
MONTANA DEPARTMENT OF TRANSPORTATION STREAM MITIGATION MONITORING REPORT

*North Fork Bear Creek
Ravalli County, Montana*

*Year Project Completed: 2011
Monitoring Report #4: Submitted December, 2016*



Prepared for:



Prepared by:



MONTANA DEPARTMENT OF TRANSPORTATION

STREAM MITIGATION MONITORING REPORT #4

YEAR 2016

*North Fork Bear Creek
Ravalli County, Montana*

MDT Project Number: NH-7-1(114)56
Control Number: 2015 003

MTFWP: MDT-R2-64-2010
USACE: NWO-1997-90821-MTH

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Cover: Root wads placed along North Fork Bear Creek upstream of U.S. Hwy 93.

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1.0 INTRODUCTION

The following report presents the results of the fourth year of post stream reconstruction monitoring at the U.S. Highway 93 crossing at North Fork Bear 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. Mitigation is to be monitored for five years to evaluate compliance toward meeting performance standards. The project was constructed in 2011; therefore, these results provide documentation of the site's condition five years following the project's completion.

As part of this project, the Montana Department of Transportation (MDT) requested authorization to replace bridges at North and South Fork Bear Creek, construct a new stream channel segment, and to place 0.07 acres of fill within jurisdictional wetlands. The North Fork Bear Creek work included removal and replacement of the U.S Highway 93 bridge, placement of rock around the new bridge abutments, creation of a new stream channel alignment, filling the deactivated stream segment, and removal of gabions downstream of the bridge. Stream mitigation was required to offset placement of riprap and other fill materials within the ordinary high watermark of the stream corridor.

Performance standards outlined in the mitigation plan for the reconstructed segment of the North Fork Bear Creek include:

1. Riparian Vegetation Coverage

- a) Greater than 50% areal coverage of desirable perennial plants within the riparian buffer zone. Desirable plants include seeded species and those colonizing from adjacent undisturbed habitats.
- b) Greater than 25% areal coverage of woody riparian shrubs and/or trees within the riparian buffer zone.
- c) Less than 10% areal coverage of Montana State listed noxious weeds within the riparian buffer zone.

2. Stream Bank Stability

- a) Less than 25% of total bank length exhibiting signs of active erosion/cutting.

Additional reporting requirements included in the monitoring plan include:

1. **As-built** - An as-built drawing will be prepared with a list of plantings for the riparian areas within the stream channel construction zone.
2. **Weed Control** - Monitoring will include identification of state designated noxious weeds and an estimate of areal coverage of each weed species.
3. **Photo Points** - A minimum of 4 photo points will be established to document conditions along the newly constructed sections.

- a) Photo points will be established to show upstream and downstream bank conditions at bridge locations.
- b) Streambank reconstruction not associated with bridges will include photo points from upstream and downstream angles.

Results of the fourth year of monitoring in 2016 are presented in Section 4, and are compared to the adopted performance standards in Section 5. A site map of the project area is included in Appendix A, and photo-documentation of the site during the 2013 and 2016 monitoring events is included in Appendix B. The as-built topographic survey of the project site as surveyed in 2013 is included in Appendix C as well as the design schematics for the project area.

2.0 SITE LOCATION

The monitoring reach includes approximately 300 feet of the North Fork of Bear Creek, extending 110 feet upstream and 100 feet downstream of the U.S. 93 Bridge (plus 90 feet beneath the bridge). The project site is located in Section 31, Township 8 North, Range 20 West, and is approximately 1 mile south of Victor, Montana (Figure 1).

3.0 MONITORING METHODS

Monitoring field crews visited the project site on July 26, 2016. The following data were collected at the North Fork Bear Creek stream mitigation site:

3.1. Riparian Vegetation Establishment

Visual estimates of all vegetation species, woody species, and noxious weeds were performed within riparian buffer areas extending 25 feet on either side of the active stream channel. Percent cover was recorded for each vegetation category based on ocular estimates.

3.2. Stream Bank Stability

Both streambanks within the project area were visually assessed to document eroding streambanks. Eroding streambanks were labeled with a specific numeric identifier, photographed, and a GPS location was recorded.

3.3. Photo Documentation

Four photo points were selected to photo-document vegetation establishment and streambank conditions within the project site. Photo documentation included upstream and downstream bank conditions at the Highway 93 Bridge. All sites selected for photo-documentation were recorded using a GPS and compass direction noted to allow for repetition during future monitoring (Appendix B).

