
MONTANA DEPARTMENT OF TRANSPORTATION STREAM MITIGATION MONITORING REPORT

*Ashley Creek
Flathead County, Montana*

*Project Completed: 2010
Monitoring Report #4: December, 2018*



Prepared for:



VISION ZERO
zero deaths · zero serious injuries
MONTANA DEPARTMENT
OF TRANSPORTATION

Prepared by:



MONTANA DEPARTMENT OF TRANSPORTATION

STREAM MITIGATION MONITORING REPORT #4

YEAR 2018

Ashley Creek
Flathead County, Montana

MDT Project Number: NH-MT 5-3(59) FST
Control Number: 2038

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1.0 INTRODUCTION

As part of construction of the U.S. Highway 2 South Kalispell Bypass project, the Montana Department of Transportation (MDT) modified a segment of Ashley Creek at the North Bridge crossing. The following report provides results of the fourth year of post construction mitigation monitoring along this segment of Ashley Creek and compares results to project performance standards outlined in the post-construction monitoring plan for the site. This project was constructed in 2010; therefore, these results provide documentation of the site's condition eight years following the project's completion. Monitoring of this site occurred annually from 2013-2015 but was not monitored in 2016 and 2017 due to construction of a second bridge over Ashley Creek.

One of the goals of the project is to provide compensatory mitigation for stream impacts associated with the U.S. 93 Alternative widening segment of the Kalispell Bypass in the Missoula District. If successful, the project will create, enhance, restore, and maintain permanent, naturally self-sustaining, native or native-like stream and riparian habitat. Prior to the project, Ashley Creek had been modified by human activities, and was V-shaped with steep side slopes (1.5:1). Objectives intended to meet the project's goal include:

- Widening 413 feet of the Ashley Creek stream channel and laying back the slopes from 1.5:1 to 2:1,
- Implementing an aggressive re-vegetation plan along the re-sloped banks to re-establish native riparian and upland vegetation.

Provisions outlined within the USACE permit include monitoring of the on and off-site stream mitigation areas for five years following channel construction to determine whether the site meets, or is trending toward meeting the performance standards specified in the mitigation plan for the site. The performance standards for the on-site mitigation plan for Ashley Creek are outlined below.

Quantitative success criteria for Ashley Creek:

1. **Riparian Buffer Success** will be achieved when:
 - a. Woody and riparian vegetation becomes established, and noxious weeds do not exceed 10% 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 non-noxious weed 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 $\geq 70\%$
 - b. Planted trees and shrubs will be considered successful where they exhibit 50% survival after 5 years.

3. **Vegetation along Stream banks** 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).
4. **Stream bank 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.

Qualitative success criteria for Ashley Creek:

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

Additional reporting requirements include:

6. **Photo Documentation** success of restored stream channel and stream bank vegetation community development showing distinct positive changes from pre-construction to final monitoring year in comparison with the established reference reach.

Results of the fourth year monitoring of the Ashley Creek project are included in Section 4 and compared to performance standards in Section 5. Additional reporting requirements including maps indicating the endpoints of riparian belt transects, perpendicular transect surveys and locations of noxious weed infestations, repeated survey results at four perpendicular transects and a longitudinal stream profile, photo documentation of the project site, and a planting schematic from the approved design are included as appendices to this report.

2.0 SITE LOCATION

The project reach includes approximately 430 feet of Ashley Creek, and extends to upstream and downstream of the U.S. Highway 93 ALT Bridge (Figure 1). The project site is located in Section 13, Township 7 North, Range 22 West, in Flathead County, Montana.

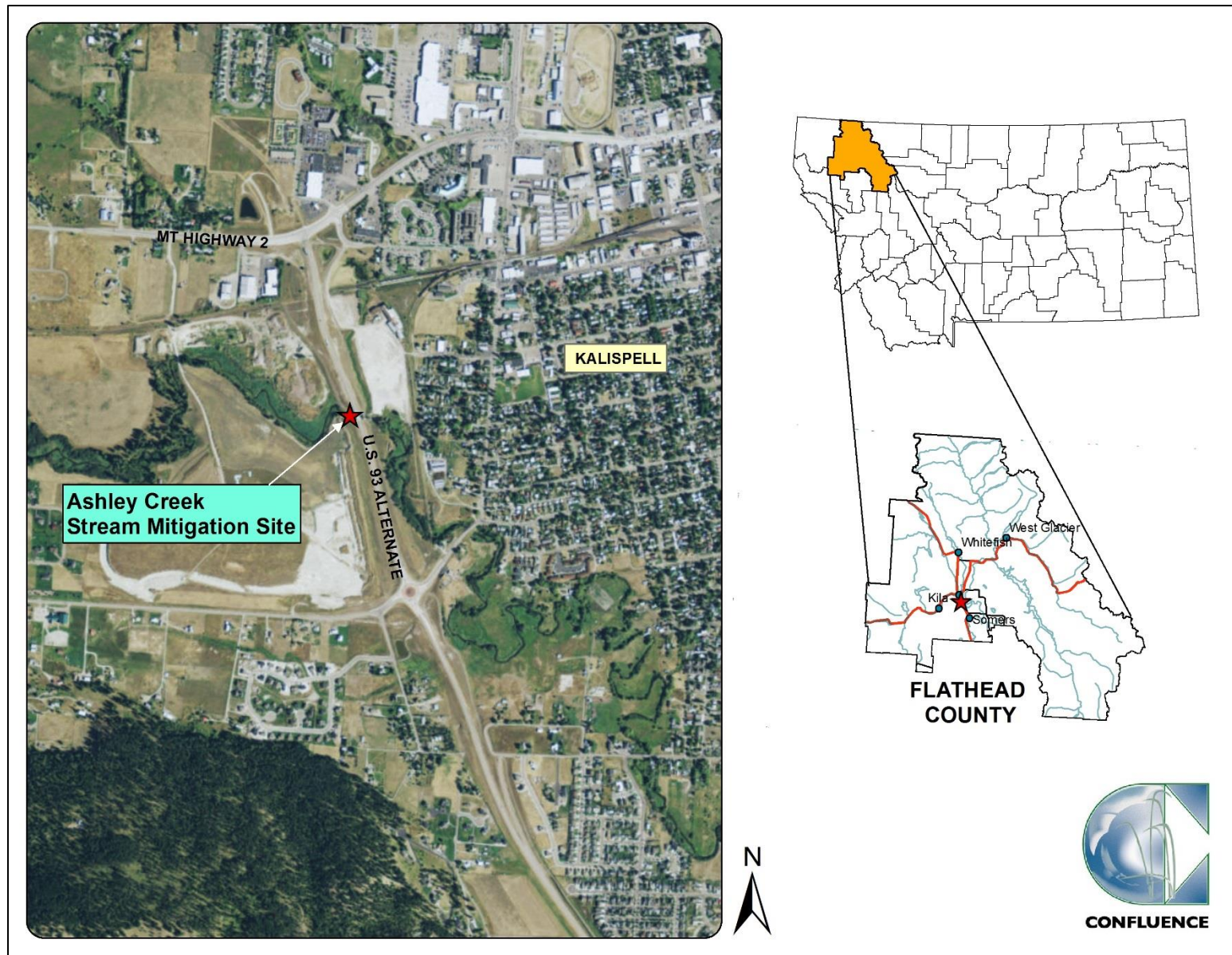


Figure 1. Location of the Ashley Creek stream mitigation monitoring site.

3.0 MONITORING METHODS

Monitoring field crews visited the project site on August 10, 2018 while survey crews visited the site on August 14, 2018. Field data collection and surveys followed methodologies as described in the 2013 monitoring report for the Ashley Creek mitigation site, which may be accessed at the following Montana Department of Transportation website:

<https://www.mdt.mt.gov/publications/brochures/stream-mitigation.shtml>.

4.0 RESULTS

4.1. Riparian and Stream Bank Vegetation Inventory

Table 1 summarizes the areal percent cover of total vegetation, bare ground, woody vegetation, and noxious weeds for the riparian transects surveyed along Ashley Creek. The channel was designed with a consistent slope from the toe of the bank up to the pedestrian/bike trail and has no definable top of bank or floodplain bench on either side of the channel (see Photo Point 2 on page C-1). As a result, the stream banks along Ashley Creek were considered within the riparian vegetation transect. In 2018 the total percent riparian cover decreased to 75%, with 18% cover by woody species, 6% by noxious weeds, and 25% bare ground. Overall, 69% of the reach exhibited non-noxious vegetation cover (75% total riparian cover minus 6% noxious weeds).

Table 1. Percent cover along riparian belt transects at Ashley Creek in 2013 through 2015, and 2018.

