MONTANA DEPARTMENT OF TRANSPORTATION
STREAM MITIGATION MONITORING REPORT

Ashley Creek
Flathead County, Montana

Project Completed: 2010
Monitoring Report #2: December, 2014

Prepared for:

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Helena, MT 59620-1001

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MONTANA DEPARTMENT OF TRANSPORTATION

STREAM MITIGATION MONITORING REPORT #2

YEAR 2014

Ashley Creek
Flathead County, Montana

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

USACE Permit: NWO-2009-01808-MTM

Prepared for:

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Cover Photo: Maximilian sunflower along the banks of the Ashley Creek Stream Mitigation Site.

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 the results of the second year of post construction mitigation monitoring along this segment of Ashley Creek and compares these 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 four years following the project's completion.

This project's goal 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 and outlined below.

<u>Quantitative success criteria for Ashley Creek:</u>

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 ≥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 second year monitoring of the Ashley Creek project 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 and other similar mitigation sites. Additional reporting requirements including a longitudinal stream profile, repeated survey results at four perpendicular transects, a planting schematic from the approved design, photo documentation of the project site, and maps indicating the endpoints of riparian belt transects, perpendicular transect surveys and locations of noxious weed infestations are included as Appendices to this report.

2.0 SITE LOCATION

The project reach includes approximately 430 feet of Ashley Creek extending to either side of the U.S. Highway 93 ALT Bridge (Figure 1). The site extends approximately 275 feet upstream and 125 feet downstream of the Highway 93 Bridge to a rock grade control structure downstream of a pedestrian bridge. The project site is located in Section 13, Township 7 North, Range 22 West, in Flathead County, Montana.

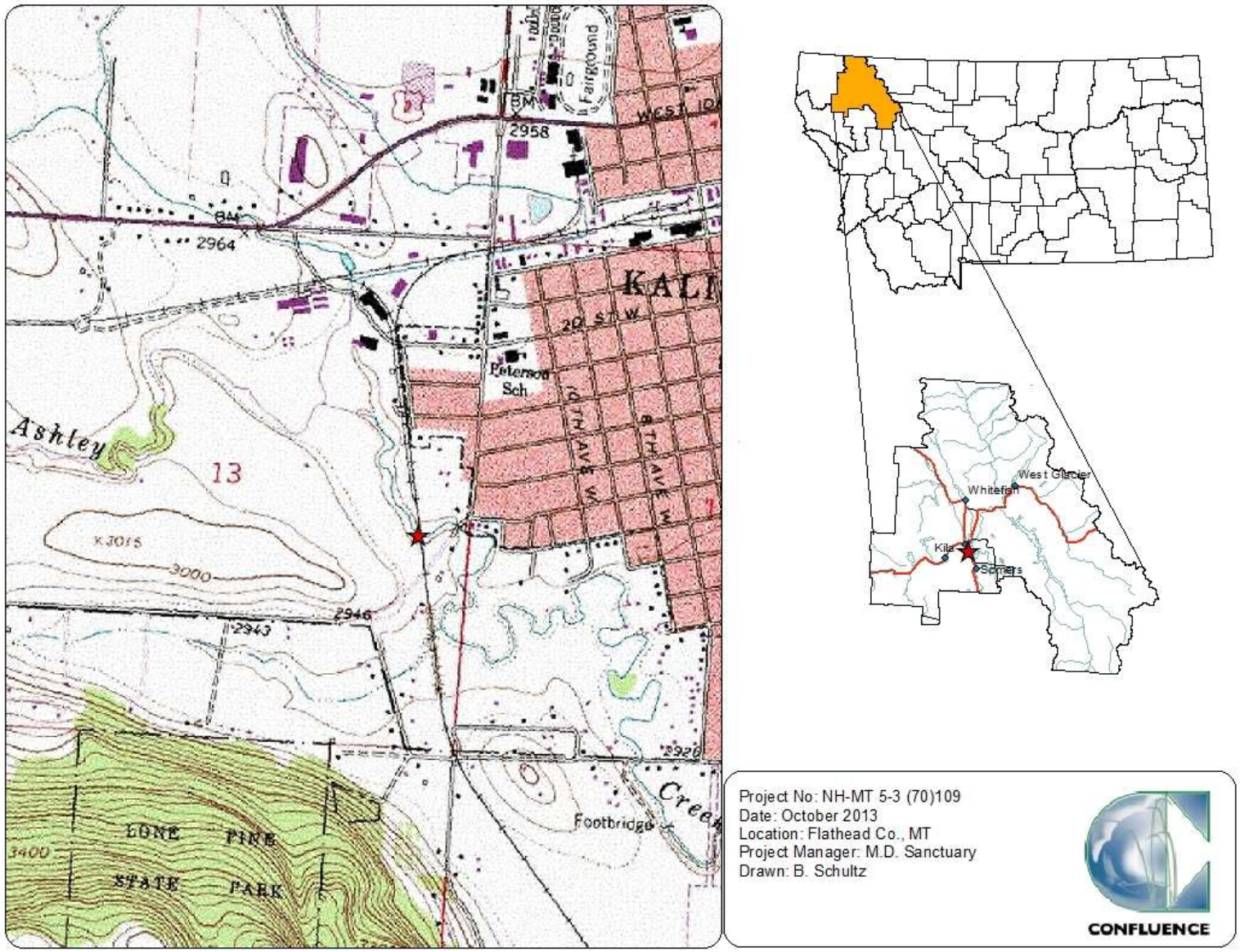


Figure 1. Location of the Ashley Creek stream mitigation monitoring site.

3.0 MONITORING METHODS

Monitoring field crews visited the project site on August 19, 2014 while survey crews visited the site on July 30, 2014. The following data were collected at the Ashley Creek stream mitigation site:

3.1. Vegetation Inventories and Community Mapping

Two riparian belt transects established during the first monitoring event in 2013 were resurveyed to document areal percent cover of total vegetation, woody vegetation, and noxious weeds. The riparian belt transect on the right (south) bank runs parallel to the channel for 208 feet, while the riparian transect on the left (north) bank is 243 feet long (Figure 2, Appendix A).

A comprehensive vegetation inventory was conducted along both stream banks, and included documenting dominant species presence, percent cover of each species, and a list of all plant species observed within three feet of the active channel. The stream bank vegetation inventory included the entire length of both stream banks within the project reach. Plant species identified along the stream banks were assigned plant stability rating based on Burton et al., 2011.

The project site was visually inspected to document the presence of noxious weeds. All noxious weed infestations were mapped on aerial photographs, with species, and extents noted. Observations of isolated noxious weeds were noted in the species lists, but not mapped.

The project area was visually inspected to document woody vegetation plantings. The inspection included recording the total number of live and dead woody plantings observed. Dominant vegetation communities within the project area were mapped on aerial photographs to document vegetative establishment within both upland and riparian zones.

3.2. Bank Erosion Inventory

Both stream banks within the project reach were visually inspected to document eroding banks. Each eroding bank within the project reach was photo-documented. Data collected at each eroding bank included bank length and potential causes of bank erosion.

3.3. Channel Surveys

Four perpendicular transects (cross sections) were re-surveyed; two at riffles and two at pools. A longitudinal profile of the channel thalweg was surveyed to document bedform complexity and aquatic habitat conditions.

3.4. Photo-Documentation

Photo documentation of the site was repeated at several locations to document vegetation establishment and stream bank conditions. Four photo documentation points were established during the 2013 monitoring event to document changes in the

site over time. Photos were taken facing upstream, downstream, left and right from the center of the channel, and at the endpoints of each perpendicular transect.

3.5. 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.

4.0 RESULTS

4.1. Riparian and Stream Bank Vegetation Inventory

Table 1 summarizes percent cover of total vegetation, bare ground, woody vegetation, and noxious weeds for the riparian and stream bank transects surveyed along Ashley Creek. Areas adjacent to the channel were re-sloped at a consistent angle from the bed of the channel to the top of the embankment; therefore, no definable stream banks exist on either side of the channel. As a result, the stream banks along Ashley Creek were considered within the riparian vegetation transect. In 2014, the project reach exhibited 28% coverage by woody species, 12% by noxious weeds, and 8% bare ground. Overall, 80% of the reach exhibited desirable vegetative cover (92% total vegetative cover minus 12% noxious weeds).

Table 1. Percent cover along riparian belt transects at Ashley Creek in 2013 and 2014.

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

Dominant species recorded along the riparian and stream bank transects were combined with visual observations in other areas to develop a vegetation community map (Figure 3, Appendix A). Slopes are dominated by 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.

Table 2 is a comprehensive list of plant species observed on site. In 2014, 66 plant species were observed on site, representing an increase by ten species from the previous monitoring event. In 2014, 39% of the species observed were hydrophytic based on the 2014 National Wetland Plant List (NWPL) (Lichvar *et al*., 2014).

Table 2. Comprehensive vegetative species list for Ashley Creek stream mitigation site in 2013 and 2014

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

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

4.2. Stream Bank Vegetation Composition

In 2014, 24 plant species were identified along the stream banks, defined as the area within three feet of the active channel (Table 3). Stability ratings were assigned to each species observed along the banks to help determine overall bank stability. Stability ratings 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). Stability indices (Burton *et al*. 2011) are provided for 16 of these 24 plants, while the remaining 9 species observed do not have assigned indices. Scores for plants that do not have designated stability indices are listed in Table 3 as N/A. Four of the 16 species (25%) having stability indices scored 6 or higher. The dominant species observed along stream banks was reed canary grass (*Phalaris arundinacea*), which has a stability index of 9 and covers approximately 40% of both stream banks.

Table 3. Comprehensive list of stream bank species and accompanying stability index values for the Ashley Creek stream mitigation site in 2014 (from Burton *et al*., 2011).