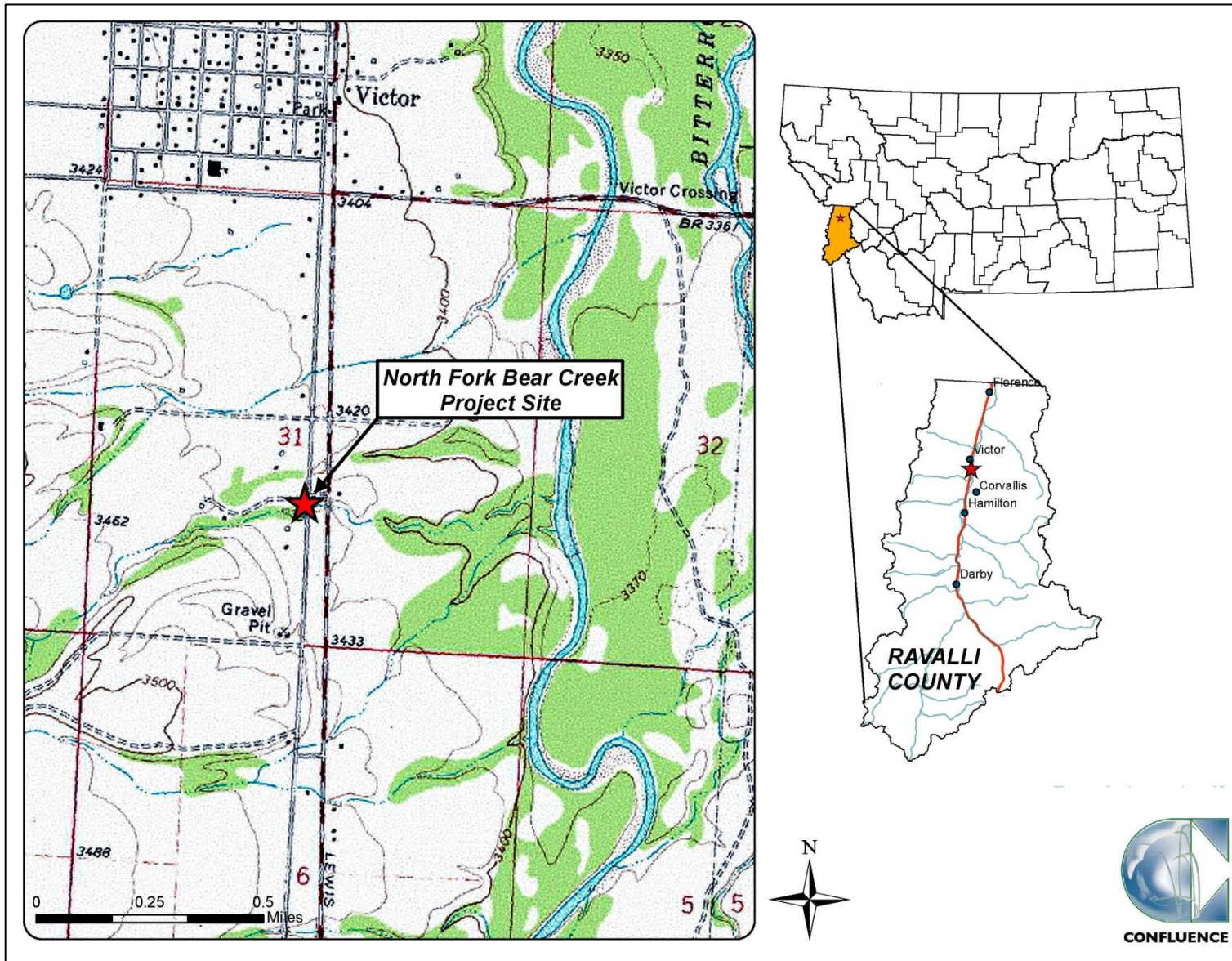


Figure 1. Project location of North Fork Bear Creek stream mitigation site.

3.4. As Built Drawings

An as-built topographic drawing of the project site was prepared as part of the 2013 (Year 1) monitoring, and included one-foot elevation contours and control points established by MDT during project construction (Appendix C).

4.0 RESULTS

4.1. Riparian Vegetation Inventory

Results of the 2013 through 2016 visual estimates of areal coverage are summarized in Table 1. In 2016, approximately 8% of the project site was bare ground, with 58% of the area vegetated with herbaceous species and 34% woody species. Overall results as compared to 2013 through 2015 were very similar, with a slight increase in percent woody cover from 27% to 34%. This result is due to continued maturation of woody species observed following three growing seasons since monitoring efforts began. The site exhibited a higher percentage of noxious weeds than observed during previous monitoring efforts, and was estimated at 45% of the total cover. Herbaceous vegetation observed at the North Fork Bear Creek site was not separated by annual, biennial, and perennial durations during the 2013 and 2014 monitoring years; therefore the total percent desirable cover parameter was not calculated.

Table 1. Visual estimate of plant coverage at North Fork Bear Creek Stream Mitigation Site from 2013 through 2016.

| YEAR | Total % Riparian Cover | % Bare Ground | % Woody Cover | % Noxious Weed Cover | % Annual/Biennial Cover | % Perennial Cover | % Desirable Cover (Shrubs + Perennials) ¹ |
|------|------------------------|---------------|---------------|----------------------|-------------------------|-------------------|--|
| 2013 | 90 | 10 | 27 | 35 | * | * | * |
| 2014 | 90 | 10 | 30 | 35 | * | * | * |
| 2015 | 90 | 10 | 32 | 40 | 9 | 9 | 41 |
| 2016 | 92 | 8 | 34 | 45 | 7 | 7 | 40 |

*Data not collected in 2013 or 2014

¹ % Desirable Cover=Total % Riparian Cover - %Noxious Weed Cover - % Annual/Biennial Cover

Table 2 includes a comprehensive list of plant species observed along the new channel alignment and riparian buffer areas from 2013 through 2016. The comprehensive list includes 109 species, representing an increase by 14 species since 2015, 42 species since 2014, and 64 species since 2013. In 2016, 40% of species observed were hydrophytic based on the 2016 National Wetland Plant List (Lichvar et al 2016).

The relatively steep stream bank along the left (north) bank of the channel upstream of the Highway 93 Bridge may hinder the growth of riparian vegetation in this area. Downstream of the bridge, stream banks are less steep and cottonwoods (*Populus* spp.) and grasses (*Poa* spp., *Elymus* spp., *Phleum pratense*, and *Phalaris arundinacea*) are abundant.