Belt Transect	Length (ft)	Total % Riparian Cover				% Bare Ground				% Woody Cover				% Noxious Weed Cover			
		2013	2014	2015	2018	2013	2014	2015	2018	2013	2014	2015	2018	2013	2014	2015	2018
Right (south bank)	208	92%	95%	85%	70%	8%	5%	15%	30%	23%	25%	25%	15%	12%	15%	11%	7%
Left (north bank)	243	84%	90%	90%	80%	16%	10%	10%	20%	30%	30%	30%	20%	10%	10%	10%	5%
Total	451	88%	92%	88%	75%	12%	8%	12%	25%	26%	28%	28%	18%	11%	12%	10%	6%

Dominant species recorded along the riparian transects were combined with visual observations in other areas to develop a vegetation community map (Figure 3, Appendix A). Four community types were observed in 2018, which included community Types 1 – *Phalaris arundinacea*, 3 – *Phalaris arundinacea/Elymus* spp., 4 – Bare Ground/*Elymus* spp., and 5 – *Cornus alba/Alnus incana*. Side slopes along the straight channel alignment are dominated by bare ground, wild rye (*Elymus* spp.), and reed canary grass (*Phalaris arundinacea*). As the planted shrubs mature and become larger over time, the corridor is expected to become more dominated by woody species. The right bank along the upstream extent of the project reach, which was not disturbed during construction, is dominated by reed canary grass. Community Type 3 on both the left and right stream banks has shifted since the 2015 monitoring event, to include community Types 4 and 5, due to the increase observed in 2018 in bare ground, red osier dogwood (*Cornus alba*), and speckled alder (*Alnus incana*). The majority of the bare ground observed within the riparian corridor was concentrated under the bridge overpass in an area that is permanently shaded. This lack of direct sunlight and precipitation beneath the overpass is contributing to the lack of vegetative cover and increase in bare ground (see additional photos 7, 8, and 9 on pages C-4 and C-5).

Table 2 provides a comprehensive list of plant species observed during the 2013 through 2015, and 2018 monitoring events. In 2018, 82 plant species were observed, representing an increase by 26 species since the initial monitoring event in 2013. Five species that had not been previously observed were documented in 2018, including two hydrophytic species and three upland species. Hydrophytic species included fringed willowherb (*Epilobium ciliatum*) and field horsetail (*Equisetum arvense*). Upland species included clasping pepperwort (*Lepidium perfoliatum*), tall hedge-mustard (*Sisymbrium altissimum*), and smooth blue American-aster (*Symphyotrichum laeve*). In 2018, 43% of the species observed were hydrophytic based on the 2016 National Wetland Plant List (NWPL) (Lichvar *et al.*, 2016).

Table 2. Comprehensive plant species list for the Ashley Creek stream mitigation site from 2013 through 2015, and 2018.

Scientific Name	Common Name	WMVC Indicator Status*	Scientific Name	Common Name	WMVC Indicator Status*
<i>Agropyron</i> sp.	Wheatgrass	N/A	<i>Medicago lupulina</i>	Black Medick	FACU
<i>Agrostis gigantea</i>	Black Bent	FAC	<i>Medicago sativa</i>	Alfalfa	UPL
<i>Agrostis stolonifera</i>	Spreading Bent	FAC	<i>Melilotus albus</i>	White Sweetclover	UPL
<i>Alnus incana</i>	Speckled Alder	FACW	<i>Melilotus officinalis</i>	Yellow Sweet-Clover	FACU
<i>Alopecurus pratensis</i>	Field Meadow-Foxtail	FAC	<i>Onopordum acanthium</i>	Scotch Thistle	UPL
<i>Amelanchier alnifolia</i>	Saskatoon Service-Berry	FACU	<i>Pascopyrum smithii</i>	Western-Wheat Grass	FACU
<i>Artemisia absinthium</i>	Absinthium	UPL	<i>Peritoma serrulata</i>	Rocky Mountain Beeplant	FACU
<i>Artemisia biennis</i>	Biennial Wormwood	FACW	<i>Phalaris arundinacea</i>	Reed Canary Grass	FACW
<i>Avena fatua</i>	Wild Oats	UPL	<i>Plantago major</i>	Great Plantain	FAC
<i>Bassia scoparia</i>	Mexican-Fireweed	FAC	<i>Poa palustris</i>	Fowl Blue Grass	FAC
<i>Betula pumila</i>	Bog Birch	OBL	<i>Poa pratensis</i>	Kentucky Blue Grass	FAC
<i>Bromus carinatus</i>	California Brome	UPL	<i>Populus angustifolia</i>	Narrow-Leaf Cottonwood	FACW
<i>Bromus inermis</i>	Smooth Brome	UPL	<i>Populus balsamifera</i>	Balsam Poplar	FAC
<i>Bromus tectorum</i>	Cheatgrass	UPL	<i>Potamogeton richardsonii</i>	Red-Head Pondweed	OBL
<i>Carex stipata</i>	Stalk-Grain Sedge	OBL	<i>Prunus virginiana</i>	Choke Cherry	FACU
<i>Centaurea stoebe</i>	Spotted Knapweed	UPL	<i>Rosa woodsii</i>	Woods' Rose	FACU
<i>Chenopodium album</i>	Lamb's-Quarters	FACU	<i>Rumex acetosa</i>	Garden Sorrel	FAC
<i>Cirsium arvense</i>	Canadian Thistle	FAC	<i>Rumex crispus</i>	Curly Dock	FAC
<i>Cirsium vulgare</i>	Bull Thistle	FACU	<i>Salix bebbiana</i>	Gray Willow	FACW
<i>Convolvulus arvensis</i>	Field Bindweed	UPL	<i>Salix drummondiana</i>	Drummond's Willow	FACW
<i>Cornus alba</i>	Red Osier	FACW	<i>Salix exigua</i>	Narrow-Leaf Willow	FACW
<i>Cynoglossum officinale</i>	Gypsy-Flower	FACU	<i>Salix lasiandra</i>	Pacific Willow	FACW
<i>Descurainia sophia</i>	Herb Sophia	UPL	<i>Scirpus microcarpus</i>	Red-Tinge Bulrush	OBL
<i>Elodea canadensis</i>	Canadian Waterweed	OBL	<i>Silene latifolia</i>	Bladder Campion	UPL
<i>Elymus canadensis</i>	Nodding Wild Rye	FAC	<i>Silene repens</i>	Creeping Catchfly	UPL
<i>Elymus hispidus</i>	Intermediate Wheatgrass	UPL	<i>Silene vulgaris</i>	Maiden's-tears	UPL
<i>Elymus repens</i>	Creeping Wild Rye	FAC	<i>Sinapis arvensis</i>	Corn Mustard	UPL
<i>Elymus trachycaulus</i>	Slender Wild Rye	FAC	<i>Sisymbrium altissimum</i>	Tall Hedge-Mustard	FACU
<i>Epilobium ciliatum</i>	Fringed Willowherb	FACW	<i>Solanum dulcamara</i>	Climbing Nightshade	FAC
<i>Equisetum arvense</i>	Field Horsetail	FAC	<i>Solidago canadensis</i>	Canadian Goldenrod	FACU
<i>Equisetum hyemale</i>	Tall Scouring-Rush	FACW	<i>Sonchus arvensis</i>	Field Sow-Thistle	FACU
<i>Festuca idahoensis</i>	Bluebunch Fescue	FACU	<i>Symphoricarpos albus</i>	Common Snowberry	FACU
<i>Galium aparine</i>	Sticky-Willy	FACU	<i>Symphoricarpos occidentalis</i>	Western Snowberry	FAC
<i>Helianthus maximiliani</i>	Maximilian Sunflower	UPL	<i>Symphyotrichum ascendens</i>	Western American-Aster	FACU
<i>Helianthus nuttallii</i>	Nuttall's Sunflower	FACW	<i>Symphyotrichum laeve</i>	Smooth Blue American-Aster	FACU
<i>Lactuca serriola</i>	Prickly Lettuce	FACU	<i>Tanacetum vulgare</i>	Common Tansy	FACU
<i>Lepidium perfoliatum</i>	Clasping Pepperwort	FACU	<i>Taraxacum officinale</i>	Common Dandelion	FACU
<i>Lupinus argenteus</i>	Silvery Lupine	UPL	<i>Thlaspi arvense</i>	Field Pennycress	UPL
<i>Lupinus lepidus</i>	Stemless-dwarf Lupine	UPL	<i>Tragopogon dubius</i>	Meadow Goat's-Beard	UPL
<i>Lupinus</i> sp.	Lupine	N/A	<i>Verbascum thapsus</i>	Great Mullein	FACU
<i>Malva neglecta</i>	Dwarf Cheeseweed	UPL	<i>Vicia americana</i>	American Purple Vetch	FAC

*2016 National Wetland Plant List; *Western Mountains, Valleys, and Coasts* (WMVC) (Lichvar *et al.* 2016)

New species identified in 2018 are **bolded**.

Species identified to genus level have been assigned an indicator status of N/A.

