MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

Hydraulic Analysis Report: St. Regis River Tributaries

Mineral County, MT
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1.0 INTRODUCTION

As part of the Mapping Activity Statement (MAS) contract for Phase II of the Mineral County Modernization Project, DOWL completed a floodplain study of 13 tributaries to the St. Regis River. The combined study included approximately 32.9 miles along the tributaries of the St. Regis River within Mineral County, MT. The length of each stream studied is as follows: Hanaker Creek (0.25 mi), Denna Mora Creek (1.3 mi), Rainy Creek (0.6 mi), Randolph Creek (1.1 mi), Silver Creek (0.7 mi), Packer Creek (4.1 mi), Timber Creek (3.6 mi), Savenac Creek (4.7 mi), Big Creek (2.9 mi), Deer Creek (0.7 mi), Twin Creek (1.3 mi), Twelvemile Creek (8.9 mi), and Little Joe Creek (2.8 mi). As described in the MAS contract, the new hydraulic study for each stream was completed using an enhanced study level without floodway analyses. The study level was related to the previous FEMA nomenclature that was described as 'Limited Detail (w/o floodway) – AE'. The enhanced analysis used LiDAR topographic data and field measurements of structures included in the *Structure Inventory Report*.

The new study for the tributaries of the St. Regis River implements updates that include higher resolution topographic information, discharge-frequency relations from a new hydrologic study, and advances in hydraulic modeling software. Included in this report are the details and information used to develop the 1-percent-annual-chance (100-year) and the 0.2-percent-annual-chance (500-year) floodplains. The hydraulic analysis for each stream includes the evaluation of the 10%, 4%, 2%, 1%, 1% plus, and 0.2% annual chance (10-yr, 25-yr, 50-yr, 100-yr, 100-yr plus, and 500-yr, respectively) flood events. DOWL completed the hydraulic analysis using Light Detection and Ranging (LiDAR) mapping developed by Quantum Spatial in 2017, hydraulic structure assessments completed by Pioneer Technical Services in 2017, and the hydrology report completed by Pioneer Technical Services in March, 2018. All structure assessments, topographic and hydrologic data were previously submitted to (and approved by) FEMA in 2017 and 2018.

The downstream study limit of each tributary is located at the respective stream's confluence with the St. Regis River. The upstream study limits are specified by the study extents described in the MIP and the profile baselines identified in the *Hydrologic Analysis Report*. The study areas of the hydraulic analyses completed for each stream are shown in Figures 1-3.

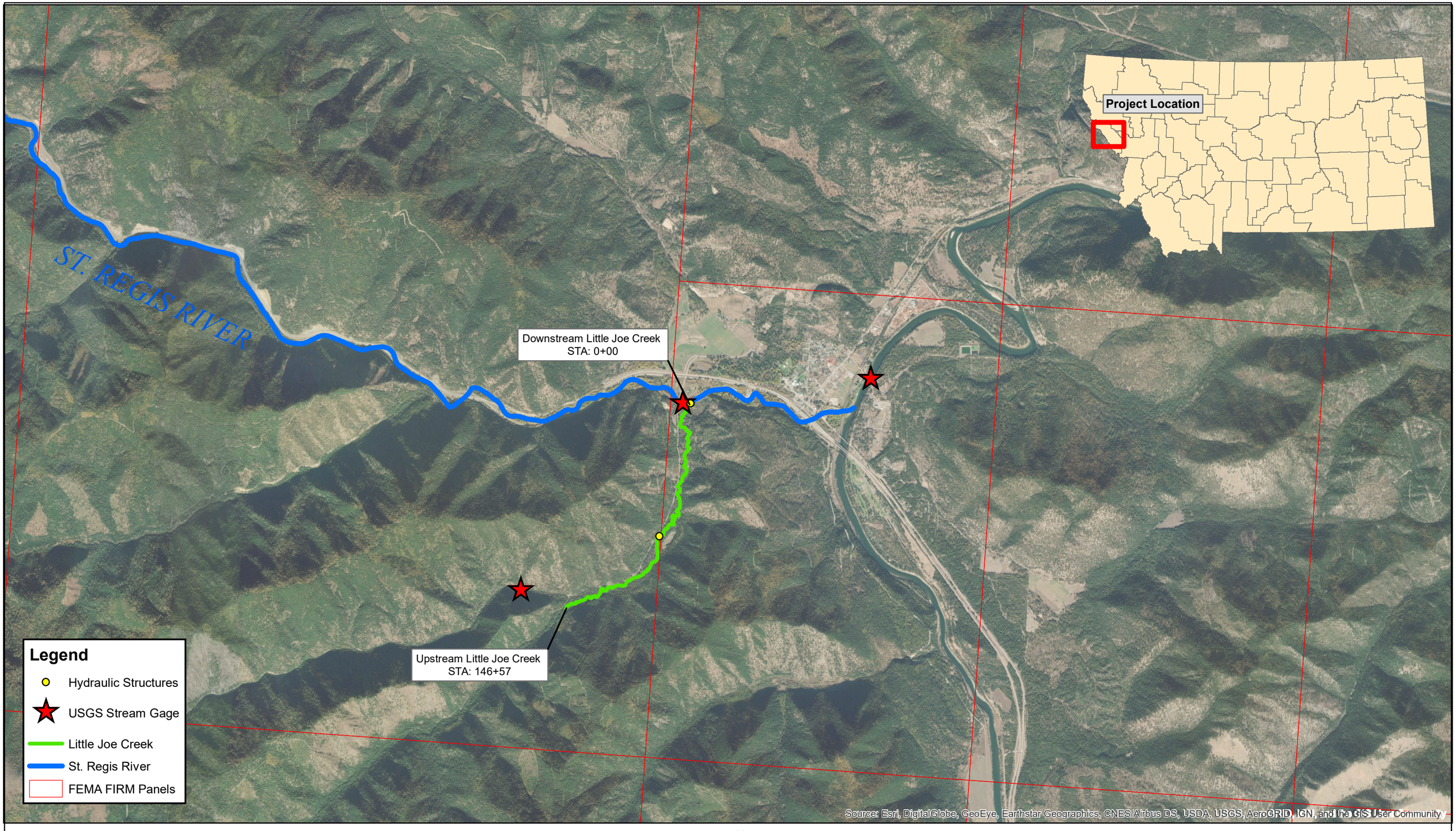

FIGURE 1: Project Overview - Little Joe Creek

St. Regis River Tributaries
Mineral County Floodplain Study

N
W E
S

0 0.5 1 2 3 4 Miles

MONTANA DNRC

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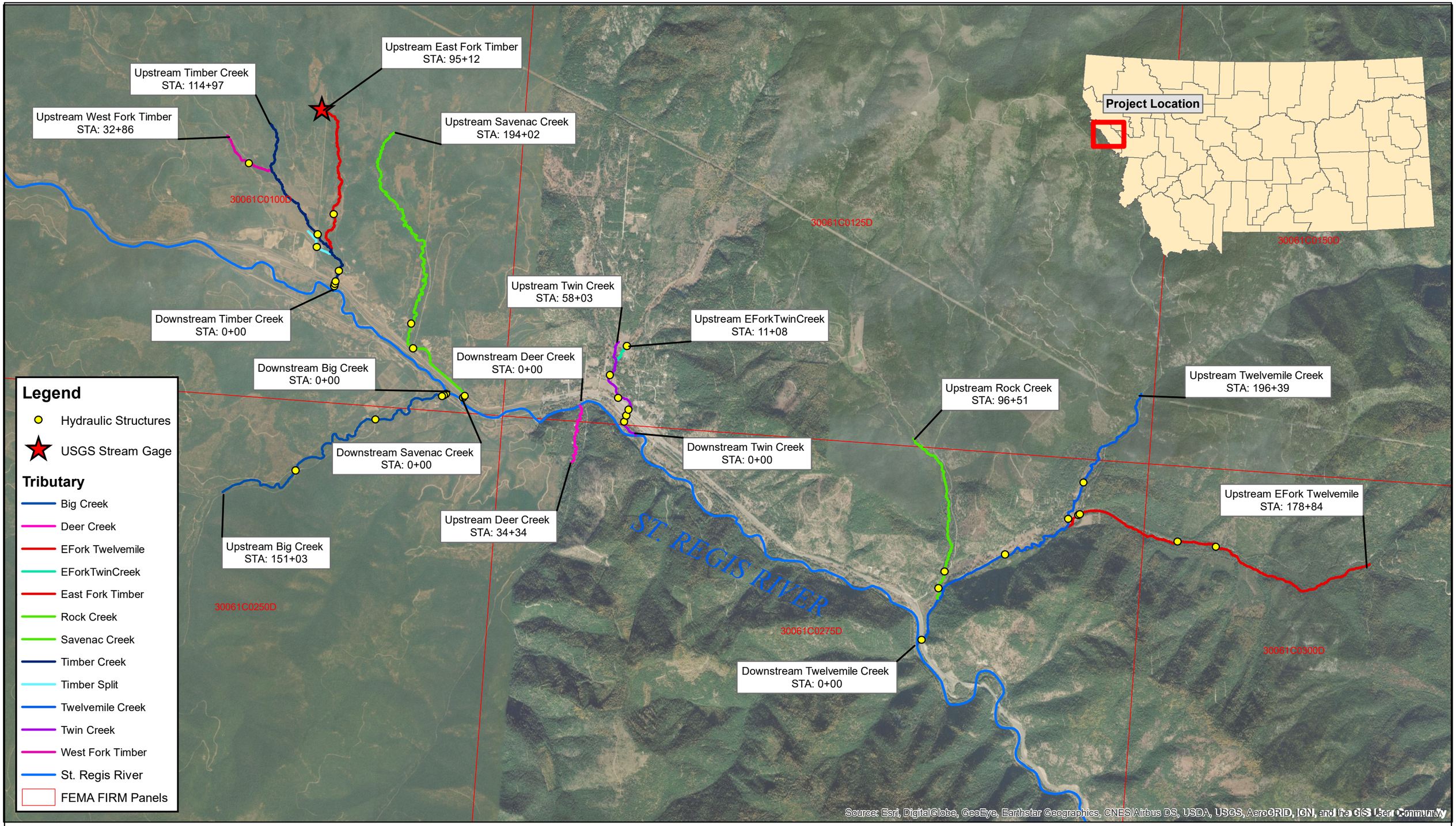

FIGURE 2: Project Overview - Twelvemile, Twin, Deer, Savenac, Big, Timber Creek

St. Regis River Tributaries
Mineral County Floodplain Study

0 0.5 1 2 3 4 Miles

N W E S

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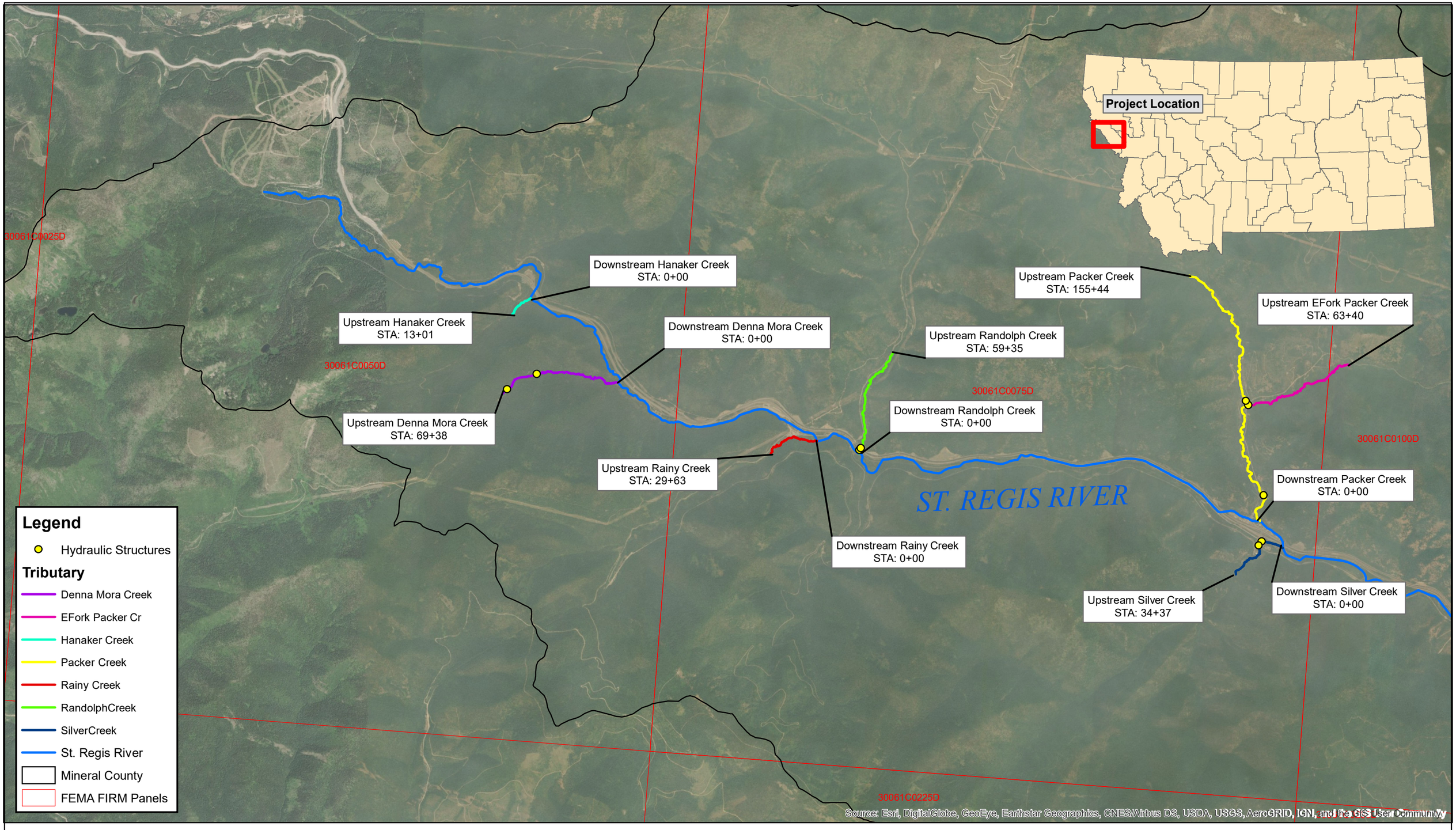

FIGURE 3: Project Overview - Silver, Packer, Randolph, Rainy, Denna Mora, Hanaker Creek

St. Regis River Tributaries
Mineral County Floodplain Study

0 0.5 1 2 3 4 Miles

N W E S

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1.1 Flood History

A Flood Insurance Study (FIS) has not been published for Mineral County, MT. In general, the basin of the St. Regis River has very limited information on historic flooding. The tributaries are not an exception to this, and detailed observations of historic flood events have not been published for these streams. While there is little information regarding the primary causes of flooding for the tributaries, it is likely that the tributaries experience similar flooding mechanisms as the St. Regis River. Therefore, the primary causes of flooding for the tributaries are assumed to be spring snowmelt events and ice jams on some of the larger tributaries.

Despite the limited information on historic flood events, two of the tributaries have USGS stream gages with peak flow records dating back to the 1960's and 1970's. These gages are as follows:

USGS gage 12353850 (East Fork of Timber Creek outside of Haugan, MT)
The gage has 16-years of record (1961-1975, 1979). The peak flood on record occurred in 1979, with a flow of 112 cfs that matched the 1% chance event. The second highest peak flood on record occurred in 1965, with a flow of 66 cfs. Based on these top two peak floods, the 10% chance event was only exceeded once (1979) during the recording period.

USGS gage 12354100 (North Fork of Little Joe Creek outside of St. Regis, MT)
The gage has 15-years of record (1960-1974). The highest peak flood on record for this gage occurred in 1972, with a maximum flow of 295 cfs. This discharge exceeded the 10% chance event flow of 268 cfs. This was the only event exceed the 10% chance event during the recording period.

1.2 Previous Studies

The existing floodplain mapping for Mineral County has not been modernized to the Digital Flood Insurance Rate Map (DFIRM) format. The effective mapping in Mineral County consists of 1982 Flood Hazard Boundary Maps that were converted to Flood Insurance Rate Maps (FIRM) in 1996. All effective mapping within Mineral County is dated and an approximate study level, except for an 800-foot reach on Flat Creek in Superior, Montana. The effective floodplain mapping of the St.

Regis River Tributaries is Approximate Zone A. Approximate Zone A flood boundaries are developed using approximate methodologies. A Flood Insurance Study (FIS) report has not been published for Mineral County, and the engineering methodologies used to establish the effective mapping are unknown.

2.0 WATERSHED DESCRIPTIONS

The St. Regis River is a tributary to the Clark Fork River and is approximately 37 miles in length. The river originates in the Lolo National Forest near the Montana-Idaho border and flows southeasterly before joining the Clark Fork River at St. Regis, MT. The river flows through a steep valley, which is bounded by the Bitterroot Mountains to the south and the Coeur D'Alene Mountains to the north. The basin has terrain that varies from a high-alpine environment at the headwaters and transitions to narrow inter-mountain valleys. The area is predominately forest and vegetation consists primarily of dense brush/trees with areas of high grasses. The tributaries in this study are located along the valley of the St. Regis River and offer similar vegetation. Down timber is common along the forested portions of the tributaries. In general, the tributaries are mountainous streams located in steep narrow drainages. As the streams descend to the valley bottom, the floodplains tend to broaden and slopes become milder. Sparse to light development can be found in the valley bottoms for some of the tributaries. Detailed descriptions of the study areas of each stream are included below.

2.1 Little Joe Creek

The Little Joe Creek study area begins at the confluence with the St. Regis River and extends approximately 2.8 miles to the upstream study limit. The Little Joe Creek basin is a large tributary to the St. Regis River, however, the study area is located in the valley bottom where slopes are mild. Vegetation includes high grass, brush, and trees. Areas of dense trees and brush are located along the creek banks. Development is sparse.

2.2 Twelvemile Creek

The Twelvemile Creek study area begins at the confluence with the St. Regis River and extends approximately 3.7 miles to the upstream study limit. The Twelvemile Creek study also includes reaches along the East Fork of Twelvemile Creek and Rock Creek. The study area on the East Fork of Twelvemile Creek begins at the confluence with Twelvemile Creek and extends approximately

3.4 miles to the upstream study limit. The study area of Rock Creek begins at the confluence with Twelvemile Creek and extends approximately 1.8 miles to the upstream study limit. In total, 8.9 miles of stream was included in the study for Twelvemile Creek.

Vegetation along each reach consists primarily of dense brush and trees. As the streams descend from the steep, narrow drainages to the valley bottom of Twelvemile Creek, high grass is also common. The downstream portion of Rock Creek has a large area of standing water with dense brush. There is sparse development adjacent to Twelvemile Creek. The East Fork of Twelvemile Creek and Rock Creek currently do not have development adjacent to the streams.

2.3 Twin Creek

The Twin Creek study area begins at the confluence with the St. Regis River and extends approximately 1.1 miles to the upstream study limit. The study also includes the West Fork of Twin Creek, which begins at the confluence with Twin Creek and extends approximately 0.2 miles to the upstream study limit. In total, 1.3 miles of stream were included in the study area for Twin Creek. Twin Creek contains areas of light development, high grass, and dense brush/trees. While there is light development throughout the study reach, development adjacent to the stream is sparse.

2.4 Deer Creek

The Deer Creek study area begins at the confluence with the St. Regis River and extends approximately 0.7 miles to the upstream study limit. Vegetation is primarily dense brush and trees. There is a significant amount of downed timber and heavy undergrowth. No development is located within the study area at this time.

2.5 Savenac Creek

The study area for Savenac Creek begins at the confluence with the St. Regis River and extends approximately 3.7 miles to the upstream study limit. Cook Creek is a tributary to the main stem of Savenac Creek and approximately 1 mile of Cook Creek was studied using shallow flooding methodologies. In total, approximately 4.7 miles of stream were studied for the Savenac Creek study area.

Vegetation is primarily dense brush/trees with areas of high grasses. The stream passes through several broad, marshy areas with dense brush and standing water. Development throughout the study area is sparse.

2.6 Big Creek

The study area for Big Creek begins at the confluence with the St. Regis River and extends approximately 2.9 miles to the upstream study limit. Vegetation is primarily dense brush/trees with areas of medium brush/trees and high grasses. Several buildings are located adjacent to the stream at the lower portion of the study area. The remainder of the stream currently does not have development.

2.7 Timber Creek

The Timber Creek study area begins at the confluence with the St. Regis River and extends approximately 2.2 miles to the upstream study limit. The West Fork (0.6 mi) and East Fork (1.8 mi) of Timber Creek were also included in the study area for a total stream length of 3.6 miles.

Vegetation consists of dense brush/trees with several large meadows with high grasses. There is no development along the West Fork or East Fork of Timber Creek. Several structures are located along the main stem of Timber Creek.

2.8 Silver Creek

The Silver Creek study area begins at the confluence with the St. Regis River and extends approximately 0.7 miles to the upstream study limit. The stream is fairly confined with little distance in the overbanks before reaching high ground. Vegetation is primarily dense brush and trees adjacent to the stream. The area is near the town of Saltese and there is moderate development throughout the study area.

2.9 Packer Creek

The study area for Packer Creek begins at the confluence with the St. Regis River near Saltese and extends approximately 2.9 miles to the upstream study limit. Approximately 1.2 miles of the West Fork of Packer Creek is also included in the study area for a total stream length of 4.1 miles.

The vegetation adjacent to each stream is primarily dense brush/trees with meadows and large areas of high grass. There is moderate development along both Packer Creek and the West Fork of Packer Creek.

2.10 Randolph Creek

The study area for Randolph Creek begins at the confluence with the St. Regis River and extends approximately 1.1 miles to the upstream study limit. Vegetation is primarily dense brush with areas of trees adjacent to the stream and several meadows of high grass in the overbanks. The stream is bounded by a road embankment to the west and a steep, forested hillside to the east. There is currently no development within the study area.

2.11 Rainy Creek

The Rainy Creek tributary begins at the confluence with the St. Regis River and extends approximately 0.6 miles to the upstream study limit. The study area is located in the valley bottom. Vegetation is primarily dense brush with several stands of timber, small areas of high grass, and gravel. The lower portion of the stream is a marshy area of dense brush with standing water. Other than an agricultural outbuilding, there is currently no development within the study area.

2.12 Denna Mora Creek

The Denna Mora study area begins at the confluence with the St. Regis River and extends approximately 1.3 miles to the upstream study limit. Vegetation is very dense brush and trees with a significant amount of downed timber. Near the middle of the study reach, there is a broad area that is marshy with standing water. This area is also very dense brush. There is no development adjacent to the stream in this study area.

2.13 Hanaker Creek

The Hanaker Creek study area begins at the confluence with the St. Regis River and extends 0.2 miles to the upstream study limit. Hanker Creek winds through a steep, wooded forest with heavy underbrush and a significant amount of downed timber. There is currently no development in the study area.

3.0 CHANNEL TOPOGRAPHY

The St. Regis River tributaries begin in high-altitude basins of the Bitteroot and Coeur D'Alene Mountains. In general, the streams descend from these high-altitude basins through narrow drainages bound by steep, mountainous slopes. As the streams approach the valley bottoms near the St. Regis River, the overbanks transition from mountainous slopes to flood benches that allow flood flows to access the natural floodplain. The channel slopes for most of the reaches included in this study range from less than 1 percent up to slopes between 2-4 percent. Several locations have slopes greater than 4 percent with a few locations reaching nearly 10 percent. Descriptions of the study area along each tributary are included below.

3.1 Little Joe Creek

The channel of Little Joe Creek has a relatively uniform slope that varies slightly between 1-2%. The channel is broad in comparison to the width of the floodplain and provides significant capacity for flood flows. While the floodplain is bound by a steep mountain slope to the East and a road embankment to the West, low lying flood benches along the valley floor allow flood flows to access the overbanks.

3.2 Twelvemile Creek

The study area of Twelvemile Creek includes the main stem as well as two tributaries to the main stem, East Fork of Twelvemile Creek and Rock Creek. The tributaries are contained in narrow valleys surrounded by steep hillsides. The mainstem meanders through the valley bottom except for a channelized segment that is confined by a road embankment. The channels are predominately straight and narrow with little to no braided areas. The slopes of the channels vary greatly throughout the study area, although most slopes are between 1-2 percent. The slopes range from less than 1 percent to nearly 10% at the upper portion of the East Fork of Twelvemile Creek.

3.3 Twin Creek

The channels of Twin Creek and East Fork of Twin Creek are very narrow with significant vegetation. The channels are poorly defined until the stream reaches De Borgia where there is a pronounced channel. Flood flows access the flood benches in the overbanks throughout the study area. The channel slopes range from less than 1 percent up to 4 percent.

3.4 Deer Creek

Most of the Deer Creek channel within the study reach is straight with a few braided sections. The aerial imagery does not represent the current conditions observed in the LiDAR. The channel was digitized according to the LiDAR data and any topographic changes that have occurred since the date of the aerial imagery. The channel slope is uniform except for a small reach near the confluence. Slopes range from approximately 2 percent to nearly 4 percent.

3.5 Savenac Creek

Savenac Creek has a narrow, shallow channel that meanders through low lying flood benches in the valley bottom. Flood flows access these flood benches throughout the study reach. At the downstream portion of the study, the stream passes through several areas of ponded water. Channel slopes range from less than 1 percent to approximately 2.5 percent.

3.6 Big Creek

Relative to the other tributaries, Big Creek has a wide channel. The active channel is relatively straight and meanders throughout the low-lying valley bottom. The channel depth varies throughout. Gravel bars are present throughout the study reach and there are historic meander bends that are accessed during flood flows. Flood flows access the flood benches in the overbanks throughout the study area. The slope of the channel has slight variances between 1-1.5 percent but is generally uniform across the study reach.

3.7 Timber Creek

Two tributaries to Timber Creek are included in the study, the East and West Forks of Timber Creek. The West Fork and the upper portions of the East Fork and mainstem have poorly defined channels that pass through very dense vegetation. On the East Fork, flood flows spill from the main channel and access a large, broad overbank. Below the confluence of the West Fork, Timber Creek passes through a large meadow where a significant amount of flow accesses the left overbank. The lower reach of Timber Creek is confined by high ground on either side of the stream and flood flows become deep, and narrow. The channel slopes are generally between 1 and 2 percent with upper reaches between 2 and 4 percent.

3.8 Silver Creek

Silver Creek has a relatively deep channel that is confined by high ground in both overbanks. Because of this, there is little conveyance in either overbank, and the floodplain is well defined. The channel slope is slightly over 2 percent at the downstream end and increases to nearly 4 percent at the top of the study area.

3.9 Packer Creek

Packer Creek has one tributary, East Fork of Packer Creek, that joins the stream approximately in the middle of the study area. The upper portion of the main stem has a small, relatively straight channel with few braided sections. Flood flows access the overbanks throughout the reach. The East Fork of Packer Creek also has a small, defined channel that passes through dense brush. Flood flows access the overbanks throughout the reach. Below the confluence of these streams, the channel is much wider and the depth increases. Flood flows access the flood benches in the overbanks throughout the reach. In the lower portion of the study, the natural floodplain is restricted by road alignments. The channel slope is generally between 1 and 2 percent with the upper portions of the study reaching nearly 4 percent.

3.10 Randolph Creek

Randolph Creek has a narrow channel that meanders through the valley bottom. The upper reach passes through vary dense brush and the channel bottom is not visible in the aerial imagery. Segments of the channel in the lower section are visible as the stream passes by several meadows and areas of light brush. The channel is straight with little to no braided segments. The channel slope varies slightly but is generally uniform with an approximate slope of 2.5 percent.

3.11 Rainy Creek

Rainy Creek has a shallow channel that meanders through the valley bottom. The lower portion of the stream passes through a large area of ponded water before reaching the confluence with the St. Regis River. The channel slope is between 1 and 2 percent.

3.12 Denna Mora Creek

Denna Mora Creek has a narrow, shallow channel that passes through very dense brush and trees with heavy downfall. The channel is not visible on aerial imagery for most of the study reach. The channel begins in a narrow, steep drainage and opens into mild, marshy areas as the valley floor widens. The channel slope begins at approximately 2 percent and increases throughout the reach to a maximum of 10 percent at the upstream study limit.

3.13 Hanaker Creek

Hanaker Creek has a small, shallow channel the descends through a steep and narrow drainage. The drainage is heavily timbered with dense undergrowth and the channel is not visible on the aerial imagery. The channel slope ranges from approximately 6 percent to 12 percent within the study area.

4.0 HYDROLOGY

Pioneer Technical Services, Inc. (Pioneer) completed the St. Regis River Tributary Study Area Hydrologic Analysis. The analysis estimated peak flows at key locations for the 50, 10, 4, 2, 1, and 0.2-percent annual chance flood events. The '1-percent plus' peak flow was also developed. Flows were calculated at 27 flow nodes located at ungaged sites along the 13 tributaries.

Pioneer used the regional regression method to calculate the flood frequency peak flow estimates at each flow node. While there were two stream gages within the tributaries, the drainage basins for the flow nodes within the study area did not meet the drainage area ratio criteria for the gage transfer method so the gage transfer method was not used. Because there is very limited peak flow data and few stream gage stations are located in the study area, the regional regression equations were selected as the most accurate method for determining the peak flow estimates for the St. Regis River tributaries.

The discharges provided in the hydrologic analysis that were used to complete the hydraulic modeling are summarized in Table 1.

Table 1: West Region Regression Estimated Discharges

Node Number	Location Description	West Region Regression Estimated Discharges (cfs)					
		10% Chance	4% Chance	2% Chance	1% Chance	0.2% Chance	1% + Chance
100	Little Joe Creek at confluence with St. Regis River	816	958	1,080	1,200	1,440	1,872
200	Twelvemile Creek at confluence with St. Regis River	658	801	922	1,040	1,310	1,622
300	Twelvemile Creek upstream of confluence with Rock Creek	577	702	808	915	1,150	1,427
400	Rock Creek confluence with Twelvemile Creek	123	159	190	223	298	348
500	Twelvemile Creek upstream of confluence with East Fork Twelvemile Creek	511	622	715	809	1010	1,262
600	East Fork Twelvemile Creek at confluence with Twelvemile Creek	96	124	148	173	231	270
700	Twin Creek at confluence with St. Regis River	178	226	267	310	407	484
800	West Twin Creek at confluence with Twin Creek	129	165	195	226	297	353
900	East Twin Creek at confluence with Twin Creek	58	77	93	110	150	172
1000	Deer Creek at confluence with St. Regis River	369	441	501	561	687	875
1100	Savenac Creek at confluence with St. Regis River	209	262	307	353	456	551
1200	Savenac Creek upstream of confluence with Cook Creek	185	232	271	311	400	485
1300	Cook Creek at confluence with Savenac Creek	30	41	50	60	85	94

Node Number	Location Description	West Region Regression Estimated Discharges (cfs)					
		10% Chance	4% Chance	2% Chance	1% Chance	0.2% Chance	1% + Chance
1400	Big Creek at confluence with St. Regis River	769	904	1,020	1,130	1,370	1,763
1500	Timber Creek at confluence with St. Regis River	123	159	190	223	299	348
1600	Timber Creek upstream of confluence with East Fork Timber Creek	82	107	128	151	205	236
1700	East Fork Timber Creek at confluence with Timber Creek	52	69	83	99	135	154
1800	Timber Creek upstream of confluence with West Fork Timber Creek	56	73	87	103	138	161
1900	West Fork Timber Creek at confluence with Timber Creek	23	32	39	48	68	74
2000	Silver Creek at confluence with St. Regis River	243	292	333	374	460	583
2100	Packer Creek at confluence with St. Regis River	368	441	503	565	696	881
2200	Packer Creek upstream of confluence with West Fork Packer Creek	214	261	300	341	427	532
2300	West Fork Packer Creek at confluence with Packer Creek	188	228	261	295	367	460
2400	Randolph Creek at confluence with St. Regis River	227	271	307	344	421	537
2500	Rainy Creek at confluence with St. Regis River	183	217	245	273	331	426
2600	Denna Mora Creek at confluence with St. Regis River	54	67	77	87	110	136
2700	Hanaker Creek at confluence with St. Regis River	75	91	104	117	146	183

5.0 HYDRAULIC MODELING

Details of the methods used to complete the hydraulic analysis for the flood study of the St. Regis River tributaries are presented below.

5.1 Hydraulic Analysis Overview

The new enhanced study for the St. Regis River tributaries includes hydraulic analyses for approximately 33 miles of stream along 13 tributaries of the St. Regis River. Detailed work maps for each modeled tributary are included in Appendix B. The hydraulic models for the study were developed following the FEMA publication *Hydraulics: One-Dimensional Analysis (Nov 2016).* A two-dimensional model was developed for an area of shallow flooding along Cook Creek which flows into Savenac Creek. This model was developed in accordance with guidance in the FEMA publication *Hydraulics: Two-Dimensional Analysis (Nov 2016)* and is described in more detail in the section Shallow Flooding – Cook Creek.

DOWL used GeoHEC-RAS to develop the preliminary model, including cross section locations, bank stations, Manning's n values, channel and overbank flow lengths, lateral structures, road profiles, and ineffective flow limits. Minor modifications to these original inputs were necessary to calibrate the model and improve model stability.

Most of the modeled reaches for the St. Regis River tributaries flow through narrow valleys that transition to wider valley bottoms with flood benches as the streams approach the St. Regis River. Most of the streams were modeled using common approaches and did not require special features such as lateral weirs. However, there are several locations along the study reach that required more complex model features to effectively represent the impacts of infrastructure and changes in topography. For each of these, the main channel was modeled using a one-dimensional model with lateral weirs used to compute overtopping flows in key locations. The modeling approach for each of these lateral weirs is discussed in greater in detail in the Lateral Weirs section of this report.

5.2 Topographic Mapping Acquisition

The LiDAR and field survey were provided in the Universal Transverse Mercator Zone 12 projection and the Montana Coordinate System, respectively. Both data sets are referenced to the North American Datum of 1983 (NAD83-2011), with elevations referenced to the North American

Vertical Datum of 1988 (NAVD88). LiDAR units are reported in meters. The field survey is reported with horizontal units of international feet and vertical units of U.S. feet. LiDAR units were converted to feet for incorporation into the hydraulic model.

5.2.1 LiDAR Survey

Topographic survey data was completed in 2017 by Quantum Spatial for the Mineral County Modernization Project. The Mineral County project included two sites: the Clark Fork area of interest (AOI) and the St. Regis AOI. Acquisition of the LiDAR for the St. Regis AOI was completed from 7/31/2017 to 8/22/2017. In the Spring of 2019, Quantum Spatial was contracted to collect additional LiDAR to serve as an expansion to the 2017 LiDAR. More information on the LiDAR acquisition and post-processing is included in Appendix A.

5.2.2 Structure Inventory

A structure inventory assessment was completed to collect information for hydraulic structures along the tributaries included in this study. Pioneer Technical Services, Inc. performed the structure inventory assessment in December of 2016. For each structure, pertinent information was recorded, including structure type, dimensions, material, and backwater potential. In total, the structure inventory included 37 structures, which were summarized in the report, *Final Field Reconnaissance and Hydraulic Structure Assessment.* In 2019, the Montana DNRC collected structure information for two additional structures. More information on the structure assessments is included in Appendix A.

5.3 Profile Baselines

The centerline of channel was used to define the profile baseline of each stream included in the hydraulic modeling for the tributaries of the St. Regis River. In general, the profile baselines developed for the *Hydrologic Analysis* were used for the hydraulic modeling. During the development of the hydraulic models, several profile baselines were refined to follow the channel centerline more closely. At several locations with narrow flood boundaries, modifications to the profile baselines were required to position the profile baseline within the flood boundary. The modifications were not significant enough to impact the tributary river stations (nearest 0.1 mi.) for the flow nodes presented in the *Hydrologic Analysis.* The river centerline was established using the LiDAR and 2015 National Agricultural Imagery Program (NAIP) aerial imagery (USDA

2015). Due to the course resolution of the NAIP Imagery, greater resolution ESRI aerial imagery was also referenced.

The river stationing for the main stem of each tributary refers to stream distance in feet above the confluence with the St. Regis River. For streams with multiple reaches, the river stationing of each reach is in stream distance in feet above the confluence with the respective tributary. The starting and ending stations of each modeled river reach are presented in Table 2. The profile baselines for each tributary are shown on the Work Maps included in Appendix B.

Table 2: River Stationing

Hydraulic Model Data				River Station of St. Regis River at Tributary Confluence (mi.)
River Name	**Reach Name**	**Starting River Station (ft)**	**Ending River Station: Last Modeled Cross Section (ft)**	
Little Joe Creek				
Little Joe Creek	Little Joe Creek	0+00	15+612	1.7
Twelvemile Creek				
Twelvemile Creek	Lower	0+00	24+61	13.0
Twelvemile Creek	Middle	28+53	110+43	--
Twelvemile Creek	Upper	113+26	196+39	--
Rock Creek	Rock Creek	0+00	96+51	--
EFork Twelvemile	EFork Twelvemile	0+00	178+84	--
Twin Creek				
Twin Creek	Lower	0+00	48+98	16.7
Twin Creek	WForkTwinCreek	50+29	58+03	--
EForkTwinCreek	EForkTwinCreek	0+00	11+08	--
Deer Creek				
Deer Creek	Deer Creek	0+00	34+34	17.3
Savenac Creek				
Savenac Creek	Savenac Creek	0+00	194+02	18.6
Big Creek				
Big Creek	Big Creek	0+00	151+03	18.7
Timber Creek				
Timber Creek	Lower Reach 1	0+00	22+24	20.2
Timber Creek	Lower Reach 2	24+27	26+66	--

Hydraulic Model Data				River Station of St. Regis River at Tributary Confluence (mi.)
River Name	**Reach Name**	**Starting River Station (ft)**	**Ending River Station: Last Modeled Cross Section (ft)**	
Timber Creek	Middle	27+54	85+24	--
Timber Creek	Upper	86+67	114+97	--
Timber Split	Split West	0+00	17+70	--
East Fork Timber	East Fork	0+00	95+12	--
West Fork Timber	West Fork	0+00	32+86	--
Silver Creek				
SilverCreek	SilverCreek	0+00	34+37	25.6
Packer Creek				
Packer Creek	Lower	0+00	72+46	25.9
Packer Creek	West Fork	74+85	155+44	--
EFork Packer Cr	East Fork	0+00	63+40	--
Randolph Creek				
RandolphCreek	RandolphCreek	0+00	59+35	30.0
Rainy Creek				
Rainy Creek	Rainy Creek	0+00	29+63	30.5
Denna Mora Creek				
Denna Mora Creek	Denna Mora Creek	0+00	69+38	32.7
Hanaker Creek				
Hanaker Creek	Hanaker Creek	0+00	13+01	33.9

5.4 Boundary Conditions

The HEC-RAS models were evaluated under the assumptions of subcritical flow and no backwater influence from the St. Regis River. The normal depth option was selected as the downstream boundary condition for determining the water surface elevation at the downstream limit of each HEC-RAS model. The channel and water surface slope near the downstream study limits were evaluated using the LiDAR. Representative slopes were selected to calculate the normal depth for each stream.

5.5 Cross Section Development

The terrain data in the HEC-RAS model was extracted from the LiDAR data. Bathymetric data was not collected for the tributaries. Considering the low flow rates and the minimal flow area beneath the water surface at the time the LiDAR was collected, DOWL did not estimate bathymetry to incorporate into the hydraulic models. GeoHECRAS Version 2.1.0 was used to place cross sections perpendicular to flow direction. Cross section extents were placed to encompass the water surface of the 0.2-percent-annual-chance flood. Typically, cross sections are placed with a target spacing of 300 to 500 feet and additional cross sections are added at key locations along the reach. These locations include structure crossing, breaks in channel slope, abrupt changes in the floodplain width, and changes in the direction of the stream. Additional cross sections were required and the cross section spacing was less than the typical 300 to 500 ft spacing for most of the tributaries.

For much of the modeled length for this study, the streams travel through steep, narrow drainages and flow is bound by the mountain slopes. In these locations, the overbanks do not convey a significant amount of flow and the flood flows are essentially conveyed in one channel with all flood flows following a similar flow path. At these locations, a single reach length was assigned to the cross section. Where flood flows access the overbanks and the reach lengths of the overbanks are distinctly different than the reach length of the main channel, separate reach lengths have been assigned to each overbank and the channel.

In general, contraction and expansion coefficients were set at 0.1 and 0.3, respectively. For cross sections near structures, the contraction and expansion coefficients were set to 0.3 and 0.5. The values of the coefficients were increased to 0.6 and 0.8 for culvert crossings that experience more significant expansion and contraction than bridge openings. All cross-section expansion and contraction coefficients follow these standard values.

As described earlier in this report, peak flows were calculated at 27 nodes throughout the study area. The flow data are input in HEC-RAS as flow change locations. Typically, flow change locations are input at the most upstream limit of each modeled reach, which corresponds to the upstream limit that each calculated flow is applied. Figure 4 through 6 show the flow change locations for each tributary.

FIGURE 4: Flow Change Locations - Little Joe Creek

St. Regis River Tributaries
Mineral County Floodplain Study

0 0.5 1 2 3 4 Miles

N W E S

East Fork Timber STA: 95+12
99 cfs (1% AC)

Timber Creek STA: 114+97
103 cfs (1% AC)

West Fork Timber STA: 32+86
48 cfs (1% AC)

Savenac Creek STA: 194+02
311 cfs (1% AC)

Savenac Creek STA: 112+36
353 cfs (1% AC)

Timber Creek STA: 85+24
151 cfs (1% AC)

Timber Split STA: 17+70
1 cfs (1% AC)
* Initial flow required for split flow

Timber Creek STA: 26+66
223 cfs (1% AC)

Twin Creek STA: 58+03
226 cfs (1% AC)

EForkTwinCreek STA: 11+08
110 cfs (1% AC)

Twin Creek STA: 48+98
310 cfs (1% AC)

Rock Creek STA: 96+51
223 cfs (1% AC)

Twelvemile Creek STA: 196+39
809 cfs (1% AC)

EFork Twelvemile STA: 178+84
173 cfs (1% AC)

Twelvemile Creek STA: 11043
915 cfs (1% AC)

Twelvemile Creek STA: 24+61
1,040 cfs (1% AC)

Big Creek STA: 151+03
1,130 cfs (1% AC)

Deer Creek STA: 34+34
561 cfs (1% AC)

ST. REGIS RIVER

Project Location

Legend

Flow Change Locations

Tributary

- Big Creek
- Deer Creek
- EFork Twelvemile
- EForkTwinCreek
- East Fork Timber
- Rock Creek
- Savenac Creek
- Timber Creek
- Timber Split
- Twelvemile Creek
- Twin Creek
- West Fork Timber
- St. Regis River

Sources: Esri, USGS, NOAA, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 5: Flow Change Locations - Twelvemile, Twin, Deer, Savenac, Big, Timber Creek

St. Regis River Tributaries
Mineral County Floodplain Study

0 0.5 1 2 3 4 Miles

N W E S

MONTANA DNRC

DOWL

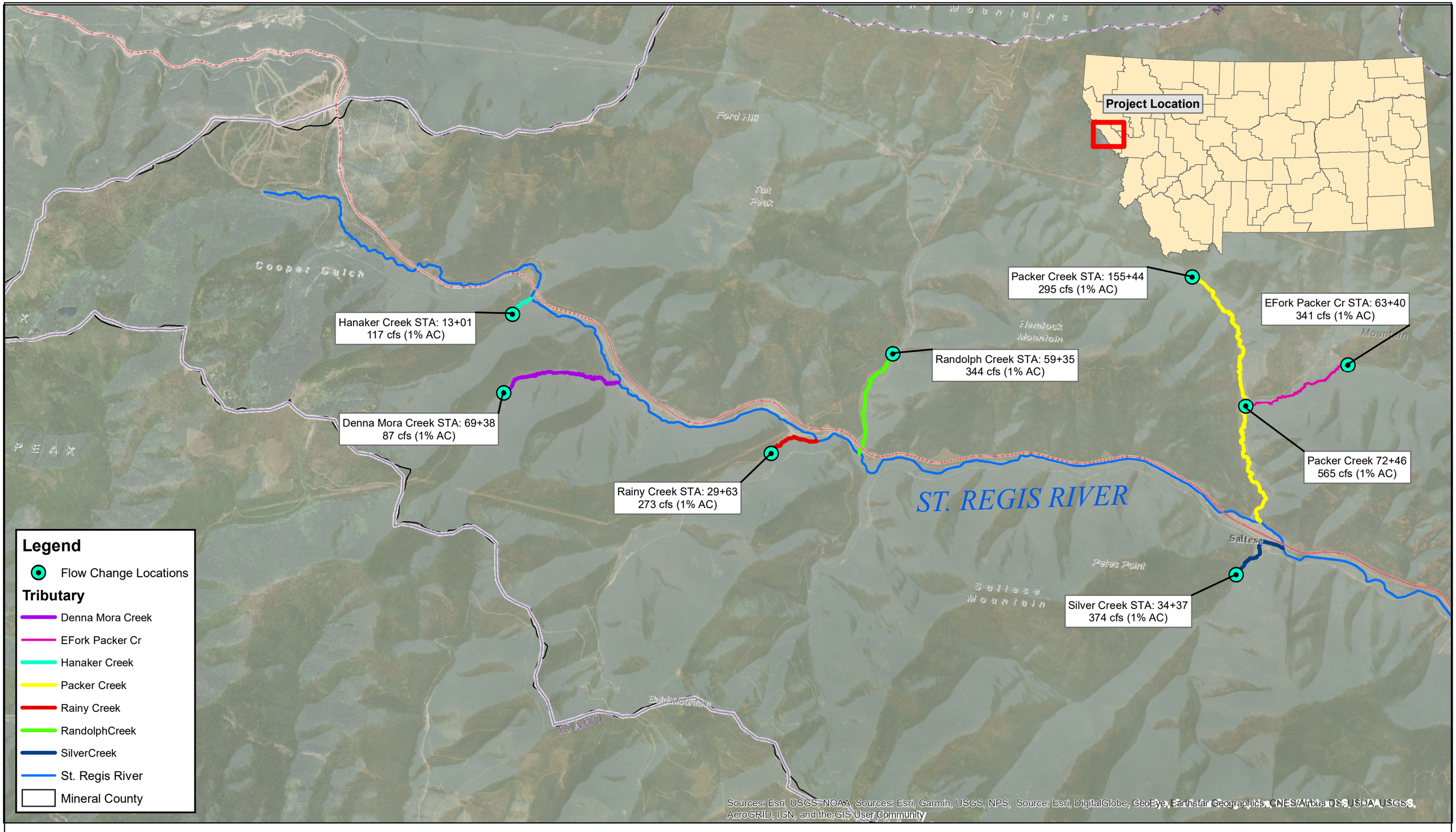

FIGURE 6: Flow Change Locations - Silver, Packer, Randolph, Rainy, Denna Mora, Hanaker Creek

St. Regis River Tributaries
Mineral County Floodplain Study

0 0.5 1 2 3 4 Miles

N W E S

5.6 Manning's Roughness Coefficients

The Manning's roughness values assigned within the hydraulic model were determined based on field observations, aerial photography, recommendations in Chow's *Open-Channel Hydraulics* and the USDA's *Photographic Guidance for Selecting Flow Resistance Coefficients in High-Gradient Channels*. The *USDA's High Gradient Channels* publication indicates that mountainous streams with high gradients tend to flow in subcritical conditions due to internal energy loss of the flow, and that Manning's roughness values correspondingly increase in these locations. The channel slopes of the St. Regis River tributaries within the study area range from less than 1 percent up to nearly 10 percent. Manning's roughness values in the steep sections of the river reach were evaluated in comparison to streams represented in USDA's *High-Gradient Channels*. The most representative streams were found to be Fool Creek and East Saint Louis Creek in Colorado as well as a stream in the Eastern Italian Alps near Rio Cordon, Italy. The stream slopes ranged from 6.3 to 11.1 percent with Manning's n values ranging from 0.095 to 0.21 during high flows. In general, the channels for the tributaries are similar with channel beds comprised of cobbles and boulders.

In most locations, a horizontal variation of the Manning's n values was used in the model to simulate the changes in the roughness for the channel and overbanks. There were several areas with uniform vegetation in both overbanks. At these locations, Manning's n values were selected for the overbanks and channel in HEC-RAS and the horizontal variation of the Manning's n values was not used. Roughness values selected for the channel bottom of the tributaries range between 0.05 and 0.15, dependent on the composition of the channel bed and the slope of the channel. The roughness values of the overbank areas range between 0.016 and 0.15, representing a range of land cover that includes paved streets, residential development, short grass, and highly vegetated areas of trees/brush.

Table 3 shows the transitions that were followed for assigning roughness values relative to the slope of the channel.

Table 3: Roughness Coefficients Relative to Slope

Channel Slope (%)	Channel "n"	Overbanks "n"
< 1	0.050	0.016-0.09
1-2	0.075	0.016-0.09
2-4	0.10	0.016-0.15
> 4	0.15	0.016-0.15

Table 4 summarizes the roughness coefficients for each tributary as well as the range of channel slopes for each tributary.

Table 4: Tributary Roughness Coefficients

Flooding Source	Channel Slope Classes	Channel "n"	Overbanks "n"
Little Joe Creek	1-2%	0.075	0.016 – 0.09
Twelvemile Creek	<1%, 1-2%, 2-4%, >4%	0.05 – 0.15	0.016 – 0.15
Twin Creek	<1%, 1-2%, 2-4%, >4%	0.05 – 0.15	0.016 – 0.15
Deer Creek	2-4%	0.10	0.15
Savenac Creek	<1%, 1-2%, 2-4%	0.05 – 0.10	0.016 – 0.15
Big Creek	1-2%	0.075	0.02 – 0.09
Timber Creek	<1%, 1-2%, 2-4%	0.05 – 0.10	0.02 – 0.15
Silver Creek	2-4%	0.10	0.02 – 0.15
Packer Creek	1-2%, 2-4%	0.075 – 0.10	0.02 – 0.15
Randolph Creek	2-4%	0.10	0.1 – 0.15
Rainy Creek	1-2%	0.075	0.02 – 0.09
Denna Mora Creek	2-4%, >4%	0.10 – 0.15	0.15
Hanaker Creek	>4%	0.15	0.15

5.7 Non-Conveyance Areas

Ineffective flow limits near the bridges, culverts, and natural constrictions are set to approximate a 1:1 contraction upstream and a 2:1 expansion downstream. A review of the modeled cross sections in HEC-RAS also reveals numerous depression areas and small side channels that are not hydraulically connected to the main channel. These areas were also classified as ineffective to represent the active areas of conveyance. Ineffective flow limits included in the hydraulic models have been documented and are included in Appendix E.

5.8 Blocked Obstructions

While most of the study area has little to no development, several streams pass through small communities. There are structures within the study area that block the effective flow within the defined cross sections. Buildings are modeled using the blocked obstructions feature in HEC-RAS to prevent conveyance at these locations. Only buildings that block effective flow are incorporated into the model; buildings located within non-conveyance areas (ineffective) are not incorporated. In addition, a blocked obstruction has been used to model a low-lying pond with standing water adjacent to the stream. At this location the depression is deep enough that the entire cross-sectional area of the pond will not effectively convey flow and the lower portion has been blocked using the obstruction. Cross sections with blocked obstructions have been documented and are included in Appendix E.

5.9 Hydraulic Structures

There are 45 crossings modeled within the study area of the St. Regis River tributaries. Crossings were defined in the hydraulic model using information provided by the *Hydraulic Structure Assessment*, LiDAR data, and photographs taken in the field. The structure assessment included information for 37 structures. The remaining 8 crossings were defined using various sources including data collected by DOWL and Montana DNRC, observations of aerial imagery, and engineering judgment. For two of these structures, one with no structure information and another crossing not visible in the aerial imagery, inline weirs were used to define the road crossings. The bridge located at Sta. 26+40 on Silver Creek is malnourished and was not included in the hydraulic model.

A summary of the modeled structures in each reach is presented in

Table 5. The ‘Structure ID’ information corresponds to the structure identification numbers from the *Hydraulic Structure Assessment*. There are 20 bridge structures, 23 culvert crossings, and 2 inline weirs within the study area. The bridges are typically single-span structures with multi-span bridges located on Little Joe Creek, Randolph Creek, and Silver Creek. The culverts range in size from small diameter corrugated metal culverts to large arch pipes at the interstate crossings.

Due to the steep topography of the St. Regis River tributaries and the limited capacity for flood flows to be conveyed in the overbanks, many of the structures develop significant backwater during large flood events. At many of these crossings, the main channel structure is overtopped. The pressure/weir bridge modeling approach has been selected for structures that experience overtopping or significant backwater. The following photos illustrate the variety of crossing structures within the study reach. Table 5 summarizes the hydraulic structures included in the hydraulic modeling.

Figure 7: Private Road (76-ft, Single-span Bridge)

Figure 8: Rock Creek Road (39-ft, Single-span Bridge)

Figure 9: Private Road (60-ft, 4-Span Bridge)

Figure 10: Packer Creek Road (2-ft dia. CMP)

Figure 11: Frontage Road (7-ft height, Pipe Arch)

Table 5: Summary of Hydraulic Structures and Key Features

Structure ID (if available)	River Station	River Name	Reach Name	Feature Description	Feature Type	Bridge Data						Culvert Data			
						Approx. Total Span Length[1] (ft)	Bridge Width (ft)	Number of Spans	Pier Type	Pier Coefficients (Cd, K)	Bridge Modeling Approach	Length (ft)	Shape	Type	Dimensions
Little Joe Creek															
B55	0+81	Little Joe Creek	Little Joe Creek	Private Road	Bridge	60	14	4	Circular Pier	1.33, 0.95	Energy Only	--	--	--	--
--[4]	87+08	Little Joe Creek	Little Joe Creek	Private Road	Culvert	--	--	--	--	--	--	48	Arch	CMP	7.8'x17.7x
Twelvemile Creek															
B70	2+96	Twelvemile Creek	Lower	Interstate 90	Culvert	--	--	--	--	--	--	189	Circular	CMP	17'
B73	67+55	Twelvemile Creek	Middle	Private Road	Bridge	76	15	--	--	--	Energy Only	--	--	--	--
B74	115+32	Twelvemile Creek	Upper	Twelvemile Road	Bridge	43	26	--	--	--	Pressure Weir	--	--	--	--
B75	136+58	Twelvemile Creek	Upper	Forest Service	Bridge	33	25.6	--	--	--	Pressure Weir	--	--	--	--
B71	6+80	Rock Creek	Rock Creek	Rock Creek Road	Bridge	39	25				Pressure Weir	--	--	--	--
B72	16+13	Rock Creek	Rock Creek	Rock Creek Road	Culvert	--	--	--	--	--	--	41	Pipe Arch	CMP	6'
--	8+93	EFork Twelvemile	EFork Twelvemile	Private Road	Bridge	21	12	--	--	--	Pressure Weir	--	--	--	--
B76	9+85	EFork Twelvemile	EFork Twelvemile	Horseback Lane	Bridge	13	12				Pressure Weir	--	--	--	--
B77	65+80	EFork Twelvemile	EFork Twelvemile	Old Mullan Road	Culvert	--	--	--	--	--	--	50	Box	Concrete	4' x 4'
B78	86+84	EFork Twelvemile	EFork Twelvemile	Old Mullan Road	Culvert	--	--	--	--	--	--	37	Box	Concrete	5' x 5'
Twin Creek															
B80	9+88	Twin Creek	Lower	Milwaukee Road Trail	Bridge	37	15			--	Energy Only	--	--	--	--
B81	13+26	Twin Creek	Lower	Interstate 90	Culvert	--	--	--	--	--	--	470	Circular	CMP	6'
B82	16+00	Twin Creek	Lower	Frontage Road	Culvert	--	--	--	--	--	--	50	Box	Concrete	5'
B83	26+49	Twin Creek	Lower	Private Road	Bridge	20	12			--	Pressure Weir	--	--	--	--
--	40+04	Twin Creek	Lower	Private Road	Culvert	--	--	--	--	--	--	26	Circular	CMP	3'
B83a	10+31	EForkTwinCreek	EForkTwinCreek	Lower Cotton Lane	Culvert	--	--	--	--	--	--	23	Circular	CMP	3'
Savenac Creek															
B86	1+41	Savenac Creek	Savenac Creek	Interstate 90	Culvert	--	--	--	--	--	--	160	Circular	CMP	8'
B86a	2+55	Savenac Creek	Savenac Creek	Frontage Road	Culvert	--	--	--	--	--	--	45	Box	Concrete	9'x9'
B92	41+05	Savenac Creek	Savenac Creek	Savanac Creek Road	Bridge	29	19	--	--	--	Pressure Weir	--	--	--	--
B93	55+00	Savenac Creek	Savenac Creek	Private	Culvert	--	--	--	--	--	--	14	Arch	CMP	4.5'

Structure ID (if available)	River Station	River Name	Reach Name	Feature Description	Feature Type	Bridge Data						Culvert Data			
						Approx. Total Span Length[1] (ft)	Bridge Width (ft)	Number of Spans	Pier Type	Pier Coefficients (Cd, K)	Bridge Modeling Approach	Length (ft)	Shape	Type	Dimensions
Big Creek															
B87	0+83	Big Creek	Big Creek	Milwaukee Road Trail	Railroad Bridge	94	14	--	--	--	Energy Only	--	--	--	--
B88	2+16	Big Creek	Big Creek	McGee Drive	Bridge	50.6	14	--	--	--	Energy Only	--	--	--	--
B89	3+07	Big Creek	Big Creek	East Big Creek Lane	Bridge	56	16	--	--	--	Energy Only	--	--	--	--
B90	46+60	Big Creek	Big Creek	Big Creek Road	Bridge	60	15	--	--	--	Energy Only	--	--	--	--
B91	107+80	Big Creek	Big Creek	Big Creek Road	Bridge	42	16	--	--	--	Energy Only	--	--	--	--
Timber Creek															
B95	2+21	Timber Creek	Timber Creek	Interstate (I-90)	Culvert	--	--	--	--	--	--	100	Pipe Arch	CMP	7'
B95	3+39	Timber Creek	Timber Creek	Interstate (I-90)	Culvert	--	--	--	--	--	--	100	Pipe Arch	CMP	7’
B96a	4+47	Timber Creek	Timber Creek	Frontage Road	Culvert	--	--	--	--	--	--	55	Pipe Arch	CMP	7'
B96[2]	10+38	Timber Creek	Timber Creek	Private Road	Culvert	--	--	--	--	--	--	20	Pipe Arch	CMP	6’
B97	39+33	Timber Creek	Timber Creek	Timber Creek Road	Culvert	--	--	--	--	--	--	42	Circular	CMP	4'
--[3]	8+34	Timber Split	Split West	Timber Creek Road	Culvert	--	--	--	--	--	--	40	Circular	Double CMP	2’
B98	25+09	East Fork Timber	East Fork	Private	Culvert	--	--	--	--	--	--	16	Circular	CMP	2'
B99	13+78	West Fork Timber	West Fork	Packer Creek Road	Culvert	--	--	--	--	--	--	23	Circular	CMP	2'
Silver Creek															
B102	10+73	Silver Creek	Silver Creek	Lohr Lane	Culvert	--	--	--	--	--	--	96	Circular	CMP	6'
B103	13+25	Silver Creek	Silver Creek	Milwaukee Road Trail	Railroad Bridge	635	19			--	Energy Only	--	--	--	--
Packer Creek															
B104a	15+96	Packer Creek	Lower	Packer Creek Road	Bridge	36	15.6			--	--	--	--	--	--
B106	75+07	Packer Creek	West Fork	Wapiti Wallow Way	Bridge	38	15			--	Pressure Weir	--	--	--	--
B105	0+96	EFork Packer Cr	East Fork	Packer Creek Road	Culvert	--	--	--	--	--	--	49	Circular	CMP	6'
Randolph Creek															
B109	2+85	Randolph Creek	Randolph Creek	Interstate	Culvert	--	--	--	--	--	--	155	Circular	CMP	10'
B110	1+54	Randolph Creek	Randolph Creek	Northern Pacific Railroad	Railroad Bridge	48	14	2	Wood Cylinder Piles	1.33, 0.95	Pressure Weir	--	--	--	--

Structure ID (if available)	River Station	River Name	Reach Name	Feature Description	Feature Type	Bridge Data						Culvert Data			
						Approx. Total Span Length[1] (ft)	Bridge Width (ft)	Number of Spans	Pier Type	Pier Coefficients (Cd, K)	Bridge Modeling Approach	Length (ft)	Shape	Type	Dimensions
Denna Mora Creek															
--	47+82	Denna Mora Creek	Denna Mora Creek	Private Road	Inline Weir	--	--	--	--	--	--	--	--	--	--
--	66+95	Denna Mora Creek	Denna Mora Creek	Private Road	Inline Weir	--	--	--	--	--	--	--	--	--	--

[1]Approximate Total Span Length is the bridge span length provided from hydraulic structure assessment
[2]Structure Data was not included in the Structure Inventory. Culvert size approximated from aerial imagery
[3]Structure Data was not included in the Structure Inventory. Culvert information was collected by DOWL during a field review.
[3]Structure Data was not included in the Structure Inventory. Culvert information was collected by DNRC during a field review.

5.9.1 Lateral Weirs

Lateral weirs were used to model flows leaving the main channel for study reaches along Twelvemile Creek, Twin Creek, and Timber Creek. Table 6 summarizes key details for the lateral weirs.

Table 6: Lateral Weir Coefficients

River Name	Reach Name	Weir Starting River Station (ft)	Scenario Modeled	Weir Coefficient Selected	Optimization (Y/N)
Twelvemile Creek	Middle	31+47	Natural Ground, Non-elevated overbank	0.2	N
Twelvemile Creek	Upper	116+40	Natural Ground, Overtopping Divide, Elevated 1-3 feet	0.75	Y
Twin Creek	Lower	17+75	Roadway, Overtopping Divide, Elevated 1-3 feet	1	N
Timber Creek	Middle	43+56	Natural Ground, Overtopping Divide, Elevated 1-3 feet	0.5	Y
Timber Creek	Middle	48+26	Natural Ground, Overtopping Divide, Elevated 1-3 feet	0.5	Y
Timber Creek	Middle	62+24	Natural Ground, Overtopping Divide, Elevated 1-3 feet	0.5	N

As indicated in Table 6, two of these lateral weirs use the flow optimization routine in HEC-RAS. Lateral weir coefficients are based on guidance from the Hydrologic Engineering Center (HEC) 2D Modeling User's Manual.

Twelvemile Creek

The lateral weir at Sta. 31+47 is immediately upstream of the junction where Rock Creek enters Twelvemile Creek. There is a low-lying divide between the streams at this location and flow from Twelvemile Creek will overtop the divide during large flood events. The modeled water surface elevations was not sensitive to the weir hydraulics and the weir was therefore set at a not optimized condition. The weir was left within the model at this location because the water surface elevations are above the cross section terrain data. Typically, FEMA standards require hydraulic models to be developed so the water surface elevations are bound by the cross section terrain data.

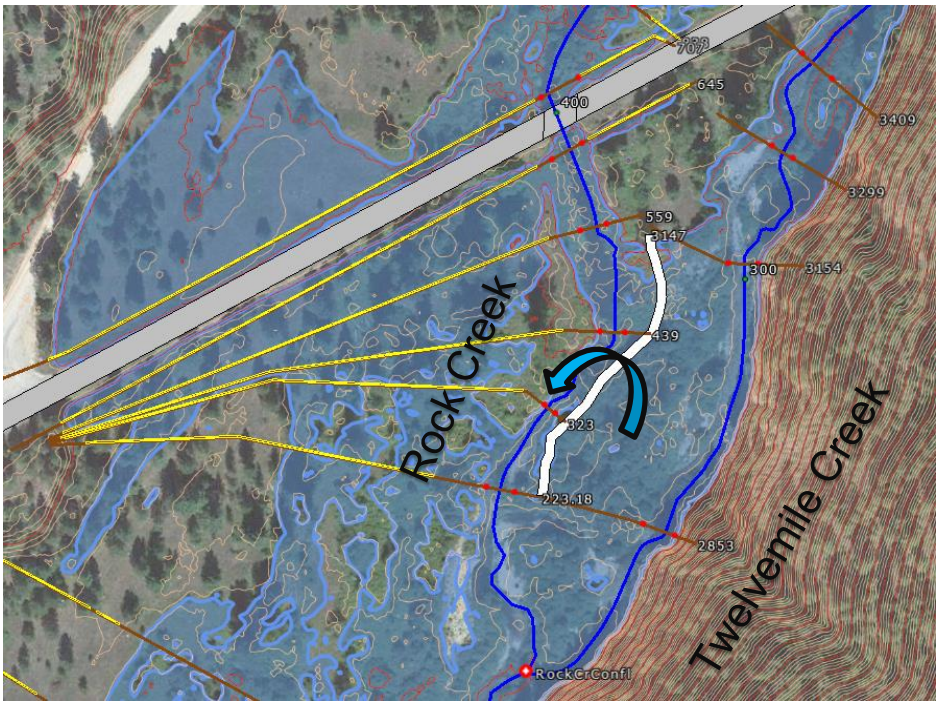

Figure 12: Lateral Weir Twelvemile Creek Sta. 31+47

The lateral weir at Sta. 116+40 is used to simulate flow overtopping the natural ground upstream of the bridge crossing at Sta. 115+32. This crossing develops significant backwater, with flow overtopping the roadway as well as the right overbank. The lateral weir was optimized to accurately model the backwater at the structure. Because the overtopping flow will travel only a short distance before reaching a road with high ground that directs the flow back into the main channel, a flow split was not used. Figure 13 shows the lateral weir and the path of flow overtopping the weir. The flow over the weir is set to re-enter the main channel downstream of the structure.

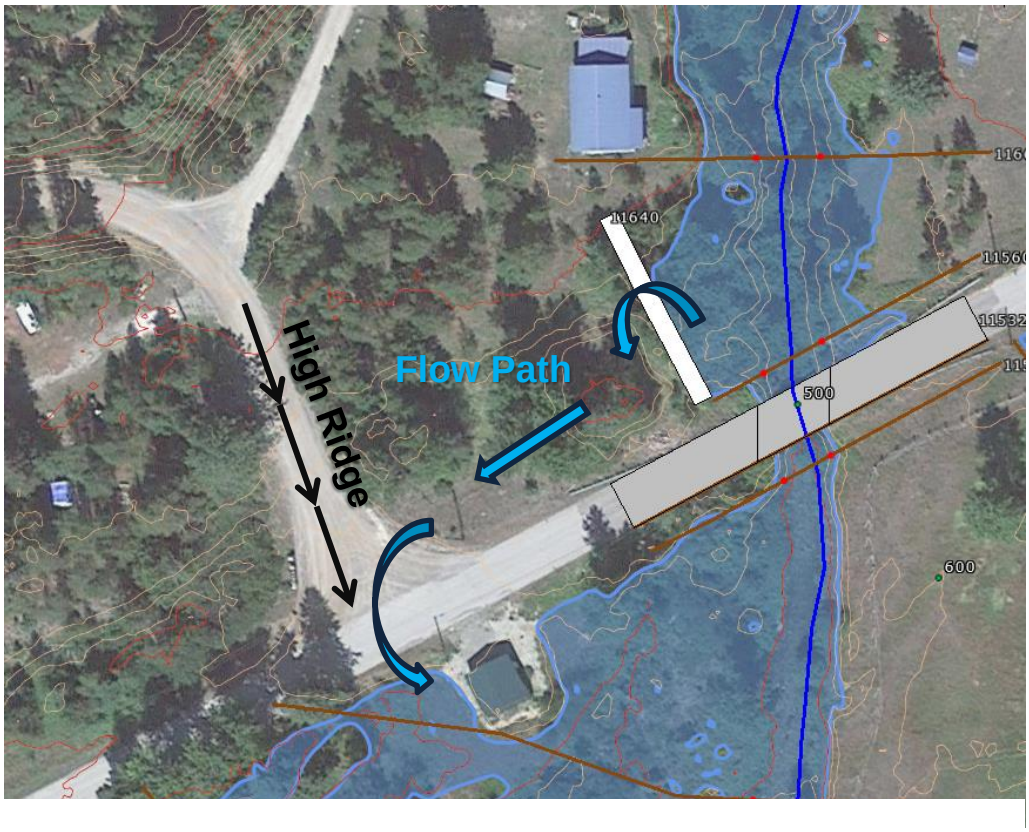

Figure 13: Lateral Weir Twelvemile Creek Sta. 116+40

Twin Creek

The lateral weir at Sta. 17+75 is located along a road in the left overbank upstream of the Frontage Road culvert at Sta. 16+00. During large flood events, the water surface is close to overtopping the left overbank at cross section 16+40. A lateral weir was therefore included in the model and was used to verify that flood flows do not leave the main channel at this location. Because the

water surface profiles are near the overtopping elevation, the lateral weir was left in the model as documentation that flood flows do not leave the main channel at this location.

Timber Creek

The lateral weir at Sta. 43+56 is located along the right overbank upstream of the culvert crossing at Sta. 39+33. Flood flows overtopping the weir at this location are significant and require modeling a flow split with an additional river reach. The flow optimization routine is used and the weir is connected to the river reach "Timber Split".

The lateral weir at Sta. 48+26 is located along the right overbank and computes flow overtopping natural high ground. The flow optimization routine is used and this weir is also connected to the river reach "Timber Split". Figure 14 shows the condition for the lateral weirs located on Timber Creek at Sta. 43+56 and 48+26.

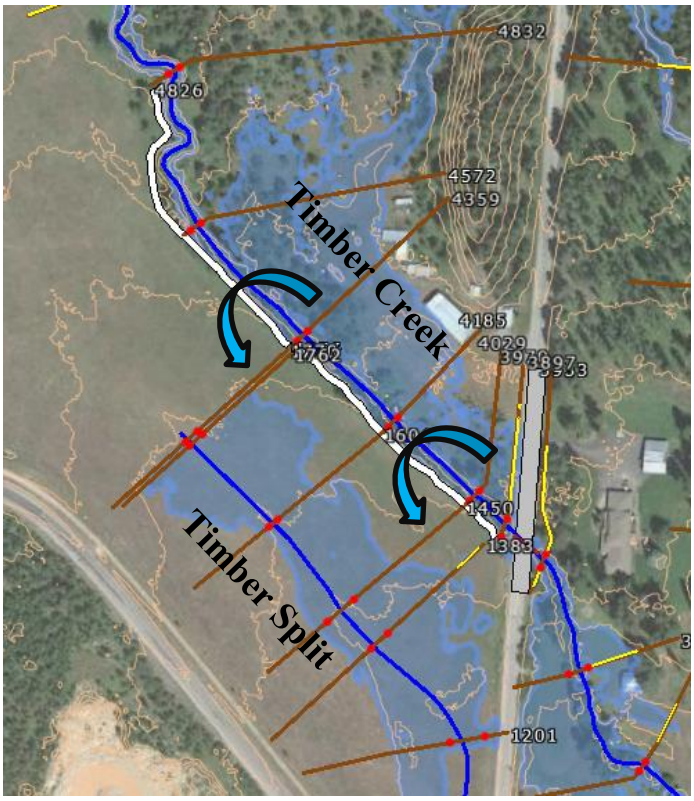

Figure 14: Lateral Weirs Timber Creek Sta. 43+56 and 39+33

The lateral weir at Sta. 62+24 is located along the right overbank where water surface elevations extend above the cross section terrain data. The weir was optimized and initially included in the model to quantify the flood flows leaving the main channel. During the 1 percent-annual-chance event, only 12 cfs overtops the weir. Based on the LiDAR topographic data, a portion of this overtopping flow will re-enter the main channel immediately downstream. Given the minor amount of overtopping and that a portion of this immediately returns, the lateral weir was set to not optimize and all flow is assumed to remain in the main channel.

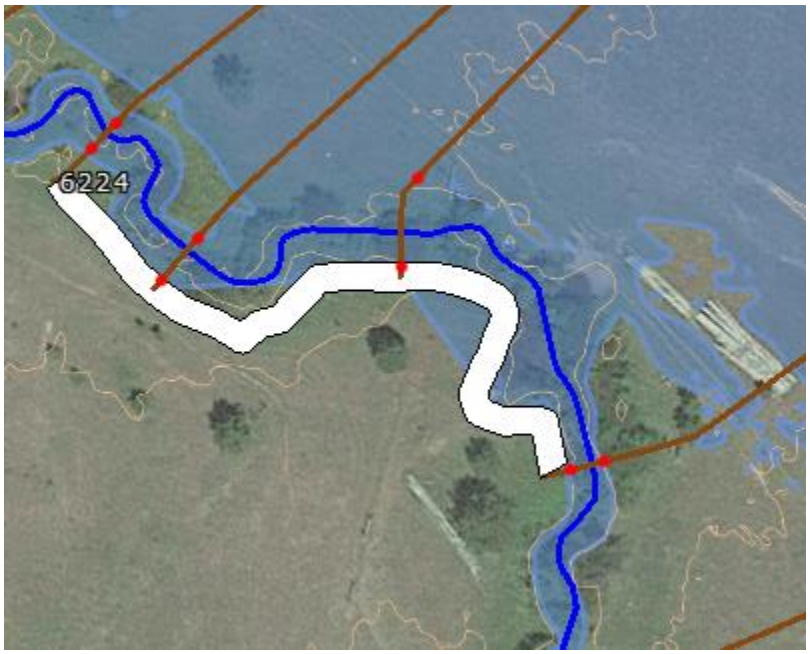

Figure 15: Lateral Weir Timber Creek Sta. 62+24

5.10 Unique Modeling Conditions

Several unique conditions were encountered during the development of the hydraulic models. These include an analysis of shallow flooding along Cook Creek, a perched culvert on Timber Creek, and a modification to include bathymetry at two crossings on Twin Creek.

5.10.1 Shallow Flooding Analysis – Cook Creek

Cook Creek is a tributary to Savenac Creek and lies partially within the study area. A one-dimensional model was initially developed for the hydraulic analysis, however, it was apparent that flow was conveyed through numerous small channels and as shallow flow in the overbanks. A two-dimensional hydraulic model was developed to better understand the flow patterns in this area. Figure 16 shows the results of the two-dimensional modeling, which shows flow patterns typical of an alluvial fan.

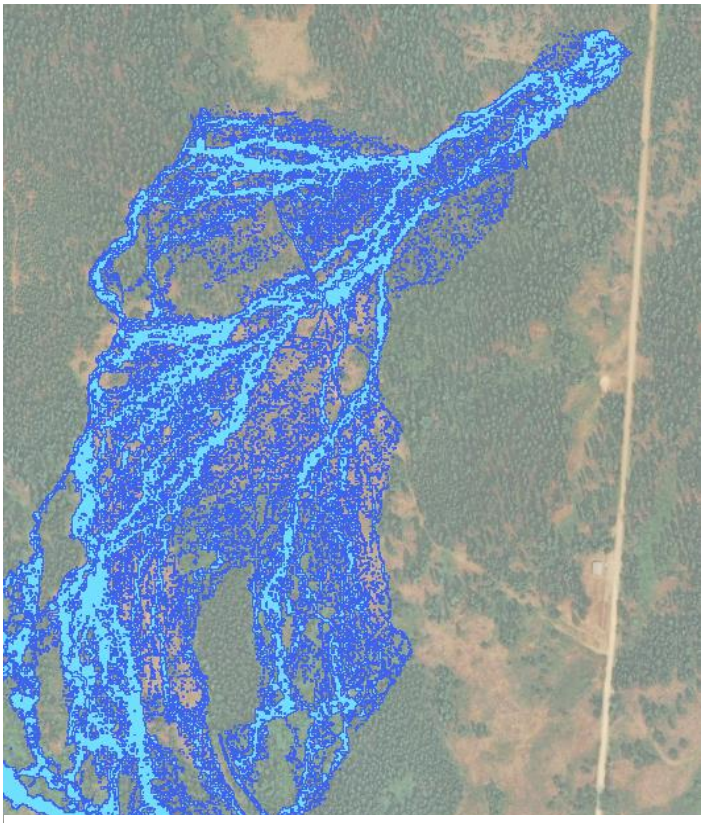

Figure 16: Cook Creek 2D Model Results

The depth of flow for the 1% annual-chance-flood event is less than 3 feet and the floodplain of Cook Creek is classified as shallow flooding zone. The two-dimensional model was developed in accordance with guidance provided in the FEMA publication *Shallow Flooding Analyses and Mapping*. The two-dimensional modeling extents overlap the extents of the one-dimensional model to provide a continuous mapping boundary. The LiDAR data acquired for the study area

was used to define the topography. A 5-ft cell spacing was defined for the mesh with breaklines used to further define topography. Roughness values were assigned based on a review of aerial imagery with a value of 0.06 for areas of 'High Grass/Pasture' and 0.12 for areas of 'Evergreen Forest.'

5.10.2 Timber Creek – Culvert at Sta. 2+21

The most downstream culvert on Timber Creek is a large arch pipe located at the Interstate 90 crossing. As shown in Figure 17, the outlet of the culvert is elevated well above the natural flow line. This condition was represented in the hydraulic model.

Figure 17: Culvert on Timber Creek

5.10.3 Twin Creek – Terrain Data

The LiDAR data immediately downstream of the Interstate 90 crossing was impacted by an area of ponded water and does not accurately represent the ground surface. This condition is illustrated in the aerial imagery in Figure 18. The overbanks were shown as significantly lower than the channel elevation and a defined channel was not evident. The LiDAR surface represented the water surface elevation when the discharge in the channel was near the bank full capacity. Below water bathymetry was therefore estimated for three cross sections in this reach: Sta. 9+38, Sta. 10+19, and Sta. 10+46 to more accurately represent the channel. The stream channel upstream of the interstate has a consistent shape and size. The channel was estimated using typical side slopes of the channel upstream of the interstate, bank locations from the LiDAR data and aerial photographs, and those portions of the stream profile that were not significantly impacted by ponding water.

Figure 18: LiDAR Impacted by Ponded Water

5.11 Model Calibration

Flood records for the tributaries of the St. Regis River are very limited. The USGS gages described earlier in this report are located on the North Fork of Little Joe Creek and the East Fork of Timber

Creek. Peak flow records for these gages date back to the 1960's and 1970's. The Hydraulic Analysis for the St. Regis River was verified through comparison to the January 1974 flood event, which was approximated to be a 4% annual-chance-flood event (25-year) for the mainstem of the St. Regis River. Flooding pictures provided by the Montana Department of Natural Resources and Conservation show flooding extents along the St. Regis River near the town of Haugen, Montana. The images also show the flooding extents for the lower reaches of several tributaries including Deer Creek, Big Creek, Savenac Creek, and Timber Creek.

While the two USGS stream gages are not located within the study area, the peak flows were recorded for the January 1974 flood event. The gage on the North Fork of Little Joe Creek is located near the upstream limit of the study area and has a 1974 peak flow of 210 cfs. Using the basin area ratio between the North Fork of Little Joe Creek and Little Joe Creek, the 1974 flood event was approximated to be less than the 10% annual-chance-flood event on Little Joe Creek. The gage on the East Fork of Timber Creek is outside the study area but is very close to the upstream study limit. The 1974 peak flow was 50 cfs, which is approximately half the 10% annual-chance-flood event of 96 cfs. From these observations, it can be inferred that the tributaries experienced peak flows less than the 10% annual-chance-flood event during the 1974 flood event.

The results of the hydraulic models for Deer Creek, Big Creek, Savenac Creek, and Timber Creek were compared to the aerial imagery from the 1974 flood event. The existing channel alignment for each stream is different than the alignment from 1974. While the stream centerlines have migrated over the years, the flow patterns within the overbanks are generally the same. The smallest flood event modeled was the 10% annual-chance-flood event. As expected the floodplain extents for this event were greater than the flooding extents observed in the aerial imagery. Further, the flow patterns in the overbanks and flood benches were similar in both the hydraulic models and the aerial photographs.

The procedures used to develop the parameters for the hydraulic models for the tributaries are also consistent with those used in developing the hydraulic model of the St. Regis River. The calibration of the St. Regis River matched closely with the 1974 flood event. Based on observations of flooding available for the 1974 flood event, the extents of flooding simulated through the hydraulic models appear to be reasonable representations of the flood hazards for the tributaries of the St. Regis River.

5.12 Quality Review

DOWL has developed an internal QA/QC process for detailed review of the Hydraulic Data and Floodplain Mapping tasks for floodplain studies. The review includes a review by a water resources engineer as well as a senior level review. The details of this review are included in Appendix D.

6.0 FLOODPLAIN MAPPING

The RAS Mapper utility in HEC-RAS version 5.0.3 was used in conjunction with ESRI ArcMap 10.3.1 to perform the floodplain mapping. The raw model outputs are included with this Hydraulic Data submittal, which includes flood boundaries and depth grids. The flood hazard boundaries will be refined during the floodplain mapping task.

Hydraulic work maps were developed to display the results of the floodplain mapping and are included in Appendix B. The work maps include the raw floodplain boundaries of the 1 and 0.2-percent-annual-chance flood events, the profile baseline of all modeled reaches along each tributary, cross section locations of the hydraulic model, and structure locations. The basemap for the work maps is the 2015 National Agriculture Imagery program (NAIP) aerial photograph.

7.0 FLOOD INSURANCE STUDY PRODUCTS

The Flood Insurance Study products required for the flood study of the St. Regis River tributaries include the flood profiles and Section 5.2 of the FIS report. The flood profiles were developed using RASPLOT Version 3.0. This software extracts the results from the HEC-RAS analysis and creates databases for each stream modeled. RASPLOT requires the user to enter information for the plot extents and labels to create the profiles. The profile information for each modeled river is exported to a DXF file. The DXF files were reviewed and the placement of several labels was adjusted using the DXF editor before exporting to PDFs. The backwater effects from the St. Regis River were incorporated into the profile plots. No other modifications were made to the water surface elevations computed by HEC-RAS.

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APPENDIX A – TECHNICAL REPORTS

PIONEER
TECHNICAL SERVICES, INC.

RESTORING OUR ENVIRONMENT ▸ DESIGNING OUR FUTURE

Mineral County Modernization Project – Phase I
St. Regis River Study Area
Hydrologic Analysis Report

Montana DNRC
July 26, 2017

Pioneer Technical Services, Inc. 106 Pronghorn Trail, Bozeman Montana 59718
www.pioneer-technical.com

Mineral County Modernization Project – Phase I

St. Regis River Study Area

Hydrologic Analysis Report

Prepared for:

State of Montana, Department of
Natural Resources and Conservation
1424 9th Avenue
Helena, Montana 59620

Prepared by:
Pioneer Technical Services, Inc.
106 Pronghorn Trail
Bozeman, Montana 59718

Mineral County Modernization Project – Phase I

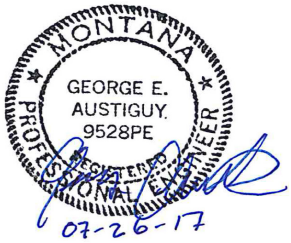
St. Regis River Study Area

Hydrologic Analysis Report

July 26, 2017

I hereby certify that all work products (maps, reports, etc.) prepared for this project were done so under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Montana.

George Austiguy P.E.



Date: 7/26/2017 Montana Registration No. 9528

Pioneer Technical Services, Inc.
106 Pronghorn Trail, Suite A
Bozeman, MT 59718

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EXECUTIVE SUMMARY

Flood flow frequency calculations were conducted for a 37.1-mile reach of the mainstem St. Regis River. The study reach extends from the confluence of the St. Regis River with the Clark Fork River in the city of St. Regis. Information gathered from this analysis will be used for future floodplain studies and mapping projects.

The hydrology of the basin is primarily snowmelt driven, although significant flows can result from precipitation events. Land use in the St. Regis River basin is primarily agricultural with irrigated farming and ranching operations.

The St. Regis River is a major tributary to the Clark Fork River located west of the continental divide in western Montana. The river tributaries originate near St. Regis Lake in the Lolo National Forest near the Montana-Idaho border. The study watershed basin area encompasses the entire St. Regis watershed area of approximately 363 square miles (HUC-12 area).

St. Regis River basin elevations within the study area range from approximately 5,200 feet in in the headwaters near St. Regis Lake to approximately 2,600 feet in the city of St. Regis. The watershed terrain varies from a high alpine environment in its headwaters to narrow inter-mountain valleys.

The primary cause of flooding on the St. Regis River is spring snowmelt and historical records of ice jams. There are historical records from several U.S. Geological Survey (USGS) stream gages on the river that date back to 1908, documenting basin flood history.

Past flood studies for the mainstem of the St. Regis River are limited. Within the mainstem St. Regis River basin, there are no FEMA Flood Insurance Studies. The USGS Report *Methods for Estimating Flood Frequency at Ungaged Sites in Montana Based on Data through Water Year 2011*, (Sando et al, 2015) was an important study, which included flood frequency analyses for the St. Regis River.

Flood flow frequency analysis was conducted to develop peak flow discharge estimates for the 50-, 10-, 4-, 2-, 1-, and 0.2-percent annual chance events. The 1%+ (plus) annual chance event was also calculated. Peak flow estimates were calculated at 10 locations (flow nodes) within the watershed (1 gaged site and 9 ungaged sites). Estimates at the gaged site were conducted using Bulletin #17C methodologies. At the ungaged sites, peak flow estimates were calculated using the Regional Regression Equation method and the Drainage Area Gage Transfer method. These methods conform to standard engineering practice. The Drainage Area Gage Transfer method was determined to produce the more accurate peak flow estimate at ungaged flow nodes.

In the St. Regis River watershed, the flood flow frequency estimates from this study for the USGS stream gage near the city of St. Regis produced peak discharge estimates that are similar to estimates from previous USGS studies.

The hydrologic analysis documented in this report conforms to FEMA standards for detailed/enhanced level studies, and the recommended flows of this analysis are deemed reliable and suitable for future floodplain studies and hydraulic analyses.

1 INTRODUCTION

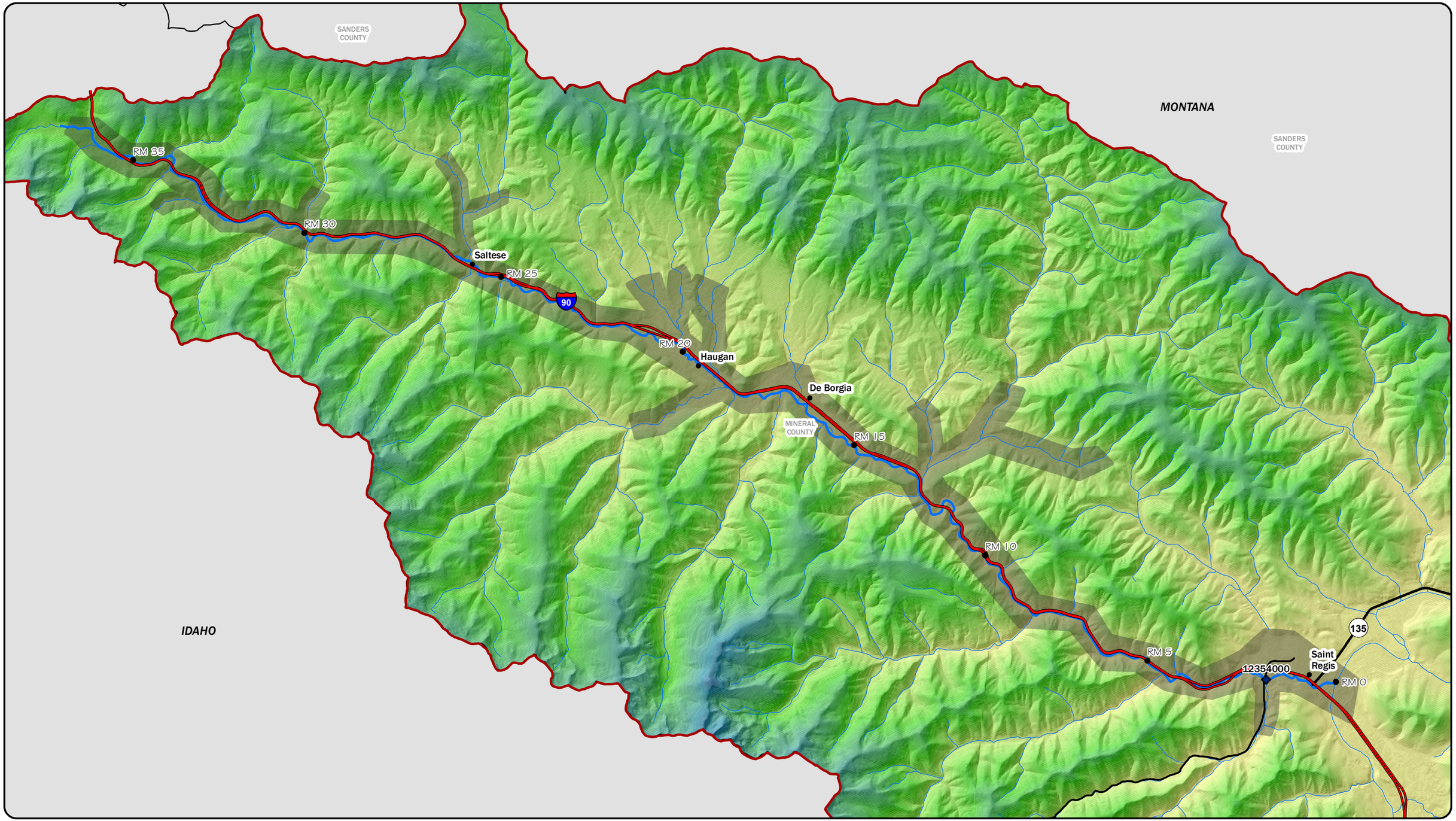
As part of the St. Regis River Floodplain Study activities, the Montana Department of Natural Resources and Conservation (DNRC) contracted Pioneer Technical Services, Inc. (Pioneer) to complete a comprehensive peak flow hydrologic analysis for the mainstem St. Regis River study reach. Flood flow frequency calculations were conducted for a 37.1-mile reach of the mainstem St. Regis River. The study does not include other tributaries. The St. Regis River study reach covers the entire St. Regis River, which extends from the headwaters at Lookout Pass on the Montana-Idaho border to the confluence with the Clark Fork River in the city of St. Regis. This study area watershed encompasses approximately 363 square miles. Information gathered from this analysis will be used for both detailed/enhanced level and limited detail level hydraulic analyses and floodplain mapping. Figure 1 shows the project study reach.

1.1 Background Information

The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP). As part of this program, FEMA supports flood hazard studies and prepares flood hazard maps and related documents. Most of the mainstem St. Regis River in Mineral County is sparsely populated outside of the city of St. Regis with a predominantly rural environment. The existing floodplain mapping for the mainstem St. Regis River includes Approximate Zone A. These existing floodplain mapping studies typically date back to the early 1980s, and do not include any floodway information.

Approximate Zone A flood maps are developed using approximate methodologies and are not based on detailed hydraulic analysis. This level of flood mapping is often used in rural areas with low populations. Base Flood Elevations (BFEs) or flood depths are not identified in Approximate Zone A mapping (a BFE is the computed elevation to which floodwater is estimated to rise during the base flood). As a result, areas designated with Zone A flood mapping are difficult for local communities to manage and administer.

Detailed and Limited Detail mapping are similar in that both use standard hydrologic and hydraulic modeling methods to estimate BFEs and flood inundation areas. Both require the same topographic accuracy. However, Limited Detail mapping does not include floodway delineation, may not include a 500-year floodplain delineation, and may allow some flexibility in the acquisition and modeling of bathymetric and structure survey data.



LEGEND

- RIVER MILES
- ACTIVE USGS GAGE
- TOWNS
- HUC 8 BOUNDARIES
- MONTANA COUNTY BOUNDARIES
- NHS INTERSTATE
- PRIMARY
- SECONDARY
- SAINT REGIS RIVER STUDY REACH
- STUDY AREA

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER, MSL, USGS

0 1 2 4
Miles

FIGURE 1

SAINT REGIS RIVER STUDY AREA

PIONEER TECHNICAL SERVICES, INC.

DATE: 6/1/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\STRGS-GI-HYD-001-17.mxd

The DNRC, in partnership with FEMA, Mineral County, and other stakeholders, initiated work to produce new floodplain studies along the St. Regis River. This St. Regis River Floodplain Study will provide the groundwork for completing floodplain mapping projects along the mainstem St. Regis River.

This report documents the hydrologic analysis methodology and results completed along the mainstem St. Regis River. This hydrologic analysis includes calculation of peak discharge estimates for the 50-, 10-, 4-, 2-, 1-, and 0.2-percent annual chance events at key flow change locations (such as significant tributary confluences, stream gages, and population centers) along the study reach. This hydrologic analysis also includes calculation of the 1% + (plus) annual chance discharge estimates. This hydrologic analysis conforms to FEMA standards for detailed/enhanced level studies (FEMA, 2016).

As part of this hydrologic analysis, the DNRC partnered with the USGS, under a non-formal agreement, to perform updated flood frequency analysis of all the stream gages along the mainstem St. Regis River through Water Year 2016. The USGS flood frequency analysis for the gaged locations was used to develop peak discharge estimates at the selected ungaged flow change locations.

1.2 Basin Description

The St. Regis River is a tributary to the Clark Fork River, located west of the continental divide in western Montana. The river tributaries originate in the Lolo National Forest near the Montana-Idaho border. The watershed is formed by the Bitterroot Mountains to the south and the Coeur D'Alene Mountains to the north. The study watershed basin area encompasses the entire St. Regis watershed area of approximately 363 square miles (HUC-12 area).

The St. Regis River basin elevations within the study area range from approximately 5,200 feet in in the headwaters near St. Regis Lake to approximately 2,600 feet in the city of St. Regis. The overall basin elevations range from 7,300 feet in the Bitterroot Mountains to 2,600 feet near the confluence with the Clark Fork River. The terrain varies from a high alpine environment in its headwaters to narrow inter-mountain valleys. The hydrology of the basin is primarily snowmelt driven, although significant flows can result from precipitation events. Land use in the St. Regis River basin is primarily agricultural with irrigated farming and ranching operations.

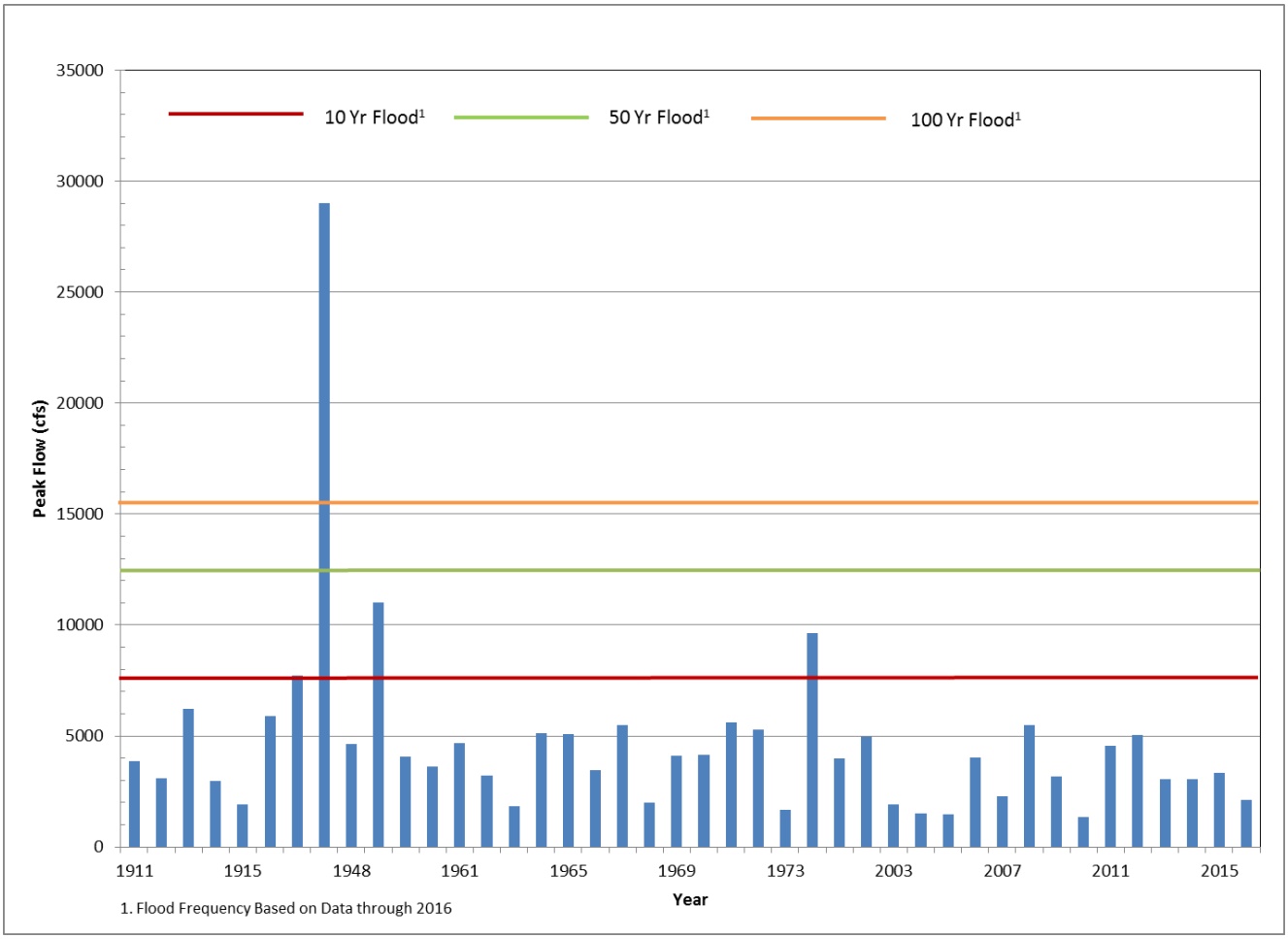
1.3 Flood History

The primary cause of flooding on the St. Regis River is spring snowmelt and historical records of ice jams. There are historical records from one USGS stream gage on the river that document flooding history. The USGS stream gage near St. Regis is representative of the mainstem St. Regis flood history upstream of the city of St. Regis. The St. Regis River near St. Regis USGS Gage (12354000) has a non-congruous flow record (1911-2016). The annual peak flow record for the St. Regis gage is shown in Figure 2. Peak flow recurrence intervals shown in Figure 2 are based

on previously published flood frequency analysis through Water Year 2011 (Scientific Investigations Report [SIR] 2015-5019-C) (Sando et al, 2015).

Figure 2 shows that the peak flood of record at St. Regis occurred in water year1934 with a flow of 29,000 cubic feet per second (cfs), exceeding the 1% (100-year) chance annual flow of 15,400 cfs. On December 22, 1933 a local newspaper, The Missoulian, reported that heavy rain along with snowmelt due to unusually warm weather caused the St. Regis River to flow out of its banks, sending water over two feet deep into the communities of Saltese, De Borgia, and St. Regis. In February of 2017 Interstate 90 west of St. Regis was closed due to flooding caused by a rain storm and melting snowpack. The second highest flood on record occurred in 1954 with a flow of 11,000 cfs. In the 105-year period of record at the St. Regis gage the 10-year flow has been exceeded four times.

Figure 2 St. Regis River at St. Regis (12354000)



2 PAST STUDIES AND EXISTING FLOOD DATA

Past flood studies for the mainstem St. Regis River are limited. Studies relevant to this hydrologic study are those that include peak flow frequency analyses. There are no FEMA Flood Insurance Studies within the mainstem St. Regis River basin in Mineral County. Table 1 shows a summary of the mainstem St. Regis River Floodplain Mapping.

Table 1 Mainstem St. Regis River Floodplain Mapping Summary

County	Map Panel Summary					Study Details			
	Community	# of FIRM Panels	# of FBFM Panels	FIRM Panel Effective Date	FIS Date	Stream	Approx (mi)	Detailed (mi)	Total (mi)
Mineral	Mineral Co.	4	0	7/6/2015	none	St. Regis	37	NA	NA

Source: FEMA Map Service Center

FIRM: Flood Insurance Rate Map

mi: Miles measured along channel alignment

USGS WRIR 03-4308 and SIR 2015-5019-C document the flood frequency analysis on one gage along the mainstem St. Regis River. These studies and investigations are discussed in more detail in the following sections.

2.1 Water Resources Investigations Report 03-4308

The USGS WRIR 03-4308 developed annual peak discharges with recurrence intervals of 2, 5, 10, 25, 50, 100, 200, and 500 years (*T*-year floods) for 660 gaged sites in Montana and in adjacent areas of Idaho, Wyoming, and Canada, based on data through Water Year 1998 (Parret and Johnson, 2004). The flood-frequency information was used in regression analyses to develop equations relating *T*-year floods to various basin and climatic characteristics, active-channel width, and bankfull width. The equations can be used to estimate flood frequency at ungaged sites. Flood-frequency data typically were determined by fitting a log-Pearson Type III probability distribution using methods described by the Interagency Advisory Committee on Water Data (IACWD), Bulletin #17B (IACWD, 1982).

Table 2 provides the WRIR 03-4308 peak discharge summary for the USGS gage in the St. Regis River mainstem.

Table 2 WRIR 03-4308 St. Regis River Peak Discharge Summary

USGS Station Number	USGS Station Name	Drainage Area (sq mi)	Years of Record	Peak Discharge (cfs) , indicated return interval (years) (cfs)						
				5	10	25	50	100	200	500
12354000	St. Regis River near St. Regis, MT	304	27	6,000	7,100	8,250	10,100	13,100	17,900	27,500

Based on systematic data through 1998

2.2 Scientific Investigations Report 2015-5019

The USGS SIR 2015-5019 updated annual peak discharges with annual exceedance probabilities of 66.7, 50, 42.9, 20, 10, 4, 2, 1, 0.5, and 0.2 percent (return intervals of 1.5, 2, 2.33, 5, 10, 25, 50, 100, 200, and 500 years, respectively) for 725 gaged sites in or near Montana, based on data through Water Year 2011. Flood-frequency data typically were determined by fitting a log-Pearson Type III probability distribution using methods described by the Interagency Advisory Committee on Water Data (IACWD), Bulletin #17B (IACWD, 1982). The study was part of a larger study to develop an online StreamStats application for Montana, in conjunction with computing streamflow characteristics at gage stations, and estimate peak flow flood frequency at ungaged sites. Table 3 provides the SIR 2015-5019-C discharge summary for St. Regis River gages.

The USGS SIR 2015-5019-F (Sando et al, 2015) selected 537 gaging stations from the gage study. The 537 gaging stations were segregated based on the following criteria: contributing drainage area less than about 2,750 square miles, peak-flow records unaffected by major regulation, small redundancy with nearby stations, and representation of peak-flow frequencies at sites within Montana. The study used regression analyses to develop equations relating annual exceedance probability (AEP) flows to various basin and climatic characteristics. The relationships developed for this study resulted in lower mean standard errors of prediction than previous regression analyses (Sand et al, 2015).

Table 3 SIR-2015-5019-C St. Regis River Peak Discharge Summary

USGS Station Number	USGS Station Name	Drainage Area (sq mi)	Years of Record	Peak Discharge (cfs) , indicated return interval (years) (cfs)						
				5	10	25	50	100	200	500
12354000	St. Regis River near St. Regis, MT	304	42	5,470	7,060	9,710	12,300	15,400	19,400	26,000

Based on systematic data through 2011

2.3 Additional Previous Studies

Additional related previous studies conducted along the St. Regis River involve water management, fisheries management or sediment management:

- *Evaluation of Channelization and Mitigation on the Fishery Resources of the St. Regis River, Montana*, Office of Biological Services, U.S. Department of the Interior Fish and Wildlife Service (Lund, 1976).
- *Hydraulic and Geomorphic Assessment of St. Regis River Boulder Clusters*, Montana State University (Boelman, 1999).

3 HYDROLOGIC ANALYSES AND RESULTS

The purpose of the hydrologic analyses conducted as part of this project is to develop peak flow discharge estimates for the 50-, 10-, 4-, 2-, 1-, and 0.2-percent annual exceedance probability events at key flow change locations (such as at significant tributaries confluences, stream gages, and population centers) along the study reach. The analysis is organized into two sections:

1. USGS Stream Gage Analysis.
2. Ungaged Flow Node Analysis.

Throughout the study area, 10 locations (flow nodes) on the St. Regis River were identified as having significant changes in streamflow or being at a critical location. Out of the 10 flow nodes on the St. Regis River, 1 is located at an active USGS stream gage site, 1 is located downstream of the USGS stream gage site, and 8 are located upstream of the stream gage (ungaged sites). The river stationing used in this report is based on the St. Regis River study alignment provided by the DNRC that was revised subsequently by Pioneer. The St. Regis River study alignment begins at the confluence of the St. Regis River and the Clark Fork River. The upstream extents of this study reach end at River Mile 37.1. The most upstream flow node is located just upstream from Saltese, approximately 24.9 river miles upstream from the lower study reach extent.

3.1 USGS Stream Gage Analysis

The USGS has currently maintains one stream gage along the St. Regis River study reach; USGS gaging station 12354000 St. Regis River near St. Regis. The oldest record dates back to 1911, with an intermittent period of record through 2002, and then continuing until present. Figure 1 shows the study reach and the location of the USGS gaging station used in the hydrologic analysis. Table 4 lists a summary of the USGS stream gage on the mainstem St. Regis River.

In 2015 the USGS updated the regional regression equations used to estimate flood frequency at ungaged sites in Montana using stream gage data through 2011 (Sando R. et al, 2015). As part of this effort, the USGS conducted flood frequency analysis on the St. Regis River.

In conjunction with this hydrologic analysis, the USGS collaborated with DNRC to conduct a flood frequency analysis for the mainstem St. Regis River using gage data through 2016. This longer period of record should produce more accurate peak discharge estimates than those based on a shorter period of record. Results of the USGS flood frequency analysis based on data through 2016 have been employed in this hydrologic analysis.

This section summarizes the St. Regis River flood frequency work conducted by the USGS. A detailed description and supporting information for the USGS flood frequency analysis is provided in Appendix A. The flood frequency analyses were performed following Bulletin #17C methods (USGS, 2016). The peak-flow dataset for USGS gage 12354000 is a mixed population dataset and therefore a station skew was used in the analysis. Systematic flood frequency calculations were completed for the gage (Appendix A, Table 2) shown in Table 4, using data through 2016. Table 5 tabulates the results of the systematic flood frequency estimates.

Table 4 St. Regis River USGS Gage Summary

Station number	Station name	Drainage[1] Area (square miles)	Period of Systematic Record[2]	Number of Annual Peaks[2]	River Station (miles)
12354000	St. Regis River near St. Regis, MT	304	1911-1917, 1934, 1948, 1959-1975, 2002-2016	42	1.7

1. Source: National Water Information System (NWIS)
2. Data from USGS flood frequency analysis (Appendix A, Table 2)

Table 5 Gage Flood Frequency Estimates Using Systematic Record

Station Number	Station name	Analysis Period of Record	Peak discharge, (cfs), for indicated exceedance probability (%)								
			66.67	50	20	10	4	2	1	0.5	0.2
			Peak discharge (cfs), for indicated return interval (years)								
			1.5	2	5	10	25	50	100	200	500
12354000	St. Regis River near St. Regis, MT	1911-1917, 1934, 1948, 1959-1975, 2002-2016	3,280	3,580	4,940	6,410	9,150	12,000	15,900	21,100	30,600

The annual precipitation record in St. Regis shows several years with above average precipitation in the mid-1990s and a few years in the 1970s and 1980s. Potential streamflow responses to these wet years would not be included in the systematic record due to the data gaps during these periods. Therefore the systematic gage data was weighted using regional regression equations to account for the systematic data gaps. Table 6 shows the results of the regional regression weighted data set (RRE wtd) along with the systematic data set (At Site) for comparison. The systematic record values are greater than the weighted values.

USGS gage 12354000 is in the West hydrologic region of Montana, which has limited representation of mixed-population stream gages, and the independent estimates from the regional regression equations do not adequately represent sites with mixed-populations of peak-

flows (USGS, 2016). For these reasons, flood flow frequency estimates using the systematic data set (at-site analysis), were selected to represent the annual chance flood potential at the St. Regis River gage location.

Table 7 compares flood frequency estimates between the 2011 SIR 2015-5019 analysis and this study's 2016 additional record analysis. The SIR 2015-5019 flood frequency estimates are a systematic analysis based on the entire period of record using Bulletin 17B methods. The 2016 flood frequency analysis is based on an additional 5 years of data and uses Bulletin 17C methods. The peak flow estimates from the current and previous USGS analyses generally compare well, characterized by similar magnitudes with smaller scale variations. Differences between the 2011 and 2016 peak flow estimates can be attributed to the different period of records and calculation methods used in the analysis.

Table 6 St. Regis River Gage Flood Frequency Estimates

Station Number	Station name	Type of Peak Flow Estimate	Peak discharge, (cfs), for indicated exceedance probability (%)								
			66.67	50	20	10	4	2	1	0.5	0.2
			Peak discharge (cfs), for indicated return interval (years)								
			1.5	2	5	10	25	50	100	200	500
12354000	St. Regis River near St. Regis, MT	At-site	3,280	3,580	4,940	6,410	9,150	12,000	15,900	21,100	30,600
12354000	St. Regis River near St. Regis, MT	RRE wtd	3,270	3,560	4,850	6,230	8,670	11,000	13,500	16,100	19,100

Table 7 USGS Flood Frequency Estimate Comparison 2011 and 2016

Station Number	Station Name	Peak Discharge, for Return Interval (years) (cfs)													
		5		10		25		50		100		200		500	
		2011	2016	2011	2016	2011	2016	2011	2016	2011	2016	2011	2016	2011	2016
06018500	St. Regis River near St. Regis, MT	5,470	4,940	7,060	6,410	9,710	9,150	12,300	12,000	15,400	15,900	19,400	21,100	26,000	30,600

3.1.1 1% + Peak Flow Estimates

The 1%+ percent annual exceedance probability event was calculated to provide a confidence range that the 1% flood frequency peak flow estimates are likely to fall within. The flood-frequency estimates equations include an "average standard error of prediction" or "average standard error of estimate" percentage that was used to define its statistical 68% confidence interval (+/- one standard deviation). The resulting upper 84% confidence limit (+ one standard deviation) was used to determine the 1% flood frequency peak flow estimates. The St. Regis River gage 1%+ flood frequency peak flow estimate is based on the "at-site" 1% estimate presented in Table 6.

Table 8 USGS 1%+ Flood Frequency Estimates 2016

Station Number	Station Name	1% + Annual Exceedance Probably Peak discharge, (cfs)
12354000	St. Regis River near St. Regis, MT	22,300

3.2 Flow Change Node Locations

Future flood studies will use hydraulic models that are composed of geometric data and streamflow data. In order to accurately model the St. Regis River, the locations of major tributary confluences and other flow change locations must be identified. The results of this hydrologic analysis will be used as the streamflow data input at the tributary confluences within the hydraulic model. A detailed review of the study area was performed to identify all potential flow change locations (flow nodes) within the mainstem St. Regis River. At each flow node, a drainage basin area was delineated and streamflow values were calculated for the various recurrence interval floods. Generally, the hydraulic models simulate flood events using steady-state conditions, and, therefore, the peak flow rate calculated at a flow node is projected to the next upstream flow node. This method was followed for the hydrologic analysis calculations. Flow nodes were assigned immediately upstream of major tributaries; this method of locating the flow nodes was employed so that the additional flow resulting from the tributary confluence is accurately reflected to the reach downstream of the confluence.

To identify significant flow change locations (flow nodes), Hydrologic Unit Code (HUC) 12-digit watershed boundaries were used to initially locate the flow change nodes. The HUC 12-digit watershed boundaries represent the smallest USGS-delineated watershed areas available in geographic information system (GIS) format. Using ArcGIS (Esri's GIS mapping software), flow nodes were located just upstream of the HUC 12 boundary intersection with the St. Regis River mainstem.

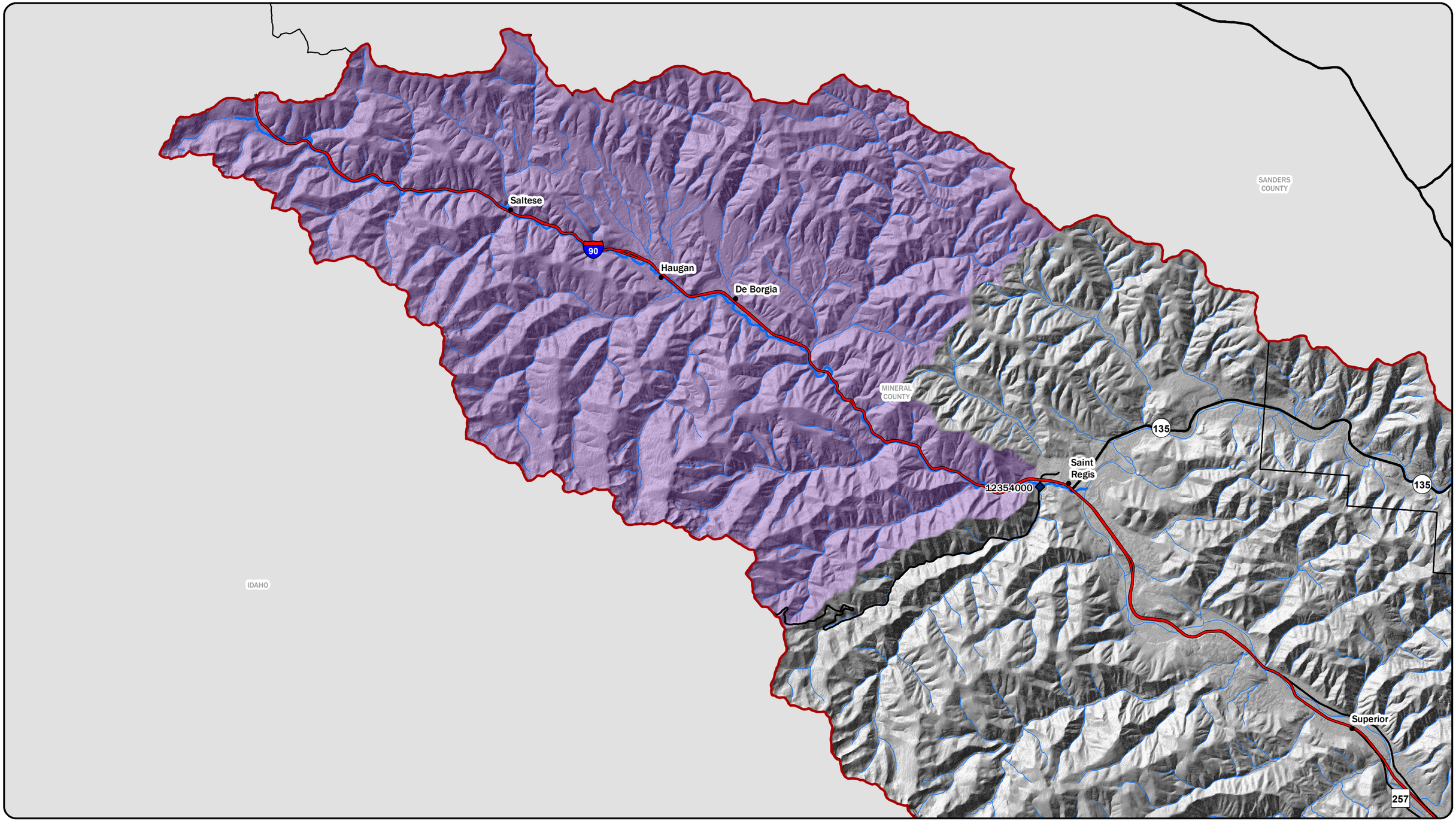
This study uses the nearest Geographic Naming Information System (GNIS) hydrographic feature name for the ungaged flow node names. In some cases these features (typically tributary streams) flow into the mainstem St. Regis River just downstream of the flow node. For hydrographic features that do not have a GNIS name, the river mile where the node is located is used as the node name.

To avoid excessive flow changes between HUC 12 boundary nodes, additional flow nodes were located immediately downstream of towns, at the end of study reaches, at county borders, or where intermediate tributaries within the HUC 12 boundaries intersected the mainstem. Two additional flow nodes were placed immediately downstream of towns, one at De Borgia and one at Saltese. A total of 3 flow nodes were added as intermediate nodes between the HUC 12 boundaries. These town nodes are identified in Table 9 .

The USGS NWIS watershed area data are GIS-calculated watershed areas using the National Hydrography Dataset Plus Version2 (NHDPlusV2) that integrates the National Elevation Dataset (NED) and the Watershed Boundary Dataset. The NHDPlusV2 NED uses 30-meter resolution DEMs. ESRI processed NHDPlus V2.1 and NED 30-meter DEMs to support the ESRI Watershed tool. The ESRI hydroconditioning process differs from the NHDPlus V2.1 process so the resulting watershed delineations do not always exactly match the USGS delineations. Differences between the USGS NWIS reported values and the ESRI processed values of the percent of area covered by forest can also be attributed to the different processes used to estimate those values.

As an accuracy check, the USGS gaging station watershed areas calculated using the Watershed tool or HUC-12 polygons, were compared to the USGS National Watershed Information System (NWIS) (http://waterdata.usgs.gov/nwis) published gaging station areas. Figure 3 shows the USGS gaging stations analyzed and the correlating GIS model-generated watershed areas within the study area. Table 10 shows the results of this comparison. Based on the one gaging station analyzed, the ESRI GIS model calculates watershed areas that are within 1% of the USGS NWIS published areas (Appendix A).

A total of 10 flow nodes were identified throughout the study reach, including 1 gaged location and 9 ungaged locations. Table 9 is a summary of all flow nodes and the associated watershed areas. Figure 4 maps the flow node locations and corresponding watershed areas from Table 9 .



LEGEND

- ACTIVE USGS GAGE
- TOWNS
- HUC 8 BOUNDARIES
- MONTANA COUNTY BOUNDARIES
- NHS INTERSTATE
- PRIMARY
- SECONDARY
- SAINT REGIS RIVER STUDY REACH

USGS BASIN

- 12354000

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER, MSL, USGS

0 1.5 3 6
Miles

FIGURE 3

SAINT REGIS RIVER
USGS WATERSHEDS

PIONEER TECHNICAL SERVICES, INC.

DATE: 4/19/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\STRGS-GI-HYD-002-17.mxd

Table 9 Flow Node and USGS Gage Station Information Used in Hydrologic Analyses

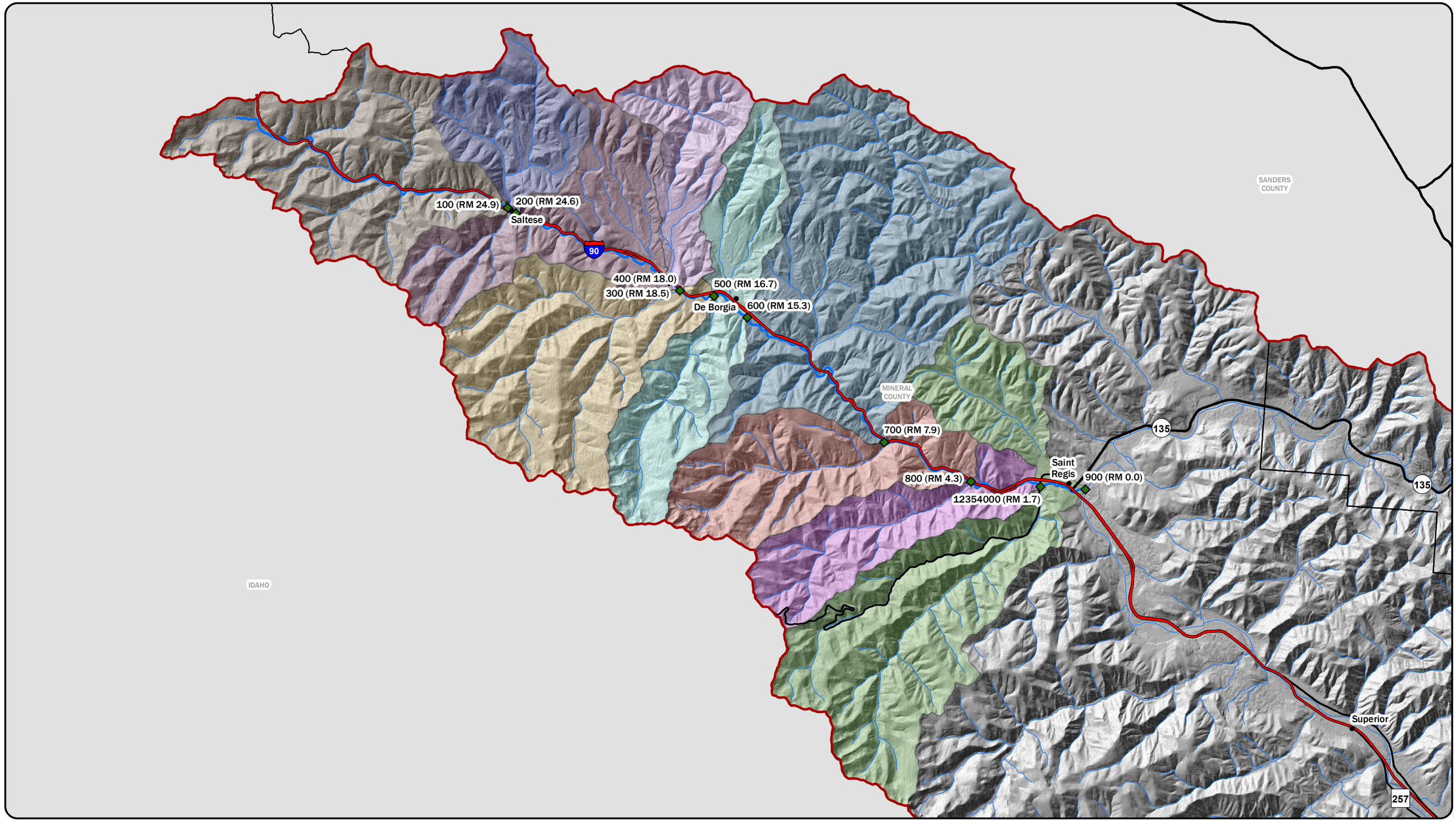
Table 10 Flow Change Node and USGS Gage Station Summary							
Node Number	**Location Description**	**River Station (mi)**	**GIS Incremental Basin Area (mi^2)**	**GIS Cumulative Basin Area (mi^2)**	**% Forest Land Cover**	**Mean Annual Precipitation (in)**	**DA_U/DA_G**
100	St. Regis River Headwaters	24.9	41.62	41.62	85.25	51.84	0.1
200	Downstream of Saltese	24.6	18.27	59.89	84.88	49.58	0.2
300	Big Creek	18.5	30.16	90.06	84.32	45.60	0.3
400	Savenac Creek	18.0	16.59	106.65	84.92	43.93	0.4
500	Deer Creek	16.7	40.99	147.64	85.55	44.09	0.5
600	Downstream of De Borgia	15.3	30.43	178.07	85.42	43.43	0.6
700	River Mile 7.9	7.9	75.04	253.11	85.15	40.94	0.8
800	River Mile 4.3	4.3	29.09	282.20	85.20	41.00	0.9
12354000	**St. Regis River near St. Regis**	**1.7**	**21.46**	**303.67**	**86.14**	**40.81**	**1.0**
41.09	Lower St. Regis River	0.0	59.23	362.90	85.44	40.86	1.2

1. Denotes an additional flow node change downstream of a town reach or intermediate tributary not associated with HUC-12 boundary
2. River miles start at the downstream extent of each study reach (mi: miles)

Table 10 USGS and GIS Model Watershed Comparison

USGS Gage Station	Station Name	USGS Published Basin Area[1] (mi2)	Proposed Basin Area[2] (mi2)	Percent Change	Relative Accuracy of Areas
12354000	St. Regis River near St. Regis, MT	304	303.7	0.11%	99.9%

1. Source: National Watershed Information System (NWIS)
2. Cumulative basin areas (watershed areas) used for hydrological analysis.



LEGEND

- FLOW NODE
- TOWNS
- HUC 8 BOUNDARIES
- MONTANA COUNTY BOUNDARIES
- NHS INTERSTATE
- PRIMARY
- SECONDARY
- SAINT REGIS RIVER STUDY REACH

FLOW CHANGE BASIN/USGS BASIN

- 900
- 12354000
- 800
- 700
- 600
- 500
- 400
- 300
- 200
- 100

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER, MSL, USGS

0 1 2 4
Miles

FIGURE 4

PIONEER TECHNICAL SERVICES, INC.

DELINEATED SUB BASIN AREAS AND FLOW NODE LOCATIONS

DATE: 4/19/2017

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3.3 Gage Transfer to Ungaged Sites

To calculate peak flood discharge estimates at the ungaged flow nodes, methods described in USGS SIR 2015-5109-F (Sando R, et al, 2015) were considered. These methods included estimating flood frequency using regional flood-frequency relations (regression analysis) and estimating flood frequency on gaged streams by translating gaged data to ungaged locations (drainage area gage transfer and logarithmic interpolation between two gaged sites).

The SIR 2015-5019-F report provides guidance on conditions where regional regression equations might not yield reliable results. These limiting guidelines include:

1. A site where the basin characteristics are outside the range of values used to develop the regression equations.
2. A site that is affected by regulation or urbanization.

The St Regis river study reach is within the West Hydrologic region as defined by SIR 2015-5019-F. For the study flow nodes identified in Table 9, basin characteristics (drainage area, % of forested land cover and mean annual precipitation) were compared with SIR 2015-5019-F Table 3 (range of values of basin characteristics used to develop regional regression equations). The comparison indicates that all the study reach flow nodes are within the range of values used to develop the West Region regional regression equations.

The St. Regis River drainage is not considered regulated. Therefore the St Regis study reach flow nodes meet the SIR 2015-5019-F guidelines and regional regression equations are considered to be applicable to the mainstem St. Regis River.

The mainstem St. Regis River has a single USGS gage site; therefore the two-site logarithmic interpolation method is not applicable to the St. Regis River study reach. The remaining option for estimating peak flow frequencies at an ungaged site with a gaging station on the same stream is the drainage area gage transfer method.

SIR 2015-5019-F contains guidelines for the drainage area gage transfer method. These guidelines require the ungaged site drainage area ratio with the gage drainage area (DA_U/DA_G) to be within 0.5 to 1.5. For sites where the values of DA_U/DA_G are outside the range of 0.5 to 1.5, SIR 2015-5019-F states that the regression equations might provide more reliable estimates than the drainage area gage transfer method. Table 9 indicates that 4 of the 9 ungaged sites have ratio values less than 0.5.

Peak flow estimates were calculated for all of the ungaged flow node locations using the drainage transfer method.

3.3.1 Drainage Area Gage Transfer Method

As stated previously, ungaged flow nodes located upstream of the St. Regis River Gaging Station 12354000 near St. Regis do not lie between two gaged stations on the same stream, therefore, the two site interpolation method cannot be employed. Estimating flood-frequency discharges at the ungaged flow nodes on the St. Regis River were calculated using the drainage area gage transfer method. This method, presented in SIR 2015-5019-F, uses a drainage area ratio of the ungaged flow node to the gaged station to transfer flow estimates from the gaged site to the ungaged site as shown below in the following equation (Sando R. et al, 2015):

$$Q_{AEP,U} = Q_{AEP,G}\left(\frac{\mathrm{DA}_U}{\mathrm{DA}_G}\right)^{\exp_{AEP}}$$

where

$Q_{AEP,U}$ is the AEP-percent peak flow at the ungaged site, in cfs

$Q_{AEP,G}$ is the AEP-percent peak flow at the gaged site, in cfs

DA_G is the drainage area at the gaged site, in square miles

DA_U is the drainage area at the ungaged site, in square miles

exp_{AEP} is the regression coefficient for a simple OLS regression relating to the log of the AEP-percent peak flow to log of drainage area within each region

As stated previously, limitations for this method include a recommended drainage area ratio (DA_U/DA_G) between 0.5 and 1.5. Five of the flow node drainage area ratios are within the recommended range (Table 9). Calculations were performed for all flow nodes for subsequent comparison to regional regression equation peak flow estimates.

Regression coefficients shown in the equation above vary based on the hydrologic region and the AEP. The applicable regression coefficients provided in Table 11 were used in these calculations. The drainage area transfer method results are shown in Table 12, and Figure 5.

Results indicate St. Regis River estimated peak flow magnitudes increase with increasing drainage area.

Table 11 Drainage Area Gage Transfer Regression Coefficients

AEP-percent Peak Flow	Regression Coefficient Relating AEP Flows to Drainage Area for West Region
Q_{50}	0.843
Q_{10}	0.794
Q_{4}	0.777
Q_{2}	0.766
Q_{1}	0.755
$Q_{0.2}$	0.735

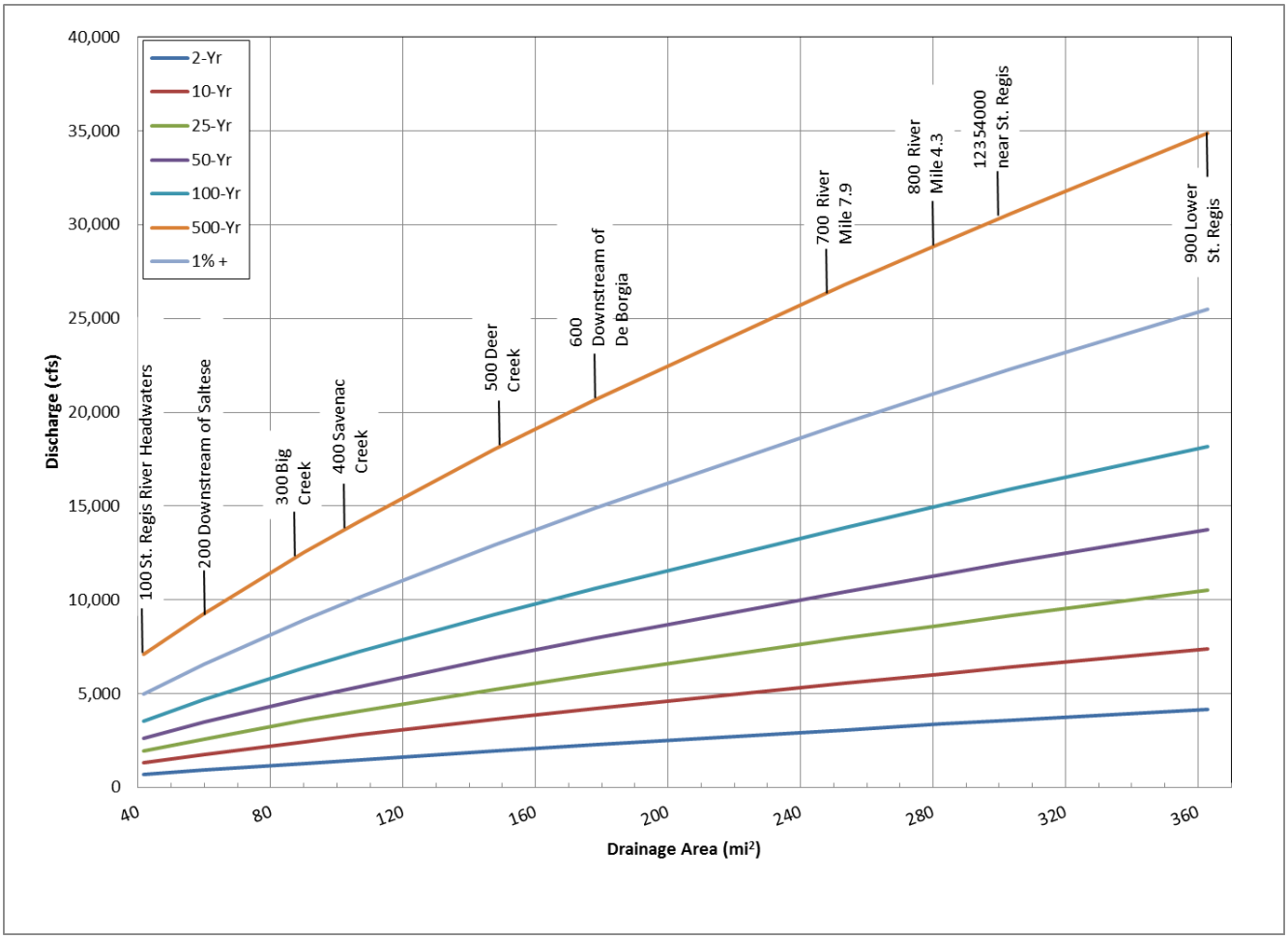
Source: SIR 2015-5019-F

Table 12 Drainage Area Gage Transfer Method Results for St. Regis River Flow Node Locations Upstream of USGS Gage 12354000

Node/USGS Station ID	Location Description	Drainage Area Gage Transfer Discharge (cfs)						
		50% Annual Chance	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	1% +
		2-year	10-year	25-year	50-year	100-year	500-year	
900	Lower St. Regis River	4,160	7,384	10,509	13,755	18,190	34,882	25,511
12354000	**St. Regis River near St. Regis, MT**	**3,580**	**6,410**	**9,150**	**12,000**	**15,900**	**30,600**	**22,300**
800	River Mile 4.3	3,365	6,047	8,643	11,345	15,044	28,994	21,099
700	River Mile 7.9	3,070	5,547	7,943	10,437	13,857	26,766	19,435
600	Downstream of De Borgia	2,283	4,196	6,044	7,973	10,626	20,670	14,903
500	Deer Creek	1,949	3,616	5,225	6,907	9,224	18,010	12,937
400*	Savenac Creek	1,482	2,793	4,058	5,384	7,216	14,181	10,120
300*	Big Creek	1,285	2,442	3,558	4,730	6,351	12,524	8,908
200*	Downstream of Saltese	911	1,766	2,592	3,460	4,668	9,279	6,546
100*	St. Regis River Headwaters	670	1,323	1,953	2,618	3,546	7,101	4,974

*Nodes where the value of DA_U/DA_G does not fall within SIR 2015-5019-F guidelines ($0.5 < DA_U/DA_G < 1.5$)

Figure 5 St. Regis River Drainage Area Gage Transfer Results



3.3.2 Regional Regression Equations Method

Ungaged flow nodes located on the St. Regis River are not regulated and are within the drainage areas supported by the West Region regression equations. The regression equations, presented in SIR 2015-5019-F, use a drainage area (A), percentage of basin with forest land cover (F), and mean annual precipitation (P) as shown below in the following set of equations (Sando R. et al, 2015):

$$Q_{50} = 0.131A^{0.920}P^{2.24}(F+1)^{-0.845}$$
$$Q_{10} = 2.44A^{0.853}P^{1.71}(F+1)^{-0.875}$$
$$Q_{4} = 6.61A^{0.831}P^{1.53}(F+1)^{-0.890}$$
$$Q_{2} = 12.2A^{0.818}P^{1.42}(F+1)^{-0.896}$$
$$Q_{1} = 21.5A^{0.806}P^{1.32}(F+1)^{-0.904}$$
$$Q_{0.2} = 63.5A^{0.783}P^{1.12}(F+1)^{-0.915}$$

where

Q_x is the X annual exceedance probability peak flow magnitude, in cfs

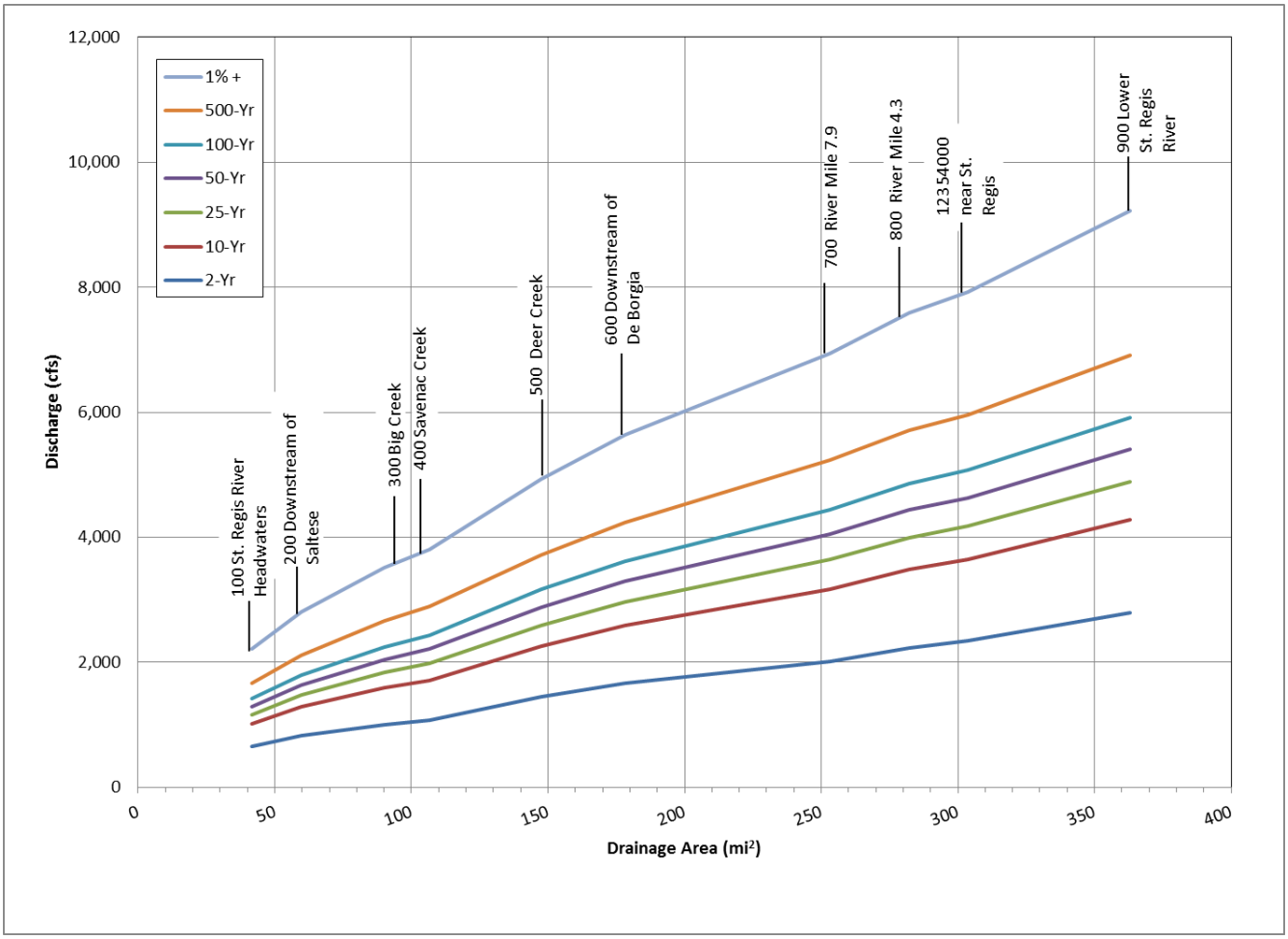
A is the contributing drainage area, in square miles

F is the percent of basin with forest land cover

P is the mean annual precipitation in inches

The West Region regression equation results are shown in Table 13. Figure 6 plots the calculated peak discharges and correlating drainage areas. Appendix B provides the flood frequency calculations at the ungaged flow nodes.

Figure 6 St. Regis River Regional Regression Equation Results



Results indicate the regional regression calculations overall produce significantly lower peak flow values than the drainage area gage transfer method estimates. These significant differences between the drainage area gage transfer estimates and the regional regression estimates may be attributed to the St Regis gage mixed population data set. The USGS, as part of their gage analysis (Appendix A), has noted that the West hydrologic region of Montana, has limited

representation of mixed-population streamgages, and the regional regression equations independent estimates do not well represent sites with mixed-populations of peak flows.

To determine which calculation method better represents peak flow values at ungaged flow nodes where the DA_U/DA_G ratio is outside the SIR 2015-5019-F guidelines , regional regression equation results were compared with drainage area transfer peak flow estimates at ungaged flow nodes that meet the SIR 2015-5019-F DA_U/DA_G guidelines. The comparison indicates that the regional regression equations are significantly lower (the 1% peak flow regional regression estimate is 33% of the drainage area gage transfer method estimate at flow node 900).

The regional regression peak flow estimates were also compared with the gage frequency analysis values at the St. Regis River gage. Results of this comparison indicate the regression estimates are significantly lower than the SIR 2015-5019-F peak flow Bulletin 17C estimates using measured historical flows and significantly lower than the peak flow estimates from the two previous USGS studies at that gage.

These observations along with the regional regression error associated with mixed population gage sites, indicate that that the regional regression equation results are not consistent with gage based estimates and therefore they were eliminated from further consideration.

The drainage area gage transfer calculation methods produce larger peak flow estimates than the regional regression methods, are developed from measured flows and therefore determined to be the most reasonable peak flow estimates for ungaged flow nodes, including nodes where DA_U/DA_G values were outside the SIR 2015-5019-F guidance 0.5-1.5 range.

Table 13 St. Regis River Regression Results for Flow Node Locations

Node/USGS Station ID	Location Description	Regional Regression Equations						
		Discharge (cfs)						
		50% Annual Chance	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	1% +
		2-year	10-year	25-year	50-year	100-year	500-year	
900	Lower St. Regis River	2,787	4,281	4,886	5,408	5,912	6,913	9,223
12354000	**St. Regis River near St. Regis, Montana**	**2,343**	**3,644**	**4,176**	**4,633**	**5,076**	**5,960**	**7,918**
800	River Mile 4.3	2,233	3,483	3,996	4,435	4,861	5,713	7,584
700	River Mile 7.9	2,015	3,168	3,644	4,051	4,447	5,241	6,937
600	Downstream of De Borgia	1,660	2,590	2,969	3,295	3,611	4,239	5,633
500	Deer Creek	1,443	2,262	2,597	2,884	3,163	3,718	4,934
400	Savenac Creek	1,068	1,714	1,984	2,213	2,438	2,890	3,803
300	Big Creek	1,000	1,591	1,837	2,045	2,249	2,656	3,508
200	Downstream of Saltese	824	1,289	1,479	1,640	1,797	2,107	2,803
100	St. Regis River Headwaters	649	1,016	1,165	1,292	1,416	1,659	2,209

1. Denotes an additional flow node change downstream of a town reach or intermediate tributary not associated with HUC-12 boundary
2. River miles start at the downstream extent of each study reach (mi: miles)

Appendix B provides all the flood frequency calculations at the ungaged flow nodes for the St. Regis River Study reach. Appendix C provides the digital calculation files.

4 SUMMARY/DISCUSSION

A peak discharge frequency analysis was conducted for the mainstem St. Regis River study reach. The St. Regis River Study reach extends 37.1 miles upstream from the confluence with the Clark Fork River in the city of St. Regis and contains one USGS stream measurement gage (USGS gaging station 12354000 St. Regis River near St. Regis). The St Regis River gage data is considered to be a mixed population data set (peak flows created by different types of events). Information gathered from this analysis will be used to support the Mineral County hydraulic analyses and floodplain mapping studies.

Previous flood studies on the St. Regis River are limited. Relevant earlier flood studies include:

- USGS WRIR 03-4308 – Peak flow data through 1998, published in 2004
- USGS SIR 2015-5019 – Peak flow data through 2011, published in 2015

As part of this analysis, the USGS collaborated with DNRC to conduct a flood frequency analysis for the mainstem St. Regis River using gage data through 2016. At the St Regis gage, the USGS conducted flood frequency estimates using two different gage record data sets; a systematic data set through 2016 (At-site) and a data set that was weighted using regional regression equations (RRE wtd). The systematic data set was weighted to account for the St Regis gage period of record data gaps. The peak flow frequency gage estimates were calculated using Bulletin #17C methodologies. The flood flow frequency estimates based on the gage At-site record data set were determined to provide the most accurate peak flow estimates for the St. Regis River basin, due to the West hydrologic region regional regression equation's poor representation of gage sites with mixed population datasets.

The systematic flood flow frequency results at the St Regis gage from this analysis were compared with flood flow frequency estimates from the previous USGS studies (Sando et al, 2015). Results indicate that the two studies produced similar peak flow values. The observed variations can be attributable to differences in the period of record and the different calculation methods (one study being conducted using Bulletin 17B methods and this analysis using Bulletin 17C methods).

Peak flow 1%+ (plus) estimates were developed for all gaged locations using standard FEMA methodologies.

In this study, flood frequency estimates for both gaged and ungaged sites were conducted. Peak flow estimates were calculated at 10 mainstem locations (flow nodes) within the watershed (1 gaged site and 9 ungaged sites). The ungaged nodes were located at major tributaries, population centers, and at the end of study reaches

At the ungaged flow nodes, both the regional regression method and the drainage area gage transfer analysis were used to calculate flood frequency peak flow estimates. Only a single

stream gage exists on the mainstem St Regis River, therefore the two-station interpolation method was not used at ungaged flow nodes.

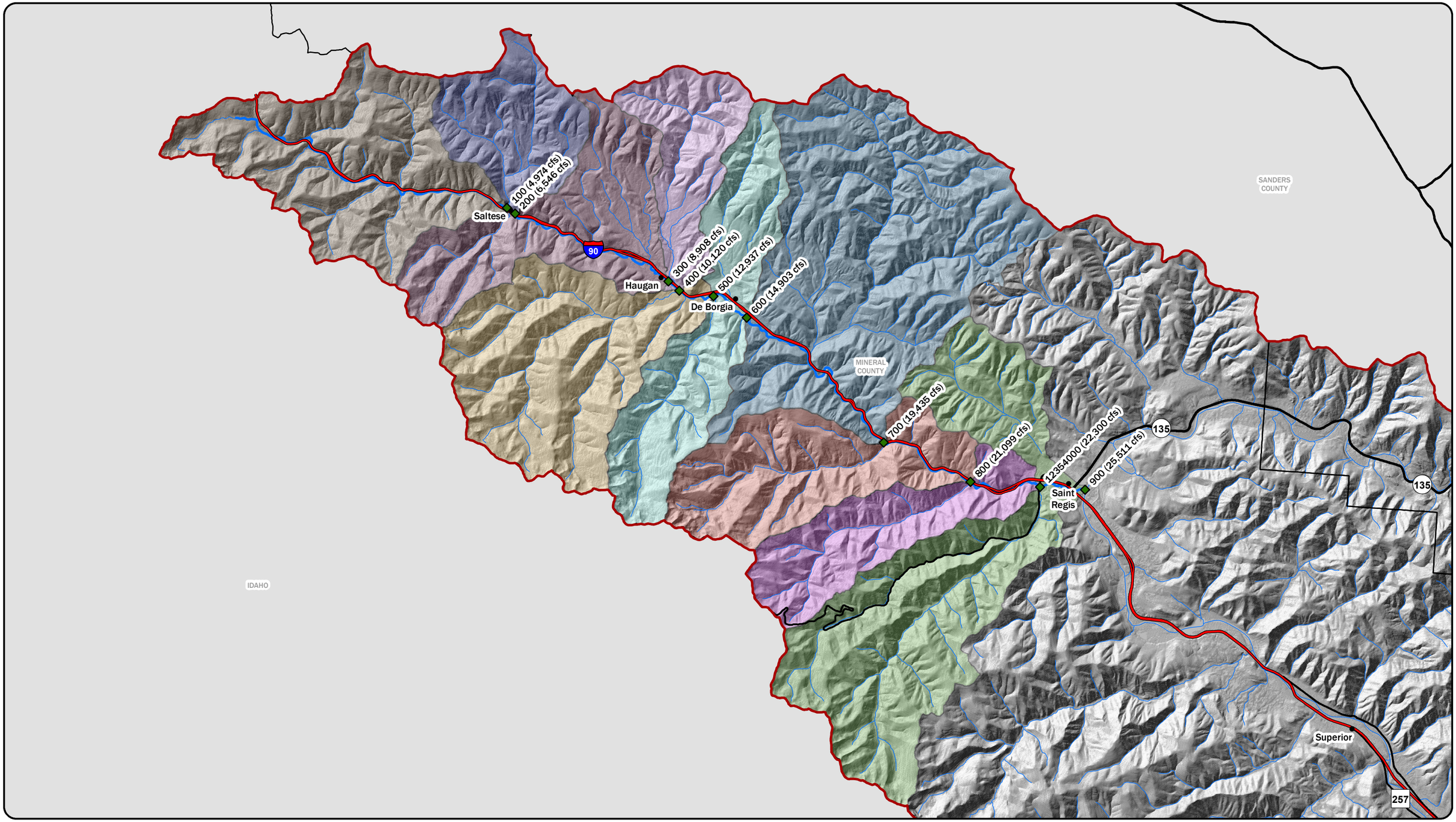
It was observed that the St. Regis River regional regression peak flow estimates produced results that were significantly lower than peak flow estimates using the gage area transfer method. The differences may be attributable to the poor correlation of regional regression estimates to watersheds with mixed population characteristics. Due to the higher confidence associated with flood frequency estimates that are based on measured stream flows, such as in the gage transfer method, the regional regression method peak flow estimates were eliminated from further consideration.

Table 14 summarizes the recommended flood frequency discharge rates for the St. Regis River. Figure 7 shows the recommended 1% annual discharge for each flow node location.

The hydrologic analysis results provided in Table 14 represent the recommended discharges at each flow node location throughout the study reach. The methods used for hydrological analysis are industry accepted methods (Bulletin #17C and SIR 2015-5019-F) based on the St. Regis River basin characteristics. This hydrologic analysis conforms to FEMA standards for detailed/enhanced level studies, and the recommended flows of this analysis are deemed reliable and suitable for future floodplain studies and hydraulic analyses.

Table 14 Flood Discharge Estimates from the Drainage Area Transfer Method

Node/USGS Station ID	Location Description	Peak Discharge (cfs)						
		50% Annual Chance	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	1% +
		2-year	10-year	25-year	50-year	100-year	500-year	
900	Lower St. Regis River	4,160	7,384	10,509	13,755	18,190	34,882	25,511
12354000	**St. Regis River near St. Regis, MT**	**3,580**	**6,410**	**9,150**	**12,000**	**15,900**	**30,600**	**22,300**
800	River Mile 4.3	3,365	6,047	8,643	11,345	15,044	28,994	21,099
700	River Mile 7.9	3,070	5,547	7,943	10,437	13,857	26,766	19,435
600	Downstream of De Borgia	2,283	4,196	6,044	7,973	10,626	20,670	14,903
500	Deer Creek	1,949	3,616	5,225	6,907	9,224	18,010	12,937
400	Savenac Creek	1,482	2,793	4,058	5,384	7,216	14,181	10,120
300	Big Creek	1,285	2,442	3,558	4,730	6,351	12,524	8,908
200	Downstream of Saltese	911	1,766	2,592	3,460	4,668	9,279	6,546
100	St. Regis River Headwaters	670	1,323	1,953	2,618	3,546	7,101	4,974



LEGEND

- FLOW NODE
- TOWNS
- HUC 8 BOUNDARIES
- MONTANA COUNTY BOUNDARIES
- NHS INTERSTATE
- PRIMARY
- SECONDARY
- SAINT REGIS RIVER STUDY REACH

FLOW CHANGE BASIN/USGS BASIN

- 900
- 12354000
- 800
- 700
- 600
- 500
- 400
- 300
- 200
- 100

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER, MSL, USGS

0 1 2 4
Miles

FIGURE 7

RECOMMENDED 1-PERCENT ANNUAL DISCHARGE FOR EACH LOCATION

PIONEER TECHNICAL SERVICES, INC.

