Montana Department of Transportation Stream Mitigation Monitoring Report

MILL CREEK MITIGATION SITE

Project Overview

MDT Project Number: NH7-1(114) 59 / UPN # 201500

Watershed: Watershed #3 - Lower Clark Fork

Monitoring Year: 2021

Years Monitored: 9th year of monitoring

Corps Permit Number: NWO-1997-90821-MTH

Monitoring Conducted By: Confluence Consulting Inc.

Monitoring Dates: August 4, 2021

Purpose of the approved project:

As part of the construction of the Bear Creek Road-South segment of U.S. Highway 93, the Montana Department of Transportation (MDT) relocated a segment of Mill Creek to align with a new permanent bridge. The realignment of Mill Creek included deactivating and filling approximately 630 feet of the channel and constructing approximately 581 feet of new channel through a relic floodplain swale.

Site Location:

Upstream Coordinates: 46.349572, -114.150031

Downstream Coordinates: 46.349953, -114.147307

County: Ravalli **Nearest Town:** Hamilton, MT

Map Included: Figure 1 on page #9

Mitigation Site Construction Started: 2011 **Construction Ended:** 2011

Dates of any recent corrective or maintenance activities (since previous report):
Activity: weed control **Date:** Fall 2020

Specific recommendations for additional corrective actions: None.

Previous Monitoring Reports and Methods Descriptions:
https://www.mdt.mt.gov/publications/brochures/stream-mitigation.shtml

Monitoring Period: 5 years from construction completion or until concurrence by US Army Corps of Engineers (USACE).

Requirements (from approved mitigation plan, banking instrument, or DA permit conditions)

Performance Standards: Data gathered during the 2021 monitoring event indicate that the Mill Creek stream mitigation site is meeting two of the three performance standards established in the monitoring plan (Table 1). Ten years post-construction, total vegetative cover throughout the site is 83% and the stream banks are reasonably stable. Woody vegetation cover failed to meet the success criteria of >50%.

Table 1. Summary of Performance Standards.

Performance Standards	Success Criteria	Criteria Achieved Y/N	Discussion
Riparian Cover	80% total vegetative coverage after 3rd year	Y	Total vegetative cover within the project site is 83% following the ninth year of monitoring. Cover value determined from the area-weighted average of 2021 cover estimates observed on the north and south banks.
	50% woody species coverage after 3rd year	N	Woody cover within the project site is 28% following the eighth year of monitoring. Cover value determined from the area-weighted average of 2021 woody cover estimates on the north and south banks.
Stream Bank Stability	Unstable banks identified within the project reach will require corrective action	Y	While several unstable banks were identified within the project, none are threatening infrastructure or the current channel alignment and thus do not require corrective action.

Additional Reporting Criteria:

1. **As-built drawings** - as built drawings based on a post-construction survey of the relocated channel, at a 1:50 scale or smaller, and planting schematic with a planted species list and number of plants planted (see the 2013 Monitoring report, Appendix G).
2. **Channel monitoring stations** - 4 permanently established channel cross-sections (i.e., transects) to collect survey data. Transects are 75' apart, and permanently marked with bank pins (see Appendix D).
3. **Photo points** - established at each monitoring station (i.e., transect) to take representative photos showing views upstream, downstream, and of both banks (see Appendix B).

Summary Data

Riparian Vegetation Inventory

Visual estimates of vegetative areal coverage for 2013, and 2019 through 2021 are provided in Table 2. In 2021, the total percent riparian cover was 83%, which included 55% cover by herbaceous species and 28% cover by woody species. The site exhibited 6% noxious weed cover in 2021, which is consistent with that observed in 2020. On the south bank, total cover decreased by 3% since 2020 due to a reduction in woody vegetation from recent beaver activity. Total and woody cover estimates on the north bank remained consistent with those observed in 2020. The north bank exhibited increased bare ground and minimal cover from

native species due to mowing and clearing on the upstream end of the project reach and herbicide applications in the vicinity of the bridge. The property owners on the upstream end of the north bank have removed nearly all woody vegetation, mowed all vegetation between stations 0+00 and 1+75, and are in the process of constructing a new home not far from the creek.

Table 2. Vegetative cover estimates at the Mill Creek Stream Mitigation Site in 2013, and 2019 through 2021.

Belt Transect	Length (ft)	Total % Riparian Cover				% Woody Cover				% Noxious Weed Cover			
		2013	2019	2020	2021	2013	2019	2020	2021	2013	2019	2020	2021
South bank	140	100	97	95	92	60	63	60	57	1	1	1	1
North bank	435	75	85	80	80	15	20	18	19	15	18	7	7
Area Weighted Average	575	81	88	84	83	26	30	28	28	11	14	6	6

In 2021, 134 plant species were observed at the mitigation site, which is an increase of six species since the 2020 monitoring event. Sixty-three of the species (47%) observed between 2013 and 2021 are hydrophytic based on the 2018 National Wetland Plant List (USACE 2018). Six plant species were observed at the site for the first time in 2021, including two native hydrophytic species, lesser bladder sedge (*Carex vesicaria*), Coville's rush (*Juncus covillei*), and four non-native upland species, sheep fescue (*Festuca ovina*), clasping pepperwort (*Lepidium perfoliatum*), yellow salsify (*Tragopogon dubius*), and yellow clover (*Trifolium aureum*).

Coville's rush is classified as a S2S3 species of concern in Montana. It's currently known to occur at less than ten wetland/riparian sites in western Montana (MTNHP 2021). The observation of this species is noteworthy and provides valuable information to support the status of its existence and viability in western Montana.

Appendix C includes a comprehensive list of plant species observed along the new channel alignment and riparian buffer areas from 2013 through 2021.

Stream Bank Vegetation Composition

Vegetation along the minimally disturbed south stream bank was dominated by speckled alder (*Alnus incana*), black cottonwood (*Populus balsamifera*), Woods' rose (*Rosa woodsii*), ponderosa pine (*Pinus ponderosa*), and non-native perennial grass species such as reed canary grass (*Phalaris arundinacea*), spreading bent grass (*Agrostis stolonifera*), creeping wild rye (*Elymus repens*), and flat-stem blue grass (*Poa compressa*). Native and non-native herbaceous cover dominates most of the restored north bank, with less cover provided by woody species. However, the west end of the north bank is now dominated by non-native grasses such as smooth brome (*Bromus inermis*), spreading bent grass, and flat-stem blue grass, along with patches of noxious weeds and bare ground. These upland species are shallow-rooted and provide minimal stability to this actively eroding bank.

Noxious Weed Inventory

The vegetation inventory along Mill Creek identified eight noxious species (Table 3). Isolated occurrences of houndstongue (*Cynoglossum officinale*), St. Johnswort (*Hypericum perforatum*), leafy spurge (*Euphorbia esula*), ox-eye daisy (*Leucanthemum vulgare*), and hoary alyssum (*Berteroa incana*) were observed in trace amounts within riparian transects but were not mapped. Noxious weed infestations mapped within the project area were within the trace (less than 1 percent) and low (1 to 5 percent) cover classes. Locations of all noxious weed infestations, with the exception of isolated weed occurrences, are shown on Figure 3 of Appendix A. Many of these infestations occur on private properties outside of the road right-of-way (ROW) and are therefore inaccessible to MDT weed control contractors without landowner permission.

Table 3. Weeds observed within the Mill Creek riparian zone in 2021.