4.2. Stream Bank Vegetation Composition

The stream bank vegetation inventory identified 19 plant species along the banks of Ashley Creek (Table 3). Stability ratings are provided on a scale from 1 to 10, and indicate a plant's ability to resist erosive forces based on root characteristics (Winward, 2000). The Winward stability ratings are based on vegetation communities rather than individual species; therefore, a vegetation community was assigned to each stream bank based on one or more dominant species. If the community type was defined by more than one dominant species, the more dominant species stability rating was reported. Success criteria outlined in the monitoring plan state the vegetation along the stream banks will be considered successful when banks are vegetated with a majority of deep-rooting riparian plant species having root stability indices ≥ 6 . Reed canary grass comprised greater than 50% cover along the left stream bank and between 11 and 20% on the right. Bare ground accounted for greater than 50% of the right stream bank and between 11 and 20% on the left. Therefore, reed canary grass, with a root stability index of 9, dominated approximately half of the streambank vegetation, while the other half was dominated by bare ground, with a root stability index of 1. The majority of the bare ground observed along the stream banks was concentrated under the bridge overpass, where there is restricted sunlight and precipitation, making it difficult for vegetation to establish.

Table 3. Plant species and their associated cover classes along the stream banks of the Ashley Creek stream mitigation site in 2018.

Streambank Species	Left Bank	Left Bank Cover Class	Right Bank	Right Bank Cover Class	WMVC Indicator Status*
<i>Agrostis stolonifera</i>	X	0	X	0	FAC
<i>Alnus incana</i>			X	0	FACW
<i>Bromus inermis</i>	X	1	X	2	UPL
<i>Carex stipata</i>	X	0			OBL
<i>Cornus alba</i>	X	0	X	1	FACW
<i>Elymus repens</i>	X	1	X	1	FAC
<i>Epilobium ciliatum</i>	X	0			FACW
<i>Equisetum arvense</i>	X	1	X	1	FAC
<i>Helianthus maximiliani</i>	X	1			UPL
<i>Lactuca serriola</i>			X	0	FACU
<i>Medicago lupulina</i>	X	0			FACU
<i>Melilotus officinalis</i>	X	0			FACU
<i>Phalaris arundinacea</i> **	X	5	X	3	FACW
<i>Salix bebbiana</i>	X	0			FACW
<i>Salix drummondiana</i>	X	0			FACW
<i>Sonchus arvensis</i>	X	0			FACU
<i>Tanacetum vulgare</i>			X	0	FACU
<i>Thlaspi arvense</i>			X	0	UPL

*2016 National Wetland Plant List; *Western Mountains, Valleys, and Coasts* (WMVC) (Lichvar *et al.* 2016)

** Dominant species observed along Ashley Creek stream banks

Classification Values and Percent Cover Classes: 0 = <1%, 1 = 1-5%, 2 = 6-10%, 3 = 11-20%, 4 = 21-50%, 5 = >50%

4.3. Noxious Weed Inventory

Fourteen infestations of four Montana Listed Priority 2B noxious weeds were mapped within the riparian corridor at the Ashley Creek stream mitigation site and are listed in Table 4. Noxious weed occurrences are displayed on Figure 3 in Appendix A with the exception of those observed in trace amounts, which were not mapped. Spotted knapweed (*Centaurea stoebe*) was observed in isolated trace amounts, and was therefore not mapped, but is included in Table 4. A low cover class (1 to 5 percent) was identified for all mapped weed occurrences within the project area. An estimated 6% of the project area has been colonized by noxious weeds, with common tansy (*Tanacetum vulgare*) identified as the most prevalent noxious weed observed on site. Cheatgrass (*Bromus tectorum*), a Priority 3 regulated weed species (not noxious), was also observed within the site.

Table 4. Montana State listed noxious weed and regulated species observed in 2018 at the Ashley Creek Stream Mitigation Site.

Category*	Scientific Name	Common Name
Priority 2B	<i>Centaurea stoebe</i>	Spotted Knapweed
	<i>Cirsium arvense</i>	Canadian Thistle
	<i>Convolvulus arvensis</i>	Field Bindweed
	<i>Cynoglossum officinale</i>	Gypsy-Flower
	<i>Tanacetum vulgare</i>	Common Tansy
Priority 3 State Regulated	<i>Bromus tectorum</i>	Cheatgrass

*Based on the Montana Department of Agriculture's Noxious Weed List, February 2017.

4.4. Woody Plant Survival

Woody plantings observed included bog birch, serviceberry, chokecherry, Woods' rose, snowberry, coyote willow, Bebb's willow, Drummond's willow, speckled alder, and red osier dogwood. Table 5 indicates the total number of woody plantings observed and the number of those that remained alive. The Ashley Creek planting plan called for installation of 130 trees and shrubs. As compared to the planting plan, 46% (60 of 130 plants) remain alive eight years following construction. Increased mortality of woody shrubs is most likely due to erosion occurring along the lower banks (particularly along the south bank) and lack of direct sunlight and precipitation to shrubs installed beneath the bridge decks.

Table 5. Woody plant survival at the Ashley Creek stream mitigation site in 2013 through 2015, and 2018.

Year	Total Plants Inspected	Surviving Plants	# of Woody Plantings in Design	Plant Survival based on Planting Plan
2013	99	93	130	72%
2014	73	66		51%
2015	106	92		71%
2018	65	60		46%

4.5. Bank Erosion Inventory

Previous monitoring reports documented bank erosion beneath the bridge and in the vicinity of a storm water culvert outlet. The following section provides an updated bank erosion inventory where new erosion is occurring and where previous erosion has been addressed. Photos of each eroding bank are included in Appendix C of this report, while Figure 2 in Appendix A provides the locations of each eroding bank. The total length of eroding bank along the reconstructed segment of Ashley Creek was 250 feet, or 29% of the total bank length of 860 feet. Of the 250 feet of eroding bank, 155 feet (62%) occurs beneath the highway bridge

Eroding bank EBL1 was originally documented in 2013 along the outlet of a storm water culvert discharging into Ashley Creek upstream of the highway bridge. During the first construction phase of the project, riprap was improperly placed below the culvert outlet to protect the bank from erosion, causing it to slough into the creek. During the most recent construction phase of the project, additional riprap was placed and keyed into the stream bed. As a result, this bank has stabilized and is no longer classified as eroding.

Eroding banks EBR1 and EBR2 occur along the south side of the channel. Inspection of the site in 2018 revealed erosion is now occurring along the previously stable segment of bank between EBR1 and EBR2. As a result, this bank erosion segment will be referred to as EBR1-2.

Erosion along bank EBR1-2 begins along a high terrace that was not disturbed during construction of the project, extends along the straight segment of the channel, and terminates at the pedestrian bridge over Ashley Creek. The eroding bank length increased from 53 feet to 97 feet in 2015, and has now lengthened to 205 feet. Of the 205 feet of erosion along this bank, 110 feet occurs beneath the bridge deck (Additional Photos 3 and 4 in Appendix C). Erosion along this bank appears to stem from saturation of fine-grained bank materials during high flows followed by sloughing of the lower bank. Vegetation along these banks does not appear capable of withstanding erosion and sloughing following high flows. This action has resulted in the exposure of bare ground along a steep lower bank angle. A clay lens exists along the toe of the bank which protects it from more rapidly eroding; however it does not protect the bank from sloughing. The upper bank along EBR1-2 also shows signs of instability, with several cracks and sloughs evident. Erosion of the upper bank may be due to a combination of lower bank failure and increased surface runoff from the adjacent bike/foot path. Erosion severity along this bank is considered high due to the lack of vegetation capable of stabilizing the bank, the relatively steep bank angle, fine grained bank materials, and lack of functional floodplain along this segment of the channel. Due to these factors, erosion is likely to continue along this bank, albeit at a slow pace due to the presence of the clay lens.

Eroding bank EBL2 also occurs along the straight channel segment of Ashley Creek opposite EBR1-2. This bank was documented as eroding during the 2014 monitoring event, and appears to be relatively stable with the exception of upper bank sloughing. The eroding bank length at EBL2 remains at 40 feet as documented in 2014. Bank

conditions and causes of erosion are identical to EBR1-2, with fine grained soils, relatively steep bank slopes, and lack of functional floodplain adjacent to the channel. A clay lens also protects the left bank from more accelerated erosion.

4.6. Channel Form

The presence of pool and riffle habitats within the project reach are illustrated by the results of perpendicular transect and longitudinal profile surveys of the channel bed. Bankfull widths and maximum depths surveyed at two pools and two riffles within the project reach are summarized in Table 6, while plotted survey results are included in Appendix B.

The longitudinal profile indicates three distinct pools occur within the reach, and have maintained their depths throughout the monitoring period. A deep pool exists at the upstream end of the project reach, where the newly aligned segment of Ashley Creek turns east. Transect #1 runs through this pool, which is formed by a tight meander bend in the channel generating scour against the riprapped north bank. This pool exhibits a bankfull width of 45.5 feet, maximum depth of 10.1 feet, with a well-developed floodplain bench on the south side of the channel. Surveys indicate the point bar along the right (south) bank initially extended northward, but has since retreated. It should be noted the left (north) bank of this transect has been riprapped. Surveying through riprap can often lead to varying results based on the exact location of surveyed points; therefore elevation changes along the left bank are not attributed to bank retreat or erosion.

