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# MONTANA DEPARTMENT OF TRANSPORTATION STREAM MITIGATION MONITORING REPORT

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*Sweathouse Creek  
Ravalli County, Montana*



Prepared for:

**MONTANA**  
**MDT**★  
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December 2013

# **MONTANA DEPARTMENT OF TRANSPORTATION**

## **STREAM MITIGATION MONITORING REPORT:**

**YEAR 2013**

*Sweathouse Creek  
Ravalli County, Montana*

MDT Project Number: NH 7-1(114)59  
Control Number: CN 201 5004

USACE Permit Number: NOW-1997-90821  
SPA Number: MDT-R2-15-2010

Prepared for:

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December 2013

CCI Project No: MDT\_.007



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- Appendix C: Riparian Transect Vegetation Results
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Cover Photo: Newly constructed stream bank on Sweathouse Creek.

## 1.0 INTRODUCTION

This 2013 Monitoring Report presents results of the first year of monitoring of a Montana Department of Transportation stream reconstruction project on Sweathouse Creek near Victor, Montana. This report includes an evaluation of monitoring results in comparison to project performance standards as specified by the U.S. Army Corps of Engineers (USACE) based on a July 25, 2013 field survey.

The Montana Department of Transportation (MDT) requested authorization for a bridge removal and replacement over Sweathouse Creek, a channel modification on Sweathouse Creek, removal and replacement of six irrigation siphons, and wetland fills at various locations thought the project. The Sweathouse crossing included: replacing the 30 foot wide bridge with a 96-foot wide bridge, filling in a 394-foot section of Sweathouse Creek and constructing a new channel 397 feet long with three left bank root wads and four right bank root wads. The USACE requires annual monitoring (5 years) of streambank stability and riparian vegetation aerial coverage. Performance standards and reporting requirements outlined in the approved 404 permit include:

1. **Riparian coverage** – 80% aerial coverage with a minimum of 50% aerial coverage by woody species by the end of the third growing season.
2. **Streambank stability** – identification of any unstable streambanks within the relocated channel.
3. **As-built** – as built drawings of the relocated channel at a 1:50 scale or smaller and planting schematic with a planted species list and number of plants planted.
4. **Perpendicular Transects** – establishment of 4 transects 75' apart with surveyed cross sections and bank pins installed as permanent reference points.
5. **Photo points** – color photos at each monitoring station showing both banks and upstream and downstream views.

## 2.0 SITE LOCATION

The project site is located in Section 30, Township 8 North, Range 20 West in Ravalli County, Montana (Figure 1). Sweathouse Creek flows beneath a newly constructed bridge approximately 0.25 miles north of Victor. The project reach includes approximately 30 feet of Sweathouse Creek upstream of the Highway 93 Bridge and extends approximately 200 feet downstream of the bridge.

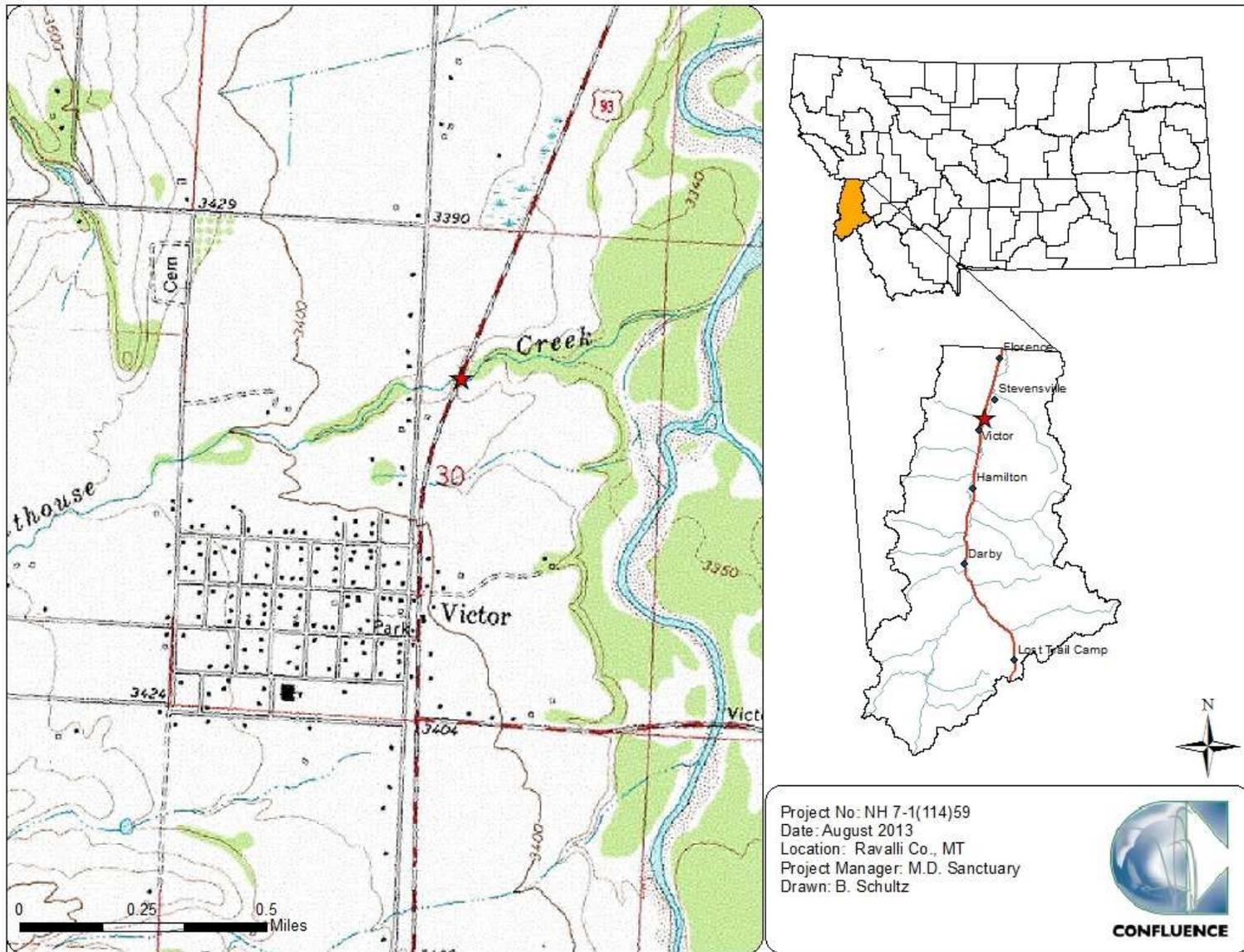


Figure 1. Project location of Sweathouse Creek stream mitigation site.

### **3.0 MONITORING METHODS**

Monitoring field crews visited the project site on July 24, 2013 while survey crews visited the site on August 13, 2013. The following data were collected at the Sweathouse Creek stream mitigation site:

#### **3.1. Riparian Vegetation Inventory - Belt Transects**

Two riparian belt transects were established; one on each side of the stream channel. The belt transect on the right (south) bank runs parallel to the downstream extent of the project reach for 200 feet, while the riparian transect on the left (north) bank is 114 feet long (Figure 1, Appendix A). GPS points were logged at riparian transect endpoints and corners with a Magellan Promark III GPS unit. Each endpoint or corner of the riparian transects were marked with t-posts or flagged vegetation (large trees) to allow for relocation during subsequent monitoring events. Field data collection at each riparian transect included aerial percent cover of total vegetation, woody vegetation, and noxious weeds.

#### **3.2. Perpendicular Transects**

Four perpendicular transects (cross sections) were surveyed; two at riffles and two at pools. Endpoints of each transect were marked with a pin, flagging, or stake and a GPS point logged for location during subsequent monitoring events. Bank pins were placed on the left and right banks of the channel to document lateral erosion at each perpendicular transect.

#### **3.3. Bank Erosion Inventory**

Both stream banks within the project reach were visually inspected to document eroding banks. Each eroding bank within the project reach was photo-documented. Data collected at each eroding bank included bank length and potential causes of bank erosion.

#### **3.4. As-Built Surveys**

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

#### **3.5. Photo-Documentation**

The project site was photographed from several locations to document vegetation establishment and stream bank conditions within the project site (Appendix D). All sites selected for photo-documentation were recorded on field maps with headings noted to allow for repetition during subsequent monitoring years. Photos were also taken at each perpendicular cross section in the upstream and downstream direction, as well as toward each stream bank.

## 4.0 RESULTS

### 4.1. Riparian Vegetation Inventory

The two riparian belt transects included a 200 foot south (right) bank transect parallel to the downstream extent of the project reach and a 114 foot transect on the left (north) bank. Extents of the riparian transects are illustrated on Figure 2 in Appendix A. Table 1 summarizes field data collection at each riparian transect including aerial percent cover of total vegetation, woody vegetation, and noxious weeds. Riparian transect vegetation results are presented in Appendix C.

Table 1. Riparian vegetation belt transect results, Sweathouse Creek.

Belt Transect	Length (ft)	Total % Riparian Cover	% Woody Cover	% Noxious Weed Cover
Right (south bank)	200	97	14	5
Left (north bank)	114	98	7	3
Total	334	97	11	4

Five Montana State-listed priority 2b noxious weeds were observed on site in trace amounts, including spotted knapweed (*Centaurea maculosa*), Canadian thistle (*Cirsium arvense*), common St. John's wort (*Hypericum perforatum*), oxeye daisy (*Leucanthemum vulgare*), and common tansy (*Tanacetum vulgare*). Cheatgrass (*Bromus tectorum*) a priority 3 state listed noxious weed was also observed in trace amounts on site.

