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# MONTANA DEPARTMENT OF TRANSPORTATION STREAM MITIGATION MONITORING REPORT

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*Lolo Creek  
Missoula County, Montana*



Prepared for:

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**MDT** ★  
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December 2013

# **MONTANA DEPARTMENT OF TRANSPORTATION**

## **STREAM MITIGATION MONITORING REPORT:**

**YEAR 2013**

*Lolo Creek  
Missoula County, Montana*

USACE Permit Number: NOW-2009-01903-MTM-Lolo Creek

Prepared for:

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CCI Project No: MDT.007



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Cover Photo: Lolo Creek streambank stabilization site in 2013.

## **1.0 INTRODUCTION**

This 2013 Monitoring Report presents results of the first year of monitoring for a bank stabilization project along Lolo Creek near Lolo, Montana. The project site includes approximately 100 feet of the north bank of Lolo Creek that parallels Highway 12. Rip-rap and two rock j-hook vanes were placed along approximately 100 feet of streambank to prevent northward movement of Lolo Creek from destabilizing the adjacent highway. This report includes an evaluation of monitoring results based on a July 25, 2013 field survey.

## **2.0 SITE LOCATION**

The project site is located in Section 28, Township 12 North, Range 22 West near Mile Post 18 along Highway 12, and is approximately 18 miles west of Lolo, Montana (Figure 1).

## **3.0 MONITORING METHODS**

### **3.1. Planted Vegetation Survival Assessment**

The project area was visually inspected to document survival rates of woody vegetation plantings. The inspection included recording the total number of live and dead woody plantings observed.

### **3.2. Photo Documentation**

The project site was photographed from several angles to document vegetation establishment and current conditions.

### **3.3. As-Built Drawings**

An as-built topographic survey of the reconstructed stream channel was performed using control points provided by MDT.

