
MONTANA DEPARTMENT OF TRANSPORTATION STREAM MITIGATION MONITORING REPORT

*Sweathouse Creek
Ravalli County, Montana*

*Year Project Completed: 2011
Monitoring Report #3: Submitted December, 2015*



Prepared for:



Prepared by:



MONTANA DEPARTMENT OF TRANSPORTATION

STREAM MITIGATION MONITORING REPORT #3

YEAR 2015

*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

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December 2015

Cover Photo: Realigned channel of Sweathouse Creek, taken in July, 2015.

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1.0 INTRODUCTION

The following report presents results of the third year of post stream re-construction monitoring at the U.S. Highway 93 stream crossing at Sweathouse Creek near Victor, Montana. This report includes an evaluation of monitoring results in comparison to project performance standards outlined in the post-construction monitoring plan for the site. The project was constructed in 2011; therefore, these results provide documentation of the site's condition four years following the project's completion.

As part of the U.S. Army Corps of Engineers (USACE) 404 permit application, 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 fill 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 root wads on the left bank and four root wads on the right bank. The USACE permit requires 5 years of annual monitoring of streambank stability and riparian vegetation areal coverage.

Mitigation performance standards outlined for the Sweathouse Creek crossing at U.S. 93 include:

1. **Riparian vegetation coverage**
 - a) Minimum of 80% total vegetative coverage by the end of the third growing season
 - b) Minimum of 50% areal coverage by woody species by the end of the third growing season.
2. **Streambank stability** – any unstable banks within the relocated channel segment will require corrective actions.

Additional reporting requirements included in the monitoring plan include:

3. **As-built survey** – 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.

Results of the third year of monitoring in 2015 are presented in Section 4, and are compared to the adopted performance standards in Section 5. Additional site

information including plots of perpendicular transect and longitudinal profile surveys, photo logs, and as-built schematics are included as appendices to this report.

2.0 SITE LOCATION

The project reach includes approximately 330 feet of Sweathouse Creek, extending 30 feet upstream and 200 feet downstream from the U.S. 93 Bridge (100 feet beneath the bridge). The new bridge is approximately 0.25 miles north of Victor, Montana. The project site is located in Section 30, Township 8 North, Range 20 West in Ravalli County, Montana (Figure 1).

3.0 MONITORING METHODS

Monitoring field crews visited the project site on July 21, 2015 while survey crews visited the site on July 27, 2015. The following data were collected at the Sweathouse Creek stream mitigation site:

3.1. Riparian Vegetation Inventory - Belt Transects

Riparian belt transects established during the first monitoring event in 2013 were re-surveyed to document areal percent cover of total vegetation, woody vegetation, and noxious weeds. 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 2, Appendix A).

3.2. 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 eroding banks included bank length, photographs and potential causes of bank erosion.

3.3. Perpendicular Transects

Four perpendicular transects (cross sections) established in 2013 were re-surveyed to document whether the channel adjusted vertically or laterally. Transects were positioned at two riffles and two pools to document variability in aquatic habitat and channel dimensions. These habitat features did not necessarily exist 75' apart; therefore the spacing between transects varied from that suggested in the additional reporting requirements for this monitoring site.

3.4. Longitudinal Profile

A longitudinal profile of the channel thalweg was surveyed to document bedform complexity and aquatic habitat conditions present within the monitoring reach.

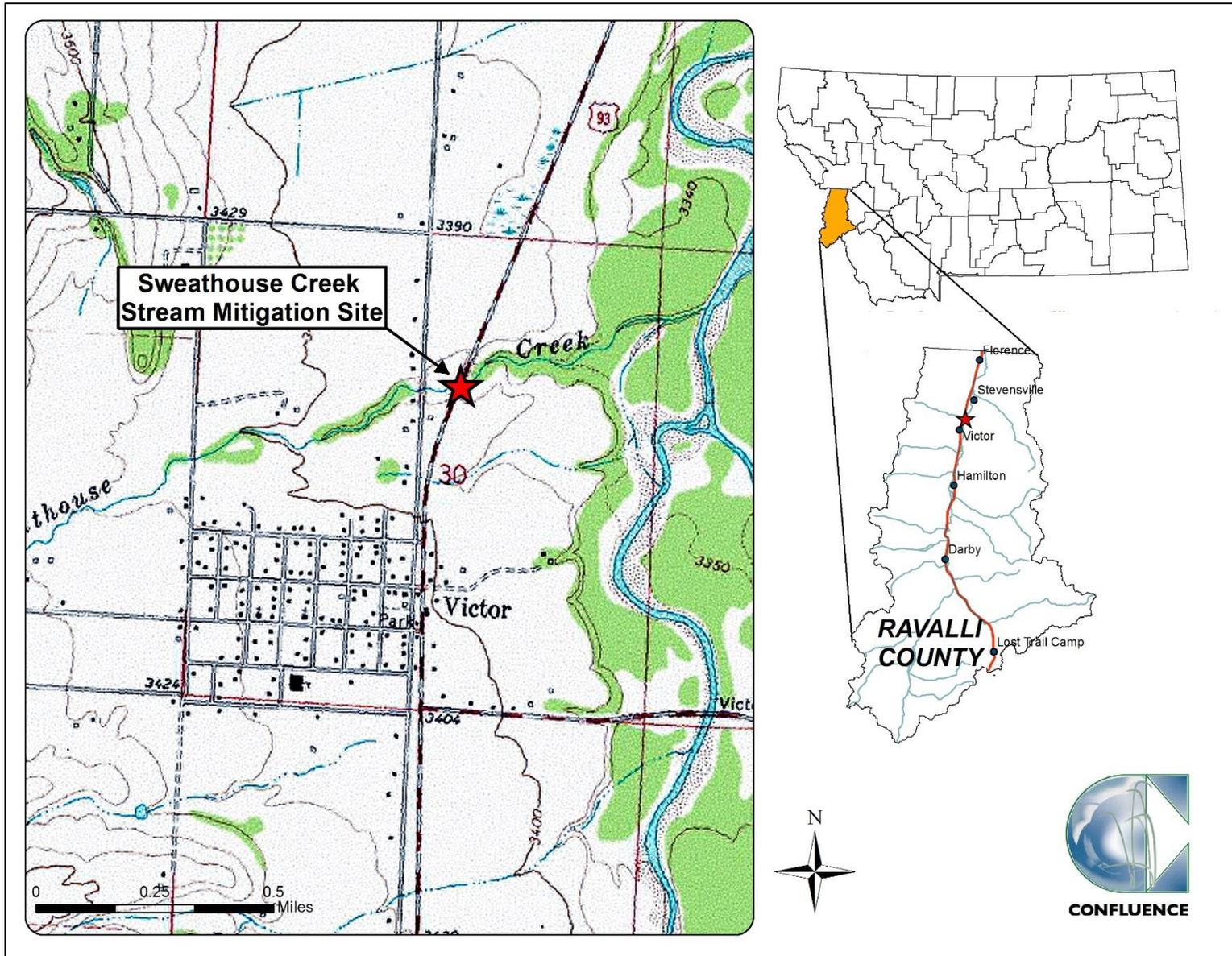


Figure 1. Project location of Sweathouse Creek stream mitigation site.

3.5. Photo-Documentation

Photos were taken at seven photo points established during the first monitoring event in 2013 to document vegetation establishment and stream bank conditions within the project site. 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 transect along the right (south) side of the channel running from the Highway 93 Bridge to the downstream extent of the project reach, and a 114-foot transect on the left (north) bank. The extents of the riparian transects are illustrated on Figure 2 in Appendix A. Table 1 summarizes the vegetation composition of each riparian transect, including areal percent cover of total vegetation, woody vegetation, and noxious weeds. In 2015, the total percent riparian cover remained at 97%, and included 86% cover by herbaceous species and 11% by woody species. Noxious weed coverage rose from 4% in 2014 to 6% in 2015.

Table 1. Riparian vegetation belt transect results, Sweathouse Creek in 2013 and 2014.

