MONTANA DEPARTMENT OF TRANSPORTATION
STREAM MITIGATION MONITORING REPORT

Bowser Creek
Flathead County, Montana

Prepared for:

MONTANA DEPARTMENT OF TRANSPORTATION
2701 Prospect Ave
Helena, MT 59620-1001

Prepared by:

CONFLUENCE
PO Box 1133
Bozeman, MT 59771-1133

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MONTANA DEPARTMENT OF TRANSPORTATION

STREAM MITIGATION MONITORING REPORT:

YEAR 2013

Bowser Creek
Flathead County, Montana

MDT Project Number: NH 15(93)
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2701 Prospect Ave
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Confluence Consulting, Inc.
P.O. Box 1133
Bozeman, MT 59771

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1.0 INTRODUCTION

As part of construction of the Kalispell Bypass U.S. Highway 2 South, the Montana Department of Transportation (MDT) relocated a portion of Bowser Creek to create space to widen the highway. Bowser Creek had been modified over decades to fit between the original Highway 2 alignment and residential development. An additional MDT right of way was acquired to provide additional space to relocate the stream outside the widened road footprint. The relocation of Bowser Creek was permitted in a modification to U.S. Army Corps (USACE) permit NWO-2009-018098-MTM on April 20, 2010. The revised permit authorized placement of 0.267 acres of wetland fill in the original Bowser Creek channel and 709 feet of stream impacts from relocating the creek into an open channel for approximately 429 feet, then into a 218 foot culvert.

The purpose of the Bowser Creek stream mitigation project is to create, enhance, restore, and maintain permanent, naturally self-sustaining, native, or native-like stream and riparian habitat. The project is designed to protect the functional values of riparian lands, floodplains, wetlands, and uplands for the benefit of fish and wildlife habitat, water quality, floodwater retention, groundwater recharge, open space, aesthetic values, and environmental education. This project is intended to provide compensatory mitigation for stream impacts associated with the U.S. Highway 2 widening segment of the Kalispell Bypass in the Missoula District.

Provisions outlined in the USACE permit include monitoring of the on and off-site stream mitigation areas for five years following channel construction to determine streambank stability and the success of riparian vegetation establishment.

<u>Quantitative success criteria include:</u>

1. **Riparian Buffer Success** will be achieved when woody and riparian vegetation becomes established, and noxious weeds do not exceed 10% cover within the riparian buffer areas. Any area within the creditable buffer area disturbed by the project construction must have at least 50% aerial cover of non-noxious weed species by the end of the monitoring period.
   a. **Vegetation Success** will be achieved where combined aerial cover of riparian and streambank vegetation communities is ≥70% and Montana State-listed noxious weeds do not exceed 10% cover.
   b. **Woody Plants** planted trees and shrubs will be considered successful where they exhibit 50% survival after 5 years.

2. **Vegetation along Streambanks** will be considered successful when banks are vegetated with a majority of deep-rooting riparian plant species having root stability indexes ≥6 (subject to 1.a and 1.b above).

3. **Streambank Stability Success** will be achieved where; following restoration, less than 25% of bank length is unstable and classified as eroding bank. For this purpose "eroding bank" will be defined as any bank greater than two feet in length that is more than 50% bare mineral soil and has no roots, surface

vegetation, or other stabilizing structure (e.g. rock, woody debris) to inhibit erosion.

<u>Non-quantitative performance criteria include:</u>

4. **Channel Form Success** will be achieved when the stream stabilizes, includes pools and riffles, allows for flood events to occupy the floodplain, and the habitat features such as riparian plant communities have successfully established along streambanks.

<u>Additional reporting requirements include:</u>

5. **Photo Document Success** of restored stream channel and streambank vegetation community development showing distinct positive changes from pre-construction to final monitoring year in comparison with the establishment reference reach.

6. **Weed Control** will be based upon annual monitoring of the site to determine weed species and degree of infestation with the site, and control measures based upon the monitoring results will be implemented by MDT in cooperation with the Flathead County Weed District to minimize and/or eliminate the intrusion of Montana State Listed Noxious weed species within the site.

This report includes the results of the first year (2013) monitoring of the Bowser Creek project site. The report provides the results of vegetation and streambank erosion monitoring, survey results at four perpendicular transects, photo-documentation of the project site, and maps indicating the endpoints of riparian belt transects, perpendicular transect surveys, vegetation communities, and noxious weeds.

2.0 SITE LOCATION

This monitoring site is located in Section 12, Township 28 North, Range 22 West, in Flathead County, Montana (Figure 1). Bowser Creek flows east within a newly constructed channel immediately north of U.S. Hwy 2 near the intersection of U.S. Highway 2 and Alternate Highway 93.

3.0 MONITORING METHODS

Monitoring field crews visited the project site on September 9, 2013 while survey crews visited the site on October 16, 2013. The following data were collected at the Bowser Creek stream mitigation site:

3.1. Riparian Vegetation Establishment - Belt Transects

Two riparian belt transects were established; one on each side of the stream channel. The belt transect on the right (south) bank is 204 feet long; while the left (north) bank is 167 feet long (Figure 2, Appendix A). GPS points were logged at riparian transect endpoints with a Magellan Promark III GPS unit. Riparian transect endpoints were marked with t-posts to allow for relocation during subsequent monitoring events.

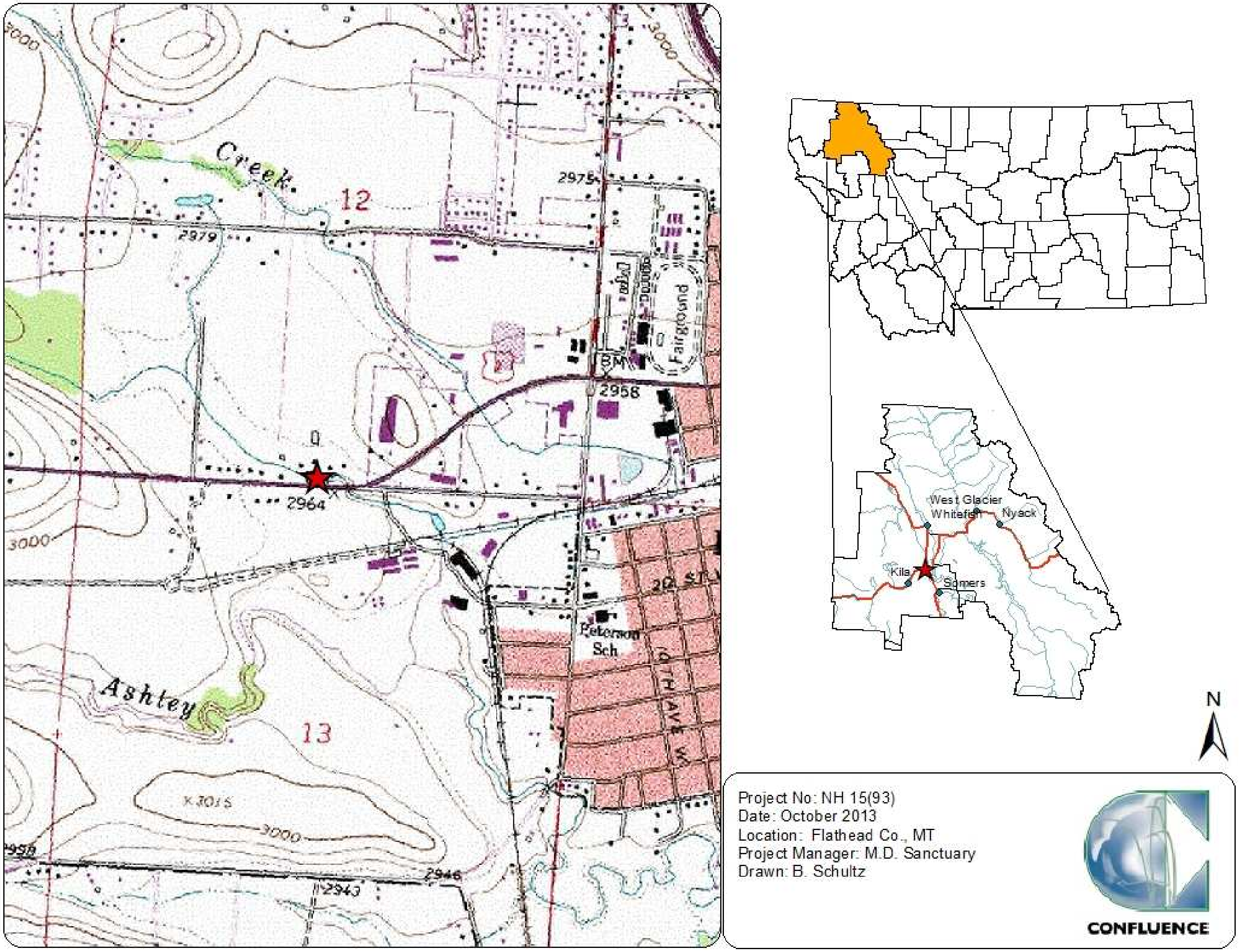


Figure 1. Project location of Bowser Creek stream mitigation site.

Field data collection at each transect included aerial percent cover of total vegetation, woody vegetation, and noxious weeds across a 25 foot wide belt centered on the transect line. A comprehensive plant list was created from transect vegetation observations and incidental observations on site.

3.2. Stream Bank Vegetation Composition

A vegetation inventory was conducted along both stream banks, and included documenting dominant species presence, percent cover, and a list of all species encountered within 3 feet of the active channel. The vegetation inventory was performed along the entire length of both banks within the project reach. Each plant species identified along the stream banks was compared with plant stability ratings provided in Appendix F of the Montana Wetland Assessment Method.

3.3. Noxious Weed Inventory

The project site was visually inspected to document the presence of noxious weeds. All noxious weed infestations were mapped on aerial photography, with species and areas of infestation recorded.

3.4. Woody Plant Survival

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

3.5. 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.

3.6. Perpendicular Transects

Four perpendicular transects (cross sections) were surveyed by licensed survey crews; 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 potential channel movement at each perpendicular transect.

3.7. Wildlife Documentation

Wildlife use of the project reach was documented by creating a list of all bird, mammal, and herpetile species observed during the site visit. Wildlife species were identified through visual observation, scat, tracks, and observation of nests, burrows, dens, feathers, etc.

3.8. Photo Documentation

The project site was photographed at several locations to document vegetation establishment and stream bank conditions. Three of these locations were selected for permanent photo-documentation sites. All sites selected for photo documentation were recorded with GPS and on field maps with headings noted to allow for repetition during subsequent monitoring years.

4.0 RESULTS

4.1. Riparian and Streambank Vegetation Inventory

The two riparian belt transects included a 204 foot long by 25 foot wide transect on the south (right) side of the creek and a 167 foot long by 25 foot wide transect on the north (left) side of the creek (Figure 3, Appendix A). Streambank vegetation transects were conducted along a three foot wide zone along the entire 465 foot length of both banks. Table 1 summarizes vegetative composition along each vegetation transect including aerial percent cover of total vegetation, woody vegetation, and noxious weeds. No bare ground was observed along any transects. Total non-noxious weed vegetative cover of the riparian zones and stream banks was 97% (100% total cover minus 3% noxious weed cover).