Table 2. Comprehensive list of plant species observed at the North Fork Bear Creek Stream Mitigation Site from 2013 through 2016.

| Scientific Name | Common Name | WMVC Indicator Status* | Duration | Scientific Name | Common Name | WMVC Indicator Status* | Duration |
|-----------------------------------|----------------------------------|------------------------|----------|---|-------------------------------|------------------------|----------|
| <i>Achillea millefolium</i> | Common Yarrow | FACU | P | <i>Miyosotis laxa</i> | Bay Forget-Me-Not | OBL | A/B/P |
| <i>Agropyron cristatum</i> | Crested Wheatgrass | NL | P | <i>Nasturtium officinale</i> | Watercress | OBL | P |
| <i>Agrostis gigantea</i> | Black Bent | FAC | P | <i>Osmorhiza occidentalis</i> | Sweet-cicely | NL | P |
| <i>Agrostis scabra</i> | Rough Bent | FAC | P | <i>Pascopyrum smithii</i> | Western-Wheat Grass | FACU | P |
| <i>Alopecurus aequalis</i> | Short-Awn Meadow-Foxtail | OBL | P | <i>Penstemon procerus</i> | Pincushion Beardtongue | FAC | P |
| <i>Alnus incana</i> | Speckled Alder | FACW | P | <i>Penstemon sp.</i> | Beardtongue | NL | P |
| <i>Alyssum alyssoides</i> | Pale Alyssum | NL | A/B | <i>Peritoma serrulata</i> | Rocky Mountain Beeplant | FACU | A |
| <i>Amelanchier alnifolia</i> | Saskatoon Service-Berry | FACU | P | <i>Phalaris arundinacea</i> | Reed Canary Grass | FACW | P |
| <i>Antennaria parvifolia</i> | Nuttall's Pussytoes | NL | P | <i>Phleum pratense</i> | Common Timothy | FAC | P |
| <i>Aster sp.</i> | Aster | NL | A/P | <i>Picea pungens</i> | Blue Spruce | FAC | P |
| <i>Bassia scoparia</i> | Mexican-Fireweed | FAC | A | <i>Pinus ponderosa</i> | Ponderosa Pine | FACU | P |
| <i>Berteroa incana</i> | Hoary False-Alyssum | NL | A/B/P | <i>Poa compressa</i> | Flat-Stem Blue Grass | FACU | P |
| <i>Bromus inermis</i> | Smooth Brome | UPL | P | <i>Poa palustris</i> | Fowl Blue Grass | FAC | P |
| <i>Bromus tectorum</i> | Cheatgrass | NL | A | <i>Poa pratensis</i> | Kentucky Blue Grass | FAC | P |
| <i>Carex nebrascensis</i> | Nebraska Sedge | OBL | P | <i>Polygonum cuspidatum</i> | Japanese Knotweed | NL | P |
| <i>Carex sp.</i> | Sedge | NL | P | <i>Populus angustifolia</i> | Narrow-Leaf Cottonwood | FACW | P |
| <i>Carex stipata</i> | Stalk-Grain Sedge | OBL | P | <i>Populus balsamifera</i> | Balsam Poplar | FAC | P |
| <i>Centaurea stoebe</i> | Spotted Knapweed | NL | B/P | <i>Potentilla anserina</i> | Silverweed | OBL | P |
| <i>Cerastium arvense</i> | Field Mouse-Ear Chickweed | FACU | P | <i>Potentilla recta</i> | Sulphur Cinquefoil | NL | P |
| <i>Chenopodium album</i> | Lamb's-Quarters | FACU | A | <i>Prunella vulgaris</i> | Common Selfheal | FACU | P |
| <i>Cirsium arvense</i> | Canadian Thistle | FAC | P | <i>Prunus virginiana</i> | Choke Cherry | FACU | P |
| <i>Cirsium vulgare</i> | Bull Thistle | FACU | B | <i>Pseudoroegneria spicata</i> | Bluebunch Wheatgrass | NL | P |
| <i>Cornus alba</i> | Red Osier | FACW | P | <i>Pseudotsuga menziesii</i> | Douglas-Fir | FACU | P |
| <i>Convolvulus arvensis</i> | Field Bindweed | NL | P | <i>Ranunculus sp.</i> | Buttercup | NL | P |
| <i>Coronilla varia</i> | Common Crown-Vetch | NL | P | <i>Ribes lacustre</i> | Bristly Black Gooseberry | FAC | P |
| <i>Crataegus douglasii</i> | Black Hawthorn | FAC | P | <i>Rosa woodsii</i> | Woods' Rose | FACU | P |
| <i>Crepis tectorum</i> | Narrowleaf Hawksbeard | NL | A | <i>Rubus idaeus</i> | Common Red Raspberry | FACU | P |
| <i>Cynoglossum officinale</i> | Gypsy-Flower | FACU | B | <i>Rubus sp.</i> | Raspberry sp. | NL | P |
| <i>Dactylis glomerata</i> | Orchard Grass | FACU | P | <i>Rumex acetosa</i> | Garden Sorrel | FAC | P |
| <i>Dasiphora fruticosa</i> | Golden-Hardhack | FAC | P | <i>Rumex acetosella</i> | Common Sheep Sorrel | FACU | P |
| <i>Deschampsia cespitosa</i> | Tufted Hairgrass | FACW | P | <i>Salix amygdaloides</i> | Peach-Leaf Willow | FACW | P |
| <i>Elymus canadensis</i> | Nodding Wild Rye | FAC | P | <i>Salix bebbiana</i> | Gray Willow | FACW | P |
| <i>Elymus glaucus</i> | Blue Wild Rye | FACU | P | <i>Salix drummondiana</i> | Drummond's Willow | FACW | P |
| <i>Elymus repens</i> | Creeping Wild Rye | FAC | P | <i>Salix lasiandra</i> | Pacific Willow | FACW | P |
| <i>Elymus trachycaulus</i> | Slender Wild Rye | FAC | P | <i>Salix sp.</i> | Willow | NL | P |
| <i>Epilobium ciliatum</i> | Fringed Willowherb | FACW | P | <i>Salsola tragus</i> | Prickly Russian-Thistle | FACU | A |
| <i>Erigeron compositus</i> | Cutleaf Fleabane | NL | P | <i>Silene noctiflora</i> | Night-flowering Catchfly | NL | A |
| <i>Festuca idahoensis</i> | Bluebunch Fescue | FACU | P | <i>Sinapis arvensis</i> | Corn Mustard | NL | A |
| <i>Galium aparine</i> | Sticky-Willy | FACU | A | <i>Sisymbrium altissimum</i> | Tall Hedge-Mustard | FACU | A/B |
| <i>Galium boreale</i> | Northern Bedstraw | FACU | P | <i>Solanum dulcamara</i> | Climbing Nightshade | FAC | P |
| <i>Geranium viscosissimum</i> | Sticky Purple Crane's-Bill | FACU | P | <i>Solidago canadensis</i> | Canadian Goldenrod | FACU | P |
| <i>Geum macrophyllum</i> | Large-Leaf Avens | FAC | P | <i>Sonchus arvensis</i> | Field Sow-Thistle | FACU | P |
| <i>Glyceria striata</i> | Fowl Manna Grass | OBL | P | <i>Symphoricarpos albus</i> | Common Snowberry | FACU | P |
| <i>Hordeum jubatum</i> | Fox-Tail Barley | FAC | P | <i>Symphoricarpos occidentalis</i> | Western Snowberry | FAC | P |
| <i>Hypericum perforatum</i> | Common St. John's-Wort | FACU | P | <i>Symphytotrichum ascendens</i> | Western American-Aster | FACU | P |
| <i>Juncus balticus</i> | Baltic Rush | FACW | P | <i>Tanacetum vulgare</i> | Common Tansy | FACU | P |
| <i>Juncus effusus</i> | Lamp Rush | FACW | P | <i>Taraxacum officinale</i> | Common Dandelion | FACU | P |
| <i>Juncus sp.</i> | Rush | NL | P | <i>Thalictrum dasycarpum</i> | Purple Meadow-Rue | FACW | P |
| <i>Lactuca scariola</i> | Prickly Lettuce | FACU | A/B | <i>Thlaspi arvense</i> | Field Pennycress | UPL | A |
| <i>Lepidium campestre</i> | Field Pepper-Grass | NL | A/B | <i>Traopogon dubius</i> | Meadow Goat's-beard | NL | A/B |
| <i>Leucanthemum vulgare</i> | Ox-Eye Daisy | FACU | P | <i>Trifolium pratense</i> | Red Clover | FACU | B/P |
| <i>Lycopus asper</i> | Rough Water-Horehound | OBL | P | <i>Trifolium repens</i> | White Clover | FAC | P |
| <i>Medicago lupulina</i> | Black Medick | FACU | A/P | <i>Verbascum thapsus</i> | Great Mullein | FACU | B |
| <i>Mellilotus officinalis</i> | Yellow Sweet-Clover | FACU | A/B/P | <i>Veronica americana</i> | American-Brooklime | OBL | P |
| <i>Mentha arvensis</i> | American Wild Mint | FACW | P | | | | |

