
MONTANA DEPARTMENT OF TRANSPORTATION STREAM MITIGATION MONITORING REPORT

*Foy's Bend Fisheries Conservation Area
Flathead County, Montana*

*Project Completed: 2013
Monitoring Report #2: December 2014*



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MONTANA DEPARTMENT OF TRANSPORTATION

STREAM MITIGATION MONITORING REPORT #2

YEAR 2014

*Foy's Bends Fisheries Conservation Area
Flathead County, Montana*

MDT Project Number: NH-MT 5-3(50) 109F
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1.0 INTRODUCTION

The Montana Department of Transportation (MDT), in partnership with Montana Fish, Wildlife and Parks, has implemented a stream mitigation project at Foy's Bend Fisheries Conservation Area (FCA) near Kalispell, Montana. The goal of the mitigation project is to offset stream and riparian impacts resulting from the Kalispell Bypass and other transportation projects in the Missoula District. Specific project objectives designed to meet this goal include:

- Providing 6,050 linear feet of riparian buffer by establishing 18 fenced exclosures within the Foy's Bend FCA
- Stabilizing 1,350 feet of an eroding bank of the Flathead River utilizing a soil lift and coir fascine.

If successful, the mitigation project will preserve, create, enhance, restore, and maintain permanent, naturally self-sustaining, native or native-like 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.

The mitigation project is to be monitored for five years to evaluate compliance toward meeting performance standards. The following report provides results from the second year of monitoring, and compares these results to a series of project performance standards outlined in the post-construction monitoring plan for the site. This project was constructed during the spring of 2013; therefore, these results provide documentation of the site's condition during the second growing season following the project's completion.

Quantitative success criteria for the Foy's Bend mitigation site:

1. **Riparian Buffer Success** will be achieved when
 - a) Woody and riparian vegetation becomes established, and noxious weeds do not exceed 5% cover within the riparian buffer areas.
 - b) Any area within the creditable buffer area disturbed by the project construction must have at least 50% areal cover of beneficial plant species by the end of the monitoring period.
2. **Vegetation Success** will be achieved when
 - a) Combined areal cover of riparian and stream bank vegetation communities is greater than or equal to 70%.
 - b) Planted trees and shrubs will be considered successful where they exhibit 50% survival after five years.
3. **Vegetation along the river bank** will be considered successful when banks are vegetated with a majority of deep-rooting riparian plant species having root stability indices greater than or equal to 6 (subject to 1.a and 1.b above).

4. **Bank Restoration Success** will be achieved based upon the rate of erosion encountered during the monitoring period, and will be based upon the assessed proper functioning condition assessment utilization Pritchard, D. et.al. Riparian Management Guide TR1737-15 "A User's Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas" 1998. The rate of erosion will be determined through the installation of bank pins upon the completion of stream bank work, and will be measured annually for a period of 5-years and/or until such time as the bank stabilizes vegetatively.

a. Rates of success will be determined by the following ratings:

i.) Rate of ≤ 0.5 feet of erosion annually - Functioning*

ii.) Rate of ≤ 1.0 foot of erosion annually - Functioning*

iii.) Rate of ≤ 1.5 feet of erosion annually - Functioning at Risk*

iv.) Rate of ≥ 3 feet of erosion annually - Functioning at Risk or not Functioning**

v.) Rate of > 5 feet or more of erosion annually - Not Functioning**

b. During the 3rd and final monitoring years, ratings for the stream bank will be based upon the Proper Functioning Condition ratings that determine if the area is supporting a healthy and stable bank area adjacent to the stream as derived from the ratings found in Pritchard (1998) for a determination of the following -

i.) **Functioning** - Supporting a healthy and stable bank area adjacent to the river

ii.) **Functioning at Risk** - One or more functions of the stream bank are adjusting to changes in the design within the reach area, and the area may be trending either towards lower or higher functionality, but more monitoring and/or adaptive management may be needed so that it can support a healthy and stable bank area in the future.

iii.) **Not Functioning** - Measurements of the functions indicate that the site is not achieving functional goals and is not supporting a healthy and stable bank reach that may be trending toward further degradation.

*If the rate of bank erosion is greater than 1 to 2 feet per year due to natural erosive actions, adaptive management will take place.

**If the rate of bank erosion is greater than 3 feet or more due to a single force of nature, such as an ice jam or a significant flood event beyond the normal riverine processes, this will be considered a major force event and restoration actions may not occur.

Results of the second year monitoring at the Foy's Bend FCA are included in Section 4 and compared to performance standards in Section 5. Section 6 provides management recommendations to maximize the potential for meeting all performance standards at this mitigation site. Additional reporting requirements including repeated survey results along the Flathead River, a planting schematic from the approved design, photo documentation of the project site, and maps indicating the endpoints of riparian belt transects, stream bank surveys, vegetation communities and locations of noxious weeds infestations are included as Appendices to this report.

2.0 SITE LOCATION

The Foy's Bend mitigation project occurs on approximately 245 acres approximately 2 miles southeast of Kalispell on the FWP-owned Foy's Bend FCA property. The project is located in Sections 26, 27, 34, and 35, Township 28 North, Range 21 West, in Flathead County, Montana (Figure 1).

3.0 MONITORING METHODS

A spring site visit was performed at the Foy's Bend FCA mitigation site in April, 2014 to inspect the reconstructed bank segment while lake levels remained below full pool. This site visit only included monitoring of erosion below the bioengineered bank treatment area during a time when this portion of the bank remained visible. Results of the spring site visit are included in this monitoring report. Monitoring field crews visited the project site again on August 20-21, 2014 to collect additional vegetation monitoring data, while survey crews visited the site on July 29, 2014. The following data were collected at the Foy's Bend FCA stream mitigation site during the August site visit:

3.1. Vegetation Inventories

Four riparian belt transects established in 2013 were re-assessed to document vegetation success, and included a 274 foot transect (T1) in enclosure #2, a 425 foot transect (T2) in enclosure #6, a 230 foot transect (T3) in enclosure #8, and a 275 foot transect (T4) in enclosure #18. The riparian transects included inventorying vegetation within a 25-foot wide belt centered by the transect alignment. Riparian transects T1 and T2 were conducted in enclosures planted with woody species per the mitigation plan. Riparian transect T3 was conducted in an enclosure that did not contain woody vegetation prior to mitigation, and was not planted with woody vegetation. Riparian transect T4 was conducted in an enclosure that included naturally occurring woody vegetation prior to mitigation, with no additional woody plantings installed. Dominant vegetation communities within each fenced enclosure within the project area were mapped to document vegetative establishment.

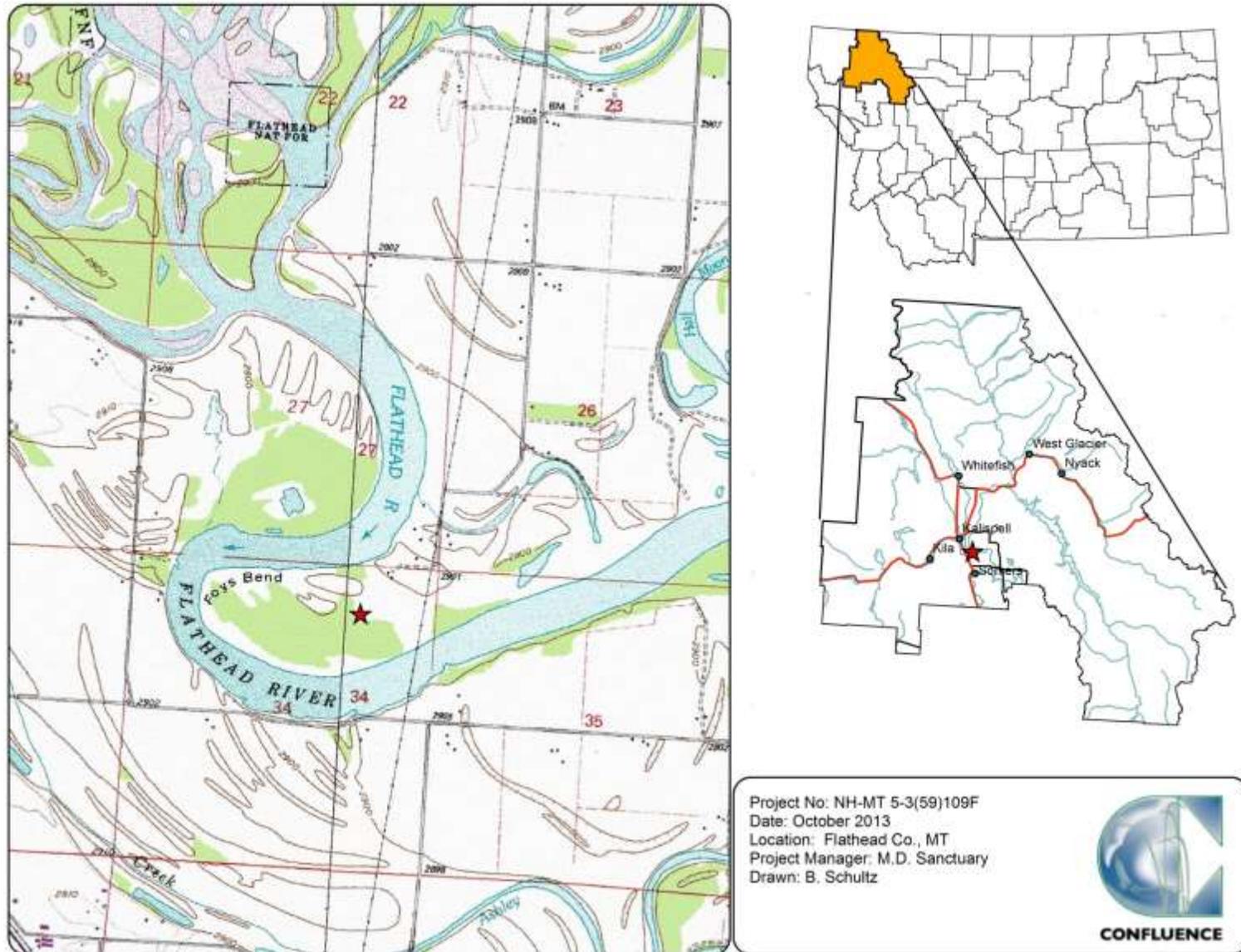


Figure 1. Project location of Foy's Bend Fisheries Conservation Area stream mitigation site.

One vegetation transect inventory was conducted along the restored stream bank. The stream bank transect (T5) was 1350 feet long and ran parallel to the Flathead River along the length of the reconstructed river bank. Data collection included areal percent cover of total vegetation, woody vegetation, and noxious weeds along a 10 foot wide belt along the entire 1350-foot length of the reconstructed bank. To assess the contribution of stream bank vegetation to stream bank stability, a comprehensive list of all species present on the bank was compiled, along with dominant vegetation. In 2013, plant species identified along the stream banks were assigned plant stability ratings based on Winward, 2000. In 2014, plant species identified along the stream banks were assigned plant stability ratings based on Burton *et al.*, 2011. This change was made per MDT request to use updated values for plant stability ratings.

Areas within the fenced enclosure and along the restored bank were visually inspected to document the presence of noxious weeds. All noxious weed infestations were mapped on aerial photography, with species, and extents noted. Any isolated occurrences of noxious weeds were noted but not mapped as an infestation.

All fenced enclosures were visually inspected to document woody vegetation plantings. The inspection included recording the total number of live and dead woody plantings observed along each row of planted shrubs. A qualitative inspection of plantings was conducted to assess successful or stunted growth. The presence of volunteer woody species within each enclosure was recorded with the species type and extent.

3.2. Stream Bank Surveys

Bank transects were re-surveyed at the 14 locations established in 2013 to monitor bank stability and determine bank retreat rates. All fascines installed along the river bank were inspected to determine whether they were still in place, have shifted, or have been washed away.

3.3. Fencing Inspections

All fencing placed by MDT was inspected for damage or wear. If any fencing was determined to be damaged or needing maintenance, it was photographed and noted. MDT was notified of any significant fencing damage.

3.4. 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.

3.5. Photo-Documentation

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

4.0 RESULTS

4.1 Riparian and Stream bank Vegetation Inventory

Table 1 presents the vegetation cover results for the four riparian belt transects and single stream bank belt transect in 2013 and 2014. Transect locations are presented on Figures 2 and 3 in Appendix A. No bare ground was observed within any of the riparian vegetation transects. 15% bare ground was observed along the stream bank transect, representing a decrease by 22% from the 2013 monitoring event.

Table 1. Percent cover of vegetation transects at the Foy's Bend stream mitigation site in 2013 and 2014.

Belt Transect	Location	Transect Type	Length (ft.)	Total % Vegetation Cover	
				2013	2014
1	Exclosure 2	Riparian	274	100	100
2	Exclosure 6	Riparian	425	100	100
3	Exclosure 8	Riparian	230	100	100
4	Exclosure 18	Riparian	275	100	100
5	Stabilized river bank	Streambank	1350	63	85

For the purposes of determining comprehensive vegetation cover for comparison against the mitigation performance standards, the four riparian belt transects were each considered to be representative of one or more of the 18 riparian exclosure areas, based upon their pre-treatment condition and mitigation activity. Boundaries for the riparian exclosure areas are presented relative to the transect alignments on Figures 2 and 3 in Appendix A. Riparian exclosures with planted woody vegetation are presented on Figures 5, 6, and 7 of Appendix A.

Transects T1 and T2 were considered representative of the 14 exclosures planted with woody vegetation. The average vegetation cover for these two transects was assigned to exclosures 1-7, 9, 10, and 13-17. Transect T3 was considered representative of the three exclosures with no woody vegetation, planted or native. The vegetation cover for transect T3 was assigned to riparian exclosures 8, 11, and 12. These three exclosures are intended to promote natural woody vegetation development due to their close proximity to existing stands of aspen and cottonwood. Transect T4 was located in the lone riparian exclosure (#18) that was not planted, but had naturally occurring woody vegetation within it prior to the mitigation project. This exclosure was also unique in that it was established by MTFWP for MDT prior to the project. Therefore, the vegetation cover from transect T4 was considered representative of exclosure 18 only. Table 2 presents each riparian exclosure, its area in acres, and its assigned vegetation cover in areal cover percentage. As shown in Table 2, the area-weighted-average of total vegetation cover for all of the riparian exclosure areas on the project site is 100%.

The stream bank transect (transect #5) was 1,350 feet long, 10 feet wide, and covered approximately 0.3 acres. It was aligned parallel and immediately adjacent to the Flathead River bank on the southern boundary of the project area (Figure 4, Appendix

A). As shown in Table 1, total vegetation cover of the stream bank transect was 85%, representing an increase by 22% from observations recorded in 2013. Bare ground was primarily observed in areas where recent sediment deposition occurred and vegetation had yet to establish.

Table 2. Exclosure size (acreage) and total percent riparian cover at the Foy's Bend stream mitigation site in 2013 and 2014.

Exclosure #	Planted	Acres	Total % Vegetation Cover	
			2013	2014
1	Yes	0.74	100%	100%
2	Yes	1.06	100%	100%
3	Yes	0.34	100%	100%
4	Yes	0.87	100%	100%
5	Yes	1.20	100%	100%
6	Yes	1.23	100%	100%
7	Yes	0.93	100%	100%
8	No	0.56	100%	100%
9	Yes	1.16	100%	100%
10	Yes	0.67	100%	100%
11	No	0.26	100%	100%
12	No	0.91	100%	100%
13	Yes	0.75	100%	100%
14	Yes	0.89	100%	100%
15	Yes	0.55	100%	100%
16	Yes	0.41	100%	100%
17	Yes	0.34	100%	100%
18	No	1.22	100%	100%
Total		14.1	100%	100%

Table 3 presents a summary of vegetation cover for all riparian exclosures and stream bank transects combined. When assessed on an area weighted basis, the 100% vegetation cover of the riparian exclosures that comprise 98% of the project area dominate, and the combined riparian exclosure and stream bank vegetation cover is 99.7% for the project as a whole.

Table 3. Area weighted average of vegetation areal cover for riparian and stream bank transects at the Foy's Bend stream mitigation site in 2013 and 2014.

Area Type	Acres	Total % Vegetation Cover	
		2013	2014
Riparian Exclosures	14.1	100%	100%
Streambank	0.3	69%	85%
Total	14.4	99.3%	99.7%

Table 4 is a comprehensive list of plant species identified at the Foy's Bend stream mitigation site in 2013 and 2014. In 2014, 96 species were observed, representing an increase by 34 species from the previous monitoring event. In 2014, 48% of the species identified on site were hydrophytic based on the 2014 National Wetland Plants Lists (NWPL) (Lichvar *et al.*, 2014).

Table 4. Comprehensive list of plant species identified at the Foy's Bend stream mitigation site in 2013 and 2014.

Scientific Name	Common Name	WMVC Indicator Status*
<i>Achillea millefolium</i>	Common Yarrow	FACU
<i>Agastache urticifolia</i>	Nettle-Leaf Giant-Hyssop	FACU
<i>Agropyron sp.</i>	Wheatgrass	NL
<i>Agrostis gigantea</i>	Black Bent	FAC
<i>Alnus incana</i>	Speckled Alder	FACW
<i>Alopecurus aequalis</i>	Short-Awn Meadow-Foxtail	OBL
<i>Alopecurus arundinaceus</i>	Creeping Meadow-Foxtail	FAC
<i>Alopecurus pratensis</i>	Field Meadow-Foxtail	FAC
<i>Alyssum alyssoides</i>	Pale Alyssum	NL
<i>Arctium lappa</i>	Greater Burdock	NL
<i>Asclepias sp.</i>	Milkweed	NL
<i>Asparagus officinalis</i>	Asparagus	FACU
<i>Aster sp.</i>	Aster	NL
<i>Aster sp. (purple)</i>	Aster	NL
<i>Bromus inermis</i>	Smooth Brome	FAC
<i>Carduus nutans</i>	Nodding Plumeless-Thistle	UPL
<i>Carex aquatilis</i>	Leafy Tussock Sedge	OBL
<i>Carex nebrascensis</i>	Nebraska Sedge	OBL
<i>Carex sp.</i>	Sedge	NL
<i>Carex utriculata</i>	Northwest Territory Sedge	OBL
<i>Carex vesicaria</i>	Lesser Bladder Sedge	OBL
<i>Carum carvi</i>	Caraway	FACU
<i>Chamerion angustifolium</i>	Fireweed	NL
<i>Chenopodium album</i>	Lamb's-Quarters	FACU
<i>Cirsium arvense</i>	Canadian Thistle	FAC
<i>Cirsium vulgare</i>	Bull Thistle	FACU
<i>Convolvulus arvensis</i>	Field Bindweed	NL
<i>Coreopsis tinctoria</i>	Golden Tickseed	FACU
<i>Cornus alba</i>	Red Osier	FACW
<i>Crataegus douglasii</i>	Black Hawthorn	FAC
<i>Cynoglossum officinale</i>	Gypsy-Flower	FACU

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

Table 4 (Continued). Comprehensive list of plant species identified at the Foy's Bend stream mitigation site in 2013 and 2014