Category*	Scientific Name	Common Name
Priority 2B	*Berteroa incana*	Hoary Alyssum
	Centaurea stoebe	Spotted Knapweed
	Cirsium arvense	Canada Thistle
	Cynoglossum officinale	Houndstongue
	Hypericum perforatum	St. Johnswort
	Euphorbia esula	Leafy Spurge
	Leucanthemum vulgare	Oxeye Daisy
	Tanacetum vulgare	Common Tansy

* Based on the MT Department of Agriculture 2019 Noxious Weed List

Woody Plant Survival

The area-weighted average of woody vegetation cover for the north and south bank belt transects was 28%, which does not meet the 50% cover threshold specified in the performance criteria. Woody vegetation cover along the north bank was estimated at 19%, which is a 1% increase since 2020. Several mature ponderosa pine and black cottonwood trees remain along the north bank and provide most of the woody cover. While no woody vegetation was observed along the backfilled channel segment, several shrub and sapling volunteers were identified along the north bank of the newly aligned channel. Multiple stressors have inhibited tree and shrub cover along the north bank, including herbicide application outside of the MDT ROW, beaver activity, and recent private land management (e.g., mowing, tree removal). Woody cover decreased by 3% along the south bank since 2020 due to recent beaver activity. No other disturbances are apparent along the north bank.

Bank Erosion Inventory

Over the past eight years, stream bank erosion has been observed within and upstream of the project reach. During this time, several bank segments have eroded as a result of depositional processes, lateral channel migration, and scour from high flow events. Some of these banks have stabilized over time while the length of eroding bank has increased along others.

In 2021, continued bank erosion was noted in five locations (Table 4) within the project reach and has continued along a sharp meander bend immediately upstream of the project reach. Descriptions of erosion along these banks are provided below, while locations are illustrated on Figure 2 in Appendix A.

Table 4. Eroding banks documented at the Mill Creek stream mitigation site.

Eroding Bank	Approximate Length (feet)	Actively Eroding in 2021?
EBL 1-2*	264	Yes
EBL5	31	Yes
EBL3	27	Yes
EBL4 a & b	75	No
ERB2	53	Yes
EBR3	54	Yes

*EBL 1-2 occurs upstream of the project reach

Bank erosion upstream of the project reach - Lateral migration has been noted along the north bank above the project reach since 2013 (Figure 2, Appendix A). Eroding bank segments, EBL1 and EBL2, were documented on the north side of the channel as two separate eroding bank segments in 2013 but were combined into one 247-foot-long eroding bank in 2014 (herein referred to as EBL1-2). This eroding bank occurs on private land upstream and outside of the MDT project reach but has been monitored since 2013 due to the potential of continued erosion that may affect the project reach. The upper 150 feet of EBL1-2 has shown relatively little change over the past five years with a bank retreat rate of between 0.2 and 0.6 feet per year (Additional Photo 1, Appendix B), and a short segment of bank between the upper and lower portions of the bank appears to be stabilizing. The lower 100 feet of the bank has migrated northward at a more rapid pace than the upper bank segment, especially in the vicinity of a large ponderosa pine tree that fell into the channel in 2016. This tree was removed from the river in 2020, as was a second large ponderosa pine that was growing on the bank. This bank segment has migrated to the north at a rate of 6-8 feet/year for the past five years (Additional Photo 2, Appendix B). Root wads and large rocks that were placed on, but not keyed into the toe of the banks are now in the middle of the right side of the channel (Additional Photos 1 & 2, Appendix B) and are causing increased scour against the bank. Severity of the erosion along EBL1-2 is considered very high.

EBL1-2 is eroding due to extensive gravel deposition just upstream of and across the channel from the eroding bank. Mid-channel bars and an advancing point bar on the right bank are forcing the thalweg up against the exposed north bank, which runs along this relatively sharp meander bend. Additionally, the substrate on the bank is highly unstable as it is primarily comprised of historic alluvial deposits consisting of unconsolidated gravel and cobble.

Bank erosion within the project reach – As with previous years, several eroding banks were observed within the project reach in 2021 (Figure 2, Appendix A). The upstream most of these eroding banks (EBL5) is located on the north bank at the mouth of the channel that was backfilled during construction. Bank erosion was first noted in this location in 2018, and since that time this bank retreated by approximately 5 feet each year, and has retreated at total of 29 feet since 2013 (Appendix D Transect #1). EBL5 has laterally retreated to the extent where it has begun to expose the rock structure that was embedded in the bank to block the former channel alignment EBL5 is now connected to EBL1-2 (described above), but was mapped separately, as it lies within the project reach, where EBL1-2 lies upstream of the project reach. While the creek has begun to erode into the former channel that was plugged during construction, it is not yet threatening to abandon its existing configuration and overtake the former alignment. The former alignment has been completely backfilled to the height of the surrounding floodplain and is not believed to be a preferential flow path at this time.

Erosion has been observed just downstream of EBL5 in a location previously numbered as EBL3. This eroding bank was originally observed in 2014 but was removed from the eroding bank inventory in 2019 because it had stabilized following the development of a gravel deposit adjacent to the bank. In 2020, this gravel deposit was washed away during the high flow events and EBL3 was again eroding. In 2021, a gravel bar had begun to develop at the upstream end of EBL3 and the bank had once again begun to stabilize. The length of EBL3 was thus reduced by approximately 30 feet in 2021.

Lateral erosion at bank EBL4 has been observed over the last five years, but in 2021 the middle section of this bank had begun to stabilize. Bank instability at EBL4 was potentially caused by natural channel adjustments and debris jams that formed following construction but the channel form in this location seems to have reached an equilibrium over the short term. The length of EBL4 was significantly reduced in 2021 and has now been separated into two separate segments (EBL4a & b). The middle section of this bank has stabilized by sediment deposits which are now being colonized by willow and perennial wetland vegetation including sedges and rushes.

Erosion at EBR2 was originally noted in 2014 along 65 feet of the channel across from the head of the deactivated (backfilled) stream channel. Erosion at this location is tied to sediment deposition leading to channel adjustments, and scour along the outside of a meander. Additional erosion along this bank segment was not observed between 2015 and 2017; however, the bank showed signs of erosion again beginning in 2018, including undercutting, slumping sod mats, and root exposure. The eroding bank length increased from 40 to 80 feet between 2018 and 2019 and remained around 80 feet in length in 2020. In 2021, 30 feet of EBR2 had stabilized due to the development of a large point bar upstream of and adjacent to the bank. This point bar is forcing the stream away from the bank, resulting in a reduction of erosive forces and allowing it to stabilize (Additional photo 5, Appendix B).

EBR3 was observed in 2013 adjacent to a woody debris jam on the right bank and was characterized by upper bank sloughing and toe scour. Very little change has been observed at EBR3 since that time and no changes were observed at during the 2021 monitoring event.

Vegetation along the upper bank includes reed canary grass, oxeye daisy, woods rose, wheatgrass, brome, small cottonwood saplings, and young willows, but the lower bank still does not support much vegetation (Additional Photo 6, Appendix B). During high flow events, the stream flows directly against this bank and has washed away the topsoil. The lack of topsoil combined with the steep slope of the bank are likely prohibiting bank stability.

Channel Form

During the 2020 monitoring event, several new depositional features were observed within the Mill Creek project reach, including mid-channel and point bars. In 2021, additional deposition was observed but to a lesser extent. Specifically, the point bar adjacent to the right bank on the upstream end of the project reach continued to increase in height and width (Additional photo 2, Appendix B). This point bar is forcing the thalweg against the north bank and is contributing to the erosion on EBL 1-2 and EBL5. The dimensions of the mid channel bar adjacent to EBL4 were captured in the cross-sectional survey of Transect #3 (Appendix D). Gravel and fine sediment deposition adjacent to the bank has allowed perennial grasses, including *Poa compressa, Phalaris arundinacea, Poa pratensis, and Agrostis stolonifera* to establish and begin to stabilize the bank. However, only one of these species is deep rooted, and unless more deep-rooted vegetation becomes established the bank will remain susceptable to erosion during high-flow events.