Streambank Species	Left bank	Right bank	WMVC Indicator Status**	Stability Index
*Phalaris arundinacea**	X	X	FACW	9
Salix bebbiana	X	X	FACW	8.5
Scirpus microcarpus	X		OBL	8.5
Symphoricarpos albus	X		FACU	6
Elymus repens	X	X	FAC	5
Equisetum hyemale	X	X	FACW	5
Pascopyrum smithii	X	X	FACU	5
Rosa woodsii	X	X	FACU	5
Vicia americana	X		FAC	5
Bromus inermis	X		FAC	2
Cirsium arvense	X	X	FAC	2
Melilotus albus	X	X	NL	2
Onopordum acanthium	X		NL	2
Poa palustris	X	X	FAC	2
Rumex crispus	X		FAC	2
Bare Ground	X	X	NL	1
Chenopodium album		X	FACU	N/A
Convolvulus arvensis	X		NL	N/A
Descurainia sophia	X		NL	N/A
Helianthus maximiliani	X	X	UPL	N/A
Lactuca serriola	X	X	FACU	N/A
Medicago sativa	X	X	UPL	N/A
Sonchus arvensis	X		FACU	N/A
Tanacetum vulgare	X	X	FACU	N/A
Thlaspi arvense	X	X	UPL	N/A

**dominant species observed along Ashley Creek stream banks.*
**Based on 2014 NWPL (Lichvar *et al*., 2014).

4.3. Noxious Weed Inventory

The Ashley Creek field assessment identified the presence of five Montana state-listed noxious weeds and one state-regulated species (Table 4). All noxious weed species observed are shown on Figure 3 in Appendix A with exception of those observed in trace amounts, which were not mapped. The combined coverage of all weed species observed within the site was 12% (Table 1).

Table 4. Montana State listed noxious weed and regulated species observed in 2014 at the Ashley Creek Stream Mitigation Site.

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

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

4.4. Woody Plant Survival

Willow, alder, birch, dogwood, snowberry, choke cherry, and Woods rose shrubs were observed as planted woody species. Table 5 indicates a survival rate of 90% for woody plants observed in 2014, a decrease by 4% from 2013 observations. Due to their relatively small size, planted woody shrubs can be difficult to find; therefore, additional shrubs likely exist along the planted corridor than are reported.

Table 5. Woody plant survival at the Ashley Creek stream mitigation site in 2013 and 2014.

YEAR	Total Plants Inspected	Surviving Plants	Plant Survival Percentage
2013	99	93	94%
2014	73	66	90%

4.5. Bank Erosion Inventory

Four bank segments were classified as eroding within the Ashley Creek project site. Photos of each eroding bank are included in Appendix C of this report. Figure 2 in Appendix A provides locations of each eroding bank. The total length of eroding bank length was 189 feet, or 22% of the total project bank length of 860 feet.

Erosion of a 40-foot bank segment at EBL1 is occurring both upstream and downstream of a stormwater culvert. During construction of the project, riprap was placed below the culvert outlet to protect the bank from erosion. Portions of the riprap placed below the culvert had sloughed into the channel. Erosion at this bank was also noted in 2013, and appears to have become more degraded in 2014. A separate inspection (RESPEC,

2014) provided additional details, causes of erosion, and recommended actions to stabilize this bank. This report cited the lack of riprap placement in a key trench at the toe of the slope, poorly graded riprap, and disturbance of fine grained soils during construction as causes for riprap failure and bank instability at this location. Stream bank vegetation consists of reed canary grass, which has an excellent root system capable of withstanding erosion (root stability index score of 9); therefore, lack of vegetation along the bank is not a contributing factor. Erosion severity at this location is considered moderate.

Eroding bank EBR1 occurs against a high terrace with a steep bank angle, which prevents vegetation from establishing. A clay lens was observed along the toe of the slope, which may provide resistance to additional lateral or vertical erosion. The 53-foot segment of eroding bank did not appear to migrate laterally following the first monitoring event in 2013. Erosion severity along this bank is considered moderate due to lack of vegetation, steep bank angle, and presence of fine grained soils.

The channel banks between STA 0+75 to 4+00 (Figure 2, Appendix A) are graded to a slope between 1.5:1 and 2:1, fine grained, and have been constructed to an elevation that provides little to no floodplain relief during high discharges. As a result, these banks are subject to saturation and sloughing during spring runoff events. Erosion along the toe of other banks within the project reach was noted in 2014 that was not in 2013 including at EBL2 (40 feet) and EBR2 (56 feet). Erosion severity of these banks was considered minor and only occurring along the bank toe. Subsequent monitoring will document whether erosion at these locations becomes more severe.

4.6. Channel Form

The formation of pool and riffle habitats within the project reach may be analyzed from the results of perpendicular transect and longitudinal profile surveys of the channel bed (Appendix B). The longitudinal profile indicates the presence of three distinct pools. A deep pool exists at the upstream end of the project reach, where the newly aligned segment of Ashley Creek turns east (transect #1). This scour pool is generated by a tight bend in the channel, causing scour against the north bank, which has been stabilized with riprap. The upper pool exhibits a bankfull depth of approximately 10 feet, with a well-developed floodplain bench on the south side of the channel. A second pool exists downstream of this bend (transect #2) and transitions into a riffle that extends downstream to a third pool forming upstream from a rock grade control structure. Channel surveys conducted in 2013 did not capture the maximum channel depth at transects #1 or #2; therefore max depth and bankfull width parameters were not calculated in the 2013 Ashley Creek monitoring report. All transects were surveyed properly in 2014, with maximum depth and bankfull width provided in Table 6.

Table 6. Channel width and depth surveyed at Ashley Creek transects in 2014.

Transect	Type	Maximum Depth (ft)	Bankfull Width (ft)
		2014	2014
1	Pool	9.9	43.6
2	Pool	9.6	32.4
3	Riffle	3.3	32.6
4	Riffle	2.6	28
Average Riffles		**3.0**	**30.3**
Average Pools		**9.8**	**38.0**

4.7. Wildlife Documentation

Table 6 provides a comprehensive list of wildlife observed on site during the 2013 and 2014 monitoring events. In 2014, five bird species were observed within the project area. 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 during 2013 and 2014 monitoring events.

Common Name	Scientific Name
Birds	
American Crow	***Corvus brachyrhynchos***
American Robin	***Turdus migratorius***
Black-billed Magpie	***Pica hudsonia***
Canada Goose	***Branta canadensis***
Common Raven	*Corvus corax*
Mallard	*Anas platyrhynchos*
Red-winged Blackbird	*Agelaius phoeniceus*
Sparrow Sp.	***Passer sp.***
Swallow sp.	*Tachycineta sp.*
Mammals	
Raccoon	*Procyon lotor*
White-tailed Deer	*Odocoileus virginianus*

Species observed in 2014 are **bolded**.

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 moving toward meeting the performance standards outlined in the monitoring plan. The second year of monitoring suggests five of the six quantitative performance standards are being met four 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 also been completed and are included as appendices to this annual monitoring report.

5.1. Riparian Buffer Establishment

Performance criteria for vegetative cover require 50% or greater cover of non-noxious weed species by the end of the monitoring period. The second year monitoring results indicated 80% of the riparian areas were vegetated with desirable species, with 92% total cover and 12% noxious weeds. Areas of bare ground were observed on both banks, and appeared limited to areas where reseeding efforts did not completely take hold or where bank erosion had occurred. No large patches of bare ground were observed. Overall, the riparian areas adjacent to Ashley Creek are revegetating well with a diverse stand of wetland, upland, and woody species present.

Noxious weed cover was approximately 12% of the project site, with relatively even distribution of weeds on both stream banks. Performance criteria for noxious weeds require 10% or less cover; as a result, weed control efforts along Ashley Creek will be necessary to achieve this performance target. The majority of the riparian areas along the project reach occur on steeply sloped banks within 25 feet of the channel; therefore, chemical treatment may be challenging without compromising water quality. Hand pulling, spot spraying, or biological control methods may be the most effective treatment for weed eradication along Ashley Creek.

5.2. Vegetation Success

Riparian vegetation transects were established along the narrow, 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 80% of the combined riparian and stream bank areas have successfully vegetated with non-noxious weed species, which meets the performance criteria goal of >70% cover.

Observed woody vegetation plantings indicated a survival rate of 90%, which exceeds the performance criteria of >50% five years following construction. Given the short timeframe since these plants were installed, the shrubs observed remain relatively small and will likely provide increased percent cover over time as they mature.
Additional monitoring for one year will determine whether this criteria is met five years following construction.

Table 8. Summary of performance criteria and reporting requirements, Ashley Creek stream mitigation site, 2014.

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 **80%** of the riparian areas have re-vegetated with non-noxious weed species.	**YES**
		1b. Montana State-listed noxious weeds do not exceed 10% cover	Vegetation surveys indicate **12%** cover of the project area by noxious weeds.	**NO**
	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 **80%**.	**YES**
		2b. Planted trees and shrubs must exhibit 50% survival after 5 years	Inspections indicated **90%** survival of observed woody plantings	**YES**
	Vegetation along Streambanks	3. Majority of plants on the river bank must have root stability indexes of at least 6	Dominant species observed along banks is reed canarygrass, with plant stability index of **9**	**YES**
	Streambank Stability Success	4. Less than 25% of bank length is unstable and classified as eroding bank.	Total eroding streambank length is 189', or **22%** of the total bank length within the project reach.	**YES**
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 streambanks.	Channel form narrative included in Section 5.5 of 2014 Monitoring Report	**YES**

5.3. Vegetation Along Stream Banks

The dominant vegetation along Ashley Creek's stream banks is reed canary grass, which scores 9 out of a possible 10 in the stability rating index (Burton *et al*., 2011). The combination of multiple vegetative species with good stability ratings and the dominant vegetation exhibiting a very high stability rating provides evidence that any erosion or bank instability occurring along the project reach is not likely due to inadequate vegetation composition.