Scientific Name	Common Name	WMVC Indicator Status*
<i>Dactylis glomerata</i>	Orchard Grass	FACU
<i>Descurainia sophia</i>	Herb Sophia	NL
<i>Elaeagnus commutata</i>	American Silver-Berry	FAC
<i>Eleocharis palustris</i>	Common Spike-Rush	OBL
<i>Elymus canadensis</i>	Nodding Wild Rye	FAC
<i>Elymus hispidus</i>	Intermediate Wheatgrass	NL
<i>Elymus repens</i>	Creeping Wild Rye	FAC
<i>Epilobium ciliatum</i>	Fringed Willowherb	FACW
<i>Equisetum arvense</i>	Field Horsetail	FAC
<i>Equisetum hyemale</i>	Tall Scouring-Rush	FACW
<i>Geum macrophyllum</i>	Large-Leaf Avens	FAC
<i>Glyceria grandis</i>	American Manna Grass	OBL
<i>Hordeum jubatum</i>	Fox-Tail Barley	FAC
<i>Juncus balticus</i>	Baltic Rush	FACW
<i>Juncus compressus</i>	Round-Fruit Rush	OBL
<i>Juncus effusus</i>	Lamp Rush	FACW
<i>Juncus sp.</i>	Rush	NL
<i>Kochia scoparia</i>	Mexican Kochia	NL
<i>Lactuca serriola</i>	Prickly Lettuce	FACU
<i>Lemna minor</i>	Common Duckweed	OBL
<i>Leucanthemum vulgare</i>	Ox-Eye Daisy	FACU
<i>Linaria vulgaris</i>	Butter-and-eggs	NL
<i>Medicago lupulina</i>	Black Medick	FACU
<i>Medicago sativa</i>	Alfalfa	UPL
<i>Melilotus albus</i>	White Sweetclover	NL
<i>Melilotus officinalis</i>	Yellow Sweet-Clover	FACU
<i>Mentha arvensis</i>	American Wild Mint	FACW
<i>Pascopyrum smithii</i>	Western-Wheat Grass	FACU
<i>Persicaria amphibia</i>	Water Smartweed	OBL
<i>Persicaria sp.</i>	Smartweed	NL
<i>Phalaris arundinacea</i>	Reed Canary Grass	FACW
<i>Phleum pratense</i>	Common Timothy	FAC
<i>Plantago lanceolata</i>	English Plantain	FACU
<i>Plantago major</i>	Great Plantain	FAC
<i>Poa palustris</i>	Fowl Blue Grass	FAC

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

Table 4 (Continued). Comprehensive list of plant species identified at the Foy's Bend stream mitigation site in 2013 and 2014

Scientific Name	Common Name	WMVC Indicator Status*
<i>Poa pratensis</i>	Kentucky Blue Grass	FAC
<i>Populus angustifolia</i>	Narrow-Leaf Cottonwood	FACW
<i>Populus balsamifera</i>	Balsam Poplar	FAC
<i>Populus tremuloides</i>	Quaking Aspen	FACU
<i>Potentilla recta</i>	Sulphur Cinquefoil	NL
<i>Prunus virginiana</i>	Choke Cherry	FACU
<i>Rosa woodsii</i>	Woods' Rose	FACU
<i>Rumex crispus</i>	Curly Dock	FAC
<i>Rumex fueginus</i>	Tierra del Fuego Dock	FACW
<i>Salix bebbiana</i>	Gray Willow	FACW
<i>Salix exigua</i>	Narrow-Leaf Willow	FACW
<i>Salix sp.</i>	Willow	NL
<i>Schoenoplectus acutus</i>	Hard-Stem Club-Rush	OBL
<i>Scirpus microcarpus</i>	Red-Tinge Bulrush	OBL
<i>Scirpus sp.</i>	Bulrush	NL
<i>Shepherdia argentea</i>	Silver Buffalo-Berry	FACU
<i>Silene vulgaris</i>	Maiden's-tears	NL
<i>Solanum dulcamara</i>	Climbing Nightshade	FAC
<i>Solidago canadensis</i>	Canadian Goldenrod	FACU
<i>Sonchus arvensis</i>	Field Sow-Thistle	FACU
<i>Sporobolus airoides</i>	Alkali-Sacaton	FAC
<i>Symphoricarpos albus</i>	Common Snowberry	FACU
<i>Tanacetum vulgare</i>	Common Tansy	FACU
<i>Taraxacum officinale</i>	Common Dandelion	FACU
<i>Thlaspi arvense</i>	Field Pennycress	UPL
<i>Tragopogon dubius</i>	Meadow Goat's-beard	NL
<i>Trifolium pratense</i>	Red Clover	FACU
<i>Trifolium repens</i>	White Clover	FAC
<i>Typha latifolia</i>	Broad-Leaf Cat-Tail	OBL
<i>Verbascum thapsus</i>	Great Mullein	FACU

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

The vegetation community type for each of the exclosure areas is presented on Figures 5 and 6 in Appendix A. Four main vegetation community types were identified on site in 2014, including:

- Type 1 - *Phalaris arundinacea*/*Poa pratensis*
- Type 2 - *Populus spp.*
- Type 3 - *Carex spp./Typha latifolia*
- Type 4 – *Alopecurus arundinaceus*/*Poa pratensis*

4.2. Stream Bank Vegetation Composition

In 2014, 49 plant species were observed along the restored stream bank, representing an increase by 14 species from the 2013 monitoring event (Table 5). Of the 49 species observed, 36 have stability indices provided by Burton et al. 2011, while the remaining 13 do not. Plants observed that do not have a designated plant stability rating score are listed in Table 5 as N/A. Of the 36 species having stability scores, 12 species scored 6 or higher. The dominant species observed along the reconstructed bank was reed canary grass (*Phalaris arundinacea*), which has a stability index of 9. Reed canary grass had an areal coverage of approximately 75% along the stream bank.

Table 5. Stream bank vegetation species observed in 2014 at the Foy's Bend stream mitigation site.

Streambank Species	WMVC Indicator Status**	Stability Index
<i>Phalaris arundinacea</i> *	FACW	9
<i>Glyceria grandis</i>	OBL	8.5
<i>Juncus balticus</i>	FACW	8.5
<i>Juncus effusus</i>	FACW	8.5
<i>Populus tremuloides</i>	FACU	8.5
<i>Schoenoplectus acutus</i>	OBL	8.5
<i>Typha latifolia</i>	OBL	8.5
<i>Cornus alba</i>	FACW	8
<i>Alnus incana</i>	FACW	7
<i>Juncus compressus</i>	OBL	7
<i>Alopecurus arundinaceus</i>	FAC	6
<i>Alyssum alyssoides</i>	NL	6
<i>Carex sp.</i>	NL	5
<i>Eleocharis palustris</i>	OBL	5
<i>Elymus repens</i>	FAC	5
<i>Equisetum arvense</i>	FAC	5
<i>Equisetum hyemale</i>	FACW	5
<i>Plantago major</i>	FAC	5
<i>Salix exigua</i>	FACW	5
<i>Sporobolus airoides</i>	FAC	5
<i>Alopecurus aequalis</i>	OBL	2
<i>Aster sp.</i>	NL	2
<i>Bromus inermis</i>	FAC	2
<i>Cirsium arvense</i>	FAC	2
<i>Dactylis glomerata</i>	FACU	2
<i>Epilobium ciliatum</i>	FACW	2

*Indicates the most common species.

**Based on 2014 NWPL (Lichvar et al., 2014)

Table 5 (Continued). Stream bank vegetation species observed in 2014 at the Foy's Bend stream mitigation site.

Streambank Species	WMVC Indicator Status**	Stability Index
<i>Geum macrophyllum</i>	FAC	2
<i>Hordeum jubatum</i>	FAC	2
<i>Melilotus albus</i>	NL	2
<i>Melilotus officinalis</i>	FACU	2
<i>Poa palustris</i>	FAC	2
<i>Rumex crispus</i>	FAC	2
<i>Solanum dulcamara</i>	FAC	2
<i>Solidago canadensis</i>	FACU	2
<i>Trifolium repens</i>	FAC	2
Bare Ground	NL	1
<i>Agastache urticifolia</i>	FACU	N/A
<i>Asclepias sp.</i>	NL	N/A
<i>Carduus nutans</i>	UPL	N/A
<i>Carum carvi</i>	FACU	N/A
<i>Chenopodium album</i>	FACU	N/A
<i>Elymus hispidus</i>	NL	N/A
<i>Lactuca serriola</i>	FACU	N/A
<i>Leucanthemum vulgare</i>	FACU	N/A
<i>Rumex fueginus</i>	FACW	N/A
<i>Sonchus arvensis</i>	FACU	N/A
<i>Tanacetum vulgare</i>	FACU	N/A
<i>Trifolium pratense</i>	FACU	N/A
<i>Verbascum thapsus</i>	FACU	N/A

*Indicates the most common species.

**Based on 2014 NWPL (Lichvar *et al.*, 2014)

4.3. Noxious Weed Inventory

The Foy's Bend field assessment identified six Montana State-listed, priority 2B, noxious weeds (Table 6). Specific weed infestations were mapped if they covered 5% or more of each riparian enclosure, and are shown on Figures 5-7 in Appendix A. Canadian thistle, common tansy and oxeye daisy were observed in trace amounts along the stream bank transect. Table 7 provides a weighted average of noxious weed cover, indicating approximately 2.8% of the mitigation site exhibits noxious weed growth. Weed spraying occurred on site in June 2014 and will be continued as part of a joint MDT-MFWP weed management program for the site.

Table 6. Montana State listed noxious weeds and regulated species observed in 2014 at the Foy's Bend Stream Mitigation site.

Category*	Scientific Name	Common Name
Priority 2B	<i>Cirsium arvense</i>	Canadian Thistle
	<i>Convolvulus arvensis</i>	Field Bindweed
	<i>Cynoglossum officinale</i>	Gypsy-Flower
	<i>Leucanthemum vulgare</i>	Ox-Eye Daisy
	<i>Linaria vulgaris</i>	Butter-and-eggs
	<i>Tanacetum vulgare</i>	Common Tansy

*Based on the MSU Extension Services' Noxious Weed List, 2013

Table 7. Weighted average of weed coverage at the Foy's Bend stream mitigation site in 2014.

Exclosure Type	Total Acres	Weed Acres	Total % Weed Cover
Riparian	14.1	0.4	2.8
Streambank	0.3	0.0	0.0
Total	14.4	0.4	2.8

4.4. Woody Plant Inventory

Cottonwood, aspen, hawthorn, chokecherry, silverberry, snowberry, currant, Wood's rose, alder, dogwood, and willows were planted within the Foy's Bend FCA riparian exclosures. In 2014, the overall woody planting survival percentage was 68%; a decrease from 91% observed during 2013 monitoring event (Table 8). Exclosures #5 and #7 had the lowest woody planting survival percentage of 56% and 57% respectively. In 2014, many plants exhibited stunted growth and were considerably smaller than thriving plants. Of the plants that did survive, approximately 26% exhibited signs of stunted growth, including overall height, number of stems, and vigor.

Fenced exclosures were constructed throughout the project site to encourage tree and other woody plant regeneration without the stress of browse. Table 9 shows the species and percent of volunteer growth within each of the 18 exclosures in 2014. Volunteer species were observed in 14 of the 18 exclosures, and ranged in percent cover from 1% to 30% of the fenced area. Exclosure #1 had the highest percent cover of volunteer regeneration with 30% of the area covered by snowberry (*Symphoricarpos albus*) and Wood's rose (*Rosa woodsii*). Volunteer regeneration monitoring will be continued throughout the monitoring efforts to document natural growth within the exclosures.

Table 8. Woody plant percentage at the Foy's Bend stream mitigation site in 2013 and 2014.

Exclosure Number	Planted (Y/N)	Total Plants Inspected	# of Healthy Plants	# of Stunted Plants	2013 Survival Percentage	2014 Survival Percentage	% Stunted Plants
					2013	2014	
1	Y	229	146	23	96%	74%	14%
2	Y	395	183	56	70%	60%	23%
3	Y	117	39	26	92%	56%	40%
4	Y	250	100	50	97%	60%	33%
5	Y	319	141	37	97%	56%	21%
6	Y	339	196	63	84%	76%	24%
7	Y	307	131	45	88%	57%	26%
9	Y	380	194	89	92%	75%	31%
10	Y	329	217	63	97%	85%	23%
13	Y	179	101	23	93%	69%	19%
14	Y	273	126	81	95%	76%	39%
15	Y	157	66	42	97%	69%	39%
16	Y	128	52	26	96%	61%	33%
17	Y	92	55	5	99%	65%	8%
Total		3494	1747	629	91%	68%	26%

Table 9. Observed volunteer species growth at the Foy's Bend FCA in 2014.

Exclosure Number	Planted (Y/N)	% Cover by Volunteers	Volunteer Species
1	Y	30%	<i>Symphoricarpos, Rosa</i>
2	Y	10%	<i>Symphoricarpos, Populus sp.</i>
3	Y	5%	<i>Populus spp.</i>
4	Y	-	-
5	Y	-	-
6	Y	20%	<i>Populus spp.</i>
7	Y	1%	<i>Populus spp.</i>
8	N	1%	<i>Populus spp.</i>
9	Y	5%	<i>Symphoricarpos, Populus spp.</i>
10	Y	25%	<i>Populus spp.</i>
11	N	15%	<i>cottonwood, aspen</i>
12	N	20%	<i>Symphoricarpos, Populus spp.</i>
13	Y	-	-
14	Y	-	-
15	Y	1%	<i>Populus spp.</i>
16	Y	1%	<i>Symphoricarpos</i>
17	Y	5%	<i>Symphoricarpos, Populus sp.</i>
18	N	5%	<i>Populus spp.</i>

4.5. Stream Bank Performance

Inspection of the bank profile survey results from 2013 and 2014 indicate very little, if any lateral migration along the upper segment of the reconstructed bank. The upper bank segment above the willow fascines was covered with coir fabric, which has remained in place. Minor increases to bank elevations along the upper bank may be due to sediment deposition during high flow events, while minor decreases to bank elevations are likely due to settling of the bank following construction, soil loss from the coir lift during high flow events, or undermining of the bank. Bank settling of less than 1 vertical foot was evident at bank profiles 2, 9, 10, and 11. Minor differences in elevations noted between 2013 and 2014 may also be due to the inherent error in survey data accuracy.

More significant changes in the surveyed bank profiles exist at the lowest extent of the bioengineered bank where it meets the native river bank material. A steeper bank slope has formed beneath the fascines at 11 of the 14 profiles, indicating bank instability is occurring below the bioengineered, upper bank segment. The reconstructed bank segment was visually inspected in April, 2014 to document potential stability issues while the level of Flathead Lake was low enough to observe unaltered portions of the bank below the fascines. These portions of the bank were not visible or suitable for surveying during the August monitoring event due to water depth. The following is a summary of observations made during the April site visit:

1) General Observations of Bioengineered Bank:

- a. Many of the sod mats placed along the bank slope in the upstream end of the bank treatment were gone. Only a few of the sod mats remained in the middle portion of the bank, and approximately 30% of the mats remained in the downstream portion. Some of the sod mats had slid down the bank slope but were still visible.
- b. Significant soil loss was observed on the bank slope below the bioengineered bank treatment.
- c. Soil loss had undermined approximately 50 feet of the bank treatment near the upstream end of the project (near survey transect #5 in Appendix A). This undercut was extended up to 2 feet beneath the soil lift and had a vertical, eroding scarp 1.5 to 2.0 feet high. Most of the conifer fascine was still suspended by the soil lift, but some of the fascine had collapsed onto the eroding bank slope below. This 50-foot section contained the lowest point of the soil lift. Since the time of construction, we estimate the unvegetated bank edge has moved a minimum of 6 feet toward the constructed bank treatment.
- d. The bank slope below the soil lift ranged from 3:1 at the upstream and downstream ends of the project to 2:1 within the badly eroding, 50-foot section of bank. This section of bank protruded out into the river more than the rest of the bank and also had faster river flow velocity.

- e. Soil had been lost from the top of the soil lift along the entire bank. This soil loss ranged from 1 to 8 inches vertically and stopped at the upper limit of a clearly defined debris line formed by wave action.
- f. Elevation change of the top surface of the soil lift appeared caused by soil loss within the lift, compaction of the brush layer beneath the soil lift, and slope failure beneath the soil lift. Elevation change was observed along the entire length of the bank treatment.
- g. Two large stumps observed at the far downstream end of the bank treatment suggested the bank had been more stable in the past.

2) Types of Erosion Observed:

- a. Internal Erosion: Piping losses of soil were observed in numerous locations. Piping was evidenced by large voids and tunnels (pipes) within the bank soils. These pipes were oriented generally perpendicular to the slope but were somewhat serpentine.

Piping was observed in the restoration area at a greater frequency than in the unaltered, eroding bank upstream. This may have been caused by subtle differences in the soils along the treatment section, but more likely was the result of the upper treated bank being more stable and preventing collapse and covering up the pipes.

Internal erosion losses likely occurred during drawdown of the river in the fall. However, it is uncertain whether pipes formed in the fall would last until spring. Alternatively, pipes may have formed during snow melt and flow of meltwater through the fine sandy bank soils.

- b. Rill Erosion: Rills were observed running perpendicular to the bank slope, indicating erosion by surface runoff. This likely occurred during snow melt and rain events. The rills were formed relatively recently, as they had relatively sharp edges, indicating they had not weathered.
- c. Wave Erosion: Waves were actively eroding the bank slope at the water surface. A small vertical scarp was observed at the erosional face. Height of the scarp ranged from a couple inches to a couple feet. Wave erosion was observed whenever wind speed increased above approximately 10 knots for more than a few minutes. Wind-caused wave erosion is expected to be significant during prolonged southwesterly winds, as the fetch is approximately 1 mile in length. Bank erosion was also observed when wakes from passing boats reached the shore. 3 boats were observed traveling in the middle of the river that each caused collapse of the vertical erosion scarp during the site visit.
- d. Mass Wasting: Mass slope failure was not observed but may have been obscured by high water. Mass failures were recently observed by Karin Boyd in this area while conducting a channel migration study of the Flathead River.

Based on these observations, it is believed the most significant cause of bank erosion is wave action combined with river transport of eroded sediment and the change in water elevation associated with operation of Kerr Dam. The general erosional process is described by:

- i. Wave action (wind and boat) cutting vertical scarp at the river water surface and depositing eroded material on the bank below the water line
- ii. River current transporting materials removed by the erosion scarp
- iii. Water level changes, leading to formation of new scarps at different elevations along the bank slope
- iv. Loss of sediments through river transport which prevent the formation of a stable slope

Monitoring of the bank during the April and August site visits indicates the bioengineered treatment has thus far been successful at stabilizing the upper bank. However, stability of the lower bank slope has not been addressed, which may result in potential failure of some segments of the bank treatment. If bank failure occurs, it will more likely result from the coir soil lifts being undermined over time than from lateral erosion against the bank during high flows.

4.6. Fascine Inspections

All fascines installed along the river bank were inspected to determine whether they were still in place, had shifted, or washed away. The entire fascine was visible during the April site visit, which indicated most of the fascine was still suspended by the soil lift, but some of the fascine had collapsed onto the eroding bank slope below. During the August visit, all fascines were observed intact; however, fascines along some sections of the bank were submerged beneath approximately 1 foot of water, presumably due to erosion of the bank beneath them and subsequent settling of the fascines.

4.7. Fencing Inspections

Eight fencing issues were documented in 2014. Photographs were taken and the location was recorded using a GPS to allow for follow up inspections. Documentation regarding fencing issues was provided to MDT immediately following the site visit.

4.8. Wildlife Documentation

Observed wildlife use of the Foy's Bend mitigation area included nine bird and one mammal species (Table 10). American robin, black-billed magpie, Canadian geese, dark-eyed junco, mourning dove, northern flicker, osprey, sparrow and swallow species were observed on site. Many white-tailed deer were also observed in 2014. Limited wildlife observations are attributed to rainy conditions during the monitoring event.

Table 10. Comprehensive list of wildlife observed at the Foy's Bend stream mitigation site in 2013 and 2014.

Common Name	Scientific Name	Common Name	Scientific Name
Birds		Birds	
American Crow	<i>Corvus brachyrhynchos</i>	Ring-necked Pheasant	<i>Phasianus colchicus</i>
American Robin	<i>Turdus migratorius</i>	Song Sparrow	<i>Melospiza melodia</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Sparrow Sp.	<i>Passer sp.</i>
Belted Kingfisher	<i>Megaceryle alcyon</i>	Swainson's Hawk	<i>Buteo swainsoni</i>
Black-billed Magpie	<i>Pica hudsonia</i>	Swallow sp.	<i>Tachycineta sp.</i>
Canada Goose	<i>Branta canadensis</i>	Tree Swallow	<i>Tachycineta bicolor</i>
Dark-eyed Junco	<i>Junco hyemalis</i>	Western Meadowlark	<i>Sturnella neglecta</i>
Great Horned Owl	<i>Bubo virginianus</i>	Mammals	
House wren	<i>Troglodytes aedon</i>	Beaver	<i>Castor canadensis</i>
Mallard	<i>Anas platyrhynchos</i>	White-tailed Deer	<i>Odocoileus virginianus</i>
Marsh Wren	<i>Cistothorus palustris</i>	Species observed in 2014 have been bolded	
Mourning Dove	<i>Zenaida macroura</i>		
Northern Flicker	<i>Colaptes auratus</i>		
Osprey	<i>Pandion haliaetus</i>		
Red-tailed Hawk	<i>Buteo jamaicensis</i>		

4.9. Photo-Documentation

Photo documentation of the site was repeated at several photo points established during the 2013 monitoring event and at several other locations to document vegetation establishment and stream bank conditions within the project site (Appendix C). All sites selected for photo-documentation were recorded on field maps with headings noted to allow for repetition during subsequent monitoring years. Photos were also repeated at each bank pin in the upstream and downstream direction, toward the bank, and toward the river to document conditions along the reconstructed river bank.