DATE: 5/18/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\STRGS-GI-HYD-004-17.mxd

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Appendix A: USGS Flood Frequency Analysis

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Wyoming-Montana Water Science Center

Helena Office
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Helena, Montana 59601

Cheyenne Office
521 Progress Circle, Suite 6
Cheyenne, WY 82007

February 16, 2017

Mr. Steve Story
Montana Department of Natural Resources
And Conservation
P.O. Box 201601
Helena, Montana 59620-1601

Dear Mr. Story:

The U. S. Geological Survey (USGS) recently prepared a draft Scientific Investigations Report ([1]Sando and others, 2017) documenting USGS' current (February 2017) peak-flow frequency analysis methods that are used in frequency analyses for a large Montana-wide streamgage network (of 725 streamgages). Reporting frequency analyses for a large statewide streamgage network poses several challenges. The frequency analyses reported by the USGS are used for many different applications, including bridge and culvert design, flood-plain mapping, dam and spillway design, analysis, and assessment, and instream-flow water rights requests. Design criteria and risk tolerance can substantially differ among these various frequency applications. Further, uncertainties related to effects of regulation and frequency-adjustment methods are important to consider when using frequency analyses for various purposes. Within this context, in many cases the USGS impartially reports multiple frequency analyses for a given streamgage to allow frequency-analysis users to make informed decisions relevant to their needs.

In cooperation with Montana Department of Natural Resources and Conservation (MT DNRC), the USGS recently computed frequency analyses for 14 streamgages in the Beaverhead River and Clark Fork Basins for publication in a data release; which currently is in draft form ([2]McCarthy and others, 2017). The frequency analyses were based on the methods described by [1]Sando and others (2017). For most of the 14 streamgages, there are multiple frequency analyses reported in the data release.

USGS and MT DNRC have had extensive discussions concerning the intended application of the frequency analyses in flood-plain mapping projects in relation to the selection of the most appropriate reported frequency analyses for the application. Based on the stated purpose of using the flood frequency analyses for flood plain mapping and the period of record and basin characteristics for each station, the type of flood frequency estimate listed for each station in Table 1 will yield the most appropriate peak-flow frequency estimate of the types of peak-flow estimates described in [1]Sando and others (2017). The following discussion explains briefly why each type of peak-flow estimate is most appropriate for each station.

[1]Sando, S.K., McCarthy, P.M., Chase, K.J., and Dutton, D.M., 2017, Methods for Peak-Flow Frequency Analysis and Reporting by the U.S. Geological Survey Wyoming-Montana Water Science Center Based on Data through Water Year 2015: U.S. Geological Survey Scientific Investigations Report 2017–XXXX, xx p.

[2]McCarthy, P.M., Sando, S.K., and Chase, K.J., 2017, Results of peak-flow frequency analysis for streamgages in the Beaverhead River and Clark Fork Basins, based on data through water year 2016: U.S. Geological Survey Data Release, XXXXXXXXXXXXX.

Table 1. Most appropriate frequency analyses selected by MT DNRC based on discussions with USGS.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF, potentially influential low flow; U, unregulated; --, not applicable; R, regulated; BP, base period used in the Maintenance of Variance Type III record extension]

Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis period[2]	Type of peak-flow frequency estimate[3]	Number of years of peak-flow records in analysis period	Analysis period of record, in water years
Most appropriate frequency analyses for Beaverhead River streamgages						
06015400.11	Beaverhead River near Grant, Montana	2,316	R (MAJ–dam)	MOVE.3	52	BP 1965–2016
06016000.10	Beaverhead River at Barretts, Montana	2,730	R (MAJ–dam)	At-site	52	1965–2016
06017000.11	Beaverhead River at Dillon, Montana	2,892	R (MAJ–dam)	MOVE.3	52	BP 1965–2016
06017500.03	Blacktail Deer Creek near Dillon, Montana	316	U	RRE wtd	--	--
06018000.11	Beaverhead River near Dillon, Montana	3,419	R (MAJ–dam)	MOVE.3	52	BP 1965–2016
06018500.10	Beaverhead River near Twin Bridges, Montana	3,618	R (MAJ–dam)	At-site	52	1965–2016
Most appropriate frequency analyses for Clark Fork streamgages						
12331800.01	Clark Fork near Drummond, Montana	2,516	U	MOVE.3	111	BP 1899–1908; 1911–23; 1929–2016
12334550.01	Clark Fork at Turah Bridge, near Bonner, Montana	3,657	U	MOVE.3	111	BP 1899–1908; 1911–23; 1929–2016
12340500.01	Clark Fork above Missoula, Montana	6,021	U	MOVE.3	111	BP 1899–1908; 1911–23; 1929–2016
12353000.01	Clark Fork below Missoula, Montana	9,017	U	MOVE.3	111	BP 1899–1908; 1911–23; 1929–2016
12354000.00	St. Regis River near St. Regis, Montana	304	U	At-site	42	1911–17; 1934; 1948; 1954; 1959–75; 2002–16
12354500.01	Clark Fork at St. Regis, Montana	10,728	U	MOVE.3	111	BP 1899–1908; 1911–23; 1929–2016
12389000.10	Clark Fork near Plains, Montana	19,964	R (MAJ–dam)	At-site	79	1938–2016
12391400.11	Clark Fork below Noxon Rapids Dam, near Noxon, Montana	21,709	R (MAJ–dam)	MOVE.3	79	BP 1938–2016

[1]The streamgage identification number and analysis designation is defined by XXXXXXXX.AB,
where,
XXXXXXXX is the streamgage identification number; A is the regulation status for the analysis period; and B is the type of peak-flow frequency analysis.
Values of A (regulation status) are defined as: A = 0, unregulated; and A = 1, regulated by major regulation.
Values of B (type of peak-flow frequency analysis) are defined as:
B = 0, at-site peak-flow frequency analysis conducted on recorded data;
B = 1, peak-flow frequency analysis conducted on combined recorded and synthesized data; synthesized data from maintenance of variance type III (MOVE.3) record extension procedure;
B = 3, at-site peak-flow frequency analysis weighted with results from RREs.

[2]Abbreviations for regulation status are defined as follows:
U, unregulated, where the cumulative drainage area upstream from all dams is less than 20 percent of the drainage area of the streamgage.
R (MAJ–dam): major dam regulation, where a single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.

[3]Abbreviations for type of frequency analysis are defined as follows:
At-site: peak-flow frequency analysis on recorded data.
RRE wtd: the at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs).
MOVE.3: peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from maintenance of variance type III (MOVE.3) record extension procedure.

Discussion of Beaverhead River Basin streamgages

For the five main-stem Beaverhead River streamgages, the most appropriate frequency analyses are based on the regulated period of 1965–2016, which primarily is defined by the closure of Clark Canyon Dam in August 1964. Clark Canyon Reservoir has more than 300,000 acre-feet of storage capacity including dedicated flood-control storage; the location of Clark Canyon Dam accounts for between 65 to 100 percent of the drainage areas of the six Beaverhead River streamgages, substantially affecting the peak-flow records of these streamgages.

During the 1965–2016 regulated period, the five main-stem Beaverhead River streamgages have variable periods of record, ranging from 19 to 52 years of data collection. Differences in the timing of the periods of record can result in substantial inconsistencies in frequency estimates for hydrologically similar streamgages. The USGS uses Maintenance of Variance Type III (MOVE.3) record extension in cases of multiple streamgages on the same large river with variable periods of record but high cross correlation. For each streamgage, the MOVE.3 record extension procedure synthesizes estimated peak flows for years of missing record; this allows synchronization of the variable periods of record to a common long-term base period. Frequency analysis of the combined recorded and synthesized datasets provides synchronized frequency estimates that might be useful for several frequency applications, including floodplain mapping. The USGS considers MOVE.3 record extension as the preferred alternative for adjusting at-site frequency estimates for streamgages that qualify for application of the MOVE.3 procedure. Two of the main-stem Beaverhead River streamgages (06016000 and 06018500; table 1) have complete periods of record within the 1965-2016 regulated period; for these streamgages, the at-site frequency analyses are most appropriate. Three of the main-stem Beaverhead River

streamgages (06015400, 06017000, and 06018000; table 1) have years of missing record within the 1965–2016 regulated period; for these streamgages, the frequency analyses on the combined recorded and MOVE.3 synthesized datasets are most appropriate.

Blacktail Deer Creek near Dillon, Montana (streamgage 06017500; table 1) is on a tributary to the Beaverhead River and has a somewhat short period of record (21 years). The peak-flow dataset for streamgage 06017500 does not qualify for application of the MOVE.3 procedure. Uncertainties in the frequency analysis for streamgage 06017500 can be reduced by weighting the at-site frequency analysis with frequency results obtained from regional regression equations (RREs). For streamgage 06017500, the RRE-weighted frequency analysis is most appropriate.

Discussion of Clark Fork Basin streamgages

The seven streamgages on the main-stem Clark Fork are variable with respect to regulation effects. The five upstream streamgages (12331800, 12334550, 12340500, 12353000, and 12354500; table 1) are considered unregulated, with less than 20 percent of their basins affected by major dam regulation. The two downstream streamgages (12389000 and 12391400; table 1) are affected by major dam regulation.

The five unregulated main-stem Clark Fork streamgages (12331800, 12334550, 12340500, 12353000, and 12354500; table 1) have variable periods of record, ranging from 31 to 101 years of data collection. For each streamgage, MOVE.3 record extension was used to synthesize estimated peak flows for years of missing record to provide synchronization of the variable periods of record to a common 111-year base period. For the five unregulated main-stem Clark Fork streamgages (12331800, 12334550, 12340500, 12353000, and 12354500; table 1), frequency analyses on the combined recorded and MOVE.3 synthesized datasets are most appropriate.

Clark Fork near Plains, Montana (streamgage 12389000; table 1) and Clark Fork below Noxon Rapids Dam, near Noxon, Montana (streamgage 12391400; table 1) are downstream from the confluence of the Clark Fork and the Flathead River. Hungry Horse and Salish-Kootenai Dams in the upper Flathead River Basin are major regulation structures with more than 3 million acre-feet of storage capacity including dedicated flood-control storage. Locations of major dams account for between 40 to 43 percent of the drainage areas of streamgages 12389000 and 12391400, substantially affecting the peak-flow records of the two downstream Clark Fork streamgages (12389000 and 12391400). The regulated period for the two downstream streamgages is 1938–2016, which primarily is defined by the completion of Salish-Kootenai Dam in 1938.

During the 1938–2016 regulated period, the two downstream Clark Fork streamgages have variable periods of record, ranging from 54 to 79 years of data collection. Streamgage 12389000 has a complete period of record within the 1938–2016 regulated period; for this streamgage, the at-site frequency analysis is most appropriate. For streamgage 12391400 MOVE.3 record extension was used to synthesize estimated peak flows for years of missing record to provide synchronization with the 1938–2016 regulated period; for this streamgage, the frequency analysis on the combined recorded and MOVE.3 synthesized datasets is most appropriate.

St. Regis River near St. Regis, Montana (streamgage 12354000; table 1) is on a tributary to the Clark Fork and has 42 peak flow records between 1922 and 2016. The peak-flow dataset for streamgage 12354000 does not qualify for the application of the MOVE.3 procedure. The peak-flow dataset for streamgage 12354000 is a mixed population dataset and therefore a station skew was used in the analysis. Streamgage 12354000 is in the West hydrologic region of Montana, which has limited representation of mixed-population streamgages, and the independent estimates from the regional regression equations do not well represent sites with mixed-populations of peak-flows. Therefore, the most appropriate peak-flow frequency analysis for streamgage 12354000 is the at-site analysis.

Summary

Based on the information/data and statistical approaches described in [1]Sando and others (2017), the USGS considers the peak-flow analyses listed in Table 1 to be most appropriate for flood-plain mapping for these 14 streamgages. Other types of analyses might be more appropriate for other applications and methods developed in the future might be more appropriate for flood-plain mapping.

We hope you find this discussion of our study results useful and appreciate you choosing USGS as a provider of unbiased scientific information to use in your floodplain management activities.

Sincerely,

John M. Kilpatrick
Center Director

Table 2. Selected frequency analyses and estimated upper 84-percent confidence levels for the 1-percent annual exceedance probability peak flows.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. U, unregulated; R, regulated; <, less than; NR, not reported; --, not applicable; BP, base period used in the Maintenance of Variance Type III record extension]

Map number (fig. 1)	Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis period[2]	Type of peak-flow frequency estimate[3]	Number of years of peak-flow records in analysis period	Analysis period of record, in water years	Annual peak flow, in cubic feet per second, for indicated annual exceedance probability (AEP), in percent										Upper 84-percent confidence level for the 1-percent AEP peak-flow	Method for determining the upper 84-percent confidence level
								66.7	50	42.9	20	10	4	2	1	0.5	0.2		
695	12354000.00	St. Regis River near St. Regis, Montana	304	U	At-site	42	1911–17, 1934, 1948, 1954, 1959–75, 2002–16	3,280	3,580	3,760	4,940	6,410	9,150	12,000	15,900	21,100	30,600	22,300	PeakFQv7.1 value

[1]Sando, S.K., McCarthy, P.M., Chase, K.J., and Dutton, D.M., 2017, Methods for Peak-Flow Frequency Analysis and Reporting by the U.S. Geological Survey Wyoming-Montana Water Science Center Based on Data through Water Year 2015: U.S. Geological Survey Scientific Investigations Report 2017–XXXX, xx p.

Appendix B: Drainage Area Transfer and Regional Regression Calculations

Node/USGS Station ID	Location Description	County	Study Reach River Station (miles)	Individual Basin Area (mi^2)	Cumulative Basin Area (mi^2)	DA_U/DA_G	Drainage Area Gage Transfer Estimated Discharge (cfs)						
							Estimated Discharge (cfs)						
							50% Annual Chance	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	1% + Annual Chance
							2-year	10-year	25-year	50-year	100-year	500-year	100-year +
900	Lower St. Regis River	Mineral	0	59	363	1.2	4,160	7,384	10,509	13,755	18,190	34,882	25,511
12354000	**St. Regis River near St. Regis, Montana**	**Mineral**	**1.7**	**21**	**304**	-	**3,580**	**6,410**	**9,150**	**12,000**	**15,900**	**30,600**	**22,300**
800	River Mile 4.3	Mineral	4.3	29	282	0.9	3,365	6,047	8,643	11,345	15,044	28,994	21,099
700	River Mile 7.9	Mineral	7.9	75	253	0.8	3,070	5,547	7,943	10,437	13,857	26,766	19,435
600	Downstream of De Borgia	Mineral	15.3	30	178	0.6	2,283	4,196	6,044	7,973	10,626	20,670	14,903
500	Deer Creek	Mineral	16.7	41	148	0.5	1,949	3,616	5,225	6,907	9,224	18,010	12,937
400	Savenac Creek	Mineral	18	17	107	0.4	1,482	2,793	4,058	5,384	7,216	14,181	10,120
300	Big Creek	Mineral	18.5	30	90	0.3	1,285	2,442	3,558	4,730	6,351	12,524	8,908
200	Downstream of Saltese	Mineral	24.6	18	60	0.2	911	1,766	2,592	3,460	4,668	9,279	6,546
100	St. Regis River Headwaters	Mineral	24.9	42	42	0.1	670	1,323	1,953	2,618	3,546	7,101	4,974

*** Recommended ratio be within 0.5 to 1.5
*West Region for regression coefficient

For an ungaged site that is not located between two gaged locations
Recommended that the drainage ratio be within 0.5 to 1.5

Regression Coefficient expAEP =	0.843	0.794	0.777	0.766	0.755	0.735	0.755

Equation recommended by SIR 2015-5019-F

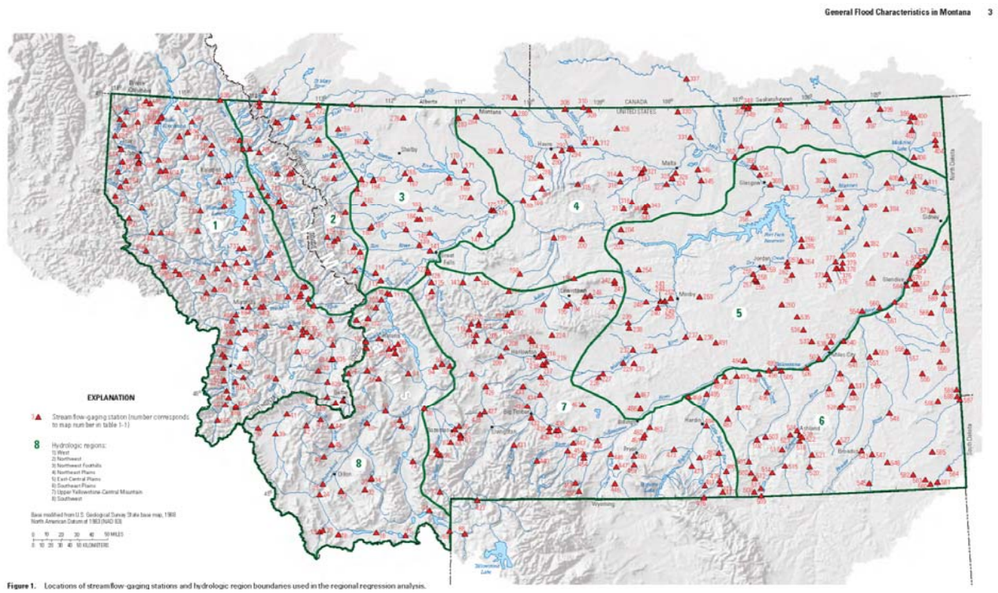


Figure 1. Locations of streamflow-gaging stations and hydrologic region boundaries used in the regional regression analysis.

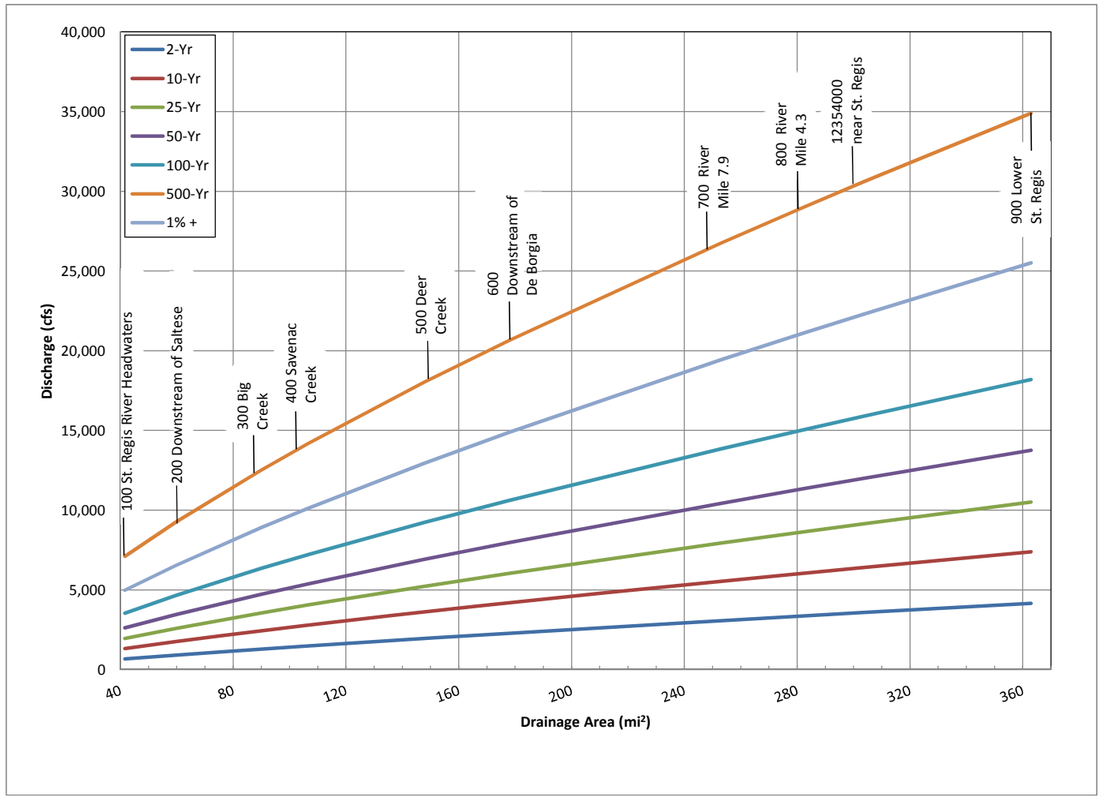


Table 5. Regression coefficients for ordinary least squares regressions relating annual exceedance probability percent peak flow to contributing drainage area for use with ungaged sites on gaged streams.

AEP-percent peak flow (Q_{AEP})	Regression coefficient relating Q_{AEP} to drainage area for indicated region							
	West Region	Northwest Region	Northwest Foothills Region	Northeast Plains Region	East-Central Plains Region	Southeast Plains Region	Upper Yellowstone-Central Mountain Region	Southwest Region
$Q_{66.7}$	0.858	0.922	0.606	0.684	0.500	0.541	0.942	0.999
Q_{50}	0.843	0.904	0.575	0.690	0.488	0.527	0.896	0.939
$Q_{42.9}$	0.836	0.890	0.564	0.681	0.483	0.523	0.866	0.911
Q_{20}	0.813	0.832	0.534	0.639	0.463	0.502	0.761	0.818
Q_{10}	0.794	0.790	0.522	0.611	0.449	0.487	0.697	0.755
Q_{4}	0.777	0.741	0.516	0.579	0.434	0.471	0.634	0.690
Q_{2}	0.766	0.707	0.517	0.557	0.423	0.460	0.595	0.647
Q_{1}	0.755	0.675	0.521	0.537	0.414	0.450	0.561	0.609
$Q_{0.5}$	0.746	0.644	0.526	0.519	0.404	0.441	0.532	0.576
$Q_{0.2}$	0.735	0.605	0.536	0.496	0.393	0.430	0.498	0.533

$$Q_{AEP,U} = Q_{AEP,G}\left(\frac{DA_U}{DA_G}\right)^{exp_{AEP}} \quad (6)$$

where

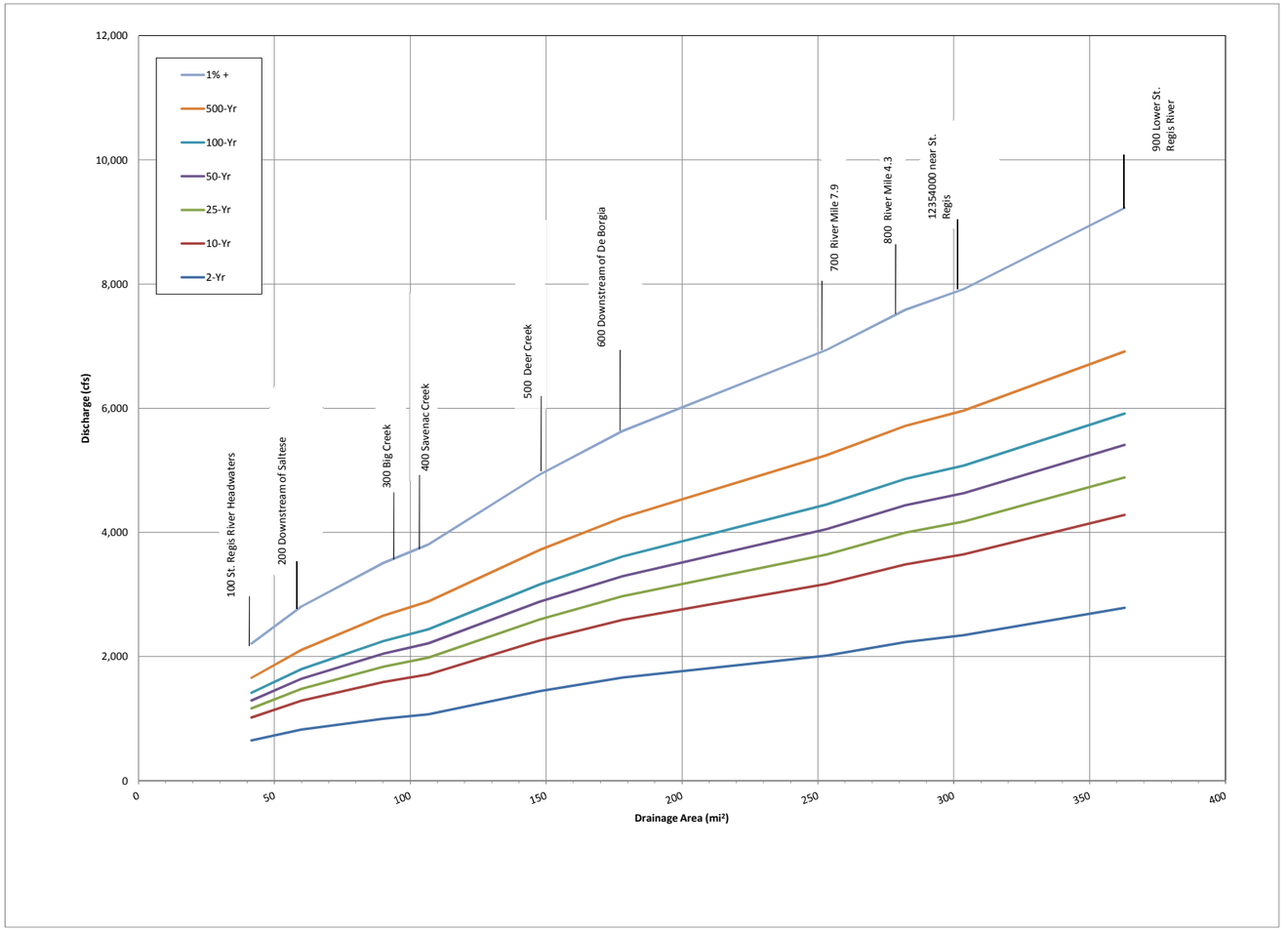
$Q_{AEP,G}$ is the AEP-percent peak flow for gaging station G, in cubic feet per second;
DA_U is the drainage area at ungaged site U, in square miles;
DA_G is the drainage area at gaging station G, in square miles; and
exp_{AEP} is the regression coefficient for an OLS regression relating the log of the AEP-percent peak flow to the log of the drainage area within each region (table 5).

Node/USGS Station ID	Location Description	County	Study Reach River Station (miles)	Methods used to develop extended record	Individual Basin Area (mi^2)	Cumulative Basin Area (mi^2)	F (%)	P (in)	Southwest Region Regression Estimated Discharge (cfs) 50% Annual Chance 2-year	10% Annual Chance 10-year	4% Annual Chance 25-year	2% Annual Chance 50-year	1% Annual Chance 100-year	0.2% Annual Chance 500-year	1% + 100-year
12354000	**St. Regis River near St. Regis, Montana**	**Mineral**	**1.7**	**At-site**	**21**	**304**	**86.14**	**41.09**	**3,580**	**3,760**	**4,940**	**6,410**	**9,150**	**12,000**	**15,900**
900	Lower St. Regis River	Mineral	0	Regression	59	363	85.44	40.86	2,787	4,281	4,886	5,408	5,912	6,913	9,223
12354000	**St. Regis River near St. Regis, Montana**	**Mineral**	**1.7**	**Regression**	**21**	**304**	**86.14**	**40.81**	**2,343**	**3,644**	**4,176**	**4,633**	**5,076**	**5,960**	**7,918**
800	River Mile 4.3	Mineral	4.3	Regression	29	282	85.20	41.00	2,233	3,483	3,996	4,435	4,861	5,713	7,584
700	River Mile 7.9	Mineral	7.9	Regression	75	253	85.15	40.94	2,015	3,168	3,644	4,051	4,447	5,241	6,937
600	Downstream of De Borgia	Mineral	15.3	Regression	30	178	85.42	43.43	1,660	2,590	2,969	3,295	3,611	4,239	5,633
500	Deer Creek	Mineral	16.7	Regression	41	148	85.55	44.09	1,443	2,262	2,597	2,884	3,163	3,718	4,934
400	Savenac Creek	Mineral	18.0	Regression	17	107	84.92	43.93	1,068	1,714	1,984	2,213	2,438	2,890	3,803
300	Big Creek	Mineral	18.5	Regression	30	90	84.32	45.60	1,000	1,591	1,837	2,045	2,249	2,656	3,508
200	Downstream of Saltese	Mineral	24.6	Regression	18	60	84.88	49.58	824	1,289	1,479	1,640	1,797	2,107	2,803
100	St. Regis River Headwaters	Mineral	24.9	Regression	42	42	85.25	51.84	649	1,016	1,165	1,292	1,416	1,659	2,209

Equation recommended by SIR 2015-5019-F

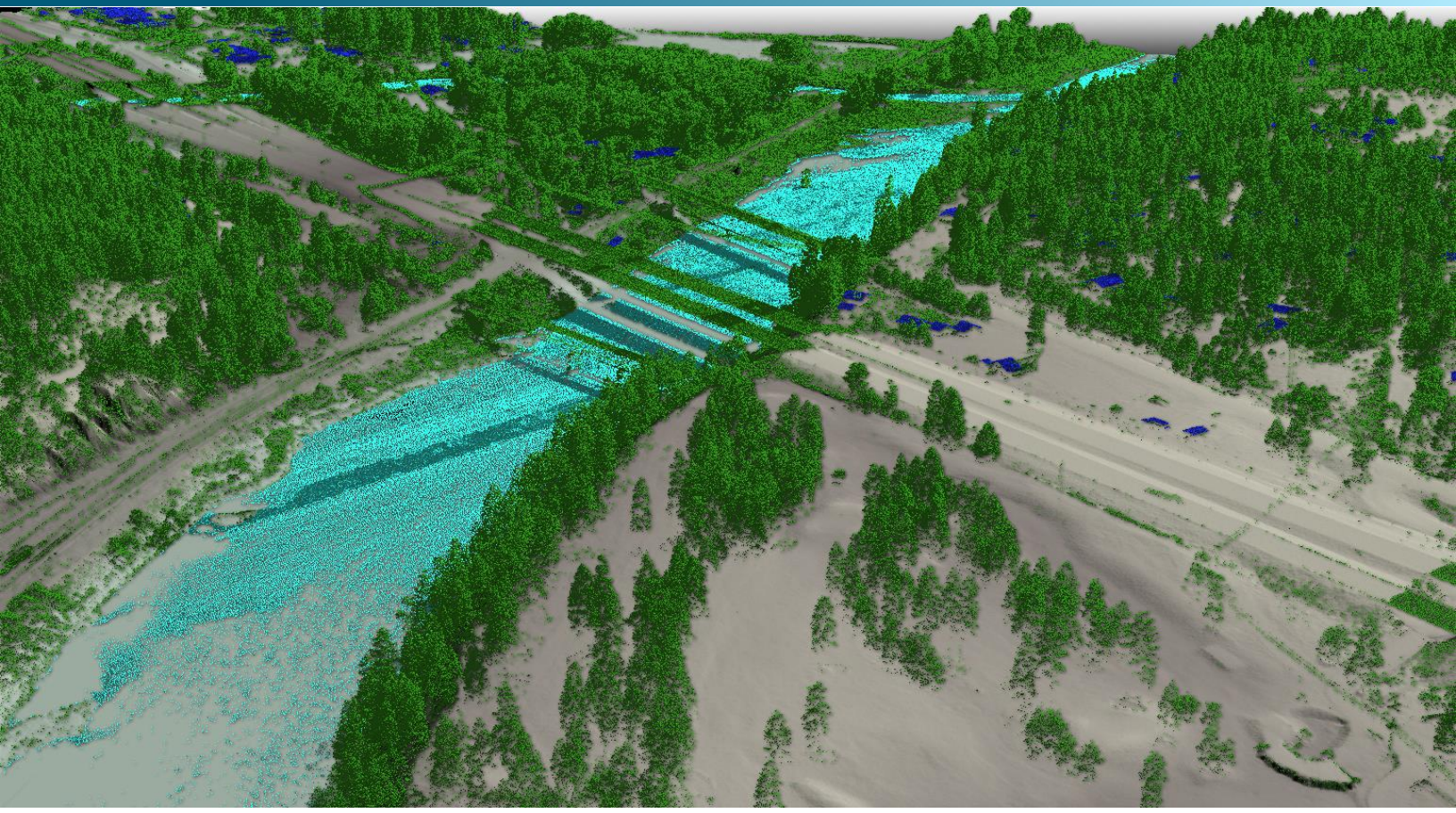
West hydrologic region
$Q_{66.7} = 0.047\ A^{0.943}\ P^{2.44}\ (F+1)^{-0.840}$
$Q_{50} = 0.131\ A^{0.920}\ P^{2.24}\ (F+1)^{-0.845}$
$Q_{42.9} = 0.199\ A^{0.910}\ P^{2.16}\ (F+1)^{-0.847}$
$Q_{20} = 0.906\ A^{0.876}\ P^{1.88}\ (F+1)^{-0.864}$
$Q_{10} = 2.44\ A^{0.853}\ P^{1.71}\ (F+1)^{-0.875}$
$Q_{4} = 6.61\ A^{0.831}\ P^{1.53}\ (F+1)^{-0.890}$
$Q_{2} = 12.2\ A^{0.818}\ P^{1.42}\ (F+1)^{-0.896}$
$Q_{1} = 21.5\ A^{0.806}\ P^{1.32}\ (F+1)^{-0.904}$
$Q_{0.5} = 35.5\ A^{0.796}\ P^{1.23}\ (F+1)^{-0.910}$
$Q_{0.2} = 63.5\ A^{0.783}\ P^{1.12}\ (F+1)^{-0.915}$

[Q_{AEP}, peak-flow magnitude, in cubic feet per second, for annual exceedance probability (AEP) in percent; n, number of streamflow-gaging stations used in developing regression equations for indicated hydrologic region; σ_A^2, model error variance; MVP, mean variance of prediction; SEP, mean standard error of prediction; SEM, mean standard error of model; Pseudo R^2, pseudo coefficient of determination; A, contributing drainage area, in square miles; P, mean annual precipitation, in inches; F, percentage of basin that is forest; E_{5000}, percentage of basin above 5,000 feet elevation; SLP_{30}, percentage of basin with slope greater than 30 percent; ET_{SPR}, Mean spring (March–June) evapotranspiration, in inches per month; E_{6000}, percent of basin above 6,000 feet elevation]



Appendix C: Digital Data and Calculation Files

November 2, 2017



St. Regis River, Montana

Beaverhead & Mineral Counties LiDAR

Technical Data Report

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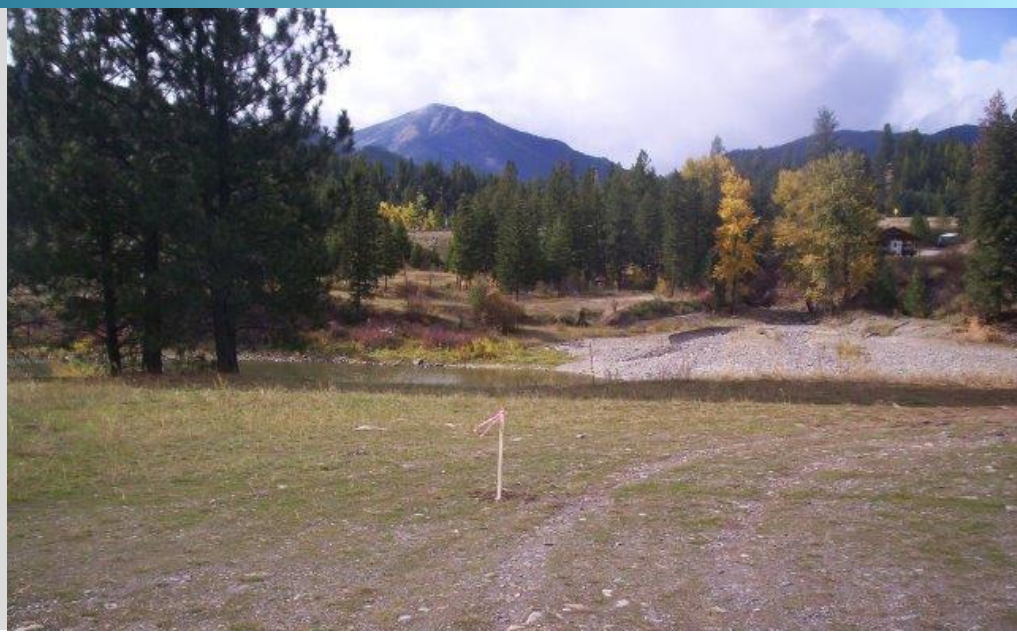
Cover Photo: This image shows a view of the St. Regis River, created from the gridded bare earth model colored by elevation, overlaid with above ground LiDAR returns colored by point classification.

INTRODUCTION



This photo taken by Gaston surveying staff shows a view of the Montana landscape near the St. Regis and Clark Fork project areas.

In October 2016, Quantum Spatial (QSI) was contracted by the State of Montana Department of Natural Resources and Conservation (MTDNRC) to collect topobathymetric Light Detection and Ranging (LiDAR) data for the Clark Fork area of interest in Mineral County, Montana, and to collect traditional near-infrared (NIR) LiDAR data for the Lima and St. Regis areas of interest in Beaverhead County, Montana. QSI acquired and processed NIR LiDAR for the Lima AOI on April 11th, 2017, and provided final contracted deliverables for the Lima AOI to MTDNRC on May 12th, 2017. The Clark Fork topobathymetric AOI was acquired by QSI between November 18th and November 26th, 2016, and delivered on July 28th, 2017. This report and LiDAR data delivery encompasses the final St. Regis River, Montana project area, and concludes the Beaverhead and Mineral Counties LiDAR Project. Data were collected to aid MTDNRC in assessing the topographic and geophysical properties of the study areas to support natural resources management and flood hazard assessment in Beaverhead and Mineral Counties.

This report accompanies the delivered NIR LiDAR data for the St. Regis River area of interest. Documented herein are contract specifications, data acquisition procedures, processing methods, and analysis of the final dataset including LiDAR accuracy and density. Acquisition dates and acreage are shown in Table 1, a complete list of contracted deliverables provided to MTDNRC is shown in Table 2, and the project extent is shown in Figure 1.

Table 1: Acquisition dates, acreage, and data types collected on the St. Regis River sites

Project Site	Contracted Acres	Buffered Acres	Acquisition Dates	Data Type	Date of Delivery
St. Regis River AOI, Beaverhead County	19,362	23,358	07/31/17, 08/01/17, 08/22/17	NIR LiDAR	11/2/17

Deliverable Products

Table 2: Products delivered to MTDNRC for the St. Regis River site

St. Regis River, Montana LiDAR Products Projection: Montana State Plane Horizontal Datum: NAD83 (2011) Vertical Datum: NAVD88 (GEOID12A) Horizontal Units: International Feet Vertical Units: US Survey Feet	
Points	LAS v 1.2 • All Classified Returns • Unclassified Flightline Swaths
Rasters	3.0 Foot ESRI Grids, Comma Delimited ASCII (*.asc), and ESRI Geodatabase • Bare Earth Digital Elevation Model (DEM)
Vectors	Shapefiles (*.shp) • Area of Interest • LiDAR Tile Index • Contours (1.0 ft) • Ground Control • Total Area Flown • 3D Building Polygons ESRI Geodatabase (*.gdb) • Contours (1.0 ft)

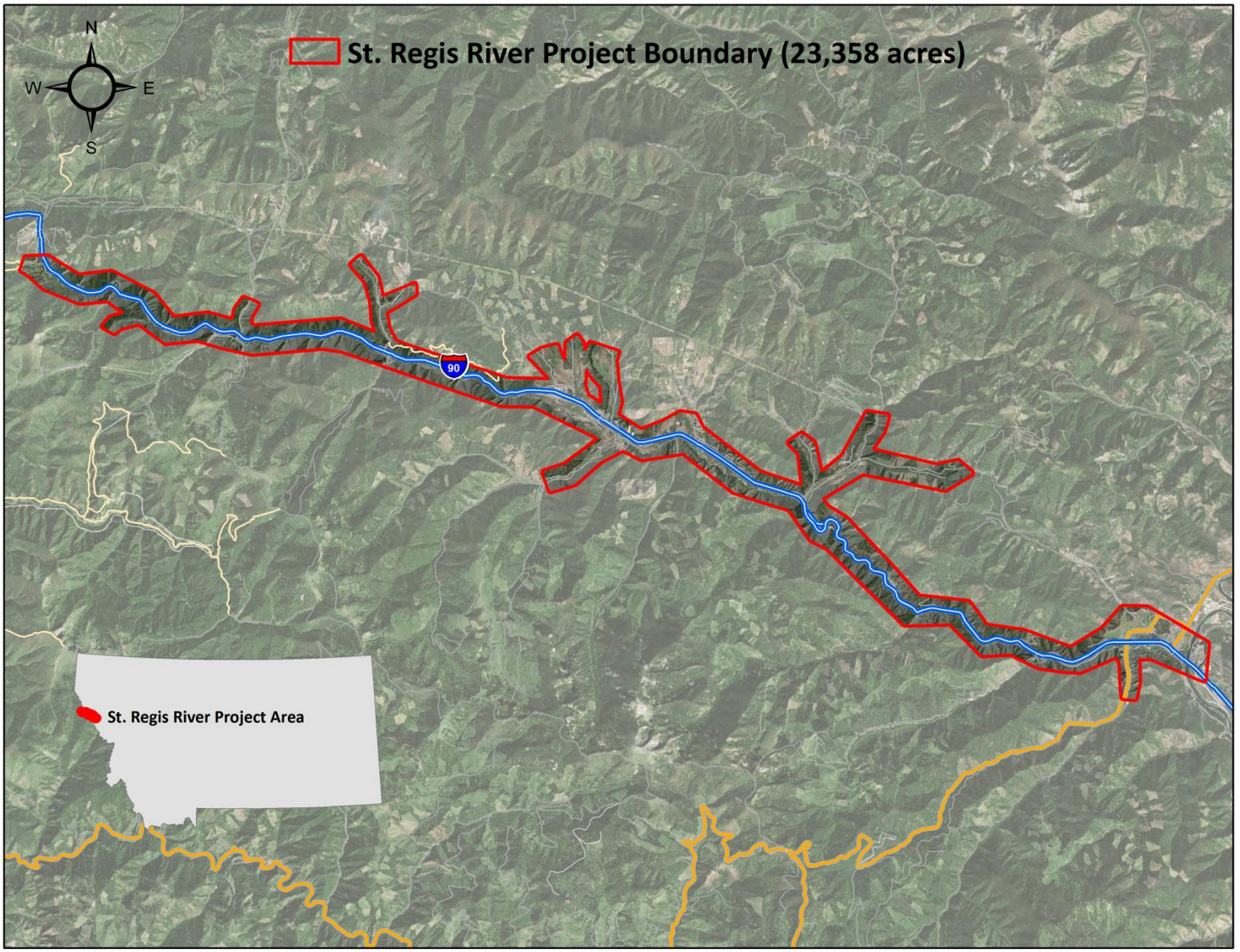


Figure 1: Location map of the St. Regis River site in Montana

ACQUISITION

QSI's Cessna Caravan

Planning

In preparation for data collection, QSI reviewed the project area and developed a specialized flight plan to ensure complete coverage of the St. Regis River LiDAR study area at the target point density of ≥8.0 points/m^2. Acquisition parameters including orientation relative to terrain, flight altitude, pulse rate, scan angle, and ground speed were adapted to optimize flight paths and flight times while meeting all contract specifications.

Factors such as satellite constellation availability and weather windows must be considered during the planning stage. Any weather hazards or conditions affecting the flights were continuously monitored due to their potential impact on the daily success of airborne and ground operations. In addition, logistical considerations including private property access and potential air space restrictions were reviewed.

Airborne LiDAR Survey

The St. Regis River LiDAR survey was accomplished using a Leica ALS80 system mounted in a Cessna Caravan. The Leica ALS80 laser system can record unlimited range measurements (returns) per pulse. It is not uncommon for some types of surfaces (e.g., dense vegetation or water) to return fewer pulses to the LiDAR sensor than the laser originally emitted. The discrepancy between first return and overall delivered density will vary depending on terrain, land cover, and the prevalence of water bodies. All discernible laser returns were processed for the output dataset. Table 3 summarizes the settings used to yield an average pulse density of ≥8 pulses/m^2 over the St. Regis River project area.

Table 3: LiDAR specifications and survey settings

LiDAR Survey Settings & Specifications	
AOI	St. Regis River, Beaverhead County
Acquisition Dates	07/31/17, 08/01/17, 08/22/17
Aircraft Used	Cessna Caravan
Sensor	Leica
Laser	ALS80
Maximum Returns	Unlimited
Resolution/Density	Average 8 pulses/m^2
Nominal Pulse Spacing	0.35 m
Survey Altitude (AGL)	1,600 m
Survey speed	110 knots
Field of View	40°
Mirror Scan Rate	50 - 52 Hz
Target Pulse Rate	320 - 340 kHz
Pulse Length	2.5 ns
Laser Pulse Footprint Diameter	35.2 cm
Central Wavelength	1064 nm
Pulse Mode	Multiple Pulses in Air (2PiA)
Beam Divergence	22 mrad
Swath Width	1,165 m
Swath Overlap	67%
GPS Baselines	≤13 nm
GPS PDOP	≤3.0
GPS Satellite Constellation	≥6
Intensity	8-bit, scaled to 16-bit
Accuracy	$RMSE_Z$ ≤ 10 cm

All areas were surveyed with an opposing flight line side-lap of ≥50% (≥100% overlap) in order to reduce laser shadowing and increase surface laser painting. To accurately solve for laser point position (geographic coordinates x, y and z), the positional coordinates of the airborne sensor and the attitude of the aircraft were recorded continuously throughout the LiDAR data collection mission. Position of the

aircraft was measured twice per second (2 Hz) by an onboard differential GPS unit, and aircraft attitude was measured 200 times per second (200 Hz) as pitch, roll and yaw (heading) from an onboard inertial measurement unit (IMU). To allow for post-processing correction and calibration, aircraft and sensor position and attitude data are indexed by GPS time.

Ground Control

Ground control surveys, including monumentation and ground survey points (GSPs), were conducted by QSI and Gaston Engineering and Surveying (Bozeman, MT), to support the airborne acquisition. Ground control data were used to geospatially correct the aircraft positional coordinate data and to perform quality assurance checks on final LiDAR data. Please see Appendix B for surveying methods and materials provided by Gaston Engineering and Surveying.

Monumentation

Monument locations were established by Gaston Engineering and Surveying and utilized by QSI for ground control and airborne trajectory processing. Gaston's coordinates for monument locations were held for the calibration and post-processing of the LiDAR point cloud. The spatial configuration of ground survey monuments provided redundant control within 13 nautical miles of the mission areas for LiDAR flights. Monuments were also used for collection of ground survey points using real time kinematic (RTK), post processed kinematic (PPK), and fast static (FS) survey techniques.

Monument locations were selected with consideration for satellite visibility, field crew safety, and optimal location for GSP coverage. QSI utilized two monuments established by Gaston for the St. Regis River LiDAR survey (Table 4, Figure 2).

Table 4: Monuments established by Gaston for the St. Regis River LiDAR acquisitions. Coordinates are on the NAD83 (2011) datum, epoch 2010.00

Monument ID	Latitude	Longitude	Ellipsoid (meters)
CP#1	47° 23' 33.37836"	-115° 25' 09.37737"	950.704
CP#2	47° 17' 39.76997"	-115° 09' 31.90525"	810.676

QSI Ground Survey Points (GSPs)

QSI's ground surveys for the Beaverhead & Mineral Counties LiDAR project included collection of ground control points to be used in the LiDAR calibration and post processing. QSI collected all ground survey points using real time kinematic, post-processed kinematic (PPK), and fast-static (FS) survey techniques. A Trimble R7 base unit was positioned at a nearby monument to broadcast a kinematic correction to a roving Trimble R8 GNSS or R10 receiver. All GSP measurements were made during periods with a Position Dilution of Precision (PDOP) of ≤ 3.0 with at least six satellites in view of the stationary and roving receivers. When collecting RTK and PPK data, the rover records data while stationary for five seconds, then calculates the pseudorange position using at least three one-second epochs. FS surveys record observations for up to fifteen minutes on each GSP in order to support longer baselines for post-processing. Relative errors for any GSP position must be less than 1.5 cm horizontal and 2.0 cm vertical in order to be accepted. See Table 5 for Trimble unit specifications.

GSPs were collected in areas where good satellite visibility was achieved on paved roads and other hard surfaces such as gravel or packed dirt roads. GSP measurements were not taken on highly reflective surfaces such as center line stripes or lane markings on roads due to the increased noise seen in the laser returns over these surfaces. GSPs were collected within as many flightlines as possible; however, the distribution of GSPs depended on ground access constraints and monument locations and may not be equitably distributed throughout the study area (Figure 2).

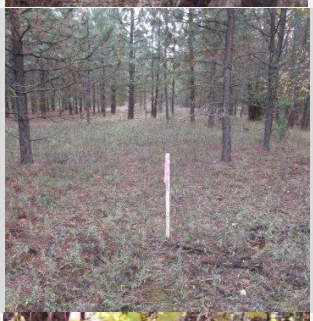
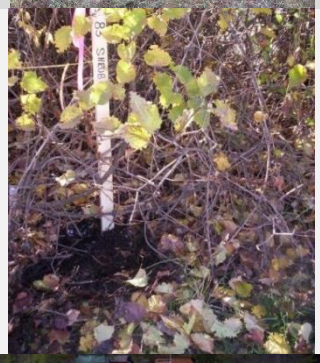
Table 5: Trimble equipment identification

Receiver Model	Antenna	OPUS Antenna ID	Use
Trimble R7 GNSS	Zephyr GNSS Geodetic Model 2 RoHS	TRM57971.00	Static
Trimble R8	Integrated Antenna R8 Model 2	TRM_R8_GNSS	Static, Rover
Trimble R10	Integrated Antenna R10	TRMR10	Static, Rover

Supplementary Ground Check Points

In addition to monument locations, Gaston Engineering and Surveying collected ground check points for the Beaverhead and Mineral Counties project areas, to be used in Non-Vegetated and Vegetated Vertical Accuracy assessment (Table 6, see LiDAR Accuracy Assessments, page 17).

Table 6: Check Points Types and Descriptions

Land cover type	Gaston code	Example	Description	Accuracy Assessment Type
Bare Earth	BARE		Hard bare ground surfaces with level slope	NVA
Urban	URBAN		Areas dominated by urban development	NVA
Forested	FOREST		Areas of mixed forest	VVA
Shrubland	SHRUB		Areas dominated by herbaceous shrubs	VVA
Tall Grass	TALL_GRASS		Areas dominated by herbaceous grassland which are not, or are infrequently, maintained	VVA

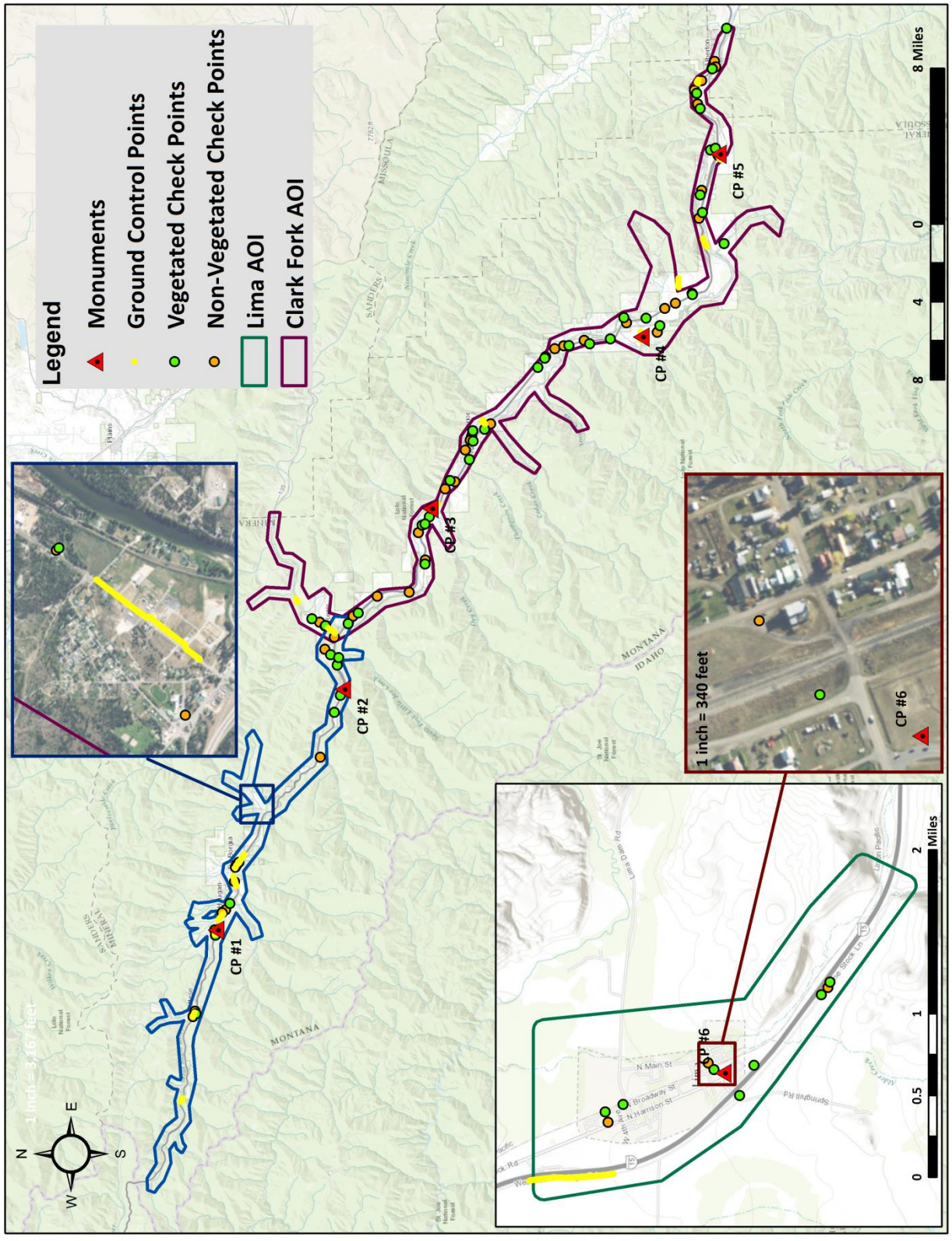
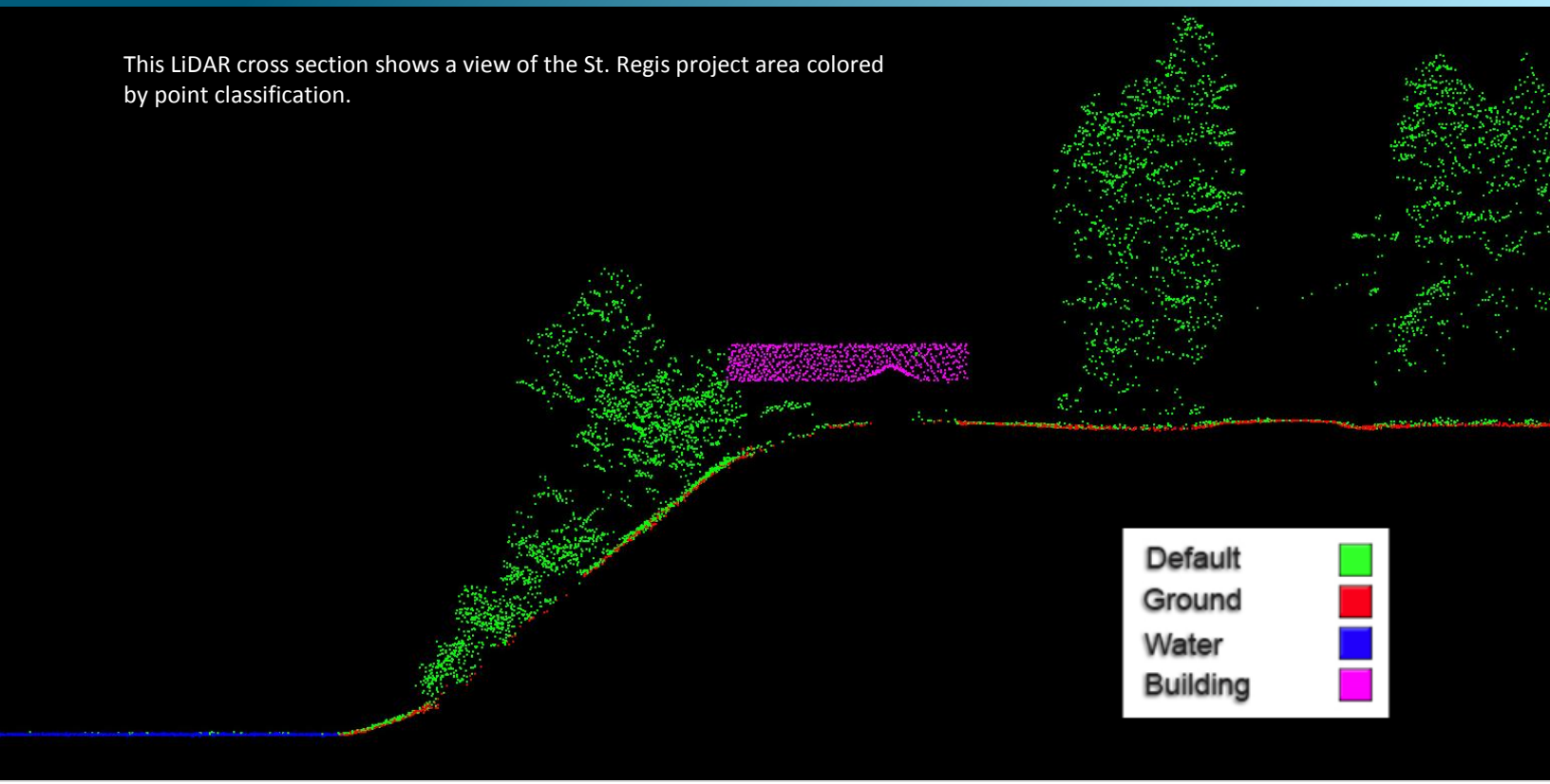


Figure 2: Ground survey location map



LiDAR Processing

Upon completion of the Lima AOI LiDAR data acquisition, QSI processing staff initiated a suite of automated and manual techniques to process the data into the requested deliverables. Processing tasks included GPS control computations, smoothed best estimate trajectory (SBET) calculations, kinematic corrections, calculation of laser point position, sensor and data calibration for optimal relative and absolute accuracy, and LiDAR point classification (Table 7). Processing methodologies were tailored for the landscape. Brief descriptions of these tasks are shown in Table 8.

Table 7: ASPRS LAS classifications applied to the Lima dataset

Classification Number	Classification Name	Classification Description
1	Default/Unclassified	Laser returns that are not included in the ground class, composed of vegetation and anthropogenic features
2	Ground	Laser returns that are determined to be ground using automated and manual cleaning algorithms
6	Buildings and Bridges	Permanent structures such as buildings and bridges
7	Noise	Laser returns that are often associated with birds, scattering from reflective surfaces, or artificial points below the ground surface

Classification Number	Classification Name	Classification Description
9	Water	Laser returns that are determined to be water using automated and manual cleaning algorithms

Table 8: NIR LiDAR processing steps for the Lima AOI

LiDAR Processing Step	Software Used
Resolve kinematic corrections for aircraft position data using kinematic aircraft GPS and static ground GPS data. Develop a smoothed best estimate of trajectory (SBET) file that blends post-processed aircraft position with sensor head position and attitude recorded throughout the survey.	Waypoint Inertial Explorer v.8.6
Calculate laser point position by associating SBET position to each laser point return time, scan angle, intensity, etc. Create raw laser point cloud data for the entire survey in *.las (ASPRS v. 1.2) format. Convert data to orthometric elevations by applying a geoid correction.	Waypoint Inertial Explorer v.8.6 Leica Cloudpro v. 1.2.2
Import raw laser points into manageable blocks (less than 500 MB) to perform manual relative accuracy calibration and filter erroneous points. Classify ground points for individual flight lines.	TerraScan v.17
Using ground classified points per each flight line, test the relative accuracy. Perform automated line-to-line calibrations for system attitude parameters (pitch, roll, heading), mirror flex (scale) and GPS/IMU drift. Calculate calibrations on ground classified points from paired flight lines and apply results to all points in a flight line. Use every flight line for relative accuracy calibration.	TerraMatch v.17
Classify resulting data to ground and other client designated ASPRS classifications (Table 7). Assess statistical absolute accuracy via direct comparisons of ground classified points to ground control survey data.	TerraScan v.17 TerraModeler v.17
Generate bare earth models as triangulated surfaces. Export models as ESRI GRIDs, Comma Delimited ASCII models, and in ESRI Geodatabase format, at a 3.0 foot pixel resolution.	TerraScan v.17 TerraModeler v.17 ArcMap v. 10.2.2
Generate building polygons from classified LiDAR returns.	TerraScan v.17 TerraModeler v.17 ArcMap v. 10.2.2

Contours

QSI generated 1 foot contours for the St. Regis River LiDAR datasets. Contour generation from LiDAR point data required a thinning operation in order to reduce contour sinuosity. The thinning operation reduced point density where topographic change is minimal (i.e., flat surfaces) while preserving resolution where topographic change was present. Contour key points were selected from the ground model every 20 feet with the spacing decreased in regions with high surface curvature (Z tolerance of 0.15 feet). Generation of contour key points eliminated redundant detail in terrain representation, particularly in areas of low relief, and provided for a more manageable dataset. Contours were produced through TerraModeler by interpolating between the contour key points at even elevation increments.

Elevation contour lines were then intersected with ground point density rasters and a confidence field was added to each contour line. Contours which crossed areas of high point density have high confidence levels, while contours which crossed areas of low point density have low confidence levels. Areas with low ground point density are commonly beneath buildings and bridges, in locations with dense vegetation, over water, and in other areas where laser penetration to the ground surface was impeded (Figure 3).

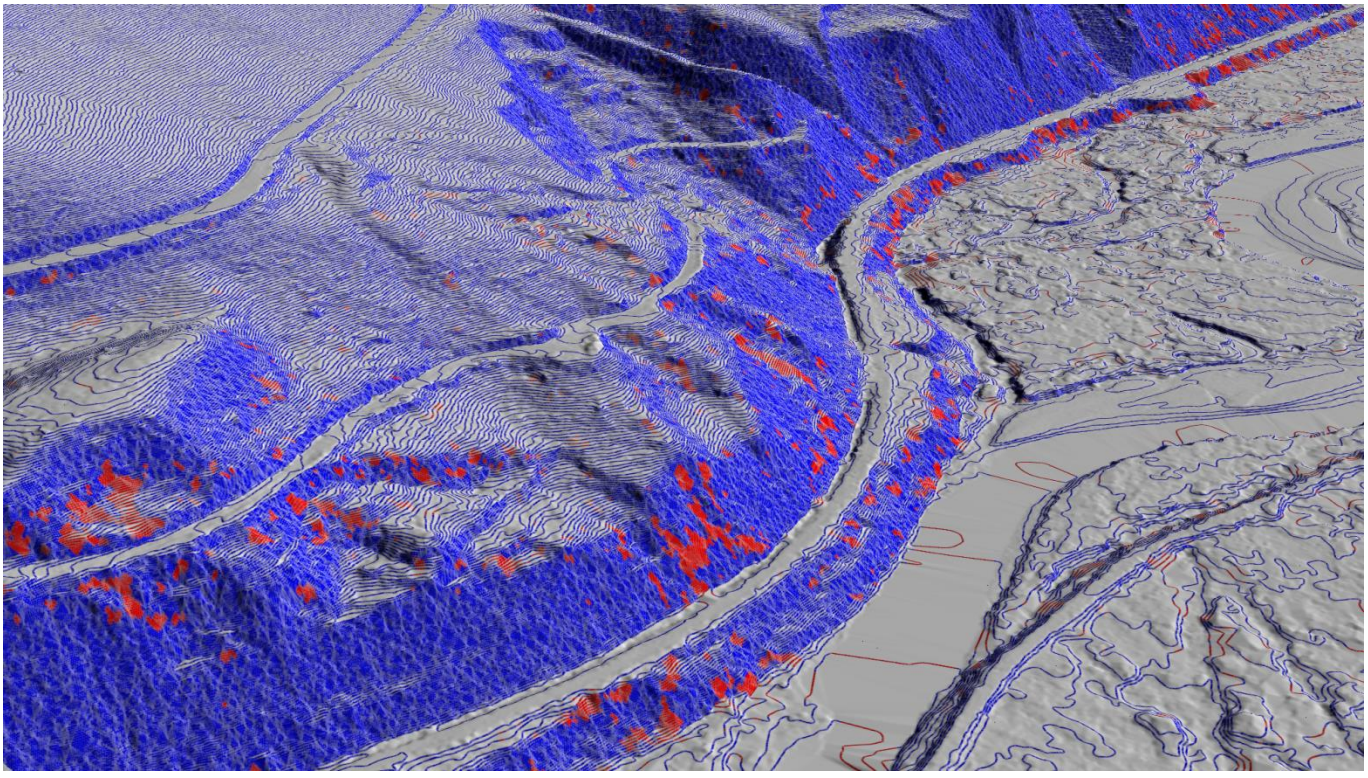


Figure 3: 1-foot contours draped over the St. Regis River bare earth elevation model. Blue contours represent high confidence while the red contours represent low confidence.

Buildings

Building classification was performed for the St. Regis River project area through a combination of automated algorithms and manual classification. Typically, manual editing of the building classification was necessary where dense canopy was immediately proximate to features. All permanent structures with area ≥ 100ft² were classified into the building category. Once classification was complete, automated routines were used generate the polygon shapefile representing building footprints. Footprints were draped over the above-ground LiDAR returns. The average height of building classified LiDAR returns was extracted and applied to the building polygons to generate a 3D building footprint for each area of interest. The final count of extracted building features by site is presented in the table below (Figure 4).

Table 9: Building Feature Extraction by Site

3D Building Footprint Results	
AOI Name	**Building Polygons Mapped (count)**
St. Regis River	4,888

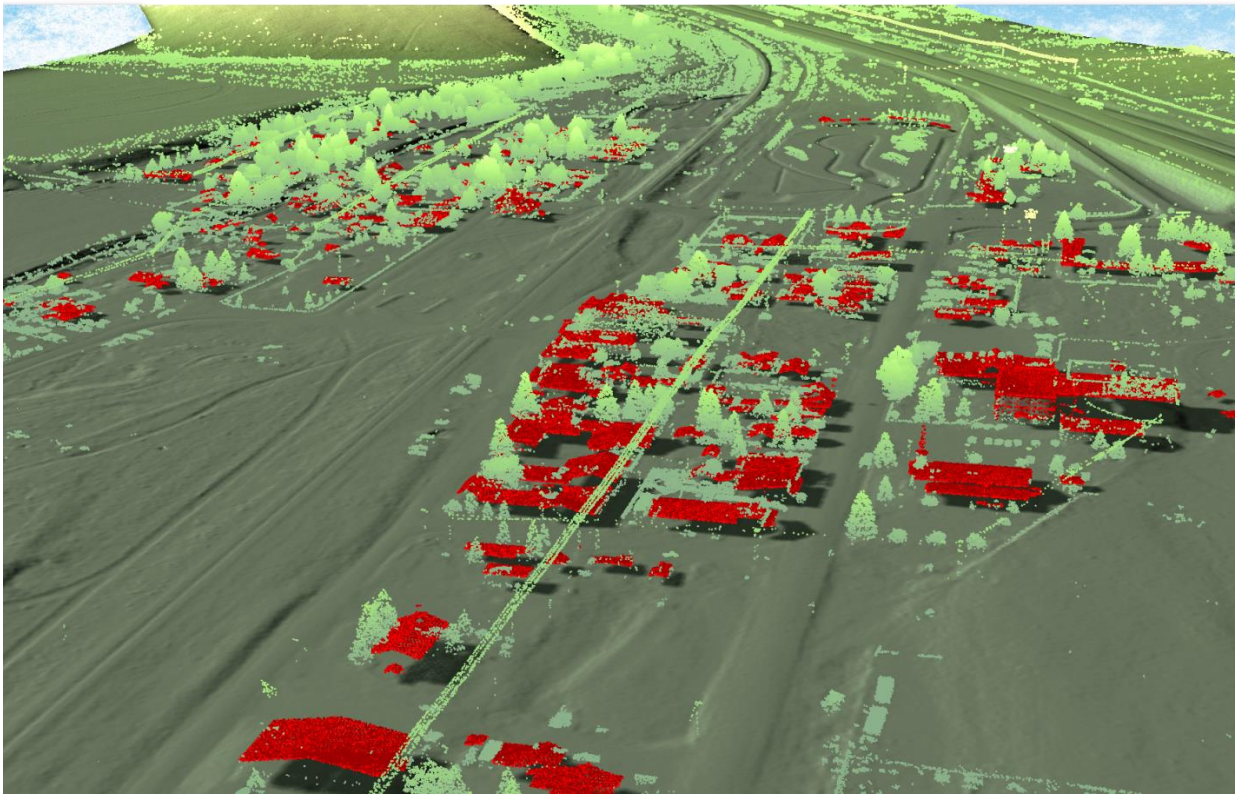
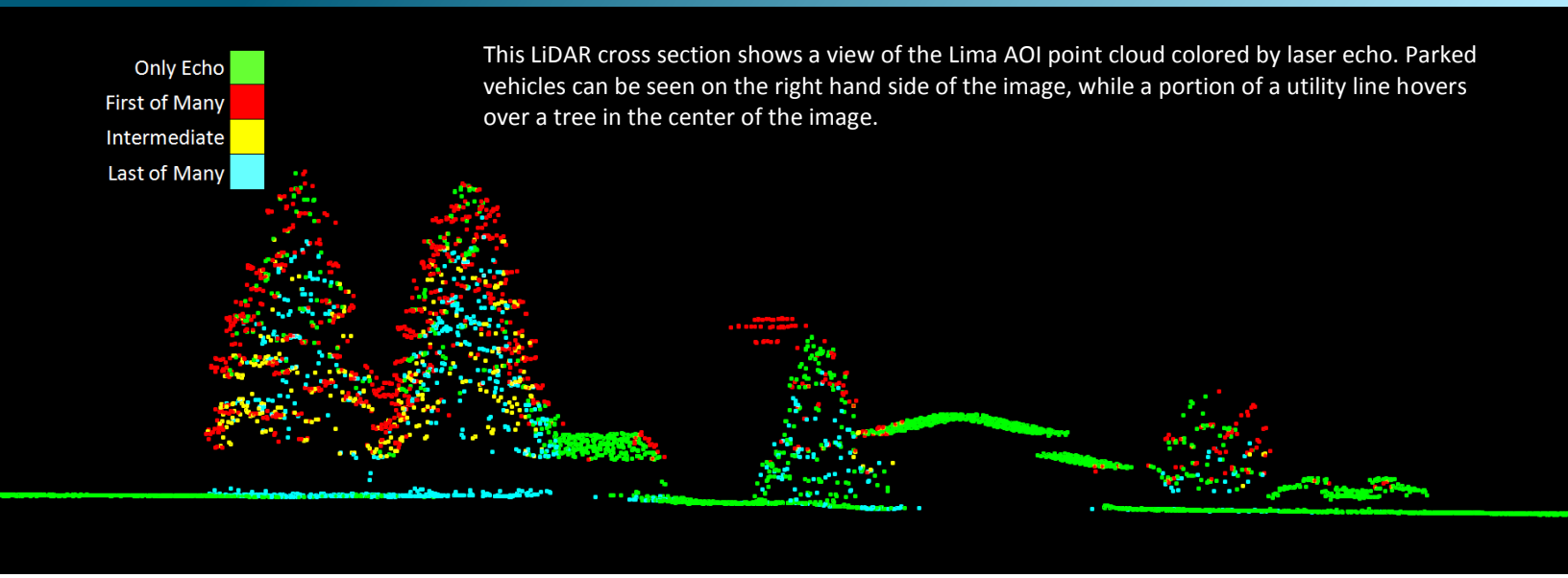


Figure 4: This image shows a view of the building classification in the previously delivered Lima AOI, created from the bare earth model colored by elevation, and overlaid with the above-ground point cloud colored by point classification.



This LiDAR cross section shows a view of the Lima AOI point cloud colored by laser echo. Parked vehicles can be seen on the right hand side of the image, while a portion of a utility line hovers over a tree in the center of the image.

LiDAR Point Density

The acquisition parameters were designed to acquire an average first-return density of 4 points/$m^2$for the Clark Fork AOI, and 6 points/m^2 for the Lima and St. Regis AOIs. First return density describes the density of pulses emitted from the laser that return at least one echo to the system. Multiple returns from a single pulse were not considered in first return density analysis. Some types of surfaces (e.g., breaks in terrain, water and steep slopes) may have returned fewer pulses than originally emitted by the laser.

First returns typically reflect off the highest feature on the landscape within the footprint of the pulse. In forested or urban areas the highest feature could be a tree, building or power line, while in areas of unobstructed ground, the first return will be the only echo and represents the bare earth surface.

The average first-return density of the St. Regis River LiDAR data was 1.07 points/ft^2 (11.48 points/m^2), while the average ground classified density was 0.20 points/ft^2 (2.12 points/m^2) (Table 10). The statistical and spatial distributions of all first return and ground classified densities per 100 x 100 m cell are portrayed in Figure 5 through Figure 7.

Table 10: Density Results

Classification	Point Density
First-Return	1.07 points/ft^2 11.48 points/m^2
Ground Classified	0.20 points/ft^2 2.12 points/m^2

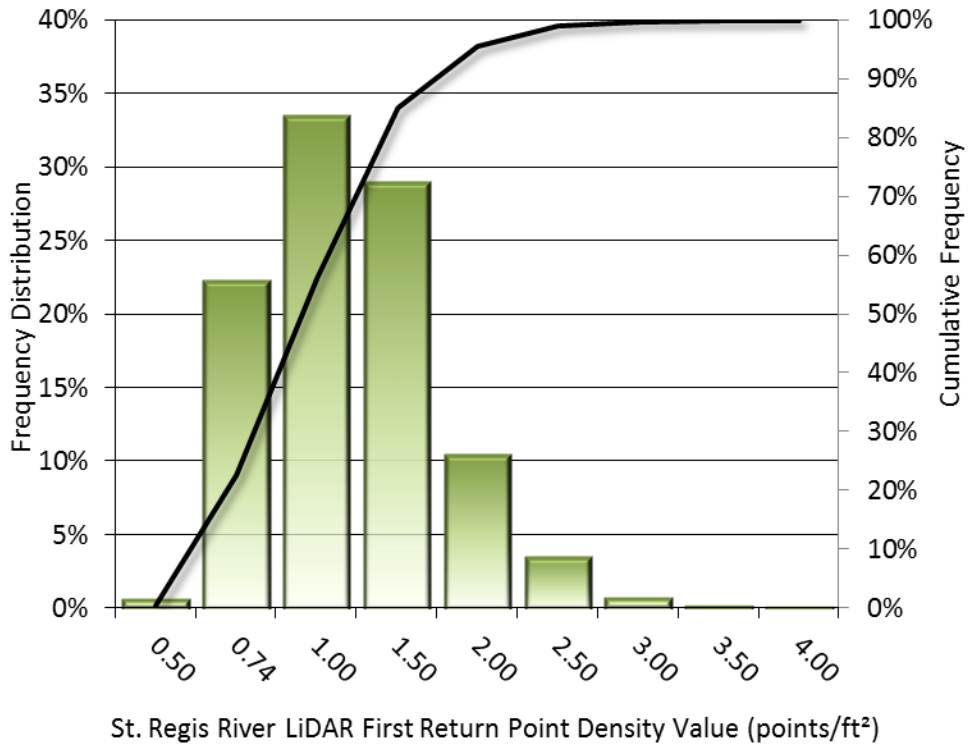


Figure 5: Frequency distribution of St. Regis River, Montana first return densities per 100 x 100 m cell

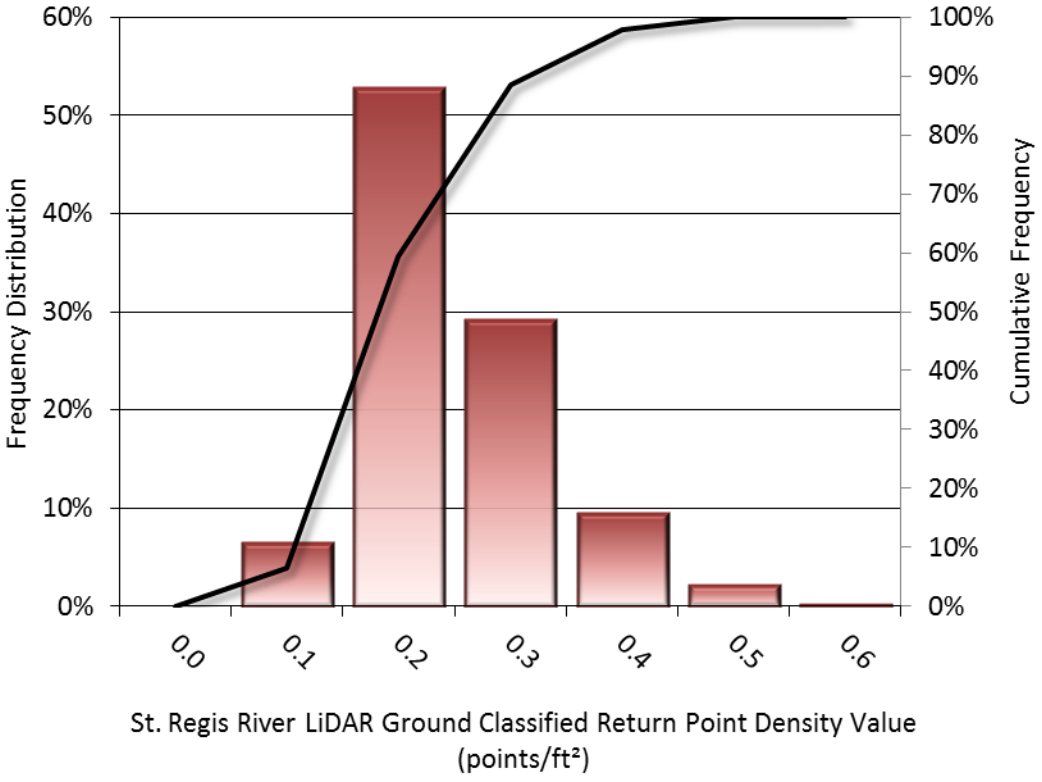


Figure 6: Frequency distribution of St. Regis River, Montana ground classified densities per 100 x 100 m cell

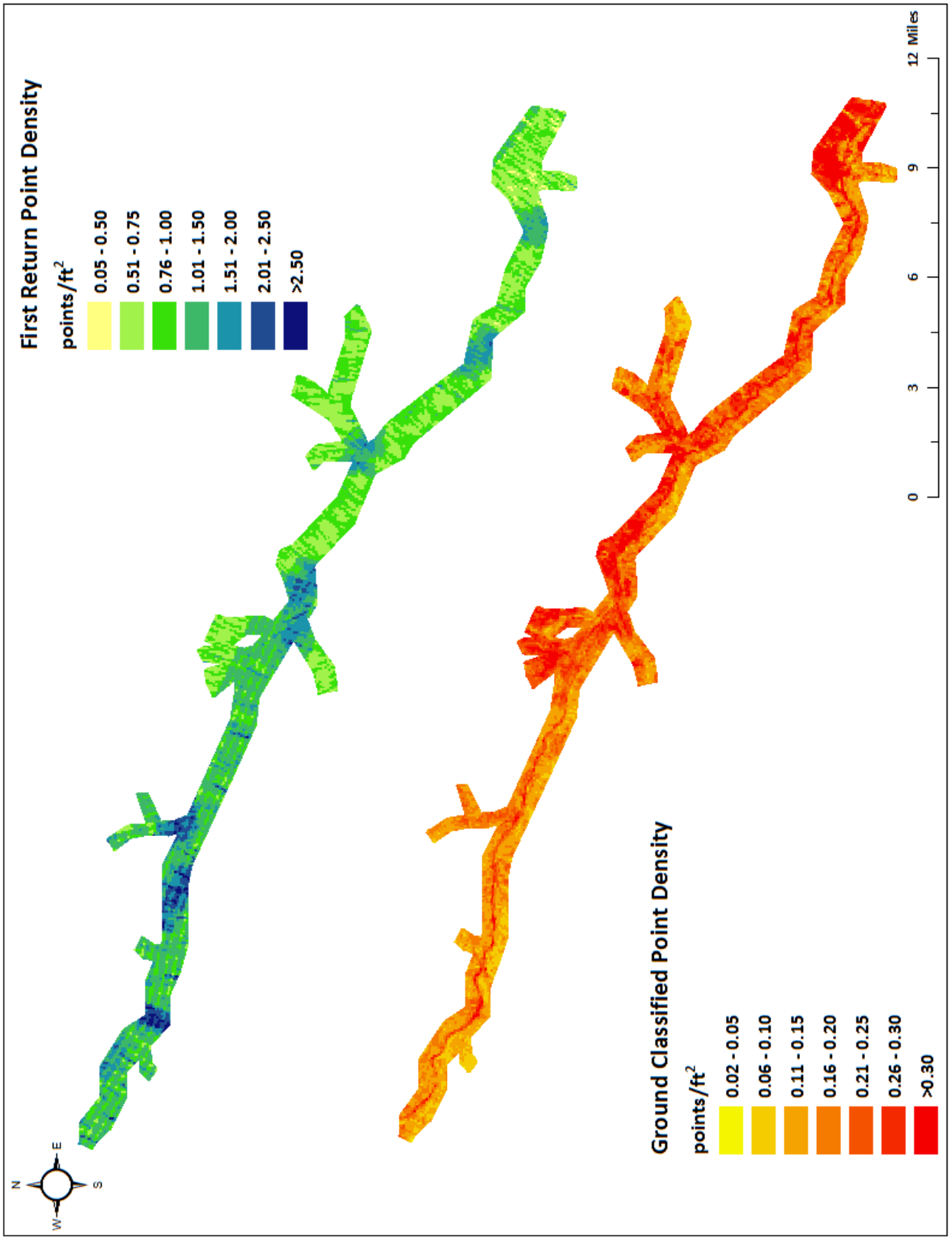


Figure 7: Density map for the St. Regis River LiDAR Project Area (100 x 100 m cells)

LiDAR Accuracy Assessments

The accuracy of the LiDAR data collection can be described in terms of absolute accuracy (the consistency of the data with external data sources) and relative accuracy (the consistency of the dataset with itself). See Appendix A for further information on sources of error and operational measures used to improve relative accuracy.

LiDAR Non-Vegetated Vertical Accuracy

Absolute accuracy was assessed using Non-vegetated Vertical Accuracy (NVA) reporting designed to meet guidelines presented in the FGDC National Standard for Spatial Data Accuracy[1]. NVA compares known ground quality assurance point data collected on open, bare earth surfaces with level slope (<20°) to the triangulated surface generated by the LiDAR points. NVA is a measure of the accuracy of LiDAR point data in open areas where the LiDAR system has a high probability of measuring the ground surface and is evaluated at the 95% confidence interval (1.96 * RMSE), as shown in Table 11.

The mean and standard deviation (sigma σ) of divergence of the ground surface model from ground check point coordinates are also considered during accuracy assessment. These statistics assume the error for x, y and z is normally distributed, and therefore the skew and kurtosis of distributions are also considered when evaluating error statistics. For the Beaverhead & Mineral Counties survey, 46 ground check points were provided by Gaston, with resulting non-vegetated vertical accuracy of 0.268 feet (0.082 meters), evaluated at the 95% confidence interval (Table 11, Figure 8).

QSI also assessed absolute accuracy using 1,882 ground control points. Although these points were used in the calibration and post-processing of the LiDAR point clouds, they still provide a good indication of the overall accuracy of the LiDAR datasets and therefore have been provided below.

Table 11: Absolute accuracy (NVA) results

Non-Vegetated Vertical Accuracy		
	Ground Check Points	**Ground Control Points**
Sample	46 points	1,882 points
NVA (1.96*RMSE)	0.268 ft 0.082 m	0.247 ft 0.075 m
Average	-0.012 ft -0.004 m	-0.034 ft -0.010 m
Median	-0.023 ft -0.007 m	-0.036 ft -0.011 m
RMSE	0.137 ft 0.042 m	0.126 ft 0.038 m
Standard Deviation (1σ)	0.138 ft 0.042 m	0.121 ft 0.037 m

[1] Federal Geographic Data Committee, ASPRS POSITIONAL ACCURACY STANDARDS FOR DIGITAL GEOSPATIAL DATA EDITION 1, Version 1.0, NOVEMBER 2014. http://www.asprs.org/PAD-Division/ASPRS-POSITIONAL-ACCURACY-STANDARDS-FOR-DIGITAL-GEOSPATIAL-DATA.html.

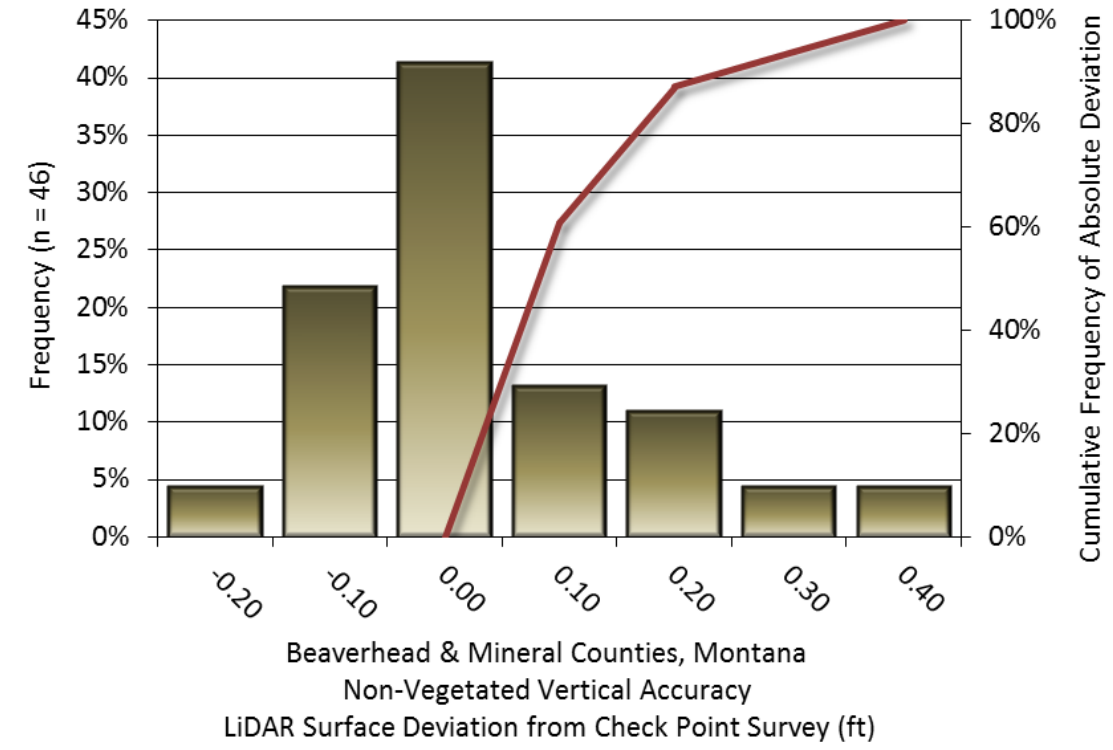


Figure 8: Frequency histogram for LiDAR surface deviation from non-vegetated check point values

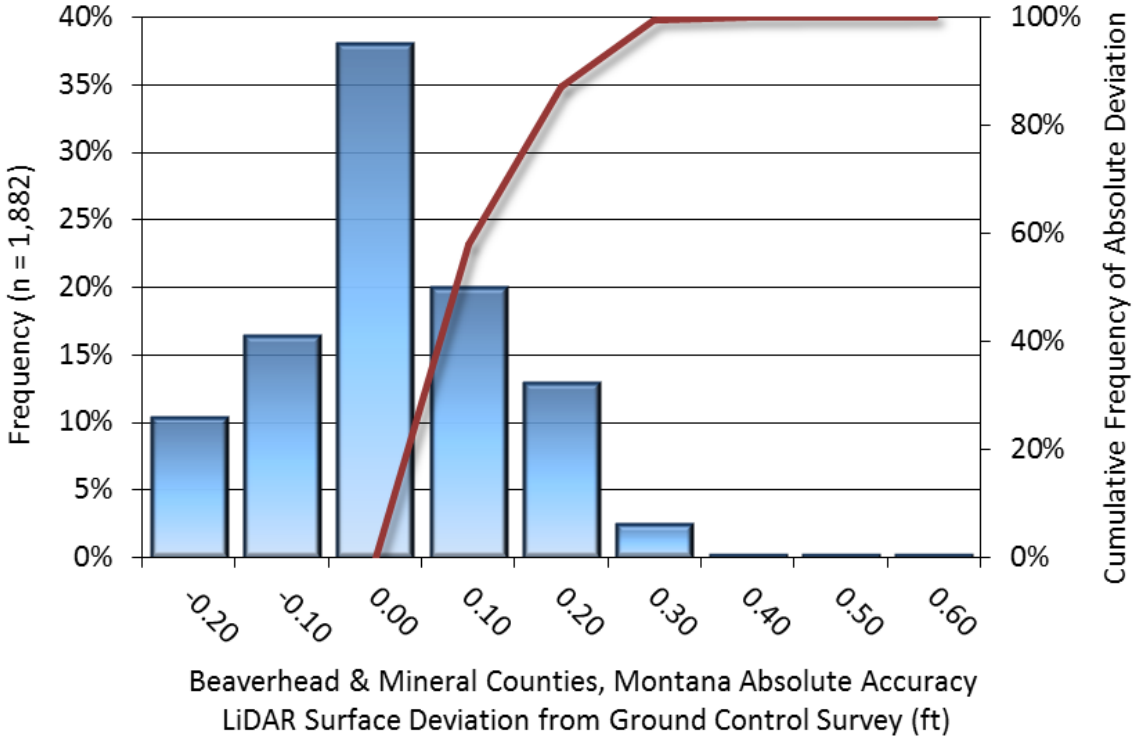


Figure 9: Frequency histogram for LiDAR surface deviation from QSI's ground control point values

LiDAR Vegetated Vertical Accuracies

Vertical accuracy was also assessed using Vegetated Vertical Accuracy (VVA) reporting. VVA compares known ground check point data collected over vegetated surfaces using land class descriptions to the triangulated ground surface generated by the ground classified LiDAR points. For the Beaverhead & Mineral Counties project, 40 vegetated ground check points were provided by Gaston and supplemented with 16 ground check points collected by QSI, with a combined total VVA of 0.412 feet (0.126 meters) evaluated at the 95th percentile (Table 12, Figure 10).

Table 12: Vegetated Vertical Accuracy for the St. Regis River AOIs

Vegetated Vertical Accuracy (VVA)	
Sample	56 points
Average	0.096 ft 0.029 m
Median	0.081 ft 0.025 m
RMSE	0.214 ft 0.065 m
Standard Deviation (1σ)	0.193 ft 0.059 m
95th Percentile	0.412 ft 0.126 m

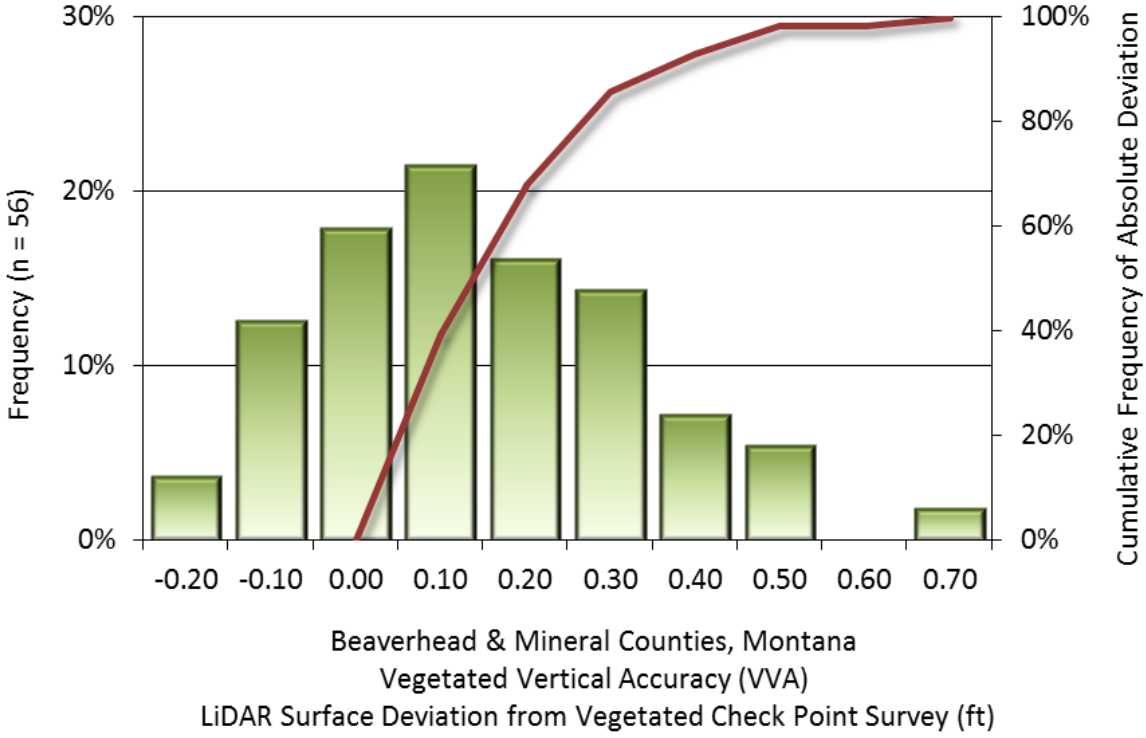


Figure 10: Frequency histogram for LiDAR surface deviation from land cover class point values (VVA)

LiDAR Relative Vertical Accuracy

Relative vertical accuracy refers to the internal consistency of the data set as a whole: the ability to place an object in the same location given multiple flight lines, GPS conditions, and aircraft attitudes. When the LiDAR system is well calibrated, the swath-to-swath vertical divergence is low (<0.10 meters). The relative vertical accuracy was computed by comparing the ground surface model of each individual flight line with its neighbors in overlapping regions. The average (mean) line to line relative vertical accuracy for the St. Regis River LiDAR project was 0.159 feet (0.049 meters) (Table 13, Figure 11).

Table 13: Relative accuracy results

Relative Accuracy	
Sample	81 surfaces
Average	0.159 ft 0.049 m
Median	0.179 ft 0.055 m
RMSE	0.181 ft 0.055 m
Standard Deviation (1σ)	0.045 ft 0.014 m
1.96σ	0.088 ft 0.027 m

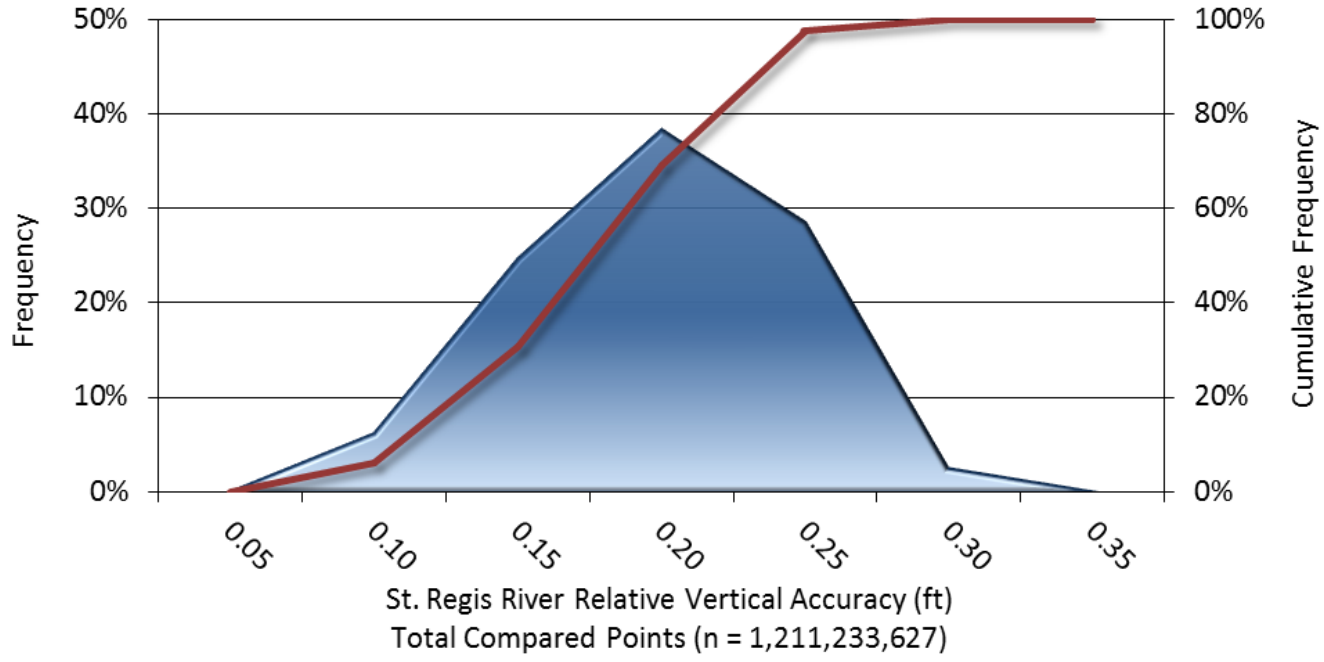


Figure 11: Frequency plot for relative vertical accuracy between flight lines

Project Name:	Clark Fork, St. Regis & Lima MT
Statement of Work No.:	
Interagency Agreement No.:	N/A
CTP Agreement No.:	N/A
Statement/Agreement Date:	October 31, 2016
Certification Date:	July 19, 2017

	Tasks/Activities Covered by This Certification (Check All That Apply)
☐	Base Map
☐	Topographic Data Development
☒	Survey – **Clark Fork, St. Regis & Lima LiDAR Checkpoint Survey**
☐	Hydrologic Analysis
☐	Hydraulic Analysis
☐	Alluvial Fan Analysis
☐	Coastal Analysis
☐	Floodplain Mapping
	This is to certify that the work summarized above was completed in October and November of 2016 in accordance with the statement/agreement cited above and all amendments thereto, together with all such modifications, either written or oral, as the Regional Project Officer and/or Assistance Officer or their representative have directed, as such modifications affect the statement/agreement, and that all such work has been accomplished in accordance with the provisions contained in *Guidelines and Specifications for Flood Hazard Mapping Partners* cited in the contract document, and in accordance with sound and accepted engineering practices within the contract provisions for respective phases of the work. This is also to certify that data files submitted for the work summarized above are complete and final. Any revisions made to the already submitted data are included in the final submittal.

Name:	Jim Verellen, PLS
Title:	Professional Land Surveyor
Firm/Agency Represented:	Gaston Engineering & Surveying, P.C.
Registration No.:	38563LS
Signature:	
	This form must be signed by a representative of the firm or agency contracted to perform the work, who must be a registered or certified professional in the area of work performed, in compliance with Federal and State regulations.

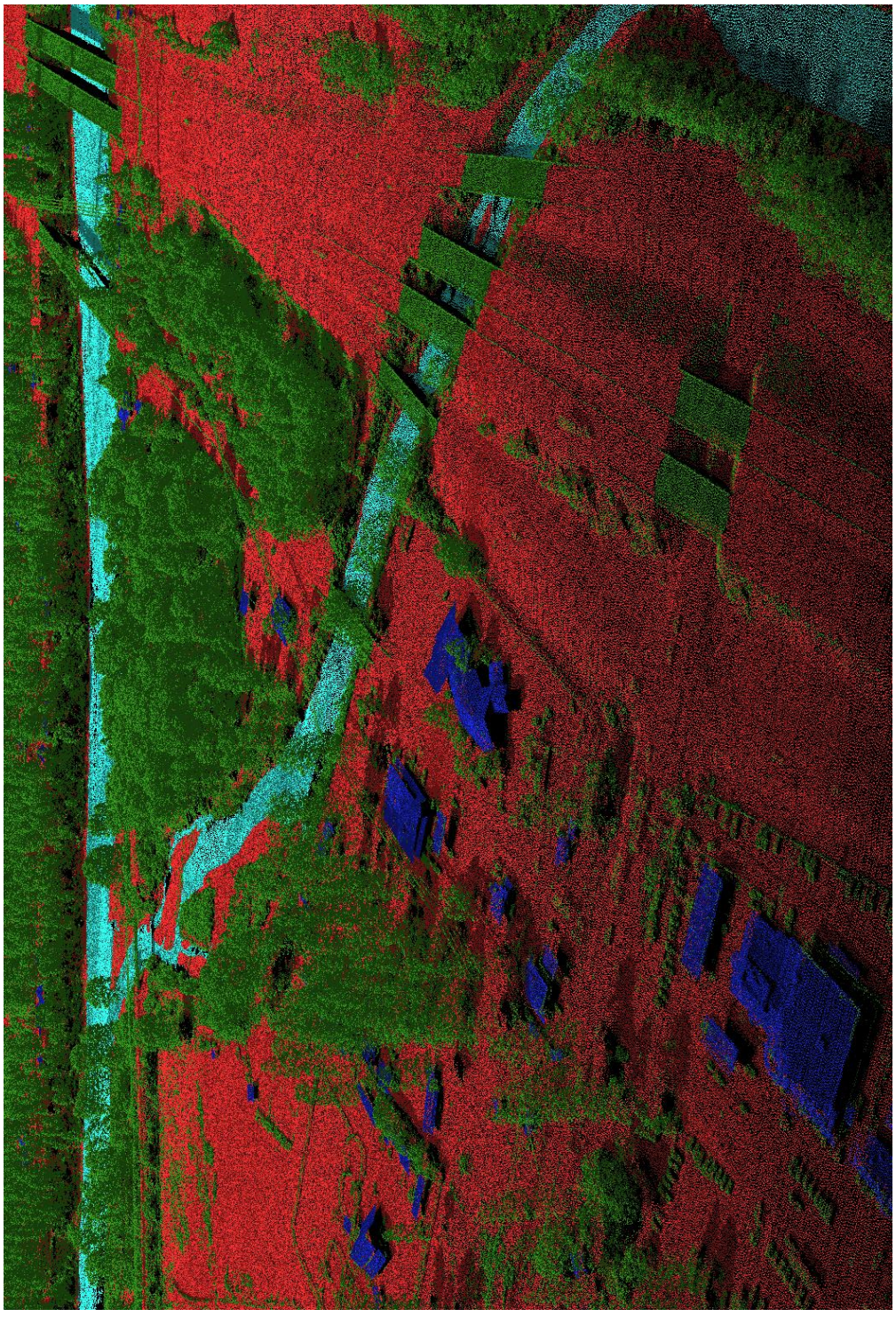


Figure 12: This image shows a view of the St. Regis River project area, created from the above ground point cloud colored by classification.

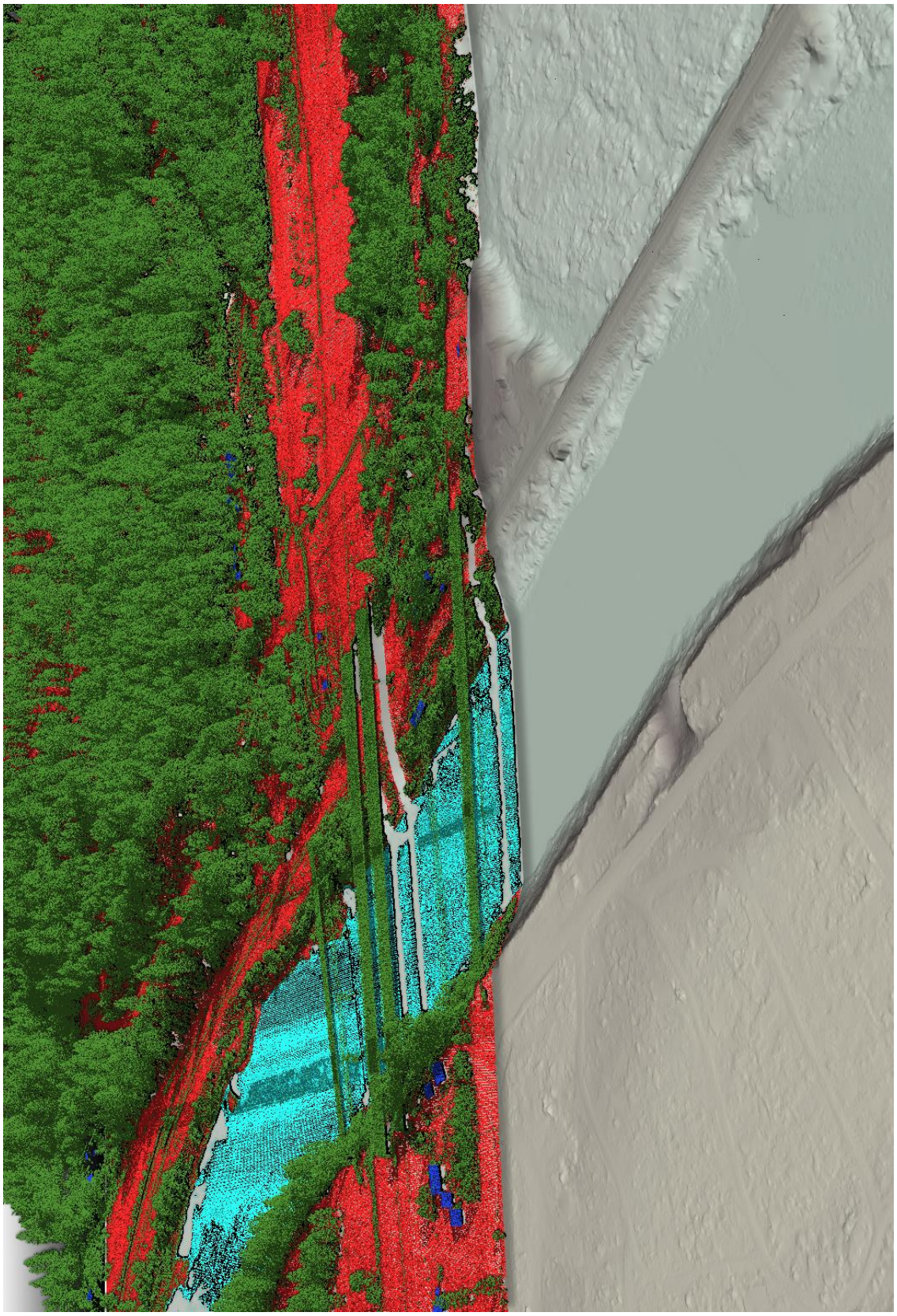


Figure 13: This image shows another view of the St. Regis River bare earth DEM, overlaid with above ground returns colored by point classification in half of the image.

GLOSSARY

1-sigma (σ) Absolute Deviation: Value for which the data are within one standard deviation (approximately 68th percentile) of a normally distributed data set.

1.96 * RMSE Absolute Deviation: Value for which the data are within two standard deviations (approximately 95th percentile) of a normally distributed data set, based on the FGDC standards for Non-vegetated Vertical Accuracy (FVA) reporting.

Accuracy: The statistical comparison between known (surveyed) points and laser points. Typically measured as the standard deviation (sigma σ) and root mean square error (RMSE).

> **Absolute Accuracy:** The vertical accuracy of LiDAR data is described as the mean and standard deviation (sigma σ) of divergence of LiDAR point coordinates from ground survey point coordinates. To provide a sense of the model predictive power of the dataset, the root mean square error (RMSE) for vertical accuracy is also provided. These statistics assume the error distributions for x, y and z are normally distributed, and thus we also consider the skew and kurtosis of distributions when evaluating error statistics.
>
> **Relative Accuracy:** Relative accuracy refers to the internal consistency of the data set; i.e., the ability to place a laser point in the same location over multiple flight lines, GPS conditions and aircraft attitudes. Affected by system attitude offsets, scale and GPS/IMU drift, internal consistency is measured as the divergence between points from different flight lines within an overlapping area. Divergence is most apparent when flight lines are opposing. When the LiDAR system is well calibrated, the line-to-line divergence is low (<10 cm).
>
> **Root Mean Square Error (RMSE):** A statistic used to approximate the difference between real-world points and the LiDAR points. It is calculated by squaring all the values, then taking the average of the squares and taking the square root of the average.

Data Density: A common measure of LiDAR resolution, measured as points per square meter.

Digital Elevation Model (DEM): File or database made from surveyed points, containing elevation points over a contiguous area. Digital terrain models (DTM) and digital surface models (DSM) are types of DEMs. DTMs consist solely of the bare earth surface (ground points), while DSMs include information about all surfaces, including vegetation and man-made structures.

Intensity Values: The peak power ratio of the laser return to the emitted laser, calculated as a function of surface reflectivity.

Nadir: A single point or locus of points on the surface of the earth directly below a sensor as it progresses along its flight line.

Overlap: The area shared between flight lines, typically measured in percent. 100% overlap is essential to ensure complete coverage and reduce laser shadows.

Pulse Rate (PR): The rate at which laser pulses are emitted from the sensor; typically measured in thousands of pulses per second (kHz).

Pulse Returns: For every laser pulse emitted, the number of wave forms (i.e., echoes) reflected back to the sensor. Portions of the wave form that return first are the highest element in multi-tiered surfaces such as vegetation. Portions of the wave form that return last are the lowest element in multi-tiered surfaces.

Real-Time Kinematic (RTK) Survey: A type of surveying conducted with a GPS base station deployed over a known monument with a radio connection to a GPS rover. Both the base station and rover receive differential GPS data and the baseline correction is solved between the two. This type of ground survey is accurate to 1.5 cm or less.

Post-Processed Kinematic (PPK) Survey: GPS surveying is conducted with a GPS rover collecting concurrently with a GPS base station set up over a known monument. Differential corrections and precisions for the GNSS baselines are computed and applied after the fact during processing. This type of ground survey is accurate to 1.5 cm or less.

Scan Angle: The angle from nadir to the edge of the scan, measured in degrees. Laser point accuracy typically decreases as scan angles increase.

Native LiDAR Density: The number of pulses emitted by the LiDAR system, commonly expressed as pulses per square meter.

Relative Accuracy Calibration Methodology:

Manual System Calibration: Calibration procedures for each mission require solving geometric relationships that relate measured swath-to-swath deviations to misalignments of system attitude parameters. Corrected scale, pitch, roll and heading offsets were calculated and applied to resolve misalignments. The raw divergence between lines was computed after the manual calibration was completed and reported for each survey area.

Automated Attitude Calibration: All data were tested and calibrated using TerraMatch automated sampling routines. Ground points were classified for each individual flight line and used for line-to-line testing. System misalignment offsets (pitch, roll and heading) and scale were solved for each individual mission and applied to respective mission datasets. The data from each mission were then blended when imported together to form the entire area of interest.

Automated Z Calibration: Ground points per line were used to calculate the vertical divergence between lines caused by vertical GPS drift. Automated Z calibration was the final step employed for relative accuracy calibration.

LiDAR accuracy error sources and solutions:

Type of Error	Source	Post Processing Solution
GPS (Static/Kinematic)	Long Base Lines	None
	Poor Satellite Constellation	None
	Poor Antenna Visibility	Reduce Visibility Mask
Relative Accuracy	Poor System Calibration	Recalibrate IMU and sensor offsets/settings
	Inaccurate System	None
Laser Noise	Poor Laser Timing	None
	Poor Laser Reception	None
	Poor Laser Power	None
	Irregular Laser Shape	None

Operational measures taken to improve relative accuracy:

Low Flight Altitude: Terrain following was employed to maintain a constant above ground level (AGL). Laser horizontal errors are a function of flight altitude above ground (about 1/3000th AGL flight altitude).

Focus Laser Power at narrow beam footprint: A laser return must be received by the system above a power threshold to accurately record a measurement. The strength of the laser return (i.e., intensity) is a function of laser emission power, laser footprint, flight altitude and the reflectivity of the target. While surface reflectivity cannot be controlled, laser power can be increased and low flight altitudes can be maintained.

Reduced Scan Angle: Edge-of-scan data can become inaccurate. The scan angle was reduced to a maximum of ±20° from nadir, creating a narrow swath width and greatly reducing laser shadows from trees and buildings.

Quality GPS: Flights took place during optimal GPS conditions (e.g., 6 or more satellites and PDOP [Position Dilution of Precision] less than 3.0). Before each flight, the PDOP was determined for the survey day. During all flight times, a dual frequency DGPS base station recording at 1 second epochs was utilized and a maximum baseline length between the aircraft and the control points was less than 13 nm at all times.

Ground Survey: Ground survey point accuracy (<1.5 cm RMSE) occurs during optimal PDOP ranges and targets a minimal baseline distance of 4 miles between GPS rover and base. Robust statistics are, in part, a function of sample size (n) and distribution. Ground survey points are distributed to the extent possible throughout multiple flight lines and across the survey area.

50% Side-Lap (100% Overlap): Overlapping areas are optimized for relative accuracy testing. Laser shadowing is minimized to help increase target acquisition from multiple scan angles. Ideally, with a 50% side-lap, the nadir portion of one flight line coincides with the swath edge portion of overlapping flight lines. A minimum of 50% side-lap with terrain-followed acquisition prevents data gaps.

Opposing Flight Lines: All overlapping flight lines have opposing directions. Pitch, roll and heading errors are amplified by a factor of two relative to the adjacent flight line(s), making misalignments easier to detect and resolve.

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GASTON ENGINEERING & SURVEYING, P.C.
PROFESSIONAL • PROGRESSIVE • PERSONAL

September 30, 2016
W.O. #16-585

RE: Survey Methodology Report
FEMA Check Point Survey
Lima, Montana

Gaston Engineering & Surveying personnel collected ground surface information via GPS RTK surveying techniques utilizing Leica GS14 GPS equipment. Check points were collected in various ground cover categories which were bare earth and vegetated/crops. RTK shots at each of the check points were taken with a minimum of 2 hours time difference to minimize error associated with poor satellite geometry.

The control point coordinates that were derived by a 4 hour static observation and 2 hour static observation averaged, served as the base control points for the RTK setup. RTK shots were surveyed utilizing Geoid 12B, which is the most recent geoid model published.

The x, y, z coordinates of each of the 6 check points were recorded twice (raw data), and then averaged to determine the adjusted check point data. This information was tabulated in .xlsx format, and submitted to QSI for further refinement of the LiDAR dataset.

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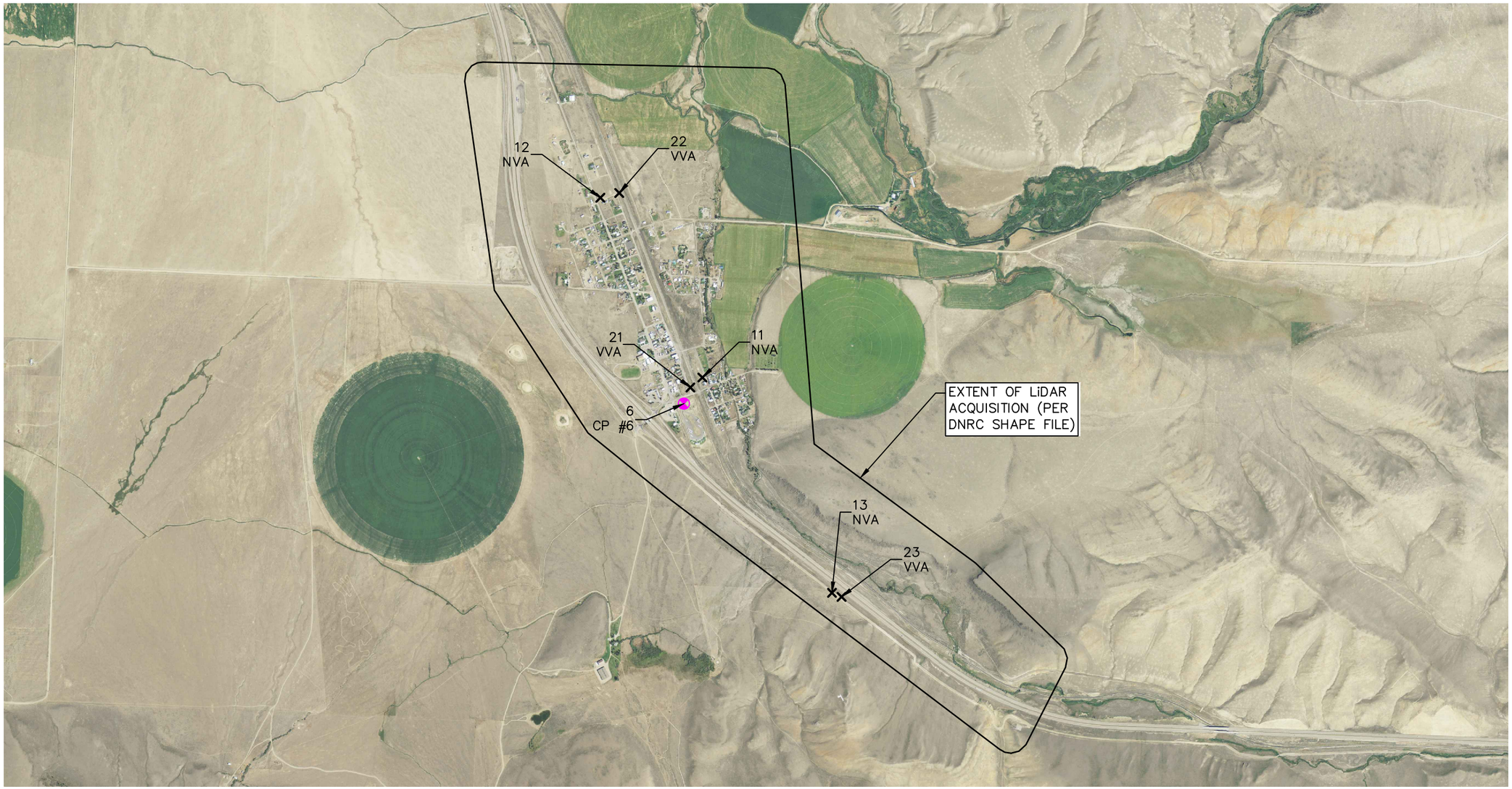
ENGINEERING/LAND SURVEYING/LAND PLANNING/MATERIALS TESTING

FEMA CHECK POINTS & CONTROL
FLOODPLAIN STUDY
LIMA, MT



LEGEND

CHECK POINT KEY
NVA = BARE EARTH
PTS # 11–13

VVA = TALL WEEDS
PTS # 21–23

CONTROL POINT
PT #6

1 **PLAN VIEW**
SCALE: 1" = 2,000'

N

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BOZEMAN, MT 59771
(406) 586-0588

DRAWN BY: JO
CHECKED BY:
DRAWING DATE: 093016
REVISION DATE:

LIMA STUDY
CHECK POINT/CONTROL EXHIBIT
FLOODPLAIN STUDY
MT DNRC
PROJECT ID# 16-585
LIMA, MT

IF THIS LINE DOES NOT MEASURE 1", THE DRAWING IS NOT SCALED CORRECTLY.

PROJECT: 16-585
DRAWING: 16-585 LIMA.dwg
TAB: CHECK POINT & CONTROL

SHEET 1 OF 1

GASTON ENGINEERING & SURVEYING, P.C.
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October 21, 2016
W.O. #16-585

RE: Survey Methodology Report
FEMA Check Point Survey
Clark-Regis, Montana

Gaston Engineering & Surveying personnel collected ground surface information via GPS RTK surveying techniques utilizing Leica GS14 GPS equipment. Check points were collected in various ground cover categories which were bare earth, urban, forested, shrubs and tall grass/crops. RTK shots at each of the check points were taken with a minimum of 2 hours' time difference to minimize error associated with poor satellite geometry.

The control point coordinates that were derived by a 4 hour static observation and 2 hour static observation averaged, served as the base control points for the RTK setup. RTK shots were surveyed utilizing Geoid 12B, which is the most recent geoid model published.

The x, y, z coordinates of each of the 75 check points were recorded twice (raw data), and then averaged to determine the adjusted check point data. This information was tabulated in .xlsx format, and submitted to QSI for further refinement of the LiDAR dataset.

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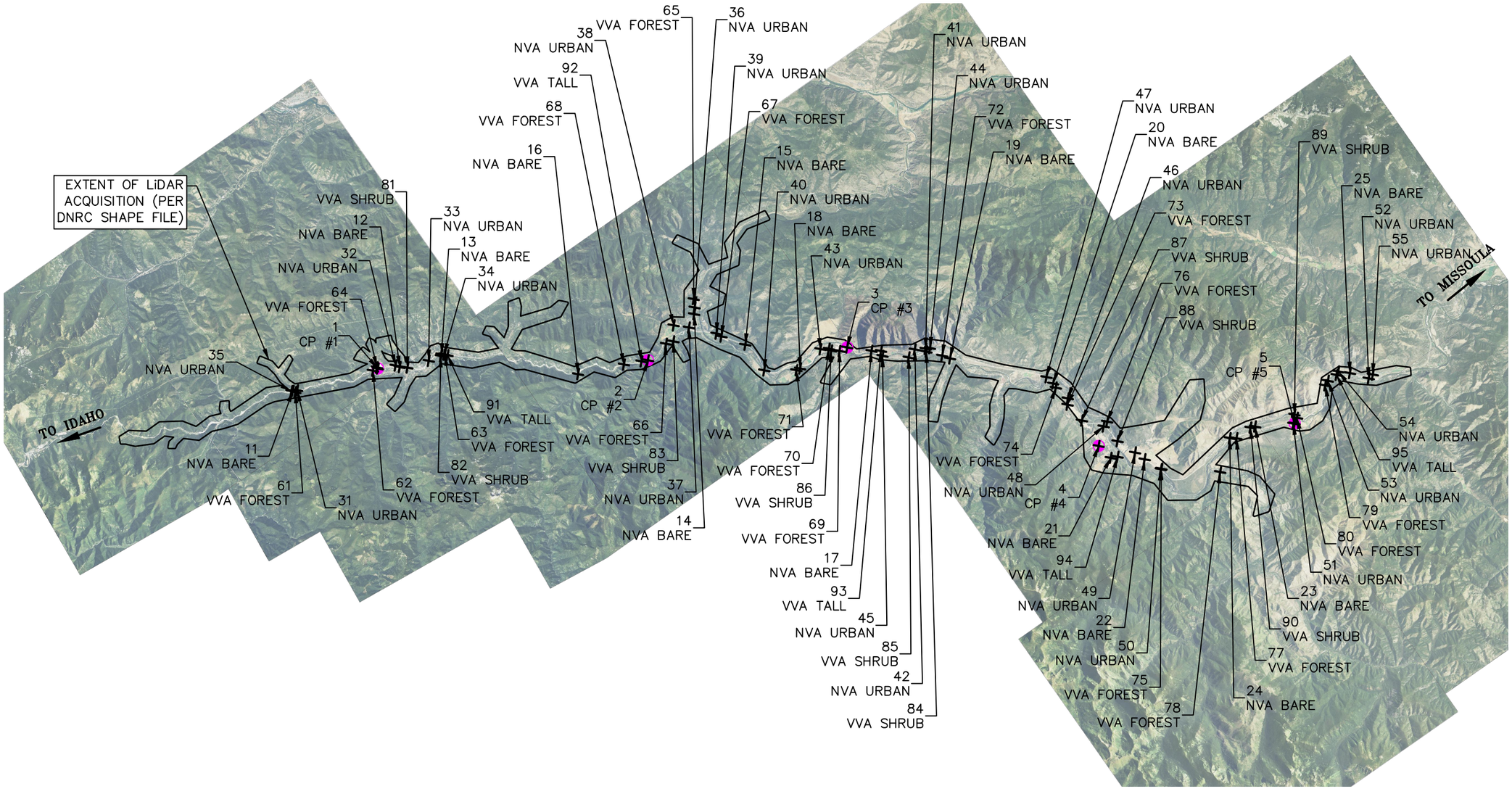
FEMA CHECK POINTS & CONTROL
FLOODPLAIN STUDY
CLARK–REGIS AREA, MT



LEGEND

CHECK POINT KEY

NVA(BE) = BARE EARTH PTS # 11–25	VVA(F) = FORESTED PTS # 61–80	VVA(TG) = TALL GRASS/CROPS PTS # 91–95
NVA(U) = URBAN PTS # 31–55	VVA(S) = SHRUBS PTS # 81–90	CONTROL POINT PTS # 1–5

1 **PLAN VIEW**
SCALE: 1" = 30,000'

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DRAWN BY: JO
CHECKED BY:
DRAWING DATE: 102116
REVISION DATE:

CLARK–REGIS STUDY
CHECK POINT/CONTROL EXHIBIT
FLOODPLAIN STUDY
MT DNRC
PROJECT ID# 16–585
CLARK–REGIS AREA, MT

IF THIS LINE DOES NOT MEASURE 1", THE DRAWING IS NOT SCALED CORRECTLY.

PROJECT: 16–585
DRAWING: 16–585
CLARK–REGIS.dwg
TAB: CHECK POINT/CONTROL

SHEET 1 OF 1

VICINITY MAP WITH TOWNS
FLOODPLAIN STUDY
CLARK–REGIS AREA, MT

1 **PLAN VIEW**
SCALE: 1" = 30,000'

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PROFESSIONAL PROGRESSIVE PERSONAL
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BOZEMAN, MT 59771
(406) 586–0588

DRAWN BY: JO
CHECKED BY:
DRAWING DATE: 102116
REVISION DATE:

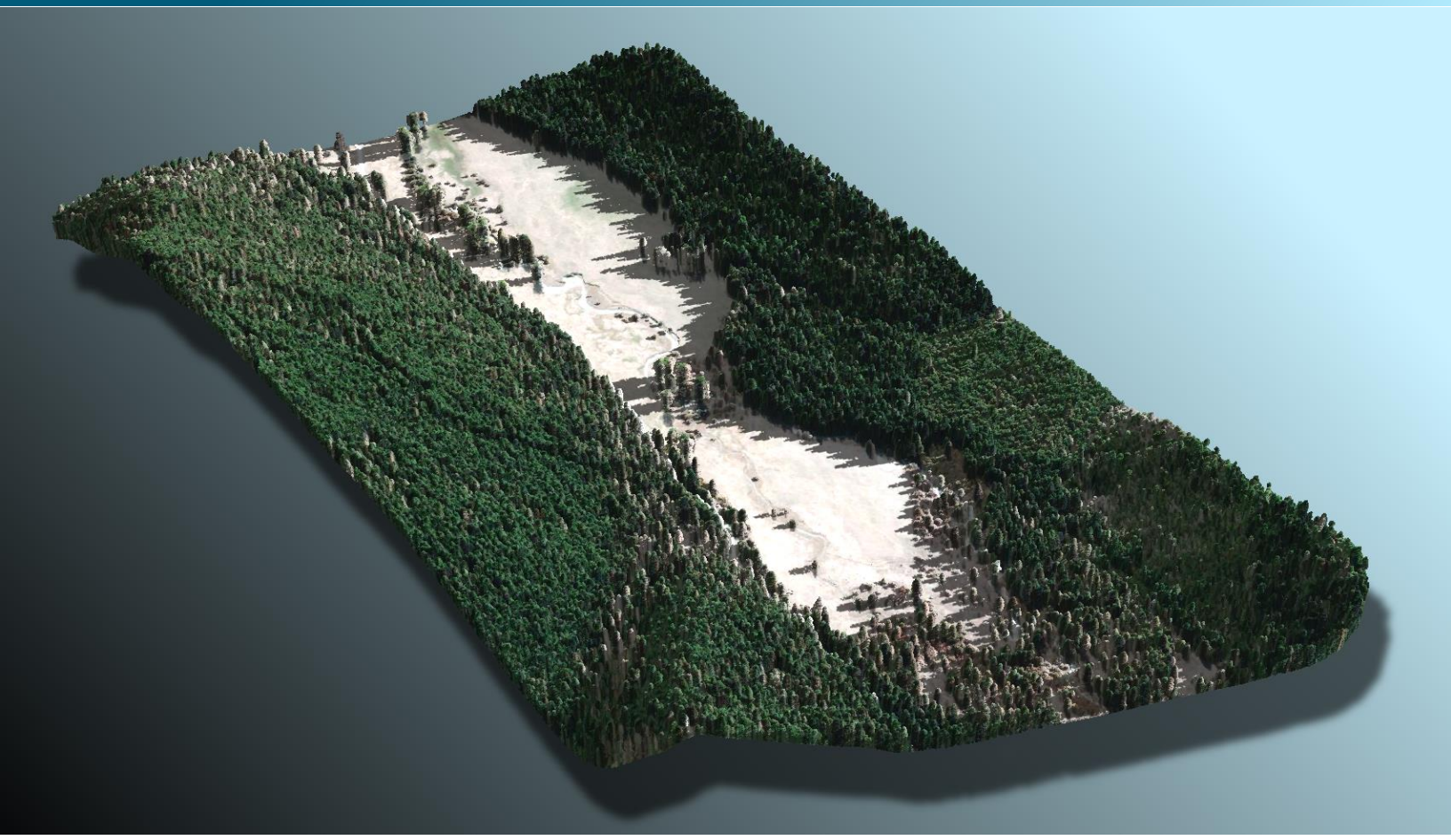
CLARK–REGIS STUDY
VICINITY MAP
FLOODPLAIN STUDY
MT DNRC
PROJECT ID# 16–585
CLARK–REGIS AREA, MT

IF THIS LINE DOES NOT MEASURE 1", THE DRAWING IS NOT SCALED CORRECTLY.

PROJECT: 16–585
DRAWING: 16–585
CLARK–REGIS.dwg
TAB: VICINITY MAP

SHEET 1 OF 1

July 9, 2019



Mineral County Tributaries, Montana LiDAR

Technical Data Report

Prepared For:

The Montana Department of Natural Resources & Conservation

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Cover Photo: A view looking south at Tamarack Creek within the northernmost AOI of the 2019 LiDAR acquisition. The image was created from the LiDAR bare earth model colored by elevation and overlaid with Virtual Earth Satellite imagery and the above ground point cloud.

INTRODUCTION

This photo taken by QSI acquisition staff shows a view of GNSS equipment set up over monument MIN_CO_TRIB_01, centrally located to the 2019 sites of LiDAR acquisition in St. Regis, Montana.

In February 2019, Quantum Spatial (QSI) was contracted by the State of Montana's Department of Natural Resources and Conservation (MTDNRC) to collect Light Detection and Ranging (LiDAR) data in the spring of 2019 for the Mineral County Tributaries site in Montana. This data acquisition serves as an 829 acre expansion to data previously provided to MTDNRC in July and November of 2017, corresponding to the Clark Fork and St. Regis project sites, respectively. Two additional adjoining areas to the 2017 St. Regis project site, comprised of data from the 2017 St. Regis acquisition, have also been processed and provided to MTDNRC as part of the Mineral County Tributaries contract. In addition, the Mineral County Tributaries project site includes topobathymetric data originally acquired in the fall of 2016, adjoining the 2017 Clark Fork project site. Reprocessed areas of interest utilized from St. Regis and Clark Fork acquisitions represent areas outside the original survey boundary extents. Data were collected to aid MTDNRC in assessing the topographic and geophysical properties of the study area in support of natural resources management and flood hazard assessment in Mineral County.

This report accompanies the delivered LiDAR data and documents contract specifications, data acquisition procedures, processing methods, and analysis of the final dataset including LiDAR accuracy and density. Acquisition dates and acreage are shown in Table 1, a complete list of contracted deliverables provided to MTDNRC is shown in Table 2, and the project extent is shown in Figure 1.

Table 1: Acquisition dates, acreage, and data types collected on the Mineral County Tributaries site

Project Site(s)	Contracted Acres	Buffered Acres	Acquisition Dates	Data Type
Clark Fork, St. Regis Add-on	568	829	4/25/2019	NIR LiDAR
Clark Fork Reprocessed	687	992	11/20/2016, 11/24/2016	Green LiDAR
St. Regis Reprocessed	113	227	8/1/2017, 8/22/2017	NIR LiDAR

Deliverable Products

Table 2: Products delivered to MTDNRC for the Mineral County Tributaries site

Mineral County Tributary LiDAR Products Projection: Montana State Plane FIPS 2500 Horizontal Datum: NAD83 (2011) Vertical Datum: NAVD88 (GEOID12A- Reprocessed AOIs, GEOID12B- Addon AOIs) Horizontal Units: International Feet Vertical Units: US Survey Feet	
Points	LAS v 1.2 • Raw Calibrated Swaths • All Classified Returns
Rasters	Bare Earth Digital Elevation Models (DEM) • 3.0 Foot Pixel Resolution • GeoTIFF Format • ESRI File Geodatabase Raster Dataset Format (*.gdb) • Space Delimited ASCII Files (*.asc) • Bathymetric Void Clipped DEM Pertaining to Clark Fork AOI Ground Density Raster Model: • 3.0 Foot Pixel Resolution • GeoTIFF Format
Vectors	Shapefiles (*.shp): • Site Boundary • Tile Index • Ground Survey Data • Total Area Flown • 1.0 Foot Contours ESRI Geodatabase (*.gdb) • 1.0 Foot Contours • 2D Water's Edge Breaklines

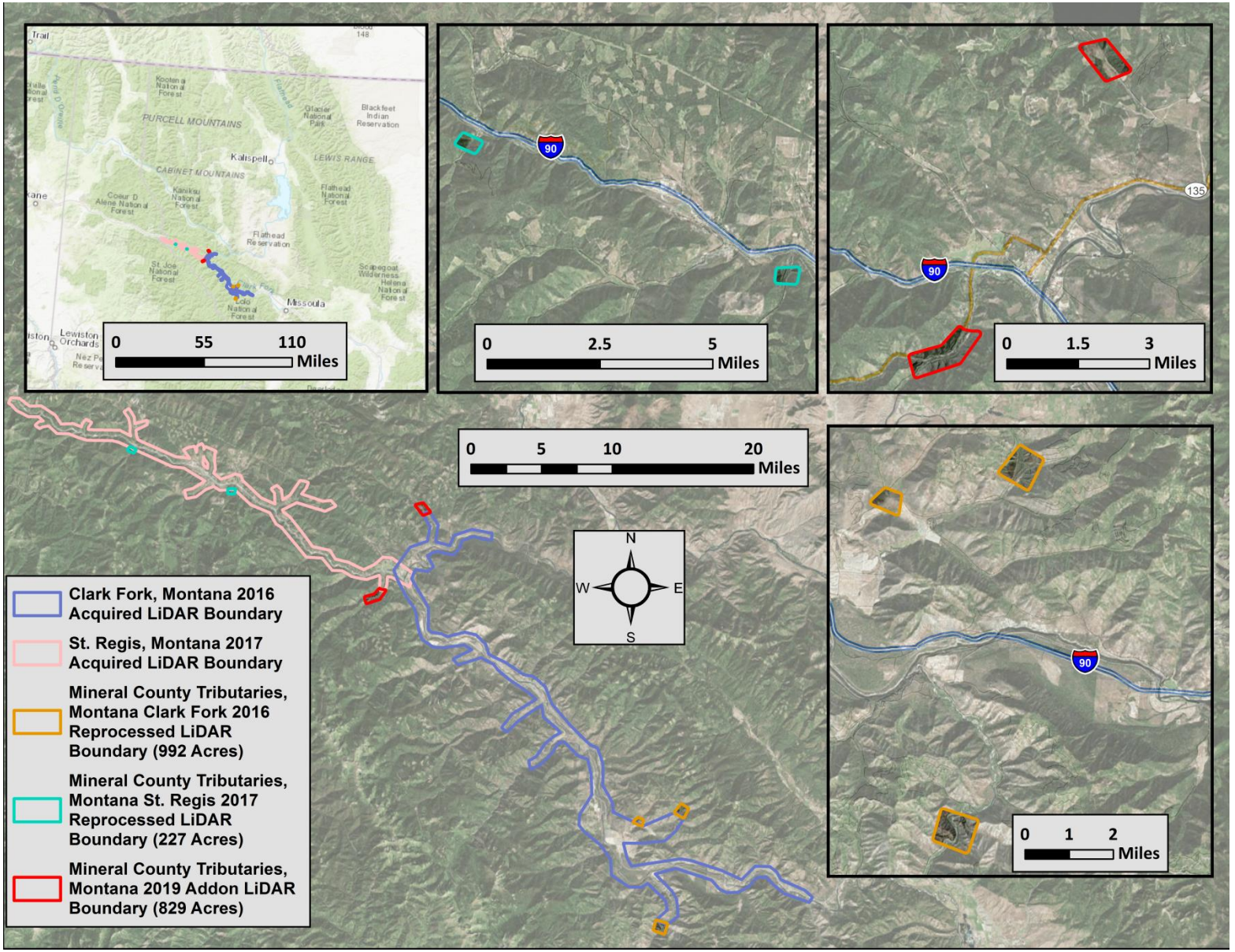


Figure 1: Location map of the Mineral County Tributaries site in Montana

ACQUISITION

QSI's Cessna Caravan

Planning

In preparation for data collection, QSI reviewed the project area and developed a specialized flight plan to ensure complete coverage of the Mineral County Tributaries LiDAR study area at the target point density of ≥8.0 points/m^2 (0.74 points/ft^2). Acquisition parameters including orientation relative to terrain, flight altitude, pulse rate, scan angle, and ground speed were adapted to optimize flight paths and flight times while meeting all contract specifications.

Factors such as satellite constellation availability and weather windows must be considered during the planning stage. Any weather hazards or conditions affecting the flight were continuously monitored due to their potential impact on the daily success of airborne and ground operations. In addition, logistical considerations including private property access and potential air space restrictions were reviewed. The flight plans utilized in acquisition of the 2019 add-on data in addition to the reprocessed areas pertaining to the 2016 and 2017 LiDAR acquisitions can be visualized in Figure 2.

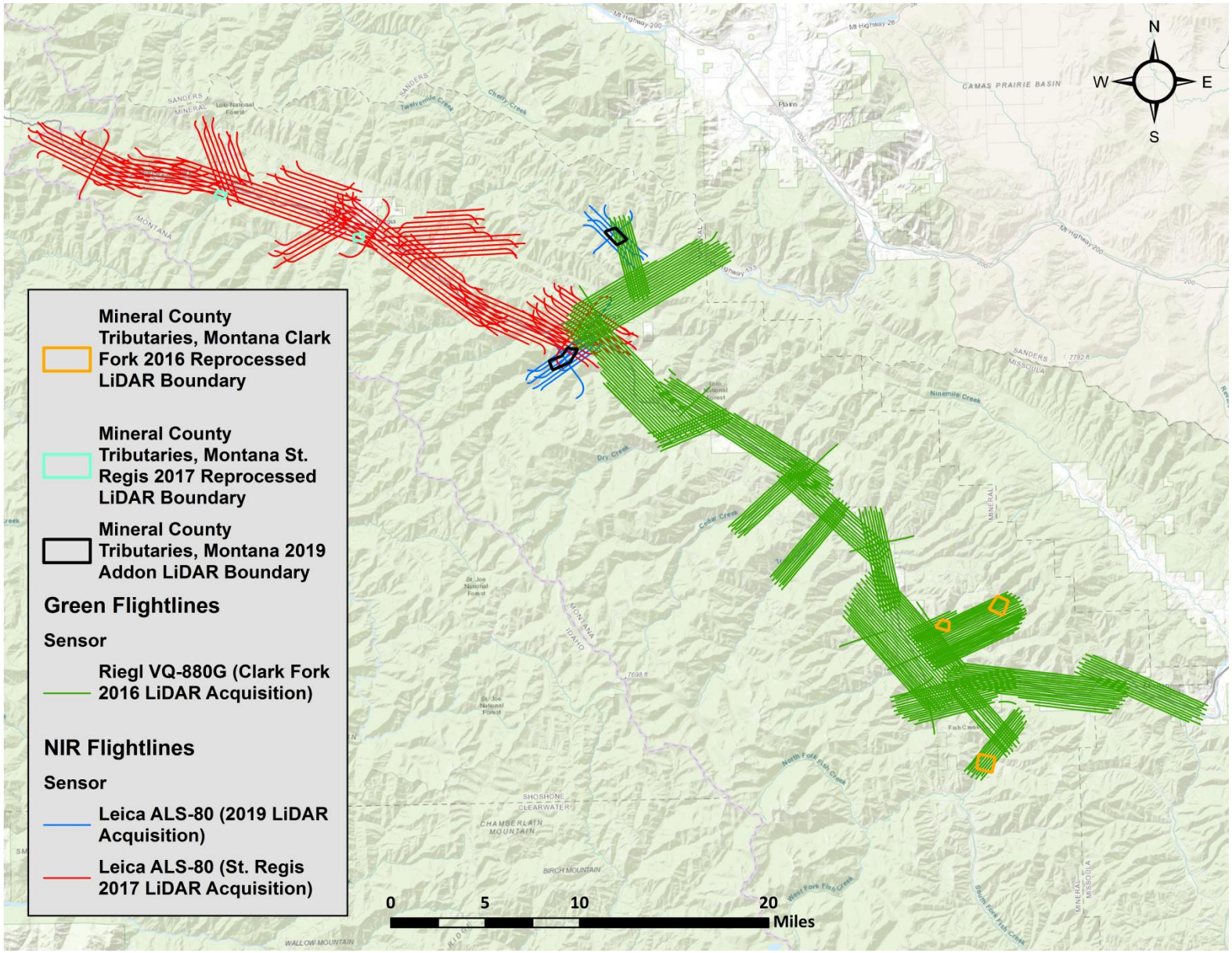


Figure 2: Mineral County Tributaries Flightline Map

Airborne LiDAR Survey

The 2019 LiDAR survey was accomplished using a Leica ALS80-HP system mounted in a Cessna Caravan. The 2016 Clark Fork and 2017 St. Regis LiDAR surveys pertaining to reprocessed areas, respectively utilized Riegl VQ-880 and Leica ALS80 systems. Table 3 summarizes the settings used to yield an average pulse density of ≥8 pulses/m^2 over the Mineral County Tributaries project area. The Riegl VQ-880-G uses a green wavelength (ʎ=532 nm) laser that is capable of collecting high resolution vegetation and topography data, as well as penetrating the water surface with minimal spectral absorption by water. The Leica ALS80 and VQ-880-G laser systems can record unlimited range measurements (returns) per pulse. It is not uncommon for some types of surfaces (e.g., dense vegetation or water) to return fewer pulses to the LiDAR sensor than the laser originally emitted. The discrepancy between first return and overall delivered density will vary depending on terrain, land cover, and the prevalence of water bodies. All discernible laser returns were processed for the output dataset.

Table 3: LiDAR specifications and survey settings

LiDAR Survey Settings & Specifications			
Survey	Mineral County Tributaries	Clark Fork, Mineral County	St. Regis River, Beaverhead County
Acquisition Dates	4/25/2019	11/20/2016, 11/24/2016	8/1/2017, 8/22/2017
Aircraft Used	Cessna Caravan	Cessna Caravan	Cessna Caravan
Sensor	Leica	Riegl	Leica
Laser	ALS80-HP	VQ-880-G	ALS80
Maximum Returns	Unlimited	Unlimited	Unlimited
Resolution/Density	Average 8 pulses/m^2	Average 4 pulses/m^2	Average 8 pulses/m^2
Nominal Pulse Spacing	0.35 m	0.5 m	0.35 m
Survey Altitude (AGL)	1,900 m	1,030 m	1,600 m
Survey speed	110 knots	100 knots	110 knots
Field of View	30°	40°	40°
Mirror Scan Rate	54.5 Hz	53.8 Hz	50-52 Hz
Target Pulse Rate	295 kHz	245 kHz	320 – 340 kHz
Pulse Length	2.5 ns	1.3 ns	2.5 ns
Laser Pulse Footprint Diameter	41.8 cm	1.03 m	35.2 cm
Central Wavelength	1,064 nm	532 nm	1,064 nm
Pulse Mode	Multi- Pulse in Air (MPiA)	Multi-Pulse in Air (MPiA)	Multi-Pulse in Air (MPiA)
Beam Divergence	0.22 mrad	0.7 mrad	0.22 mrad
Swath Width	1,018 m	750 m	1,165 m
Swath Overlap	54%	60%	67%
Intensity	8-bit, scaled to 16-bit	16-bit	8 bit, scaled to 16-bit
Accuracy	$RMSE_Z$ (Non-Vegetated) ≤ 20 cm at 95% confidence interval	$RMSE_Z$ (Non-Vegetated) ≤ 30 cm 95% confidence interval	$RMSE_Z$ (Non-Vegetated) ≤ 10 cm 95% confidence interval
	Horizontal Accuracy (σ) ≤ 30 cm	Horizontal Accuracy (σ) ≤ 50 cm	Horizontal Accuracy (σ) ≤ 30 cm

All areas were surveyed with an opposing flight line side-lap of ≥50% (≥100% overlap) in order to reduce laser shadowing and increase surface laser painting. To accurately solve for laser point position (geographic coordinates x, y and z), the positional coordinates of the airborne sensor and the attitude of the aircraft were recorded continuously throughout the LiDAR data collection mission. Position of the aircraft was measured twice per second (2 Hz) by an onboard differential GPS unit, and aircraft attitude was measured 200 times per second (200 Hz) as pitch, roll and yaw (heading) from an onboard inertial measurement unit (IMU). To allow for post-processing correction and calibration, aircraft and sensor position and attitude data are indexed by GPS time. QSI utilized TerraPos Precise Point Positioning (PPP) processing techniques to post-process the LiDAR flight trajectories with a high level of position accuracy without the use of a static base station.

Ground Survey

Ground control surveys, including monumentation and ground survey point (GSP) collection, were conducted to support the airborne acquisition. Ground control data were used to geospatially correct the aircraft positional coordinate data and to perform quality assurance checks on final LiDAR data.

Monumentation

Ground survey monument MIN_CO_TRIB_01 was utilized for collection of ground survey points using post processed kinematic (PPK) survey techniques for the 2019 LiDAR acquisition. Please see the St. Regis River and Clark Fork reports for a discussion of monumentation and survey methodology utilized for the 2016 and 2017 surveys pertaining to the reprocessed areas of the Mineral County Tributaries project site.

QSI established one new monument for the Mineral County Tributaries LiDAR project (Table 4, Figure 3). The monument location was selected with consideration for satellite visibility, field crew safety, and optimal location for GSP coverage. New monumentation was set using 5/8" x 30" rebar topped with stamped 2 ½ " aluminum caps. QSI's professional land surveyor, Steven J. Hyde (MTPLS#60192 LS) oversaw and certified the monuments' establishment.

Table 4: Monument positions for the Mineral County Tributaries acquisition. Coordinates are on the NAD83 (2011) datum, epoch 2010.00

Monument ID	Latitude	Longitude	Ellipsoid (meters)
MIN_CO_TRIB_01	47° 18' 02.08477"	-115° 05' 36.63542"	785.1395

QSI utilized static Global Navigation Satellite System (GNSS) data collected at 1 Hz recording frequency for the survey monument. During post-processing, the static GNSS data were triangulated with nearby Continuously Operating Reference Stations (CORS) using the Online Positioning User Service (OPUS[1]) for precise positioning. Multiple independent sessions over the same monument were processed to confirm antenna height measurements and to refine position accuracy.

Monuments were established according to the national standard for geodetic control networks, as specified in the Federal Geographic Data Committee (FGDC) Geospatial Positioning Accuracy Standards for geodetic networks.[2] This standard provides guidelines for classification of monument quality at the 95% confidence interval as a basis for comparing the quality of one control network to another. The monument rating for this project is shown in Table 5.

[1] OPUS is a free service provided by the National Geodetic Survey to process corrected monument positions. http://www.ngs.noaa.gov/OPUS.

[2] Federal Geographic Data Committee, Geospatial Positioning Accuracy Standards (FGDC-STD-007.2-1998). Part 2: Standards for Geodetic Networks, Table 2.1, page 2-3. http://www.fgdc.gov/standards/projects/FGDC-standards-projects/accuracy/part2/chapter2

Table 5: Federal Geographic Data Committee monument rating for network accuracy

Direction	Rating
1.96 * St Dev $_{NE}$:	0.020 m
1.96 * St Dev $_{z}$:	0.020 m

For the Mineral County Tributaries LiDAR project, the monument coordinates contributed no more than 2.8 cm of positional error to the geolocation of the final ground survey points and LiDAR, with 95% confidence.

Ground Survey Points (GSPs)

Ground survey points were collected using post-processed kinematic (PPK) survey techniques. PPK surveys compute corrections to raw GNSS logs obtained by the rover and base station during post-processing to achieve a high level of accuracy. PPK surveys record data while stationary for at least five seconds, calculating the position using at least three one-second epochs. All GSP measurements were made during periods with a Position Dilution of Precision (PDOP) of ≤ 3.0 with at least six satellites in view of the stationary and roving receivers. See Table 6 for Trimble unit specifications.

GSPs were collected in areas where good satellite visibility was achieved on paved roads and other hard surfaces such as gravel and paved surfaces. GSP measurements were not taken on highly reflective surfaces such as center line stripes or lane markings on roads due to the increased noise seen in the laser returns over these surfaces. GSPs were collected within as many flightlines as possible; however, the distribution of GSPs depended on ground access constraints and monument locations and may not be equitably distributed throughout the study area (Figure 3).