### 4.2. Perpendicular Transect Surveys

Four perpendicular transects were surveyed, including two pools and two riffles. Plots for each surveyed transect are included in Appendix B. These transects indicate the development of point bars and deeper scour pools at both pool transects (transects #2 and #3) as compared to the riffles. The lower riffle (transect #4) lies at the downstream end of a pool, and exhibits some bar development on the north bank. No evidence of erosion was noted at any of the surveyed transects. Perpendicular transects will be re-surveyed during subsequent monitoring events to document bar formation, pool depths, or lateral channel movements.

### 4.3. Bank Erosion Inventory

Field examination documented no eroding stream banks within the project area. The toe of the treated banks are stable (no erosion) and willow stems are growing well on the right bank between the coir material layers. Willow stems are also establishing on upper and lower parts of the left bank. A potential coir log failure was noted on the upstream right bank (Photo Point 2.1, Appendix D) where the coir was not keyed sufficiently into the bank. Maintenance of this section is noted in Section 6 of this report. Although Sweathouse Creek does not have an active stream gage, inspection of gage data from the Bitterroot River suggest tributary streams were subject to overbank flows in 2011 and near bankfull flows in 2013. These flood events deposited debris, sand, and twigs on the floodplain adjacent to the reconstructed segment of Sweathouse Creek. A point bar is forming on the left stream bank, as noted by gravel deposits

shown in Photos 1.2 and 3.1 in Appendix D. The point bar features developing on the north side of the channel are also illustrated on the left side of the perpendicular transect survey results for Transects #2 and #3 (Appendix B). Of note, the flood events in 2011 and 2013 have generated bar development within the channel; however, no active erosion was evident along banks across from these bar formations due to the bioengineered root wad and coir fabric bank treatments installed along the south/east bank.

## 5.0 COMPARISON OF RESULTS TO PERFORMANCE STANDARDS

Monitoring of the Sweathouse Creek Stream Mitigation site is intended to document whether the reconstructed segment of the channel is meeting performance standards outlined in the Army Corps 404 permit issued for the project. The first year of monitoring suggests two of the three quantitative standards are being met three years post-construction including total vegetative cover within the riparian zone and absence of eroding banks. Table 2 summarizes the performance criteria and monitoring requirements specified for the Sweathouse Creek stream mitigation site.

**Table 2. Summary of performance criteria and monitoring requirements for Sweathouse Creek.**

Monitoring or Reporting Requirement	Parameter	Success Criteria	Status
1a	Riparian Coverage	80% total vegetative coverage after 3rd year.	Project area has <b>97%</b> vegetative cover.
1b	Riparian Coverage	50% coverage of woody vegetation after 3rd year.	Project area has <b>11%</b> woody cover (14% of south bank and 9% of north bank)
2	Stream Bank Stability	Identification of any unstable streambanks within the relocated channel.	No unstable stream bank identified within project area
3	As Built	As Built drawings of the reconstructed channel at 1:50 scale or smaller and planting schematic with a planted species list and number of plants installed.	As-builts and Planting Schematic provided in Appendix E
4	Perpendicular Transects	Establishment of 4 transects 75' apart with surveyed cross sections and bank pins installed as permanent reference points.	Transect results included in Appendix B
5	Photo Points	Color photos at each monitoring station showing both banks and upstream and downstream views.	Photo logs included in Appendix D

### 5.1. Riparian Buffer Establishment

Total riparian vegetative cover, measured at 97%, exceeds the performance standard of 80% aerial coverage. Vegetation is establishing well within the riparian zone (defined as within 25' of the stream banks), particularly along the north and west sides of the creek. Herbaceous vegetation along the south and east side of the creek has also established well; although it is being mowed to the edge of the channel by the adjacent landowner.

Woody riparian vegetation, measured at 11% cover, currently does not meet the performance standard of 50% aerial coverage by the end of the third growing season. Many of the willow cuttings installed along the toe of both banks are successfully establishing, which is an encouraging sign toward long-term vegetative bank stability. These willows provide a fairly consistent, but very thin band of woody vegetation along the edge of the stream bank; however, little to no additional woody vegetation is establishing within the remainder of the 25' wide riparian zone. Woody vegetation cover on the north (unmowed) bank is 9%, while the cover on the south (mowed) bank is 14%. The higher percent woody cover on the south bank is due to successful establishment of willow cuttings along the entire bank, whereas a shorter segment of the north bank has willow cutting establishment. Based on these data, woody plants installed within the riparian buffer zones had relatively poor survival rates. Woody plants that did survive following installation remain relatively small and have yet to provide enough cover to meet the performance criteria for this category.

The adjacent landowner has mowed the vegetation nearly to the edge of the bank; therefore, it is likely any small woody vegetation installed away from the edge of the south bank has been largely eliminated. The ability to meet the woody vegetation cover criteria will largely depend on cooperation with the adjacent landowner to maintain an intact riparian buffer. MDT biologists installed approximately 150 dogwood, Wood's rose, and willows within the riparian zone in an attempt to establish woody species composition; however, it appears much of this woody vegetation has been removed due to frequent mowing on the south bank, or did not survive on the north bank. Given the relatively low woody species composition on both sides of the channel, supplemental woody vegetation plantings on both banks may be necessary to achieve the target percent cover of 50%.

## **5.2. Bank Erosion Inventory**

No stream bank erosion was noted within the Sweathouse Creek stream mitigation site. Root wads installed along the south bank appeared secure, with no evidence of undercutting or bank sloughing. The root wads provide structure for the development of pool scour features, as evidenced by results of Transects #2 and #3 in Appendix B. Results of transect surveys and their associated photos indicate gravel point bar development on the inside of the meander bend, and generation of scour pools against the root wads. These banks offer good fish habitat and cover, as evidenced by observations of several trout utilizing the root wad structures. Based on the observations and transect data, the bioengineered banks are successfully providing pool habitat features while maintaining bank integrity throughout the project reach.

## **6.0 MANAGEMENT RECOMMENDATIONS**

### **6.1. Woody Vegetation Establishment**

As noted in Section 5, woody vegetation establishment within the project reach is mainly limited to a thin band of willows establishing from cuttings installed along the toe of the banks. Willow cutting survival rates appear relatively high, which is encouraging for

long term bank stability. Survival of additional woody plantings within the riparian zone appears marginal, and may be partially attributed to mowing on the south bank. Installation of additional plantings such as willow, alder, Wood's rose, chokecherry, or water birch is recommended within the riparian zones on both sides of the channel to improve overall percent cover of woody species.

Monitoring observations noted the landowner to the south of the project reach is mowing all of the vegetation down to the stream bank (Photo Point 6.2). In order to maintain long term bank stability downstream of the bridge, it is important to maintain a healthy, un-mowed vegetative buffer between the lawn and the stream bank to promote root growth and soil stability between and downstream of the root wads. It is recommended that MDT establishes an agreement with the adjacent landowner to maintain a minimum buffer of 25' from the banks to encourage establishment of deep-rooted woody and herbaceous vegetation. In addition to erosion prevention, establishment of a riparian buffer would help protect water quality in Sweathouse Creek by filtering any adjacent herbicide or fertilizer applications.

### **6.2. Coir Log/fabric Installation**

Design details for Sweathouse Creek included a sequence for installing erosion control blankets along both sides of the channel. Inspection of the coir fabric revealed the contractor adhered to the design sequence and constructed an encapsulated soil lift by backfilling over the leading edge of the fabric, wrapping the fabric around the soil, and securing the back edge of the coir into a key trench. The upstream extent of the coir fabric on the south bank was exposed (Photo Point 2.1), revealing the outer corner of the soil lift. This location may be susceptible to erosion, as it is the upstream extent of the bioengineered bank. It is important to key the upstream end of coir fabric soil lifts back into the streambank to prevent the leading edge of the fabric from unraveling. Additional design details for keying in the upstream extent of the fabric soil lifts are recommended to improve stability in these susceptible areas.

## **Appendix A**

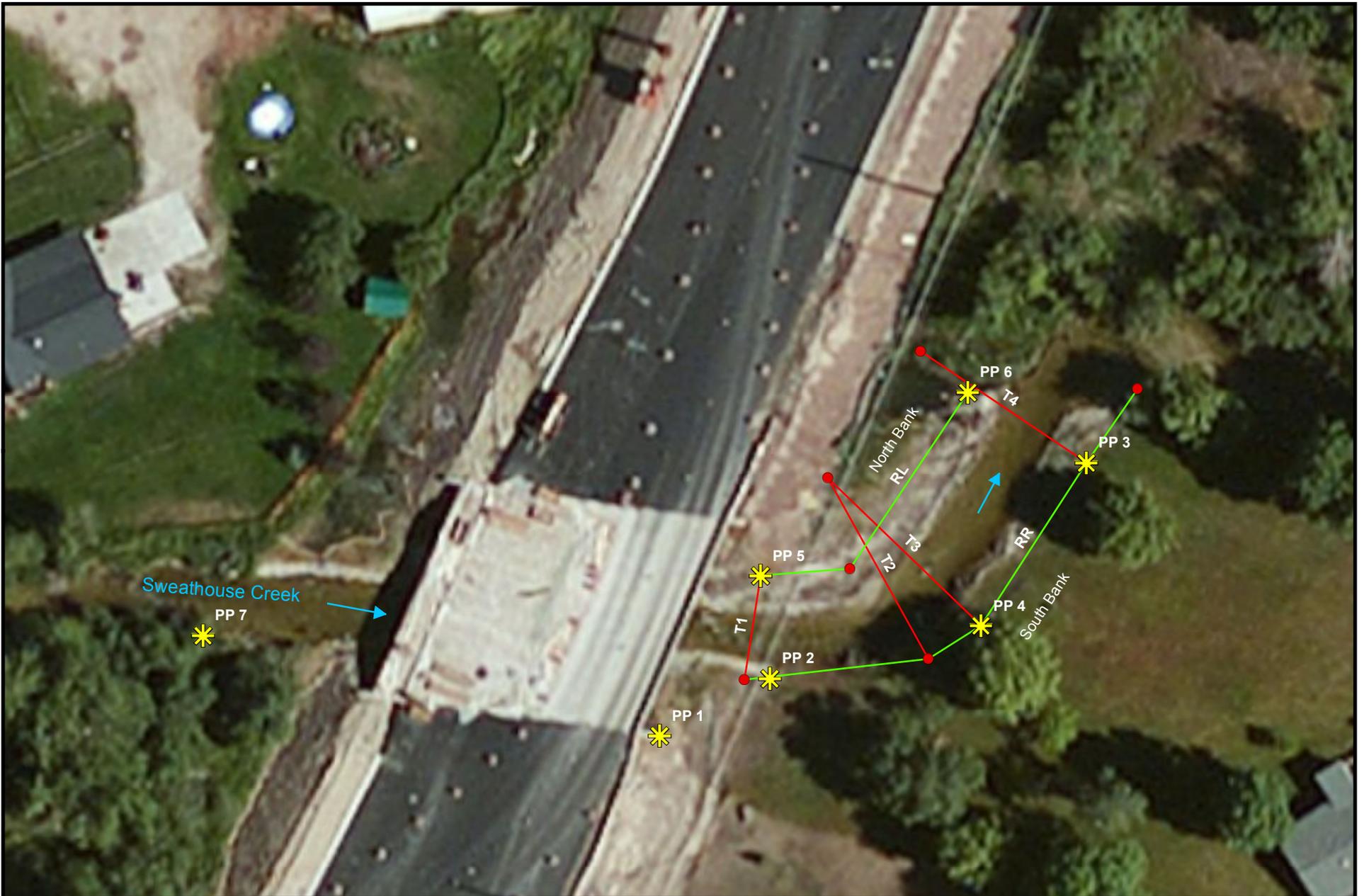
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### Project Site Map