5.0 COMPARISON OF RESULTS TO PERFORMANCE STANDARDS

Monitoring of the Foy's Bend mitigation site is intended to document whether the reconstructed river bank and riparian enhancement plots are meeting performance standards outlined in the post-construction monitoring plan for the site. The second year of monitoring suggests all six of the six performance standards are currently being met, while one additional standard will be monitored during monitoring years 3 and 5 (Table 11).

Table 11. Comparison of results to performance criteria for the Foy's Bend mitigation site, 2014.

Parameter	Performance Standard	Status	Site Meeting Performance Criteria?
Riparian Buffer Success	Areas within creditable riparian buffer disturbed during construction must have 50% or greater areal cover of non-noxious weed species by the end of the monitoring period	Riparian exclosures exhibit between 60% and 100% cover of non-noxious weed species	YES
	Noxious weeds do not exceed 5% cover within the riparian buffer areas.	<3% cover of noxious weeds observed site-wide	YES
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 100%	YES
	Planted trees and shrubs must exhibit 50% survival after 5 years	Woody vegetation planted within exclosures has 68% survival	YES
Bank Restoration Success	i.) Rate of ≤ 0.5 feet of erosion annually - Functioning* ii.) Rate of ≤ 1.0 foot of erosion annually - Functioning* iii.) Rate of ≤ 1.5 feet of erosion annually - Functioning at Risk* iv.) Rate of ≥ 3 feet of erosion annually - Functioning at Risk or not Functioning** v.) Rate of > 5 feet or more of erosion annually - Not Functioning**	Bioengineered upper bank segment has eroded ≤ 0.5 feet annually ¹	YES ¹
	Pritchard (1998) Lotic Assessment Scores: Functional; Functional-At-Risk; Non-Functional	TBD in monitoring years 3 and 5	N/A
Vegetation along river bank	Majority of plants on the river bank must have root stability indexes of at least 6	Dominant vegetation on stream bank has stability rating of 9	YES

1. performance criteria does not account for bank instability beneath bioengineered treatment

* If the rate of bank erosion is greater than 1 to 2 feet per year due to natural erosive actions, adaptive management will take place

** If the rate of bank erosion is greater than 3 feet or more due to a single force of nature, such as an ice jam or a significant flood event beyond the normal riverine processes, this will be considered a force majeure event and restoration actions may not occur.

5.1. Riparian Buffer Success

Vegetation monitoring of the riparian and stream banks indicated 97.2% of disturbed areas had successfully revegetated with desirable species following reconstruction of the bank and installation of the riparian exclosures. Desirable vegetative cover was determined by subtracting the percent of weedy species cover (2.8%) 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 ($\leq 5\%$) is also currently being met at this project site. It should be noted that although the site-wide criteria for weed coverage is being met, some of the riparian exclosures exhibit a high occurrence of Canadian thistle, and should be treated to prevent further spread of this species. Weed spraying did occur in June 2014 and will continue to be treated as part of a joint weed management plan with MDT and MFWP.

5.2. Vegetation Success

Total combined areal vegetative cover of the riparian exclosures and the reconstructed river bank is currently 99.7% (100% of the exclosures and 85% of the river bank). Site-wide coverage of weed species is currently 2.8%. The performance criterion for this category specifies $\geq 70\%$ of the combined riparian and stream bank vegetation communities must have vegetative establishment.

Woody vegetation plantings indicated a survival percentage of 68% following the second growing season. 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. Most of the planted riparian exclosures had survival percentages above 60%. Riparian exclosures #5 and #7 indicated the lowest survival percentages of woody plantings, which were below 60%. Competition and shading by dense stands of herbaceous vegetation establishing within the exclosures is considered a potential contributing factor in the stunted growth rates. Weather and herbivory is considered the most influential factor in overall shrub survival. Continued monitoring of woody vegetation within the exclosures will help to further determine causes of reduced survival percentages.

Volunteer species were observed in 14 of the 18 exclosures and ranged in percent coverage from 1% to 30% of the fenced area. Volunteer species regeneration along the stream bank was observed in limited amounts, primarily along the toe of the stream bank where willow bundles were placed. Volunteer regeneration will be continued to be monitored during future monitoring events.

5.3. Bank Restoration Success

Determination of bank restoration success requires a) monitoring erosion rates over multiple years to determine the functional performance of the bank segment, and b) conducting a Functional Assessment of the reconstructed bank using lotic inventory

assessment protocols (Pritchard 1998). Monitoring of the 14 bank profiles established in 2013 indicated stabilization of the upper segment of the bioengineered bank has been largely effective, and no lateral erosion of the upper bank has been observed. As a result, the stabilized, upper segment of the bank is rated as "functioning" based on the success criteria of lateral erosion of <0.5 feet. Areas of the bank below the bioengineered treatment are eroding due to multiple causes that are acting to undermine the upper bank. Although the performance criteria for bank stability is currently being met, the bank is at risk of failure due to the instability caused by fluctuating lake levels, wave action created by boats and wind, river currents, and potentially mass wasting beneath the bioengineered treatments on the upper bank. The Functional Assessment will be performed on the reconstructed stream bank during monitoring years 3 and 5 following completion of the bank reconstruction project.

5.4. Vegetation along Stream bank

The most prevalent species observed along the bank was reed canary grass, having approximately 75% areal coverage of the stream bank and stability index of 9. Given the dominant vegetation present along the bank has a stability rating well above 6, the performance criterion for stream bank vegetation is currently being met two growing seasons following completion of the project.

6.0 MANAGEMENT AND DESIGN RECOMMENDATIONS

6.1. Coir Bank Reconstruction Materials

Designs for the reconstructed river bank included placing a layer of coir fabric along the toe of the bank slope to temporarily protect the resloped bank while planted vegetation established. The coir fabric has been effective at withstanding erosion along the bank; however, the large gaps between the coir strands allowed some of the fine soils to escape during high flows. Portions of the fabric layer are sagging as a result of these fine materials being stripped from within the coir.

Fine soils placed within protective coir may be secured if a second, finer layer of coir fabric is placed between the outer coir layer and the soil. This second layer is often used in bioengineered stream banks to prevent fine soil loss when the bank is submerged. The recommended fabric to achieve this goal is North American Green, product #125-BN. This product includes a fine coir mesh and biodegradable reinforcement twine.

6.2. Beaver Evidence

In 2013, evidence of beaver activity was noted near the upstream extent of the reconstructed bank, and included trampled bank vegetation to the edge of the river and several planted woody stems with chew marks. Beaver use in this area may reduce survival rates of planted woody vegetation along the bank. If beavers jeopardize the project's success, management actions may be warranted. No evidence of beavers was observed during 2014 monitoring events.

6.3. Thistle Infestations

Riparian exclosures planted with woody species consistently exhibited occurrences of Canadian thistle. The majority of thistle appeared to generate along the edges of the burlap rows and soil within plant pots. Canadian thistle was observed in all exclosures, but was particularly dense in the planted exclosures. Aggressive combat of thistle colonization is recommended to continuously meet the performance criteria for noxious weed cover across the Foy's Bend project site. Weed spraying did occur in June 2014 and will continue to be treated as part of a joint weed management plan with MDT and MFWP.

6.4. Fence Installation

Fencing around the riparian exclosures was installed very well, with eight minor issues noted. Photo documentation and GPS location was previously provided to MDT.

7.0 LITERATURE CITED

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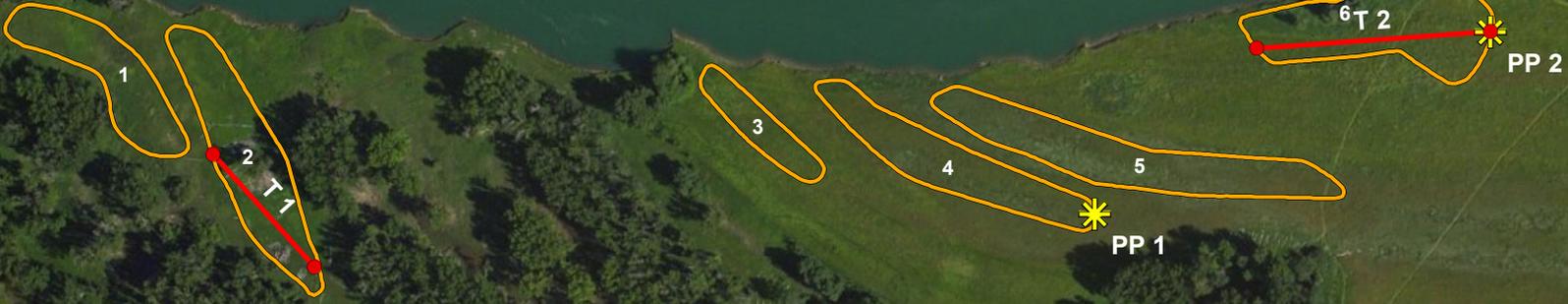
Appendix A

Project Site Maps

MDT Stream Mitigation Monitoring
Foy's Bend Fisheries Conservation Area
Flathead County, Montana



← Flathead River



Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Legend

-  Photo Points
-  Riparian Transects
-  Transect Endpoints
-  Enclosures



**2014 Monitoring
Foy's Bend**

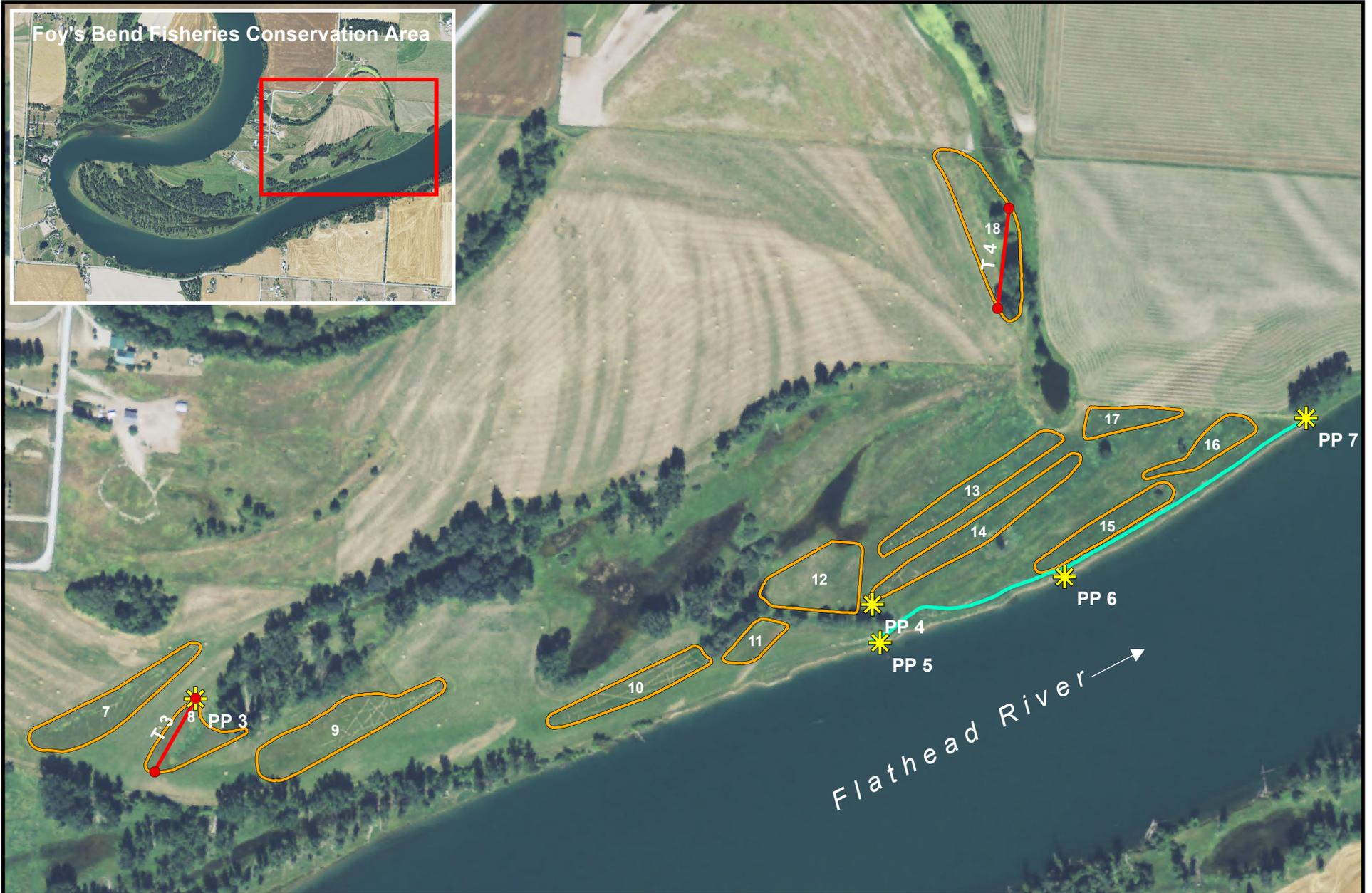
Figure 2

Date: 09/16/2014

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Foy's Bend Fisheries Conservation Area



Legend

-  Photo Points
-  Riparian Transect
-  Restored Streambank Fenceline
-  Transect Endpoints
-  Exclosures



**2014 Monitoring
Foy's Bend**

Figure 3

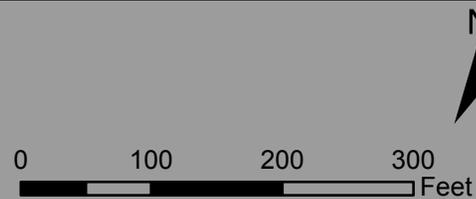
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Legend

- Photo Points
- Exclosures
- Streambank Profiles
- Restored Streambank Fenceline

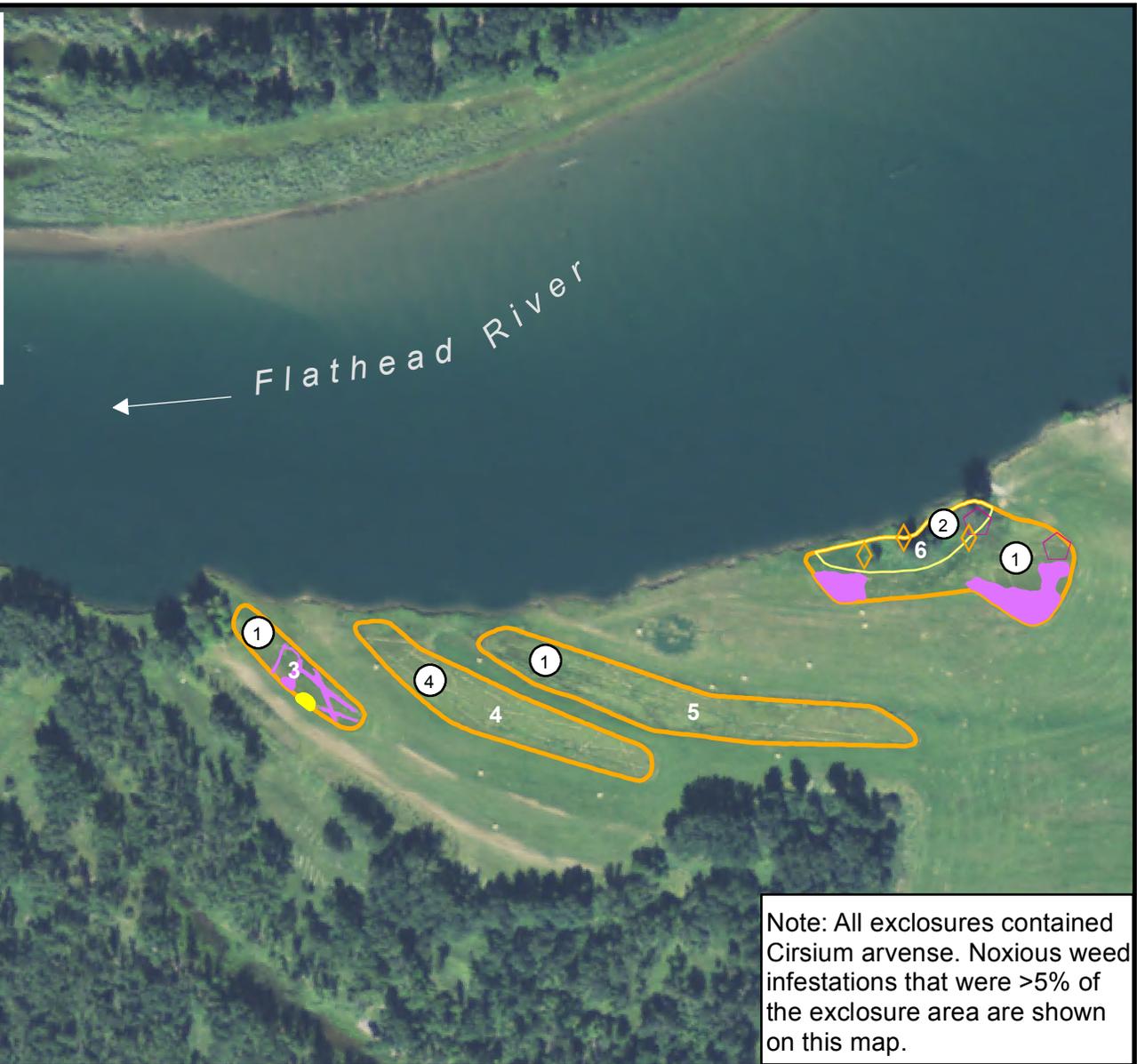


**2014 Monitoring
Foy's Bend
Bank Profiles**

Figure 4

Date: 09/16/2014

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Note: All exclosures contained *Cirsium arvense*. Noxious weed infestations that were >5% of the exclosure area are shown on this map.