Table 6: QSI ground survey equipment identification

Receiver Model	Antenna	OPUS Antenna ID	Use
Trimble R7 GNSS	Zephyr GNSS Geodetic Model 2 RoHS	TRM57971.00	Static, Rover
Trimble R8	Integrated Antenna	TRM_R8_GNSS	Rover

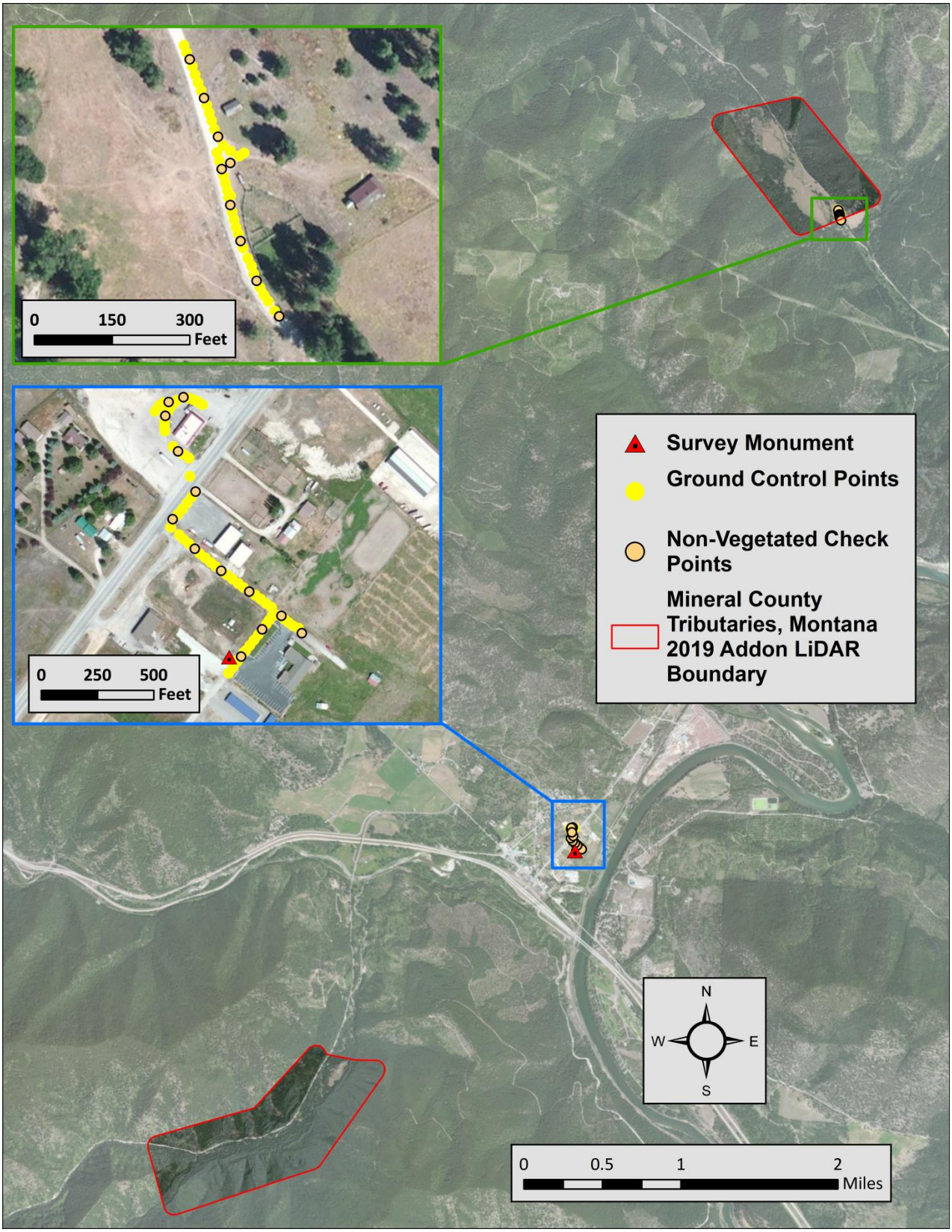
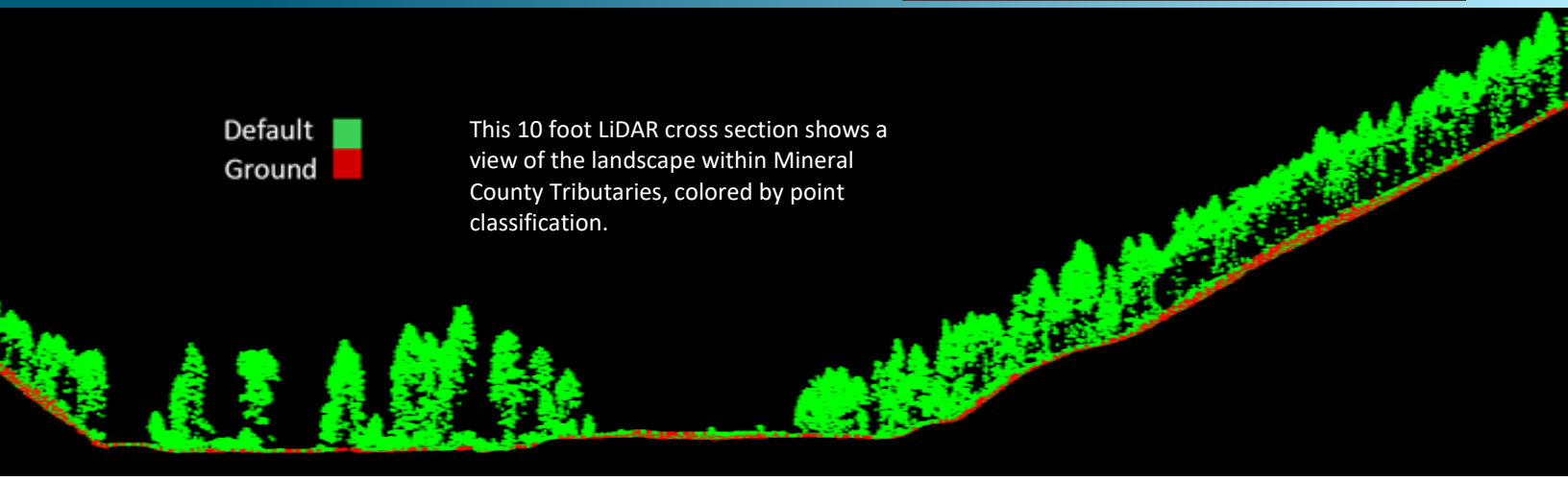


Figure 3: Ground survey location map



This 10 foot LiDAR cross section shows a view of the landscape within Mineral County Tributaries, colored by point classification.

LiDAR Data

Upon completion of data acquisition, QSI processing staff initiated a suite of automated and manual techniques to process the data into the requested deliverables. Processing tasks included GPS control computations, smoothed best estimate trajectory (SBET) calculations, kinematic corrections, calculation of laser point position, sensor and data calibration for optimal relative and absolute accuracy, and LiDAR point classification (Table 7). Processing methodologies were tailored for the landscape. Brief descriptions of these tasks are shown in Table 8.

Table 7: ASPRS LAS classification standards applied to the Mineral County Tributaries dataset

Classification Number	Classification Name	Classification Description
1	Default/Unclassified	Laser returns that are not included in the ground class, composed of vegetation and anthropogenic features
2	Ground	Laser returns that are determined to be ground using automated and manual cleaning algorithms.
6	Buildings	Permanent structures with a minimum area 100 ft² or larger, classified using automated routines.
7	Noise	Laser returns that are often associated with birds, scattering from reflective surfaces, or artificial points below the ground surface.
25	Water Column	Refracted Riegl sensor returns that are determined to be water using automated and manual cleaning algorithms. *Clark Fork Reprocessed AOI only
26	Bathymetric Bottom	Refracted Riegl sensor returns that fall within the water's edge breakline which characterize the submerged topography. *Clark Fork Reprocessed AOI only
27	Water Surface	Green laser returns that are determined to be water surface points using automated and manual cleaning algorithms. *Clark Fork Reprocessed AOI only

Table 8: LiDAR processing workflow

LiDAR Processing Step	Software Used
Resolve kinematic corrections for aircraft position data using kinematic aircraft GPS and static ground GPS data. Develop a smoothed best estimate of trajectory (SBET) file that blends post-processed aircraft position with sensor head position and attitude recorded throughout the survey.	Waypoint Inertial Explorer v.8.7
Calculate laser point position by associating SBET position to each laser point return time, scan angle, intensity, etc. Create raw laser point cloud data for the entire survey in *.las (ASPRS v. 1.2) format. Convert data to orthometric elevations by applying a geoid correction.	Leica Cloudpro v. 1.2.4
Import raw laser points into manageable blocks to perform manual relative accuracy calibration and filter erroneous points. Classify ground points for individual flight lines.	TerraScan v.19
Using ground classified points per each flight line, test the relative accuracy. Perform automated line-to-line calibrations for system attitude parameters (pitch, roll, heading), mirror flex (scale) and GPS/IMU drift. Calculate calibrations on ground classified points from paired flight lines and apply results to all points in a flight line. Use every flight line for relative accuracy calibration.	TerraMatch v.19
Apply refraction correction to all subsurface returns within the Clark Fork reprocessed AOI.	Las Monkey 2.4.2 (QSI proprietary software)
Classify resulting data to ground and other client designated ASPRS classifications (Table 7). Assess statistical absolute accuracy via direct comparisons of ground classified points to ground control survey data.	TerraScan v.19 TerraModeler v.19
Generate bare earth models as triangulated surfaces. Export all surface models as GeoTIFFs (*Tif) at a 3.0 foot pixel resolution.	LAS Product Creator 3.3 (QSI proprietary)
Generate contour lines from classified contour keypoints. Export all contours as polyline shapefiles.	TerraScan v.19 TerraModeler v.19 ArcMap v. 10.3.1

Bathymetric Refraction

The water surface models used for refraction are generated using elevation information derived from the NIR channel to inform where the green water surface level is located, and then water surface points are classified for both the forward and reverse look directions of the green scanner. Points are filtered and edited to obtain the most accurate representation of the water surface and are used to create a water surface model for each flight line and look direction. Water surface classification and modeling is processed on each flight line to accommodate water level changes due to tide and temporal changes in water surface. Each look direction (forward and reverse) are modeled separately to correctly model short duration time dependent surface changes that change between the times that each look direction records a unique location. The water surface model created is raster based with an associated surface normal vector to obtain the most accurate angle of incidence during refraction. The refraction processing is done using the proprietary Quantum Spatial software Las Monkey.

LiDAR Derived Products

Because hydrographic laser scanners penetrate the water surface to map submerged topography, this affects how the data should be processed and presented in derived products from the LiDAR point cloud. The following discusses certain derived products that vary from the traditional (NIR) specification and delivery format.

Topobathymetric DEMs

Bathymetric bottom returns can be limited by depth, water clarity, and bottom surface reflectivity. Water clarity and turbidity affects the depth penetration capability of the green wavelength laser with returning laser energy diminishing by scattering throughout the water column. Additionally, the bottom surface must be reflective enough to return remaining laser energy back to the sensor at a detectable level. Although the predicted depth penetration range of the Riegl VQ-880-G sensor is 1.5 Secchi depths on brightly reflective surfaces, it is not unexpected to have no bathymetric bottom returns in turbid or non-reflective areas.

As a result, creating digital elevation models (DEMs) presents a challenge with respect to interpolation of areas with no returns. Traditional DEMs are “unclipped”, meaning areas lacking ground returns are interpolated from neighboring ground returns (or breaklines in the case of hydro-flattening), with the assumption that the interpolation is close to reality. In bathymetric modeling, these assumptions are prone to error because a lack of bathymetric returns can indicate a change in elevation that the laser can no longer map due to increased depths. The resulting void areas may suggest greater depths, rather than similar elevations from neighboring bathymetric bottom returns. Therefore, QSI created a water polygon with bathymetric coverage to delineate areas with successfully mapped bathymetry. This shapefile was used to control the extent of the delivered clipped topobathymetric model to avoid false triangulation (interpolation from TIN’ing) across areas in the water with no bathymetric returns.

Contours

Contour generation from LiDAR point data required a thinning operation in order to reduce contour sinuosity. The thinning operation reduced point density where topographic change is minimal (i.e., flat surfaces) while preserving resolution where topographic change was present. Model key points were selected from the ground model by interpolating between contour key points at even elevation increments. Generation of model key points eliminated redundant detail in terrain representation, particularly in areas of low relief, and provided for a more manageable dataset.

Ground point density rasters were developed to identify areas of low confidence within the contour lines. Areas greater than two acres with an average point density of less than .05 points/ft^2 are described as low confidence. No areas defined as low confidence exist within the Mineral County Tributaries dataset.

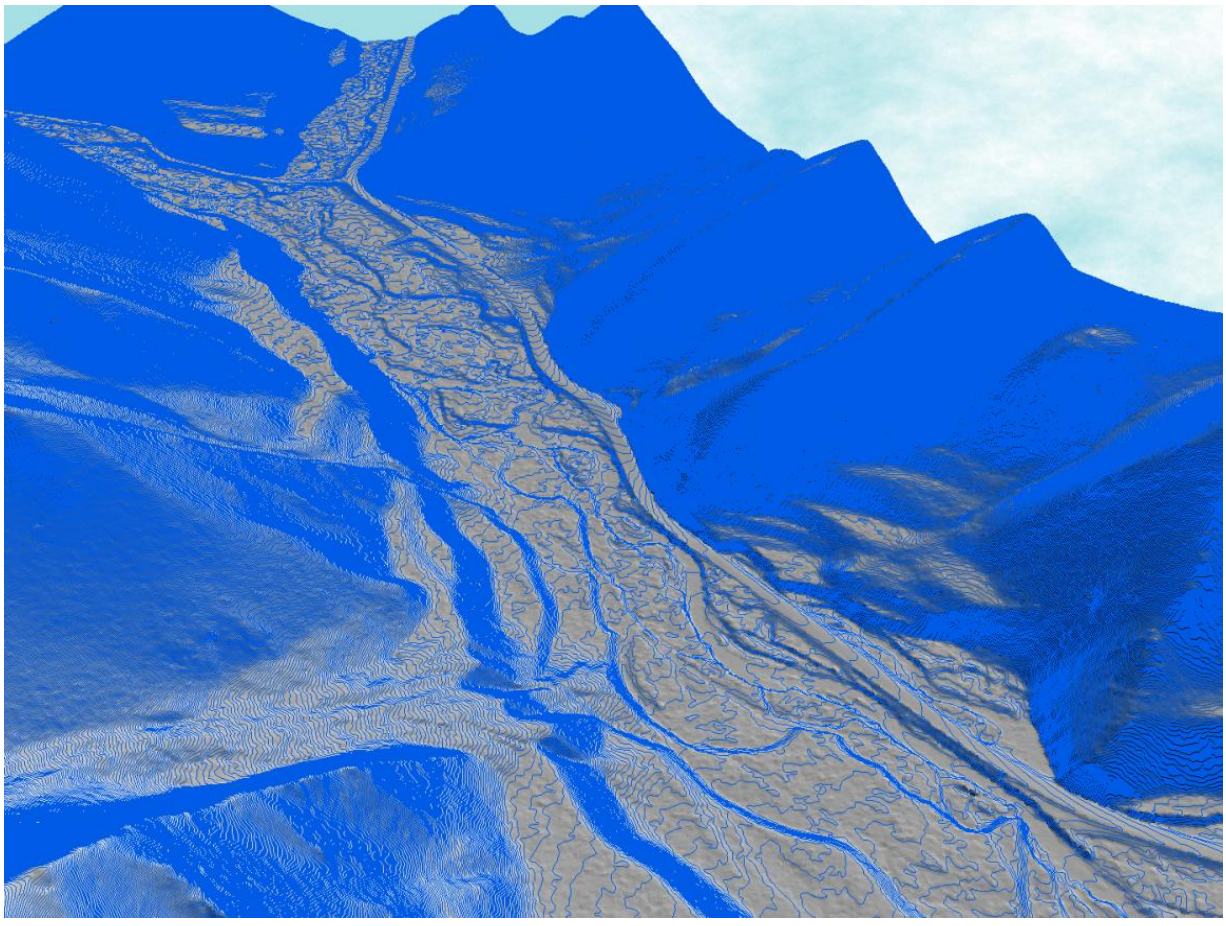
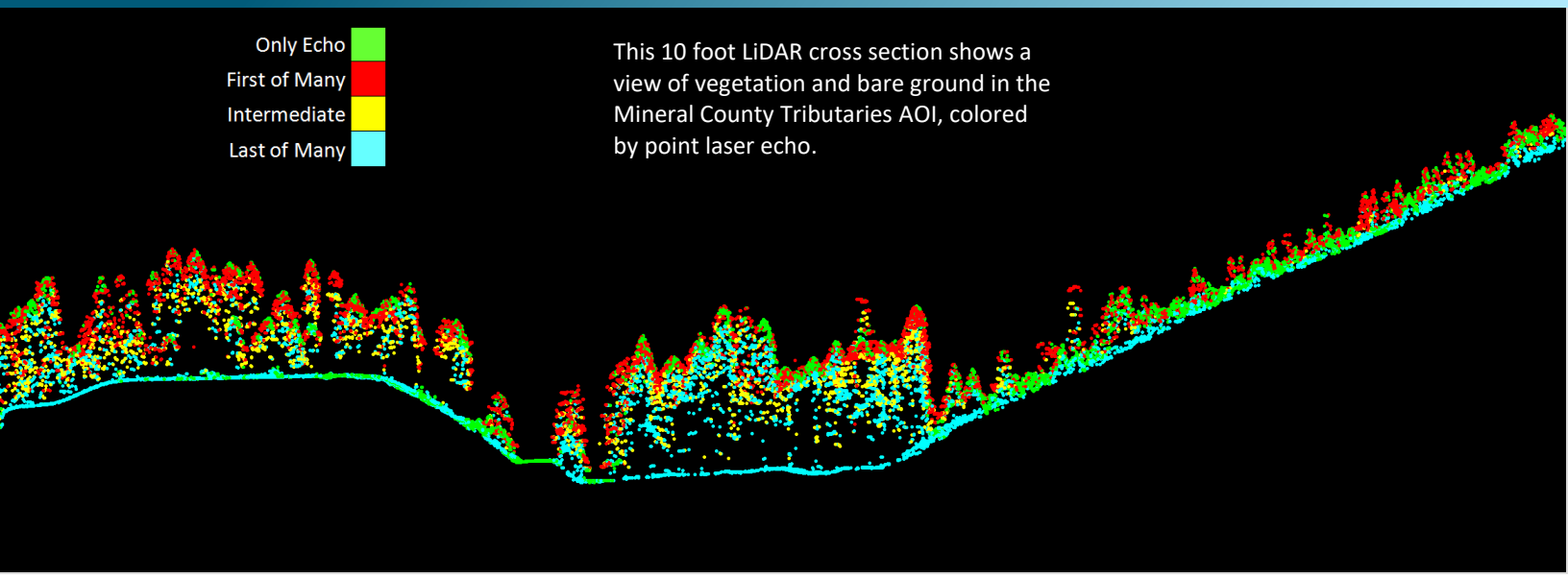


Figure 4: Contours draped over the Mineral County Tributaries bare earth elevation model



This 10 foot LiDAR cross section shows a view of vegetation and bare ground in the Mineral County Tributaries AOI, colored by point laser echo.

LiDAR Density

The acquisition parameters were designed to acquire an average first-return density of 8 points/m^2 (0.74 points/ft^2). First return density describes the density of pulses emitted from the laser that return at least one echo to the system. Multiple returns from a single pulse were not considered in first return density analysis. Some types of surfaces (e.g., breaks in terrain, water and steep slopes) may have returned fewer pulses than originally emitted by the laser. First returns typically reflect off the highest feature on the landscape within the footprint of the pulse. In forested or urban areas the highest feature could be a tree, building or power line, while in areas of unobstructed ground, the first return will be the only echo and represents the bare earth surface.

The density of ground-classified LiDAR returns was also analyzed for this project. Terrain character, land cover, and ground surface reflectivity all influenced the density of ground surface returns. In vegetated areas, fewer pulses may penetrate the canopy, resulting in lower ground density.

The average first-return density of LiDAR data for the Mineral County Tributaries 2019 LiDAR acquisition was 1.16/ft^2 (12.53 points/m^2) while the average ground classified density was 0.25 points/ft^2 (2.66 points/m^2). For reprocessed areas corresponding to the 2016 and 2017 LiDAR acquisitions, the average first-return density of LiDAR data was 1.69 points/ft^2 (18.23 points/m^2) while the average ground classified density was 0.47 points/ft^2 (5.03 points/m^2) (Table 9).

Additionally, for the reprocessed topobathymetric portion corresponding to the 2016 Clark Fork Acquisition, density values of only bathymetric returns were calculated for areas containing at least one bathymetric bottom return. Areas lacking bathymetric returns were not considered in calculating an average density value. Within the successfully mapped area, a bathymetric bottom return density of 0.51 points/ft_2 (5.51 points/m_2) was achieved. The statistical and spatial distributions of first return densities and classified ground return densities per 100 m x 100 m cell are portrayed in Figure 5 through Figure 11.

Table 9: Average LiDAR point densities

Classification	Point Density 2019 Acquisition	Point Density 2016-2017 Acquisitions
First-Return	1.16 points/ft^2 12.53 points/m^2	1.69 points/ft^2 18.23 points/m^2
Ground Classified	0.25 points/ft^2 2.66 points/m^2	0.47 points/ft^2 5.03 points/m^2

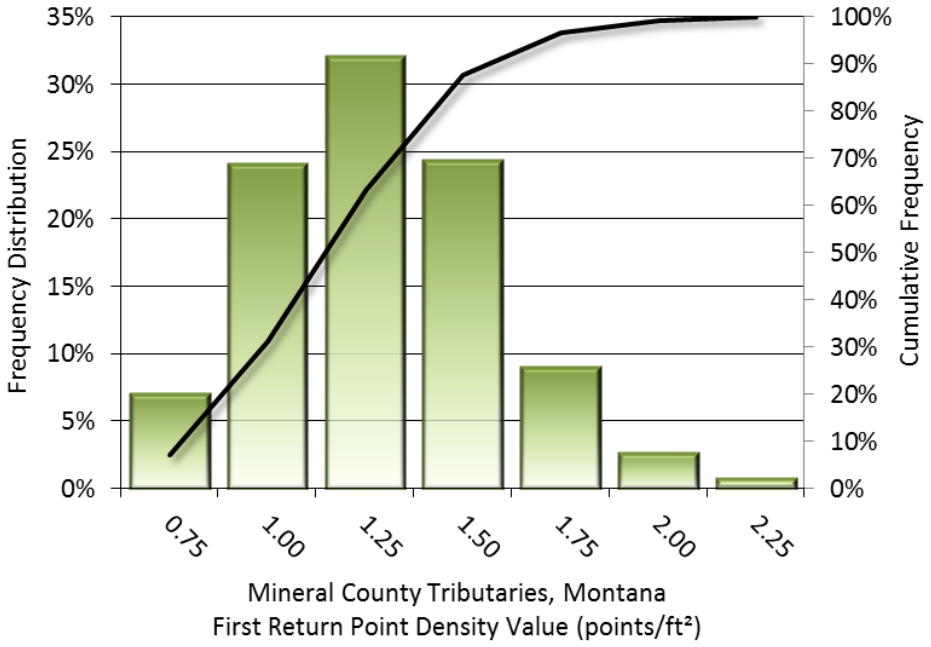


Figure 5: Frequency distribution of first return point density values of 2019 acquisition per 100 x 100 m cell

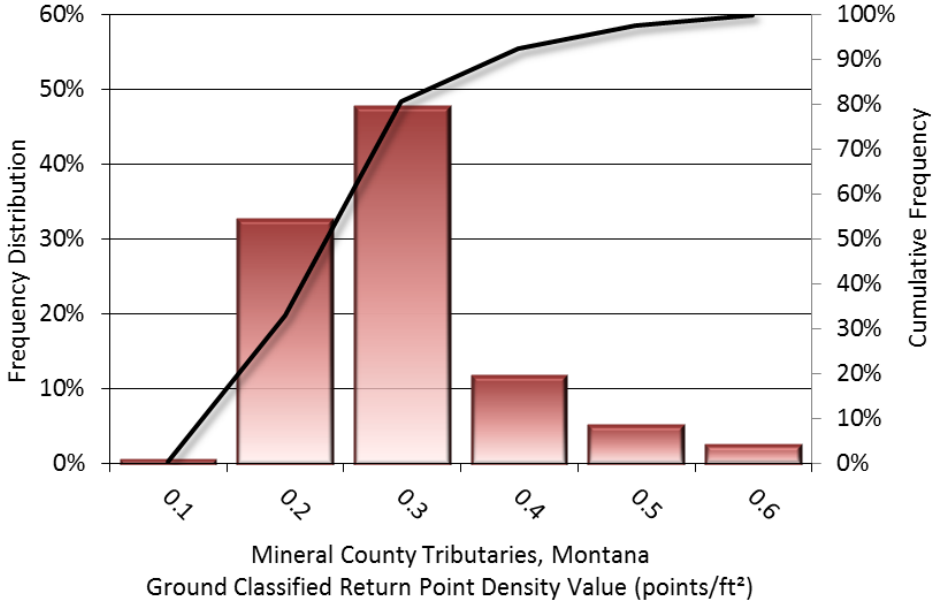


Figure 6: Frequency distribution of ground-classified return point density values of 2019 acquisition per 100 x 100 m cell

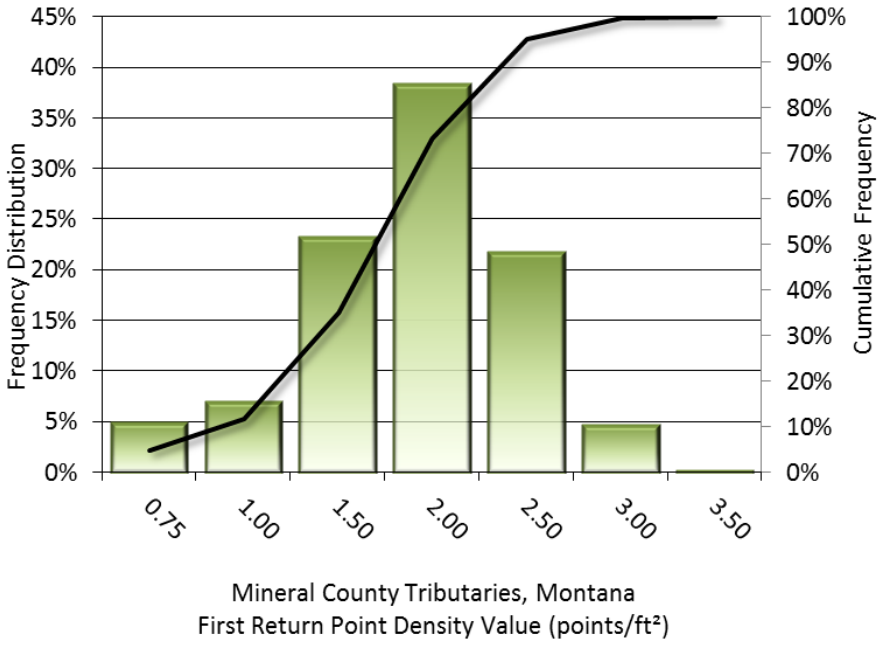


Figure 7: Frequency distribution of first return point density values of 2016-2017 acquisitions per 100 x 100 m cell

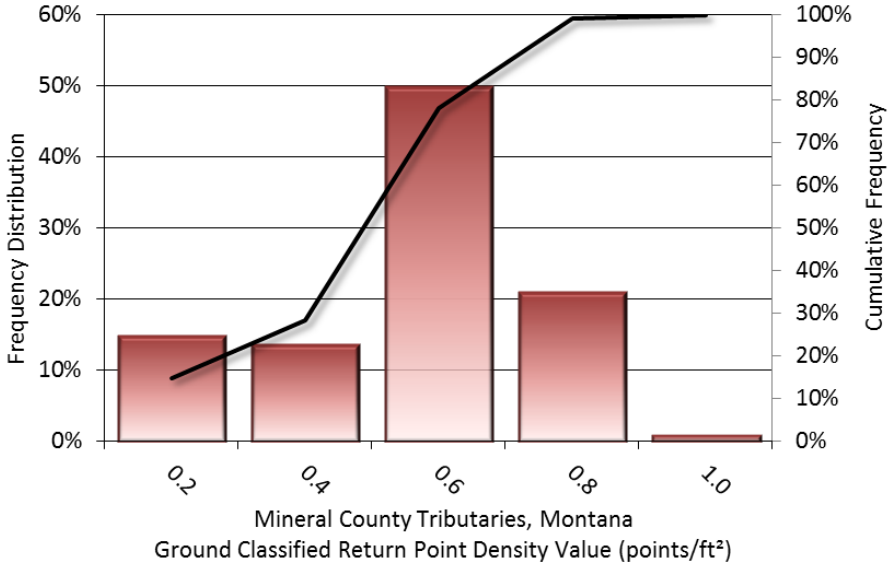


Figure 8: Frequency distribution of ground-classified return point density values of 2016-2017 acquisitions per 100 x 100 m cell

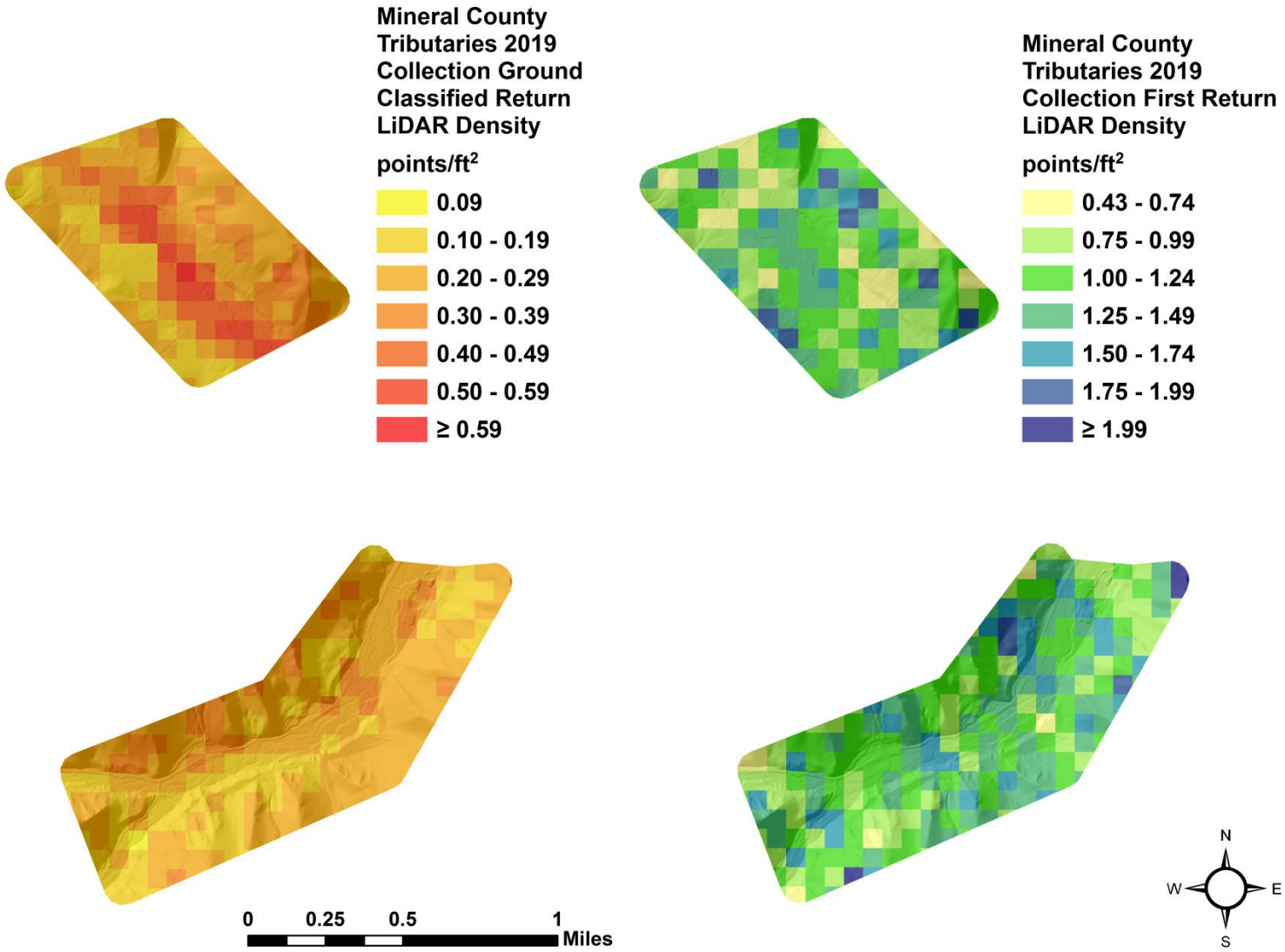


Figure 9 : First return and ground-classified point density map for the Mineral County Tributaries 2019 LiDAR Acquisition (100 m x 100 m cells)

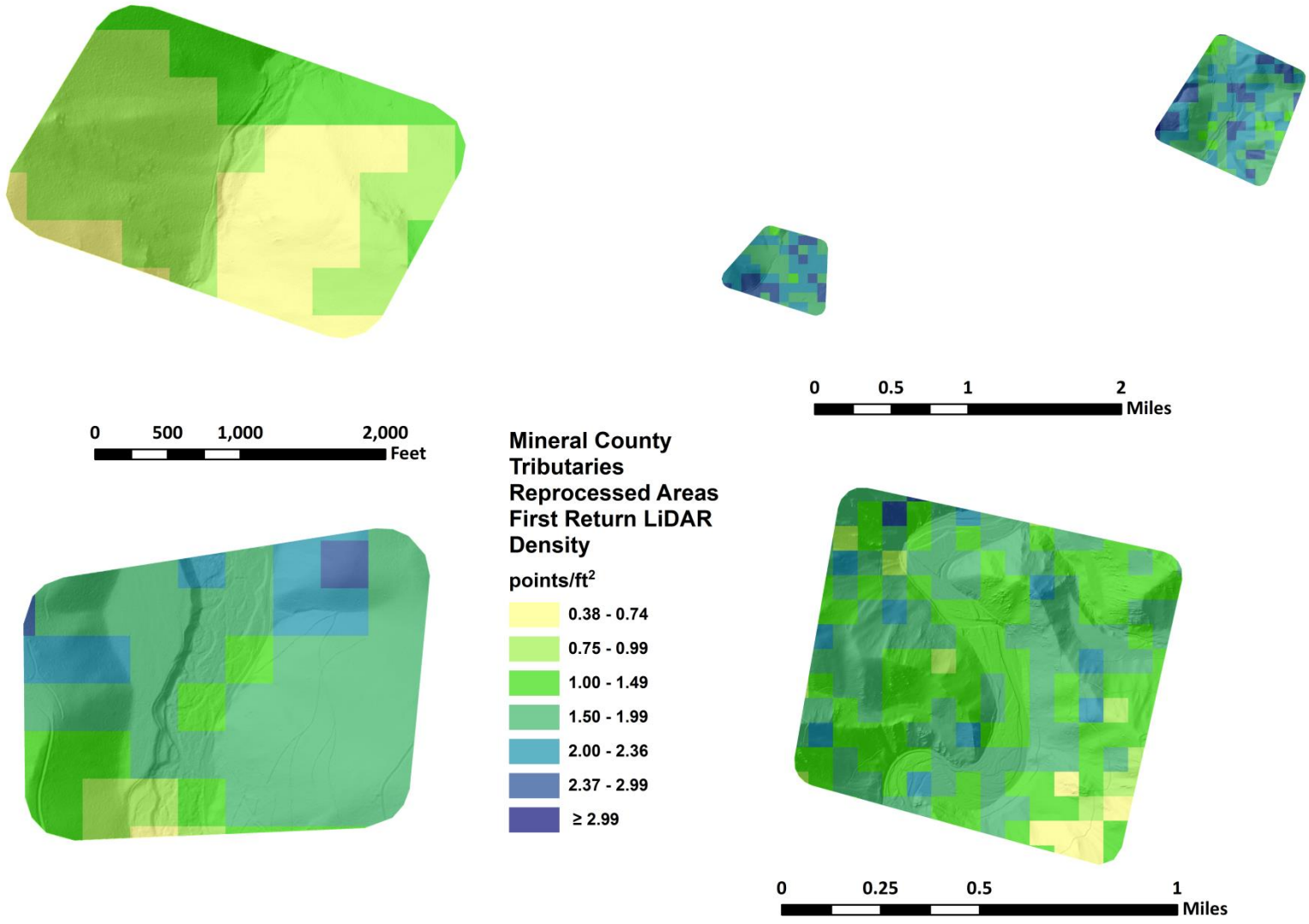


Figure 10: First return density map for the Mineral County Tributaries site 2016-2017 LiDAR acquisitions (100 m x 100 m cells)

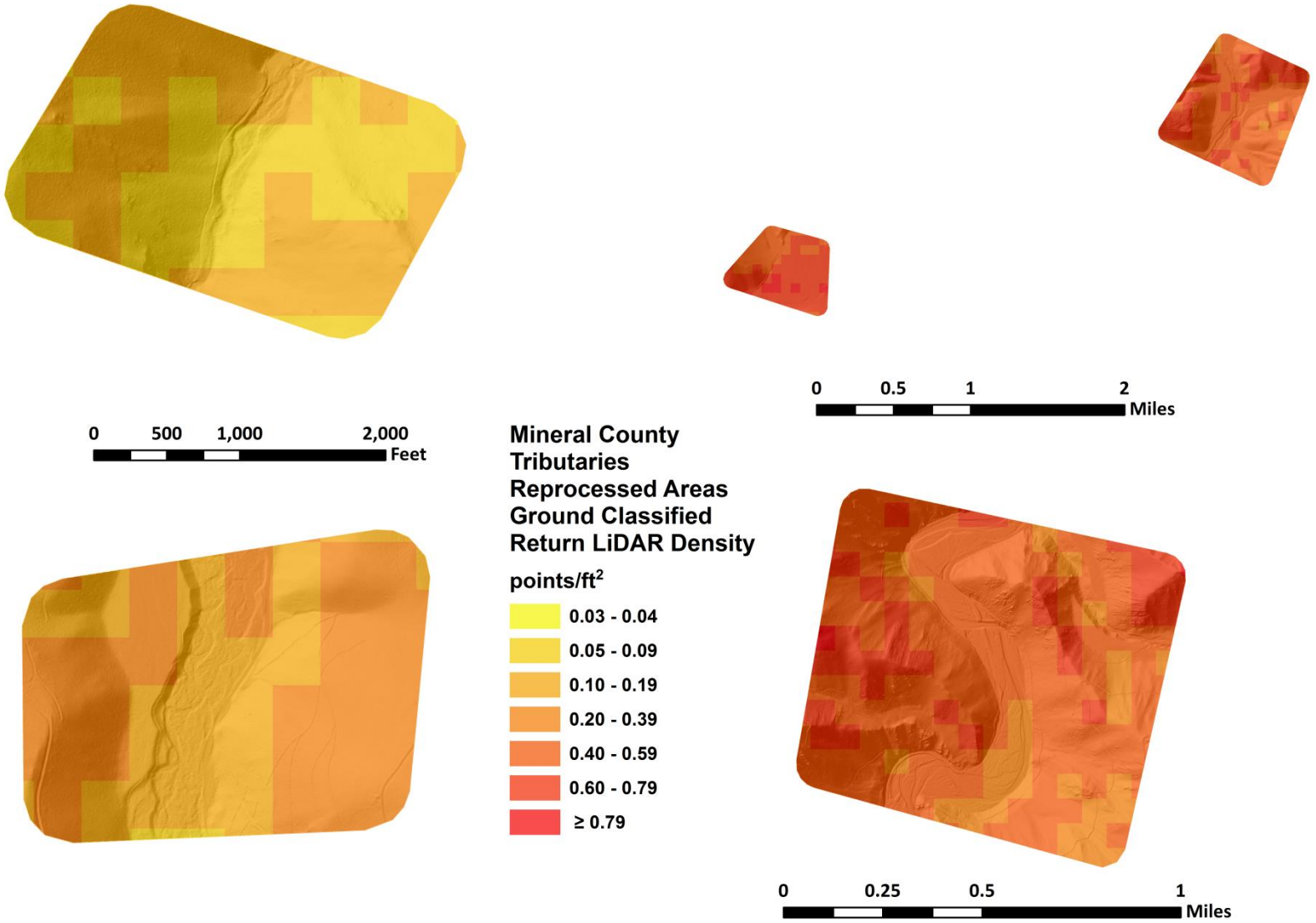


Figure 11: Ground classified return density map for the Mineral County Tributaries site 2016-2017 LiDAR acquisitions (100 m x 100 m cells)

LiDAR Accuracy Assessments

The accuracy of the LiDAR data collection can be described in terms of absolute accuracy (the consistency of the data with external data sources) and relative accuracy (the consistency of the dataset with itself). See Appendix A for further information on sources of error and operational measures used to improve relative accuracy.

LiDAR Non-Vegetated Vertical Accuracy

Absolute accuracy was assessed using Non-Vegetated Vertical Accuracy (NVA) reporting designed to meet guidelines presented in the FGDC National Standard for Spatial Data Accuracy[3]. NVA compares known ground check point data that were withheld from the calibration and post-processing of the LiDAR point cloud to the triangulated surface generated by the unclassified LiDAR point cloud as well as the derived gridded bare earth DEM. NVA is a measure of the accuracy of LiDAR point data in open areas where the LiDAR system has a high probability of measuring the ground surface and is evaluated at the 95% confidence interval (1.96 * RMSE), as shown in Table 10.

The mean and standard deviation (sigma σ) of divergence of the ground surface model from quality assurance point coordinates are also considered during accuracy assessment. These statistics assume the error for x, y and z is normally distributed, and therefore the skew and kurtosis of distributions are also considered when evaluating error statistics. For the Mineral County Tributaries 2019 survey, 22 ground check points were withheld from the calibration and post processing of the LiDAR point cloud, with resulting non-vegetated vertical accuracy of 0.104 feet (0.032 meters) as compared to unclassified LAS, and 0.100 feet (0.031 meters) as compared to the bare earth DEM, with 95% confidence (Figure 12, Figure 13).

QSI also assessed absolute accuracy using 88 ground control points. Although these points were used in the calibration and post-processing of the LiDAR point cloud, they still provide a good indication of the overall accuracy of the LiDAR dataset, and therefore have been provided in Table 10 and Figure 14. Please see the LiDAR accuracy assessment section within the St. Regis and Clark Fork technical data reports for accuracy statistics pertaining to the Mineral County Tributaries reprocessed areas of interest.

[3] Federal Geographic Data Committee, ASPRS POSITIONAL ACCURACY STANDARDS FOR DIGITAL GEOSPATIAL DATA EDITION 1, Version 1.0, NOVEMBER 2014. http://www.asprs.org/PAD-Division/ASPRS-POSITIONAL-ACCURACY-STANDARDS-FOR-DIGITAL-GEOSPATIAL-DATA.html.

Table 10: Absolute accuracy results

Absolute Vertical Accuracy			
	NVA, as compared to unclassified LAS	**NVA, as compared to bare earth DEM**	**Ground Control Points**
Sample	22 points	22 points	88 points
95% Confidence (1.96*RMSE)	0.104 ft 0.032 m	0.100 ft 0.031 m	0.076 ft 0.023 m
Average	0.022 ft 0.007 m	0.029 ft 0.009 m	0.000 ft 0.000 m
Median	0.015 ft 0.005 m	0.033 ft 0.010 m	0.000 ft 0.000 m
RMSE	0.053 ft 0.016 m	0.051 ft 0.016 m	0.039 ft 0.012 m
Standard Deviation (1σ)	0.049 ft 0.015 m	0.044 ft 0.013 m	0.039 ft 0.012 m

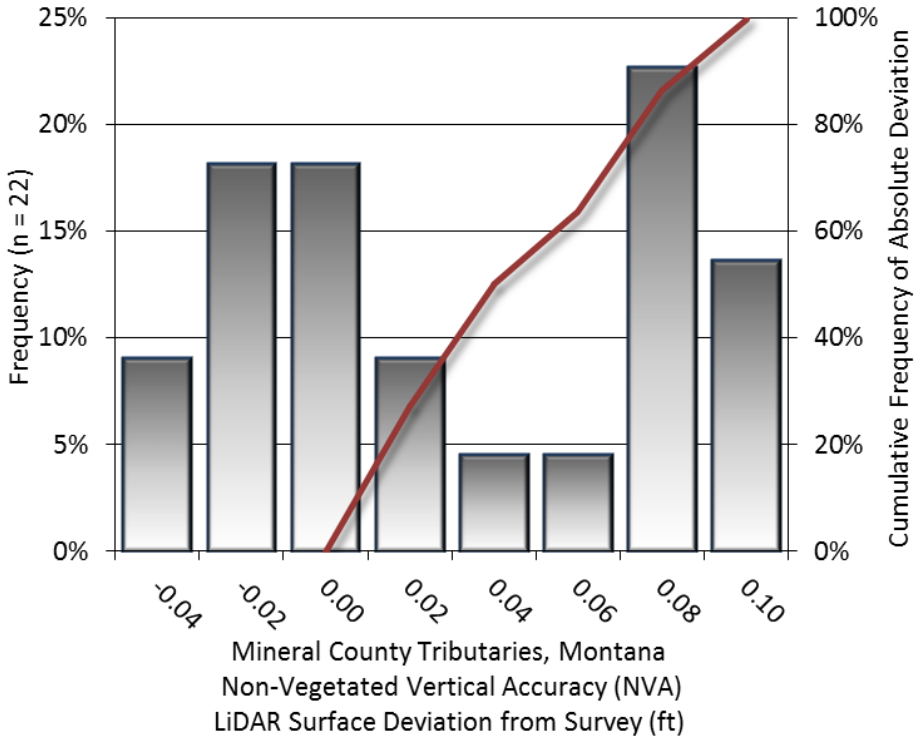


Figure 12: Frequency histogram for LiDAR unclassified LAS deviation from ground check point values (NVA)

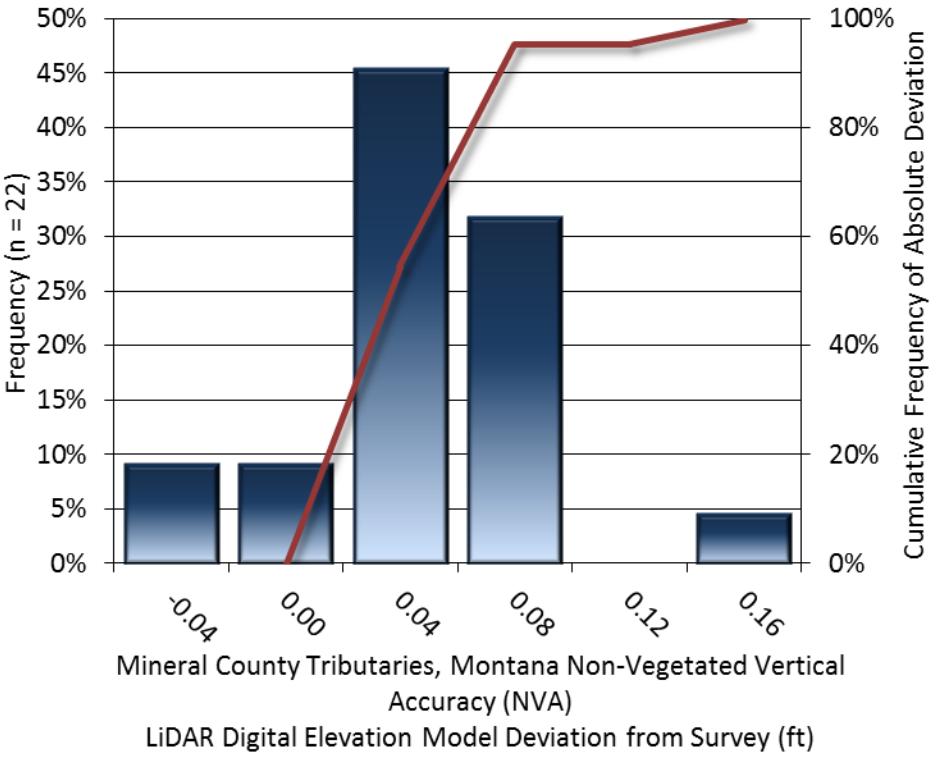


Figure 13: Frequency histogram for LiDAR bare earth DEM surface deviation from ground check point values (NVA)

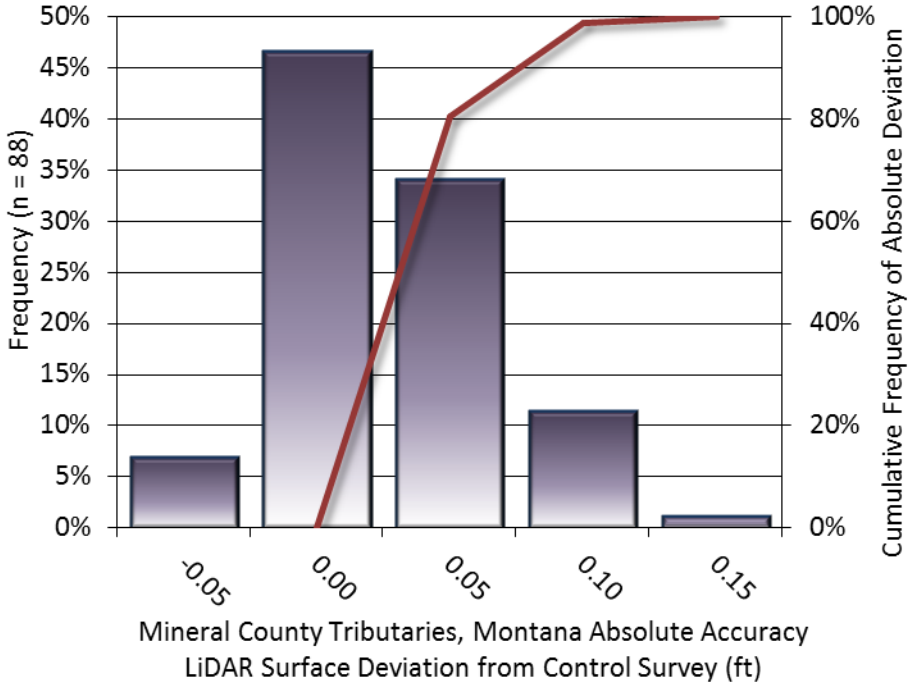


Figure 14: Frequency histogram for LiDAR surface deviation from ground control point values

LiDAR Relative Vertical Accuracy

Relative vertical accuracy refers to the internal consistency of the data set as a whole: the ability to place an object in the same location given multiple flight lines, GPS conditions, and aircraft attitudes. When the LiDAR system is well calibrated, the swath-to-swath vertical divergence is low (<0.10 meters). The relative vertical accuracy was computed by comparing the ground surface model of each individual flight line with its neighbors in overlapping regions. The average (mean) line to line relative vertical accuracy for the Mineral County Tributaries 2019 LiDAR acquisition was 0.182 feet (0.056 meters) (Table 11, Figure 15).

Table 11: Relative accuracy results

Relative Accuracy	
Sample	11 surfaces
Average	0.182 ft 0.056 m
Median	0.176 ft 0.054 m
RMSE	0.184 ft 0.056 m
Standard Deviation (1σ)	0.101 ft 0.031 m
1.96σ	0.101 ft 0.031 m

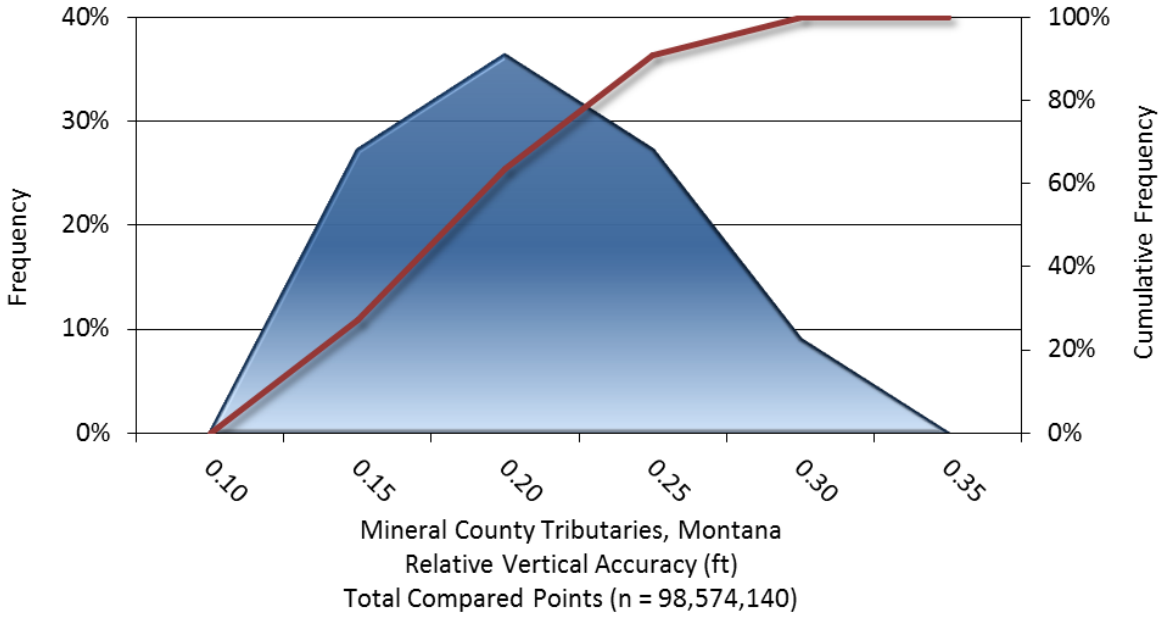


Figure 15: Frequency plot for relative vertical accuracy between flight lines

LiDAR Horizontal Accuracy

LiDAR horizontal accuracy is a function of Global Navigation Satellite System (GNSS) derived positional error, flying altitude, and INS-derived attitude error. The obtained $RMSE_r$ value is multiplied by a conversion factor of 1.7308 to yield the horizontal component (ACCr) of the National Standards for Spatial Data Accuracy (NSSDA) reporting standard where a theoretical point will fall within the obtained radius 95 percent of the time. Using a flying altitude of 1,900 meters, an IMU error of 0.0068 decimal degrees, and a GNSS positional error of 0.032 meters, the horizontal accuracy for the 2019 LiDAR collection is 0.40 meters (1.31 feet) at the 95% confidence level. The 2016 Clark Fork and 2017 St. Regis project sites have horizontal accuracy values of 0.25 meters (0.83 feet) and 0.06 meters (0.18 feet) respectively (Table 12). Data from the Mineral County Tributaries dataset have been tested to meet horizontal requirements at the 95% confidence level, using NSSDA reporting methods.

Table 12: Horizontal Accuracy

Horizontal Accuracy			
Site	**2016 Clark Fork Acquisition**	**2017 St. Regis Acquisition**	**2019 Mineral County Tributaries Acquisition**
$RMSE_r$	0.48 ft 0.15 m	0.11 ft 0.03 m	0.76 ft 0.23 m
ACC_r	0.83 ft 0.25 m	0.18 ft 0.06 m	1.31 ft 0.40 m

CERTIFICATIONS

Quantum Spatial, Inc. provided LiDAR services for the Mineral County Tributaries project as described in this report.

I, Ashley Daigle, have reviewed the attached report for completeness and hereby state that it is a complete and accurate report of this project.

Ashley Daigle

Ashley Daigle Jul 10, 2019
Project Manager
Quantum Spatial, Inc.

I, Steven J. Hyde, PLS, being duly registered as a Professional Land Surveyor in and by the state of Montana, hereby certify that the methodologies, static GNSS occupations used during airborne flights, and ground survey point collection were performed using commonly accepted Standard Practices. Field work conducted for this report was conducted on May 5, 2019.

Accuracy statistics shown in the Accuracy Section of this Report have been reviewed by me and found to meet the "National Standard for Spatial Data Accuracy".

Steven J. Hyde, PLS July 09, 2019
Quantum Spatial, Inc.
Corvallis, OR 97330

Figure 16: A view looking southwest at Tamarack Creek within the northernmost AOI of the 2019 LiDAR acquisition. The image was created from the LiDAR bare earth model colored by elevation and overlaid with Virtual Earth Satellite imagery and the above ground point cloud.

GLOSSARY

1-sigma (σ) Absolute Deviation: Value for which the data are within one standard deviation (approximately 68th percentile) of a normally distributed data set.

1.96 * RMSE Absolute Deviation: Value for which the data are within two standard deviations (approximately 95th percentile) of a normally distributed data set, based on the FGDC standards for Non-vegetated Vertical Accuracy (NVA) reporting.

Accuracy: The statistical comparison between known (surveyed) points and laser points. Typically measured as the standard deviation (sigma σ) and root mean square error (RMSE).

> **Absolute Accuracy:** The vertical accuracy of LiDAR data is described as the mean and standard deviation (sigma σ) of divergence of LiDAR point coordinates from ground survey point coordinates. To provide a sense of the model predictive power of the dataset, the root mean square error (RMSE) for vertical accuracy is also provided. These statistics assume the error distributions for x, y and z are normally distributed, and thus we also consider the skew and kurtosis of distributions when evaluating error statistics.
>
> **Relative Accuracy:** Relative accuracy refers to the internal consistency of the data set; i.e., the ability to place a laser point in the same location over multiple flight lines, GPS conditions and aircraft attitudes. Affected by system attitude offsets, scale and GPS/IMU drift, internal consistency is measured as the divergence between points from different flight lines within an overlapping area. Divergence is most apparent when flight lines are opposing. When the LiDAR system is well calibrated, the line-to-line divergence is low (<10 cm).
>
> **Root Mean Square Error (RMSE):** A statistic used to approximate the difference between real-world points and the LiDAR points. It is calculated by squaring all the values, then taking the average of the squares and taking the square root of the average.

Data Density: A common measure of LiDAR resolution, measured as points per square meter.

Digital Elevation Model (DEM): File or database made from surveyed points, containing elevation points over a contiguous area. Digital terrain models (DTM) and digital surface models (DSM) are types of DEMs. DTMs consist solely of the bare earth surface (ground points), while DSMs include information about all surfaces, including vegetation and man-made structures.

Intensity Values: The peak power ratio of the laser return to the emitted laser, calculated as a function of surface reflectivity.

Nadir: A single point or locus of points on the surface of the earth directly below a sensor as it progresses along its flight line.

Overlap: The area shared between flight lines, typically measured in percent. 100% overlap is essential to ensure complete coverage and reduce laser shadows.

Pulse Rate (PR): The rate at which laser pulses are emitted from the sensor; typically measured in thousands of pulses per second (kHz).

Pulse Returns: For every laser pulse emitted, the number of wave forms (i.e., echoes) reflected back to the sensor. Portions of the wave form that return first are the highest element in multi-tiered surfaces such as vegetation. Portions of the wave form that return last are the lowest element in multi-tiered surfaces.

Real-Time Kinematic (RTK) Survey: A type of surveying conducted with a GPS base station deployed over a known monument with a radio connection to a GPS rover. Both the base station and rover receive differential GPS data and the baseline correction is solved between the two. This type of ground survey is accurate to 1.5 cm or less.

Post-Processed Kinematic (PPK) Survey: GPS surveying is conducted with a GPS rover collecting concurrently with a GPS base station set up over a known monument. Differential corrections and precisions for the GNSS baselines are computed and applied after the fact during processing. This type of ground survey is accurate to 1.5 cm or less.

Scan Angle: The angle from nadir to the edge of the scan, measured in degrees. Laser point accuracy typically decreases as scan angles increase.

Native LiDAR Density: The number of pulses emitted by the LiDAR system, commonly expressed as pulses per square meter.

Relative Accuracy Calibration Methodology:

Manual System Calibration: Calibration procedures for each mission require solving geometric relationships that relate measured swath-to-swath deviations to misalignments of system attitude parameters. Corrected scale, pitch, roll and heading offsets were calculated and applied to resolve misalignments. The raw divergence between lines was computed after the manual calibration was completed and reported for each survey area.

Automated Attitude Calibration: All data were tested and calibrated using TerraMatch automated sampling routines. Ground points were classified for each individual flight line and used for line-to-line testing. System misalignment offsets (pitch, roll and heading) and scale were solved for each individual mission and applied to respective mission datasets. The data from each mission were then blended when imported together to form the entire area of interest.

Automated Z Calibration: Ground points per line were used to calculate the vertical divergence between lines caused by vertical GPS drift. Automated Z calibration was the final step employed for relative accuracy calibration.

LiDAR accuracy error sources and solutions:

Type of Error	Source	Post Processing Solution
GPS (Static/Kinematic)	Long Base Lines	None
	Poor Satellite Constellation	None
	Poor Antenna Visibility	Reduce Visibility Mask
Relative Accuracy	Poor System Calibration	Recalibrate IMU and sensor offsets/settings
	Inaccurate System	None
Laser Noise	Poor Laser Timing	None
	Poor Laser Reception	None
	Poor Laser Power	None
	Irregular Laser Shape	None

Operational measures taken to improve relative accuracy:

Low Flight Altitude: Terrain following was employed to maintain a constant above ground level (AGL). Laser horizontal errors are a function of flight altitude above ground (about 1/3000th AGL flight altitude).

Focus Laser Power at narrow beam footprint: A laser return must be received by the system above a power threshold to accurately record a measurement. The strength of the laser return (i.e., intensity) is a function of laser emission power, laser footprint, flight altitude and the reflectivity of the target. While surface reflectivity cannot be controlled, laser power can be increased and low flight altitudes can be maintained.

Reduced Scan Angle: Edge-of-scan data can become inaccurate. The scan angle was reduced to a maximum of ±15° from nadir, creating a narrow swath width and greatly reducing laser shadows from trees and buildings.

Quality GPS: Flights took place during optimal GPS conditions (e.g., 6 or more satellites and PDOP [Position Dilution of Precision] less than 3.0). Before each flight, the PDOP was determined for the survey day. During all flight times, a dual frequency DGPS base station recording at 1 second epochs was utilized and a maximum baseline length between the aircraft and the control points was less than 13 nm at all times.

Ground Survey: Ground survey point accuracy (<1.5 cm RMSE) occurs during optimal PDOP ranges and targets a minimal baseline distance of 4 miles between GPS rover and base. Robust statistics are, in part, a function of sample size (n) and distribution. Ground survey points are distributed to the extent possible throughout multiple flight lines and across the survey area.

50% Side-Lap (100% Overlap): Overlapping areas are optimized for relative accuracy testing. Laser shadowing is minimized to help increase target acquisition from multiple scan angles. Ideally, with a 50% side-lap, the nadir portion of one flight line coincides with the swath edge portion of overlapping flight lines. A minimum of 50% side-lap with terrain-followed acquisition prevents data gaps.

Opposing Flight Lines: All overlapping flight lines have opposing directions. Pitch, roll and heading errors are amplified by a factor of two relative to the adjacent flight line(s), making misalignments easier to detect and resolve.

PIONEER
TECHNICAL SERVICES, INC.

RESTORING OUR ENVIRONMENT ▸ DESIGNING OUR FUTURE

Mineral County Modernization Project - Phase 1
St. Regis River Study Area
Final Field Reconnaissance and Hydraulic Structure Assessment

Montana Department of Natural Resources and Conservation (DNRC)
August 4, 2017

Pioneer Technical Services, Inc. 106 Pronghorn Trail, Suite A, Bozeman Montana 59718
www.pioneer-technical.com

Mineral County Modernization Project - Phase 1

St. Regis River Studya Area

Final Field Reconnaissance and Hydraulic Structure Assessment Report

Prepared for:

State of Montana, Department of Natural Resources and Conservation

1424 9th Avenue

Helena, Montana 59620-1601

Prepared by:

Pioneer Technical Services, Inc.

106 Pronghorn Trail

Suite A

Bozeman, Montana 59718

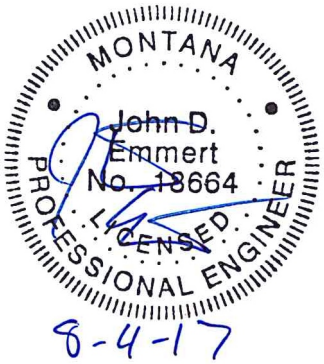
Mineral County Modernization Project - Phase 1

St. Regis River Study Area

Final Field Reconnaissance and Hydraulic Structure Assessment

August 4, 2017

I hereby certify that all work products (maps, reports, etc.) prepared for this project were done so under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Montana.



J.D. Emmert, P.E.

Date: 8/4/17 Montana Registration No. 18664

Pioneer Technical Services, Inc.
106 Pronghorn Trail, Suite A
Bozeman, MT 59718

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1 INTRODUCTION

The mainstem of the St. Regis River extends approximately 37 miles from its mouth at the Clark Fork River near the town of St. Regis, Montana, to the headwaters near Lookout Pass east of the Montana-Idaho border. The St. Regis River is located entirely within Mineral County. The existing floodplain mapping for Mineral County has not yet been modernized to Digital Flood Insurance Rate Map (DFIRM) format. The effective mapping in Mineral County consists of 1982 Flood Hazard Boundary Maps that were converted to Flood Insurance Rate Maps (FIRM) by letter in 1996. All the effective mapping is approximate, with the exception of an 800-foot stretch on Flat Creek in the Town of Superior, Montana, updated by a Letter of Map Revision (LOMR) in 2014, and is outdated and difficult to administer.

In 2008, Mineral County, the Montana Department of Natural Resources and Conservation (DNRC), and the Federal Emergency Management Agency (FEMA) conducted a scoping effort as part of planning for future DFIRM project funding. Due to funding limitation and project needs, Mineral County was not selected for a countywide DFIRM conversion at that time. The DNRC has continued to be engaged with Mineral County providing mapping technical assistance, training, and outreach assistance to the county's floodplain administrator. However, updated mapping and countywide modernization has remained an unmet need for Mineral County and a priority for the DNRC's mapping program.

Mineral County expressed strong interest in updated mapping to better manage and regulate floodplain areas. The Mineral County Board of Commissioners provided a letter to DNRC dated June 29, 2016, regarding current floodplain maps. This letter stated,

> *"These floodplain maps create an unnecessary burden on landowners in approximation with surface water throughout Mineral County. Numerous land owners have had to obtain a Letter of Map Amendment for structures located well above the floodplain elevation due to fact that some of the property is located within the Approximate Zone A area.*
>
> *Mineral County is committed to protecting the river systems, managing flood risks, and to participating in the Federal Flood Insurance Program. Detailed studies would be of the most benefit to Mineral County residents. Current floodplain study information would allow Mineral County to better regulate floodplain areas."*

In 2016, DNRC submitted a project grant application to FEMA to complete **Phase I of the Mineral County Modernization Project**. Upon approval of the project grant, the DNRC, in partnership with FEMA and Mineral County, initiated work to produce new floodplain studies along the Clark Fork and St. Regis Rivers. This first phase of the Mineral County Modernization Project will provide the groundwork for scoping and completing floodplain mapping projects throughout Mineral County. The first phase of the project, as outlined in this report, is comprised of the following activities:

1. Structure and bathymetric survey for the entire 37-miles of the St. Regis River.
2. Field reconnaissance and hydraulic structure assessment of structures on 13 tributaries to the St. Regis River.
3. Hydrologic analysis.

This report documents the methodology and results of the field reconnaissance and hydraulic structure assessment activities completed in late December of 2016 in the St. Regis River corridor.

2 PURPOSE OF INVESTIGATION

The purpose of this investigation was to collect and organize relevant information for hydraulic structures along select tributaries of the St. Regis River, and to assess each structure's potential to create a floodplain conveyance restriction during flood conditions. The tributaries investigated included Hanaker Creek, Denna Mora Creek, Rainy Creek, Randolph Creek, Silver Creek, Packer Creek, Timber Creek, Savanac Creek, Big Creek, Deer Creek, Twin Creek, Twelvemile Creek, and Little Joe Creek. The information collected from this investigation will support future floodplain studies along the St. Regis River and its tributaries.

3 METHODOLOGY

The Pioneer Technical Services, Inc. (Pioneer) team completed a detailed review of the study area along the St. Regis River prior to fieldwork to locate all structures and identify ownership in the study area. The team first identified hydraulic structure types and locations from aerial imagery and information provided by DNRC. Each identified structure was assigned an identification code that included a 'B' for bridge and a number corresponding to the order of the structure along the mainstem, beginning at the downstream extent of the study reach and progressing upstream. Structure numbers were assigned to structures along the mainstem as well as structures on the tributaries. The numbering for the St. Regis River started at B49 because numbers B1-B48 were assigned to structures on the Clark Fork River and its tributaries. The mainstem structures are being surveyed as part of a separate structure and bathymetric survey project and are therefore not inventoried as part of this report. However, these structures are shown on relevant figures in this report for reference purposes. Any non-sequential numbering in this report is due to the numbering assigned to mainstem structures during the planning phase of the field operations data collection process. Additionally, several of the river-spanning structures are Interstate 90 (I-90) bridges, each with separate east-west traffic structures. Unless a figure shows otherwise, most of those I-90 structures are counted as a single bridge and have one structure identifier. The team identified 33 structures for assessment along the selected tributaries of the St. Regis River prior to fieldwork.

Prior to and throughout the fieldwork tasks, extensive coordination with local landowners, communities, the Mineral County Road Department, the Montana Department of Transportation (MDT), DNRC, and Pioneer took place. Pioneer and DNRC coordinated a landowner notification process to request landowner permission to access properties prior to fieldwork. The notification letter to landowners described the purpose of the study and the upcoming fieldwork activities and provided project contact information to allow landowners to voice concerns and/or ask questions. As a follow-up to the letters, approximately 5 to 7 days prior to starting fieldwork Pioneer made courtesy calls to any landowners who requested more information. Pioneer noted landowner concerns and instructions and completed the fieldwork accordingly. Additionally, Pioneer sent letters to and contacted MDT, the Mineral County Road Department, United States Forest Service (USFS), and Montana Rail Line to identify any future construction projects involving changes to road structures and obtain structure as-built information. The landowner notification letter, MDT letter, county road department letter, USFS letter, and Montana Rail Link Letter are provided in **Appendix A**.

The team began field activities at Randolph Creek (a tributary to the St. Regis River near Taft, Montana) on December 5, 2016, progressed downstream of the St. Regis River, and finished on December 6, 2016, at Little Joe Creek near St. Regis, Montana. One structure identified during the detailed study area review was not inventoried due to the presence of a locked gate at the access to the property. Also during fieldwork, the team found 1 structure to be in a different location than previously identified. Five structures were discovered during fieldwork activities and inventoried, resulting in a total structure inventory count of 37 structures along the tributaries of the St. Regis River. These 37 structures are shown on **Figures 1-5 (**at the end of this section).

The team recorded the following characteristics for all inventoried structures: location, type, condition, structure-specific dimensions, material type, and backwater potential. All structure attributes were recorded using a Juniper Mesa 2 Geo tablet with Global Positioning System (GPS) using Collector for ArcGIS. The collection database was designed to collect pertinent characteristics and information related to bridge, culvert, and diversion structures. The database was also designed to collect up to 4 span measurements per bridge, or a bridge with a maximum of 3 piers. Each span measurement field also had a corresponding description field (e.g., Span 1 and Span 1 Description). Bridge B103 had 5 piers, which exceeded the collection database format, so additional span information was summarized and stored under the Number of Piers Description field as a string (see **Appendix B** and Section 4.3).

Once the team completed the fieldwork, quality assurance personnel extracted the database from ArcGIS Online and verified the data quality. The results from the structure inventory, including the data summary tables, structure figures, and photographs, are provided in **Appendix B**.

3.1 Structure Measurements

At each structure, the team acquired measurements using a 25-foot tape measure, 200-foot tape measure, and a measuring wheel.

3.1.1 Bridges

The typical measurements taken for bridge structures included the following:

- **Span Length(s)**: Span length was measured between abutments and/or between piers.
- **Deck Width**: Deck width was measured perpendicular to traffic from the outermost face on the upstream side of the structure to the outermost face on the downstream side of the structure.
- **Deck Thickness**: Deck thickness was measured from the top of the deck to the low chord of the structure.
- **Guard Rail Height**: Guardrail height was measured from the top of the guardrail to the top of the deck surface.
- **Pier Width**: Pier width was measured perpendicular to stream flow at the widest point of the pier.

3.1.2 Culverts

The typical measurements taken for culverts included the following:

- **Culvert Length**: Culvert length was measured at the maximum horizontal distance from the culvert inlet to the culvert outlet.
- **Culvert Height**: Culvert height was measured at the maximum vertical height inside the culvert.
- **Inlet/Outlet Relative to the Deck**: Inlet/outlet relative to the deck was measured vertically from the road deck edge to the top of the culvert inlet/outlet.

Due to unsafe highway traffic, some of the culvert structure lengths (B70, B81, B86, B109) were estimated from aerial imagery using Google Earth.

3.2 Structure Photographs

In addition to measurements, field personnel took photographs of each structure and the surrounding conditions. Generally, four photographs were taken for each structure:

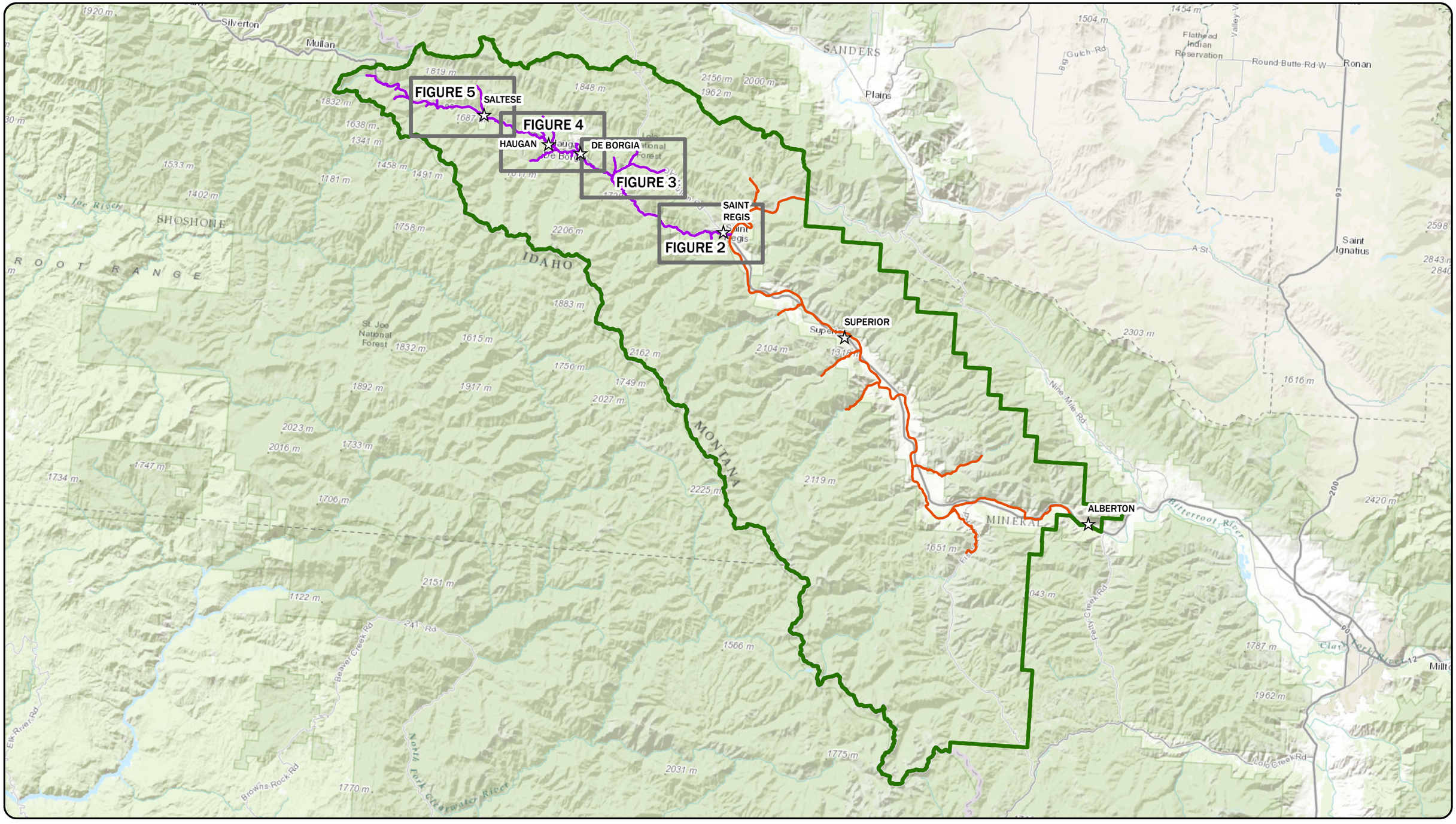
1. View of the upstream channel taken from on top of the structure.
2. View of the downstream channel taken from on top of the structure.
3. View of the structure looking upstream.
4. View of the structure looking downstream.

Due to unsafe highway traffic or access, the team did not take all four photographs for some structures (see **Appendix B**).

3.3 Flow Constriction Assessment

To evaluate site and structure conditions at each location, the team qualitatively assessed each structure for potential to back up water during flood conditions. The structures were rated 'Low,' 'Moderate,' or 'High' for backwater potential during the base flood. A 'Low' rating represented a structure with little or no floodplain or channel encroachment and little backwater potential. A 'Moderate' rating indicated a structure with a moderate degree of floodplain encroachment, such as a slightly elevated roadway embankment or slightly constrictive abutments that reduce flood flow conveyance. A 'High' rating indicated a structure that typically included an elevated road or highway embankment spanning the majority of the floodplain, which was likely to cause a significant backwater condition.

Most of the structures were rated as 'Low' for backwater potential (not appearing to pose a constriction within the flood plain) or 'Moderate' (mainly due to elevated road grades encroaching the floodplain). One railroad bridge, B103, was rated as 'Other' indicating no backwater potential due to the extreme size and height of the structure in comparison to the tributary of interest (Silver Creek).



LEGEND

- ☆ TOWNS
- SHEET INDEX
- MINERAL COUNTY BOUNDARY
- CLARK FORK STUDY AREA
- SAINT REGIS STUDY AREA

N

DISPLAYED AS:
PROJECTION/ZONE: MSP NAD83
DATUM: NAVD88
UNITS: INTL FEET
SOURCE: PIONEER/DNRC/USGS

0 3.5 7 14
Miles

FIGURE 1

MINERAL COUNTY
STRUCTURE INVENTORY
LOCATION MAP

PIONEER TECHNICAL SERVICES, INC.

DATE: 5/16/2017

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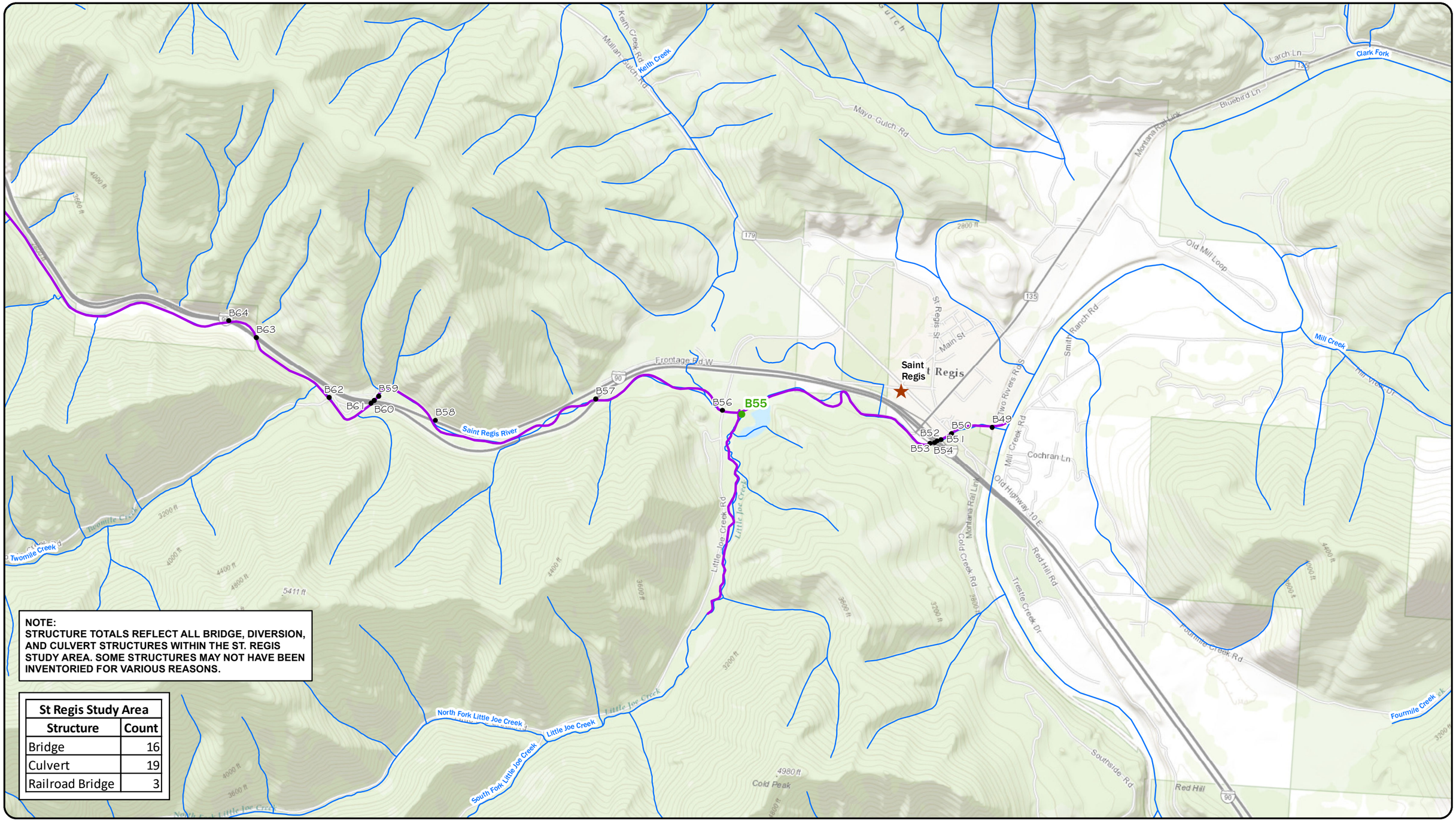

NOTE:
STRUCTURE TOTALS REFLECT ALL BRIDGE, DIVERSION, AND CULVERT STRUCTURES WITHIN THE ST. REGIS STUDY AREA. SOME STRUCTURES MAY NOT HAVE BEEN INVENTORIED FOR VARIOUS REASONS.

St Regis Study Area	
Structure	**Count**
Bridge	16
Culvert	19
Railroad Bridge	3

LEGEND

- BRIDGE
- CULVERT
- DIVERSION
- RAILROAD BRIDGE
- SURVEYED STRUCTURE
- TOWNS
- MINERAL COUNTY BOUNDARY
- SAINT REGIS STUDY AREA
- STREAMS

N

DISPLAYED AS:
PROJECTION/ZONE: MSP NAD83
DATUM: NAVD88
UNITS: INTL. FEET
SOURCE: PIONEER/DNRC/USGS

0 0.25 0.5 1
Miles

FIGURE 2

MINERAL COUNTY
STRUCTURE INVENTORY
ST. REGIS STRUCTURES

PIONEER TECHNICAL SERVICES, INC.

DATE: 5/16/2017

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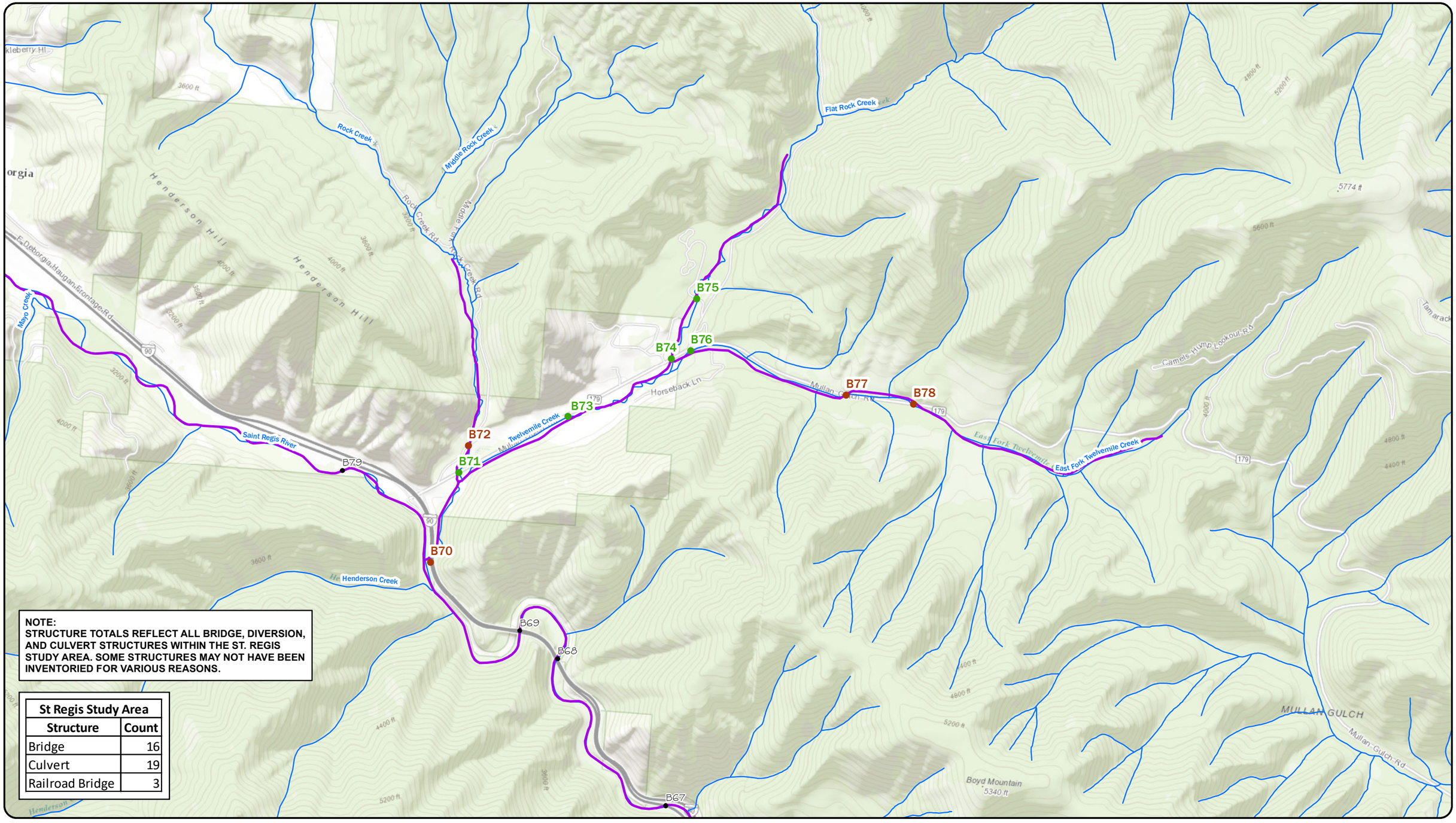

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Structure	**Count**
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Culvert	19
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LEGEND

- BRIDGE
- CULVERT
- DIVERSION
- RAILROAD BRIDGE
- SURVEYED STRUCTURE
- TOWNS
- MINERAL COUNTY BOUNDARY
- SAINT REGIS STUDY AREA
- STREAMS

N

DISPLAYED AS:
PROJECTION/ZONE: MSP NAD83
DATUM: NAVD88
UNITS: INTL FEET
SOURCE: PIONEER/DNRC/USGS

0 0.25 0.5 1
Miles

FIGURE 3

MINERAL COUNTY
STRUCTURE INVENTORY
ST. REGIS STRUCTURES

PIONEER TECHNICAL SERVICES, INC.

DATE: 5/16/2017

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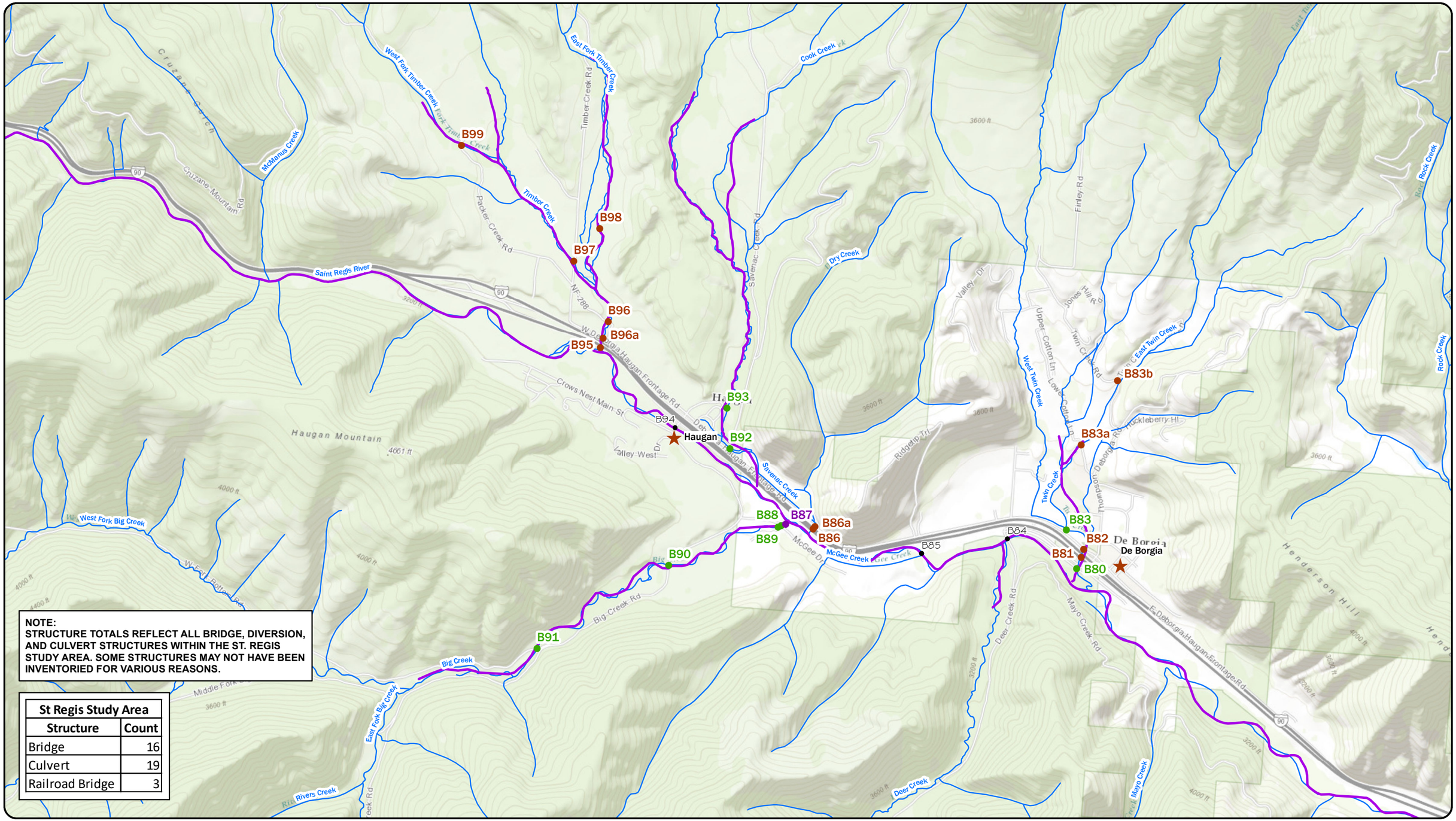

NOTE:
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St Regis Study Area	
Structure	Count
Bridge	16
Culvert	19
Railroad Bridge	3

LEGEND

- BRIDGE
- CULVERT
- DIVERSION
- RAILROAD BRIDGE
- SURVEYED STRUCTURE
- TOWNS
- MINERAL COUNTY BOUNDARY
- SAINT REGIS STUDY AREA
- STREAMS

N

DISPLAYED AS:
PROJECTION/ZONE: MSP NAD83
DATUM: NAVD88
UNITS: INTL FEET
SOURCE: PIONEER/DNRC/USGS

0 0.25 0.5 1
Miles

FIGURE 4

MINERAL COUNTY
STRUCTURE INVENTORY
ST. REGIS STRUCTURES

PIONEER TECHNICAL SERVICES, INC.

DATE: 5/16/2017

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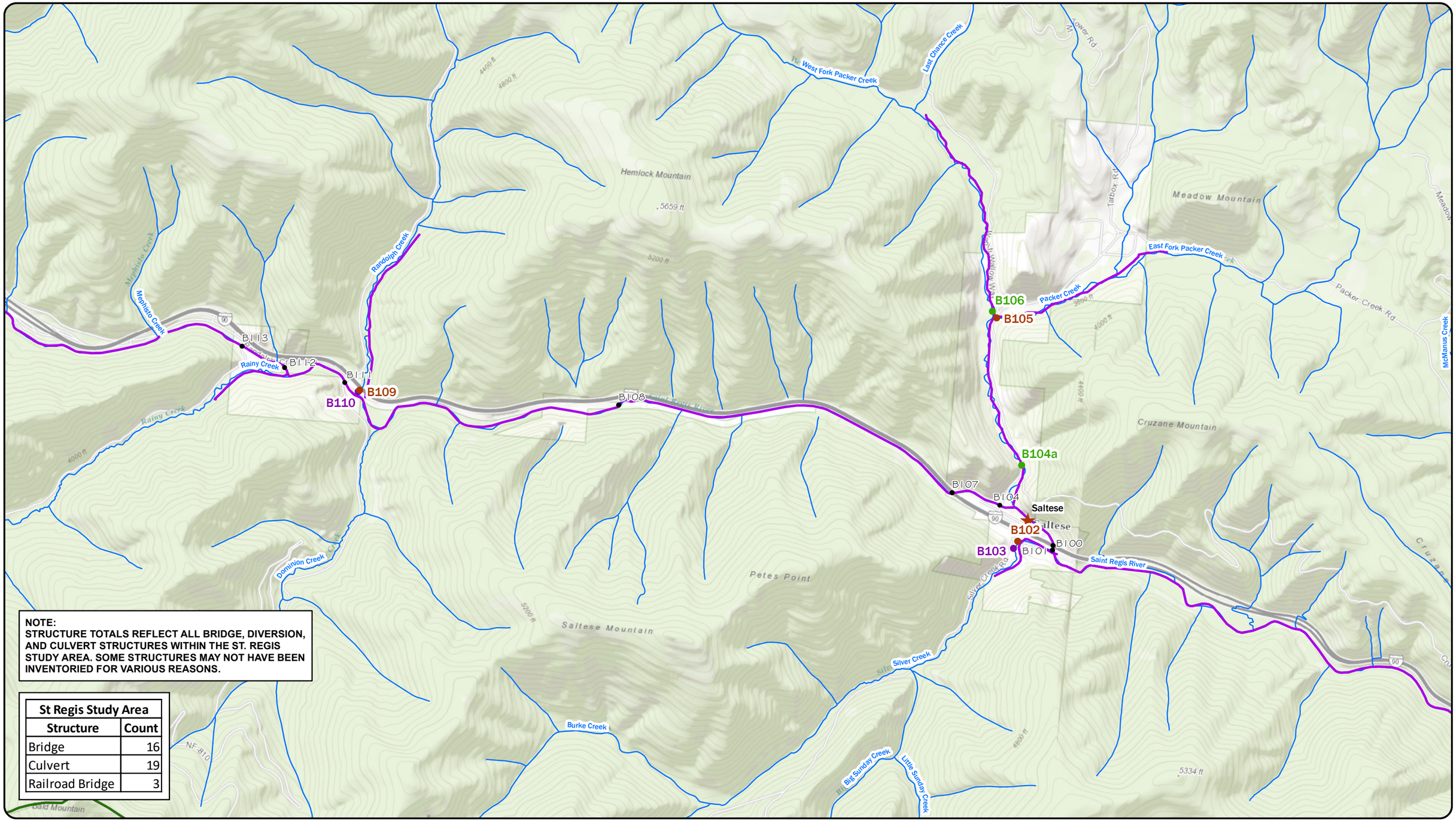

NOTE:
STRUCTURE TOTALS REFLECT ALL BRIDGE, DIVERSION, AND CULVERT STRUCTURES WITHIN THE ST. REGIS STUDY AREA. SOME STRUCTURES MAY NOT HAVE BEEN INVENTORIED FOR VARIOUS REASONS.

St Regis Study Area	
Structure	Count
Bridge	16
Culvert	19
Railroad Bridge	3

LEGEND

- BRIDGE
- CULVERT
- DIVERSION
- RAILROAD BRIDGE
- SURVEYED STRUCTURE
- TOWNS
- MINERAL COUNTY BOUNDARY
- SAINT REGIS STUDY AREA
- STREAMS

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DISPLAYED AS:
PROJECTION/ZONE: MSP NAD83
DATUM: NAVD88
UNITS: INTL. FEET
SOURCE: PIONEER/DNRC/USGS

0 0.25 0.5 1
Miles

FIGURE 5

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY
STRUCTURE INVENTORY
ST. REGIS STRUCTURES

DATE: 5/16/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\STRGS-GI-PLN-005-17.mxd

4 SUMMARY/OVERVIEW

Pioneer completed a field reconnaissance and hydraulic structure assessment for select tributaries along the entire length of the St. Regis River from its mouth at the Clark Fork River near the town of St. Regis, Montana, to the headwaters near Lookout Pass east of the Montana-Idaho border. The tributaries investigated included Hanaker Creek, Denna Mora Creek, Rainy Creek, Randolph Creek, Silver Creek, Packer Creek, Timber Creek, Savanac Creek, Big Creek, Deer Creek, Twin Creek, Twelvemile Creek, and Little Joe Creek. Information collected from this investigation will support future floodplain studies.

The team began field activities at Randolph Creek (a tributary to the St. Regis River near Taft, Montana) on December 5, 2016, progressed downstream of the St. Regis River, and finished on December 6, 2016, at Little Joe Creek near St. Regis, Montana. In total, 37 structures were inventoried. Structure-specific attributes were collected using a Juniper Mesa 2 Geo tablet with GPS using Collector for ArcGIS.

4.1 Backwater Potential

To establish the backwater potential for all structures, the team rated each structure from 'Low' to 'High' for its potential to create a backwater condition, as described in Section 3.3. **Table 1** summarizes the backwater potential for the inventoried structures.

Table 1. Backwater Potential Summary

Backwater Potential Rating	Inventoried Bridges[1]	Percent of Total (%)[2]	Inventoried Culverts	Percent of Total (%)[2]
High	0	0%	5	28%
Moderate	10	53%	6	33%
Low	8	42%	7	39%
Other*	1	5%	0	0%
Total	19	100%	18	100%

[1] Includes five railroad bridges.
[2] Total may not sum to 100% due to rounding.
*See Section 3.3.
Note: Table reflects all inventoried structures within the study area. The table does not include structures that were not inventoried.

Per the table, no bridges were rated as 'High' backwater potential, 53% were rated as 'Moderate' (indicating slightly elevated road grades or abutments with a moderate degree of encroachment), and approximately 42% of the bridges were rated as 'Low.' The railroad bridge B103 was rated as 'Other' (no backwater potential) due to the extreme size and height of the structure in comparison to the tributary of interest (Silver Creek).

The culverts inventoried were nearly equally split between each rating for backwater potential. Approximately 28% of the culverts were rated as 'High' due to elevated interstate and/or

frontage road grades significantly constricting floodplain conveyance, 33% were rated as 'Moderate' due to slightly elevated road grades, and the remaining 39% of culverts were rated as 'Low.'

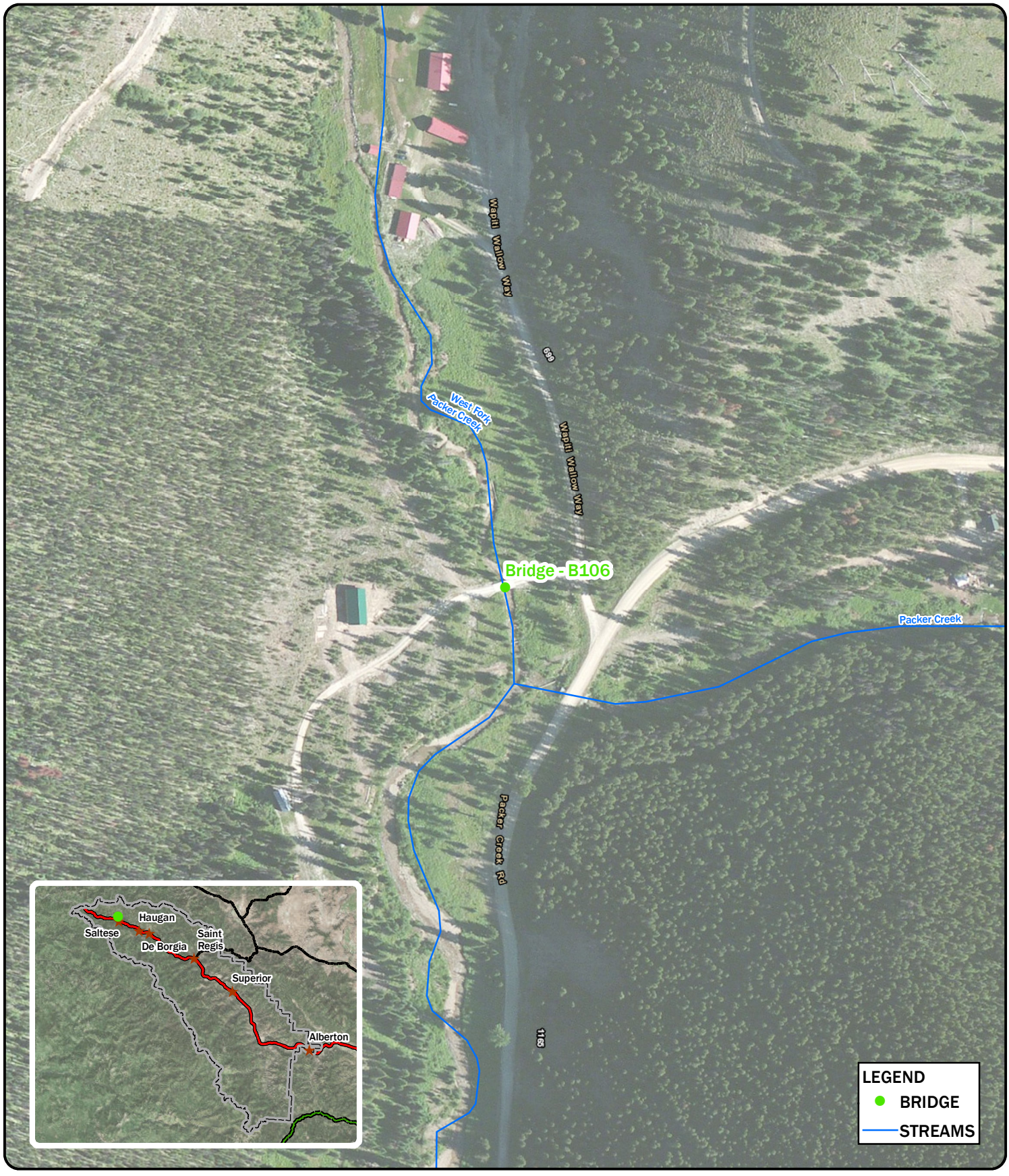
4.2 Supporting Information

All landowner, county, and MDT notification letters are provided in **Appendix A**. The structure inventory data are presented in **Appendix B**, and raw field data recorded in logbooks are provided in **Appendix C**. As discussed previously in Section 3, some structures could not be identified or may have missing information; consequently, the information in **Appendix B** for those structures may be incomplete. Structure as-built information and additional remedial structure plans obtained from MDT, Mineral County, USFS, and/or Montana Rail Link is provided in **Appendix D**.

4.3 Project Database

In addition to this report, Pioneer constructed a project ESRI Geographic Information System (GIS) database as a digital work product. Following completion of fieldwork, the structure attributes were transferred to a final ESRI geodatabase. The geodatabase provides a spatial view of the structures, and includes all structure attributes and photographs collected as well as additional supporting information. After importing the data into ArcGIS, the IDENTIFY tool may be used to display attributes and attachments for each structure. Within the database, photographs, aerial views, and where applicable, as-built drawings of the structures are provided in an attached PDF file. An example PDF for bridge structure B106 is shown in **Figures 6-8**.

Figure 6. Mineral County Structure Inventory B106: 1 of 3



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B106

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY
STRUCTURE INVENTORY
B106

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

Figure 7. Mineral County Structure Inventory B106: 2 of 3

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B106_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B106_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

Figure 8. Mineral County Structure Inventory B106: 3 of 3

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B106_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B106_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County

Appendix A

Notification Letters and Logs

PIONEER TECHNICAL SERVICES, INC.

Engineering and Environmental Services

November 2016

Dear Landowner along the St. Regis and/or Clark Fork River,

We are writing to inform you that the Montana Department of Natural Resources and Conservation (DNRC) has hired our firm to complete a bridge and diversion structure inventory and conduct survey work along the St. Regis and Clark Fork Rivers. The work will ultimately help to update and increase the accuracy of the floodplain mapping along selected reaches of these rivers. We will survey channel cross sections approximately every 1,000 feet over a 36-mile stretch of the St. Regis River, and collect basic information on bridges and diversion structures for the main stem and select tributaries of the St. Regis and Clark Fork Rivers to develop a hydraulic structure inventory. The inventory will cover the entire 58 miles of the Clark Fork River and 36 miles of the St. Regis River within Mineral County (area noted in the image below).

We are sending you this courtesy notice because you have been identified as a landowner along the river channel in the study area. Our survey personnel will start the work in the middle of November and continue working as long as weather permits. If we do not get to your property before cold weather shuts down the work, we will send a follow up letter in the spring to inform you that work has started again. We plan to survey or collect information approximately 50 feet beyond the water's edge at each cross section, bridge, or diversion structure. If you do not wish for our survey personnel to enter your property, please notify us using the contact information below. If you would like to be contacted on your cell phone or via email prior to the survey personnel accessing your property, please provide that contact information to one of the project contacts listed below.

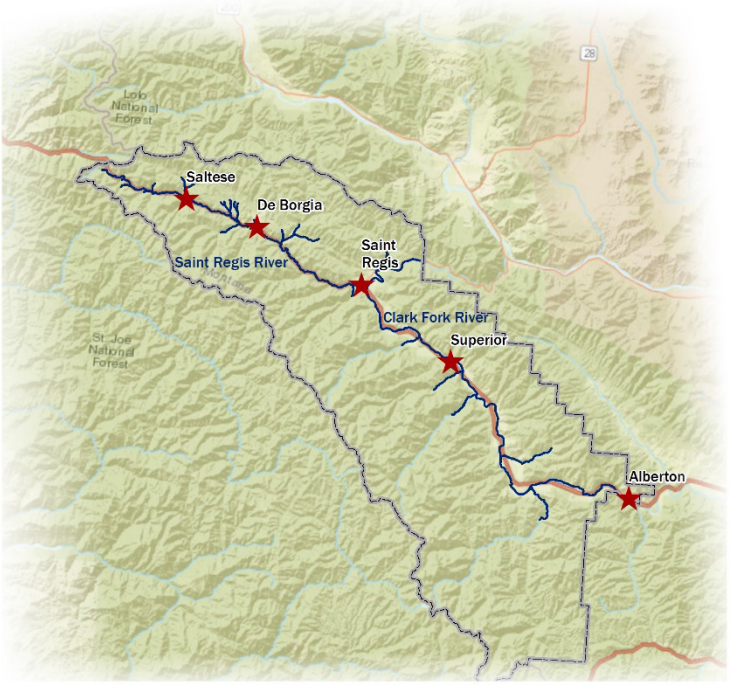
Thank you for your time. If you have any questions or comments, please direct all correspondence to the following:

Department of Natural Resources and Conservation (DNRC)

Tiffany Lyden, Outreach Specialist
DNRC Floodplain Management Program
1424 9th Ave.
Helena, MT 59601
tlyden@mt.gov (406) 444-0599

Pioneer Technical Services, Inc.

George Austiguy P.E., Senior Project Manager
106 Pronghorn Trail
Bozeman, MT 59718
gaustiguy@pioneer-technical.com (406) 723-1981



PIONEER TECHNICAL SERVICES, INC.

Engineering and Environmental Services

January 2017

Montana Department of Transporation
Attn: Ken Barnes
PO Box 201001
Helena, MT 59620-1001

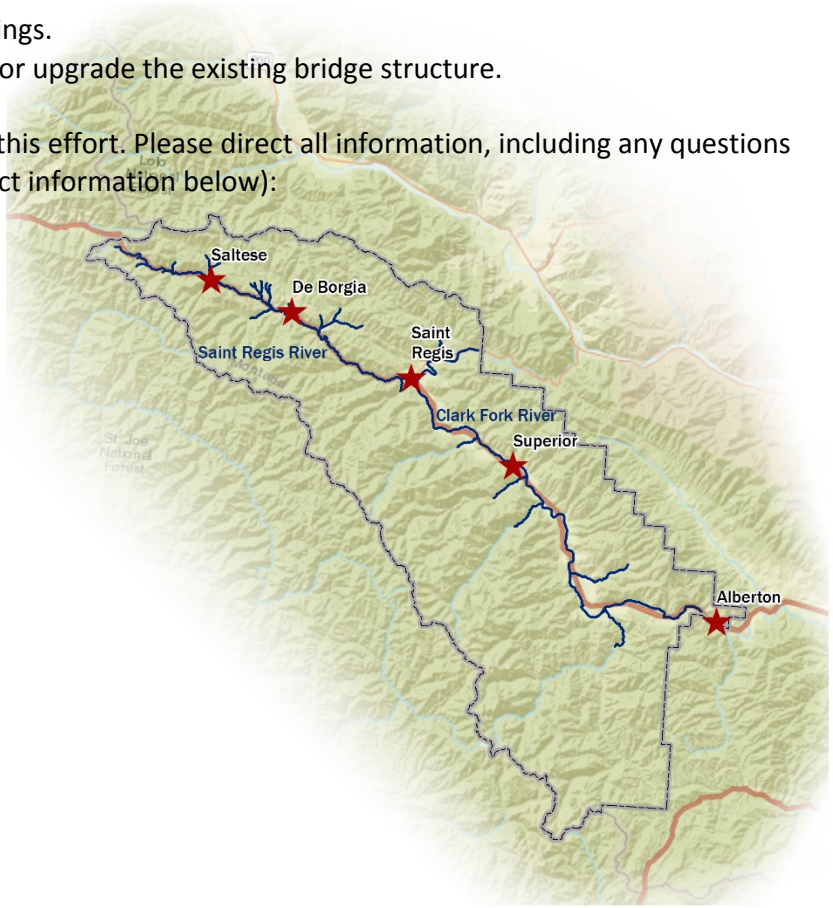
Attention Montana Department of Transportation,

The Montana Department of Natural Resources and Conservation (DNRC) has hired our firm to complete a bridge and diversion structure inventory and conduct survey work along the Clark Fork and St. Regis Rivers and their tributaries. The work will ultimately help refine the current floodplain mapping of these rivers. A major part of the work is to collect basic information on bridges and diversion structures to develop a hydraulic structure inventory. The inventory covers the entire 58 miles of the Clark Fork River and 36 miles of the St. Regis River within Mineral County (area noted in the image below).

Attached is a list and figure identifying the river structures that may be under your jurisdiction within the project area. We are requesting additional information on these structures, specifically:

- A copy of the As-Built Drawings.
- Any future plans to replace or upgrade the existing bridge structure.

We appreciate your participation in this effort. Please direct all information, including any questions or comments, to Mr. Emmert (contact information below):



Sincerely,

Pioneer Technical Services, Inc.

Contact:

J.D. Emmert, P.E.
Senior Engineer
106 Pronghorn Trail
Suite A
Bozeman, MT 59718
jemmert@pioneer-technical.com
(406) 723-1982

River/Creek Name	Structure Type	Road Name	Notes
Clark Fork and St. Regis	Bridge	I-90	**36** Interstate crossings in Mineral County
Clark Fork	Bridge	Southside Crossing	Off Exit #43 to Southside Crossing
Dry Creek	Bridge	South Side Road	Off Exit #43 to Southside Road
Dry Creek	Bridge	Flying H Lane	Off Exit #43 to Flying H Road
Clark Fork	Bridge	Old Highway 10	Off Exit #70 heading N on Old Highway 10
East Twin Creek	Bridge	Haugan Deborgia E/ Frontage Road	Off Exit #18 to Frontage Road heading NE
Clark Fork	Bridge	South Frontage Road West	Off Exit #77 to Frontage Road East heading SE
Clark Fork	Bridge	Old Highway 10 W	Off Exit #66 to Old Highway 10
Clark Fork	Bridge	Lozeau Crossover Road	Off Exit #55 to Lozeau Crossover Road, bridge before Mullan Road East
Clark Fork	Bridge	River Street	Off Exit #47 to River Street in Superior Heading N
Clark Fork	Bridge	Old Highway 10	Off Exit #33 to MT 135,to Old Highway 10
Tamarack Creek	Bridge	HW 135	Off Exit #33 to MT 135, culvert before Tamarack Creek Road turnoff
Tamarack Creek	Bridge	Tamarack Creek Road	Off Exit #33 to MT 135, 2 miles down Tamarack Creek Road
Cedar creek	Bridge	Diamond Match Road	Off Exit #47 to Diamond Match Road Heading SW
Trout Creek	Bridge	Trout Creek Road	Off Exit #47 to Diamond Match Road Heading SW
Nemote Creek	Bridge	Nemote Creek Road 454	Off Exit #61 to Tarkio Loop, NE on Nemote Creek Road
Nemote Creek	Bridge	Round Mountain Road	Off Exit #61 to Tarkio Loop, NW to South Fork Nemote Creek Road
Nemote Creek	Bridge	South Fork Nemote Creek Road	Off Exit #61 to Tarkio Loop, NW to South Fork Nemote Creek Road
Nemote Creek	Bridge	South Fork Nemote Creek Road	Off Exit #61 to Tarkio Loop, NW to South Fork Nemote Creek Road
Nemote Creek	Bridge	S Fork Nemote Creek Road access Road	Access Road after Messiah Way off South Fork Nemote Creek Road
Nemote Creek	Bridge	Sheridan Road	Sheridan Road off South Fork Nemote Creek Road
Nemote Creek	Bridge	Frontage Road/Mullan Road East	Off Exit #61 to 1.5 miles down Mullan Road East
St. Regis	Bridge	Old Highway 10	Off Exit #33 to Old Highway 10 heading W
St. Regis	Bridge	Little Joe Road	Off Exit #33 to Old Highway 10 heading W to Little Joe Road
St. Regis	Bridge	2 mile Road	Off Exit #30 to Two Mile Creek Road heading W
St. Regis	Bridge	Entrance to Interstate	Entrance to Interstate at Exit #16
Timber Creek	Bridge	Timber Creek Road	Off Exit #16 to Frontage Road to Timber Creek Road
St. Regis	Bridge	Access Road off Exit #10	Off Exit #10 to Silver Creek Road heading south to Access Road
St. Regis	Bridge	Packer Creek Road	Off Exit #10 to Frontage Road heading NW to Packer Creek Road
Packer Creek	Bridge	Packer Creek Road	Off Exit #10 to Frontage Road heading NW to Packer Creek Road

MDT BRIDGES IN MINERAL COUNTY	
STRUCTURE	**COUNT***
I-90 BRIDGE	36
OTHER BRIDGE/CULVERT	29
**TOTAL COUNT FOR FIGURE 1 & 2*	

LEGEND

- MINERAL COUNTY BOUNDARY
- MDT STRUCTURES
- OTHER ROAD
- INTERSTATE 90
- MT HIGHWAY 135
- RIVER/STREAM

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD1983
UNITS: INT'L FEET
SOURCE: ESRI/MSL/PIONEER

0 5,500 11,000 22,000
Feet

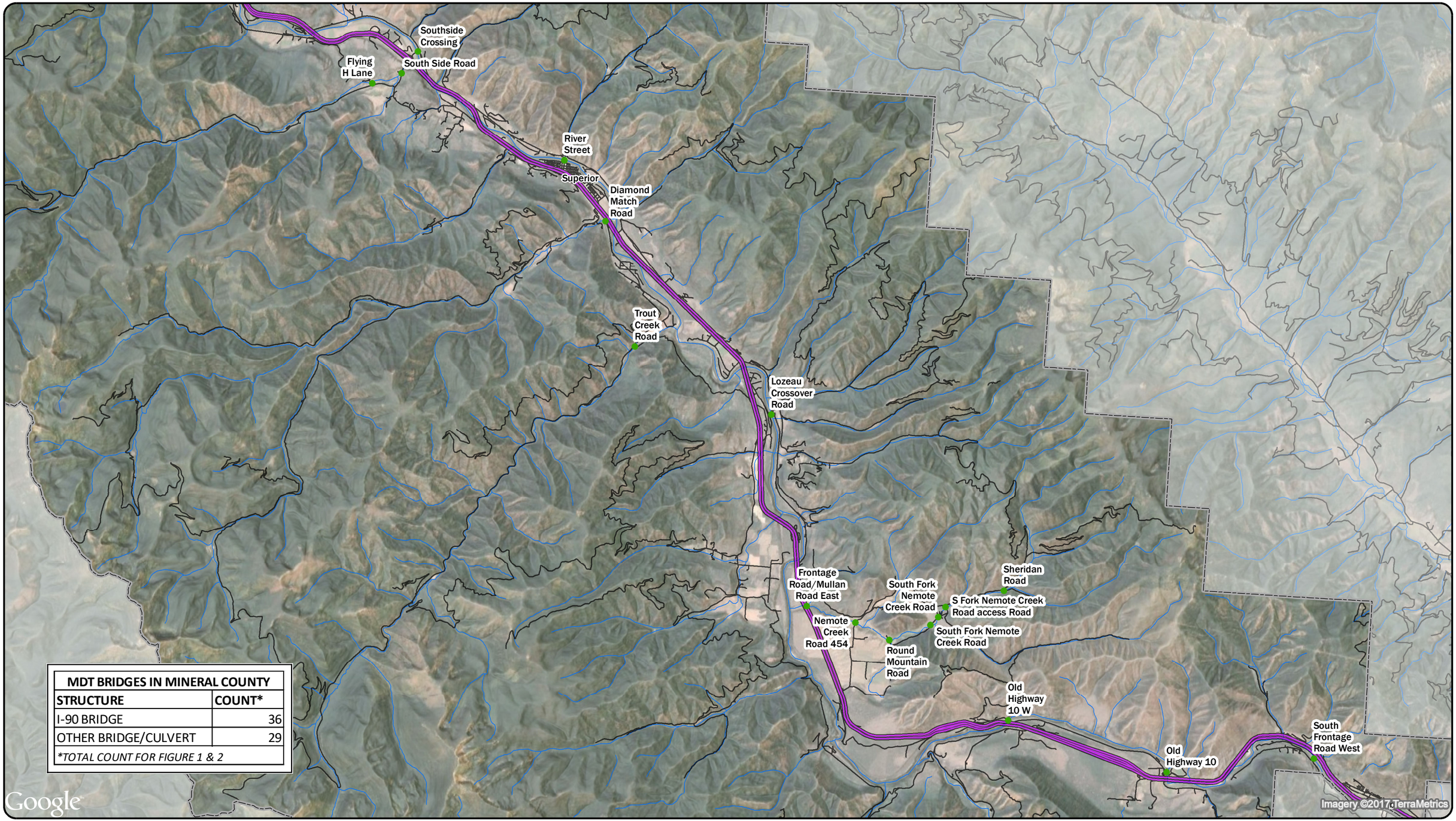
FIGURE 1

MINERAL COUNTY
MDT BRIDGES

PIONEER TECHNICAL SERVICES, INC.

DATE: 1/13/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-MDT-GIS-PLN-001-17.mxd



MDT BRIDGES IN MINERAL COUNTY	
STRUCTURE	COUNT*
I-90 BRIDGE	36
OTHER BRIDGE/CULVERT	29
*TOTAL COUNT FOR FIGURE 1 & 2	

LEGEND

- MINERAL COUNTY BOUNDARY
- INTERSTATE 90
- MDT STRUCTURES
- RIVER/STREAM
- OTHER ROAD

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD1983
UNITS: INT'L FEET
SOURCE: ESRI/MSL/PIONEER

0 5,500 11,000 22,000
Feet

FIGURE 2

MINERAL COUNTY
MDT BRIDGES

PIONEER TECHNICAL SERVICES, INC.

DATE: 1/13/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-MDT-GIS-PLN-002-17.mxd

PIONEER TECHNICAL SERVICES, INC.

Engineering and Environmental Services

January 2017

Mineral County Road Department
595 Diamond Match Road
PO Box 97
Superior, MT 59872

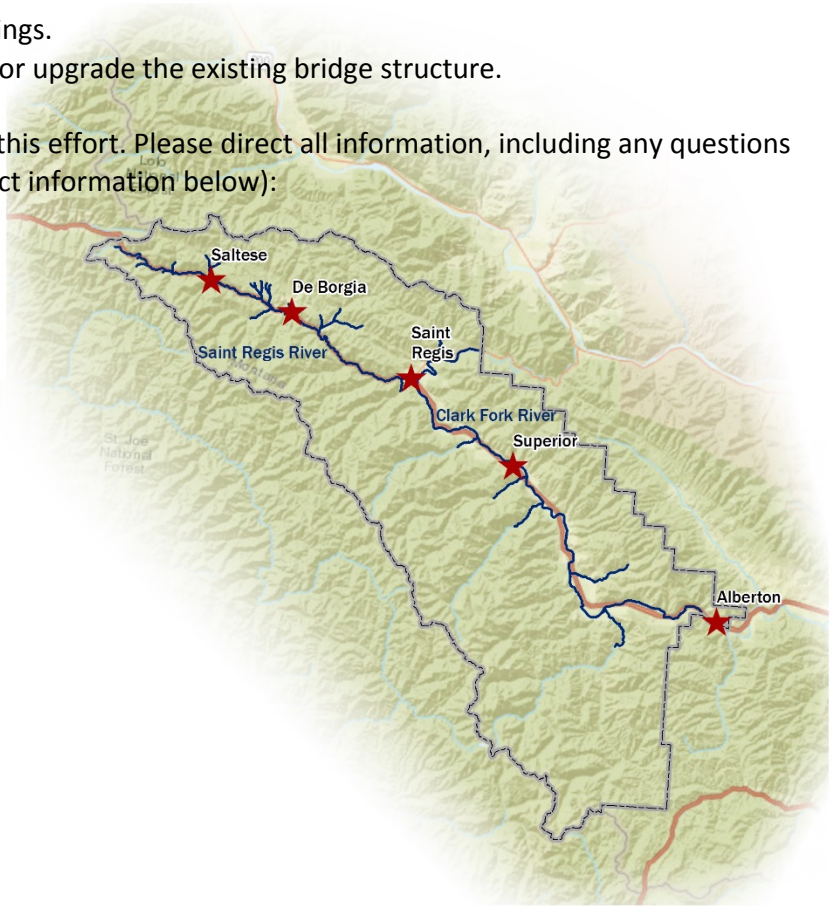
Attention Mineral County Road Department,

The Montana Department of Natural Resources and Conservation (DNRC) has hired our firm to complete a bridge and diversion structure inventory and conduct survey work along the Clark Fork and St. Regis Rivers and their tributaries. The work will ultimately help refine the current floodplain mapping of these rivers. A major part of the work is to collect basic information on bridges and diversion structures to develop a hydraulic structure inventory. The inventory covers the entire 58 miles of the Clark Fork River and 36 miles of the St. Regis River within Mineral County (area noted in the image below).

Attached is a list and figure identifying the river structures that may be under your jurisdiction within the project area. We are requesting additional information on these structures, specifically:

- A copy of the As-Built Drawings.
- Any future plans to replace or upgrade the existing bridge structure.

We appreciate your participation in this effort. Please direct all information, including any questions or comments, to Mr. Emmert (contact information below):



Sincerely,

Pioneer Technical Services, Inc.

Contact:

J.D. Emmert, P.E.
Senior Engineer
106 Pronghorn Trail
Suite A
Bozeman, MT 59718
jemmert@pioneer-technical.com
(406) 723-1982

River/Creek Name	Structure Type	Road Name	Notes
Clark Fork	Bridge	Southside Crossing	Off Exit #43 to Southside Crossing
Dry Creek	Bridge	South Side Road	Off Exit #43 to Southside Road
Dry Creek	Bridge	Flying H Lane	Off Exit #43 to Flying H Road
East Twin Creek	Bridge	Haugan Deborgia E/ Frontage Road	Off Exit #18 to Frontage Road heading NE
Clark Fork	Bridge	Lozeau Crossover Road	Off Exit #55 to Lozeau Crossover Road, bridge before Mullan Road East
Trout Creek	Bridge	Trout Creek Road	Off Exit #47 to Diamond Match Road Heading SW
Nemote Creek	Bridge	Round Mountain Road	South Fork Nemote Creek Road heading NW to Round Mountain Road
Nemote Creek	Bridge	South Fork Nemote Creek Road	Off Exit #61 to Tarkio Loop, NW to South Fork Nemote Creek Road
Nemote Creek	Bridge	South Fork Nemote Creek Road	Off Exit #61 to Tarkio Loop, NW to South Fork Nemote Creek Road
Nemote Creek	Bridge	South Fork Nemote Creek Road Access Road	Access Road after Messiah Way off South Fork Nemote Creek Road
Nemote Creek	Bridge	Sheridan Road	Sheridan Road off South Fork Nemote Creek Road
Rock Creek	Bridge	Mullan Gulch Road	Off Exit #22 to Mullan Gulch Road heading NE
Rock Creek	Bridge	Rock Creek Road	Off Exit #22 to Mullan Gulch Road heading NE to Rock Creek Road
12 Mile Creek	Bridge	12 Mile Road	Off Exit #22 to Mullan Gulch Road heading NE just after Cabin Loop turnoff
12 Mile Creek	Bridge	Old Mullan Road	Off Exit #22 to Mullan Gulch Road heading NE
12 Mile Creek	Bridge	Old Mullan Road	Off Exit #22 to Mullan Gulch Road heading NE
Big Creek	Bridge	Milwaukee Trail Road	Off Exit #18 to Coker lane to Milwaukee Trail Road
Big Creek	Bridge	McGee Dr	Off Exit #18 to Coker lane to Milwaukee Trail Road to McGee Drive
Big Creek	Bridge	East Big Creek Lane	Off Exit #18 to Coker lane to Milwaukee Trail Road to Big Creek Lane
St. Regis	Bridge	Access Road off Exit #10	Off Exit #10 to Silver Creek Road heading S to Access Road
Silver Creek	Bridge	Lohr Lane	Off Exit #10 to Silver Creek Road heading S to Lohr Lane
Silver Creek	Bridge	Milwaukee Trail Road	Off Exit #10 to Silver Creek Road heading S to Milwaukee Trail Road
St. Regis	Bridge	Access Road off Randolf Creek Road	Off Exit #5 to Hanaker Creek Road to Rainy Creek Road

BRIDGES IN MINERAL COUNTY	
STRUCTURE	COUNT*
CITY/COUNTY	23
*TOTAL COUNT FOR FIGURE 1 & 2	

LEGEND

- MINERAL COUNTY BOUNDARY
- MDT STRUCTURES
- OTHER ROAD
- INTERSTATE 90
- MT HIGHWAY 135
- RIVER/STREAM

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD1983
UNITS: INT'L FEET
SOURCE: ESRI/MSL/PIONEER

0 5,500 11,000 22,000
Feet

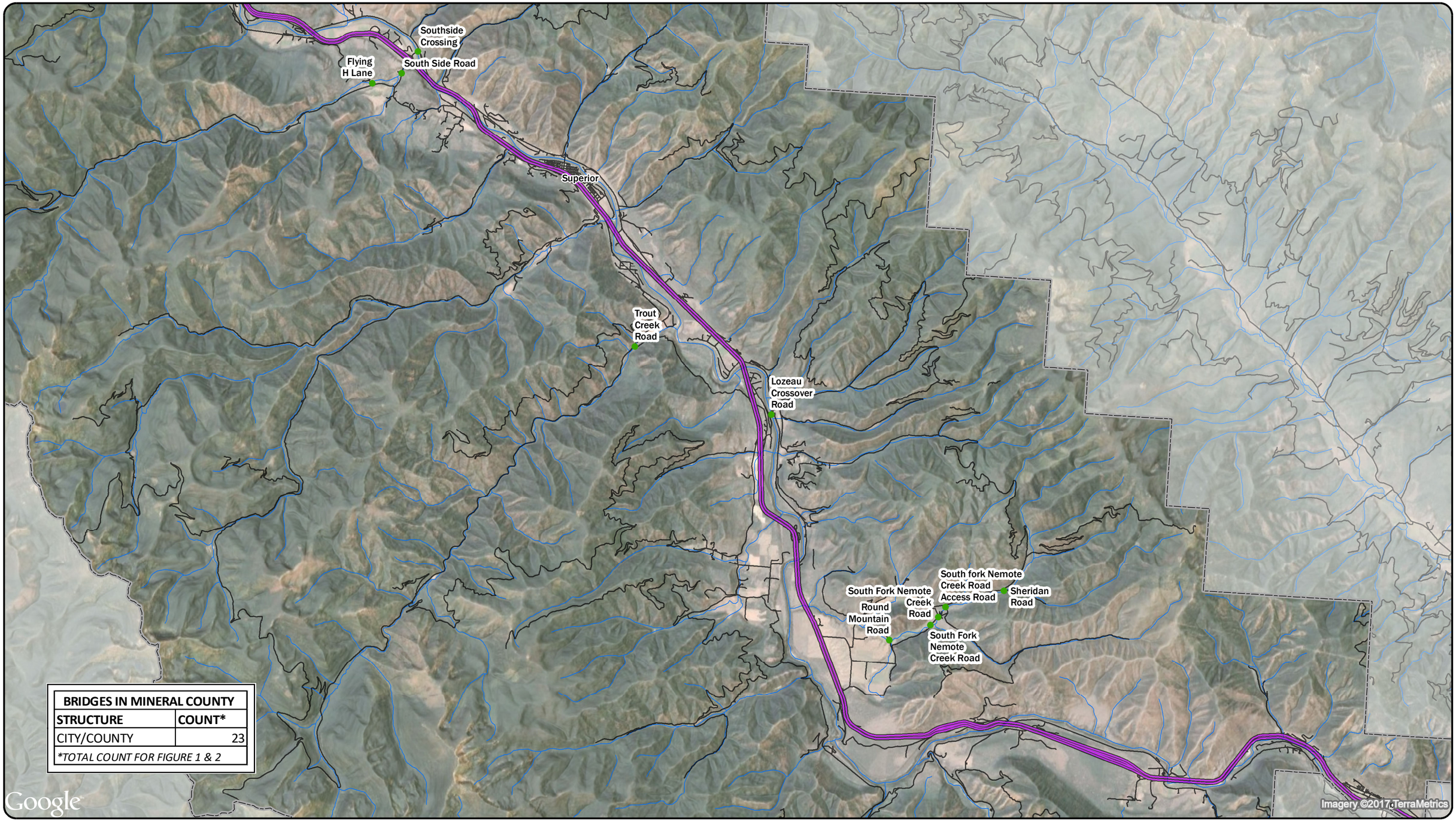
FIGURE 1

MINERAL COUNTY
CITY/COUNTY BRIDGES

PIONEER TECHNICAL SERVICES, INC.

DATE: 1/13/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-CTY-GIS-PLN-001-17.mxd



BRIDGES IN MINERAL COUNTY	
STRUCTURE	COUNT*
CITY/COUNTY	23
*TOTAL COUNT FOR FIGURE 1 & 2	

LEGEND

- MINERAL COUNTY BOUNDARY
- INTERSTATE 90
- MDT STRUCTURES
- RIVER/STREAM
- OTHER ROAD

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD1983
UNITS: INT'L FEET
SOURCE: ESRI/MSL/PIONEER

0 5,500 11,000 22,000
Feet

FIGURE 2

MINERAL COUNTY
CITY/COUNTY BRIDGES

PIONEER TECHNICAL SERVICES, INC.

DATE: 1/13/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-CTY-GIS-PLN-002-17.mxd

PIONEER TECHNICAL SERVICES, INC.

Engineering and Environmental Services

January 2017

Lolo National Forest Superior Ranger District
Attn: Carole Johnson & Nate Kegel
PO Box 460
209 West Riverside
Superior, MT 59872

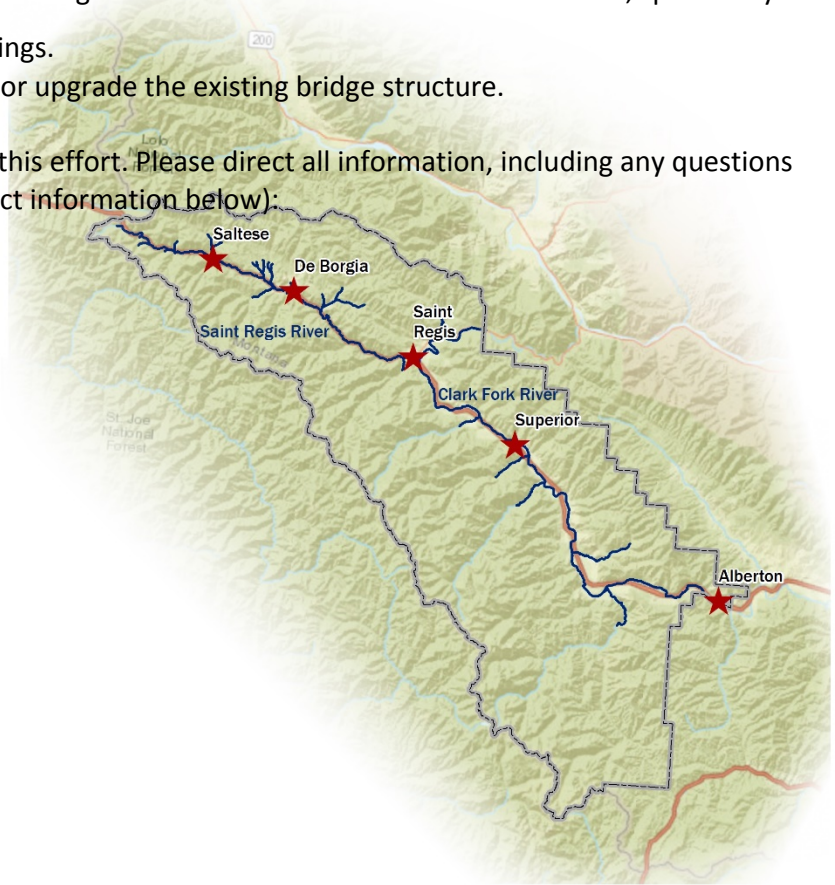
Attention Lolo National Forest Supervisor's Office,

The Montana Department of Natural Resources and Conservation (DNRC) has hired our firm to complete a bridge and diversion structure inventory and conduct survey work along the Clark Fork and St. Regis Rivers and their tributaries. The work will ultimately help refine the current floodplain mapping of these rivers. A major part of the work is to collect basic information on bridges and diversion structures to develop a hydraulic structure inventory. The inventory covers the entire 58 miles of the Clark Fork River and 36 miles of the St. Regis River within Mineral County (area noted in the image below).

Attached is a list and figure identifying the river structures that may be under your jurisdiction within the project area. We are requesting additional information on these structures, specifically:

- A copy of the As-Built Drawings.
- Any future plans to replace or upgrade the existing bridge structure.

We appreciate your participation in this effort. Please direct all information, including any questions or comments, to Mr. Emmert (contact information below):



Sincerely,

Pioneer Technical Services, Inc.

Contact:

J.D. Emmert, P.E.
Senior Engineer
106 Pronghorn Trail
Suite A
Bozeman, MT 59718
jemmert@pioneer-technical.com
(406) 723-1982

River/Creek Name	Structure Type	Road Name	Notes
East Twin Creek	Bridge	Milwaukee Trail Road	Off Exit #18 to Milwaukee Trail Road
Cedar creek	Bridge	Lynch Ranch Lane	Off Exit #47 to Lynch Ranch Lane
Cedar creek	Bridge	Forrest Service 8923	Off Exit #47 to Upham Gulch Road
Little Joe Creek	Bridge	Off Little Joe Road	Off Exit #33 to Old Highway 10 heading W to Little Joe Road
St. Regis	Bridge	Route 889	Off Exit #26 to Ward Creek Road heading S
12 mile creek	Bridge	Off 12 Mile Road	Off Exit #22 to Twelve Mile Creek turnoff , then to Access Road on left
St. Regis	Bridge	Milwaukee Trail Road	Off Exit #22 to Access Road heading W along Interstate to Milwaukee Trail Road
St. Regis	Bridge	Deer Creek Road	Off Exit #18 to Coker lane to Deer Creek Road
St. Regis	Bridge	Milwaukee Trail Road	Off Exit #18 to Coker lane to Milwaukee Trail Road
Big Creek	Bridge	Milwaukee Trail Road	Off Exit #18 to Coker lane to Milwaukee Trail Road
Big Creek	Bridge	Big Creek Road	Off Exit #18 to Coker lane to Milwaukee Trail Road to Big Creek Road
Big Creek	Bridge	Big Creek Road	Off Exit #18 to Coker lane to Milwaukee Trail Road to Big Creek Road
Savanac Creek	Bridge	Savanac Creek Road	Off Exit #16 to frontage Road to Savanac Creek Road
Savanac Creek	Bridge	Drive off Savanac Creek Road	Private Drive Off north side of Savanac Creek Road
Timber Creek	Bridge	Timber Creek Road	Exit #16 culvert on De Borgia Frontage Road to Timber Creek Road veering NW
Timber Creek	Bridge	East Fork Timber Creek Road	Off Exit #16 to frontage Road to east fork of Timber creek Road
St. Regis	Bridge	Randolf Creek	Old Railroad Crossing 3 miles past Exit #10
Randolf Creek	Bridge	Randolf Creek	Old Railroad Crossing 1 mile E of Exit #5
St. Regis	Bridge	Dominion Creek Road	Rainy Creek Road off Exit #5 to Access Road
St. Regis	Bridge	Access Road off Randolf Creek Road	Off Exit #5 to Hanaker Creek Road to Rainy Creek Road
St. Regis	Bridge	Rainy Creek Road	Off Exit #5 to Hanaker Creek Road heading W, to Denna Mora Creek Road
St. Regis	Bridge	Denna Mora Creek Road	Off Exit #5 to Hanaker Creek Road heading W, past Denna Mora Creek Road
St. Regis	Bridge	Denna Mora Creek Road	Off Exit #5 to Hanaker Creek Road heading W, to Denna Mora Creek Road
St. Regis	Bridge	Hawker Creek Road	Old Railroad crossing 3 miles W of Exit #5
St. Regis	Bridge	Northern Pacific Trail	Old Railroad crossing 3.5 miles W of Exit #5

BRIDGES IN MINERAL COUNTY	
STRUCTURE	COUNT*
USFS	25
*TOTAL COUNT FOR FIGURE 1 & 2	

LEGEND

- MINERAL COUNTY BOUNDARY
- MDT STRUCTURES
- OTHER ROAD
- INTERSTATE 90
- RIVER/STREAM

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD1983
UNITS: INT'L FEET
SOURCE: ESRI/MSL/PIONEER

0 4,500 9,000 18,000
Feet

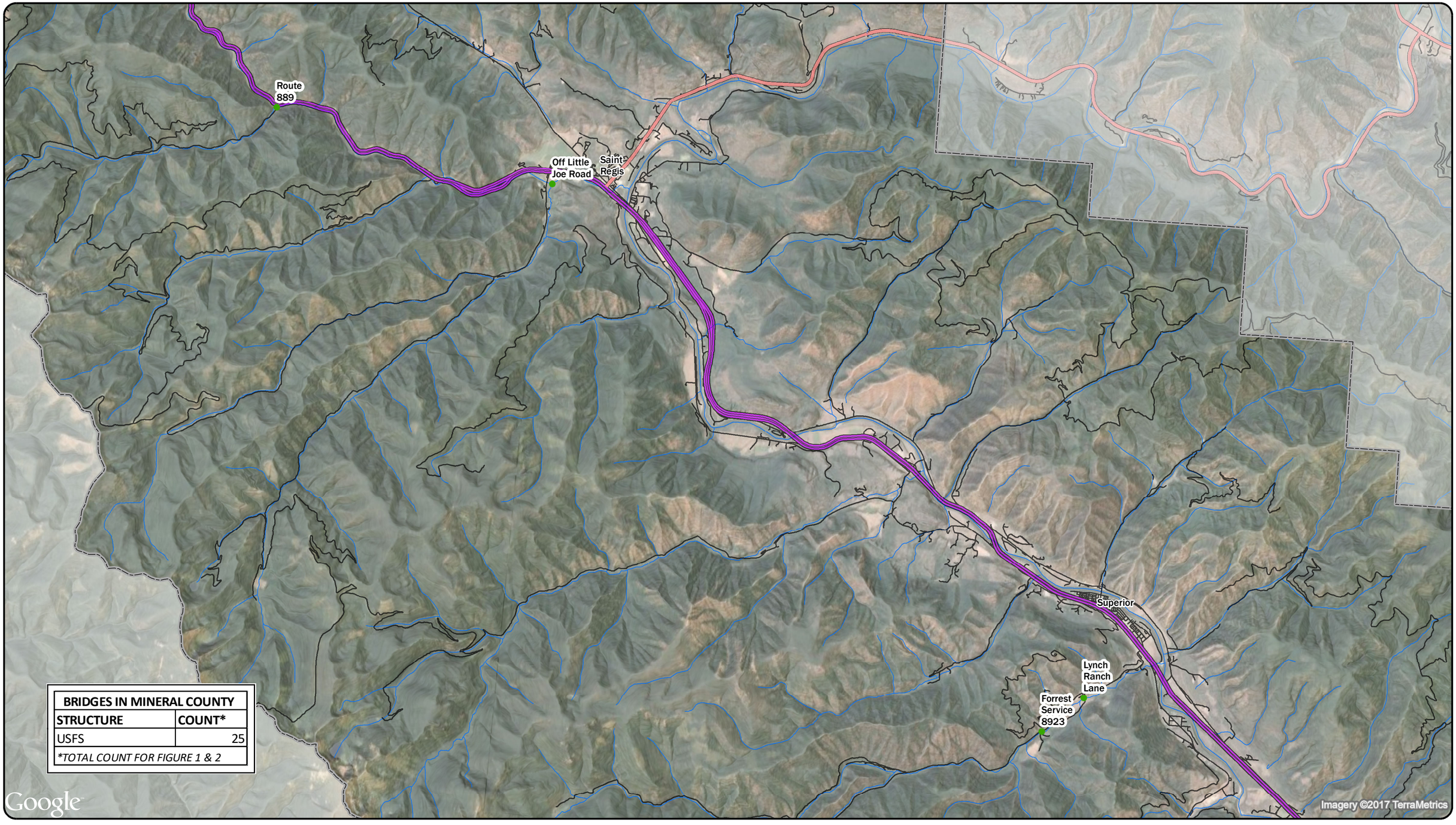
FIGURE 1

MINERAL COUNTY
USFS BRIDGES

PIONEER TECHNICAL SERVICES, INC.

DATE: 1/13/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-USFS-GIS-PLN-001-17.mxd



BRIDGES IN MINERAL COUNTY	
STRUCTURE	COUNT*
USFS	25
*TOTAL COUNT FOR FIGURE 1 & 2	

LEGEND

- MINERAL COUNTY BOUNDARY
- MDT STRUCTURES
- OTHER ROAD
- INTERSTATE 90
- MT HIGHWAY 135
- RIVER/STREAM

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD1983
UNITS: INT'L FEET
SOURCE: ESRI/MSL/PIONEER

0 4,500 9,000 18,000
Feet

FIGURE 2

MINERAL COUNTY
USFS BRIDGES

PIONEER TECHNICAL SERVICES, INC.

DATE: 1/13/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-USFS-GIS-PLN-002-17.mxd

PIONEER TECHNICAL SERVICES, INC.

Engineering and Environmental Services

January 2017

Montana Rail Link, Inc.
PO Box 16390
101 International Dr.
Missoula, MT 59808

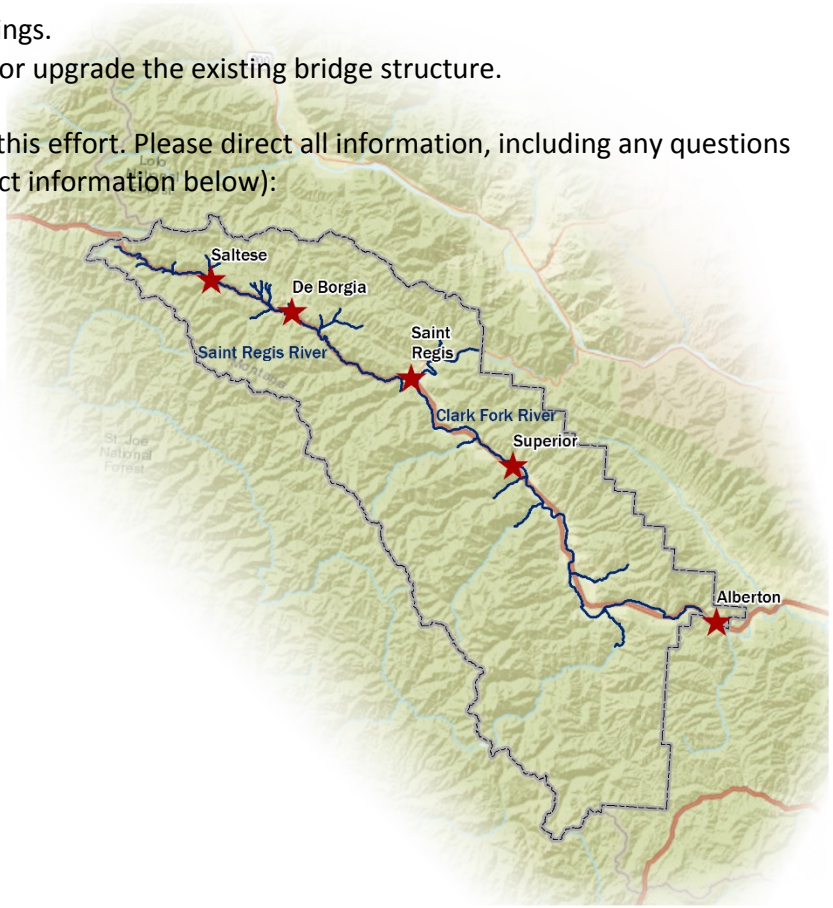
Attention Montana Rail Link,

The Montana Department of Natural Resources and Conservation (DNRC) has hired our firm to complete a bridge and diversion structure inventory and conduct survey work along the Clark Fork and St. Regis Rivers and their tributaries. The work will ultimately help refine the current floodplain mapping of these rivers. A major part of the work is to collect basic information on bridges and diversion structures to develop a hydraulic structure inventory. The inventory covers the entire 58 miles of the Clark Fork River and 36 miles of the St. Regis River within Mineral County (area noted in the image below).

Attached is a list and figure identifying the river structures that may be under your jurisdiction within the project area. We are requesting additional information on these structures, specifically:

- A copy of the As-Built Drawings.
- Any future plans to replace or upgrade the existing bridge structure.

We appreciate your participation in this effort. Please direct all information, including any questions or comments, to Mr. Emmert (contact information below):



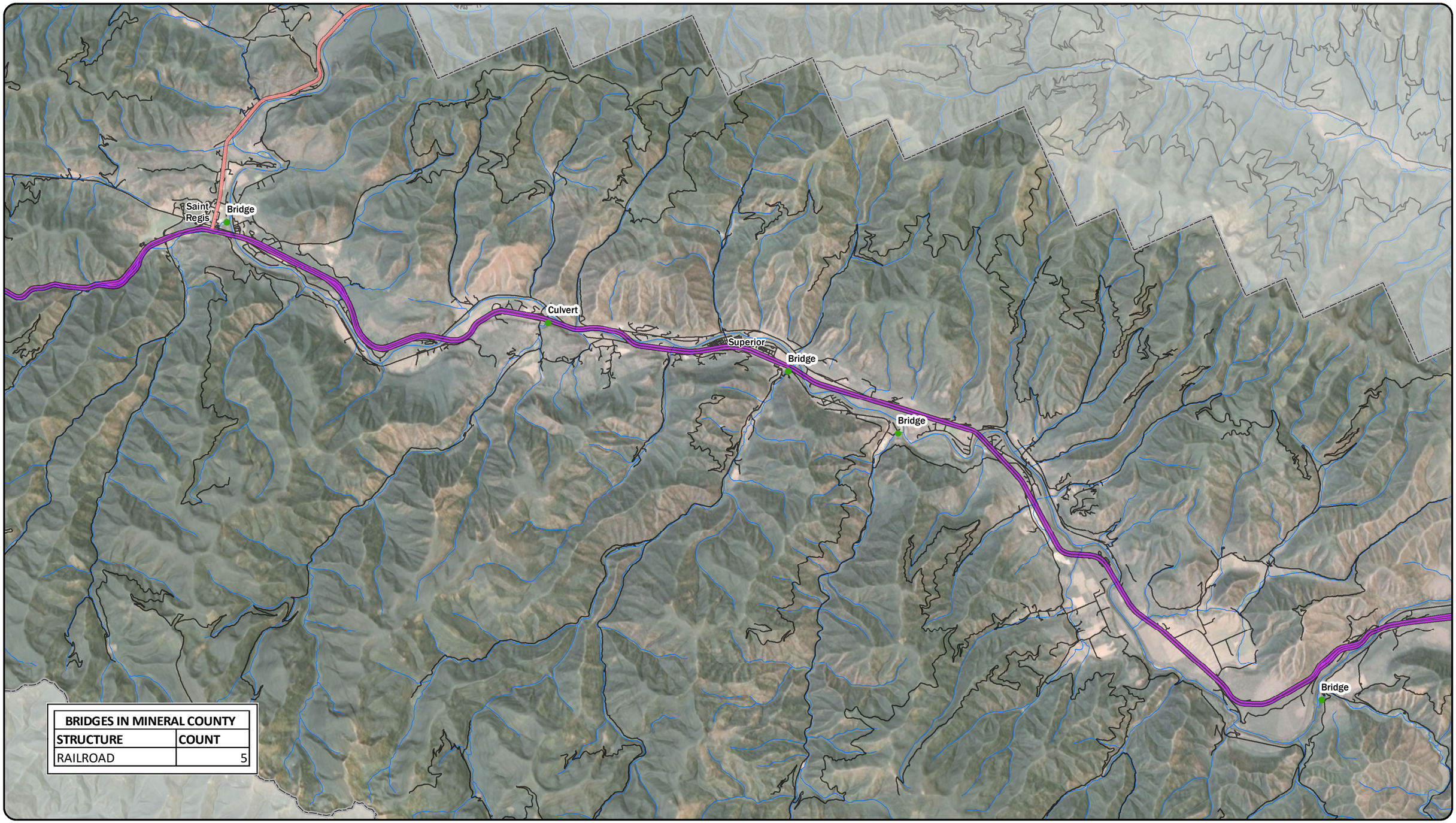
Sincerely,

Pioneer Technical Services, Inc.

Contact:

J.D. Emmert, P.E.
Senior Engineer
106 Pronghorn Trail
Suite A
Bozeman, MT 59718
jemmert@pioneer-technical.com
(406) 723-1982

River/Creek Name	Structure Type	Road Name	Notes
Dry Creek	Bridge	Railroad - Montana Rail Link	Railroad Crossing near Exit #43
Cedar Creek	Bridge	Railroad - Montana Rail Link	Off Exit #47 to Diamond Match Road Heading SE, just after Cedar Creek Road
Trout Creek	Bridge	Railroad - Montana Rail Link	Off Exit #55 to Cyr Iron Mountain Road heading E, near Grandview Lane
Fish Creek	Bridge	Railroad - Montana Rail Link	Off Exit #66, near Lower Fish Creek Road
St. Regis	Bridge	Railroad - Montana Rail Link	Off Exit #33 to old Highway 10 heading E towards river



LEGEND

- MINERAL COUNTY BOUNDARY
- MDT STRUCTURES
- OTHER ROAD
- INTERSTATE 90
- MT HIGHWAY 135
- RIVER/STREAM

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD1983
UNITS: INT'L FEET
SOURCE: ESRI/MSL/PIONEER

0 5,500 11,000 22,000
Feet

FIGURE 1

MINERAL COUNTY
RAILROAD BRIDGES

PIONEER TECHNICAL SERVICES, INC.