Belt Transect	Length (ft)	Total % Riparian Cover			% Woody Cover			% Noxious Weed Cover		
		2013	2014	2015	2013	2014	2015	2013	2014	2015
Right (south bank)	200	97	96	97	14	10	12	5	5	5
Left (north bank)	114	98	98	98	7	7	10	3	3	8
Total	334	97	97	97	11	9	11	4	4	6

Table 2 includes a comprehensive list of plant species observed along the new channel alignment and riparian buffer areas. In 2015, 99 species were observed, representing an increase of 14 species from the 2014 monitoring event and 44 species from the initial monitoring event in 2013. In 2015, 55% of the species observed were hydrophytic based on the 2014 National Wetland Plant List (NWPL) (Lichvar et al, 2014).

Table 2. Comprehensive list of plant species identified at the Sweathouse Creek stream mitigation site in 2013, 2014, and 2015.

Scientific Name	Common Name	WMVC Indicator Status*	Scientific Name	Common Name	WMVC Indicator Status*
<i>Achillea millefolium</i>	Common Yarrow	FACU	<i>Medicago sativa</i>	Alfalfa	UPL
<i>Agropyron cristatum</i>	Crested Wheatgrass	NL	<i>Mellilotus albus</i>	White Sweetclover	NL
<i>Agrostis scabra</i>	Rough Bent	FAC	<i>Mellilotus officinalis</i>	Yellow Sweet-Clover	FACU
<i>Algae, brown</i>	Algae, brown	NL	<i>Mentha arvensis</i>	American Wild Mint	FACW
<i>Algae, green</i>	Algae, green	NL	<i>Mimulus guttatus</i>	Seep Monkey-Flower	OBL
<i>Alnus incana</i>	Speckled Alder	FACW	<i>Myriophyllum</i> sp.	Water-Milfoil	NL
<i>Alopecurus aequalis</i>	Short-Awn Meadow-Foxtail	OBL	<i>Onopordum acanthium</i>	Scotch Thistle	NL
<i>Alopecurus pratensis</i>	Field Meadow-Foxtail	FAC	<i>Pascopyrum smithii</i>	Western-Wheat Grass	FACU
<i>Alyssum alyssoides</i>	Pale Alyssum	NL	<i>Persicaria amphibia</i>	Water Smartweed	OBL
<i>Betula pumila</i>	Bog Birch	OBL	<i>Persicaria</i> sp.	Smartweed	NL
<i>Bromus tectorum</i>	Cheatgrass	NL	<i>Phalaris arundinacea</i>	Reed Canary Grass	FACW
<i>Carex aquatilis</i>	Leafy Tussock Sedge	OBL	<i>Phleum pratense</i>	Common Timothy	FAC
<i>Carex</i> sp.	Sedge	NL	<i>Plantago lanceolata</i>	English Plantain	FACU
<i>Carex stipata</i>	Stalk-Grain Sedge	OBL	<i>Plantago major</i>	Great Plantain	FAC
<i>Carex utriculata</i>	Northwest Territory Sedge	OBL	<i>Poa palustris</i>	Fowl Blue Grass	FAC
<i>Centaurea stoebe</i>	Spotted Knapweed	NL	<i>Poa pratensis</i>	Kentucky Blue Grass	FAC
<i>Cerastium</i> sp.	Chickweed	NL	<i>Populus angustifolia</i>	Narrow-Leaf Cottonwood	FACW
<i>Chenopodium album</i>	Lamb's-Quarters	FACU	<i>Populus balsamifera</i>	Balsam Poplar	FAC
<i>Cirsium arvense</i>	Canadian Thistle	FAC	<i>Populus tremuloides</i>	Quaking Aspen	FACU
<i>Cirsium vulgare</i>	Bull Thistle	FACU	<i>Prunus emarginata</i>	Bitter Cherry	FACU
<i>Cornus alba</i>	Red Osier	FACW	<i>Ranunculus acris</i>	Tall Buttercup	FAC
<i>Dactylis glomerata</i>	Orchard Grass	FACU	<i>Ranunculus aquatilis</i>	White Water-Crowfoot	OBL
<i>Dasiphora fruticosa</i>	Golden-Hardhack	FAC	<i>Ranunculus</i> sp.	Buttercup	NL
<i>Deschampsia cespitosa</i>	Tufted Hairgrass	FACW	<i>Ribes setosum</i>	Inland Gooseberry	NL
<i>Descurainia sophia</i>	Herb Sophia	NL	<i>Rubus idaeus</i>	Common Red Raspberry	FACU
<i>Eleocharis palustris</i>	Common Spike-Rush	OBL	<i>Rubus parviflorus</i>	Western Thimble-Berry	FACU
<i>Elymus cinereus</i>	Great Basin Wildrye	NL	<i>Rumex acetosa</i>	Garden Sorrel	FAC
<i>Elymus hispidus</i>	Intermediate Wheatgrass	NL	<i>Rumex crispus</i>	Curly Dock	FAC
<i>Elymus repens</i>	Creeping Wild Rye	FAC	<i>Salix amygdaloides</i>	Peach-Leaf Willow	FACW
<i>Epilobium ciliatum</i>	Fringed Willowherb	FACW	<i>Salix babylonica</i>	Chinese Willow	FACW
<i>Equisetum arvense</i>	Field Horsetail	FAC	<i>Salix boothii</i>	Booth's Willow	FACW
<i>Geum macrophyllum</i>	Large-Leaf Avens	FAC	<i>Salix drummondiana</i>	Drummond's Willow	FACW
<i>Glyceria grandis</i>	American Manna Grass	OBL	<i>Salix exigua</i>	Narrow-Leaf Willow	FACW
<i>Glyceria striata</i>	Fowl Manna Grass	OBL	<i>Salix lasiandra</i>	Pacific Willow	FACW
<i>Hordeum jubatum</i>	Fox-Tail Barley	FAC	<i>Schoenoplectus acutus</i>	Hard-Stem Club-Rush	OBL
<i>Hypericum perforatum</i>	Common St. John's-Wort	FACU	<i>Scirpus microcarpus</i>	Red-Tinge Bulrush	OBL
<i>Juncus balticus</i>	Baltic Rush	FACW	<i>Scrophularia lanceolata</i>	Lance-Leaf Figwort	FAC
<i>Juncus compressus</i>	Round-Fruit Rush	OBL	<i>Silene latifolia</i>	Bladder Campion	NL
<i>Juncus effusus</i>	Lamp Rush	FACW	<i>Silene vulgaris</i>	Maiden's-tears	NL
<i>Juncus ensifolius</i>	Dagger-Leaf Rush	FACW	<i>Solanum dulcamara</i>	Climbing Nightshade	FAC
<i>Juncus</i> sp.	Rush	NL	<i>Solidago canadensis</i>	Canadian Goldenrod	FACU
<i>Lathyrus sylvestris</i>	Flat Pea	NL	<i>Sonchus arvensis</i>	Field Sow-Thistle	FACU
<i>Lemna minor</i>	Common Duckweed	OBL	<i>Tanacetum vulgare</i>	Common Tansy	FACU
<i>Lepidium campestre</i>	Field Pepper-Grass	NL	<i>Taraxacum officinale</i>	Common Dandelion	FACU
<i>Leucanthemum vulgare</i>	Ox-Eye Daisy	FACU	<i>Thlaspi arvense</i>	Field Pennycress	UPL
<i>Leymus cinereus</i>	Great Basin Lyme Grass	FAC	<i>Trifolium pratense</i>	Red Clover	FACU
<i>Lupinus</i> sp.	Lupine	NL	<i>Trifolium repens</i>	White Clover	FAC
<i>Lycopus asper</i>	Rough Water-Horehound	OBL	<i>Typha latifolia</i>	Broad-Leaf Cat-Tail	OBL
<i>Medicago lupulina</i>	Black Medick	FACU	<i>Verbascum thapsus</i>	Great Mullein	FACU
			<i>Veronica americana</i>	American-Brooklime	OBL

*Based on 2014 NWPL (Lichvar *et al.*, 2014)
New species identified in 2015 are **bolded**.