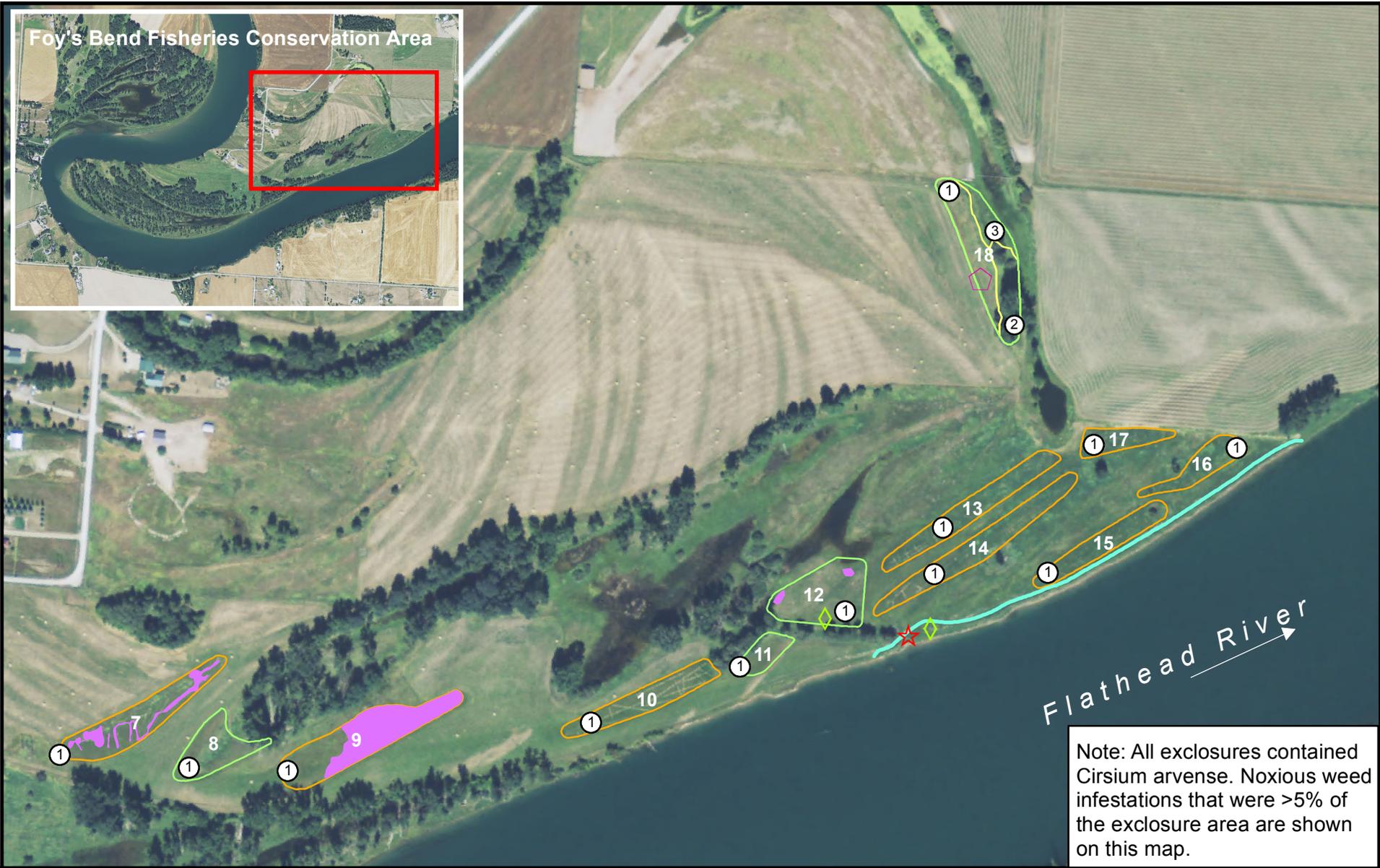
Legend

- Planted Exclosure
- Vegetation Community Boundary
- Cirsium arvense* infestation
- Linaria vulgaris* infestation
- Cirsium arvense*
- Cynoglossum officinale*
- Leucanthemum vulgare*
- Linaria vulgaris*
- ★ *Tanacetum vulgare*
- 1 Phalaris/Poa Community
- 2 Populus Community
- 4 Alopecurus/Poa Community

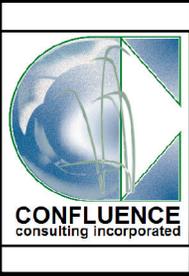


2014 Monitoring Foy's Bend

Figure 5
Date: 09/17/2014
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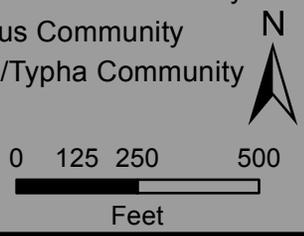


Note: All exclosures contained *Cirsium arvense*. Noxious weed infestations that were >5% of the exclosure area are shown on this map.



Legend

Planted Exclosure	<i>Cirsium arvense</i> infestation	Phalaris/Poa Community
Unplanted Exclosure	<i>Linaria vulgaris</i> infestation	Populus Community
Vegetation Community Boundary	<i>Cynoglossum officinale</i>	Carex/Typha Community
Restored Streambank Fenceline	<i>Leucanthemum vulgare</i>	
	<i>Tanacetum vulgare</i>	



**2014 Monitoring
Foy's Bend**

Figure 6

Date: 09/17/2014

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Legend

- Planted Exclosure
- Unplanted Exclosure
- Streambank Profiles
- Restored Streambank Fenceline
- ◆ Leucanthemum vulgare
- ★ Tanacetum vulgare
- ◇ Cirsium arvense



**2014 Monitoring
Foy's Bend
Bank Stability
Problems**

Figure 7

Date: 11/13/2014

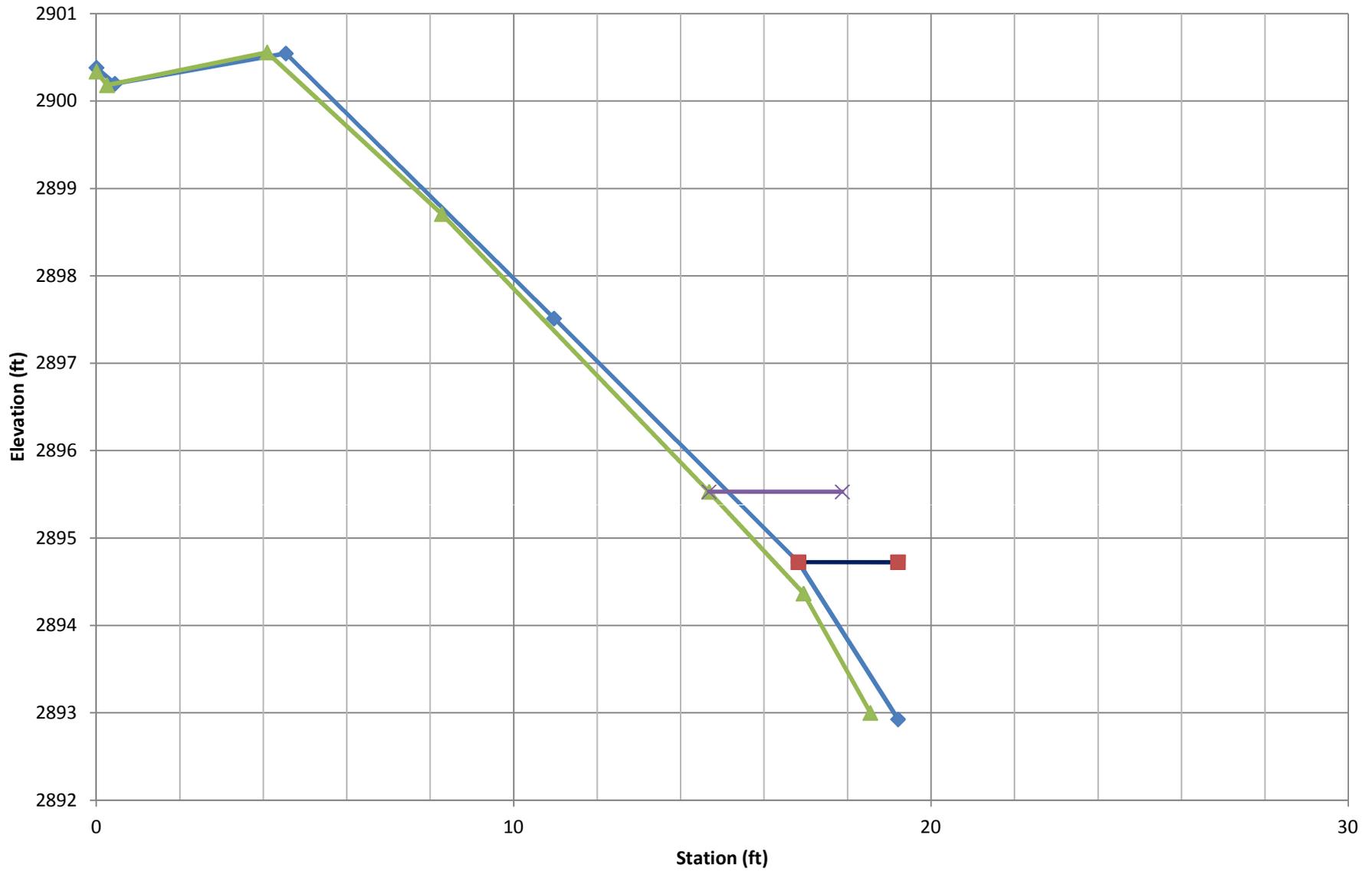
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Appendix B

Reconstructed Bank Transect Plots

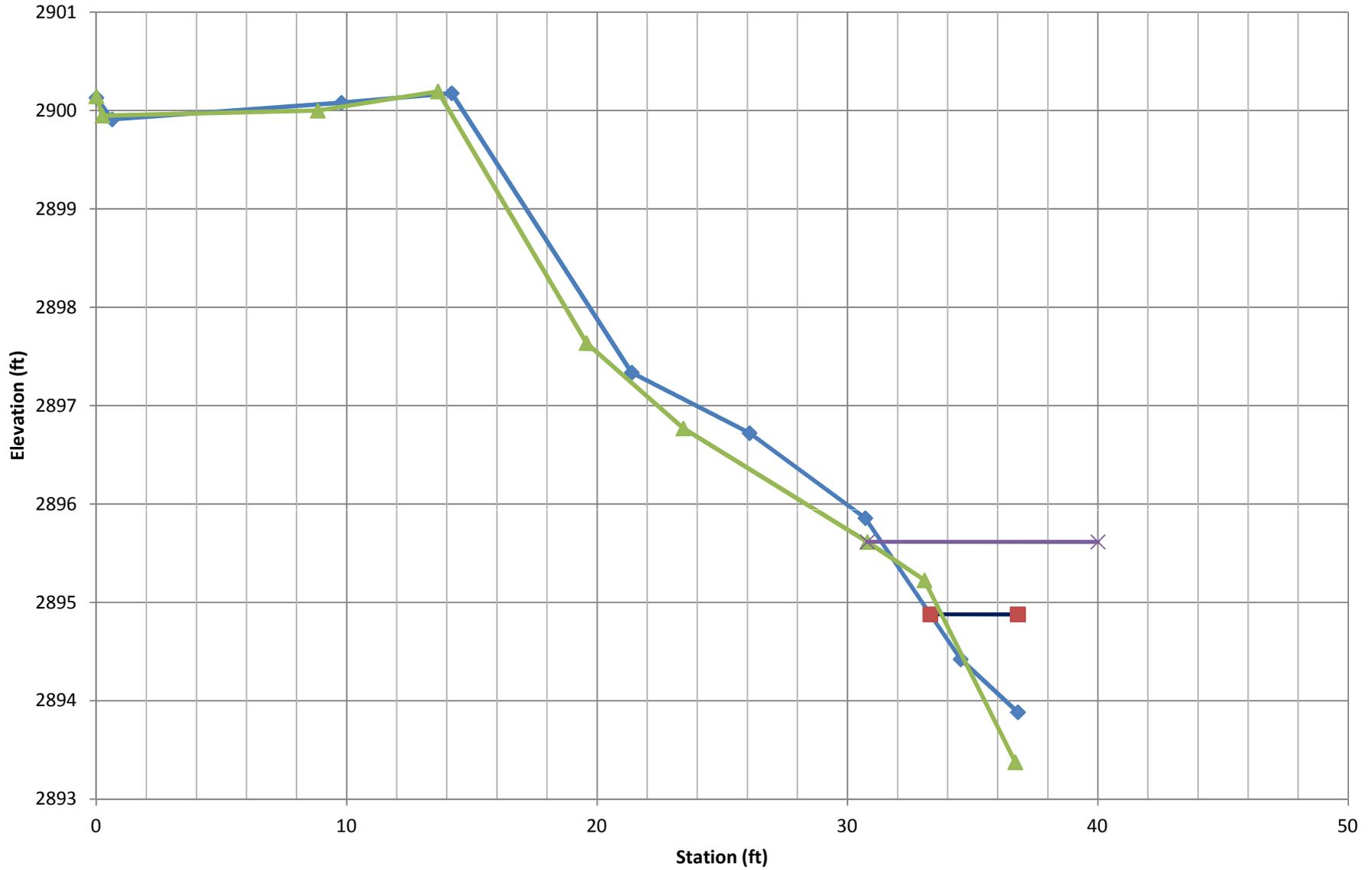
MDT Stream Mitigation Monitoring
Foy's Bend Fisheries Conservation Area
Flathead County, Montana

Foy's Bend Bank Transect #1



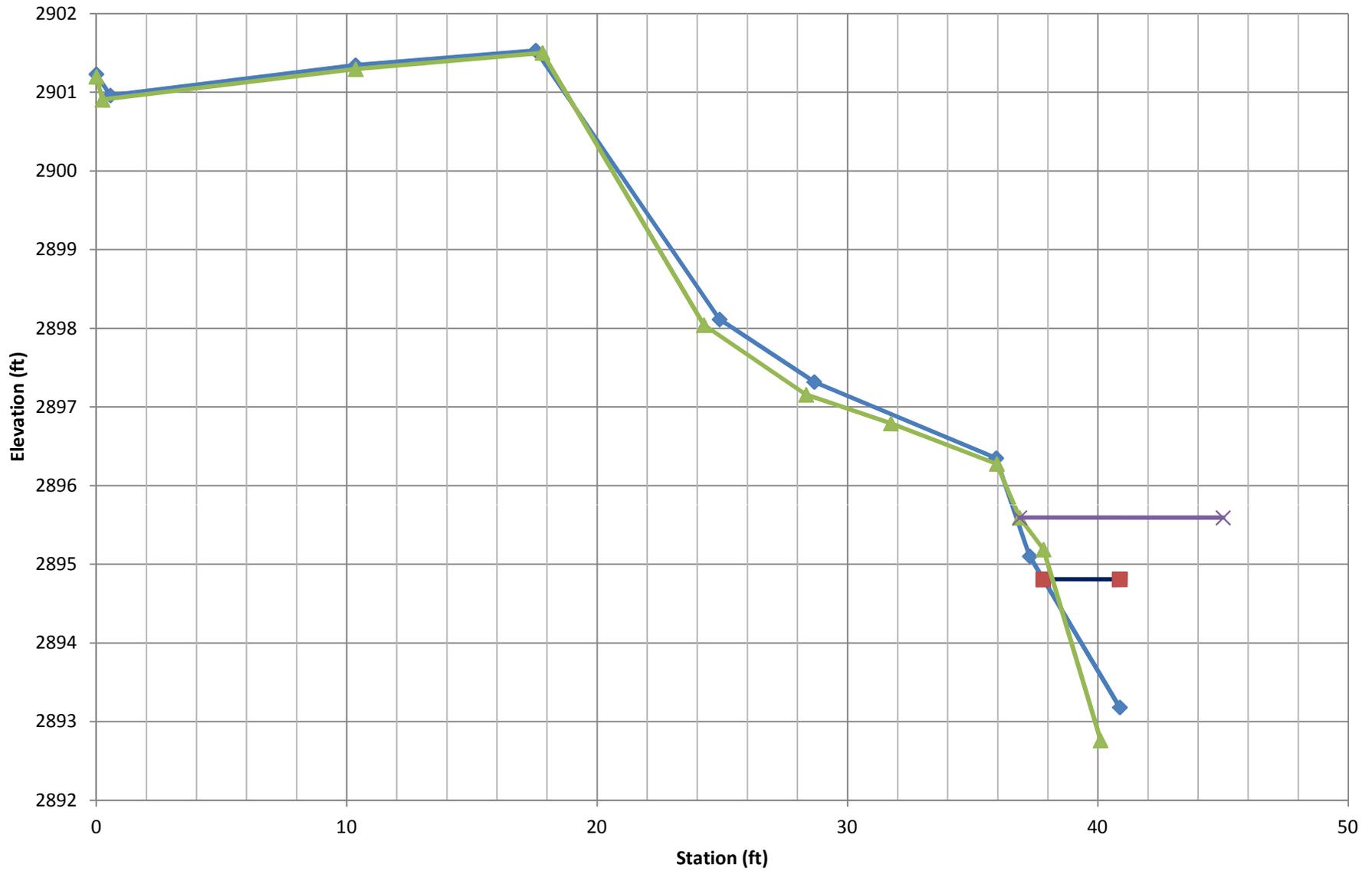
◆ 2013 XS ■ 2013 WS ▲ 2014 XS × 2014 WS

Foy's Bend Bank Transect #2



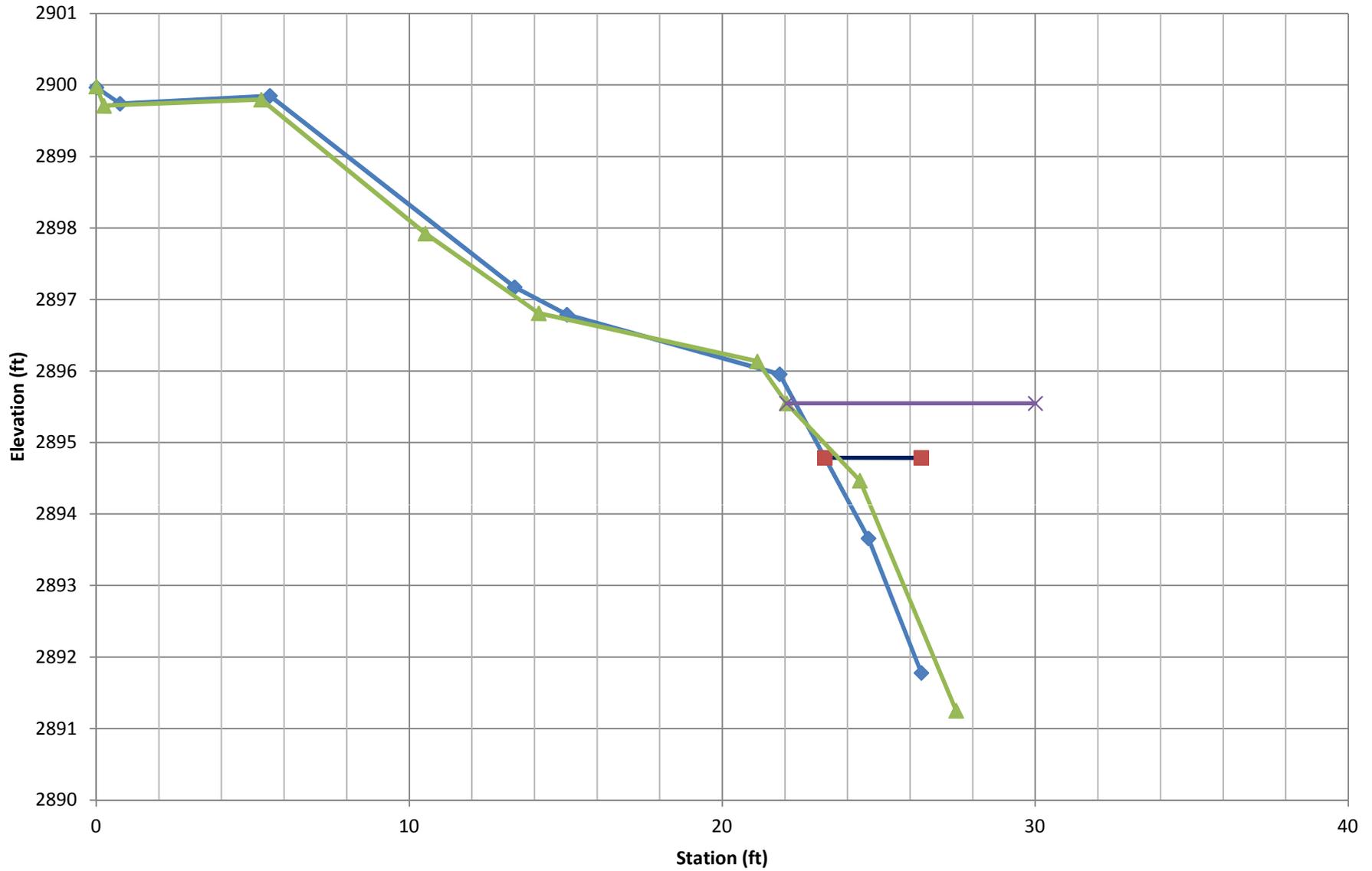
—◆— 2013 XS —■— 2013 WS —▲— 2014 XS —×— 2014 WS