DATE: 1/13/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-RR-GIS-PLN-001-17.mxd

Appendix B

Hydraulic Structure Inventory

Structure Inventory Data

Structure Number	Date of Inspection	Latitude	Longitude	Road Name	River - Mainstem	Tributary	Structure Type	Structure Type Info	Structure Condition	Structure Condition Description
B55[1]	December 6, 2016	47.29661897	-115.121073	Private (Off of Little Joe Road)	St. Regis	Little Joe Creek	Bridge	May be old railroad bridge	Fair	
B70	December 6, 2016	47.34933059	-115.2912401	Interstate (I-90)	St. Regis	Twelvemile Creek	Culvert		Good	
B71	December 5, 2016	47.35668974	-115.2886731	Mullan Gulch Road	St. Regis	Rock Creek	Bridge		Good	
B72	December 5, 2016	47.35885161	-115.287782	Rock Creek Road	St. Regis	Rock Creek	Culvert		Good	
B73	December 5, 2016	47.36178215	-115.2763611	Private (Off of Mullan Gulch Road)	St. Regis	Twelvemile Creek	Bridge		Good	
B74	December 5, 2016	47.36698531	-115.2647433	Twelvemile Road	St. Regis	Twelvemile Creek	Bridge		Good	
B75	December 5, 2016	47.37192381	-115.2622954	Forest Service (Off of Twelvemile Road)	St. Regis	Twelvemile Creek	Bridge		Good	
B76	December 5, 2016	47.36771648	-115.2625443	Horseback Lane	St. Regis	East Fork Twelvemile Creek	Bridge		Good	
B77	December 5, 2016	47.36428537	-115.2426857	Old Mullan Road	St. Regis	East Fork Twelvemile Creek	Culvert	Box culvert	Good	
B78	December 5, 2016	47.36480248	-115.2359551	Old Mullan Road	St. Regis	East Fork Twelvemile Creek	Culvert	Box culvert	Good	
B80	December 5, 2016	47.37540932	-115.3514277	Milwaukee Road Trail	St. Regis	East Twin Creek	Bridge		Good	
B81	December 5, 2016	47.37636294	-115.3510248	Interstate (I-90)	St. Regis	East Twin Creek	Culvert		Good	
B82	December 5, 2016	47.37701234	-115.3508005	Frontage Road	St. Regis	East Twin Creek	Culvert	Dual box culvert with wingwall and guardrail on road	Good	
B83[2]	April 25, 2017	47.37843203	-115.3530057	Private	St. Regis	East Twin Creek	Bridge	Wood	Fair	
B83a	December 5, 2016	47.38530315	-115.3520002	Lower Cotton Lane	St. Regis	East Twin Creek	Culvert		Good	
B83b[3]	December 5, 2016	47.3906442	-115.3483054	Twin Creek Road	St. Regis	East Twin Creek	Culvert		Good	
B86	December 5, 2016	47.37702527	-115.382717	Interstate (I-90)	St. Regis	Savanac Creek	Culvert		Good	
B86a[4]	December 5, 2016	47.37720677	-115.3824987	Frontage Road	St. Regis	Savanac Creek	Culvert		Good	
B87	December 5, 2016	47.37724816	-115.3859862	Milwaukee Road Trail	St. Regis	Big Creek	Railroad Bridge	Tracks removed	Good	
B88	December 5, 2016	47.37708632	-115.3864756	McGee Drive	St. Regis	Big Creek	Bridge		Fair	Bent/rusty guard rail
B89	December 5, 2016	47.3769436	-115.3868183	East Big Creek Road	St. Regis	Big Creek	Bridge		Poor	Bows at center of bridge
B90	December 5, 2016	47.37324683	-115.3993232	Big Creek Road	St. Regis	Big Creek	Bridge		Good	
B91	December 5, 2016	47.36581533	-115.4139929	Big Creek Road	St. Regis	Big Creek	Bridge		Good	
B92	December 5, 2016	47.38291566	-115.3931566	Savanac Creek Road	St. Regis	Savanac Creek	Bridge		Good	
B93[5]	December 5, 2016	47.38612717	-115.3938767	Private (Off of Savanac Creek Road)	St. Regis	Savanac Creek	Bridge		Good	
B95	December 5, 2016	47.38945233	-115.4066437	Interstate (I-90)	St. Regis	Timber Creek	Culvert	2 culverts (one for each directional lane of the interstate)	Good	
B96[6]		47.39230498	-115.4085741		St. Regis	Timber Creek	Culvert			
B96a	December 5, 2016	47.39094499	-115.4090166	Frontage Road	St. Regis	Timber Creek	Culvert	Culvert with guardrails	Good	
B97	December 5, 2016	47.39689749	-115.4131462	Timber Creek Road	St. Regis	Timber Creek	Culvert		Good	
B98	December 5, 2016	47.39965445	-115.4103834	Private (Off of Timber Creek Road)	St. Regis	East Fork Timber Creek	Culvert		Good	
B99	December 5, 2016	47.40545216	-115.4273376	East Fork Timber Creek Road	St. Regis	West Fork Timber Creek	Culvert		Good	
B102[7]	December 5, 2016	47.40858575	-115.5104941	Lohr Lane	St. Regis	Silver Creek	Culvert		Good	
B103	December 5, 2016	47.40801426	-115.5109456	Milwaukee Road Trail	St. Regis	Silver Creek	Railroad Bridge	Tracks removed	Good	
B104a	December 5, 2016	47.41468984	-115.5107489	Packer Creek Road	St. Regis	Packer Creek	Bridge		Good	
B105	December 5, 2016	47.426258	-115.5149969	Packer Creek Road	St. Regis	Packer Creek	Culvert		Good	
B106	December 5, 2016	47.42675237	-115.5155654	Wapiti Wallow Way	St. Regis	West Fork Packer Creek	Bridge		Good	
B109	December 5, 2016	47.41656834	-115.5890802	Interstate (I-90)	St. Regis	Randolph Creek	Culvert		Good	
B110	December 5, 2016	47.4164289	-115.5892499	Northern Pacific Railroad	St. Regis	Randolph Creek	Railroad Bridge	Tracks removed	Good	Covered in snow

Note[1]: Abutments for bridge B55 appear to be stacked railroad ties.
Note[2]: During field data collection B83 was found to be in a different location than originally planned
Note[3]: Stormwater culvert adjacent to culvert B83a.
Note[4]: Beaver dam located approximately 100' upstream of structure B86a.
Note[5]: Bridge B93 is made of stone with CMP, dual culverts (halved) beneath the structure.
Note[6]: Bridge B96 was not inventoried due to a closed gate on private property.
Note[7]: Abandoned culvert adjacent to culvert B102.

Structure Inventory Data

Structure Number2	Span 1 (ft)	Span 1 Description	Span 2 (ft)	Span 2 Description	Span 3 (ft)	Span 3 Description	Span 4 (ft)	Span 4 Description	Deck Width (ft)	Deck Thickness (ft)	Guardrail Height (ft)
B55	16	West to Pier 1	13	Pier 1 to Pier 2	15.6	Pier 2 to Pier 3	15	Pier 3 to Pier 4	14	3.00	
B70											
B71	39	Entire length							25	3.00	2.5
B72											
B73	76	Entire length							15	4.00	1
B74	43	Entire length							26	1.00	2.6
B75	33	Entire length							25.6	4.00	3.00
B76	13	Entire length							12	1.00	
B77											
B78											
B80	37	Entire length							15	3.00	
B81											
B82											
B83	20								12	3.00	0.50
B83a											
B83b											
B86											
B86a											
B87	94	Entire length							14	3.00	4.6
B88	50.6	Entire length							14	1.00	3.00
B89	56	Entire length							16	3.6	3.00
B90	60	Entire length							15	4.00	3.00
B91	42	Entire length							16	3.5	2.6
B92	29	Entire Length							19	1.00	1.00
B93	20	West to Pier 1	26	Pier 1 to East					14	3.00	1.00
B95											
B96											
B96a											
B97											
B98											
B99											
B102											
B103	635	Entire length	35	Appoximated between all piers					19	10.00	3.6
B104a	36	Entire length							15.6	3.8	2.5
B105											
B106	38	Entire length							15	2.3	
B109											
B110	17	South to Pier 1	15	Pier 1 to 2	14.4	Pier 2 to North			14	1.6	1.4

Structure Inventory Data

Structure Number3	Culvert Height (ft)	Inlet 2 Deck (ft)	Out 2 Deck (ft)	Culvert Length (ft)	Structure Material Type	Structure Material Type Description	Abutment Type	Abutment Fill Configuration	Abutment Info
B55					Wood		Stub	Sloped	
B70	17.00	3	4	189	Corrugated Metal				
B71					Concrete		Stub	None	
B72	6	3	4	41	Corrugated Metal				
B73					Steel/Wood		Stub	None	
B74					Concrete		Stub	None	
B75					Wood		Stub	None	Wingwalls off of wood stub abutment
B76					Wood	And concrete	Mechnical Stabilized Earth	Sloped	
B77	4.00	5	6	50	Concrete				
B78	5.00	5.6	6	37	Concrete				
B80					Wood		Stub	None	
B81	6.00	5.6	2	470	Corrugated Metal				
B82	5.00	3.6	4	46	Concrete				
B83					Steel/Wood				Estimated dimensions
B83a	3.00	1	1.5	23	Corrugated Metal				
B83b	2.00	2.6	3	64	Corrugated Metal				
B86	8.00	5	5	222	Corrugated Metal				
B86a	9.00	2.5	2.5	45	Concrete	Box			
B87					Steel/Wood		Stub	None	
B88					Concrete	Steel wood deck	Vertical Concrete	Sloped	
B89					Wood	Large tires used in abutments	Stub	None	
B90					Steel/Wood		Vertical Wood	None	
B91					Wood		Vertical Wood	None	
B92					Concrete	Wood guardrails	Stub	None	
B93	4.4	3	3	14	Rock		Stub	None	
B95	7.00	8.6	4	100	Corrugated Metal				
B96									
B96a	7.00	4.6	4.6	55	Corrugated Metal				
B97	4.00	2	2.6	42	Corrugated Metal				
B98	2.00	2	2.5	16	Corrugated Metal				
B99	2.00	3	3	23	Corrugated Metal				
B102	6.00	4.5	11	117	Corrugated Metal				
B103					Steel/Wood		Vertical Concrete	Sloped	
B104a					Wood		Vertical Wood	None	
B105	6.00	2	3	49	Corrugated Metal				
B106					Wood		Stub	Sloped	
B109	10	27	42		Corrugated Metal				
B110					Wood		Vertical Steel/Vertical Wood	None	

Structure Inventory Data

Structure Number4	Number of Piers	Number of Piers Description	Pier Type	Pier Type Description	Pier Width (ft)	Backwater Potential	Backwater Potential Description
B55	4		Group of Cylinders	Wood cross bracing	1	Moderate	Elevated road grade
B70						High	Interstate grade elevation high
B71	0					Moderate	Water elevation near bottom of bridge in December, thick deck
B72						Moderate	Elevated road grade
B73	0					Moderate	Moderately elevated road grades on either side of structure
B74	0					Low	
B75	0					Moderate	Elevated road grade
B76	0					Low	
B77						Moderate	Elevated road grade
B78						Moderate	
B80	0					Moderate	Water level up to bottom of bridge in December
B81						High	Elevated interstate road grade
B82						High	Elevated frontage road grade
B83						Low	Low
B83a						Low	
B83b						Low	
B86						High	Interstate elevation grade high, culvert immediately upstream from structure
B86a						Moderate	Elevated road grade
B87	0					Moderate	Two bridges directly upstream (B88 and B89).
B88	0					Low	Approximately 125' upstream from old Milwalkee Trail bridge (B87), and directly downstream from B89.
B89	0					Low	Two bridges directly downstream (B88 and B87).
B90	0					Moderate	Elevated road grade
B91	0					Moderate	
B92	0					Moderate	Elevated road grade
B93	1		Other	Rock	1	Moderate	
B95						High	Interstate elevation grades high
B96							
B96a						Moderate	Frontage road grade elevation moderate
B97						Low	
B98						Low	
B99						Low	
B102						Low	
B103	5	4 piers are 25 ft wide, 1 pier is 2 ft	Other	Steel with steel cross members, concrete footers	25	Other	None; extremely high structure and small tributary in comparison.
B104a	0					Low	
B105						Low	
B106						Low	
B109						Moderate	Interstate elevation grade high
B110	2		Group of Cylinders	Wood	1	Low	

Structures Surveyed under Activity 1 of the Mineral County Floodplain Study
and are Included in the Field Survey Report and not this Hydraulic Structure Inventory Report

Structure Number	River - Mainstem
B49	St Regis
B50	St Regis
B51	St Regis
B52	St Regis
B53	St Regis
B54	St Regis
B56	St Regis
B57	St Regis
B58	St Regis
B59	St Regis
B60	St Regis
B61	St Regis
B62	St Regis
B63	St Regis
B64	St Regis
B65	St Regis
B66	St Regis
B67	St Regis
B68	St Regis
B69	St Regis
B79	St Regis
B84	St Regis
B85	St Regis
B94	St Regis
B100	St Regis
B101	St Regis
B104	St Regis
B107	St Regis
B108	St Regis
B111	St Regis
B112	St Regis
B113	St Regis
B114	St Regis
B115	St Regis
B116	St Regis
B117	St Regis
B118	St Regis
B119	St Regis

N

DISPLAYED AS:
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DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B55

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B55

DATE: 5/12/2017

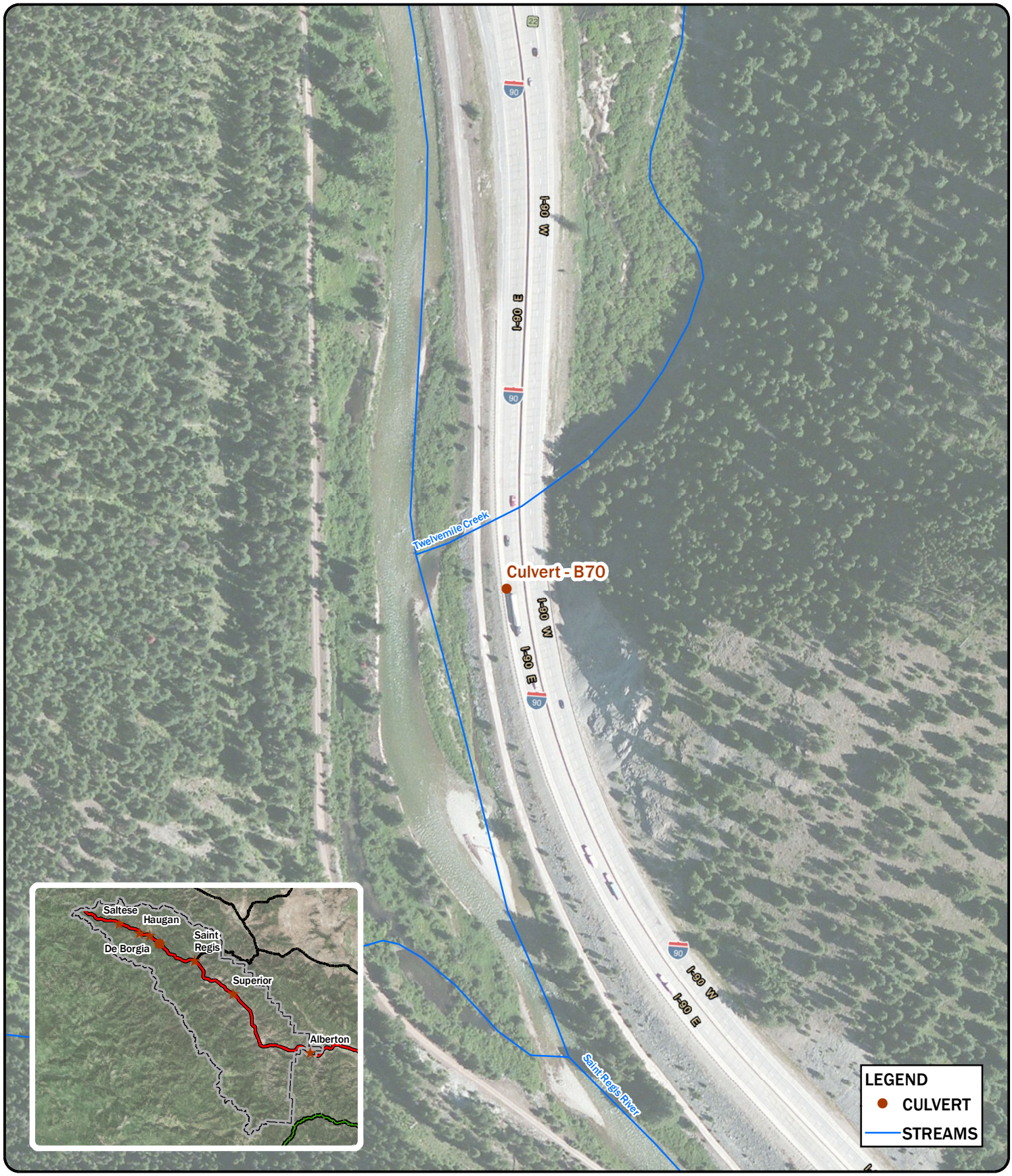
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B55_1.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B55_2.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream from structure
	Project: DNRC Mineral County

	Photo Number: Bridge_B55_3.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream at structure
	Project: DNRC Mineral County

	Photo Number: Bridge_B55_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County



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PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

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Feet

FIGURE B70

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B70

DATE: 5/12/2017

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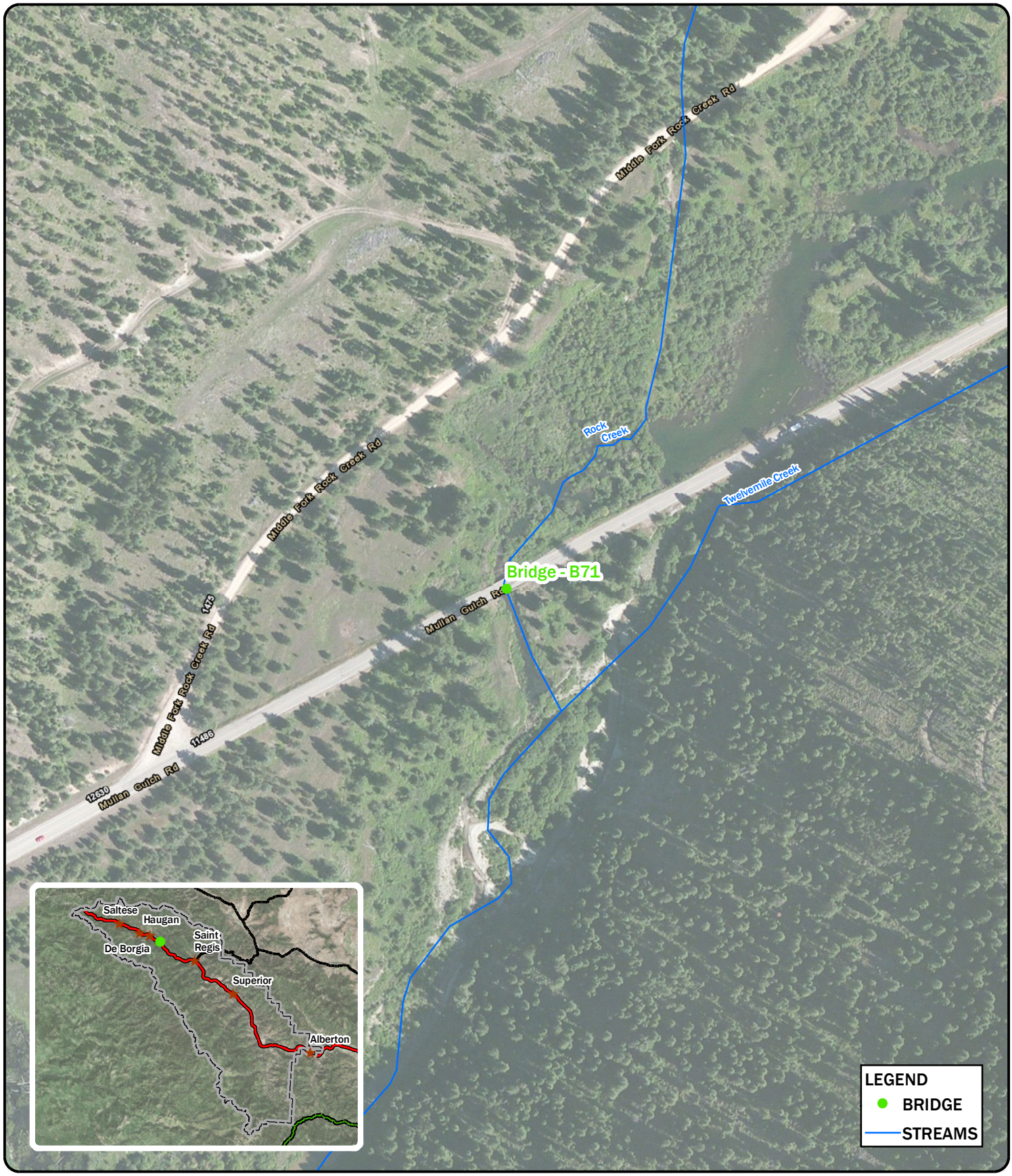
PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B70_1.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B70_2.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B70_3.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B70_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County



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DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

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Feet

FIGURE B71

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B71

DATE: 5/12/2017

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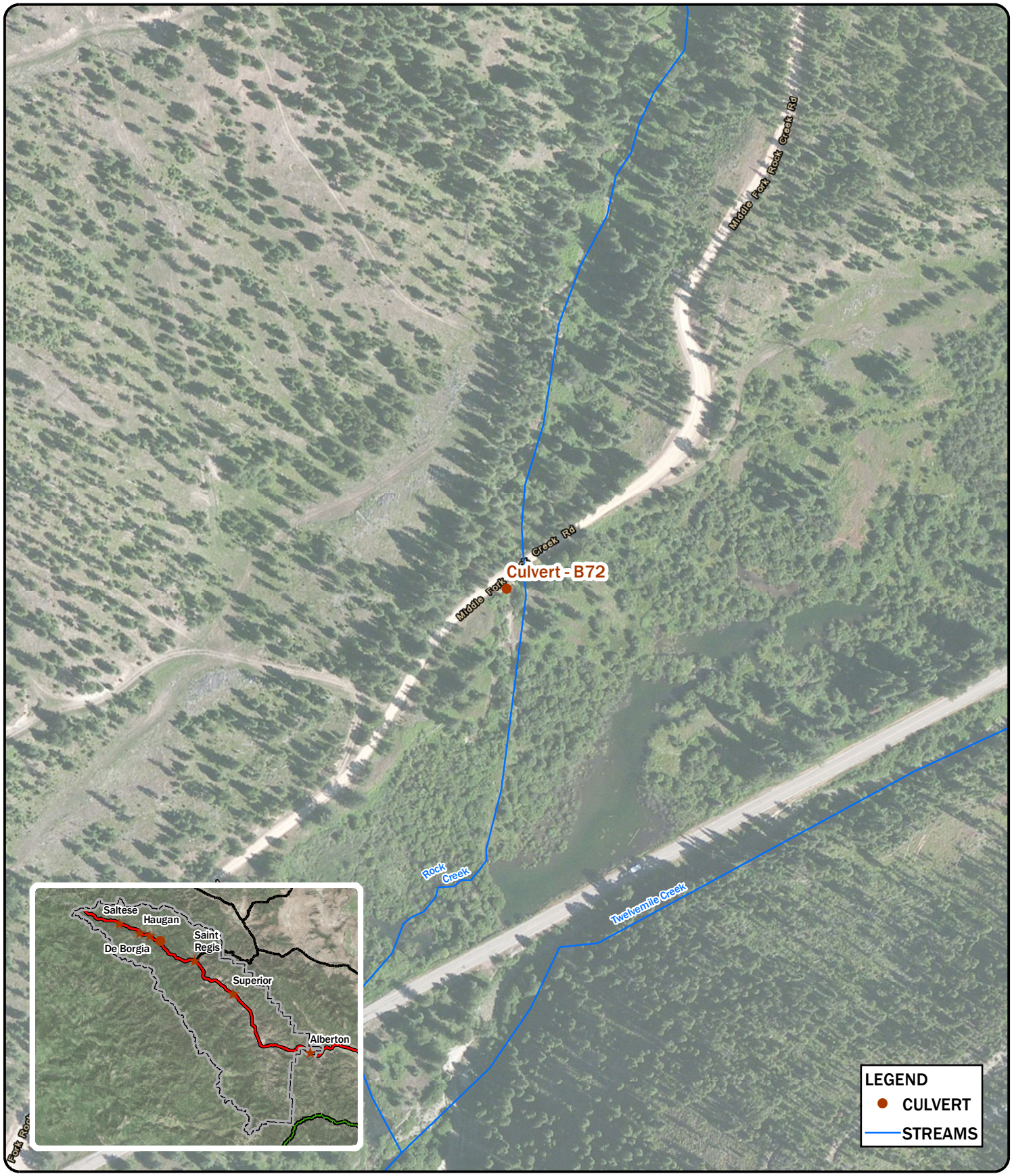
PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B71_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B71_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B71_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B71_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



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DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

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Feet

FIGURE B72

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY
STRUCTURE INVENTORY
B72

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

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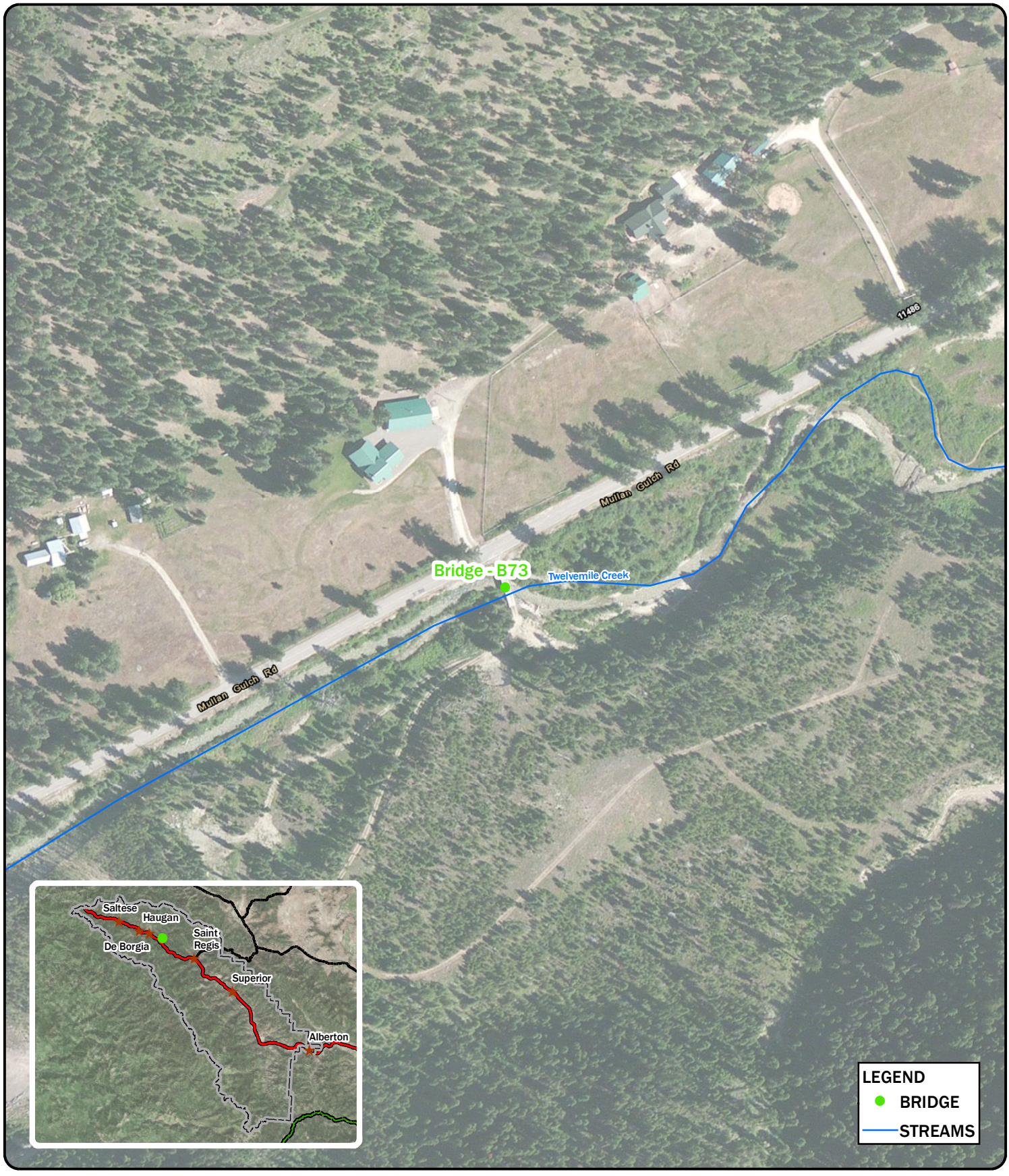
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B72_2.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B72_3.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B72_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County



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DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

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Feet

FIGURE B73

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B73

DATE: 5/12/2017

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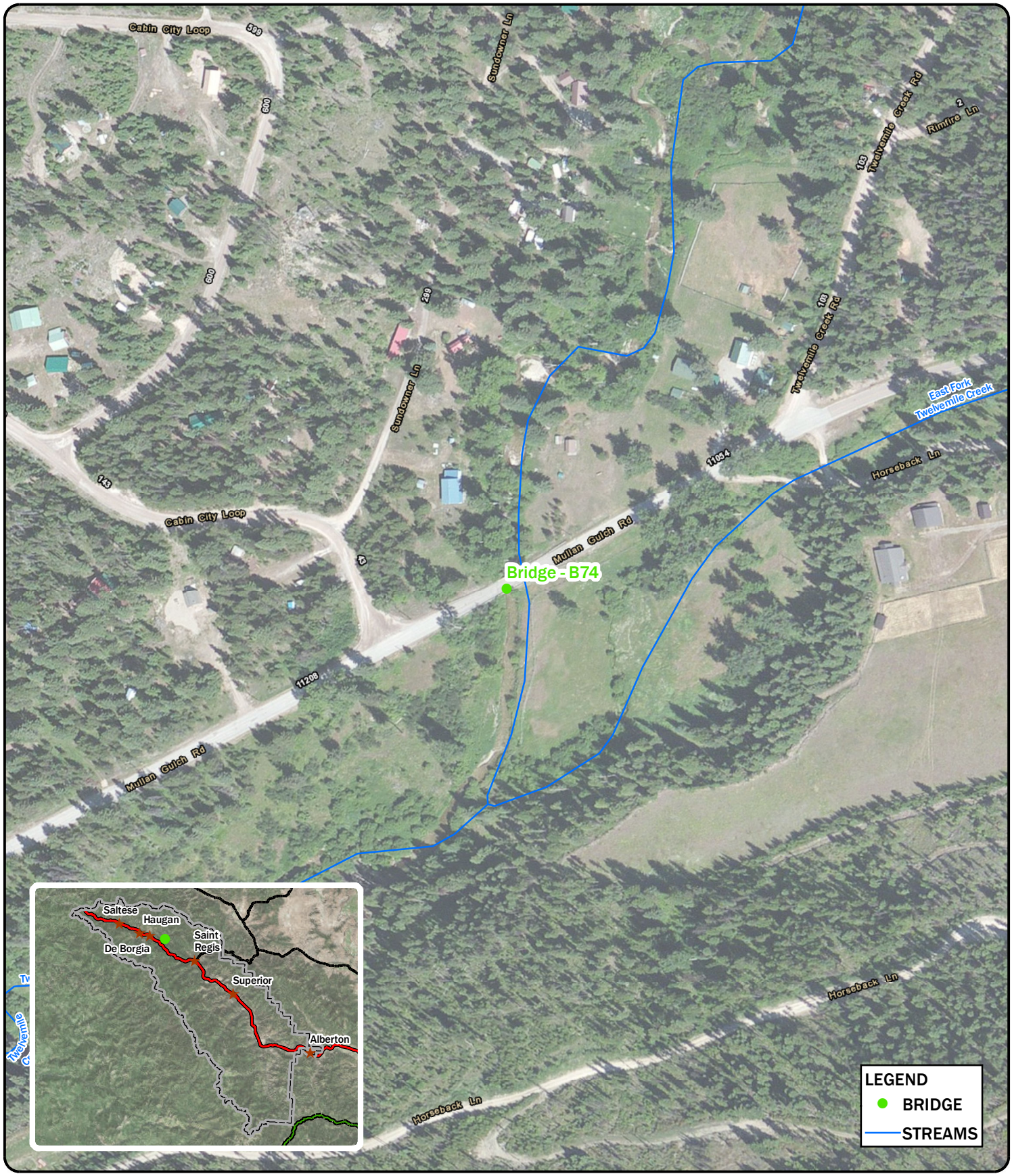
PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B73_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B73_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B73_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B73_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



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DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

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Feet

FIGURE B74

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B74

DATE: 5/12/2017

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PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B74_1.jpg
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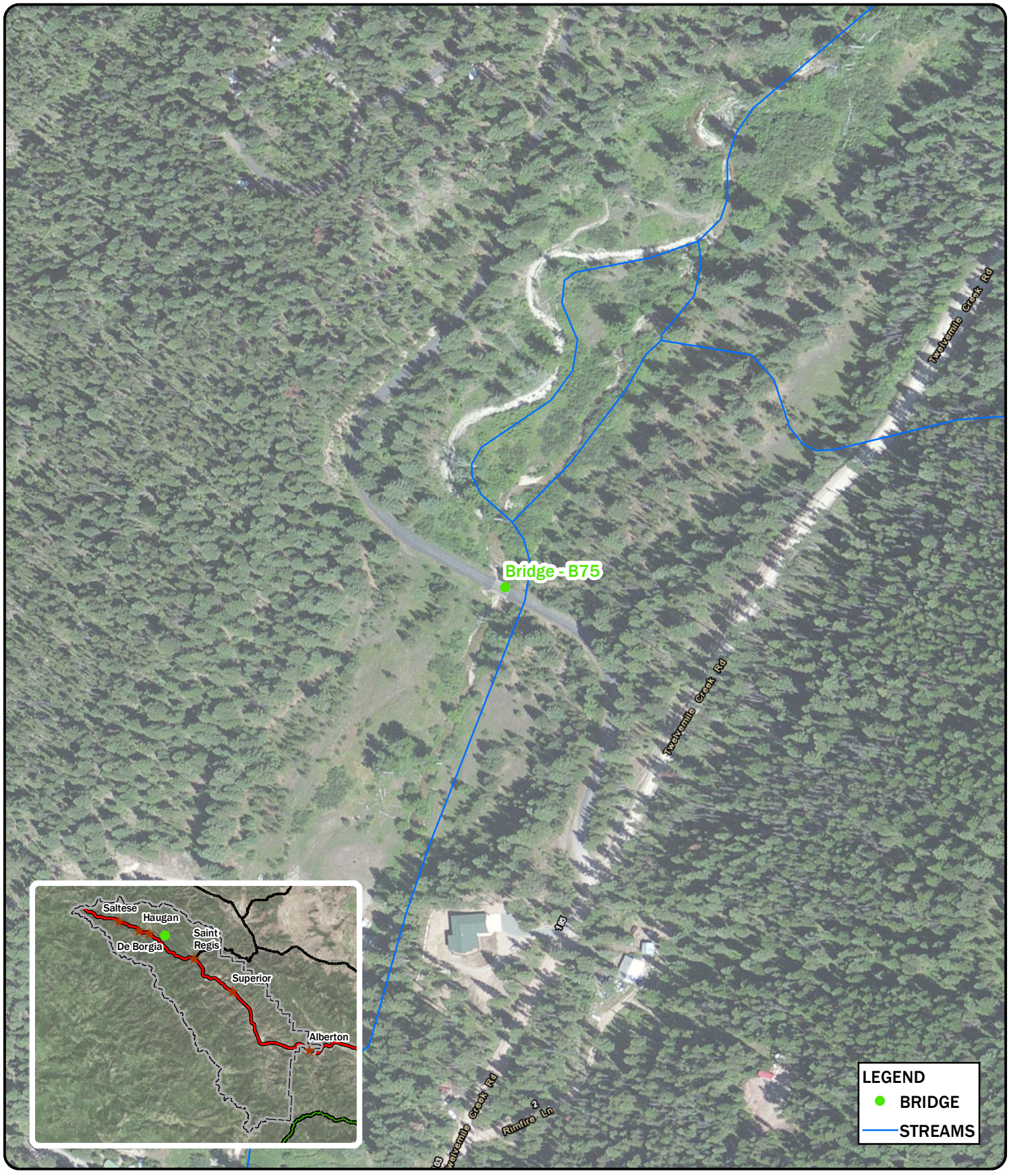
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B74_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B74_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B74_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



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DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B75

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B75

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

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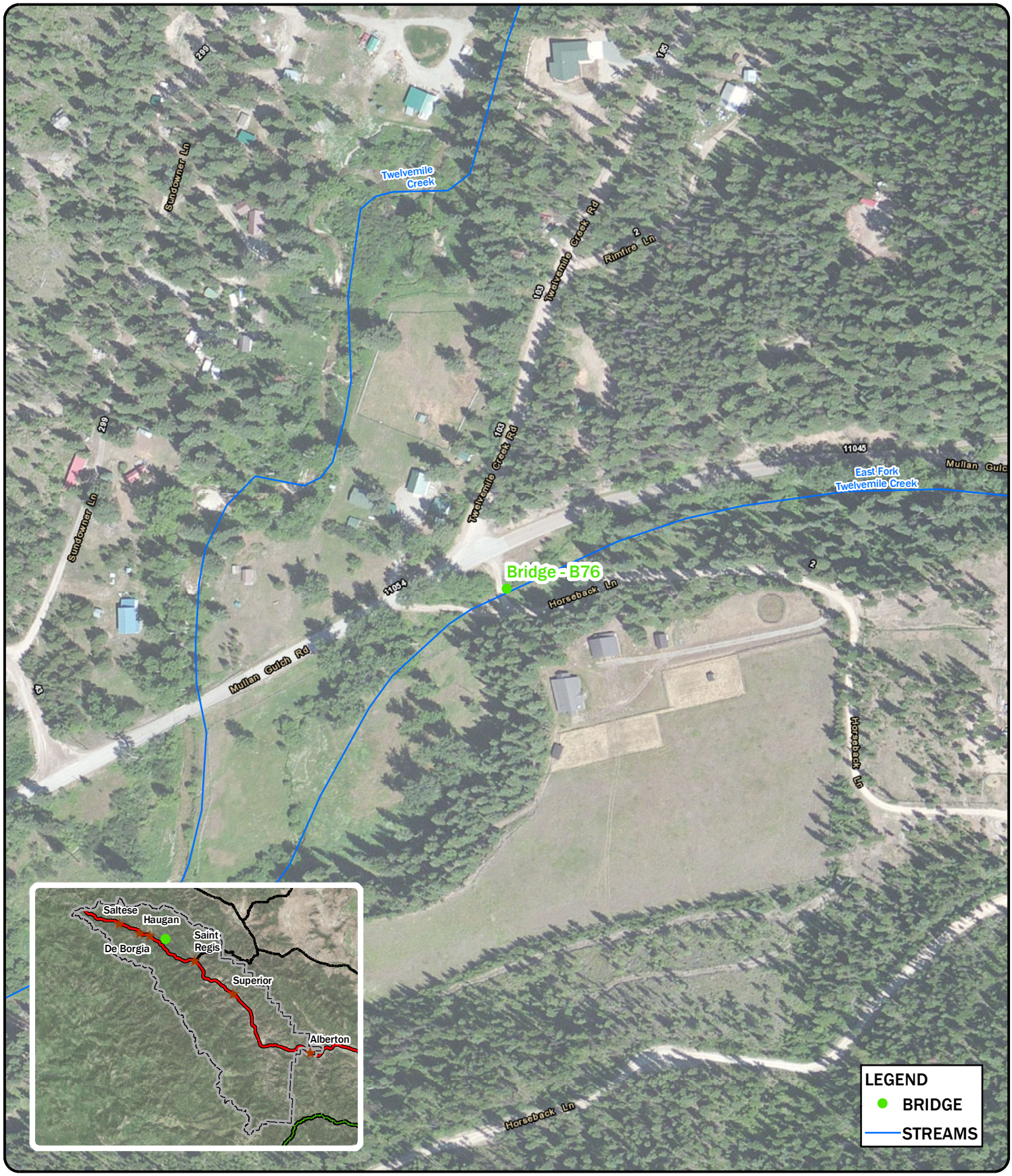
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B75_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

	Photo Number: Bridge_B75_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

	Photo Number: Bridge_B75_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



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DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B76

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B76

DATE: 5/12/2017

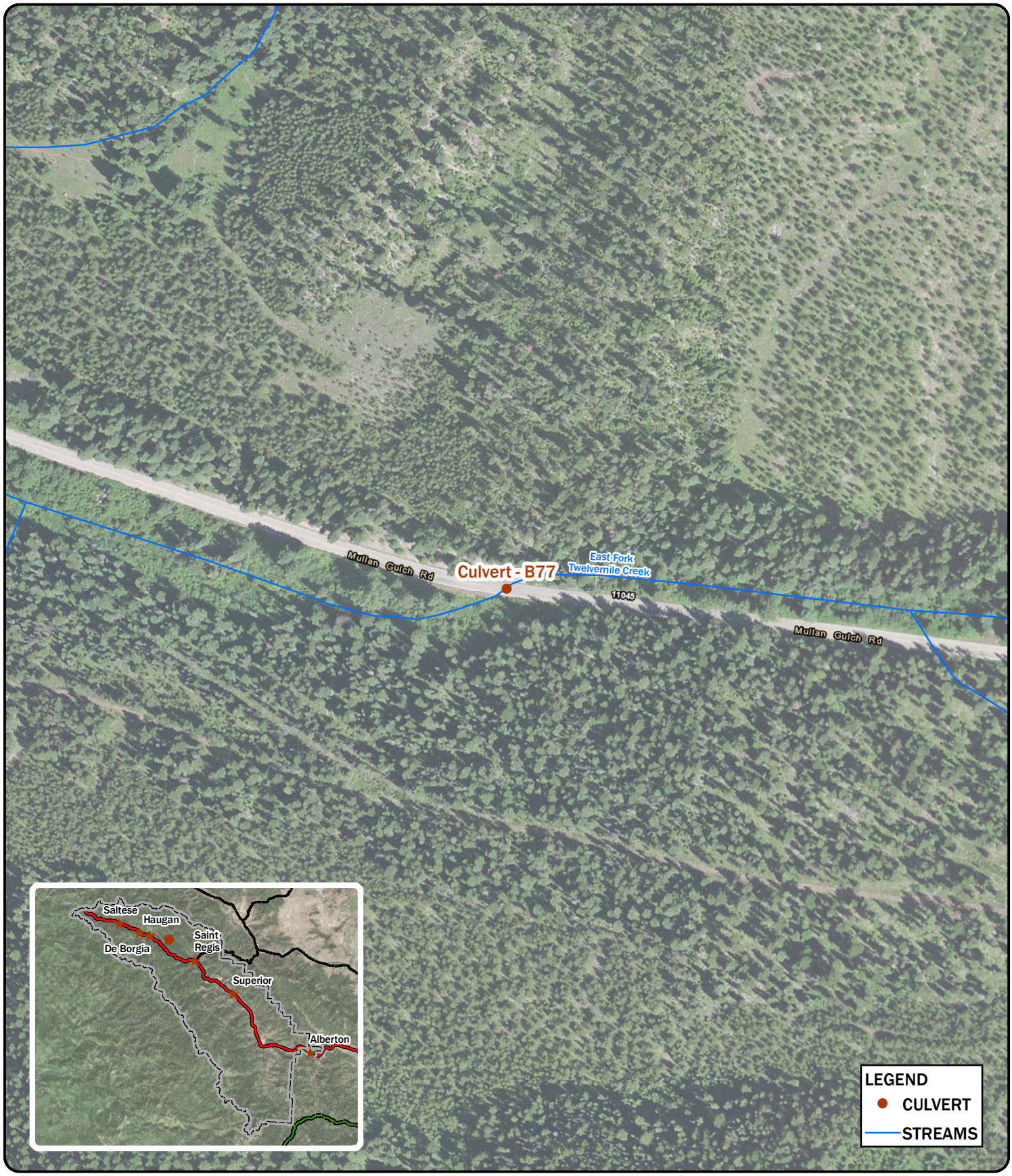
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B76_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B76_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B76_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B76_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B77

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B77

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B77_1.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B77_2.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B77_3.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B77_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B78

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B78

DATE: 5/12/2017

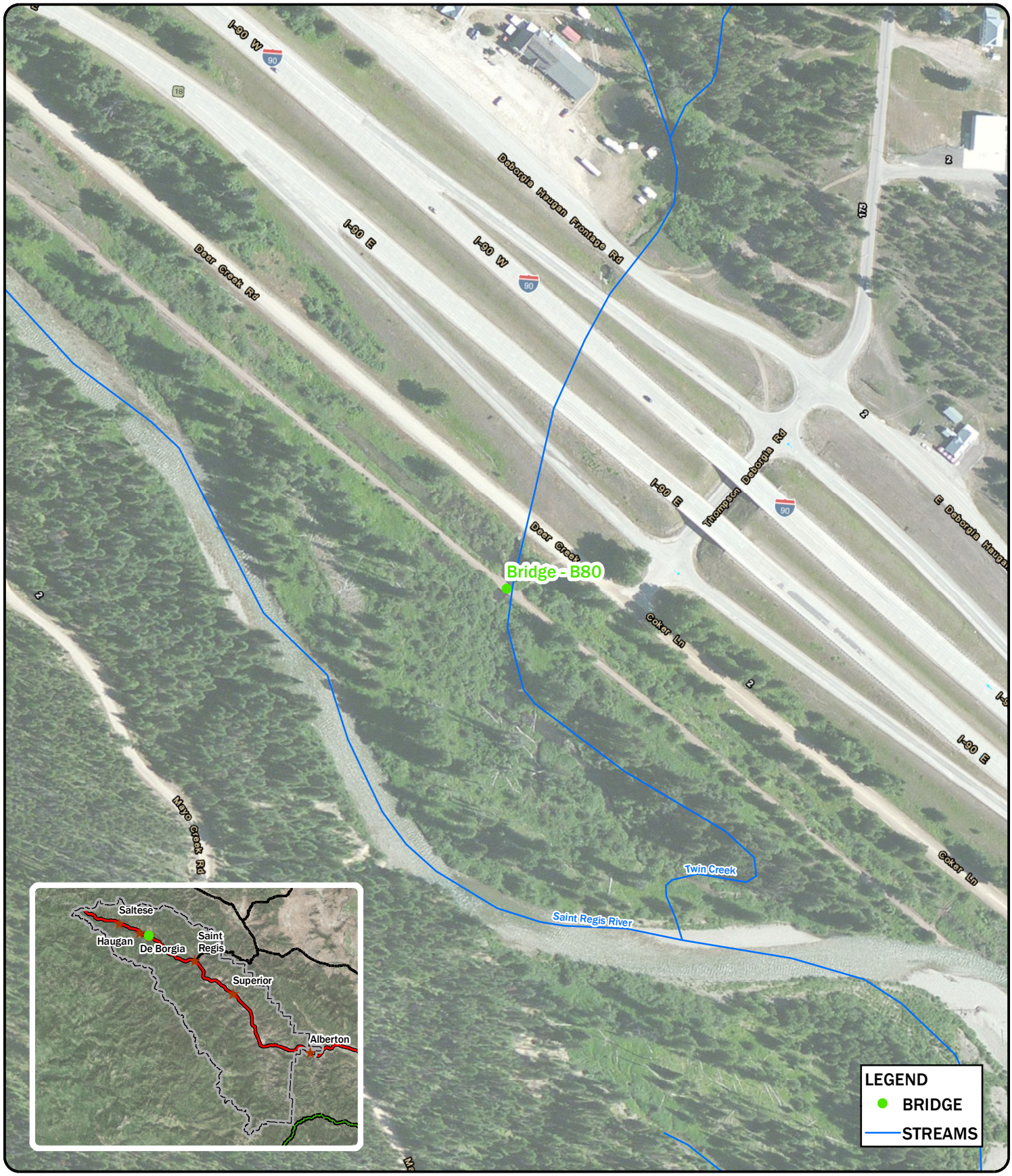
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B78_1.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B78_2.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B78_3.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B78_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B80

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B80

DATE: 5/12/2017

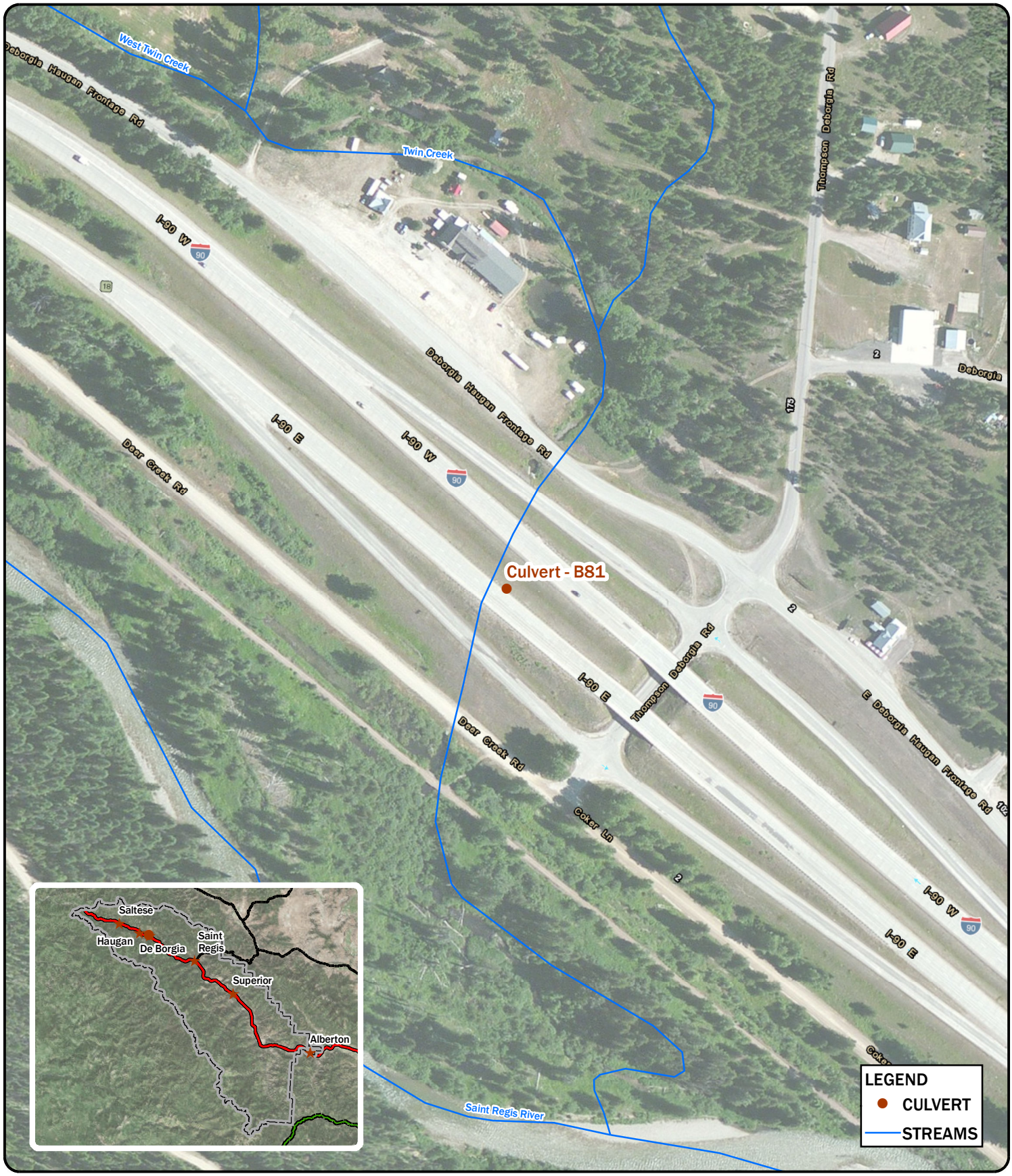
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B80_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B80_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B80_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B80_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B81

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B81

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B81_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B81_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B81_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B81_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B82

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B82

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B82_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B82_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B82_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B82_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B83

PIONEER TECHNICAL SERVICES, INC.

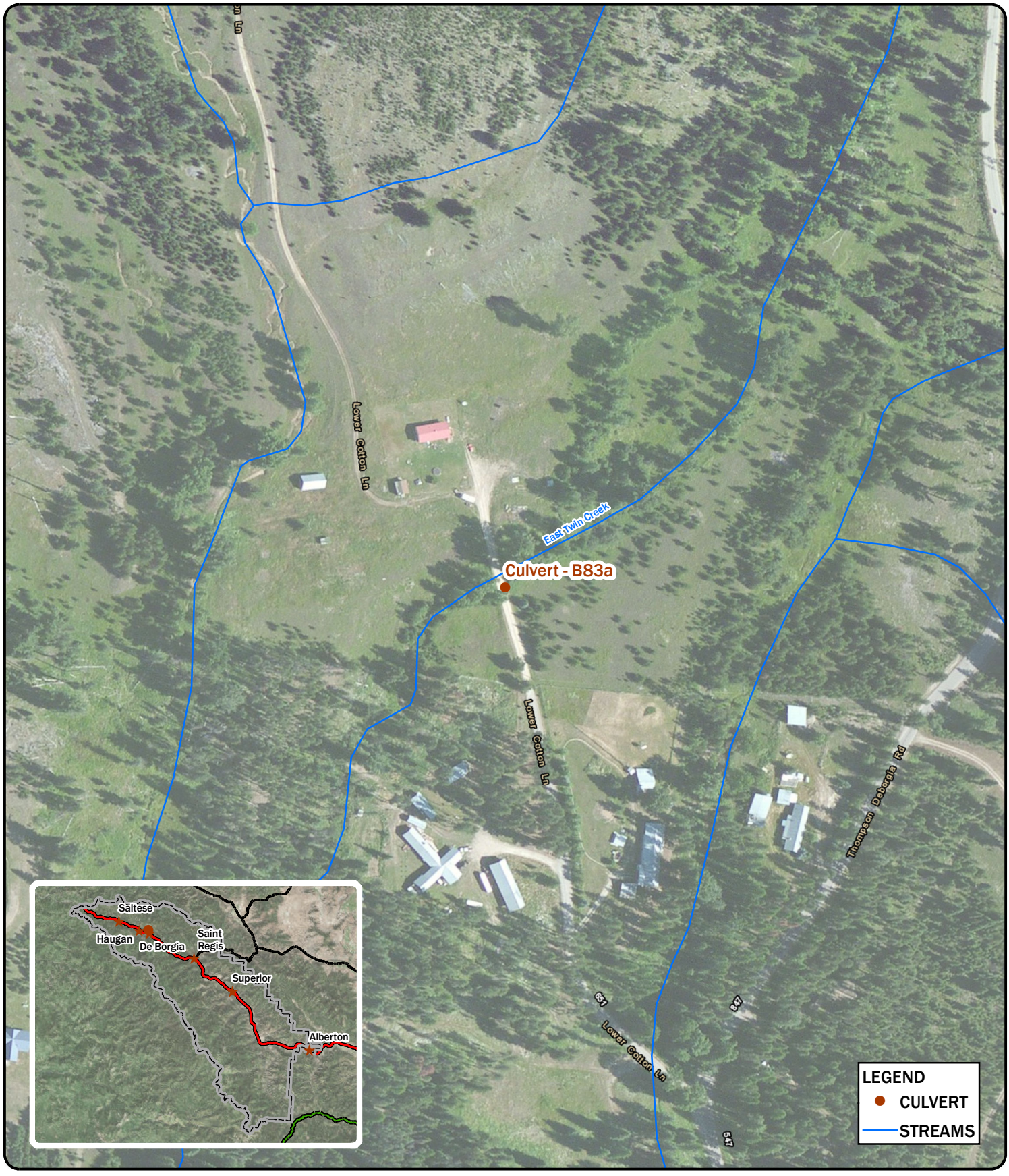
MINERAL COUNTY STRUCTURE INVENTORY B83

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

	Photo Number: Bridge_B83_0.jpg
	Date: Wednesday, April 26, 2017
	Description:
	Project: DNRC Mineral County

	Photo Number: Bridge_B83_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B83a

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B83a

DATE: 5/12/2017

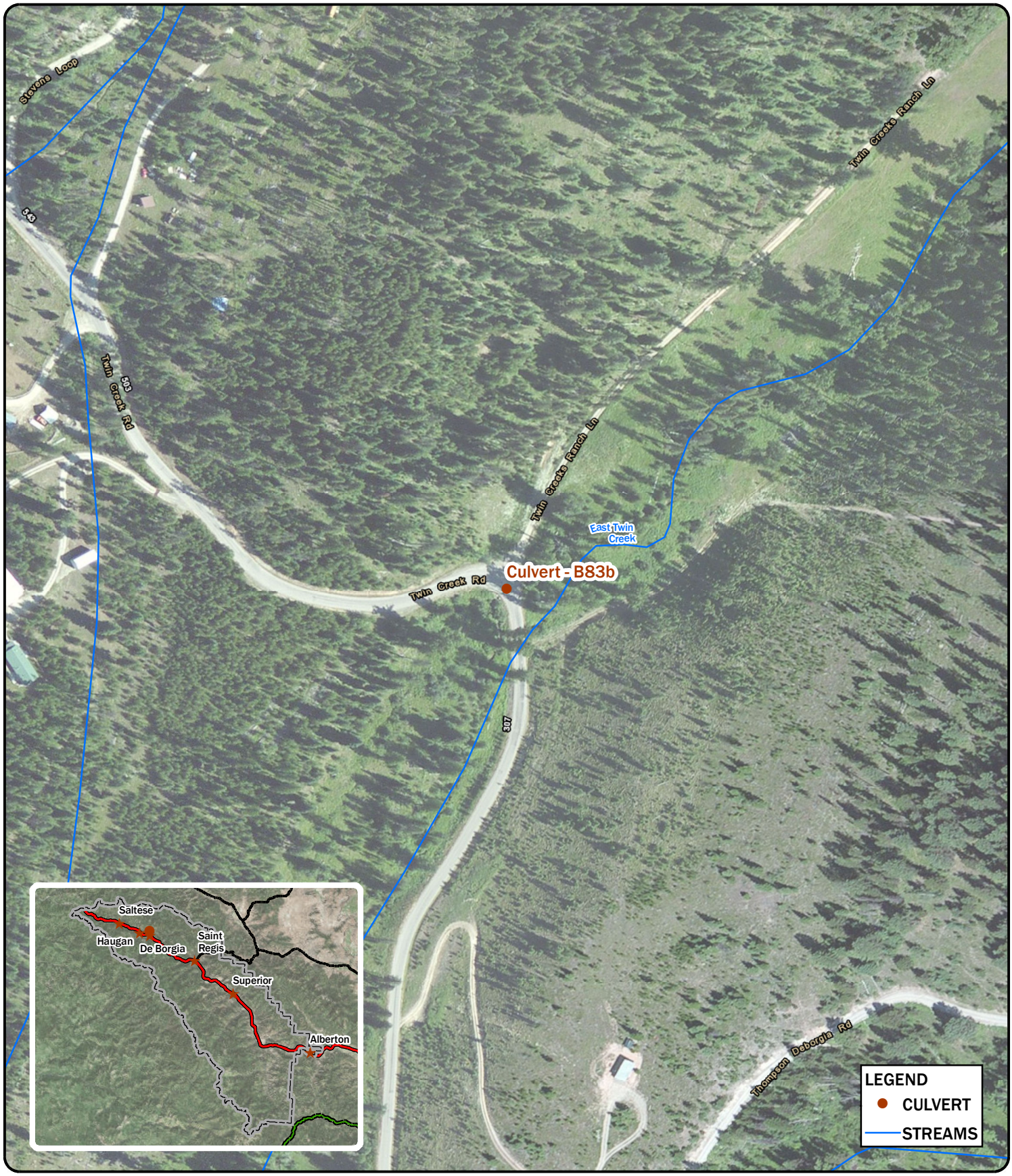
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B83a_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B83a_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B83a_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B83a_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B83b

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B83b

DATE: 5/12/2017

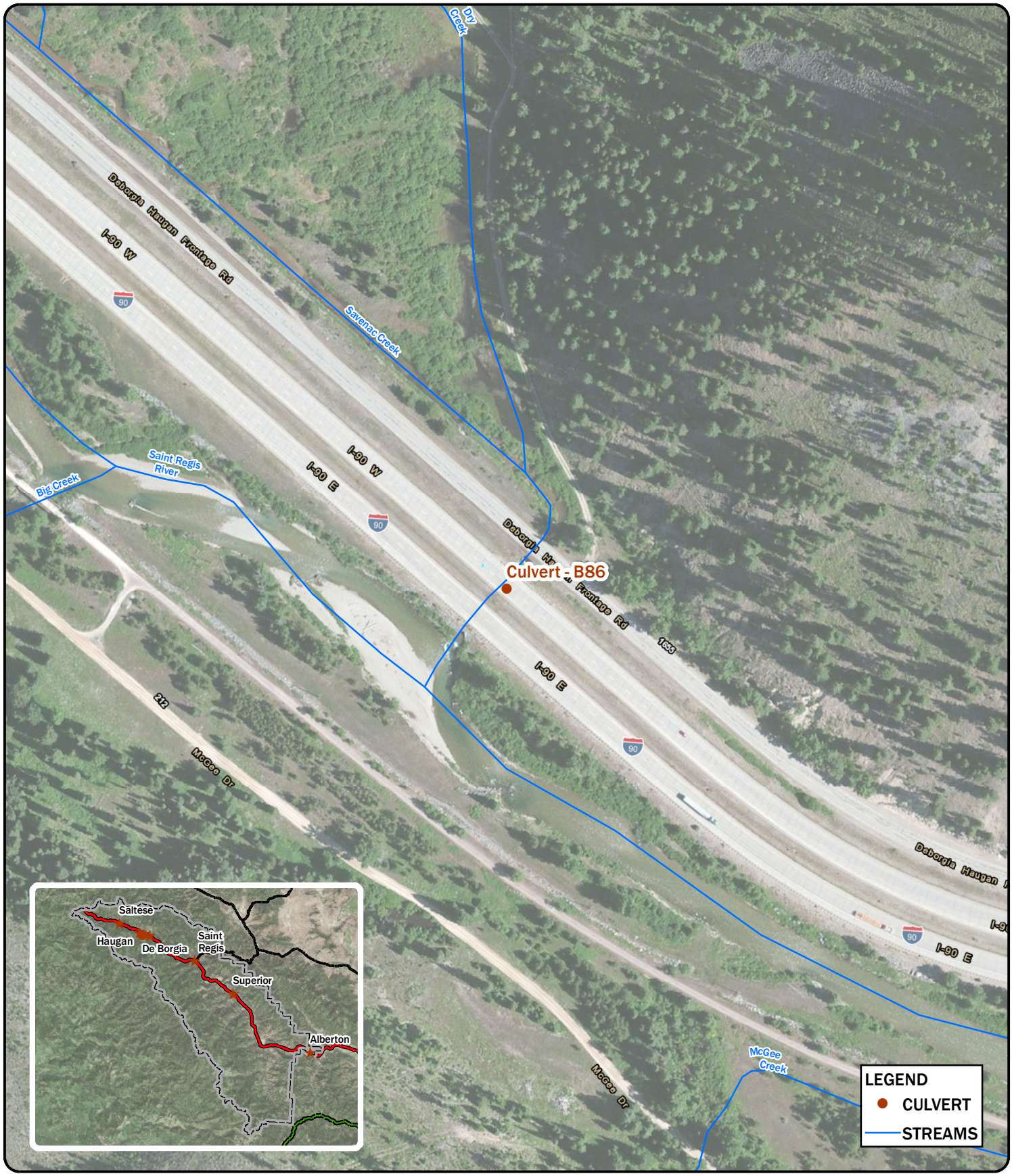
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B83b_1.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B83b_2.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B83b_3.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B83b_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County



DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B86

PIONEER TECHNICAL SERVICES, INC.

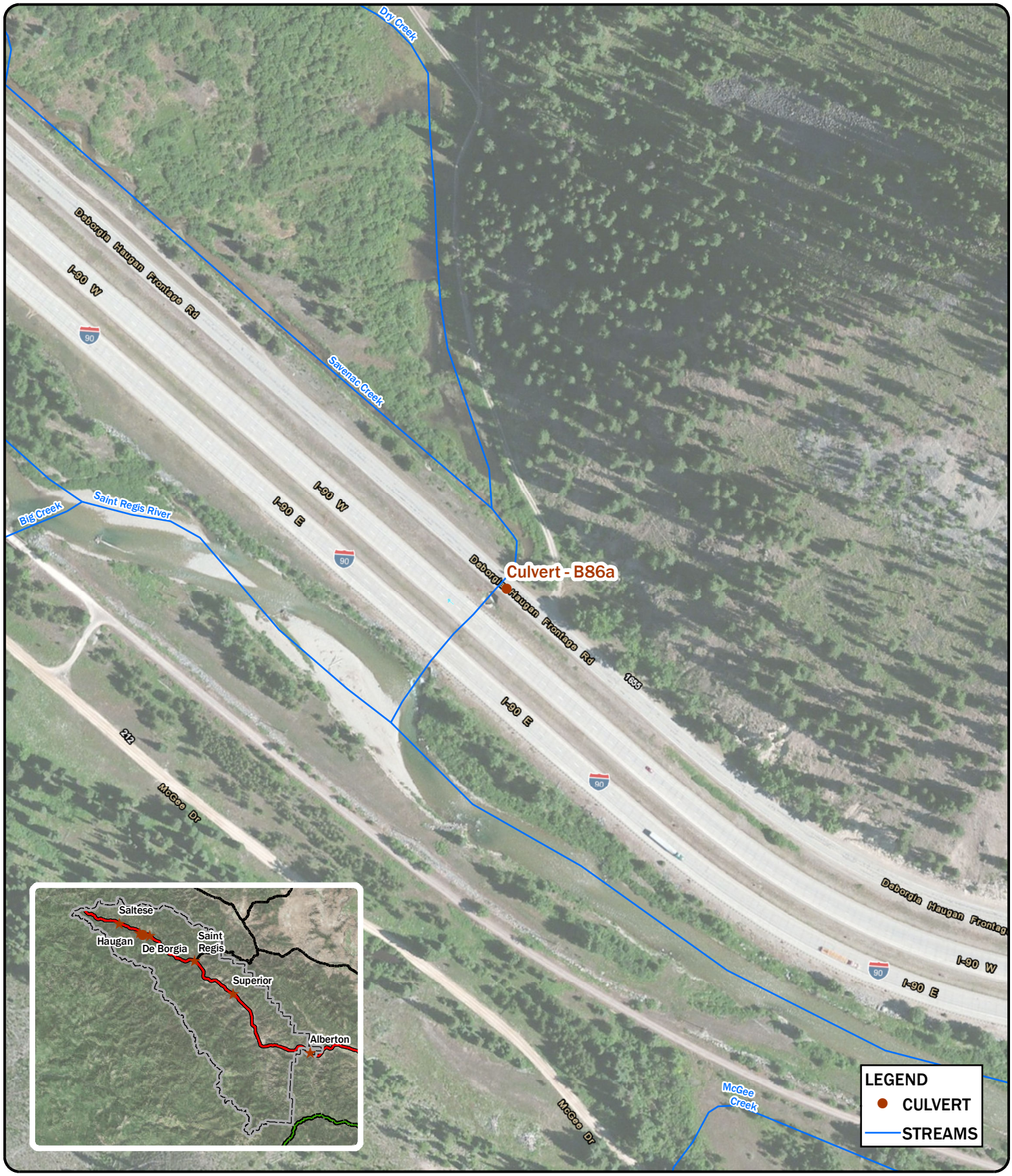
MINERAL COUNTY STRUCTURE INVENTORY B86

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B86_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B86_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B86a

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY
STRUCTURE INVENTORY
B86a

DATE: 5/12/2017

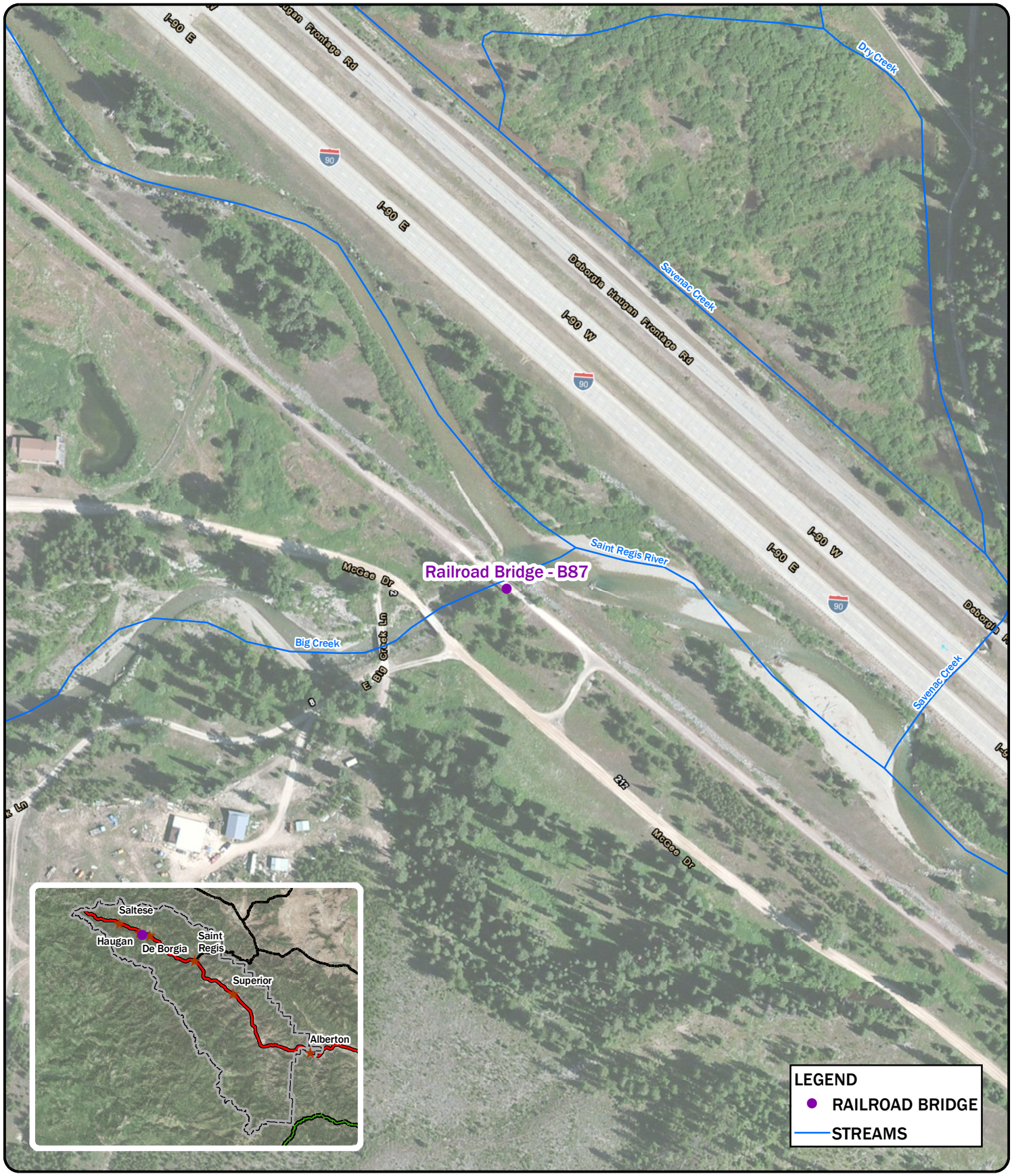
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B86a_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B86a_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B86a_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B86a_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B87

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B87

DATE: 5/12/2017

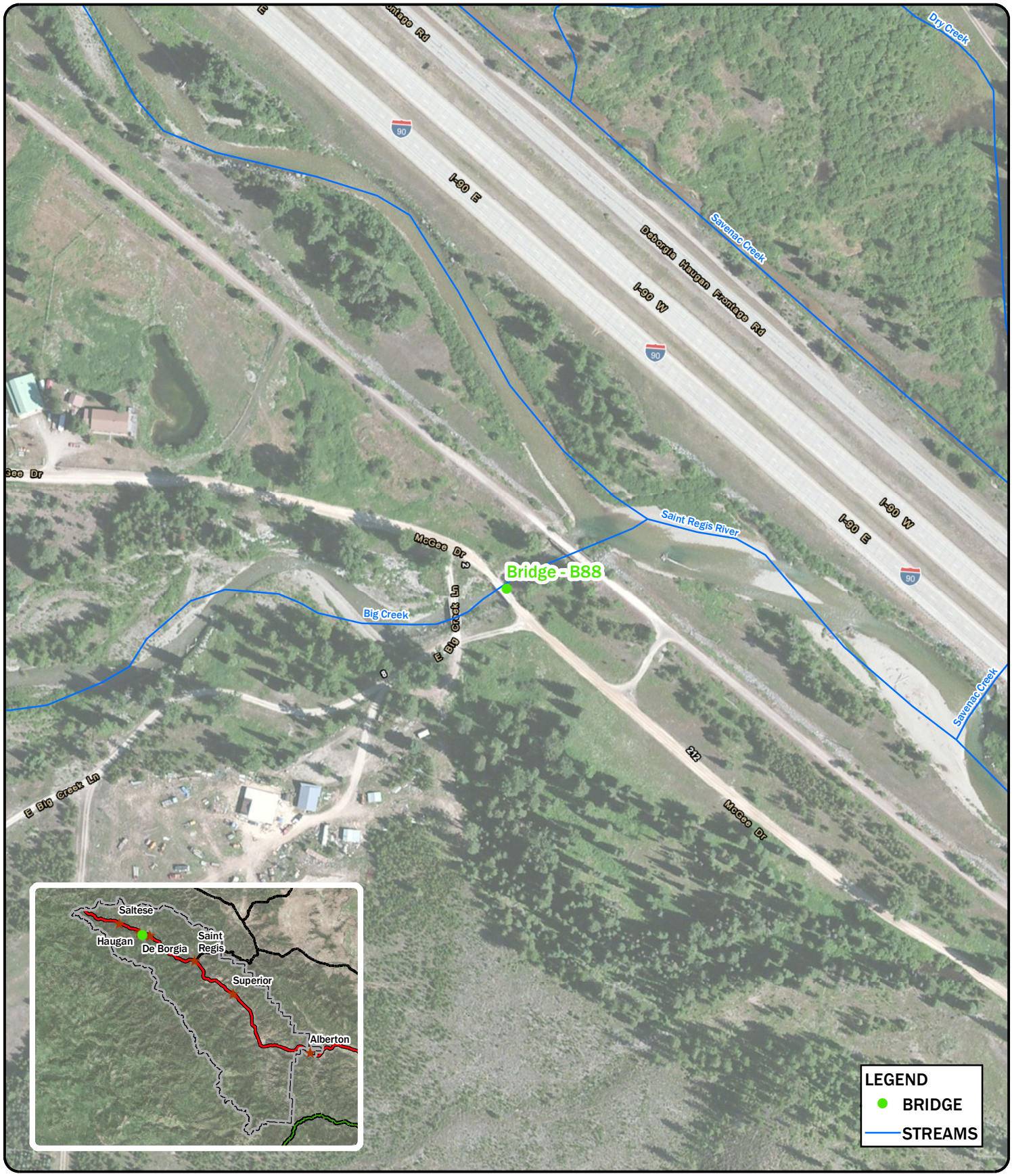
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Railroad Bridge_B87_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Railroad Bridge_B87_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Railroad Bridge_B87_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Railroad Bridge_B87_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B88

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B88

DATE: 5/12/2017

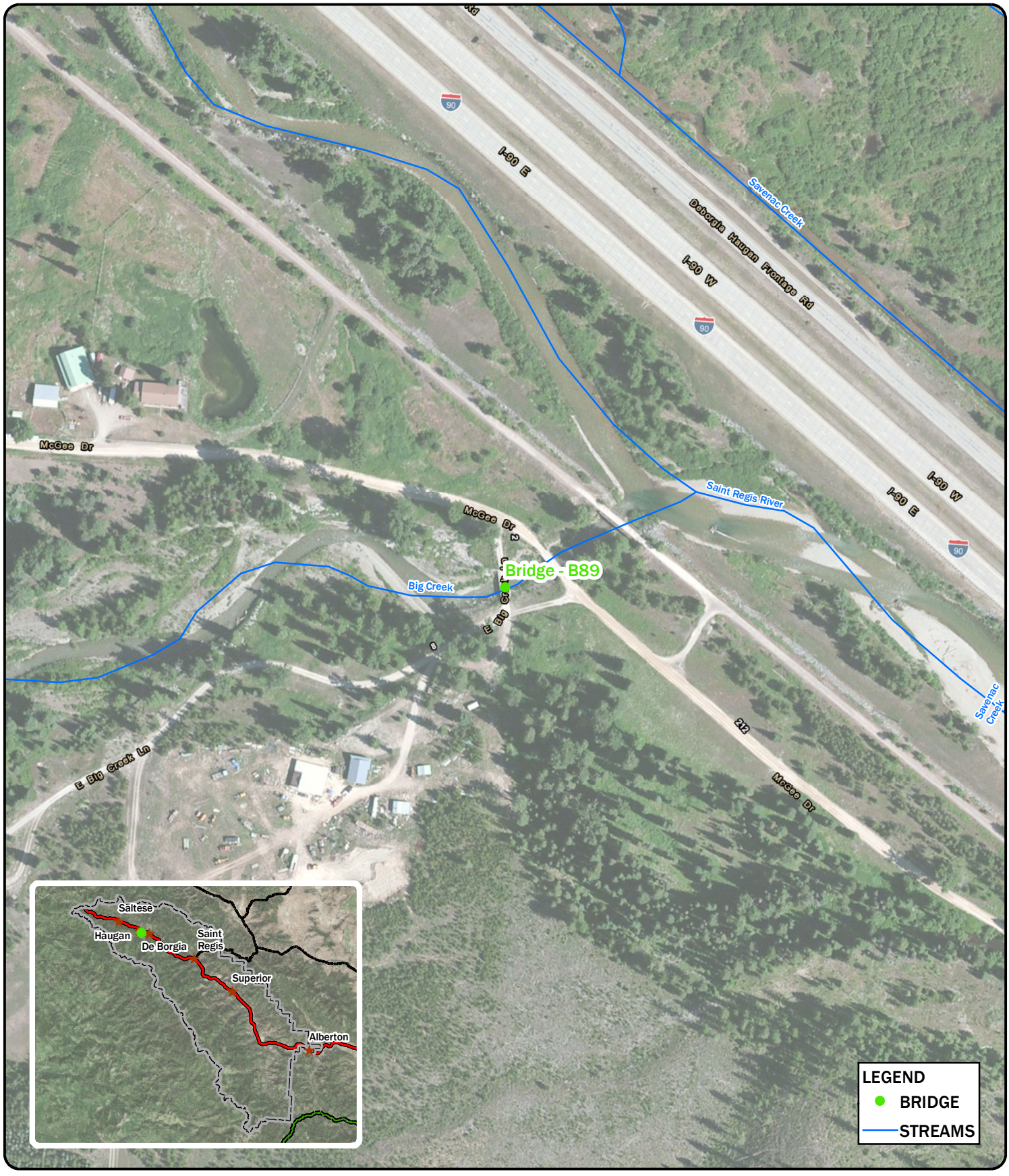
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B88_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B88_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B88_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B88_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B89

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B89

DATE: 5/12/2017

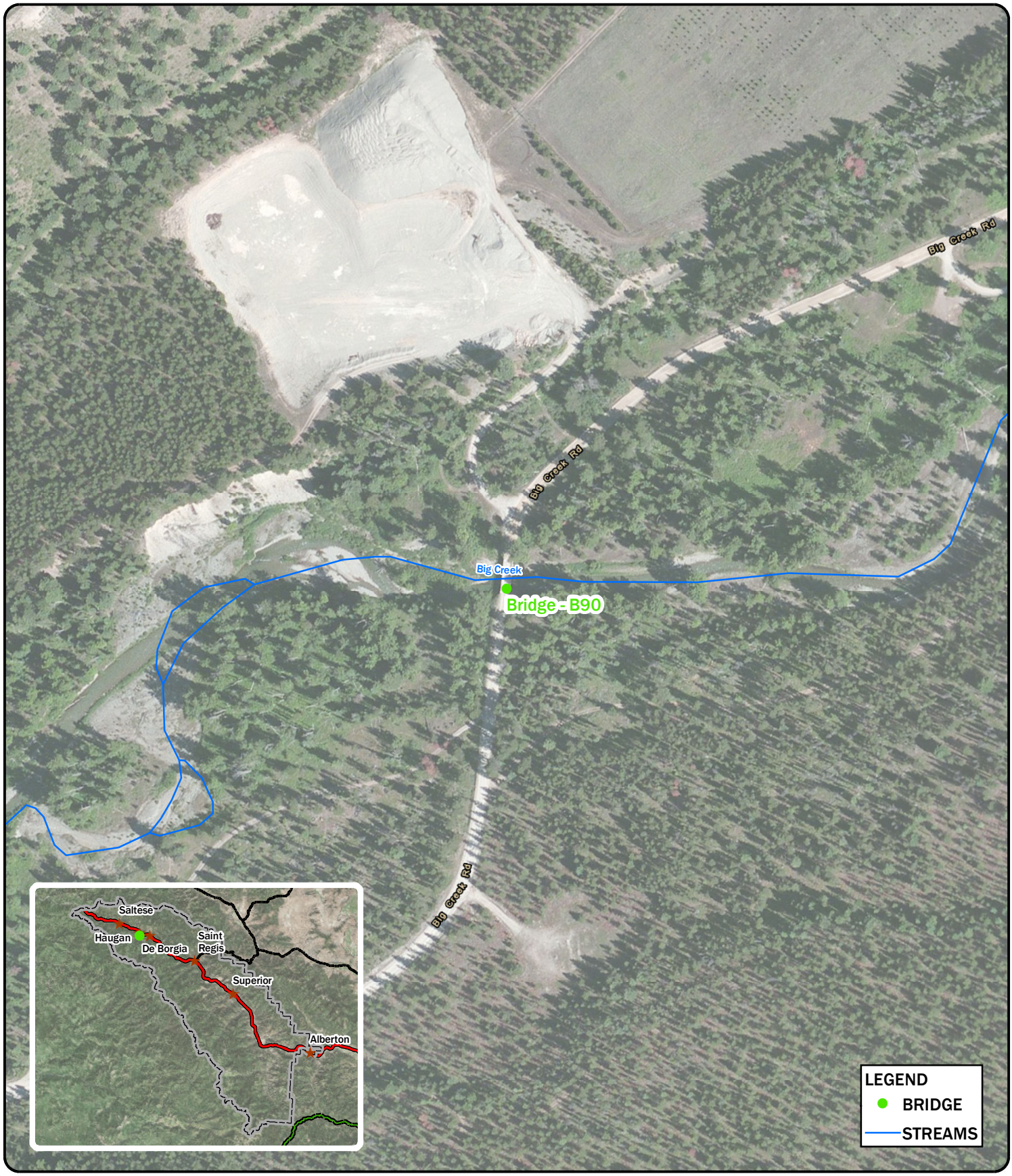
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B89_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B89_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B89_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B89_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B90

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B90

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.

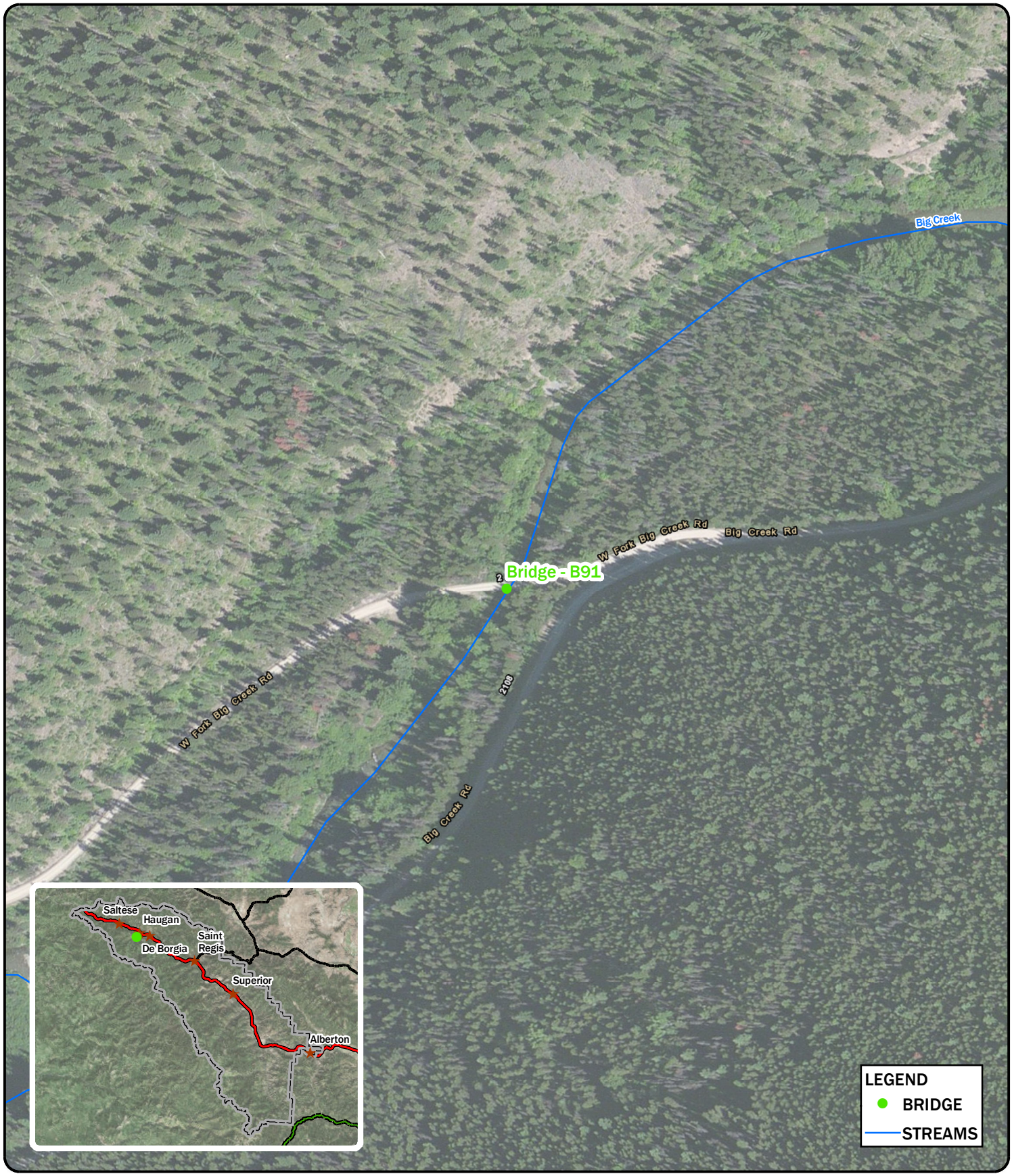
Photo Number: Bridge_B90_1.jpg
Date: Monday, December 5, 2016
Description: Looking upstream from structure
Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.

Photo Number: Bridge_B90_2.jpg
Date: Monday, December 5, 2016
Description: Looking downstream from structure
Project: DNRC Mineral County

Photo Number: Bridge_B90_3.jpg
Date: Monday, December 5, 2016
Description: Looking upstream at structure
Project: DNRC Mineral County

Photo Number: Bridge_B90_4.jpg
Date: Monday, December 5, 2016
Description: Looking downstream at structure
Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B91

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B91

DATE: 5/12/2017

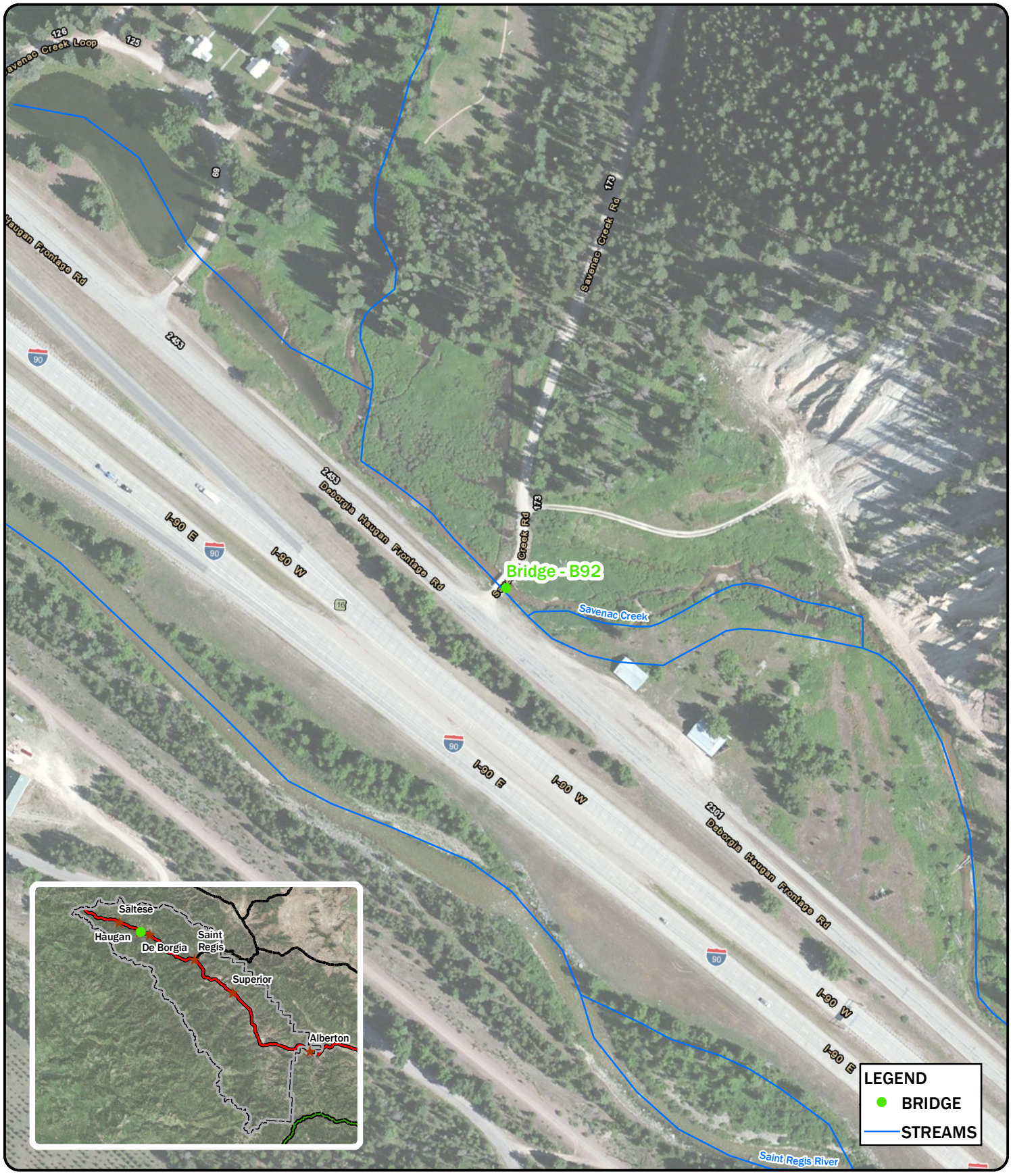
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B91_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B91_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B91_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B91_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B92

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B92

DATE: 5/12/2017

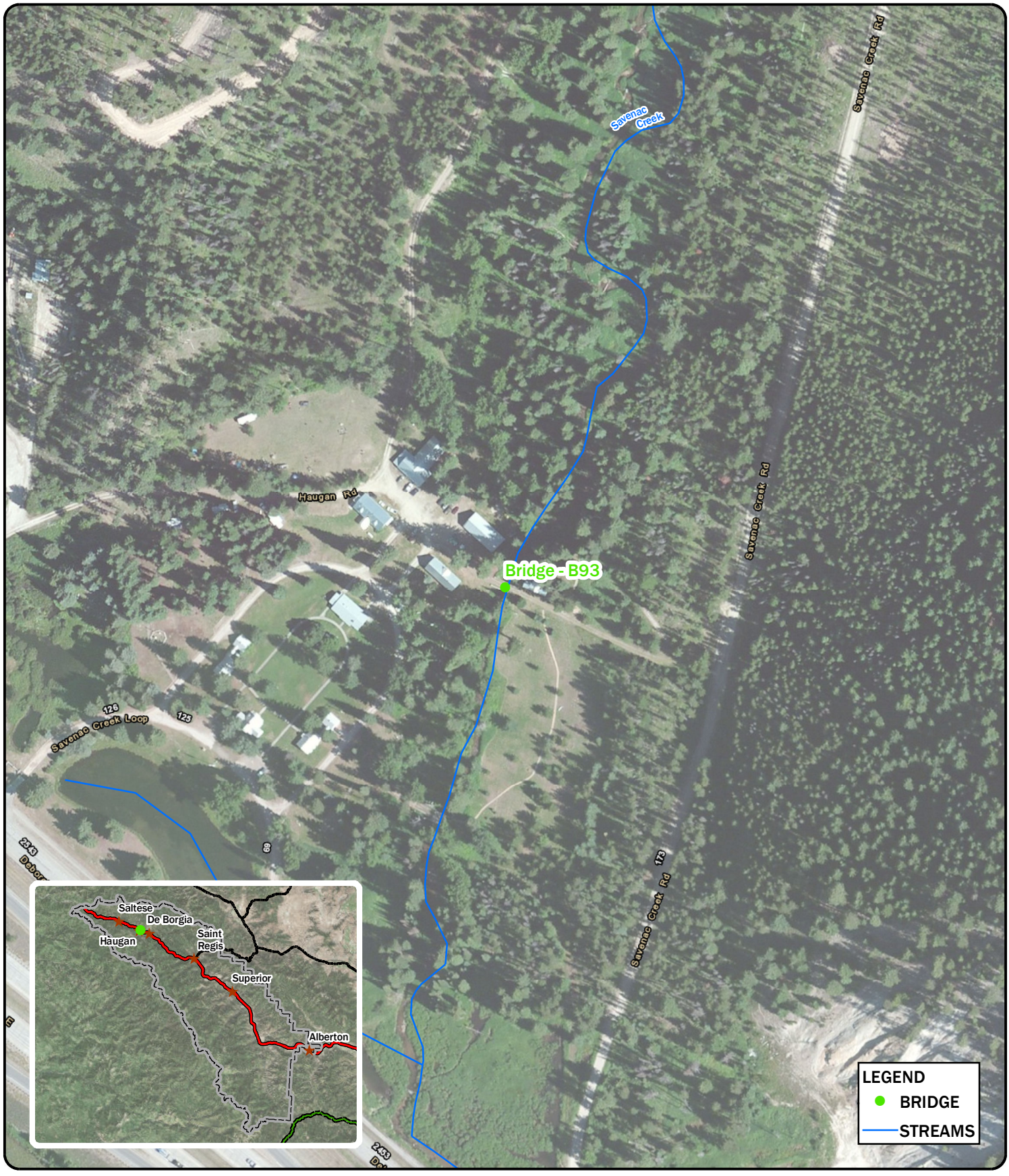
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B92_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B92_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B92_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B92_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B93

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B93

DATE: 5/12/2017

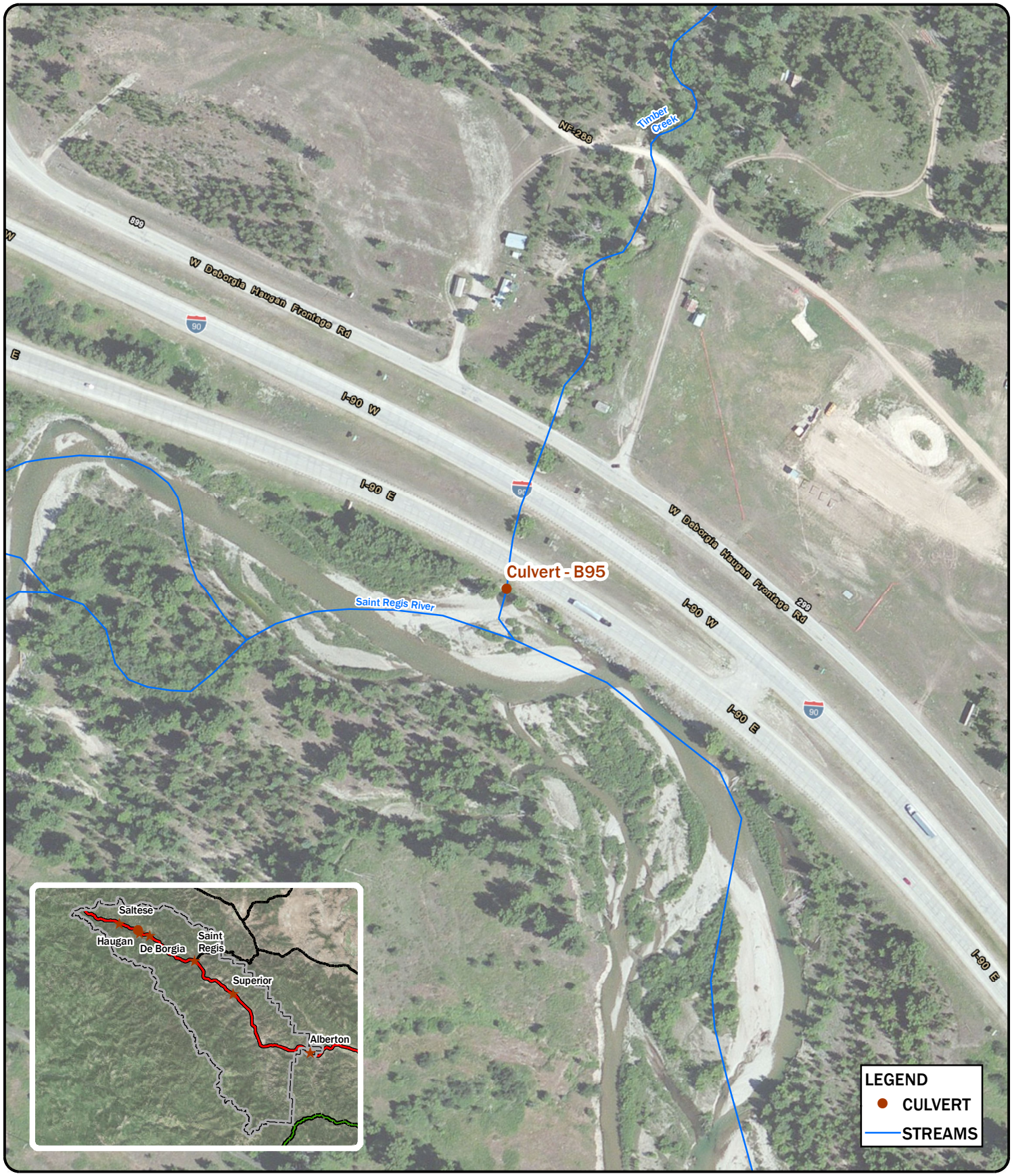
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B93_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B93_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B93_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B93_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B95

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B95

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B95_1.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B95_2.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B95_3.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B95_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B96

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B96

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B96a

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B96a

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B96a_1.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B96a_2.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B96a_3.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B96a_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County

N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B97

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B97

DATE: 5/12/2017

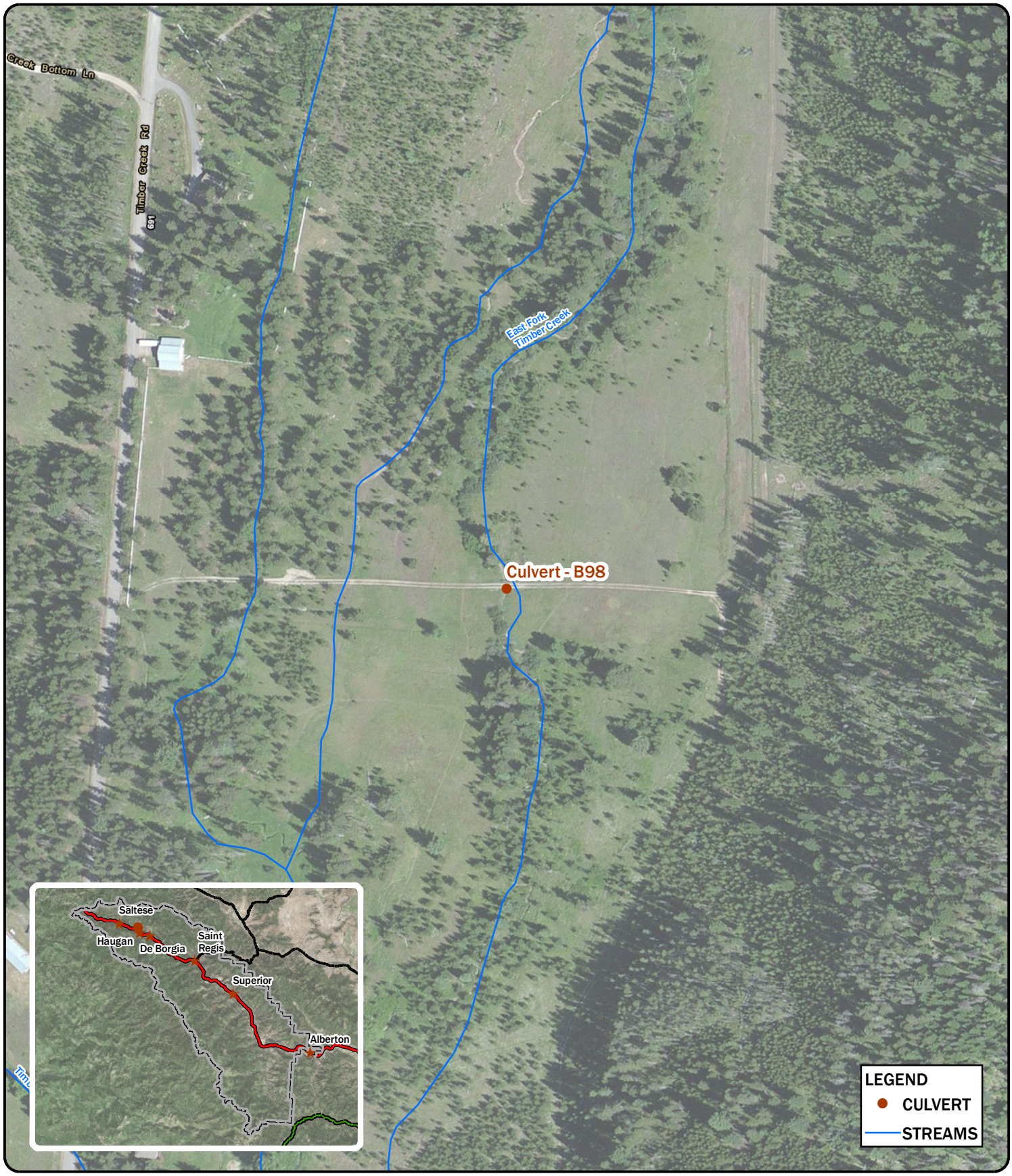
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B97_1.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B97_2.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B97_3.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B97_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B98

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B98

DATE: 5/12/2017

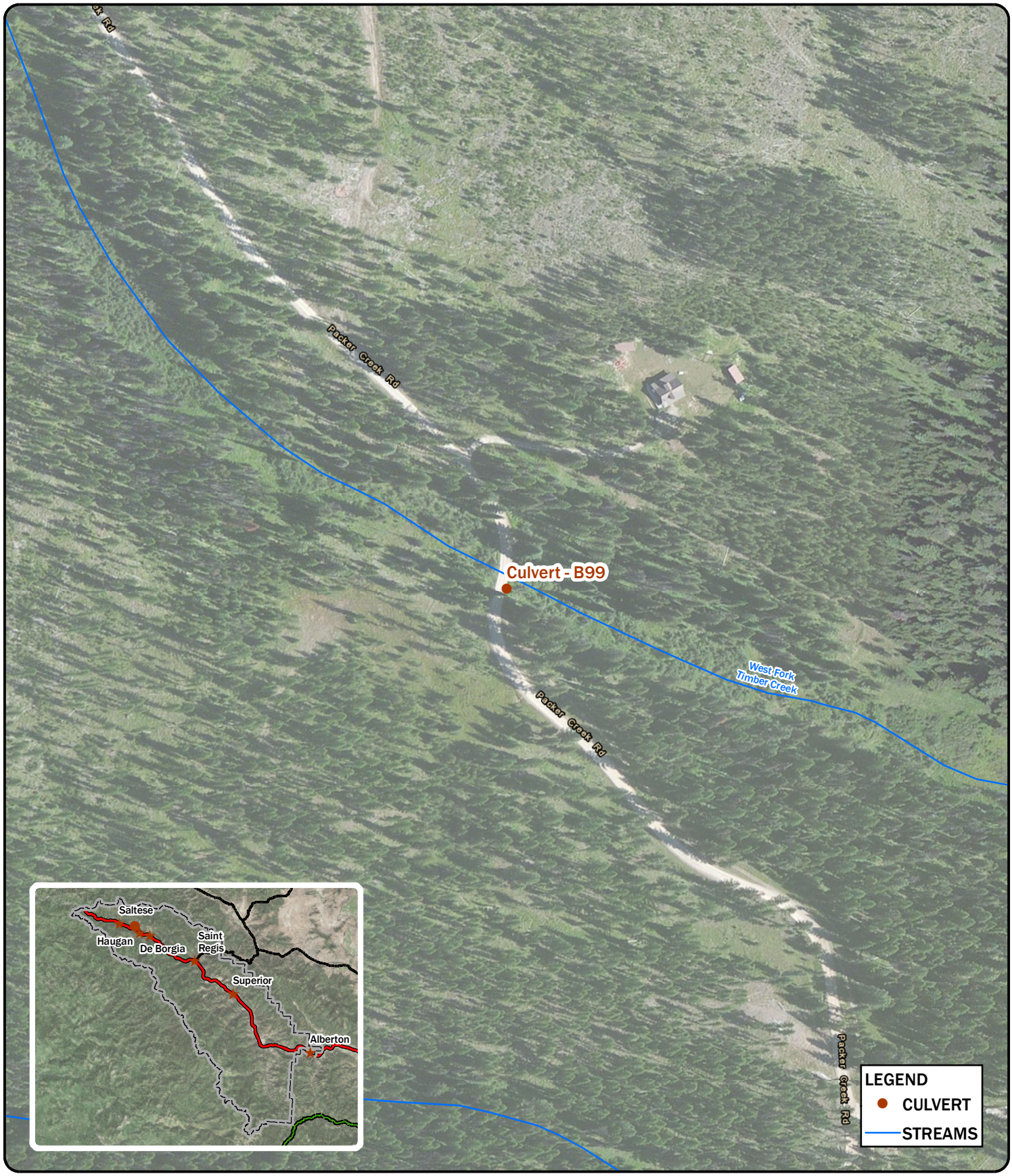
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B98_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B98_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B98_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B98_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B99

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B99

DATE: 5/12/2017

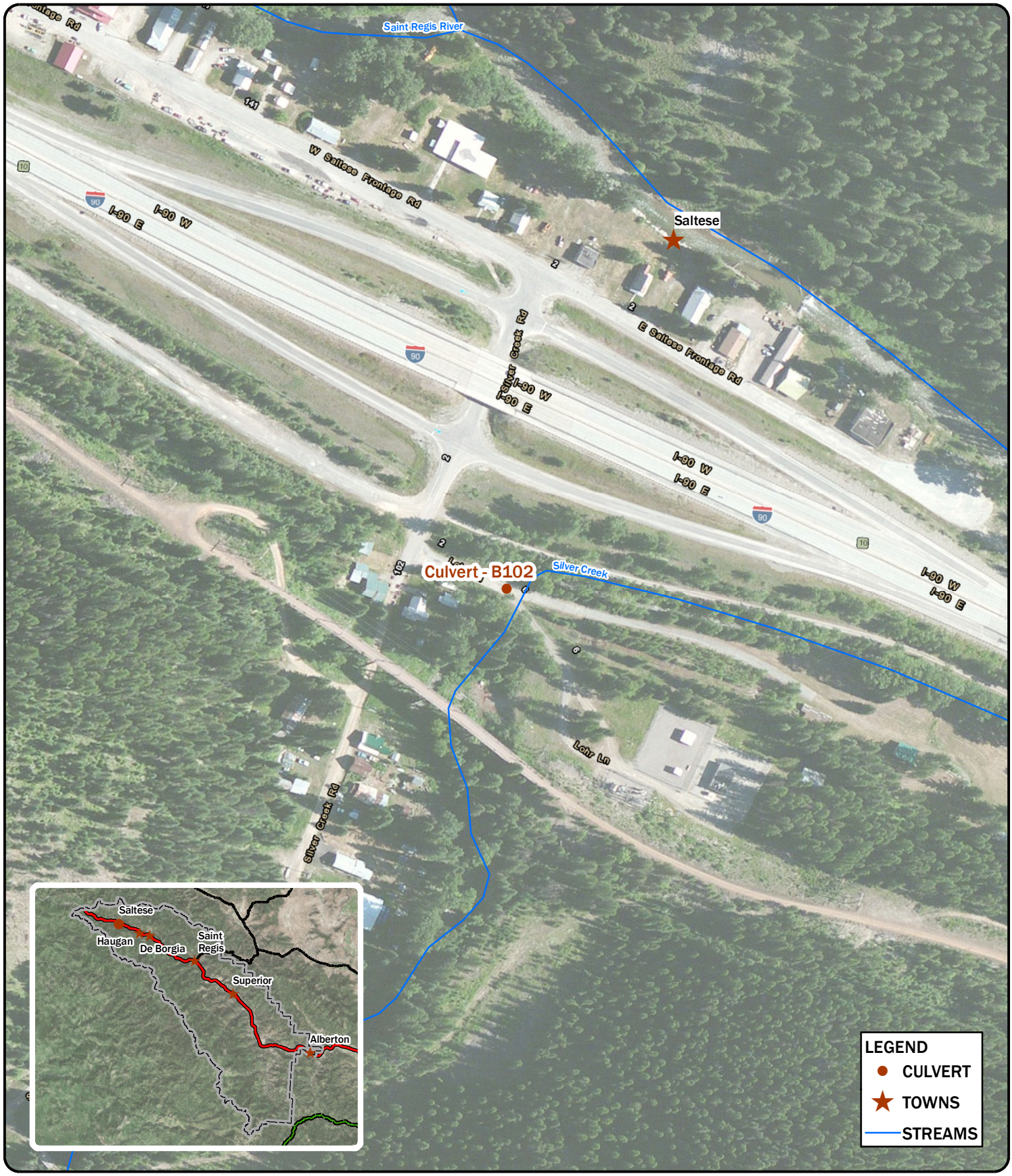
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B99_1.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B99_2.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B99_3.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B99_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B102

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B102

DATE: 5/12/2017

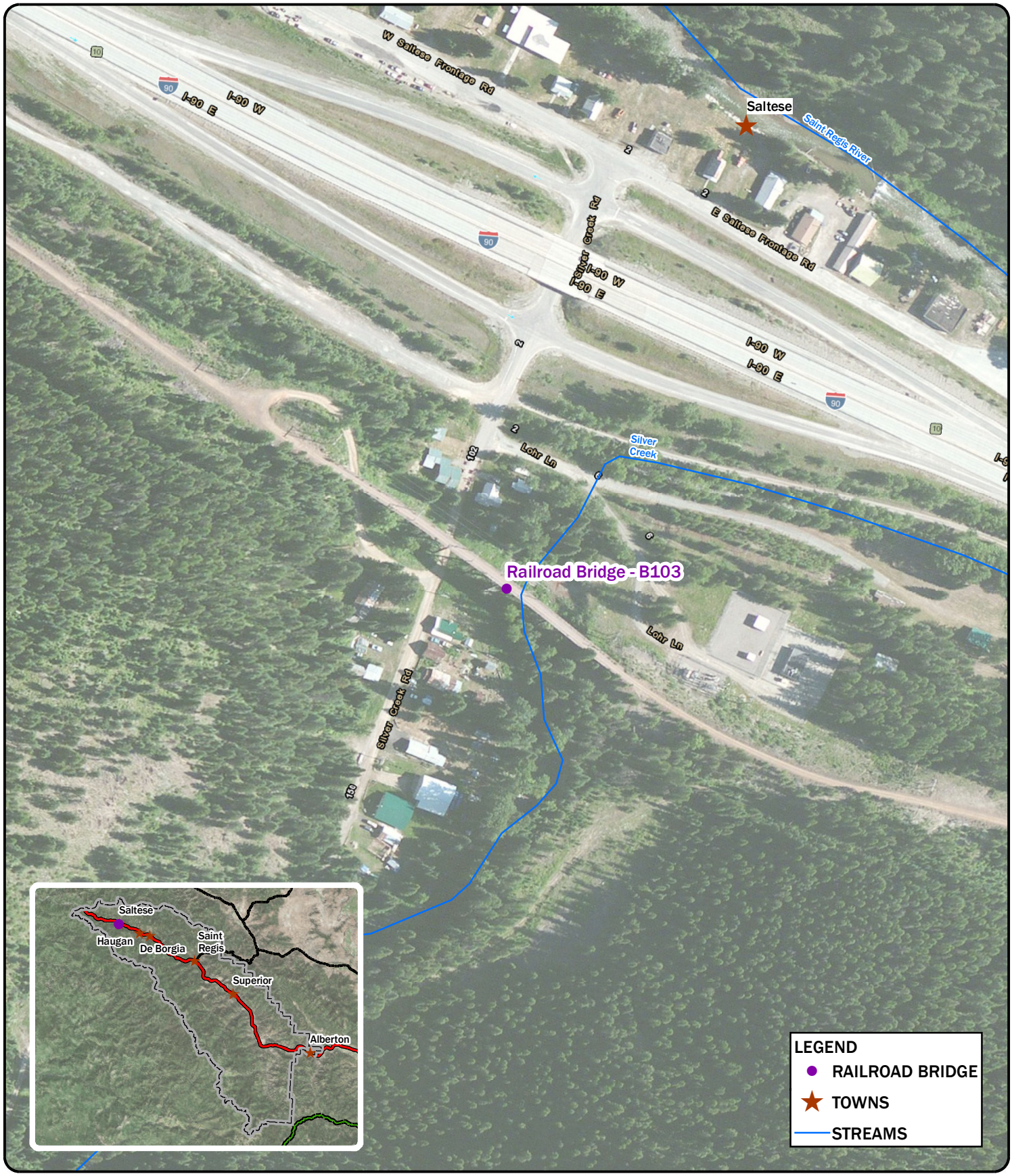
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B102_1.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B102_2.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B102_3.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B102_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B103

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B103

DATE: 5/12/2017

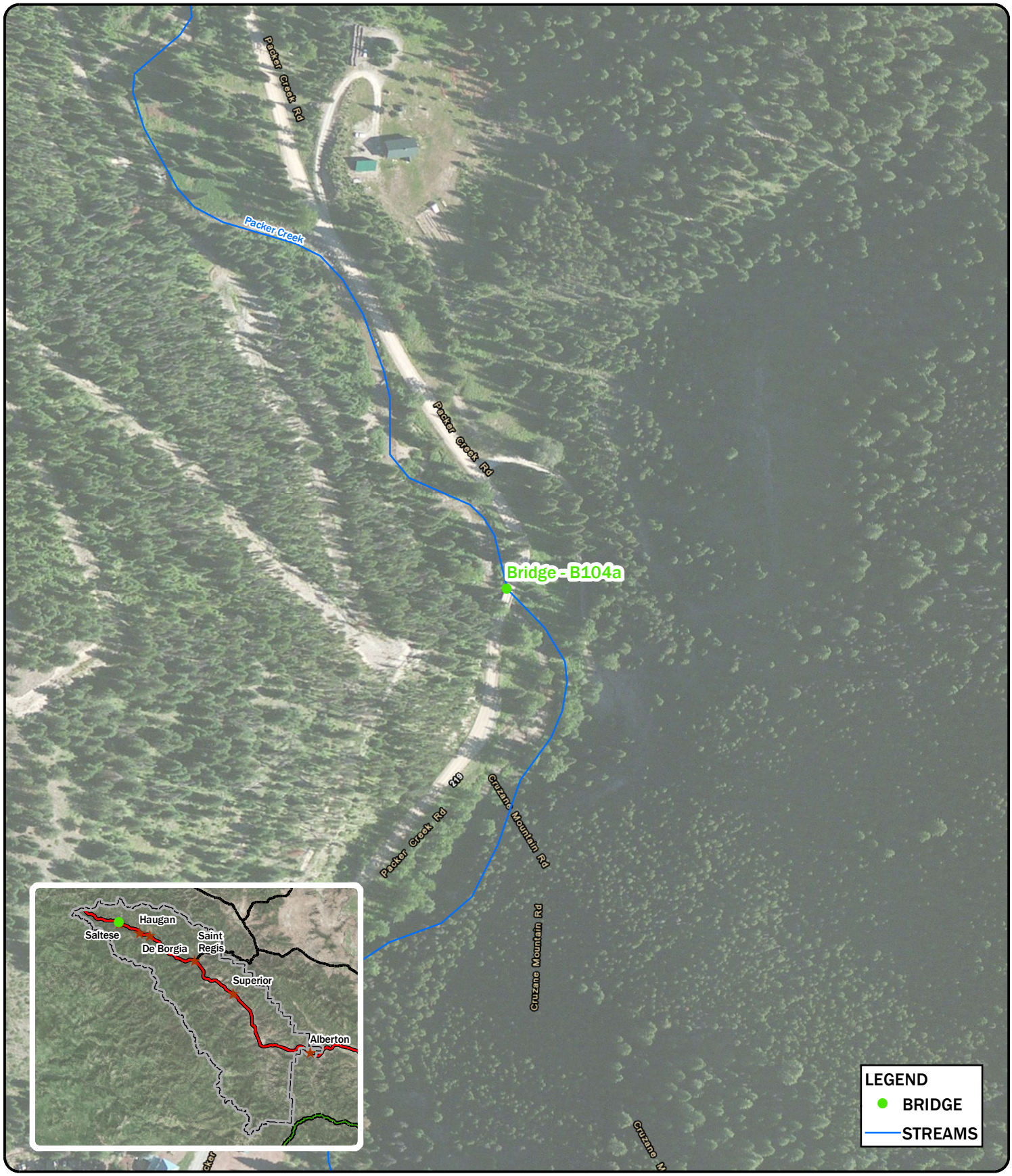
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

Photo Number: Railroad Bridge_B103_1.jpg
Date: Monday, December 5, 2016
Description: Looking upstream from structure
Project: DNRC Mineral County

Photo Number: Railroad Bridge_B103_2.jpg
Date: Monday, December 5, 2016
Description: Looking downstream from structure
Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Railroad Bridge_B103_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Railroad Bridge_B103_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B104a

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B104a

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.

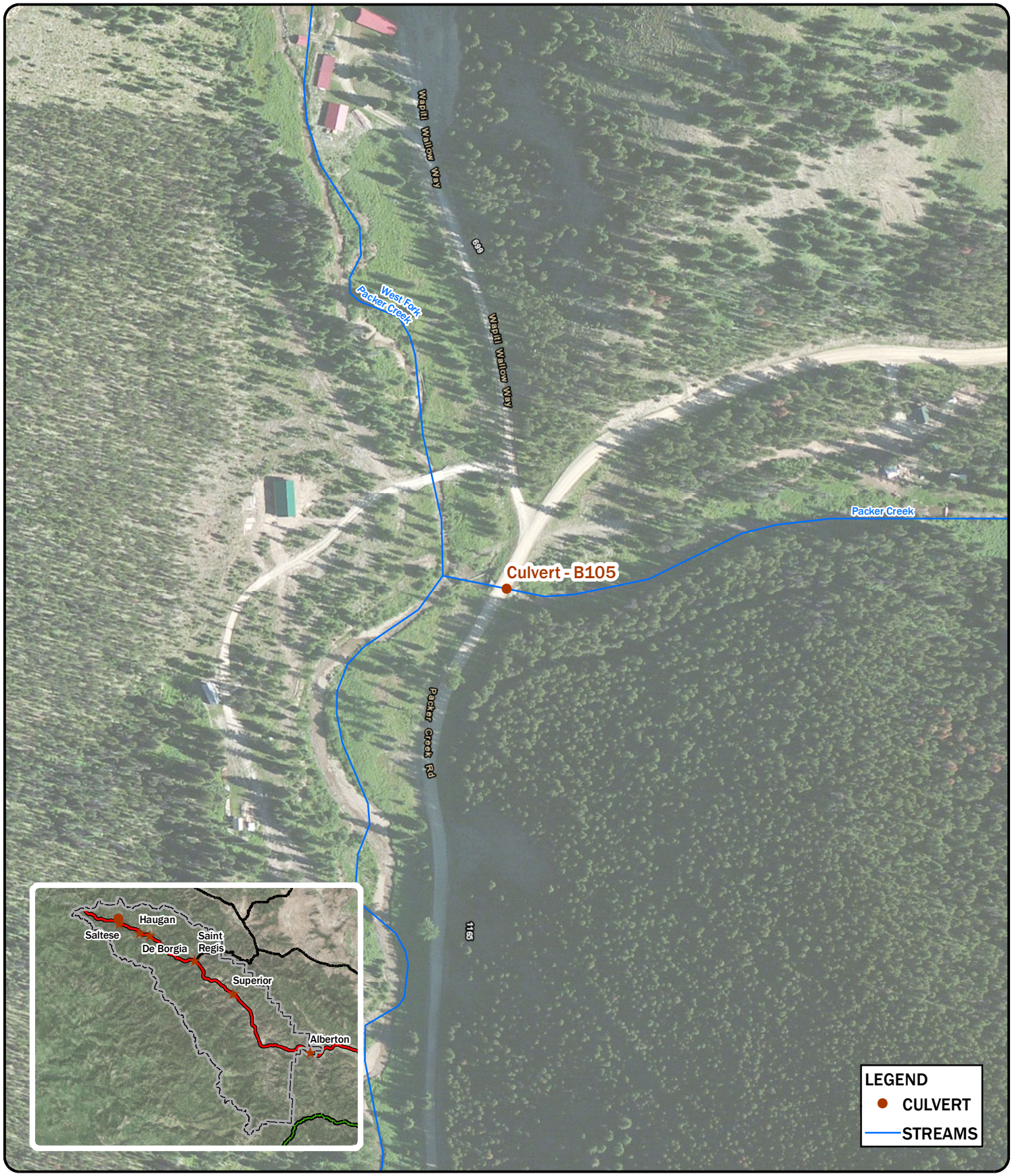
Photo Number: Bridge_B104a_1.jpg
Date: Monday, December 5, 2016
Description: Looking upstream from structure
Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.

Photo Number: Bridge_B104a_2.jpg
Date: Monday, December 5, 2016
Description: Looking downstream from structure
Project: DNRC Mineral County

Photo Number: Bridge_B104a_3.jpg
Date: Monday, December 5, 2016
Description: Looking upstream at structure
Project: DNRC Mineral County

Photo Number: Bridge_B104a_4.jpg
Date: Monday, December 5, 2016
Description: Looking downstream at structure
Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B105

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B105

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.

Photo Number: Culvert_B105_1.jpg

Date: Monday, December 5, 2016

Description: Looking upstream from structure

Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.

Photo Number: Culvert_B105_2.jpg

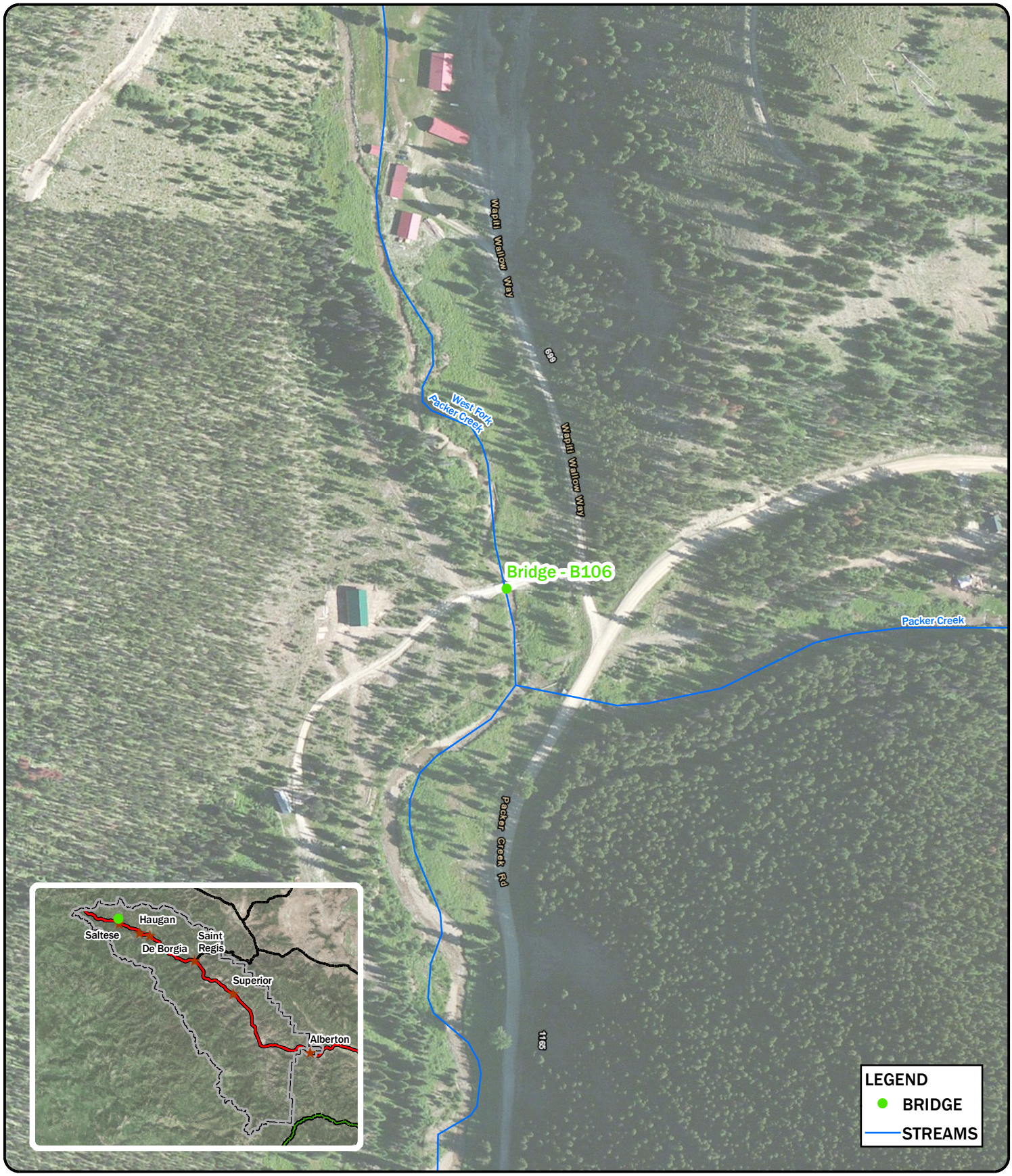
Date: Monday, December 5, 2016

Description: Looking downstream from structure

Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B105_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B105_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B106

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B106

DATE: 5/12/2017

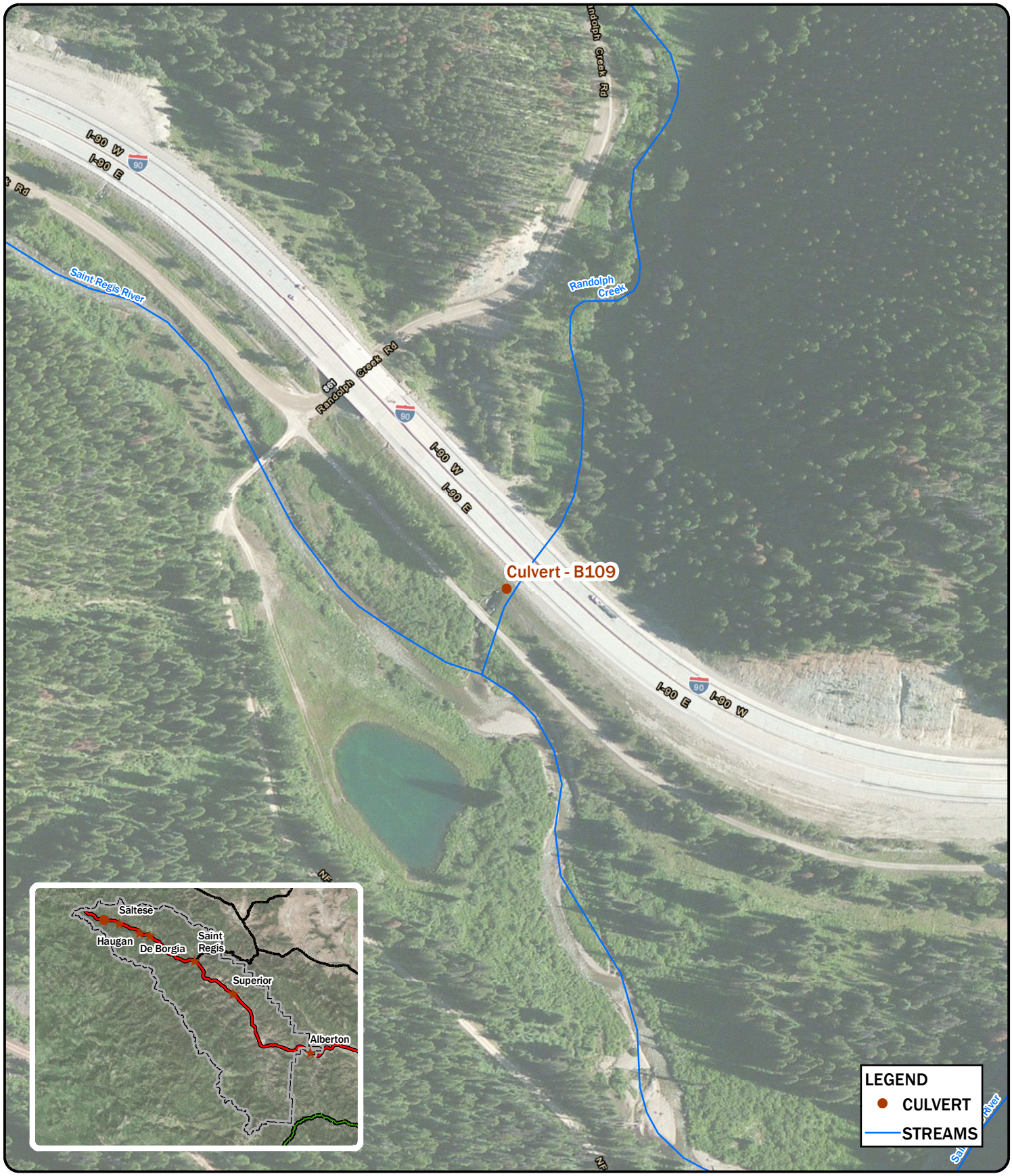
Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B106_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B106_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B106_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Bridge_B106_4.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B109

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B109

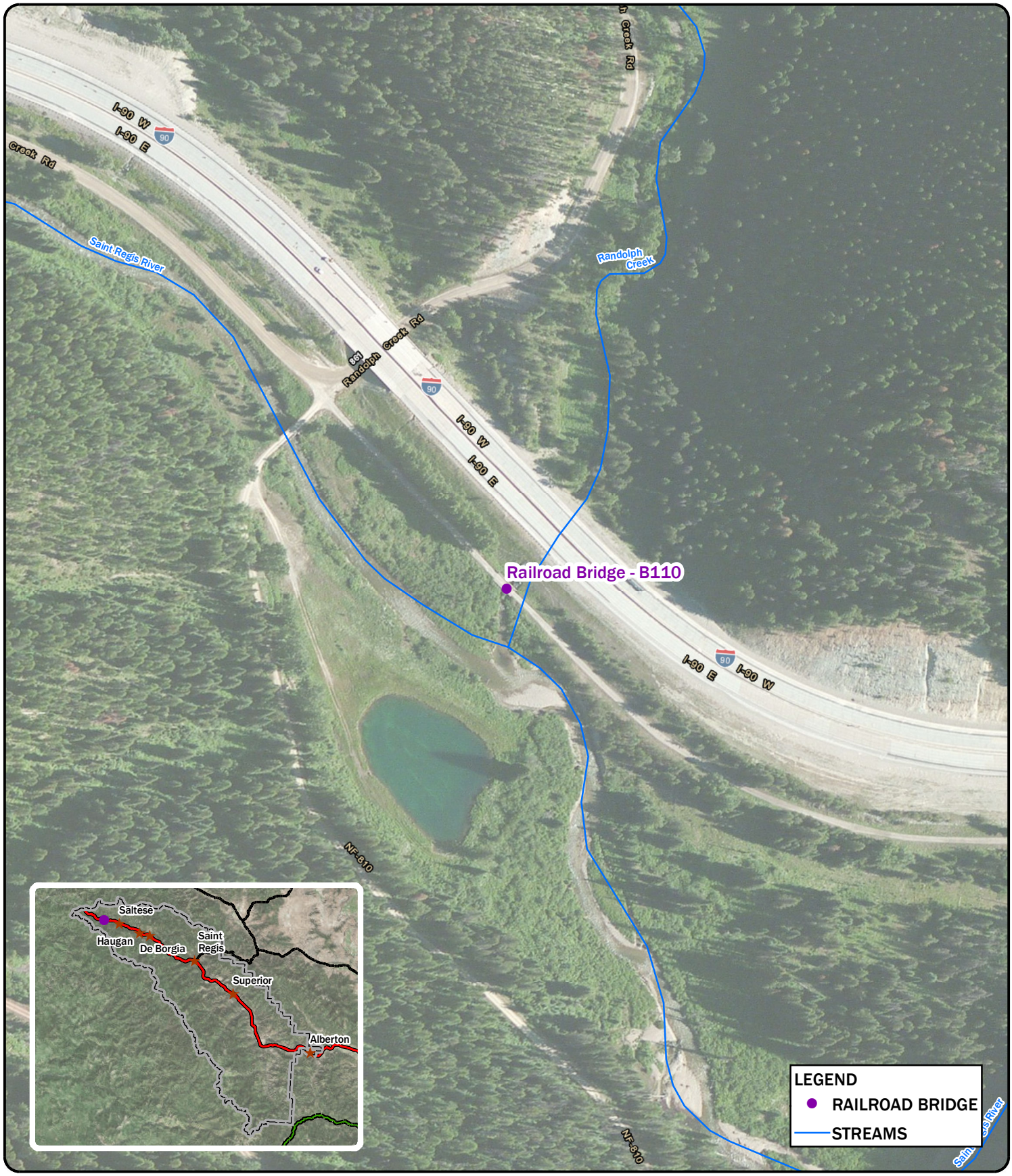
DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B109_1.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B109_2.jpg
	Date: Monday, December 5, 2016
	Description: Looking downstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Culvert_B109_3.jpg
	Date: Monday, December 5, 2016
	Description: Looking upstream at structure
	Project: DNRC Mineral County



N

DISPLAYED AS:
PROJECTION/ZONE: MONTANA STATE PLANE
DATUM: NAD 1983
UNITS: INT'L FEET
SOURCE: PIONEER/ESRI/NRIS

0 100 200 400
Feet

FIGURE B110

PIONEER TECHNICAL SERVICES, INC.

MINERAL COUNTY STRUCTURE INVENTORY B110

DATE: 5/12/2017

Path: G:\DNRC\Mineral -Beaverhead County\Mineral County\CAD-GIS\GIS\StructureInventory\MINCO-GIS-STRINV-001-17.mxd

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Railroad Bridge_B110_1.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream from structure
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number: Railroad Bridge_B110_2.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream from structure
	Project: DNRC Mineral County

	Photo Number: Railroad Bridge_B110_3.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking upstream at structure
	Project: DNRC Mineral County

	Photo Number: Railroad Bridge_B110_4.jpg
	Date: Wednesday, April 26, 2017
	Description: Looking downstream at structure
	Project: DNRC Mineral County

Appendix C

Field Datasheets

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/05/16 TIME: 0900

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: CLOUDY, COLD, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B110

ROAD NAME: NP RAILROAD

TRIBUTARY NAME: RANDOLPH CRK

STRUCTURE TYPE: RR BRIDGE

TYPE INFO: TRACKS REMOVED

STRUCTURE CONDITION: GOOD

CONDITION INFO: SNOW COVER.

STRUCTURE MATERIAL TYPE: WOOD

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	~~17~~	FT	~~E~~ TO PIER 1
Span 2	15	FT	PIER 1 TO PIER 2
Span 3	14.4	FT	PIER 2 TO ~~WEST END~~ NORTH
Span 4	—	FT	
Deck Width	14	FT	
Deck Thickness	1.6	FT	
Guard Rail Height	1.4	FT	
Pier Number	2	EACH	
Pier Type	WOOD	-	GROUP OF CYLINDERS
Pier Width	1 FT	FT	
Abutment Type	VERTICAL STEEL / WOOD	-	
Abutment Fill Configuration	NONE	-	
Backwater Potential	LOW	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (23)	2 (24)	4 (26)	3 (25)

ADDITIONAL INFORMATION: * RR TRACKS REMOVED

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 0830

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: CLOUDY, COLD, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B109

ROAD NAME: I-90

TRIBUTARY NAME: RANDOLPH CRK

STRUCTURE TYPE: CMP CULVERT

TYPE INFO: —

STRUCTURE CONDITION: GOOD

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: CMP

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	10	FT	
Inlet to Deck	27	FT	CULVERT TO HWY (ANGLED)*
Outlet to Deck	42	FT	CULVERT TO HIGHWAY (ANGLED)*
Culvert Length	~~AM~~ 155	FT	GOOGLE
Culvert Entrance Type	MITERED	-	CONFORMED TO SLOPE
Backwater Potential ~~MODERATE~~	~~HIGH~~	-	INTERSTATE ELEVATION HIGH

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	☒ 3 (29)	☒ 1 (27)	☒ 2 (28)	☒

ADDITIONAL INFORMATION: INTERSTATE ELEVATION GRADE HIGH

PIONEER FIELD DATA SHEET Page 1 of 1

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 902

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, cold, 20 °F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B106 STRUCTURE CONDITION: GOOD

ROAD NAME: Wapiti Wallow Way CONDITION INFO: —

TRIBUTARY NAME: West Fork Packer Creek STRUCTURE MATERIAL TYPE: Wood

STRUCTURE TYPE: Bridge MATERIAL TYPE INFO: —

TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	38	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	15	FT	
Deck Thickness	2.3	FT	
Guard Rail Height	N/A	FT	No guard rail
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	STUB	-	WOOD
Abutment Fill Configuration	SLOPED	-	
Backwater Potential	Low	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (30)	2 (31)	4 (33)	3 (32)

ADDITIONAL INFORMATION:

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 902

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Calm, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B105 STRUCTURE CONDITION: GOOD

ROAD NAME: Packer Creek Rd. CONDITION INFO: —

TRIBUTARY NAME: Packer Creek STRUCTURE MATERIAL TYPE: CMP

STRUCTURE TYPE: Culvert MATERIAL TYPE INFO: —

TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	6	FT	
Inlet to Deck	2	FT	(VERTICAL)
Outlet to Deck	9 ½ (SLOPED)	FT	3 FT (VERTICAL)
Culvert Length	49	FT	
Culvert Entrance Type	PROJECTING	-	(OTHER)
Backwater Potential	LOW	-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (34)	2 (35)	4 (37)	3 (36)

ADDITIONAL INFORMATION:

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 0930

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B104A

ROAD NAME: Packer Crk Rd

TRIBUTARY NAME: Packer Crk

STRUCTURE TYPE: Bridge

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: Wood

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	36	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	15.6	FT	
Deck Thickness	3.8	FT	
Guard Rail Height	2.5	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	Vertical	-	(Wood)
Abutment Fill Configuration	N/A	-	
Backwater Potential	Low	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (38)	2 (39)	4 (41)	3 (40)

ADDITIONAL INFORMATION:

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 0930

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B102 STRUCTURE CONDITION: GOOD

ROAD NAME: Lone Ln. CONDITION INFO: —

TRIBUTARY NAME: Silver Crk STRUCTURE MATERIAL TYPE: CMP

STRUCTURE TYPE: Culvert MATERIAL TYPE INFO: —

TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	6	FT	
Inlet to Deck	4.5	FT	
Outlet to Deck	11	FT	
Culvert Length	117	FT	
Culvert Entrance Type	Mitered to	-	Slope
Backwater Potential	Low	-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (42)	2 (43)	4 (45)	3 (44)

ADDITIONAL INFORMATION: Abandoned culvert next to new one

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1100

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B103

ROAD NAME: Rattlesnake Rd. Trail

TRIBUTARY NAME: Silver Crk

STRUCTURE TYPE: RR Bridge

TYPE INFO: (No Tracks)

STRUCTURE CONDITION: Good

CONDITION INFO: ~~Steel / Wood~~

STRUCTURE MATERIAL TYPE: Steel / Wood

MATERIAL TYPE INFO: -

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	635 (Total)	FT	5 Piers ~
Span 2	35'	FT	(Approximate between all)
Span 3	"	FT	
Span 4	"	FT	(6 total spans)
Deck Width	19	FT	
Deck Thickness	≥ 18	FT	
Guard Rail Height	3.6	FT	
Pier Number	5	EACH	
Pier Type	Steel	-	(Other) - Steel cross members and concrete footers
Pier Width	25	FT	Small one = 2 feet
Abutment Type	Vertical	-	Concrete (Sloped)
Abutment Fill Configuration	Sloped	-	
Backwater Potential	No None	-	Very high structure & very small tributary

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (46)	2 (47)	3 (48)	X 4 (49)

ADDITIONAL INFORMATION: Pic # 4 looking upstream. Taken from freeway exit. (49)

off of Packer Cr. Rd.

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1046

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B99 STRUCTURE CONDITION: GOOD

ROAD NAME: E. Fork Timber Creek Rd CONDITION INFO: —

TRIBUTARY NAME: West Fork Timber Crk STRUCTURE MATERIAL TYPE: CMP

STRUCTURE TYPE: Culvert MATERIAL TYPE INFO: —

TYPE INFO:

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	2	FT	
Inlet to Deck	3	FT	VERTICAL
Outlet to Deck	3	FT	
Culvert Length	23	FT	
Culvert Entrance Type	OTHER	-	PROJECTS 1/2 FOOT
Backwater Potential	LOW	-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (50)	2 (51)	3 (52)	4 (53)

ADDITIONAL INFORMATION:

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1100

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B98

ROAD NAME: Private (off Timber Creek)

TRIBUTARY NAME: E. Fork Timber Creek

STRUCTURE TYPE: culvert

TYPE INFO: –

STRUCTURE CONDITION: Good

CONDITION INFO: –

STRUCTURE MATERIAL TYPE: CMP

MATERIAL TYPE INFO: –

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	2	FT	
Inlet to Deck	2	FT	
Outlet to Deck	2.5	FT	
Culvert Length	16	FT	
Culvert Entrance Type	OTHER	-	Projects 1/2 foot
Backwater Potential	LOW	-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (54)	2 (55)	3 (56)	4 (57)

ADDITIONAL INFORMATION:

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1114

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: BG7 STRUCTURE CONDITION: Good

ROAD NAME: Timber Creek RD CONDITION INFO: —

TRIBUTARY NAME: Timber Creek STRUCTURE MATERIAL TYPE: CMP

STRUCTURE TYPE: Culvert MATERIAL TYPE INFO: —

TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	4	FT	
Inlet to Deck	2	FT	
Outlet to Deck	2.6	FT	
Culvert Length	42	FT	
Culvert Entrance Type	OTHER	-	PROJECTS ~ 1 FT
Backwater Potential	LOW	-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (58)	2 (59)	3 (60)	4 (61)

ADDITIONAL INFORMATION: —

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1127

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

~~BRIDGE~~ * CULVERT

STRUCTURE NUMBER: B96A

ROAD NAME: ~~Timber Creek Rd.~~ FRONTAGE RD.

TRIBUTARY NAME: Timber Creek

STRUCTURE TYPE: ~~Bridge~~ CULVERT

TYPE INFO: - → with guardrails

STRUCTURE CONDITION: Good

CONDITION INFO: -

STRUCTURE MATERIAL TYPE: CMP

MATERIAL TYPE INFO: -

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	7	FT	
Inlet to Deck	4.6	FT	
Outlet to Deck	4.6	FT	
Culvert Length	55	FT	
Culvert Entrance Type	MITERED	-	TO SLOPE
Backwater Potential	MODERATE	-	Moderately raised (elevated) frontage road grade

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (62)	2 (63)	3 (64)	4 (65)

ADDITIONAL INFORMATION: * CULVERT W/ GUARDRAILS ON ROAD. DID NOT COLLECT B96 (THOUGHT THIS WAS B96)

PIONEER FIELD DATA SHEET Page 1 of 1

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1127

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B95 STRUCTURE CONDITION: Good

ROAD NAME: Under I-90 Interstate CONDITION INFO: —

TRIBUTARY NAME: Timber Creek STRUCTURE MATERIAL TYPE: CMP

STRUCTURE TYPE: Culverts (2) MATERIAL TYPE INFO: —

TYPE INFO: — → one for each directional lane of the interstate

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	NORTH CULVERT MEASUREMENT	UNITS	SOUTH CULVERT NOTES
Culvert Height	7	FT	7
Inlet to Deck	8.6	FT	6.5
Outlet to Deck	4	FT	5
Culvert Length	100	FT	112.6
Culvert Entrance Type	MITERED	-	TO SLOPE
Backwater Potential	HIGH	-	HIGH → Freeway grade elevation high

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	(N) (66)	2 (N)	~~(S)~~	3 (S)

ADDITIONAL INFORMATION: (66) (N) (N) (67) (68)

(2) CULVERTS UNDER FREEWAY

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1215

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B93 STRUCTURE CONDITION: Good

ROAD NAME: Private Dr. on Savanac Cr. Rd. CONDITION INFO: —

TRIBUTARY NAME: Savanac Creek STRUCTURE MATERIAL TYPE: Rock (stone)

STRUCTURE TYPE: Bridge MATERIAL TYPE INFO: —

TYPE INFO: → with dual culverts beneath

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	20	FT	W TO PIER 1
Span 2	26	FT	PIER 1 TO EAST
Span 3	—	FT	
Span 4	—	FT	
Deck Width	14	FT	
Deck Thickness	3	FT	
Guard Rail Height	1	FT	
Pier Number	1	EACH	
Pier Type	OTHER	-	Rock (stone)
Pier Width	1	FT	
Abutment Type	STUB	-	
Abutment Fill Configuration	None	-	
Backwater Potential	Moderate	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	4.4	FT	CMP DUAL CULVERTS
Inlet to Deck	3	FT	Good condition
Outlet to Deck	3	FT	
Culvert Length	14	FT	
Culvert Entrance Type	OTHER (METAL)		Dual culverts under bridge
Backwater Potential	Moderate	-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (69)	2 (70)	3 (71)	4 (72)

ADDITIONAL INFORMATION: —

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1230

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B92

ROAD NAME: Savanac Cr. Rd

TRIBUTARY NAME: Savanac Creek

STRUCTURE TYPE: Bridge

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: Concrete / Wood (Guardrails)

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	29	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	19	FT	
Deck Thickness	1	FT	
Guard Rail Height	1	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	Stub	-	Concrete
Abutment Fill Configuration	None	-	
Backwater Potential	Moderate	-	(Slightly raised rd. grade)

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (73)	2 (74)	3 (75)	4 (76)

ADDITIONAL INFORMATION: —

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/14 TIME: 1358

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B91

ROAD NAME: Big Creek Rd

TRIBUTARY NAME: BFG Creek

STRUCTURE TYPE: Bridge

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: Wood

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	42	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	16	FT	
Deck Thickness	3.5	FT	
Guard Rail Height	2.6	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	Vertical	-	Wood
Abutment Fill Configuration	None	-	
Backwater Potential	Moderate	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (94)	2 (95)	3 (96)	4 (97)

ADDITIONAL INFORMATION: —

PIONEER FIELD DATA SHEET

Page 1 of 1

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/14 TIME: Cloudy, cold, 20 1415

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS:

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B90

ROAD NAME: Big Creek Rd.

TRIBUTARY NAME: Big Creek

STRUCTURE TYPE: Bridge

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: Wood / Steel

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	60	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	~~B~~ 15	FT	
Deck Thickness	4	FT	
Guard Rail Height	3	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	Vertical	-	Wood
Abutment Fill Configuration	None	-	
Backwater Potential M	Moderate	-	(High rd grade)

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
heck box once photo has been collected	1 (98)	2 (99)	3 (100)	4 (101)

DITIONAL INFORMATION: —

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1308

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: cloudy, cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B89

ROAD NAME: E. Big Creek Lane

TRIBUTARY NAME: Big Creek

STRUCTURE TYPE: Bridge

TYPE INFO: —

STRUCTURE CONDITION: Poor ~~Fair~~ (BOWS @ CENTER)

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: wood

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	56	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	16	FT	
Deck Thickness	~~2~~ 3.6	FT	
Guard Rail Height	3	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	STUB	-	(WOOD & TIRES)
Abutment Fill Configuration	NONE	-	LARGE TIRES
Backwater Potential	LOW	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (82)	2 (83)	3 (84)	4 (85)

ADDITIONAL INFORMATION: ~125' upstream from B88 (bridge). Vehicle (landowners) drove over bridge

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1308

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B88

ROAD NAME: McGill DR.

TRIBUTARY NAME: Big Creek

STRUCTURE TYPE: Bridge

TYPE INFO: —

STRUCTURE CONDITION: ~~Good~~ Fair

CONDITION INFO: Bent & rusty guard rail

STRUCTURE MATERIAL TYPE: Concrete / steel / wood deck

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	50.6	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	14	FT	
Deck Thickness	1	FT	
Guard Rail Height	3	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	Vertical	-	Concrete
Abutment Fill Configuration	Sloped	-	
Backwater Potential	Low	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (86)	2 (87)	3 (88)	4 (89)

ADDITIONAL INFORMATION: ~125' upstream from old Milwaukee Trail bridge. (B
and downstream from B89.

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/14 TIME: 13:08

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B87 STRUCTURE CONDITION: Good

ROAD NAME: Milwaukee Trail Rd. CONDITION INFO: —

TRIBUTARY NAME: Big Creek STRUCTURE MATERIAL TYPE: Wood / Steel

STRUCTURE TYPE: RR Bridge MATERIAL TYPE INFO: —

TYPE INFO: Tracks removed

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	94	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	14	FT	
Deck Thickness	3	FT	
Guard Rail Height	4.6	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	Wood	-	Vertical stub, footer(s)
Abutment Fill Configuration	None	-	
Backwater Potential	~~Low~~ Moderate	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (90)	2 (91)	3 (92)	4 (93)

ADDITIONAL INFORMATION: Two bridges directly upstream (B89 and B88).

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/8/16 TIME: 1242

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B86a

ROAD NAME: Frontage Rd

TRIBUTARY NAME: Savanac CR

STRUCTURE TYPE: Culvert

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: Concrete Box

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	9'	FT	
Inlet to Deck	2.5	FT	
Outlet to Deck	2.5	FT	
Culvert Length	45	FT	
Culvert Entrance Type	Squared	-	Headwall
Backwater Potential	Moderate	-	Mod High RD Grade

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (79)	2 (80)	1 (copy B86) (3) (77)	4 (81)

ADDITIONAL INFORMATION:

* Copied photo from B86. Beaver dam ~ 100' upstream

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1242

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B86
ROAD NAME: Interstate (I-90)
TRIBUTARY NAME: Savanac Creek
STRUCTURE TYPE: Culvert
TYPE INFO: CMP

STRUCTURE CONDITION: Good
CONDITION INFO: —
STRUCTURE MATERIAL TYPE: CMP
MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	8'	FT	
Inlet to Deck	5'	FT	slope vertical
Outlet to Deck	5	FT	
Culvert Length	222	FT	Google
Culvert Entrance Type	Mitered to	-	slope
Backwater Potential	High	-	

Huge culvert get to other side

Google

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	2 (78)	X	X	1 (77)

ADDITIONAL INFORMATION:

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1514

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B83a

ROAD NAME: Lower Cotton Ln.