Longitudinal Profile - The 2021 longitudinal profile indicates that, as would be expected in a highly dynamic system, pool and riffle locations have moved around quite a bit over the years as sediment is redistributed within the reach. In general, the number of pool-riffle sequences has remained relatively consistent over time (Appendix D). Six pools are being maintained with riffles between each pool, thus indicating that the mitigation reach is supporting a healthy diversity of aquatic habitat types. Based on riffle crest elevations, the longitidunal profile also indicates the bed profile of the reach is neither downcutting nor aggrading.

When the project reach is viewed from above (Figure 2, Appendix A) it is apparent that the thalweg has laterally shifted, thus changing the bank locations subject to erosive forces (See Bank Erosion Inventory discussion above).

Channel Cross Sections - Four permanently established channel cross sections (i.e., transects) were surveyed in 2021, as has been the case since 2013. Transects #2 and #3 were originally established across scour pools and transects #1 and #4 were established across riffles.

While transect #1 (T1) was originally positioned at a riffle, survey data from 2013-2015 indicated that a pool had formed in this location; likely caused by point bar development on the right side of the channel just upstream of T1. Over the last 3-4 years, additional deposition on the right side of the channel has forced more flow against the bank, where the pool that intersects T1 now occurs. The channel width at T1 has increased annually by 4-5 feet as a result of erosion on the north bank (Appendix D).

Transect #2 (T2) was originally established at a pool adjacent to a woody debris jam along the north bank. The debris jam has mostly washed away and since 2015, a gravel deposit has been observed adjacent to the north bank. This deposit has caused the thalweg and the pool to shift toward the right bank (see photos of Transect #2, Appendix B).

Transect #3 (T3) generally maintained the same geometry from 2013 to 2019, although increased pool depth was observed in 2019. However, between the 2019 and 2020 monitoring events, a large gravel bar developed along the north bank, forcing the thalweg and the majority of the flow to shift to the right side of the channel. The T3 cross-section no longer contains a pool and now represents a run. This change in channel form was maintained in 2021 (Appendix D).

Transect #4 (T4) is located at a riffle just upstream of the U.S. Highway 93 Bridge. Channel geometry has remained relatively consistent at this location since 2013. A point bar has gradually developed along the north bank, and the thalweg has moved closer to the right bank (Appendix D). Bar development along the north bank may eventually result in erosion along the right bank; however increased erosion has not been observed in the vicinity of T4 to date.

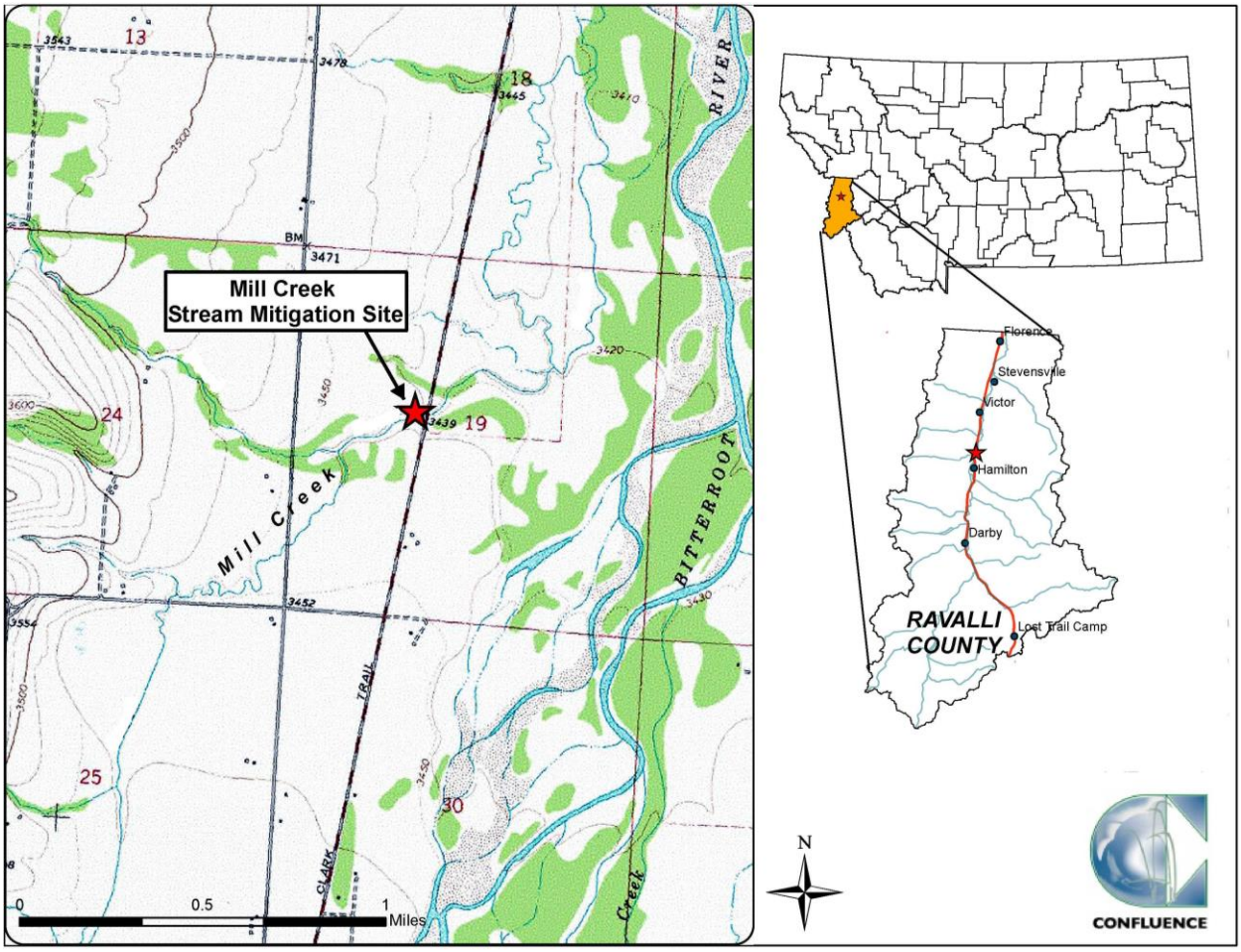
Conclusions

In 2021, the Mill Creek mitigation site met two of the three established performance standards. Although bank erosion above the project reach is considered severe, none of the eroding banks within the project reach are unstable enough to require corrective action. As a result, the performance criteria for stream bank stability were met in 2021. The site met the performance criteria for total vegetative cover but failed to meet the 50% cover threshold for woody species. MDT will coordinate with the Corps to discuss future monitoring, and to evaluate potential modifications to woody planting performance standards for this stream mitigation area.

Bank erosion and changes in channel form observed within the monitoring reach since annual monitoring began in 2013 are thought to be the result of natural fluvial processes in the Mill Creek watershed. This conclusion is supported by longitudinal and cross-sectional profiles, which indicate that the Mill Creek's stream bed naturally adjusts to accommodate high sediment loads and the influx of woody debris. Because these changes are a result of natural channel adjustments and no infrastructure is in jeopardy, no corrective actions are warranted at this this time. The current hands-off management approach which allows the channel to freely adjust and migrate over time, is beneficial to the project reach as it has enabled the development of high-quality habitat features such as scour pools, gravel bars, and riffle complexes. However, bank erosion on the upstream end of the project reach has begun to threaten the rock structure that blocks the head of the former channel that was filled during construction.