*Based on 2016 NWPL (Lichvar *et al.* 2016).
Duration: A=Annual; B=Biennial; P=Perennial
New species identified in 2016 are **bolded**

Twenty-four infestations of Montana Listed Priority 2B noxious weeds and three infestations of Priority 1B noxious weeds were mapped within the riparian corridor (Table 3 and Figure 2, Appendix A). Cheatgrass (*Bromus tectorum*), a Montana Priority 3 regulated weed species was also identified across the site. Two noxious weed species observed in 2014 (*Convolvulus arvensis* and *Cynoglossum officinale*) were not observed in 2015 or 2016 despite an extensive search. As a result, they have been removed from the list of noxious weeds observed on site.

Each noxious weed infestation 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). Weed infestations with trace cover classes were not mapped but were included in the overall areal coverage estimate of noxious weeds observed in the project area. An estimated 45% of the project area has been colonized by noxious weed infestations. Weeds were observed on both stream banks, upstream and downstream of the Highway 93 Bridge.

Table 3. Weeds observed within the North Fork Bear Creek riparian zone in 2016.

| Category* | Scientific Name | Common Name |
|----------------------------|-----------------------------|------------------------|
| Priority 1B | <i>Polygonum cuspidatum</i> | Knotweed Complex |
| Priority 2B | <i>Berteroa incana</i> | Hoary False-Alyssum |
| | <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>Potentilla recta</i> | Sulphur Cinquefoil |
| | <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

Attempts at establishing woody riparian vegetation within the project reach included installing cuttings along the banks upstream and downstream of the Highway 93 Bridge. Cottonwood and willow (*Salix* spp.) cuttings installed along the banks were unsuccessful. Only one of the cuttings has developed leafy stems, which have sprouted from the base of the plant. Upon inspection, all cuttings were installed to a depth of approximately one foot, with 4 to 5 feet of the stem extending above ground. The need for specialized equipment to install willow stems in rocky/cobbly substrate was likely the limiting factor for installing the cuttings to the proper depth. High mortality of these cuttings can be attributed to the shallow planting depth and inability of the cuttings to quickly extend roots down to the low water table elevation.

4.2. Bank Erosion Inventory

Field examination of the North Fork Bear Creek project site documented no actively eroding streambanks within the project area. New banks with large woody debris installations appeared stable with no undercutting or lateral channel migration evident.

During the 2014 monitoring event, the trunk of one root wad installed upstream of Highway 93 appeared more exposed than the year prior (see Additional Photo 1 in Appendix B). The following is an excerpt from the monitoring report from this site (CCI, 2014):

The exposure of this trunk appeared as a result of the loss of cobble material placed on the upper six inches of the bank during high flows in 2014. Cobble materials placed over this root wad were covered with a layer of topsoil and coir fabric during construction; however, the fabric has peeled back from the top of the bank and is no longer providing protection of the upper bank. If additional cobbles adjacent to this root wad mobilize during subsequent high flows, the root ball may create a scouring hydraulic against the bank, reducing the ability of the root wad to provide bank protection. Although the bank is not currently considered eroding due to the lack of lateral channel movement, continued monitoring is highly recommended to determine whether this segment of the project reach becomes more susceptible to erosion.