TRIBUTARY NAME: E. Twin Creek

STRUCTURE TYPE: Culvert

TYPE INFO: —

STRUCTURE CONDITION: GOOD

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: CMP

MATERIAL TYPE INFO:

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	3	FT	
Inlet to Deck	1	FT	
Outlet to Deck	1.5	FT	
Culvert Length	23	FT	
Culvert Entrance Type	OTHER	-	PROJECTS 1/2 FOOT
Backwater Potential	LOW	-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (112)	2 (113)	3 (114)	4 (115)

ADDITIONAL INFORMATION:

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1524

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Calm, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B83b

ROAD NAME: Twin Creek Rd

TRIBUTARY NAME: E. Twin Creek

STRUCTURE TYPE: Culvert

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: CMP

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	2	FT	
Inlet to Deck	2.6	FT	
Outlet to Deck	3	FT	
Culvert Length	64	FT	
Culvert Entrance Type	Metered	-	To Slope
Backwater Potential	Low	-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (116)	2 (117)	3 (118)	4 (119)

ADDITIONAL INFORMATION: Storm drain culvert adjacent to trib culvert

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1443

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, cold, 20° F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B82

ROAD NAME: Frontage Rd.

TRIBUTARY NAME: E. Twin Creek

STRUCTURE TYPE: Culvert

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: Dual Box (concrete)

MATERIAL TYPE INFO: Guard rail on road ~2'

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	5	FT	
Inlet to Deck	3.6	FT	
Outlet to Deck	4	FT	
Culvert Length	46	FT	
Culvert Entrance Type	Square	-	Dual box w/ FETS (wingwall)
Backwater Potential	High	-	High road grade

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	☒ 1 (109)	☒ 2 (110)	☒ (#3) (108) (copy 108 from B81)	☒ 4 (111)

ADDITIONAL INFORMATION: ☒ Copied photo

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/05/16 TIME: 1430

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: CLOUDY, COLD, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B81 STRUCTURE CONDITION: GOOD

ROAD NAME: (I-90) INTERSTATE CROSSING CONDITION INFO: -

TRIBUTARY NAME: E. TWIN CRK STRUCTURE MATERIAL TYPE: CMP

STRUCTURE TYPE: CULVERT MATERIAL TYPE INFO: -

TYPE INFO: -

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	6	FT	
Inlet to Deck	5.6	FT	
Outlet to Deck	2	FT	
Culvert Length	470	FT	GOOGLE
Culvert Entrance Type	OTHER	-	PROJECTS ~ 2'
Backwater Potential	HIGH	-	(HIGH RD GRADE)

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	☒ 3	1 ☒ ☒	B80 #4 ☒ (4)	☒ ☒ 2

ADDITIONAL INFORMATION: * (COPIED PHOTO (108) ~~(106)~~ (106) (104) 4 (107)

COPY FROM B80

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/05/16 TIME: 1430

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B80

ROAD NAME: Millwaker Trail Rd.

TRIBUTARY NAME: East Twin Creek

STRUCTURE TYPE: Bridge

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: Wood

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	37	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	15	FT	
Deck Thickness	3	FT	
Guard Rail Height	None	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	Stub	-	(Wood)
Abutment Fill Configuration	None	-	
Backwater Potential	Moderate	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1 (102)	2 (103)	3 (104)	4 (105)

ADDITIONAL INFORMATION: Water level up to bottom of bridge (ponding)

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1550

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B78

ROAD NAME: Old Mullan Rd.

TRIBUTARY NAME: E Fork Twelve Mile Creek

STRUCTURE TYPE: Culvert

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: Concrete Box

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	5	FT	
Inlet to Deck	5.6	FT	
Outlet to Deck	6	FT	
Culvert Length	37	FT	
Culvert Entrance Type	Square	-	Headwall
Backwater Potential	~~Medium~~	-	Moderate

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1	2	3	4

ADDITIONAL INFORMATION: (120) (121) (122) (123)

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1600

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B77

ROAD NAME: old Mullan Rd.

TRIBUTARY NAME: E. Fork Twelvemile Cr.

STRUCTURE TYPE: Culvert

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: Concrete Box

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	4	FT	
Inlet to Deck	5	FT	
Outlet to Deck	6	FT	
Culvert Length	50	FT	
Culvert Entrance Type	Square	-	Headwall
Backwater Potential M	Medium	-	Moderate Elevated Road grade

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	2	1	4	3

ADDITIONAL INFORMATION: (125) (124) (127) (126)

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1600

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B76

ROAD NAME: Horseback Ln

TRIBUTARY NAME: E. Fork 12 Mile

STRUCTURE TYPE: Bridge

TYPE INFO: -

STRUCTURE CONDITION: Good

CONDITION INFO: -

STRUCTURE MATERIAL TYPE: Concrete / wood

MATERIAL TYPE INFO: -

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	13	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	12	FT	
Deck Thickness	1	FT	
Guard Rail Height	None	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	~~None~~	-	Mech stabalized Earth
Abutment Fill Configuration	~~None~~ sloped	-	Mech stabalized Earth
Backwater Potential L	Low	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1	2	3	4

ADDITIONAL INFORMATION: (128) (129) (130) (131)

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1420

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B75

ROAD NAME: OFF 12 MILE RD

TRIBUTARY NAME: 12 MILE CRK

STRUCTURE TYPE: BRIDGE

TYPE INFO: —

STRUCTURE CONDITION: GOOD

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: WOOD

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	33	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	25.6	FT	
Deck Thickness	4	FT	
Guard Rail Height	3	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	STUB	-	WOOD - WINGWALLS OFF STUB
Abutment Fill Configuration	NONE	-	
Backwater Potential M	MODERATE	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1	2	3	4

ADDITIONAL INFORMATION: (132) (133) (134) (135)

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1020

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B74

ROAD NAME: Twelvemile Road

TRIBUTARY NAME: Twelvemile Creek

STRUCTURE TYPE: Bridge

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: some cracking on guardrails

STRUCTURE MATERIAL TYPE: Concrete

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	43	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	26	FT	
Deck Thickness	1	FT	
Guard Rail Height	2.6	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	Stub	-	Concrete
Abutment Fill Configuration	None	-	
Backwater Potential L	Low	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1	2	3	4

ADDITIONAL INFORMATION: (136) (137) (138) (139)

PIONEER FIELD DATA SHEET

Page 1 of 1

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/5/16 TIME: 1040

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

Private

STRUCTURE NUMBER: B73 → Mullan Gulch

ROAD NAME: (off of ~~Twelvemile Rd~~)

TRIBUTARY NAME: Twelvemile Creek

STRUCTURE TYPE: Bridge

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: Wood/Steel

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	76	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	15	FT	
Deck Thickness	4	FT	
Guard Rail Height	1	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	Stubs	-	Wood
Abutment Fill Configuration	None	-	
Backwater Potential	Moderate	-	Moderately high rd. grade

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1	2	3	4

ADDITIONAL INFORMATION: (140) (141) (142) (143)

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/05/16 TIME: 1650

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Cloudy, Cold, 20°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B71

ROAD NAME: ~~Rock Creek Rd.~~ Mullen Gulch Road

TRIBUTARY NAME: ROCK CRUK

STRUCTURE TYPE: Bridge

TYPE INFO: —

STRUCTURE CONDITION: Good

CONDITION INFO: —

STRUCTURE MATERIAL TYPE: Concrete

MATERIAL TYPE INFO: —

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	39	FT	
Span 2	—	FT	
Span 3	—	FT	
Span 4	—	FT	
Deck Width	25	FT	
Deck Thickness	~~E~~ 3	FT	
Guard Rail Height	2.5	FT	
Pier Number	—	EACH	
Pier Type	—	-	
Pier Width	—	FT	
Abutment Type	STUBS	-	Concrete
Abutment Fill Configuration	None	-	
Backwater Potential	~~Low~~ Moderate		

B72 & 74 Culvert

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	6	FT	CMP - Good Condition
Inlet to Deck	3	FT	Rock Crk Road
Outlet to Deck	4	FT	
Culvert Length	41	FT	
Culvert Entrance Type	Metered	-	To Slope
Backwater Potential	~~Low~~ Moderate -		

Pics: 1, 2, 3, 4 (148 - 151)

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

B71

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1	2	3	4

ADDITIONAL INFORMATION: (144) (145) (146) (147)

* Water elevation near bottom of bridge on B71

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/6/16 TIME: 0900

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Slightly cloudy, 15°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B70

ROAD NAME: Interstate (I-90)

TRIBUTARY NAME: Twelvemile Creek

STRUCTURE TYPE: Culvert

TYPE INFO: –

STRUCTURE CONDITION: Good

CONDITION INFO: –

STRUCTURE MATERIAL TYPE: CMP

MATERIAL TYPE INFO: –

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		FT	
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width		FT	
Deck Thickness		FT	
Guard Rail Height		FT	
Pier Number		EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type		-	
Abutment Fill Configuration		-	
Backwater Potential		-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	17	FT	
Inlet to Deck	3	FT	
Outlet to Deck	4 (ACCESS RD)	FT	10 FT - ACCESS ROAD TO INTERSTATE
Culvert Length	189	FT	GOOGLE
Culvert Entrance Type	~~PROJECTING~~	-	METERED TO SLOPE - SLIGHTLY
Backwater Potential	H164	-	PROJECTS @ TOP OF CULVERT

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1	2	3	4

ADDITIONAL INFORMATION: ~~No Access on North side (inlet)~~

(152) (153) (154) (155)

*Call Anton before inventory 406-280-0054 ✓

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory DATE: 12/16/14 TIME: 0930

FIELD CREW: N.Hockaday & B. Kamrud WEATHER CONDITIONS: Partly Cloudy, 10°F

STRUCTURE INFORMATION:

STRUCTURE NUMBER: B55 STRUCTURE CONDITION: Fair

ROAD NAME: Private (Off of Little Joe Rd.) CONDITION INFO: -

TRIBUTARY NAME: Little Joe Creek STRUCTURE MATERIAL TYPE: Wood

STRUCTURE TYPE: Bridge MATERIAL TYPE INFO: -

TYPE INFO: May be Abandoned RR

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	16	FT	W to Pier 1
Span 2	13	FT	Pier 1 to 2
Span 3	15.6	FT	Pier 2 to 3
Span 4	15	FT	Pier 3 to ~~East~~ 4
Deck Width	14	FT	
Deck Thickness	3	FT	
Guard Rail Height	—	FT	
Pier Number	4	EACH	
Pier Type	Wood	-	Cross Brace / Group of Cylinders
Pier Width	1	FT	
Abutment Type	Stub	-	Stacked for ties
Abutment Fill Configuration	Sloped	-	Earthen
Backwater Potential	Moderate	-	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected	1	2	3	4

ADDITIONAL INFORMATION: Pier 4 to East = 13

(156) (157) (158) (159)

Appendix D

Bridge Structure Record Drawings

INCLUDED AS DIGITAL FILE

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory **DATE:** 8/23/2019 **TIME:** 1130 hrs.

FIELD CREW: Larry Schock, DNRC **WEATHER CONDITIONS:** Partly Cloudy, 60's

STRUCTURE INFORMATION:

STRUCTURE NUMBER:	Little Joe Creek Culvert	**STRUCTURE CONDITION:**	Good
ROAD NAME:	Little Joe Road	**CONDITION INFO:**	Mitered entrance, straight projection outlet
TRIBUTARY NAME:	Little Joe Creek Culvert	**STRUCTURE MATERIAL TYPE:**	CMP
STRUCTURE TYPE:	Culvert Arch, open bottom	**MATERIAL TYPE INFO:**	6" x 2" Corrugation
TYPE INFO:	Rise 7.8 ft x Span 17.7 ft.		

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1		**FT**	
Span 2		**FT**	
Span 3		**FT**	
Span 4		**FT**	
Deck Width		**FT**	
Deck Thickness		**FT**	
Guard Rail Height		**FT**	
Pier Number		**EACH**	
Pier Type		**-**	
Pier Width		**FT**	
Abutment Type		**-**	
Abutment Fill Configuration		**-**	
Backwater Potential		**-**	

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height	**7.8**	**FT**	**1/2 round, Arch bottomless culvert**
Inlet to Deck	**10.8**	**FT**	
Outlet to Deck	**10.8**	**FT**	
Culvert Length	**48**	**FT**	**48 ft. barrel, 54 ft. w/ mitered entrance**
Culvert Entrance Type	**mitered**	**-**	
Backwater Potential	**Yes**	**-**	**Evidence of backwater effect**

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		**FT**	
Backwater Potential		**-**	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected				

ADDITIONAL INFORMATION: Culvert approximately centered in riparian floodplain w/ 84 ft. on right and 82 ft. on left side, evidence of backwater effe

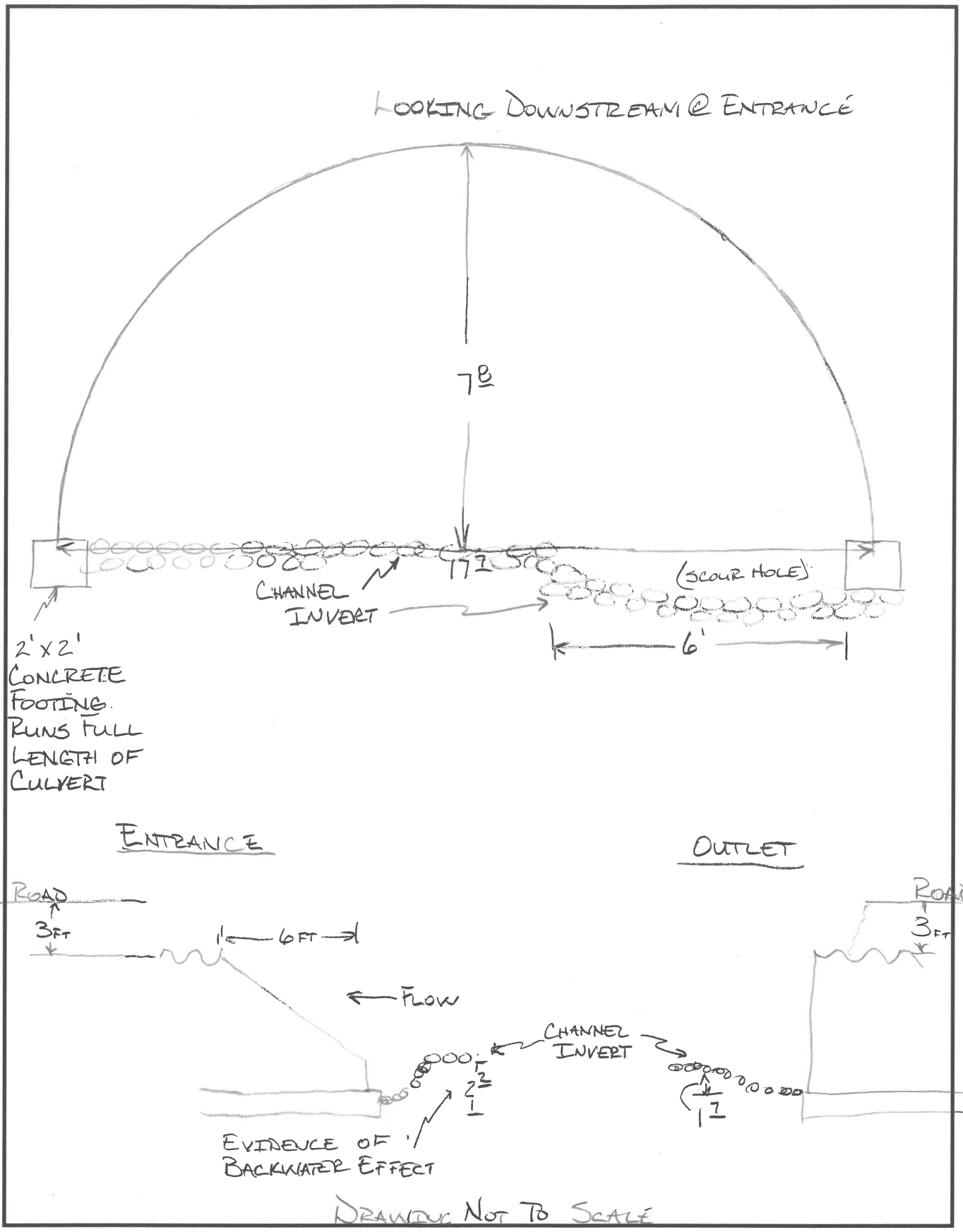
See attached notes.

State of Montana • Department of Natural Resources and Conservation • 1424 9th Ave., PO Box 210601 • Helena, MT 59620-1601

BY L. SCHOCK DATE 8/23/19 SUBJECT LITTLE JOE CRK SHEET NO. 1 OF 1

CHKD. BY _____ DATE _____ JOB NO. _____

BOTTOMLESS ARCH CULVERT



PIONEER TECHNICAL SERVICES, INC.	Photo Number:
	Date:8/23/2019
	Description: Inlet Little Joe Creek Culvert
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number:
	Date: 8.23/2019
	Description: Outlet Little Joe Creek Culvert
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number:
	Date:8/23/2019
	Description: Looking upstream from Little Joe Creek Culvert Invert
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number:
	Date: 8/23/2019
	Description: Looking downstream from the outlet of Little Joe Creek Culvert
	Project: DNRC Mineral County

PIONEER FIELD DATA SHEET

PROJECT: DNRC Mineral County Hydraulic Structure Inventory **DATE:** 8/23/2019 **TIME:** 1030 hrs.

FIELD CREW: Larry Schock, DNRC **WEATHER CONDITIONS:** Partly Cloudy, 60's

STRUCTURE INFORMATION:

STRUCTURE NUMBER: Silver Creek Bridge **STRUCTURE CONDITION:** Very Poor-Colapsed

ROAD NAME: Silver Creek Road **CONDITION INFO:** Bridge Colapsed into stream channel

TRIBUTARY NAME: Silver Creek **STRUCTURE MATERIAL TYPE:** Treated wooden timbers

STRUCTURE TYPE: Wooden Bridge **MATERIAL TYPE INFO:** Wood planking on top of logs

TYPE INFO: Timber crib abutments

STRUCTURE PARAMETERS:

BRIDGE	MEASUREMENT	UNITS	NOTES
Span 1	28	FT	Bridge Deck has collpased into the stream channel
Span 2		FT	
Span 3		FT	
Span 4		FT	
Deck Width	16.5	FT	
Deck Thickness	2	FT	1.5 ft. log stringers, 3.5 in. cross planking, and 3.5 in tire treads
Guard Rail Height	NA	FT	Stringers 8.4 ft above invert before collapse
Pier Number	NA	EACH	
Pier Type		-	
Pier Width		FT	
Abutment Type	30	FT	Wooded crib at edge of active channel
Abutment Fill Configuration	Earthen & Rock	-	Trapizoidal w/ narrow edge at edge of channel
Backwater Potential	Yes	-	Centered bridge, blocks 1/2 riparian floodplain

CULVERT	MEASUREMENT	UNITS	NOTES
Culvert Height		FT	
Inlet to Deck		FT	
Outlet to Deck		FT	
Culvert Length		FT	
Culvert Entrance Type		-	
Backwater Potential		-	

DIVERSION STRUCTURE	MEASUREMENT	UNITS	NOTES
Span		FT	
Backwater Potential		-	

PHOTOGRAPHS	1.) Upstream from Structure	2.) Downstream from Structure	3.) Upstream at Structure	4.) Downstream at Structure
Check box once photo has been collected				

ADDITIONAL INFORMATION: Bridge has collapsed and is effectively blocking high flows in channel. Bridge approximately centered in riparian floodp

Approximately 24 ft. Of riparian floodplain to the right of the bridge and 30 ft. to the left.

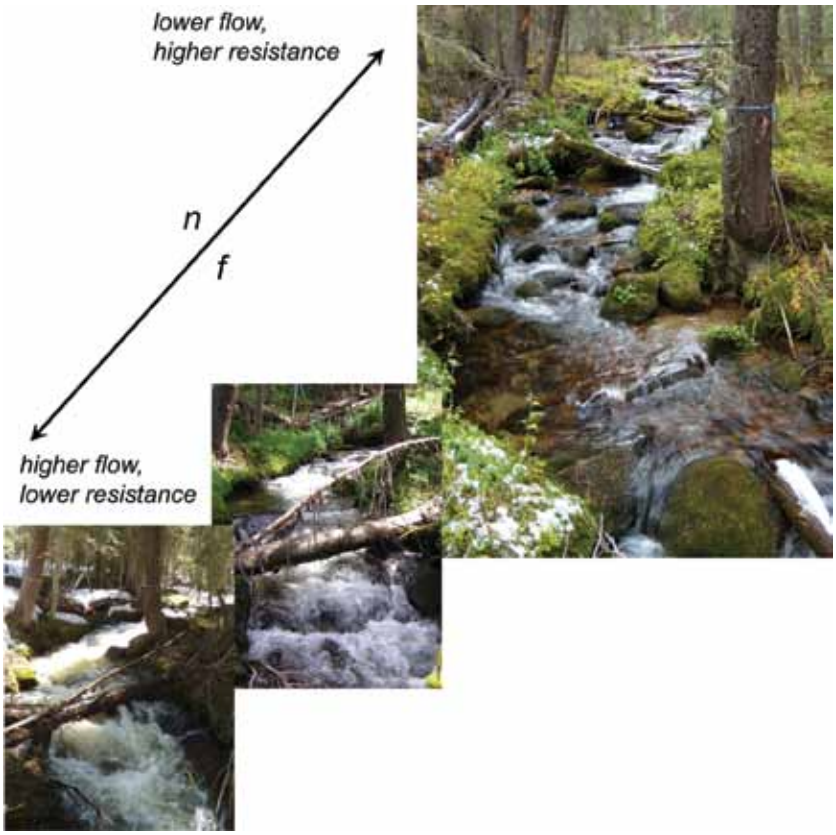
PIONEER TECHNICAL SERVICES, INC.	Photo Number:
	Date:8/23/2019
	Description: Looking downstream at the Silver Creek Bridge
	Project: DNRC Mineral County

PIONEER TECHNICAL SERVICES, INC.	Photo Number:
	Date: 8/23/2019
	Description: Looking upstream at the Silver Creek Bridge
	Project: DNRC Mineral County

USDA
United States Department of Agriculture

Photographic Guidance for Selecting Flow Resistance Coefficients in High-Gradient Channels

Steven E. Yochum, Francesco Comiti, Ellen Wohl, Gabrielle C. L. David, Luca Mao



Forest Service
Rocky Mountain Research Station
General Technical Report RMRS-GTR-323
July 2014

Yochum, Steven E.; Comiti, Francesco; Wohl, Ellen; David, Gabrielle C. L.; Mao, Luca. 2014. **Photographic Guidance for Selecting Flow Resistance Coefficients in High-Gradient Channels.** Gen. Tech. Rep. RMRS-GTR-323. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 91 p.

Abstract

Photographic guidance is presented to assist with the estimation of Manning's *n* and Darcy-Weisbach *f* in high-gradient plane-bed, step-pool, and cascade channels. Reaches both with and without instream wood are included. These coefficients are necessary for the estimation of reach-average velocity, energy loss, and discharge. Using data collected in 19 stream channels located in the State of Colorado and the Eastern Italian Alps, on slopes ranging from 2.4 to 21 percent, guidance is provided for low through bankfull flows. Guidance for low flow resistance estimation is additionally provided using data collected in 29 channels in the State of Washington, New Zealand, Chile, and Argentina. Bankfull *n* values range from 0.048 to 0.30 and low flow *n* values range from 0.057 to 0.96. Discussions of flow resistance mechanisms and quantitative prediction tools are also presented.

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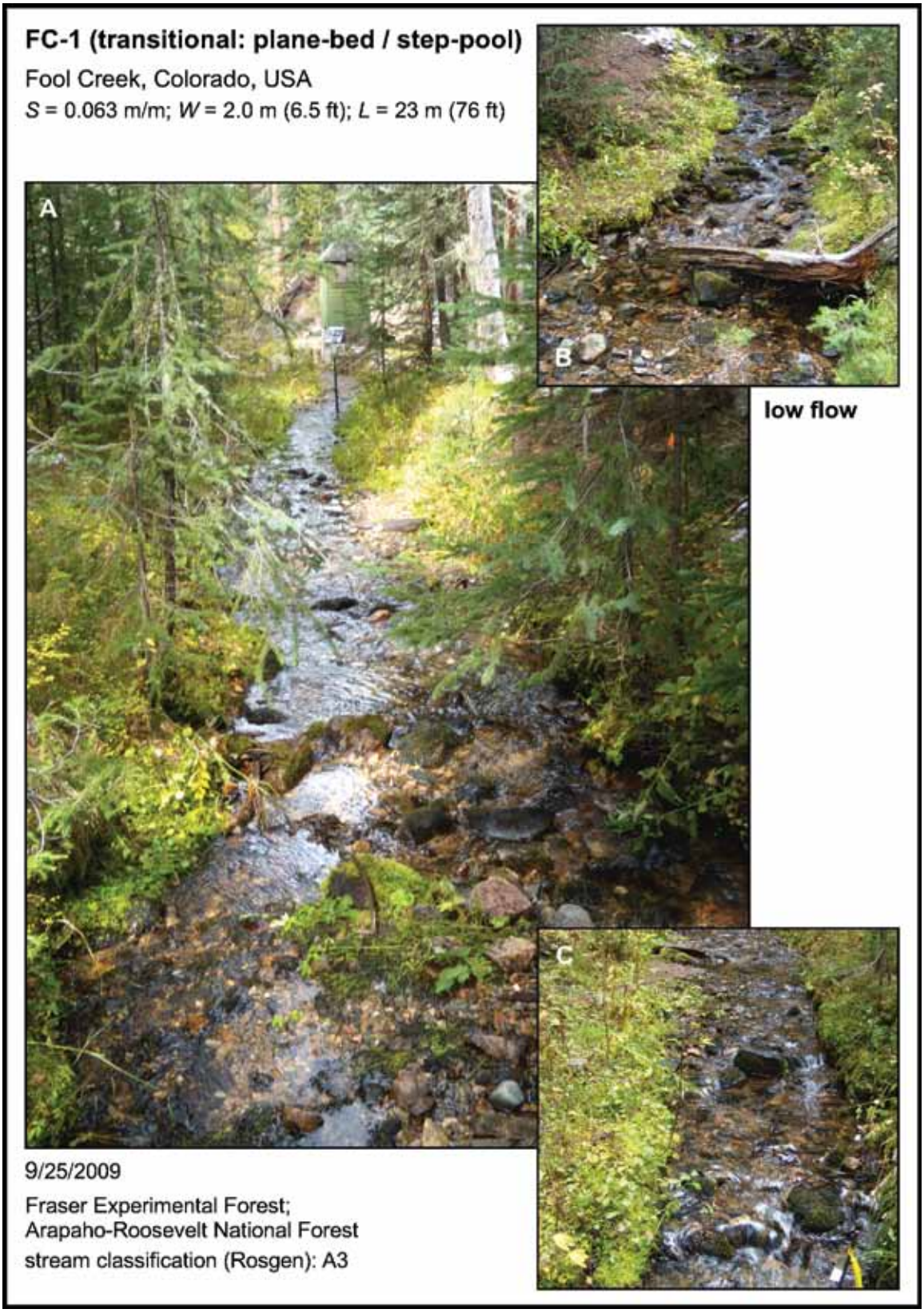
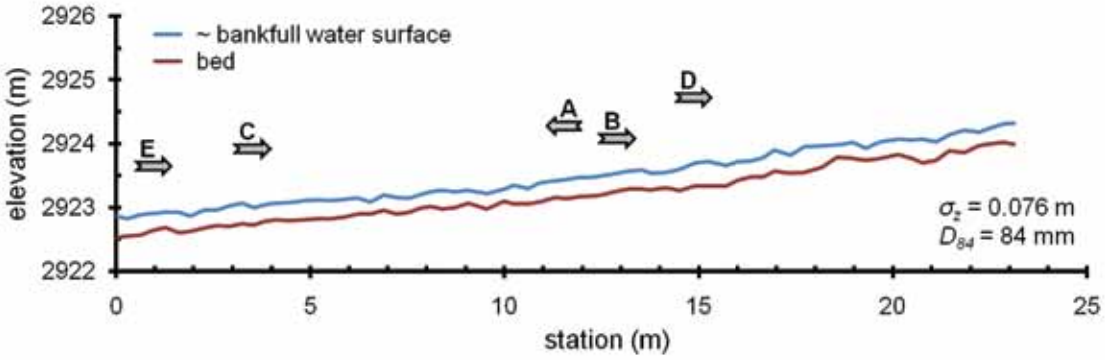

FC-1 (transitional: plane-bed / step-pool)
Fool Creek, Colorado, USA
S = 0.063 m/m; W = 2.0 m (6.5 ft); L = 23 m (76 ft)
A
B
low flow
C
9/25/2009
Fraser Experimental Forest;
Arapaho-Roosevelt National Forest
stream classification (Rosgen): A3

FC-1

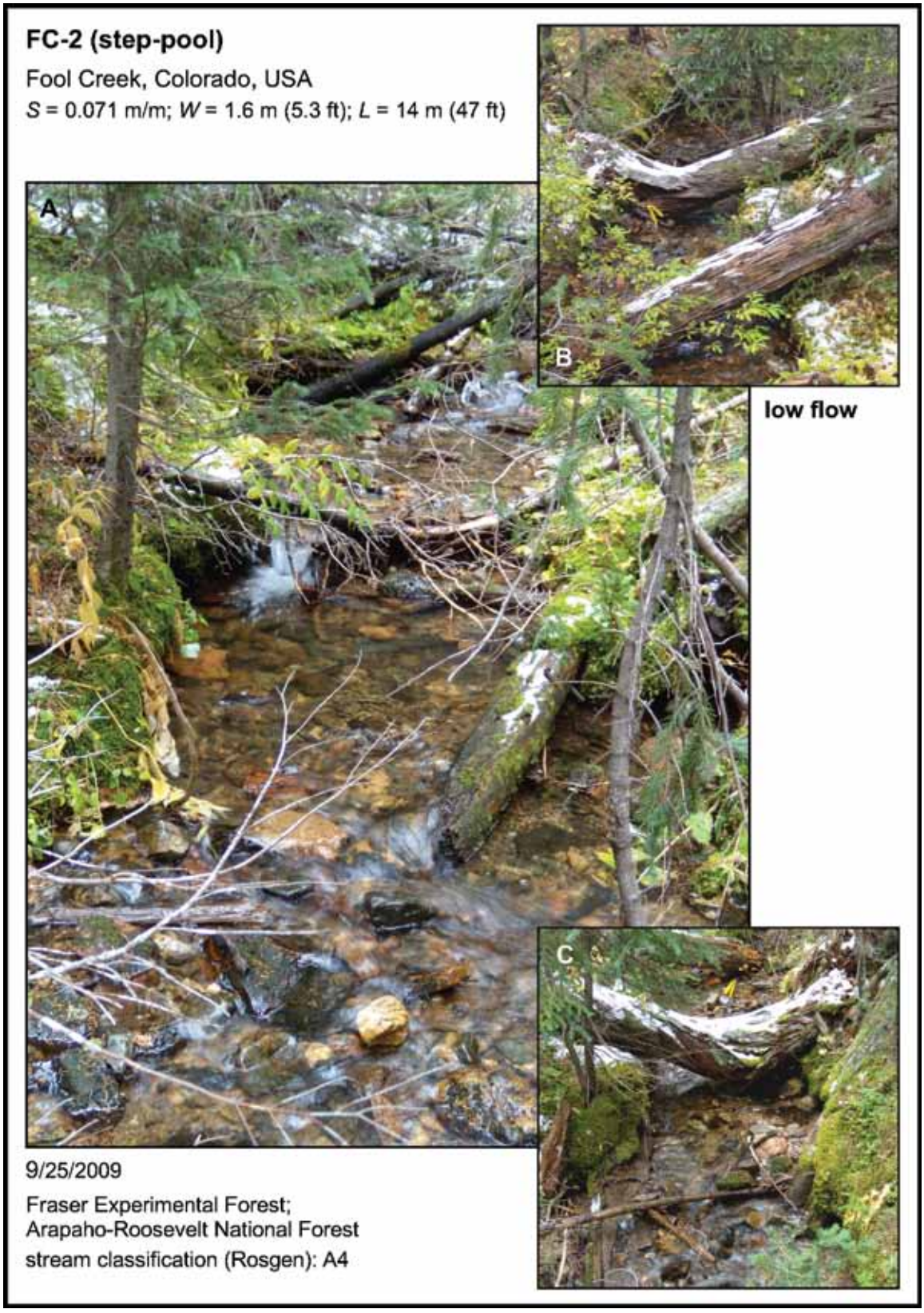
longitudinal profile



~ bankfull flow	**mid flow**	**low flow** (facing page)
***n* = 0.095**	***n* = 0.13**	***n* = 0.20**
***f* = 1.3**	***f* = 3.0**	***f* = 7.6**
V = 0.79 m/s (2.6 ft/s)	*V* = 0.40 m/s (1.3 ft/s)	*V* = 0.19 m/s (0.63 ft/s)
Q = 0.23 cms (8.2 cfs)	*Q* = 0.049 cms (1.7 cfs)	*Q* = 0.014 cms (0.49 cfs)
R = 0.16 m (0.53 ft)	*R* = 0.10 m (0.33 ft)	*R* = 0.063 m (0.21 ft)
W = 2.0 m (6.5 ft)	*W* = 1.6 m (5.3 ft)	*W* = 1.3 m (4.2 ft)
Fr = 0.58	*Fr* = 0.38	*Fr* = 0.23

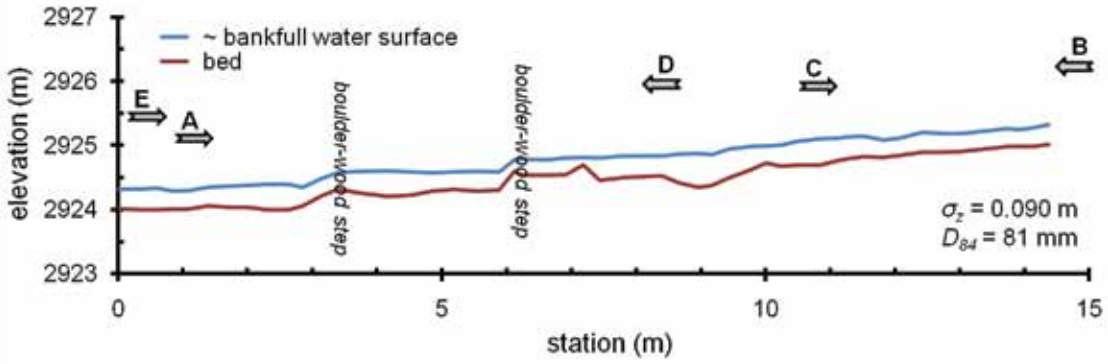
~ bankfull flow 6/11/2008

mid flow 7/5/2007


FC-2 (step-pool)
Fool Creek, Colorado, USA
S = 0.071 m/m; W = 1.6 m (5.3 ft); L = 14 m (47 ft)
A
B
low flow
C
9/25/2009
Fraser Experimental Forest;
Arapaho-Roosevelt National Forest
stream classification (Rosgen): A4

FC-2

longitudinal profile



~ bankfull flow	**mid flow**	**low flow** (facing page)
***n* = 0.13**	***n* = 0.22**	***n* = 0.24**
***f* = 2.2**	***f* = 8.0**	***f* = 11**
V = 0.66 m/s (2.2 ft/s)	*V* = 0.28 m/s (0.91 ft/s)	*V* = 0.17 m/s (0.55 ft/s)
Q = 0.24 cms (8.5 cfs)	*Q* = 0.038 cms (1.3 cfs)	*Q* = 0.013 cms (0.45 cfs)
R = 0.18 m (0.59 ft)	*R* = 0.11 m (0.36 ft)	*R* = 0.060 m (0.20 ft)
W = 1.6 m (6.5 ft)	*W* = 1.4 m (4.6 ft)	*W* = 1.1 m (3.7 ft)
Fr = 0.44	*Fr* = 0.24	*Fr* = 0.21

~ bankfull flow 6/13/2008

mid flow 7/23/2008

ESL-8 (step-pool)

East Saint Louis Creek, Colorado, USA

S = 0.094 m/m; *W* = 3.2 m (10.4 ft); *L* = 31 m (101 ft)

low flow

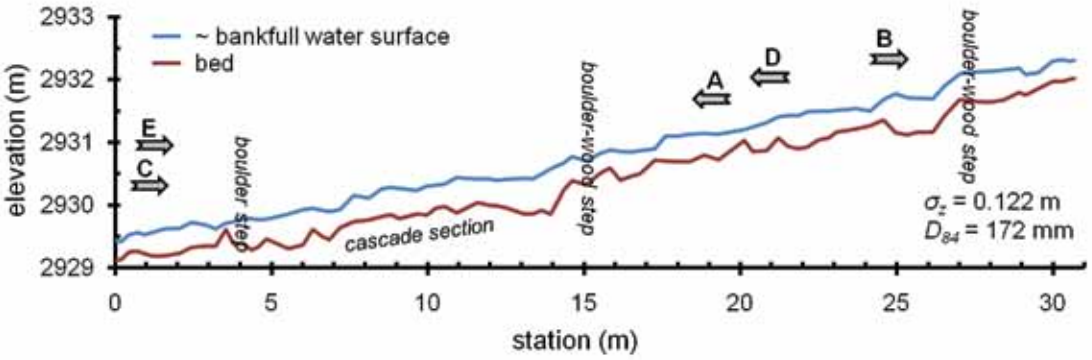
9/25/2009

Fraser Experimental Forest;
Arapaho-Roosevelt National Forest

stream classification (Rosgen): A3

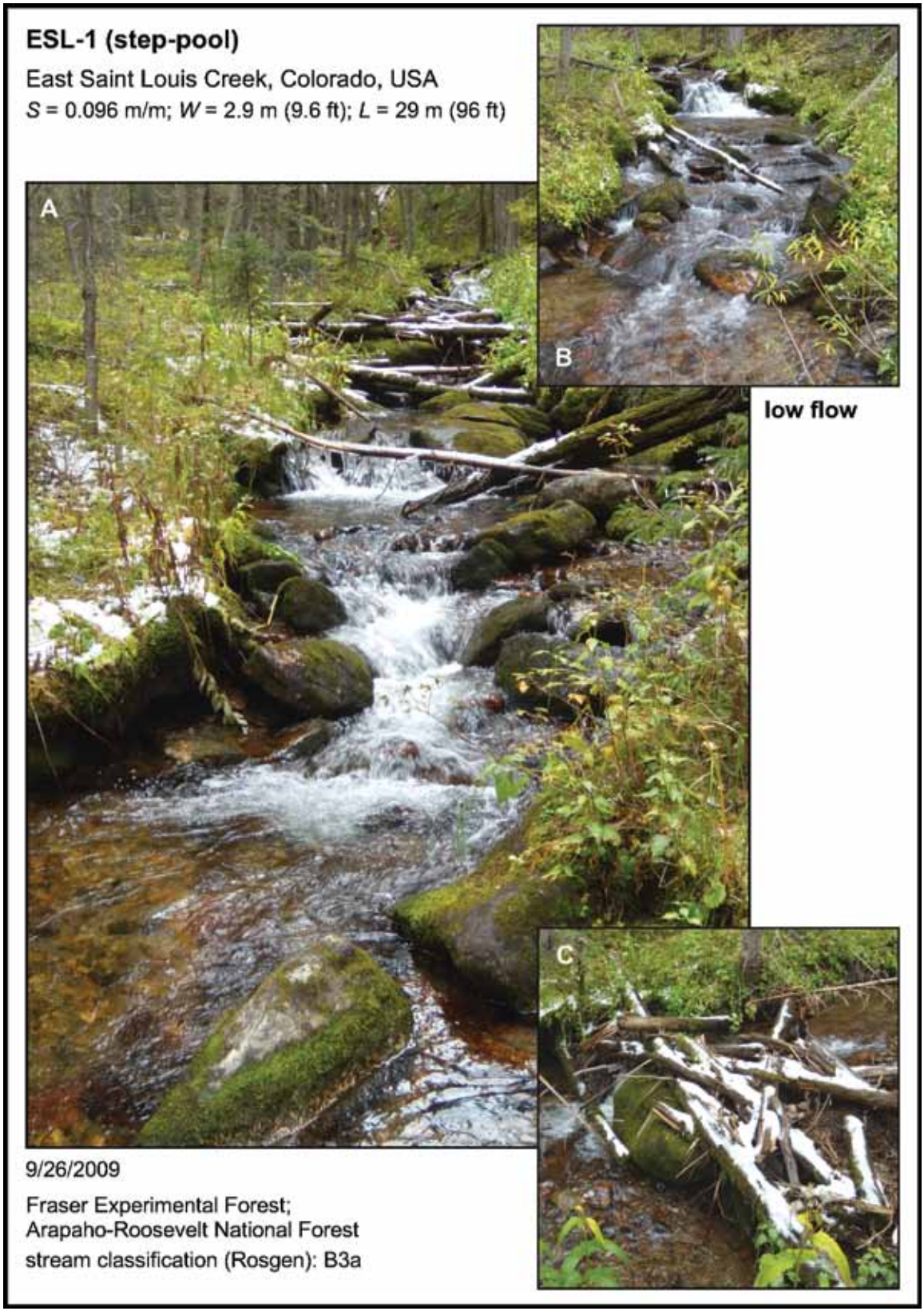
ESL-8

longitudinal profile



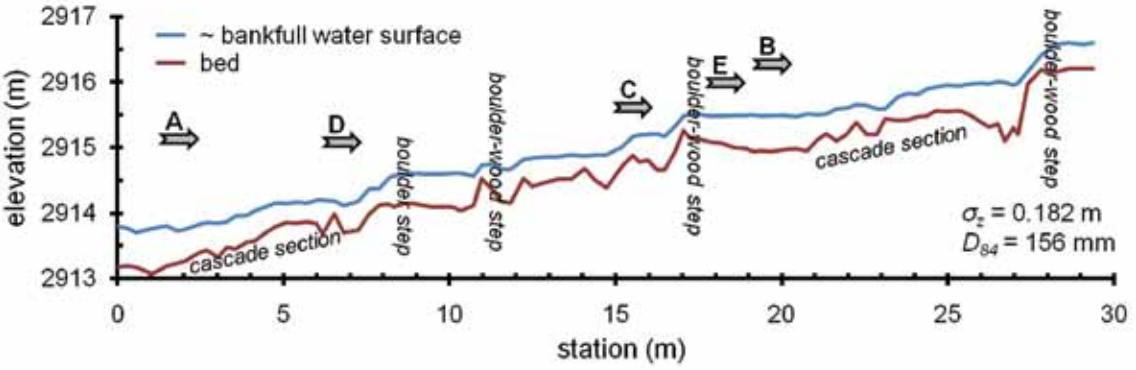
~ bankfull flow	**mid flow**	**low flow** (facing page)
***n* = 0.18**	***n* = 0.20**	***n* = 0.24**
***f* = 4.2**	***f* = 5.3**	***f* = 8.2**
V = 0.64 m/s (2.1 ft/s)	*V* = 0.53 m/s (1.7 ft/s)	*V* = 0.35 m/s (1.2 ft/s)
Q = 0.46 cms (16 cfs)	*Q* = 0.29 cms (10 cfs)	*Q* = 0.10 cms (3.5 cfs)
R = 0.23 m (0.76 ft)	*R* = 0.21 m (0.70 ft)	*R* = 0.16 m (0.52 ft)
W = 3.2 m (10.4 ft)	*W* = 3.0 m (9.9 ft)	*W* = 2.6 m (8.5 ft)
Fr = 0.38	*Fr* = 0.33	*Fr* = 0.26

~ bankfull flow 6/9/2008 7/16/2008


ESL-1 (step-pool)
East Saint Louis Creek, Colorado, USA
S = 0.096 m/m; W = 2.9 m (9.6 ft); L = 29 m (96 ft)
A
B
low flow
C
9/26/2009
Fraser Experimental Forest;
Arapaho-Roosevelt National Forest
stream classification (Rosgen): B3a

ESL-1

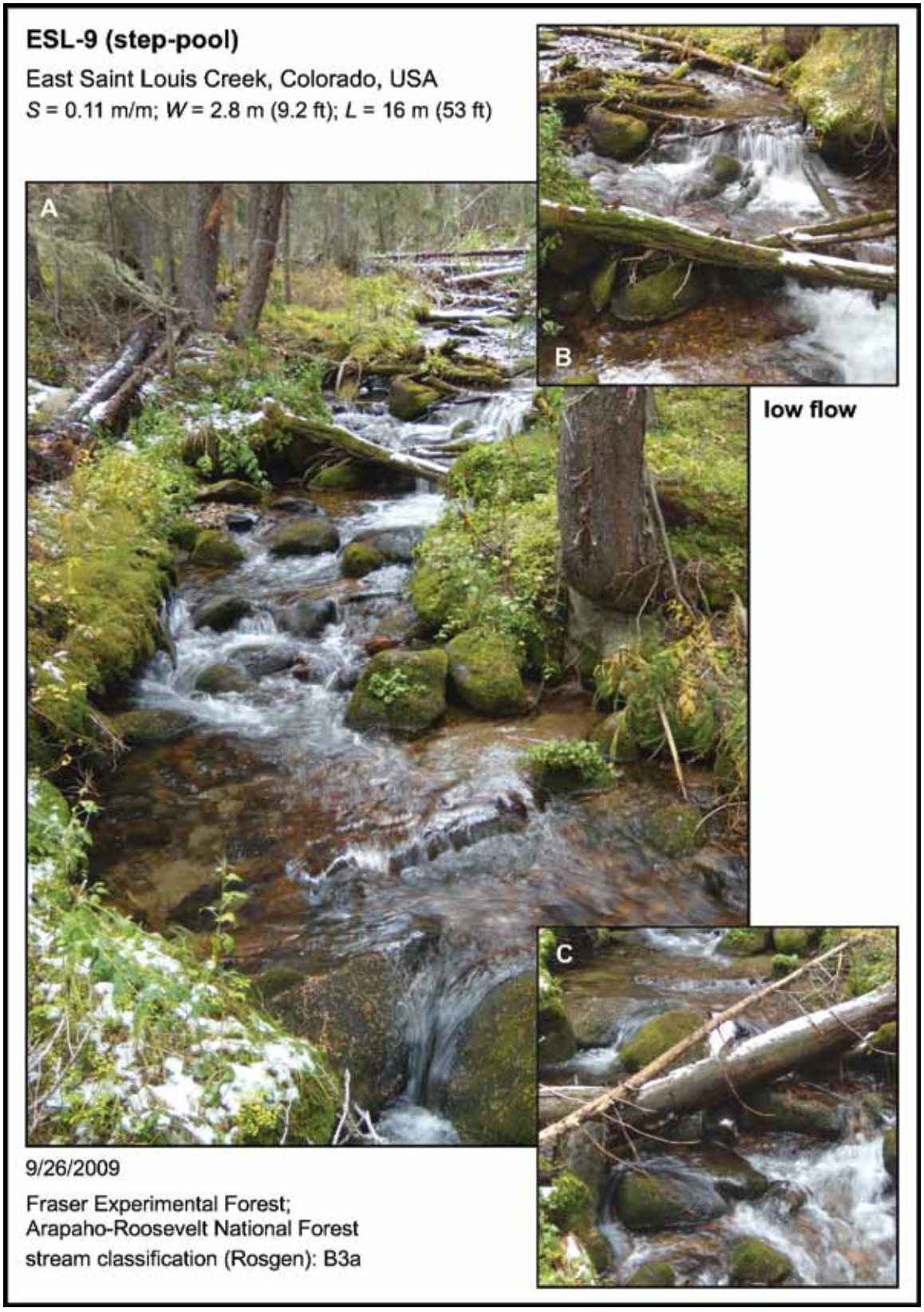
longitudinal profile



~ bankfull flow	mid flow
***n* = 0.19**	***n* = 0.27**
***f* = 4.5**	***f* = 9.4**
V = 0.65 m/s (2.1 ft/s)	*V* = 0.42 m/s (1.4 ft/s)
Q = 0.60 cms (20 cfs)	*Q* = 0.24 cms (8.3 cfs)
R = 0.25 m (0.83 ft)	*R* = 0.20 m (0.67 ft)
W = 2.9 m (9.6 ft)	*W* = 2.6 m (8.5 ft)
Fr = 0.35	*Fr* = 0.26

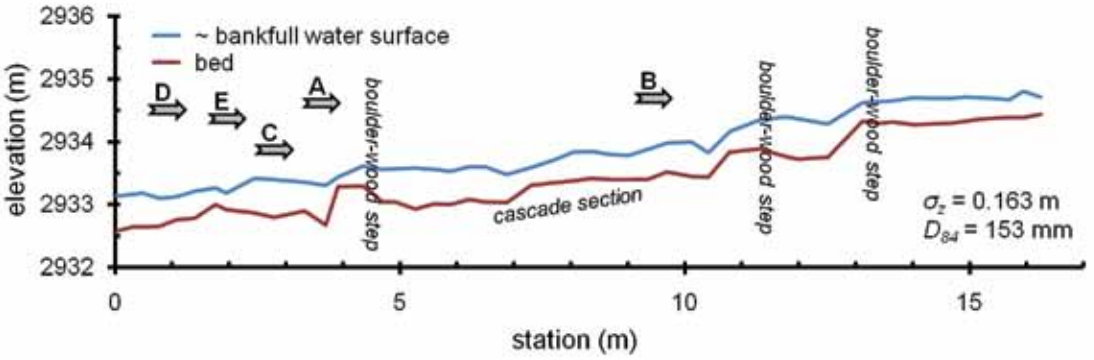
~ bankfull flow 6/10/2008

mid flow 7/22/2008


ESL-9 (step-pool)
East Saint Louis Creek, Colorado, USA
S = 0.11 m/m; W = 2.8 m (9.2 ft); L = 16 m (53 ft)
A
B
low flow
C
9/26/2009
Fraser Experimental Forest;
Arapaho-Roosevelt National Forest
stream classification (Rosgen): B3a

ESL-9

longitudinal profile



~ bankfull flow	**mid flow**	**low flow** (facing page)
***n* = 0.21**	***n* = 0.26**	***n* = 0.28**
***f* = 5.5**	***f* = 8.8**	***f* = 10.9**
V = 0.64 m/s (2.1 ft/s)	*V* = 0.43 m/s (1.4 ft/s)	*V* = 0.33 m/s (1.1 ft/s)
Q = 0.57 cms (20 cfs)	*Q* = 0.20 cms (7.1 cfs)	*Q* = 0.11 cms (3.8 cfs)
R = 0.25 m (0.82 ft)	*R* = 0.20 m (0.66 ft)	*R* = 0.17 m (0.55 ft)
W = 2.8 m (9.2 ft)	*W* = 2.6 m (8.5 ft)	*W* = 2.3 m (7.5 ft)
Fr = 0.36	*Fr* = 0.27	*Fr* = 0.23

~ bankfull flow 6/8/2008

mid flow 7/11/2007

APPENDIX B – WORKING MAPS

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Little Joe Creek
- Junction

Labels

- 1234 Stream Station
- 1234.56 Water Surface Elevation

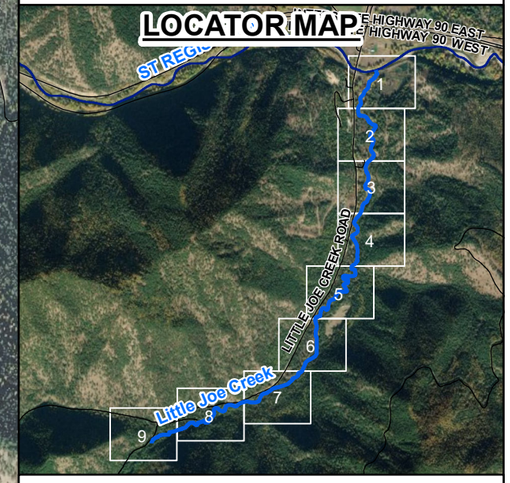
0 1,100 2,200 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Little Joe Creek Index Map

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Little Joe Creek
- Cross Sections
- Roadway Crossings
- Roads
- 10' Contours

Little Joe Creek

- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Junction

Labels

1234 Stream Station

1234.56 Water Surface Elevation

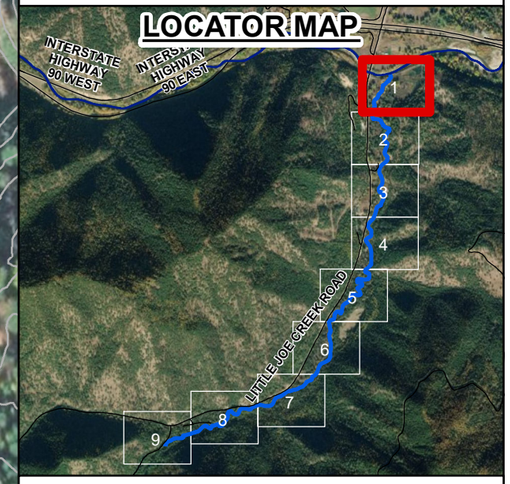
0 90 180 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Little Joe Creek Map 1 of 9

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Little Joe Creek
- Cross Sections
- Roadway Crossings
- Roads
- 10' Contours

Little Joe Creek

- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Junction

Labels

1234 Stream Station

1234.56 Water Surface Elevation

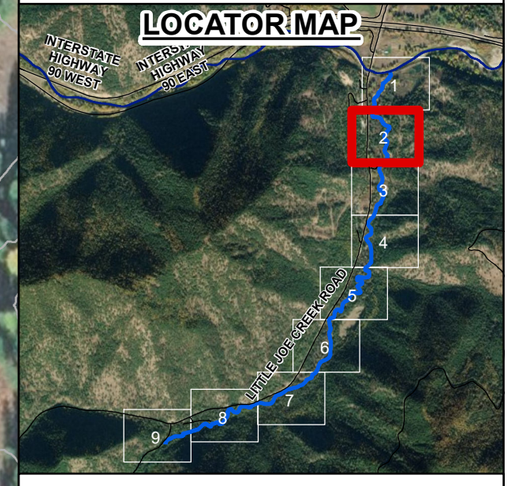
0 90 180 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Little Joe Creek Map 2 of 9

1361
2,673.97
2,679.61
1774
2264
2,685.55
2,692.22
2724
BIG GAME CROSSING ROAD
LITTLE JOE CREEK ROAD
Little Joe Creek

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Little Joe Creek
- Cross Sections
- Roadway Crossings
- Roads
- 10' Contours

Little Joe Creek

- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Junction

Labels

1234 Stream Station

1234.56 Water Surface Elevation

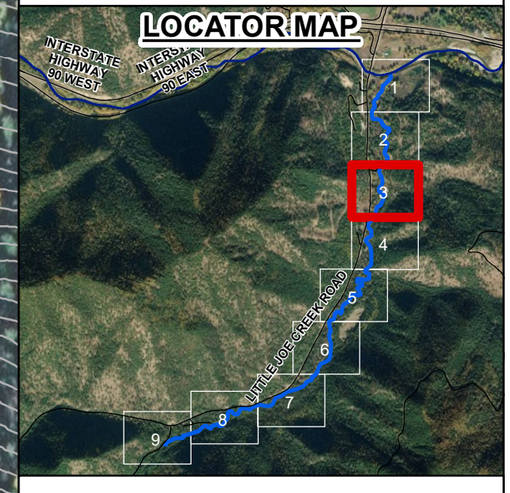
0 90 180 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Little Joe Creek Map 3 of 9

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Little Joe Creek
- Cross Sections
- Roadway Crossings
- Roads
- 10' Contours

Little Joe Creek

- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Junction

Labels

1234 Stream Station

1234.56 Water Surface Elevation

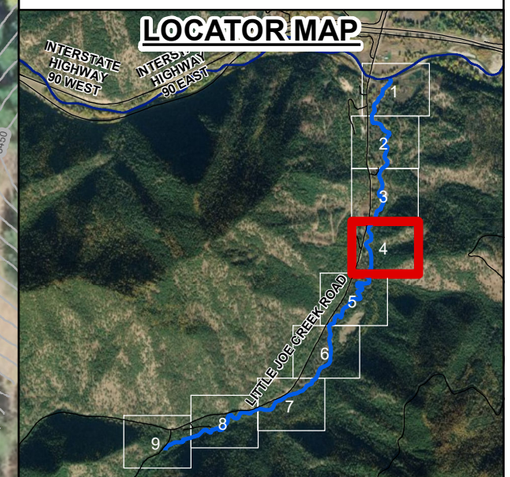
0 90 180 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Little Joe Creek Map 4 of 9

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Little Joe Creek
- Cross Sections
- Roadway Crossings
- Roads
- 10' Contours

Little Joe Creek

- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Junction

Labels

1234 Stream Station

1234.56 Water Surface Elevation

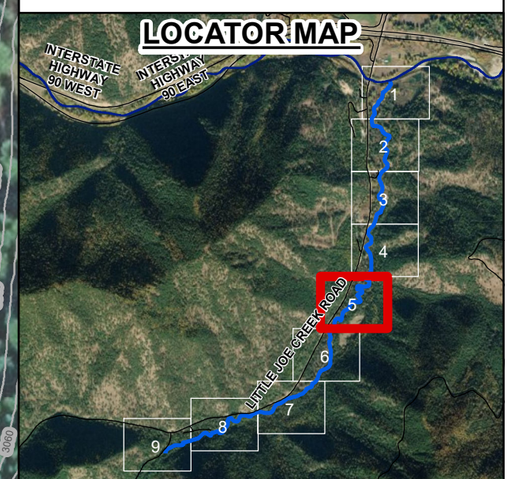
0 90 180 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Little Joe Creek Map 5 of 9

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Little Joe Creek
- Cross Sections
- Roadway Crossings
- Roads
- 10' Contours

Little Joe Creek

- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Junction

Labels

1234 Stream Station

1234.56 Water Surface Elevation

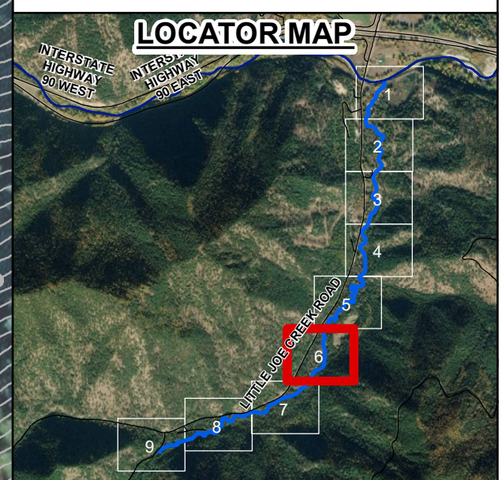
0 90 180 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Little Joe Creek Map 6 of 9

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Little Joe Creek
- Cross Sections
- Roadway Crossings
- Roads
- 10' Contours

Little Joe Creek
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Junction

Labels

1234 Stream Station

1234.56 Water Surface Elevation

0 90 180 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP

Little Joe Creek Map 7 of 9

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

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1234 Stream Station

1234.56 Water Surface Elevation

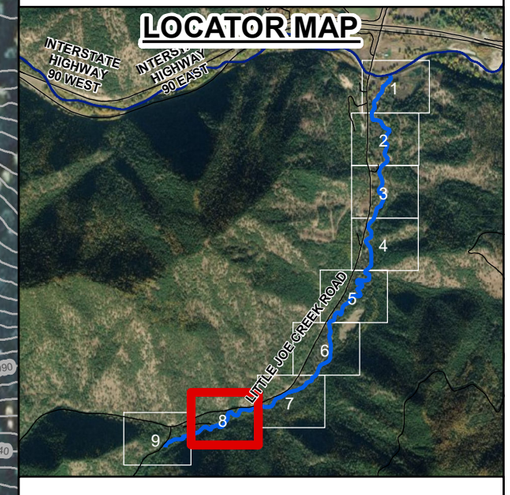
0 90 180 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

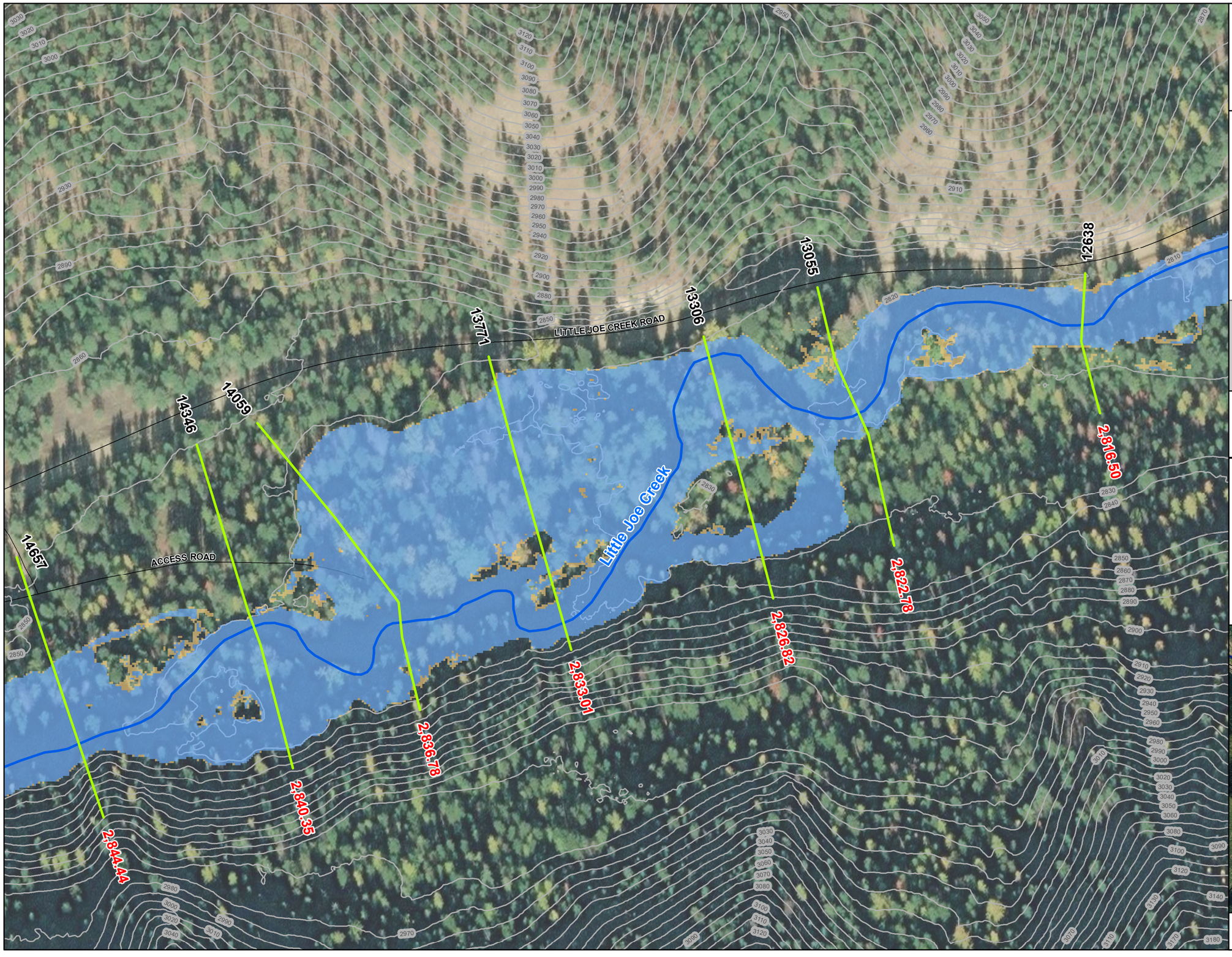
MONTANA DNRC

DOWL

LOCATOR MAP



Little Joe Creek Map 8 of 9



MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Little Joe Creek
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1234 Stream Station

1234.56 Water Surface Elevation

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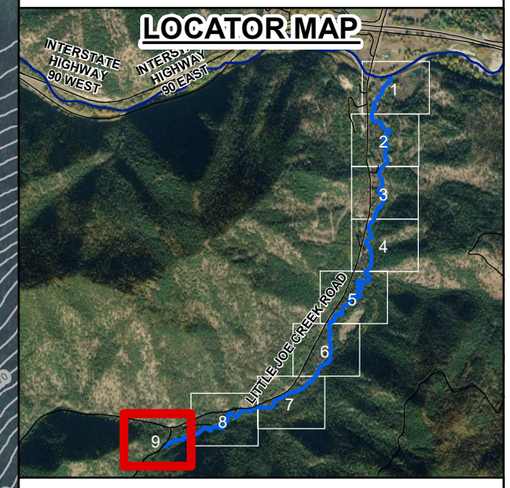
Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

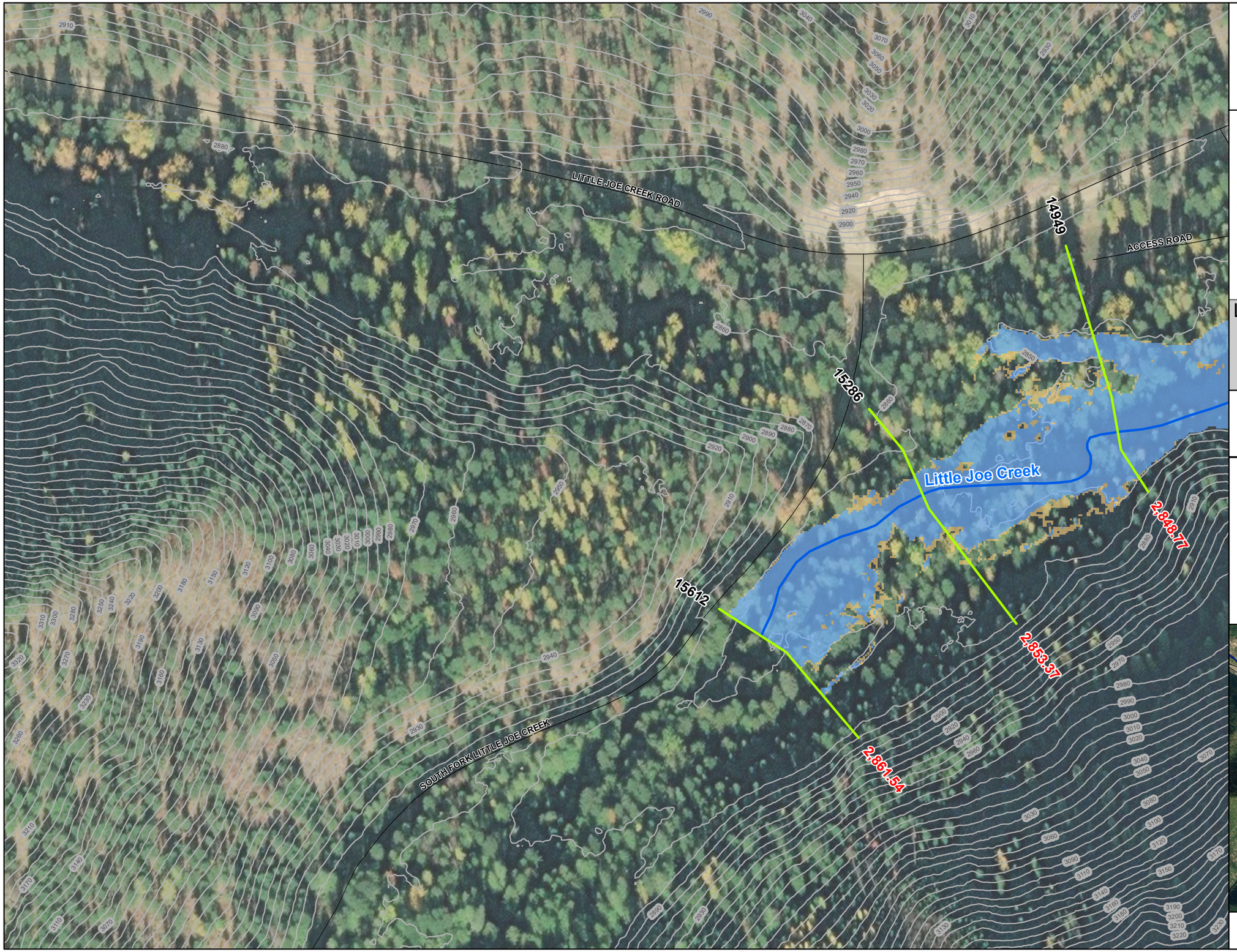
MONTANA DNRC

DOWL

LOCATOR MAP



Little Joe Creek Map 9 of 9



MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Twelvemile Creek
- Rock Creek
- EFork Twelvemile

Labels

- 1234 Stream Station
- 1234.56 Water Surface Elevation

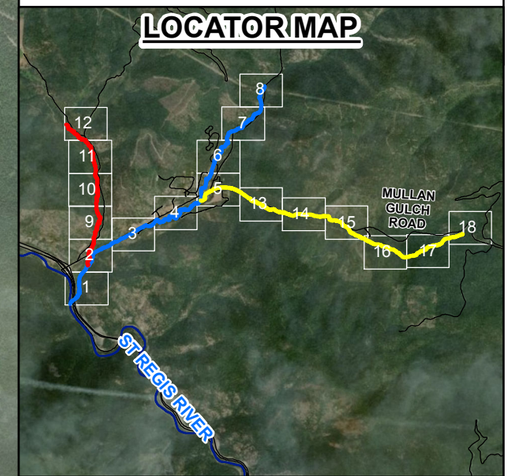
0 1,750 3,500 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

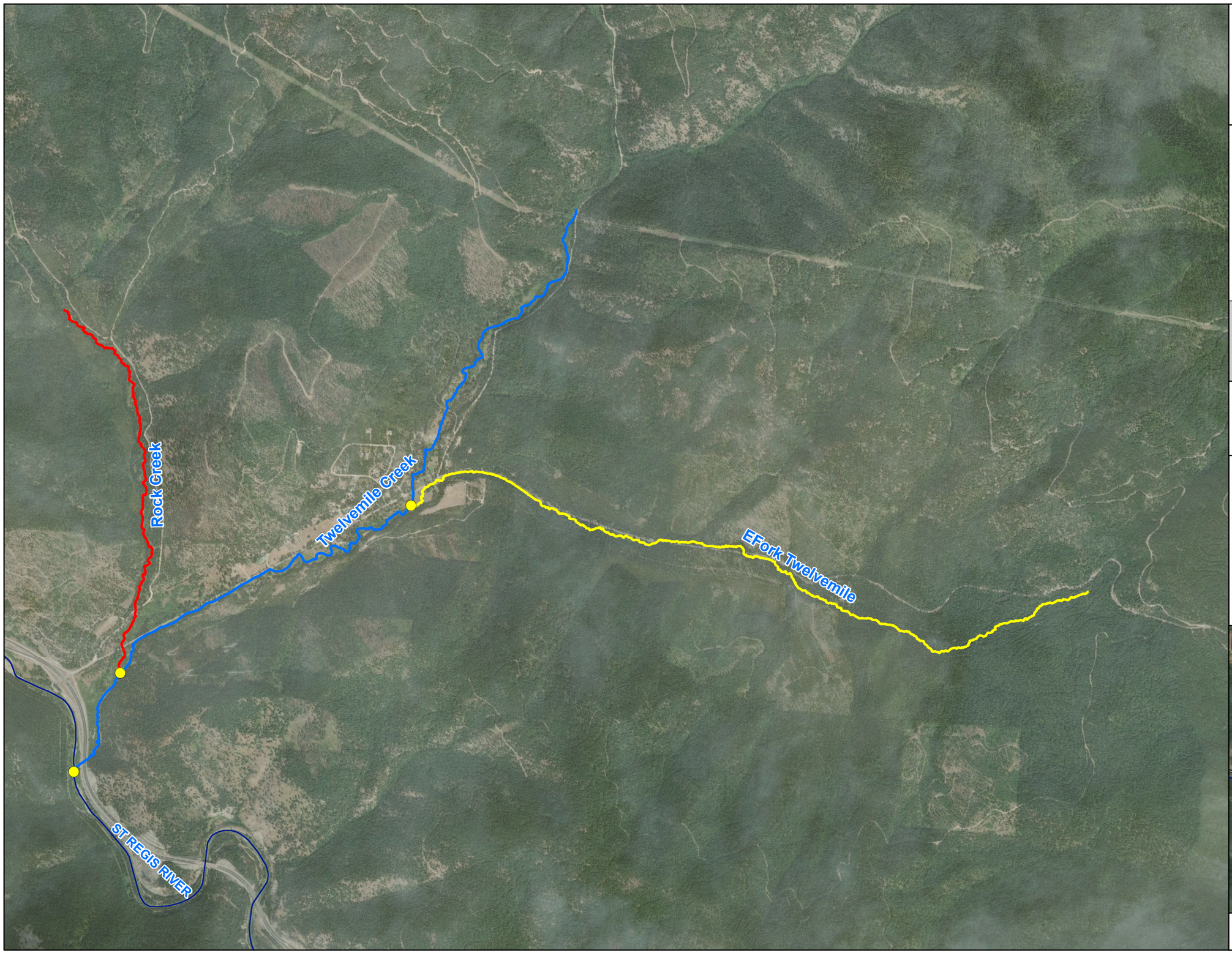
MONTANA DNRC

DOWL

LOCATOR MAP



Twelvemile Creek Index Map



MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

Legend

- Junctions
- Stream Reach (Varies by Color)
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
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- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

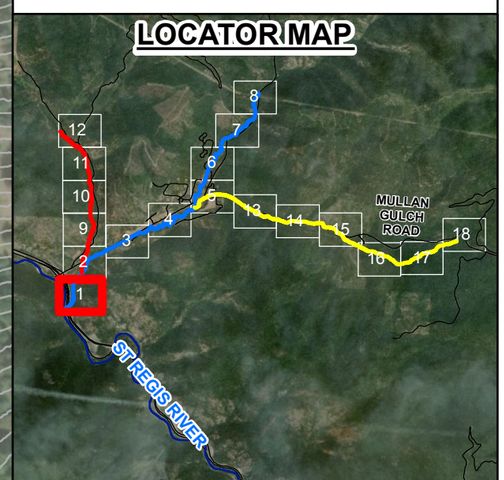
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Twelvemile Creek Map 1 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

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Hydraulic Work Map - St. Regis River Flood Study
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MONTANA DNRC

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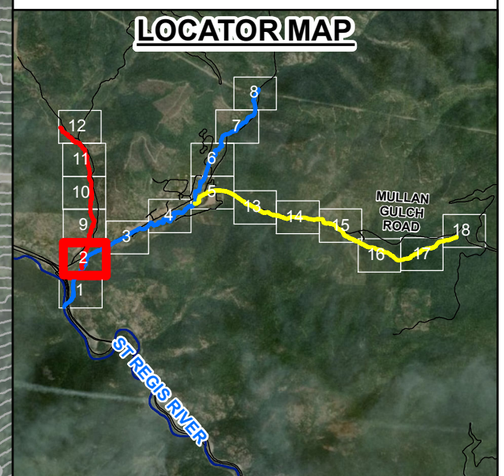

Twelvemile Creek Map 2 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

Legend

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Hydraulic Work Map - St. Regis River Flood Study
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MONTANA DNRC

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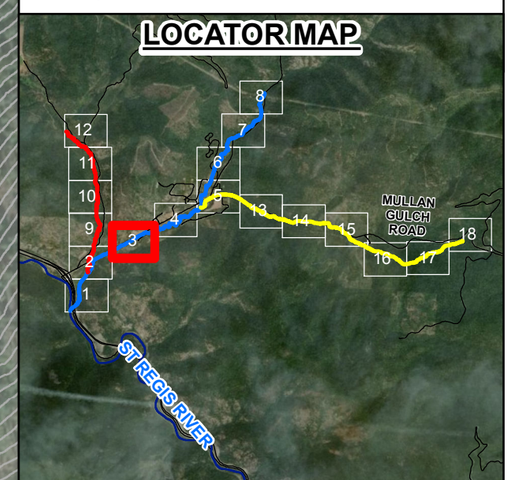

Twelvemile Creek Map 3 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

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Hydraulic Work Map - St. Regis River Flood Study
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MONTANA DNRC

DOWL

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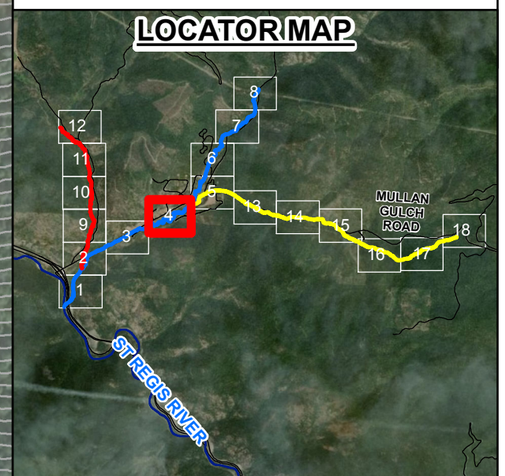

Twelvemile Creek Map 4 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

Legend

- Junctions
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Hydraulic Work Map - St. Regis River Flood Study
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MONTANA DNRC

DOWL

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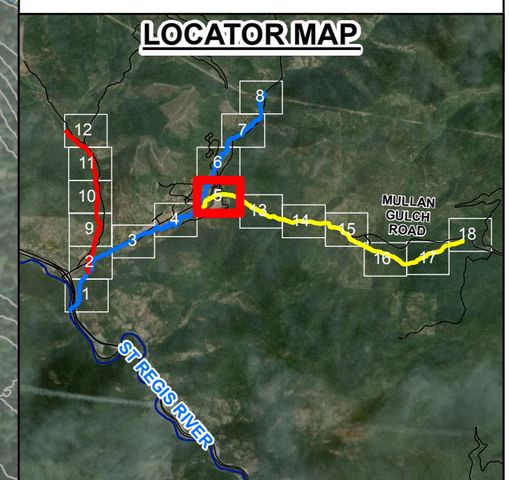

Twelvemile Creek Map 5 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

Legend

- Junctions
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Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
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MONTANA DNRC

DOWL

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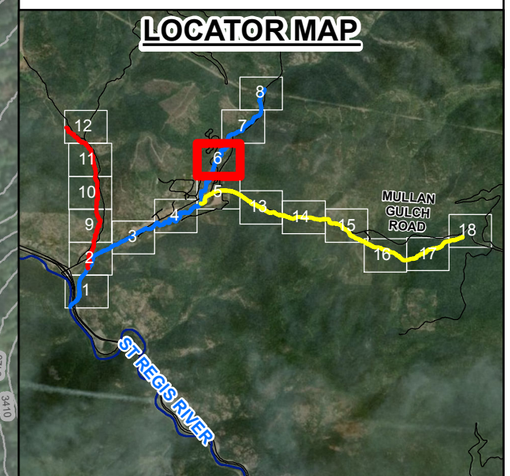

Twelvemile Creek Map 6 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

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Hydraulic Work Map - St. Regis River Flood Study
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MONTANA DNRC

DOWL

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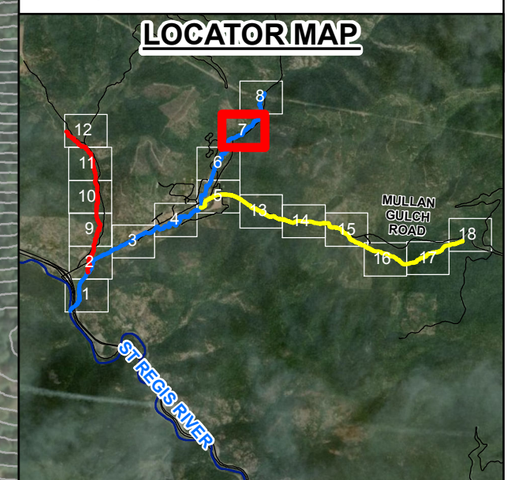

Twelvemile Creek Map 7 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

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MONTANA DNRC

DOWL

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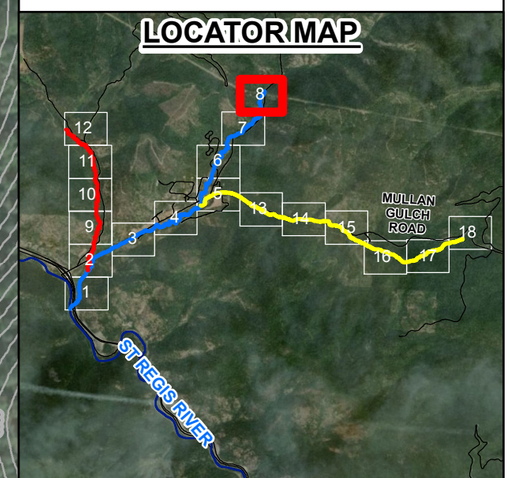

Twelvemile Creek Map 8 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

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Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
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MONTANA DNRC

DOWL

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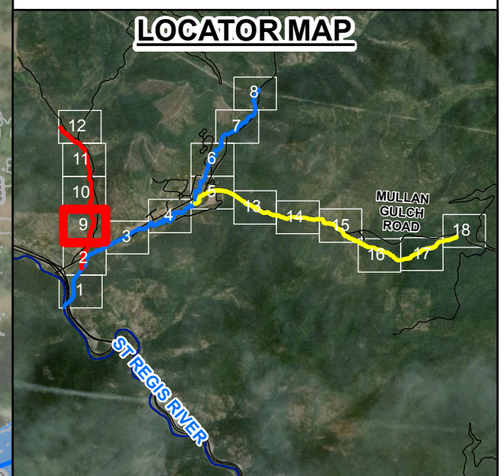

Twelvemile Creek Map 9 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

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Hydraulic Work Map - St. Regis River Flood Study
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MONTANA DNRC

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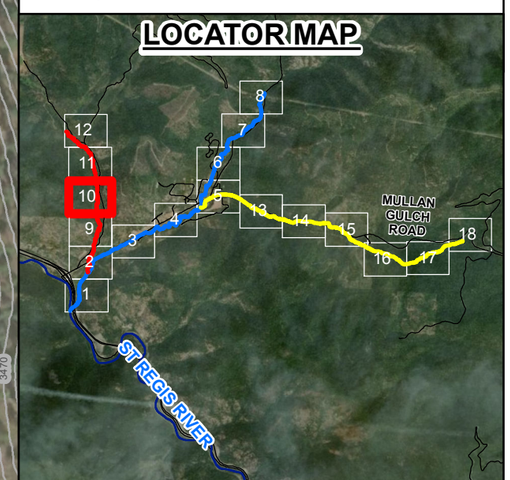

Twelvemile Creek Map 10 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

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MONTANA DNRC

DOWL

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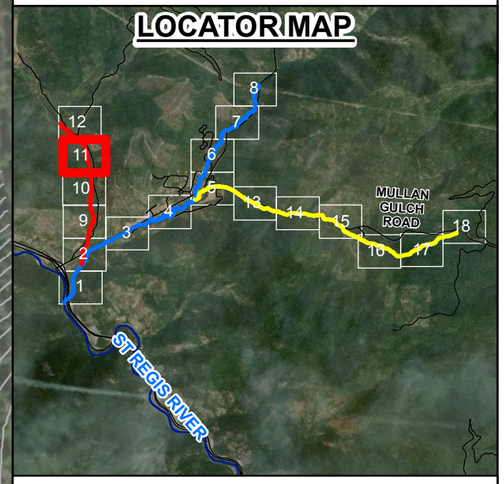

Twelvemile Creek Map 11 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

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Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
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Topographic Data, LiDAR 2016
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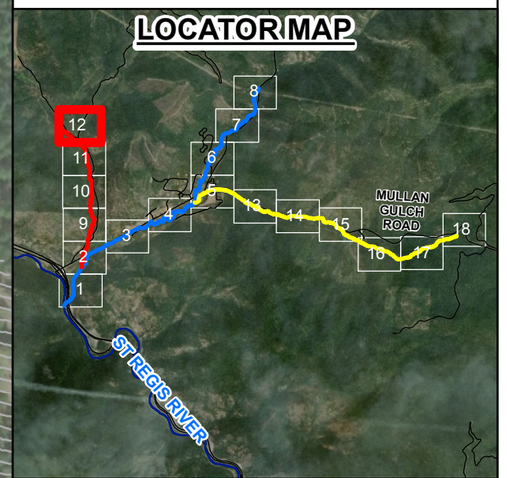
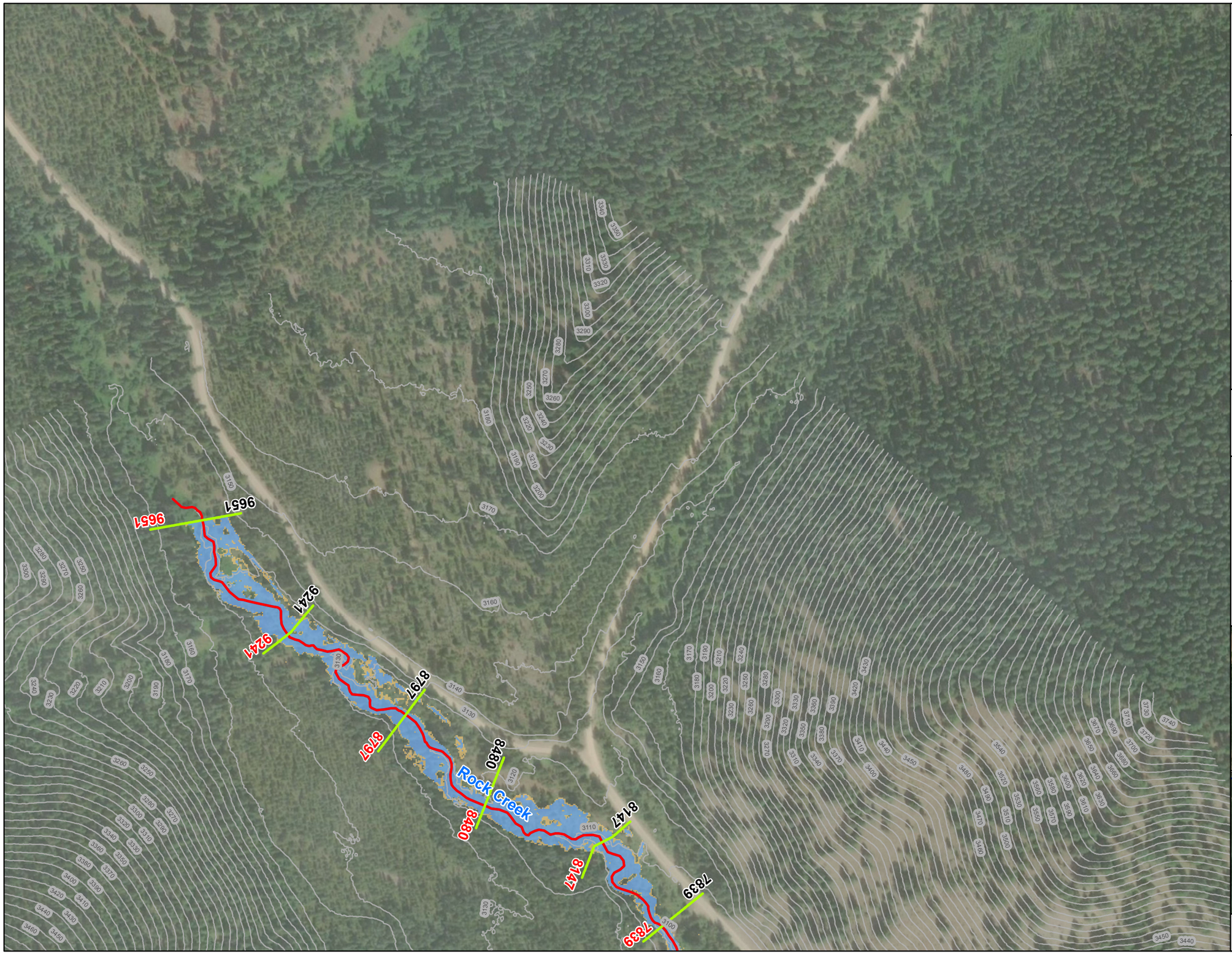
MONTANA DNRC

DOWL

LOCATOR MAP



Twelvemile Creek Map 12 of 18



MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

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Hydraulic Work Map - St. Regis River Flood Study
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MONTANA DNRC

DOWL

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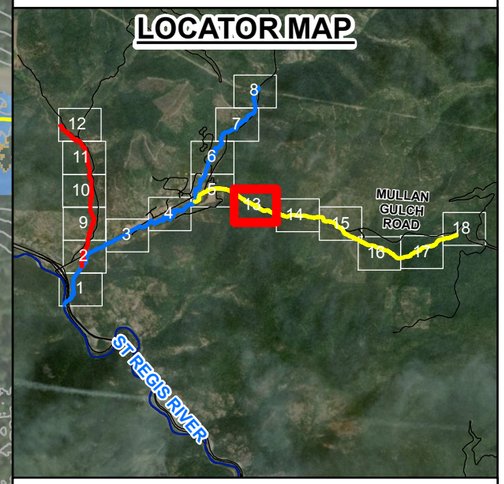

Twelvemile Creek Map 13 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

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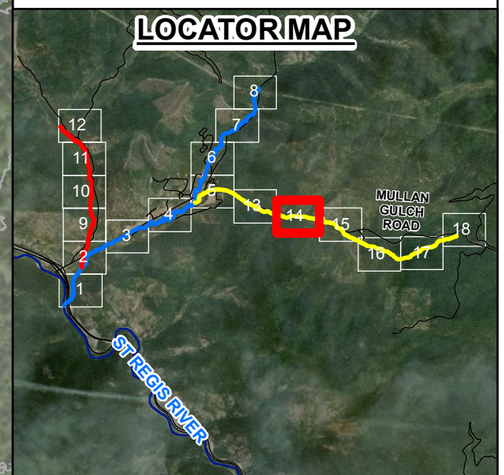

Twelvemile Creek Map 14 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

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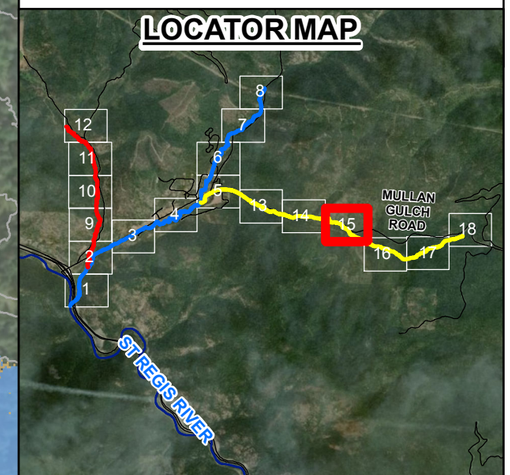

Twelvemile Creek Map 15 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

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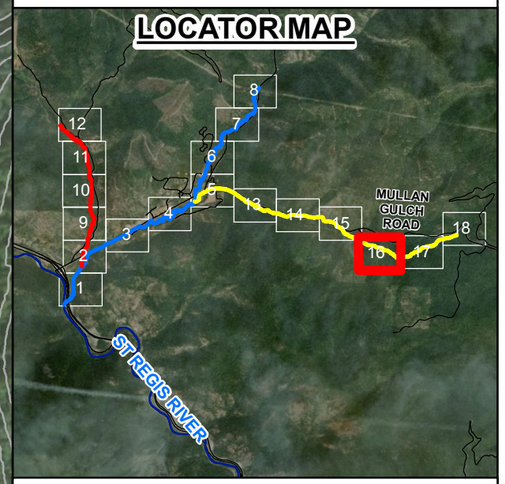

Twelvemile Creek Map 16 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: Decemeber 21, 2018

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MONTANA DNRC

DOWL

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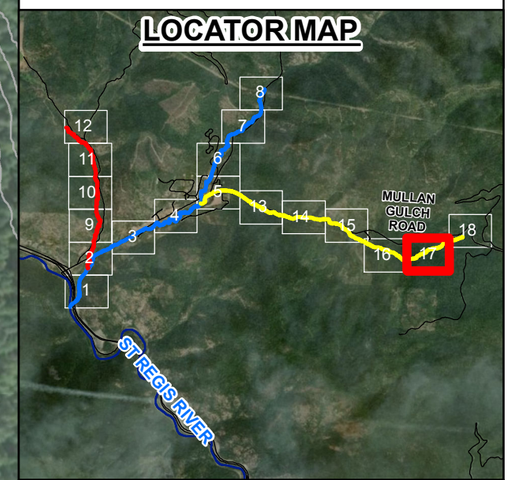
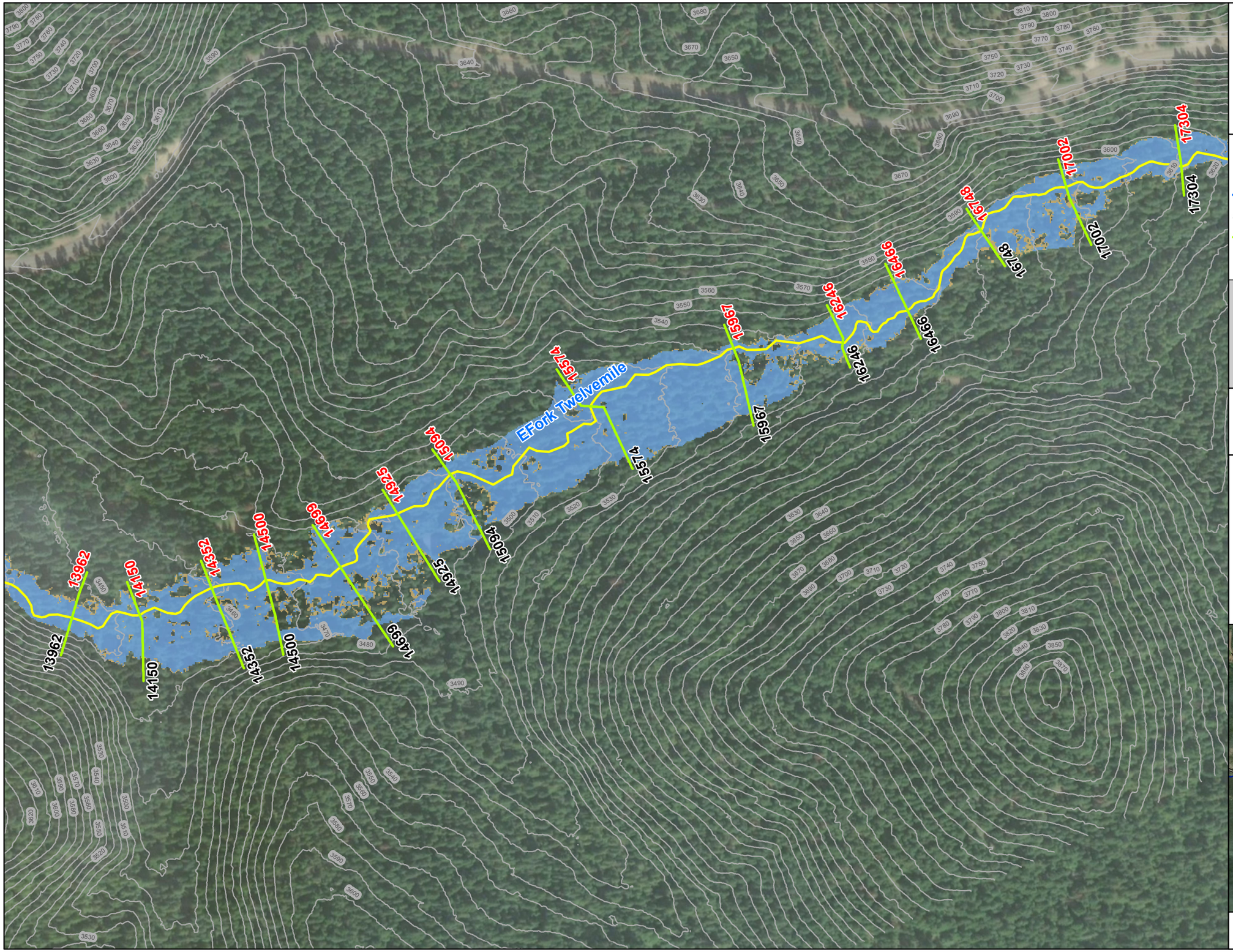


Twelvemile Creek Map 17 of 18



MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

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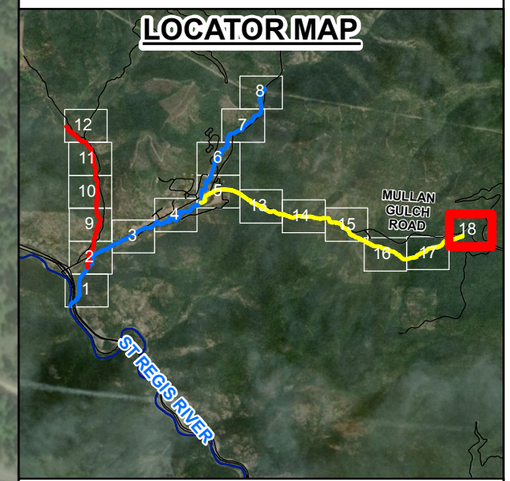
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Twelvemile Creek Map 18 of 18

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Twin Creek
- EForkTwinCreek

Labels

1234	Stream Station
1234.56	Water Surface Elevation

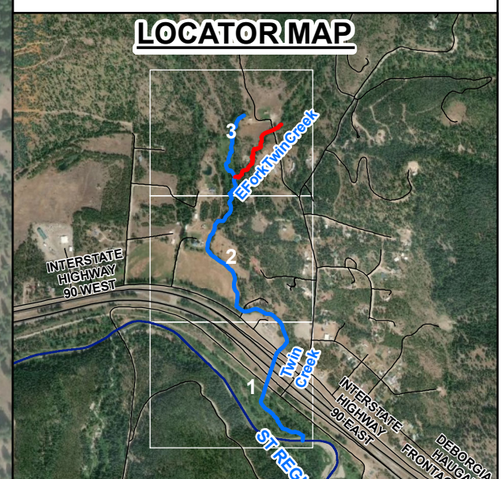
0 500 1,000 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Twin Creek Index Map

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Stream Reach (Varies by Color)
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

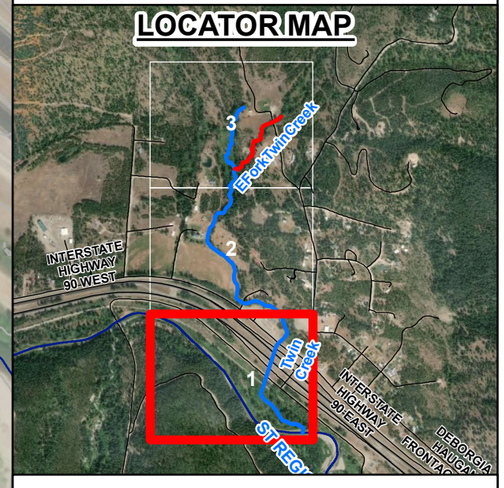
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Twin Creek Map 1 of 3

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Stream Reach (Varies by Color)
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

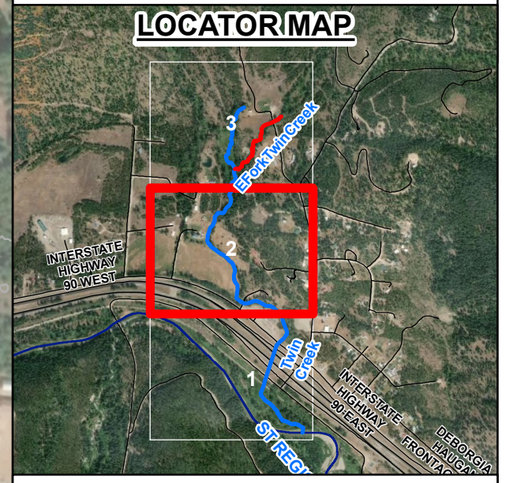
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Twin Creek Map 2 of 3

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Stream Reach (Varies by Color)
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

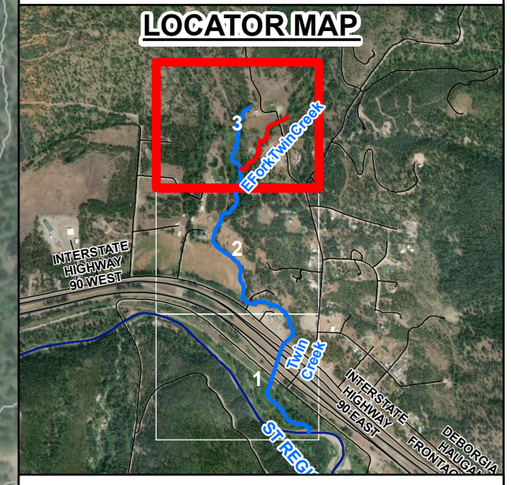
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Twin Creek Map 3 of 3

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Deer Creek
- Junctions

Labels

- 1234 Stream Station
- 1234.56 Water Surface Elevation

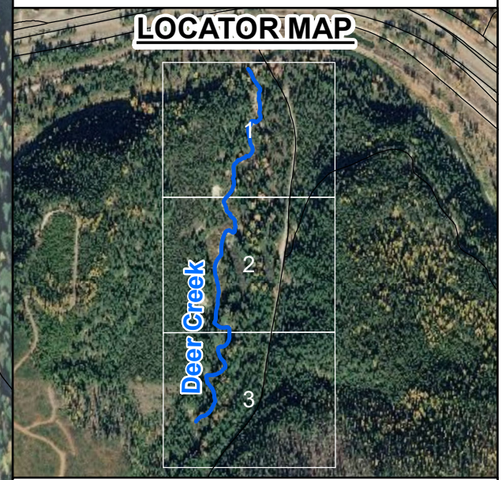
0 310 620 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Deer Creek Index Map

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Deer Creek
- Cross Sections
- Roads
- 10' Contours

Deer Creek
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Junctions

Labels

1234 Stream Station

1234.56 Water Surface Elevation

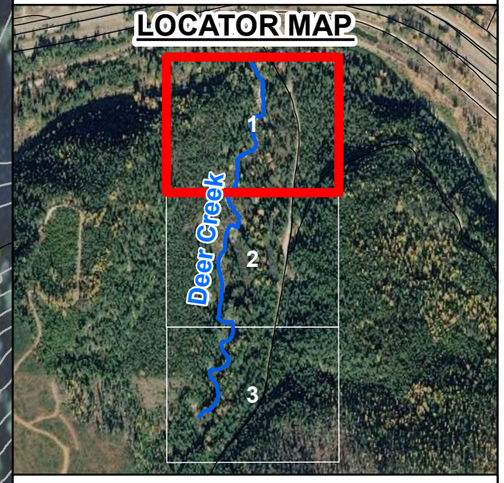
0 80 160 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Deer Creek Map 1 of 3

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Deer Creek
- Cross Sections
- Roads
- 10' Contours

Deer Creek
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Junctions

Labels

1234 Stream Station

1234.56 Water Surface Elevation

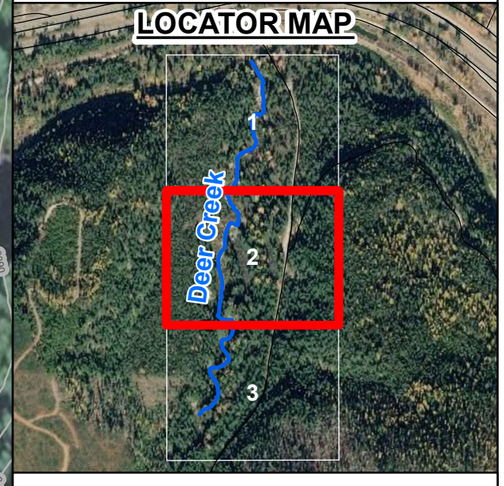
0 80 160 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Deer Creek Map 2 of 3

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Deer Creek
- Cross Sections
- Roads
- 10' Contours

Deer Creek

- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Junctions

Labels

1234 Stream Station

1234.56 Water Surface Elevation

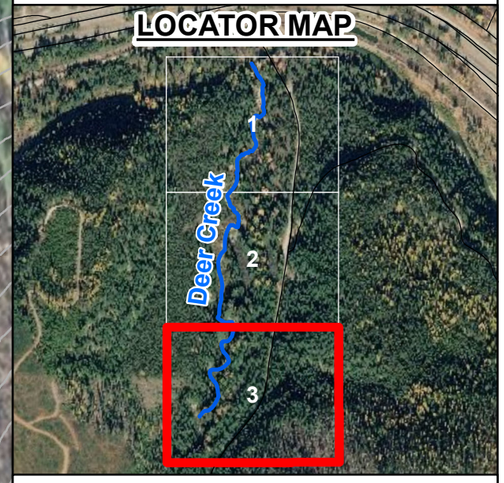
0 80 160 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Deer Creek Map 3 of 3

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Savenac Creek

Labels

- 1234 Stream Station
- 1234.56 Water Surface Elevation

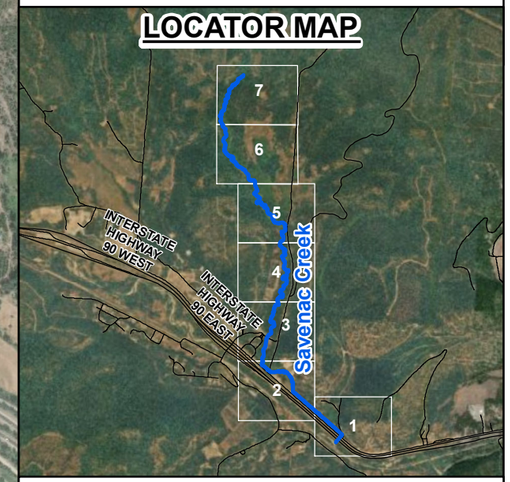
0 1,000 2,000 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Savenac Creek Index Map

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Savenac Creek
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Shallow Flooding
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

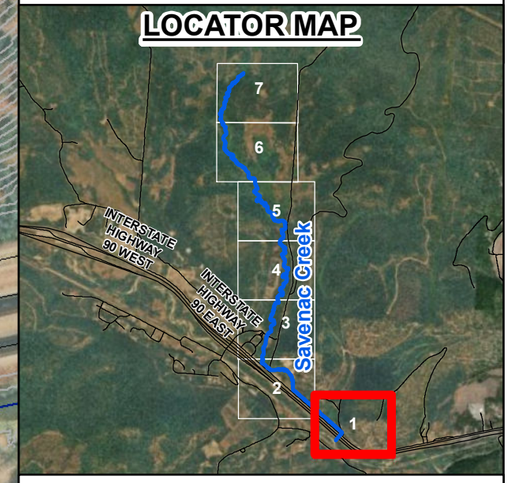
0 200 400 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Savenac Creek Map 1 of 7

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Savenac Creek
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Shallow Flooding
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

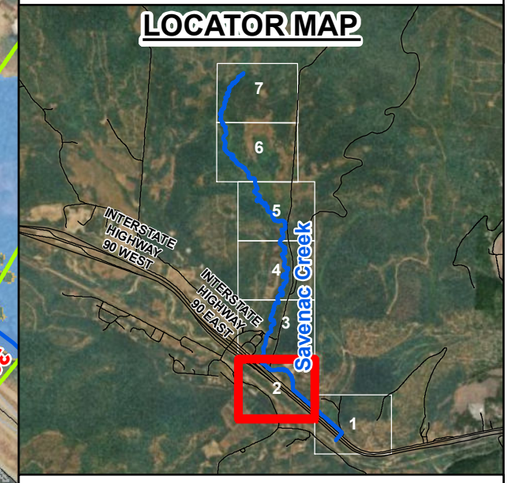
0 200 400 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Savenac Creek Map 2 of 7

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Savenac Creek
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Shallow Flooding
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

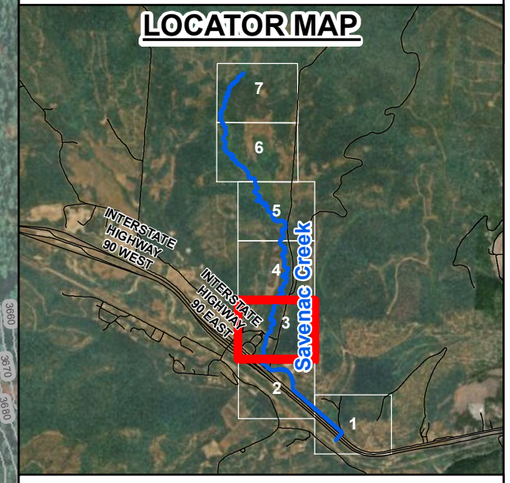
0 200 400 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Savenac Creek Map 3 of 7

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Savenac Creek
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Shallow Flooding
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

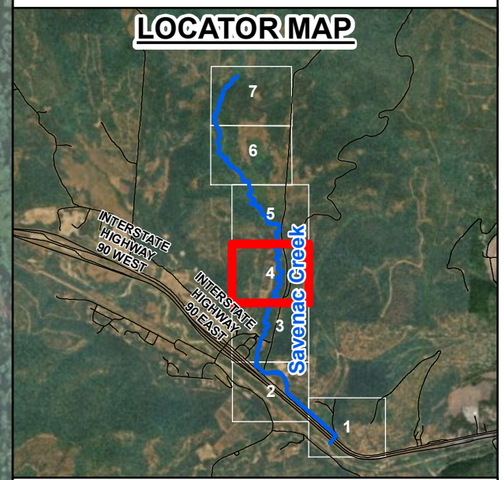
0 200 400 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Savenac Creek Map 4 of 7

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Savenac Creek
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Shallow Flooding
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

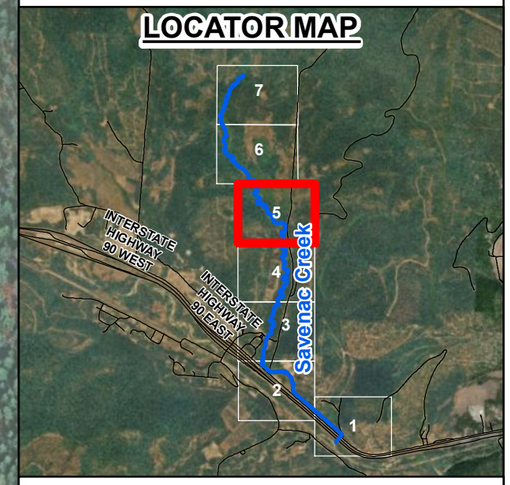
0 200 400 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Savenac Creek Map 5 of 7

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Savenac Creek
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Shallow Flooding
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

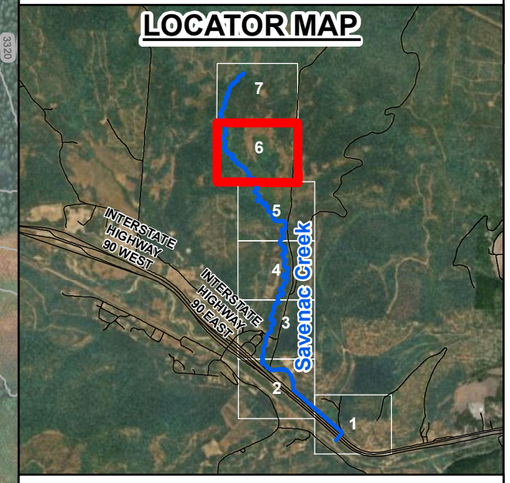
0 250 500 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Savenac Creek Map 6 of 7

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Savenac Creek
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Shallow Flooding
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

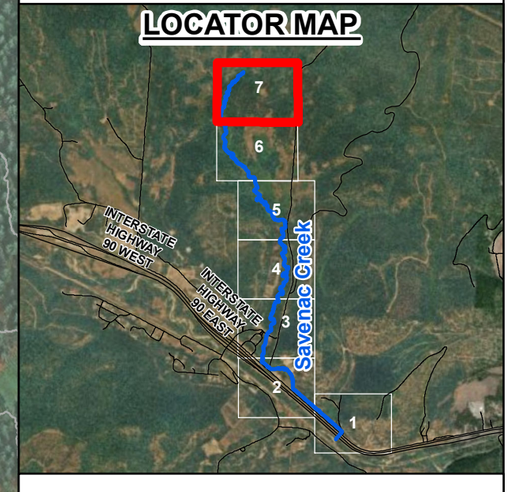
0 250 500 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Savenac Creek Map 7 of 7

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Big Creek

Labels

1234 Stream Station

1234.56 Water Surface Elevation

0 750 1,500 Feet

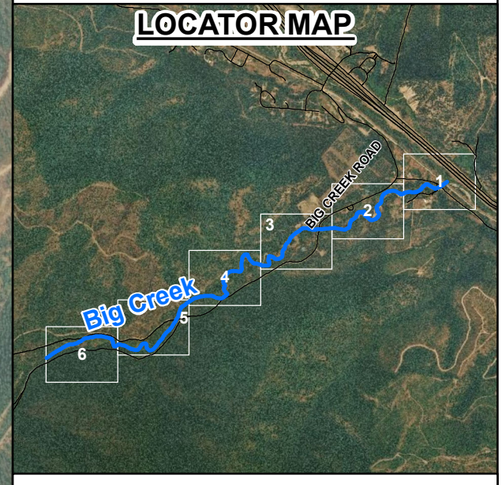
N

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Big Creek Index Map

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Big Creek
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

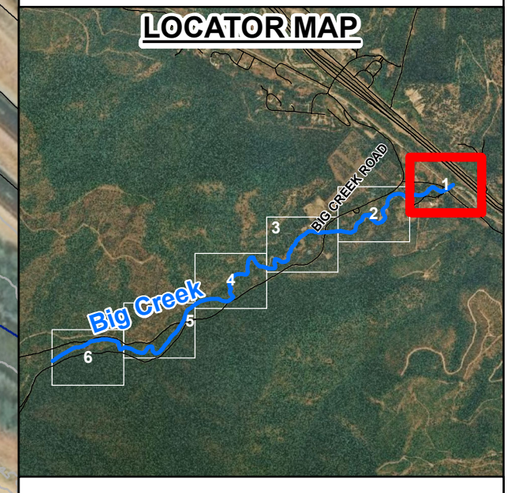
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

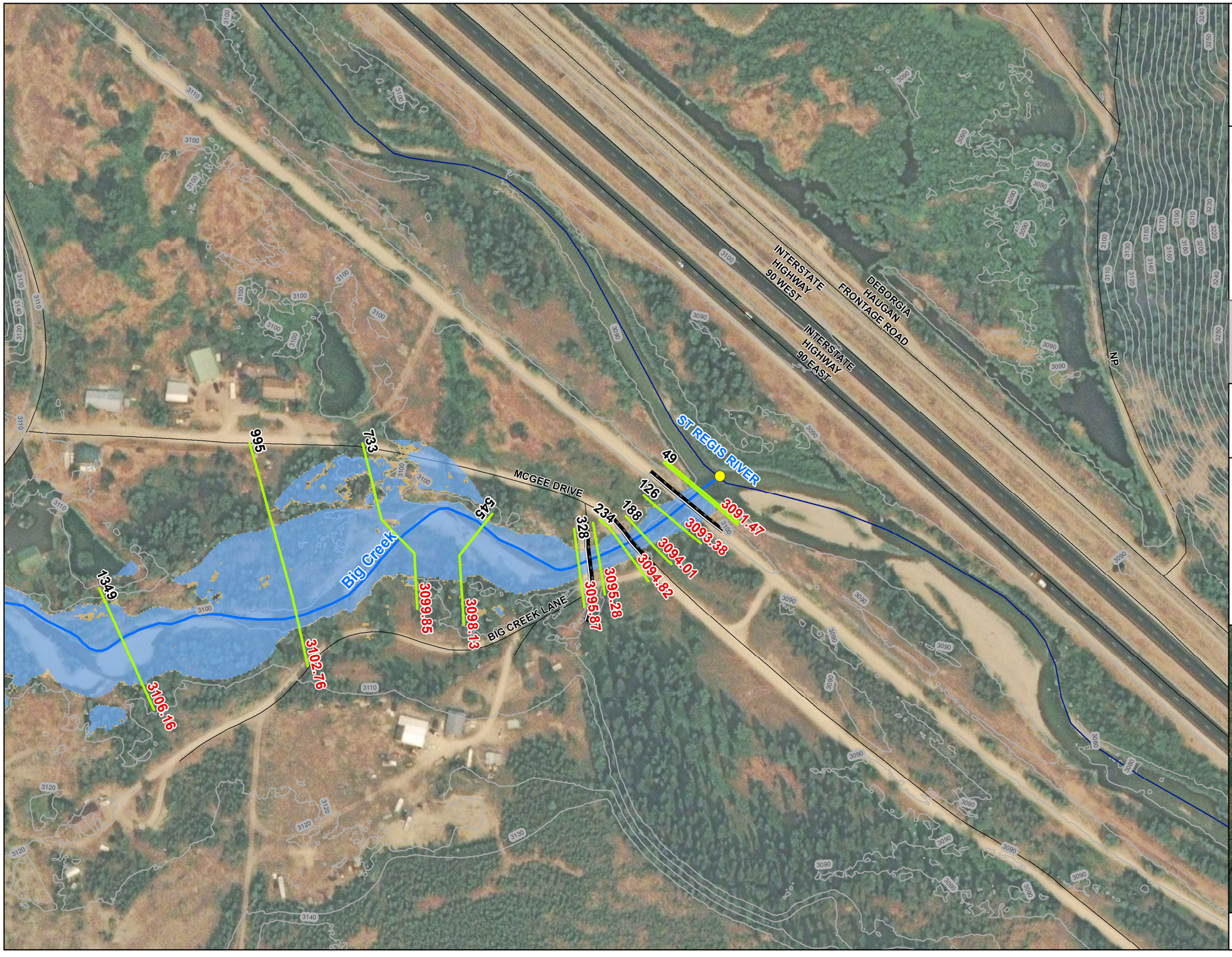
MONTANA DNRC

DOWL

LOCATOR MAP



Big Creek Map 1 of 6



MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Big Creek
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

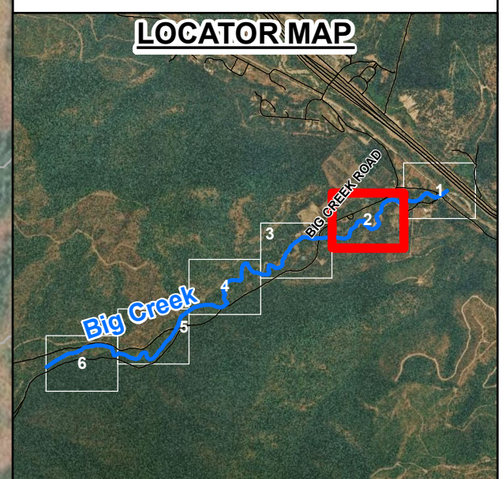
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Big Creek Map 2 of 6

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Big Creek
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

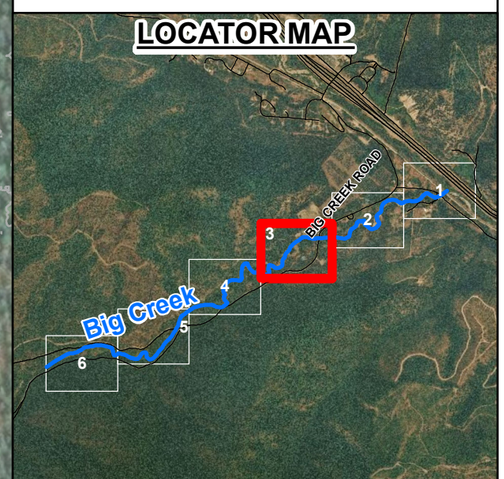
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Big Creek Map 3 of 6

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Big Creek
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

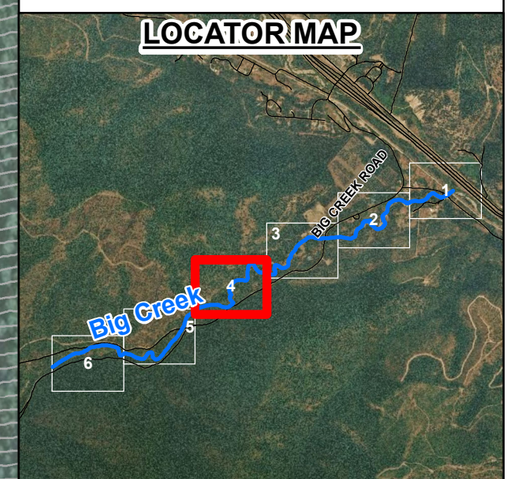
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Big Creek Map 4 of 6

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Big Creek
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

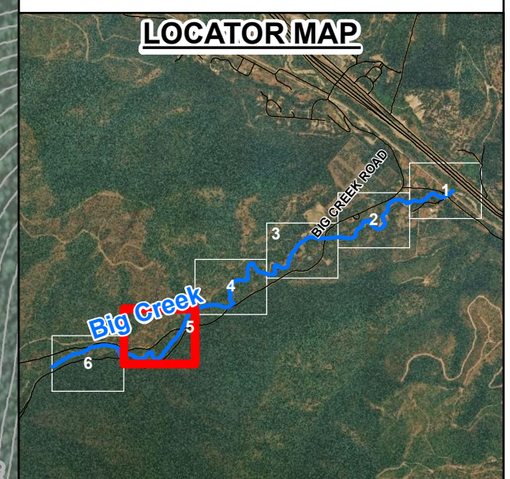
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Big Creek Map 5 of 6

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Big Creek
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

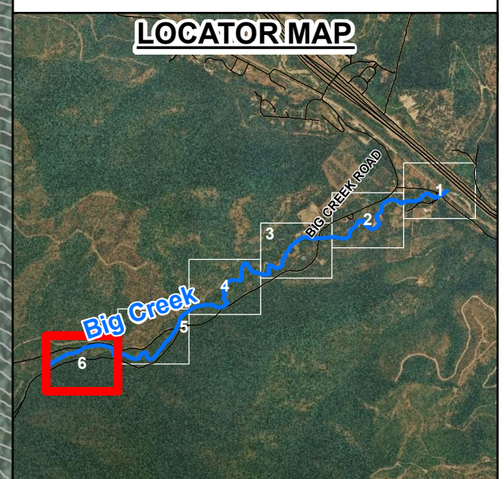
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Big Creek Map 6 of 6

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junction
- Timber Creek
- Timber Split
- East Fork Timber
- West Fork Timber

Labels

- 1234 Stream Station
- 1234.56 Water Surface Elevation

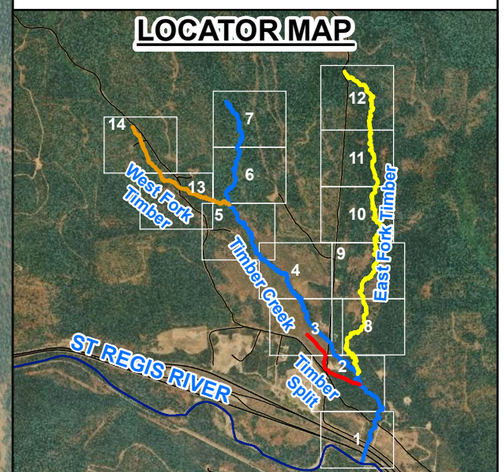
0 750 1,500 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Index Map

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
- Stream Reach (Varies by Color)
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

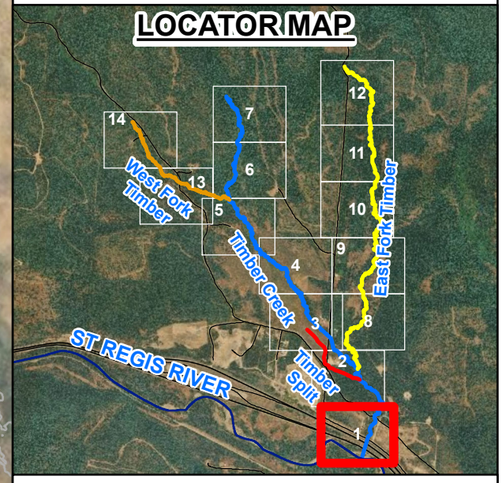
0 125 250 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 1 of 14

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
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1234.56 Water Surface Elevation

0 125 250 Feet

Hydraulic Work Map - St. Regis River Flood Study
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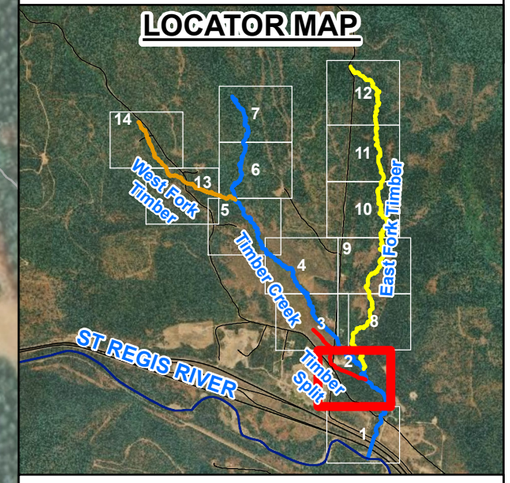
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 2 of 14

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
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1234 Stream Station

1234.56 Water Surface Elevation

0 125 250 Feet

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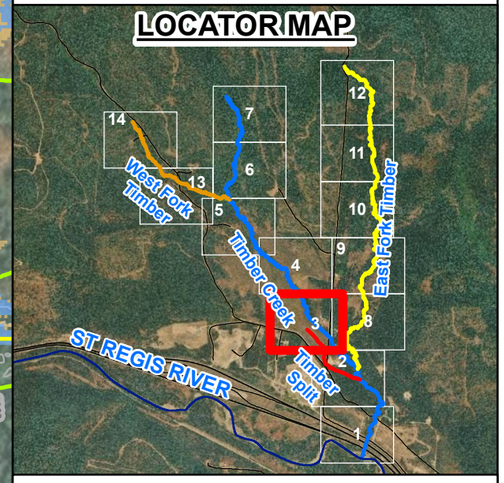
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 3 of 14

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
- Stream Reach (Varies by Color)
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
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1234 Stream Station

1234.56 Water Surface Elevation

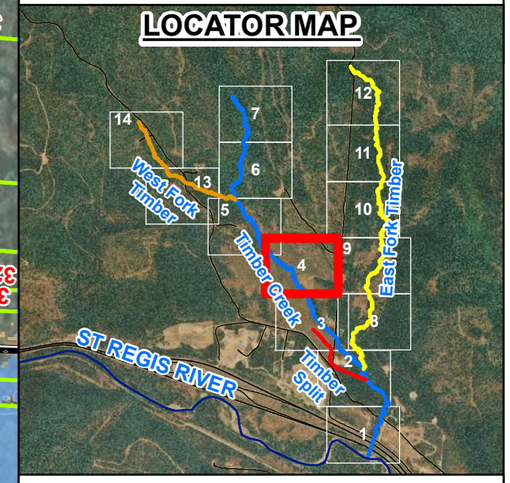
0 125 250 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 4 of 14

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
- Stream Reach (Varies by Color)
- Roadway Crossing
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1234 Stream Station

1234.56 Water Surface Elevation

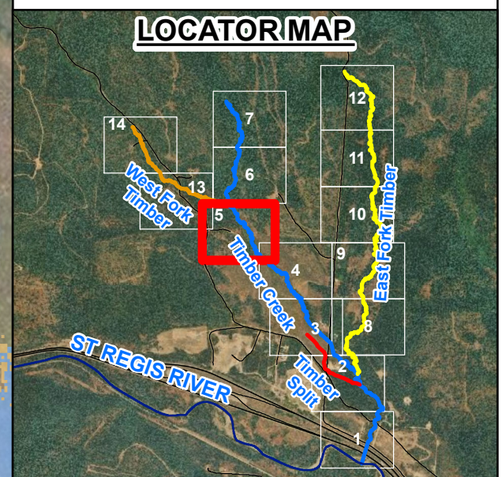
0 125 250 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 5 of 14

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
- Stream Reach (Varies by Color)
- Roadway Crossing
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- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

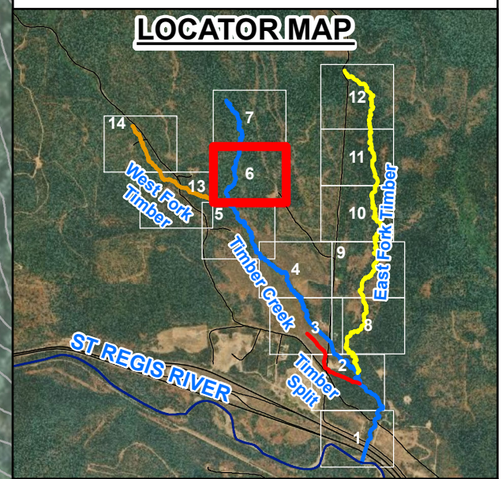
0 125 250 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 6 of 14

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
- Stream Reach (Varies by Color)
- Roadway Crossing
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- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

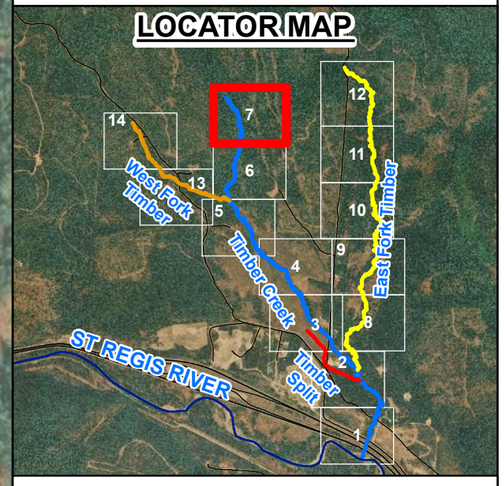
0 125 250 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 7 of 14

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
- Stream Reach (Varies by Color)
- Roadway Crossing
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1234 Stream Station

1234.56 Water Surface Elevation

0 125 250 Feet

Hydraulic Work Map - St. Regis River Flood Study
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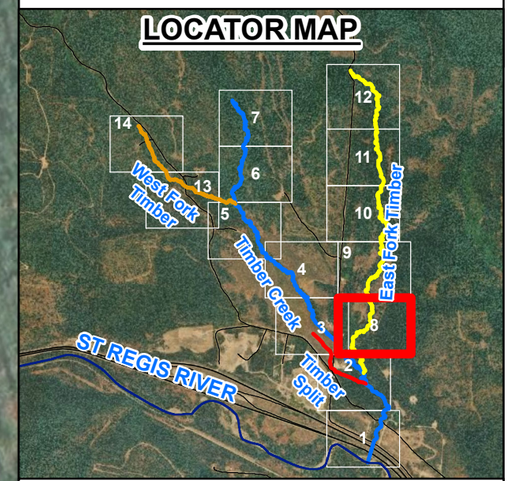
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 8 of 14

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
- Stream Reach (Varies by Color)
- Roadway Crossing
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- 1% AC (100 yr)
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1234.56 Water Surface Elevation

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Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
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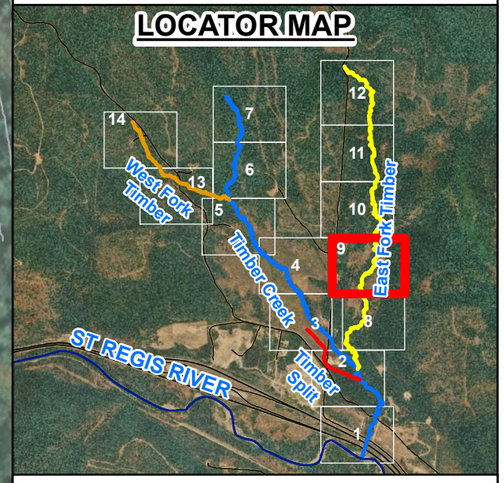
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 9 of 14

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
- Stream Reach (Varies by Color)
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

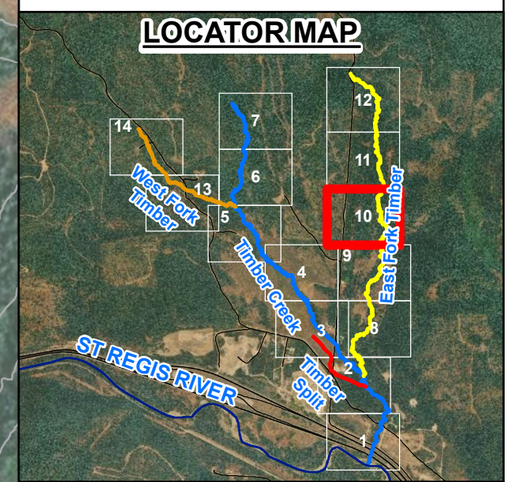
0 125 250 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 10 of 14

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
- Stream Reach (Varies by Color)
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
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1234 Stream Station

1234.56 Water Surface Elevation

0 125 250 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
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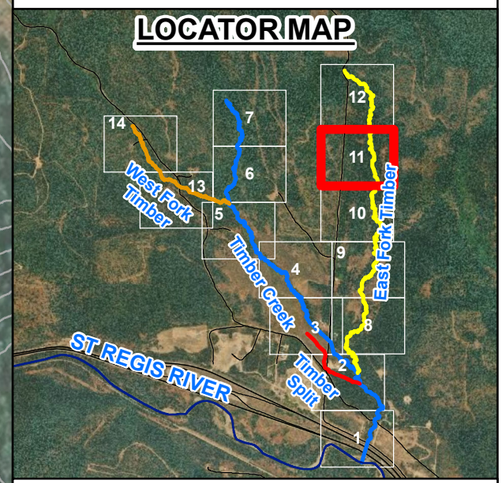
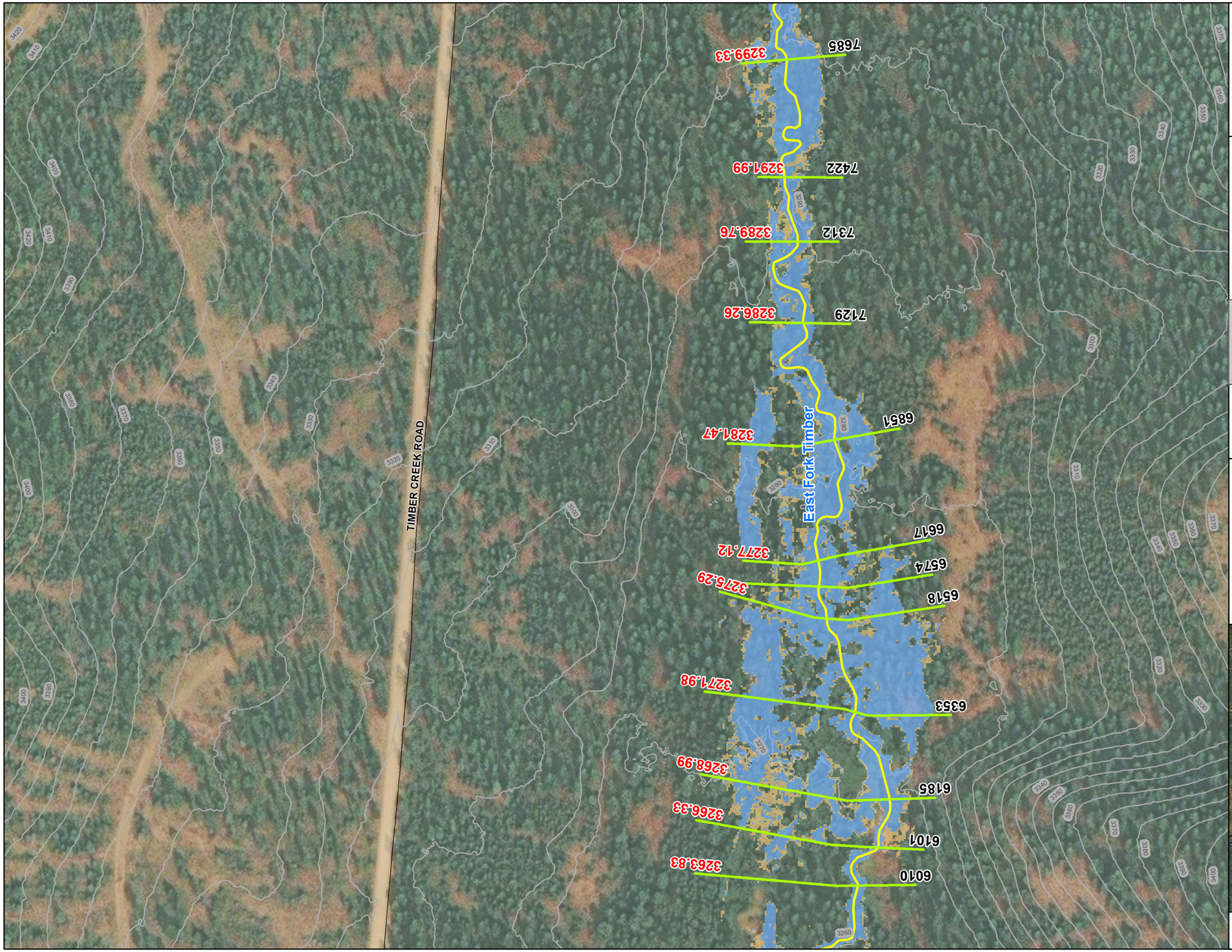
MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 11 of 14



MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

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- Junction
- Stream Reach (Varies by Color)
- Roadway Crossing
- Cross Sections
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1234 Stream Station

1234.56 Water Surface Elevation

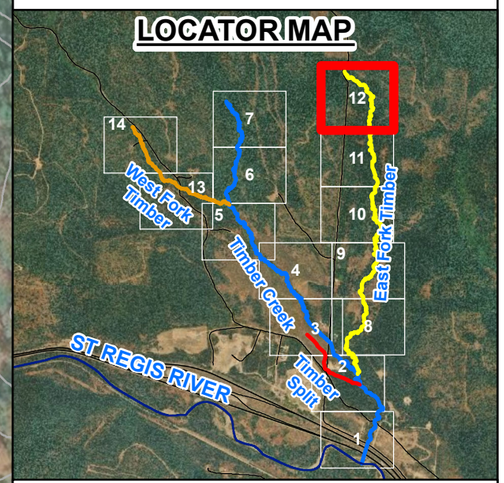
0 140 280 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 12 of 14

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
- Stream Reach (Varies by Color)
- Roadway Crossing
- Cross Sections
- 1% AC (100 yr)
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1234 Stream Station

1234.56 Water Surface Elevation

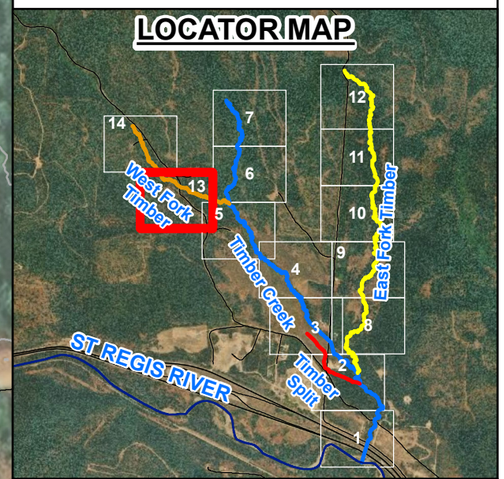
0 125 250 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Timber Creek Map 13 of 14

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 12, 2018

Legend

- Junction
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- Roadway Crossing
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- 0.2% AC (500 yr)
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1234 Stream Station

1234.56 Water Surface Elevation

0 125 250 Feet

Hydraulic Work Map - St. Regis River Flood Study
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MONTANA DNRC

DOWL

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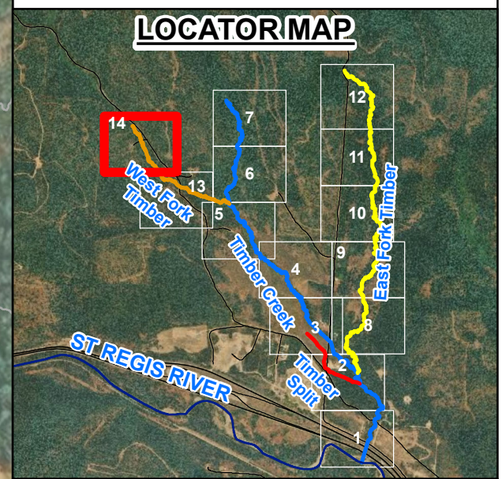
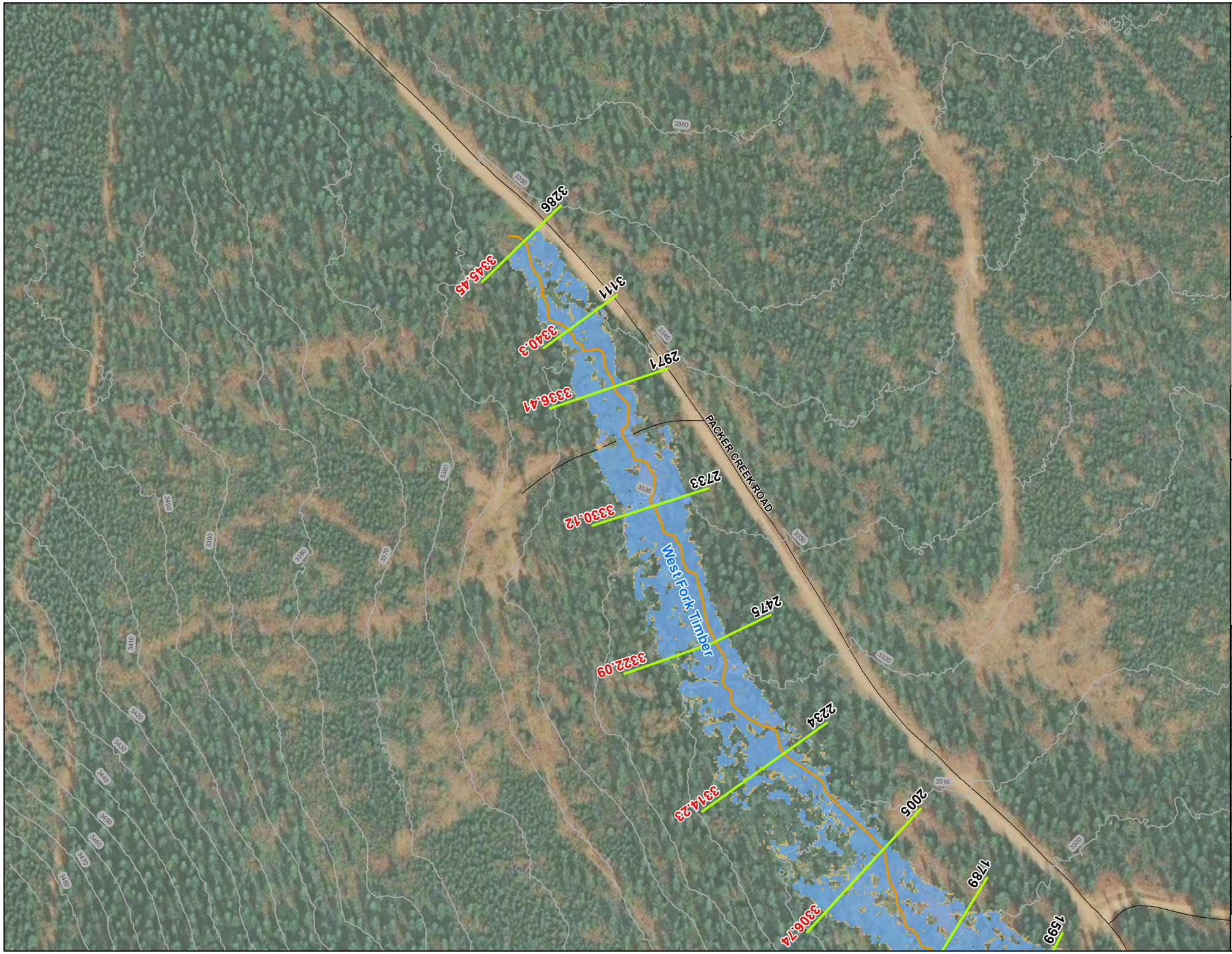


Timber Creek Map 14 of 14



MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Silver Creek
- Junctions

Labels

1234 Stream Station

1234.56 Water Surface Elevation

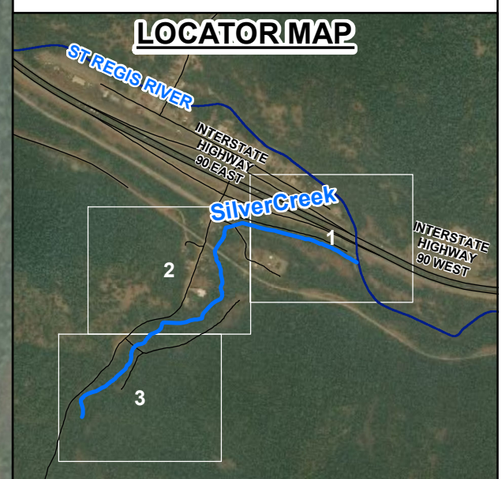
0 175 350 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Silver Creek Index Map

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Silver Creek
- Cross Sections
- Roadway Crossings
- Roads
- 10' Contours

Silver Creek
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Junctions

Labels

1234 Stream Station

1234.56 Water Surface Elevation

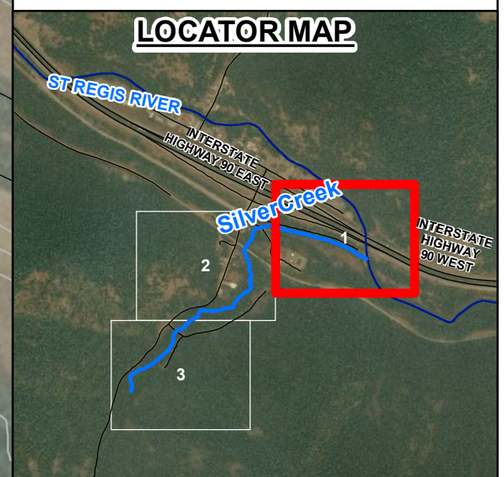
0 80 160 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Silver Creek Map 1 of 3

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Silver Creek
- Cross Sections
- Roadway Crossings
- Roads
- 10' Contours

Silver Creek
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- Junctions

Labels

1234 Stream Station

1234.56 Water Surface Elevation

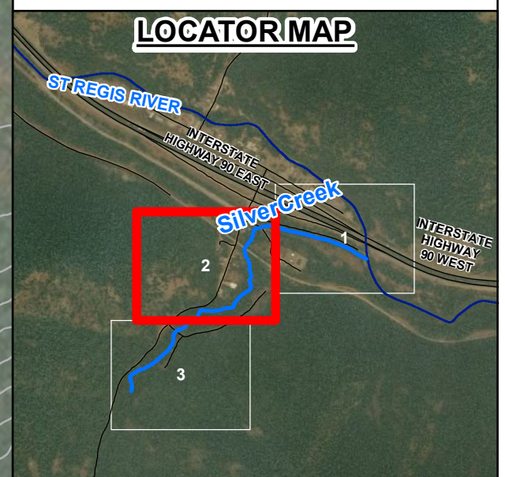
0 80 160 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Silver Creek Map 2 of 3

997
1111
1206
1304
1351
1545
1801
2102
2324
3,373.19
3,381.11
3,381.38
3,381.87
3,383.86
3,388.52
3,396.31
3,405.48
LOHR LANE
SILVER CREEK ROAD
ACCESS ROAD
Silver Creek

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: September 18, 2019

Legend

- Silver Creek
- Cross Sections
- Roadway Crossings
- Roads
- 10' Contours

Silver Creek
- 1% AC (100 yr)
- 0.2% AC (500 yr)
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Labels

1234 Stream Station

1234.56 Water Surface Elevation

0 80 160 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County, MT Risk MAP - MAS No. 2016-01
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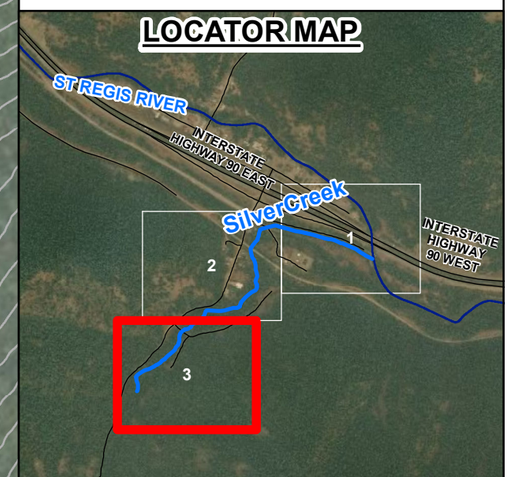
MONTANA DNRC

DOWL

LOCATOR MAP



Silver Creek Map 3 of 3

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Packer Creek
- EFork Packer Cr

Labels

- 1234 Stream Station
- 1234.56 Water Surface Elevation

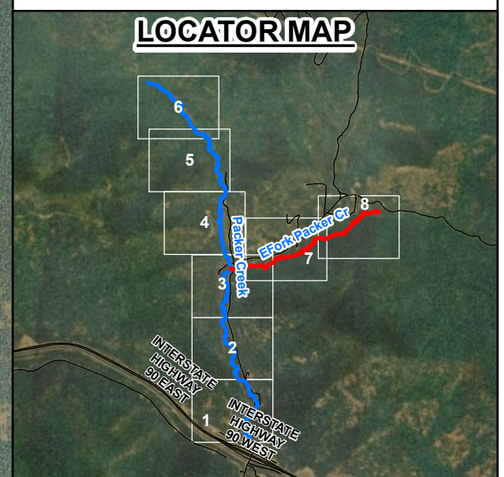
0 1,000 2,000 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Packer Creek Index Map

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Stream Reachs (Varies by Color)
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

0 250 500 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
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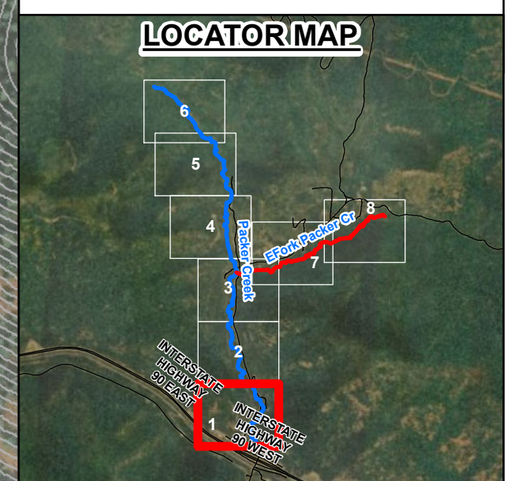
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Packer Creek Map 1 of 8

3411.36
2648
3407.87
2331
3403.07
2107
3400.09
1769
3393.88
1574
1611
3391.13
3388.15
1417
3381.59
1080
3374.85
747
3369.75
420
3366.62
217.93
ST REGIS RIVER
PACKER CREEK ROAD
Packer Creek
INTERSTATE HIGHWAY 90 EAST
INTERSTATE HIGHWAY 90 WEST
SALTESE FRONTAGE ROAD
EXIT 10 ON RAMP
HIAWATHA

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

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0 250 500 Feet

Hydraulic Work Map - St. Regis River Flood Study
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NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
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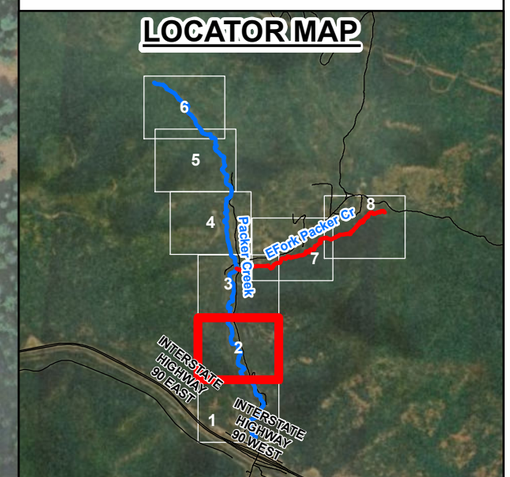
MONTANA DNRC

DOWL

LOCATOR MAP



Packer Creek Map 2 of 8

PACKER CREEK ROAD

Packer Creek

5314 3448.66

4817 3441.5

4419 3434.64

4030 3429.87

3591 3422.67

3251 3417.53

2832 3411.36

2648 3407.87

2331 3403.07

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Stream Reaches (Varies by Color)
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1234.56 Water Surface Elevation