Stream bank vegetation inventories along Ashley Creek identified 25% of species had stability scores ≥ 6 when compared to all species having stability scores (Burton *et al*., 2011). This result is considerably lower than reported in 2013, and is primarily due to more conservative stability scores provided by Burton et al. 2011 versus the stability scores used in 2013 (Winward 2000).

5.4. Stream Bank Stability Success

The stream bank inventory identified four eroding stream banks, totaling 189 feet, or 18% of the total project bank length of 860 feet. Eroding bank EBL1 is currently being evaluated by MDT to repair and stabilize as part of a bridge expansion project over Ashley Creek, which is currently scheduled for 2015-2016.

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 surveyed transects at pool and riffle features (Appendix B). Three well developed pools occur within the reach, each separated by a distinct riffle. Pool features exist on the upstream meander bend as well as within the straight segment of the channel. Pool depths are considerably deep (6-10 feet) and provide adequate, slow water habitat for fish. Riffle depths averaged three feet, and provide shallow habitat for insect production.

Bank erosion has been observed within the project reach within the straight segment of the channel beneath the Highway 93 Bridge. Erosion rates do not appear overly rapid, and lateral migration has been limited to between 1-2 feet following construction. Bank repairs at the stormwater culvert outlet upstream of the bridge may be warranted due to improper placement of riprap materials during construction. 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.

The monitoring results collected to date indicate the modified segment of Ashley Creek is close to meeting all of the performance criteria adopted in the monitoring plan four years following construction. If the channel continues to maintain overall stability, vegetation continues to mature, and weed control actions prove effective, the site will successfully achieve all intended performance targets. Project objectives including a) widening 413 feet of Ashley Creek and re-sloping banks to between 1.5:1 and 2:1, and

b) implementing an aggressive re-vegetation plan along the re-sloped banks to re-establish native riparian and upland vegetation have thus far been accomplished.

6.0 MANAGEMENT AND DESIGN RECOMMENDATIONS

6.1. Bank Slopes

Results of the surveyed transects suggest the north bank through the modified channel segment has been graded to a slope ranging from 1.7:1 and 1.9:1, which falls within the range of bank slopes stated in the project's objectives. The height of the north bank between the top of the stream bank and the pedestrian trail is approximately 10 feet. These bank slopes, combined with the bank height results in an incised channel segment with relatively steeply vegetated banks. Tall stream banks composed of fine grained materials are susceptible to erosion, as there is little opportunity for flood discharges to spread across a functional floodplain and dissipate energy. Portions of the bank toe consist of a clay lens which provides some degree of toe stability and protection from erosion. However, much of the toe consists of fine grained soils that will saturate and slough when constructed to steep slopes. Bank sloughing is occurring on the left bank near the upstream end of the project reach adjacent to a stormwater culvert outlet (Photo Point 4.2), and may partially be attributed to the slope of the constructed bank in this area.

The reconstructed bridge span accommodates paved pedestrian trails on both sides of the creek. However, the span does not accommodate a functional floodplain on either side of the channel. Future bridge spans that are capable of accommodating gentler bank slopes (2H:1V minimum) and a floodplain bench on one or both sides of the channel (such as that shown in Photo Point 3.2) to allow flood discharges to dissipate energy and decrease the potential for bank erosion are recommended. Pedestrian and bike trails can be designed to function as floodplain terraces if designed to the proper elevation, (although they would be periodically inundated during flood events preventing pedestrian use). This approach would allow for a greater capacity for flooding while maintaining a pedestrian use corridor.

6.2. Culvert outlet on north bank

Stone materials placed along the toe of the bank beneath a culvert upstream from the new bridge have continued to slough into the stream channel. These materials appear to be sloughing due to the steep bank angle (steeper than 1H:1V), saturation of the bank when the culvert discharges water on the bank, and improper placement of riprap beneath the culvert outlet. Stone toe protection beneath this culvert will need to be replaced to maintain bank and culvert protection if additional material continues to slough. MDT is currently evaluating stabilization alternatives at the outlet of this culvert as part of a bridge expansion project over Ashley Creek.

6.3. Woody planting success

Woody plantings within the Ashley Creek project area appeared to have very good survival success. If survival rates continue to show promising results, these planting

specifications are recommended for future designs along similar stream channel configurations.

7.0 LITERATURE CITED

Burton, T.A., S.J. Smith, and E.R. Cowley. 2011. Riparian area management: Multiple indicator monitoring (MIM) of stream channels and streamside vegetation. Technical Reference 1737-23.BLM/OC/ST-10/003+1737. U.S. Department of the Interior, Bureau of Land Management, National Operations Center, Denver, CO. 155 pp.

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

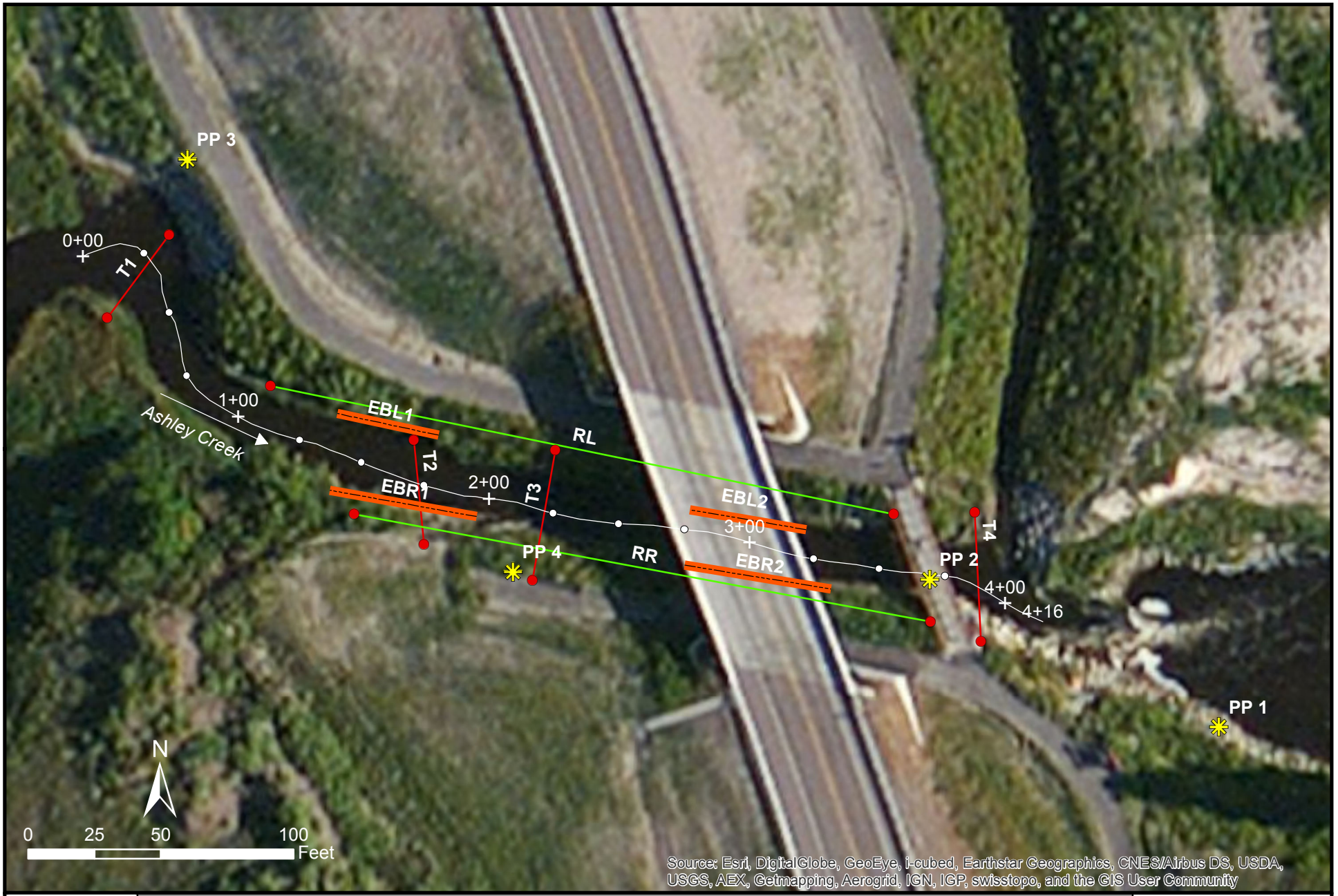
RESPEC 2014. Technical Memorandum provided to KLJ on 10/22/14. Subject: Kalispell Bypass – Ashley Creek Culvert

Winward, A.H. 2000. Monitoring the Vegetation Resources in Riparian Areas. USFS RMRS-GTR-47.