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MDT Stream Mitigation Monitoring  
Sweathouse Creek  
Ravalli County, Montana

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### Legend

-  Photo Points
-  Riparian and Perpendicular Transect Endpoints
-  Pool and Riffle Transects
-  Riparian Transects



### 2013 Monitoring Sweathouse Creek

Figure 2

Date: 12/5/2013

X:/MDT\_.007/mains

## **Appendix B**

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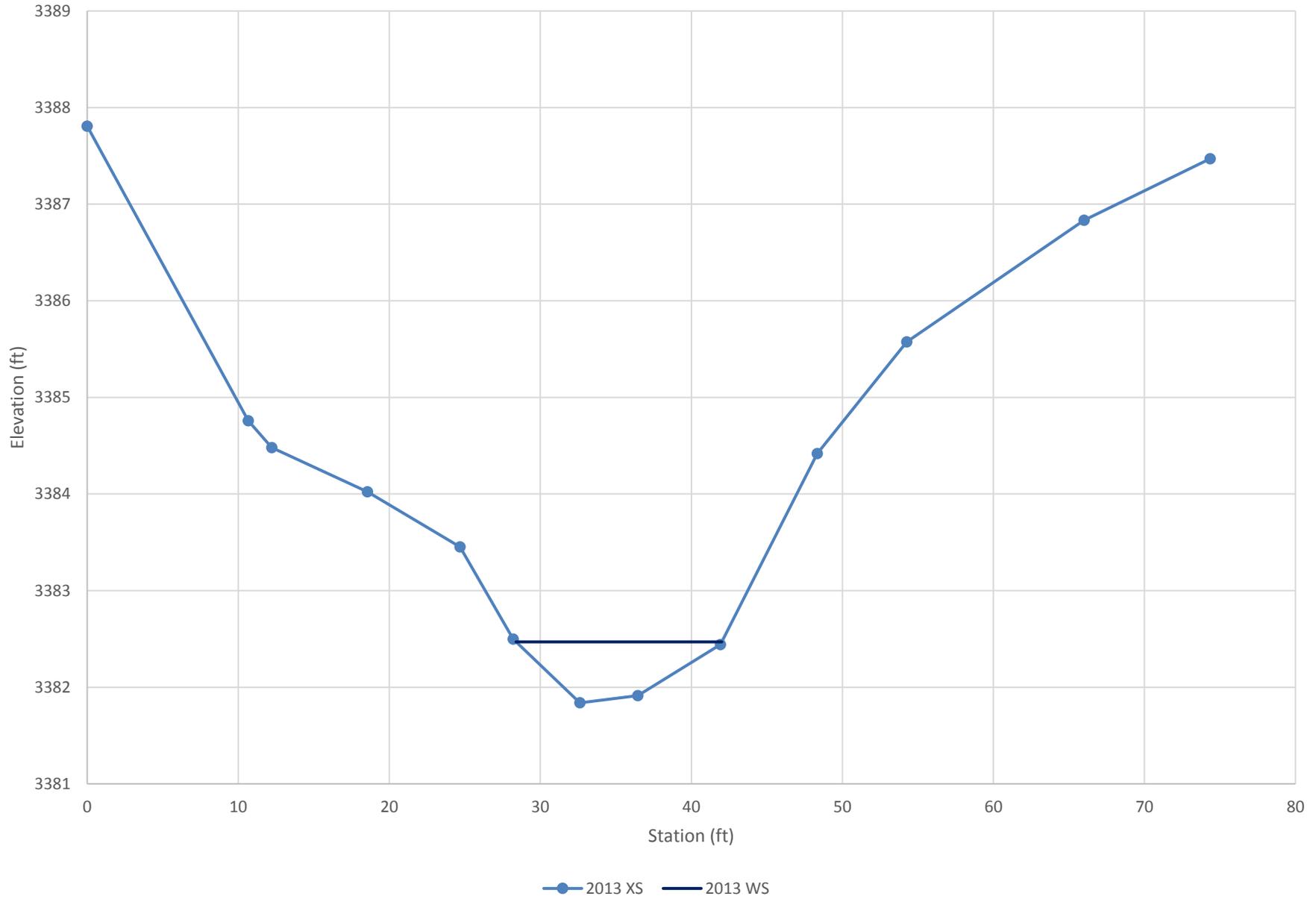
### Perpendicular Transect Plots

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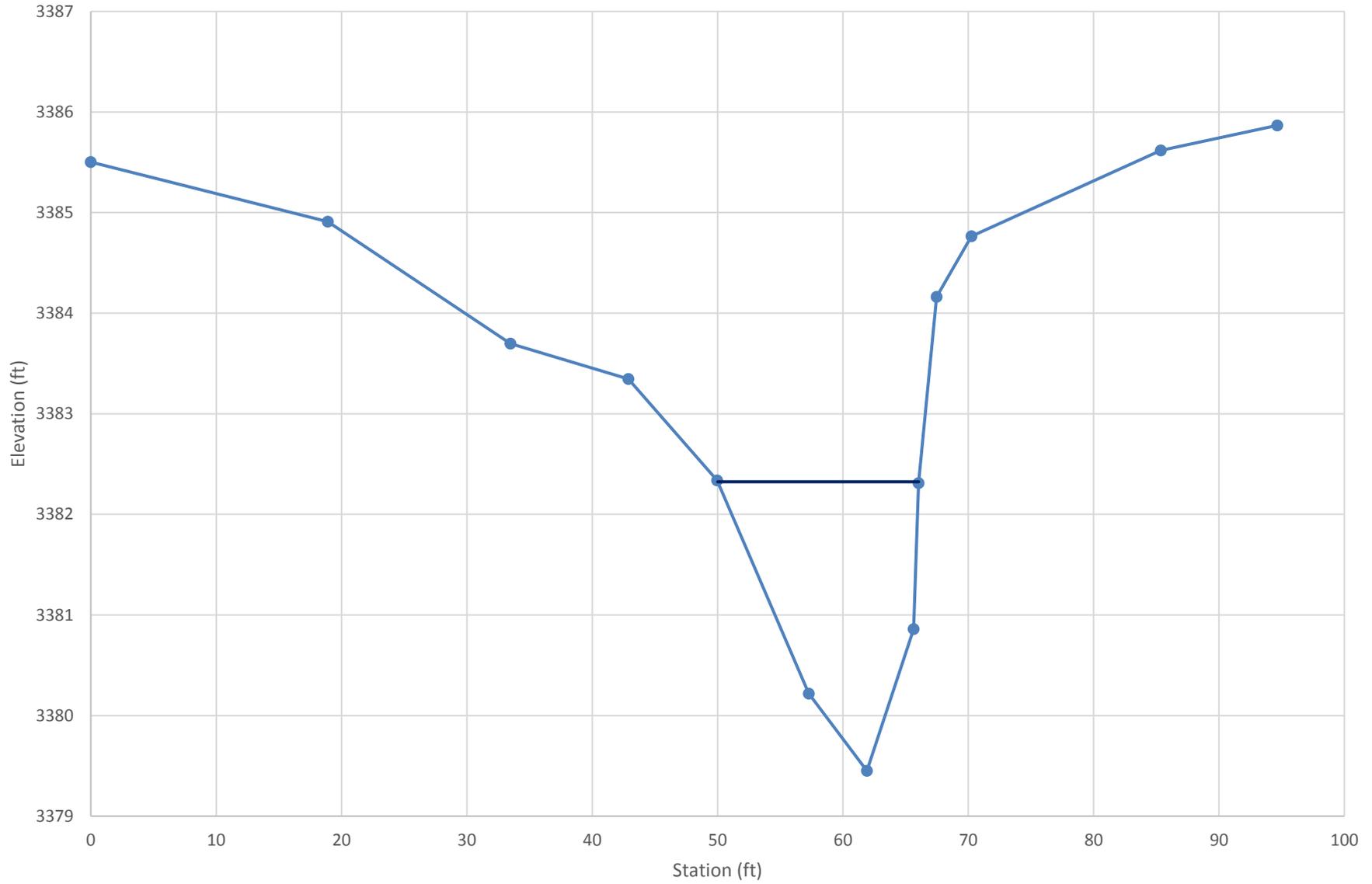
MDT Stream Mitigation Monitoring  
Sweathouse Creek  
Ravalli County, Montana