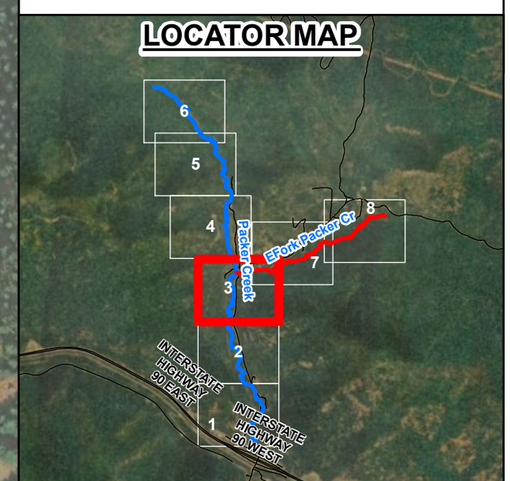
0 250 500 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Packer Creek Map 3 of 8

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Stream Reachs (Varies by Color)
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contuors

Labels

1234 Stream Station

1234.56 Water Surface Elevation

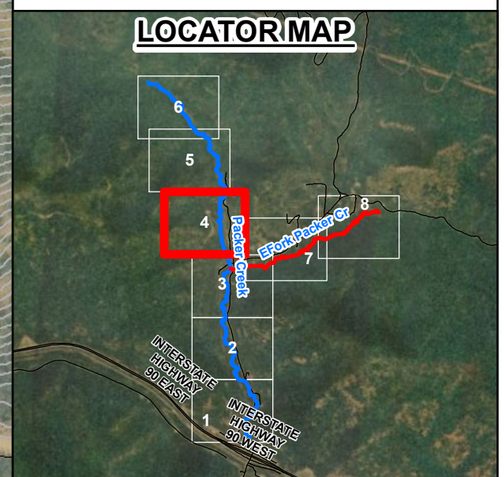
0 250 500 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Packer Creek Map 4 of 8

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Stream Reachs (Varies by Color)
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contuors

Labels

1234 Stream Station

1234.56 Water Surface Elevation

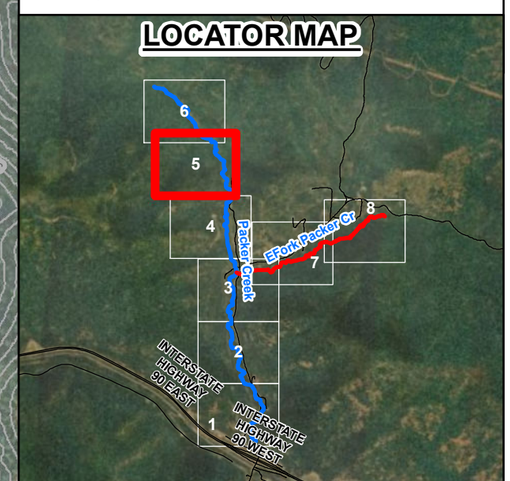
0 250 500 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Packer Creek Map 5 of 8

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Stream Reachs (Varies by Color)
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

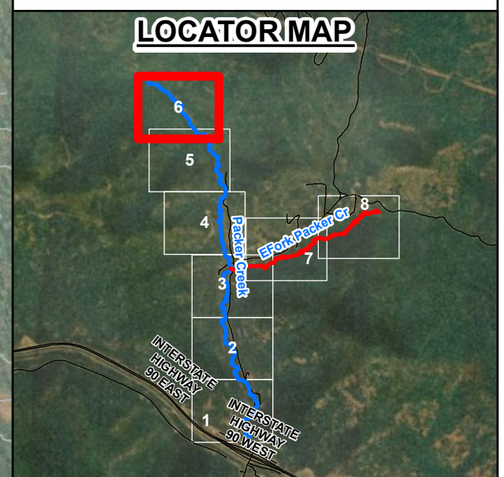
0 250 500 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Packer Creek Map 6 of 8

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Stream Reachs (Varies by Color)
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contours

Labels

1234 Stream Station

1234.56 Water Surface Elevation

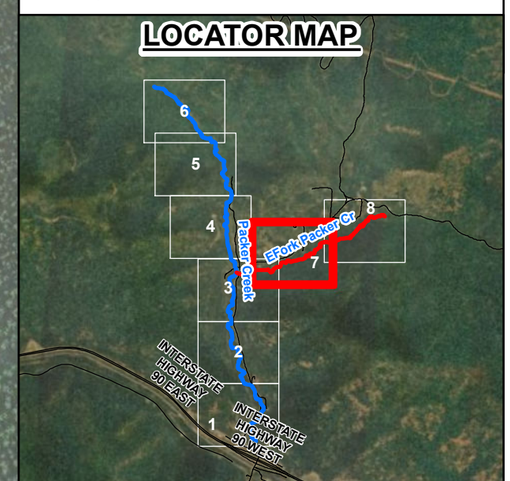
0 250 500 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Packer Creek Map 7 of 8

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Stream Reachs (Varies by Color)
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contuors

Labels

1234 Stream Station

1234.56 Water Surface Elevation

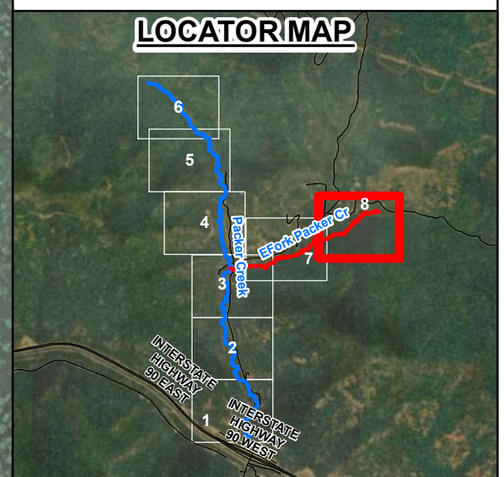
0 250 500 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Packer Creek Map 8 of 8

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Randolph Creek

Labels

- 1234 Stream Station
- 1234.56 Water Surface Elevation

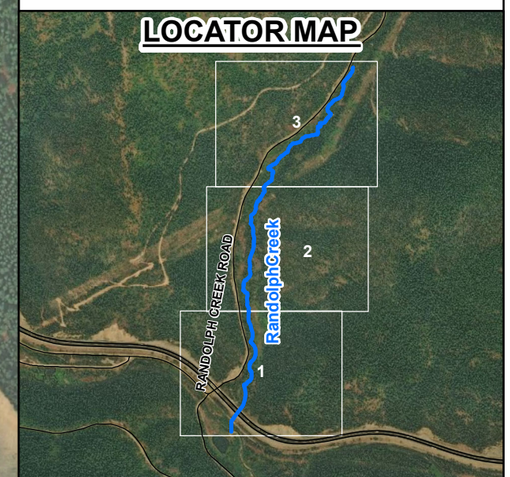
0 500 1,000 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Randolph Creek Index Map

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Randolph Creek
- Roadway Crossings
- Cross Section
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contuors

Labels

1234	Stream Station
1234.56	Water Surface Elevation

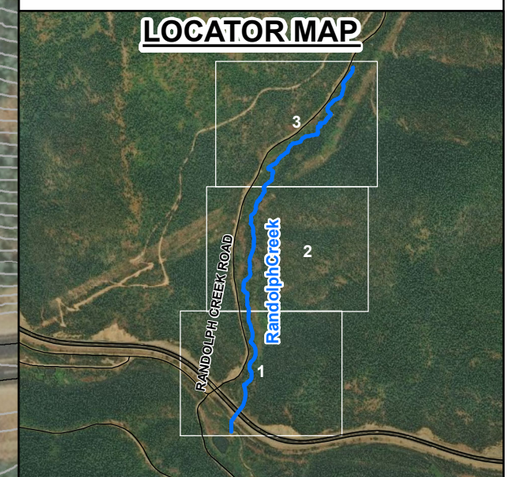
0 200 400 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

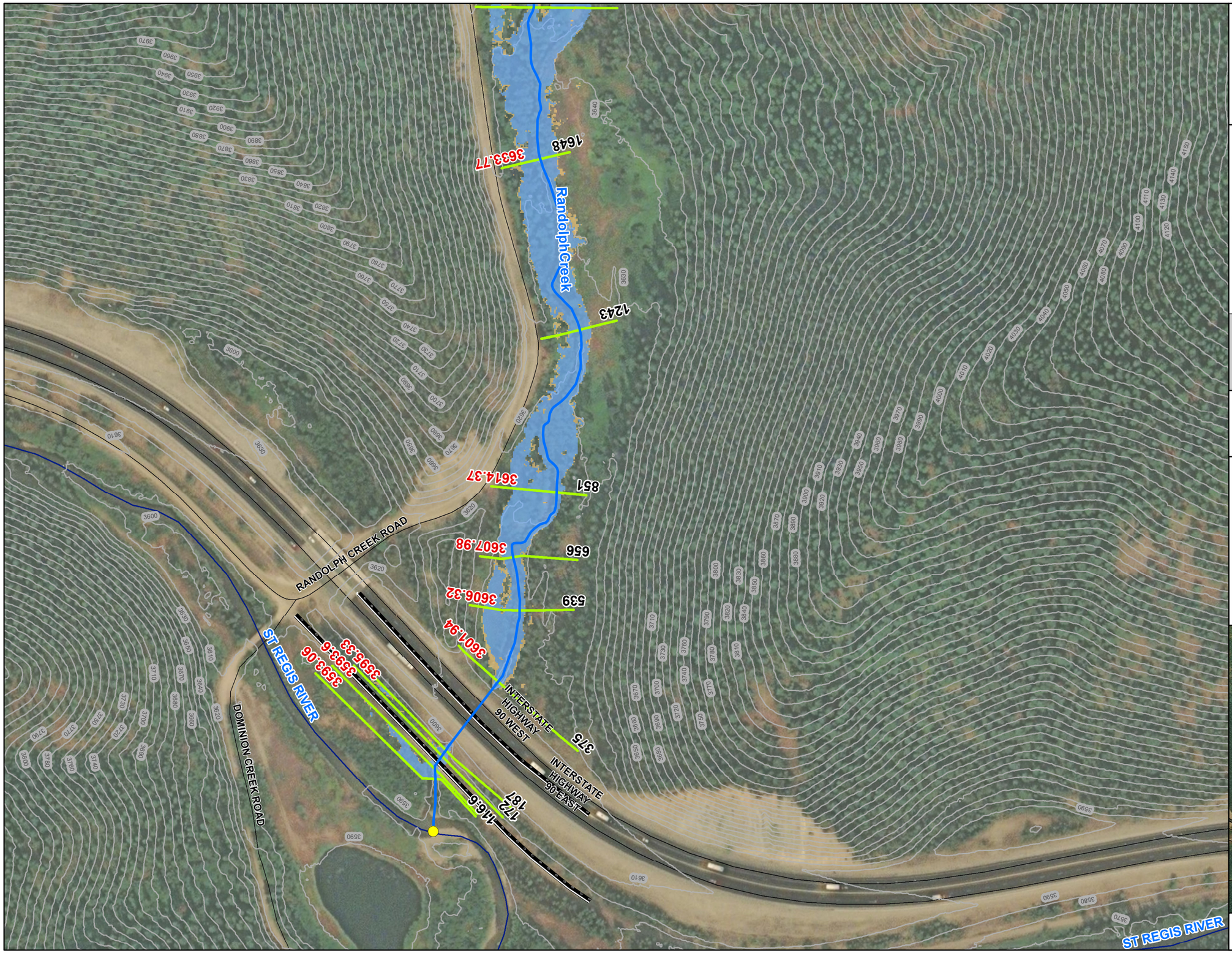
MONTANA DNRC

DOWL

LOCATOR MAP



Randolph Creek Map 1 of 3



MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Randolph Creek
- Roadway Crossings
- Cross Section
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contuors

Labels

1234 Stream Station

1234.56 Water Surface Elevation

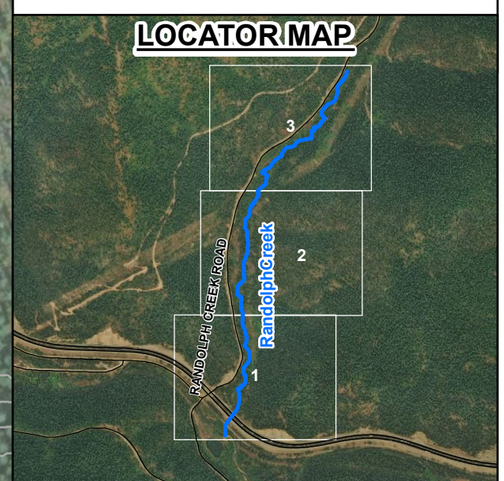
0 200 400 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

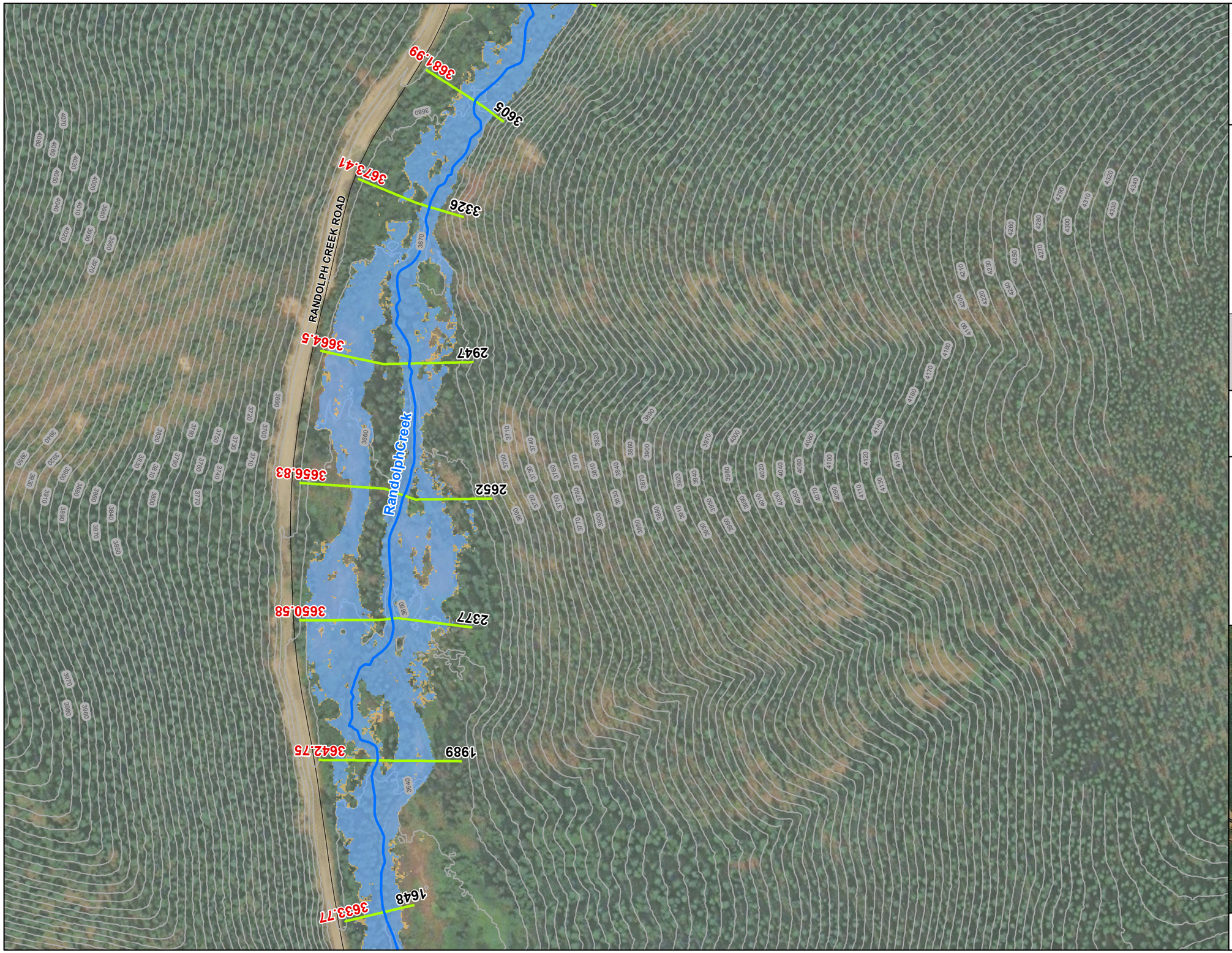
MONTANA DNRC

DOWL

LOCATOR MAP



Randolph Creek Map 2 of 3



MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Randolph Creek
- Roadway Crossings
- Cross Section
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contuors

Labels

- 1234 Stream Station
- 1234.56 Water Surface Elevation

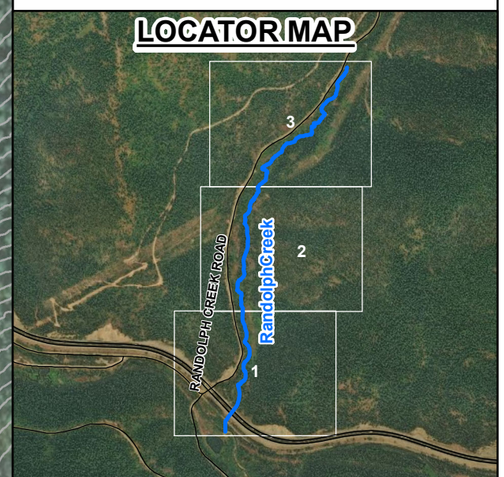
0 200 400 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Randolph Creek Map 3 of 3

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Rainy Creek

Labels

- 1234 Stream Station
- 1234.56 Water Surface Elevation

0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP

Rainy Creek Index Map

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Rainy Creek
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contuors

Labels

1234 Stream Station

1234.56 Water Surface Elevation

0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP

Rainy Creek Map1 of 1

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Denna Mora Creek

Labels

1234	Stream Station
1234.56	Water Surface Elevation

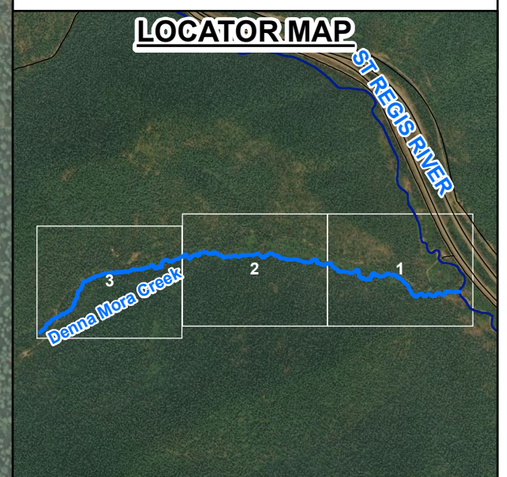
0 500 1,000 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Denna Mora Creek Index Map

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Denna Mora Creek
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contuors

Labels

1234 Stream Station

1234.56 Water Surface Elevation

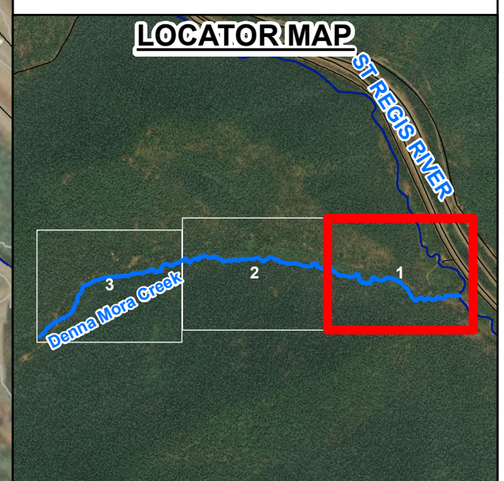
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Denna Mora Creek Map 1 of 3

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Denna Mora Creek
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contuors

Labels

1234 Stream Station

1234.56 Water Surface Elevation

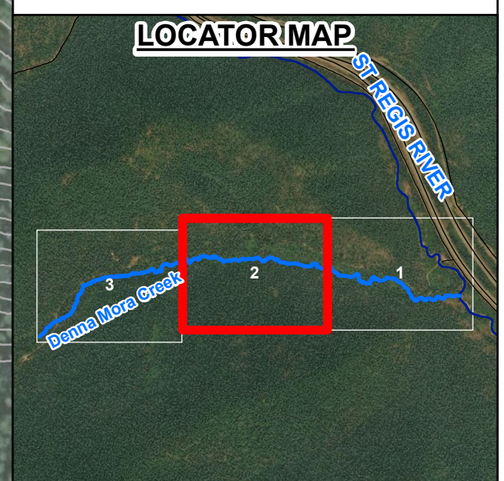
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Denna Mora Creek Map 2 of 3

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Denna Mora Creek
- Roadway Crossings
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contuors

Labels

1234 Stream Station

1234.56 Water Surface Elevation

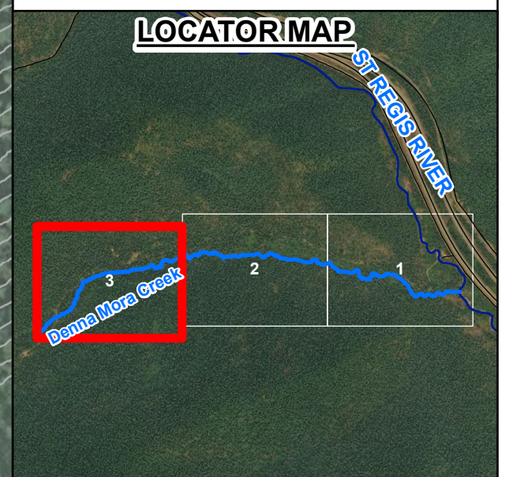
0 150 300 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Denna Mora Creek Map 3 of 3

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Hanaker Creek

Labels

- 1234 Stream Station
- 1234.56 Water Surface Elevation

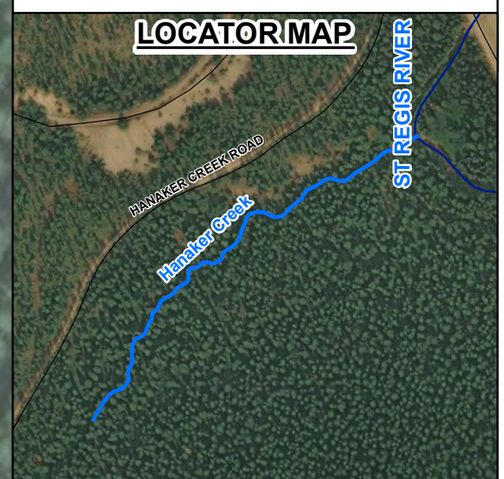
0 75 150 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

DOWL

LOCATOR MAP



Hanaker Creek Index Map

MINERAL COUNTY PRELIMINARY HYDRAULIC WORKMAPS

Date: December 21, 2018

Legend

- Junctions
- Hanaker Creek
- Cross Sections
- 1% AC (100 yr)
- 0.2% AC (500 yr)
- 10' Contuors

Labels

1234 Stream Station

1234.56 Water Surface Elevation

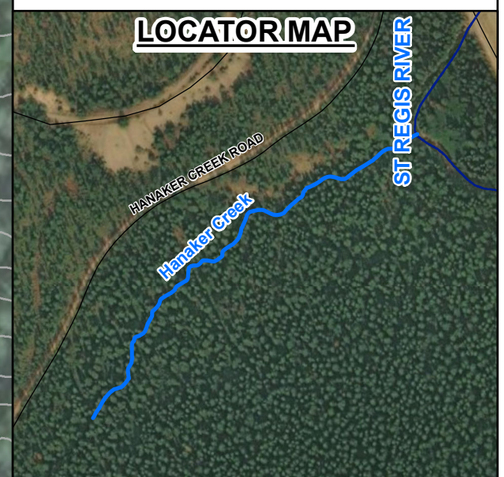
0 75 150 Feet

Hydraulic Work Map - St. Regis River Flood Study
Mineral County County, MT Risk MAP - MAS No. 2016-01
NAIP 2015, Horizontal Datum: NAD83
Topographic Data, LiDAR 2016
Horizontal Datum: NAD83, Vertical Datum: NAVD88, Feet

MONTANA DNRC

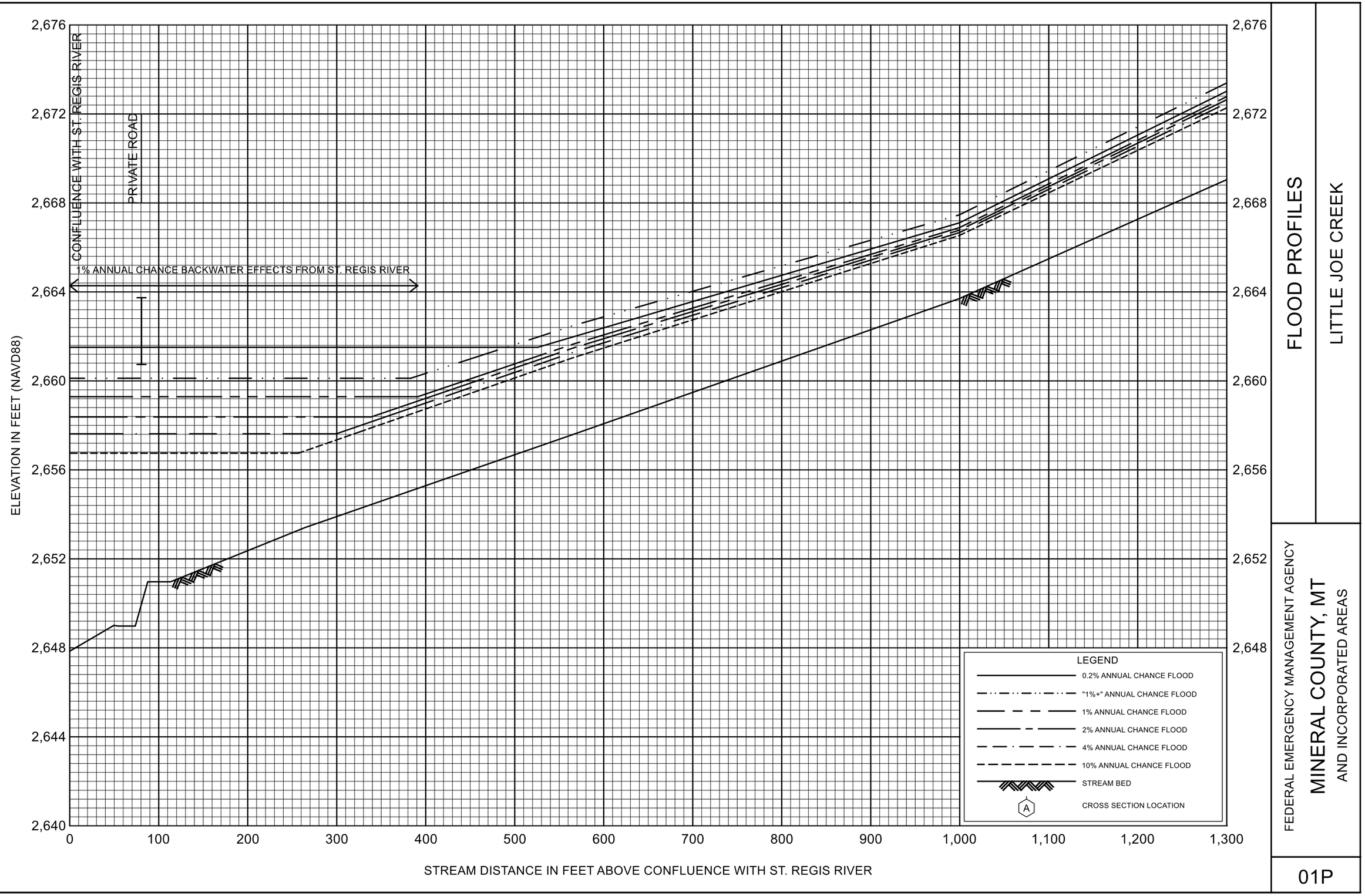
DOWL

LOCATOR MAP



Hanaker Creek Map 1 of 1

APPENDIX C – FLOOD PROFILES



FLOOD PROFILES

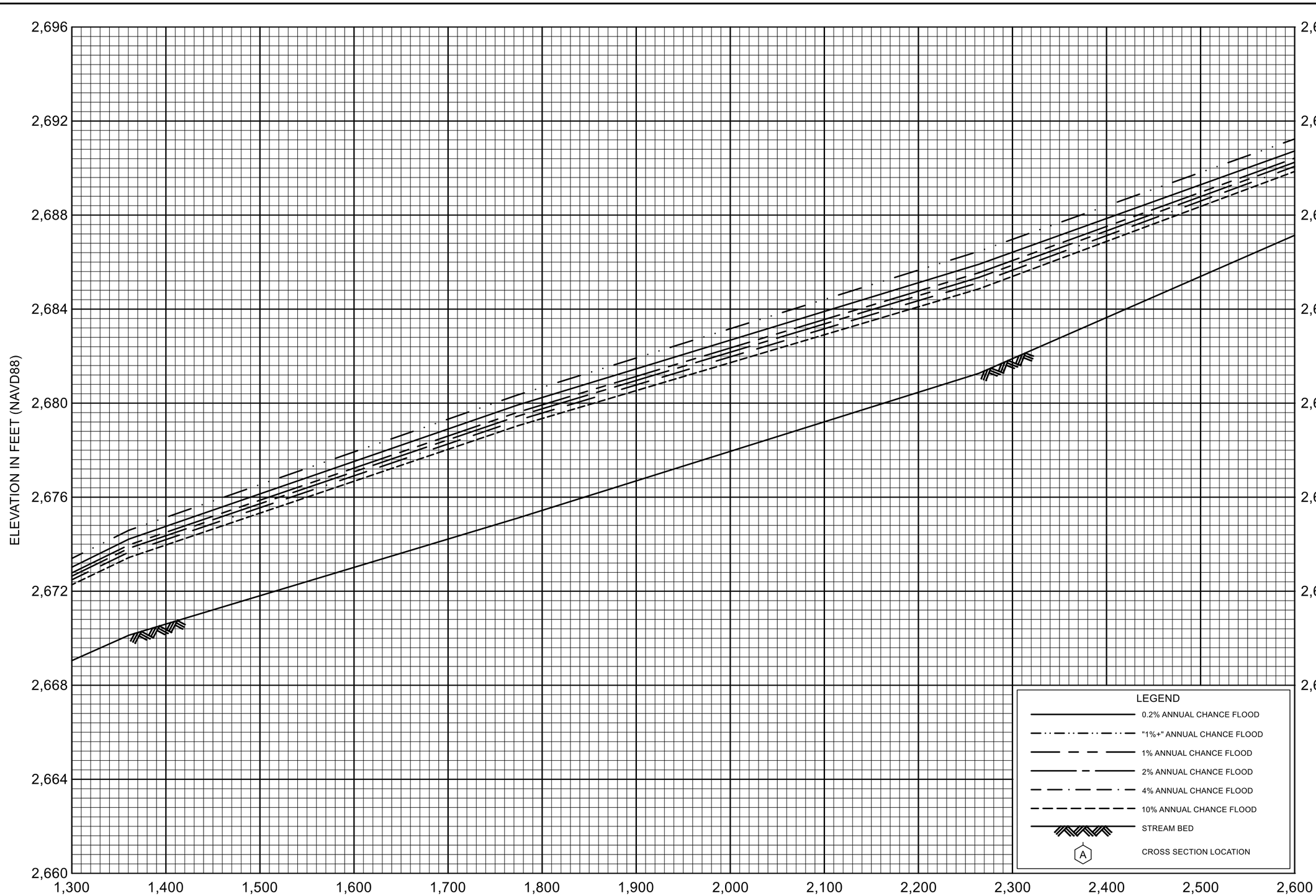
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

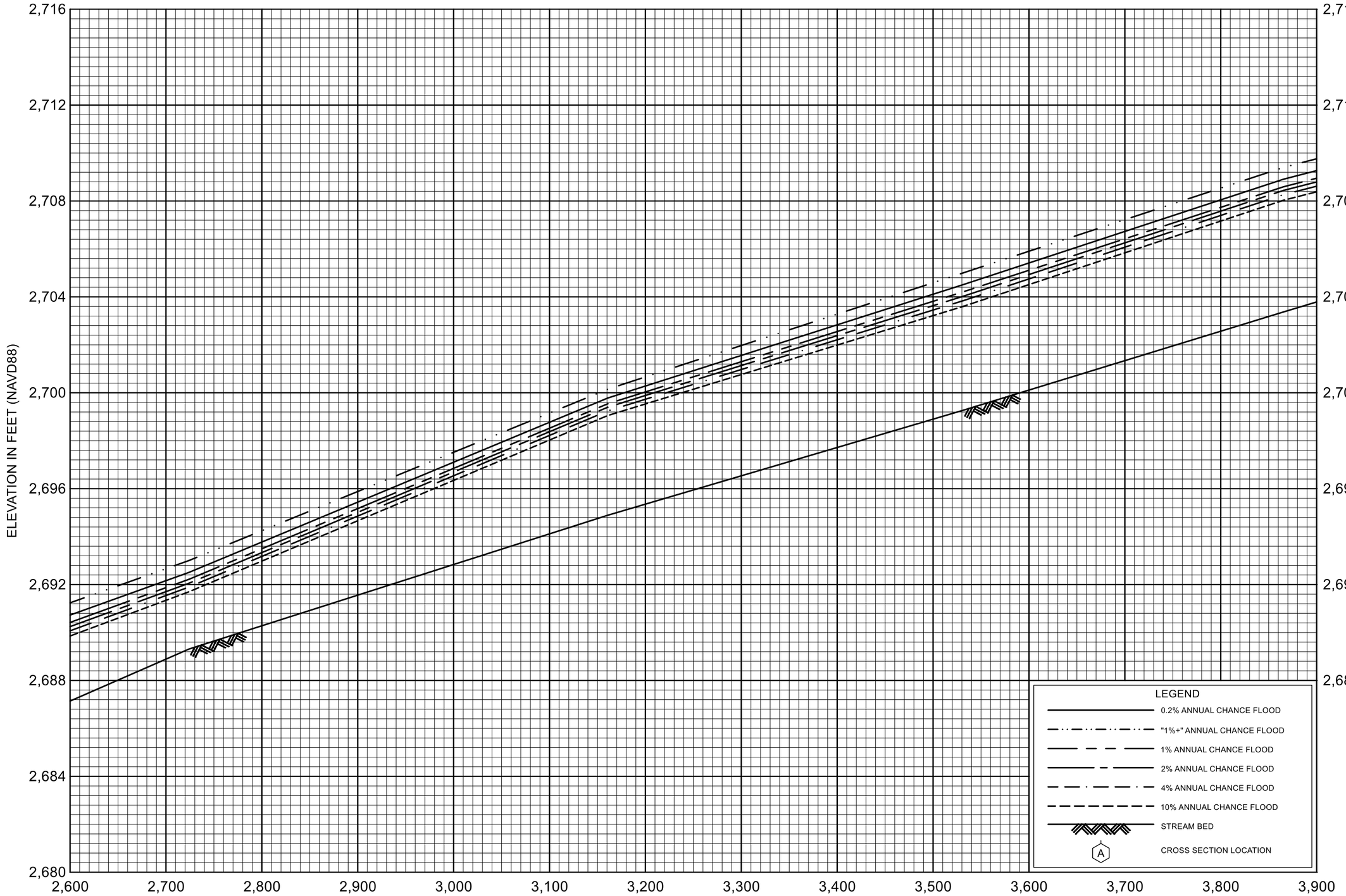
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

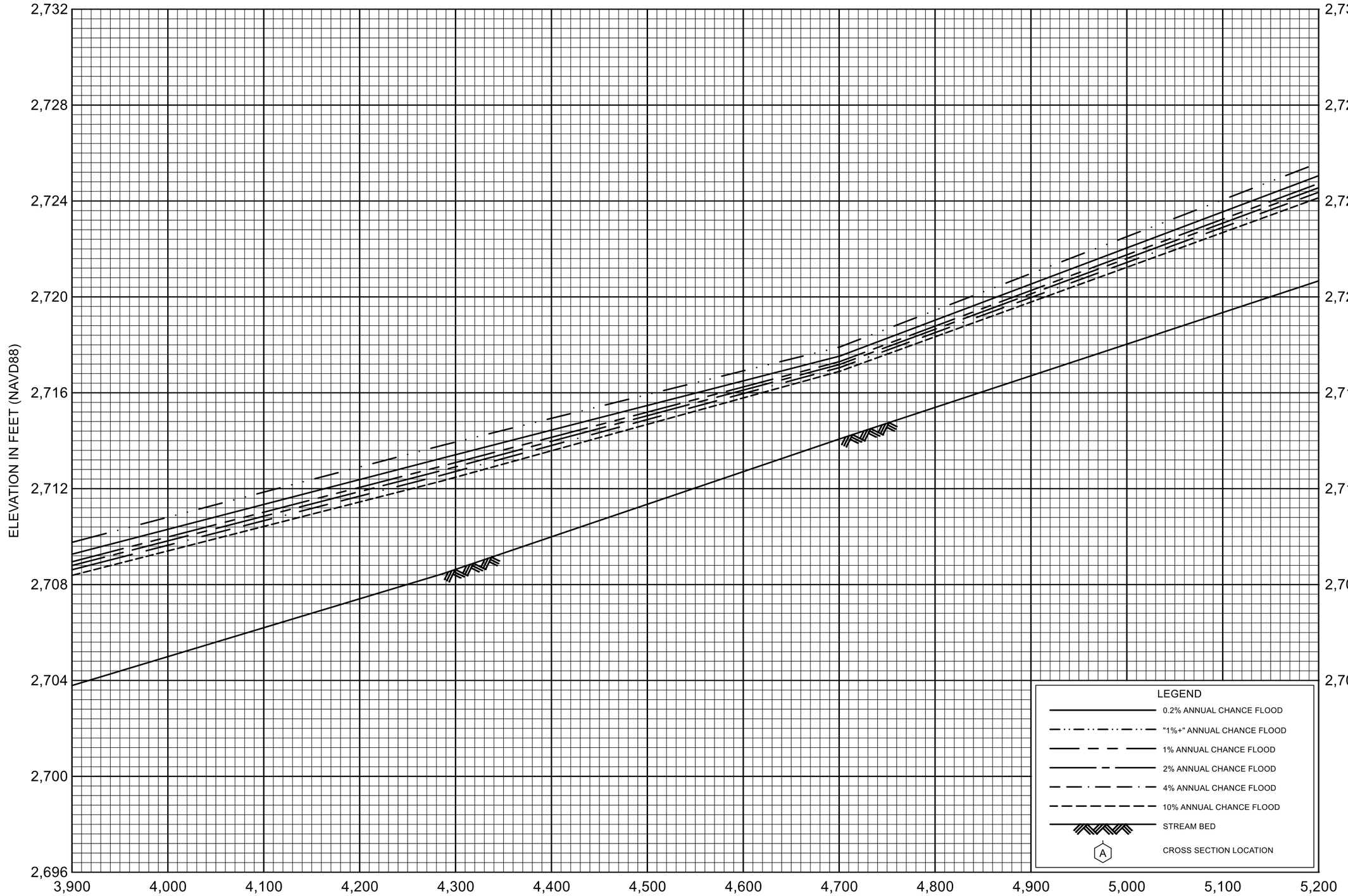
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

03P



FLOOD PROFILES

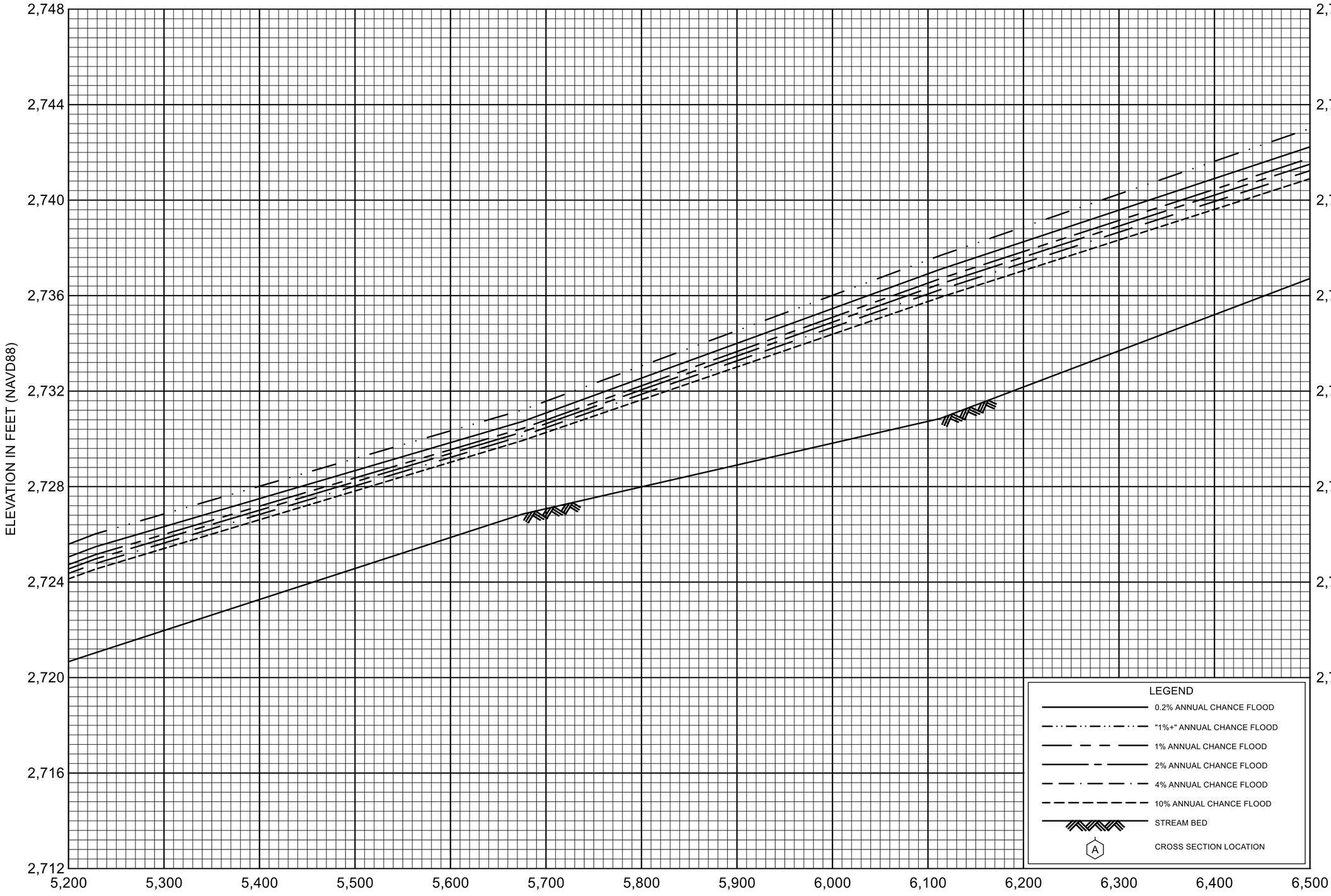
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

04P



FLOOD PROFILES

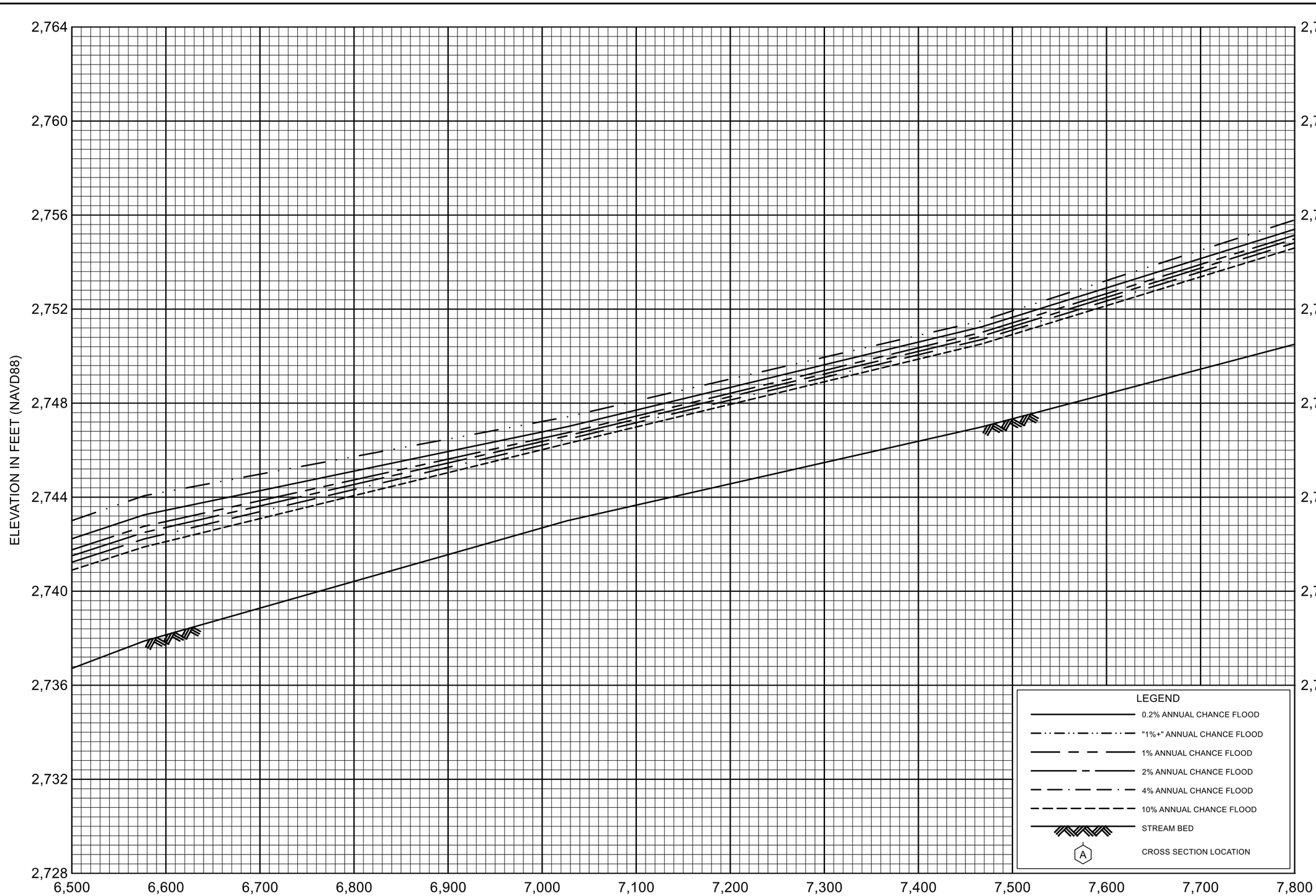
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

05P



FLOOD PROFILES

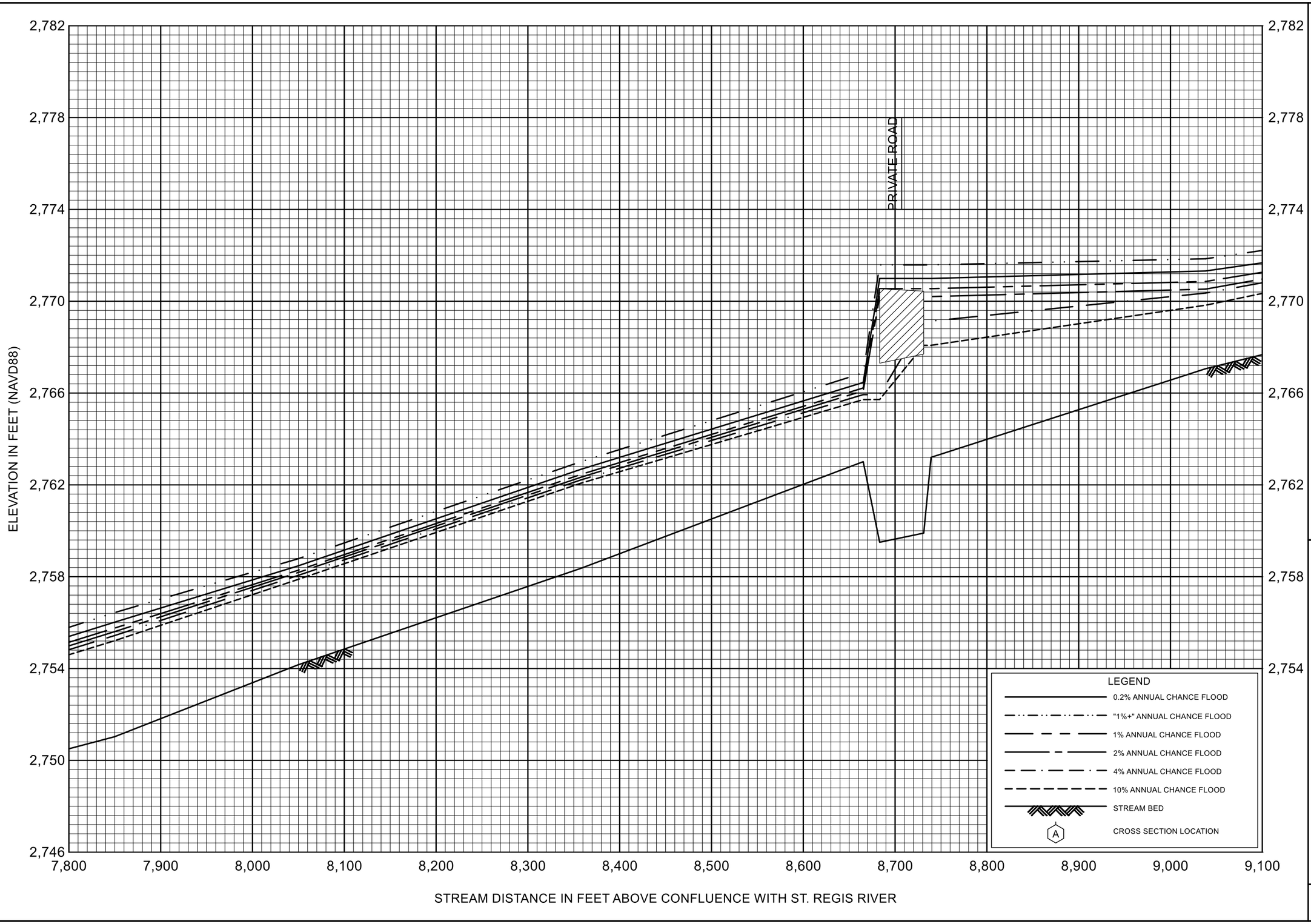
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

06P



FLOOD PROFILES

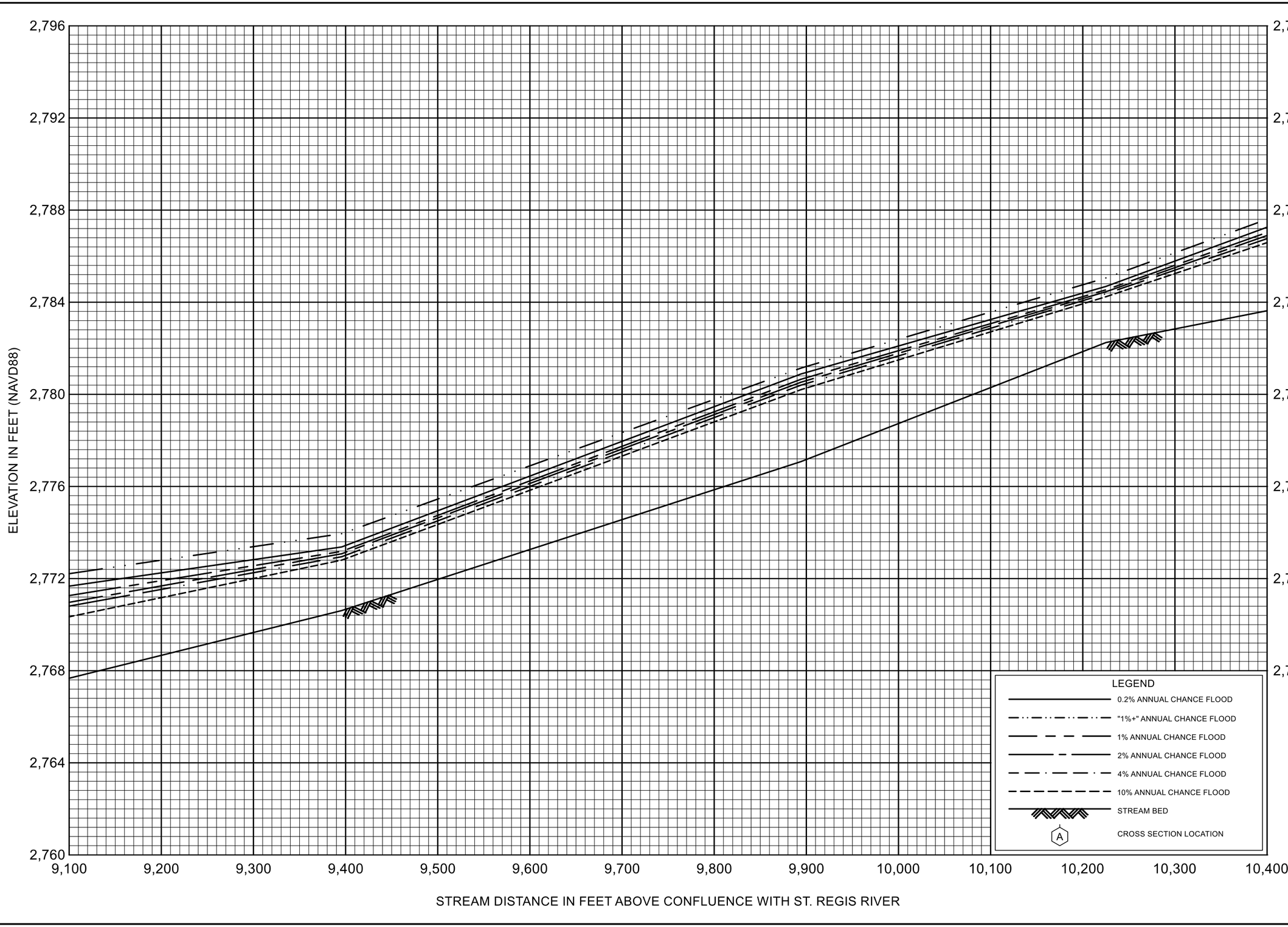
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

07P



FLOOD PROFILES

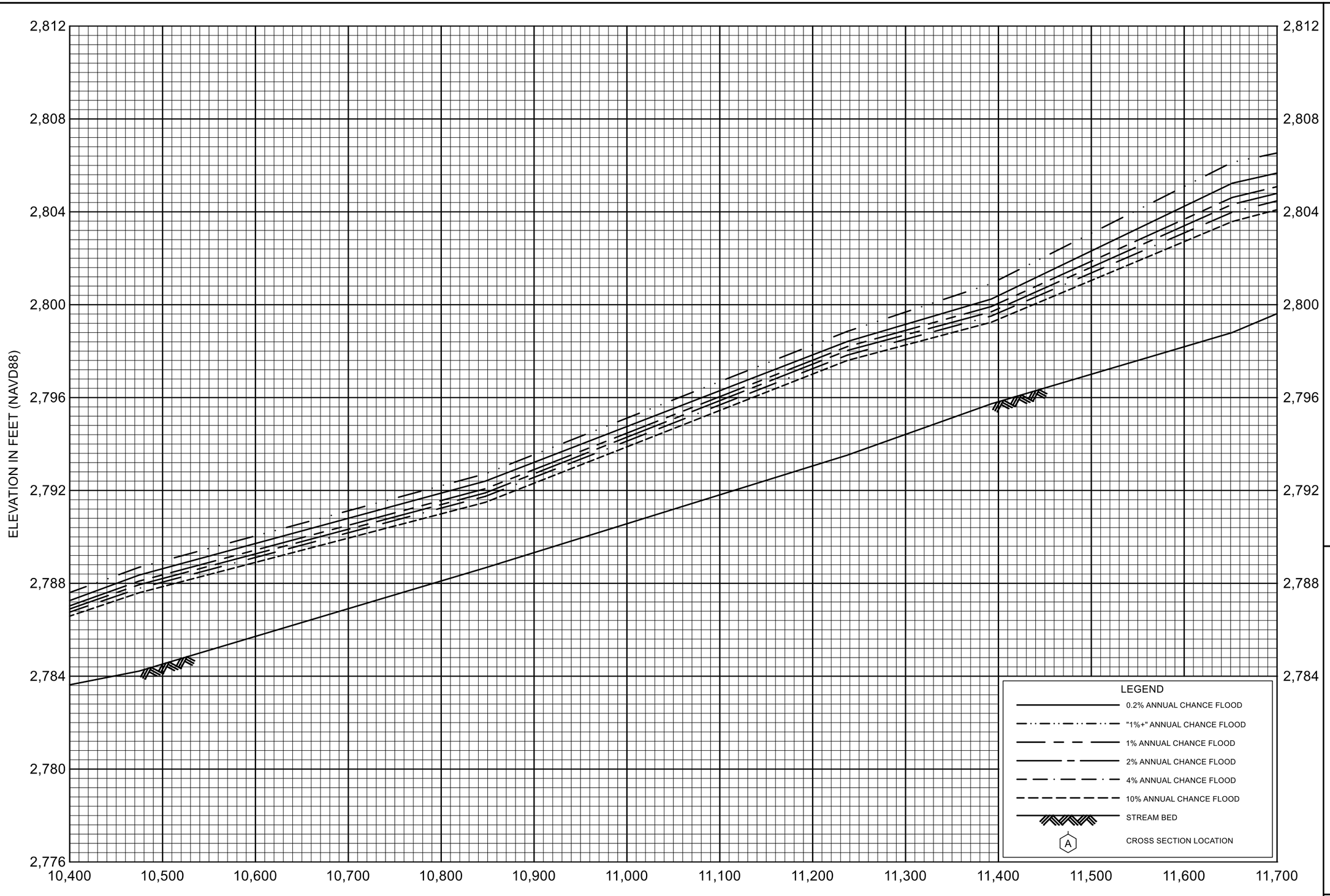
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

08P



FLOOD PROFILES

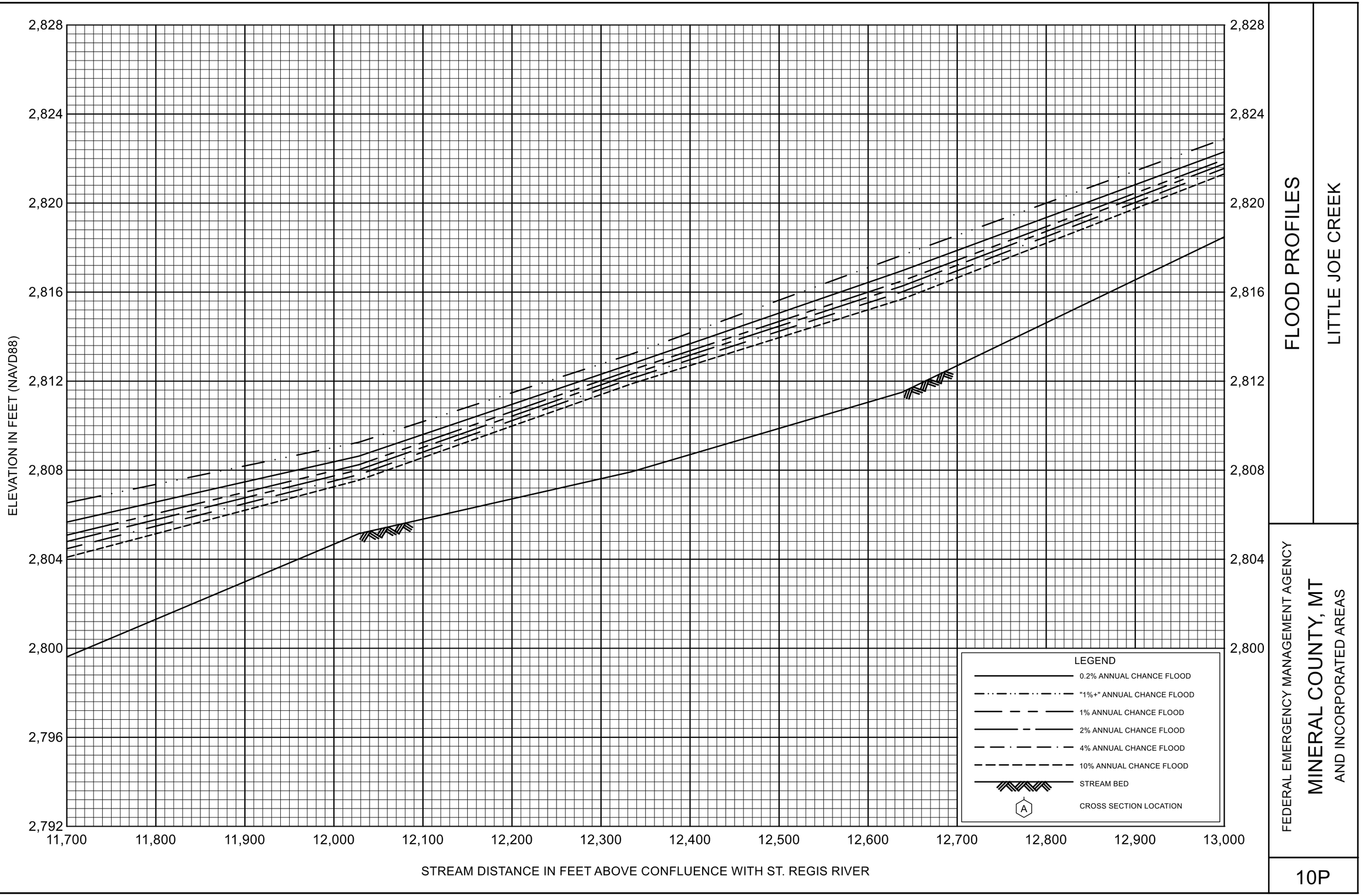
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

09P



FLOOD PROFILES

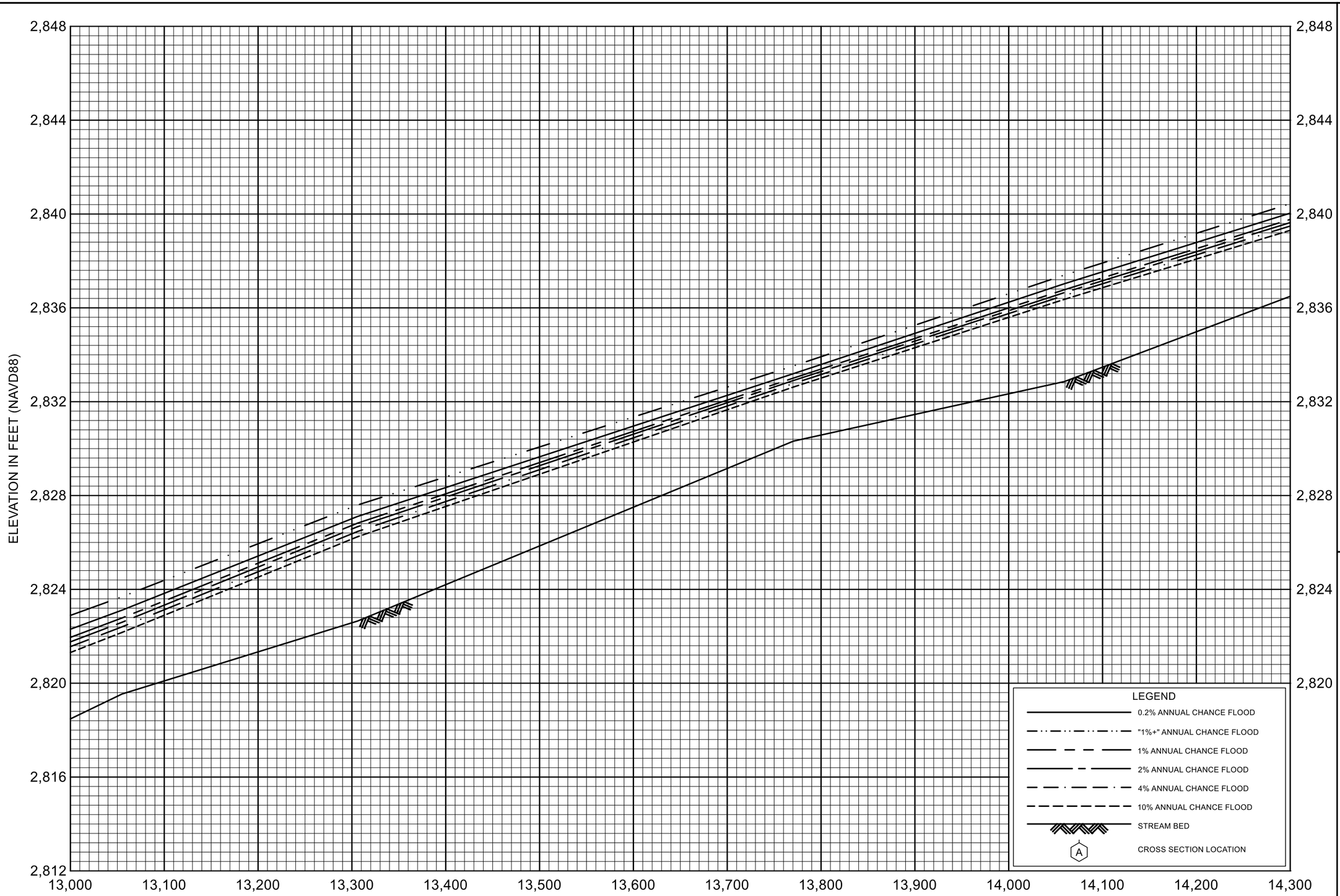
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

10P



FLOOD PROFILES

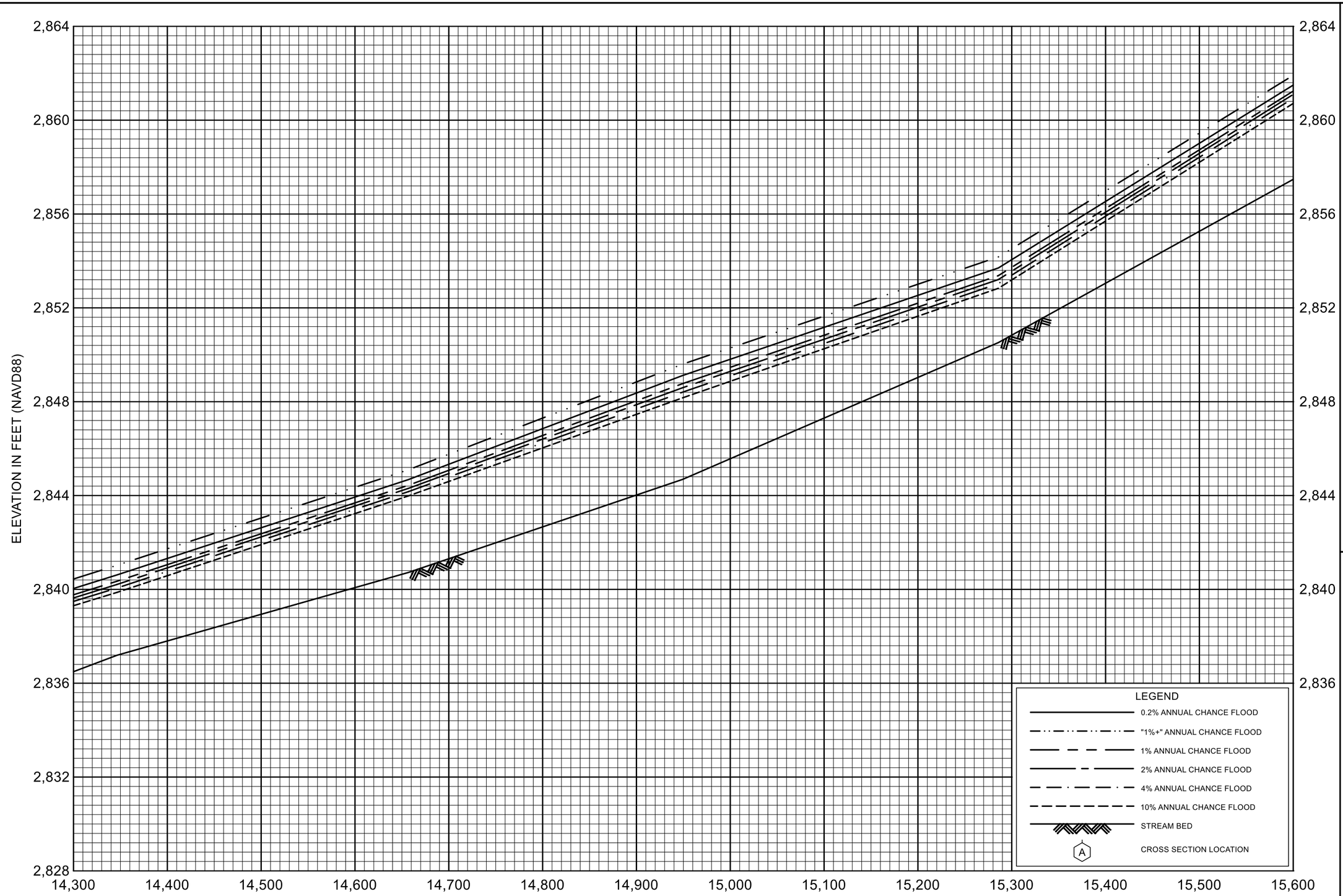
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

11P



FLOOD PROFILES

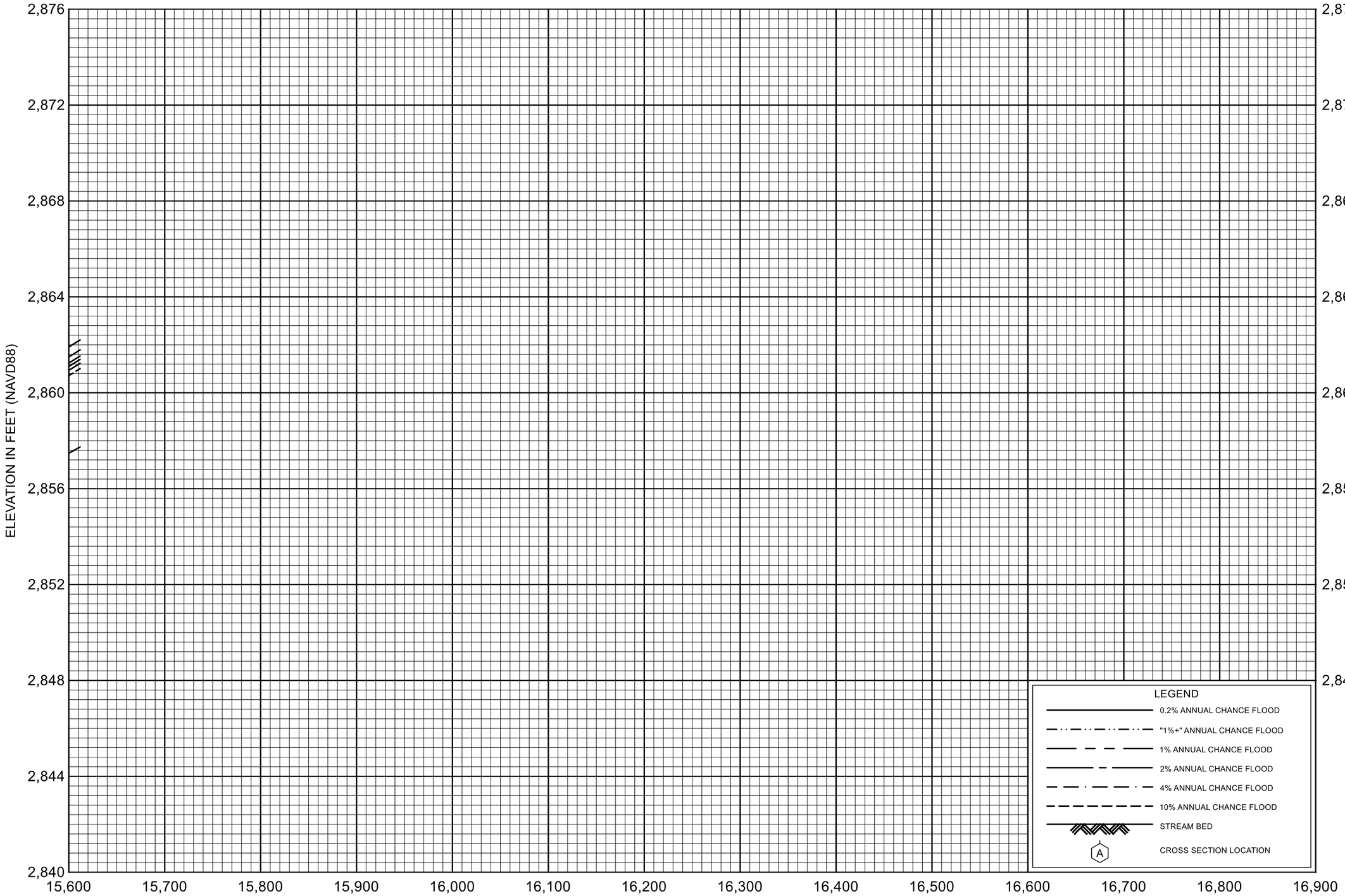
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

12P



FLOOD PROFILES

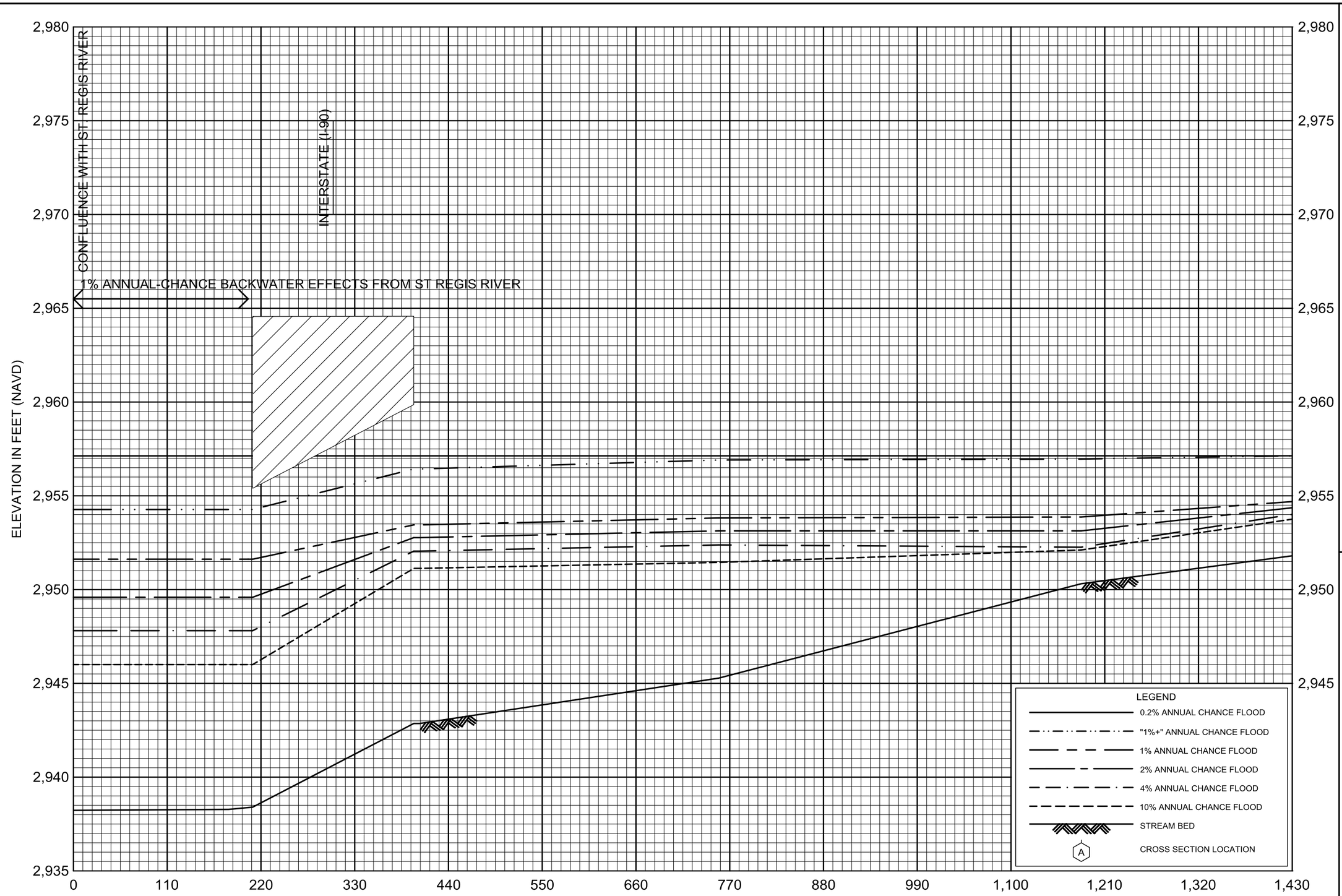
LITTLE JOE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

13P



FLOOD PROFILES

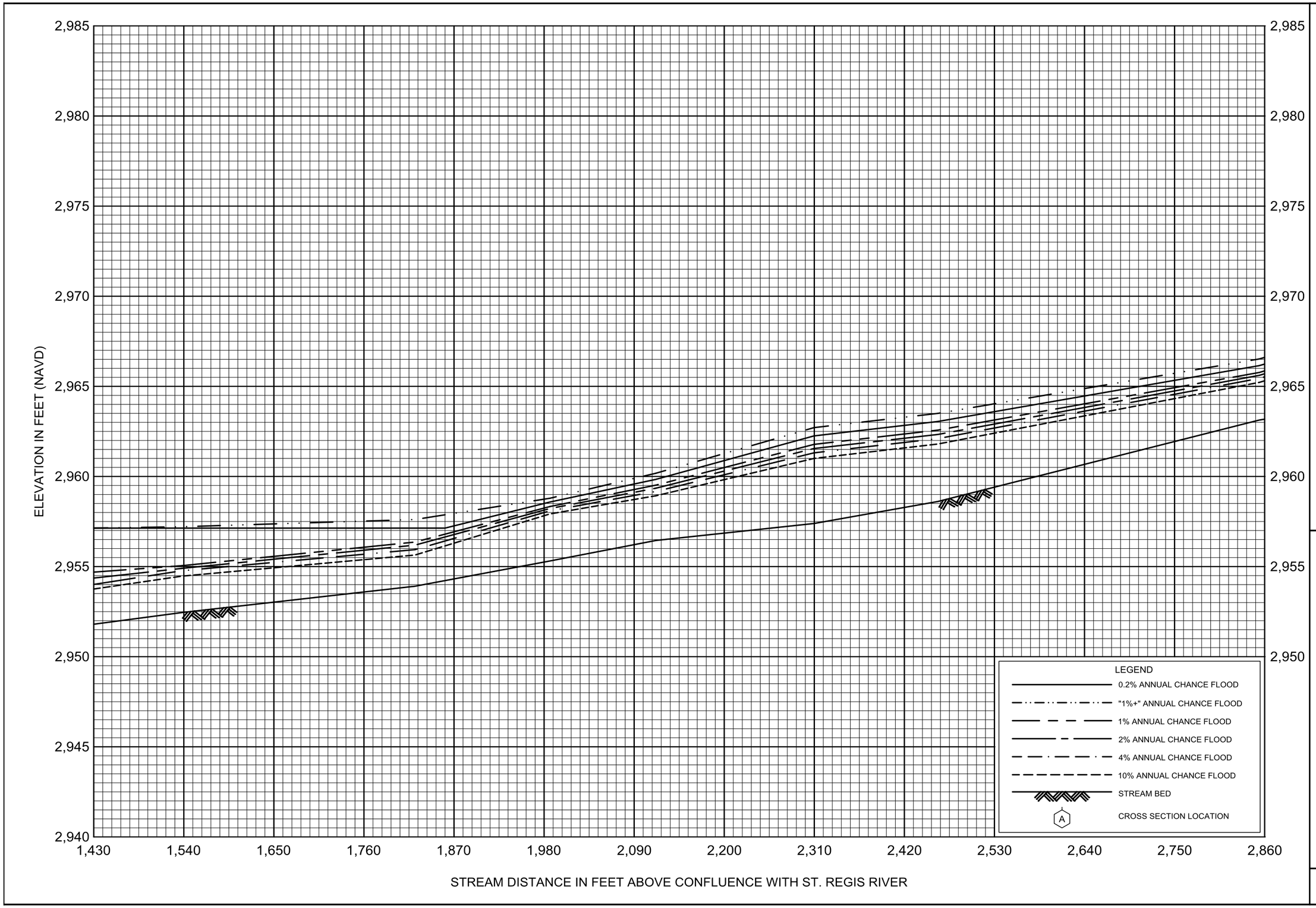
TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

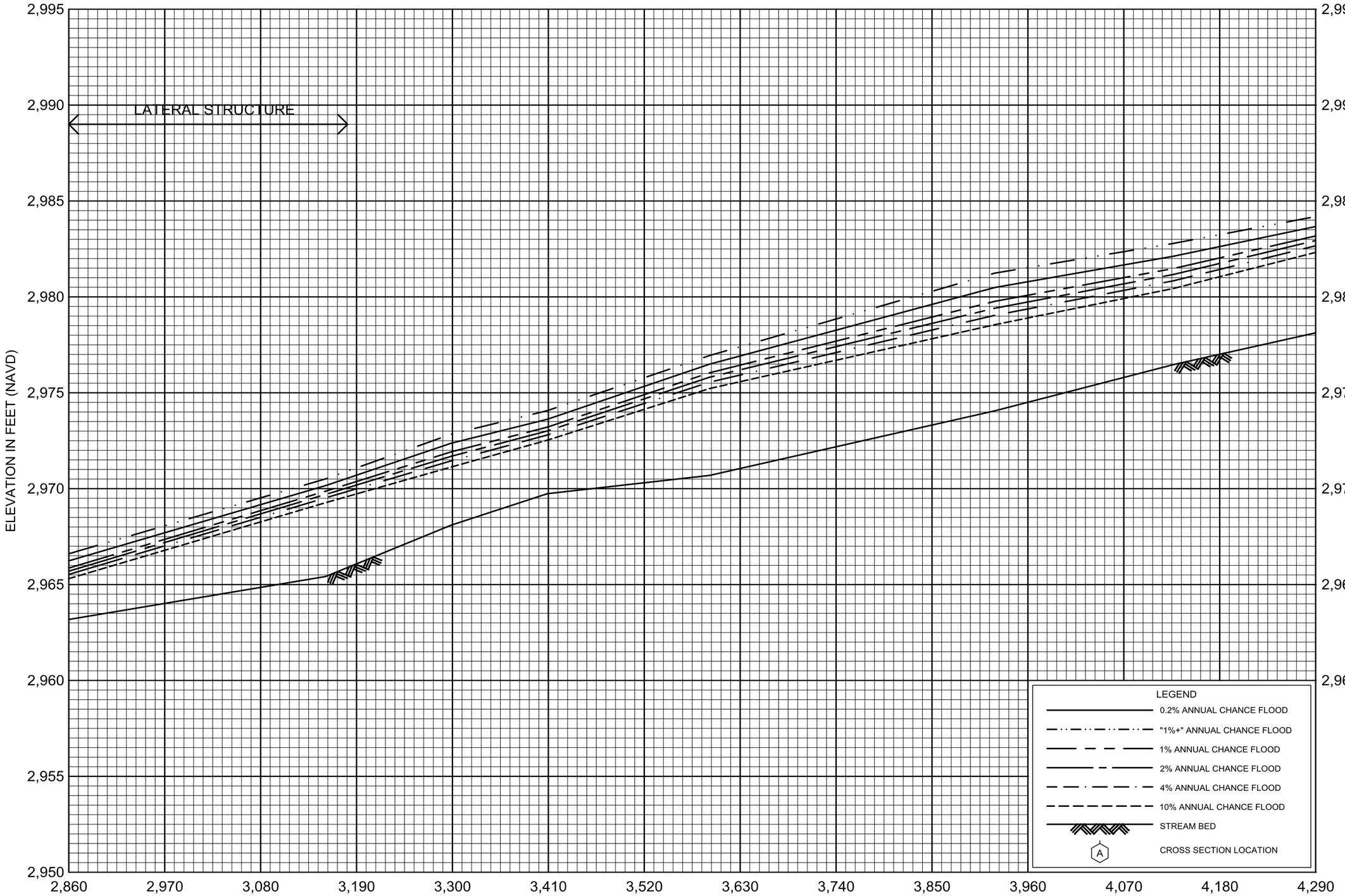
TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

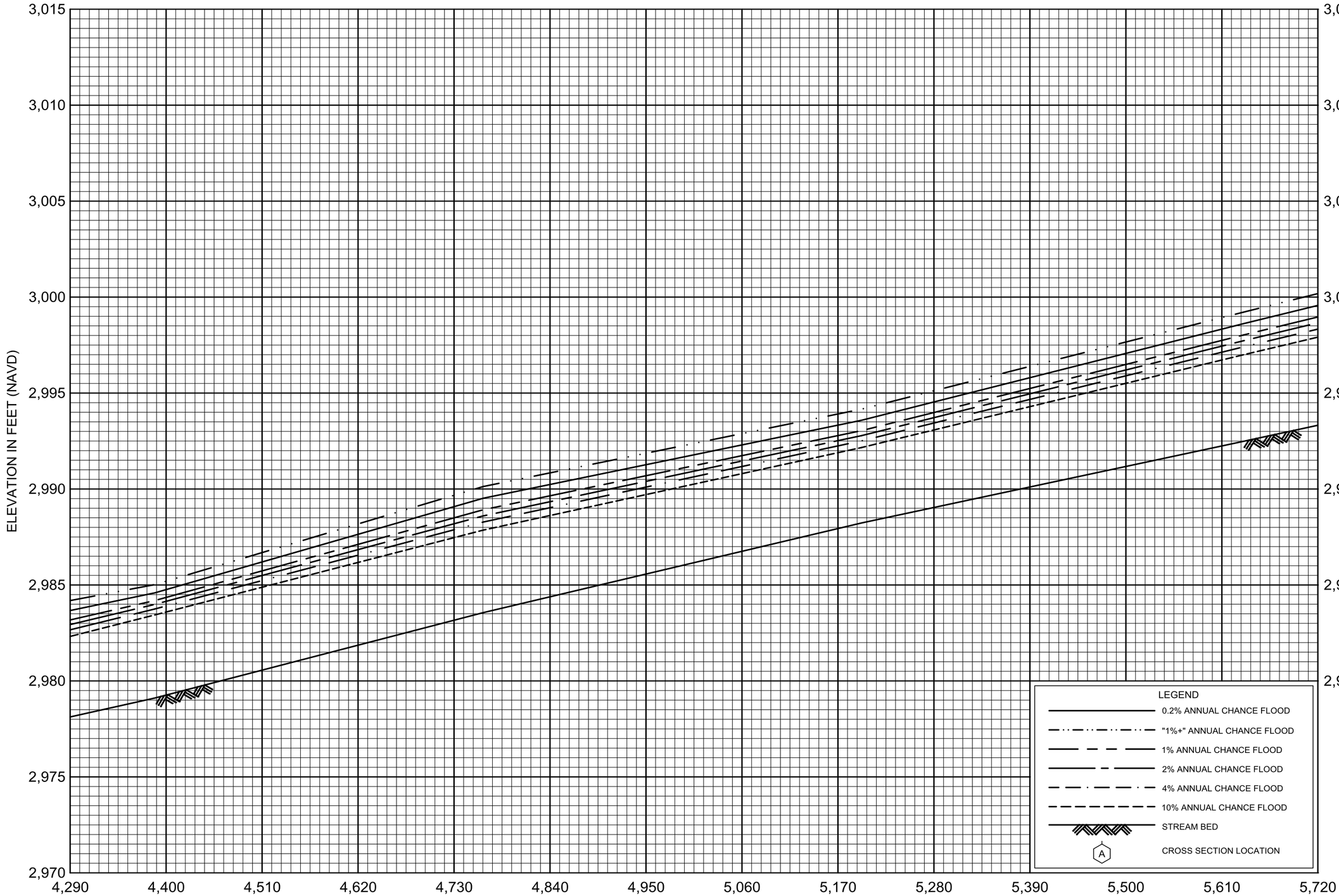
TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

03P



FLOOD PROFILES

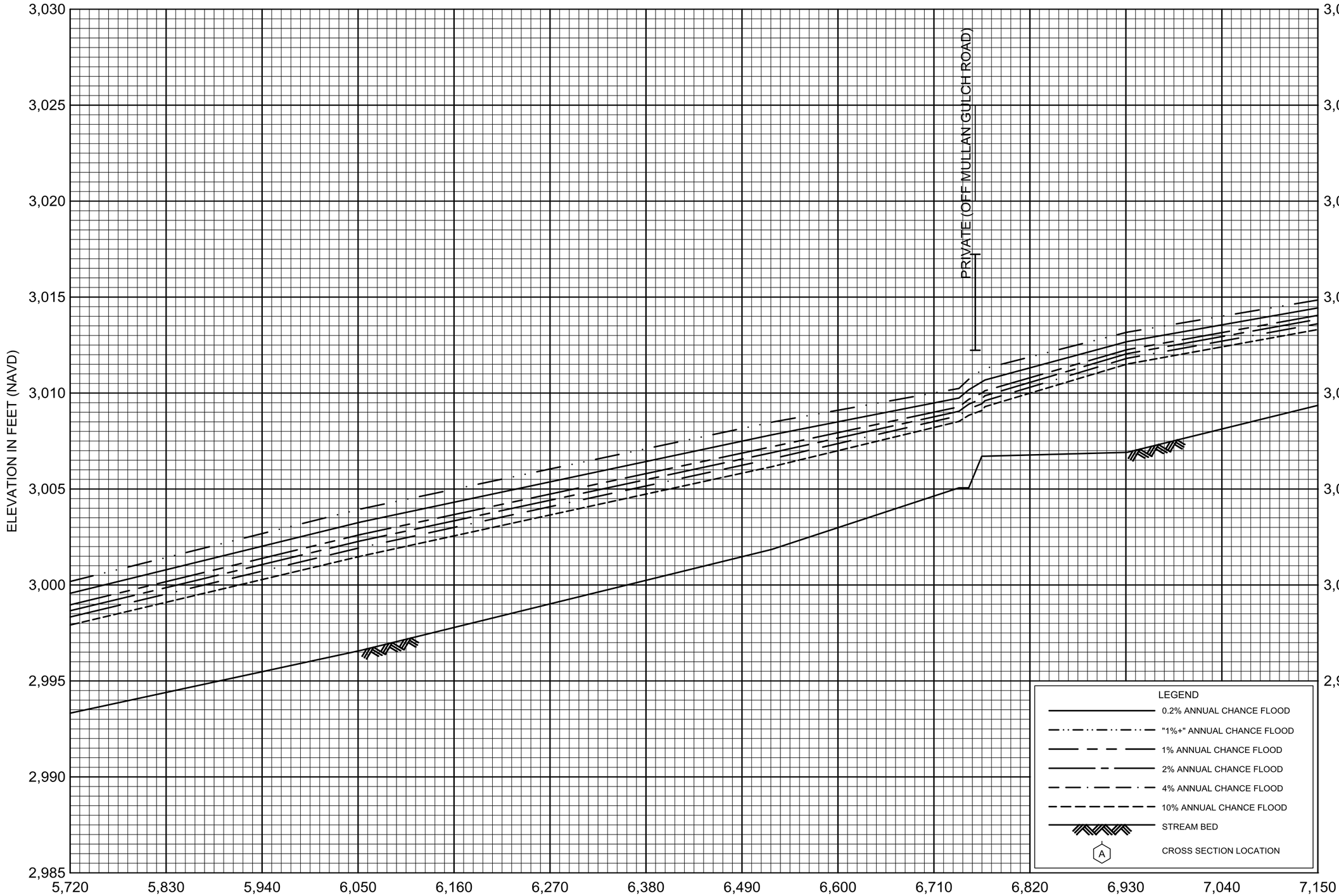
TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

04P



FLOOD PROFILES

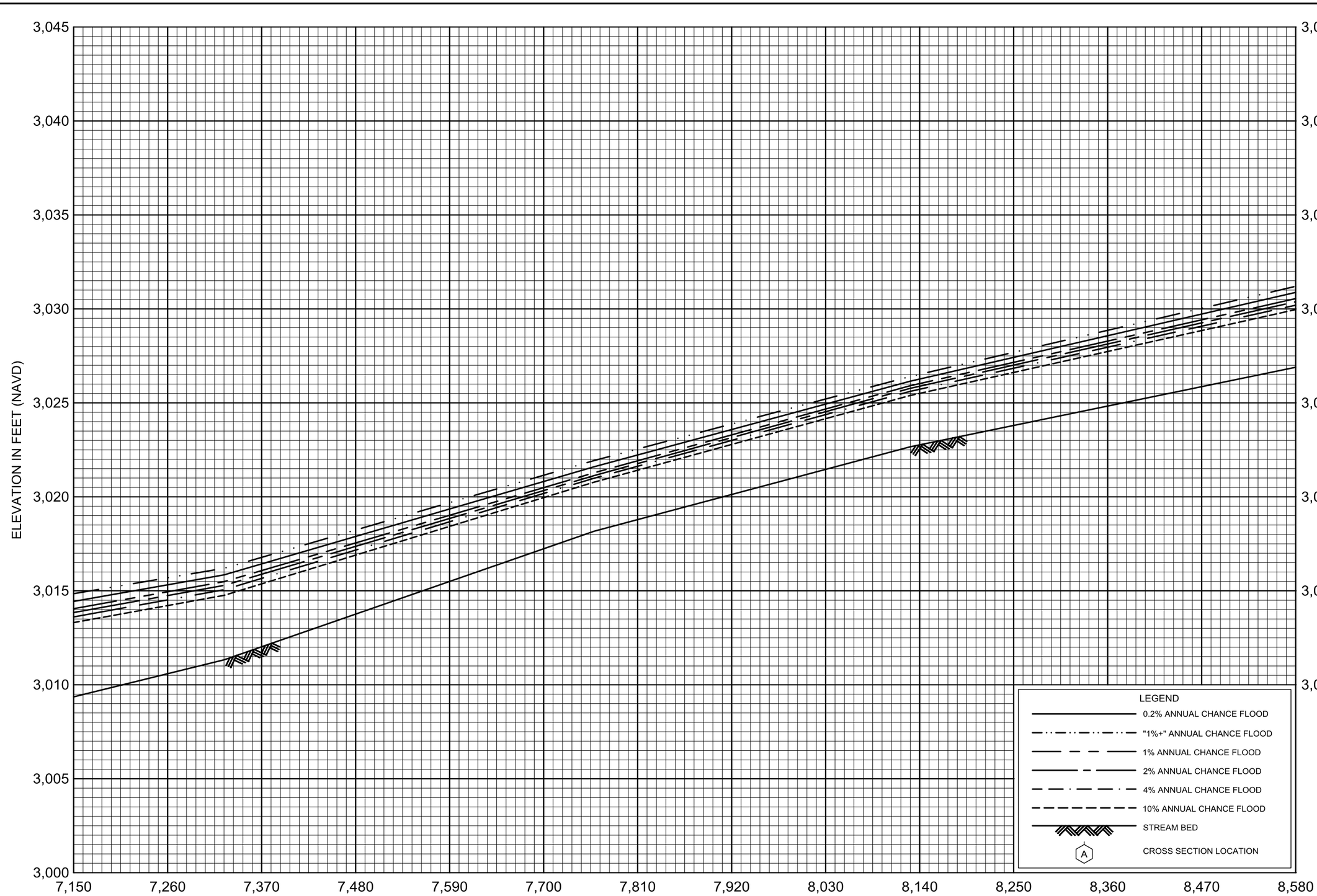
TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

05P



FLOOD PROFILES

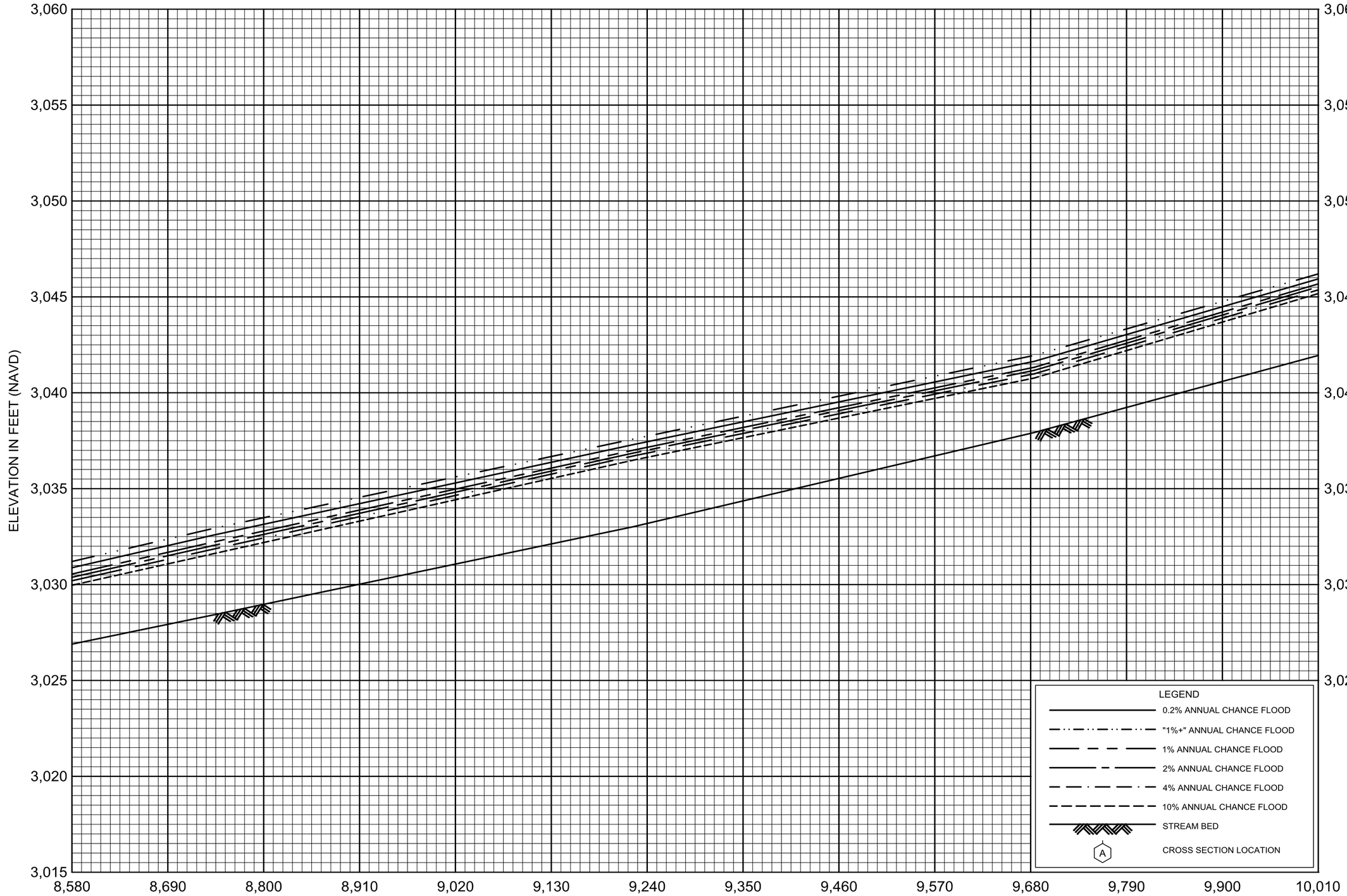
TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

06P



FLOOD PROFILES

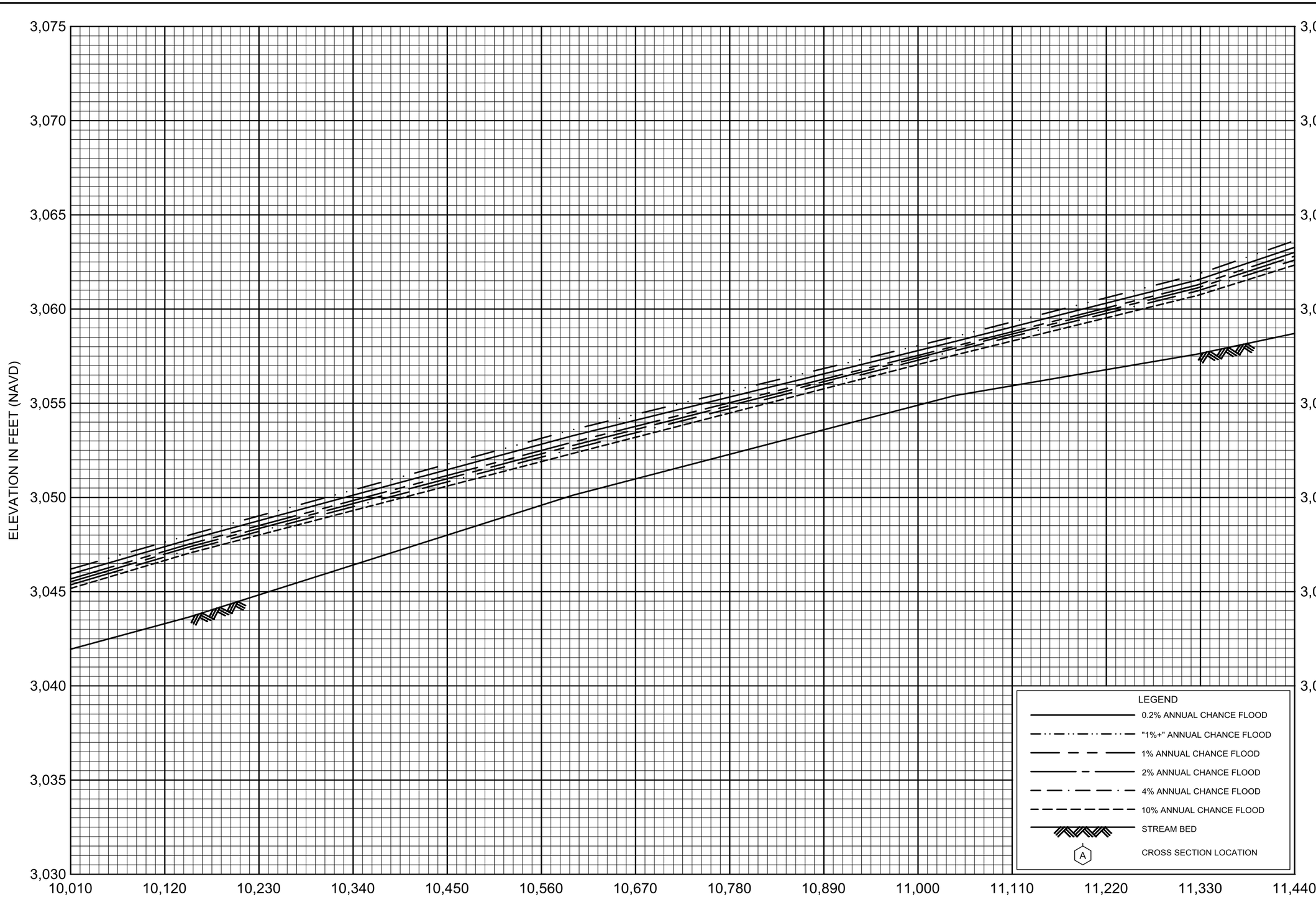
TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

07P



FLOOD PROFILES

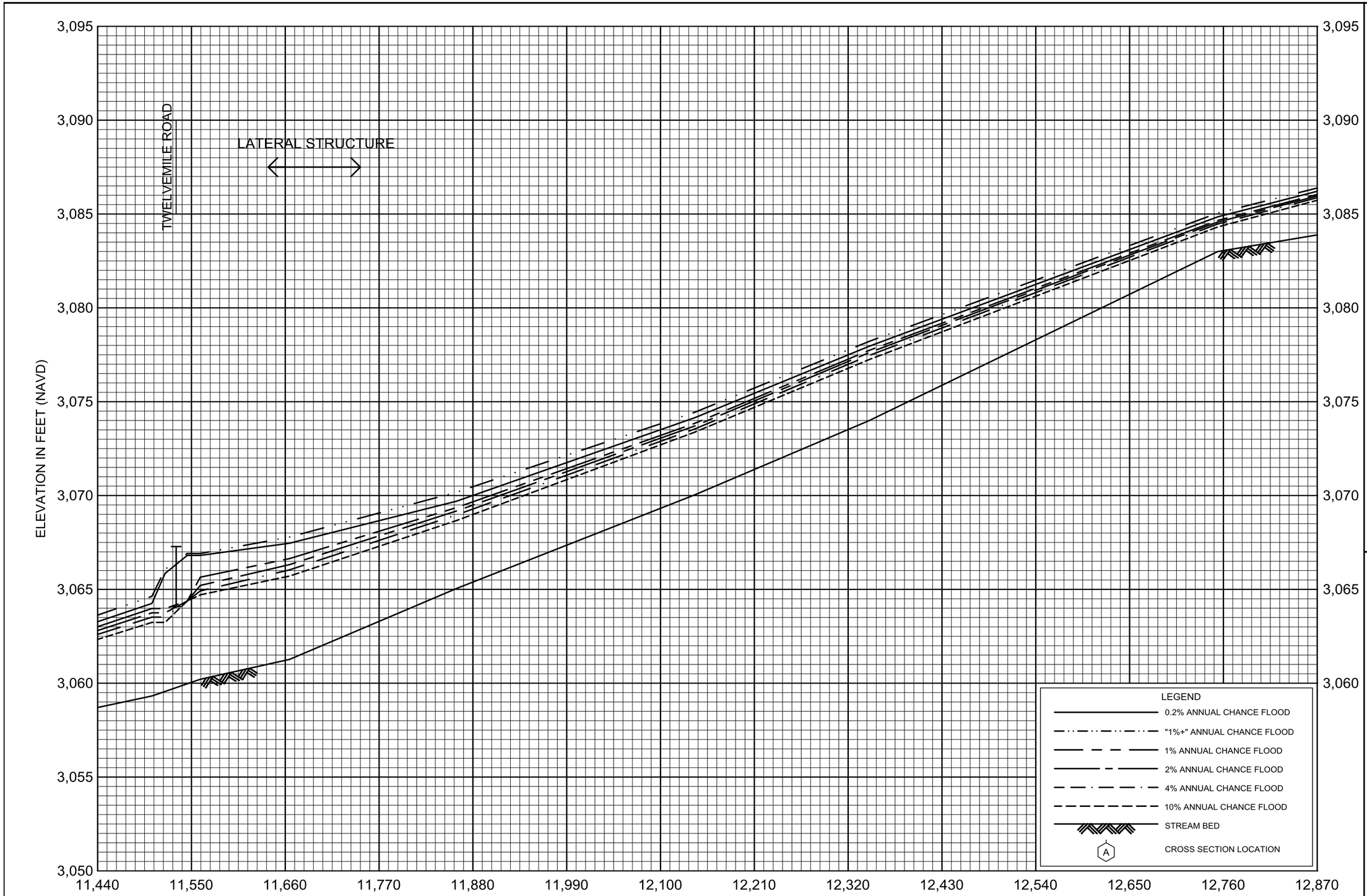
TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

08P



FLOOD PROFILES

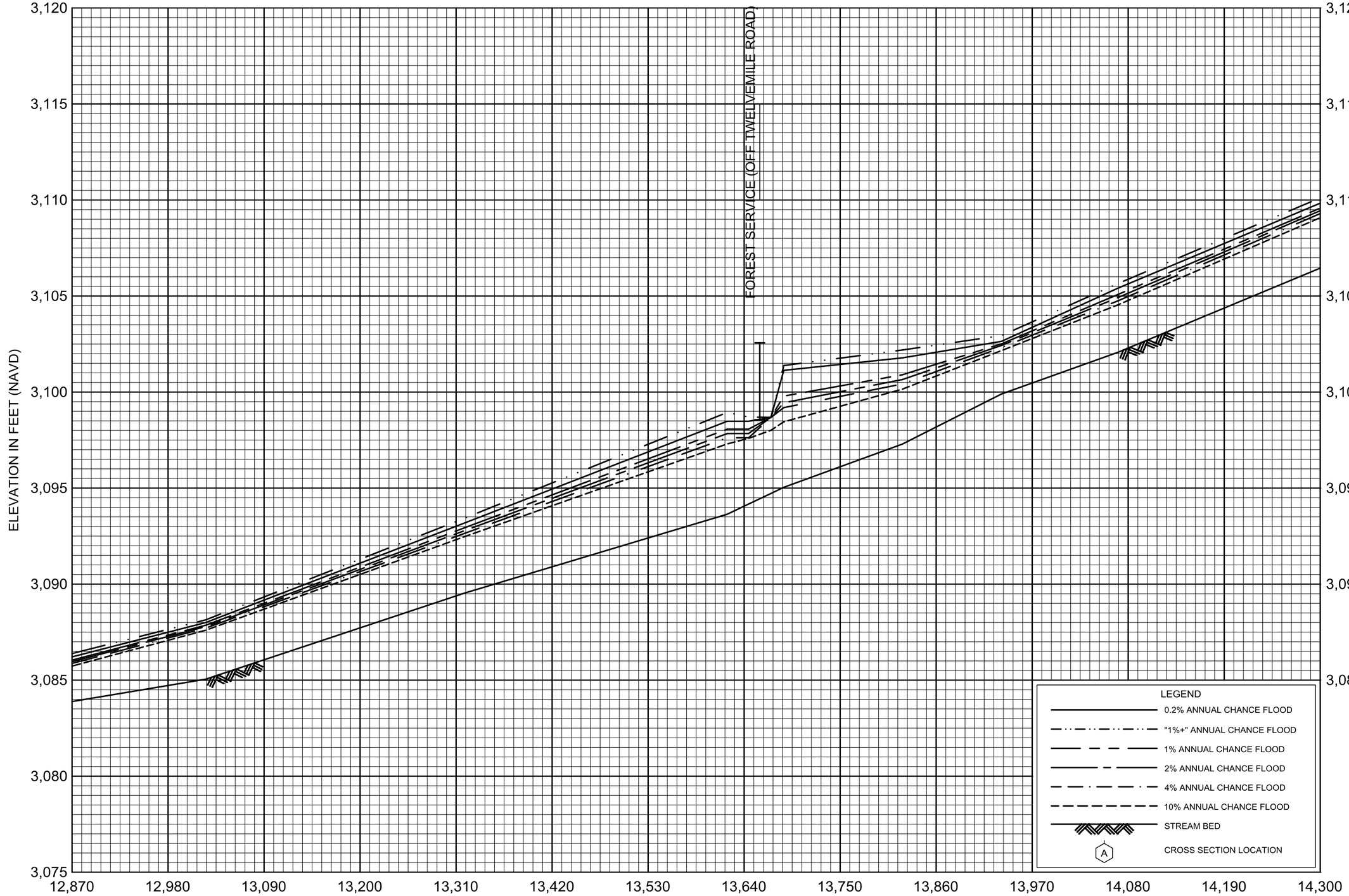
TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

09P



FLOOD PROFILES

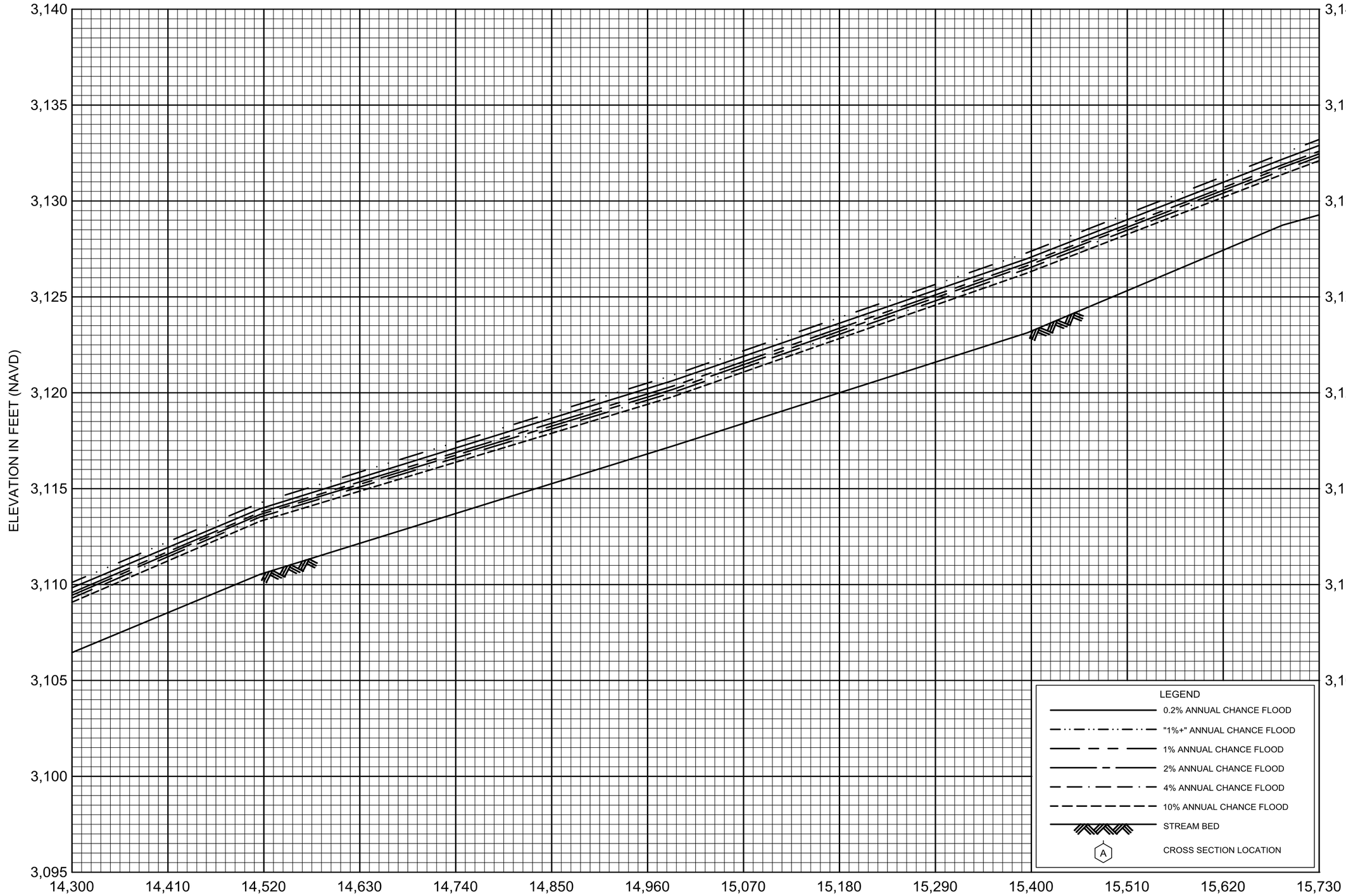
TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

10P



FLOOD PROFILES

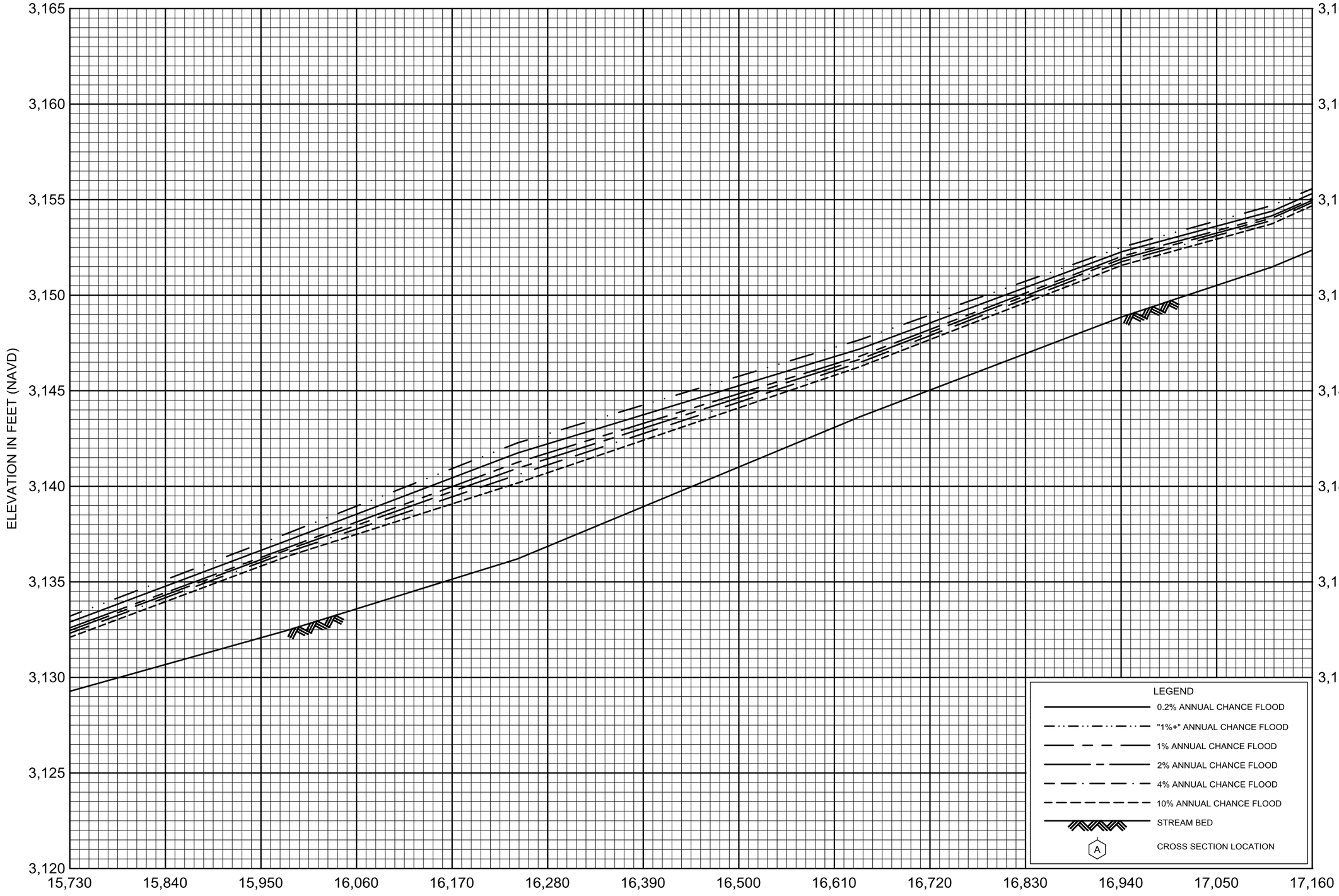
TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

11P



FLOOD PROFILES

TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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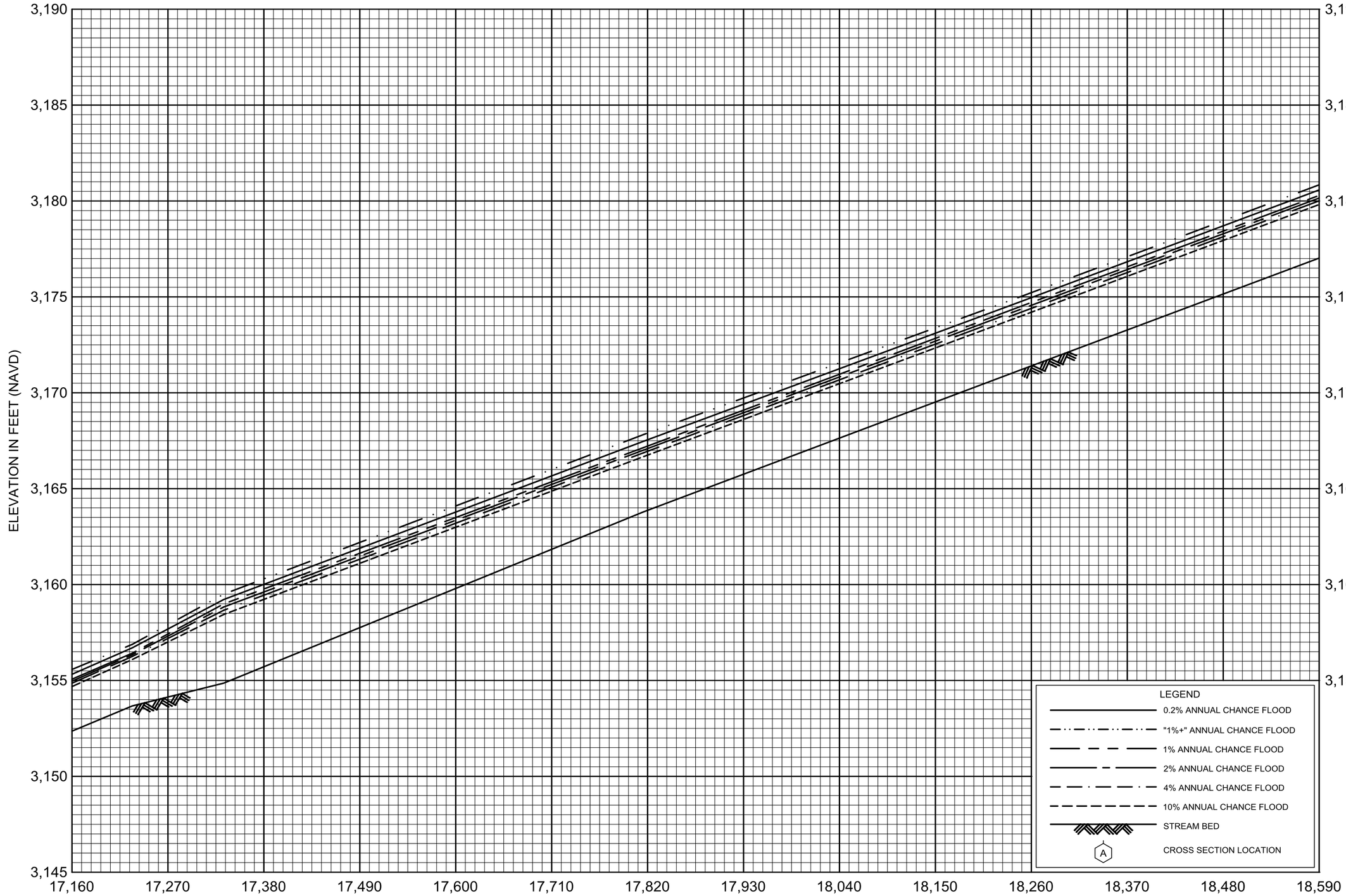

FLOOD PROFILES

TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

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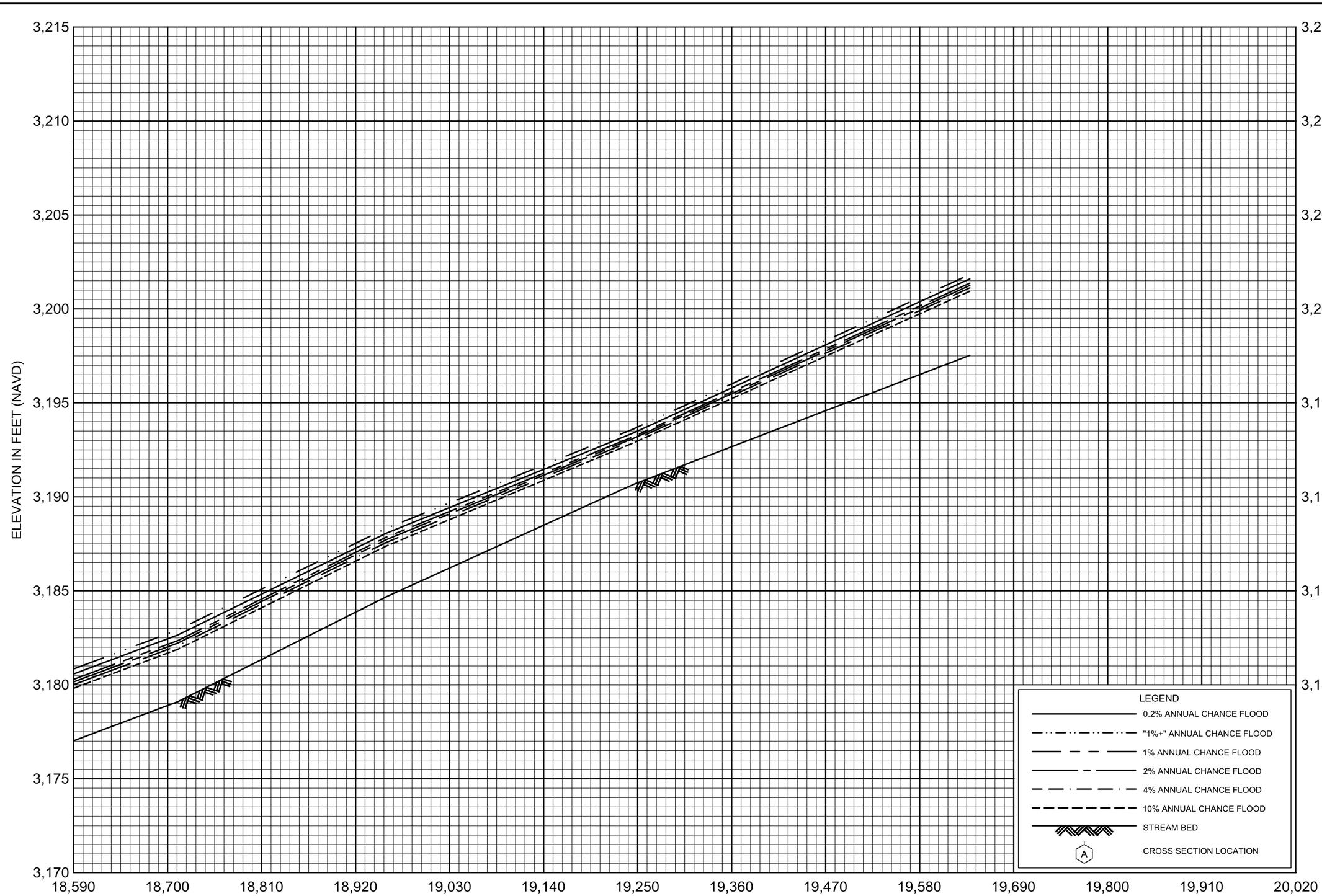


FLOOD PROFILES

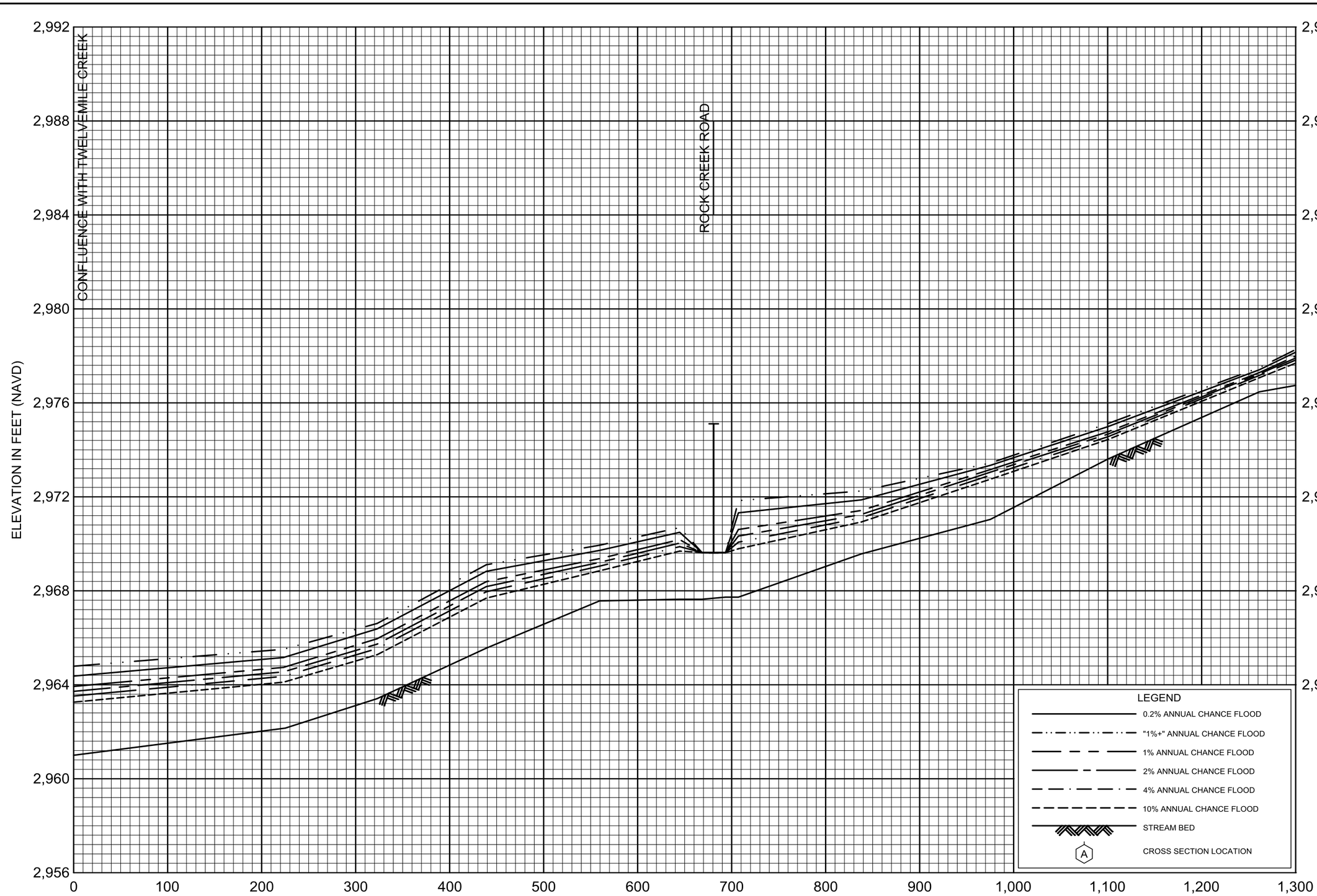
TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

14P



FLOOD PROFILES

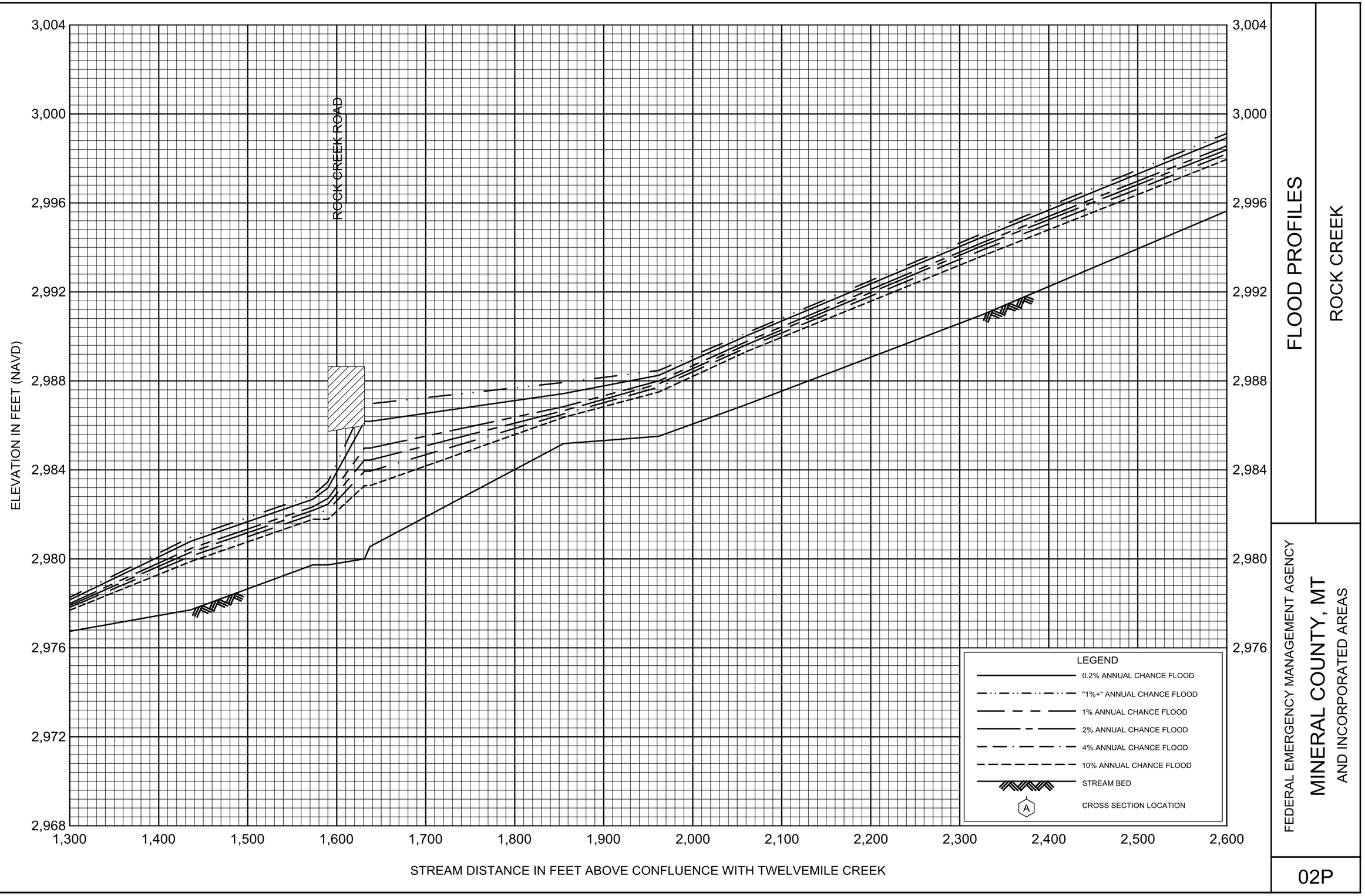
ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

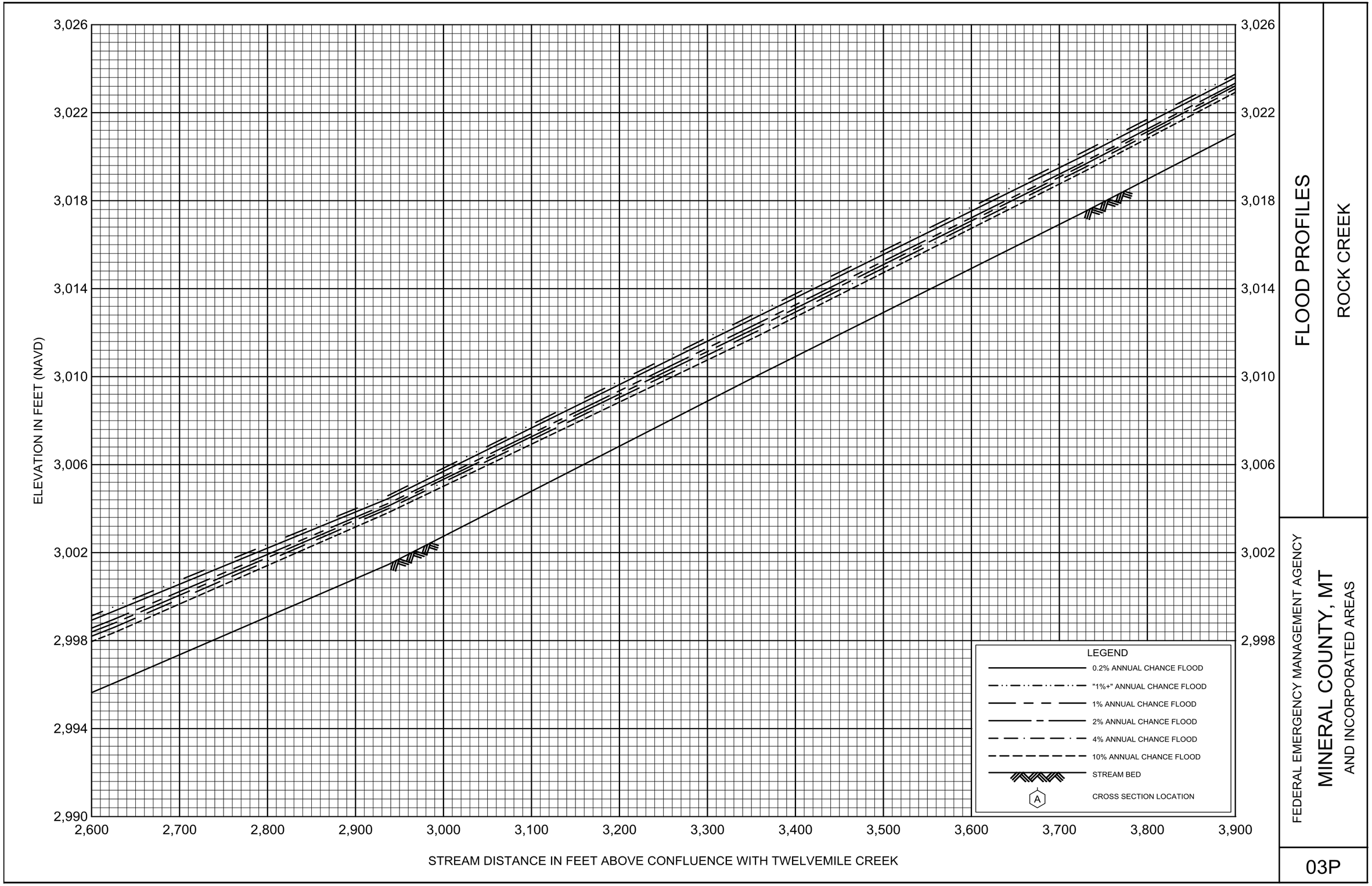
ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

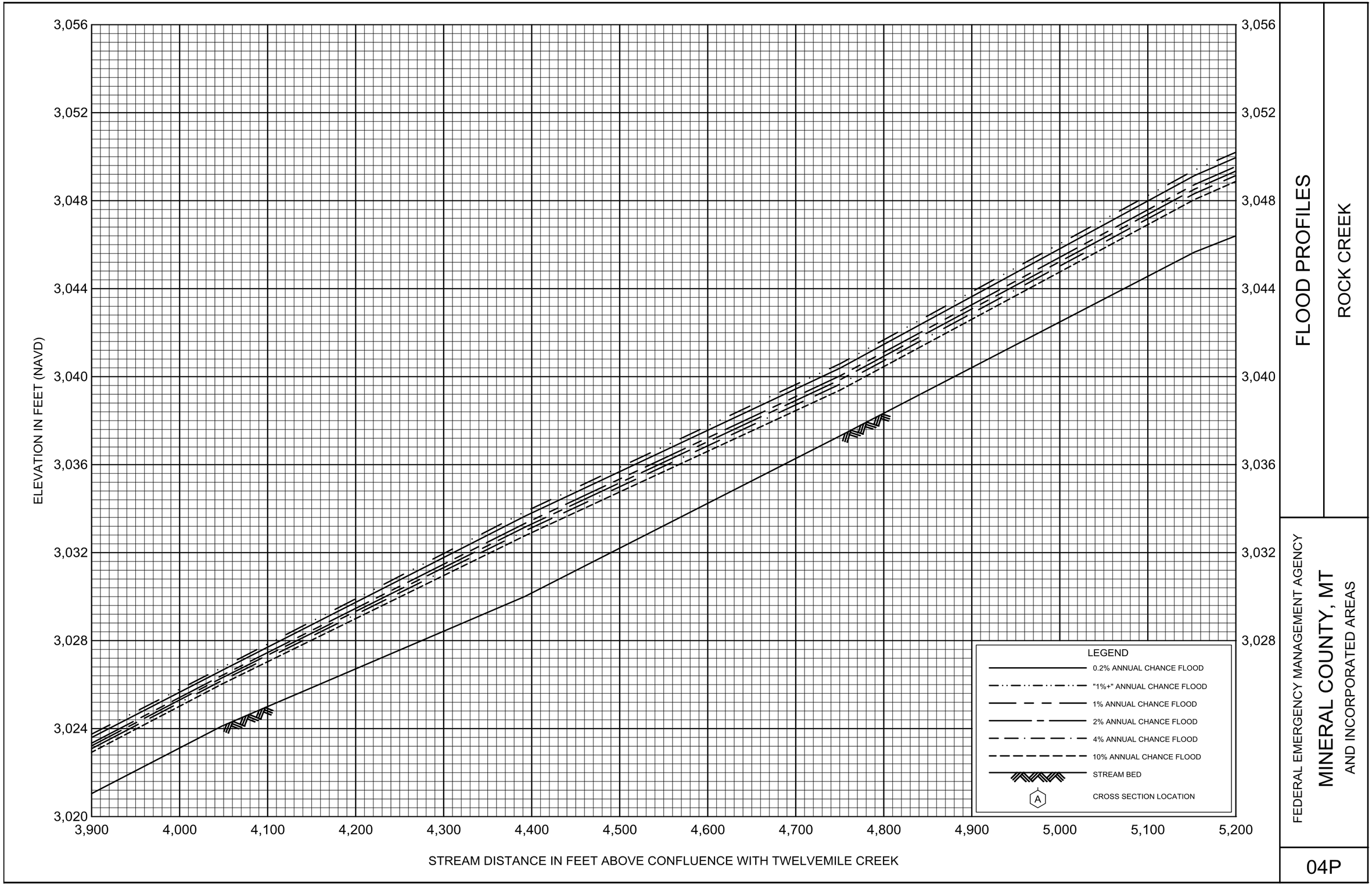
ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

03P



FLOOD PROFILES

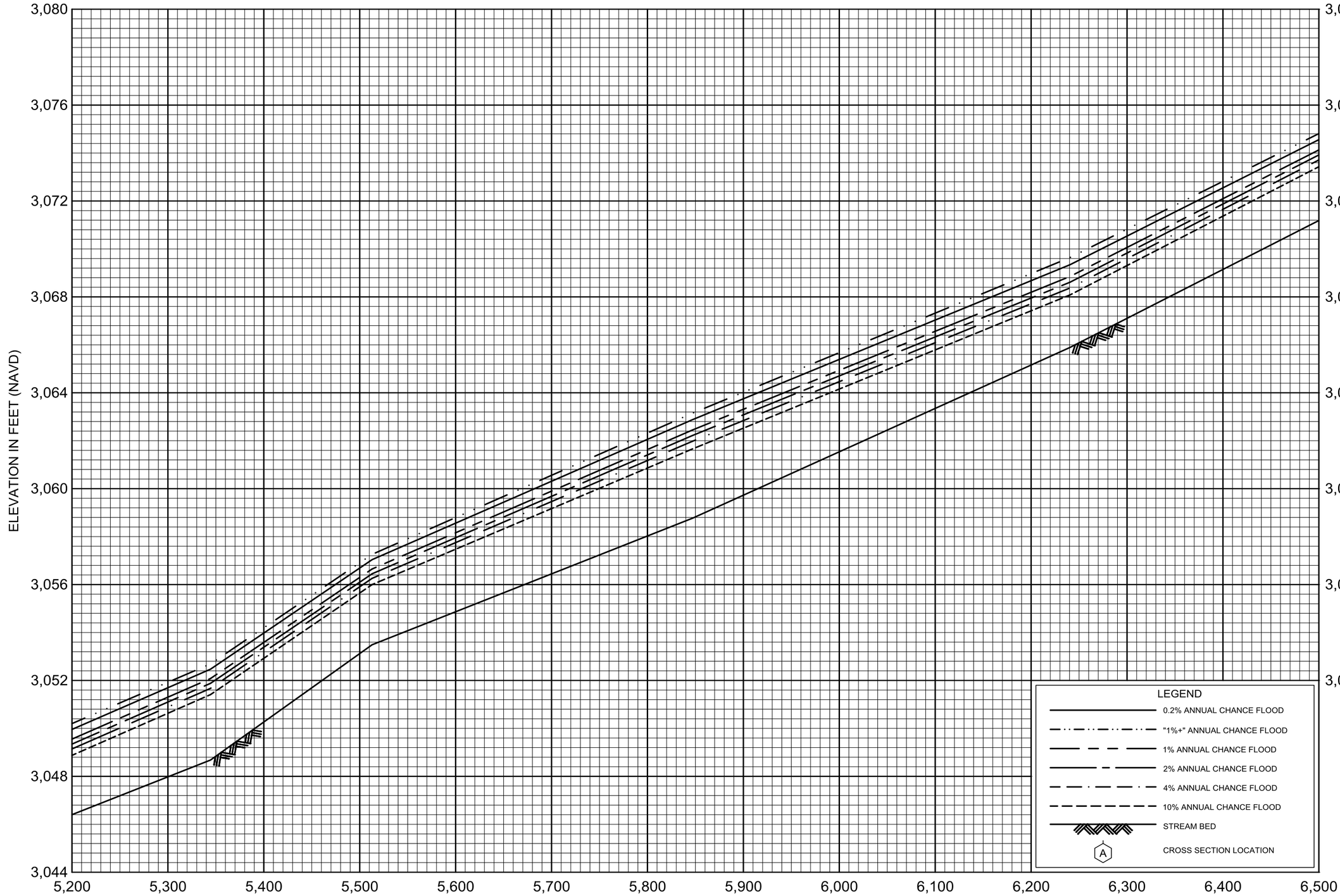
ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

04P



FLOOD PROFILES

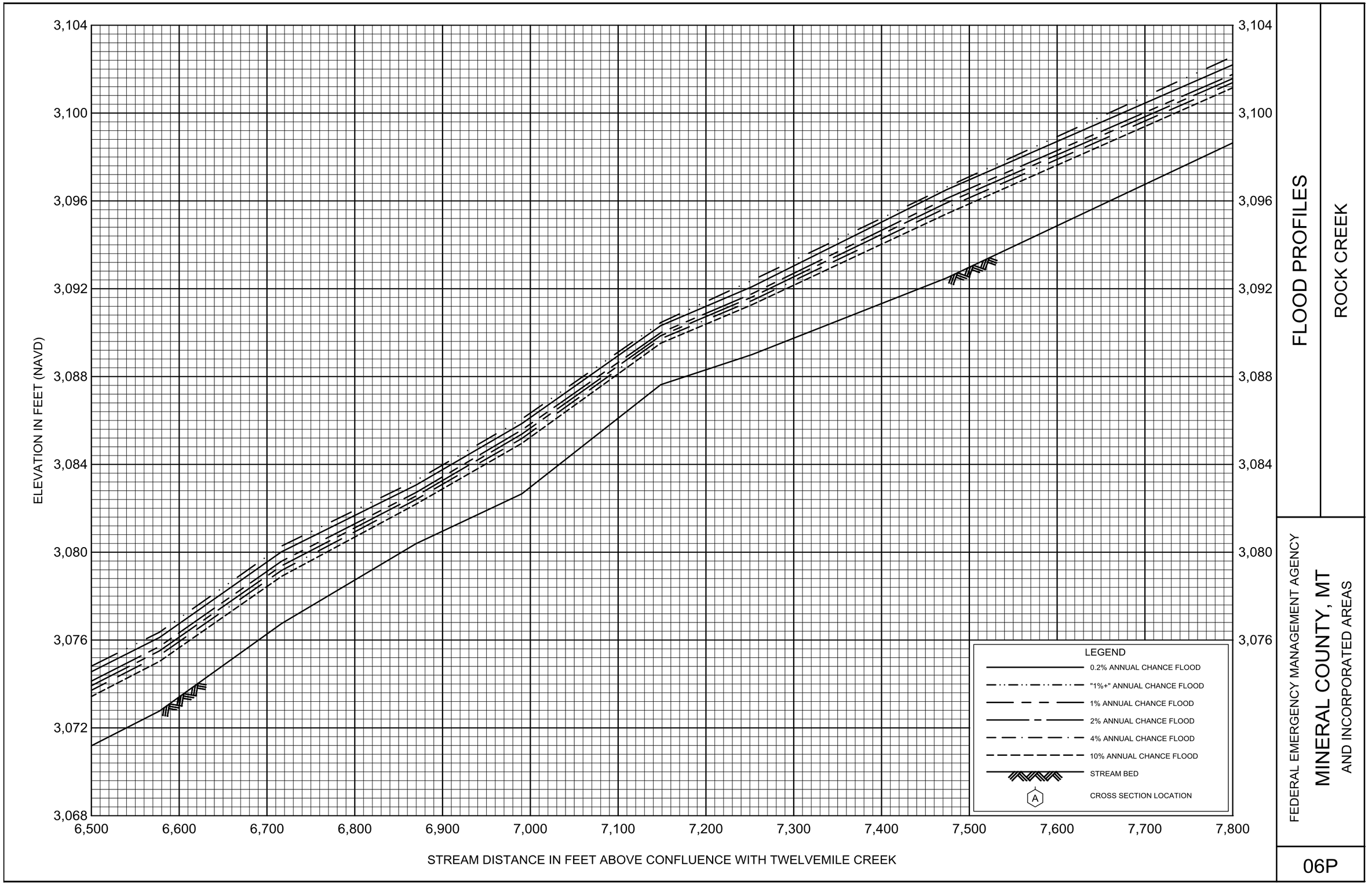
ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

05P



FLOOD PROFILES

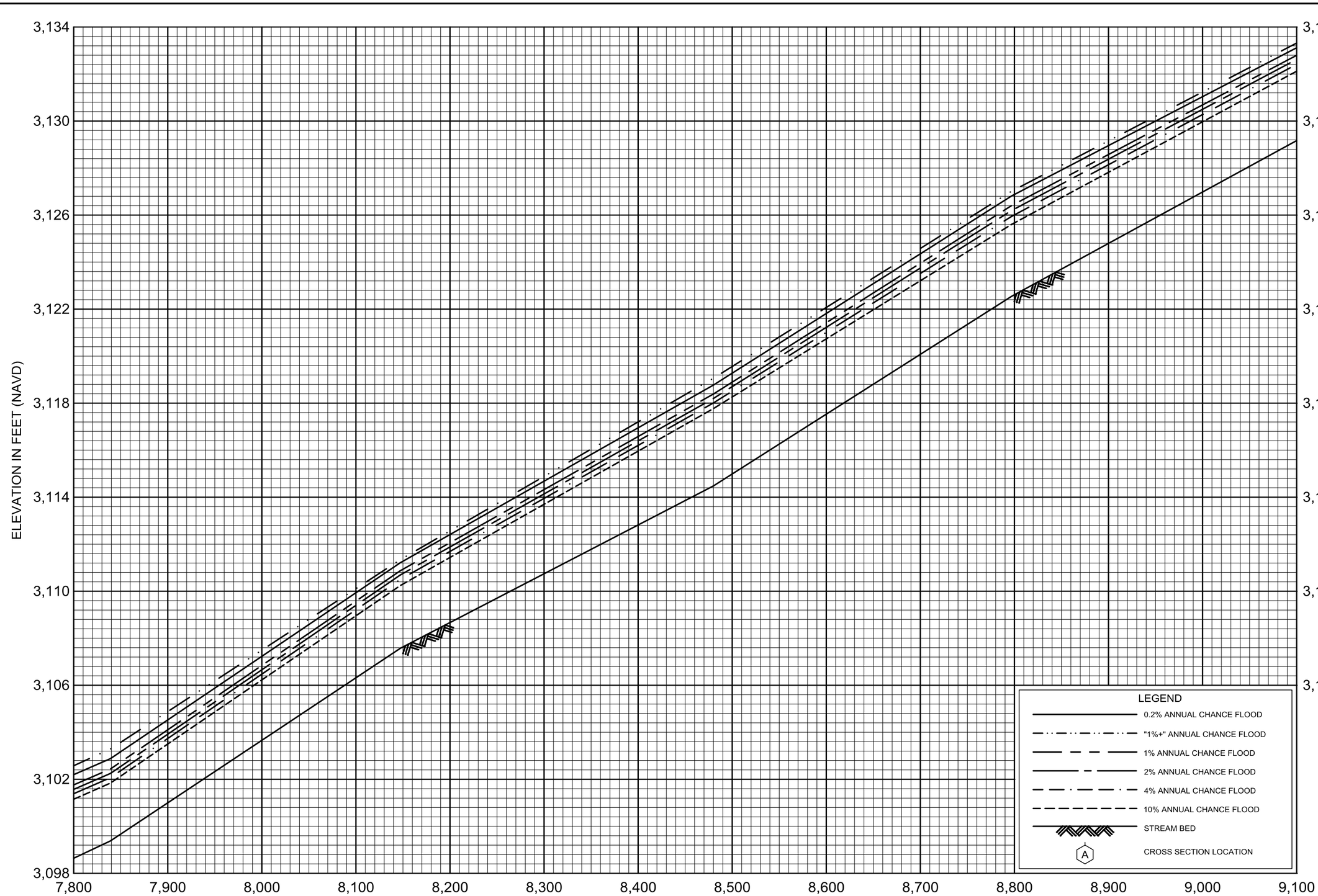
ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