Maps, Plans, Photos:

Figure 1. Mill Creek mitigation site Location Map



Project Area Maps: See Appendix A (Figure 2 – Monitoring Features, Figure 3 – Noxious Weeds)

Photos: See Appendix B (Monitoring Photos and Survey Photos)

Comprehensive Plant Species List: See Appendix C (Table C-1)

Perpendicular Transects and Longitudinal Profile Plots: See Appendix D (Transects # 1-4 and Profile)

Plans: See Appendix G of 2013 Monitoring Report - https://www.mdt.mt.gov/other/webdata/external/planning/STREAM-MITIGATION/2013_REPORTS/2013_MILL_CREEK_MONITORING_REPORT.PDF

References

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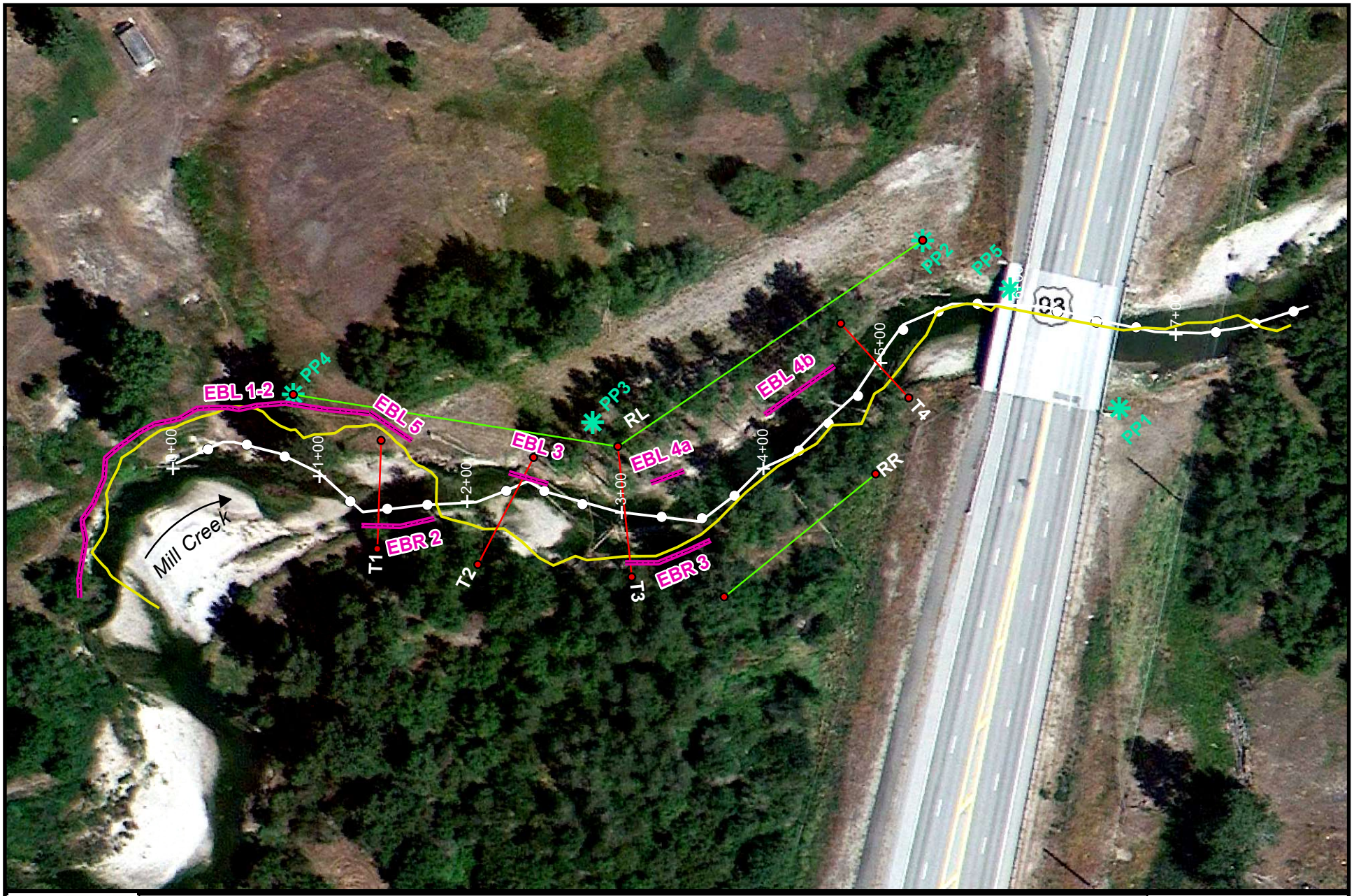
APPENDIX A
PROJECT AREA MAPS

MDT Streams Mitigation Monitoring
Mill Creek
Ravalli County, Montana



CONFLUENCE
consulting incorporated

Legend

- 2013 Channel Centerline
- Major Station (100')
- Minor Station (25')
- Photo Points
- Eroding Banks
- Pool and Riffle Transects
- Riparian Transects
- 2021 Thalweg

N

0 25 50 100 150 200 Feet

2021 Monitoring Features Mill Creek

Figure 2

Date: 10/15/2021

MillCreek_features2021

CONFLUENCE
consulting incorporated

Legend

- *Centaurea stoebe*
- *Cirsium arvense*
- *Tanacetum vulgare*

N

0 50 100 150 200 Feet

2021 Monitoring Noxious Weeds Mill Creek

Figure 3

Date: 9/16/2021

MillCreek_Weeds2021.mxd

APPENDIX B
PROJECT AREA MONITORING AND SURVEY PHOTOGRAPHS

MDT Streams Mitigation Monitoring
Mill Creek
Ravalli County, Montana

MONITORING PHOTO LOG

SITE NAME: Mill Creek
MONITORING YEARS: 2013 and 2021

CONFLUENCE

2013

2021

Photo Point 1.2: View from southeast corner of bridge looking downstream. **Compass:** 45° (Northeast)

2013

2021

Photo Point 2.3: View from Photo Point 2 looking upstream. **Compass:** 248° (West-Southwest)

2013

2021

Photo Point 2.5: View of deactivated channel alignment. **Compass:** 248° (West-Southwest)

MONITORING PHOTO LOG

SITE NAME: Mill Creek
MONITORING YEARS: 2013 and 2021

2013

2021

Photo Point 3.1: View of deactivated channel segment from Photo point 3. **Compass:** 68° (East-Northeast)

2013

2021

Photo Point 3.2: View of deactivated channel plug. **Compass:** 45° (East)

2013

2021

Photo Point 3.5: View of upstream extent of deactivated channel segment. **Compass:** 270° (West)

MONITORING PHOTO LOG

SITE NAME: Mill Creek
MONITORING YEARS: 2013 and 2021

2013

2021

Photo Point 3.8: View looking across deactivated channel segment. **Compass:** 90° (East)

2013

2021

Photo Point 4.3: Looking upstream at point bar formation along the right bank. **Compass:** 225° (Southwest)

2013

2021

Photo Point 5.2: View looking upstream from bridge. **Compass:** 203° (South-Southwest)

MONITORING PHOTO LOG

SITE NAME: Mill Creek
MONITORING YEARS: 2013 and 2021

2014

2021

Additional Photo 1: Upper end of eroding Bank EBL1-2.

MONITORING PHOTO LOG

SITE NAME: Mill Creek
MONITORING YEARS: 2013 and 2021

2014

2021

Additional Photo 2: Lower end of eroding Bank EBL1-2.

MONITORING PHOTO LOG

SITE NAME: Mill Creek
MONITORING YEARS: 2013 and 2021

2014

2021

Additional Photo 3: Upper section of Eroding Streambank EBL3.

MONITORING PHOTO LOG

SITE NAME: Mill Creek
MONITORING YEARS: 2013 and 2021

2013

2021

Additional Photo 4: Eroding streambank EBL4.

2013

2021

Additional Photo 5: Eroding streambank EBR2.

2013

2021

Additional Photo 6: Eroding streambank EBR3.