The 2015 and 2016 monitoring events revealed no additional loss of cobbles or other bank materials in the vicinity of this root wad and tree trunk. The bank has not further destabilized, and no corrective actions are warranted at this location. No evidence of high water debris deposits or drift lines were noted, indicating the North Fork of Bear Creek likely did not experience an out of bank flow event during spring runoff periods during the past two years.

The North Fork of Bear Creek was flowing approximately 2 cfs during the 2016 monitoring event, which occurred mid-summer during a year characterized by below average flows in many rivers statewide. This discharge was enough to connect pools formed by the channel scouring against the rootwads placed along the north bank (see Additional Photo 2 in Appendix B). These pools contained several 2-4" trout (species not identified) capable of utilizing the deeper water habitat.

5.0 COMPARISON OF RESULTS TO PERFORMANCE CRITERIA

Monitoring of the North Fork Bear Creek Stream Mitigation site is intended to document whether the reconstructed segment of the channel is meeting or moving toward meeting performance standards outlined in the North Fork Bear Creek Mitigation Plan. Results from the fourth year of monitoring indicates two of the four performance standards are being met five years post-construction, including percent woody vegetation cover and stream bank stability (Table 4). Percent cover of a) desirable perennial species and b) noxious weed species failed to meet the success criteria of >50% and <10% respectively. Photographs of photo points (Appendix B) and as-built drawings (Appendix C) have been provided as additional documentation of the site's condition in this monitoring report.

Table 4. Performance results of North Fork Bear Creek five years following project completion.

| Monitoring Parameter | Performance Criteria | Status 3 Years Following Construction | Meeting Performance Criteria? |
|----------------------|---|---|-------------------------------|
| Riparian Cover | Greater than 50% aerial coverage of desirable perennial plants, including seeded species and those colonizing from adjacent undisturbed habitats. | Desirable cover estimated at 40% (92% total cover - 45% weed cover - 7% annual/biennial). | No |
| | Greater than 25% aerial coverage of woody riparian shrubs and/or trees. | Woody riparian species cover estimated at 34% of project area and increasing over past 3 years | Yes |
| | Less than 10% aerial coverage of site has Montana noxious weeds. | Noxious weed cover is estimated at 45% of the project area. | No |
| Streambank Stability | Less than 25% of total bank length exhibiting signs of active erosion/cutting | Erosion inventory documented 0% of project reach exhibits active erosion/cutting | Yes |

5.1. Riparian Cover

Desirable perennial plants including riparian shrubs, trees, and forbs were estimated at 40% cover of the project site. This estimate was calculated by subtracting the sum of the visual estimates for noxious weed cover (45%), bare ground (8%), and annual/biennial cover (7%) from 100. The monitoring criteria specify the site must exhibit greater than 50% cover by desirable perennial species; therefore this site is currently not meeting this performance criterion.

Percent cover of woody vegetation has increased by 2-3% per year since the initial monitoring event in 2013. The majority of woody plants include shrubs and trees that existed prior to relocating the channel and volunteer species that are colonizing the site. Only one of the woody cuttings planted along the north bank survived due to ineffective planting techniques.

Many infestations of noxious weeds were observed along both banks of the project reach. Although each individual weed infestation is relatively small in extent, the area of all infestations combined warrants concern and must be addressed to achieve the success criterion for riparian cover.

5.2. Streambank Stability

No streambank erosion has been observed along the reconstructed banks within the North Fork Bear Creek Stream Mitigation Site. Root wads placed along the north bank both upstream and downstream of the bridge appear stable. Cobble placed atop one of the rootwads upstream of the bridge appeared to have washed out during 2014; however no additional bank erosion has been noted in this area during the past two years. Given the integrity of the channel, no measures are currently warranted to improve bank stability within the project reach.

6.0 MAINTENANCE CONCERNS

A livestock corral exists immediately adjacent to the project reach upstream of the U.S. Highway 93 Bridge. This corral was not being used during the 2016 monitoring event, and has grown in with many noxious weeds and undesirable species. The extent of this bare, disturbed ground may be contributing to the abundance of weeds observed along the North Fork Bear Creek site. The extent of noxious weeds in the area has increased during each monitoring event, with several new infestations identified during the past two years. An aggressive revegetation plan may be required to eventually meet the success criteria outlined for noxious weeds and desirable perennial vegetation coverage at this project site.

7.0 LITERATURE CITED

Confluence Consulting, Incorporated. 2014. Montana Department of Transportation Stream Mitigation Monitoring Report, North Fork Bear Creek, Ravalli County, Montana.

Lichvar, R.W., D.L. Banks, W.N. Kirchner, and N.C. Melvin. 2016. *The National Wetland Plant List. 2016 Update of Wetland Ratings*. Phytoneuron 2016-30: 1-17. Published 28 April 2016. ISSN 2153 733X