Appendix A

Project Site Maps

MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana



CONFLUENCE
consulting incorporated

Legend

- Photo Points
- Riparian and Perpendicular Transect Endpoints
- Channel Thalweg
- Major Station (100')
- Minor Station (25')
- Eroding Banks
- Pool and Riffle Transects
- Riparian Transects

2014 Monitoring
Ashley Creek

Figure 2

Date: 11/10/2014

X:/MDT_.007/mains

CONFLUENCE
consulting incorporated

Legend

- Project Boundary
- Vegetation Community Boundary
- Centaurea stoebe
- Cirsium arvensis
- Convolvulus arvensis
- Tanacetum vulgare
- 1 Phalaris Community
- 3 Phalaris/Elymus Community

N

0 25 50 Feet

2014 Monitoring Ashley Creek

Figure 3

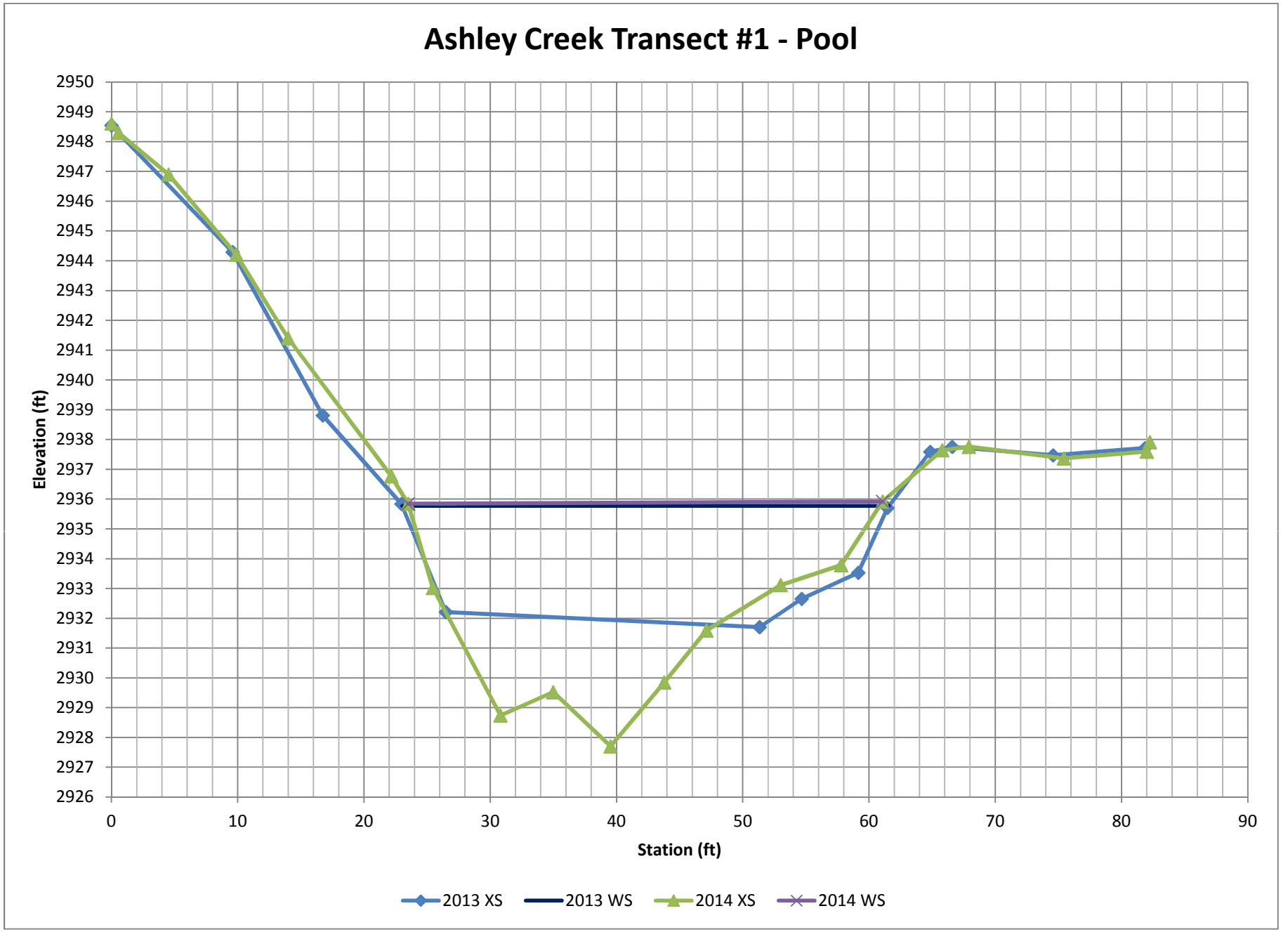
Date: 09/22/2014

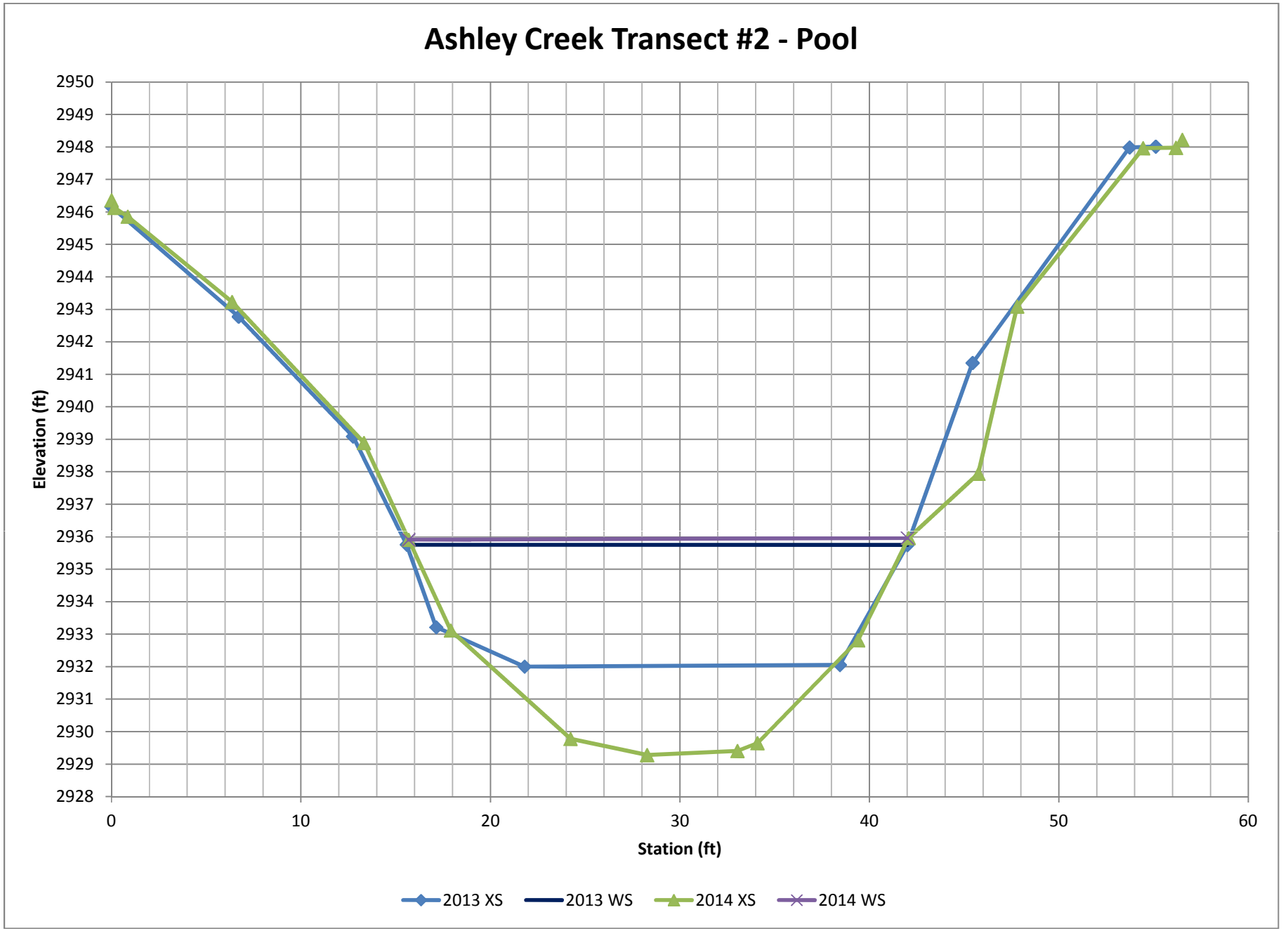
X:/MDT_.007/mains

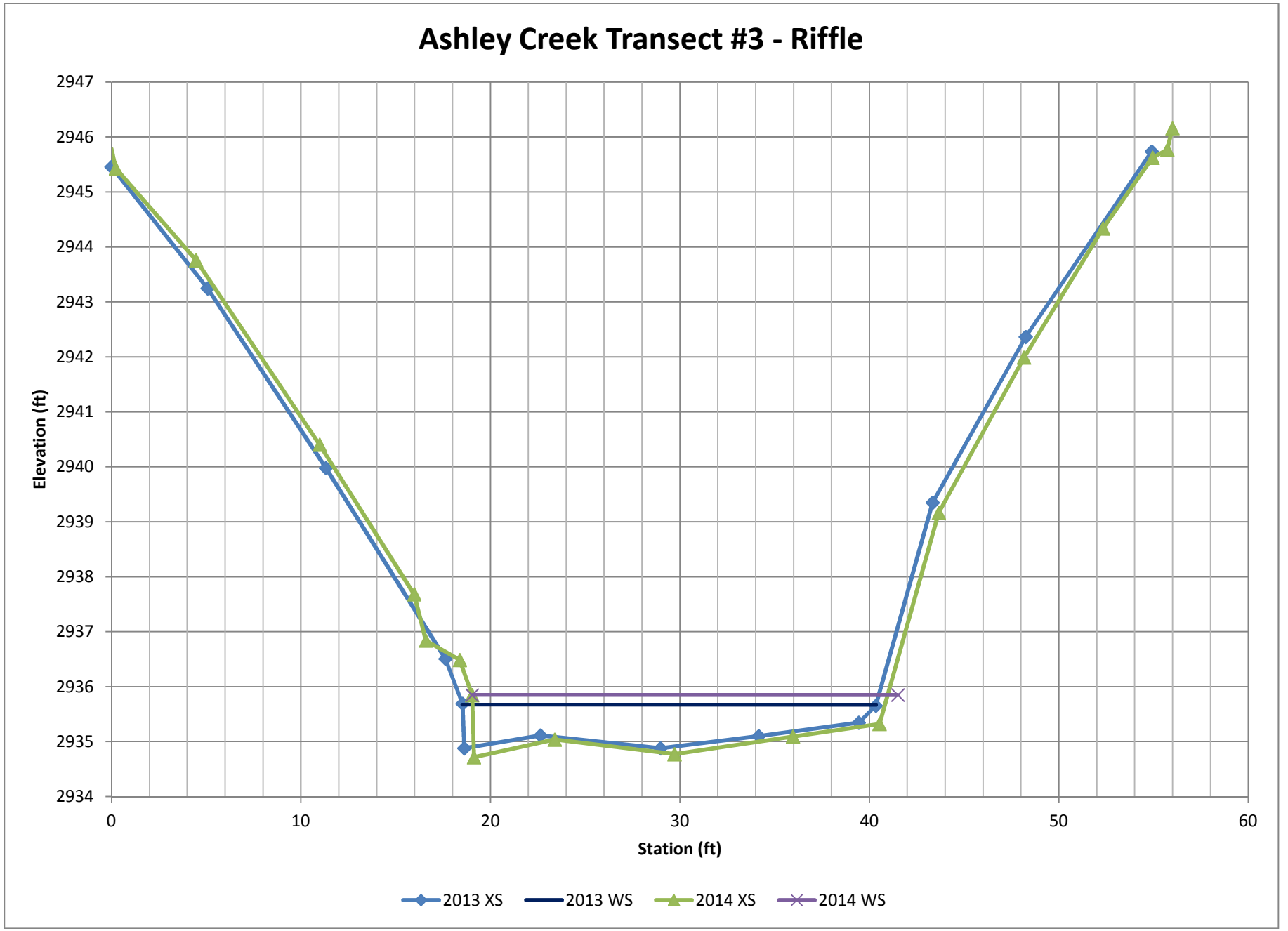
Appendix B

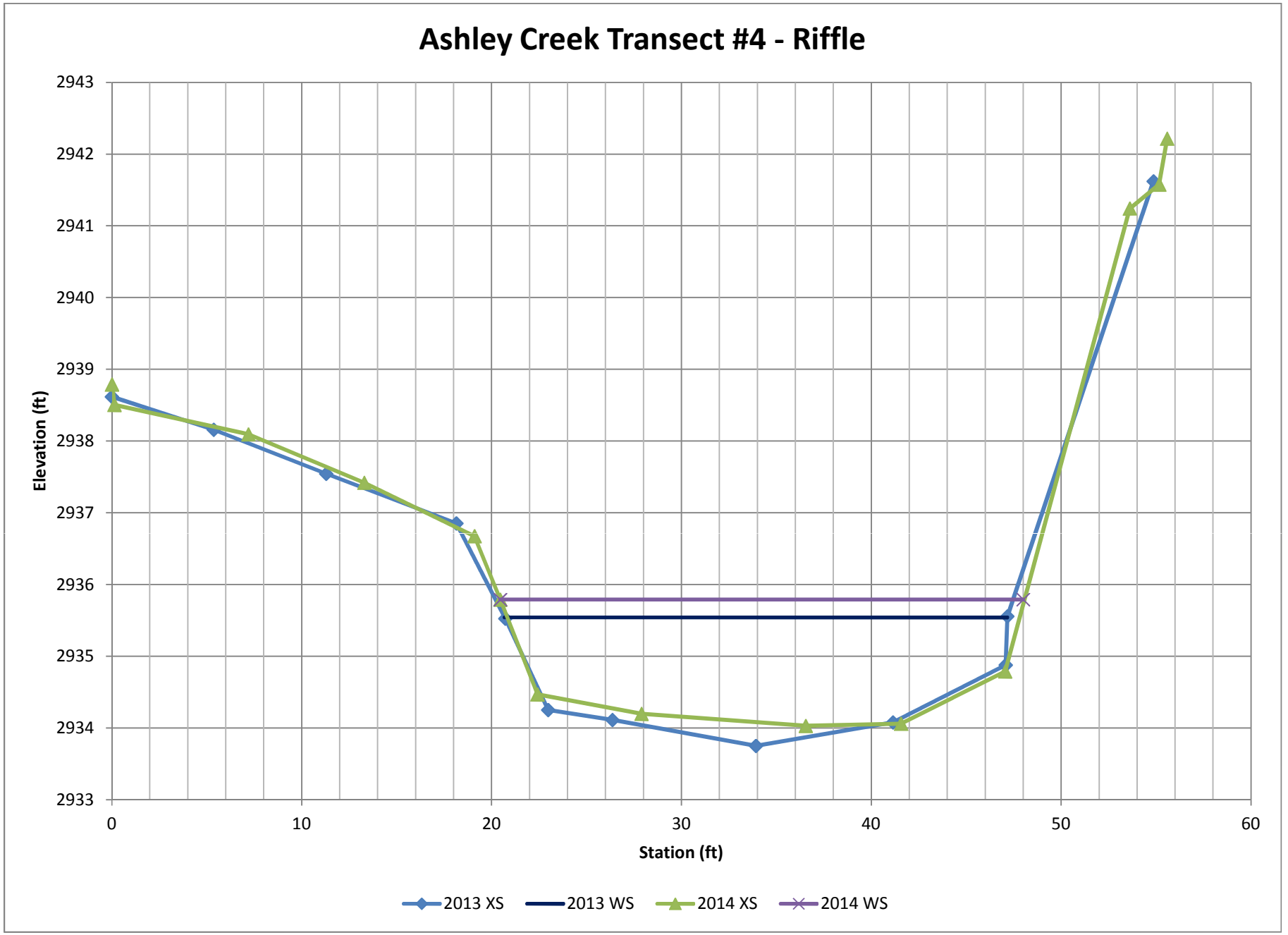
Perpendicular Transect Plots and Longitudinal Profile

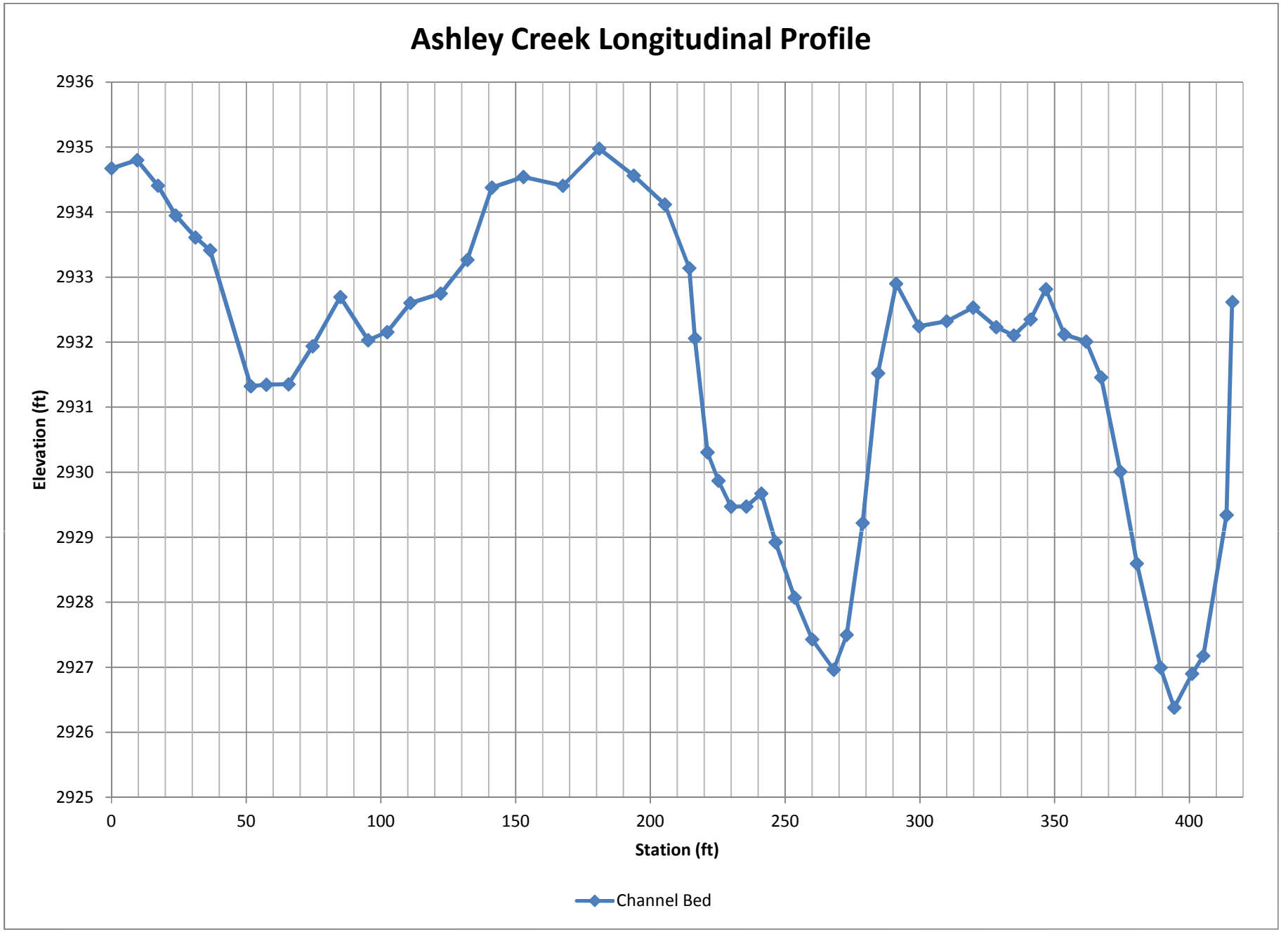
MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana


Ashley Creek Transect #1 - Pool
Elevation (ft)
2950
2949
2948
2947
2946
2945
2944
2943
2942
2941
2940
2939
2938
2937
2936
2935
2934
2933
2932
2931
2930
2929
2928
2927
2926
0
10
20
30
40
50
60
70
80
90
Station (ft)
2013 XS
2013 WS
2014 XS
2014 WS


Ashley Creek Transect #2 - Pool
Elevation (ft)
2950
2949
2948
2947
2946
2945
2944
2943
2942
2941
2940
2939
2938
2937
2936
2935
2934
2933
2932
2931
2930
2929
2928
0
10
20
30
40
50
60
Station (ft)
2013 XS
2013 WS
2014 XS
2014 WS


Ashley Creek Transect #3 - Riffle
Elevation (ft)
2947
2946
2945
2944
2943
2942
2941
2940
2939
2938
2937
2936
2935
2934
0
10
20
30
40
50
60
Station (ft)
2013 XS
2013 WS
2014 XS
2014 WS


Ashley Creek Transect #4 - Riffle
2943
2942
2941
2940
2939
2938
2937
2936
2935
2934
2933
Elevation (ft)
0
10
20
30
40
50
60
Station (ft)
2013 XS
2013 WS
2014 XS
2014 WS


Ashley Creek Longitudinal Profile
Elevation (ft)
2936
2935
2934
2933
2932
2931
2930
2929
2928
2927
2926
2925
0
50
100
150
200
250
300
350
400
Station (ft)
Channel Bed

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 2014 Monitoring Event

CONFLUENCE

Photo Point 1—2013
Description: View of grade control structure downstream of project area. **Compass:** 315 (Northwest)

Photo Point 1—2014
Description: View of grade control structure downstream of project area. **Compass:** 315 (Northwest)

Photo Point 2—2013
Description: View looking upstream from pedestrian bridge. **Compass:** 293 (West-Northwest)

Photo Point 2—2014
Description: View looking upstream from pedestrian bridge. **Compass:** 293 (West-Northwest)

Photo Point 3.1—2013
Description: View looking south at upstream end of project site. **Compass:** 180 (South)

Photo Point 3.1—2014
Description: View looking south at upstream end of project site. **Compass:** 180 (South)

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Event

CONFLUENCE

Photo Point 3.2—2013
Description: View looking west at upstream end of project site. **Compass:** 225 (Southwest)

Photo Point 3.2—2014
Description: View looking west at upstream end of project site. **Compass:** 225 (Southwest)

Photo Point 4.1—2013
Description: View of channel looking downstream.
Compass: 90 (East)

Photo Point 4.1—2014
Description: View of channel looking downstream.
Compass: 90 (East)

Photo Point 4.2—2013
Description: View of channel looking upstream.
Compass: 315 (Northwest)

Photo Point 4.2—2014
Description: View of channel looking upstream.
Compass: 315 (Northwest)

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Event

CONFLUENCE

Photo 5—2103
Description: View of Ashley/Spring Creek confluence.
Compass: 0 (North)

Photo 5—2104
Description: View of Ashley/Spring Creek confluence.
Compass: 0 (North)

Photo 6—2013
Description: View of EBR1 on south side of channel.
Compass: 225 (South-Southwest)

Photo 6—2014
Description: View of EBR1 on south side of channel.
Compass: 225 (South-Southwest)

Photo 7—2013
Description: View of EBL1 beneath culvert outlet on north streambank upstream of bridge.
Compass: 0 (North)

Photo 7—2014
Description: View of EBL1 beneath culvert outlet on north streambank upstream of bridge.
Compass: 0 (North)

PHOTO INFORMATION

PROJECT NAME: Ashley Creek Stream Mitigation Site

DATE: 2013 and 2014 Monitoring Event

CONFLUENCE

Photo 8—2104
Description: EBL2; Low water with no vegetation.
Compass: 315 (Northwest)

Photo 9—2014
Description: EBL2; Loose geo-tech fabric at the up-stream end of eroding streambank.

Photo 10—2014
Description: EBR2; Erosion caused by high flow events,. Streambank actively eroding and sloughing. Note: Photo has been altered due to explicit language on background wall.

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T1 LEFT: LOOKING SOUTHWEST TO T1 RIGHT

T1 RIGHT: LOOKING NORTHEAST TO T1 LEFT

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T1 LEFT: LOOKING SOUTHWEST UPSTREAM

T1 LEFT: LOOKING SOUTHEAST DOWNSTREAM

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T1 LEFT: LOOKING SOUTHWEST UPSTREAM FROM BANK

T1 LEFT: LOOKING SOUTHEAST DOWNSTREAM FROM BANK

T1 RIGHT: LOOKING NORTH UPSTREAM

T1 RIGHT: LOOKING EAST DOWNSTREAM

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T2 LEFT: LOOKING SOUTH TO T2 RIGHT

T2 RIGHT: LOOKING NORTH TO T2 LEFT

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T2 LEFT: LOOKING WEST UPSTREAM

T2 LEFT: LOOKING EAST DOWNSTREAM

T2: LOOKING WEST UPSTREAM FROM CREEK

T2: LOOKING EAST DOWNSTREAM FROM CREEK

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T2 RIGHT: LOOKING WEST UPSTREAM

T2 RIGHT: LOOKING EAST DOWNSTREAM

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T3 LEFT: LOOKING SOUTH TO T3 RIGHT

T3 RIGHT: LOOKING NORTH TO T3 LEFT

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T3 LEFT: LOOKING WEST UPSTREAM

T3 LEFT: LOOKING EAST DOWNSTREAM

T3: LOOKING WEST UPSTREAM FROM CREEK

T3: LOOKING EAST DOWNSTREAM FROM CREEK

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T3 RIGHT: LOOKING WEST UPSTREAM

T3 RIGHT: LOOKING EAST DOWNSTREAM

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T4 LEFT: LOOKING SOUTH TO T4 RIGHT

T4 RIGHT: LOOKING NORTH TO T4 LEFT

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T1 LEFT: LOOKING WEST UPSTREAM

T1 LEFT: LOOKING EAST DOWNSTREAM

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T4: LOOKING WEST UPSTREAM FROM CREEK

T4: LOOKING EAST DOWNSTREAM FROM CREEK

PROJECT NAME: 2014 MDT STREAM MITIGATION—ASHLEY CREEK

DATE: 7-30-14

T4 RIGHT: LOOKING WEST UPSTREAM

T4 RIGHT: LOOKING EAST DOWNSTREAM

Appendix D

Channel Construction Details

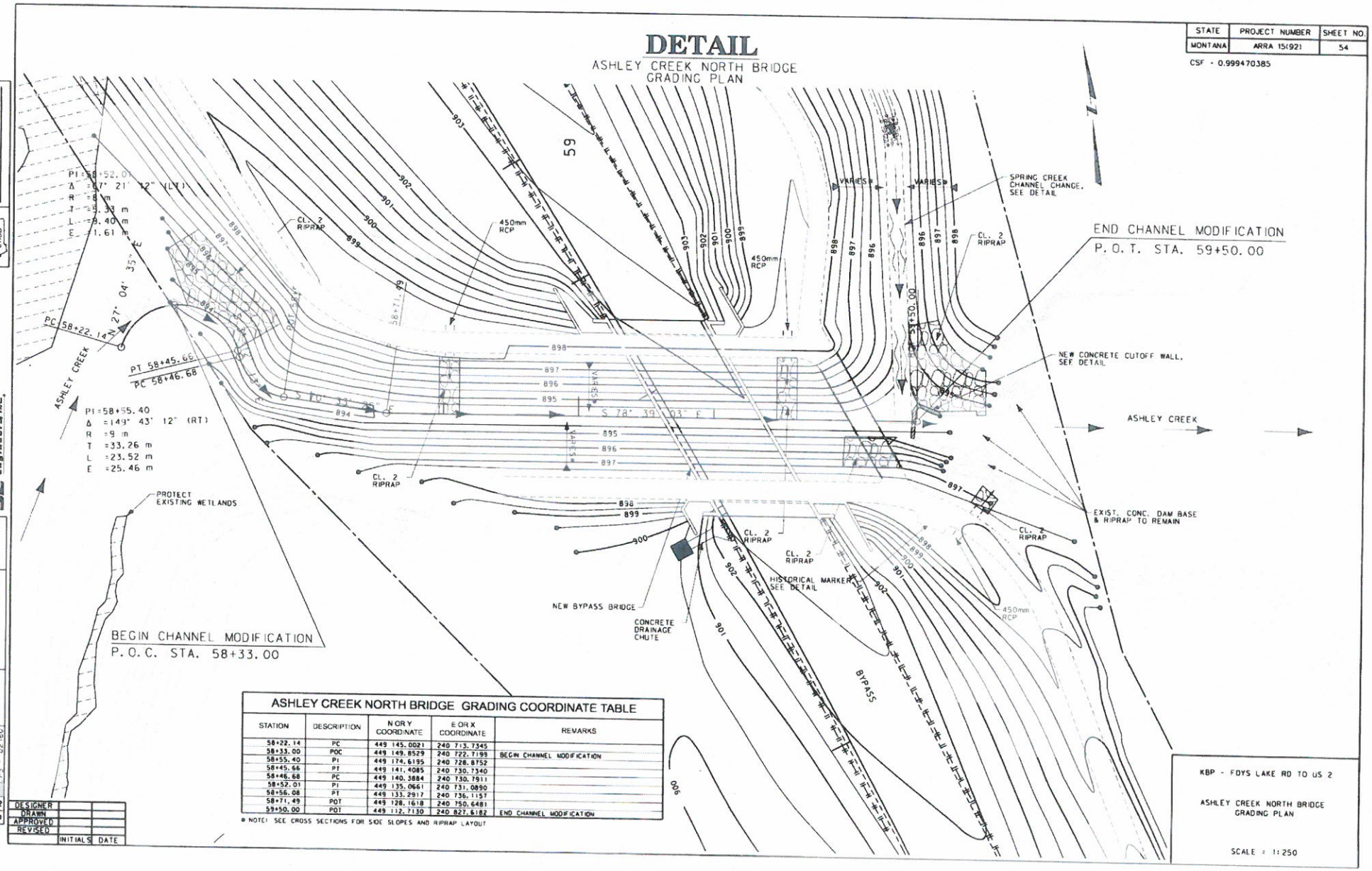
MDT Stream Mitigation Monitoring
Ashley Creek
Flathead County, Montana