Nineteen infestations of Montana Listed Priority 2B noxious weeds and one infestation of a Montana Listed Priority 2A noxious weed were mapped within the riparian corridor at the Sweathouse Creek stream mitigation site and are listed in Table 3 (Figure 3,

Appendix A). Cheatgrass (*Bromus tectorum*), a Montana Priority 3 regulated weed species (not a Montana Listed noxious weed) was also identified across the site.

Each noxious weed occurrence was identified in areas less than 0.1 acre in size with cover classes ranging from trace (less than 1 percent) to low (1 to 5 percent). Noxious weeds have continued to increase at the site, with 14 new infestations since 2014. An estimated 6% of the project area has been colonized by noxious weeds. Weeds were observed on both stream banks, and were primarily concentrated downstream of the Highway 93 Bridge.

Table 3. Montana State listed noxious weed and regulated species observed in 2015 at the Sweathouse Creek Stream Mitigation Site.

Category*	Scientific Name	Common Name
Priority 2A	<i>Ranunculus acris</i>	Tall Buttercup
Priority 2B	<i>Centaurea stoebe</i>	Spotted Knapweed
	<i>Cirsium arvense</i>	Canadian Thistle
	<i>Hypericum perforatum</i>	Common St. John's-Wort
	<i>Leucanthemum vulgare</i>	Ox-Eye Daisy
	<i>Tanacetum vulgare</i>	Common Tansy
Priority 3 State Regulated	<i>Bromus tectorum</i>	Cheatgrass

*Based on the Montana Dept. of Agriculture's Noxious Weed List, 2015.
New species identified in 2015 are listed in **bold**.

4.2. Erosion Inventory

The erosion inventory conducted in 2015 did not reveal any new bank erosion within the project reach. A 15-foot long eroding stream bank documented in 2014 along the right (south) bank between the first and second root wads downstream of the Highway 93 Bridge (see Additional Photo 4 on page 8 of Appendix C) does not appear to have eroded further laterally in the past year. Erosion along this bank appeared due to scour of gravels and cobbles that had been placed beneath the coir logs to construct the bank. Movement of these cobbles has resulted in a 15-foot segment of the bank to undercut, loss of one coir log, and bank calving adjacent to a second coir log. Erosion along this bank is considered moderate due to the relatively short segment exhibiting erosion and no evidence of continued lateral migration one year following its initial discovery.

During construction of the project, the first coir log placed downstream of the highway bridge on the south bank was not keyed into the bank well and was exposed to high flows. Photo point #2.1 was established to document whether this log held in place. Monitoring at this location to date has indicated the coir log has not detached from the bank and remains in place.

4.3. Perpendicular Transect Surveys

Two pool and two riffle transects within the project were re-surveyed in 2015 to document vertical or lateral channel adjustments. Plots for each surveyed transect are

included in Appendix B, and are plotted from left to right looking downstream. Repetition of these transects over the past 3 years indicates relatively minor adjustments to the bed and banks. Both pool transects indicate the channel is maintaining deeper water habitat by scouring against wood structures installed on the right bank. Riffles also largely maintained bed elevations and channel dimensions, indicating relatively good sediment and bedload transport. The point bar along the left (north) bank appears to adjust from year to year, but has maintained its overall slope. No evidence of erosion was noted at any of the surveyed transects. Perpendicular transects will be re-surveyed during subsequent monitoring events to continue documenting bar formation, pool depths, or lateral channel movements.

4.4. Longitudinal Profile Surveys

A longitudinal profile surveyed down the length of the channel thalweg in 2014 and 2015 are also included in Appendix B. In 2015, the profile survey did not include points beneath the Highway 93 Bridge due to a malfunctioning total station survey instrument; however, the remaining profile length indicates the stream bed maintained relatively consistent elevations. One long pool is evident within the profile, extending from STA 2+30 downstream to STA 3+10. This section of the channel occurs along the meander bend downstream of the bridge and has several root wads and logs installed along the bank to encourage scour and pool development. Juvenile and small trout up to 8" have been observed utilizing this pool. Both pool transects surveyed lie within this segment of the channel. A second pool is developing on the next meander bend downstream, where the longitudinal profile ends. Continued monitoring of the channel bed elevation will document whether aggradation or degradation is occurring within the project reach.

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 Sweathouse Creek mitigation monitoring plan. The third year of monitoring suggests one of the three performance standards is being met four years post-construction. Additional reporting requirements outlined in the monitoring plan including schematics of an as-built topographic survey, repetition of perpendicular transect surveys, and photo documentation of the site are included as appendices in this report.

Table 4. Performance results of Sweathouse Creek 4 years following construction.

Parameter	Success Criteria	Status	Meeting Performance Criteria?
Riparian Coverage	80% total vegetative coverage after the 3rd year.	Project area has 97% vegetative cover.	Yes
	50% coverage of woody vegetation after the 3rd year.	Project area has 11% woody cover (12% of south bank and 10% of north bank)	No
Stream Bank Stability	Unstable banks identified within the project reach will require corrective action	One eroding streambank, with moderate severity, was identified in 2014 but did not erode further in 2015.	Corrective action may be required at eroding bank

5.1. Riparian Vegetation Coverage

Vegetative cover along the Sweathouse Creek Mitigation Site has consistently measured above 95% for the past three monitoring years, and exceeds the performance standard of 80% areal coverage. Vegetation has established well within the riparian zone (defined as within 25' of the stream banks), particularly along the north stream bank. Herbaceous vegetation along the south stream bank has also established well; although mowing has continued up to the edge of the channel by the adjacent landowner.

In 2015, percent cover of the riparian corridor by woody riparian vegetation increased by 2% from 2014 to 11%; however, it remains below the performance standard of 50% coverage by the end of the third growing season. Many of the willow cuttings installed along the toe of both banks have survived 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-foot wide riparian zone.

Woody vegetation cover on the north (not mowed) bank is 10%, while the cover on the south (mowed) bank is 12%. The higher percent woody cover on the south bank is due to successful establishment of the thin band of willow cuttings along the entire bank and mature trees that established prior to construction of the project. Based on these data, woody plants installed within the riparian buffer zones had relatively poor survival rates especially along the south bank. Woody plants that have survived to date have yet to provide enough cover to meet the performance criteria for this category.

The adjacent landowner to the south of the creek has continued to mow all vegetation up 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 eliminated. The ability to meet the woody vegetation cover criteria will largely depend on cooperation of 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 all 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 is necessary to achieve the target percent cover of 50%.

5.2. Bank Erosion Inventory

The 15-foot section of eroding bank along Sweathouse Creek identified in 2014 did not erode further in 2015 and is not currently jeopardizing any woody structures installed along the south bank. This moderately eroding bank occurs between two root wads installed to protect the bank from lateral erosion. One of the coir logs placed to protect the upper bank washed out, exposing the upper bank to active flows. Vegetation along this bank has been consistently mowed, and woody vegetation planted during the project's construction has only sparsely established along the bank toe. As a result of

the erosion occurring along this bank, corrective actions may be necessary to maintain 100% stability within the project reach.

6.0 LITERATURE CITED

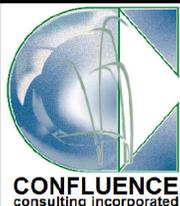
Lichvar, R.W., M. Butterwick, N.C. Melvin, and W.N. Kirchner. 2014. *The National Wetland Plant List. 2014 Update of Wetland Ratings*. Phytoneuron 2014-41:1-42.

Montana Department of Agriculture. Montana Noxious Weed List. July 2015. Accessed in September 2015 at <http://agr.mt.gov/agr/Programs/Weeds/PDF/2015WeedList.pdf>.