Foy's Bend Bank Transect #3



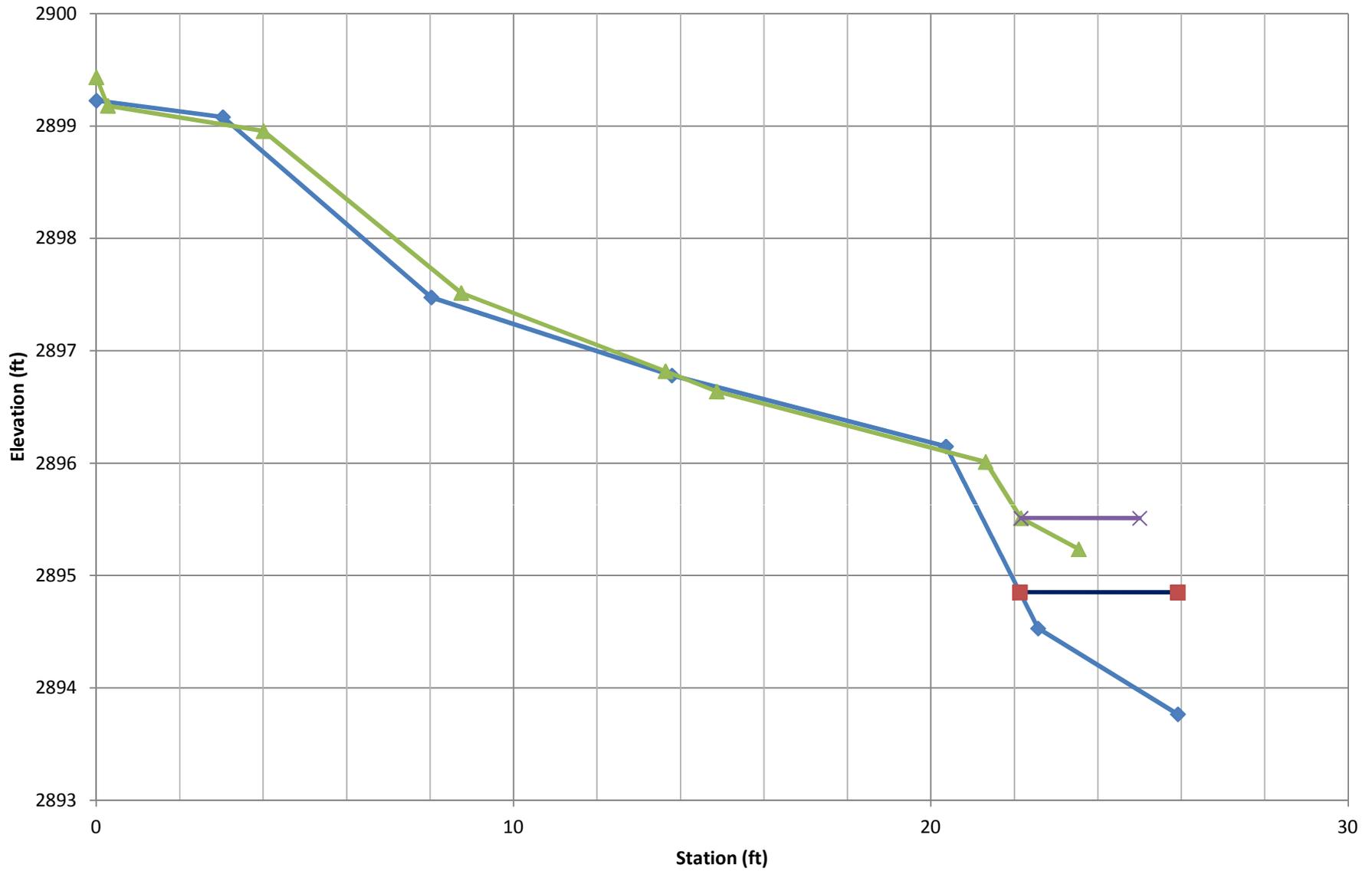
◆ 2013 XS ■ 2013 WS ▲ 2014 XS × 2014 WS

Foy's Bend Bank Transect #4



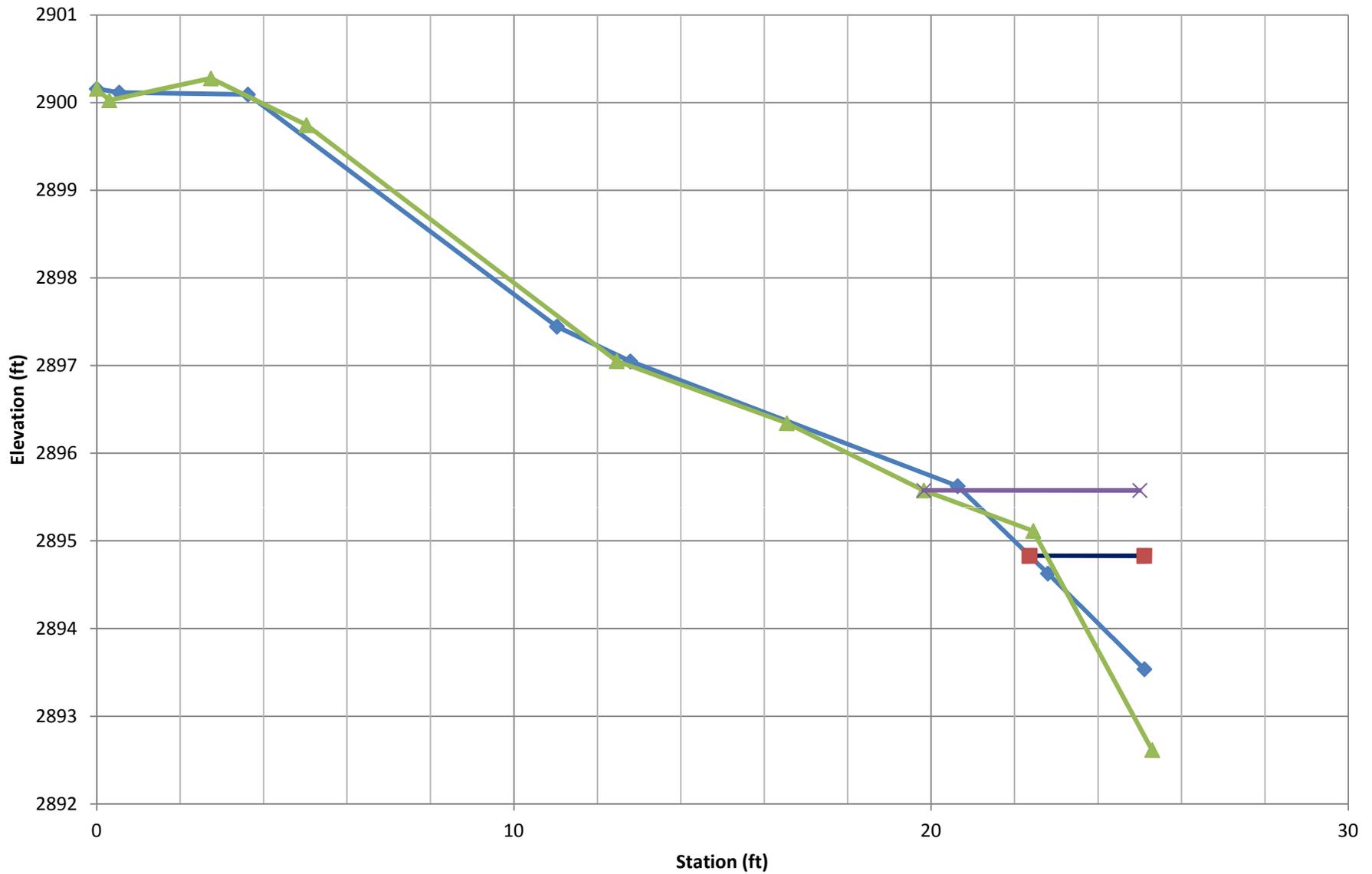
◆ 2013 XS ■ 2013 WS ▲ 2014 XS ✕ 2014 WS

Foy's Bend Bank Transect #5



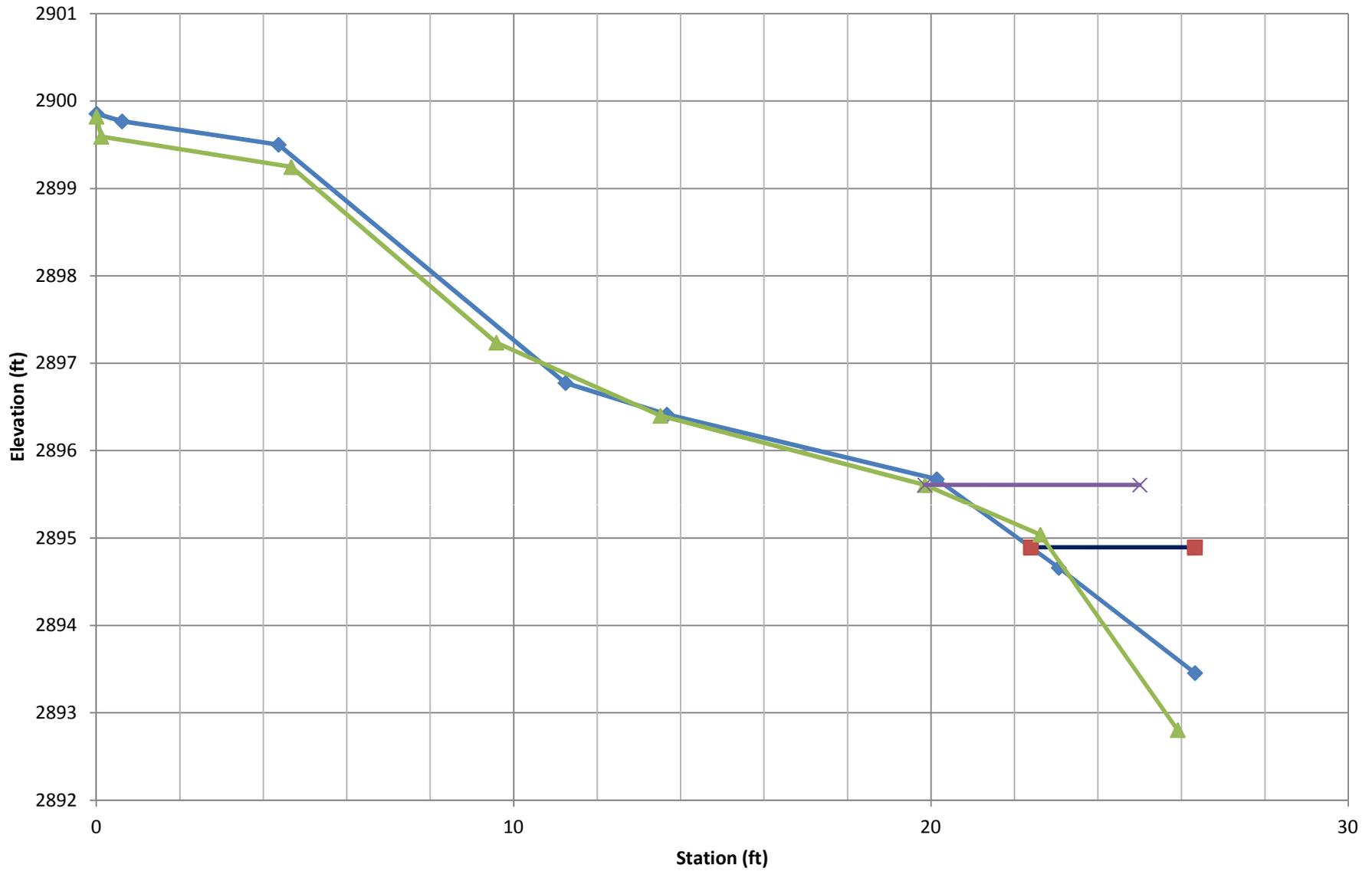
◆ 2013 XS ■ 2013 WS ▲ 2014 XS × 2014 WS

Foy's Bend Bank Transect #6



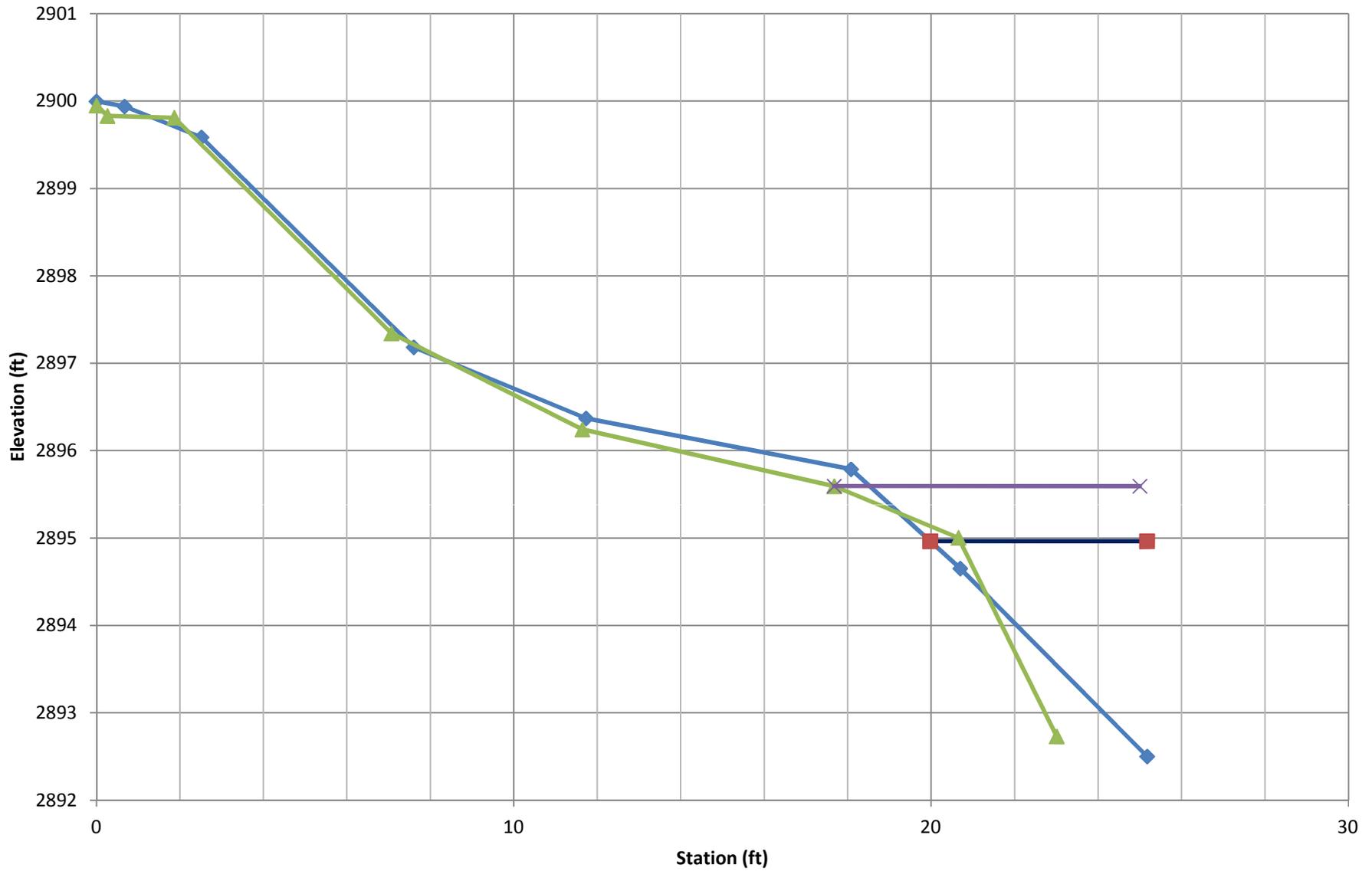
◆ 2013 XS ■ 2013 WS ▲ 2014 XS × 2014 WS

Foy's Bend Bank Transect #7



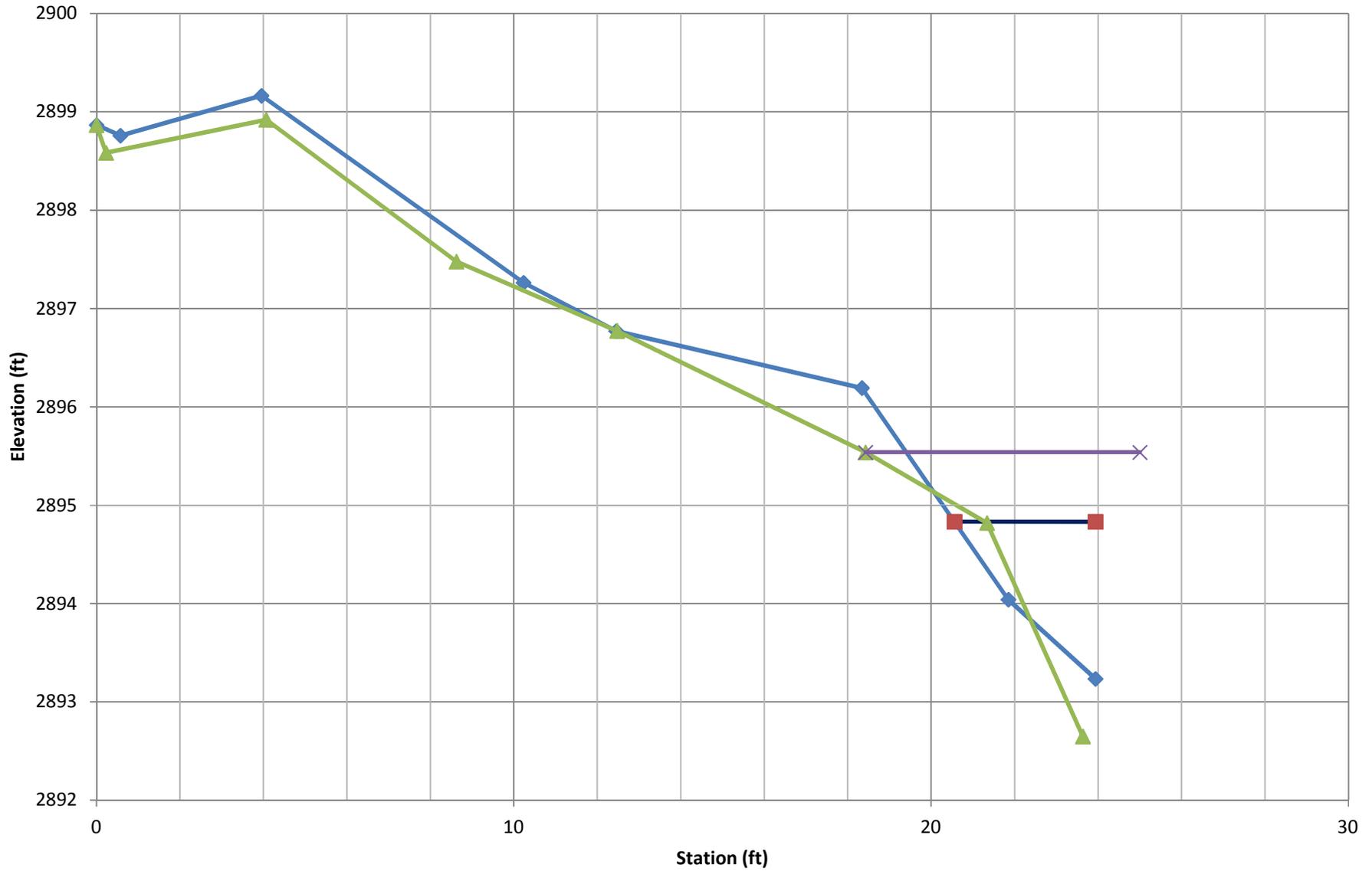
◆ 2013 XS ■ 2013 WS ▲ 2014 XS × 2014 WS

Foy's Bend Bank Transect #8



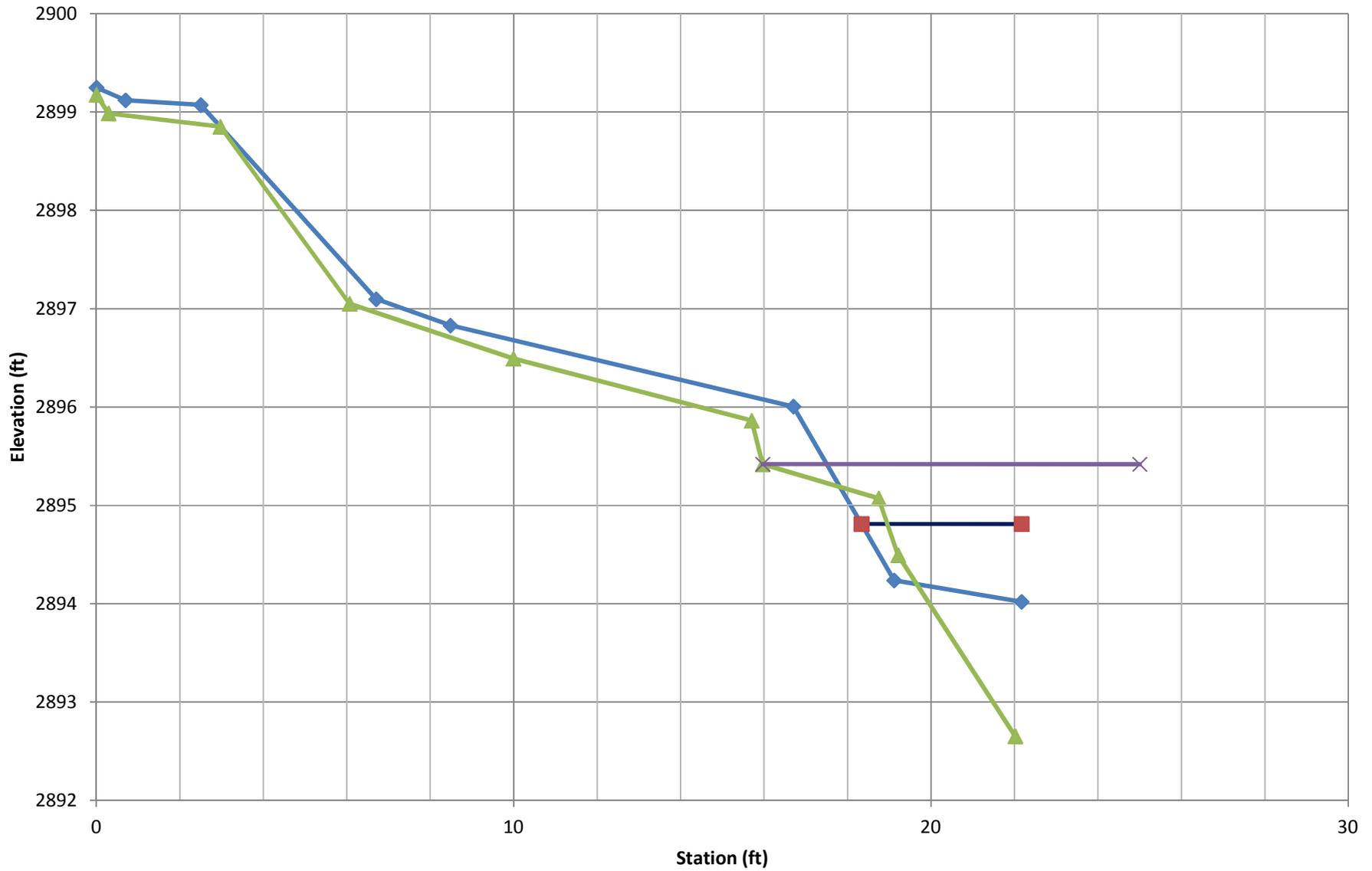
—◆— 2013 XS —■— 2013 WS —▲— 2014 XS —×— 2014 WS

Foy's Bend Bank Transect #9



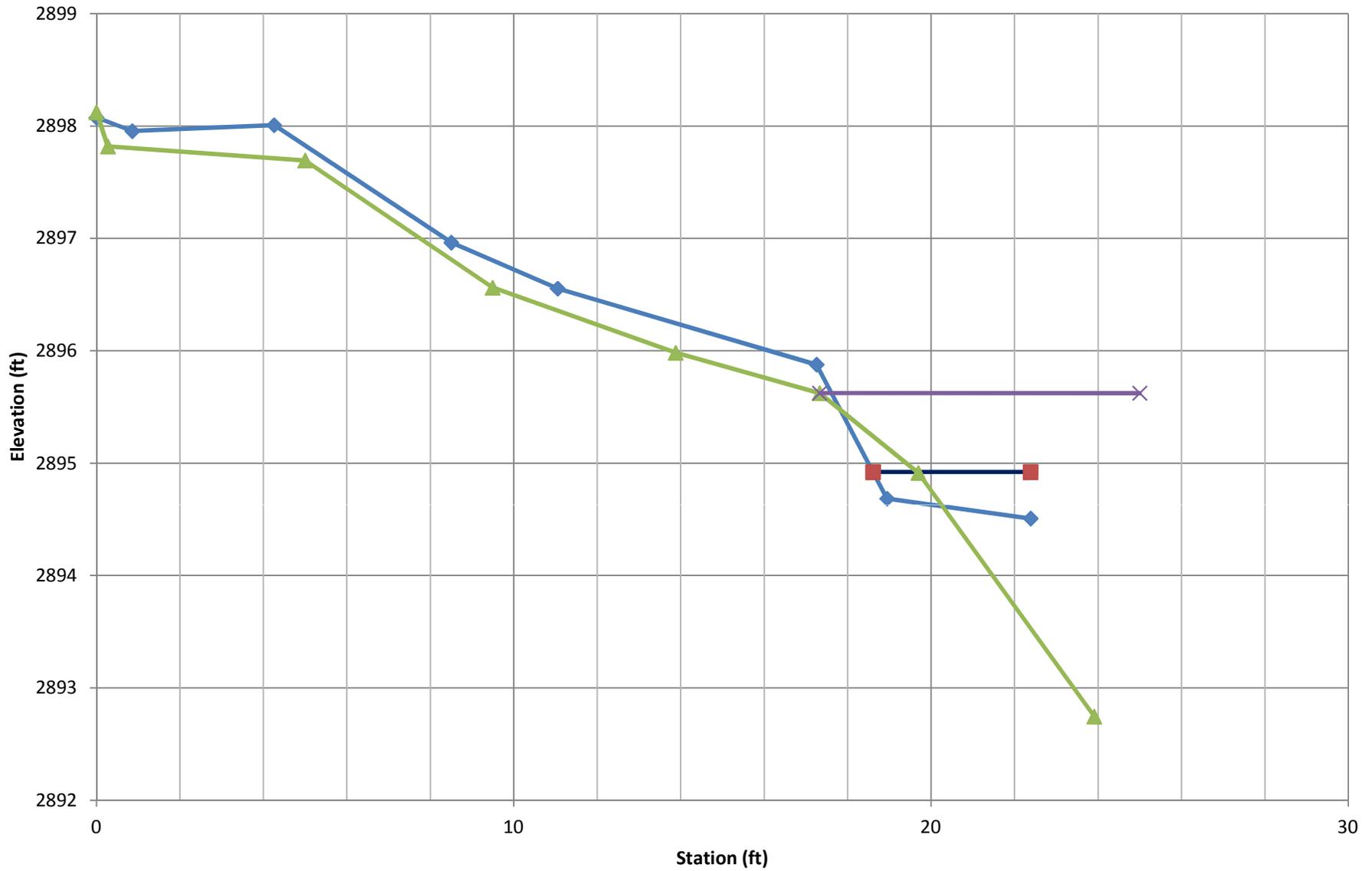
◆ 2013 XS ■ 2013 WS ▲ 2014 XS × 2014 WS

Foy's Bend Bank Transect #10



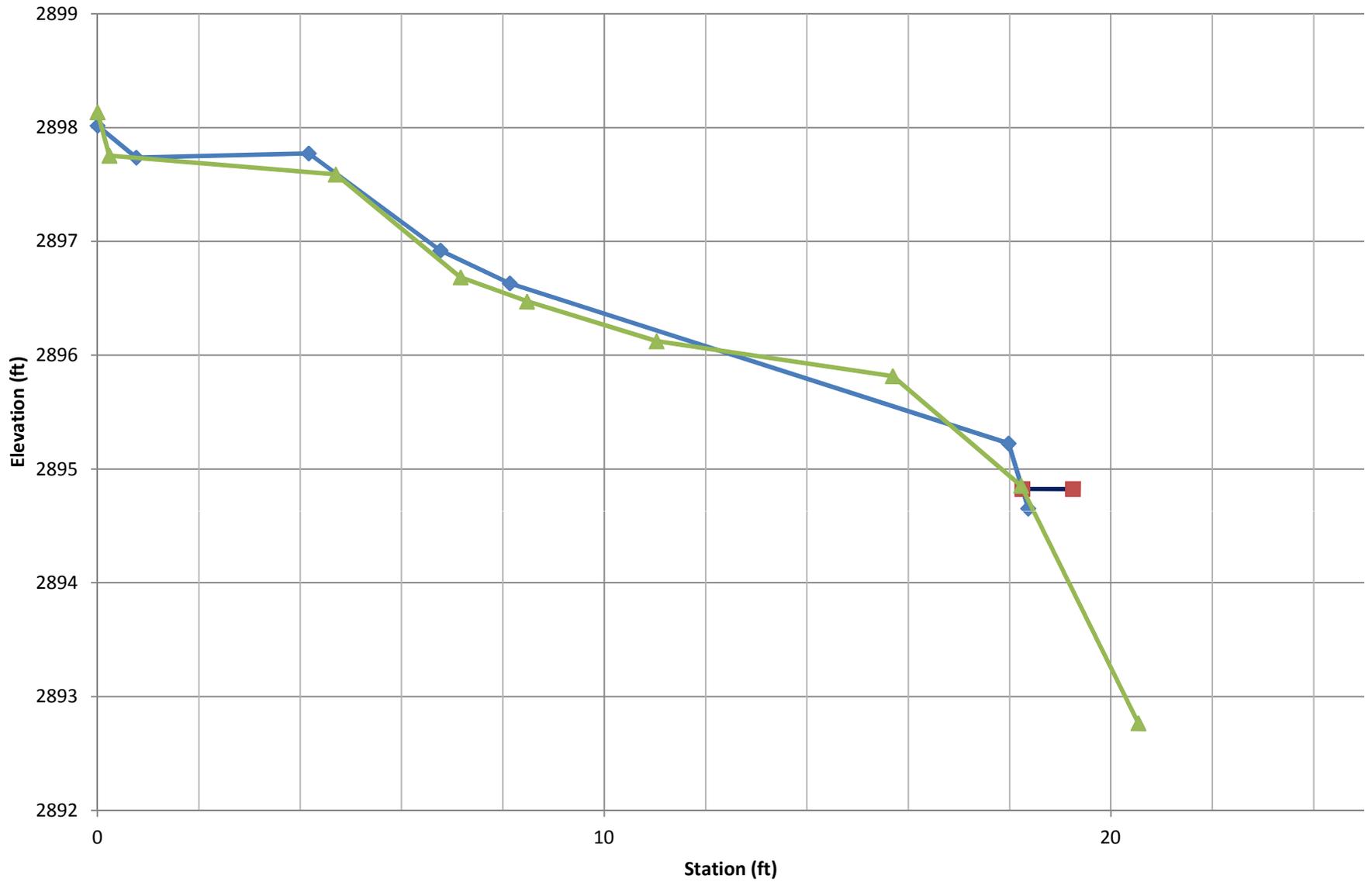
◆ 2013 XS ■ 2013 WS ▲ 2014 XS × 2014 WS

Foy's Bend Bank Transect #11



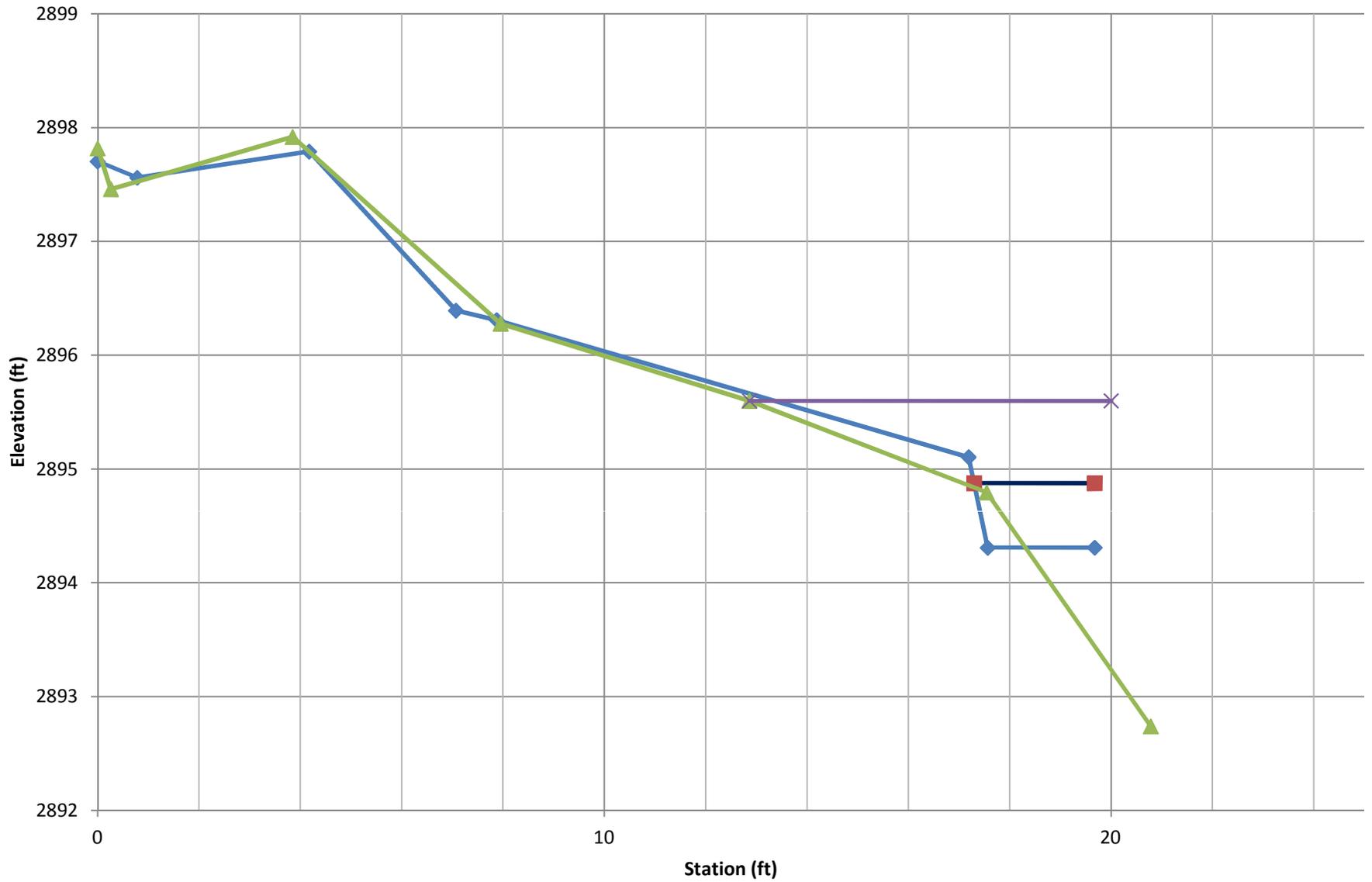
◆ 2013 XS ■ 2013 WS ▲ 2014 XS ✕ 2014 WS

Foy's Bend Bank Transect #12



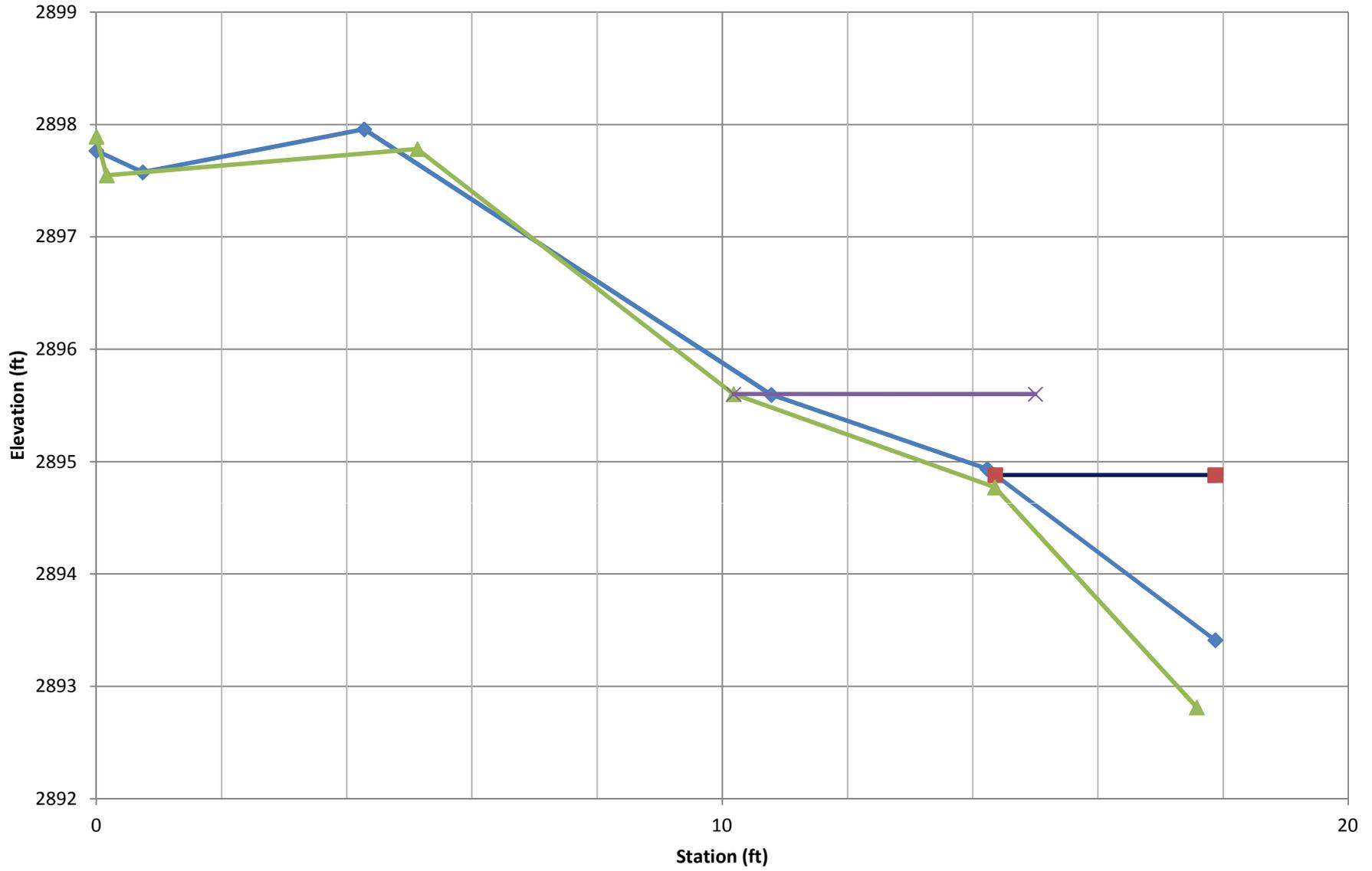
—◆— 2013 XS —■— 2013 WS —▲— 2014 XS —×— 2014 WS

Foy's Bend Bank Transect #13



◆ 2013 XS ■ 2013 WS ▲ 2014 XS × 2014 WS

Foy's Bend Bank Transect #14



—◆— 2013 XS —■— 2013 WS —▲— 2014 XS —×— 2014 WS

Appendix C

Project Site Photos

MDT Stream Mitigation Monitoring
Foy's Bend Fisheries Conservation Area
Flathead County, Montana

PHOTO INFORMATION

PROJECT NAME: Foy's Bend Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



Photo Point 1—2013
Location: Exclosure 4
Compass: 315 (Northwest)



Photo Point 1—2014
Location: Exclosure 4
Compass: 315 (Northwest)



Photo Point 2—2013
Location: Exclosure 6
Compass: 90 (East)



Photo Point 2—2014
Location: Exclosure 6
Compass: 90 (East)



Photo Point 3.1—2013
Location: Exclosure 8
Compass: 135 (Southeast)



Photo Point 3.1—2014