SURVEY PHOTO LOG

SITE NAME: Mill Creek
MONITORING YEAR: 2021

CONFLUENCE

Survey Photo 1. Looking West (upstream) from the North bank at T1.

Survey Photo 2. Looking Southeast (downstream) from the North bank at T1.

Survey Photo 3. Looking Northwest (upstream) from South bank at T1.

Survey Photo 4. Looking northeast (downstream) from the South bank at T1.

Survey Photo 5. Looking Northwest (upstream) from the middle of creek at T1.

Survey Photo 6. Looking East (downstream) from the middle of the creek at T1.

SURVEY PHOTO LOG

SITE NAME: Mill Creek
MONITORING YEAR: 2021

Survey Photo 7. Looking West (upstream) from the North bank at T2.

Survey Photo 8. Looking East (downstream) from the North bank at T2.

Survey Photo 9. Looking North across the channel from the South bank at T2.

Survey Photo 10. Looking South across the channel from the T2 North bank.

Survey Photo 11. Looking northwest (upstream) from the South bank at T2.

Survey Photo 12. Looking East (downstream) from the South bank at T2.

SURVEY PHOTO LOG

SITE NAME: Mill Creek
MONITORING YEAR: 2021

Survey Photo 13. Looking West (upstream) from middle of the creek at T2.

Survey Photo 14. Looking East (downstream) from middle of the creek at T2.

Survey Photo 15. Looking West (upstream) from the North bank at T3.

Survey Photo 16. Looking southeast (downstream) from the North bank at T3.

Survey Photo 17. Looking West (upstream) from the South bank at T3.

Survey Photo 18. Looking Northeast (downstream) from the South bank at T3.

SURVEY PHOTO LOG

SITE NAME: Mill Creek
MONITORING YEAR: 2021

Survey Photo 19. Looking West (upstream) from middle of creek at T3.

Survey Photo 20. Looking East (downstream) from middle of creek at T3.

Survey Photo 21. T4 looking West upstream from middle creek.

Survey Photo 22. T4 looking East downstream from middle creek.

Survey Photo 23. Looking Southwest (upstream) from the North bank at T4.

Survey Photo 24. Looking East (downstream) from the North bank at T4.

APPENDIX C
2013 – 2021 COMPREHENSIVE PLANT SPECIES LIST

MDT Streams Mitigation Monitoring
Mill Creek
Ravalli County, Montana

Table C-1. Comprehensive list of plant species observed at the Mill Creek Stream Mitigation Site from2013 through 2021.

Scientific Name	Common Name	WMVC Indicator Status*
Achillea millefolium	Common Yarrow	FACU
Agropyron cristatum	Crested Wheatgrass	UPL
Agrostis gigantea	Black Bent	FAC
Agrostis scabra	Rough Bent	FAC
Agrostis stolonifera	Spreading Bent	FAC
Algae, brown	Algae, brown	N/A
Algae, green	Algae, green	N/A
Alnus incana	Speckled Alder	FACW
Alopecurus aequalis	Short-Awn Meadow-Foxtail	OBL
Alyssum alyssoides	Pale Alyssum	UPL
Amelanchier alnifolia	Saskatoon Service-Berry	FACU
Antennaria parvifolia	Nuttall's Pussytoes	UPL
Artemisia absinthium	Absinthium	UPL
Aster sp.	Aster	N/A
Bassia scoparia	Burningbush	FAC
Berteroa incana	Hoary False-Alyssum	UPL
Betula pumila	Bog Birch	OBL
Bromus arvensis	Field Brome	UPL
Bromus inermis	Smooth Brome	UPL
Bromus japonicus	Japanese Brome	UPL
Bromus tectorum	Cheatgrass	UPL
Calamagrostis canadensis	Bluejoint	FACW
Calamagrostis stricta	Slim-Stem Reed Grass	FACW
Camelina microcarpa	Little-Pod False Flax	FACU
Carduus nutans	Nodding Plumeless-Thistle	UPL
Carex aquatilis	Leafy Tussock Sedge	OBL
Carex bebbii	Bebb's Sedge	OBL
Carex nebrascensis	Nebraska Sedge	OBL
Carex sp.	Sedge	N/A
Carex stipata	Stalk-Grain Sedge	OBL
Carex utriculata	Northwest Territory Sedge	OBL
Carex vesicaria	**Lesser Bladder Sedge**	**OBL**
Centaurea stoebe	Spotted Knapweed	UPL
Cerastium arvense	Field Mouse-Ear Chickweed	FACU
Chamaenerion angustifolium	Narrow-Leaf Fireweed	FACU
Cicuta douglasii	Western Water-Hemlock	OBL
Cirsium arvense	Canadian Thistle	FAC
Cirsium vulgare	Bull Thistle	FACU
Collomia linearis	Narrow-Leaf Mountain-Trumpet	FACU
Cornus alba	Red Osier	FACW

Scientific Name	Common Name	WMVC Indicator Status*
Crataegus douglasii	Black Hawthorn	FAC
Cynoglossum officinale	Gypsy-Flower	FACU
Dactylis glomerata	Orchard Grass	FACU
Dasiphora fruticosa	Golden-Hardhack	FAC
Deschampsia caespitosa	Tufted Hairgrass	FACW
Descurainia sophia	Herb Sophia	UPL
Eleocharis palustris	Common Spike-Rush	OBL
Elymus canadensis	Nodding Wild Rye	FAC
Elymus glaucus	Blue Wild Rye	FACU
Elymus repens	Creeping Wild Rye	FAC
Epilobium brachycarpum	Panicled Willowherb	UPL
Epilobium ciliatum	Fringed Willowherb	FACW
Equisetum arvense	Field Horsetail	FAC
Equisetum hyemale	Tall Scouring-Rush	FACW
Erodium cicutarium	Stork's Bill	UPL
Euphorbia esula	Leafy Spurge	UPL
Festuca idahoensis	Bluebunch Fescue	FACU
Festuca ovina	**Sheep Fescue**	**UPL**
Filago arvensis	Field Fluffweed	UPL
Fragaria virginiana	Virginia Strawberry	FACU
Geum macrophyllum	Large-Leaf Avens	FAC
Geum sp.	Avens	N/A
Glyceria grandis	American Manna Grass	OBL
Glyceria striata	Fowl Manna Grass	OBL
Holcus lanatus	Common Velvet Grass	FAC
Hypericum perforatum	Common St. John's-Wort	FACU
Juncus balticus	Baltic Rush	FACW
Juncus covillei	**Coville's Rush**	**FACW**
Juncus effusus	Lamp Rush	FACW
Juncus ensifolius	Dagger-Leaf Rush	FACW
Juncus sp.	Rush	N/A
Juncus tenuis	Lesser Poverty Rush	FAC
Juniperus scopulorum	Rocky Mountain Juniper	UPL
Lactuca serriola	Prickly Lettuce	FACU
Lepidium campestre	Field Pepper-Grass	UPL
Lepidium perfoliatum	**Clasping Pepperwort**	**FACU**
Leucanthemum vulgare	Ox-Eye Daisy	FACU
Lolium perenne	Perennial Rye Grass	FAC
Lotus corniculatus	Garden Bird's-Foot-Trefoil	FAC
Lupinus sericeus	Pursh's Silky Lupine	UPL
Lycopus asper	Rough Water-Horehound	OBL
Maianthemum stellatum	Starry False Solomon's-Seal	FAC