Transect #2 runs through a second pool which has formed along a straight channel segment between Station 1+40 and 2+30. The bankfull width of the channel at Transect #2 has reduced from 31 to 26.5 feet due to a bar developing on the left (north) side of the channel. The developing bar is immediately downstream of a culvert outlet that was repaired in 2015 by placing additional rock along the toe of the bank. This rock may be contributing to the bar development, which is likely to direct water toward the south bank. This bank (EBR1-2) shows continued signs of instability and bank sloughing; however the clay lens at the bank toe has protected it from more severe lateral migration.

Transect #3 runs through a 50-foot riffle that extends from Station 2+30 to 2+80. Bank erosion has been relatively limited here, also due to the clay lens evident at the bank toe. The bankfull width and depth at Transect #3 have remained relatively consistent over the monitoring period, and are 26.3 and 2.7 feet respectively.

Transect #4 is located just upstream of the confluence with Spring Creek. As shown in the longitudinal profile, its location lies at the tail end of the third pool, and is approximately 20 feet upstream of the next riffle crest. The channel has exhibited minor changes since 2013, and has a bankfull width of 28 feet and maximum depth of 2.8 feet.

Table 6. Channel width and depth surveyed at Ashley Creek transects.

Transect	Type	Maximum Depth (ft)				Bankfull Width (ft)			
		2013	2014	2015	2018	2013	2014*	2015	2018
1	Pool	**	9.9	10.1	10.1	43.8	43.6	45.1	45.5
2	Pool	**	8.2	7.9	7.8	29.0	30.8	31.0	26.5
3	Riffle	2.6	2.8	2.8	2.7	26.3	26.3	27.0	26.3
4	Riffle	3	2.7	2.6	2.9	30.0	29.5	28.5	28.0
Average Riffles		2.8	2.8	2.7	2.8	28.2	27.9	27.8	27.1
Average Pools		N/A	9.1	9.0	9.0	36.4	37.2	38.1	36.0

** Maximum depth was not surveyed at pools in 2013.

4.7. Wildlife Documentation

Table 7 provides a comprehensive list of wildlife observed on site during each of the four monitoring events. No new wildlife species were observed in 2018. The relatively low number of species observed is attributed to the proximity of the project to Highway 93, frequent usage of the bike path next to the stream channel, and an overall lack of mature riparian habitat.

Table 7. Comprehensive list of wildlife species observed at Ashley Creek.

Common Name	Scientific Name
Birds	
American Crow	<i>Corvus brachyrhynchos</i>
American Robin	<i>Turdus migratorius</i>
Black-billed Magpie	<i>Pica hudsonia</i>
Black-capped chickadee	<i>Poecile atricapillus</i>
Canada Goose	<i>Branta canadensis</i>
Common Raven	<i>Corvus corax</i>
Mallard	<i>Anas platyrhynchos</i>
Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Sparrow sp.	<i>Passer</i> sp.
Swallow sp.	<i>Tachycineta</i> sp.
Mammals	
Raccoon (tracks)	<i>Procyon lotor</i>
White-tailed Deer (tracks)	<i>Odocoileus virginianus</i>

5.0 COMPARISON OF RESULTS TO PERFORMANCE STANDARDS

Monitoring of the modified segment of Ashley Creek is intended to document whether the site is meeting, or trending toward meeting the performance standards outlined in the monitoring plan. The fourth year of monitoring suggests three of the six quantitative performance standards are being met eight years after the project was constructed (Table 8). Channel form success is considered a qualitative criterion, and is discussed in more detail in the following section. Additional reporting requirements including photo documentation of the project site, and as-built topographic surveys have been completed and are included as appendices to this annual monitoring report to provide further evidence of the site's condition.

Table 8. Summary of performance criteria and reporting requirements, Ashley Creek stream mitigation site, 2018.

Type	Parameter	Performance Standard	Status	Site Meeting Performance Standards?
Quantitative Performance Criteria	Riparian Buffer Establishment	1a. 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 transect surveys indicate 69% of the riparian areas have revegetated with non-noxious weed species.	YES
		1b. Montana State-listed noxious weeds do not exceed 10% cover	Vegetation surveys indicate 6% cover of the project area by noxious weeds.	YES
	Vegetation Success	2a. Combined aerial cover of riparian and stream bank vegetation communities is at least 70%	Combined aerial cover of riparian and stream bank vegetation communities is 75% .	YES
		2b. Planted trees and shrubs must exhibit 50% survival after 5 years	Inspections indicated 46% survival of woody plantings, based on planting plan, 6 years following installation	NO
	Vegetation along Stream Banks	3. Majority of plants on the stream bank must have root stability indices of at least 6	Dominant vegetation along 50% of both stream banks is reed canarygrass, with root stability index of 9, while the other 50% of both stream banks is dominated by bare ground with a root stability index of 1.	NO
	Stream Bank Stability Success	4. Less than 25% of bank length is unstable and classified as eroding bank.	Total eroding stream bank length is 250', or 29% of the total bank length within the project reach.	NO
Qualitative Performance Criteria	Channel Form Success	5. Achieved when the stream stabilizes, includes pool and riffles, allows for flood events to occupy the floodplain, and the habitat features such as riparian plant communities have successfully established along stream banks.	Channel form narrative included in Section 5.5 of 2015 Monitoring Report	NO

5.1. Riparian Buffer Establishment

Performance criteria for vegetation cover require 50% or greater cover of non-noxious weed species by the end of the monitoring period. The fourth year monitoring results indicated 69% of the riparian areas were vegetated with non-noxious species, with 75% total cover, and 6% noxious weed cover. Bare ground was observed in 2018 on both banks, and was 5% higher than observed during the 2015 monitoring event.

Noxious weeds comprised approximately 6% of the riparian transects, therefore the site is currently meeting the performance goal of 10% or less noxious weed cover. Although noxious weed infestations were scattered along the entire length of both banks, they were most heavily concentrated near the pedestrian bridge and adjacent to the newly constructed highway overpass.

5.2. Vegetation Success

Riparian vegetation transects were established along the narrowly vegetated zone between the active stream channel and the adjacent pedestrian trail / vehicle access road. These riparian areas included the 3-foot stream bank vegetation zone on both banks; therefore, the results provided in Table 1 are also reflective of the combined stream bank and riparian zones. These results indicate the combined aerial cover for riparian and stream bank vegetation communities is 75%, which meets the performance criteria goal of >70% cover. While the combined aerial cover is meeting the success criteria, low sunlight beneath the bridge overpass may be limiting riparian vegetation establishment. With the addition of a second bridge over Ashley Creek, 48% (220 of 460 feet) of the riparian transects are affected by partial or total shade.

A total of 65 trees and shrubs were located within the project area. Of these, 60 remained alive. The planting plan sheet called for 130 planted trees and shrubs; therefore, 65 additional trees/shrubs were not located. If 100% of the planted trees/shrubs that were not located are assumed dead, the current survival rate is 46% (60 of 130 plants). The performance criteria requires >50% survival five years following construction. As compared to the planting plan for Ashley Creek, survival rates of woody vegetation installed within the project area are not currently meeting the success criteria. The majority of woody shrubs were installed beneath the bridges, which have permanently shaded the banks beneath them and likely hinder the ability of both woody and herbaceous plants to thrive.

5.3. Stream Bank Vegetation Composition

Reed canary grass comprised greater than 50% cover along the left stream bank and between 11 and 20% on the right. Bare ground, due to bank erosion and limited sunlight beneath the bridge overpass, accounted for greater than 50% of the right stream bank and between 11 and 20% on the left. Therefore, reed canary grass, with a root stability index of 9, dominated approximately half of the streambank vegetation, while the other half was dominated by bare ground, with a root stability index of 1. Based on the high amount of bare ground present within the project reach, the stream bank vegetation is not currently meeting the success criteria.

Placement of the 110-foot wide bridge over Ashley Creek and its adjacent riparian corridor has affected the ability of vegetation to successfully establish due to a lack of direct sunlight and precipitation. To help achieve the desired performance standards, MDT may wish to revegetate the sloped banks with more shade tolerant species.

5.4. Stream Bank Stability Success

The stream bank inventory identified two eroding stream banks, totaling 250 feet, or 29% of the total project bank length of 860 feet. Of this 250 feet, approximately 155 feet (62%) of erosion is occurring beneath the bridge decks. Eroding bank EBL1 and EBL2 have combined into one long eroding bank segment that is currently 205 feet long. Although inspection of the surveyed transects indicates the erosion rate is not particularly rapid along this bank, lateral movement of the toe has resulted in a steep bank angle, upper bank sloughing, soils and vegetation collapsing into the channel. The toe of the bank is partially protected by a clay lens; however the steep bank angle, lack of floodplain to dissipate energy during high flows, and poorly establishing vegetation along the stream banks will likely result in continued; albeit slow erosion along this bank. Success criteria for channel stability indicate less than 25% of the banks may exhibit erosion; which is currently not being met along Ashley Creek.