DETAIL

ASHLEY CREEK NORTH BRIDGE
GRADING PLAN

STATE	PROJECT NUMBER	SHEET NO.
MONTANA	ARRA 15(92)	54

CSF - 0.999470385



ASHLEY CREEK NORTH BRIDGE GRADING COORDINATE TABLE

STATION	DESCRIPTION	N OR Y COORDINATE	E OR X COORDINATE	REMARKS
58+22.14	PC	449 145.0021	240 713.7345	
58+33.00	POC	449 149.8529	240 722.7199	BEGIN CHANNEL MODIFICATION
58+55.40	PI	449 174.6195	240 728.8752	
58+45.66	PT	449 141.4085	240 730.7340	
58+46.68	PC	449 140.3884	240 730.7911	
58+52.01	PI	449 135.0661	240 731.0890	
58+56.08	PT	449 133.2917	240 736.1157	
58+71.49	POT	449 128.1618	240 750.6481	
59+50.00	POT	449 112.7130	240 827.6182	END CHANNEL MODIFICATION

* NOTE! SEE CROSS SECTIONS FOR SIDE SLOPES AND RIPRAP LAYOUT

KBP - FOYS LAKE RD TO US 2

ASHLEY CREEK NORTH BRIDGE
GRADING PLAN

SCALE = 1:250

	INITIALS	DATE
DESIGNER		
DRAWN		
APPROVED		
REVISED		

MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CADD

SE Stallings Engineers, Inc.

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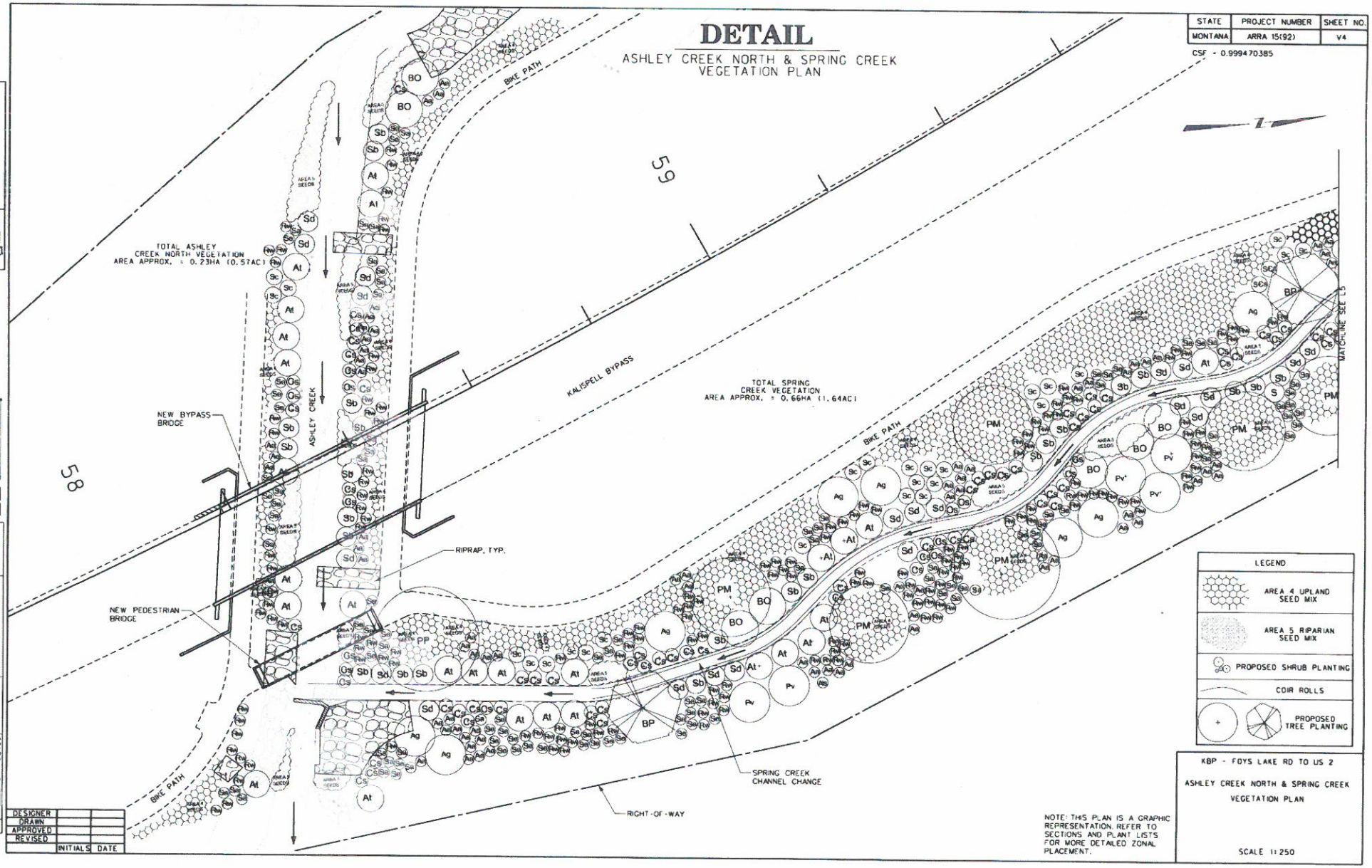
10/6/2009 11:16:22 AM REVIEWED BY
CHECKED BY
NO. DATE

DETAIL

ASHLEY CREEK NORTH & SPRING CREEK
VEGETATION PLAN

STATE	PROJECT NUMBER	SHEET NO.
MONTANA	ARRA 15(92)	V4

CSF - 0.999470385



LEGEND

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

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

KBP - FOYS LAKE RD TO US 2

ASHLEY CREEK NORTH & SPRING CREEK VEGETATION PLAN

SCALE 1:250

	INITIALS	DATE
DESIGNER		
DRAWN		
APPROVED		
REVISED		

MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CADD

SE Stalling Engineers, INC.