Table 1. Percent cover of vegetation transects at Bowser Creek in 2013.

Belt Transect	Length (ft)	Total % Vegetation Cover	% Woody Cover	% Noxious Weed Cover
Right (South) Riparian	204	100%	2%	2%
Left (North) Riparian	167	100%	14%	5%
Riparian Subtotal		100%	8%	4%
Right (South) Streambank	465	100%	17%	4%
Left (North) Streambank	465	100%	12%	4%
Streambank Subtotal		100%	15%	4%
Area Weighted Total		100%	9%	3%

The results in Table 1 indicate the reconstructed segment of Bowser Creek is densely revegetating, and primarily consists of herbaceous vegetation along the riparian and stream bank zones. Woody riparian vegetation is also establishing; however, the small size of woody plantings is currently only capable of providing a relatively limited percent cover. Percent cover of noxious weeds was 5% or less for all transects, and 3% across the entire site. Additional detail on noxious weeds observed is included in Section 4.3.

Dominant species recorded along the riparian and streambank transects were combined with visual observations in other areas to develop a vegetation community map (Figure 4, Appendix A). The upper side slopes of the project are dominated by wild rye (*Elymus spp.*), while the lower slopes and riparian zones adjacent to the channel are dominated by reed canary grass (*Phalaris arundinacea*).

Table 2 is a comprehensive list of vegetative species identified along the two belt transects, two streambank transects, and other incidental plants observed. In 2013, 56 plant species were observed within the Bowser Creek stream mitigation project site. An inventory of riparian vegetation data and species cover for each side of the channel is included in Appendix C.

Table 2. Comprehensive vegetative species list for Bowser Creek in 2013.

Scientific Name	Common Name	Scientific Name	Common Name
Achillea millefolium	Common Yarrow	*Mentha arvensis*	American Wild Mint
Agropyron cristatum	Crested Wheatgrass	*Nasturtium officinale*	Watercress
Agrostis gigantea	Black Bent	*Onopordum acanthium*	Scotch Cottonthistle
Alnus incana	Speckled Alder	*Pascopyrum smithii*	Western-Wheat Grass
Alopecurus arundinaceus	Creeping Meadow-Foxtail	*Phalaris arundinacea*	Reed Canary Grass
Artemisia biennis	Biennial Wormwood	*Plantago lanceolata*	English Plantain
Beckmannia syzigachne	American Slough Grass	*Plantago major*	Great Plantain
Bromus inermis	Smooth Brome	*Poa palustris*	Fowl Blue Grass
Carex utriculata	Northwest Territory Sedge	*Poa pratensis*	Kentucky Blue Grass
Chenopodium album	Lamb's-Quarters	*Ranunculus sp.*	Buttercup
Cirsium arvense	Canadian Thistle	*Rosa woodsii*	Woods' Rose
Cirsium vulgare	Bull Thistle	*Rumex crispus*	Curly Dock
Cornus alba	Red Osier	*Salix bebbiana*	Gray Willow
Cynoglossum officinale	Gypsy-Flower	*Salix drummondiana*	Drummond's Willow
Elymus canadensis	Nodding Wild Rye	*Salix exigua*	Narrow-Leaf Willow
Elymus repens	Creeping Wild Rye	*Solidago canadensis*	Canadian Goldenrod
Epilobium ciliatum	Fringed Willowherb	*Sonchus arvensis*	Field Sow-Thistle
Equisetum arvense	Field Horsetail	*Symphoricarpos albus*	Common Snowberry
Geum triflorum	Old-Man's-Whiskers	*Tanacetum vulgare*	Common Tansy
Glyceria striata	Fowl Manna Grass	*Taraxacum officinale*	Common Dandelion
Helianthus maximiliani	Maximilian's Sunflower	*Thlaspi arvense*	Field Penny-Cress
Lactuca serriola	Prickly Lettuce	*Trifolium pratense*	Red Clover
Lemna minor	Common Duckweed	*Trifolium repens*	White Clover
Leucanthemum vulgare	Ox-Eye Daisy	*Triglochin maritima*	Seaside Arrow-Grass
Lysichiton americanus	Yellow-Skunk-Cabbage	*Typha latifolia*	Broad-Leaf Cat-Tail
Medicago lupulina	Black Medick	*Urtica dioica*	Stinging Nettle
Medicago sativa	Alfalfa	*Verbascum thapsus*	Great Mullein
Melilotus officinalis	Yellow Sweet-Clover	*Vicia americana*	American Purple Vetch

Vegetation data collection along the riparian transects revealed a high percentage of Scotch cottonthistle (*Onopordum acanthium*), a primary establishment species commonly found in recently disturbed areas. Given the species is not considered a noxious weed, its occurrence did not count against the results for desirable vegetative cover. However, the proliferation of Scotch cottonthistle throughout the riparian areas of Bowser Creek warrants consideration for control efforts in tandem with efforts to contain noxious weeds.

4.2. Streambank Vegetation Composition

Thirty-nine plant species were observed along the Bowser Creek streambanks, defined as the zone within three feet of the active channel (Table 3). Stability ratings were assigned to each species observed along the banks to help determine overall bank stability. Stability ratings (1-10 scale) indicate a plant's ability to resist erosive forces based on root characteristics (Winward 2000). Nineteen of the 39 species observed have stability indices provided by Winward; while the remaining 20 species do not. Scores for plants without stability indices are listed in Table 3 as N/A. Fifteen of the 19 species (79%) with stability indices scored 6 or higher. The dominant species observed along the banks was reed canarygrass (*Phalaris arundinacea*), which has a stability index of 9. Reed canary grass comprised >50% cover on both banks.

Table 3. Comprehensive list of plant species and accompanying stability index values (from Winward, 2000) for Bowser Creek in 2013.

Streambank Species	Left Bank	Right Bank	NWPL R9 Indicator**	Stability Index
*Phalaris arundinacea**		x	FACW	9
Carex utriculata	x	x	OBL	9
Typha latifolia	x	x	OBL	9
Cornus alba	x	x	FACW	8
Glyceria striata		x	OBL	8
Poa palustris		x	FACW	8
Salix bebbiana	x	x	FACW	8
Salix exigua		x	FACW	8
Solidago canadensis	x	x	FACU	8
Salix drummondiana	x	x	FACW	7
Utrica dioica		x	FAC	7
Alopecurus arundinaceus	x	x	FAC	6
Cirsium arvense	x	x	FAC	6
Rosa woodsii	x		FACU	6
Equisetum arvense		x	FAC	5
Artemisia biennis	x		FACW	4
Geum triflorum	x	x	FACU	4
Mentha arvensis		x	FACW	4
Nasturtium officinale	x	x	OBL	4
Agrostis gigantea	x	x	FAC	3

Streambank Species	Left Bank	Right Bank	NWPL R9	Stability Index
Beckmannia syzigachne	x		OBL	N/A
Chenopodium album	x		FACU	N/A
Cirsium vulgare	x	x	FACU	N/A
Cynoglossum officinale	x	x	FACU	N/A
Epilobium ciliatum	x	x	FACW	N/A
Helianthus maximiliani	x	x	UPL	N/A
Lemna minor	x	x	OBL	N/A
Leucanthemum vulgare	x	x	FACU	N/A
Lysichiton americanus		x	OBL	N/A
Medicago sativa	x		UPL	N/A
Melilotus officinalis		x	FACU	N/A
Onopordum acanthium	x	x	UPL	N/A
Plantago major	x	x	FAC	N/A
Ranunculus spp.		x	NL	N/A
Sonchus arvensis	x	x	FACU	N/A
Taraxacum officinale		x	FACU	N/A
Trifolium pratense	x		FACU	N/A
Trifolium repens	x		FAC	N/A
Triglochin maritima	x		OBL	N/A
Vicia americana	x		FAC	N/A

**dominant species observed along Bowser Creek stream banks*
***National Wetland Plant List Region 9 Wetland Plant Indicator Status.*

4.3. Noxious Weed Inventory

The Bowser Creek field assessment included identification of four Montana State-listed noxious weeds. Listed noxious weeds identified within the project area included Canadian thistle (*Cirsium arvense*), gypsy-flower (*Cynoglossum officinale*), common tansy (*Tanacetum vulgare*), and oxeye daisy (*Leucanthemum vulgare*). Infestations of Canadian thistle were observed at two locations, which are illustrated in Figure 2, in Appendix A. Other noxious weed species observed were isolated cases.

4.4. Woody Plant Survival

Willows, alder, dogwood, snowberry, birch, and Wood's rose were observed on site as planted woody vegetation species. Many planted shrubs may not have been found during the inventory due to the density of herbaceous vegetation growth along the corridor. Table 4 indicates a very high survival rate of woody plants observed during the 2013 monitoring event.

Table 4. Woody plant survival at the Bowser Creek stream mitigation site in 2013.

Total Plants Inspected	Surviving Plants	Plant Survival Rate
127	122	96%

4.5. Streambank Performance

No eroding streambanks were observed at Browser Creek during the site visit. All banks were well vegetated and showed no signs of bank erosion, sloughing, or instability.

4.6. Perpendicular Transect Surveys and Channel Planform

Two transects were surveyed at pools and two at riffles, with maximum depth and bankfull width for each indicated in Table 5. These results indicate variability in channel dimensions, with maximum depths ranging from 1.7 to 3.6 feet and widths ranging from 6.3 to 14.8 feet. The range of channel widths and depths observed by these transects indicates the establishment of variable habitat elements throughout the reach.

Table 5. Pool and riffle width and depth at Bowser Creek 2013.

Transect	Type	Max Depth (ft)	Bankfull Width (ft)
1	Pool	1.7	6.3
2	Riffle	2.5	14.7
3	Pool	3.6	14.8
4	Riffle	1.9	7.4
	Average Riffles	2.4	11.1
	Average Pools	2.7	9.0

Surveyed pool depths were 1.7 feet (transect #1) and 3.6 feet (transect #3). Pool design depth was 2.7 feet, indicating the pool at transect #1 is relatively shallow, while the pool at transect #3 is relatively deep. Depths at both riffles were slightly deeper than the design depth of 1.7 feet.

Plots for each surveyed transect (Appendix B) reveal a trapezoidal shape for both pools and riffles. This pattern of symmetrical channel cross section shape provides evidence that the channel is transporting sediment across the entire width of the channel during high flow events and is not developing depositional features such as point bars on the inside of meander bends. Design plans indicate two of the three pool segments are designed with the same gently meandering radius of curvature as riffle segments (20 meters). This gently meandering channel planform geometry is not designed to generate deep scour pools and well developed point bars; and as such, pool habitats in the reconstructed channel segment are expected to be only slightly deeper than riffles over time. Based on the surveyed channel dimensions, planform geometry, and the overall design slope of 0.47%, the reconstructed channel segment is expected to transport sediment through the project reach without developing significant depositional features. This sediment transport process is considered an improvement over pre-project conditions, which included a series of backwatered sloughs upstream of culverts installed beneath residential driveways. Continued monitoring at the established transect locations will document substrate deposition, pool scour, and whether the channel maintains lateral stability over time.