5.5. Channel Form Success

The development of pool and riffle habitat features within this segment of Ashley Creek is evident by inspecting the longitudinal profile and transects at pool and riffle features (Appendix B). Three pools have continued to exhibit deeper habitats within the reach, each of which are separated by a distinct riffle. Pool features occur along a sharp meander bend at the upstream extent of the project and within the straight segment of the channel. Pool depths are considerably deep (8-10 feet) and provide adequate, slow water habitat for fish. Maximum riffle depths average 2.7 feet, and continue to provide shallower habitat for insect production.

Bank erosion has been observed within the project reach along the straight segment of the channel upstream and beneath the Highway 93 Bridge. Erosion rates do not appear overly rapid, (<1 foot/year); however, the length of erosion observed has increased during each of the past four monitoring events. An eroding bank that was previously identified where a storm water culvert outlets to the channel has been repaired; however the south bank shows continued signs of instability. A vertical grade control structure exists at the downstream extent of the project reach, immediately below the confluence of Spring Creek. This grade control will provide long term vertical stability of the altered segment of Ashley Creek.

Construction of the bypass highway over Ashley Creek included incorporating a bike path on both sides of the creek beneath the new bridge. These bike paths were built on embankments well above the floodplain to ensure their protection during high water events. While these embankments provide adequate elevation to protect the bike paths, they encroach against the channel and eliminate a functional floodplain throughout the project reach. During high water events, Ashley Creek must pass

through this confined reach, which contains fine grained stream banks graded to a relatively steep slope. As a result of these conditions, the lower slopes of the embankments are eroding and preventing establishment of stable vegetation communities. Erosion along the lower banks is expected to continue as the channel widens in an effort to establish a functional floodplain. Additionally, low sunlight and lack of precipitation beneath the bridge overpass is limiting riparian vegetation establishment, thus influencing overall channel form success. Therefore, channel form along Ashley creek is not currently meeting the success criteria, and additional actions are likely warranted to prevent continued erosion.

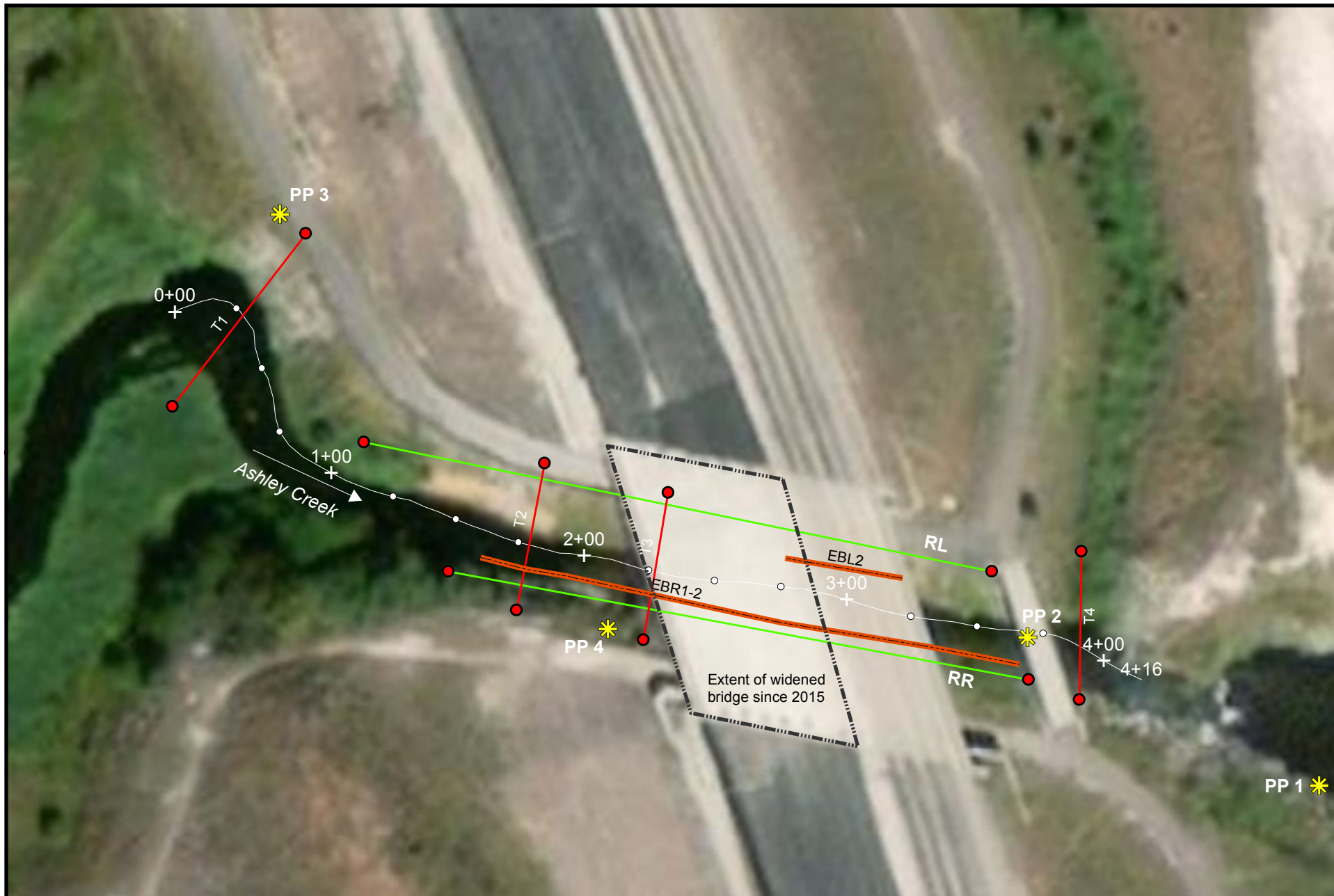
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Appendix A

Project Site Maps

MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana



Legend

- ★ Photo Points
- Channel Thalweg
- + Major Station (100')
- o Minor Station (25')
- Eroding Banks
- Pool and Riffle Transects
- Riparian Transects