06P



FLOOD PROFILES

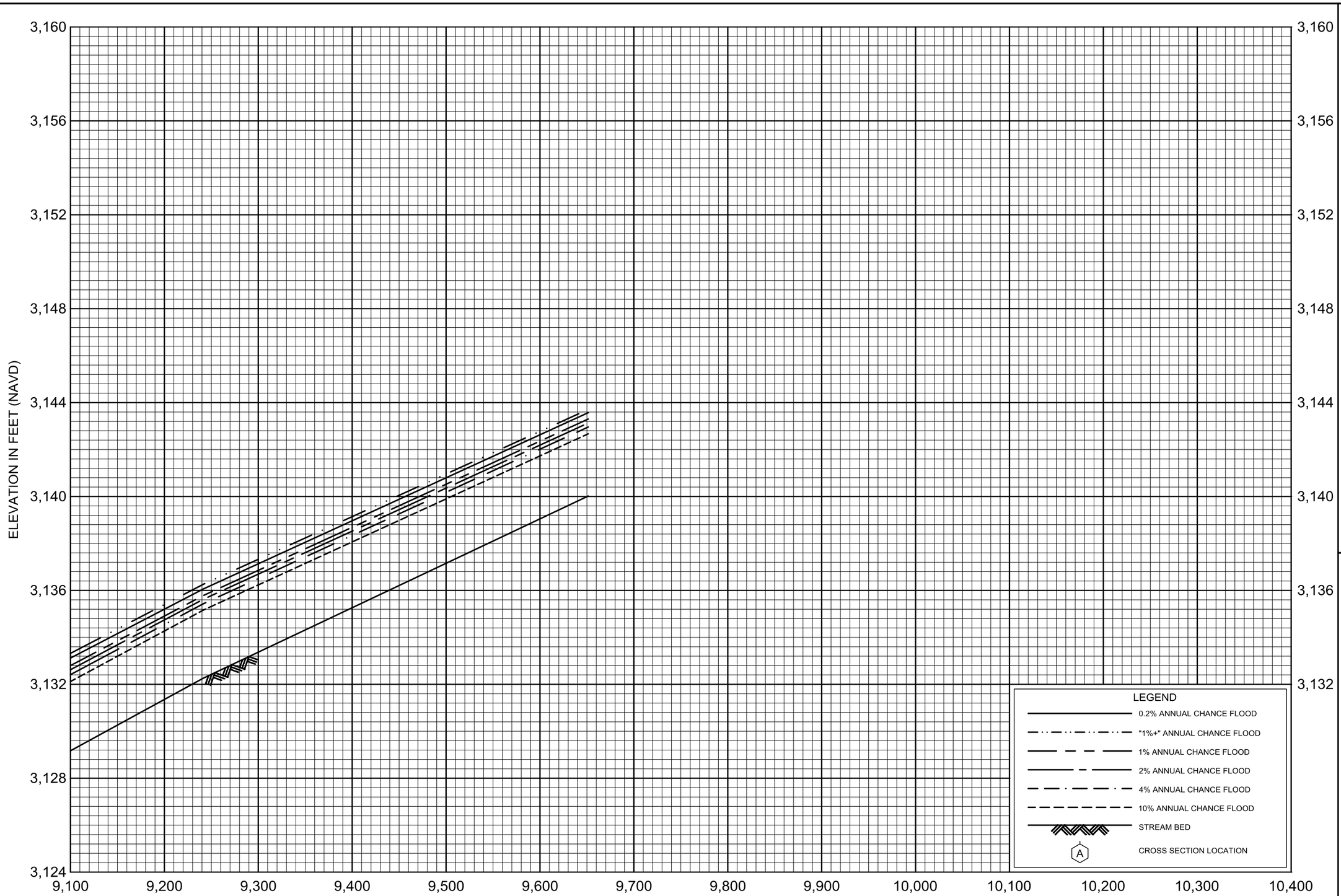
ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

07P



FLOOD PROFILES

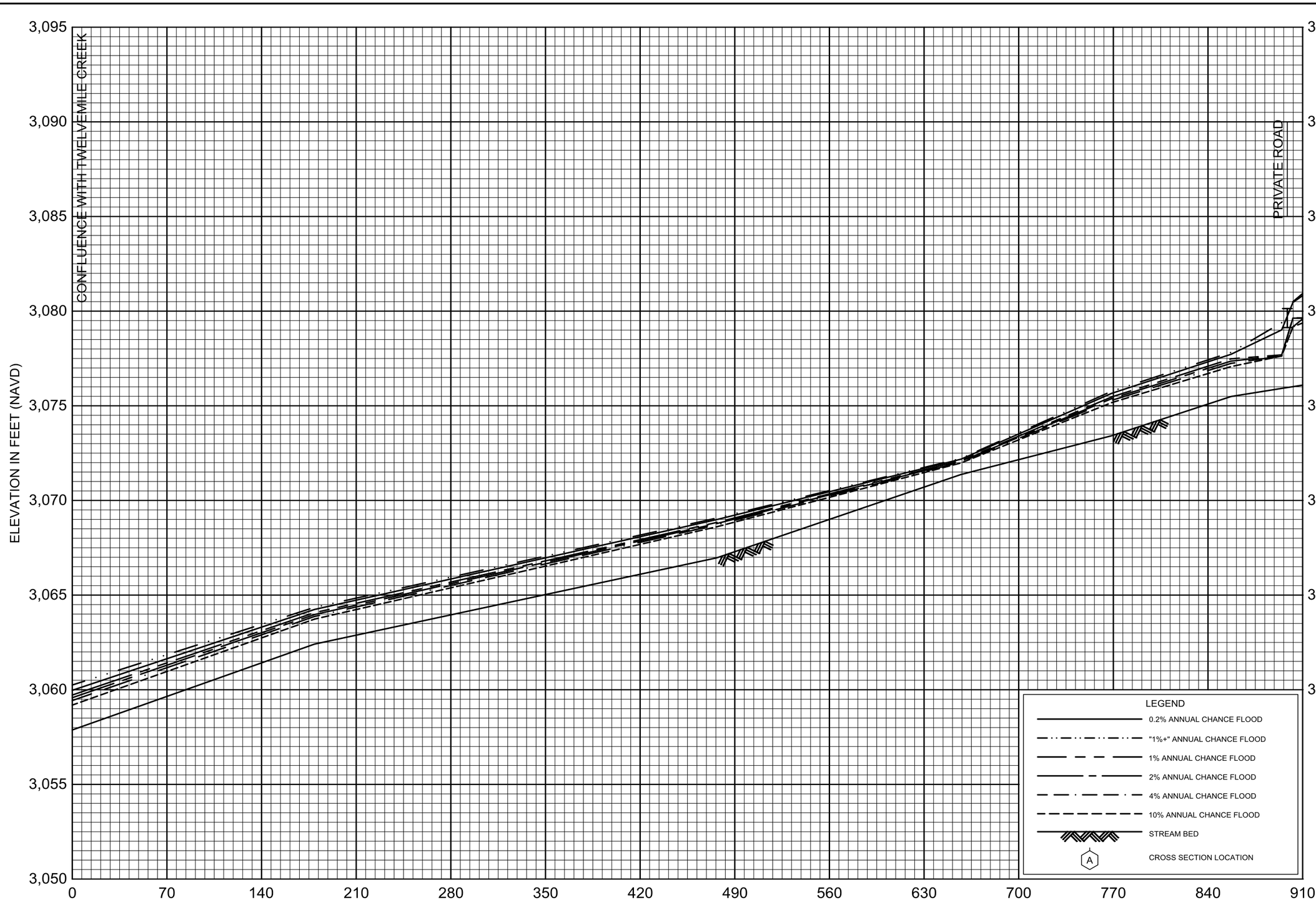
ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

08P



FLOOD PROFILES

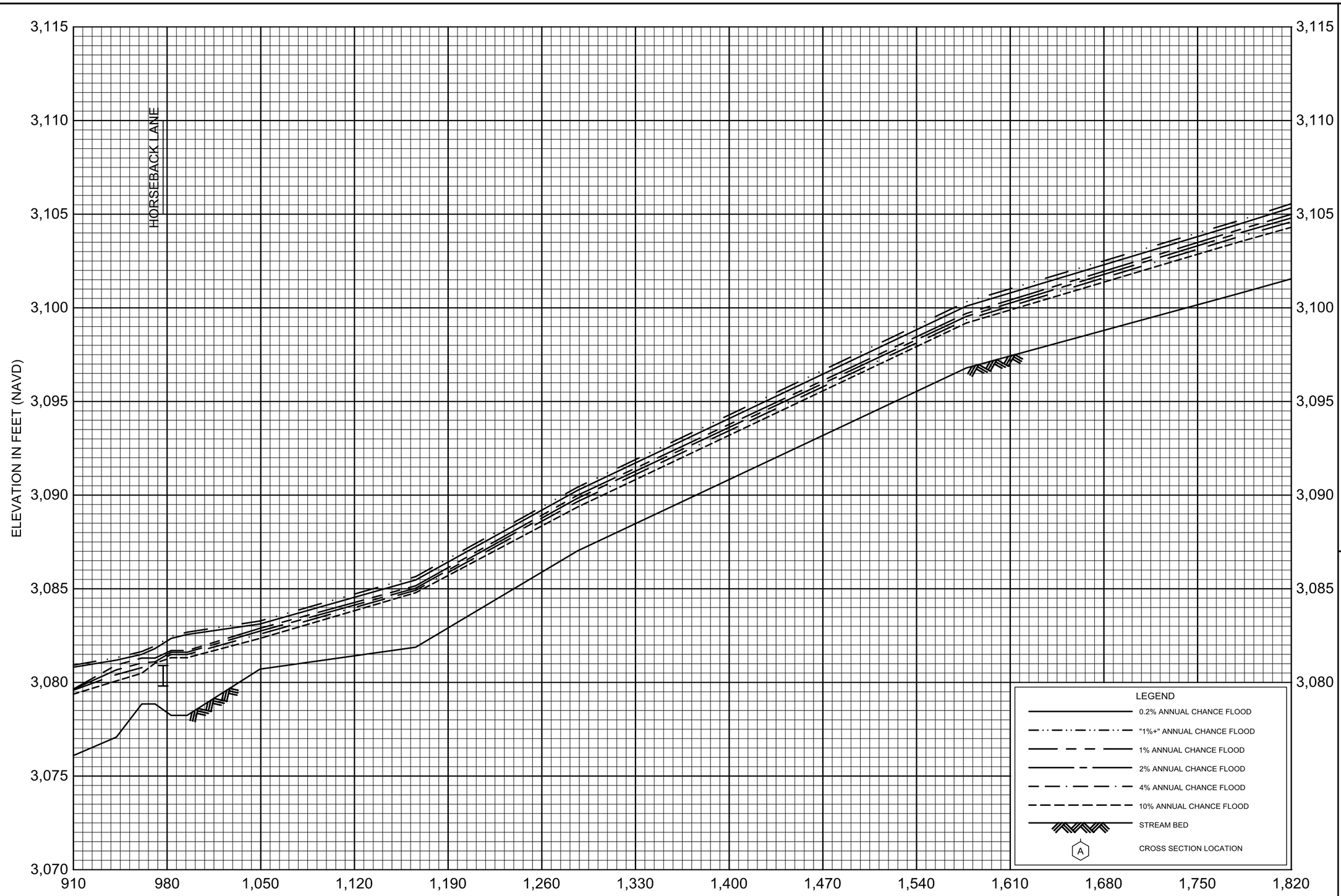
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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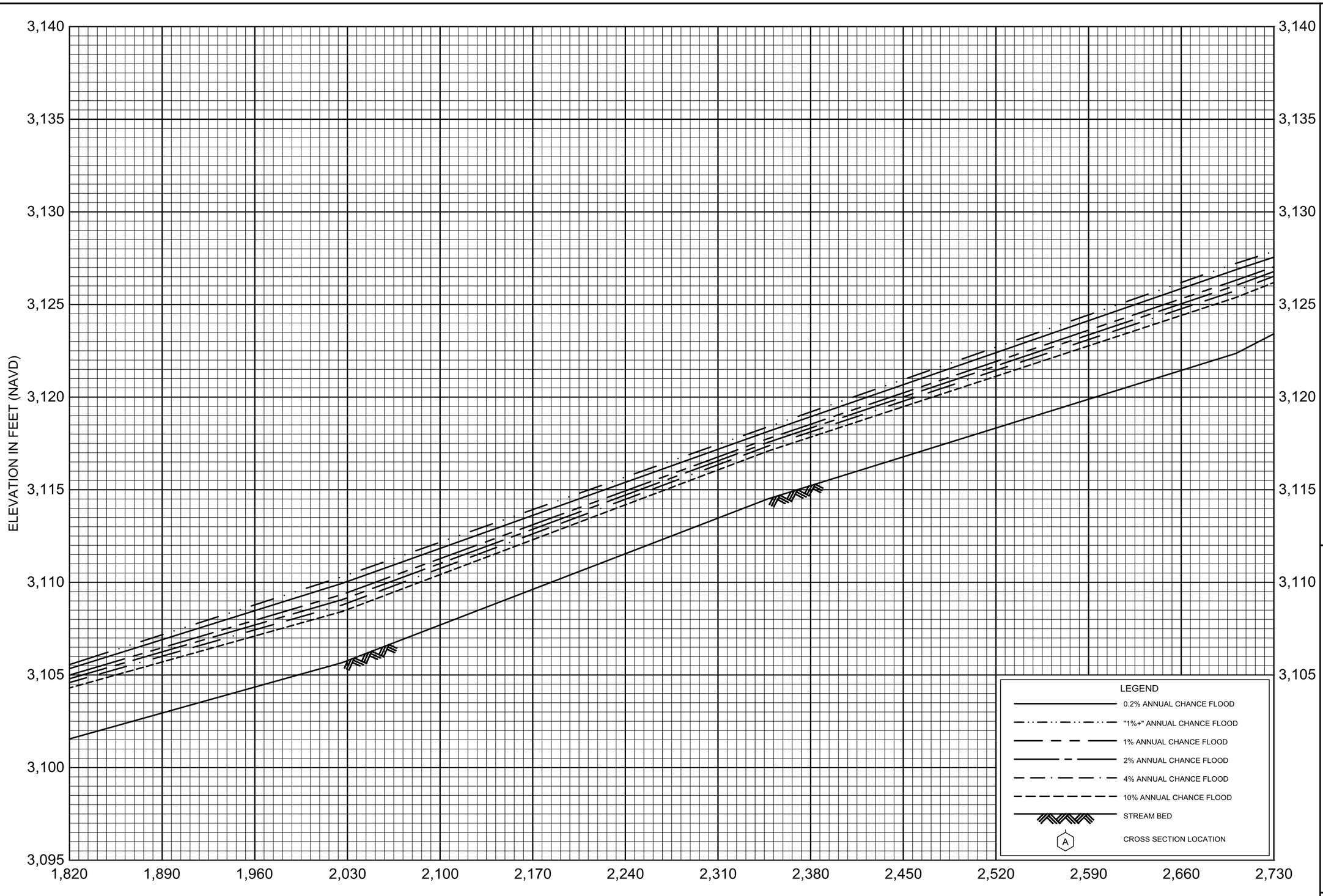


FLOOD PROFILES

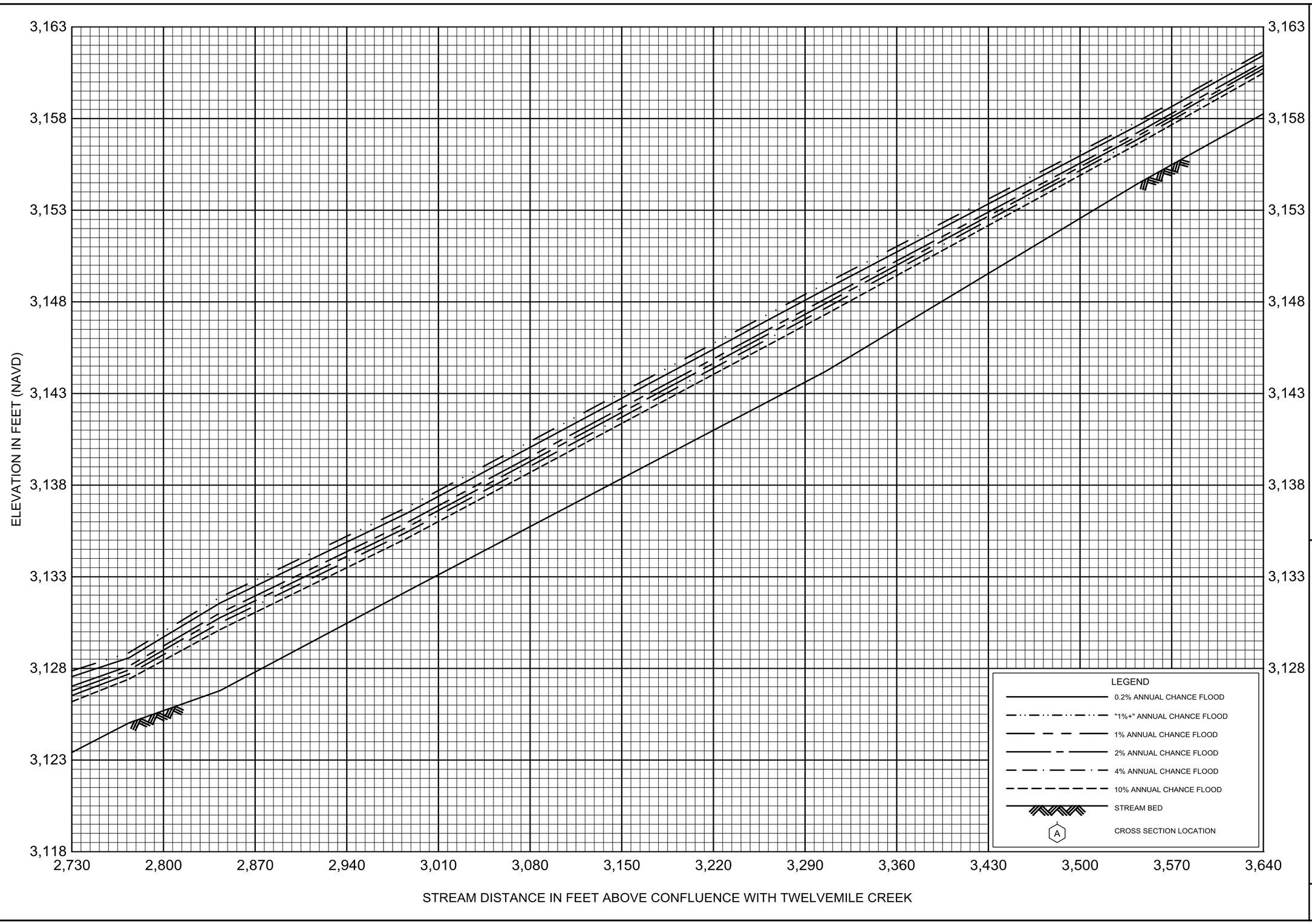
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

03P



FLOOD PROFILES

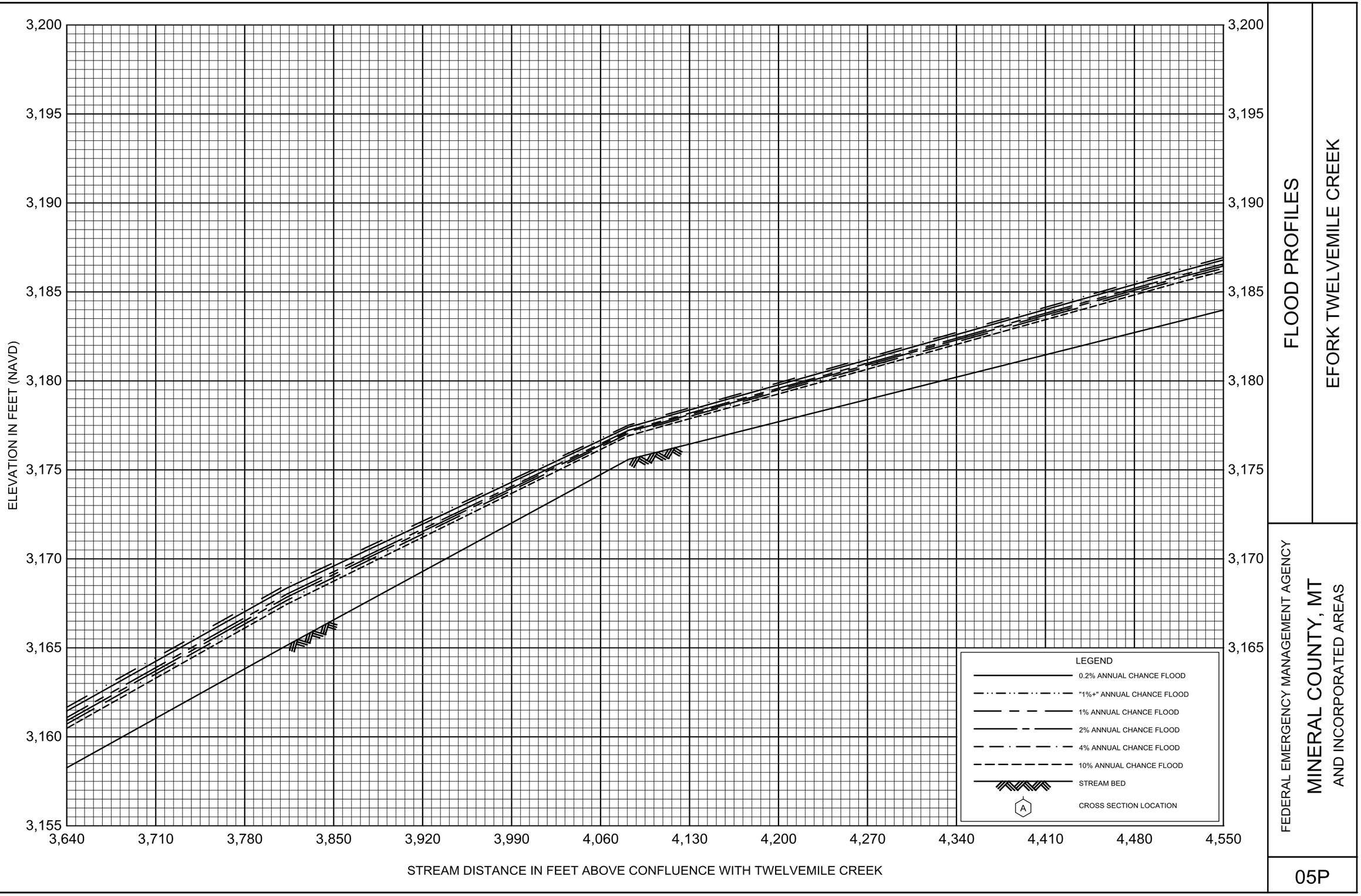
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

04P



FLOOD PROFILES

EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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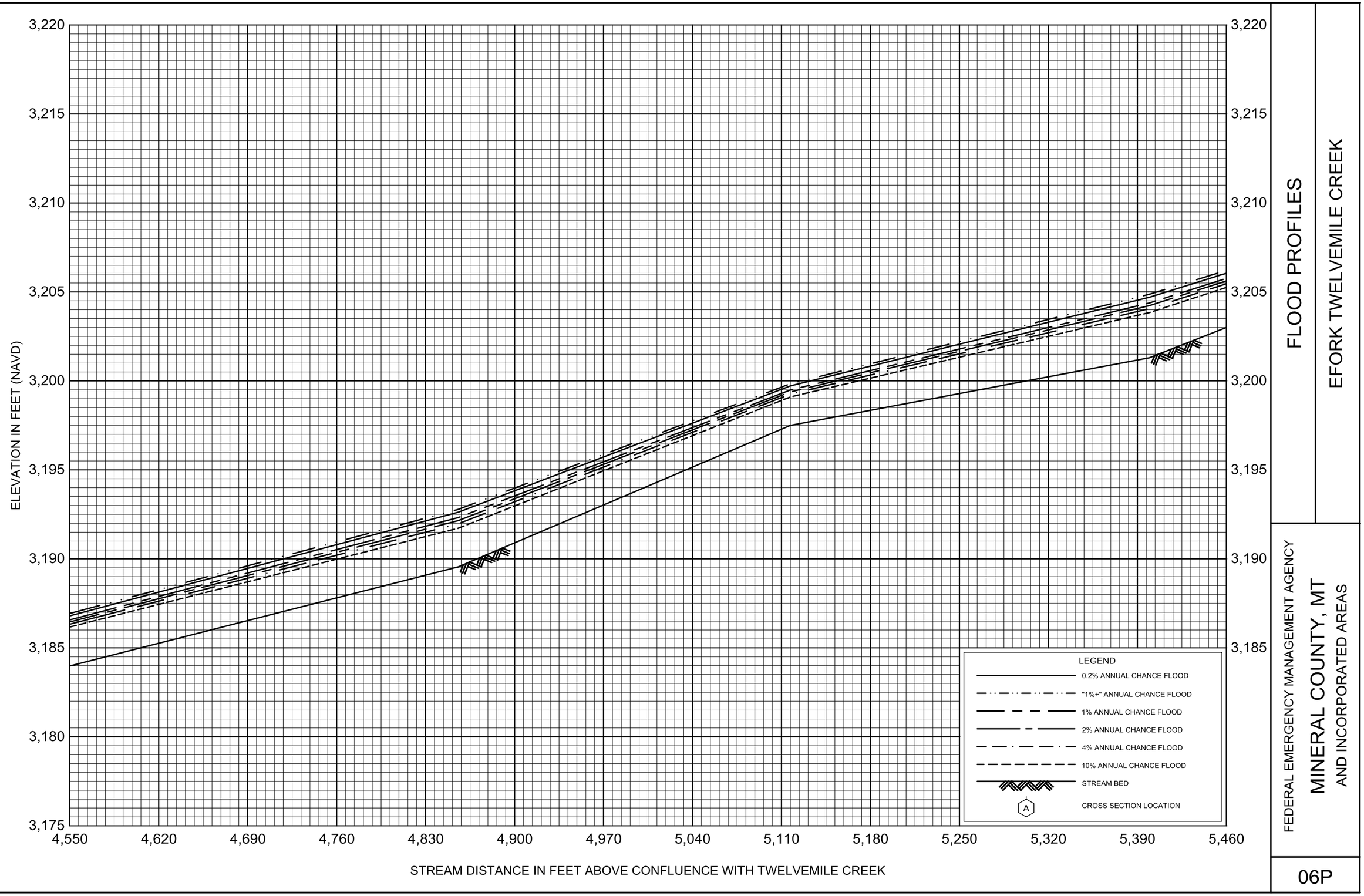


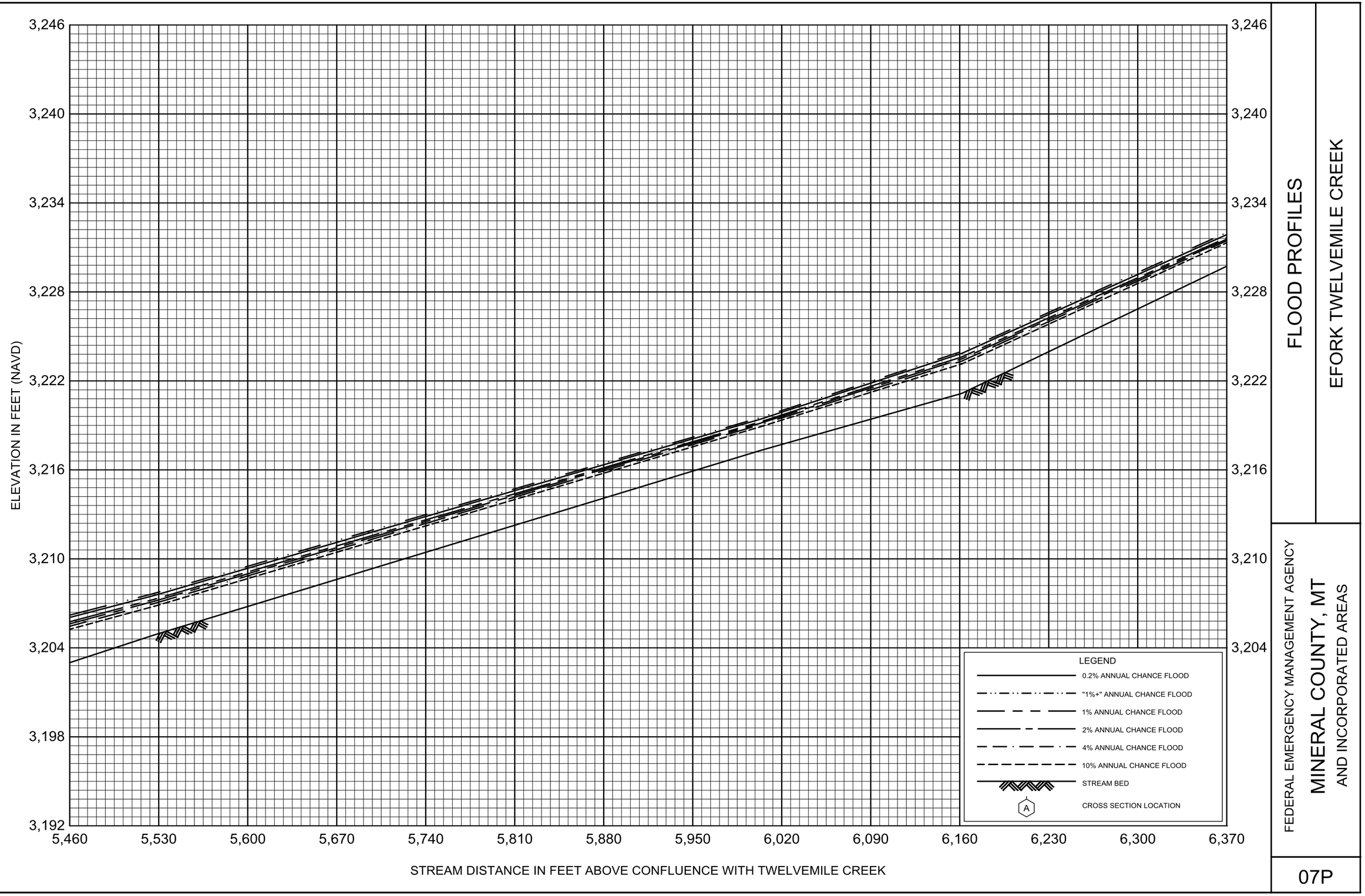
FLOOD PROFILES

EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

06P



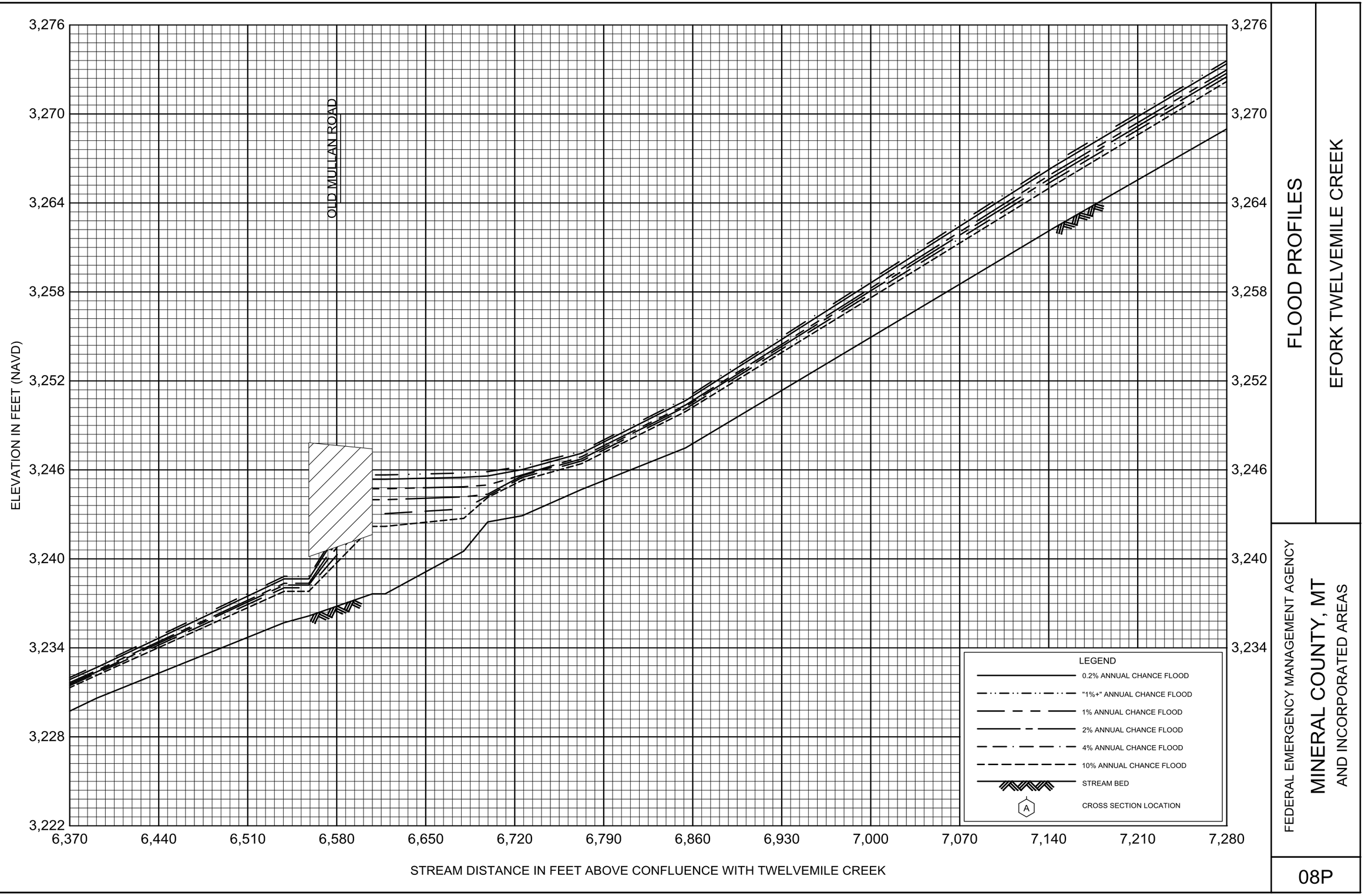
FLOOD PROFILES

EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

07P



FLOOD PROFILES

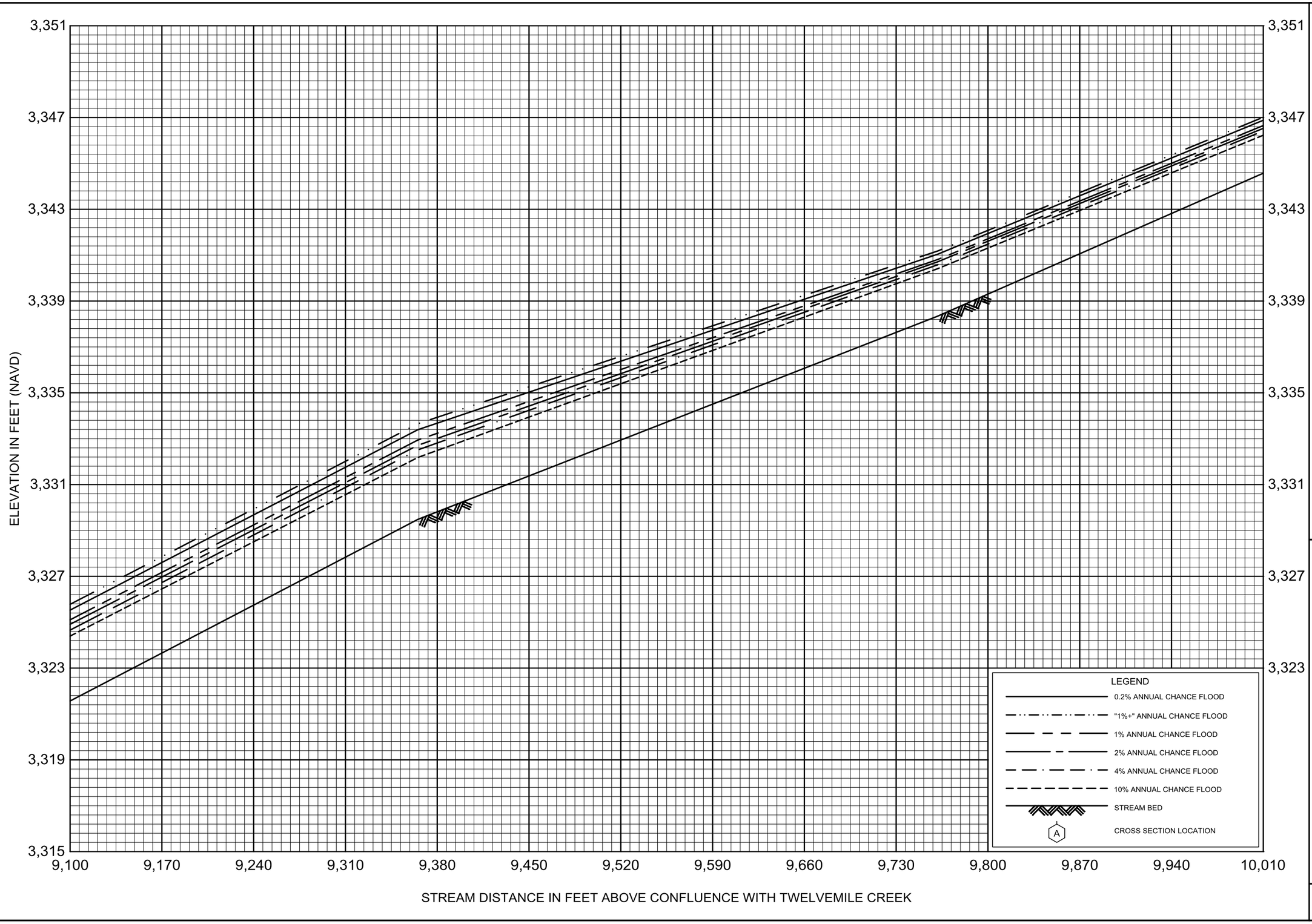
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

08P



FLOOD PROFILES

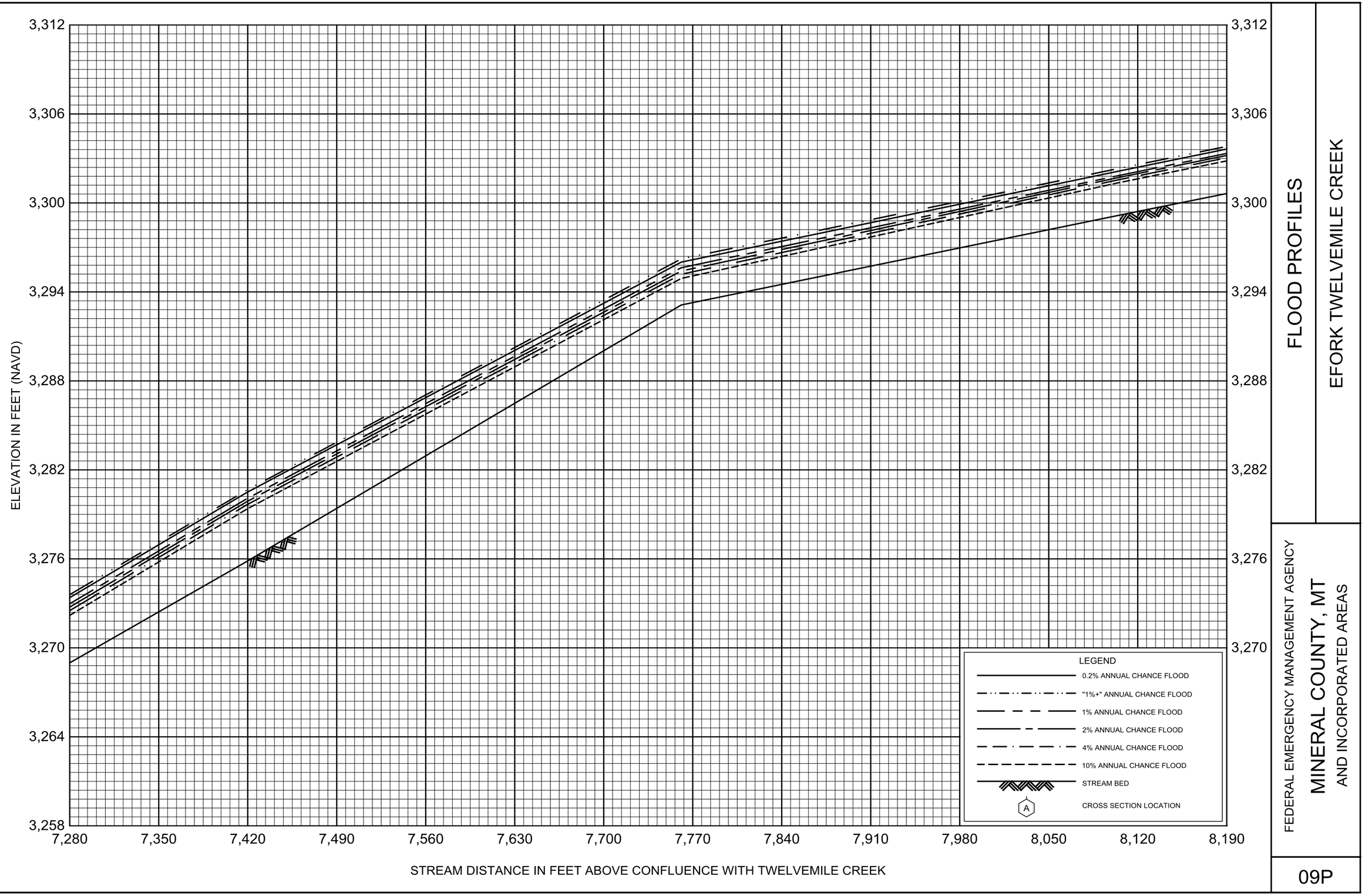
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

11P



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EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

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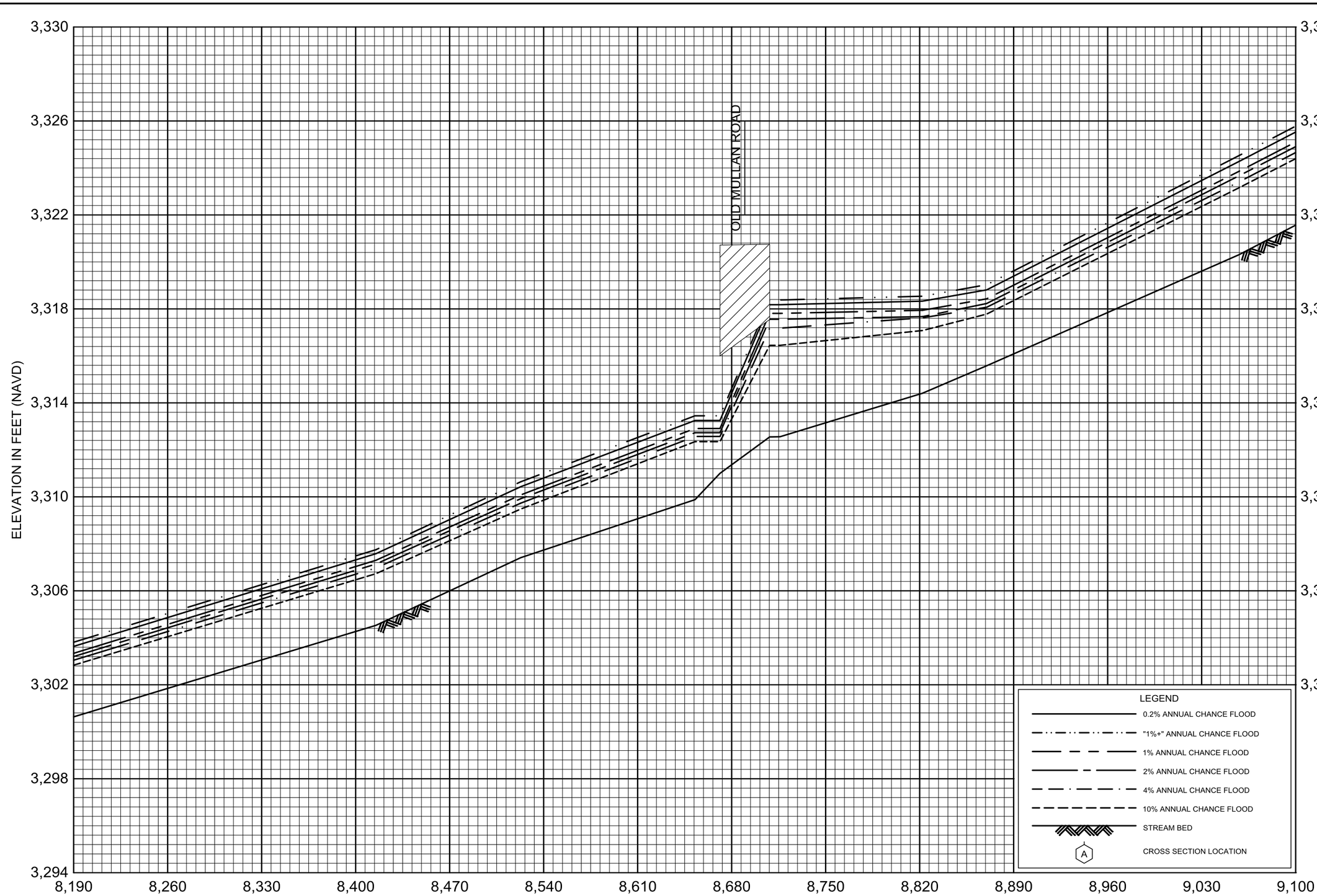


FLOOD PROFILES

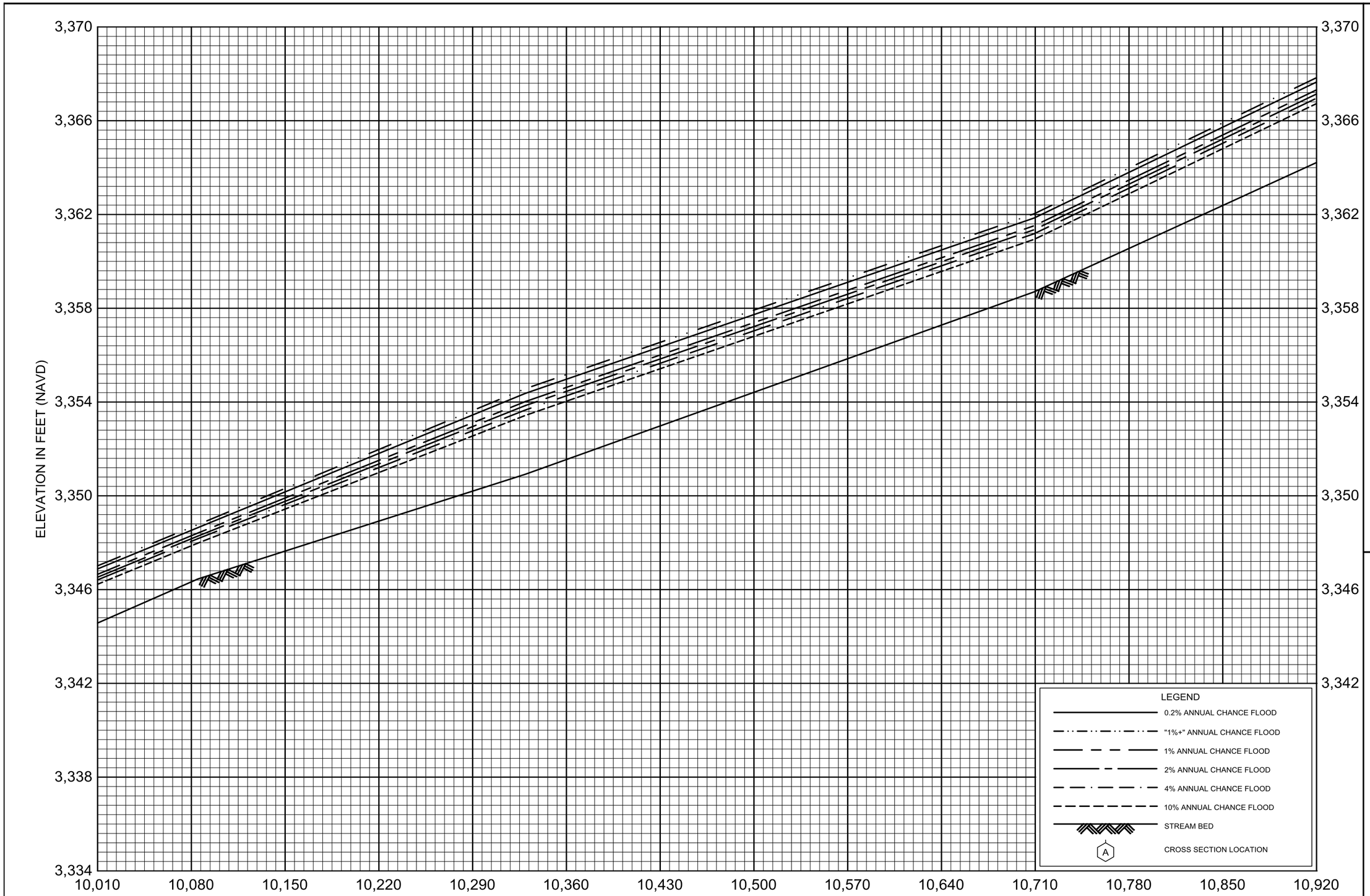
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

10P



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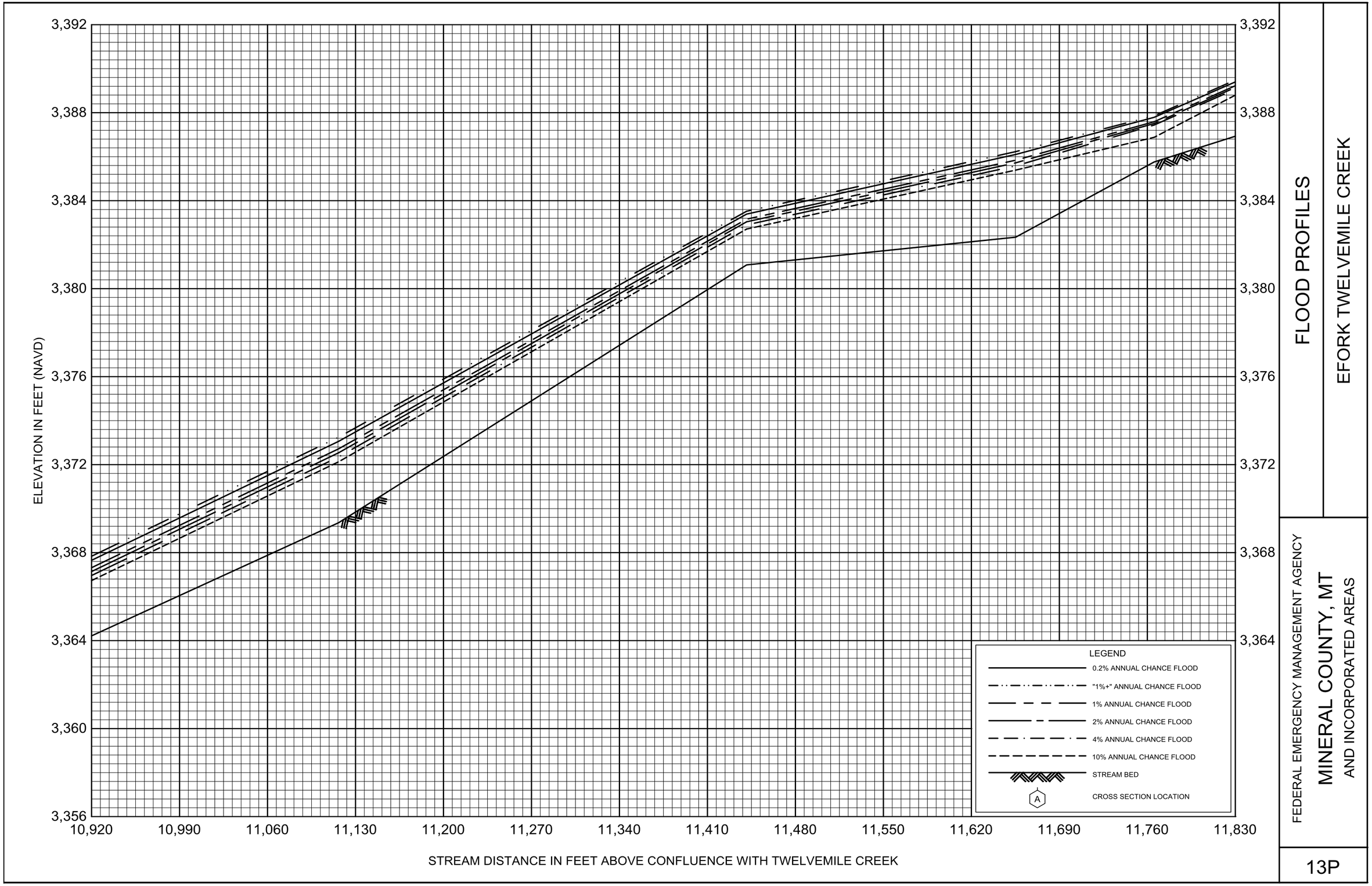

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MINERAL COUNTY, MT
AND INCORPORATED AREAS

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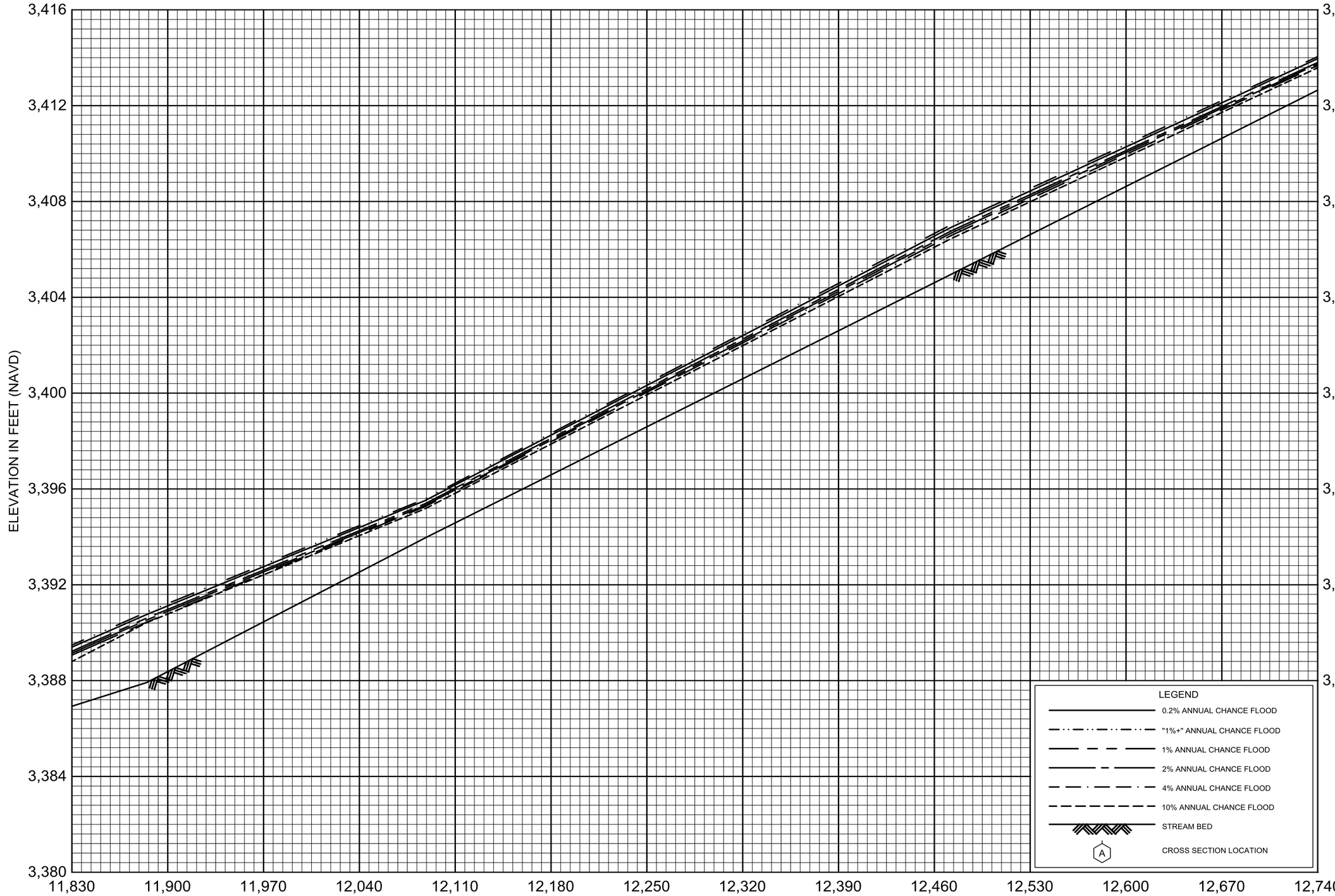

FLOOD PROFILES

EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

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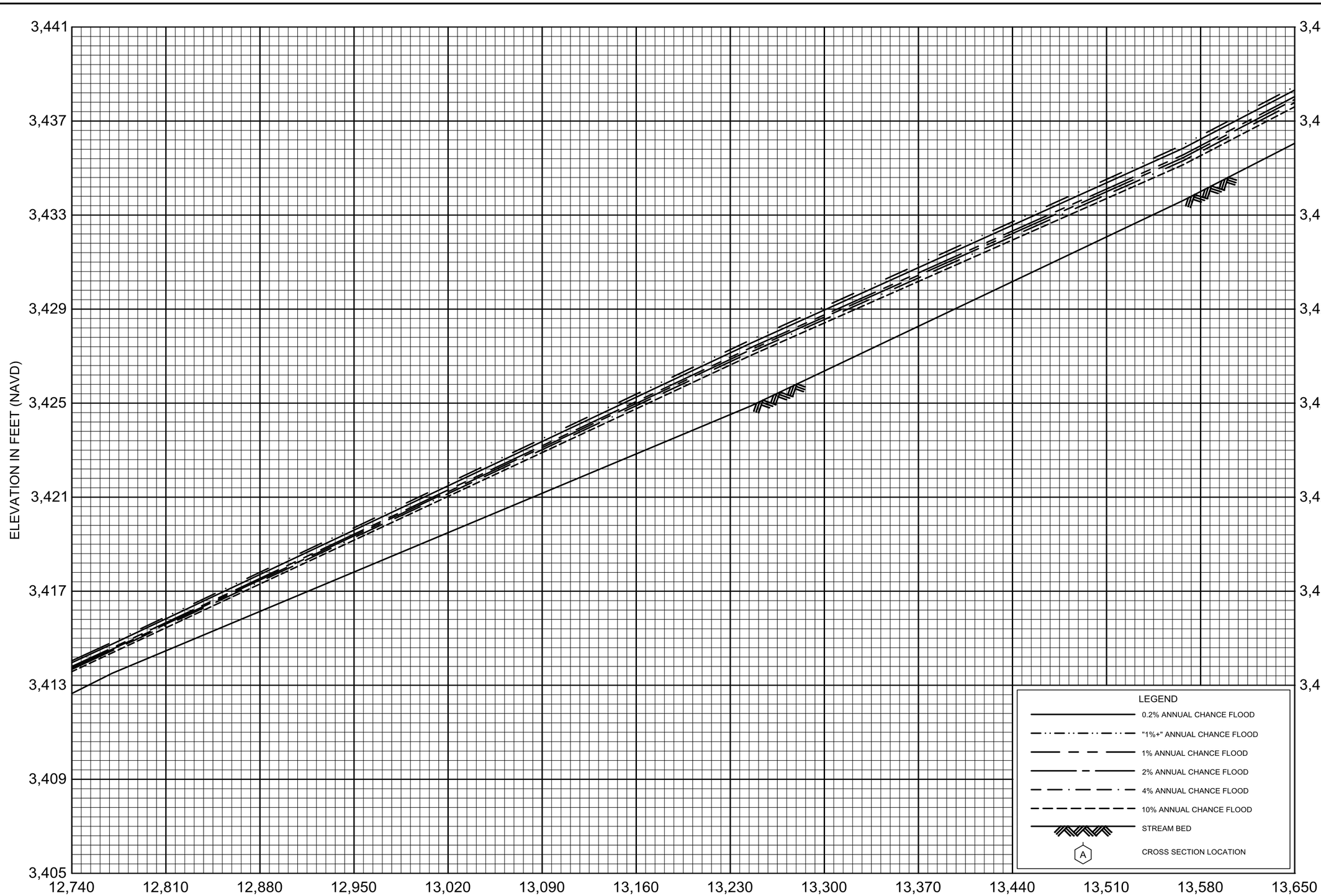

FLOOD PROFILES

EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

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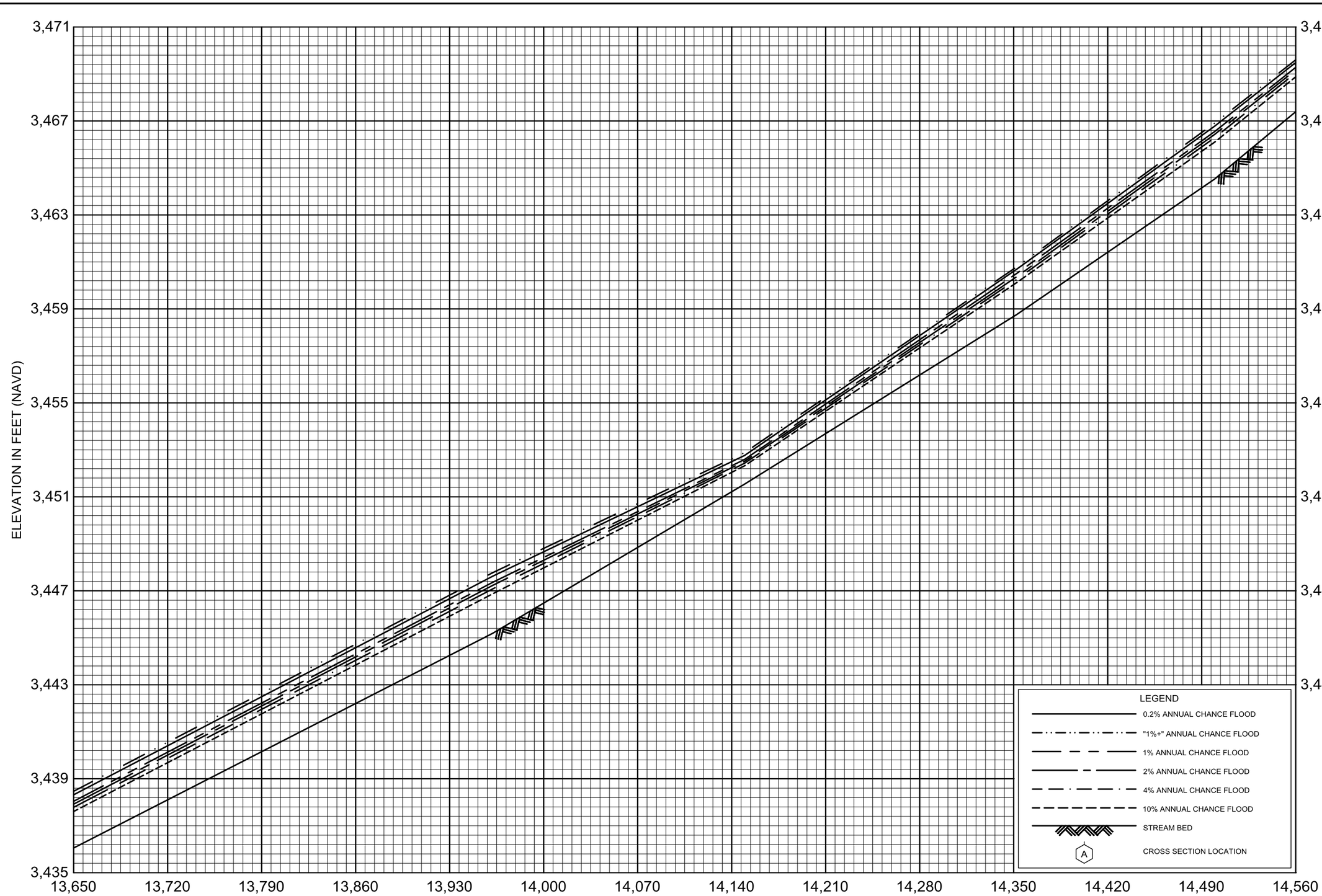


FLOOD PROFILES

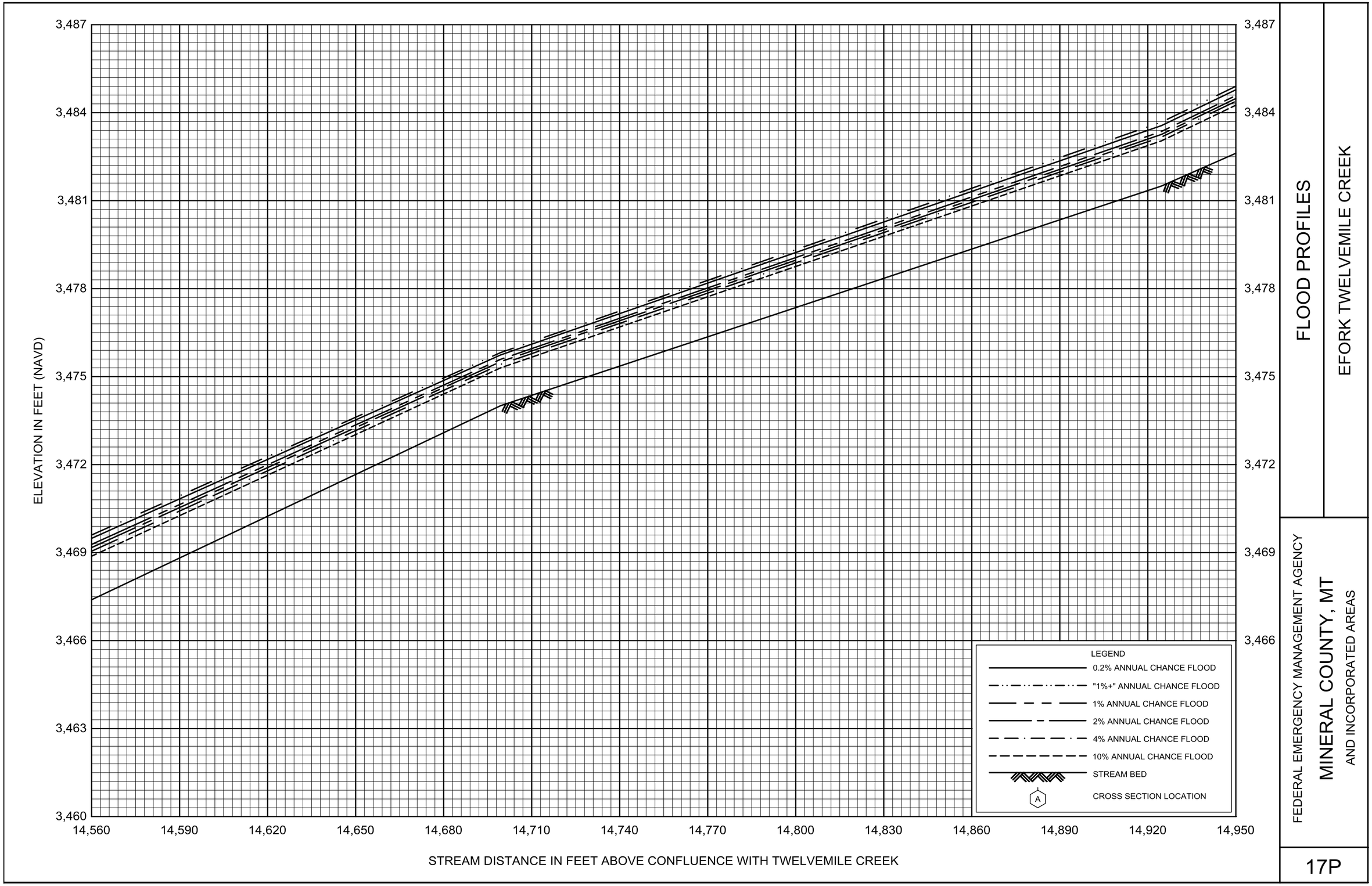
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

16P



FLOOD PROFILES

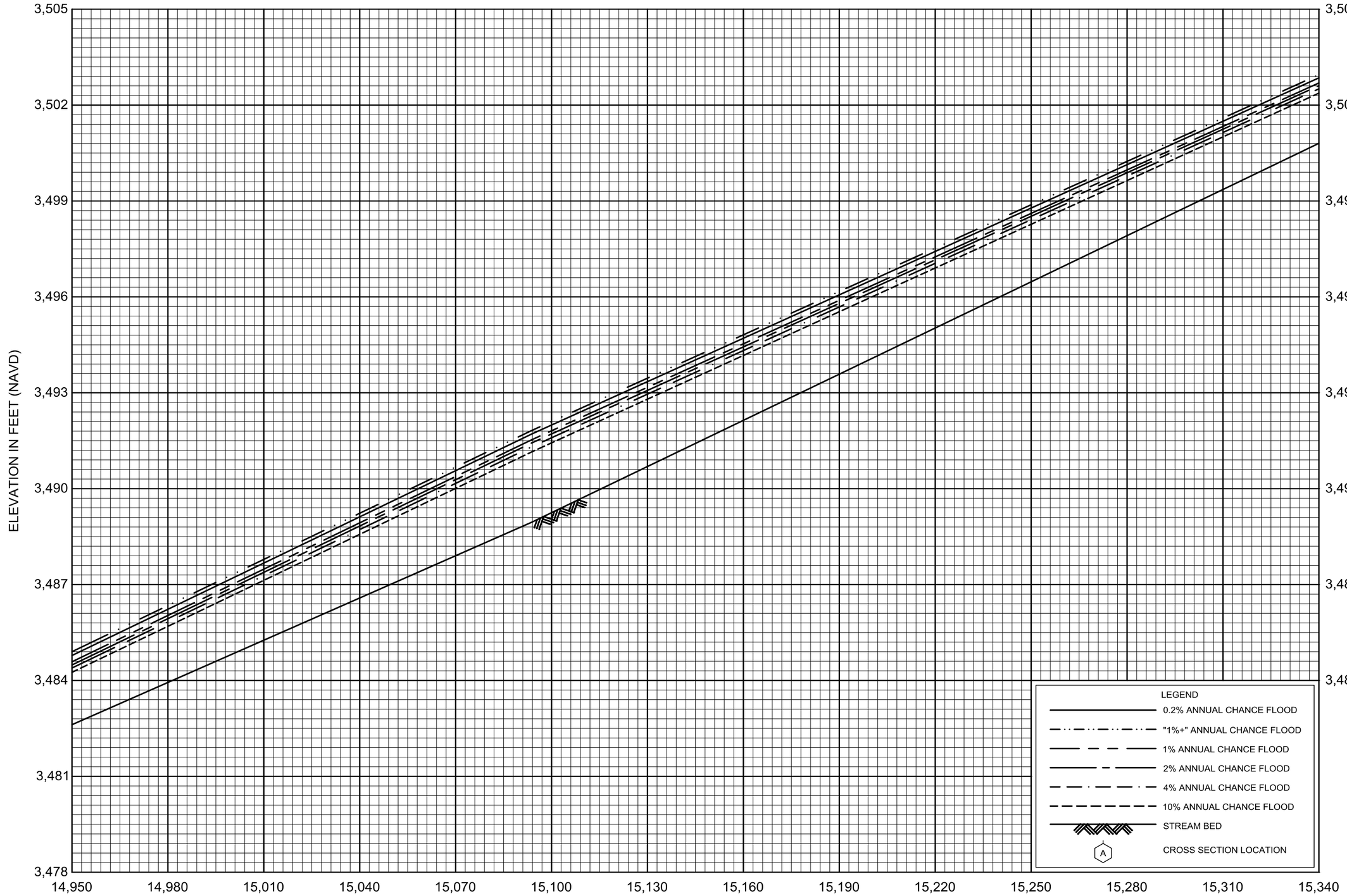
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

17P



FLOOD PROFILES

EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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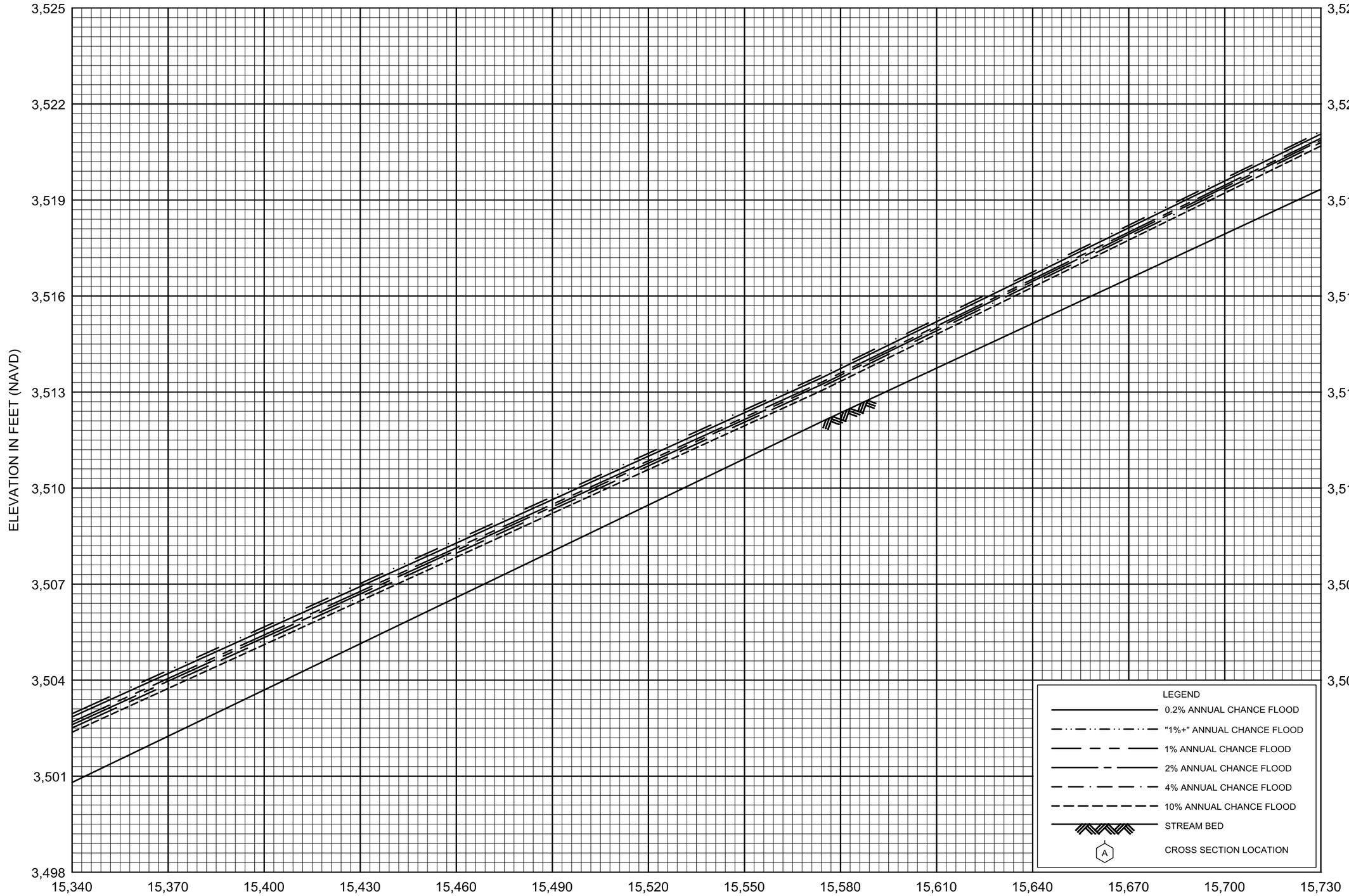


FLOOD PROFILES

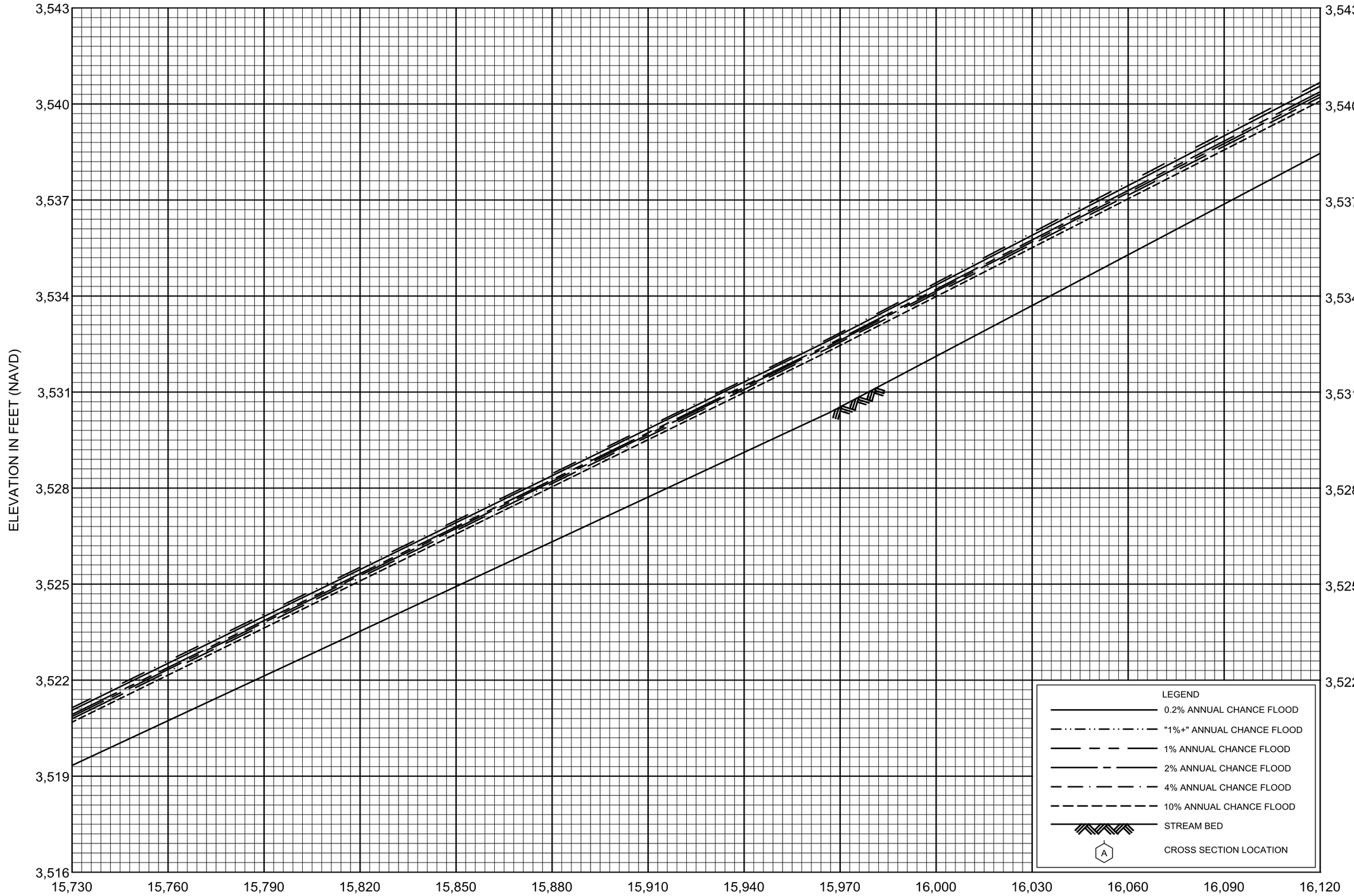
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

19P



FLOOD PROFILES

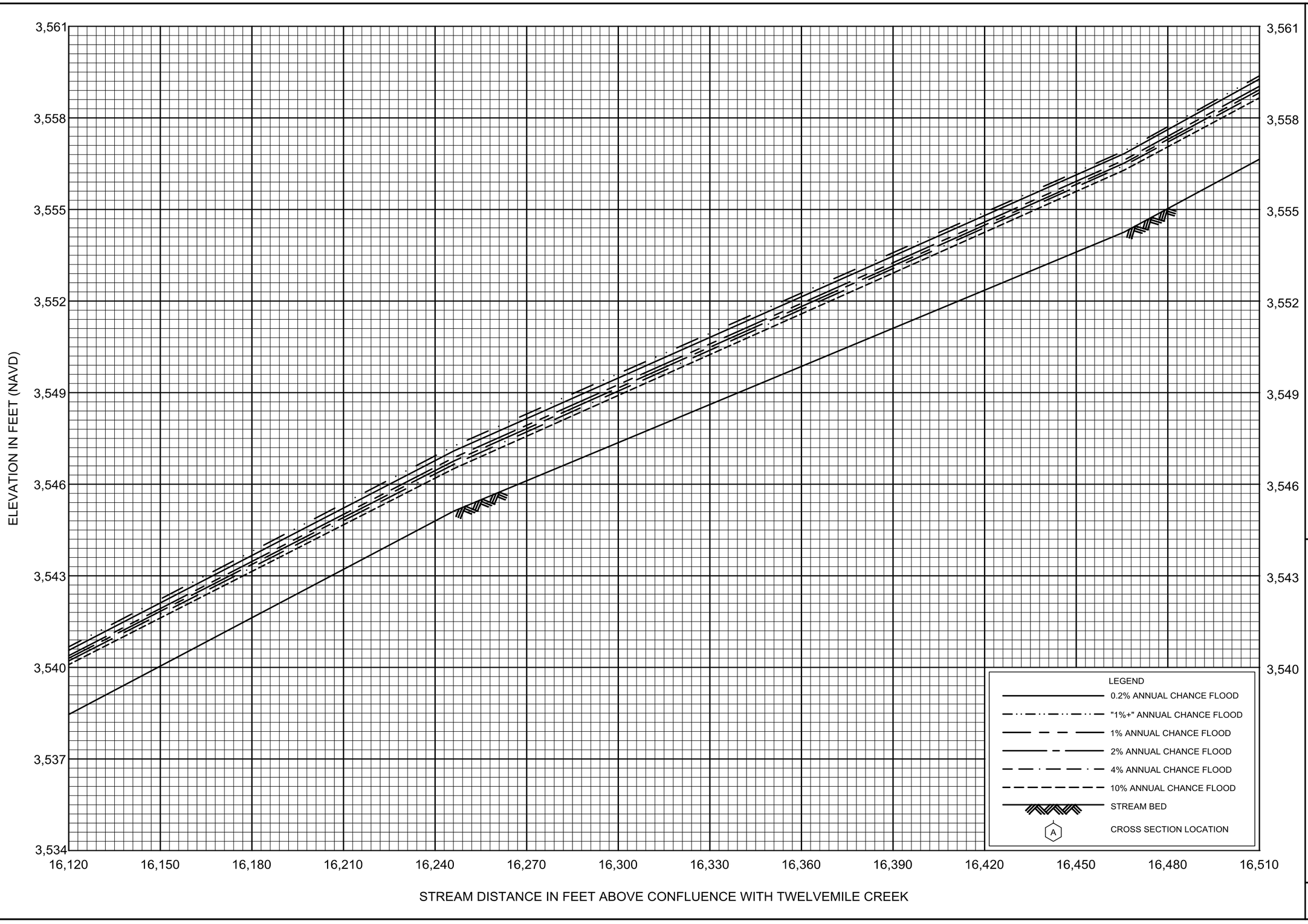
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

20P



FLOOD PROFILES

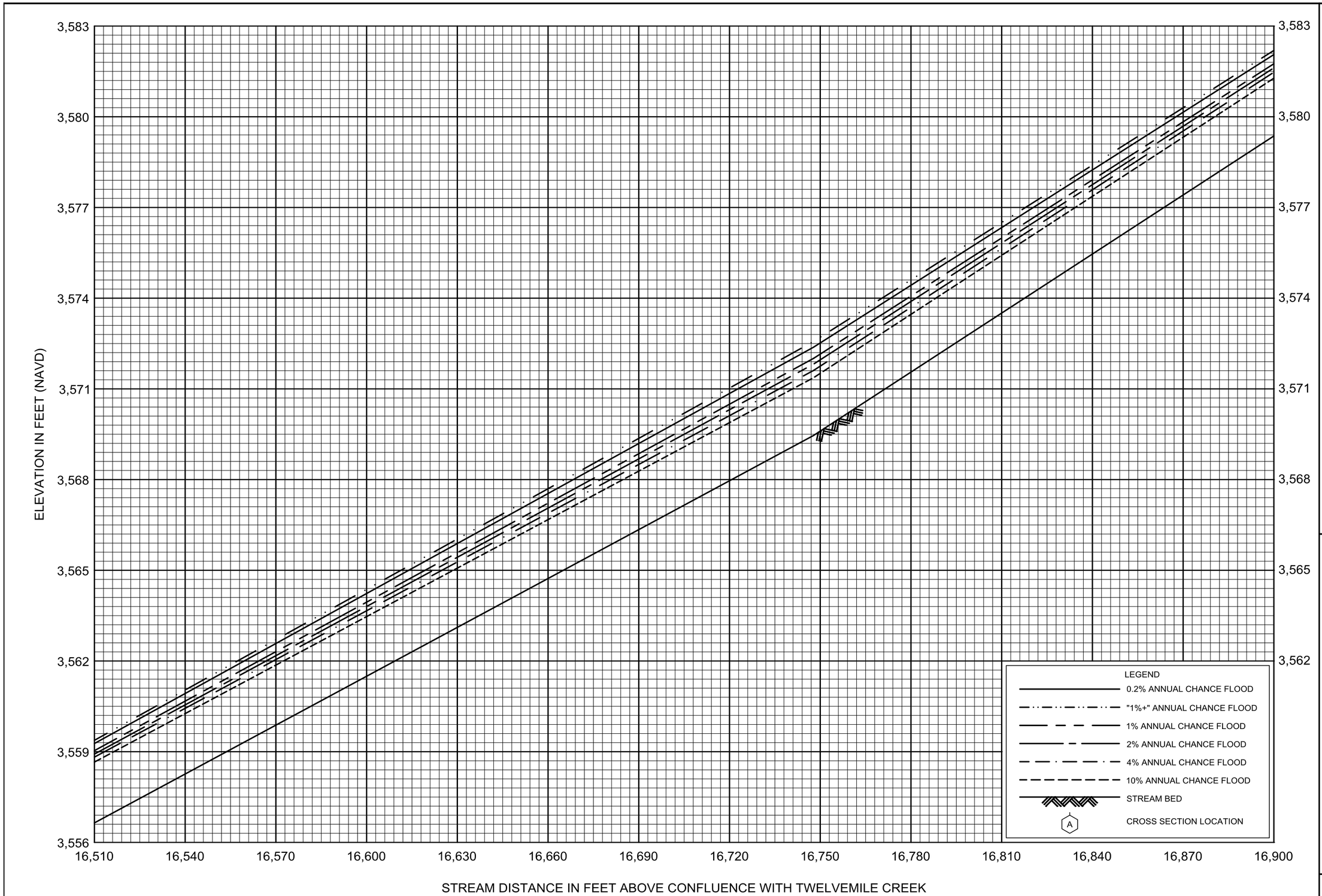
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

21P



FLOOD PROFILES

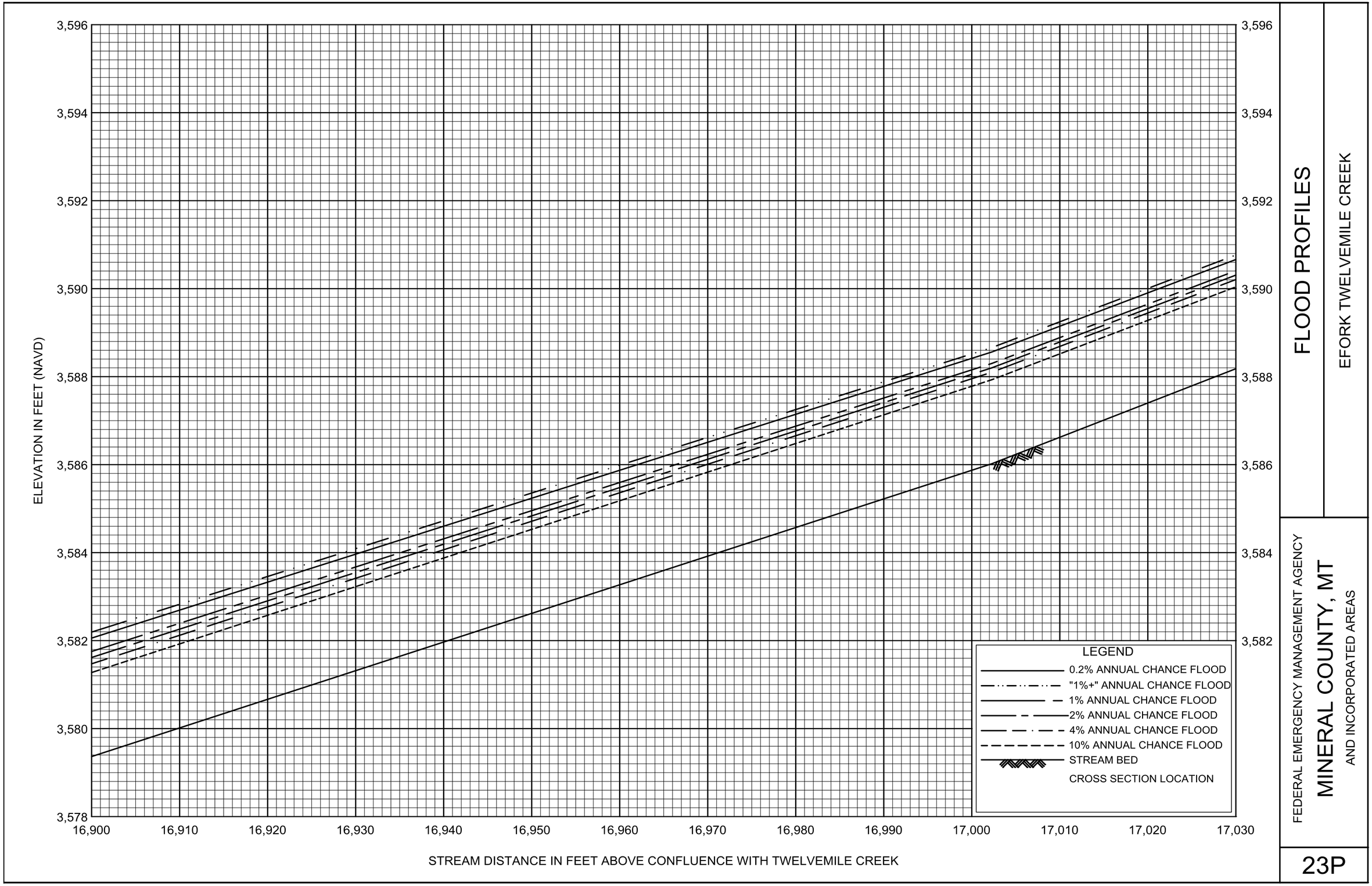
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

22P



FLOOD PROFILES

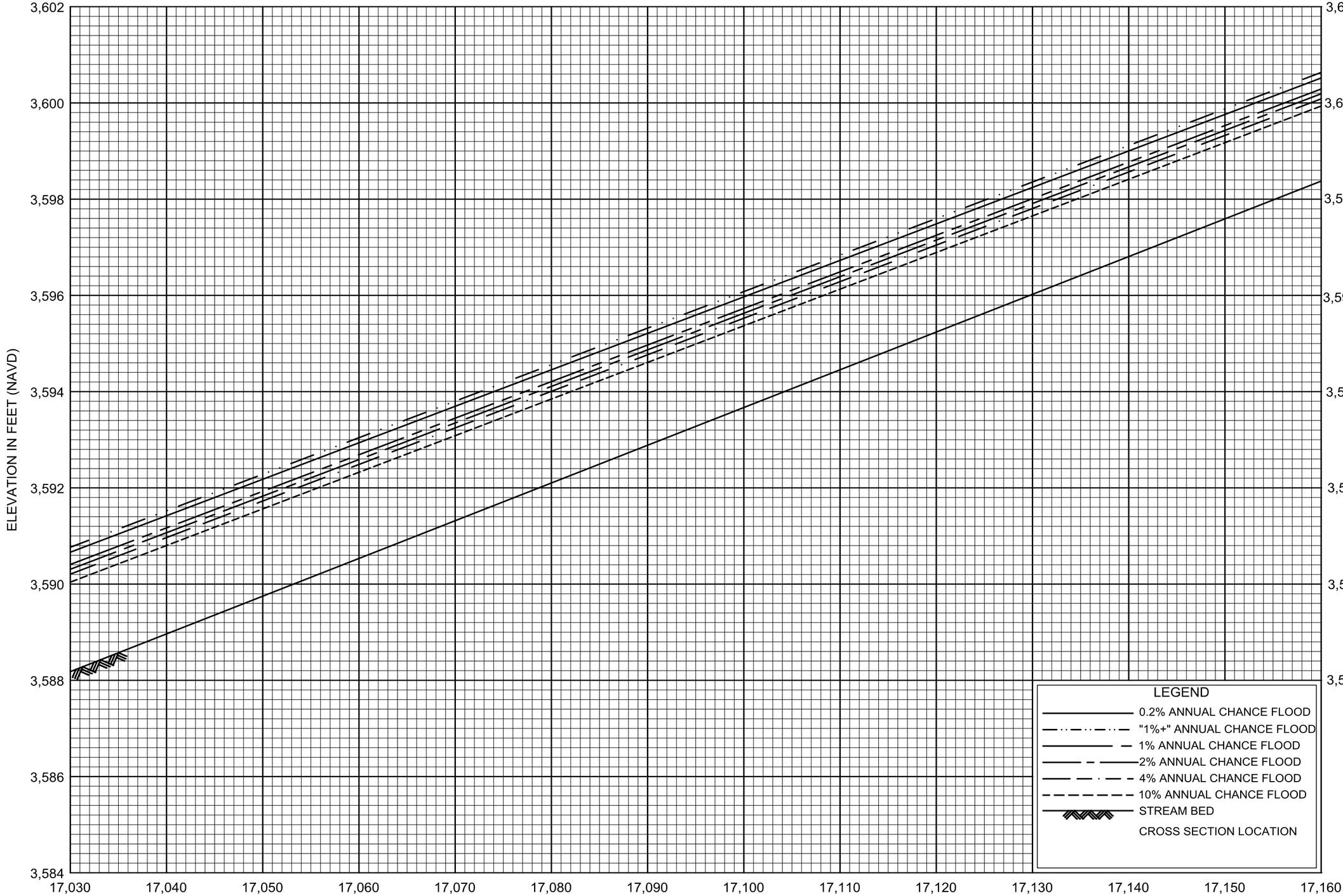
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

23P



FLOOD PROFILES

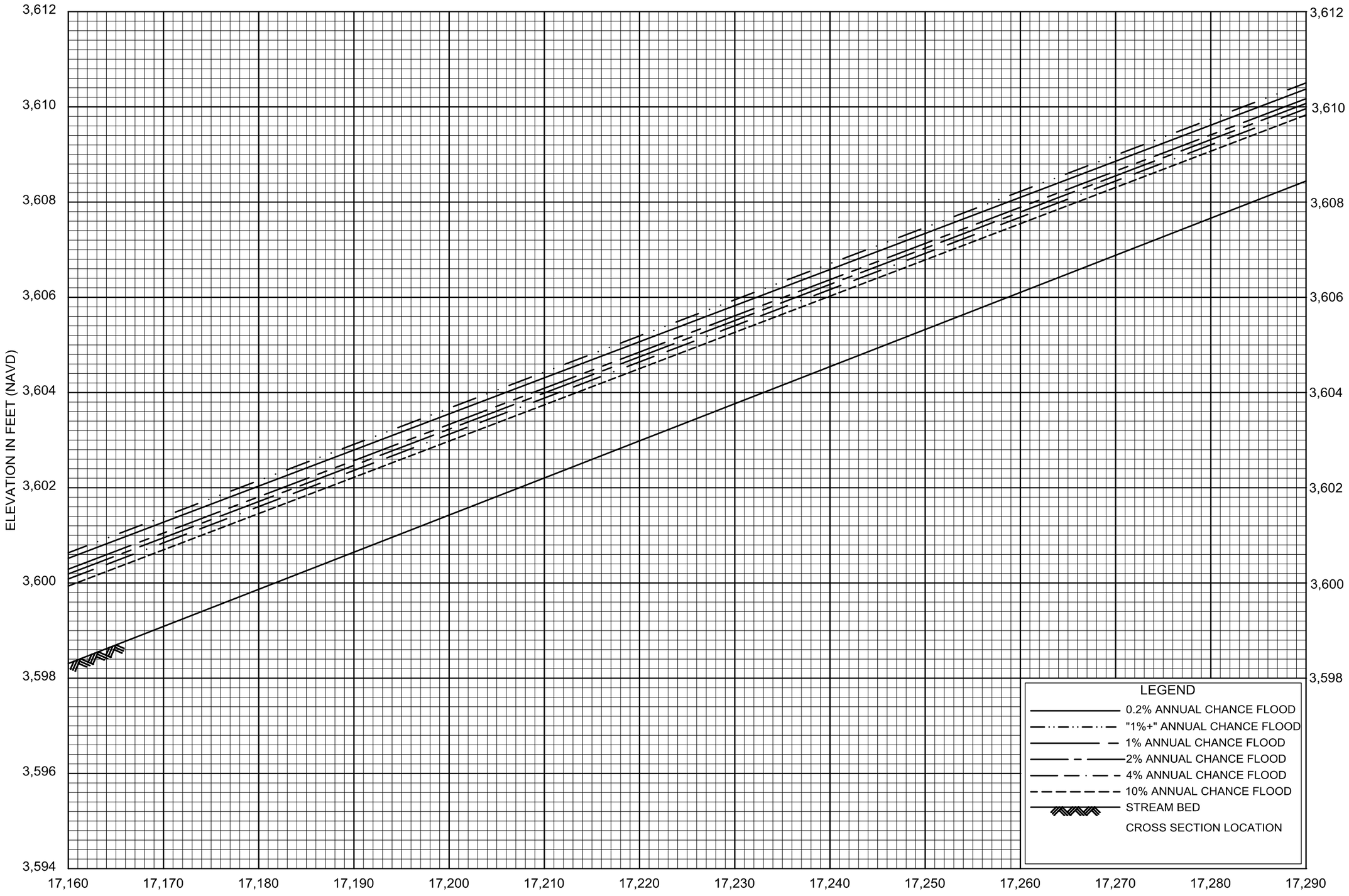
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

24P



FLOOD PROFILES

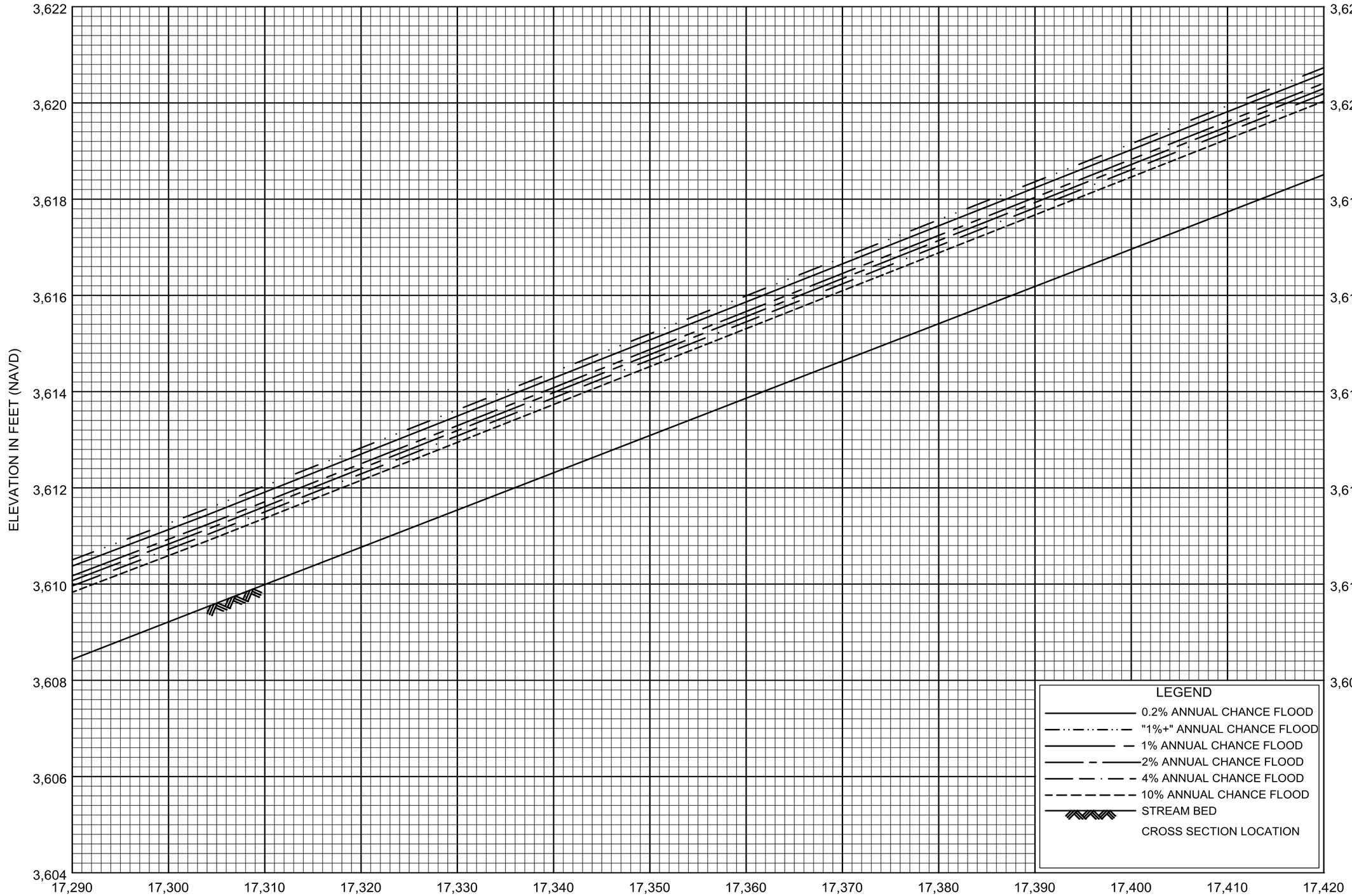
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

25P



FLOOD PROFILES

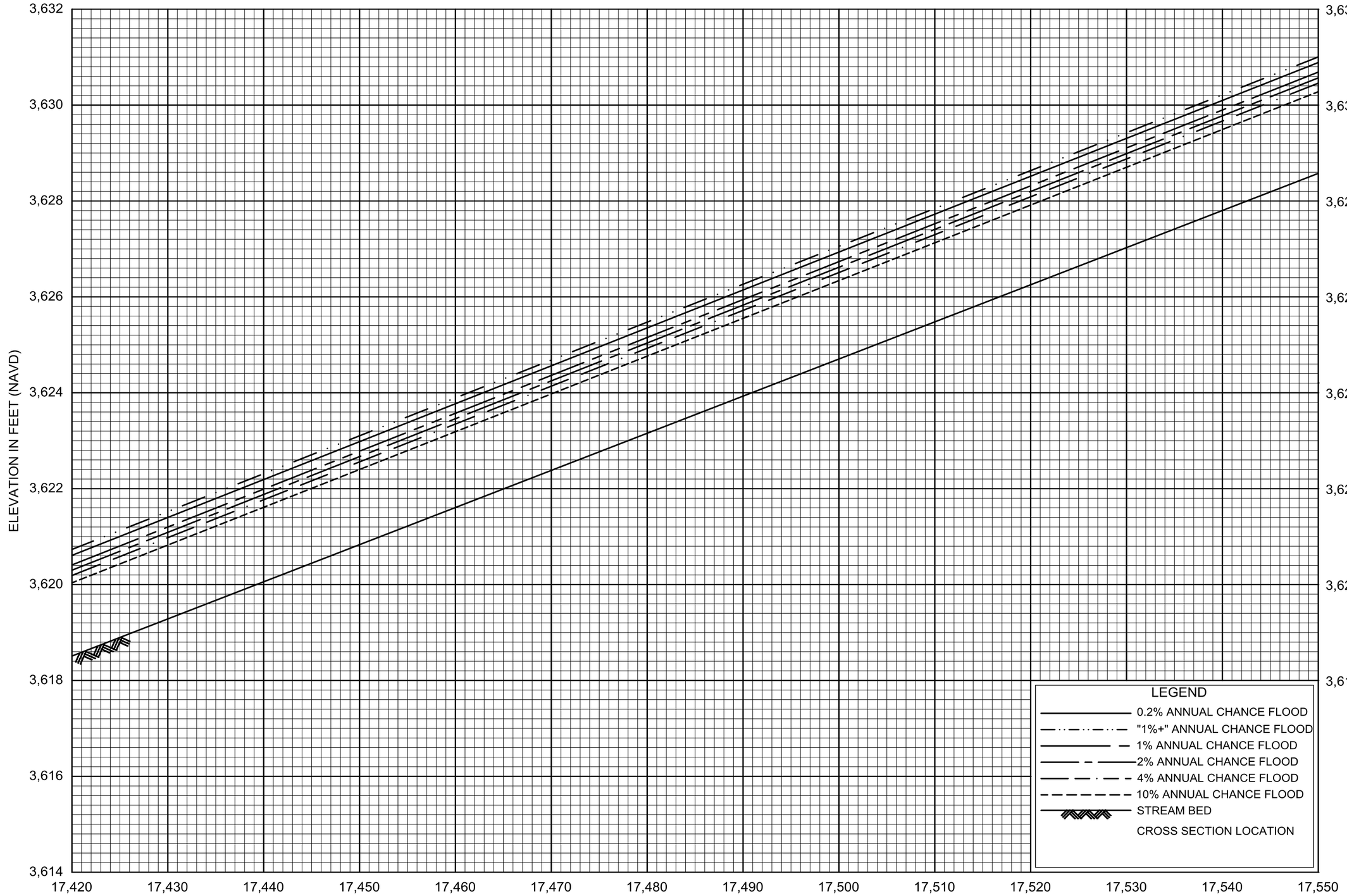
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

26P



FLOOD PROFILES

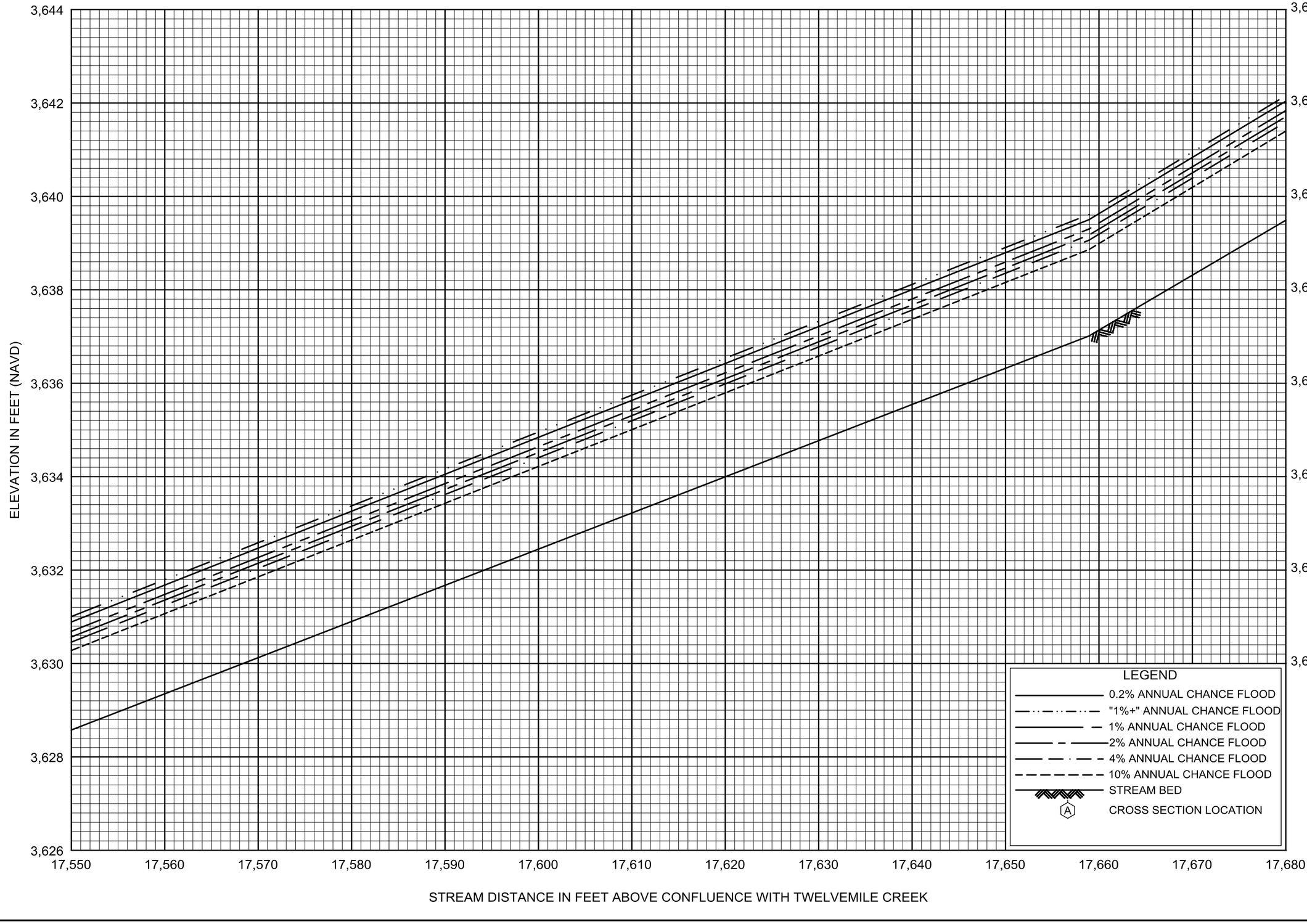
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

27P



FLOOD PROFILES

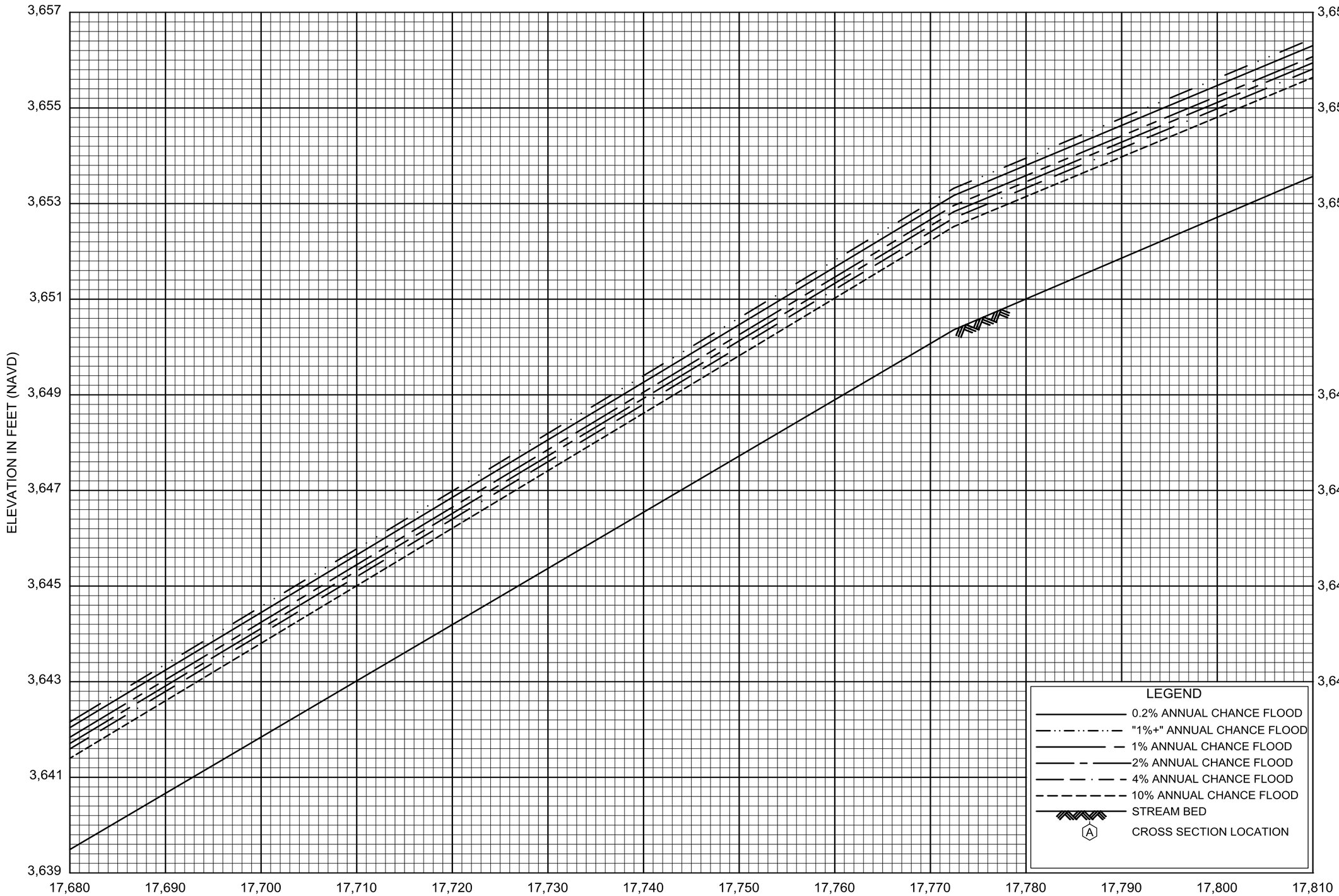
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

28P



FLOOD PROFILES

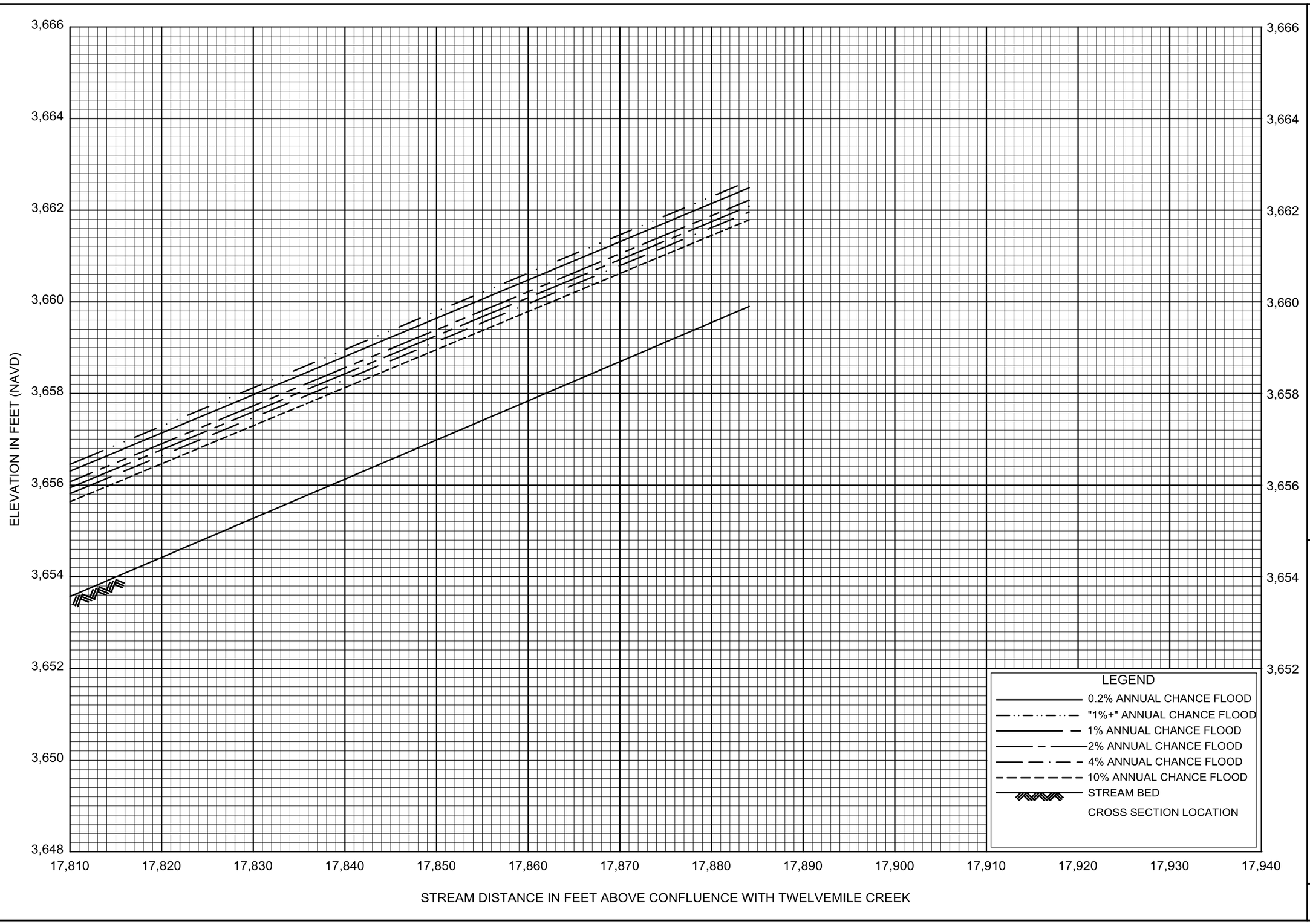
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

29P



FLOOD PROFILES

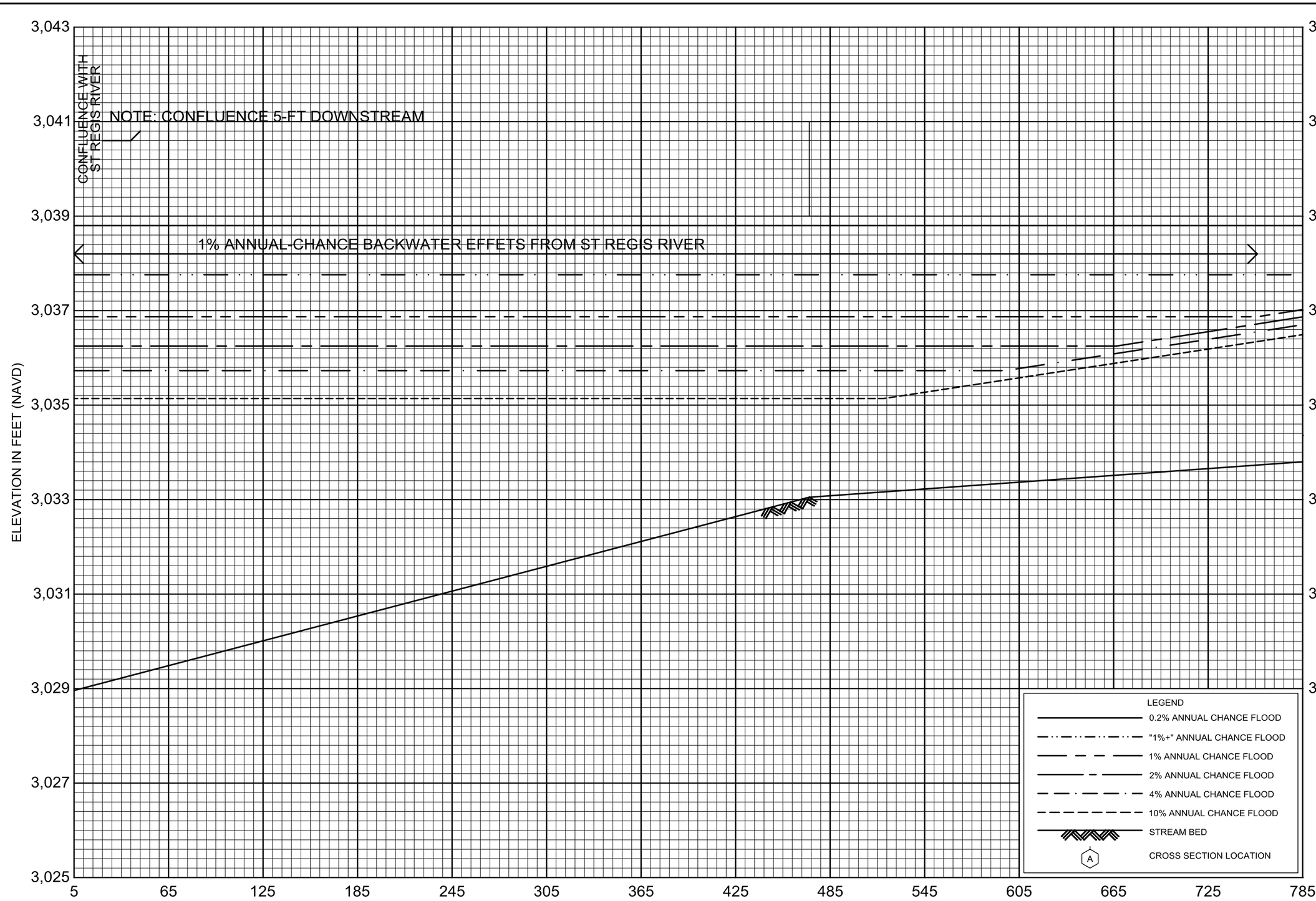
EFORK TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

30P



FLOOD PROFILES

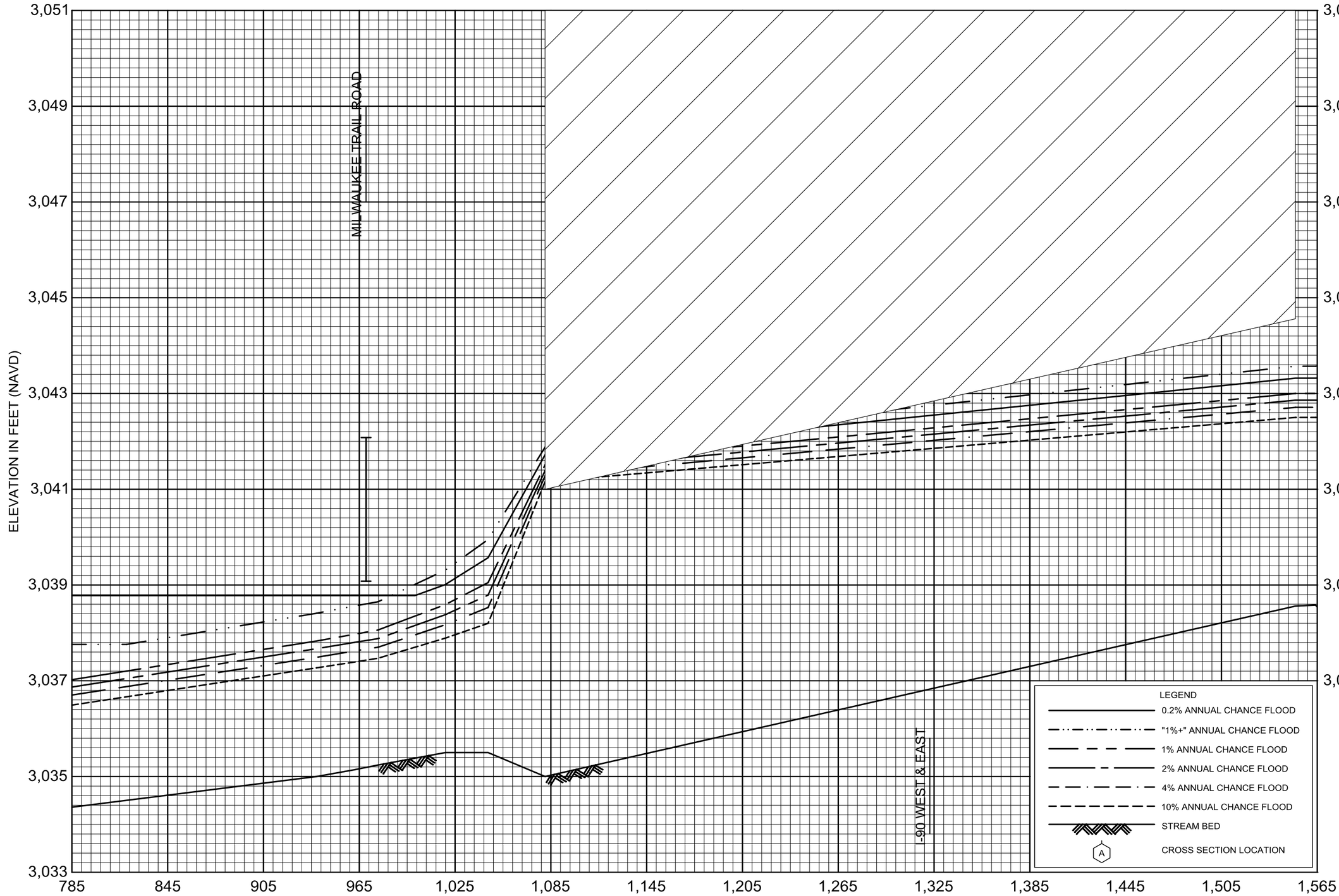
TWIN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

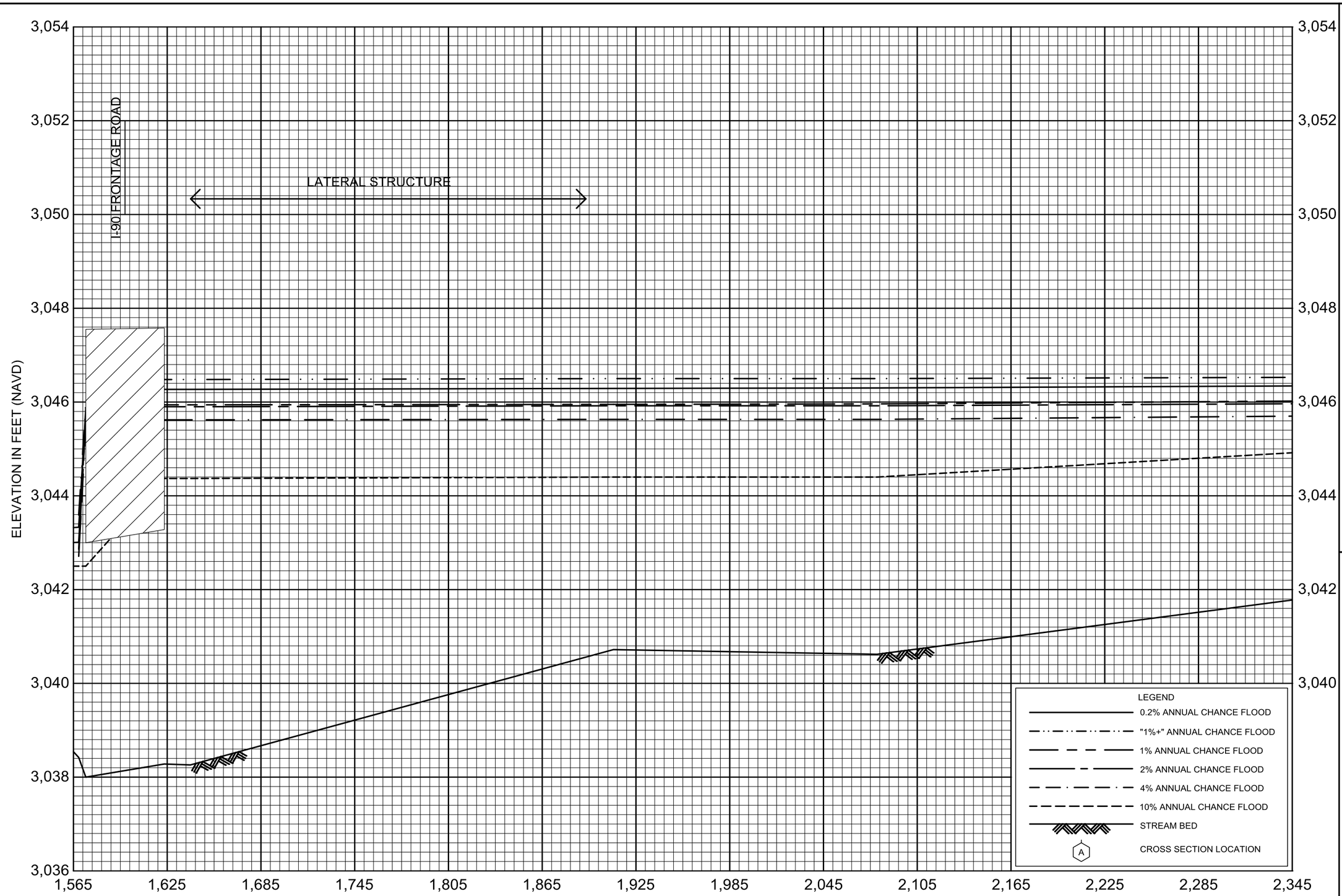
TWIN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

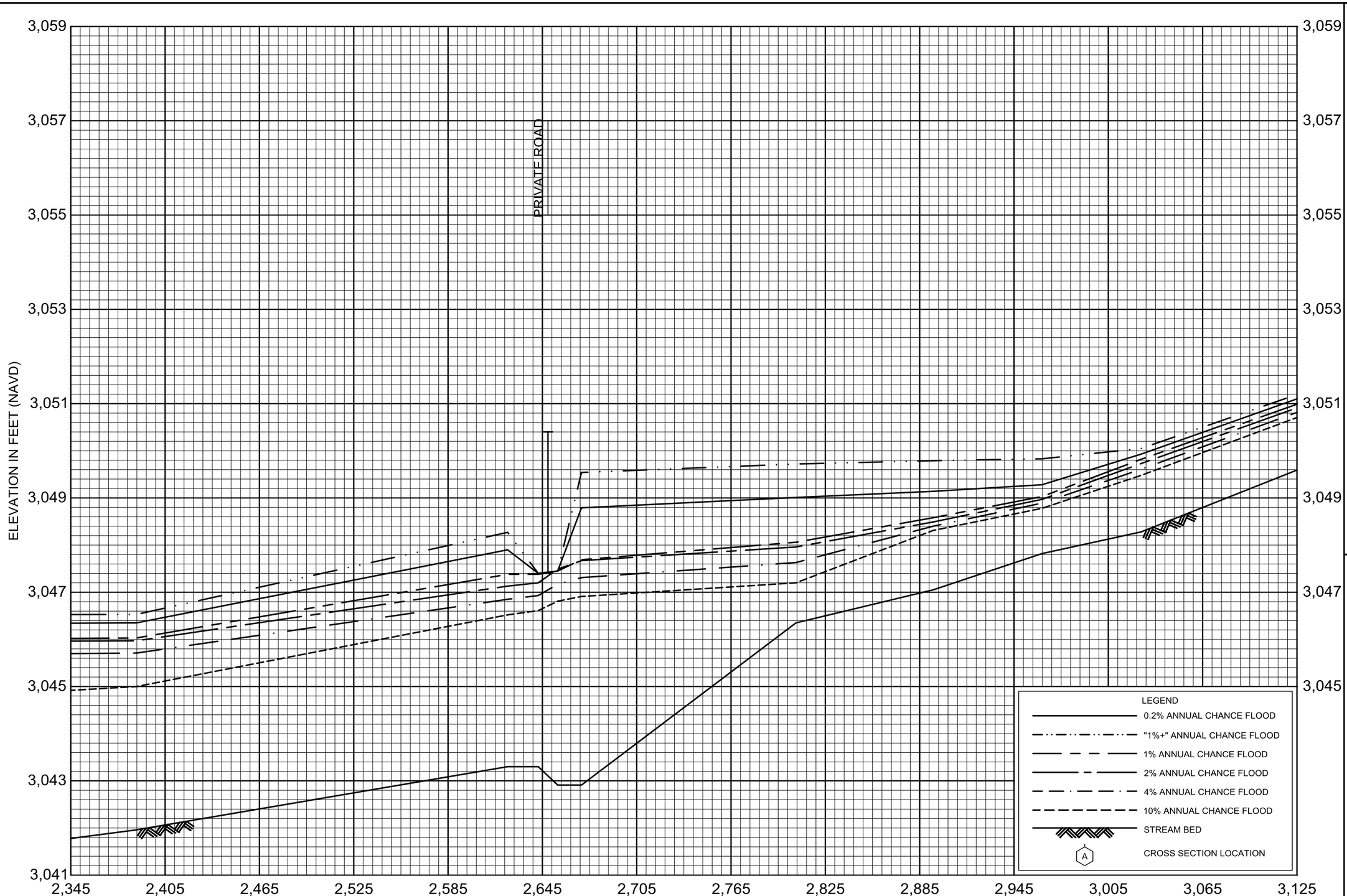
TWIN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

03P



FLOOD PROFILES

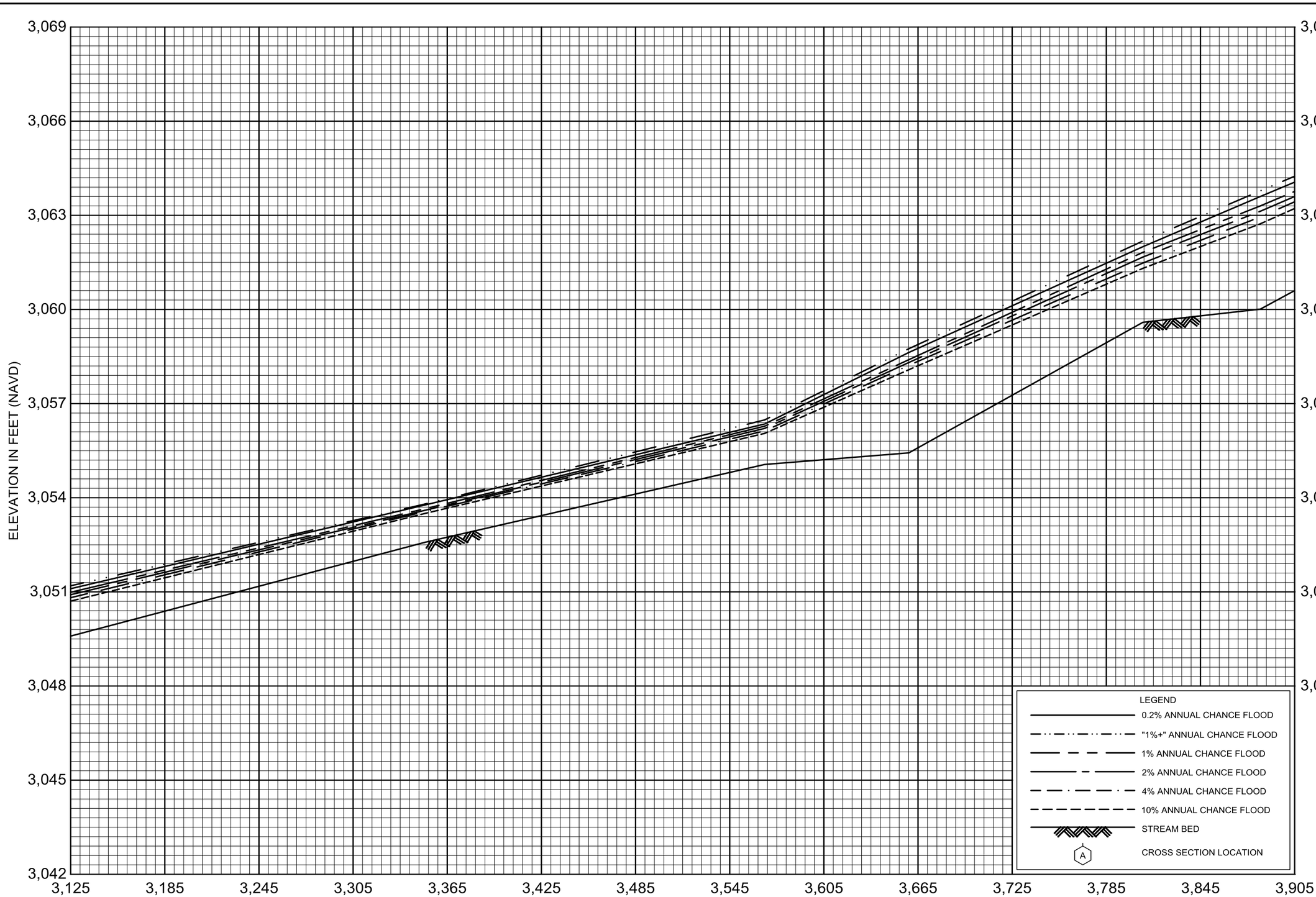
TWIN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

04P



FLOOD PROFILES

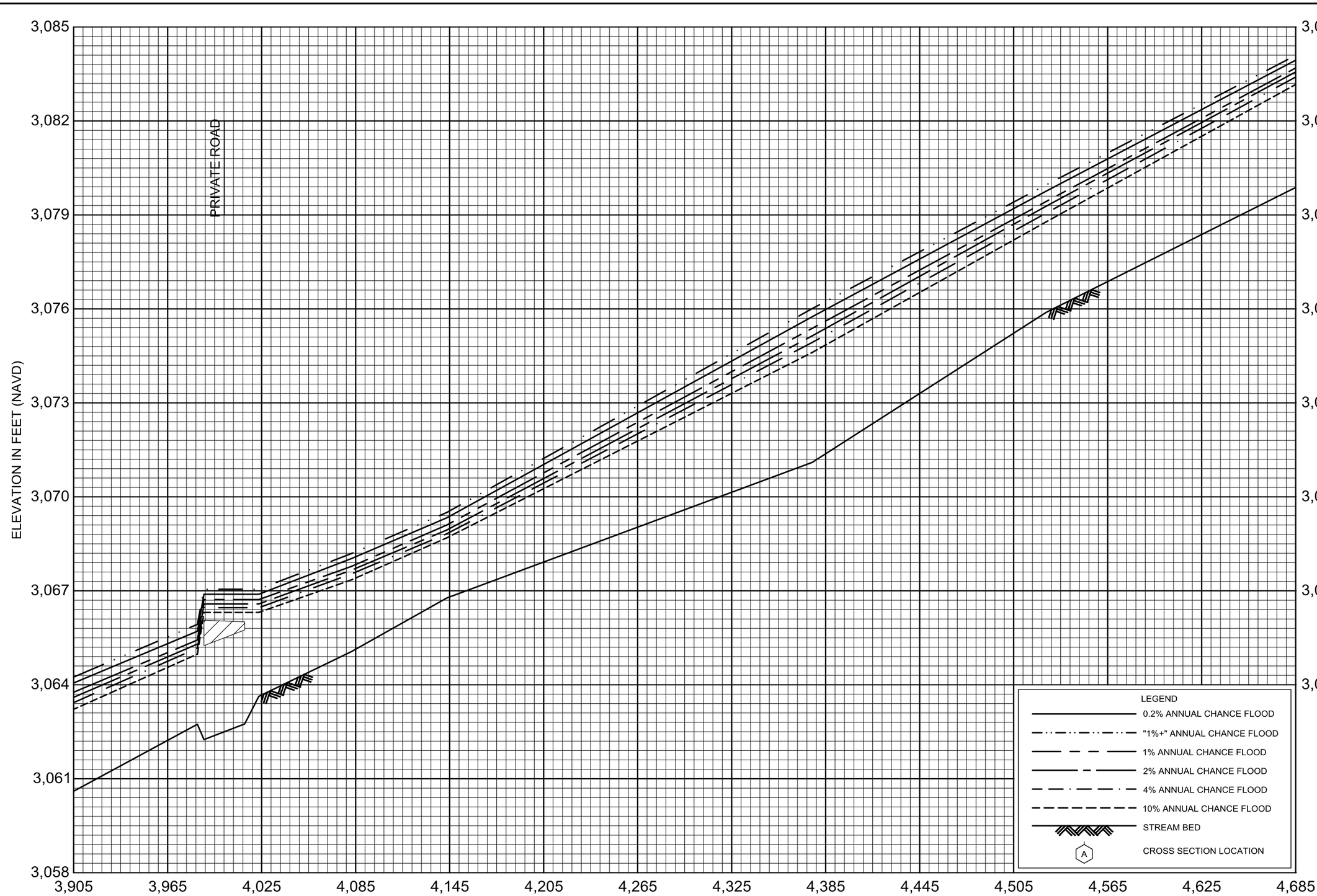
TWIN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

05P



FLOOD PROFILES

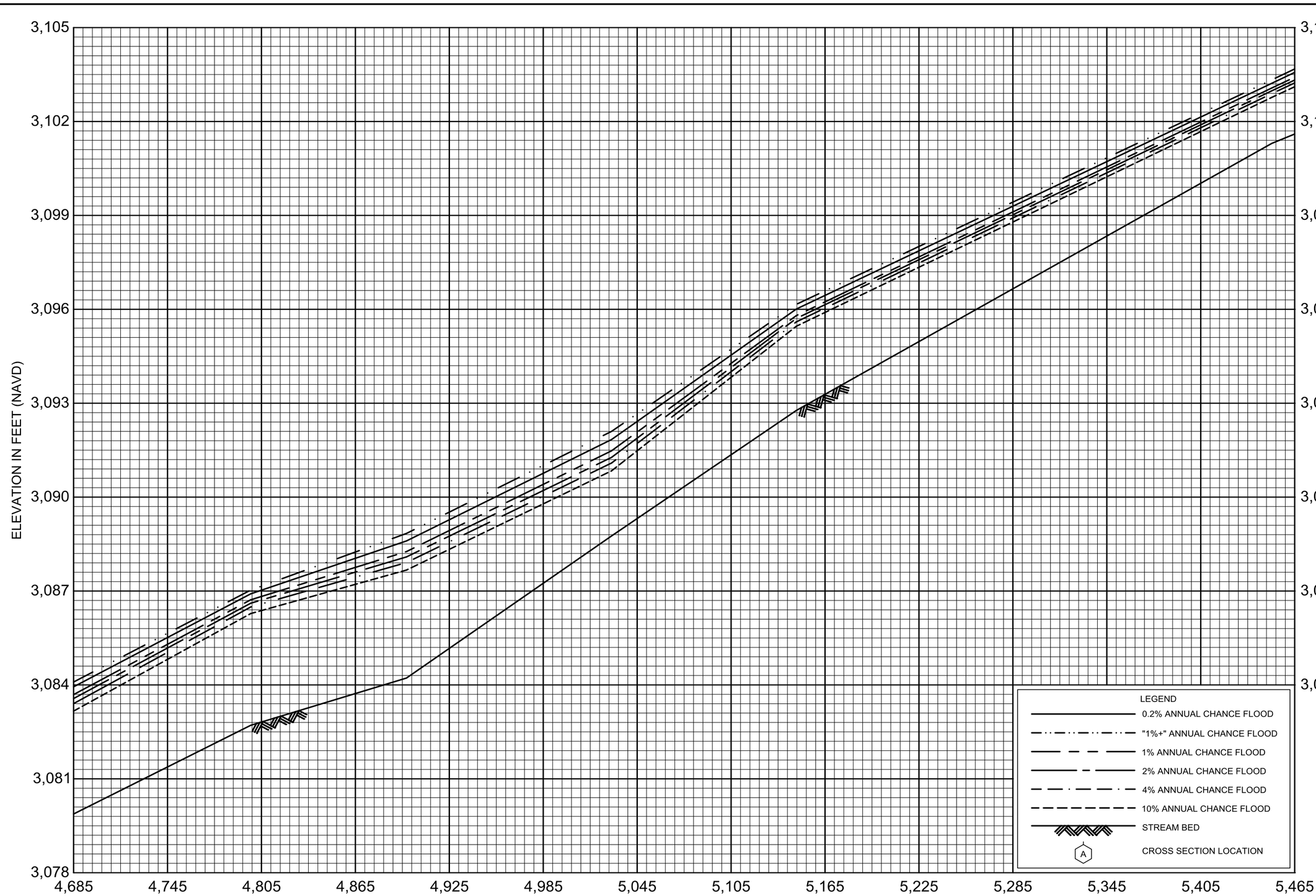
TWIN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

06P



FLOOD PROFILES

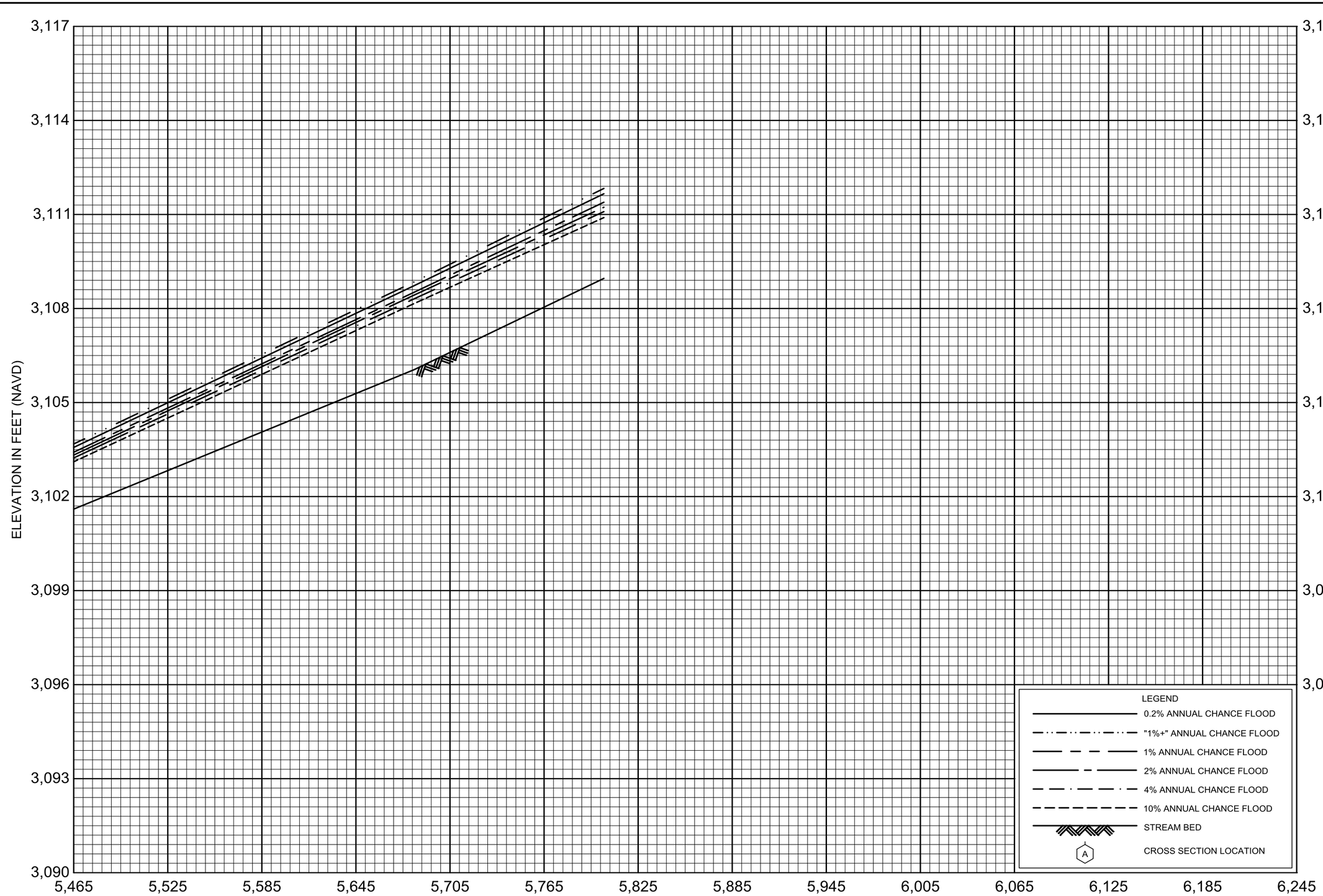
TWIN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

07P



FLOOD PROFILES

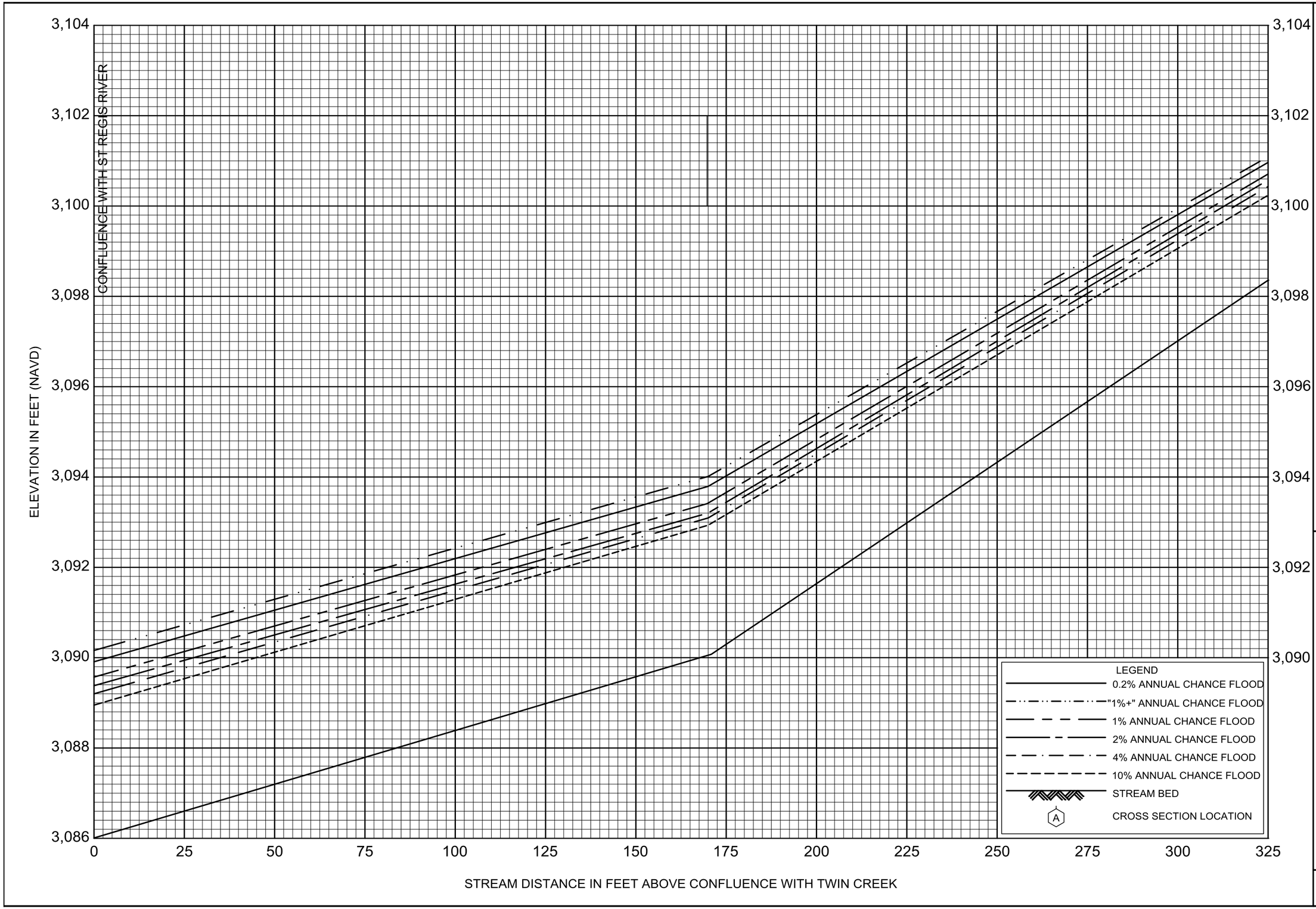
TWIN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