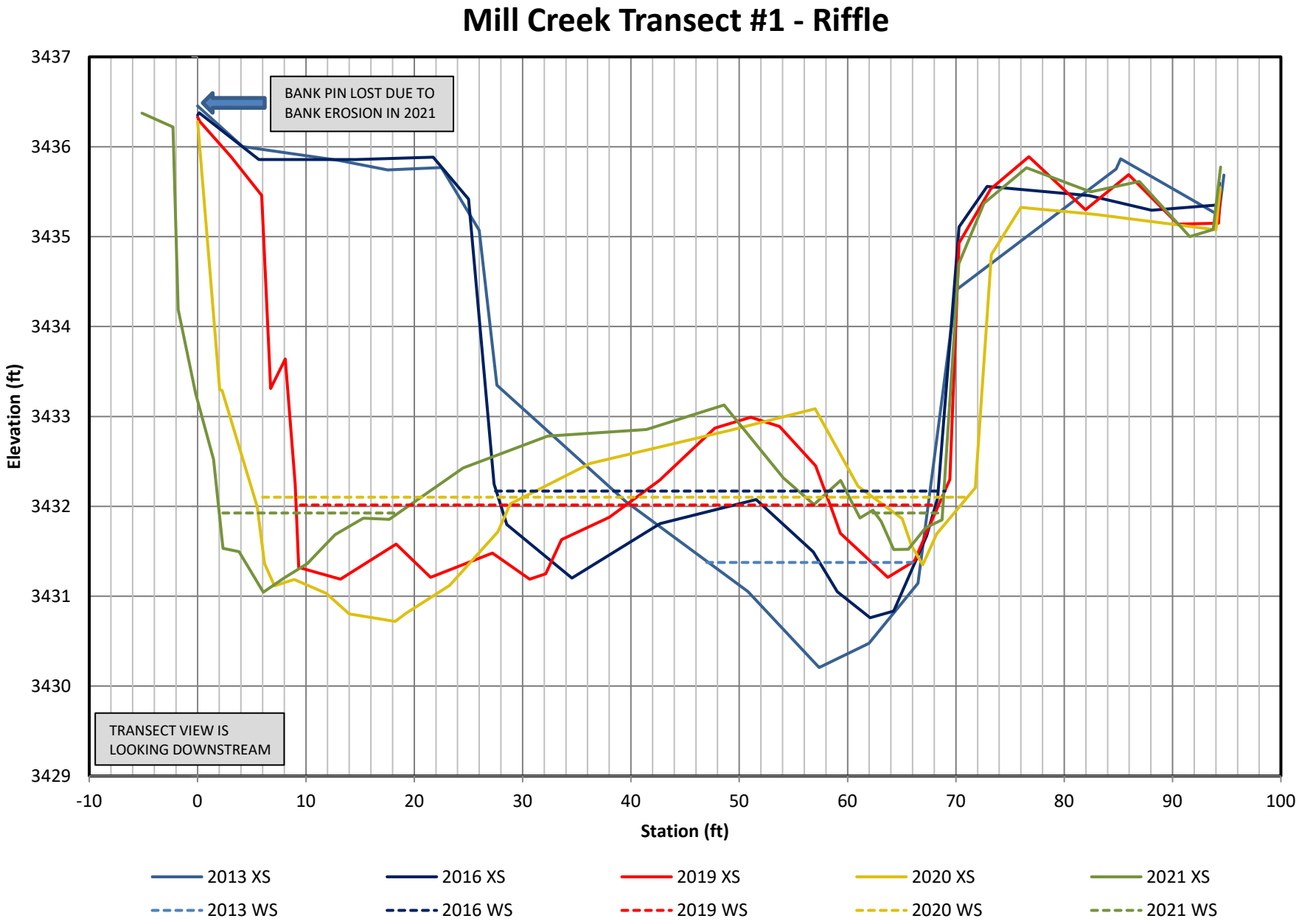
Scientific Name	Common Name	WMVC Indicator Status*
Medicago lupulina	Black Medick	FACU
Melilotus officinalis	Yellow Sweet-Clover	FACU
Mentha arvensis	American Wild Mint	FACW
Mimulus guttatus	Seep Monkey-Flower	OBL
Myosotis laxa	Bay Forget-Me-Not	OBL
Nepeta cataria	Catnip	FACU
Oenothera villosa	Hairy Evening-Primrose	FAC
Onopordum acanthium	Scotch Thistle	UPL
Pascopyrum smithii	Western-Wheat Grass	FACU
Persicaria amphibia	Water Smartweed	OBL
Persicaria sp.	Smartweed	N/A
Phalaris arundinacea	Reed Canary Grass	FACW
Phleum pratense	Common Timothy	FAC
Pinus ponderosa	Ponderosa Pine	FACU
Plantago major	Great Plantain	FAC
Poa compressa	Flat-Stem Blue Grass	FACU
Poa palustris	Fowl Blue Grass	FAC
Poa pratensis	Kentucky Blue Grass	FAC
Populus angustifolia	Narrow-Leaf Cottonwood	FACW
Populus balsamifera	Balsam Poplar	FAC
Prunella vulgaris	Common Selfheal	FACU
Pseudoroegneria spicata	Bluebunch Wheatgrass	UPL
Ranunculus aquatilis	White Water-Crowfoot	OBL
Ranunculus repens	Creeping Buttercup	FAC
Ranunculus sp.	Buttercup	N/A
Ribes lacustre	Bristly Black Gooseberry	FAC
Rosa woodsii	Woods' Rose	FACU
Rubus idaeus	Common Red Raspberry	FACU
Rumex acetosella	Common Sheep Sorrel	FACU
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 vulgaris	Maiden's-tears	UPL
Sisymbrium altissimum	Tall Hedge-Mustard	FACU
Solanum dulcamara	Climbing Nightshade	FAC
Solidago canadensis	Canadian Goldenrod	FACU
Sonchus arvensis	Field Sow-Thistle	FACU
Symphoricarpos albus	Common Snowberry	FACU
Symphyotrichum laeve	Smooth Blue American-Aster	FACU
Tanacetum vulgare	Common Tansy	FACU

Scientific Name	Common Name	WMVC Indicator Status*
Taraxacum officinale	Common Dandelion	FACU
Thinopyrum intermedium	Intermediate Wheatgrass	UPL
Thlaspi arvense	Field Pennycress	UPL
Tragopogon dubius	**Yellow Salsify**	**UPL**
Tragopogon pratensis	Meadow Goat's-beard	UPL
Trifolium aureum	**Yellow Clover**	**UPL**
Trifolium pratense	Red Clover	FACU
Trifolium repens	White Clover	FAC
Verbascum thapsus	Great Mullein	FACU
Veronica americana	American-Brooklime	OBL