Location: Exclosure 8
Compass: 135 (Southeast)

PHOTO INFORMATION

PROJECT NAME: Foy's Bend Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



Photo Point 3.2—2013
Location: Exclosure 8
Compass: 158 (South-Southeast)



Photo Point 3.2—2014
Location: Exclosure 8
Compass: 158 (South-Southeast)



Photo Point 3.3—2013
Location: Exclosure 8
Compass: 203 (South-Southwest)



Photo Point 3.3—2014
Location: Exclosure 8
Compass: 203 (South-Southwest)



Photo Point 4—2013
Location: Exclosure 14
Compass: 90 (East)



Photo Point 4—2014
Location: Exclosure 14
Compass: 90 (East)

PHOTO INFORMATION

PROJECT NAME: Foy's Bend Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



Photo Point 5.1—2013
Location: Restored streambank upstream end
Compass: 270 (West)



Photo Point 5.1—2014
Location: Restored streambank upstream end
Compass: 270 (West)



Photo Point 5.2—2013
Location: Restored streambank looking downstream
Compass: 45 (Northeast)



Photo Point 5.2—2014
Location: Restored streambank looking downstream
Compass: 45 (Northeast)



Photo Point 6.1—2013
Location: Restored streambank upstream
Compass: 270 (West)



Photo Point 6.1—2014
Location: Restored streambank upstream
Compass: 270 (West)

PHOTO INFORMATION

PROJECT NAME: Foy's Bend Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



Photo Point 6.2—2013
Location: Restored streambank looking upstream
Compass: 45 (Northeast)



Photo Point 6.2—2014
Location: Restored streambank looking upstream
Compass: 45 (Northeast)



Photo Point 7—2013
Location: Extent of restored streambank, looking up-stream. **Compass:** 45 (Northeast)



Photo Point 7—2014
Location: Extent of restored streambank, looking up-stream. **Compass:** 45 (Northeast)

PHOTO INFORMATION

PROJECT NAME: Foy's Bend Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



Photo 1 - Snowberry emergence through coir fabric.