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### Sweathouse Creek Transect #1 - Riffle

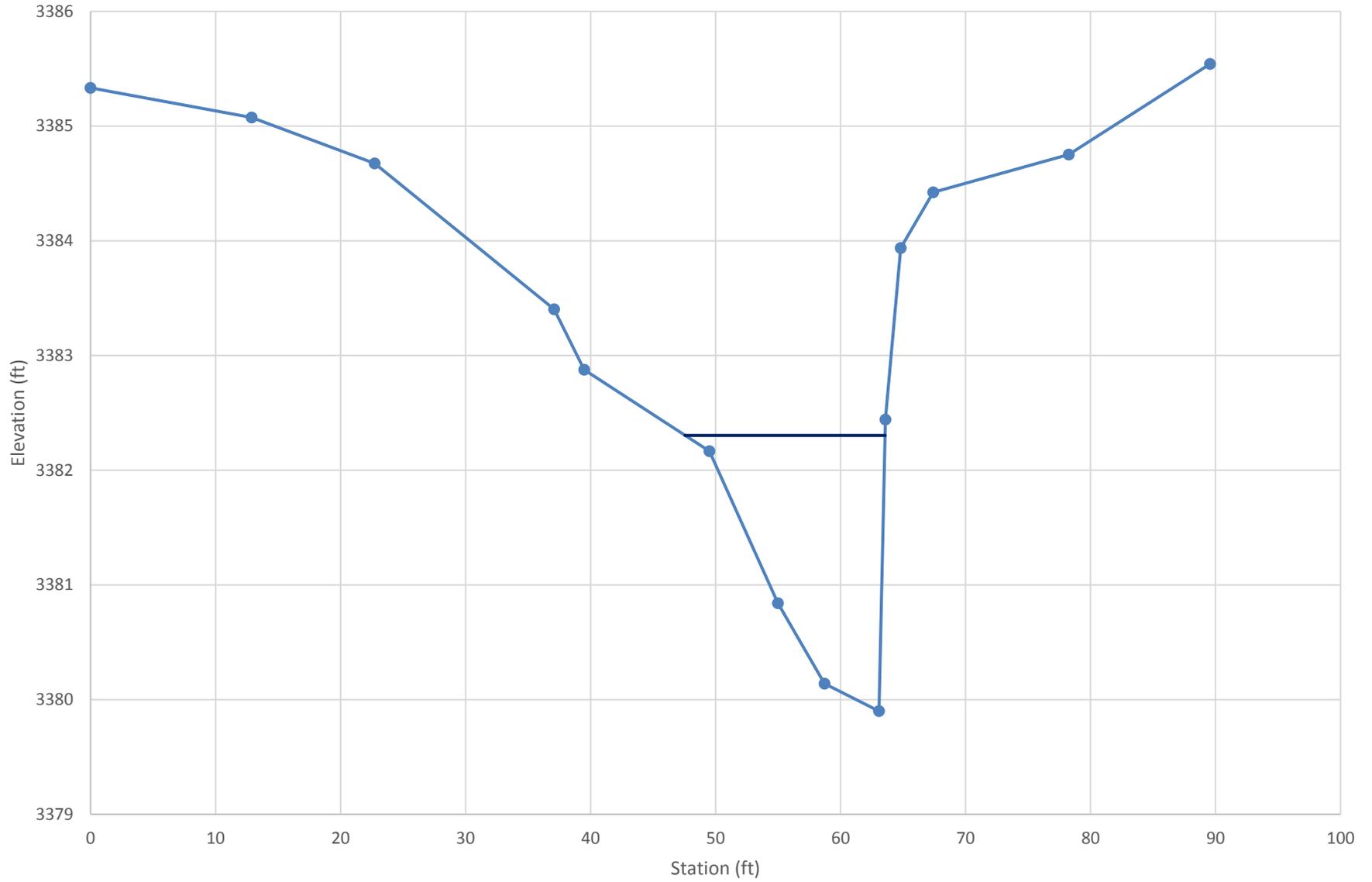


Sweathouse Creek Transect #2 - Pool



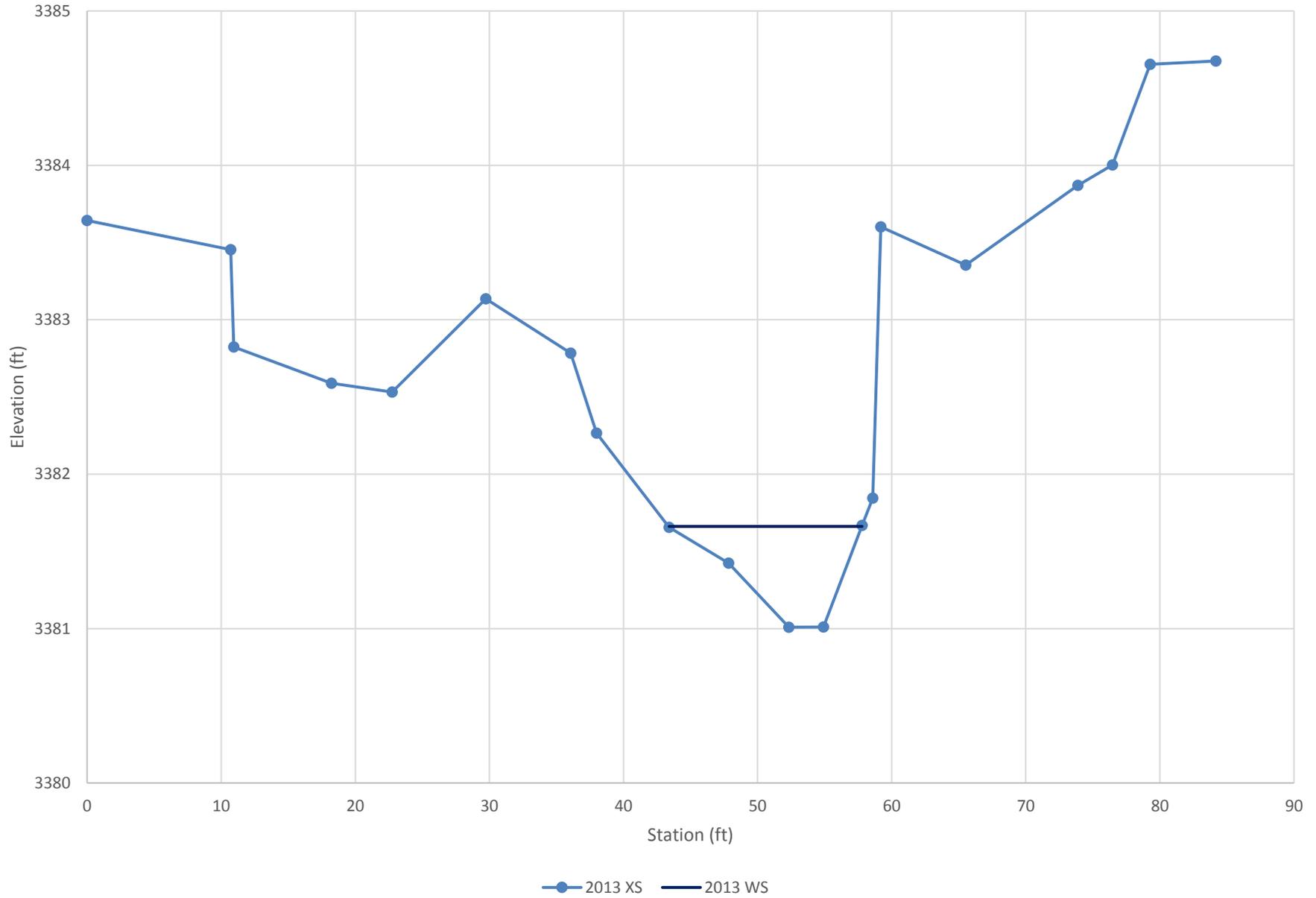
● 2013 XS — 2013 WS

Sweathouse Creek Transect #3 - Pool



—●— 2013 XS    — 2013 WS

Sweathouse Creek Tansect #4 - Riffle



## **Appendix C**

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### Riparian Transect Vegetation Results

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MDT Stream Mitigation Monitoring  
Sweathouse Creek  
Ravalli County, Montana

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# Interval Data Summary Report

Site: **Sweathouse Creek**

date: 7/24/2013 9:22:03 AM

**Transect Number:** 1      **Compass Direction from Start:** \_\_\_\_\_

**Interval Data:**

**Ending Station**      25   **Community Type:** /

Species	Cover class	Species	Cover class
Bare Ground	1	Cirsium arvense	0
Leucanthemum vulgare	2	Medicago lupulina	1
Onopordum acanthium	0	Pascopyrum smithii	2
Plantago lanceolata	2	Poa pratensis	5
Ranunculus aquatilis	1	Salix exigua	3
Silene latifolia	0	Taraxacum officinale	3
Trifolium pratense	3	Trifolium repens	3

**Ending Station**      129   **Community Type:** /

Species	Cover class	Species	Cover class
Bare Ground	1	Carex utriculata	1
Juncus arcticus	2	Leucanthemum vulgare	1
Plantago lanceolata	1	Plantago major	1
Poa pratensis	5	Ranunculus aquatilis	0
Salix exigua	2	Scrophularia lanceolata	0
Taraxacum officinale	2	Trifolium pratense	2
Trifolium repens	2	Verbascum thapsus	0

## Interval Data Summary Report

**Ending Station** 200 **Community Type:** /

Species	Cover class	Species	Cover class
Achillea millefolium	1	Alnus incana	2
Bare Ground	0	Bare Ground	1
Carex utriculata	2	Cirsium arvense	0
Dactylis glomerata	1	Dasiphora fruticosa	1
Deschampsia cespitosa	2	Elymus repens	3
Epilobium ciliatum	0	Glyceria striata	1
Hypericum perforatum	1	Juncus arcticus	3
Juncus effusus	2	Juncus ensifolius	2
Leucanthemum vulgare	1	Medicago lupulina	1
Medicago sativa	1	Mimulus guttatus	0
Onopordum acanthium	1	Pascopyrum smithii	2
Persicaria amphibia	0	Phalaris arundinacea	3
Phleum pratense	3	Plantago lanceolata	1
Poa pratensis	5	Populus tremuloides	2
Ranunculus sp.	0	Salix exigua	1
Salix lasiandra	1	Silene latifolia	0
Tanacetum vulgare	0	Taraxacum officinale	2
Trifolium pratense	2	Trifolium repens	2
Verbascum thapsus	0		

**Transect Notes:**

right bank: start at tpost. go to first stump; then to second stump, continue to larger stump/partially live alder. Beyond first stump is survey stake. Second stump has survey marker.