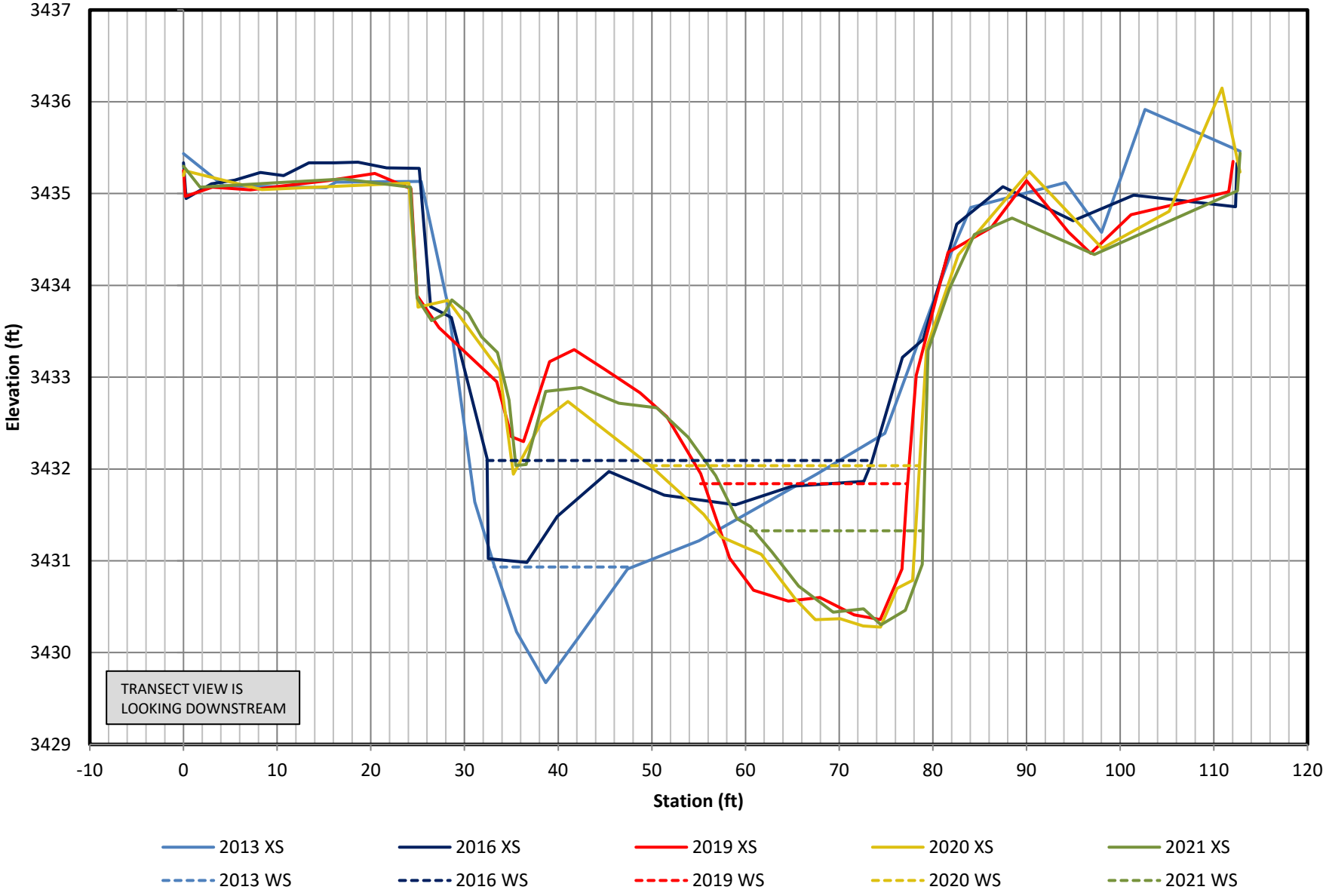
* 2018 National Wetland Plant List; Western Mountains, Valleys, and Coast Region (WMVC) (USACE 2018)
New species identified in 2021 are **bolded**
Species identified to genus level have been assigned an indicator status of N/A

APPENDIX D
LONGITUDINAL PROFILE AND PERPENDICULAR TRANSECT PLOTS

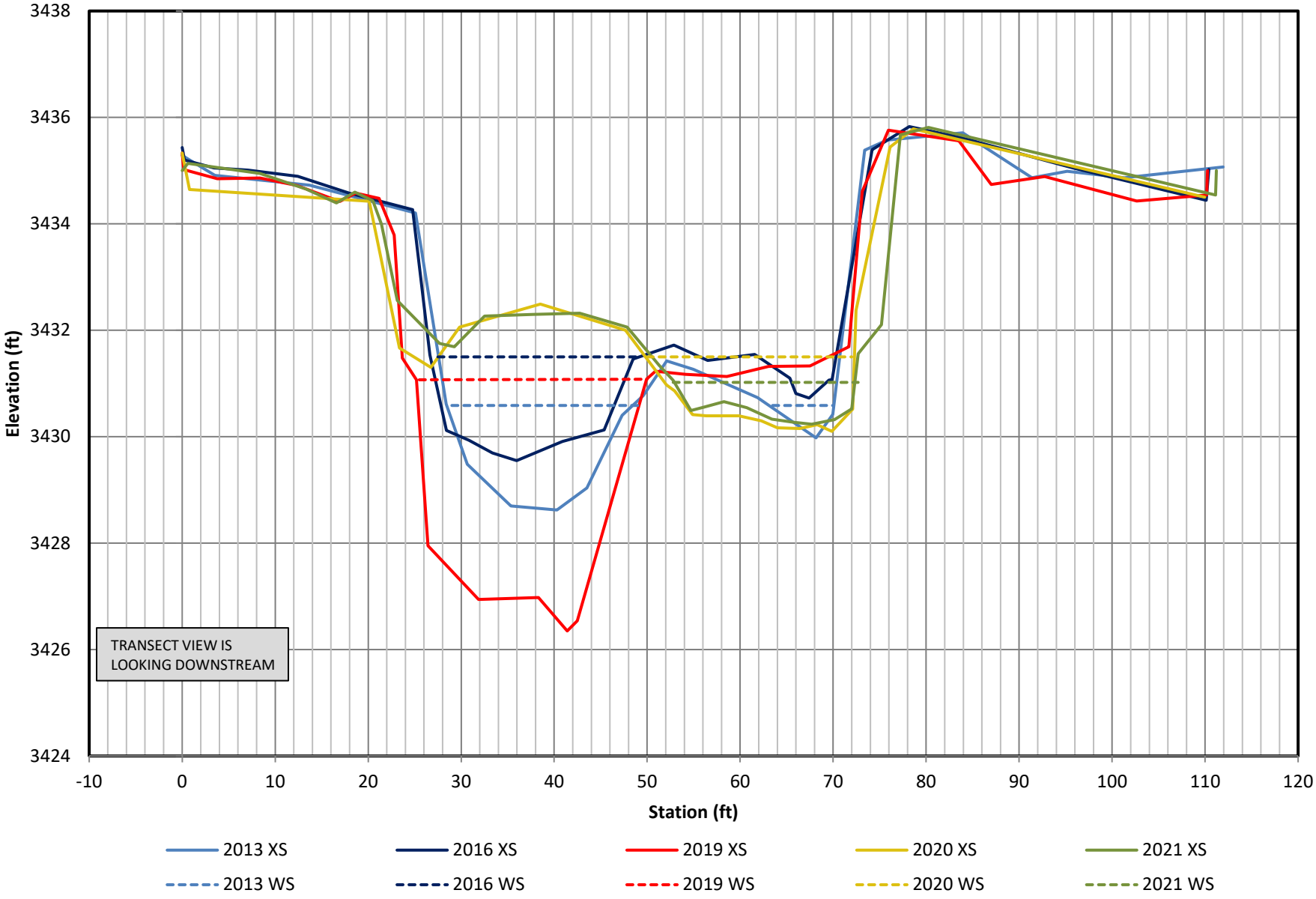
MDT Streams Mitigation Monitoring
Mill Creek
Ravalli County, Montana


Mill Creek Transect #1 - Riffle
BANK PIN LOST DUE TO BANK EROSION IN 2021
TRANSECT VIEW IS LOOKING DOWNSTREAM
Elevation (ft)
3437
3436
3435
3434
3433
3432
3431
3430
3429
-10
0
10
20
30
40
50
60
70
80
90
100
Station (ft)
2013 XS
2016 XS
2019 XS
2020 XS
2021 XS
2013 WS
2016 WS
2019 WS
2020 WS
2021 WS