Photo 2 - Snowberry and Wood's rose colonization in Exclosure 1.



Photo 3 – Planted dogwood in a sea of *Phalaris*.



Photo 4 – *Cirsium arvense* population in Exclosure 6.



Photo 5 – Aspen colonization in Exclosure 6.



Photo 6 – Aspen colonization in Exclosure 10.

PHOTO INFORMATION

PROJECT NAME: Foy's Bend Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Events



Photo 7 - Willow growth along streambank.



Photo 8 - Dogwood growth and sediment along streambank.



Photo 9 – Coir fabric sagging due to lack of sediment.



Photo 10 – Fine sediment accumulation on top of willow bundles along streambank.



Photo 11 – Coir slumping due to lack of sediment.



Photo 12 – Evidence of erosion beneath willows and coir.

PHOTO INFORMATION

PROJECT NAME: Foy's Bend Stream Mitigation Site

DATE: April, 2014 Site Visit



Photo 13 – Project site taken from the upstream end of the bank treatment. (Photo taken in April, 2014).



Photo 14– Failure of bank slope beneath bioengineered bank treatment. Note undermining of soil lift a fascine

PHOTO INFORMATION

PROJECT NAME: Foy's Bend Stream Mitigation Site

DATE: April, 2014 Site Visit



Photo 15 – Scarp caused by wave erosion along the bank (Photo taken in April, 2014).



Photo 16– Holes created by collapsing pipe from internal erosion of the bank



PHOTOGRAPHIC INSPECTION INFORMATION

Page 1 of 30

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



EAST END OF PROJECT LOOKING WEST UPSTREAM



EAST END OF PROJECT LOOKING WEST UPSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T1: LOOKING SOUTH



T1: LOOKING NORTH



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T1: LOOKING WEST UPSTREAM



T1: LOOKING EAST DOWNSTREAM

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T2: LOOKING SOUTH



T2: LOOKING NORTH
C-12



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND
DATE: 7-29-14



T2: LOOKING WEST UPSTREAM



T2: LOOKING EAST DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

Page 6 of 30

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T3: LOOKING SOUTH



T3: LOOKING NORTH



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T3: LOOKING WEST UPSTREAM



T3: LOOKING EAST DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

Page 8 of 30

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T4: LOOKING SOUTH



T4: LOOKING NORTH



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T4: LOOKING WEST UPSTREAM



T4: LOOKING EAST DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T5: LOOKING SOUTH



T5: LOOKING NORTH



PHOTOGRAPHIC INSPECTION INFORMATION

Page 11 of 30

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T5: LOOKING WEST UPSTREAM



T5: LOOKING EAST DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T6: LOOKING SOUTH



T6: LOOKING NORTH
C-20



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND
DATE: 7-29-14



T6: LOOKING WEST UPSTREAM



T6: LOOKING EAST DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND
DATE: 7-29-14



T7: LOOKING SOUTH



T7: LOOKING NORTH



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T7: LOOKING WEST UPSTREAM



T7: LOOKING EAST DOWNSTREAM

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T8: LOOKING SOUTH



T8: LOOKING NORTH



PHOTOGRAPHIC INSPECTION INFORMATION

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PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T8: LOOKING WEST UPSTREAM



T8: LOOKING EAST DOWNSTREAM

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T9: LOOKING SOUTH



T9: LOOKING NORTH



PHOTOGRAPHIC INSPECTION INFORMATION

Page 19 of 30

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T9: LOOKING WEST UPSTREAM



T9: LOOKING EAST DOWNSTREAM

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T10: LOOKING SOUTH



T10: LOOKING NORTH
C-28



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T10: LOOKING WEST UPSTREAM



T10: LOOKING EAST DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

Page 22 of 30

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T11: LOOKING SOUTH



T11: LOOKING NORTH



PHOTOGRAPHIC INSPECTION INFORMATION

Page 23 of 30

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T11: LOOKING WEST UPSTREAM



T11: LOOKING EAST DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T12: LOOKING SOUTH



T12: LOOKING NORTH



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T12: LOOKING WEST UPSTREAM



T12: LOOKING EAST DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T13: LOOKING SOUTH



T13: LOOKING NORTH



PHOTOGRAPHIC INSPECTION INFORMATION

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PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T13: LOOKING WEST UPSTREAM



T13: LOOKING EAST DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

Page 28 of 30

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T14: LOOKING SOUTH



T14: LOOKING NORTH



PHOTOGRAPHIC INSPECTION INFORMATION

Page 29 of 30

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



T14: LOOKING WEST UPSTREAM



T14: LOOKING EAST DOWNSTREAM



PHOTOGRAPHIC INSPECTION INFORMATION

Page 30 of 30

PROJECT NAME: 2014 MDT STREAM MITIGATION — FOYS BEND

DATE: 7-29-14



WEST END OF PROJECT LOOKING EAST DOWNSTREAM



WEST END OF PROJECT LOOKING EAST DWONSTREAM

Appendix D

Foy's Bend Mitigation Design Sheets

MDT Stream Mitigation Monitoring
Foy's Bend Fisheries Conservation Area
Flathead County, Montana

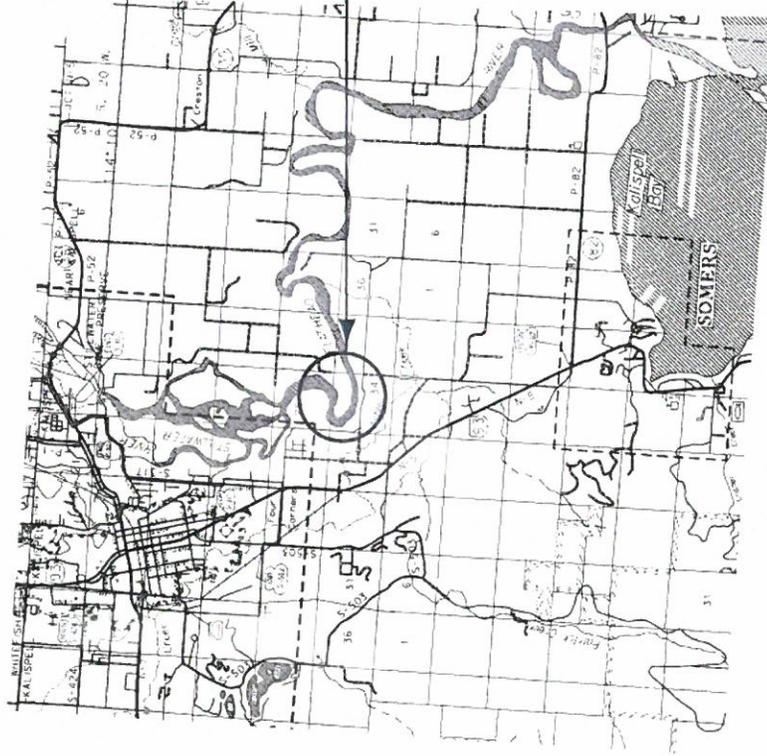
MONTANA DEPARTMENT OF TRANSPORTATION

FEDERAL AID PROJECT NH 15(99)
 AQUATIC RESOURCES MITIGATION
 FOY'S BEND STREAM MITIGATION
 FLATHEAD COUNTY

LENGTH N/A miles



THIS PROJECT



THIS CONTRACT
 AQUATIC RESOURCE MITIGATION
 NH 15(99)

MONTANA DEPARTMENT OF TRANSPORTATION	
APPROVED : <u>JANUARY 14</u> 20 <u>15</u>	
TIM REARDON DIRECTOR OF TRANSPORTATION	
BY	BUREAU CHIEF ENVIRONMENTAL SERVICES
U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION	
APPROVED :	DATE
DIVISION ADMINISTRATOR	

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ROAD PLANS	SHEET NO.
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DETAILS	5-11
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RIPARIAN BUFFER ZONE #2	10
FENCING COORDINATE TABLES	11

NOTES

UTILITIES

CALL THE UTILITIES UNDERGROUND LOCATION CENTER (1-800-424-5555) OR OTHER NOTIFICATION SYSTEM FOR THE MARKING AND LOCATION OF ALL LINES AND SERVICE BEFORE EXCAVATING. ALL CLEARANCES OR DEPTHS PROVIDED FOR UTILITIES ARE FROM EXISTING GROUND LINE.

PIEZOMETERS

DO NOT DISTURB EXISTING PIEZOMETERS ON THE PROJECT.

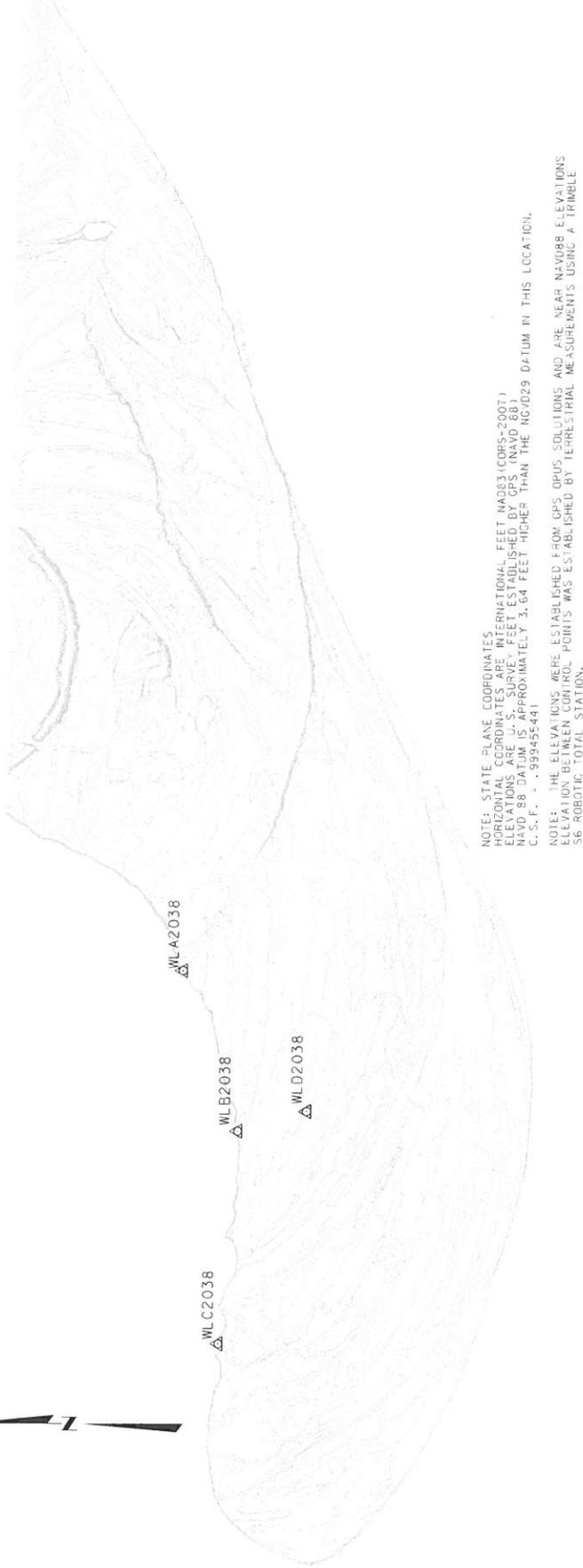
STAGING AREA

STAGING AREA LOCATION MUST BE APPROVED BY BOTH THE PROJECT MANAGER AND MT FISH, WILDLIFE, & PARKS (FWP), COORDINATE WITH FWP AT LEAST 2 WEEKS PRIOR TO CONSTRUCTION TO DETERMINE A LOCATION. FWP CONTACTS:
 JOEL TOHTZ (406) 751-4570
 KRIS TEMPEL (406) 751-4573
 ALAN WOOD (406) 751-4595

WETLANDS

WETLANDS EXIST WITHIN THE PROJECT AREA AND BEYOND THE PROJECT LIMITS. A WETLAND DELINEATION HAS NOT BEEN COMPLETED FOR THIS PROJECT. IMPACTS TO WETLAND AREAS ARE NOT ANTICIPATED IN ASSOCIATION WITH THE PLANNED WORK. SO NO PERMITS FOR WETLAND IMPACTS HAVE BEEN OBTAINED. ANY ACTION IMPACTING WETLAND AREAS WITHOUT THE APPROPRIATE PERMITTING IS THE RESPONSIBILITY OF THE CONTRACTOR.

CONTROL DIAGRAM



NOTE: STATE PLANE COORDINATES
 HORIZONTAL COORDINATES ARE INTERNATIONAL FEET NAD83(CORS-2007)
 VERTICAL COORDINATES ARE SURVEY FEET ESTABLISHED BY GPS (NAVD 88)
 NAVD 88 DATUM IS APPROXIMATELY 3.64 FEET HIGHER THAN THE NGVD29 DATUM IN THIS LOCATION.
 C.S.F. = 9999455441

NOTE: THE ELEVATIONS WERE ESTABLISHED FROM GPS OPUS SOLUTIONS AND ARE NEAR NAVD88 ELEVATIONS
 56. ROBOTIC TOTAL STATION.

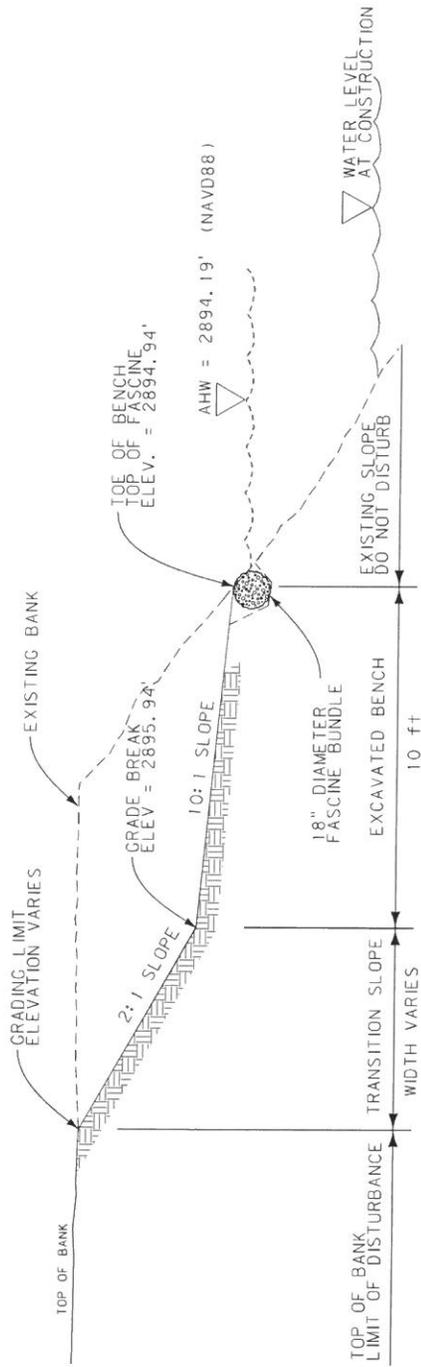
THIS PROJECT UTILIZES LIDAR SURVEY DATA COLLECTED BETWEEN SEPTEMBER 22 AND 29, 2009 AS PART OF THE FLATHEAD
 CHANNEL MITIGATION ZONE STUDY COMMISSIONED BY THE MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY, MONTANA FISH,
 WILDLIFE, AND PARKS, AND THE FLATHEAD LAKERS.

CONTROL MARK ABSTRACT

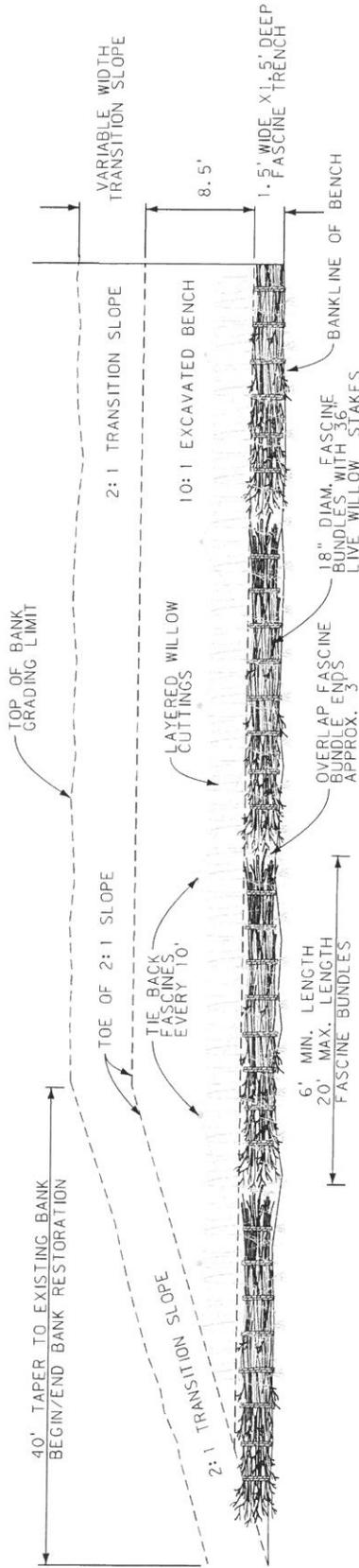
POINT NAME/NUMBER	N OR Y COORDINATE	E OR X COORDINATE	POINT ELEVATION	LOCATION AND DESCRIPTION
A2038	810,332.138	1,458,149,352	2,900.63	WL A2038 FROM THE INTERSECTION OF HOLT STAGE AND STEEL BRIDGE ROAD ON THE EAST SIDE OF THE NEWLY REPLACED OLD STEEL BRIDGE GO SOUTH ON STEEL BRIDGE ROAD 4.8 MILES TO A FWP PARKING CORAL WITH GREEN GATES. TURN WEST AND FOLLOW ROAD GOING WESTERLY AT 1200 FEET ROAD TURNS SOUTHERLY GO AROUND A DEAD COTTONWOOD IN CONTINUING WEST ON THE BANK OF THE FARM ROAD. IT IS ALSO 85 FEET FROM A POWERPOLE WHICH BEARS 34 DEGREES. MARK IS 9 FEET WEST OF TOP OF BANK. SET A 2" A.C. MARK WL A2038 2012. WITNESS POST SET 3 FEET NORTH.
B2038	809,464.721	1,457,854,826	2,901.65	WL B2038 FROM POINT WL A2038 FOLLOW THE FARM FIELD ROAD IN A DOWNSTREAM DIRECTION STAYING ON THE RIVER SIDE OF THE HAYFIELD 95 FEET MARK IS NORTH TOWARDS THE RIVER 35 FEET. MARK IS DOWNSTREAM 95 FEET FROM AN 8 FOOT HIGH T-POST. SET A 2" A.C. MARK WL B2038 2012 WITNESS POST 3 FEET NORTH.
C2038	808,361.675	1,457,949,167	2,899.94	WL C2038 FROM THE INTERSECTION OF HOLT STAGE AND STEEL BRIDGE ROAD ON THE EAST SIDE OF THE NEWLY REPLACED OLD STEEL BRIDGE GO SOUTH ON STEEL BRIDGE ROAD 4.8 MILES TO A FWP PARKING CORAL WITH GREEN GATES. TURN WEST AND FOLLOW ROAD GOING WESTERLY AT 1200 FEET ROAD TURNS SOUTHERLY GO AROUND A DEAD COTTONWOOD IN CONTINUING WEST ON THE BANK OF THE FARM ROAD. IT IS ALSO 85 FEET FROM A POWERPOLE WHICH BEARS 34 DEGREES. MARK IS 9 FEET WEST OF TOP OF BANK. SET A 2" A.C. MARK WL C2038 2012 WITNESS POST 3 FEET EAST.
D2038	805,588.808	1,457,489,729	2,901.38	WL D2038 FROM POINT B2038 GO 365 FEET AT AN 87 DEGREE OF 186 DEGREES. SET A 2" A.C. MARK WL D2038 2012 WITH A WITNESS POST 3 FEET SOUTH. MARK IS NORTH FROM THE SOUTH EDGE OF THE FIELD 35 FEET.