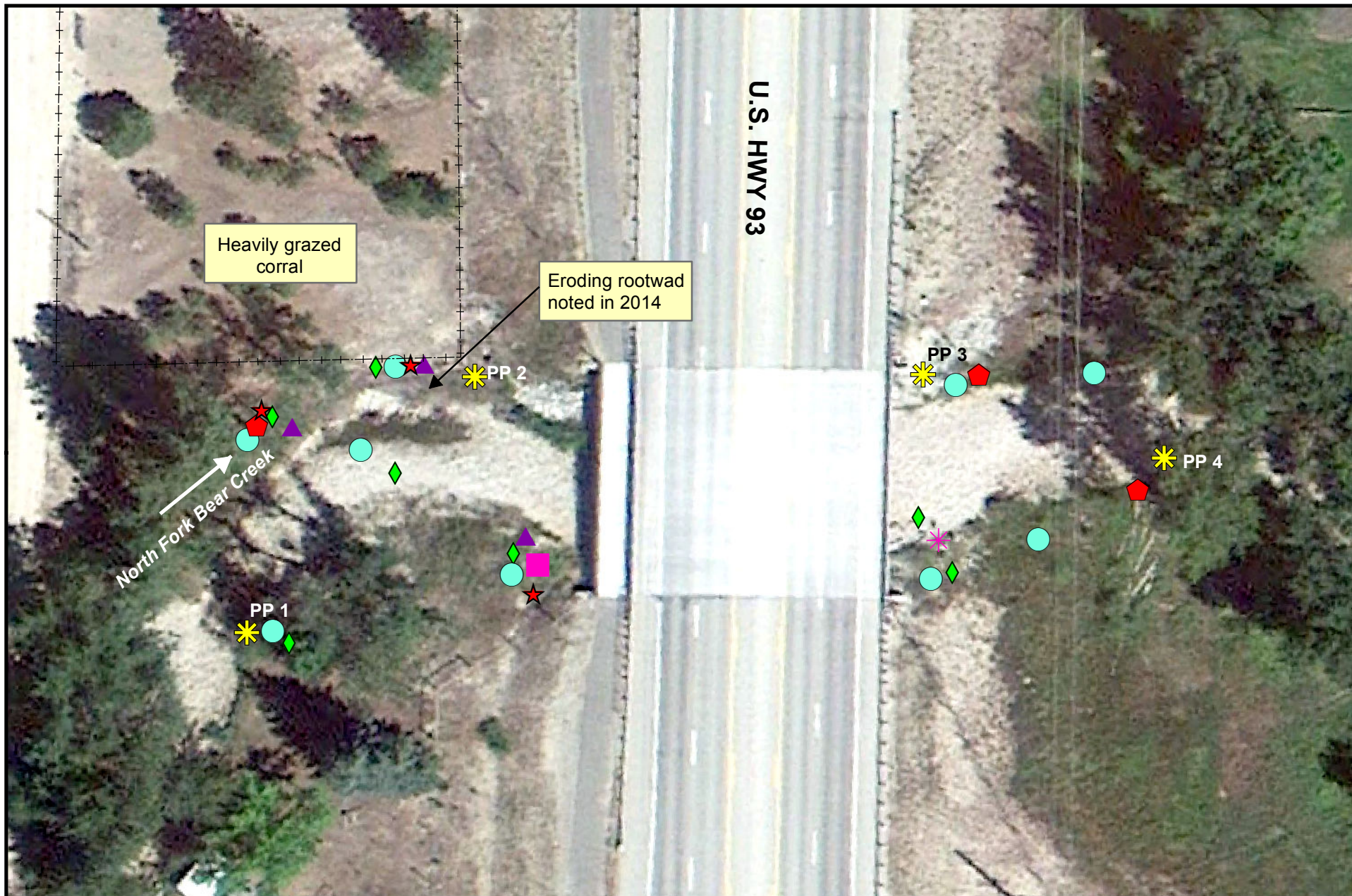
Websites

Montana Department of Agriculture. Montana Noxious Weed List. July 2015. Accessed September 2016 at <http://agr.mt.gov/agr/Programs/Weeds/PDF/2015WeedList.pdf>.

Appendix A

Project Site Map

MDT Stream Mitigation Monitoring
North Fork Bear Creek
Ravalli County, Montana

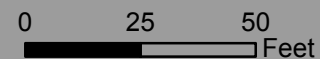


Legend

- Photo Points
- Berteroa incana*
- Centaurea stoebe*

- Hypericum perforatum*
- Leucanthemum vulgare*
- Polygonum cuspidatum*
- Potentilla recta*

- Tanacetum vulgare*



**2016 Monitoring
NF Bear Creek**

Figure 2

Date: 09/28/2016

NFBear_features2016.mxd

Appendix B

Project Area Photos

MDT Stream Mitigation Monitoring
North Fork Bear Creek
Ravalli County, Montana

PHOTO INFORMATION

PROJECT NAME: North Fork Bear Creek Stream Mitigation Site

DATES: 2013 and 2016 Monitoring Events



Photo Point 1.1—2013
Description: View of tributary/culvert entering from west. **Compass:** 270 (West)



Photo Point 1.1—2016
Description: View of tributary/culvert entering from west. **Compass:** 270 (West)



Photo Point 1.2—2013
Description: View of north streambank looking downstream. **Compass:** 45 (Northeast)



Photo Point 1.2—2016
Description: View of north streambank looking downstream. **Compass:** 45 (Northeast)



Photo Point 1.3—2013
Description: View of north streambank. **Compass:** 90 (East)



Photo Point 1.3—2016
Description: View of north streambank. **Compass:** 90 (East)

PHOTO INFORMATION

PROJECT NAME: North Fork Bear Creek Stream Mitigation Site

DATE: 2013 and 2016 Monitoring Events



Photo Point 1.4—2013
Description: View of dry channel looking upstream.
Compass: 230 (Southwest)



Photo Point 1.4—2016
Description: View of wetted channel looking upstream. **Compass:** 230 (Southwest)



Photo Point 2.1—2013
Description: View of root wads on north bank.
Compass: 225 (Southwest)



Photo Point 2.1—2016
Description: View upstream of root wads on north bank. **Compass:** 225 (Southwest)



Photo Point 2.2—2013
Description: View across channel of south stream-bank.



Photo Point 2.2—2016
Description: View across channel of south stream-bank.