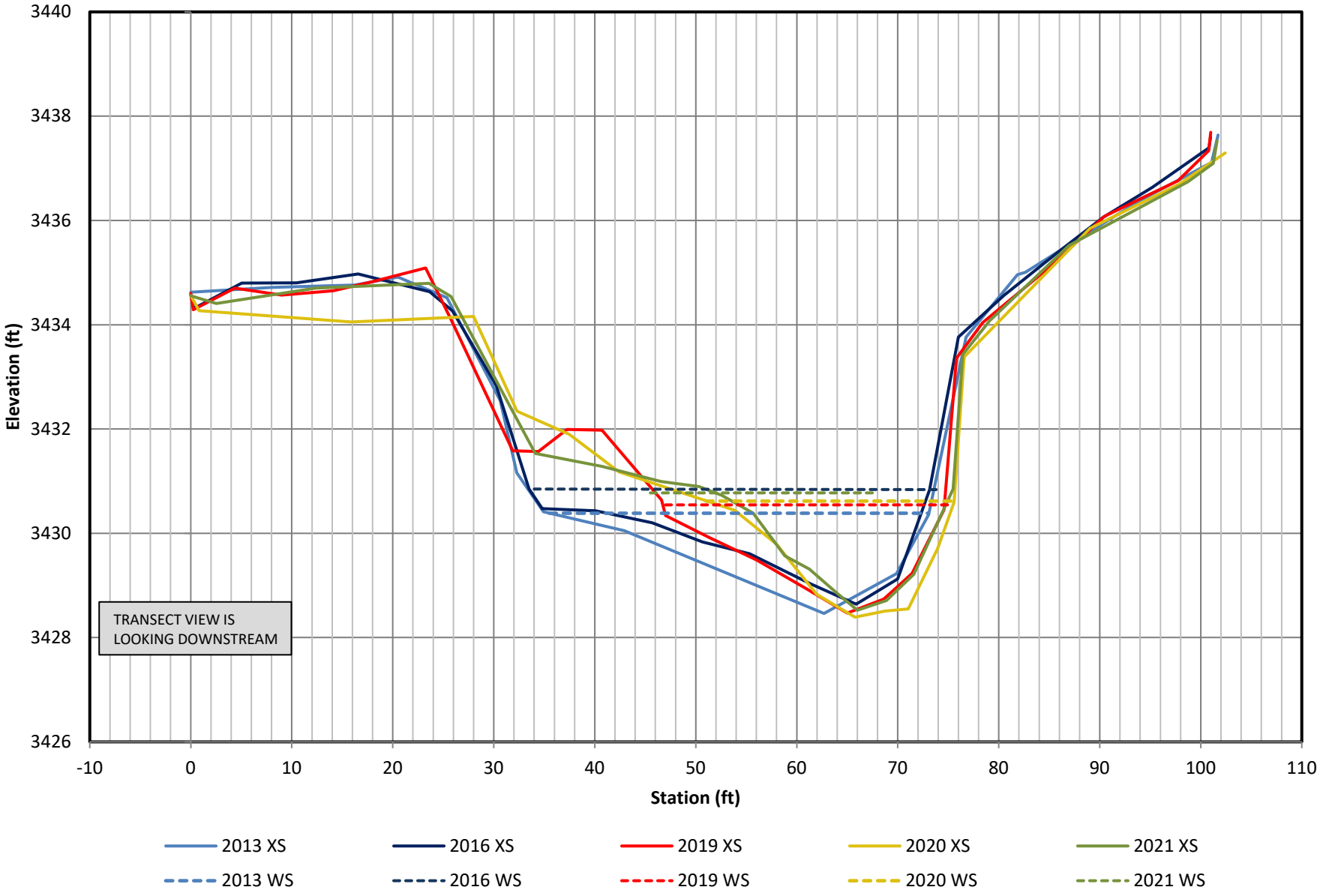
Mill Creek Transect #2 - Pool

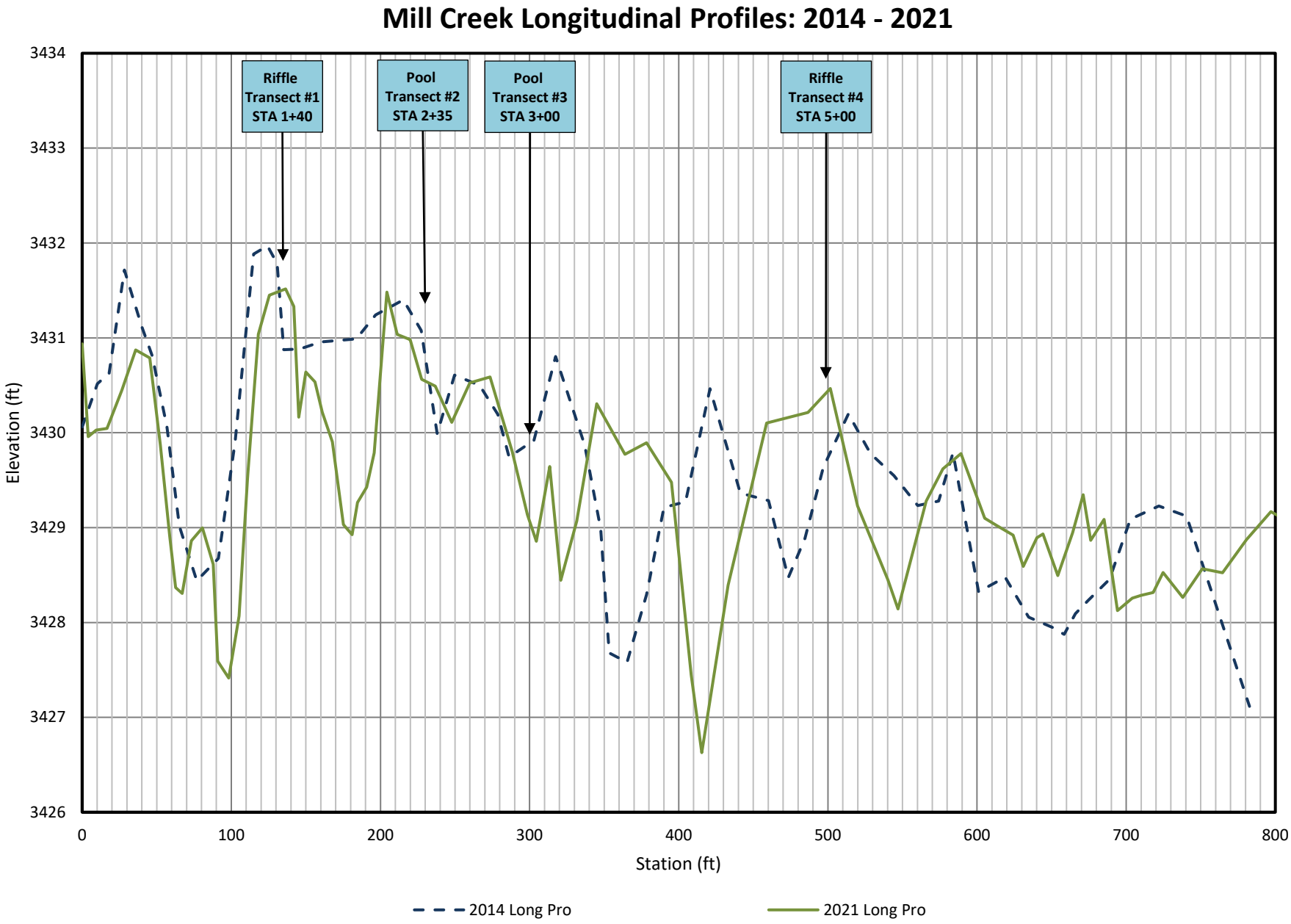


Mill Creek Transect #3 - Pool



Mill Creek Transect #4 - Riffle




Mill Creek Longitudinal Profiles: 2014 - 2021
Riffle Transect #1 STA 1+40
Pool Transect #2 STA 2+35
Pool Transect #3 STA 3+00
Riffle Transect #4 STA 5+00
Elevation (ft)
3434
3433
3432
3431
3430
3429
3428
3427
3426
0
100
200
300
400
500
600
700
800
Station (ft)
2014 Long Pro
2021 Long Pro