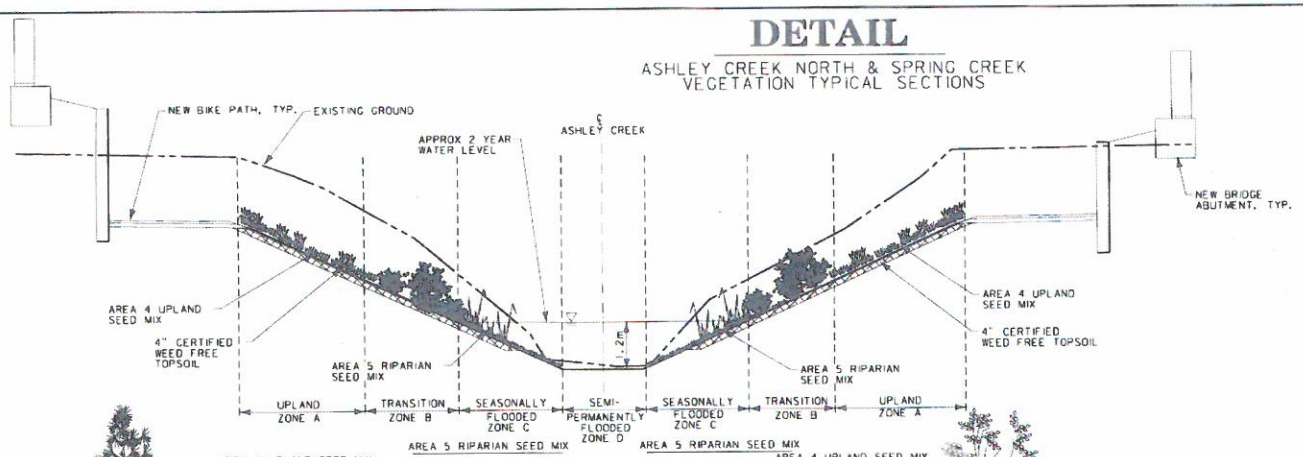
DETAIL

ASHLEY CREEK NORTH & SPRING CREEK VEGETATION TYPICAL SECTIONS

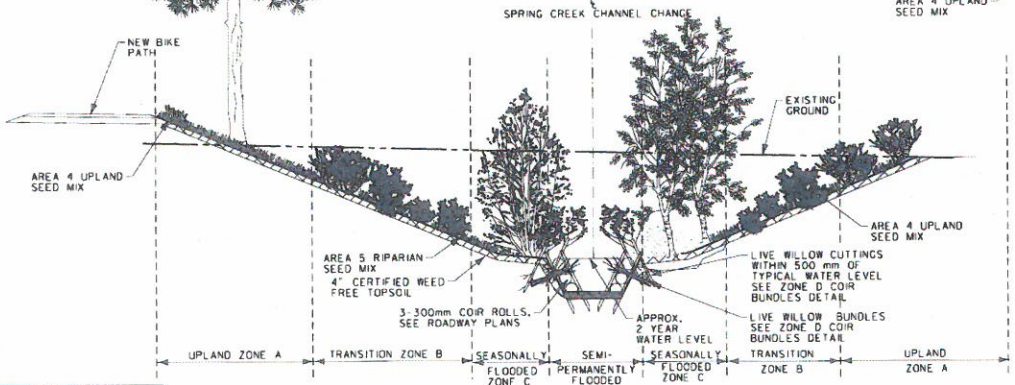
STATE	PROJECT NUMBER	SHEET NO.
MONTANA	ARRA 15(92)	V3

CSF = 0.999470385

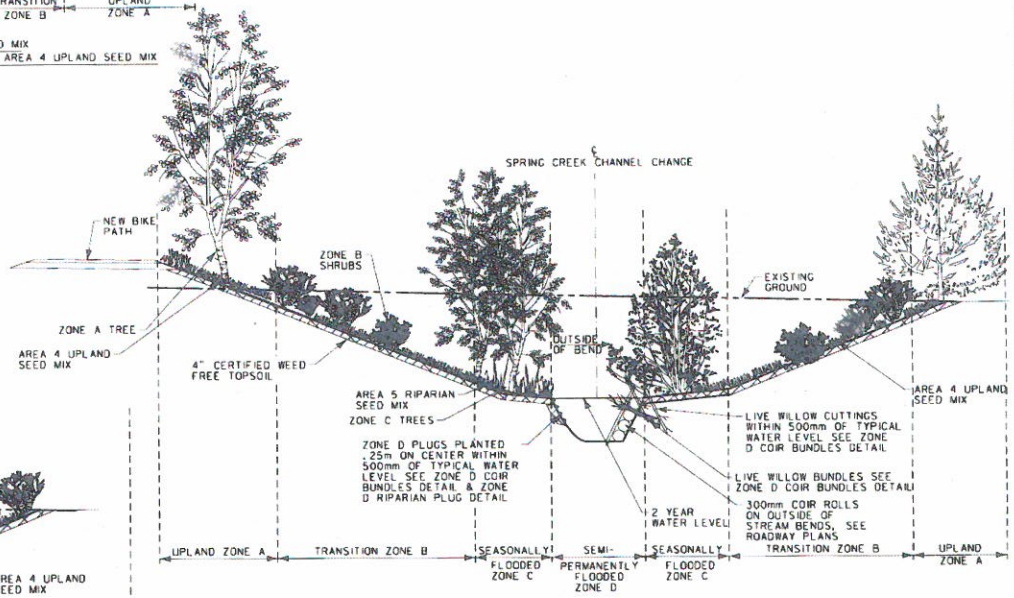
NOTES: 1. SEE ROADWAY PLANS FOR CHANNEL CONSTRUCTION DETAILS.
2. TYPICAL SECTIONS ARE GENERAL CONCEPTUAL DESIGN. FOR INFORMATION ONLY



ASHLEY CREEK NORTH BRIDGE TYPICAL SECTION
SCALE: NOT TO SCALE



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



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

KBP - FOYS LAKE RD TO US 2

ASHLEY CREEK NORTH & SPRING CREEK VEGETATION TYPICAL SECTIONS

NO SCALE

DESIGNER		
DRAWN		
APPROVED		
REVISED		
	INITIALS	DATE

MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CADD

SE Stalling Engineering, Inc.

DETAIL

ASHLEY CREEK NORTH & SPRING CREEK
VEGETATION SUMMARY & DETAILS

STATE	PROJECT NUMBER	SHEET NO.
MONTANA	ARRA 15(92)	V2

CSF - 0.999470385

CHANNEL PLANTING SEQUENCE

1. PLACE COIR ROLL AS PER COIR ROLLS DETAIL IN ROADWAY PLANS AND SPECIAL PROVISIONS.
2. INSTALL PLANTS BETWEEN THE DATES OF OCTOBER 1 AND NOVEMBER 15 OR APRIL 30 AND JUNE 1 PROVIDED THE GROUND IS NOT FROZEN.
3. PLANT RIPARIAN PLUGS AS PER PLANTING DETAIL. INSTALL CUTTINGS BETWEEN APRIL 15 AND MAY 1.
4. PLANT WILLOW CUTTINGS AND BUNDLES AS PER PLANTING DETAIL.
5. INSTALL JUTE NETTING ON SLOPES GREATER THAN 3:1 AS PER SPECIAL PROVISIONS.
6. SEED UPLAND AREA 4 AND RIPARIAN AREA 5 AS PER SEEDING SPECIAL PROVISIONS.
7. PLANT TREES AND SHRUBS AS PER PLANTING DETAILS.
8. APPLY WEED FREE ORGANIC COMPOST MULCH AS PER SPECIAL PROVISIONS.

ASHLEY CREEK NORTH & SPRING CREEK CHANNEL CHANGE PLANT LIST *

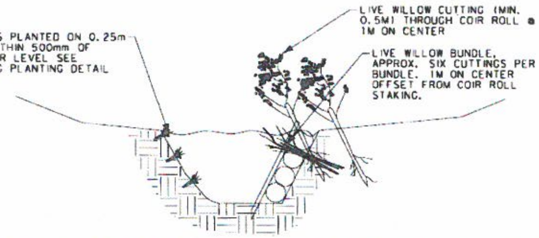
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	SIZE
ZONE A UPLAND				
TREES				
BP	BETULA PAPYRIFERA	PAPER BIRCH	4	10' B&B
PP	PINUS PONDEROSA	PONDEROSA PINE	3	7' B&B
PM	PSEUDOTSUGA MENZIESII	DOUGLAS FIR	8	6' B&B
ZONE B TRANSITIONAL				
SHRUBS				
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	SIZE
Aa	AMELANCHIER ALNIFOLIA	SASKATOON SERVICEBERRY	108	1 GAL.
Pv	PRUNUS VIRGINIANA	COMMON CHOKECHERRY	8	5 GAL.
Rw	ROSA WOODSII	WOODS ROSE	243	1 GAL.
Sc	SHEPHERDIA CANADENSIS	CANADA BUFFALOBERRY	41	1 GAL.
Sa	SYMPHORICARPOS ALBUS	SNOWBERRY	156	1 GAL.
ZONE C SEASONALLY FLOODED				
TREES				
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	SIZE
BO	BETULA OCCIDENTALIS	WATER BIRCH	11	15 GAL.
SHRUBS				
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	SIZE
At	ALNUS INCANA SSP. TENUIFOLIA	THIN-LEAF ALDER	43	5 GAL.
Cs	CORNUS STOLONIFERA/SERICEA	RED-OSIER DOGWOOD	102	1 GAL.
Sb	SALIX BEBBIANA	BEBB WILLOW	38	5 GAL.
Sd	SALIX DRUMMONDIANA	DRUMMOND WILLOW	33	5 GAL.
ZONE D SEMI-PERMANENTLY FLOODED				
COIR ROLL STAKING SPACE @ 1m ON CENTER				
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	
Sb	SALIX DRUMMONDIANA	DRUMMOND WILLOW	500	CUTTINGS
Sb	SALIX EXIGUA	SANDBAR WILLOW	500	CUTTINGS
COIR ROLL LAYERING SPACE 6 CUTTINGS PER BUNDLE @ 1m ON CENTER				
TYPE	BOTANICAL NAME	COMMON NAME	QNTY	
Sb	SALIX DRUMMONDIANA	DRUMMOND WILLOW	1500	CUTTINGS
Sb	SALIX EXIGUA	SANDBAR WILLOW	1500	CUTTINGS
STREAMBANK PLUGS				
	BOTANICAL NAME	COMMON NAME	QNTY	
	CAREX NEBRASCENSIS	NEBRASKA SEDGE	288	PLUGS
	CAREX UTRICULATA	BEAKED SEDGE	403	PLUGS
	CAREX VESICARIA	INFLATED SEDGE	288	PLUGS
	GLYCERIA ELATA (STRIATA)	FOWL MANNAGRASS	173	PLUGS

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

JUTE NETTING *

STATION FROM	STATION TO	square meters
58+19.56	61+31.96	6372
TOTAL		6372

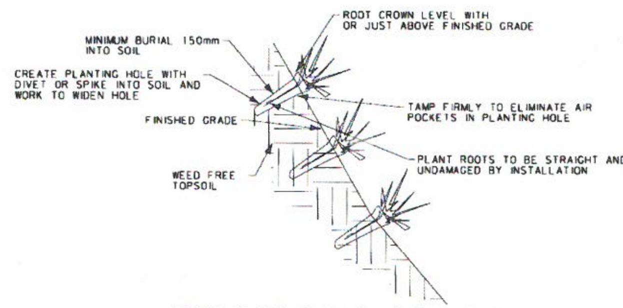
* FOR INFORMATION ONLY. INCLUDE ALL COSTS AND INCIDENTAL ITEMS ASSOCIATED WITH THE INSTALLATION OF THIS ITEM IN THE LUMP SUM BID PRICE FOR "VEGETATION".



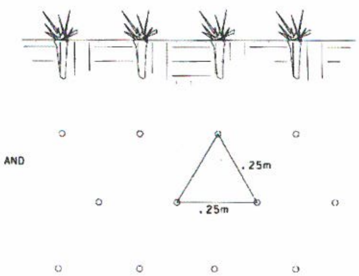
ZONE D COIR BUNDLES WITH WILLOW CUTTINGS AND LAYERING
SCALE: NOT TO SCALE

HARVESTING AND INSTALLATION NOTE:

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



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



SPACING

DESIGNER		
DRAWN		
APPROVED		
REVISED		
	INITIALS	DATE

KBP - FOYS LAKE RD TO US 2

ASHLEY CREEK NORTH & SPRING CREEK VEGETATION SUMMARY & DETAILS

NO SCALE

MONTANA DEPARTMENT OF TRANSPORTATION

MONTANA CADD

SE Stelling Engineers, Inc.

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