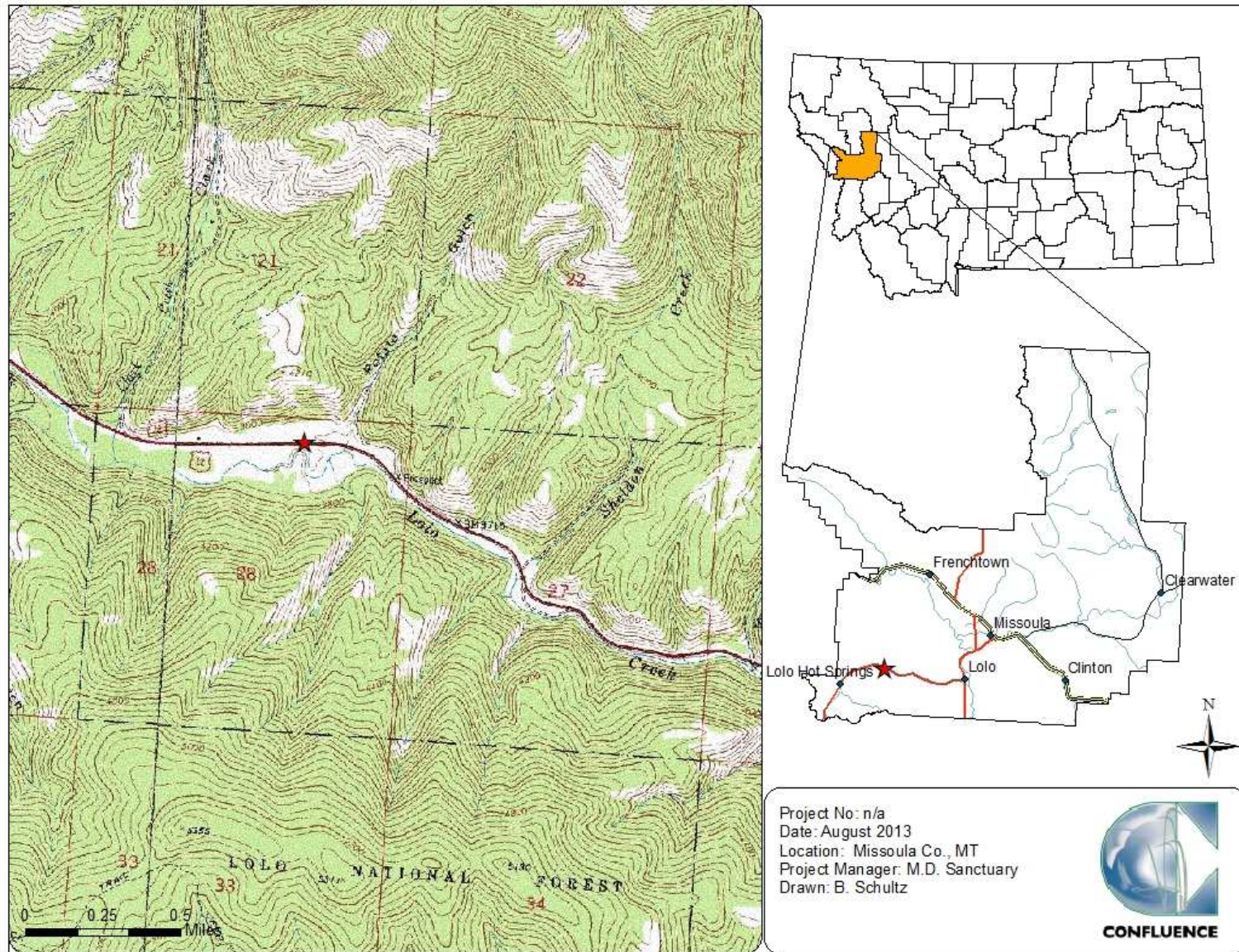


Figure 1. Location of Lolo Creek stream mitigation site.

## 4.0 RESULTS

### 4.1. Planted Vegetation Survival Assessment

Vegetation along the rip-rap streambank was inspected to determine survival rates of woody vegetation species (willows). Photos were taken upstream, downstream, and across the channel to document vegetation establishment at this site (Appendix B).

Evidence of planted woody vegetation included one row of willow stems below the riprap revetment. Plant survival success was low (13%), with approximately 6 live, and 47 dead willow stems observed (Table 1).

**Table 1. Survival rate of woody vegetation in 2013.**

Total Plants Inspected	Surviving Plants	Plant Survival Rate
47	6	13%

The Lolo Creek field assessment identified four Montana State-listed noxious weeds within the project area. Listed noxious weeds observed included ox-eye daisy (*Leucanthemum vulgare*), spotted knapweed (*Centaurea maculosa*), Canadian thistle (*Cirsium arvense*), and common tansy (*Tanacetum vulgare*). Each of these species was observed in trace amounts (<1%) along the streambank between the highway and riprap. Weed control is recommended. Chemical treatment for weeds may be problematic due to the close proximity of the channel; therefore hand pulling is recommended along the bank between the riprap and the highway to maintain a low percentage of weeds within the project site.

### 4.2. As-Built Surveys

An as-built topographic drawing of the project site was generated using Micro-Station (Appendix B) to illustrate 1 foot contours. The survey provides information regarding the angle of each j-hook vane relative to the stream bank, and the slope of each j-hook vane relative to the stream bed.

The upper (western) j-hook vane is approximately 22 feet long from the toe of the bank to the vane tip. This vane was installed at approximately a 60 degree angle from the stream bank (0 degrees being parallel, 90 degrees being perpendicular to the bank). The slope of the vane from the toe of the bank to the tip of the vane is nearly flat, with a positive slope of 0.33% (sloping downward toward the bank). The configuration of this j-hook varies from the typical design detail drawing, which specifies placing the rock at a 20-30 degree angle to the bank, and a 2-7% slope from the bank out to the tip of the vane.

The lower (eastern) j-hook vane is approximately 26 feet long from the toe of the slope to the vane tip. This vane was installed at an upstream angle approximately 30 degrees from the stream bank, which falls within the range of angles specified in the typical design drawings. This vane was constructed with a 1.5% slope from the toe of the bank

to the tip of the vane. A pool has developed downstream from this vane; however it is difficult to determine whether this pool formed as a result of the vane placement or due to scour against a woody debris jam along the bank.

## **5.0 MANAGEMENT AND DESIGN RECOMMENDATIONS**

### **5.1. Willow cutting establishment in riprap**

Willow stems were installed along the toe of the riprap, many of which appeared positioned parallel to the stream bed. The survival rate of these willows was poor, and may have been due to being submerged for too long during runoff. The project was constructed in late August prior to the cutting harvest source going dormant for the season. The timing of the willow harvest and installation likely had the greatest influence on the low survival rates. When possible, woody cuttings should be harvested and installed while they are dormant to prevent stress on the plants while they remain in the growing season.

Prior to installing rock riprap, it is recommended to place cuttings in a key trench, allowing their tips to point upward and extend above the water surface as flood discharges recede. It is also recommended to place several layers of cuttings within the rip-rap as it is installed to generate a greater variety of planting elevations. If cuttings are installed during riprap installation, placing topsoil over each layer of cuttings prior to placing the next layer of riprap is suggested to improve root/soil contact. Large, interstitial spaces often exist between layers of riprap, which can result in desiccation of the cuttings or washing away during high flow events. Filling the riprap voids with unsorted gravels following installation of the rock will fill these interstitial areas, provide better soil contact with the cuttings, and improve cutting survival.