4.7. Wildlife Documentation

Observed wildlife use of the Bowser Creek stream mitigation area was fairly limited during the 2013 monitoring event. No bird, wildlife, or herpetile species were observed during the site visit, although several deer beds were found within the project area (Table 6). The relative lack of wildlife use of the project reach may be attributed to the proximity with Highway 2, the time of day that the monitoring event took place (late afternoon), and high temperatures on the date observations.

Table 6. Wildlife observations at Bowser Creek in 2013.

Common Name	Scientific Name
White-tailed Deer	Odocoileus virginianus

5.0 COMPARISON OF RESULTS TO PERFORMANCE STANDARDS

Monitoring of the Bowser Creek Stream Mitigation site is intended to document whether the reconstructed segment of the channel and riparian zones are meeting the performance standards outlined in the Army Corps 404 permit issued for the project. The first year of monitoring suggests all six of the quantitative performance standards are being met three years post-construction (Table 7). Additional non-quantitative monitoring requirements including photo-documentation, channel form, and vegetation community mapping are included in this report as further documentation of the site's current condition.

5.1. Riparian Buffer Success

Vegetation monitoring of the riparian buffer and stream banks indicated 97% of disturbed areas had successfully revegetated with non-noxious weed species following construction. Desirable vegetative cover was determined by subtracting the percent of noxious weed species cover (3%) from the total vegetative cover for the site (100%). Performance criteria specify at least 50% of the disturbed areas within the creditable buffer area must be vegetated with non-weedy species; therefore, this criterion is currently being met. The performance criterion for noxious weeds (≤10%) is also currently being met at this project site.

Total combined aerial vegetative cover of the riparian zone and both right and left stream banks along Bowser Creek is currently 100%. Both riparian and streambank zones are heavily vegetated with woody and herbaceous species. The performance criterion for this category specifies ≥70% of the combined riparian and streambank vegetation communities must have vegetative establishment; therefore, this criterion is currently being met.

Table 7. Quantitative Performance standards for the Bowser Creek Stream Mitigation Site.

Monitoring Requirement	Type	Parameter	Performance Standard	Status
1a	Performance Criteria	Riparian Buffer Success	Areas within creditable riparian buffer disturbed during construction must have 50% or greater aerial cover of non-noxious weed species by the end of the monitoring period	Vegetation transects indicate **96%** cover of the riparian zones with non-noxious weed species
1b	Performance Criteria	Riparian Buffer Success	Noxious weeds do not exceed 10% cover within the riparian buffer areas.	Vegetation transects indicate **4%** cover of noxious weeds within riparian zones
1c	Performance Criteria	Vegetation Success	Combined aerial cover of riparian and stream bank vegetation communities is at least 70%	Combined aerial cover of riparian and stream bank vegetation is **97%**
1d	Performance Criteria	Vegetation Success	Planted trees and shrubs must exhibit 50% survival after 5 years	Planted tree and shrub survival documented at **96%.**
2	Performance Criteria	Vegetation along Streambanks	Majority of plants on the river bank must have root stability indexes of at least 6	**15 of 19 (79%)** species with plant stability ratings score 6 or higher.
3	Performance Criteria	Streambank Stability Success	Less than 25% of bank length is unstable and classified as eroding bank. Eroding bank will be defined as any bank greater than two feet in length that is more than 50% bare mineral soil and has no roots, surface vegetation, or other stabilizing structure (rock, woody debris) to inhibit erosion	Observations noted **0%** of the stream banks are eroding or unstable.
4	Qualitative Criteria	Channel Form	Will be achieved when the stream stabilizes, includes pools and riffles, allows for flood events to occupy the floodplain, and the habitat features such as riparian plant communities have successfully established along streambanks.	Evidence of overall channel stability, presence of at least one pool, ability of flood events to occupy the floodplain, and establishment of riparian plant communities is provided in this Monitoring Report
5	Reporting Requirement	Photo Documentation	Photo document success of restored stream channel and streambank vegetation community development showing distinct positive changes from pre-construction to final monitoring year in comparison with the establishment reference reach	Photo Documentation included in Appendix D
6	Reporting Requirement	Weed Control	Will be based on annual monitoring of the site to determine weed species and degree of infestation within the site, and control measures based on the monitoring results will be implemented by MDT in cooperation with the Flathead County Weed District to minimize and/or eliminate the intrusion of State Listed noxious weed species within the site.	Species and percent cover of noxious weeds included in 2013 Monitoring Report

Woody vegetation plantings indicated a survival rate of 96% three years following construction. The performance criteria states 50% of the woody plants installed must survive five years following construction; therefore, additional monitoring is necessary to meet this criterion. Woody plants remain relatively small but should provide increased percent cover of the site as they mature. Dense vegetation growth within the riparian corridor made locating smaller woody plantings difficult; however very few dead woody plantings were observed throughout the project site. Several large 15 foot tall paper birch trees installed at the top of the north embankment did not survive, potentially due to their elevation above the water table. Smaller woody shrubs installed throughout the riparian corridor showed excellent survival.

5.2. Vegetation Along Streambanks

Streambank vegetation inventories along Bowser Creek identified that the majority (79%) of species had stability scores ≥6 when compared to all species with stability scores. The most prevalent species observed along the banks was reed canary grass, covering over 50% of the stream banks and having a stability index of 9. These results indicate the criteria for streambank vegetation is currently being met.

5.3. Streambank Stability

The streambank inventory did not identify any stream segments with eroding or unstable banks. All banks were well vegetated with several species providing bank protection. As a result, the performance criterion for streambank stability is currently being met.

5.4. Channel Form Success

The reconstructed section of Bowser Creek has stabilized following completion of the project, as evidenced by a lack of eroding banks or vertical head cuts. A dense stand of vegetation has established along the streambanks and within the riparian corridor adjacent to the channel, and will provide a natural resistance to erosive forces during flood events.

Results of the perpendicular transect surveys indicate the channel currently exhibits variability in both channel width and depth, with at least one relatively deep pool formation documented at transect #3. The channel cross section shape appears to be relatively uniform, with no point bars or other depositional features noted. This cross sectional shape is often observed in channels similar to the reconstructed segment of Bowser Creek with relatively straight planform geometry, low sinuosity, and gently meandering planform. As a result of these design parameters, the development of sustained, deep pool habitat is not expected within the project reach, although sediment transport has been improved over pre-construction conditions. Continued monitoring at pool and riffle features will provide evidence if the channel maintains habitat variability, stability, and develops any depositional features at these monitoring locations over time.

The Bowser Creek channel has been designed to convey an estimated 2 year return interval discharge within the low flow channel. Discharges greater than the 2 year flow are able to access a floodplain approximately 14 feet wide with a design grade of 5%

slope toward the channel. Beyond this floodplain, the floodway has been designed to convey up to a 100 year discharge without over-topping Highway 2.

Data and photos included in this monitoring report provide evidence of establishment of vegetation along Bowser Creek's banks and riparian corridor. To date, woody shrubs are establishing adjacent to the creek, and once they mature, will provide additional habitat components such as shade, cover, and woody debris to the channel.

5.5. Photo Documentation

Three permanent photo documentation locations were established along Bowser Creek to document changes in vegetation community and site conditions over time. Photographs were take upstream, downstream, and toward the left and right banks at each of the four perpendicular transects. All photographs of the Bowser Creek mitigation site have been cataloged in Appendix D.

5.6. Maintenance Issues

This monitoring report includes documentation of four noxious weed species within the Bowser Creek mitigation site. Infestations of Canadian thistle have been mapped (Figure 4, Appendix A) for guidance toward future weed spraying efforts. Isolated occurrences of gypsy-flower (*Cynoglossum officinale*), common tansy (*Tanacetum vulgare*), and oxeye daisy (*Leucanthemum vulgare*) were also observed, but were not mapped due to infrequent observations. Riparian and stream bank vegetation transects indicated the site has approximately 3% cover by noxious weeds. In addition to these species, much of the riparian corridor contains Scotch cottonthistle and bull thistle, both undesirable, but not noxious species. Weed spraying efforts may also want to target this species to enable more beneficial riparian vegetation establishment.

6.0 MANAGEMENT AND DESIGN RECOMMENDATIONS

6.1. Weed Management

Noxious weeds were observed within approximately 3% of the Bowser Creek project area. Although the cover of observed noxious weeds remains relatively low, Scotch cottonthistle and bull thistle were among the most abundant species on site, comprising approximately 50% of the total cover. These species should also be targeted during weed control efforts in order to increase riparian vegetation diversity throughout the project area.

6.2. Use of Reference Data to Document Successful Pool Formation

The reconstructed segment of Bowser Creek has been designed with a low sinuosity and very broadly sweeping meanders. The ability of this channel segment to maintain long term pool habitat may be limited by the relatively straight planform geometry and prescribed radius of curvatures. However, it should be noted that the ability of Bowser Creek to successfully generate pool habitat should take into account the creek's natural ability to do so. In order to determine whether Bowser Creek is successfully providing adequate pool habitats, survey results from the reconstructed pool segments should be compared against appropriate reference reach pool data. If the reference reach data suggests a relatively straight planform alignment is appropriate, development of deep pools will be naturally limited. Collection of reference reach data is suggested for use in developing more specific success criteria pertaining to pool development on future stream mitigation projects.

6.3. Floodplain and Riparian Development

Side slope designs along Bowser Creek provide room for a very narrow, 14 foot wide riparian and floodplain zone. Perpendicular transect survey results (Appendix B) illustrate a narrow bankfull bench adjacent to the creek has been constructed for flood inundation and wetland/riparian vegetation establishment. Integrating a slightly steeper upland side slope design would provide for a wider, more functional floodplain and riparian zone by allowing the stream to access a larger, flat zone adjacent to the active channel (Figure 2). Constructing steeper side slopes and a wider floodplain area requires additional excavation; therefore a cost/benefit analysis of creating additional floodplain and wetland features, and the associated mitigation credits, is potentially worth consideration for future stream and riparian mitigation designs.

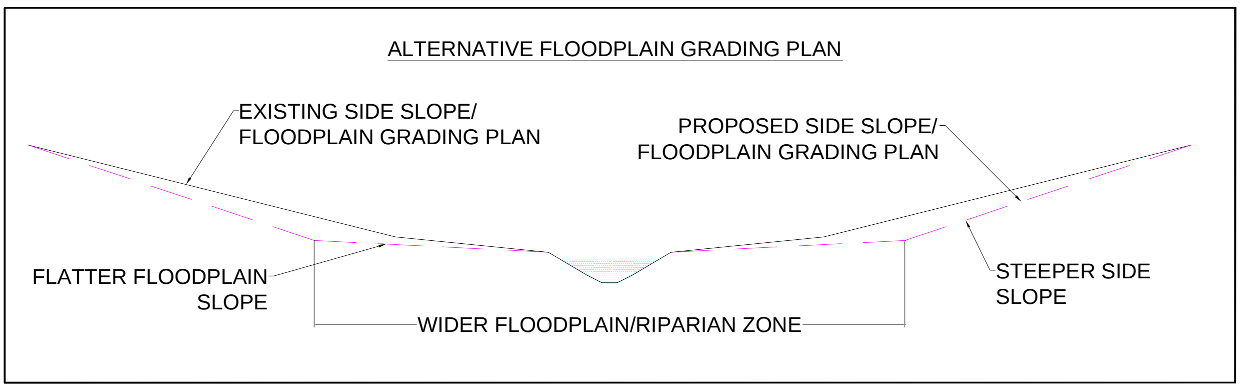


Figure 2. Alternative grading plan to increase floodplain and riparian areas.