PHOTO INFORMATION

PROJECT NAME: North Fork Bear Creek Stream Mitigation Site

DATE: 2013 and 2016 Monitoring Events



Photo Point 2.3—2013

Description: View from north bank looking across channel. **Compass:** 135 (Southeast)



Photo Point 2.3—2016

Description: View from north bank looking across channel. **Compass:** 135 (Southeast)



Photo Point 3.1—2013

Description: View downstream from north bridge abutment. **Compass:** 90 (East)



Photo Point 3.1—2016

Description: View downstream from north bridge abutment. **Compass:** 90 (East)



Photo Point 3.2—2013

Description: View of south streambank from left abutment. **Compass:** 135 (Southeast)



Photo Point 3.2—2016

Description: View of south streambank from left abutment. **Compass:** 135 (Southeast)

PHOTO INFORMATION

PROJECT NAME: North Fork Bear Creek Stream Mitigation Site

DATE: 2013 and 2016 Monitoring Events



Photo Point 3.3—2013
Description: View across channel of south bank from north bridge abutment. **Compass:** 180 (South)



Photo Point 3.3—2016
Description: View across channel of south bank from north bridge abutment. **Compass:** 180 (South)



Photo Point 4.1—2013
Description: View from south bank looking upstream from downstream extent. **Compass:** 270 (West)



Photo Point 4.1—2016
Description: View from south bank looking upstream from downstream extent. **Compass:** 270 (West)



Photo Point 4.2—2013
Description: View of root wads on north bank downstream of bridge. **Compass:** 0 (North)



Photo Point 4.2—2016
Description: View of root wads on north bank downstream of bridge. **Compass:** 0 (North)

PHOTO INFORMATION

PROJECT NAME: North Fork Bear Creek Stream Mitigation Site

DATE: 2013 and 2016 Monitoring Events



Photo Point 4.3—2013
Description: View of north bank from downstream extent of project site. **Compass:** 68 (East-Northeast)



Photo Point 4.3—2016
Description: View of north bank from downstream extent of project site. **Compass:** 68 (East-Northeast)



Additional Photo 1—2014
Description: Root wads upstream of bridge.



Additional Photo 1—2016
Description: Root wads upstream of bridge.



Additional Photo 2—2014
Description: Root wad upstream of bridge showing scour.



Additional Photo 2—2016
Description: Root wads upstream of bridge.

Appendix C

As Built Drawings and Design Schematics

MDT Stream Mitigation Monitoring
North Fork Bear Creek
Ravalli County, Montana

| CONTROL TABLE | | | | |
|---------------|------------|------------|----------|-------------|
| PNT# | NORTHING | EASTING | ELEV. | DESCRIPTION |
| CI2015 | 820308.760 | 797947.813 | 3435.224 | MDT AL CAP |
| CG2015 | 819805.449 | 798080.492 | 3436.854 | MDT AL CAP |



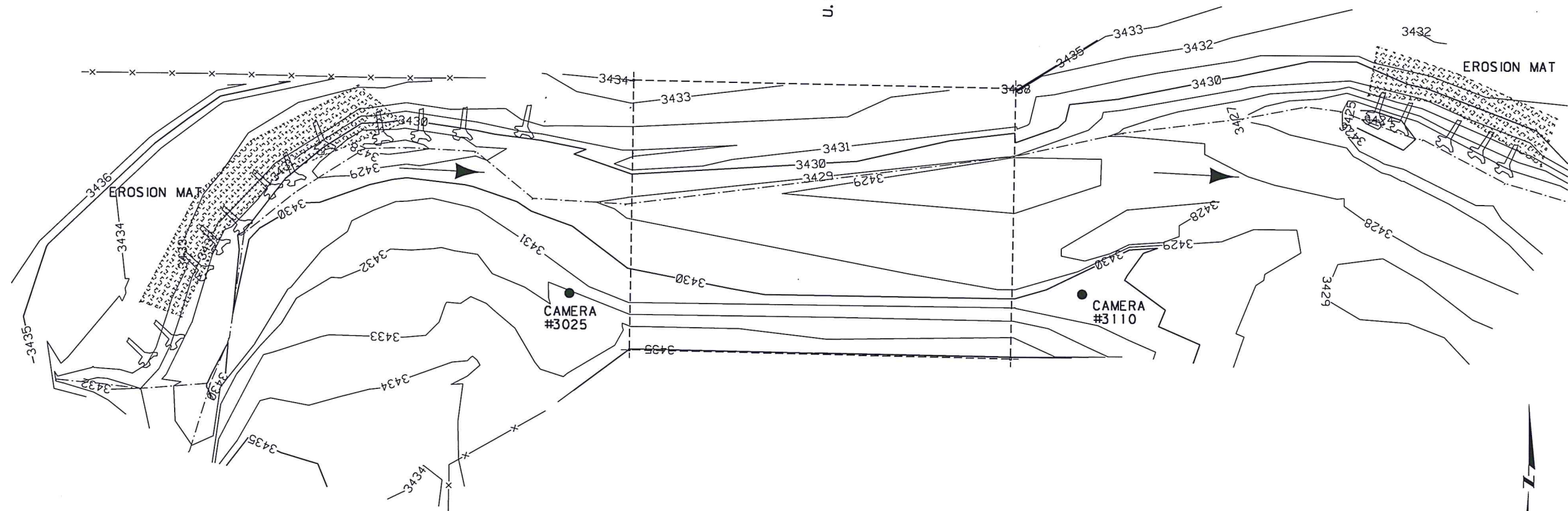
LEGEND



ROOT BALL



U. S. HWY 93



AS-BUILT TOPOGRAPHIC DRAWING OF THE NORTH FORK OF BEAR CREEK CHANNEL

SURVEYOR NOTES:

1. THIS SURVEY IS BASED ON FOUND MDT ALUMINUM CAPS STAMPED CI2015 AND CG2015 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 CI2015.
2. THE COORDINATES SHOWN HEREON ARE BASED ON MONTANA STATE PLANE GRID