### **5.2. J-hook vane installation**

Rock vanes are most effective at preventing erosion when installed at an upstream angle between 20-30 degrees from the bank and at a downward slope of 2-7%. The upper vane has been installed at a 60 degree angle to the bank and an inverted slope of 0.3%. It is unclear if the rock vane was installed at this slope, or if the rock has settled following the latest runoff event. The configuration (bank angle) and elevations of rock near the bank toe of this j-hook vane vary from the typical design figures. The configuration and elevations of this vane would not typically halt erosion in its vicinity; however, large riprap has also been placed along the toe of bank downstream of this vane for approximately 100 feet, preventing bank erosion between the two vanes. Given the additional rock placement is preventing erosion between the j-hooks and no erosion was observed upstream of the upper j-hook, no corrective actions are recommended at this time.

The lower j-hook vane has been installed at a proper angle to the bank (30%), and at a 1.5% slope, comes close to meeting the specified range of 2-7% specified in the design. This vane appears to be functioning well, with a scour pool developing downstream.



If installed to the proper angle, slope, and spacing, vanes can be effective at reducing bank erosion by reducing erosive stress on the toe of nearby banks. Vane angles and slopes protect these banks by forcing the thalweg of the channel away from the bank toward the center of the channel. Correct spacing of each j-hook vane relative to the next vane downstream eliminates the need to install additional riprap between each vane and can reduce material costs necessary for bank stabilization. Guidance manuals for rock and barb spacing are available from NRCS (2005) and Rosgen (2006).

## **6.0 LITERATURE CITED**

Natural Resource Conservation Service. 2005. Design of Stream Barbs. Technical Note 23. U.S. Department of Agriculture, Portland, Oregon.

Rosgen, D. 2006. The Cross Vane, W-Weir, and J-hook vane structures.. Their Description, Design, and Application for Stream Stabilization and River Restoration. Wildland Hydrology, Pagosa Springs, CO.

## **Appendix A**

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### Project Site Photographs

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MDT Stream Mitigation Monitoring  
Lolo Creek  
Missoula County, Montana

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## PHOTO INFORMATION

PROJECT NAME: Lolo Creek Stream Mitigation Site

DATE: July 25, 2013



**Photo 1**  
**Description:** Looking downstream of project site.  
**Compass:** 130 (Southeast)



**Photo 4**  
**Description:** Downstream extent of riprap and coir.  
**Compass:** 40 (Northeast)



**Photo 2**  
**Description:** Looking at downstream j-hook vane.  
**Compass:** 90 (East)



**Photo 5**  
**Description:** Coir and bank vegetation establishment.  
**Compass:** 330 (North-Northwest)



**Photo 3**  
**Description:** Looking at downstream j-hook vane.  
**Compass:** 90 (East)



**Photo 6**  
**Description:** Coir fabric above riprap.  
**Compass:** 0 (North)

**PHOTO INFORMATION**

PROJECT NAME: Lolo Creek Stream Mitigation Site

DATE: July 25, 2013



**Photo 7**  
**Description:** Upstream view of both j-hook vanes.  
**Compass:** 230 (Southwest)



**Photo 9**  
**Description:** Downstream extent of project area.  
**Compass:** 90 (East)



**Photo 8**  
**Description:** Upstream j-hook vane.  
**Compass:** 270 (West)



**Photo 10**  
**Description:** Upstream project extent.  
**Compass:** 270 (West)



**Photo 11**  
**Description:** Full extent of project area.  
**Taken in 2013**



**PHOTOGRAPHIC INFORMATION** page 1 of 5

PROJECT NAME: MDT Stream Mitigation Lolo Creek

DATE: August 13, 2013



Lolo Creek—North Bank Looking East



Lolo Creek—North Bank Looking East  
A-3



**PHOTOGRAPHIC INFORMATION** page 2 of 5

PROJECT NAME: MDT Stream Mitigation Lolo Creek

DATE: August 13, 2013



Lolo Creek Looking Upstream



Lolo Creek Looking Upstream  
A-4



**PHOTOGRAPHIC INFORMATION** page 3 of 5

PROJECT NAME: MDT Stream Mitigation Lolo Creek

DATE: August 13, 2013



Lolo Creek East Limits Looking Downstream



Lower J Hook in Channel  
A-5



**PHOTOGRAPHIC INFORMATION** page 4 of 5

PROJECT NAME: MDT Stream Mitigation Lolo Creek

DATE: August 13, 2013



Upper J Hook in Channel



In Channel Looking Downstream  
A-6





**PHOTOGRAPHIC INFORMATION** page 5 of 5

PROJECT NAME: MDT Stream Mitigation Lolo Creek

DATE: August 13, 2013



South of Creek Looking at North Bank



North of Creek Looking at South Bank  
A-7

## **Appendix B**

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### As Built Surveys

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MDT Stream Mitigation Monitoring  
Lolo Creek  
Missoula County, Montana

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