# Interval Data Summary Report

Transect Number: 2

Compass Direction from Start: \_\_\_\_\_

**Interval Data:**

**Ending Station**      57 **Community Type:** /

Species	Cover class	Species	Cover class
Achillea millefolium	1	Agropyron cristatum	0
Bare Ground	1	Carex utriculata	1
Cirsium arvense	0	Dactylis glomerata	2
Deschampsia cespitosa	1	Elymus cinereus	1
Glyceria grandis	1	Glyceria striata	1
Juncus arcticus	2	Juncus effusus	2
Juncus ensifolius	1	Leucanthemum vulgare	1
Melilotus officinalis	3	Mimulus guttatus	0
Pascopyrum smithii	3	Phalaris arundinacea	4
Rumex crispus	0	Salix exigua	1
Scirpus microcarpus	0	Silene latifolia	0
Taraxacum officinale	2	Trifolium pratense	3
Trifolium repens	3	Verbascum thapsus	0

**Ending Station**      98 **Community Type:** /

Species	Cover class	Species	Cover class
Agropyron cristatum	0	Bare Ground	0
Dactylis glomerata	1	Deschampsia cespitosa	2
Juncus arcticus	3	Juncus effusus	2
Juncus ensifolius	2	Leucanthemum vulgare	1
Melilotus officinalis	4	Pascopyrum smithii	4
Phalaris arundinacea	4	Phleum pratense	4
Populus balsamifera	1	Rumex crispus	0
Salix exigua	1	Scirpus microcarpus	0
Trifolium pratense	3	Trifolium repens	3
Verbascum thapsus	1		

**Ending Station**      114 **Community Type:** /

Species	Cover class	Species	Cover class
Carex sp.	4	Deschampsia cespitosa	1
Glyceria striata	2	Juncus arcticus	3
Juncus effusus	1	Juncus ensifolius	2
Mimulus guttatus	0	Phalaris arundinacea	3
Rumex crispus	0	Salix exigua	4
Trifolium pratense	2	Trifolium repens	2
Typha latifolia	1		

Transect Notes:

## **Appendix D**

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### Project Site Photos

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MDT Stream Mitigation Monitoring  
Sweathouse Creek  
Ravalli County, Montana

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**PHOTO INFORMATION**

PROJECT NAME: Sweathouse Creek

DATE: July 24, 2013



**Photo Point 1.1**  
**Description:** View of north bank from bridge abutment.  
**Compass:** 45 (Northeast)



**Photo Point 3.1**  
**Description:** Looking upstream from downstream end of project reach. **Compass:** 225 (Southwest)



**Photo Point 1.2**  
**Description:** View of both banks looking downstream from bridge abutment. **Compass:** 68 (East-Northeast)