3
2
1

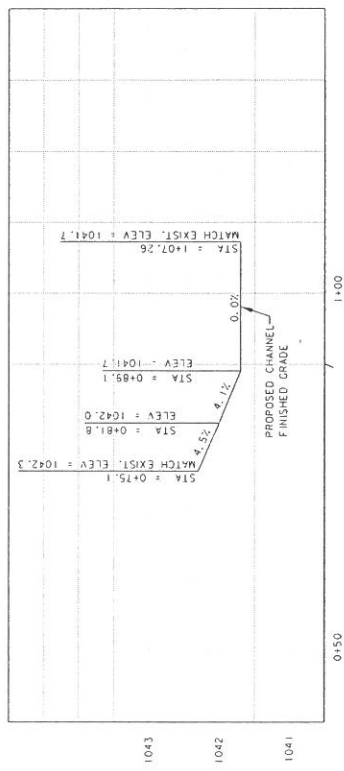
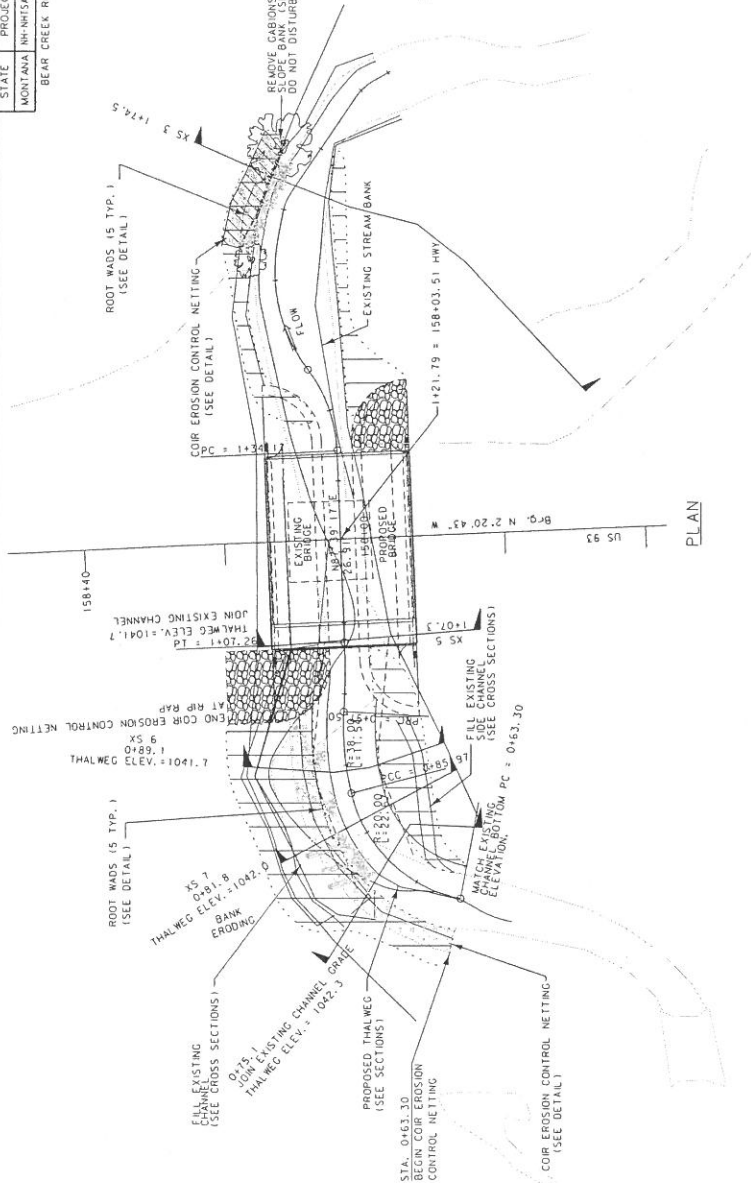


...NF BEAR CREEK PLAN.dgn
12/9/2013
11:02:51 AM awibe

DESIGNED BY ARNE W
REVIEWED BY
CHECKED BY LARRY R

N.F. BEAR CREEK

MDT STREAM MITIGATION MONITORING SURVEY



COORDINATE TABLE

| STATION | NORTHING | EASTING |
|---------|-------------|-------------|
| 0176.03 | 36,218.1167 | 56,132.1603 |
| 0185.97 | 36,221.2271 | 56,204.3003 |
| 0191.78 | 36,222.6477 | 56,210.5363 |
| 1102.39 | 36,222.0482 | 56,221.2141 |
| 1107.46 | 36,222.2420 | 56,226.0927 |
| 1140.14 | 36,233.4034 | 56,226.3948 |
| 1156.61 | 36,233.6668 | 56,222.3869 |
| 1163.48 | 36,227.4917 | 56,224.3830 |
| 1171.10 | 36,230.1936 | 56,227.8178 |
| 1172.67 | 36,229.8772 | 56,229.1522 |
| 1190.33 | 36,219.1764 | 56,303.7597 |
| 1192.11 | 36,218.2584 | 56,304.6191 |
| 1194.62 | 36,216.0744 | 56,305.8532 |

- NOTES:**
- REMOVE ALL EXISTING GABIONS, APPROXIMATE STATION 1+63 TO 1+78, AND ALL ROOT WAD AND STRUCTURES BETWEEN STATIONS 1+63 AND 1+78 AS DIRECTED BY ENGINEER.
 - INSTALL SIX (6) ROOT WAD STRUCTURES BETWEEN STATION 0+66 AND 1+10 AS DIRECTED BY ENGINEER.
 - DO NOT DISTURB EXISTING STUMPS/ROOT WADS NEAR STATION 0+90
 - DO NOT DISTURB TREES IN GABION AREA 1+78



T. 8 N.R. 20 W.