BANK RESTORATION DETAIL

TYPICAL SECTION



PLAN VIEW

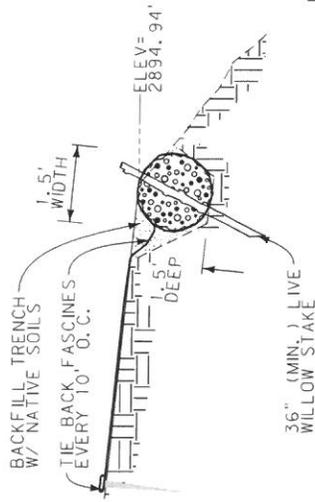


NOTE:
 PREPARE 18" DIAMETER FASCINE BUNDLES WITH 1/2" TO 2" CONIFER SLASH & WILLOW CUTTINGS WITH ALL BRANCH ENDS FACING THE SAME DIRECTION. TIE EVERY 12" ON CENTER. POSITION END TO END AND OVERLAP ENDS APPROX. 3" OR MORE. LEAVING NO GAPS BETWEEN BUNDLES. PLACE BUNDLES ENTIRELY WITHIN THE TRENCH AT THE SPECIFIED ELEVATION.

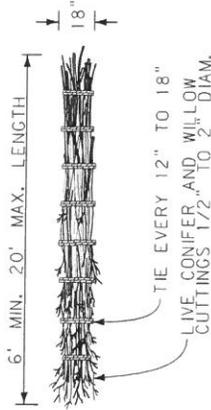
MDTA NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION	DESIGNED BY: ENG. SAUNDERS, PE 12/05/2012	UPRN 2038013 F.O.Y.'S BEND STREAM MITIGATION SHEET 5
	CHECKED BY: [REDACTED] 11/14/2013 2:52:04 PM	

BANK RESTORATION DETAIL

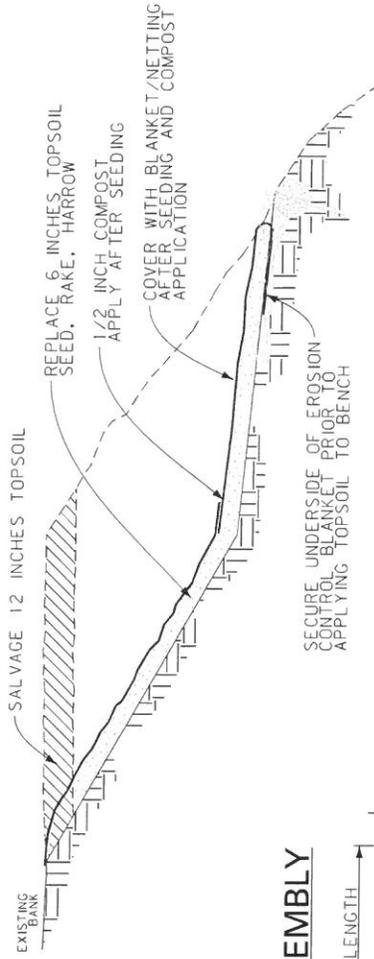
FASCINE INSTALLATION



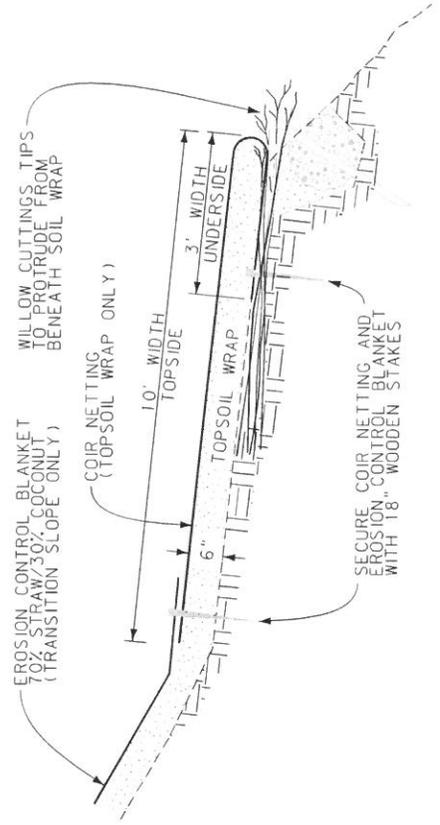
FASCINE ASSEMBLY



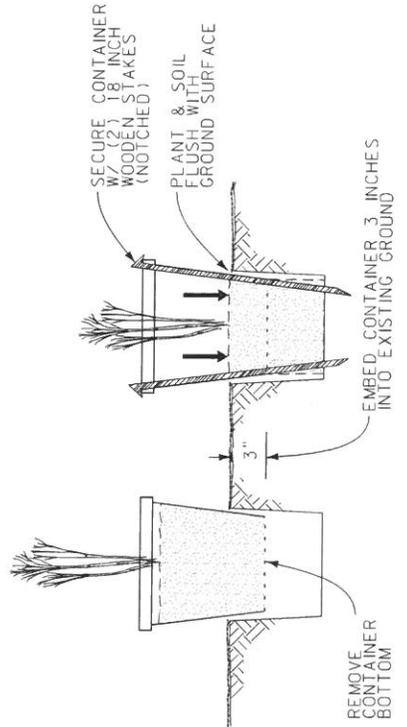
TOPSOIL SALVAGE & PLACE



TOPSOIL WRAP

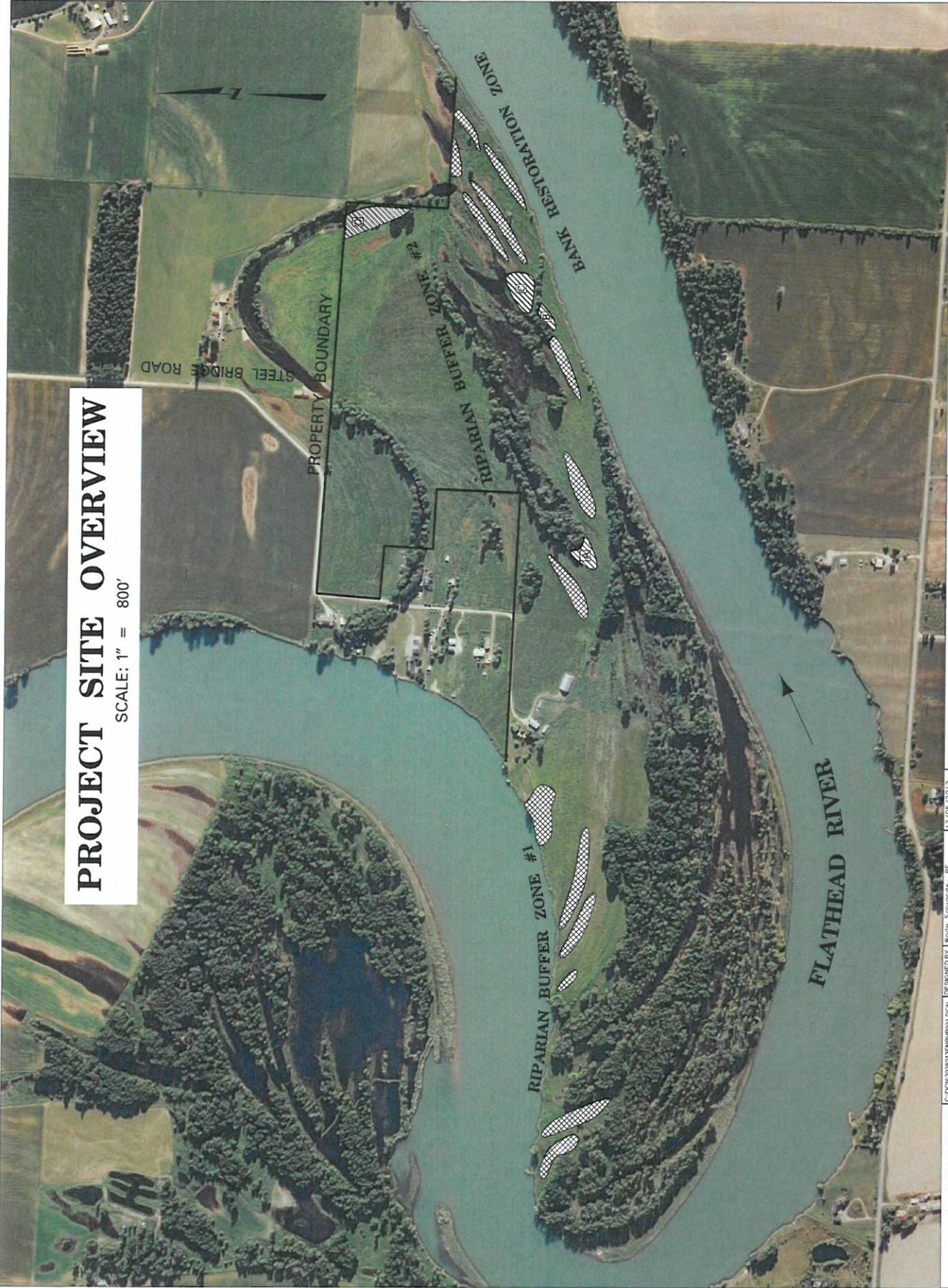


RODENT PROTECTION



PROJECT SITE OVERVIEW

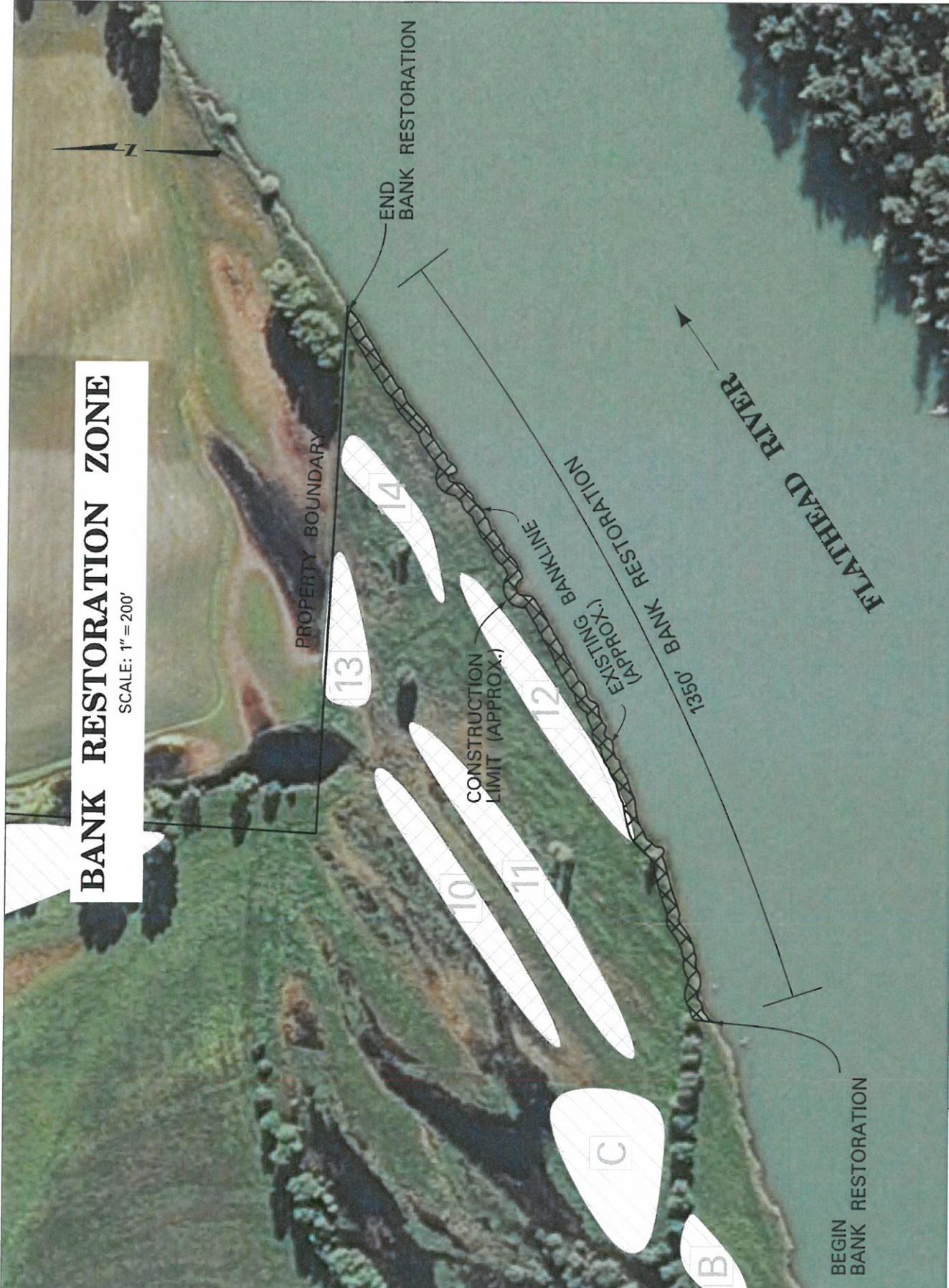
SCALE: 1" = 800'



MDTA MONTANA DEPARTMENT OF TRANSPORTATION	DESIGNED BY: WOOD, SCOTT & CO., P.C.	12/20/2012
	CHECKED BY: [blank]	[blank]
FOY'S BEND STREAM MITIGATION		UPN 2038013
NH 151991		SHEET 7

BANK RESTORATION ZONE

SCALE: 1" = 200'



MDTA MONTANA DEPARTMENT OF TRANSPORTATION	DESIGNED BY: BOB SCHNEIDER, PE	12/08/2012	UPN 2038013	NH 15/951	SHEET 8
	REVIEWED BY: [blank]	11/4/2013			
	C:\DOK\2038013\ENVP\PROJ\LOG	07/13			
	CHECKED BY: [blank]	8:50:18 AM			

RIPARIAN AREA #1

SCALE: 1" = 400'



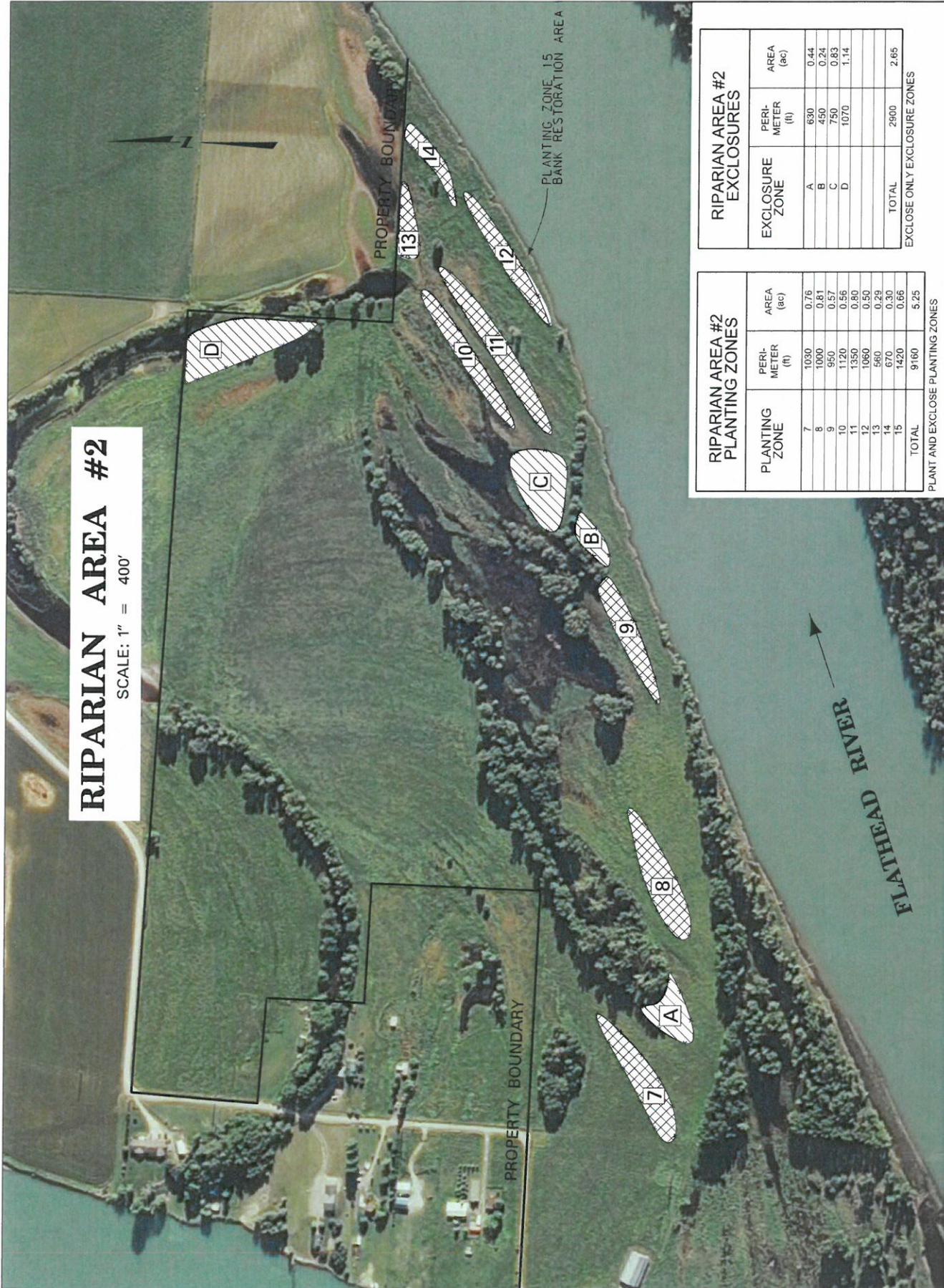
RIPARIAN AREA #1 PLANTING ZONES

PLANTING ZONE	PERL. METER (ft)	AREA (ac)
1	830	0.61
2	1070	0.99
3	410	1.18
4	1000	0.70
5	1430	1.04
6	960	1.17
TOTAL	5720	5.63

PLANT AND EXCLOSE PLANTING ZONES

RIPARIAN AREA #2

SCALE: 1" = 400'



RIPARIAN AREA #2 PLANTING ZONES

PLANTING ZONE	PERI-METER (ft)	AREA (ac)
7	1030	0.76
8	1000	0.61
9	950	0.57
10	1120	0.56
11	1350	0.80
12	1060	0.50
13	560	0.29
14	670	0.30
15	1420	0.66
TOTAL	9160	5.25

RIPARIAN AREA #2 EXCLOSURES

EXCLOSURE ZONE	PERI-METER (ft)	AREA (ac)
A	630	0.44
B	450	0.34
C	750	0.63
D	1070	1.14
TOTAL	2900	2.65

PLANT AND EXCLOSURE PLANTING ZONES

EXCLOSURE ONLY EXCLOSURE ZONES