**Photo Point 3.2**  
**Description:** View of downstream extent of project area. **Compass:** 45 (Northeast)



**Photo Point 2.1**  
**Description:** View of un-keyed coir log on south bank  
**Compass:** 90 (East)



**Photo Point 3.3**  
**Description:** View of the north bank looking across channel. **Compass:** 315 (Northwest)

**PHOTO INFORMATION**

PROJECT NAME: Sweathouse Creek

DATE: July 24, 2013



**Photo Point 4.1**  
**Description:** View of both banks looking upstream.  
**Compass:** 45 (Northeast)



**Photo Point 5.1**  
**Description:** View from north bank looking upstream underneath bridge. **Compass:** 270 (West)



**Photo Point 4.2**  
**Description:** View of north bank and point bar development. **Compass:** 315 (Northwest)



**Photo Point 5.2**  
**Description:** View of south bank.  
**Compass:** 180 (South)



**Photo Point 4.3**  
**Description:** View of both banks looking downstream.  
**Compass:** 225 (Southwest)



**Photo Point 5.3**  
**Description:** View of vegetation on north bank.  
**Compass:** 90 (East)

## PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek

DATE: July 24, 2013



**Photo Point 6.1**

**Description:** View of north bank vegetation.  
**Compass:** 225 (Southwest)



**Photo Point 7.1**

**Description:** View of north streambank upstream of bridge. **Compass:** 68 (East-Northeast)



**Photo Point 6.2**

**Description:** View of south bank looking across channel. **Compass:** 135 (Southeast)



**Photo Point 7.2**

**Description:** View looking downstream beneath bridge. **Compass:** 90 (East)



**Photo Point 6.3**

**Description:** View looking across channel from north bank. **Compass:** 90 (East)



**Photo Point 7.3**

**Description:** View of north bank looking across stream channel. **Compass:** 0 (North)

## PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek

DATE: July 24, 2013



**Photo 1**

**Description:** View of project reach from the downstream extent. **Compass:** 250 (West-Southwest)



**Photo 4**

**Description:** View of willow cutting establishment on south bank. **Compass:** 90 (East)



**Photo 2**

**Description:** Root wads along south streambank. **Compass:** 45 (Northeast)



**Photo 5**

**Description:** Log structure along south streambank. **Compass:** 110 (East-Southeast)



**Photo 3**

**Description:** Point bar formation on north side of channel. **Compass:** 250 (West-Southwest)



**Photo 6**

**Description:** Willow growth from coir along south streambank. **Compass:** 90 (East)



**PHOTOGRAPHIC INFORMATION** page 1 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek  
DATE: August 13, 2013



Transect 1 South Looking North



Transect 1 South Looking Upstream  
D-5

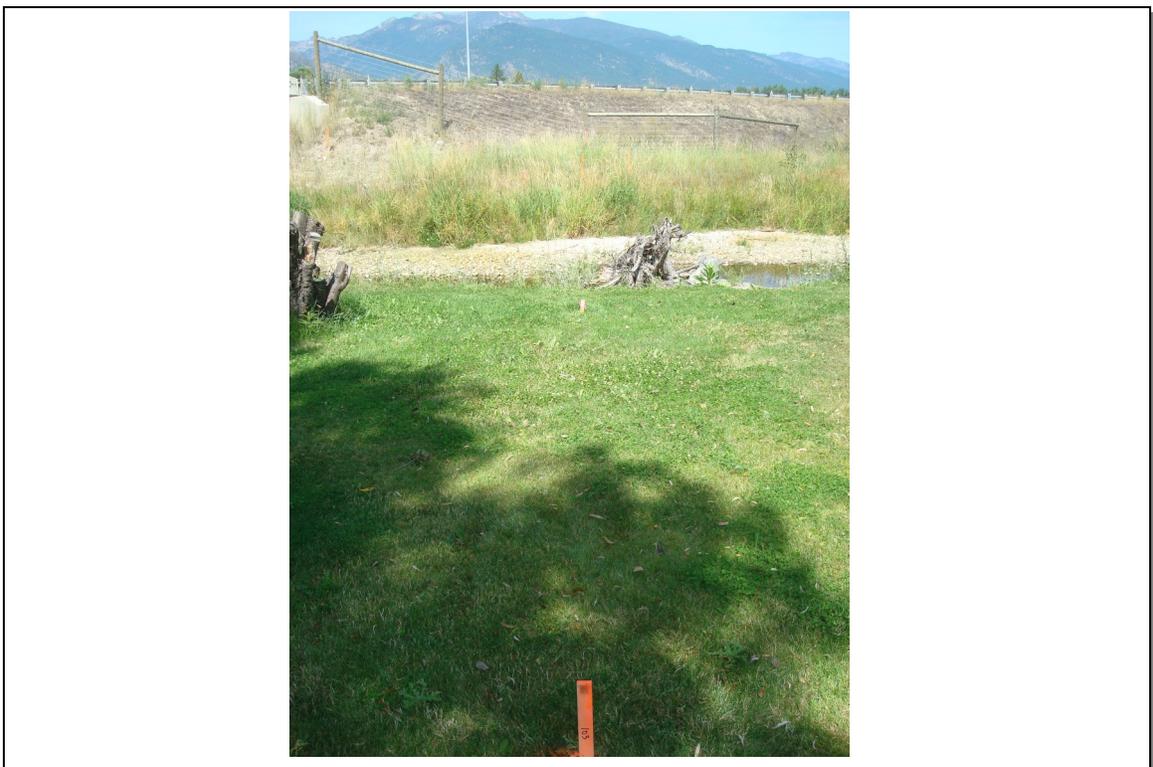


**PHOTOGRAPHIC INFORMATION** page 2 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek  
DATE: August 13, 2013



Transect 1 South Looking Downstream



Transect 2 South Looking Northwest  
D-6

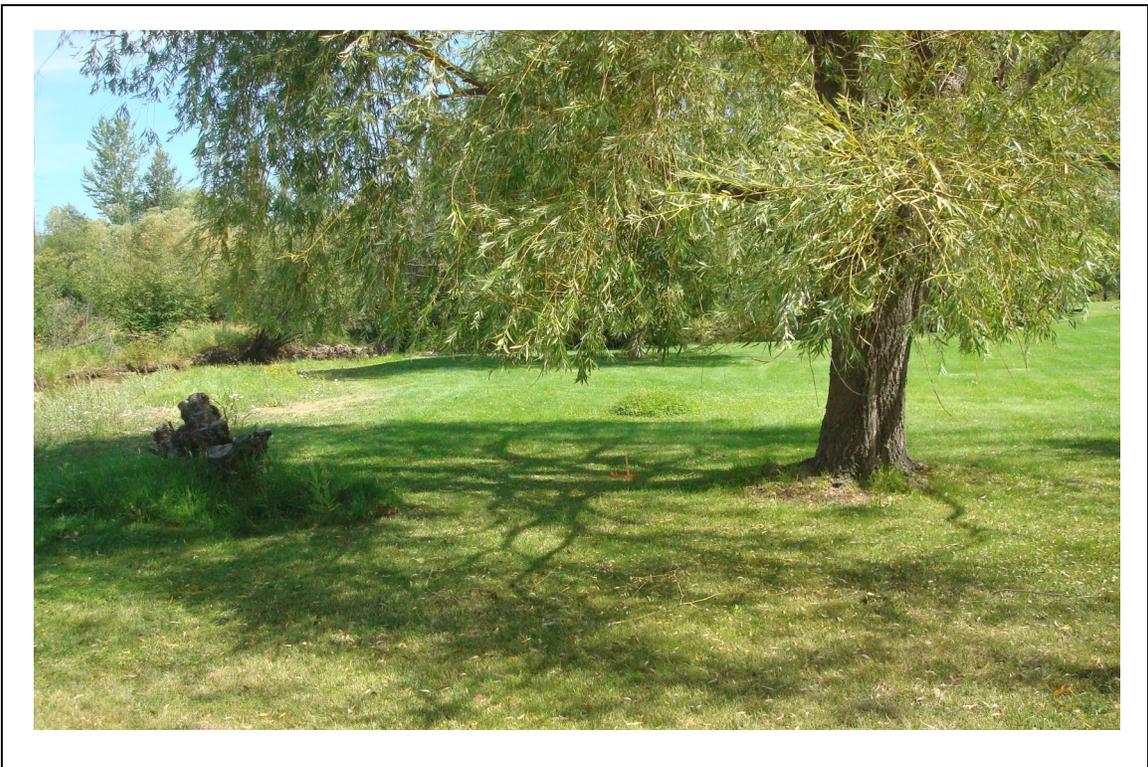


**PHOTOGRAPHIC INFORMATION** page 3 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek  
DATE: August 13, 2013



Transect 2 South Looking Upstream



Transect 2 South Looking Downstream  
D-7

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek

DATE: August 13, 2013



Transect 3 South Looking Northwest



Transect 3 South Looking Upstream  
D-8



**PHOTOGRAPHIC INFORMATION** page 5 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek  
DATE: August 13, 2013



Transect 3 South Looking Downstream



Transect 4 South Looking West  
D-9



**PHOTOGRAPHIC INFORMATION** page 6 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek  
DATE: August 13, 2013



Transect 4 South Looking Upstream



Transect 4 South Looking Downstream  
D-10



**PHOTOGRAPHIC INFORMATION** page 7 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek

DATE: August 13, 2013



Transect 4 in Creek—Upstream



Transect 4 in Creek—Downstream  
D-11



**PHOTOGRAPHIC INFORMATION** page 8 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek  
DATE: August 13, 2013



Transect 2 in Creek—Upstream



Transect 2 in Creek—Downstream  
D-12

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek

DATE: August 13, 2013



Transect 4 North Looking East



Transect 4 North Looking Upstream  
D-13

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek  
DATE: August 13, 2013



Transect 4 North Looking Downstream



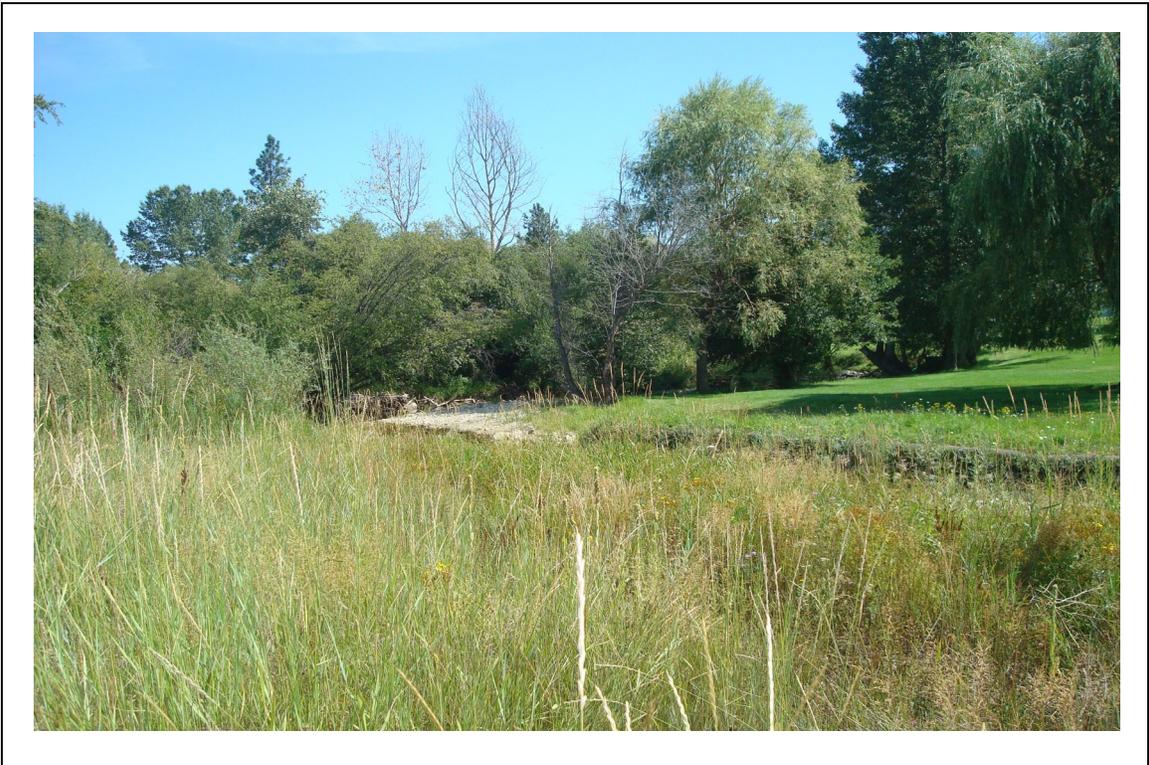
Transect 3 North Looking Southeast  
D-14