6.4. Riparian Vegetation Zone

Design plans indicate riparian planting zones were only prescribed on the south side of Bowser Creek. Increasing the steepness of side slopes as illustrated Figure 2 would result in a wider riparian corridor, allowing for increased riparian vegetation establishment and the ecological benefits of such features along both sides of the channel. Consideration of this alternative grading plan is suggested for future stream mitigation projects.

6.5. Vegetation Success

The first monitoring event documented high survival rates of woody vegetation plantings. The majority of woody plants that did not survive were mature birch transplants installed along the north boundary of the project area near the top of the embankment. These trees appeared to die due to their lack of ability to reach the low water table. Mature willow transplants often have higher survival rates if the top 2/3 of the exposed branches are removed following installation. This technique focuses more energy toward production of roots during the first few years after installation. Overall, the planting techniques integrated on this project resulted in high survival success rates to date; it is therefore recommended future designs on similar stream and riparian corridors incorporate similar planting specifications.

7.0 LITERATURE CITED

Montana Department of Transportation, 2008. Montana Wetland Assessment Method. Helena, Montana.

Winward, 2000. Monitoring the Vegetation Resources in Riparian Areas. Gen. Tech. Report RMRS-GTR.47. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Appendix A

Project Site Maps

MDT Stream Mitigation Monitoring
Bowser Creek
Flathead County, Montana

CONFLUENCE consulting incorporated

Legend

Photo Points

Riparian and Perpendicular Transect Endpoints

Pool and Riffle Transects

Riparian Transects

N

0 25 50 100 150 Feet

2013 Monitoring Bowser Creek

Figure 3

Date: 10/15/2013

X:/MDT_.007/mains

2013 Monitoring Bowser Creek

Figure 4

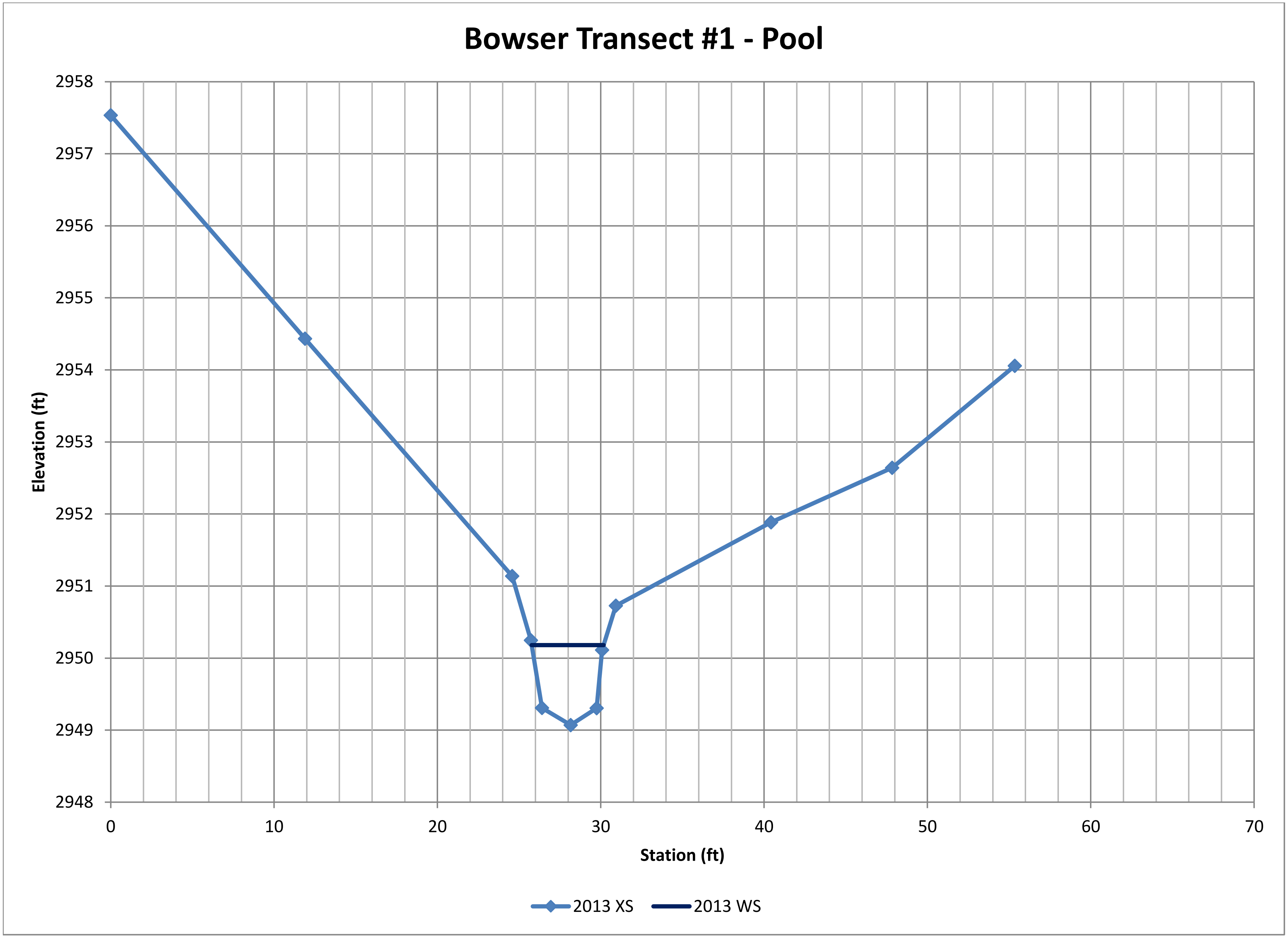
