent soil loss and sediment loading into Lefthand Creek. The restoration included mulching, road stabilization with armored rock crossings and drop structures, and channel stabilization with log grade stabilizers. The other two fires did not require restoration treatments.

The time frame from the initial project planning and grant application to receipt of funding and project start date can be over a two year period. The in-kind contributors who signed onto the project during the application process may not be available over the three year project implementation phase. We offset this challenge with having partners contribute more in-kind match and adding new partners as the project progressed.

VIII. FUTURE ACTIVITY RECOMMENDATIONS

Future activities that are planned for within the project area include:

1. Follow-up assessment and maintenance – During 2012 we will assess project BMP effectiveness and revegetate the project area when needed.

2. Amend Forest Plan – We plan to continue pursuing a Municipal Supply Watershed designation to the Forest Plan for the James Creek Geographic Area of the Arapahoe Roosevelt National Forest. This designation would add to the current forest plan a special protection for James Creek as a drinking water source for the Town of Jamestown and Lefthand Creek as the drinking water source for Left Hand Water District.

3. Participation in forest land management – We will continue to stay active in U.S. Forest Service Boulder Ranger District policy and planning regarding the upcoming travel management plan for our geographic area. We will also continue to attend the monthly meetings with the off road recreational community at the Boulder Ranger District.

5. Source Water Protection Plan – We will continue to work on local source water protection in the Lefthand/James Creek watersheds.

ATTACHMENTS

A. Restoration Project Time Line

B. Progress Report (Spring 2009 - Fall 2011)

C. Materials Cost Estimates*

D. BMPs Implemented Table*

E. Estimation of Soil Loss Table*

F. Carnage Canyon Design Plan*

G. Lefthand OHV Area Sample and Analysis Plan*

H. Lefthand OHV Area Restoration Project Phase 1 Final Report*

I. Lefthand Creek Monitoring Report*

J. Water Quality Monitoring Data*

K. Lefthand OHV Area Project Outreach Material*

L. Photolog of Lefthand OHV Area Restoration Project

* Attachments that will be included only on the CD or electronic copy of this report.