0 25 50 100 Feet



Ashley Creek - 2018 Monitoring Features

Figure 2

Date: 10/24/2018

Ashley_features2018.mxd



Legend

Vegetation Community Boundary

◆ Cirsium arvense

✱ Convolvulus arvensis

▲ Cynoglossum officinale

★ Tanacetum vulgare

① Phalaris Community

③ Phalaris/Elymus Community

④ Bare Ground/Elymus Community

⑤ Cornus/Alnus Community

Ashley Creek - 2018 Noxious Weeds and Vegetation Communities

Figure 3

Date: 10/24/2018

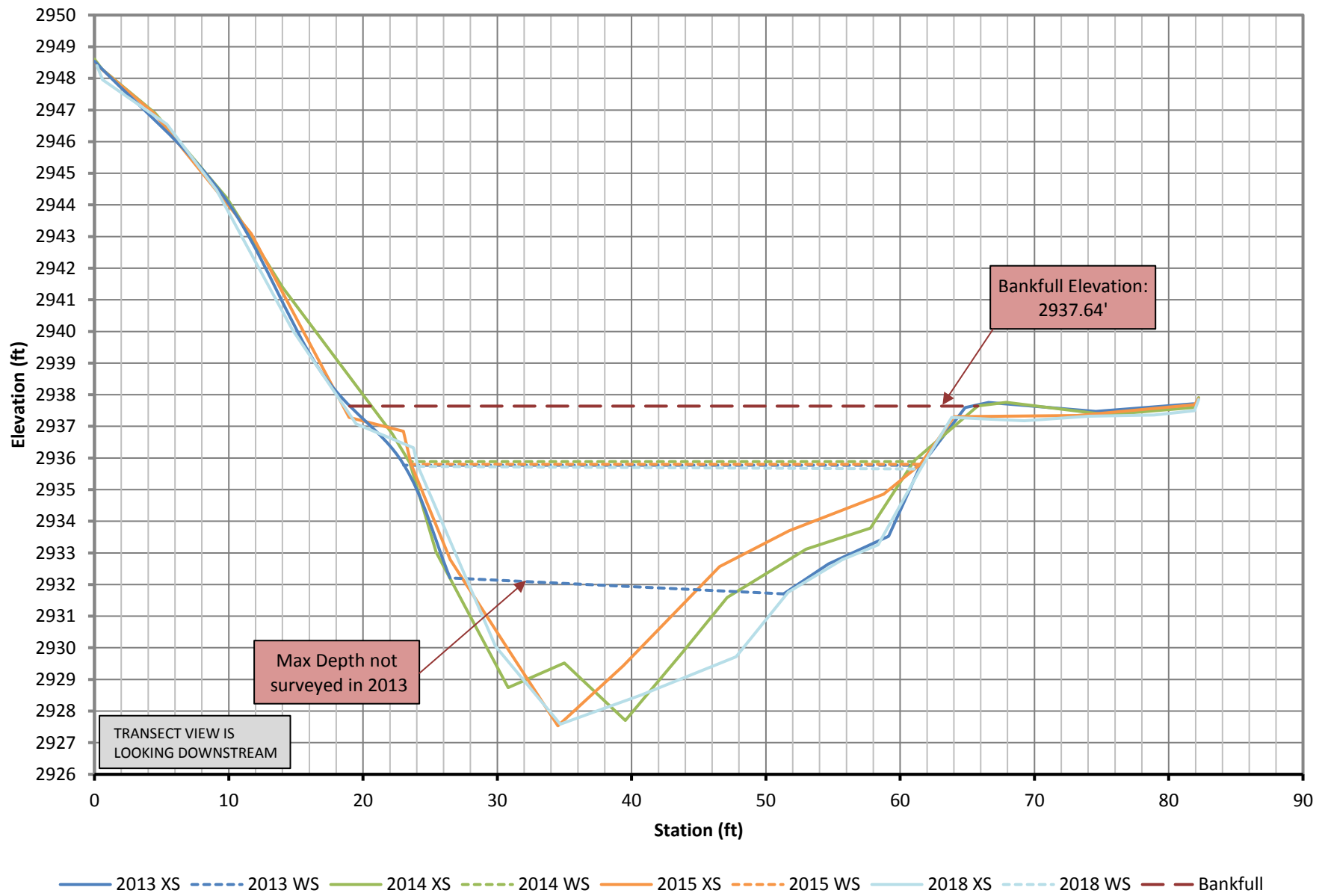
Ashley_monitor2018.mxd

Appendix B

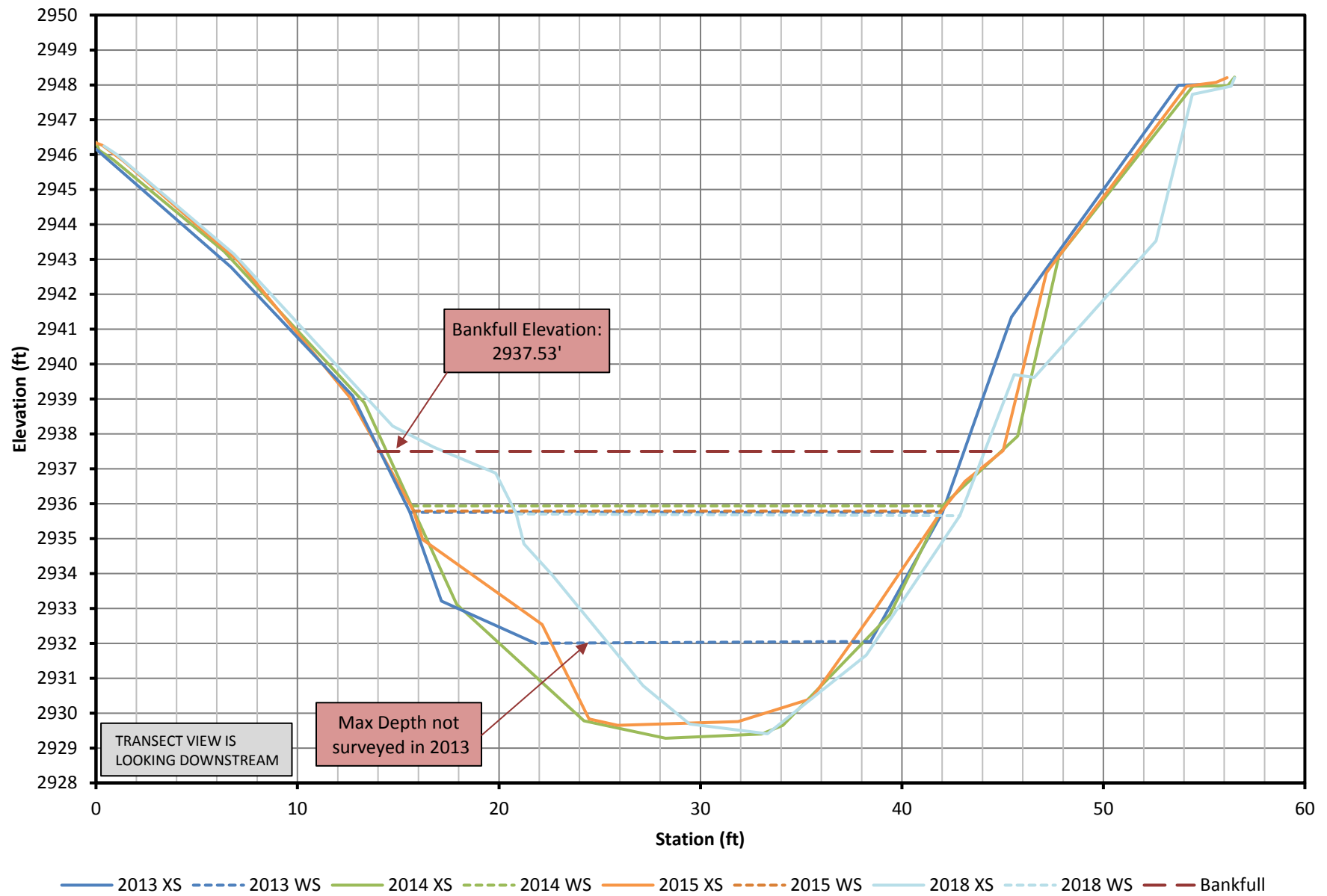
Perpendicular Transect Plots and Longitudinal Profile

MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana

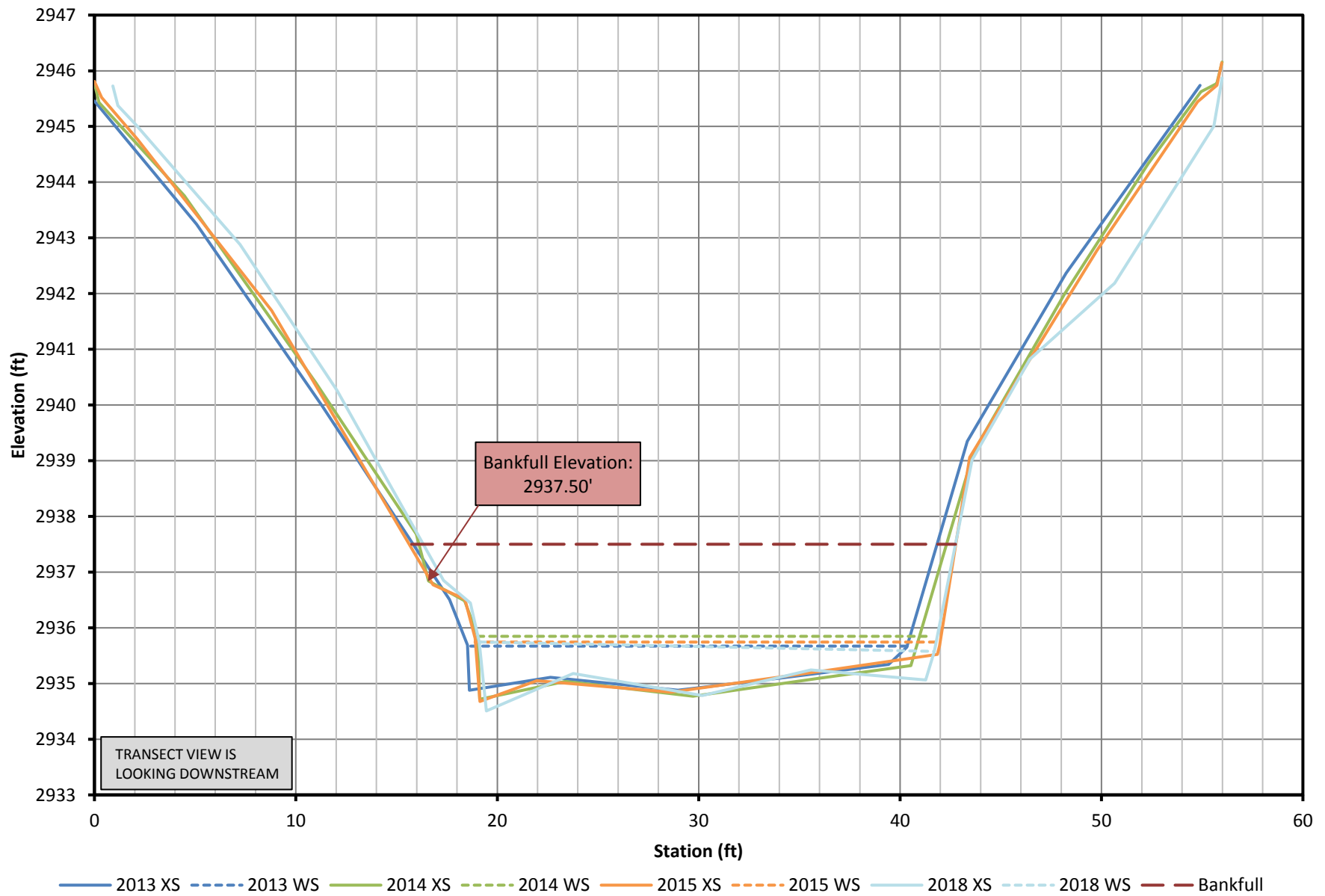
Ashley Creek Transect #1 - Pool



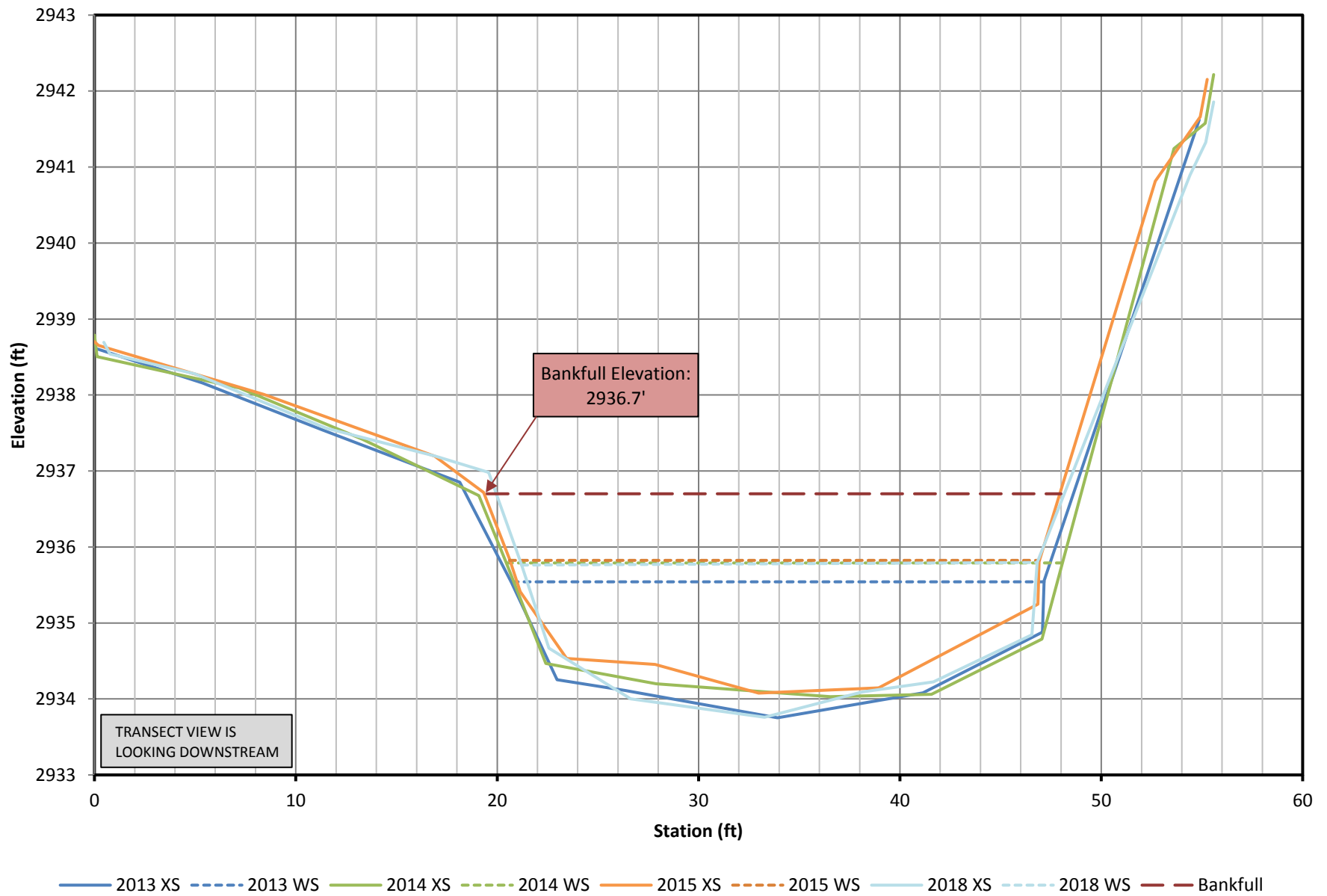
Ashley Creek Transect #2 - Pool



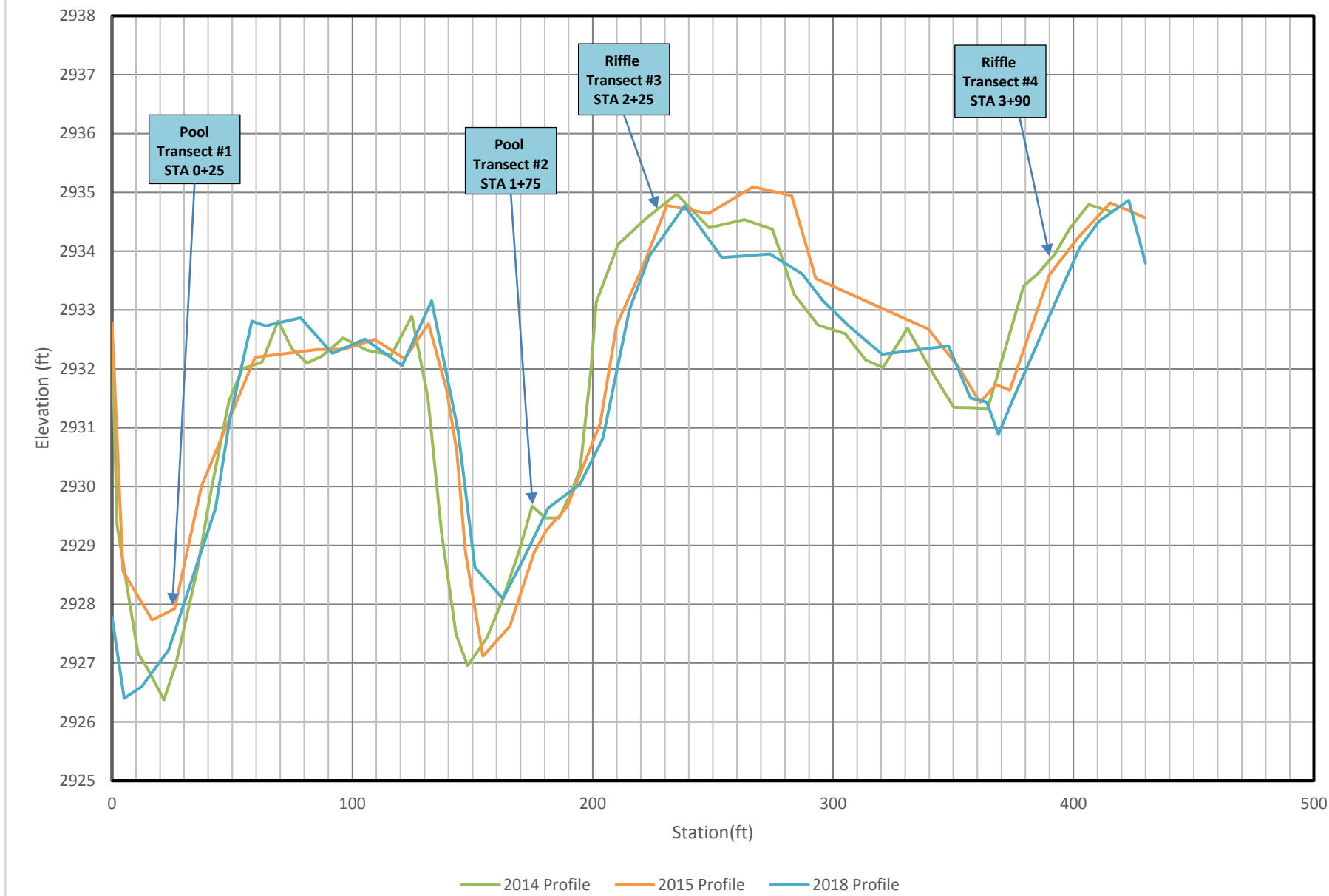
Ashley Creek Transect #3 - Riffle



Ashley Creek Transect #4 - Riffle



Ashley Creek Longitudinal Profiles



Appendix C

Project Area Photos

MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2018 Monitoring Events



2013



2018

Photo Point 1: View of grade control structure downstream of project area. **Compass:** 315 (Northwest)



2013



2018

Photo Point 2: View looking upstream from pedestrian bridge. **Compass:** 315 (Northwest)



2013



2018

Photo 3.1: View looking south at upstream end of project site. **Compass:** 180 (South)

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2018 Monitoring Events



2013



2018

Photo 3.2: View looking at upstream end of project site. **Compass:** 225 (Southwest)



2013



2018

Photo 4.1: View looking downstream from south bank. **Compass** 90 (East)



2013



2018

Photo 4.2: View of channel looking upstream from south bank. **Compass** 315 (Northwest)

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2018 Monitoring Events



2013

2018

Additional Photo 1: View of Ashley/Spring Creek confluence.



2013

2018

Additional Photo 2: Upper end of Eroding Bank EBR1 –2



2013

2018

Additional Photo 3: Middle of Eroding Bank EBR1-2.

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2018 Monitoring Events



2018

Additional Photo 4: Middle of Eroding Bank EBR1-2.



2013



2018

Additional Photo 5: Downstream end of eroding Bank EBR 1-2.