Appendix A

Project Site Maps

MDT Stream Mitigation Monitoring
Sweathouse Creek
Ravalli County, Montana



Legend

-  Photo Points
-  Riparian and Perpendicular Transect Endpoints

-  Channel Thalweg
-  Major Station (100')
-  Minor Station (25')

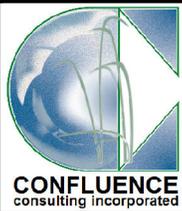
-  Eroding Banks
-  Pool and Riffle Transects
-  Riparian Transects

2015 Monitoring Features Sweathouse Creek

Figure 2

Date: 09/29/2015

Sweathouse_features2015



Legend

- | | | | |
|---|-----------------------------|---|-----------------------------|
|  | <i>Centaurea stoebe</i> |  | <i>Leucanthemum vulgare</i> |
|  | <i>Cirsium arvense</i> |  | <i>Ranunculus acris</i> |
|  | <i>Hypericum perforatum</i> |  | <i>Tanacetum vulgare</i> |



**2015 Monitoring
Noxious Weeds
Sweathouse Creek**

Figure 3

Date: 09/28/2015

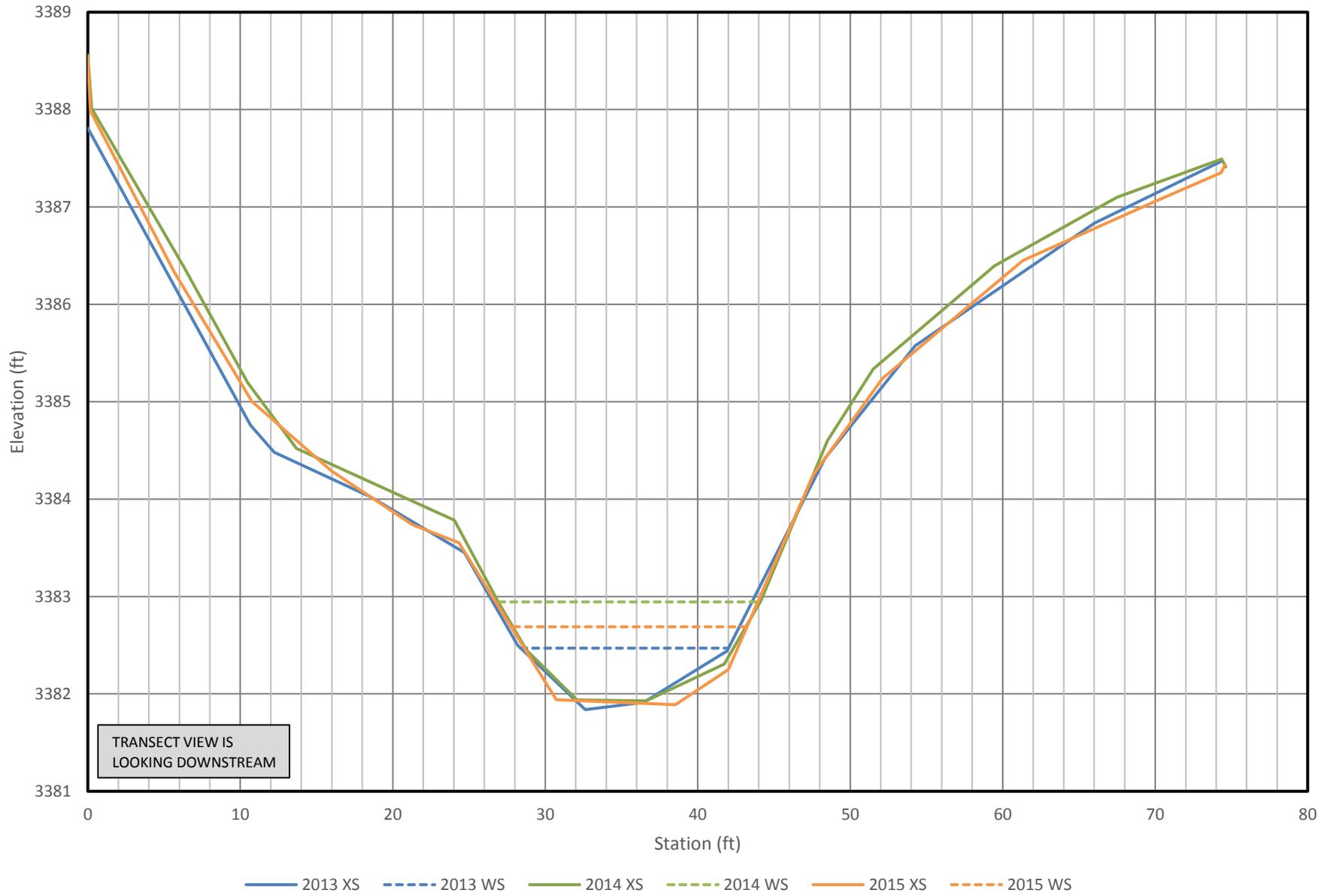
Sweathouse_weeds2015.mxd

Appendix B

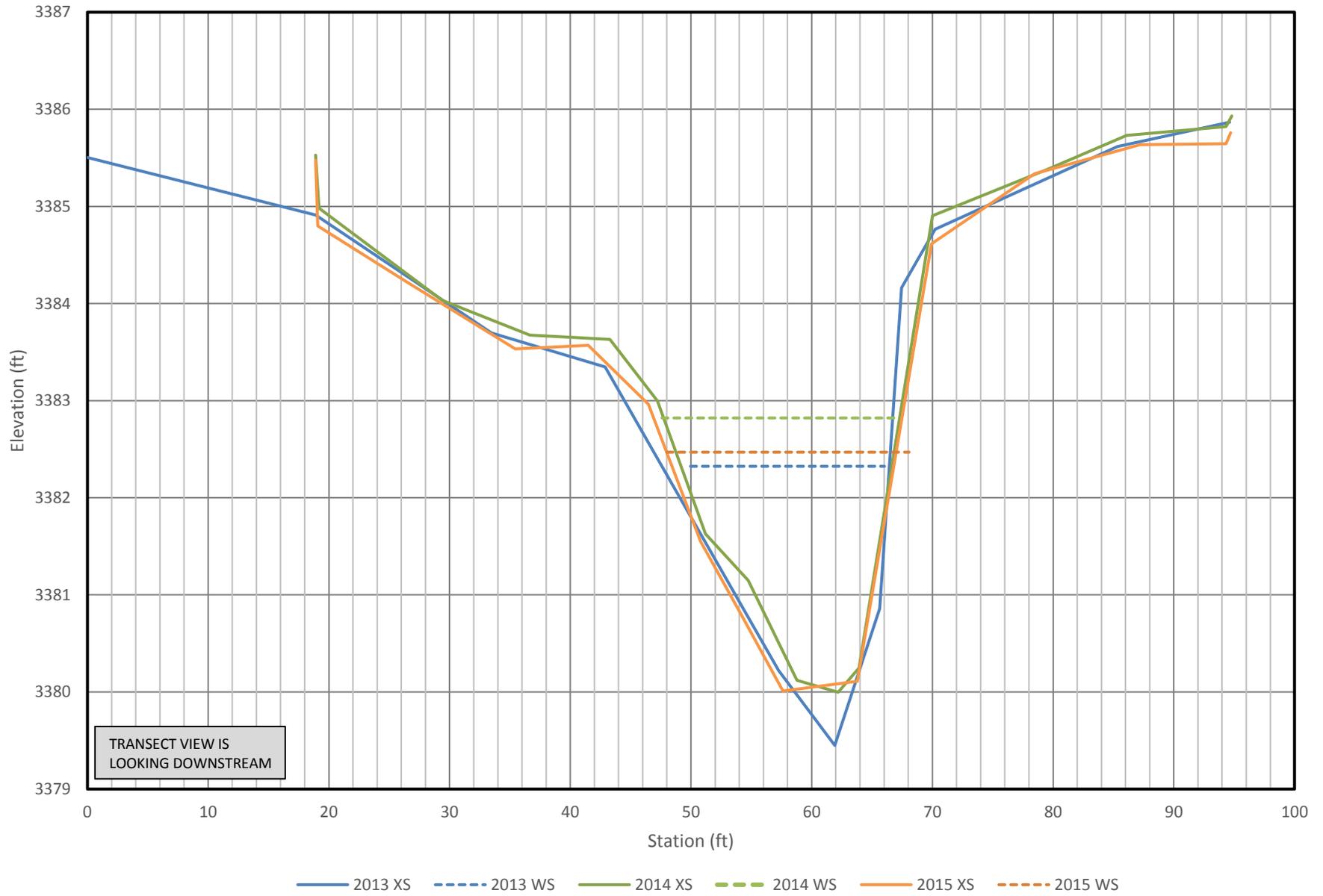
Perpendicular Transect and Longitudinal Profile Plots