PROJECT NAME: MDT Stream Mitigation Sweathouse Creek  
DATE: August 13, 2013



Transect 3 North Looking Upstream



Transect 3 North Looking Downstream  
D-15



**PHOTOGRAPHIC INFORMATION** page 12 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek  
DATE: August 13, 2013



Transect 2 North Looking Southeast



Transect 2 North Looking Upstream  
D-16



**PHOTOGRAPHIC INFORMATION** page 13 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek

DATE: August 13, 2013



Transect 2 North Looking Downstream



Transect 1 North Looking South  
D-17



**PHOTOGRAPHIC INFORMATION** page 14 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek

DATE: August 13, 2013



Transect 1 North Looking Downstream



Transect 1 North Looking Upstream  
D-18



**PHOTOGRAPHIC INFORMATION** page 15 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek  
DATE: August 13, 2013



Transect 1 in Creek - Looking Upstream



Transect 1 in Creek—Looking Downstream



**PHOTOGRAPHIC INFORMATION** page 16 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek  
DATE: August 13, 2013



Under Bridge Looking Downstream



Under Bridge Looking Upstream  
D-20



**PHOTOGRAPHIC INFORMATION** page 17 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek

DATE: August 13, 2013



West Bridge in Creek Looking South



West Bridge in Creek Looking North  
D-21

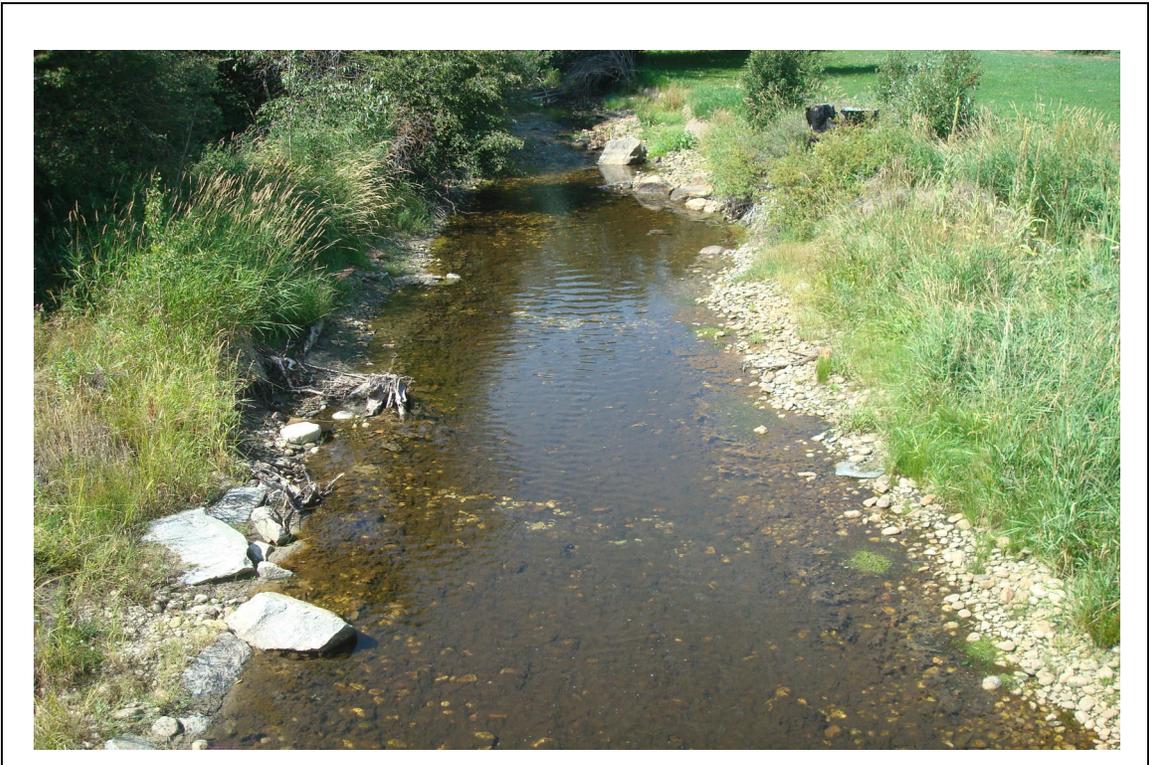


**PHOTOGRAPHIC INFORMATION** page 18 of 18

PROJECT NAME: MDT Stream Mitigation Sweathouse Creek  
DATE: August 13, 2013



West Bridge in Creek Looking Upstream



West Bridge on Path Looking Upstream  
D-22

## **Appendix E**

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### As Built Surveys & Planting Schematics

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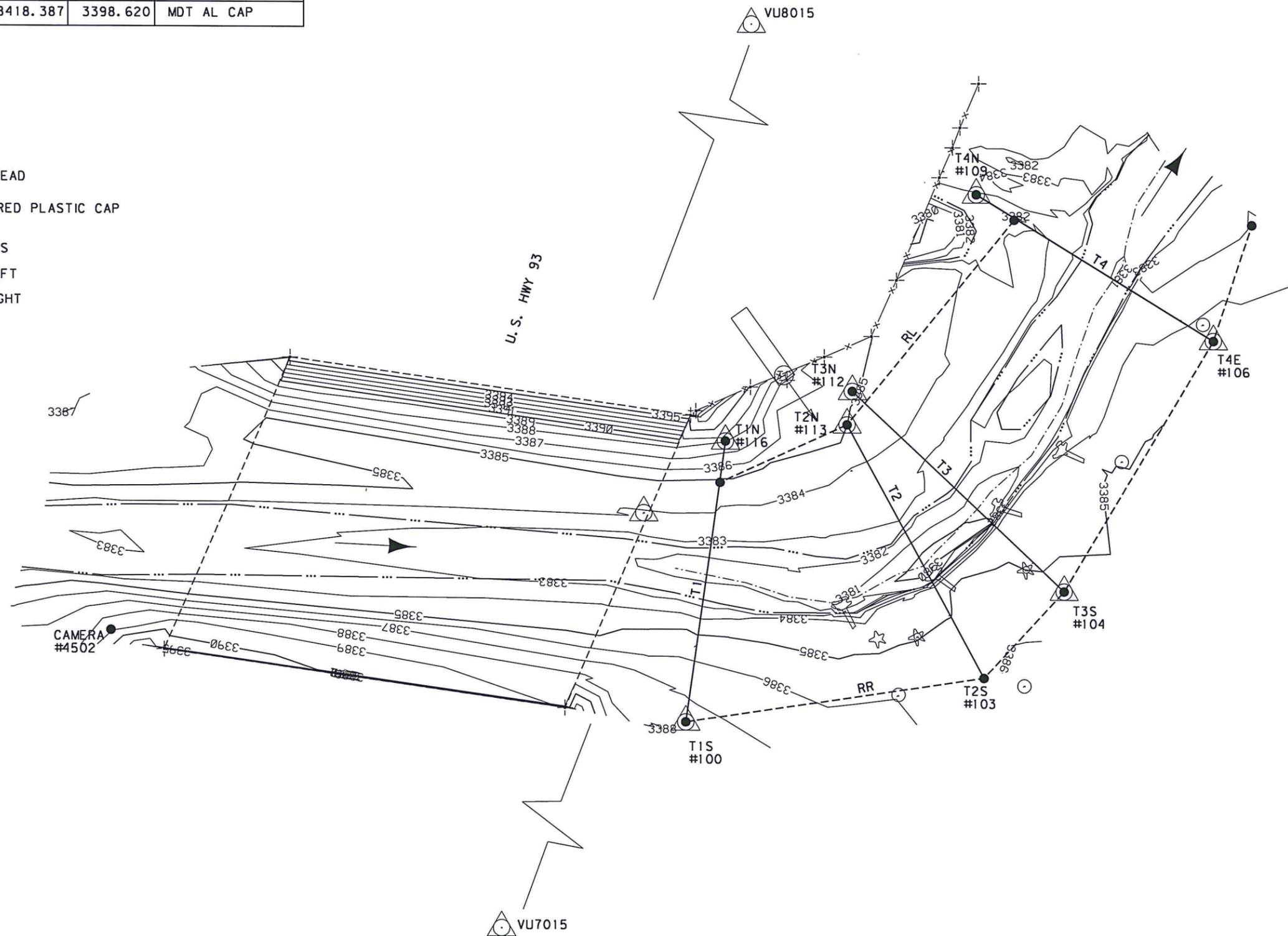
MDT Stream Mitigation Monitoring  
Sweathouse Creek  
Ravalli County, Montana

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CONTROL TABLE				
PNT#	NORTHING	EASTING	ELEV.	DESCRIPTION
VU8015	828172.704	798795.833	3398.807	MDT AL CAP
VU7015	826995.289	798418.387	3398.620	MDT AL CAP

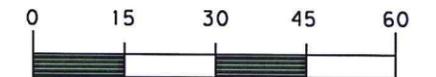
LEGEND

-  ROOT BALL
-  TREE STUMP
-  SPRINKLER HEAD
-  IRON PIN W/RED PLASTIC CAP
- T1 TRANSECTIONS
- RL RIPTRANS LEFT
- RR RIPTRANS RIGHT



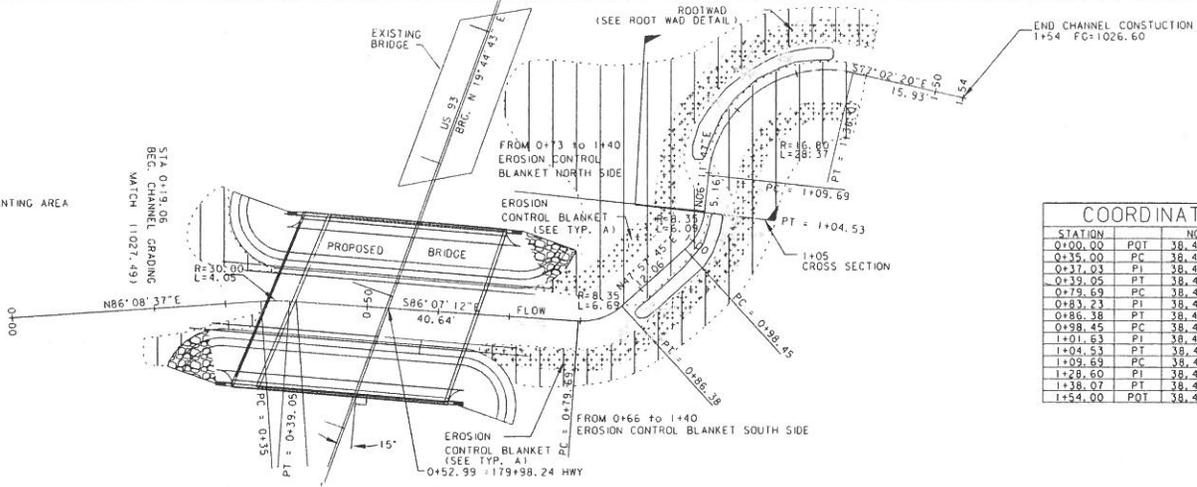
SURVEYOR NOTES:

- THIS SURVEY IS BASED ON FOUND MDT ALUMINUM CAPS STAMPED VU8015 AND VU7015 BUT THEY DO NOT HAVE ESTABLISHED MDT COORDS AND ELEVATIONS. THEREFORE LOCAL CONTROL WAS ESTABLISHED FOR THIS SITE WITH TRIMBLE GPS RTK SURVEY AND THE APPROXIMATE ASSUMED ELEVATION AT MDT ALUM CAP VU8015.
- THE COORDINATES SHOWN HEREON ARE BASED ON MONTANA STATE PLANE GRID