2014



2018

Additional Photo 6: Stabilized culvert outlet.

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2018 Monitoring Events



2013



2018

Additional Photo 7: Eroding Bank EBL2



2018

Additional Photo 8: Toe of eroding bank EBR1-2 showing bank sloughing.



2018

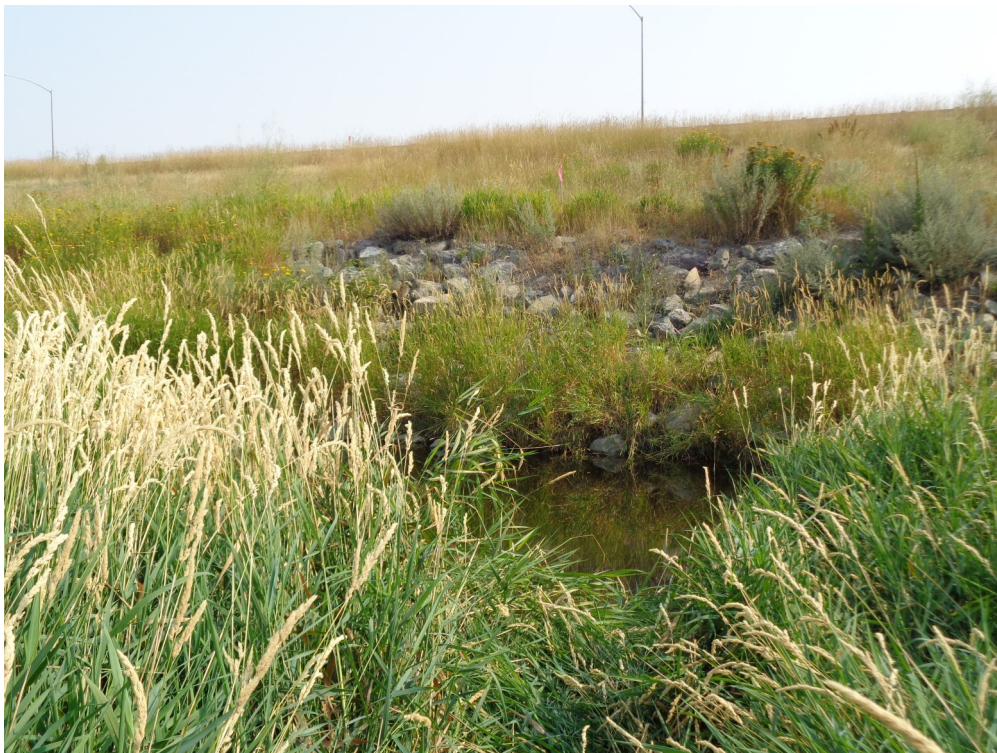
Additional Photo 9: Toe of eroding bank EBR1-2 showing potential loss of woody vegetation.

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T1 Left: Looking South West to T1 Right



T1 Right: Looking North East to T1 Left

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T1 Left Looking South West Upstream



T1 Left: Looking South East Downstream

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T1 Right: Looking North Upstream



T1 Right: Looking East down stream

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T2 Left: Looking South to T2 Right



T2 Right: Looking North to T2 Left

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T2 Left Looking West Upstream



T2 Left: Looking East down stream

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T2: Looking West from Creek



T2: Looking East from creek

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T2 Right: Looking North Upstream



T2 Right: Looking East down stream

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T3 Left: Looking South West to T3 Right



T3 Right: Looking North East to T3 Left

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T3 Left Looking West Upstream



T3 Left: Looking East down stream



PHOTOGRAPHIC INSPECTION INFORMATION

Page 10 of 15

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T3: Looking West from Creek

Photo too dark to include in Photo Log

T3: Looking East from Creek

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T3 Right: Looking West Upstream



T3 Right: Looking East down stream

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T4 Left: Looking South to T4 Right



T4 Right: Looking North to T4 Left (mouth of Spring Creek)

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK
DATE: 8-14-18



T1 Left Looking West Upstream



T1 Left: Looking East down stream

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T4: Looking West from Creek



T4: Looking East from Creek

PROJECT NAME: 2018 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 8-14-18



T4 Right: Looking West Upstream



T4 Right: Looking East down stream

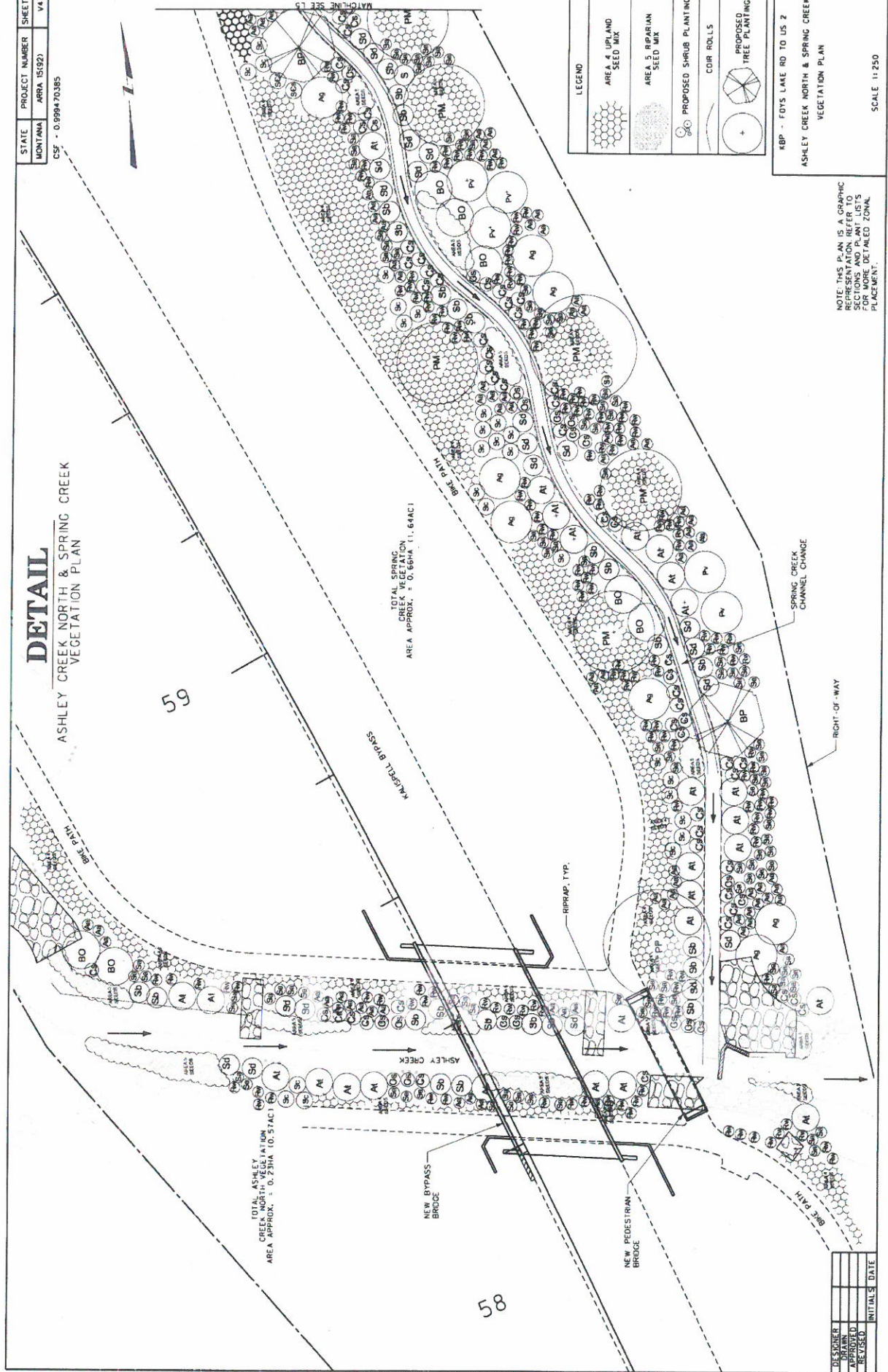
Appendix D

Channel Construction Details

MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana

STATE	PROJECT NUMBER	SHEET NO.
MONTANA	ARRA 151921	VA
CSF - 0.99470385		

DETAIL ASHLEY CREEK NORTH & SPRING CREEK VEGETATION PLAN



LEGEND	
	AREA 4 UPLAND SEED MIX
	AREA 5 RIPARIAN SEED MIX
	PROPOSED SHRUB PLANTING
	COR ROLL
	PROPOSED TREE PLANTING

KBP - FOYS LAKE RD TO US 2
 ASHLEY CREEK NORTH & SPRING CREEK
 VEGETATION PLAN

NOTE: THIS PLAN IS A GRAPHIC REPRESENTATION OF THE VEGETATION SECTIONS AND PLANT LISTS FOR MORE DETAILED ZONAL PLACEMENT.

SCALE 1:250



SE Engineering, Inc.

DESIGNER	DATE
DRAWN	
APPROVED	
REVISED	