MDT Stream Mitigation Monitoring
Sweathouse Creek
Ravalli County, Montana

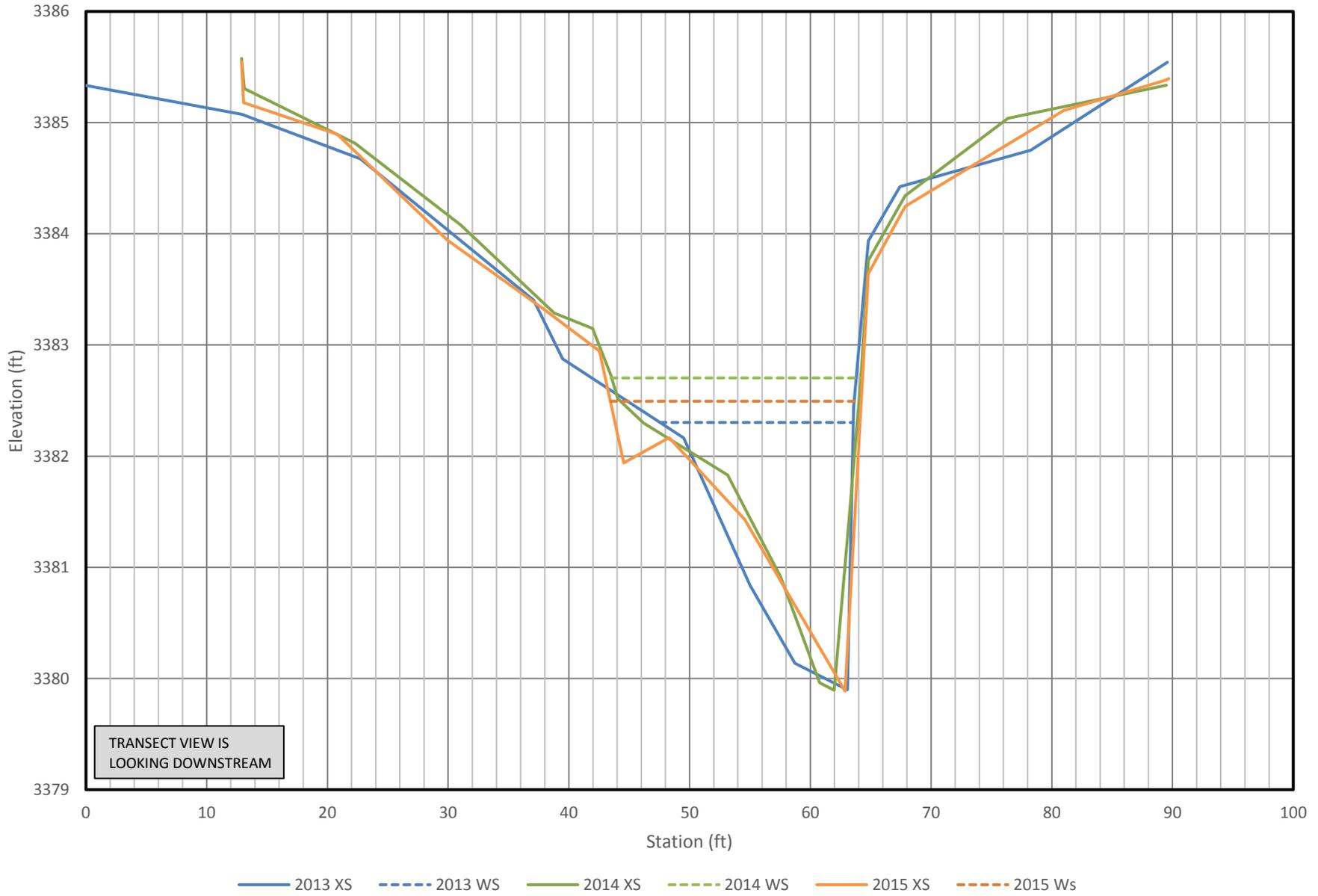
Sweathouse Creek Transect #1 - Riffle



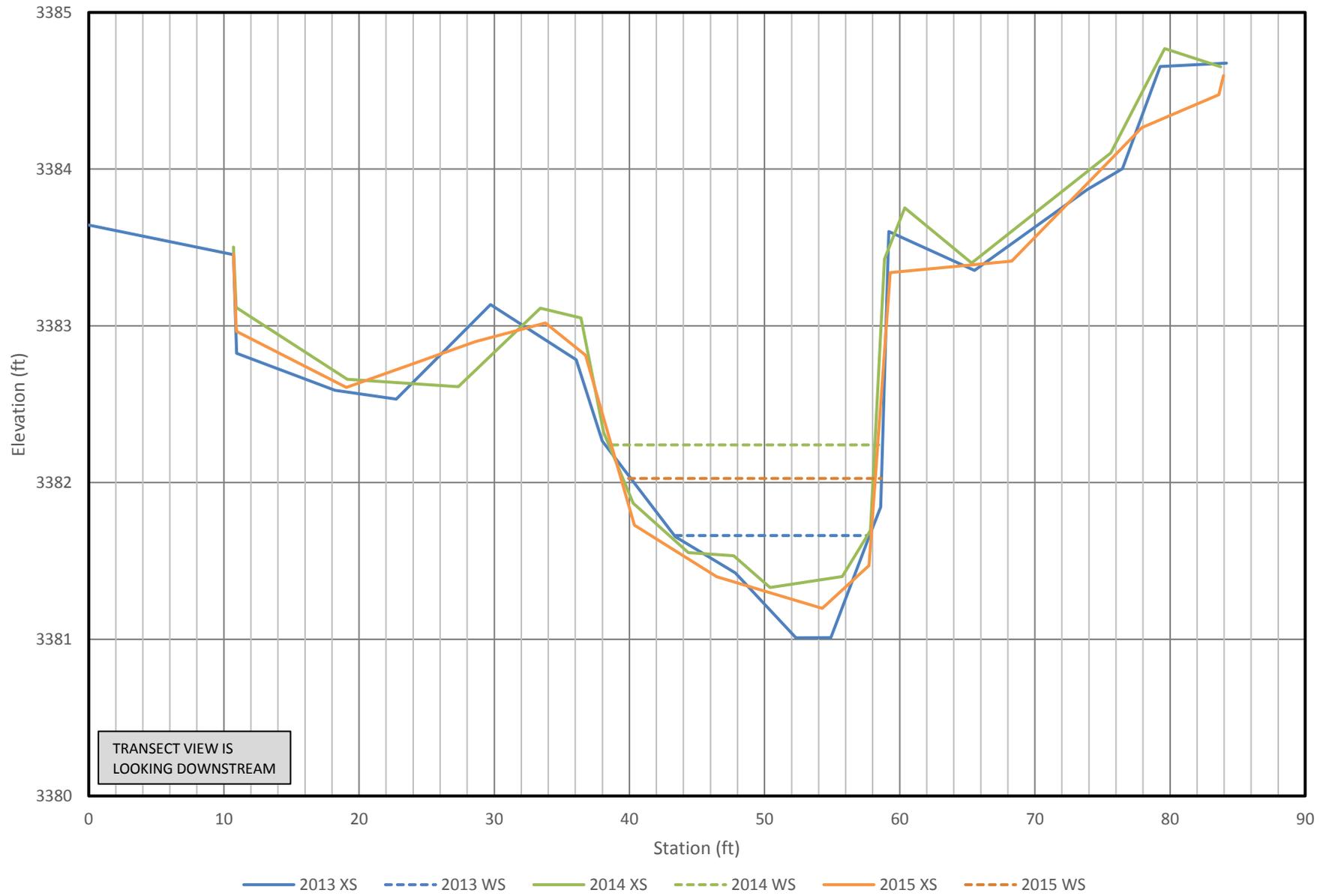
Sweathouse Creek Transect #2 - Pool



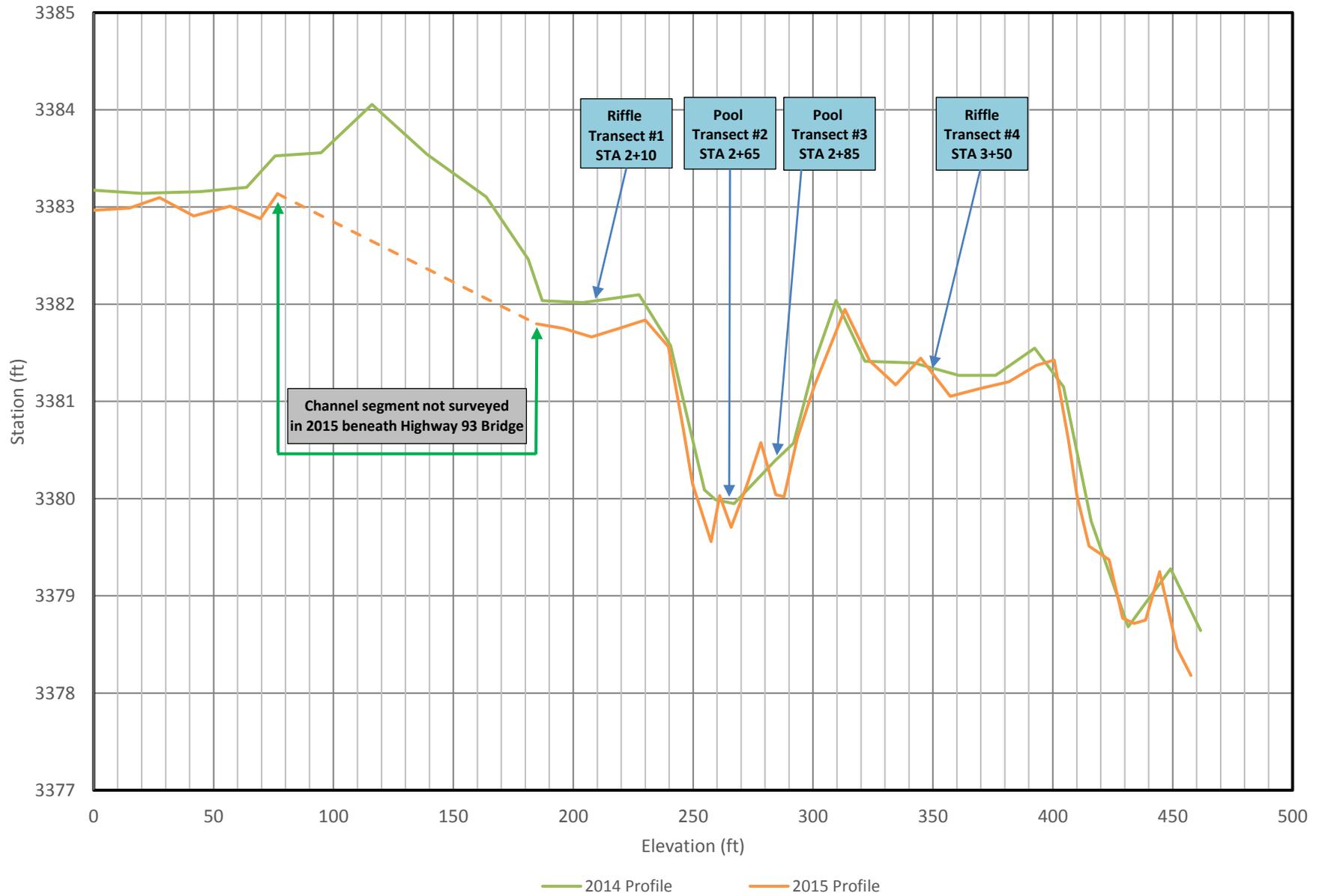
Sweathouse Creek Transect #3 - Pool



Sweathouse Creek Transect #4 - Riffle



Sweathouse Creek Longitudinal Profiles: 2014 and 2015



Appendix C

Project Site Photos

MDT Stream Mitigation Monitoring
Sweathouse Creek
Ravalli County, Montana

PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2015 Monitoring Events



Photo Point 1.1—2013
Description: View of north bank from bridge abutment.
Compass: 45 (Northeast)



Photo Point 1.1—2015
Description: View of north bank from bridge abutment.
Compass: 45 (Northeast)



Photo Point 1.2—2013
Description: View of both banks looking downstream from bridge abutment. **Compass:** 68 (East-Northeast)



Photo Point 1.2—2015
Description: View of both banks looking downstream from bridge abutment. **Compass:** 68 (East-Northeast)