Date: 10/15/2013

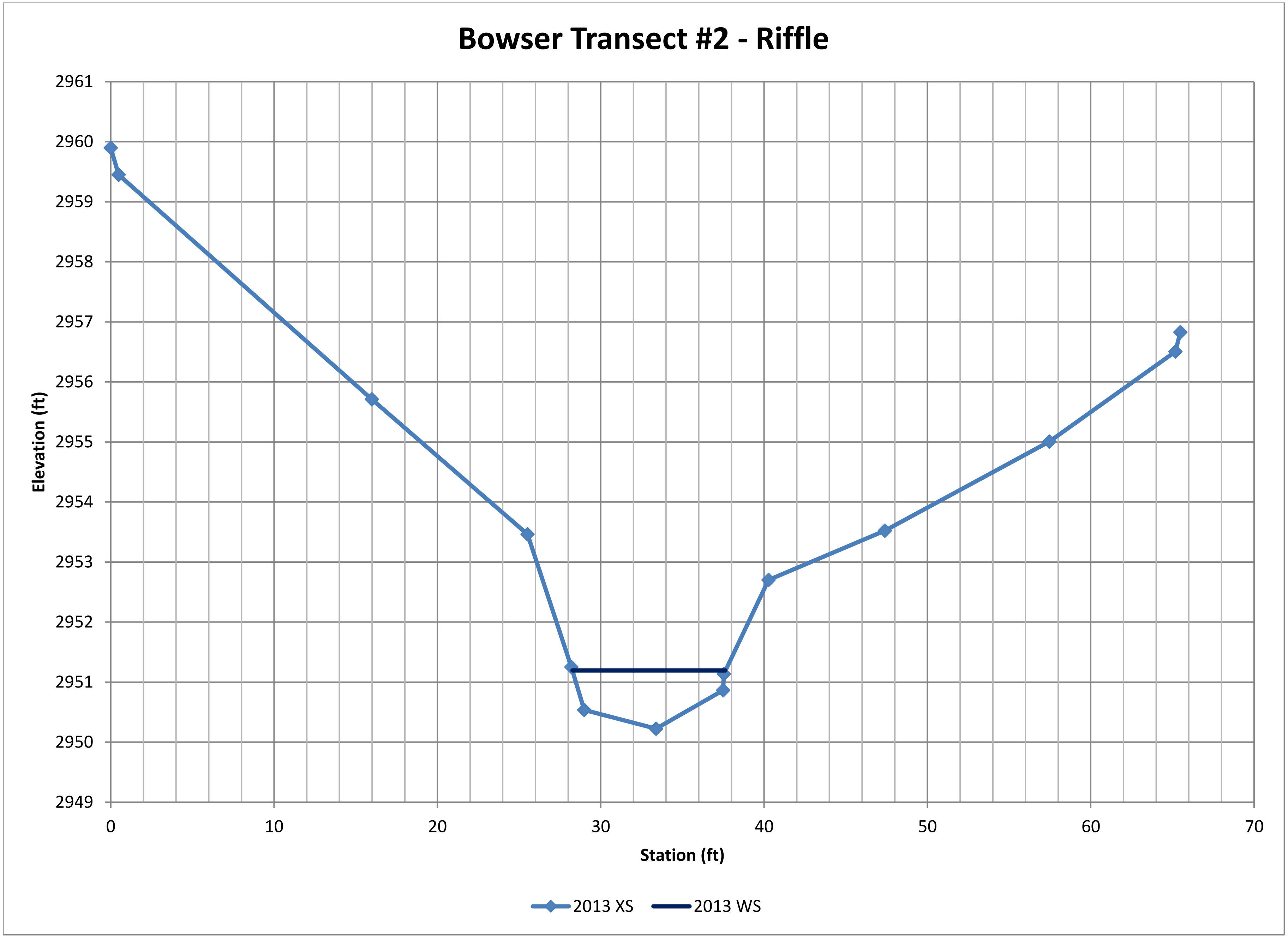
X:/MDT_.007/mains

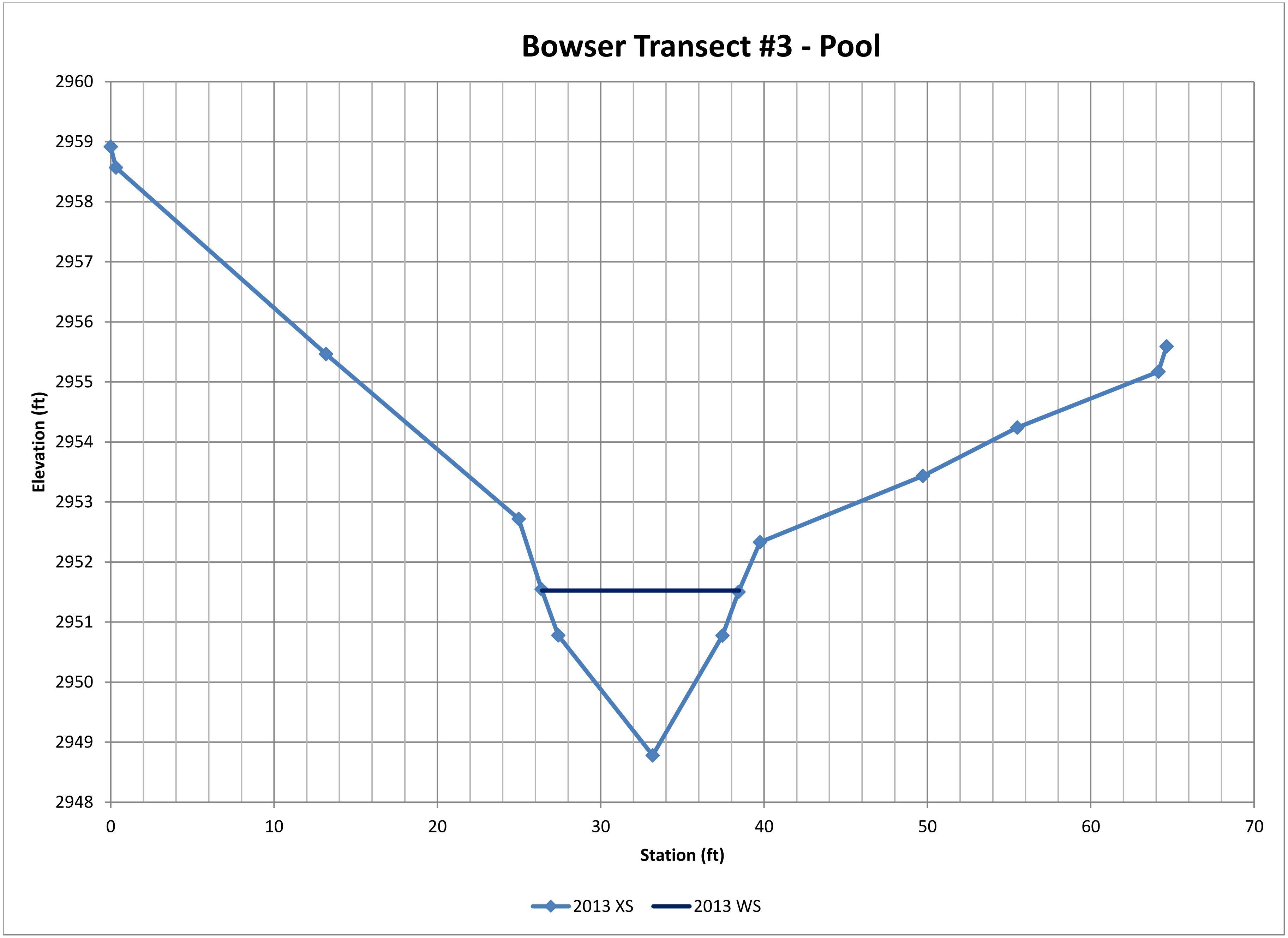
Appendix B

Perpendicular Transect Plots

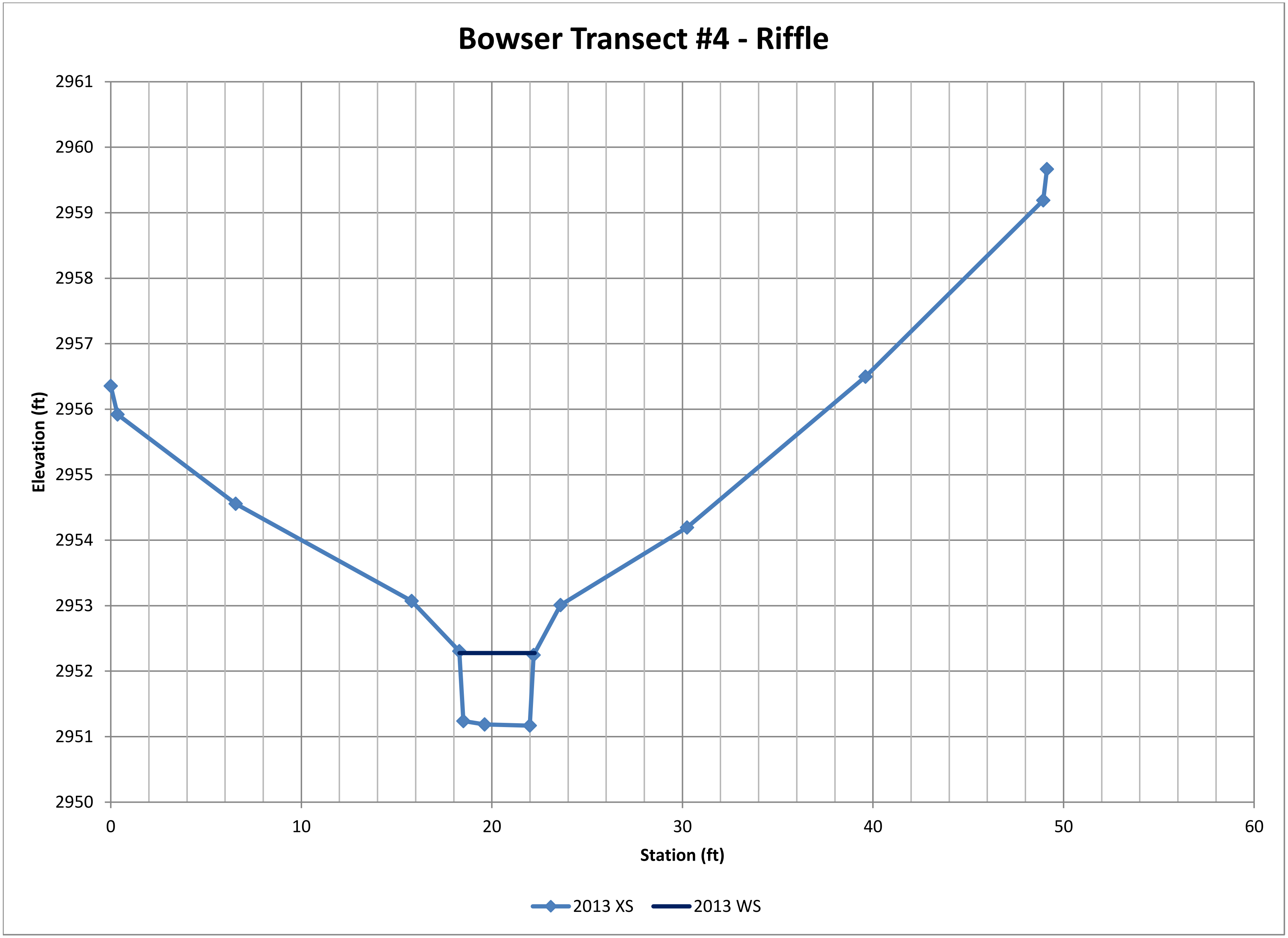
MDT Stream Mitigation Monitoring
Bowser Creek
Flathead County, Montana


Bowser Transect #1 - Pool
Elevation (ft)
2958
2957
2956
2955
2954
2953
2952
2951
2950
2949
2948
0
10
20
30
40
50
60
70
Station (ft)
2013 XS
2013 WS


Bowser Transect #2 - Riffle
Elevation (ft)
2961
2960
2959
2958
2957
2956
2955
2954
2953
2952
2951
2950
2949
0
10
20
30
40
50
60
70
Station (ft)
2013 XS
2013 WS



Bowser Transect #3 - Pool
Elevation (ft)
2960
2959
2958
2957
2956
2955
2954
2953
2952
2951
2950
2949
2948
0
10
20
30
40
50
60
70
Station (ft)
2013 XS
2013 WS



Bowser Transect #4 - Riffle
Elevation (ft)
2961
2960
2959
2958
2957
2956
2955
2954
2953
2952
2951
2950
0
10
20
30
40
50
60
Station (ft)
2013 XS
2013 WS

Appendix C

Riparian Vegetation Transect Results

MDT Stream Mitigation Monitoring
Bowser Creek
Flathead County, Montana

Interval Data Summary Report

Site: **Bowser Creek**

date: 9/9/2013 3:23:32 PM

Transect Number: 1 **Compass Direction from Start:** ______

Interval Data:

Ending Station 68 **Community Type:** /

Species	Cover class	Species	Cover class
Agrostis gigantea	2	Alnus incana	1
Bromus inermis	3	Cirsium arvense	1
Cornus alba	1	Elymus canadensis	5
Leucanthemum vulgare	1	Medicago lupulina	1
Medicago sativa	2	Melilotus officinalis	3
Mentha arvensis	1	Phalaris arundinacea	4
Rumex crispus	0	Sonchus arvensis	1
Thlaspi arvense	1	Trifolium pratense	1
Trifolium repens	1		

Ending Station 204 **Community Type:** /

Species	Cover class	Species	Cover class
Agrostis gigantea	3	Bromus inermis	4
Cirsium vulgare	0	Elymus canadensis	5
Lactuca serriola	0	Medicago lupulina	1
Medicago sativa	2	Phalaris arundinacea	4
Plantago lanceolata	0	Poa pratensis	2
Rumex crispus	0	Sonchus arvensis	1
Thlaspi arvense	0	Trifolium pratense	1
Trifolium repens	1	Verbascum thapsus	0

Transect Notes:

t1 right bank riparian belt.