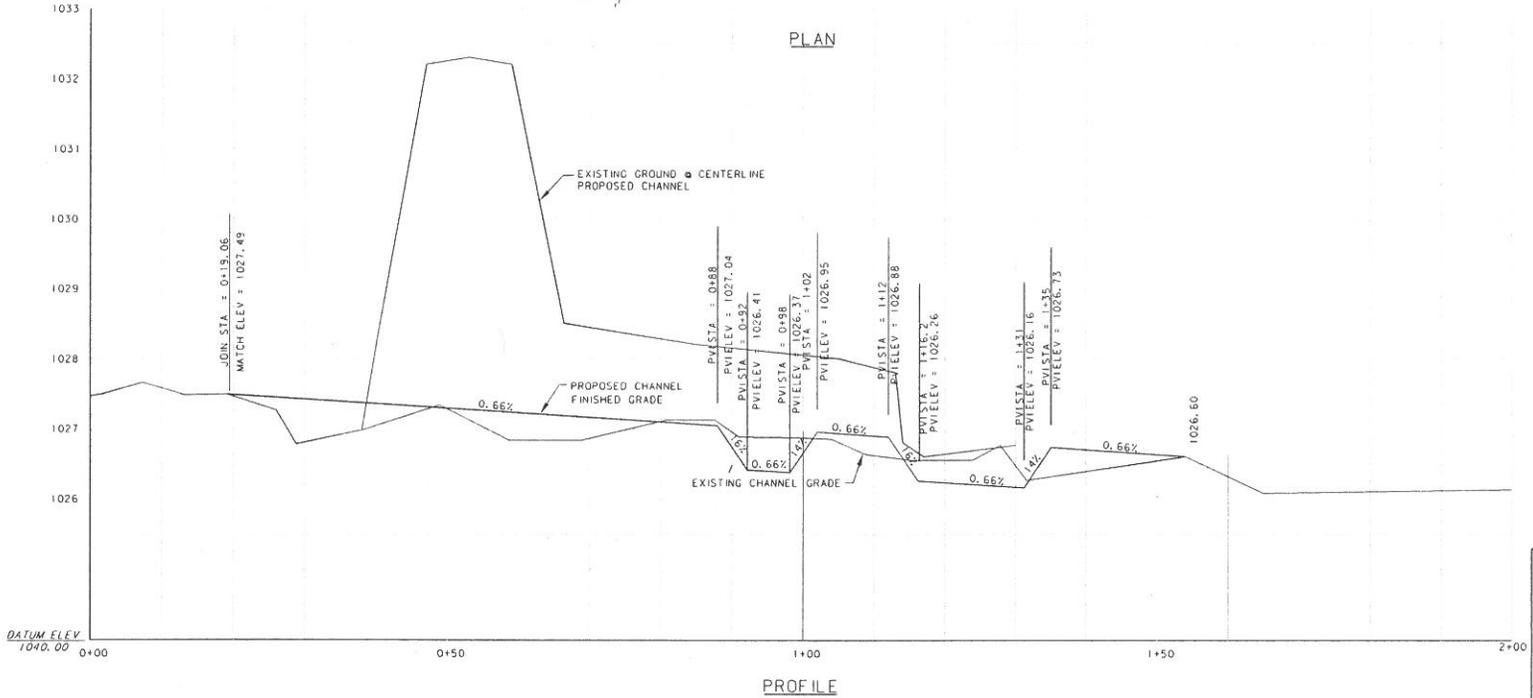
STATE	PROJECT NUMBER	SHEET NO.
MONTANA	NH 7-11115159	28
VICTOR URBAN		

- LEGEND**
- ROOT WAD
  - EROSION CONTROL BLANKET
  - RIP RAP
  - VEGETATION & WILLOW PLANTING AREA



**COORDINATE TABLE**

STATION	POT	NORTHING	EASTING
0+00.00	POT	38,404.6187	56,198.6875
0+35.00	PC	38,407.0326	56,233.6082
0+37.03	PI	38,407.1630	56,235.6320
0+39.05	PT	38,407.0319	56,237.6558
0+79.69	PC	38,404.2817	56,278.2049
0+83.23	PI	38,404.0424	56,281.7341
0+86.38	PT	38,406.4110	56,284.3612
0+88.45	PC	38,414.4878	56,293.3196
1+01.63	PI	38,416.6210	56,295.6857
1+04.53	PT	38,419.7881	56,296.0296
1+09.69	PC	38,424.9181	56,296.5855
1+28.60	PI	38,443.7182	56,298.6277
1+38.07	PT	38,439.4768	56,317.0564
1+54.00	POT	38,435.9032	56,332.5834



**SWEATHOUSE CREEK  
CHANNEL  
RESTORATION  
DETAIL  
STA. 179+98  
SHEET 1 OF 2  
NO SCALE**

MDTX MONTANA DEPARTMENT OF TRANSPORTATION  
MONTANA CADD

LAND & WATER CONSULTING, INC.

DATE: 06/20/2015 09:47:00  
PROJECT: SWEATHOUSE CREEK RESTORATION  
SHEET: 28 OF 28  
DRAWN: JRS  
CHECKED: JRS

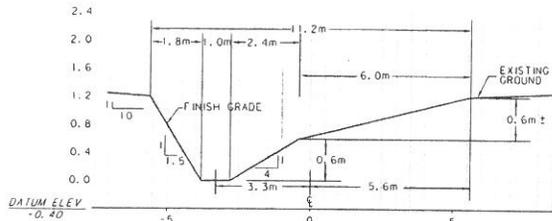
STATE	PROJECT NUMBER	SHEET NO.
MONTANA	NH 7-1(115)59	29
VICTOR URBAN		

MDTX MONTANA DEPARTMENT OF TRANSPORTATION

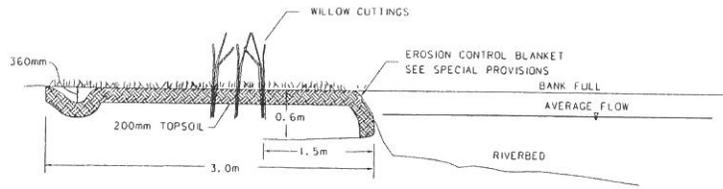
MONTANA CADD

LAND & WATER CONSULTING, INC.

1500 20th St. Suite 100  
 Helena, MT 59601  
 (406) 442-2222  
 www.lwconsulting.com

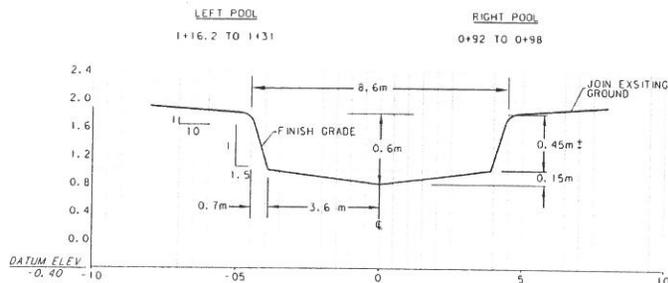


TYPICAL POOL LEFT CROSS SECTION



1. SUB EXCAVATE BANKS 0.6 METERS.
2. LAY LOWER BLANKET MINIMUM 1.5 METERS FROM EDGE OF BANK.
3. BACK FILL WITH NATIVE MATERIAL AND 0.2 METERS TOPSOIL.
4. WRAP BLANKET AND EXTEND 3.0 METERS MIN. FROM BANK EDGE.

EROSION CONTROL BLANKET TYPICAL  
SWEATHOUSE CREEK



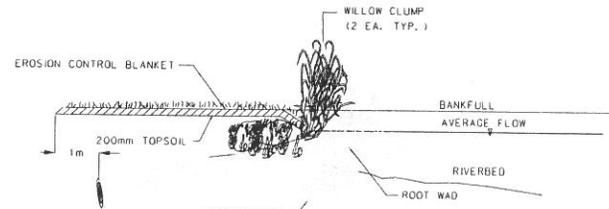
TYPICAL RIFFLE CROSS SECTION

RIFFLE

(INCLUDES TRANSITIONS)

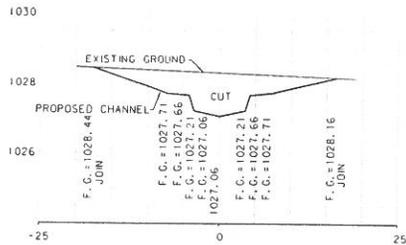
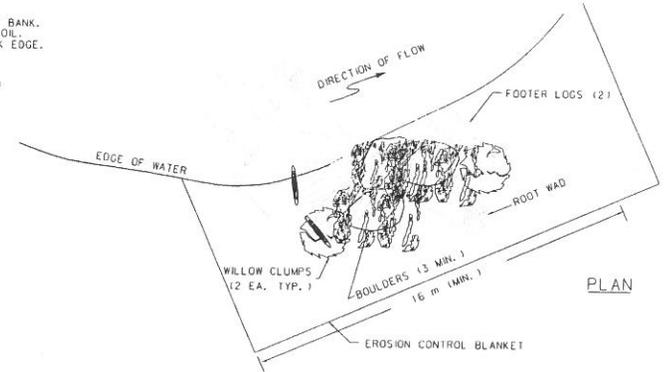
NOTES:

1. SEE PLANS FOR POOL LOCATIONS. POOL LEFT (PL) SHOWN, MIRROR ABOUT CENTERLINE (CL) FOR POOL RIGHT LOOKING DOWNSTREAM.
2. TRANSITION 4.0m BETWEEN POOL: RIFFLE.
3. ROUND SLOPES FOR NATURAL APPEARANCE.

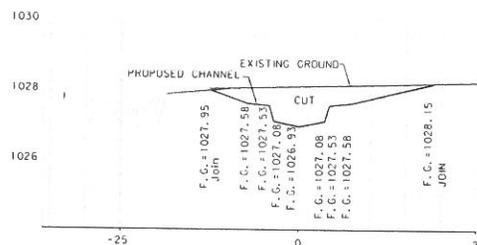


CROSS SECTION

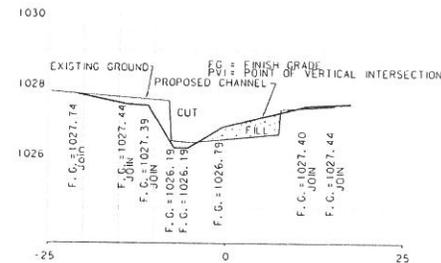
ROOT WAD TYPICAL  
SWEATHOUSE CREEK



CROSS SECTION 0+85



CROSS SECTION 1+05



CROSS SECTION 1+25

SWEATHOUSE CREEK  
CHANNEL  
RESTORATION  
DETAILS  
STA. 179+98  
SHEET 2 OF 2  
NO SCALE