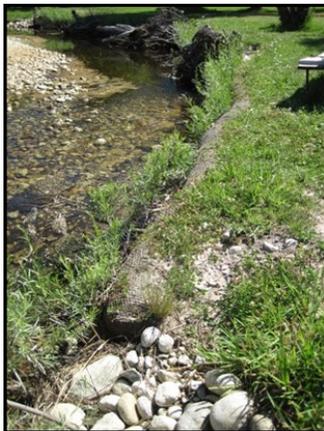


Photo Point 2.1—2013
Description: View of un-keyed coir log on south bank
Compass: 90 (East)

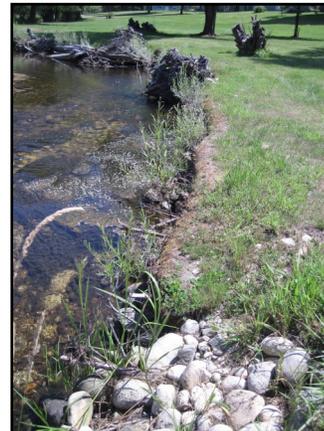


Photo Point 2.1—2015
Description: View of un-keyed coir log on south bank
Compass: 90 (East)

PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2015 Monitoring Events



Photo Point 3.1—2013
Description: Looking upstream from downstream end of project reach. **Compass:** 225 (Southwest)



Photo Point 3.1—2015
Description: Looking upstream from downstream end of project reach. **Compass:** 225 (Southwest)



Photo Point 3.2—2013
Description: View of downstream extent of project area. **Compass:** 45 (Northeast)



Photo Point 3.2—2015
Description: View of downstream extent of project area. **Compass:** 45 (Northeast)



Photo Point 3.3—2013
Description: View of the north bank looking across channel. **Compass:** 315 (Northwest)

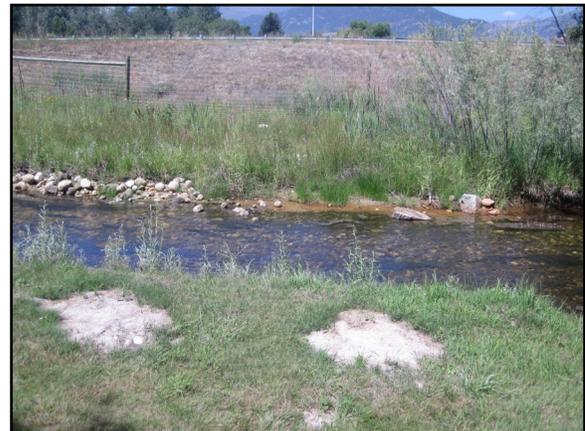


Photo Point 3.3—2015
Description: View of the north bank looking across channel. **Compass:** 315 (Northwest)

PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2015 Monitoring Events



Photo Point 4.1—2013
Description: View of both banks looking upstream.
Compass: 45 (Northeast)



Photo Point 4.1—2015
Description: View of both banks looking upstream.
Compass: 45 (Northeast)



Photo Point 4.2—2013
Description: View of north bank and point bar development. **Compass:** 315 (Northwest)



Photo Point 4.2—2015
Description: View of north bank and point bar development. **Compass:** 315 (Northwest)



Photo Point 4.3—2013
Description: View of both banks looking downstream.
Compass: 225 (Southwest)



Photo Point 4.3—2015
Description: View of both banks looking downstream.
Compass: 225 (Southwest)

PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2015 Monitoring Events



Photo Point 5.1—2013
Description: View from north bank looking upstream underneath bridge. **Compass:** 270 (West)



Photo Point 5.1—2015
Description: View from north bank looking upstream underneath bridge. **Compass:** 270 (West)



Photo Point 5.2—2013
Description: View of south bank. **Compass:** 180 (South)



Photo Point 5.2—2015
Description: View of south bank. **Compass:** 180 (South)



Photo Point 5.3—2013
Description: View of vegetation on north bank. **Compass:** 90 (East)



Photo Point 5.3—2015
Description: View of vegetation on north bank. **Compass:** 90 (East)

PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2015 Monitoring Events



Photo Point 6.1—2013
Description: View of north bank vegetation.
Compass: 225 (Southwest)



Photo Point 6.1—2015
Description: View of north bank vegetation.
Compass: 225 (Southwest)



Photo Point 6.2—2013
Description: View of south bank looking across channel.
Compass: 135 (Southeast)



Photo Point 6.2—2015
Description: View of south bank looking across channel.
Compass: 135 (Southeast)



Photo Point 6.3—2013
Description: View looking across channel from north bank.
Compass: 90 (East)



Photo Point 6.3—2015
Description: View looking across channel from north bank.
Compass: 90 (East)

PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2015 Monitoring Events



Photo Point 7.1—2013
Description: View of north streambank upstream of bridge. **Compass:** 68 (East-Northeast)



Photo Point 7.1—2015
Description: View of north streambank upstream of bridge. **Compass:** 68 (East-Northeast)



Photo Point 7.2—2013
Description: View looking downstream beneath bridge. **Compass:** 90 (East)



Photo Point 7.2—2015
Description: View looking downstream beneath bridge. **Compass:** 90 (East)



Photo Point 7.3—2013
Description: View of north bank looking across stream channel. **Compass:** 0 (North)



Photo Point 7.3—2015
Description: View of north bank looking across stream channel. **Compass:** 0 (North)

PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek Mitigation Site

DATE: 2013 and 2015 Monitoring Events



Additional Photo 1 - 2013
Description: Root wads along south streambank.
Compass: 45 (Northeast)



Additional Photo 1 - 2015
Description: Root wads along south streambank.
Compass: 45 (Northeast)



Additional Photo 2 - 2013
Description: Point bar formation on north side of channel. **Compass:** 250 (West-Southwest)



Additional Photo 2 - 2015
Description: Point bar formation on north side of channel. **Compass:** 250 (West-Southwest)



Additional Photo 3 - 2013
Description: Log structure along south streambank.
Compass: 110 (East-Southeast)



Additional Photo 3 - 2015
Description: Log structure along south streambank.
Compass: 110 (East-Southeast)

PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2013 and 2015 Monitoring Events



Additional Photo 4 - 2013
Description: Willow growth from coir along south streambank. **Compass:** 90 (East)



Additional Photo 4 - 2015
Description: Eroding bank EBR1 along right (south bank). **Compass:** 90 (East)



Additional Photo 5 - 2015
Description: Willow cutting growth along north bank **Compass:** 270 (West)



Additional Photo 6 - 2015
Description: Willow cutting growth. **Compass:** 180 (South)



Additional Photo 7 - 2015
Description: Pool development along root wads **Compass:** 90 (East)



Additional Photo 8 - 2015
Description: Pool development along woody debris **Compass:** 45 (Northeast)

PHOTO INFORMATION

PROJECT NAME: Sweathouse Creek Stream Mitigation Site

DATE: 2015 Monitoring Events



Additional Photo 9: Eroding Bank EBR1 - 2015
Description: Looking upstream toward Highway 93 bridge from north bank.



Additional Photo 10: Eroding Bank EBR1 - 2015
Description: Looking downstream from north bank.



Additional Photo 11: Eroding Bank EBR1 - 2015
Description: Looking across the channel at eroding bank.



Additional Photo 12: Noxious Weed - 2015
Description: St. Johnswort observed on north bank



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE
DATE: 7-27-15



TRANSECT 1 NORTH LOOKING SOUTH



TRANSECT 1 SOUTH LOOKING NORTH



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE
DATE: 7-27-15



TRANSECT 1 NORTH LOOKING UPSTREAM



TRANSECT 1 NORTH LOOKING DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE
DATE: 7-27-15



TRANSECT 1 IN CREEK UPSTREAM



TRANSECT 1 IN CREEK DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE
DATE: 7-27-15



TRANSECT 1 SOUTH LOOKING UPSTREAM



TRANSECT 1 SOUTH LOOKING DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE
DATE: 7-27-15



TRANSECT 2 NORTH LOOKING SOUTHEAST



TRANSECT 2 SOUTH LOOKING NORTHWEST



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE
DATE: 7-27-15



TRANSECT 2 NORTH LOOKING UPSTREAM



TRANSECT 2 NORTH LOOKING DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE
DATE: 7-27-15



TRANSECT 2 IN CREEK UPSTREAM



TRANSECT 2 IN CREEK DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE
DATE: 7-27-15



TRANSECT 2 SOUTH LOOKING UPSTREAM



TRANSECT 2 SOUTH LOOKING DOWNSTREAM

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE

DATE: 7-27-15



TRANSECT 3 NORTH LOOKING SOUTHEAST



TRANSECT 3 SOUTH LOOKING NORTHWEST

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE

DATE: 7-27-15



TRANSECT 3 NORTH LOOKING UPSTREAM



TRANSECT 3 NORTH LOOKING DOWNSTREAM

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE

DATE: 7-27-15



TRANSECT 3 IN CREEK UPSTREAM



TRANSECT 3 IN CREEK DOWNSTREAM

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE

DATE: 7-27-15



TRANSECT 3 SOUTH LOOKING UPSTREAM



TRANSECT 3 SOUTH LOOKING DOWNSTREAM

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE

DATE: 7-27-15



TRANSECT 4 NORTH LOOKING EAST



TRANSECT 4 SOUTH LOOKING WEST

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE

DATE: 7-27-15



TRANSECT 4 NORTH LOOKING UPSTREAM



TRANSECT 4 NORTH LOOKING DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE
DATE: 7-27-15



TRANSECT 4 IN CREEK UPSTREAM



TRANSECT 4 IN CREEK DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2015 MDT STREAM MITIGATION—SWEATHOUSE
DATE: 7-27-15