Interval Data Summary Report

Transect Number: 2 **Compass Direction from Start:** ______

Interval Data:

Ending Station 167 **Community Type:** /

Species	Cover class	Species	Cover class
Artemisia biennis	2	Bromus inermis	4
Carex utriculata	1	Cirsium arvense	1
Cirsium vulgare	0	Cornus alba	1
Cynoglossum officinale	0	Elymus canadensis	4
Epilobium ciliatum	0	Lactuca serriola	1
Medicago lupulina	1	Medicago sativa	2
Melilotus officinalis	3	Mentha arvensis	0
Pascopyrum smithii	3	Plantago major	0
Poa palustris	3	Poa pratensis	3
Rosa woodsii	1	Rumex crispus	0
Salix bebbiana	2	Sonchus arvensis	1
Symphoricarpos albus	2	Taraxacum officinale	2
Thlaspi arvense	0	Trifolium pratense	1
Trifolium repens	1	Typha latifolia	1
Verbascum thapsus	0		

Transect Notes:

Appendix D

Project Area Photos

MDT Stream Mitigation Monitoring
Bowser Creek
Flathead County, Montana

PHOTO INFORMATION

PROJECT NAME: Bowser Creek Stream Mitigation Site

DATE: September 09, 2013

CONFLUENCE

Photo Point 1
Description: View looking west (upstream) of Bowser Creek. **Compass**: 270 (West)

Photo Point 2.1
Description: View looking northwest at Bowser Creek. **Compass**: 315 (Northwest)

Photo Point 2.2
Description: View across Bowser Creek looking north. **Compass**: 0 (North)

Photo Point 2.3
Description: View looking northeast across Bowser Creek. **Compass**: 45 (Northeast)

Photo Point 2.4
Description: View looking east across Bowser Creek. from photo point 2. **Compass**: 90 (East)

Photo Point 3.1
Description: View looking east (downstream) of Bowser Creek from photo point 3.**Compass**: 90 (East)

PHOTO INFORMATION

PROJECT NAME: Bowser Creek Stream Mitigation Site

DATE: September 09, 2013

Photo Point 3.2
Description: Downstream view of Bowser Creek channel from photo point 3. **Compass**: 90 (East)

Photo 1
Description: Instream vegetation on Bowser Creek. **Compass**: 90 (East)

Photo 2
Description: View across Bowser Creek of culvert on north side of channel. **Compass**: 0 (North)

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 2 Left Looking South

Transect 2 Left Looking Upstream West

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 2 Left Looking Downstream East

Transect 2 Right Looking North

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 2 South

Transect 1 South

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 1 Right Looking Northeast

Transect 1 Left Looking South

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 1 In Channel Looking Upstream Northwest

Transect 1 Left Looking South

PHOTOGRAPHIC INFORMATION

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 3 South

Transect 3 Right Looking Northeast

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 3 Right Looking West

Transect 3 Right Looking Northwest

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 3 Looking East

Transect 3 in Channel Looking West

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 3 Right Looking East

Transect 4 South

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 4 Right Looking North

Transect 4 in Channel Looking East

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 4 in Channel Looking Northwest

Transect 4 North

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 4 Left Looking South

Transect 4 Left Looking East

PROJECT NAME: MDT Stream Mitigation Bowser Creek

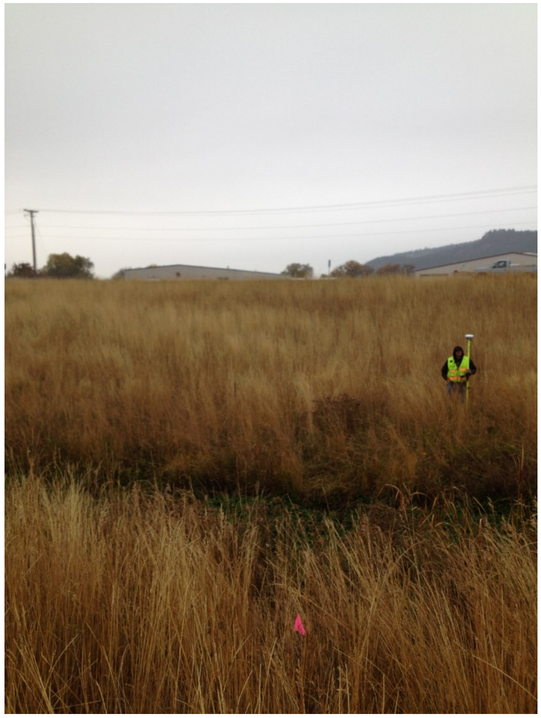
DATE: October 16, 2013

Transect 4 Left Looking West

Transect 3 North

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013



Transect 3 Left Looking South

Transect 3 Left Looking East

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

Transect 3 Left Looking West

North of Transect 1 Looking South

PROJECT NAME: MDT Stream Mitigation Bowser Creek

DATE: October 16, 2013

PP1 Looking West—Upstream

Appendix E

Construction Plan Sheets

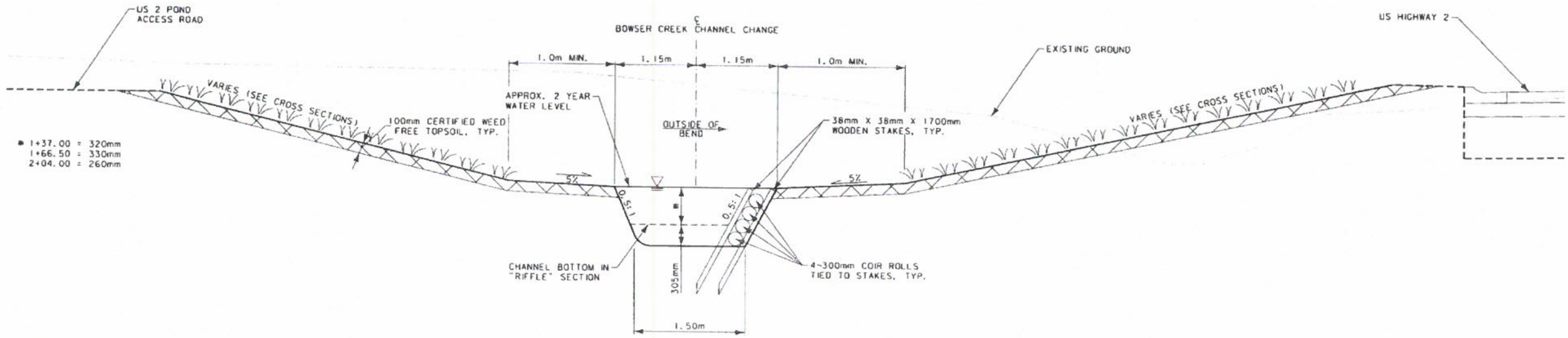
MDT Stream Mitigation Monitoring
Bowser Creek
Flathead County, Montana

STATE	PROJECT NUMBER	SHEET NO.
MONTANA	NH 15(93)	39

CSF - 0.999470385

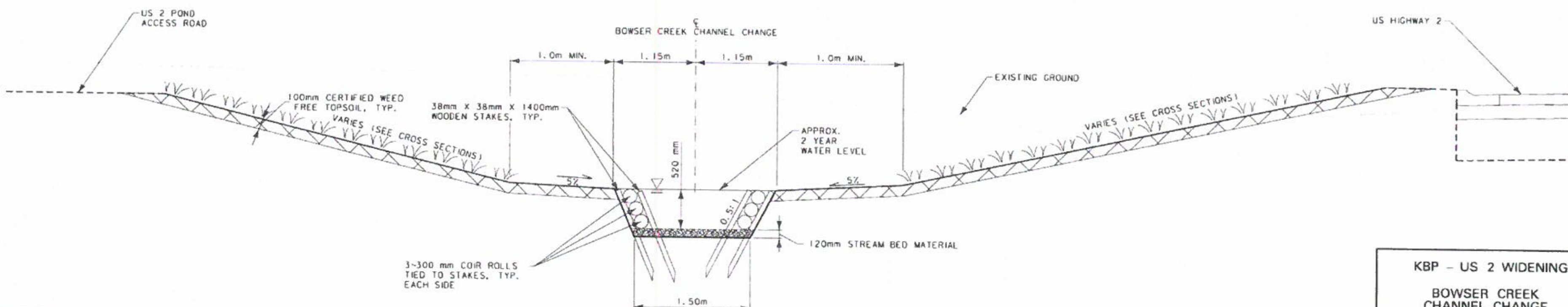
DETAIL

BOWSER CREEK CHANNEL CHANGE POOL SECTION



NOTE: SEE VEGETATION PLANS FOR SEEDING & PLANTINGS

BOWSER CREEK CHANNEL CHANGE RIFFLE SECTION



NOTE: SEE VEGETATION PLANS FOR SEEDING & PLANTINGS

KBP - US 2 WIDENING

BOWSER CREEK
CHANNEL CHANGE
POOL SECTION
RIFFLE SECTION

NO SCALE

DESIGNER		
DRAWN		
APPROVED		
REVISED		
	INITIALS	DATE

DESIGNED BY
REVIEWED BY
CHECKED BY

STATE	PROJECT NUMBER	SHEET NO.
MONTANA	NH 15(93)	40

CSF= 0.999470385

DETAIL

BOWSER CREEK CHANNEL CHANGE

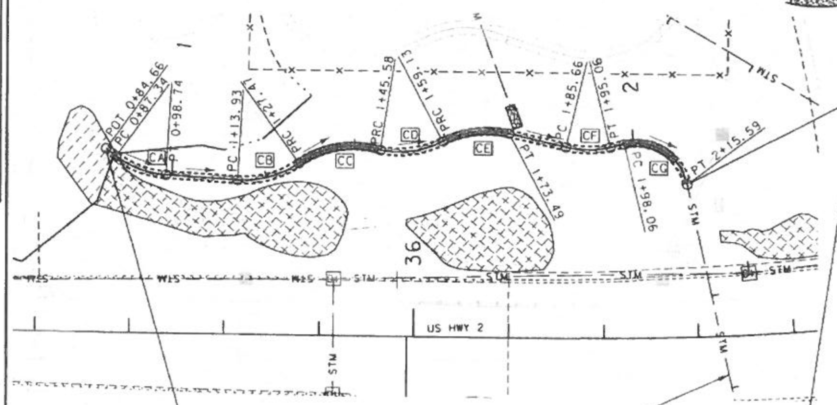
LEGEND

STREAM RIFFLE SECTION

STREAM POOL SECTION

SPRING CREEK CHANNEL CHANGE CURVE DATA

CURVE	P.I.	Δ	RADIUS (m)	T	L	E	BACK TANGENT	AHEAD TANGENT
CA	0+93.20	32° 39' 20" LT	20.00	5.86	11.40	0.84	S 50° 45' 07" E	S 83° 24' 28" E
CB	1+20.97	38° 48' 07" LT	20.00	7.04	13.54	1.20	S 83° 24' 28" E	N 57° 47' 25" E
CC	1+37.20	51° 53' 00" RT	20.00	9.73	18.11	2.24	N 57° 47' 25" E	S 70° 19' 35" E
CD	1+52.63	38° 48' 35" LT	20.00	7.04	13.55	1.20	S 75° 55' 20" E	N 65° 16' 06" E
CE	1+66.63	41° 08' 10" RT	20.00	7.50	14.36	1.36	N 65° 16' 06" E	S 73° 35' 44" E
CF	1+90.45	26° 56' 29" LT	20.00	4.79	9.40	0.57	S 73° 35' 44" E	N 79° 27' 47" E
CG	2+09.31	91° 18' 24" RT	11.00	11.25	17.53	4.74	N 79° 27' 47" E	S 9° 13' 48" E

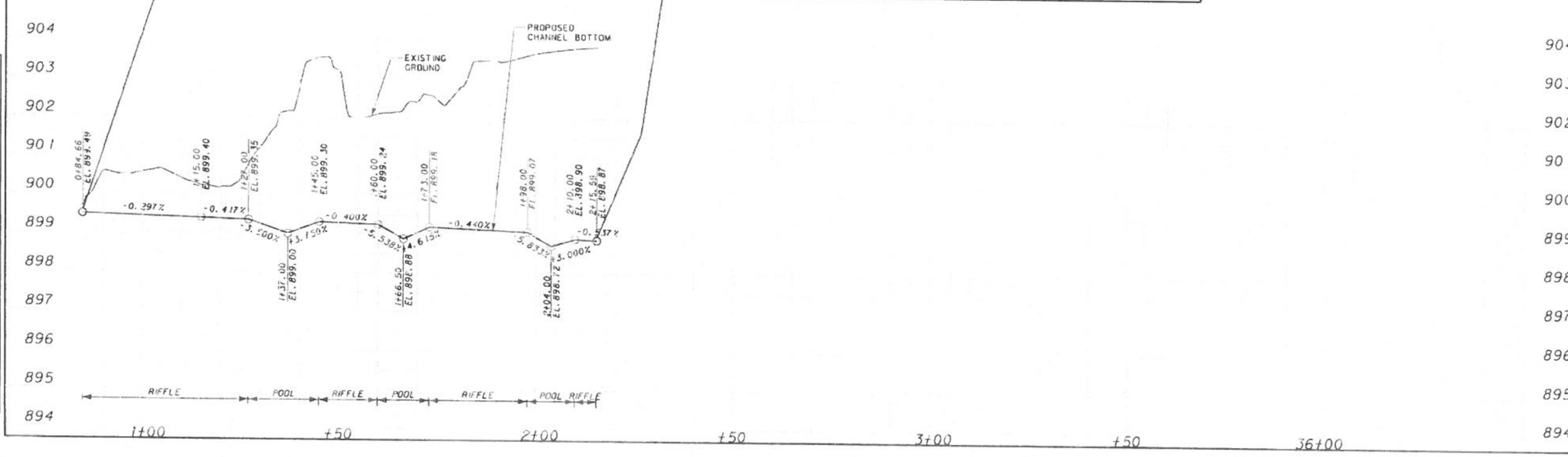


P.O.T. STA. 2+15.59
END BOWSER CREEK CHANNEL CHANGE=
STA. 36+56.67 US 2

P.O.T. STA. 0+84.66
BEGIN BOWSER CREEK CHANNEL CHANGE =
STA. 35+34.77 US 2

CENTERLINE COORDINATE TABLE

STATION	DESCRIPTION	N OR Y COORDINATE	E OR X COORDINATE	REMARKS
0+84.66	POT	449 740.9132	240 357.7066	BEGIN CHANNEL CHANGE
0+87.34	PC	449 739.2154	240 359.7848	
0+93.20	PI	449 735.5085	240 364.3220	
0+98.74	PT	449 734.8359	240 370.1422	
1+13.93	PC	449 733.0927	240 385.2258	
1+20.97	PI	449 732.2841	240 392.2228	
1+27.47	PRC	449 736.0384	240 398.1823	
1+37.20	PI	449 741.2244	240 406.4145	
1+45.58	PRC	449 737.9489	240 415.5760	
1+52.63	PI	449 736.2352	240 422.4094	
1+59.13	PRC	449 739.1827	240 428.8082	
1+66.63	PI	449 742.3225	240 435.6246	
1+73.49	PT	449 740.2030	240 442.8239	
1+85.66	PC	449 736.7665	240 454.4968	
1+90.45	PI	449 735.4135	240 459.0926	
1+95.06	PT	449 736.2896	240 463.8025	
1+98.06	PC	449 736.8382	240 466.7522	
2+09.31	PI	449 738.8962	240 477.8162	
2+15.59	PT	449 727.7881	240 479.6213	END CHANNEL CHANGE



MONTANA CADD

MDT MONTANA DEPARTMENT OF TRANSPORTATION

SE Stelling Engineers, Inc.

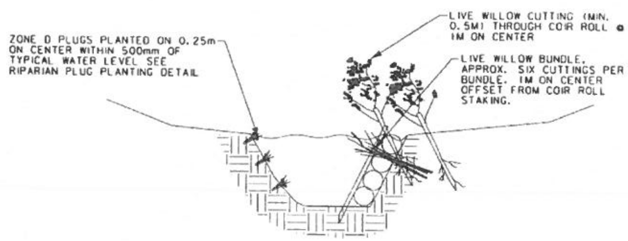
DESIGNED BY	
REVIEWED BY	
CHECKED BY	
EPS - U9652	

STATE	PROJECT NUMBER	SHEET NO.
MONTANA	NH 15(93)	V1

CSF = 0.999470385

DETAIL

TABLE OF CONTENTS & DETAILS



ZONE D COIR BUNDLES WITH WILLOW CUTTINGS AND LAYERING
SCALE: NOT TO SCALE

HARVESTING AND INSTALLATION NOTE:

1. HARVEST AND PLANT CUTTINGS DURING DORMANT SEASON.
2. USE HEALTHY STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD.
3. MAKE CLEAN CUTS AND DO NOT DAMAGE CUTTINGS OR SPLIT ENDS DURING INSTALLATTION.
4. BRIEFLY SOAK CUTTINGS IN WATER AND ROOTING HORMONE PRIOR TO INSTALLATION.
5. FOR LAYERING, BUNDLE 6 CUTTINGS TOGETHER AND BIND WITH BIODEGRADABLE JUTE STRING.
6. INSTALL WILLOW CUTTING AND WILLOW BUNDLE LAYERING DURING BANK GRADING AND COIR PLACEMENT.
7. WILLOW CUTTING AND WILLOW BUNDLES SHALL EXTEND INTO EXPECTED MOISTURE SOIL ZONES.
8. IF NECESSARY, CUT SMALL HOLES IN COIR ROLLS AND INSERT LIVE WILLOW CUTTING.
9. INSERT BUNDLES INTO SOIL BETWEEN COIR ROLLS.

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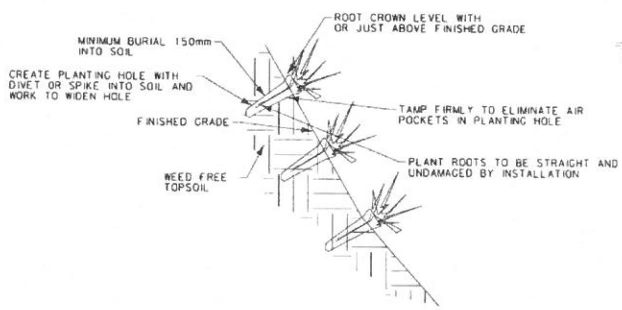
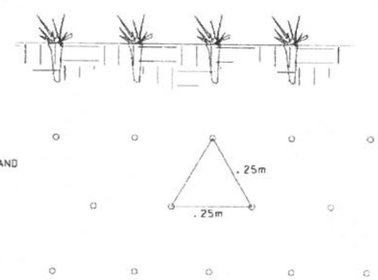
DETAILS	SHEET NO.
TABLE OF CONTENTS & DETAILS	V1
BOWSER CREEK VEGETATION TYPICAL SECTIONS & SUMMARY	V2
BOWSER CREEK VEGETATION PLAN	V3
US HWY 2 DETENTION POND VEGETATION PLAN	V4



ZONE D RIPARIAN PLUG PLANTING
FOR INSIDE BEND OF SPRING CREEK POOLS
SCALE: NOT TO SCALE



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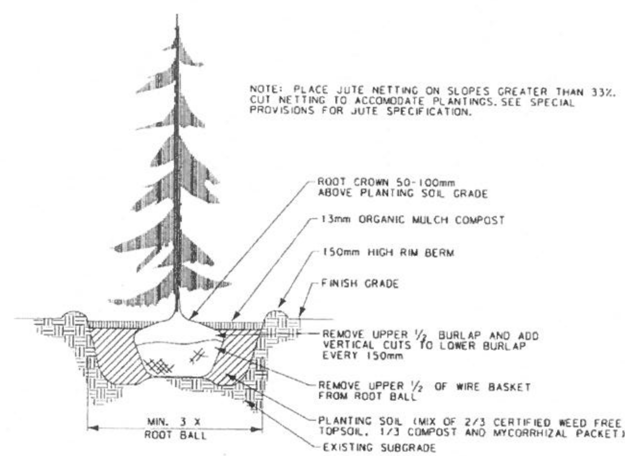
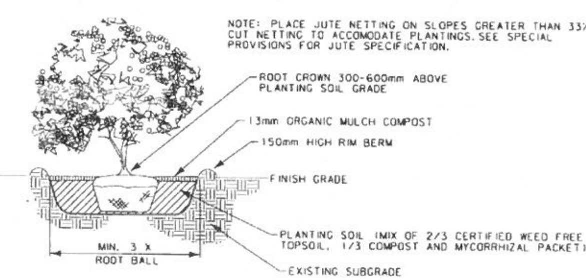


TREE PLANTING
SCALE: NOT TO SCALE



SHRUB PLANTING
SCALE: NOT TO SCALE

KBP - US 2 WIDENING

TABLE OF CONTENTS & DETAILS

NO SCALE

DESIGNER		
DRAWN		
APPROVED		
REVISED		
	INITIALS	DATE

MDT MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CADD

SE Stelling Engineers, INC.

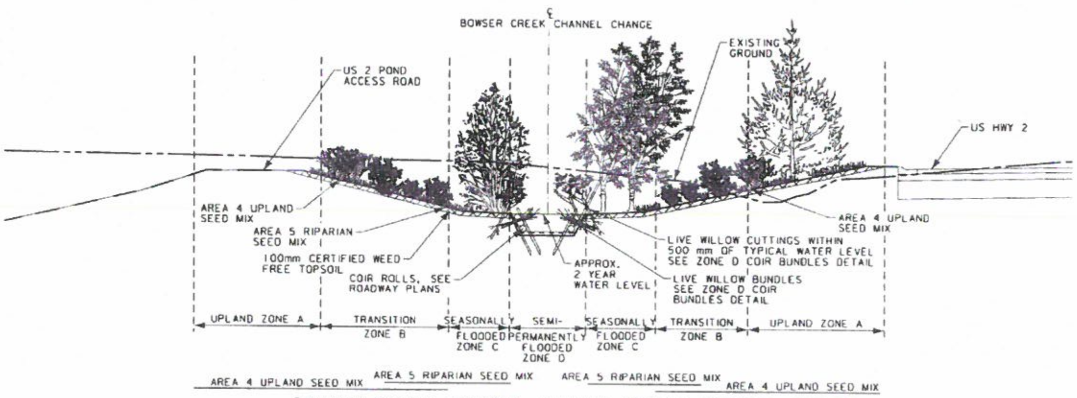
NOTES: 1. SEE ROADWAY PLANS FOR CHANNEL CONSTRUCTION DETAILS.
2. TYPICAL SECTIONS ARE GENERAL CONCEPTUAL DESIGN. FOR INFORMATION ONLY