TRANSECT 4 SOUTH LOOKING UPSTREAM



TRANSECT 4 SOUTH LOOKING DOWNSTREAM

Appendix D

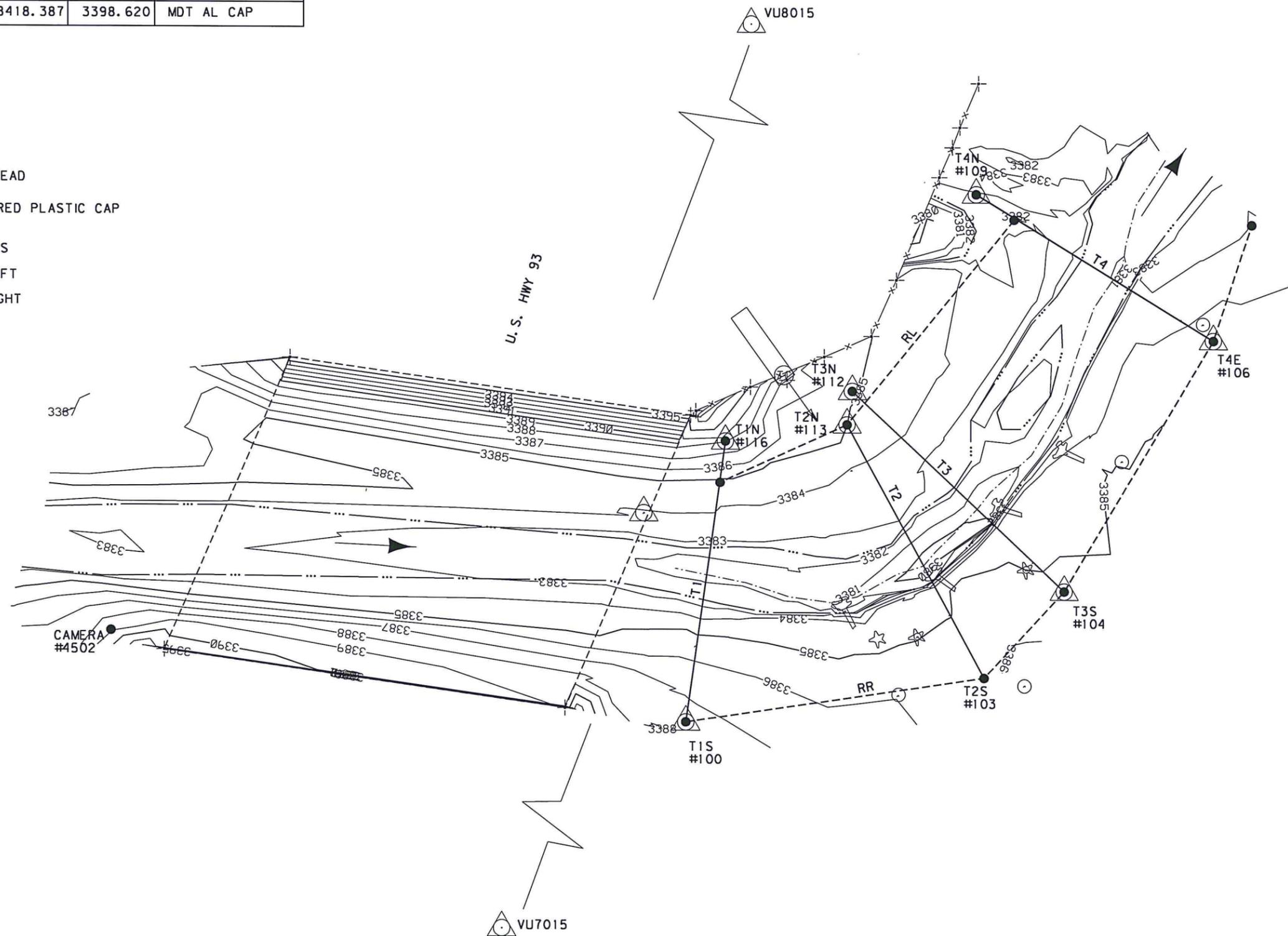
As Built Surveys & Planting Schematics

MDT Stream Mitigation Monitoring
Sweathouse Creek
Ravalli County, Montana

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



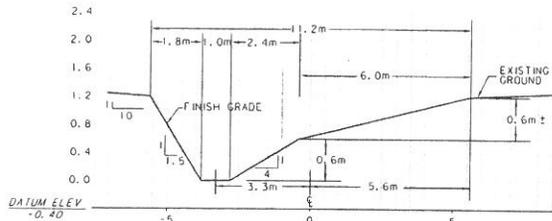
STATE	PROJECT NUMBER	SHEET NO.
MONTANA	NH 7-1(115)59	29
VICTOR URBAN		

MDTX MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CAD

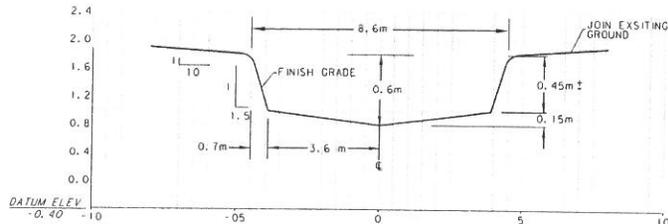
LAND & WATER CONSULTING, INC.

15000 15000 15000 15000 15000
 9/27/2010
 11:21 AM
 CPS - 10208



TYPICAL POOL LEFT CROSS SECTION

LEFT POOL 1+16.2 TO 1+31
RIGHT POOL 0+92 TO 0+98



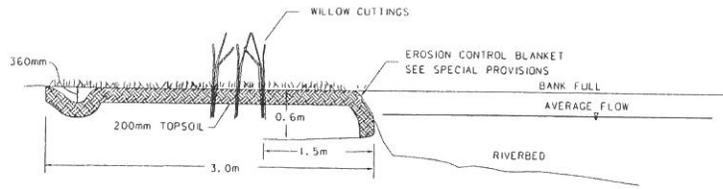
TYPICAL RIFFLE CROSS SECTION

RIFFLE

(INCLUDES TRANSITIONS)

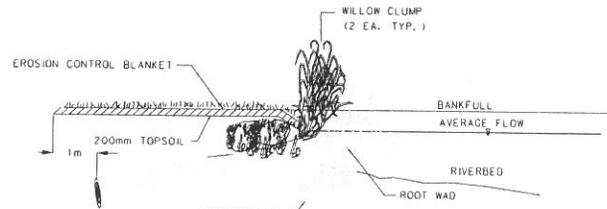
NOTES:

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

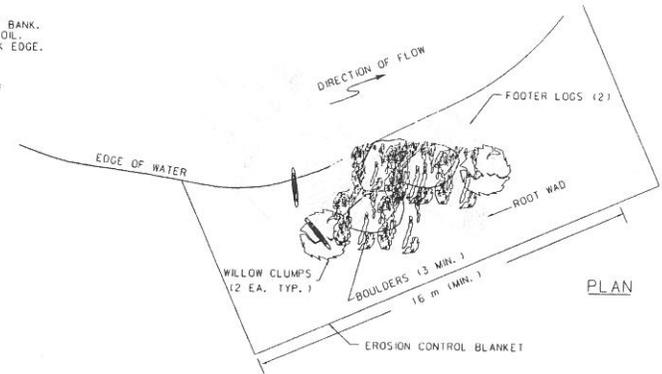


EROSION CONTROL BLANKET TYPICAL
SWEATHOUSE CREEK

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

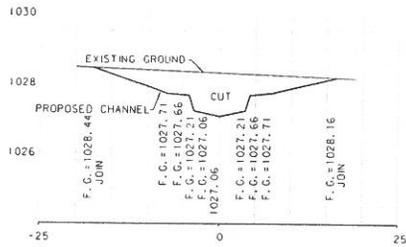


CROSS SECTION

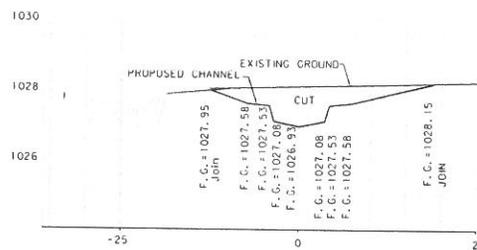


PLAN

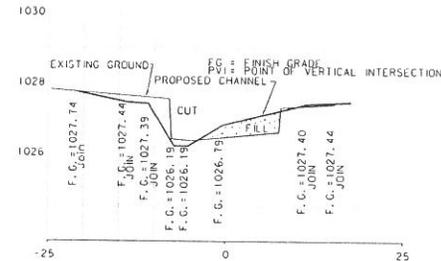
ROOT WAD TYPICAL
SWEATHOUSE CREEK



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