DETAIL

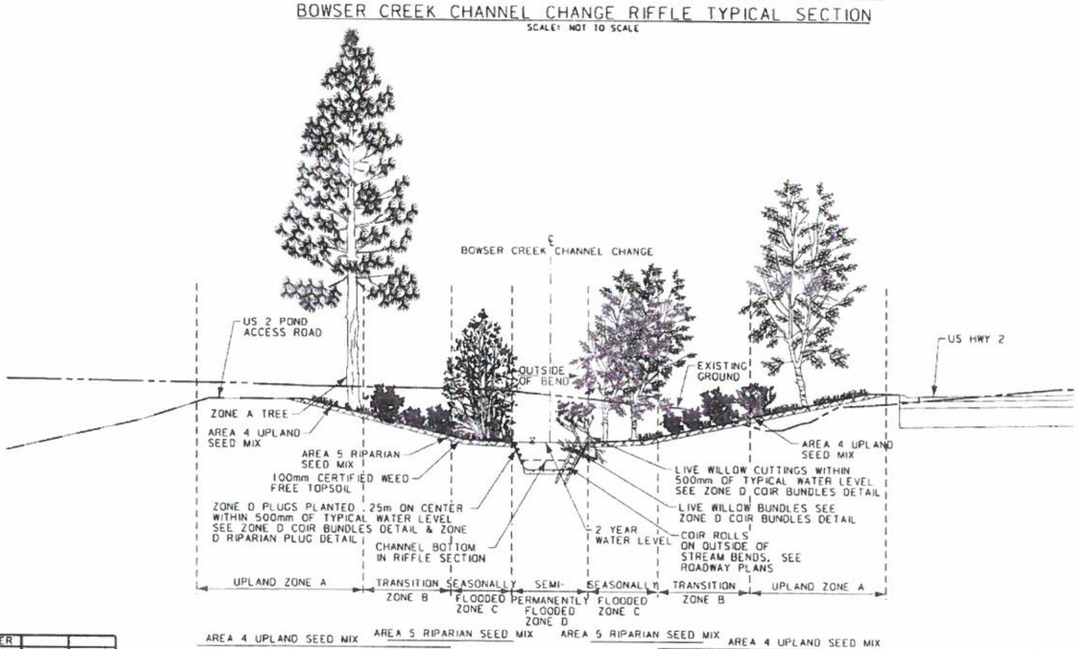
BOWSER CREEK VEGETATION TYPICAL SECTIONS & SUMMARY

STATE	PROJECT NUMBER	SHEET NO.
MONTANA	NH 15(93)	V2

CSF = 0.999470385



BOWSER CREEK CHANNEL CHANGE RIFFLE TYPICAL SECTION
SCALE: NOT TO SCALE



BOWSER CREEK CHANNEL CHANGE POOL TYPICAL SECTION
SCALE: NOT TO SCALE

CHANNEL PLANTING SEQUENCE

1. PLACE COIR ROLL AS PER COIR ROLLS DETAIL IN ROADWAY PLANS AND SPECIAL PROVISIONS.
2. INSTALL PLANTS BETWEEN THE DATES OF OCTOBER 1 AND MAY 15 PROVIDED THE GROUND IS NOT FROZEN.
3. PLANT RIPARIAN PLUGS AS PER PLANTING DETAIL.
4. PLANT WILLOW CUTTINGS AND BUNDLES AS PER PLANTING DETAIL.
5. INSTALL JUTE NETTING ON SLOPES GREATER THAN 3:1 AS PER SPECIAL PROVISIONS.
6. SEED UPLAND AREA 4 AND RIPARIAN AREA 5 AS PER SEEDING SPECIAL PROVISIONS.
7. PLANT TREES AND SHRUBS AS PER PLANTING DETAILS.
8. APPLY MYCORRHIZAL FUNGI AS PER SPECIAL PROVISIONS.
9. APPLY WEED FREE ORGANIC COMPOST MULCH AS PER SPECIAL PROVISIONS.

BOWSER CREEK CHANNEL CHANGE PLANT LIST *				
ZONE A UPLAND				
TREES				
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	SIZE
BP	BETULA PAPYRIFERA	PAPER BIRCH	6	10' B&B
PP	PINUS PONDEROSA	PONDEROSA PINE	1	7' B&B
ZONE B TRANSITIONAL				
SHRUBS				
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	SIZE
Aa	AMELANCHIER ALNIFOLIA	SASKATOON SERVICEBERRY	124	1 GAL.
Pv	PRUNUS VIRGINIANA	COMMON CHOKECHERRY	7	5 GAL.
Rw	ROSA WOODSII	WOODS ROSE	177	1 GAL.
Sc	SHEPHERDIA CANADENSIS	CANADA BUFFALOBERRY	27	1 GAL.
Sa	SYMPHORICARPOS ALBUS	SNOWBERRY	57	1 GAL.
ZONE C SEASONALLY FLOODED				
TREES				
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	SIZE
BO	BETULA OCCIDENTALIS	WATER BIRCH - MUTLISTEM	5	15 GAL.
SHRUBS				
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	SIZE
At	ALNUS INCANA SSP. TENUIFOLIA	THIN-LEAF ALDER	21	5 GAL.
Cs	CORNUS STOLONIFERA/SERICEA	RED-OSIER DOGWOOD	40	1 GAL.
Sb	SALIX BEBBIANA	BEBB WILLOW	18	5 GAL.
Sd	SALIX DRUMMONDIANA	DRUMMOND WILLOW	22	5 GAL.
ZONE D SEMI-PERMANENTLY FLOODED				
COIR ROLL STAKING SPACE @ 1m ON CENTER				
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	
Sb	SALIX DRUMMONDIANA	DRUMMOND WILLOW	222	CUTTINGS
Sb	SALIX EXIGUA	SANDBAR WILLOW	222	CUTTINGS
COIR ROLL LAYERING SPACE 6 CUTTINGS PER BUNDLE @ 1m ON CENTER				
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	
Sb	SALIX DRUMMONDIANA	DRUMMOND WILLOW	666	CUTTINGS
Sb	SALIX EXIGUA	SANDBAR WILLOW	666	CUTTINGS
STREAMBANK PLUGS				
	BOTANICAL NAME	COMMON NAME	QNTY	
	CAREX NEBRASCENSIS	NEBRASKA SEDGE	120	PLUGS
	CAREX UTRICULATA	BEAKED SEDGE	167	PLUGS
	CAREX VESICARIA	INFLATED SEDGE	120	PLUGS
	GLYCERIA ELATA (STRIATA)	FOWL MANNAGRASS	73	PLUGS

* FOR INFORMATION ONLY. INCLUDE ALL COSTS AND INCIDENTAL ITEMS ASSOCIATED WITH THE INSTALLATION OF THIS ITEM IN THE LUMP SUM BID PRICE FOR "VEGETATION".

JUTE NETTING *		
STATION		square meters
FROM	TO	
35+34.77	36+58.67	200
TOTAL		200

* FOR INFORMATION ONLY. INCLUDE ALL COSTS AND INCIDENTAL ITEMS ASSOCIATED WITH THE INSTALLATION OF THIS ITEM IN THE LUMP SUM BID PRICE FOR "VEGETATION".

KBP – US 2 WIDENING
BOWSER CREEK
VEGETATION TYPICAL SECTIONS & SUMMARY
NO SCALE

DESIGNER		
DRAWN		
APPROVED		
REVISED		
	INITIALS	DATE

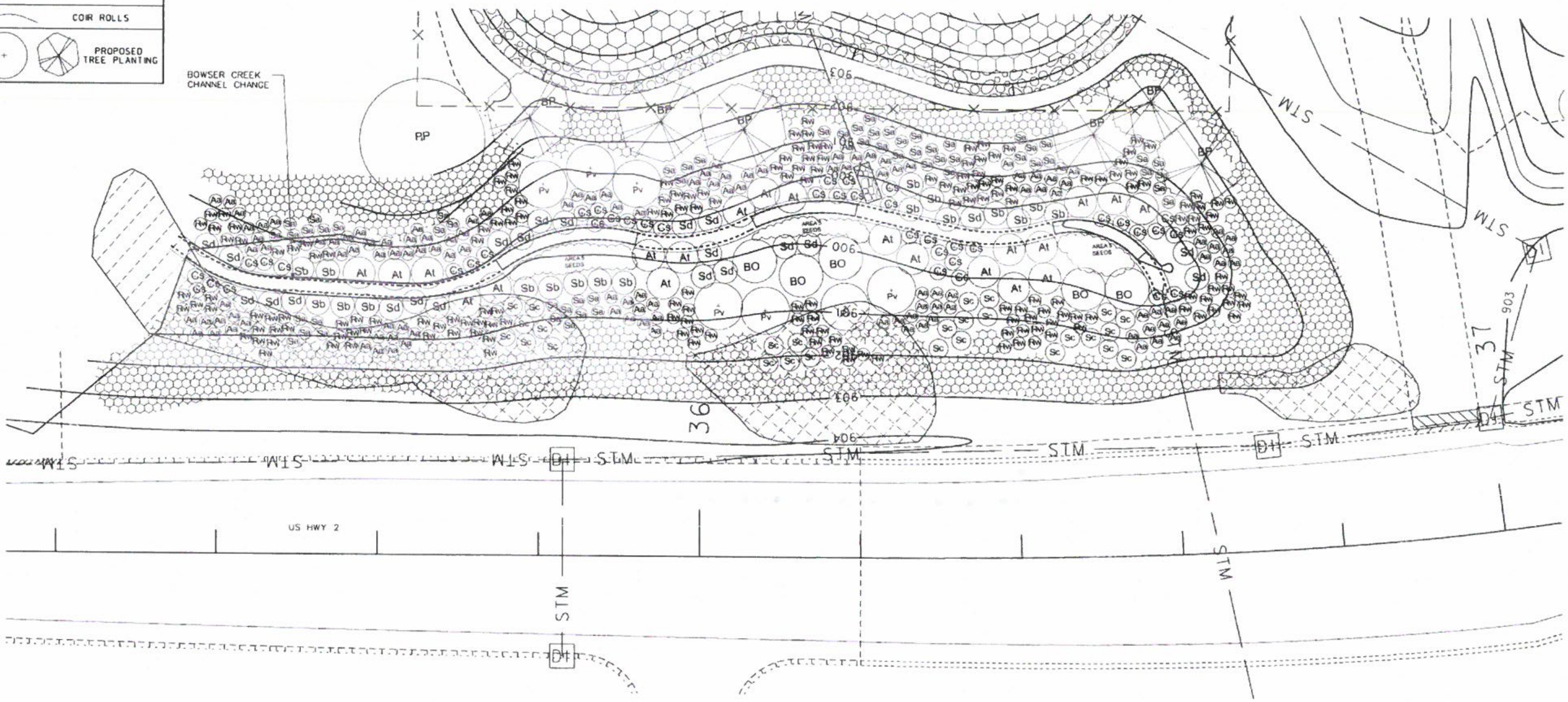
STATE	PROJECT NUMBER	SHEET NO.
MONTANA	NH 15(93)	V3

CSF = 0.999470385

DETAIL

BOWSER CREEK
VEGETATION PLAN

LEGEND
AREA 4 UPLAND SEED MIX
AREA 5 RIPARIAN SEED MIX
PROPOSED SHRUB PLANTING
COIR ROLLS
PROPOSED TREE PLANTING



NOTE: THIS PLAN IS A GRAPHIC REPRESENTATION. REFER TO SECTIONS AND PLANT LISTS FOR MORE DETAILED ZONAL PLACEMENT.

KBP – US 2 WIDENING

BOWSER CREEK
VEGETATION PLAN

SCALE = 1:250

DESIGNER		
DRAWN		
APPROVED		
REVISED		
	INITIALS	DATE

DESIGNED BY
REVIEWED BY
CHECKED BY

SE Sterling Engineering, INC.

MDT MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CADD