08P



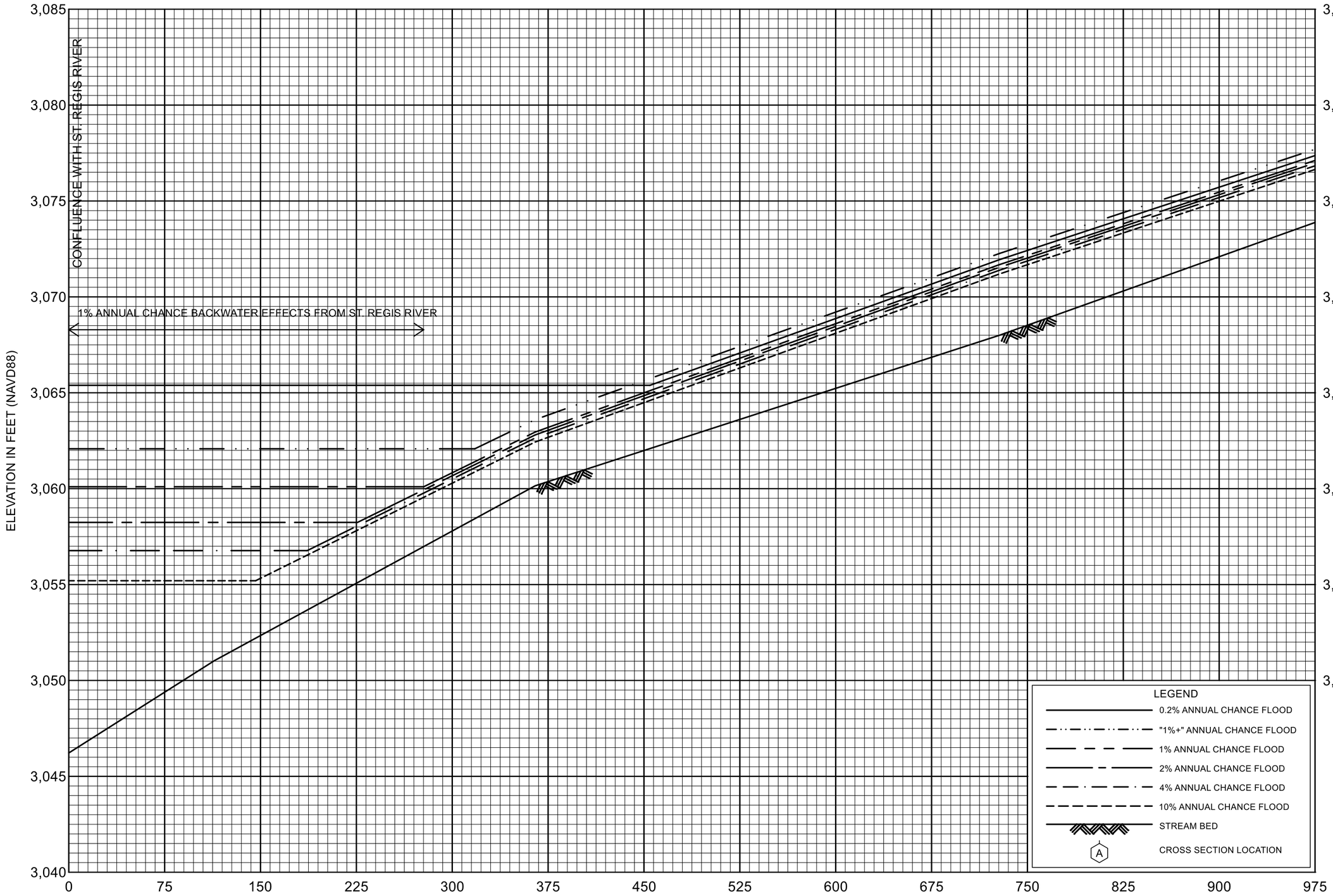
FLOOD PROFILES

EAST FORK TWIN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

01P



FLOOD PROFILES

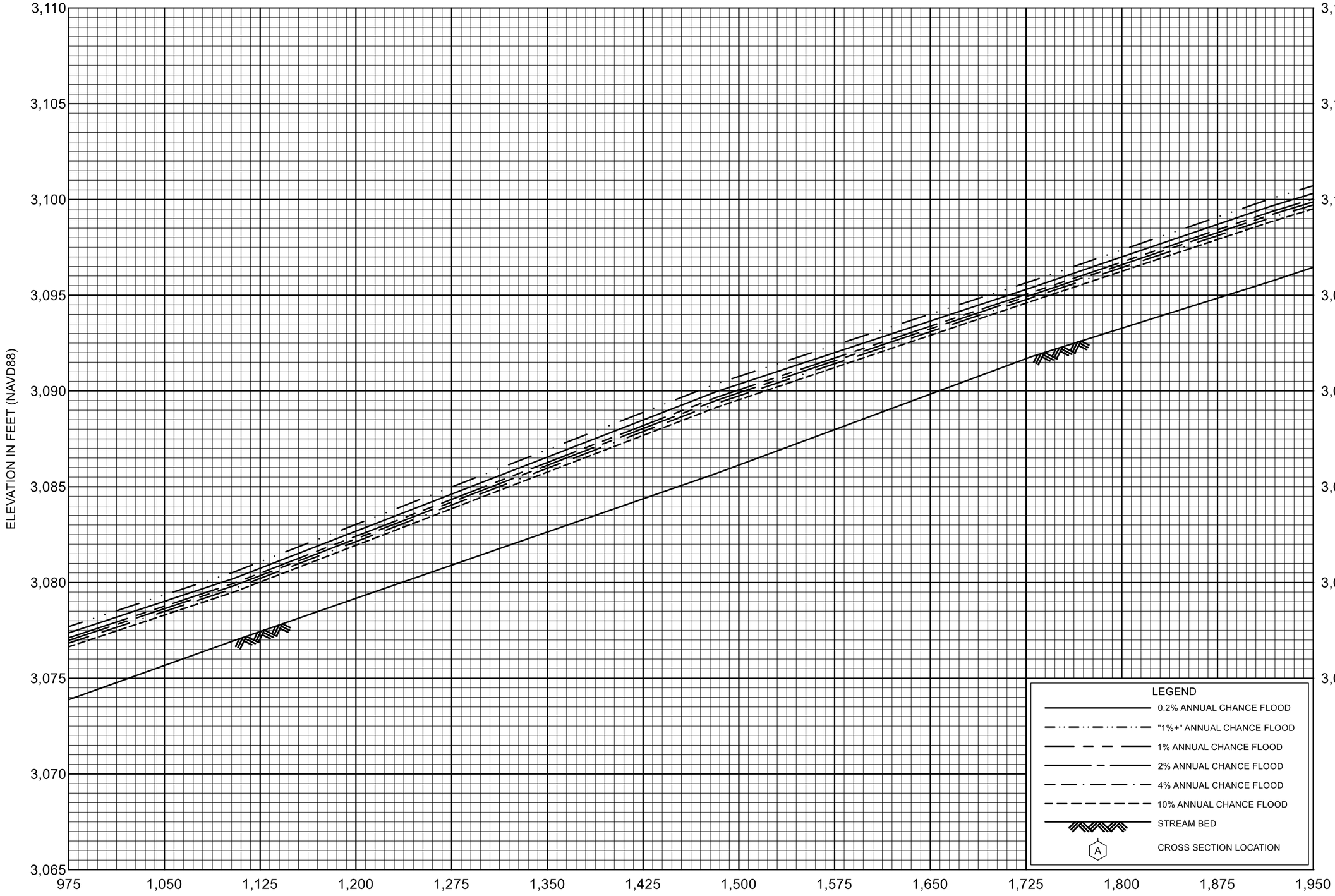
DEER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

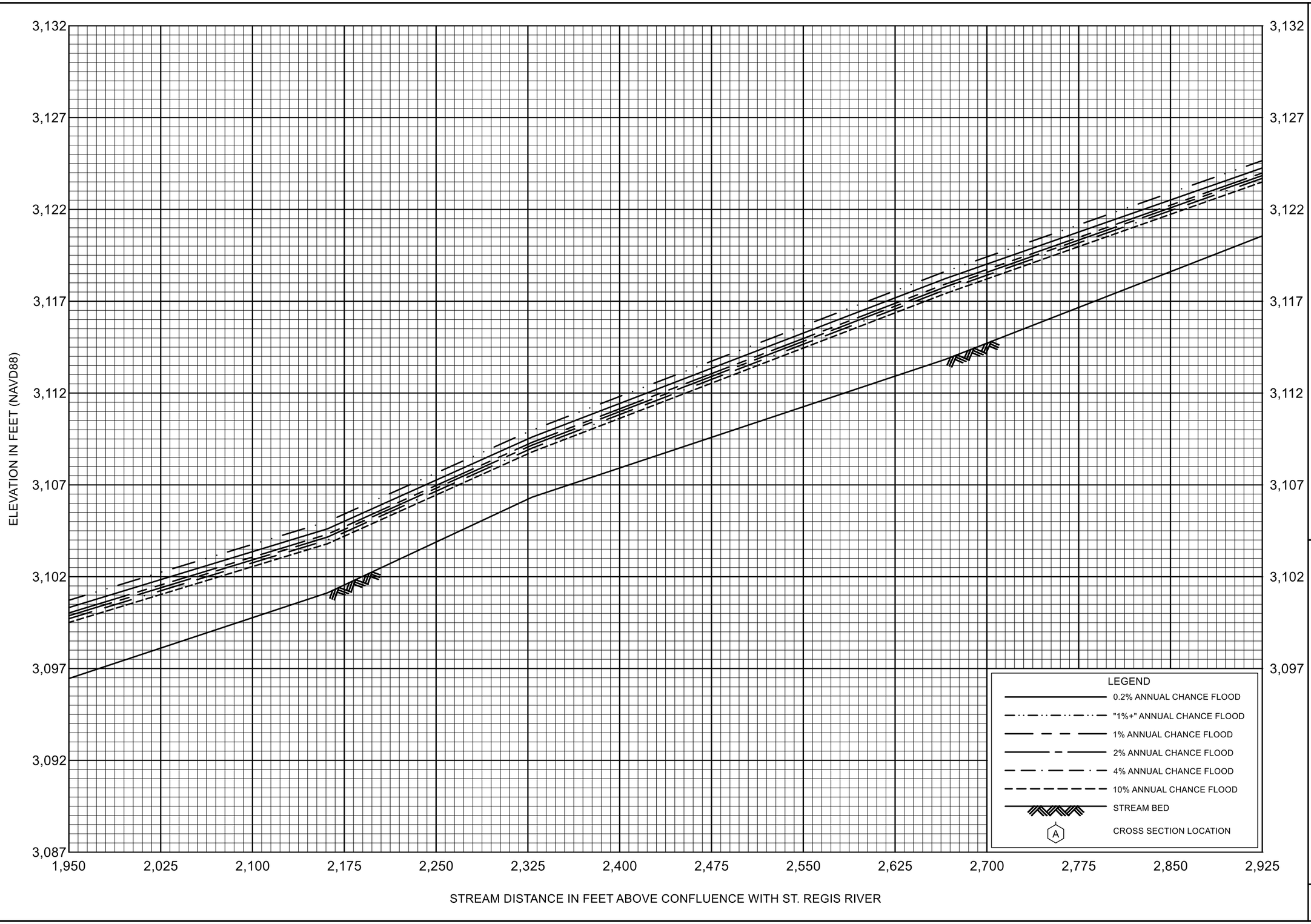
DEER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

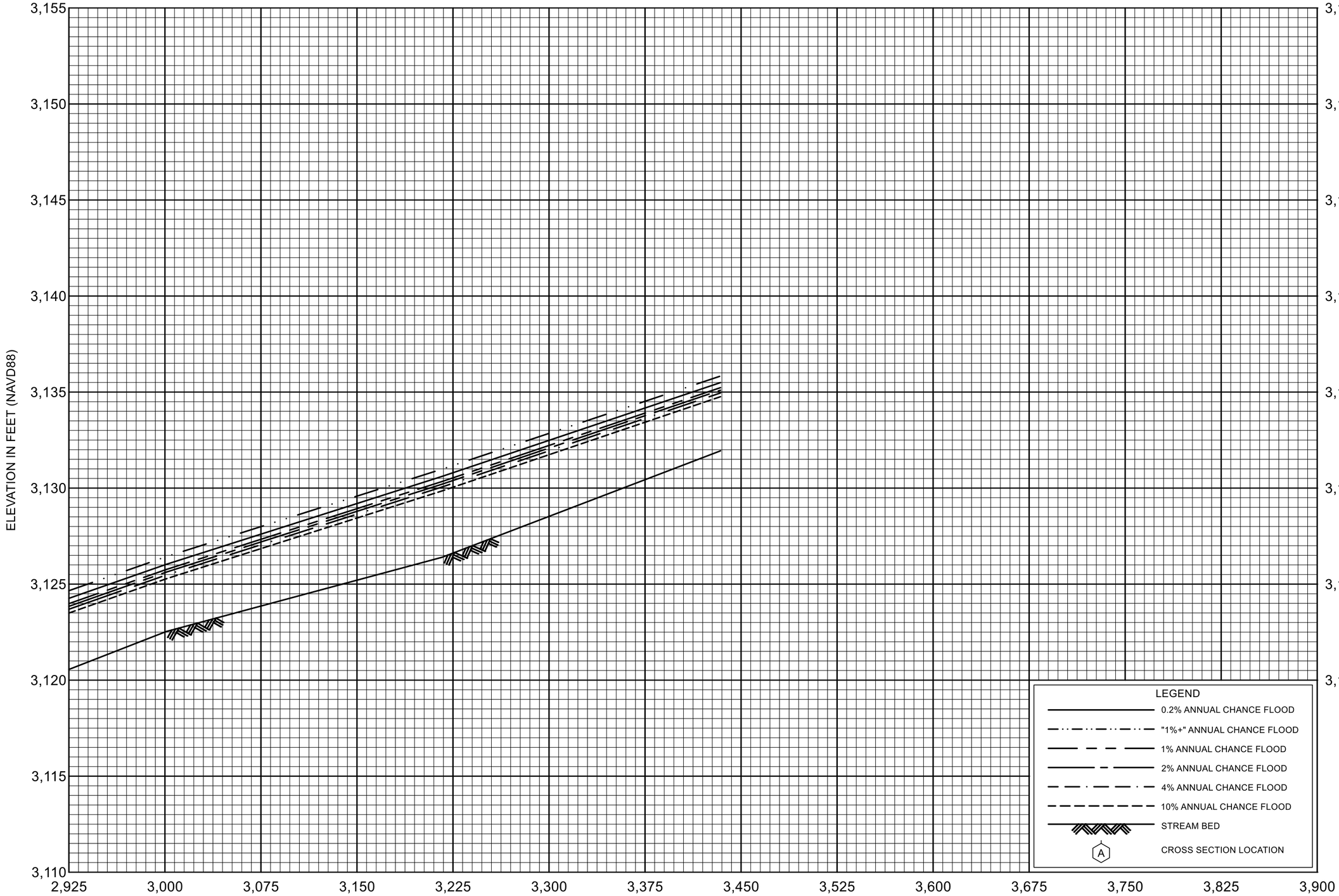
DEER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

03P



FLOOD PROFILES

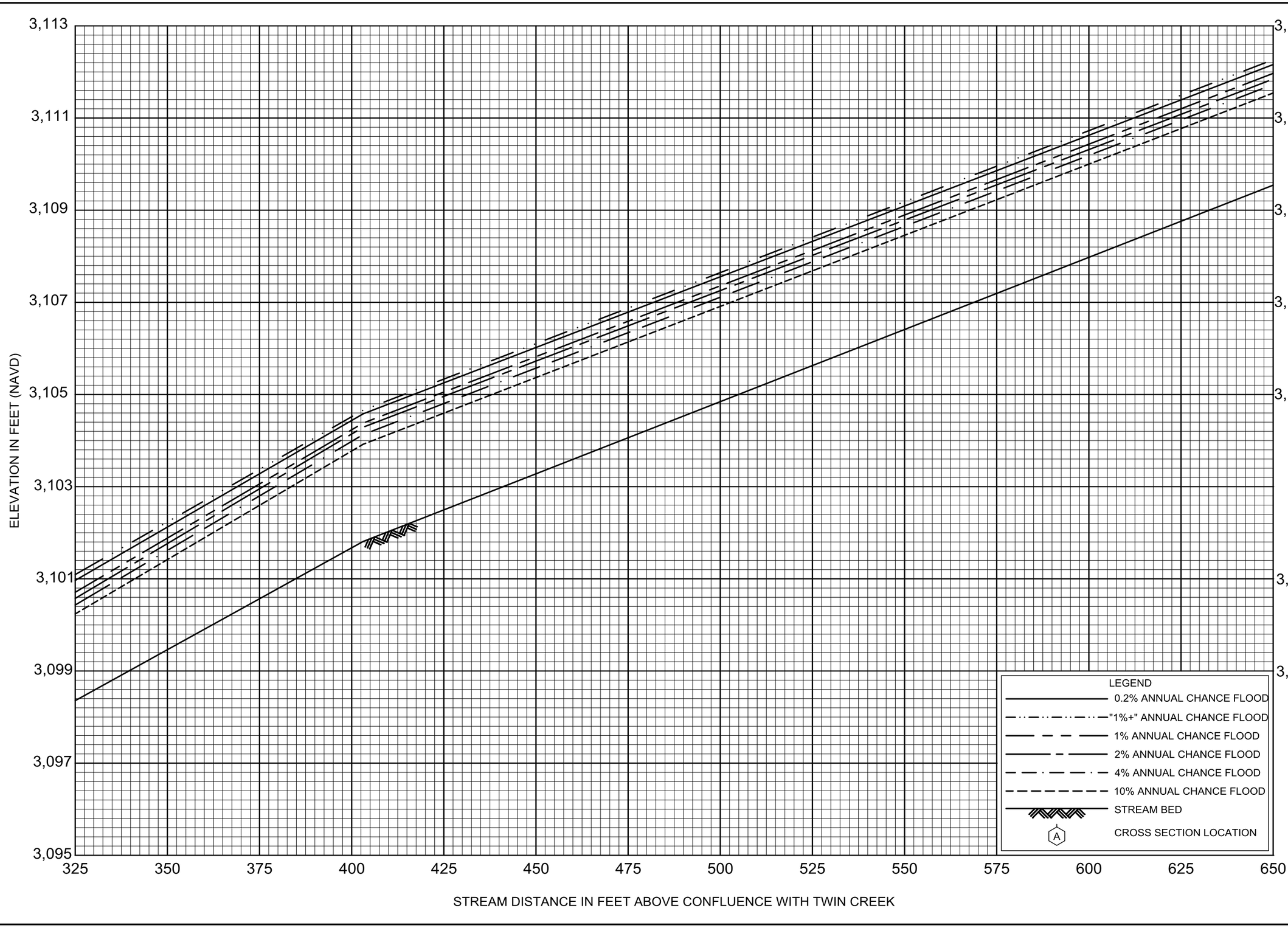
DEER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

04P



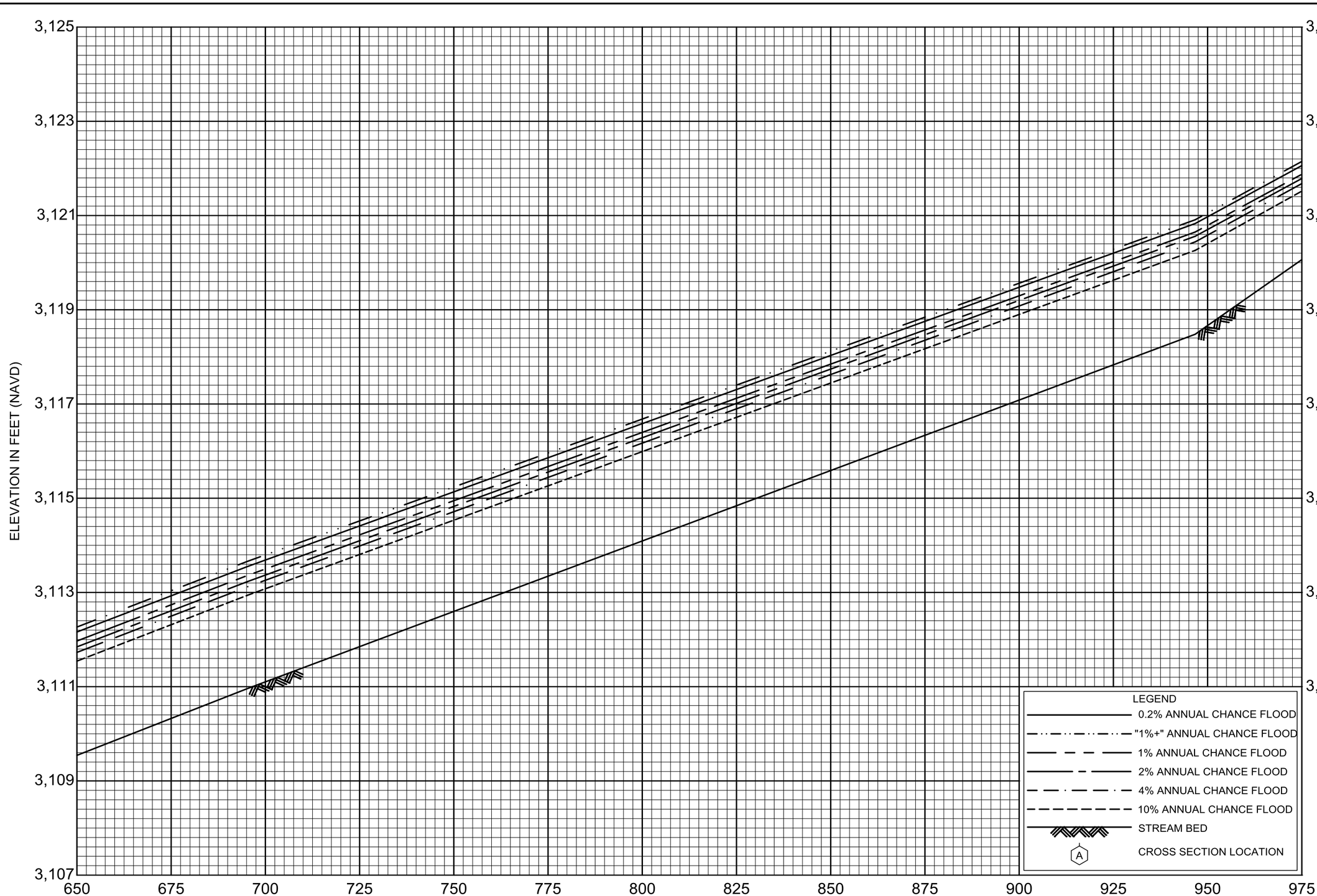
FLOOD PROFILES

EAST FORK TWIN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

02P



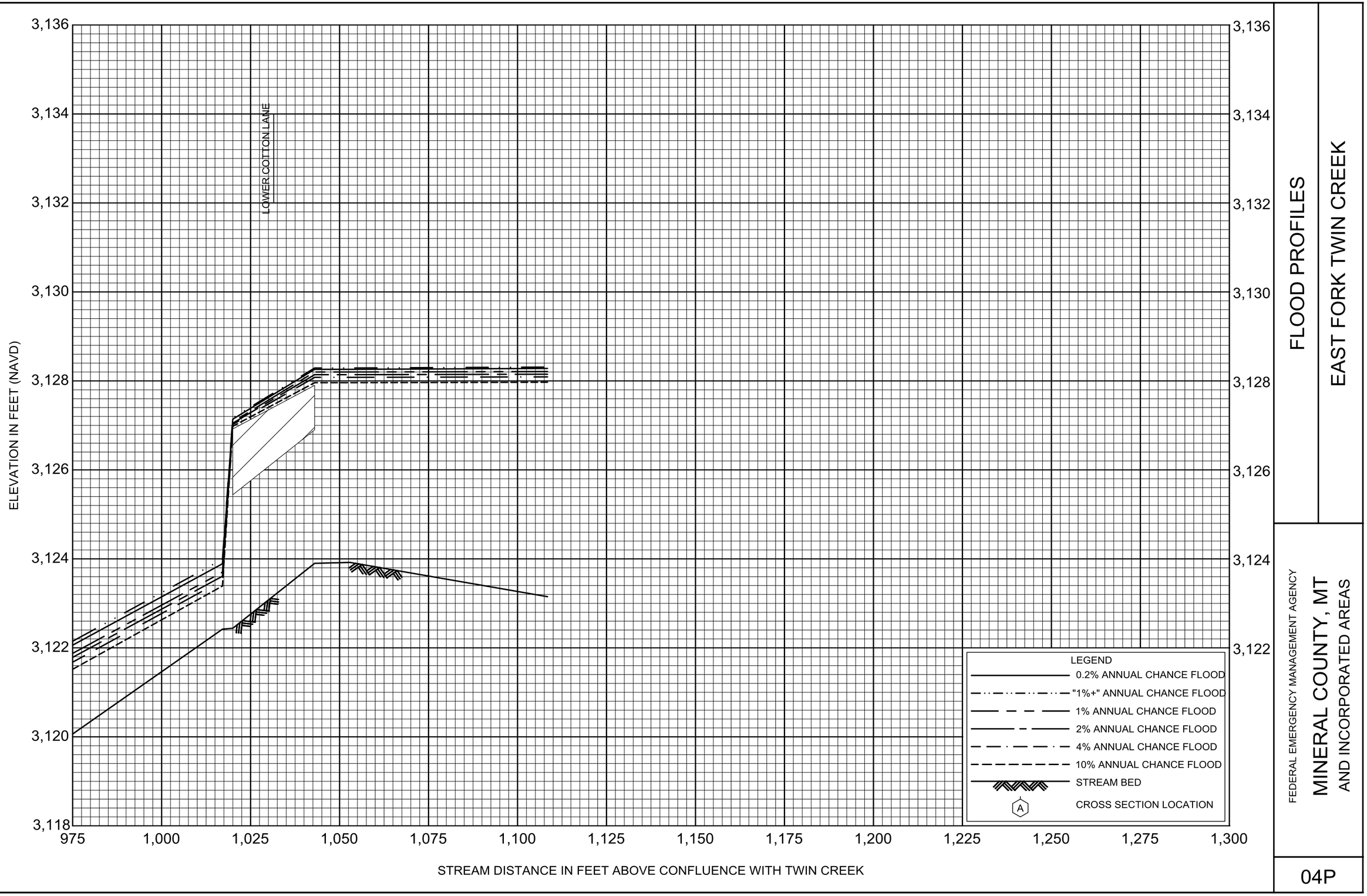
FLOOD PROFILES

EAST FORK TWIN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

03P



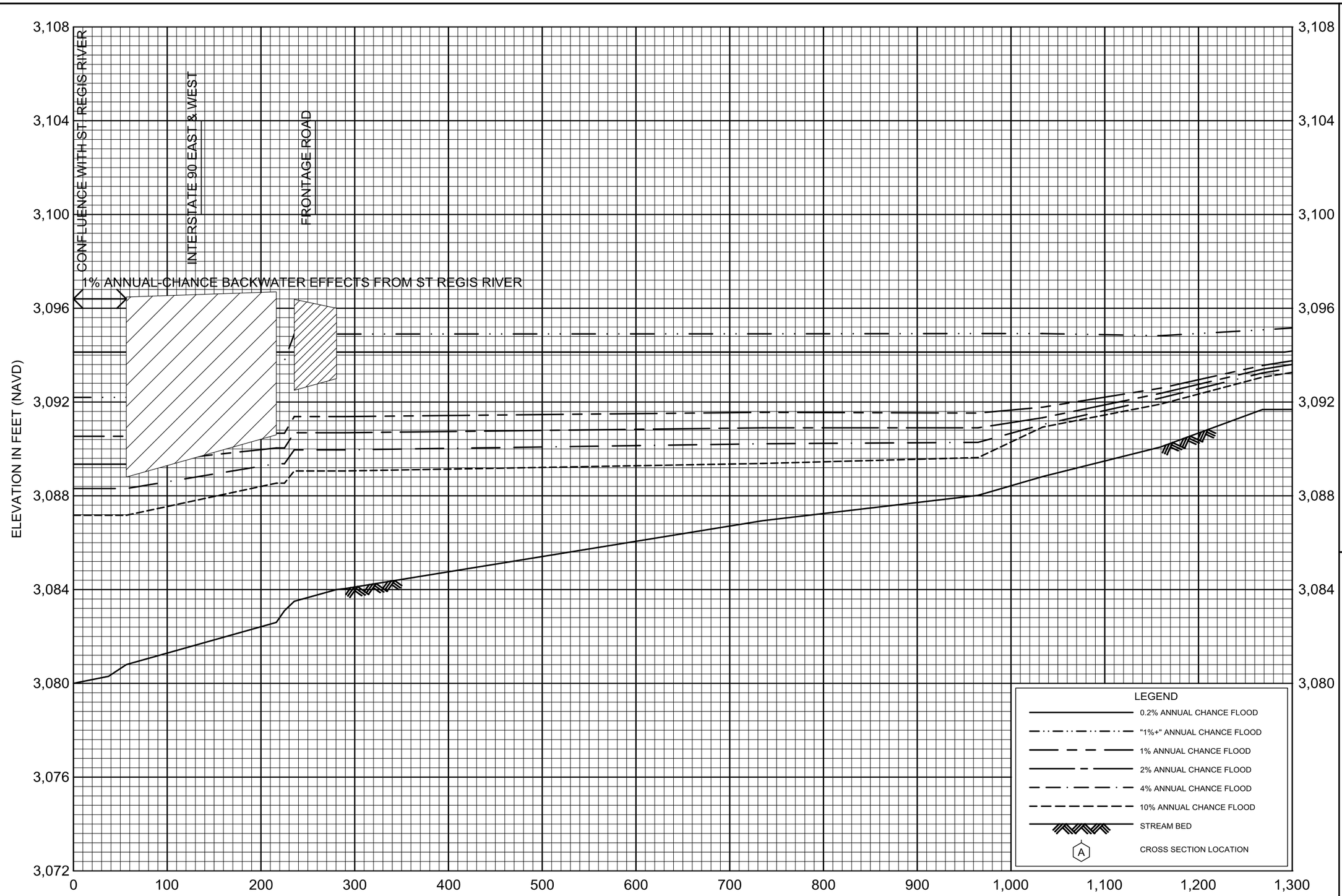
FLOOD PROFILES

EAST FORK TWIN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

04P



FLOOD PROFILES

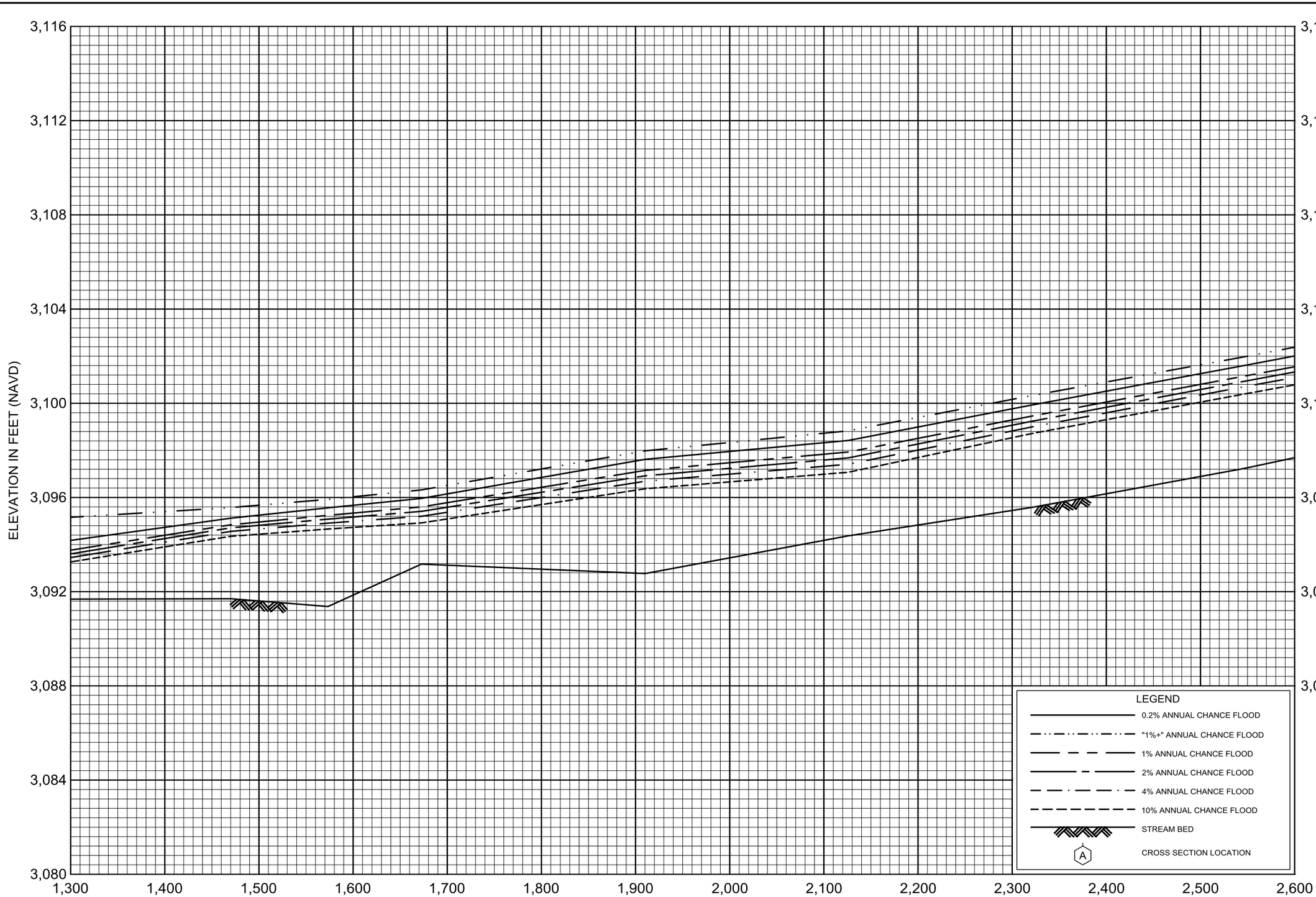
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

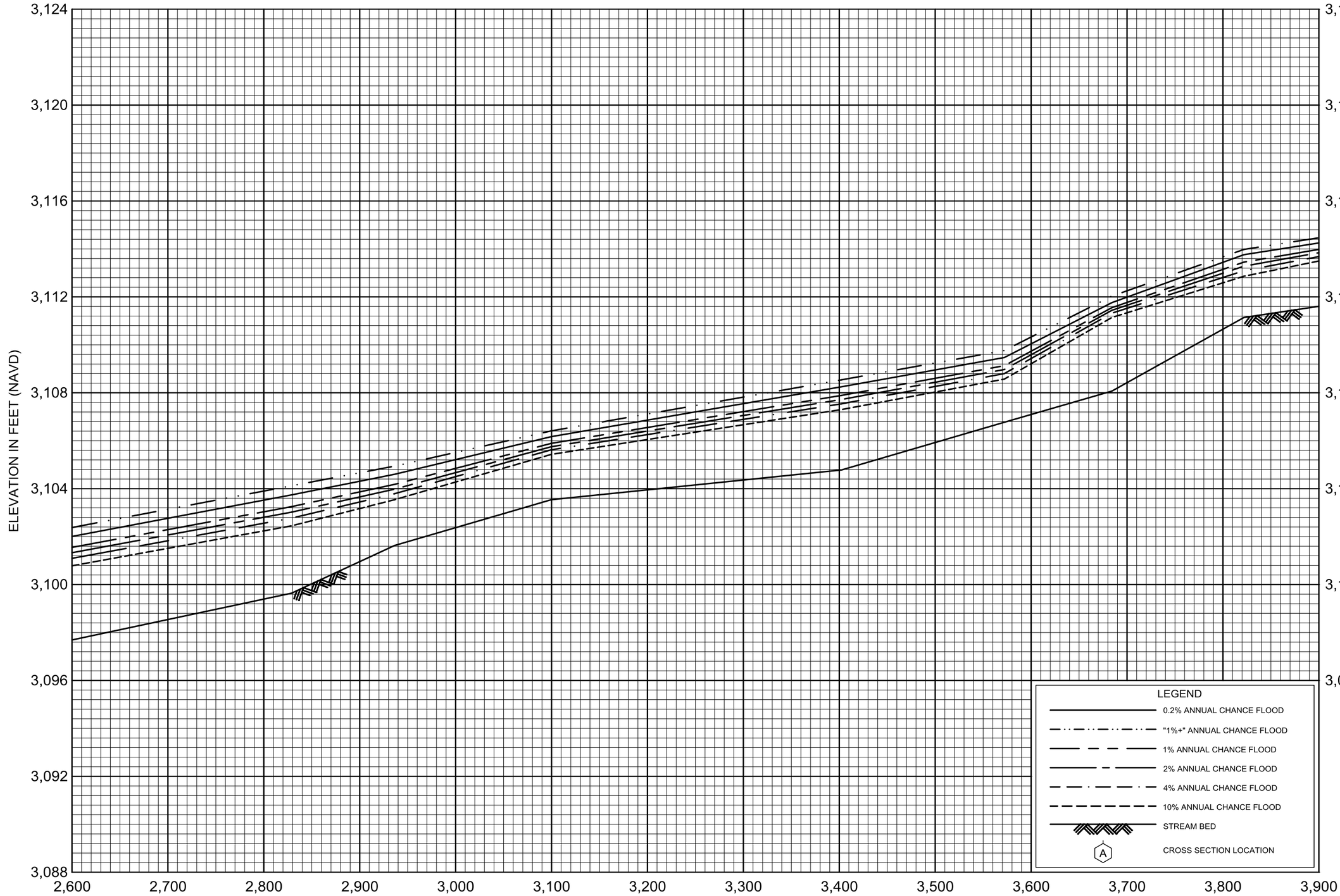
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

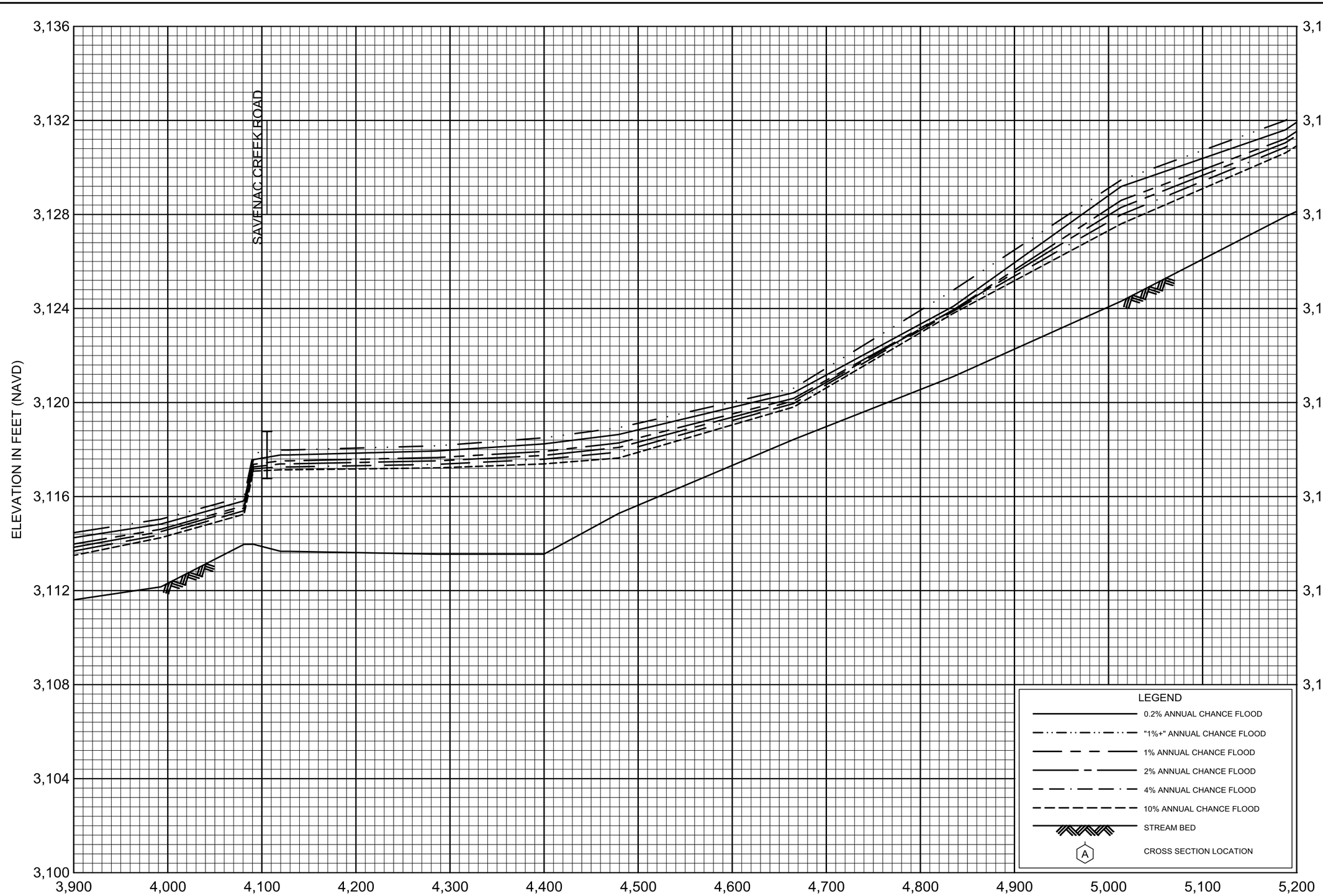
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

03P



FLOOD PROFILES

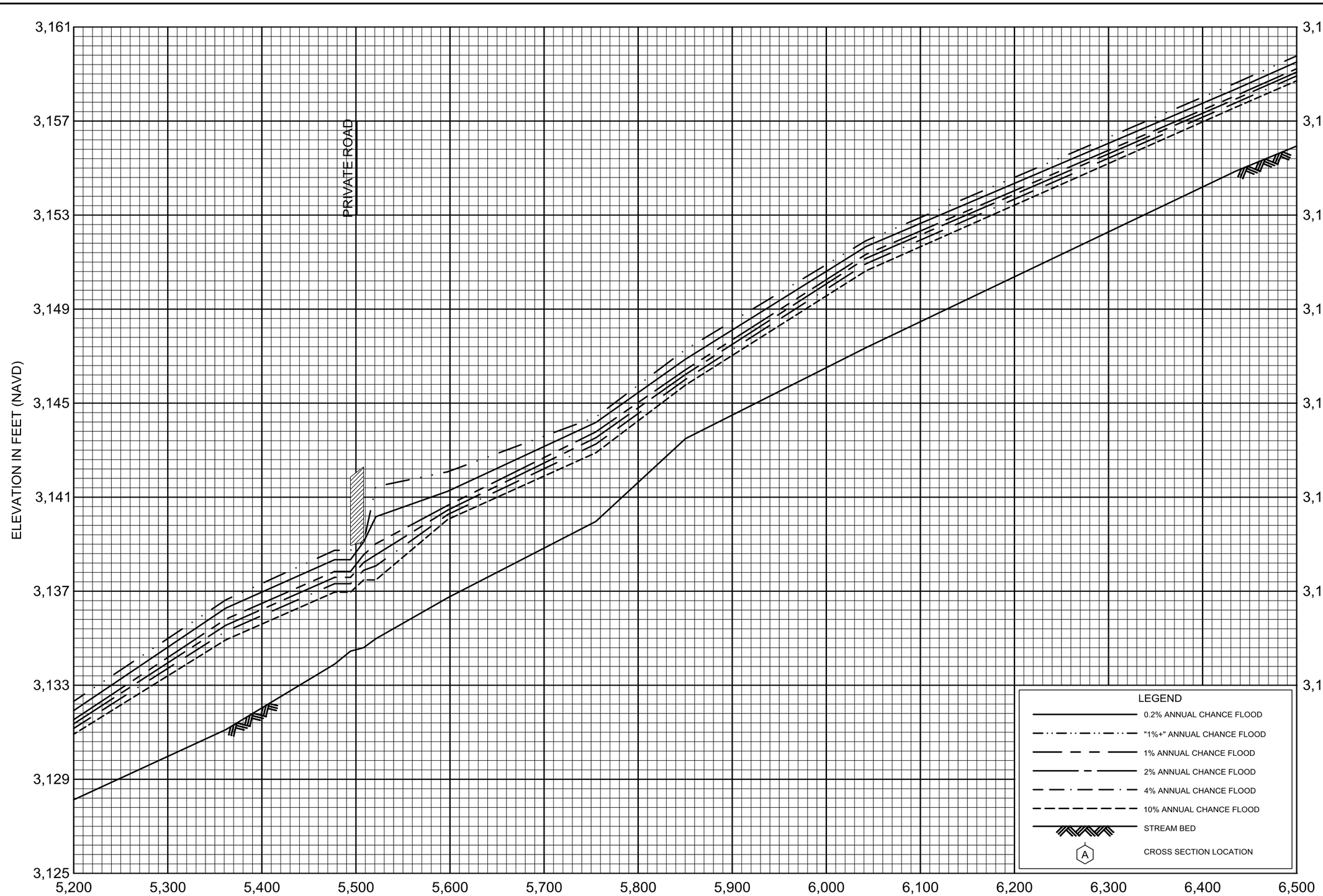
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

04P



FLOOD PROFILES

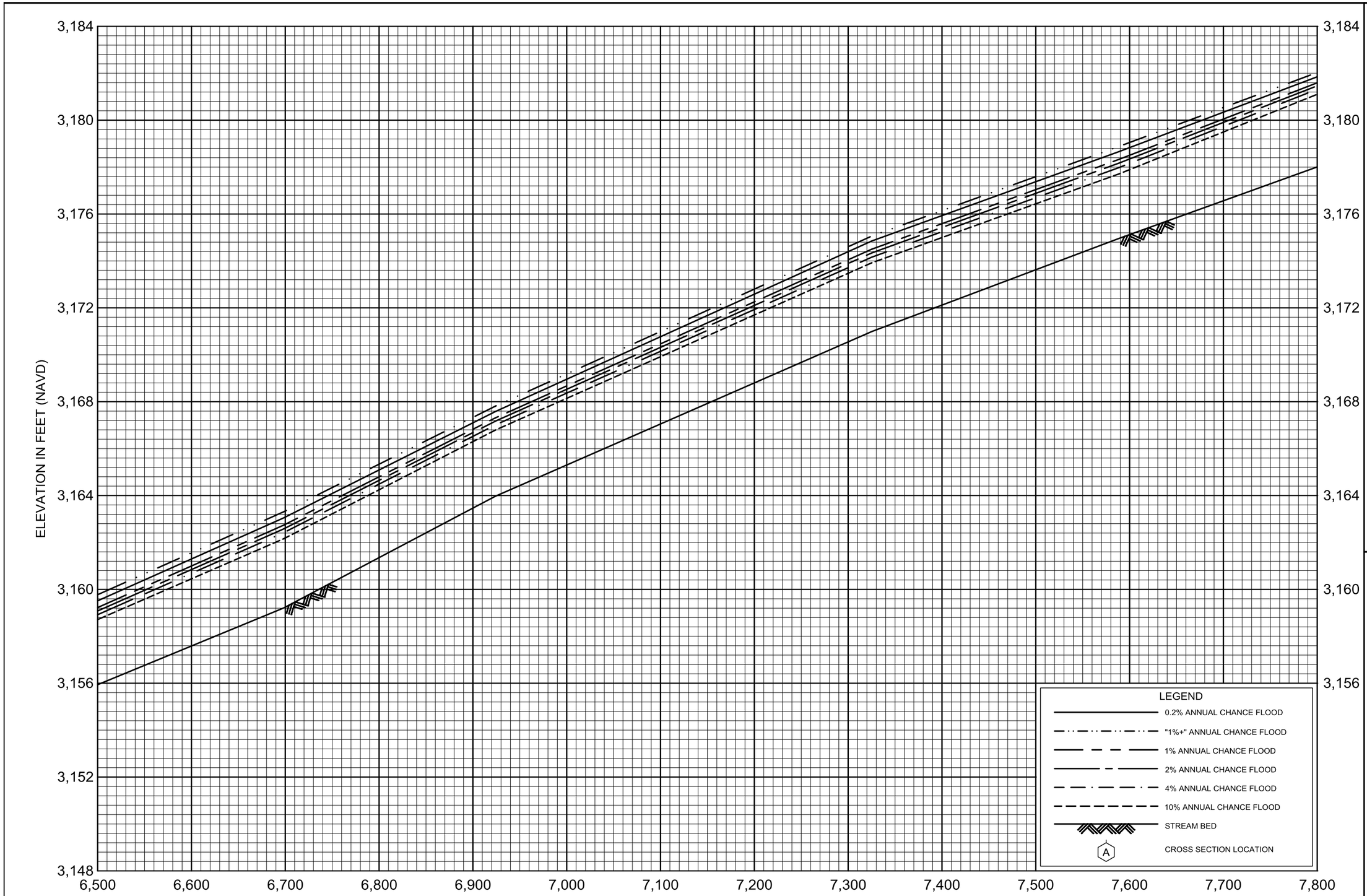
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

05P



FLOOD PROFILES

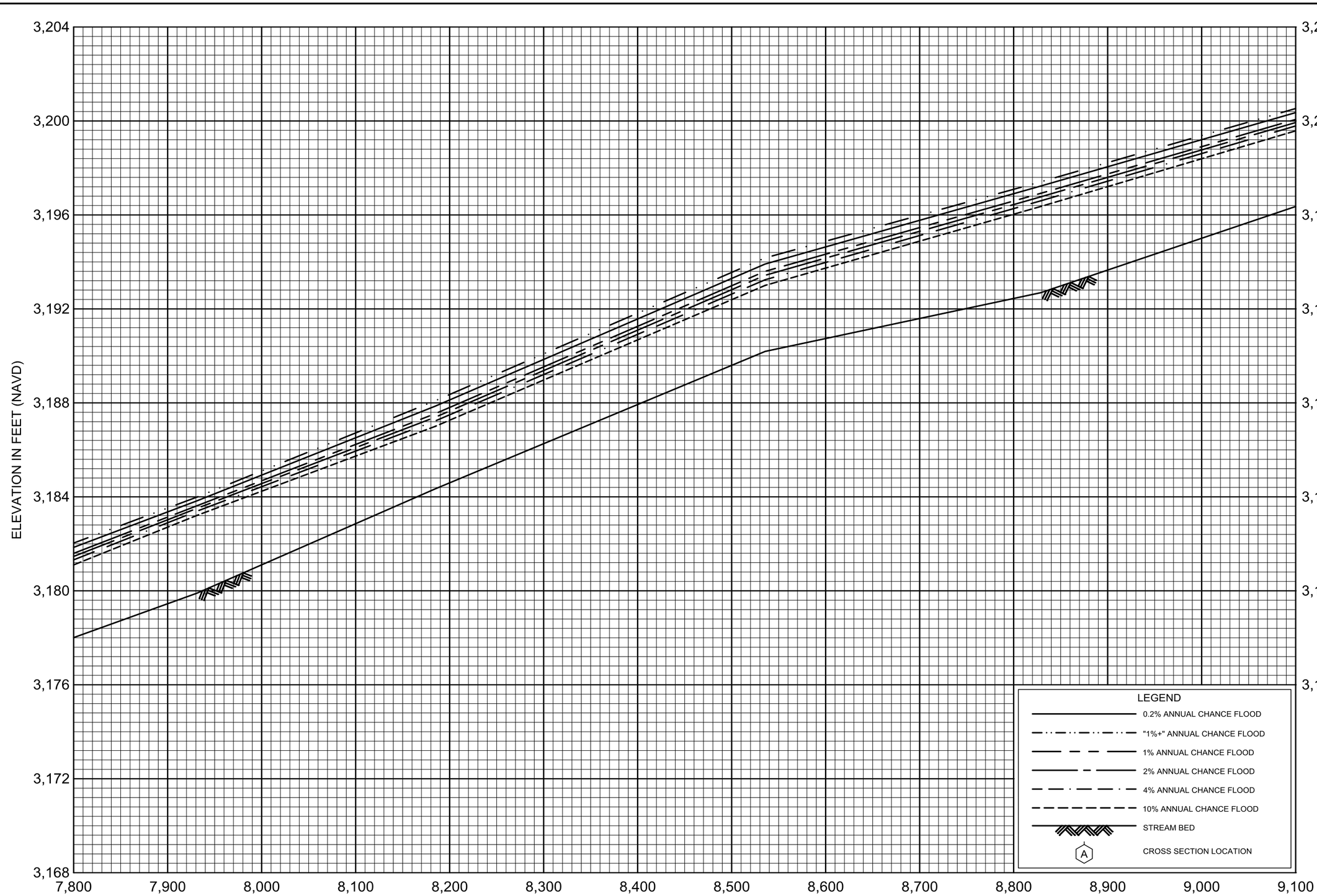
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

06P



FLOOD PROFILES

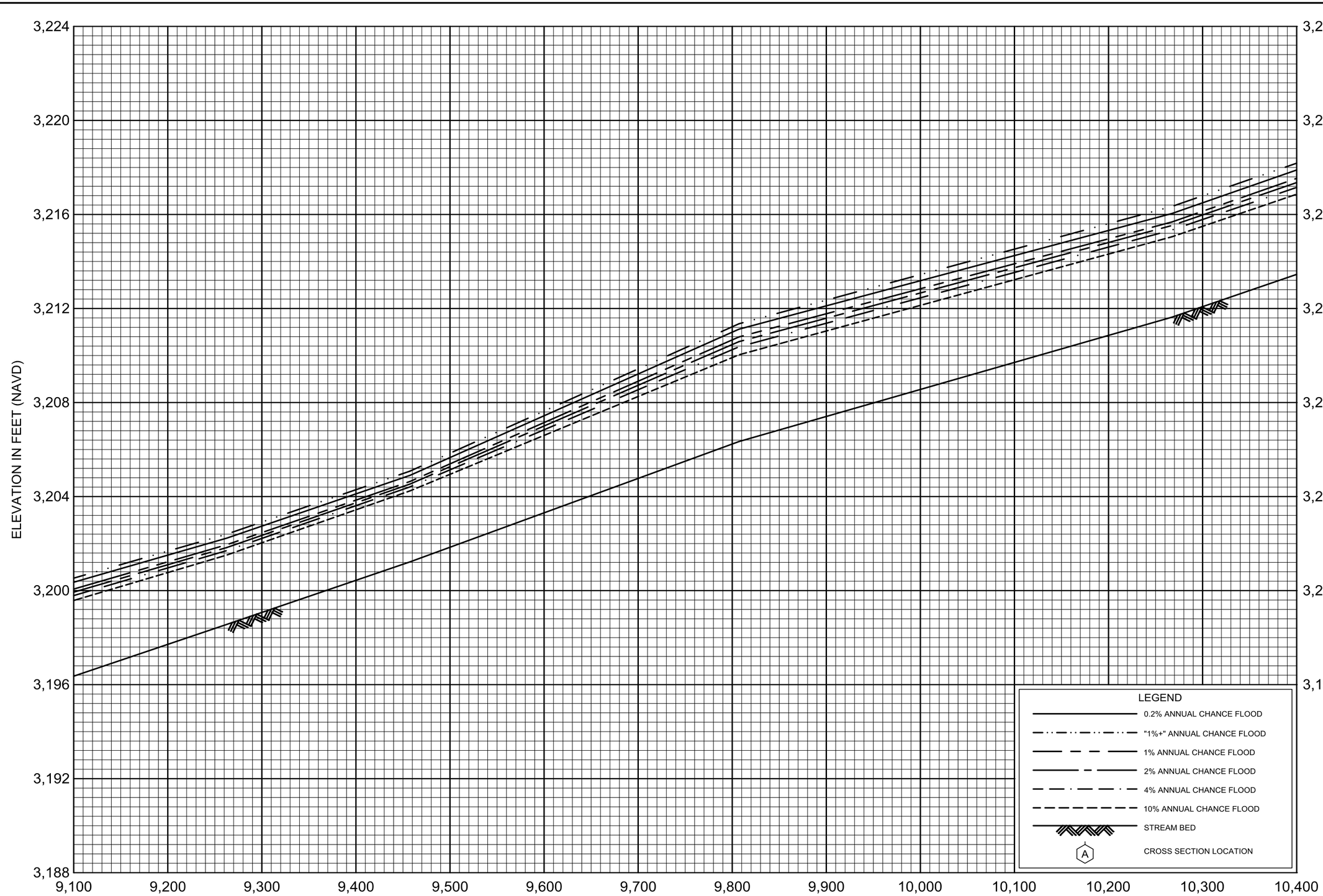
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

07P



FLOOD PROFILES

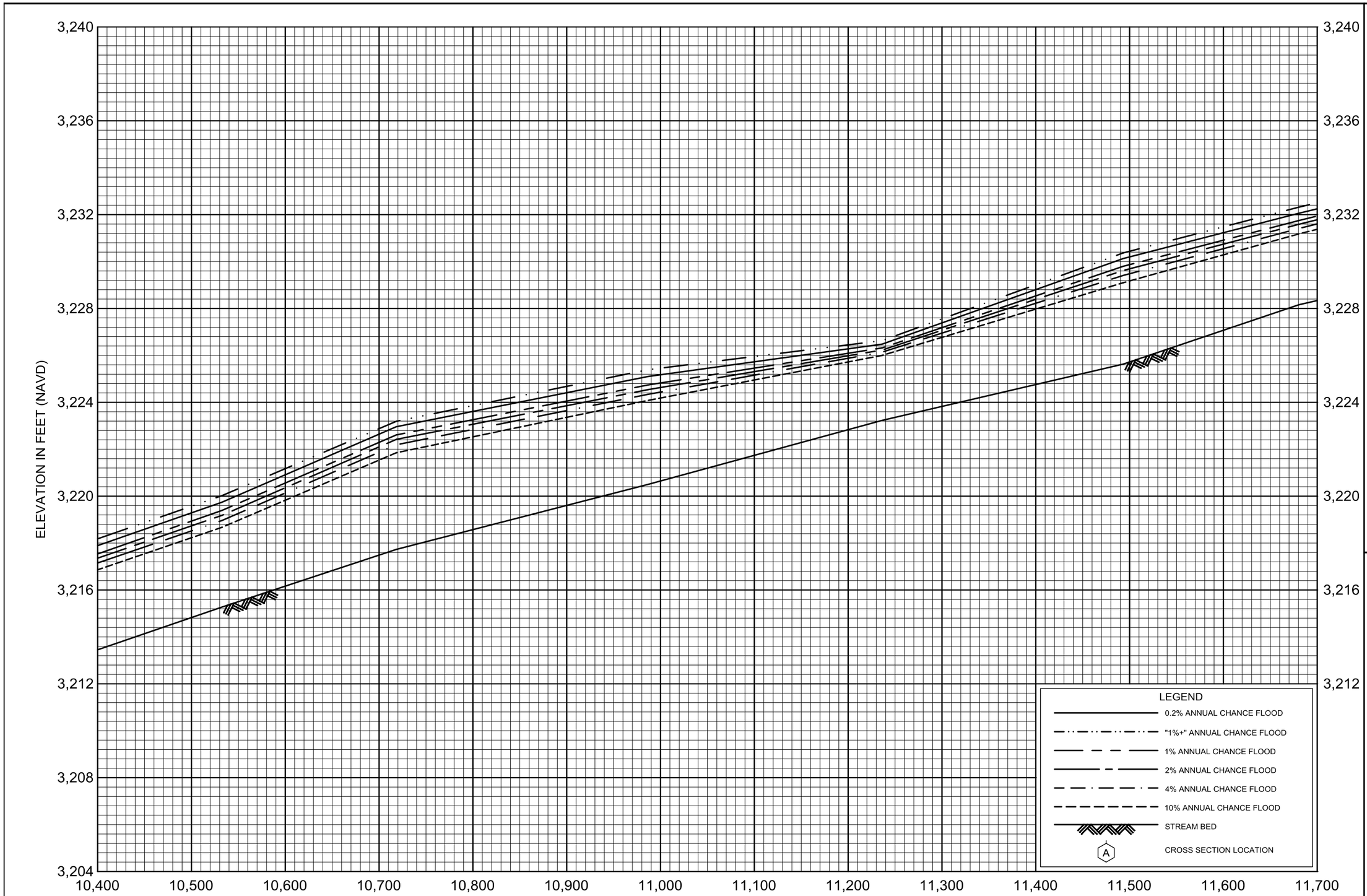
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

08P



FLOOD PROFILES

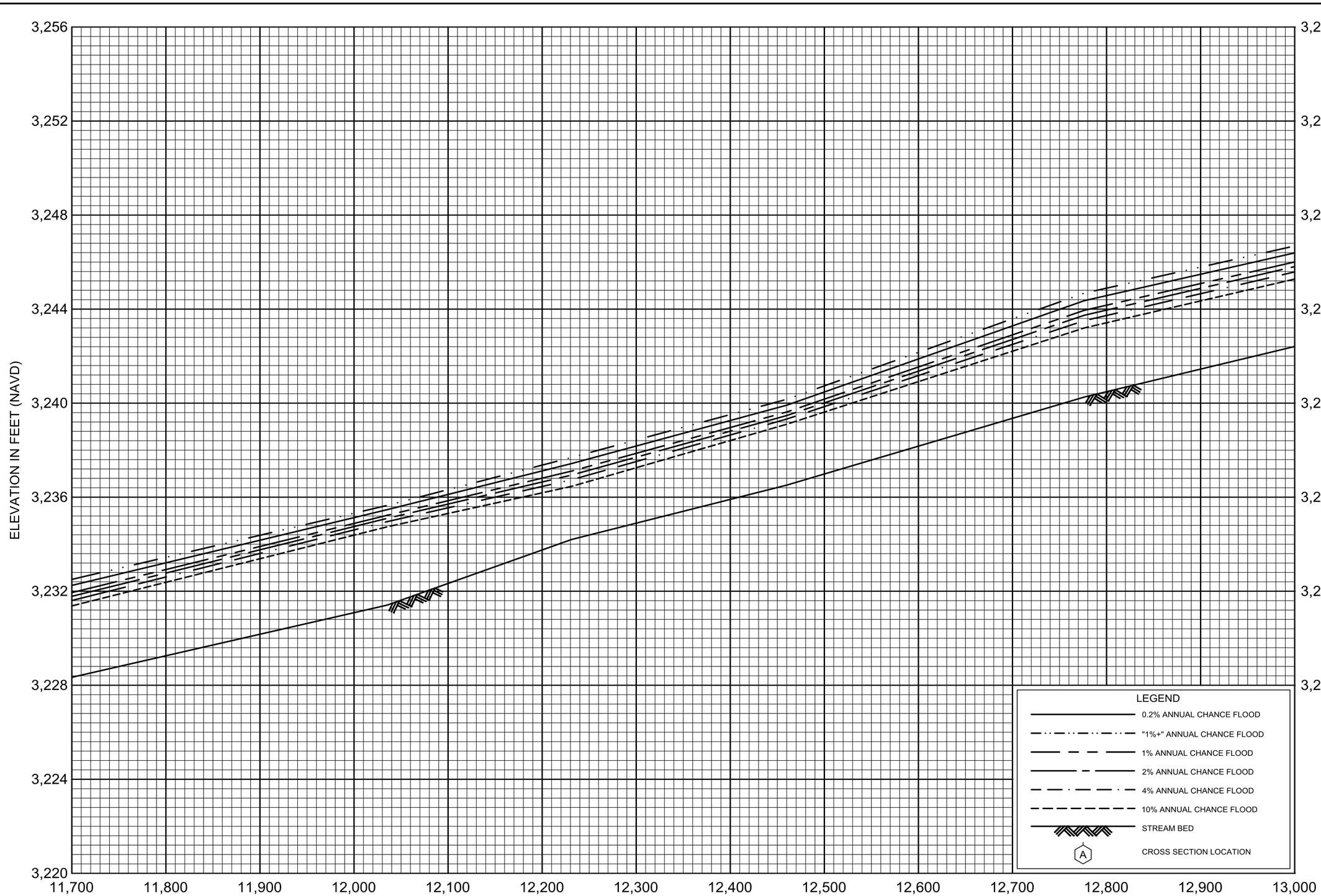
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

09P



FLOOD PROFILES

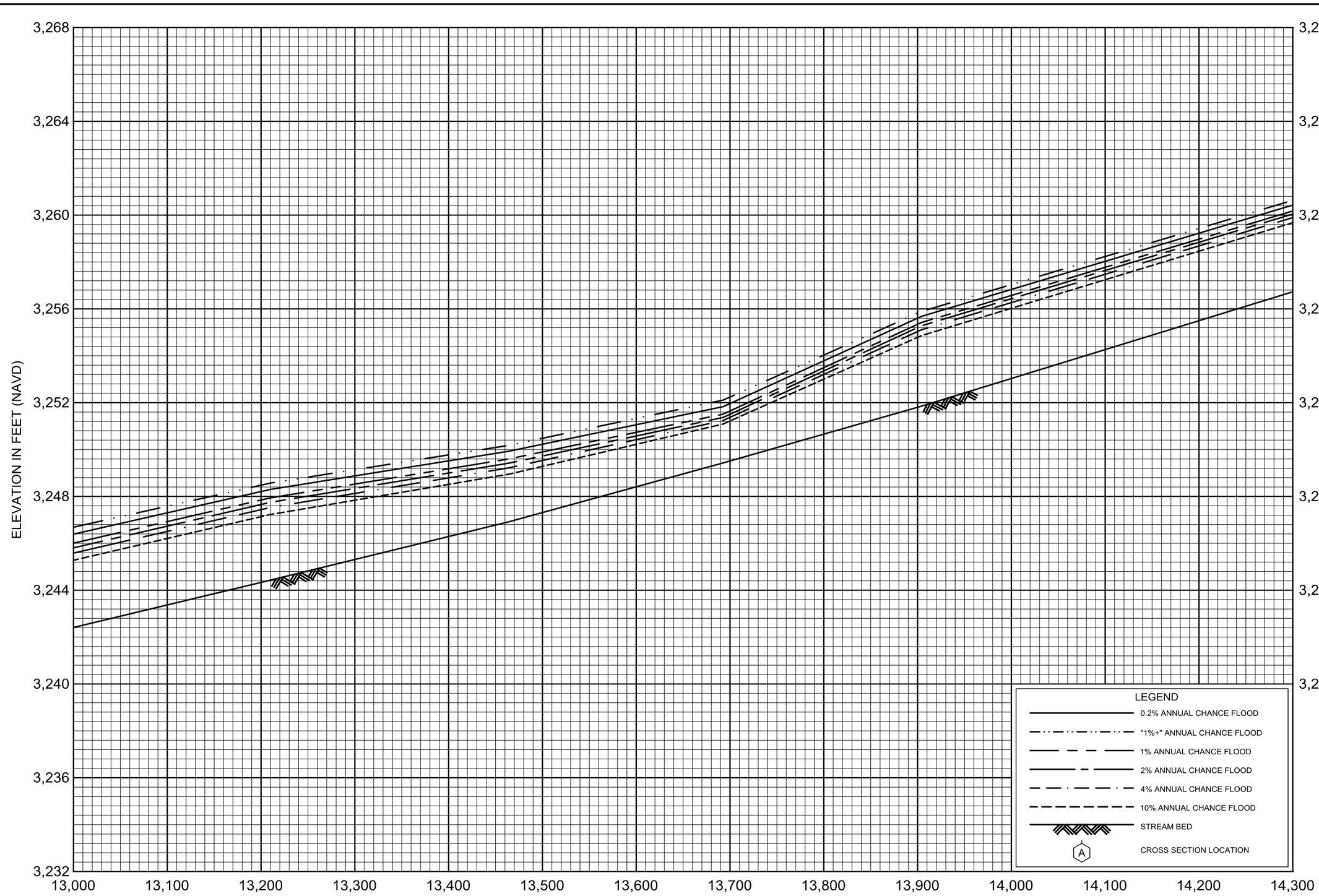
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

10P



FLOOD PROFILES

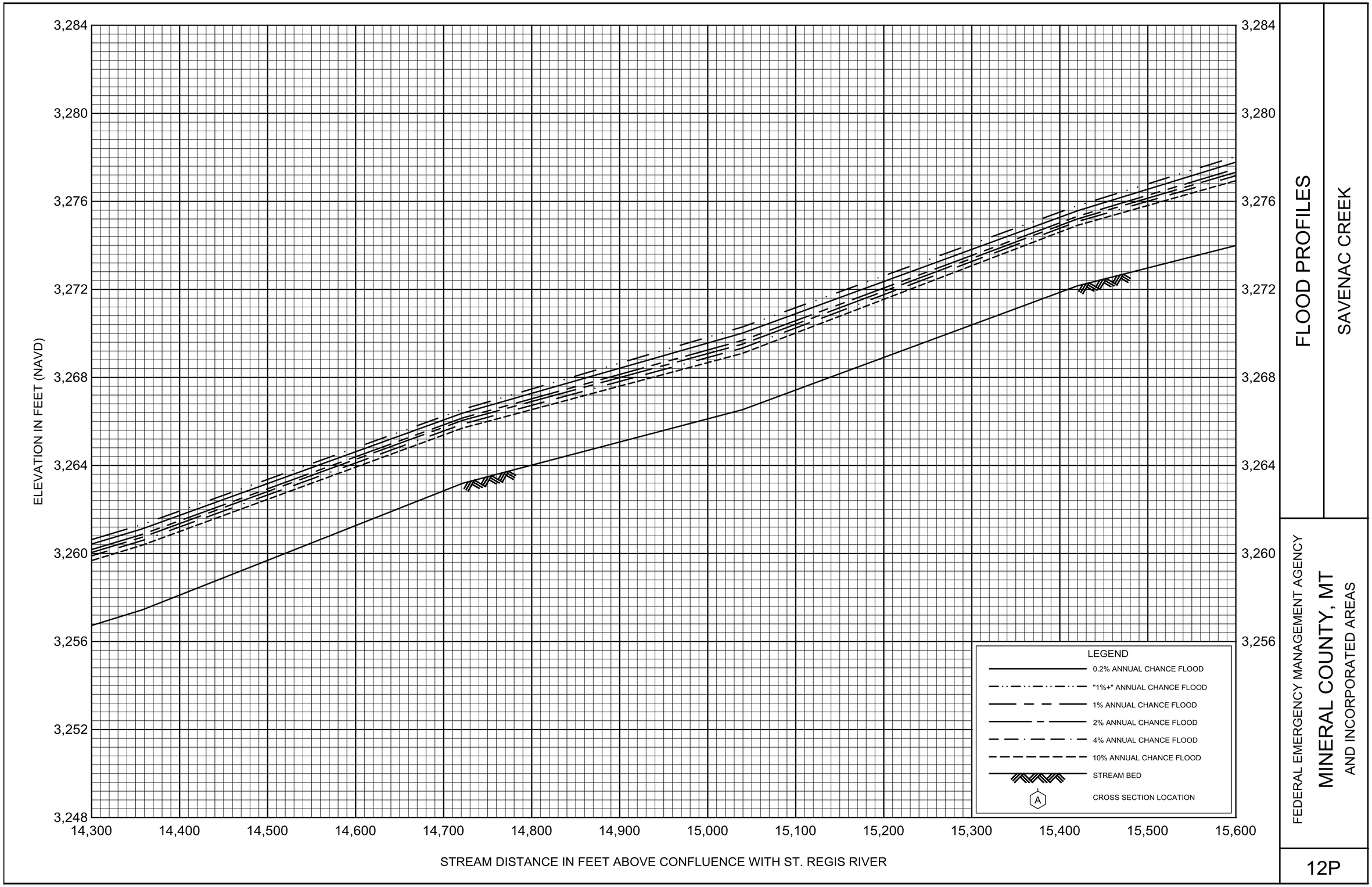
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

11P



FLOOD PROFILES

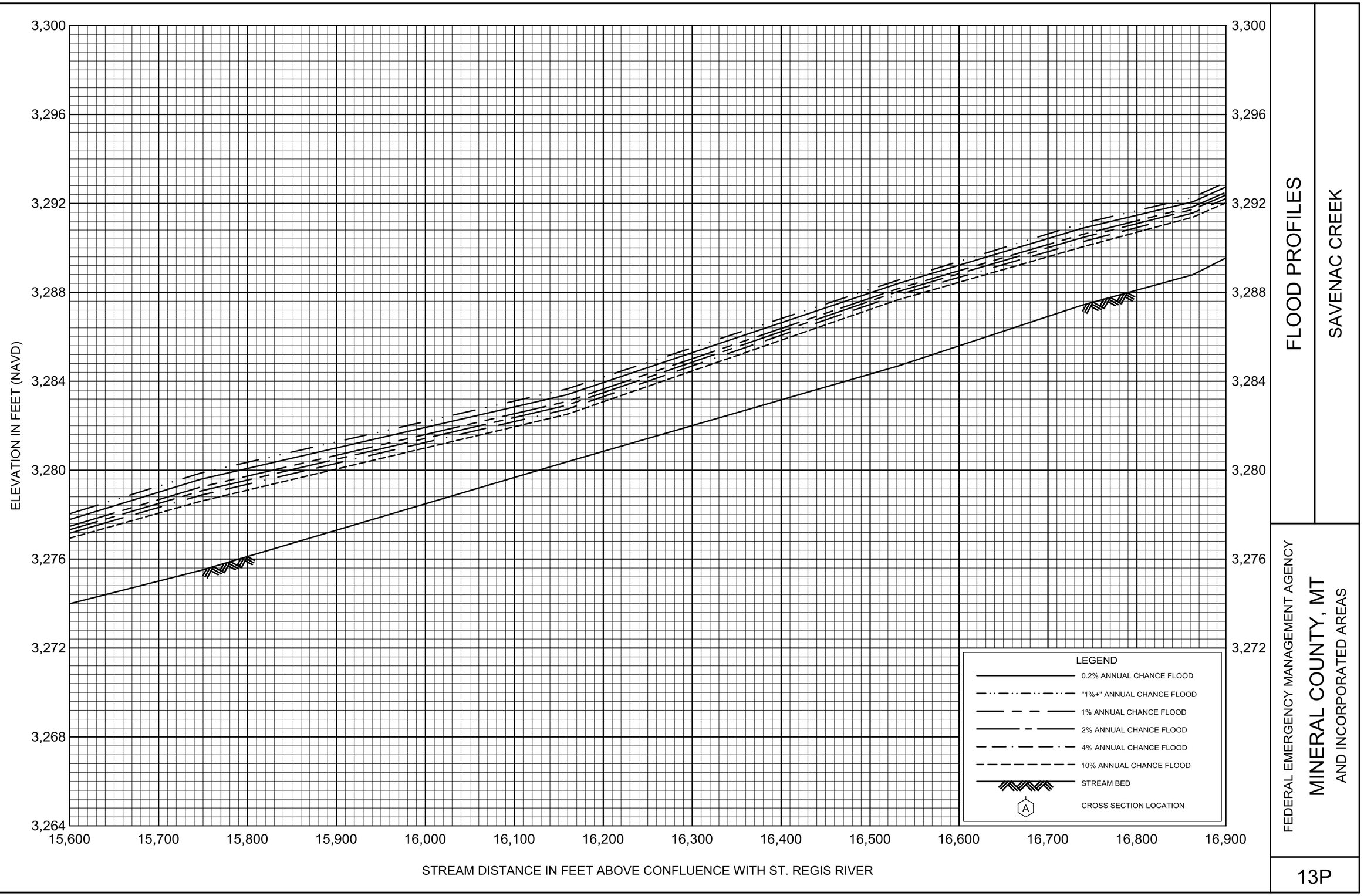
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

12P



FLOOD PROFILES

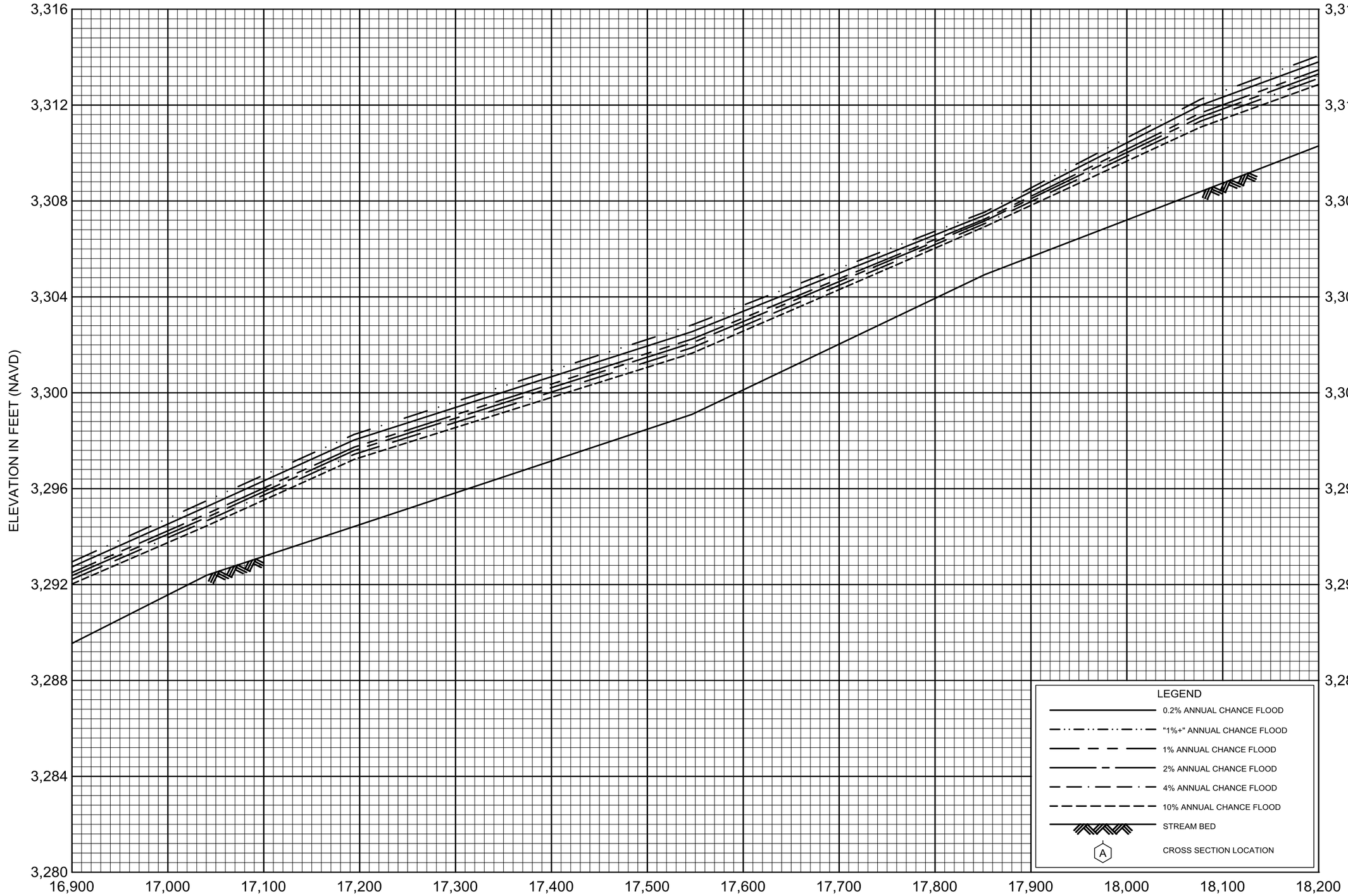
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

13P



FLOOD PROFILES

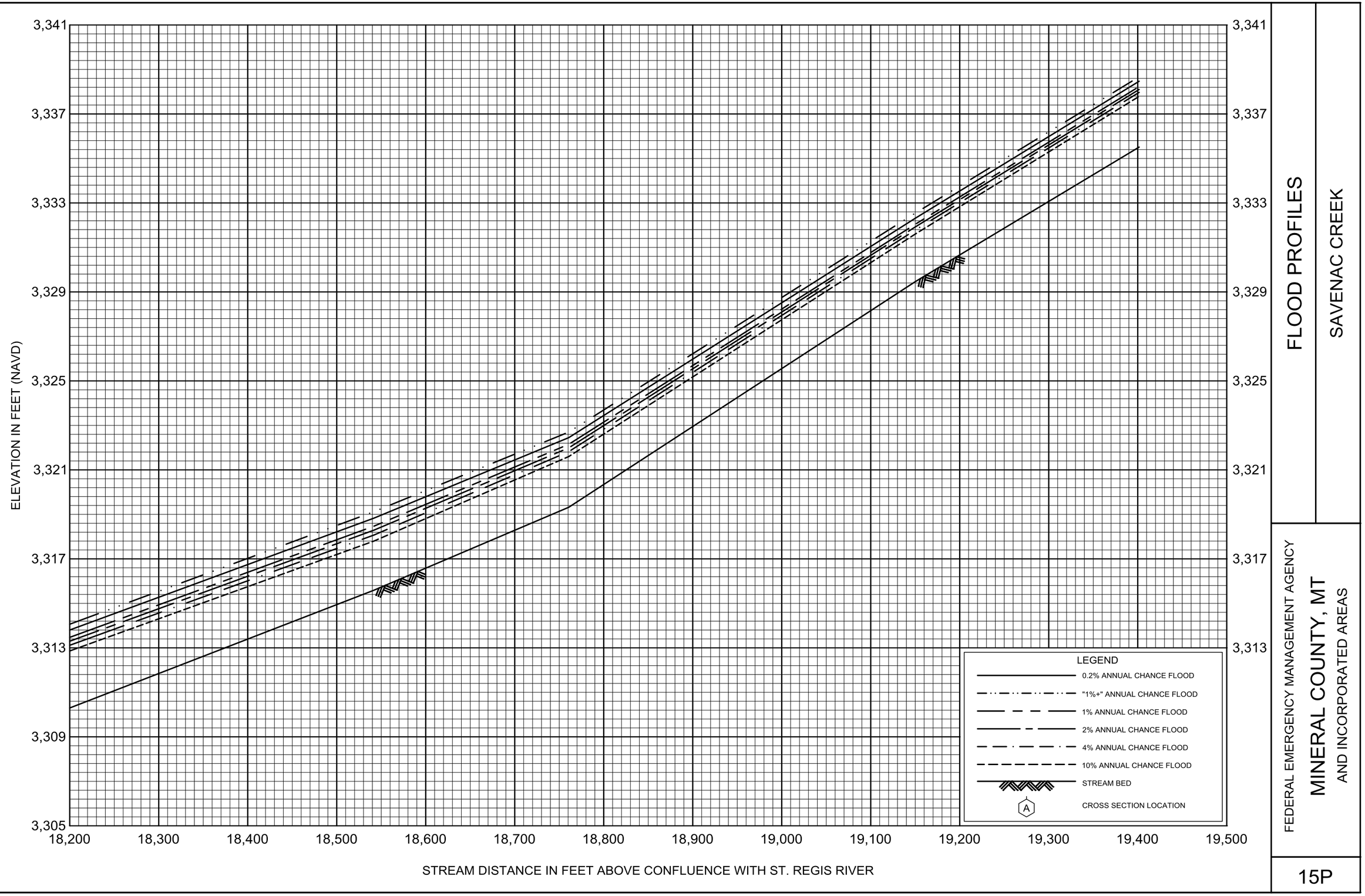
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

14P



FLOOD PROFILES

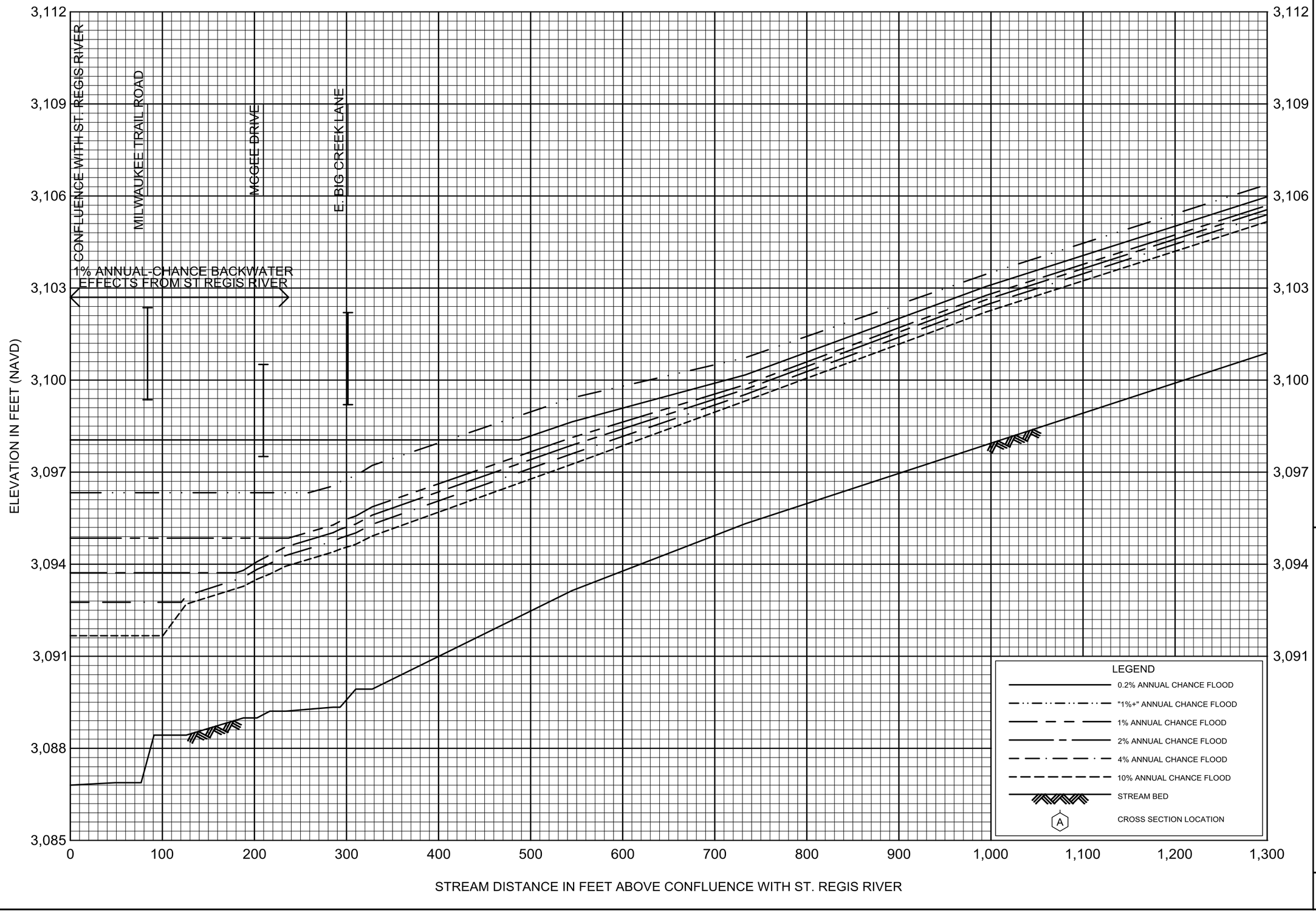
SAVENAC CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

15P



FLOOD PROFILES

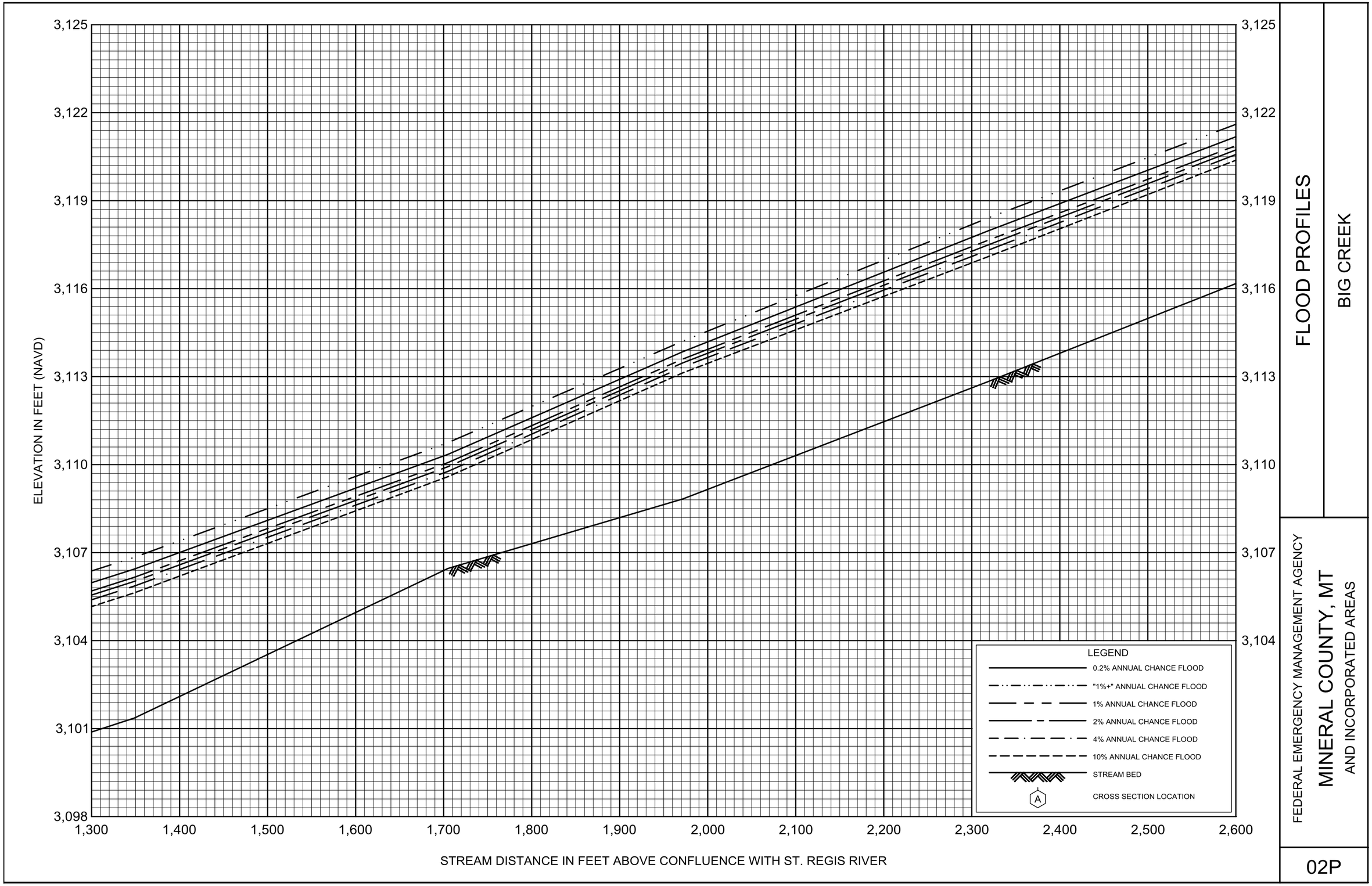
BIG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

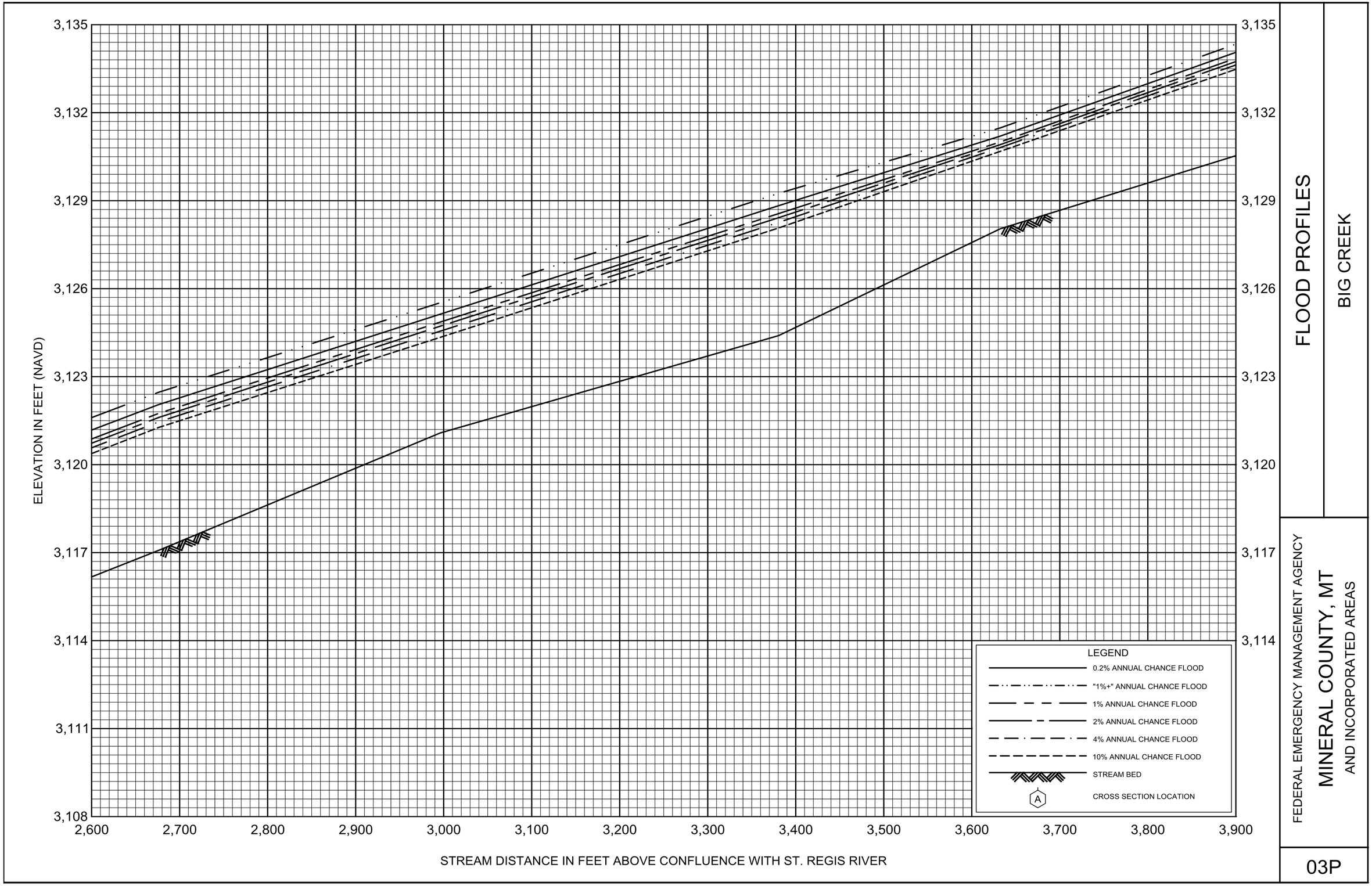
BIG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

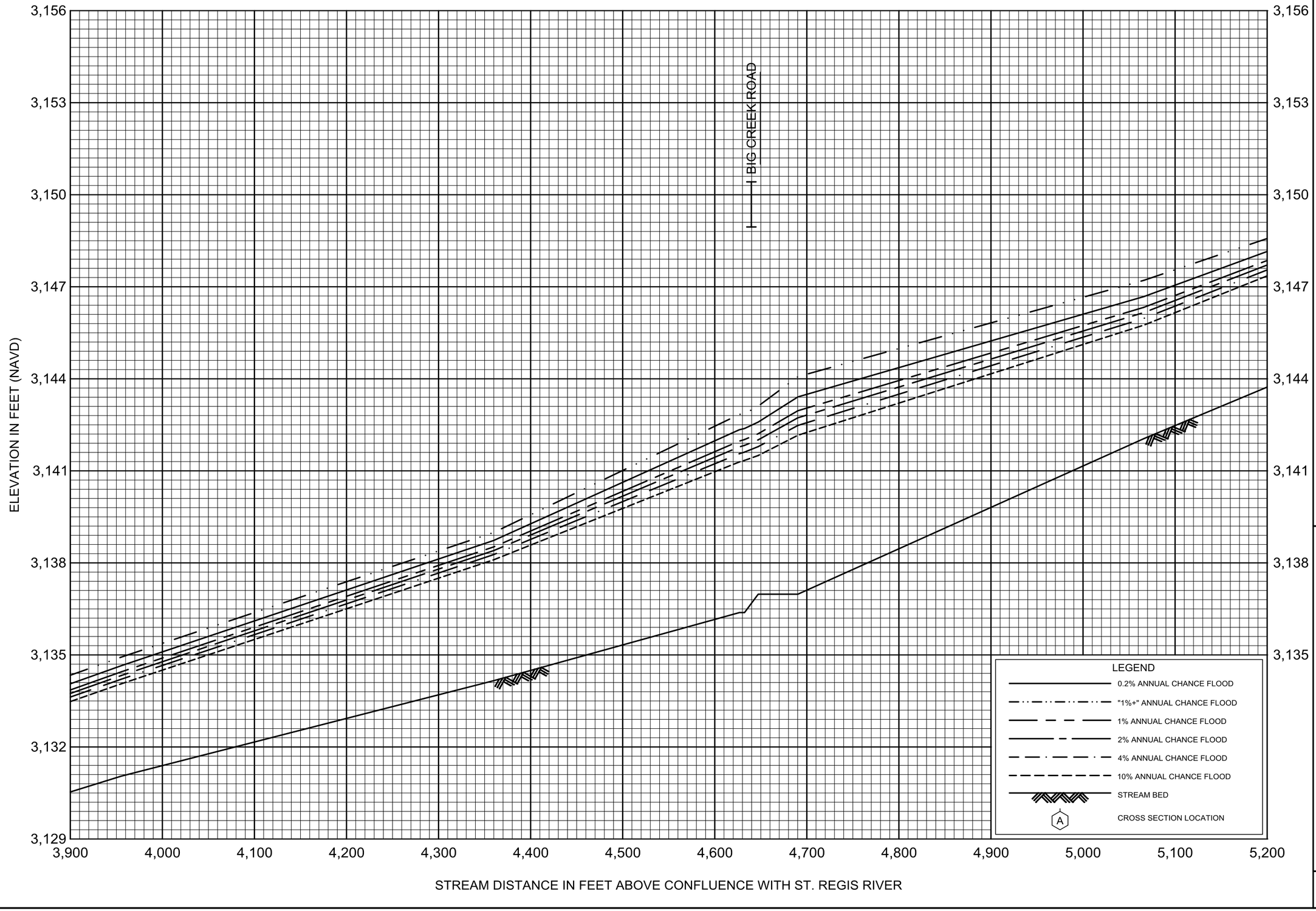
BIG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

03P



FLOOD PROFILES

BIG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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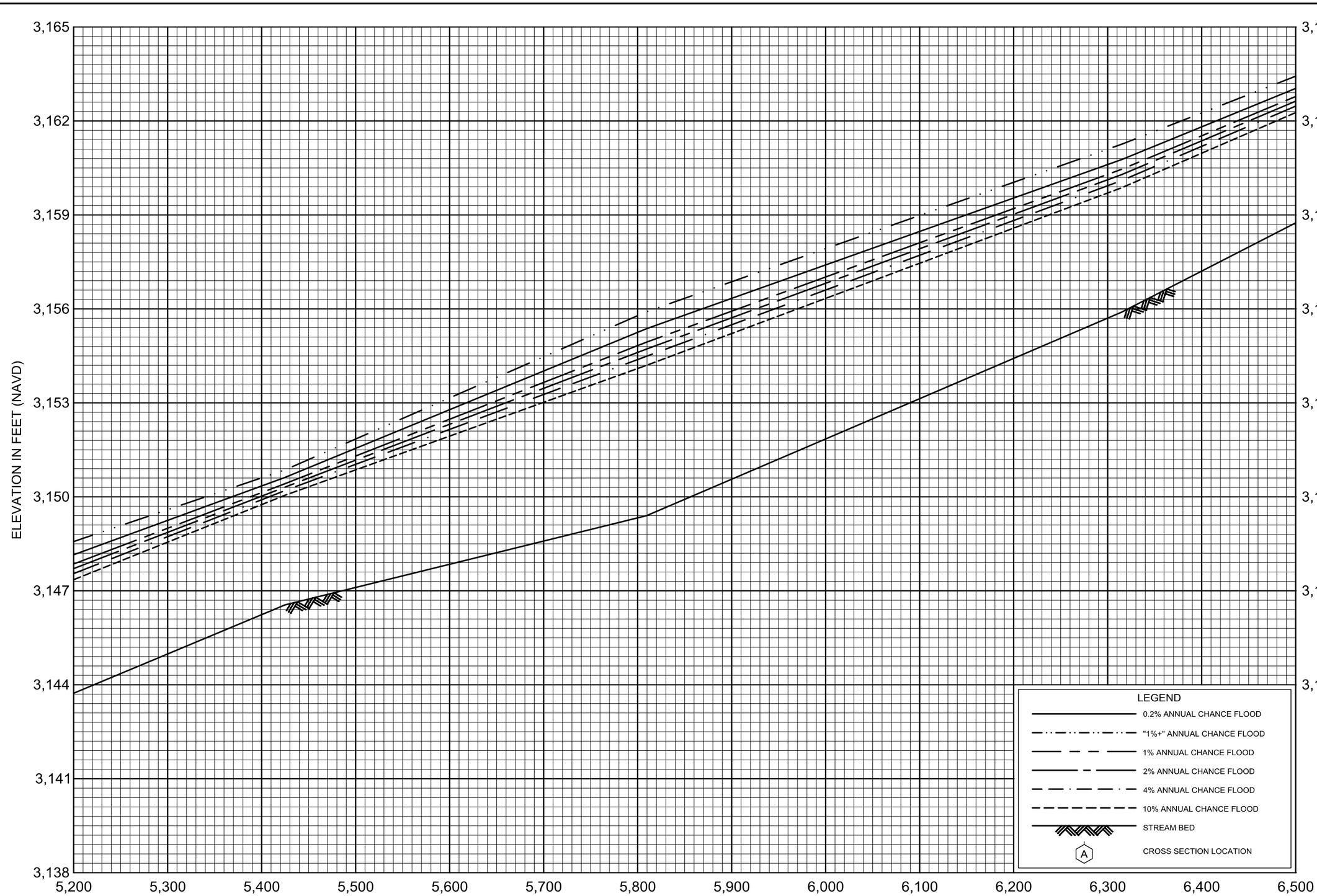

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BIG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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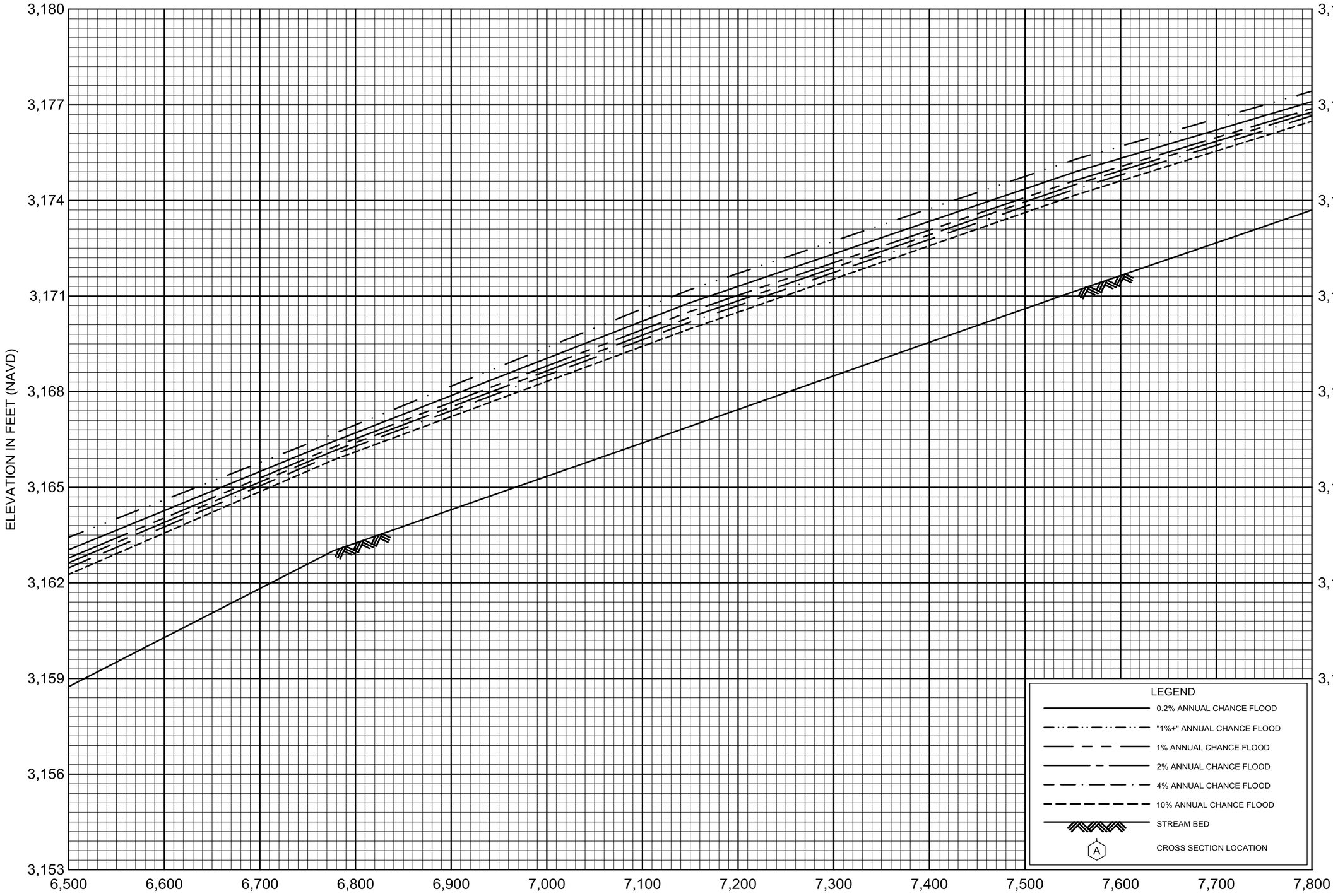

FLOOD PROFILES

BIG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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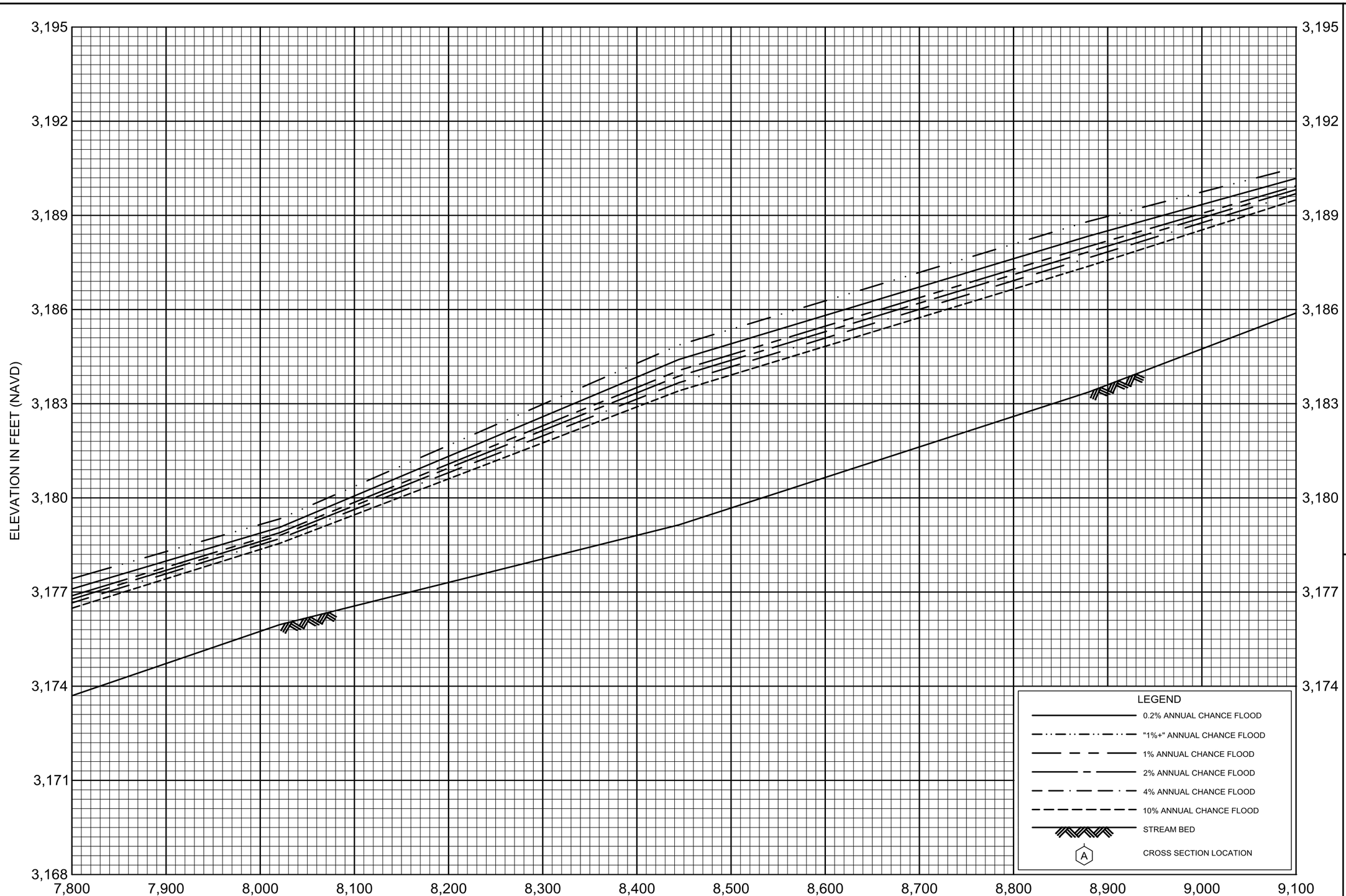

FLOOD PROFILES

BIG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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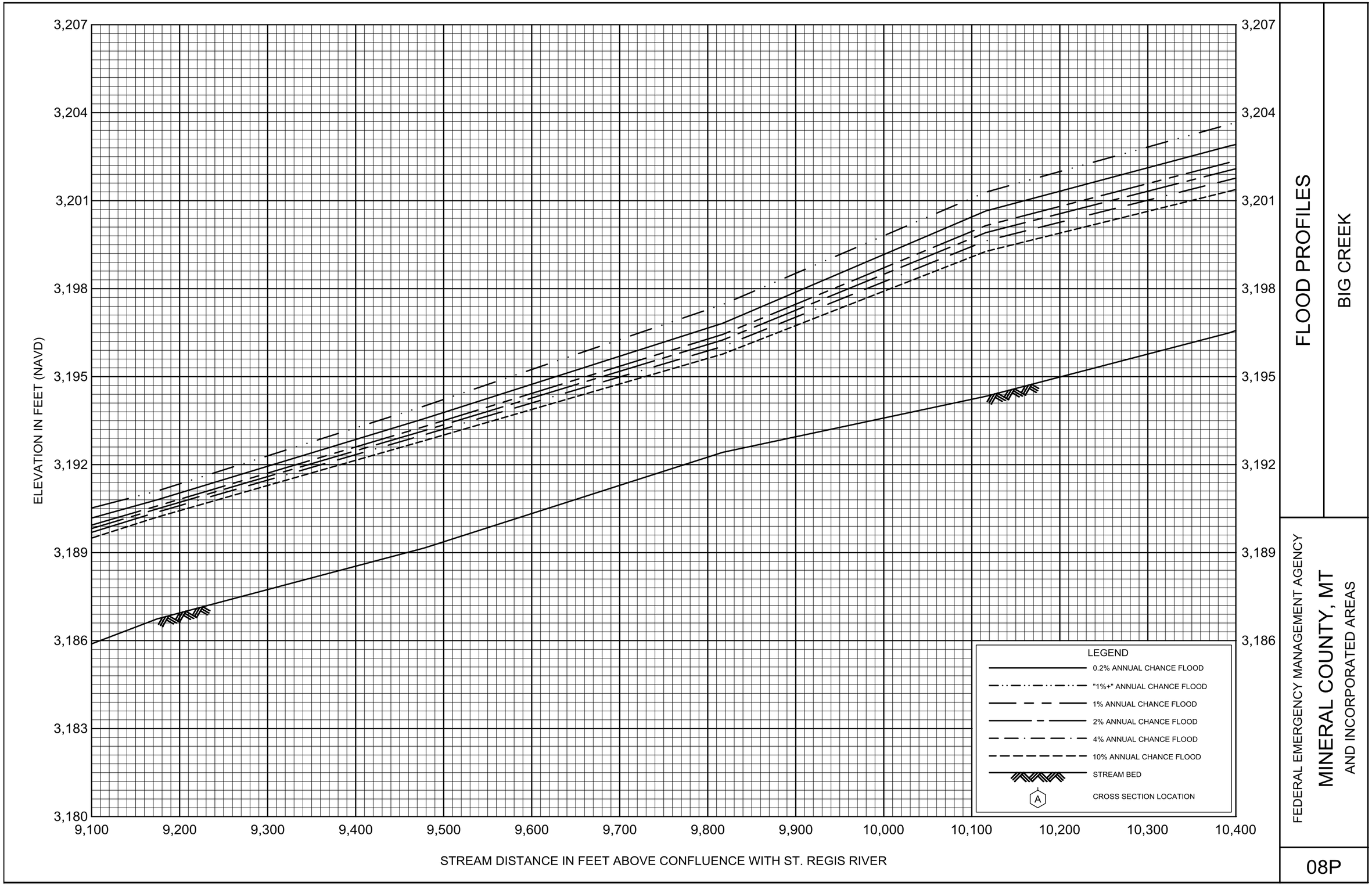

FLOOD PROFILES

BIG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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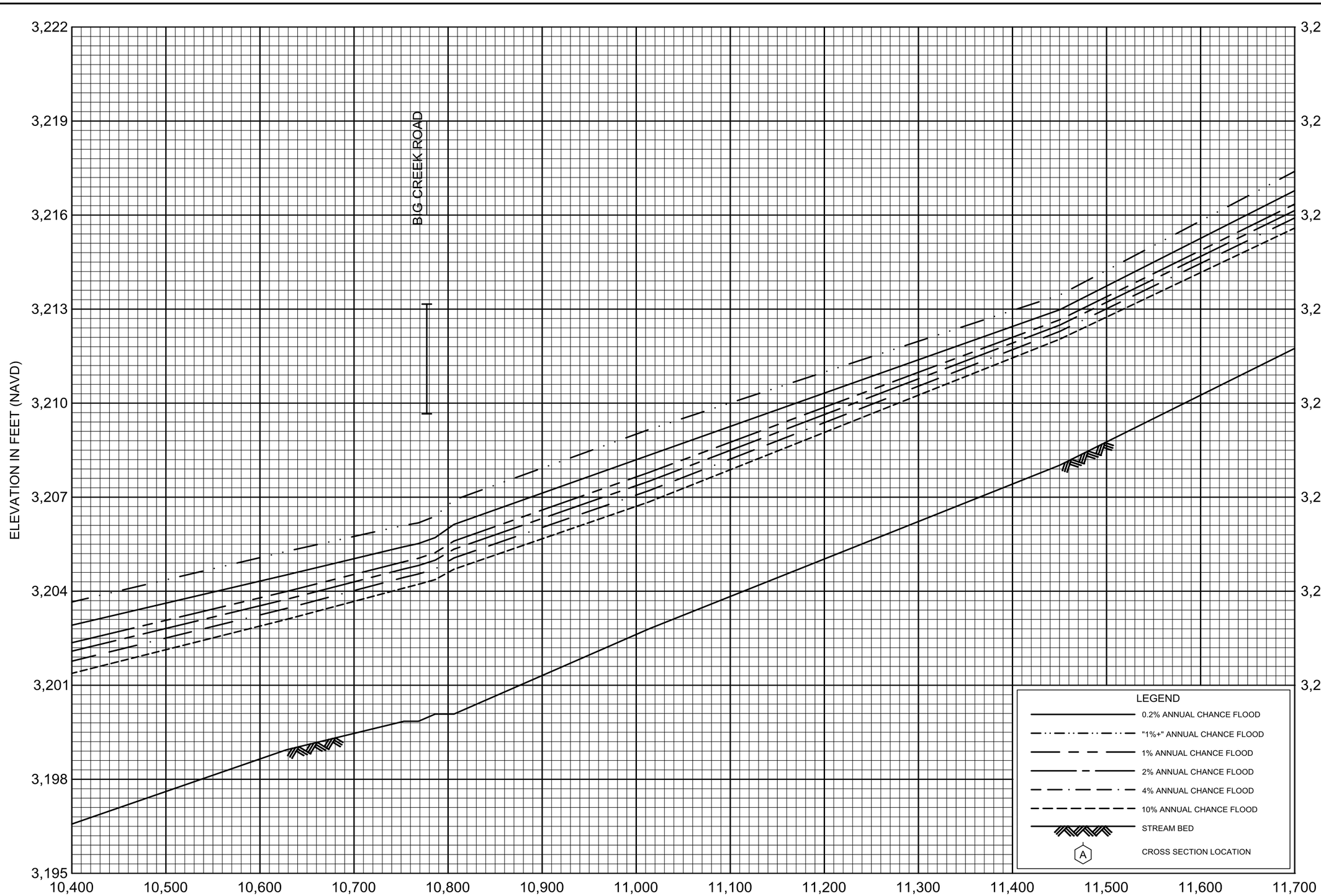

FLOOD PROFILES

BIG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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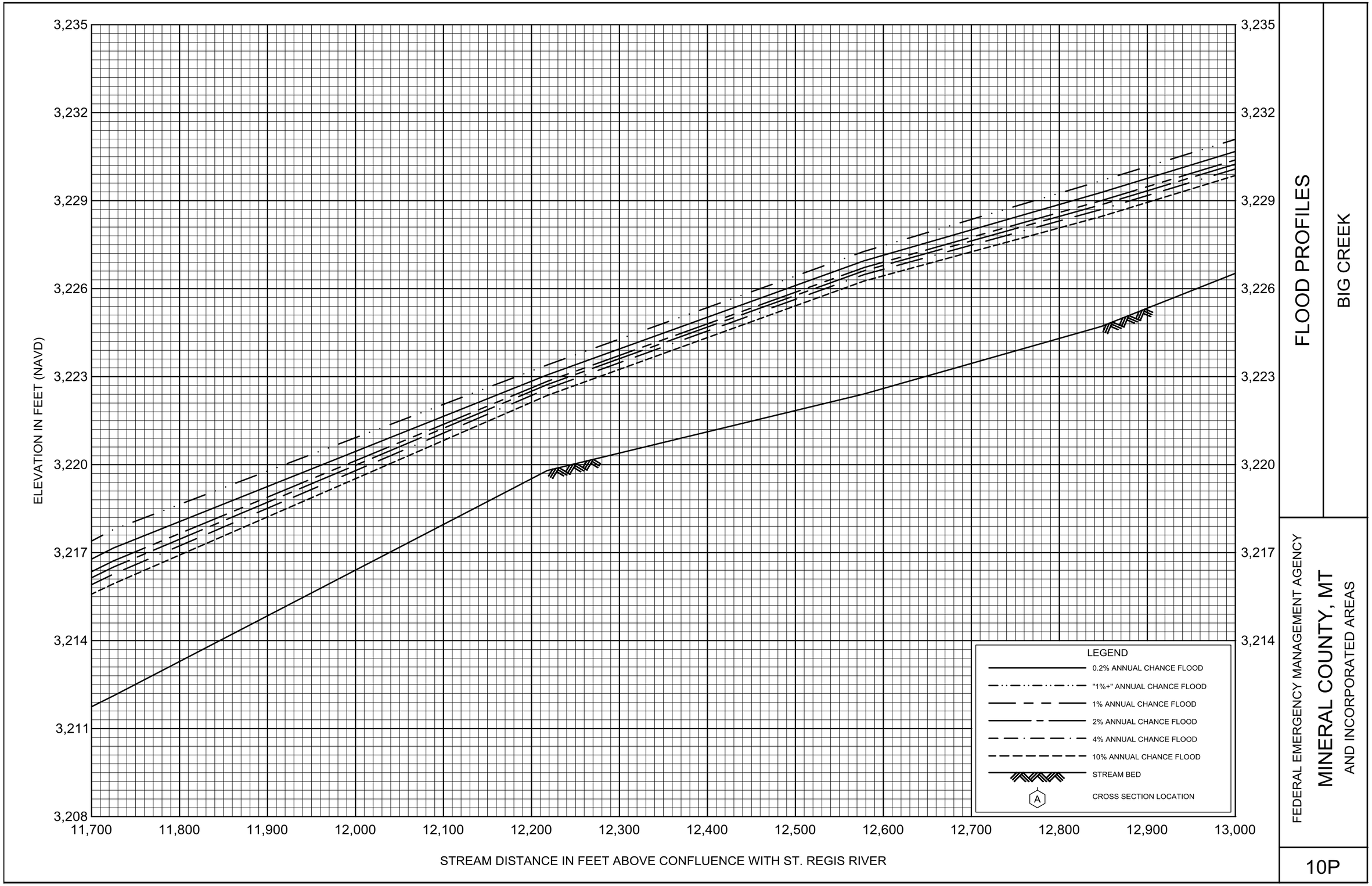

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BIG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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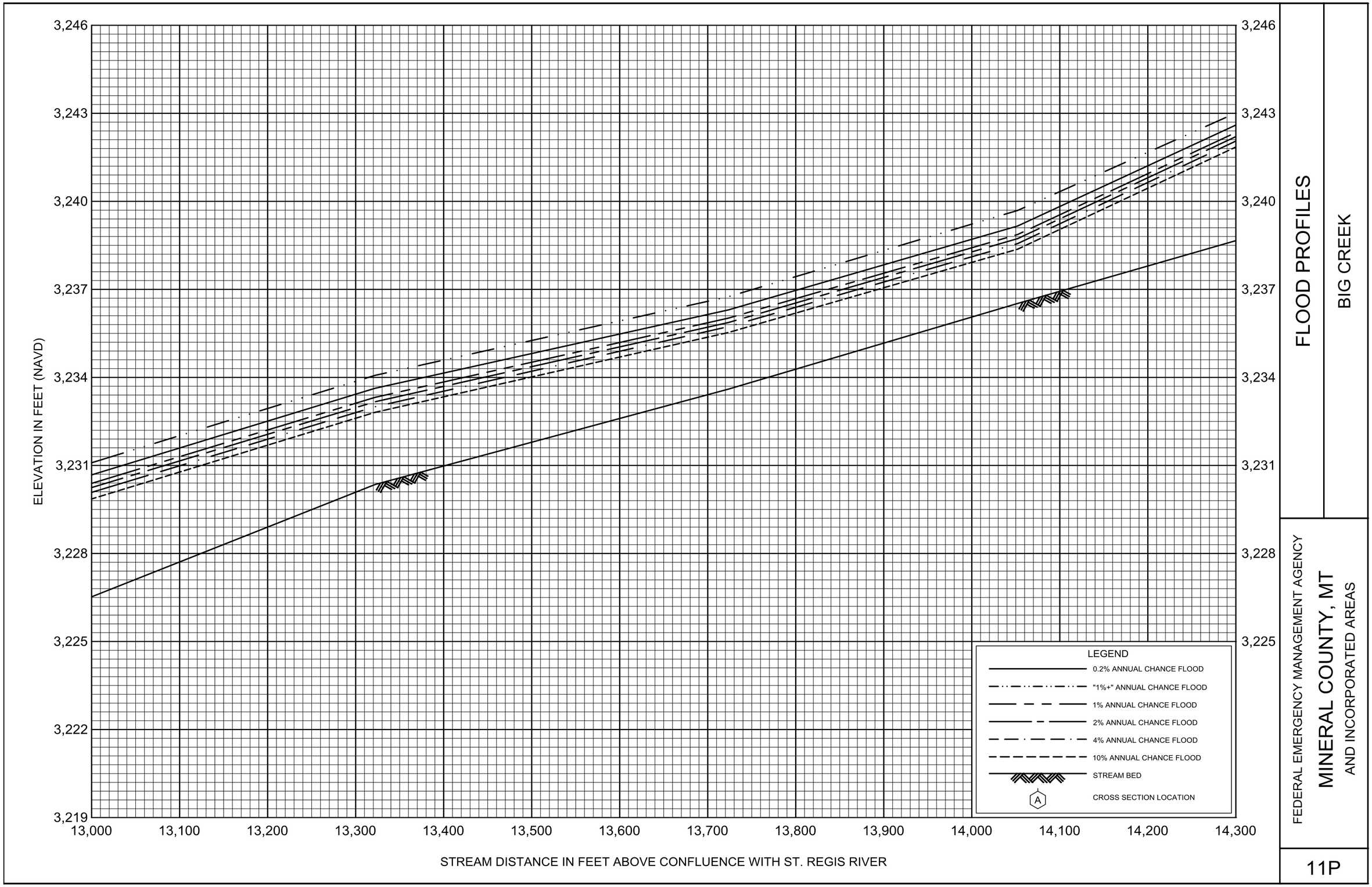

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BIG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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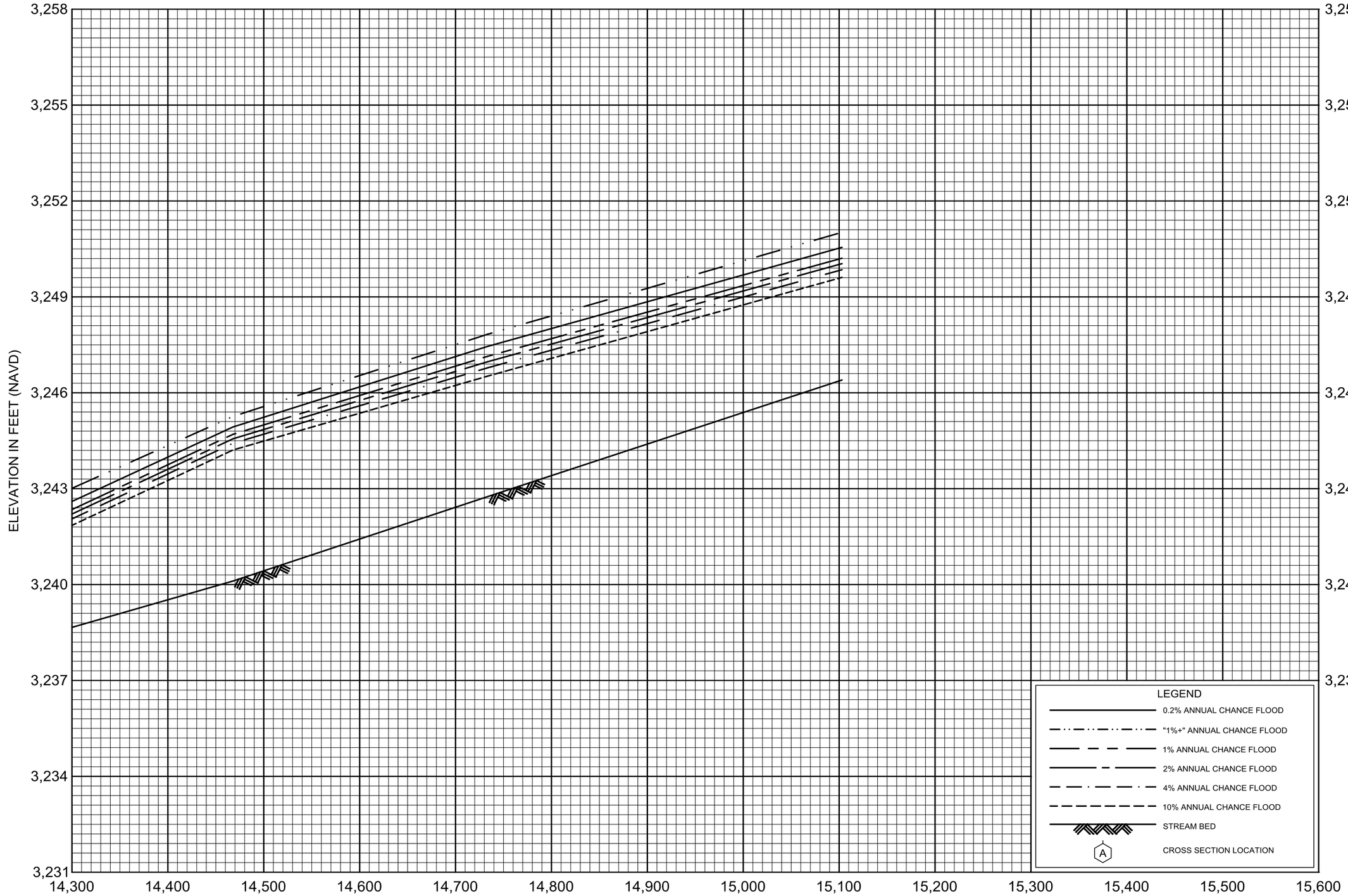

FLOOD PROFILES

BIG CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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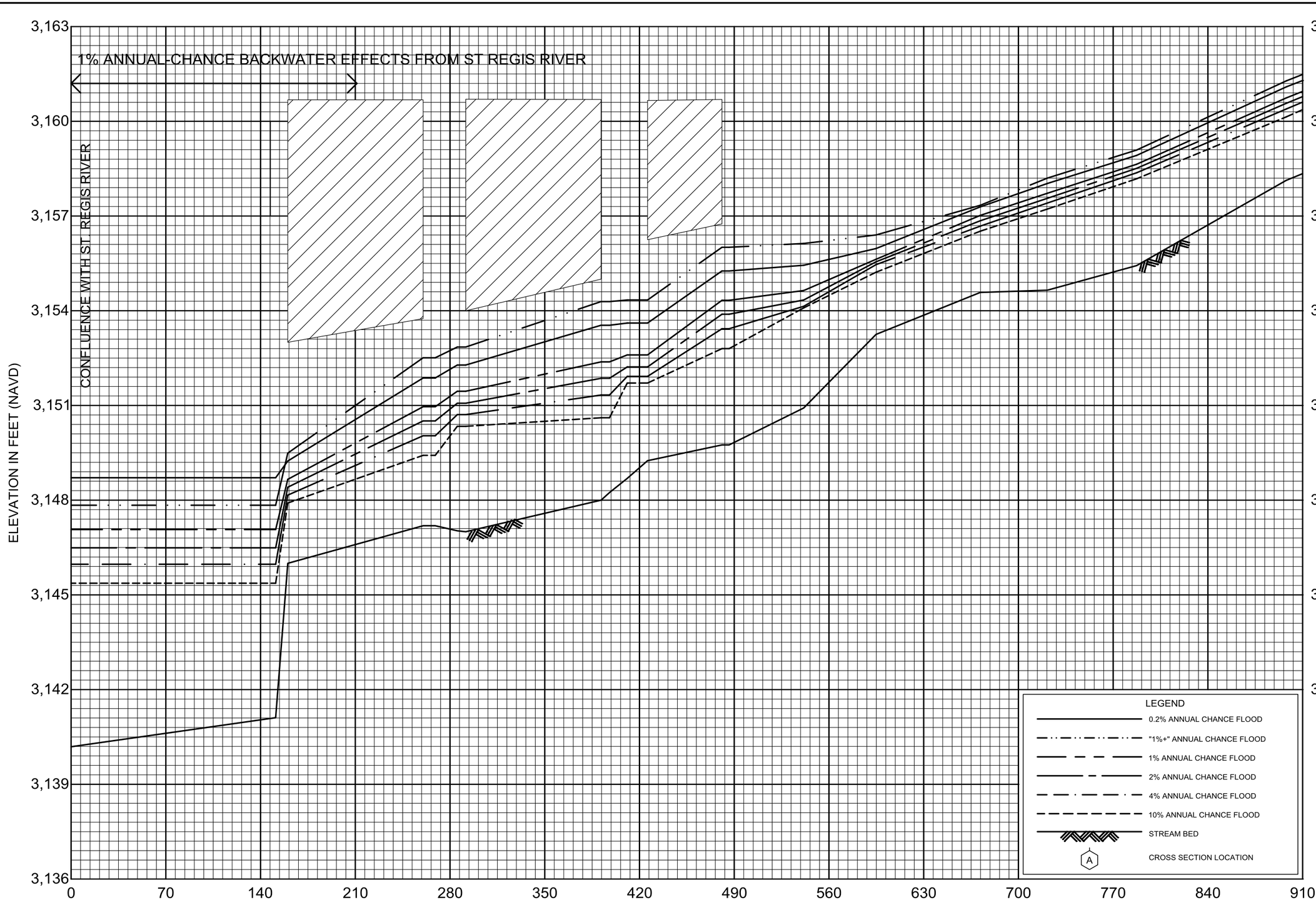

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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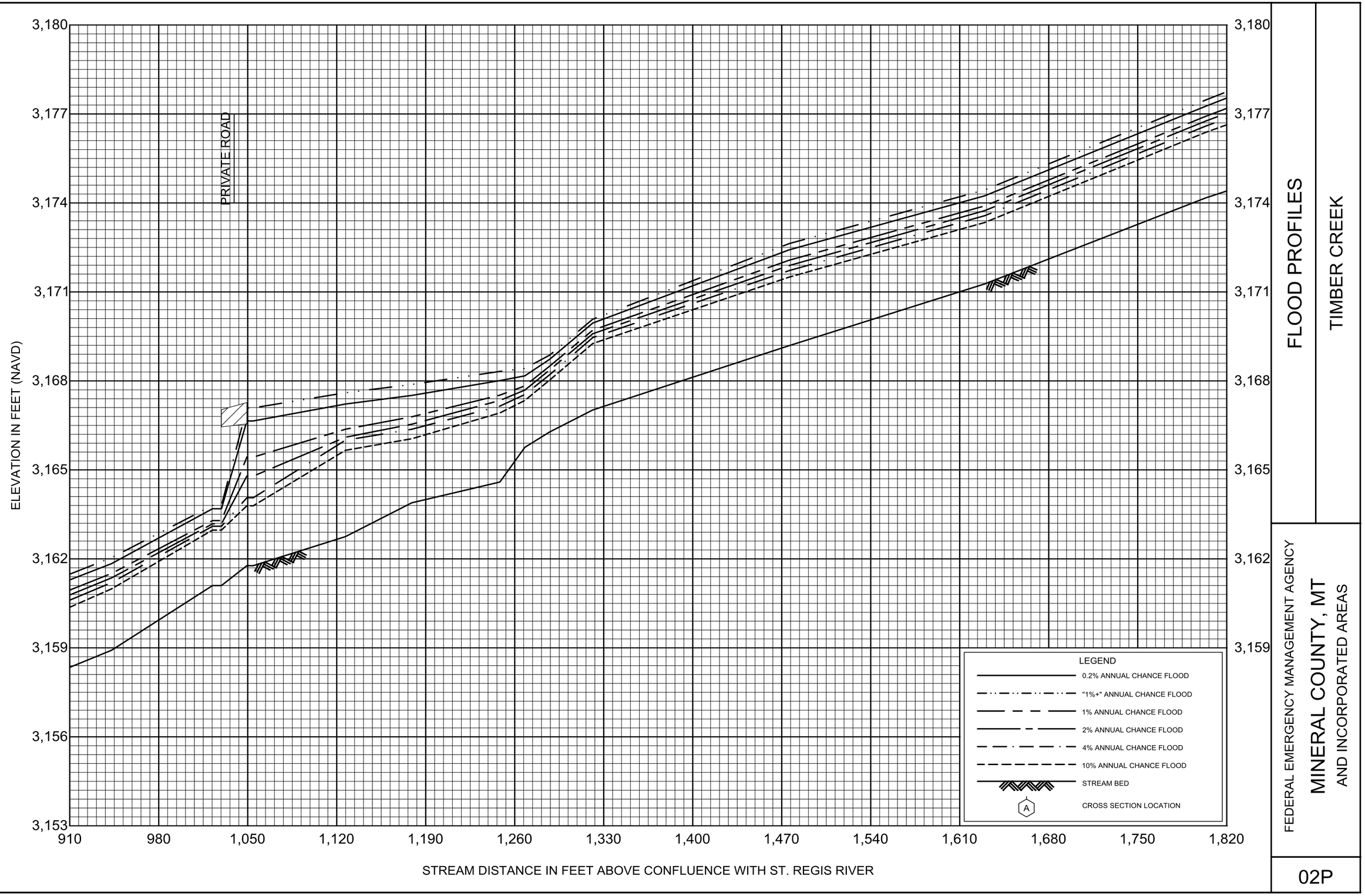

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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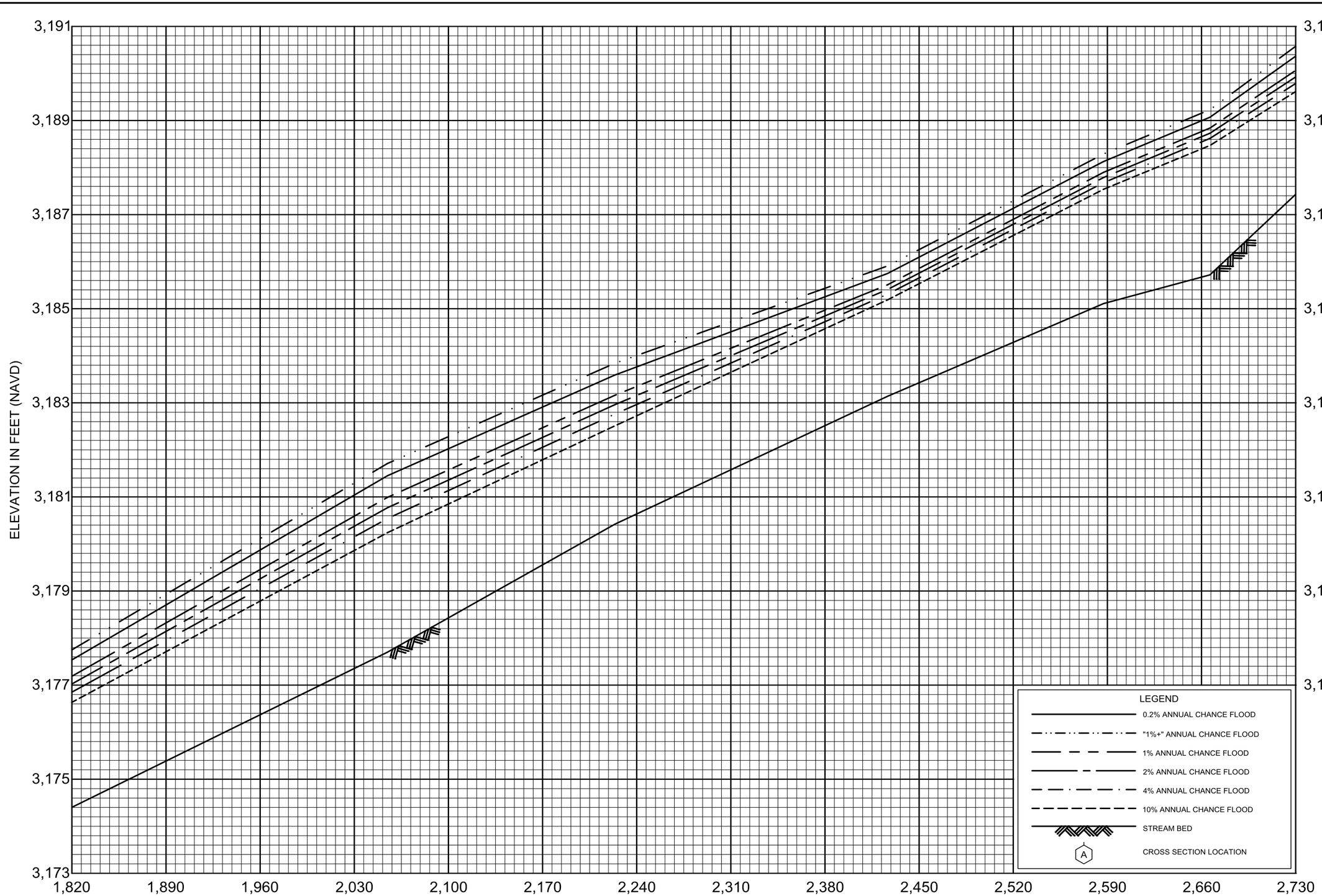

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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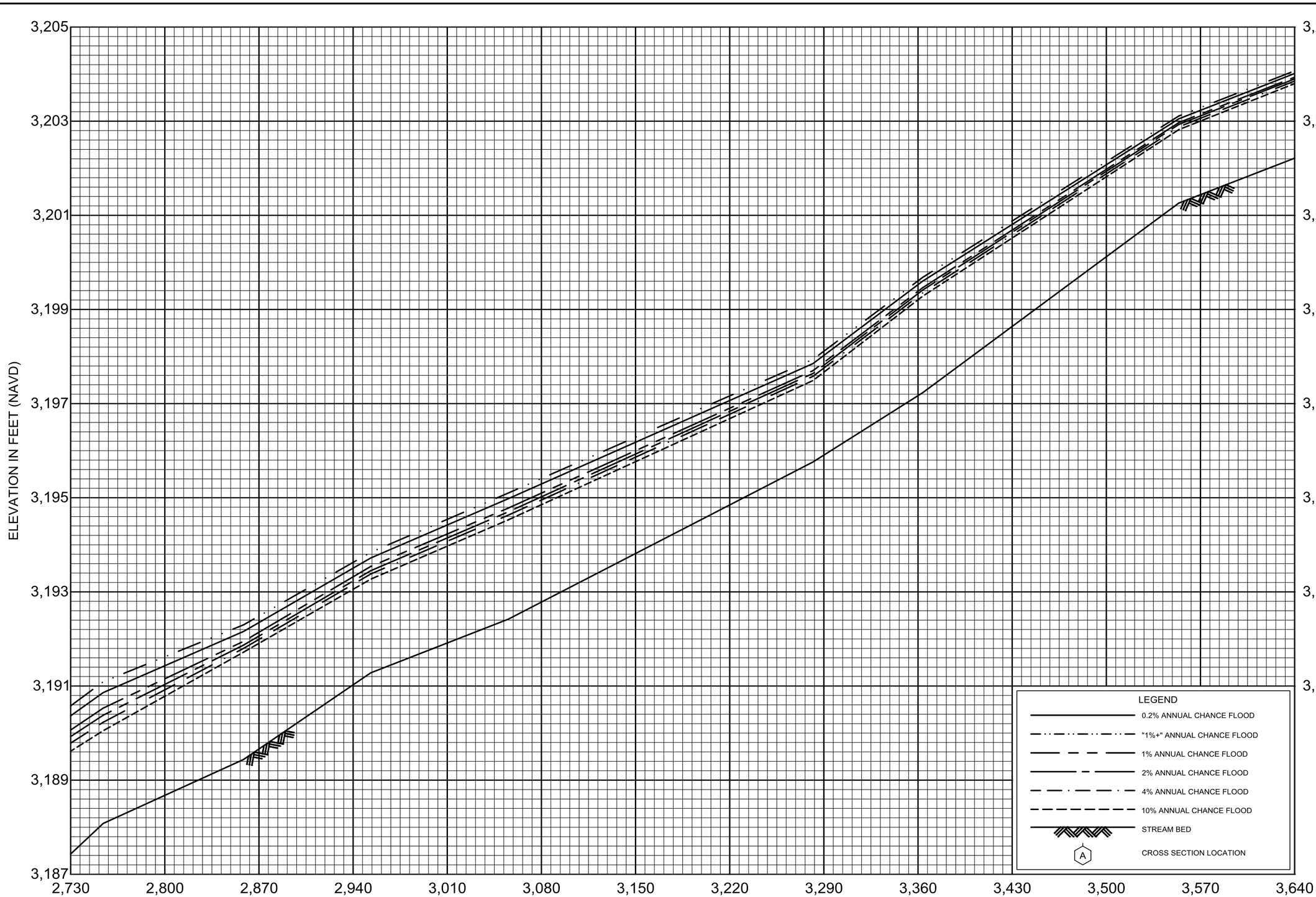

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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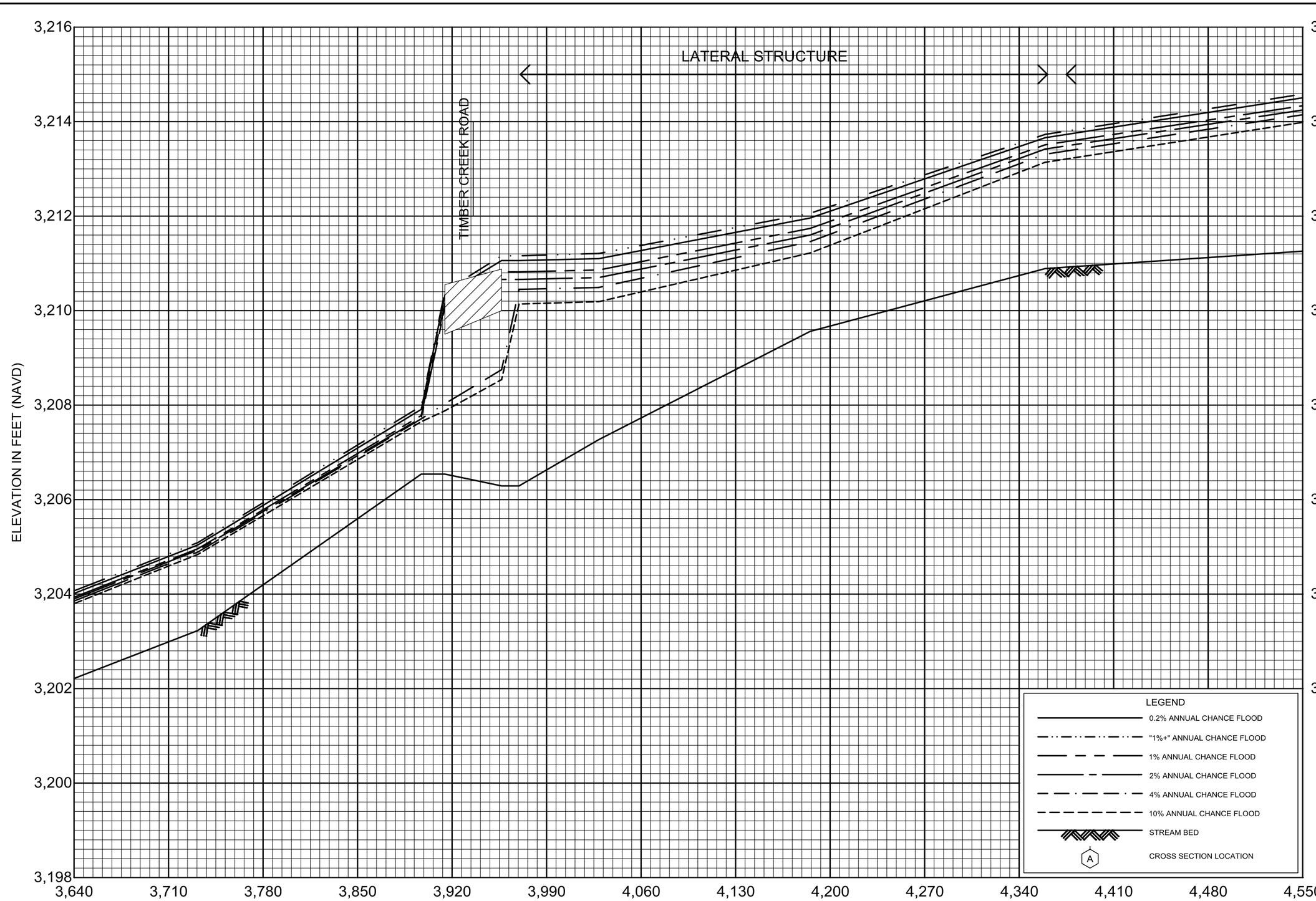

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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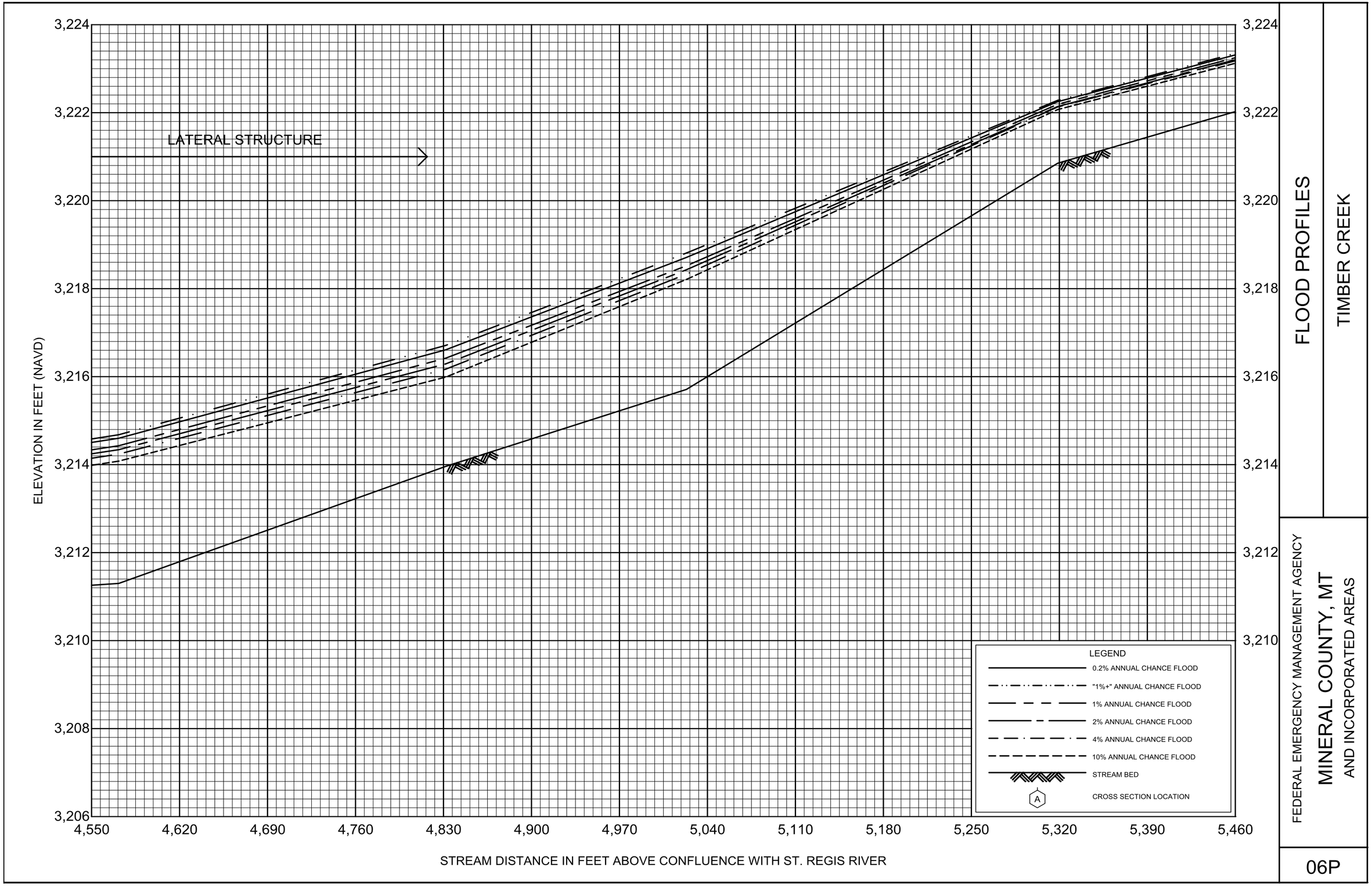

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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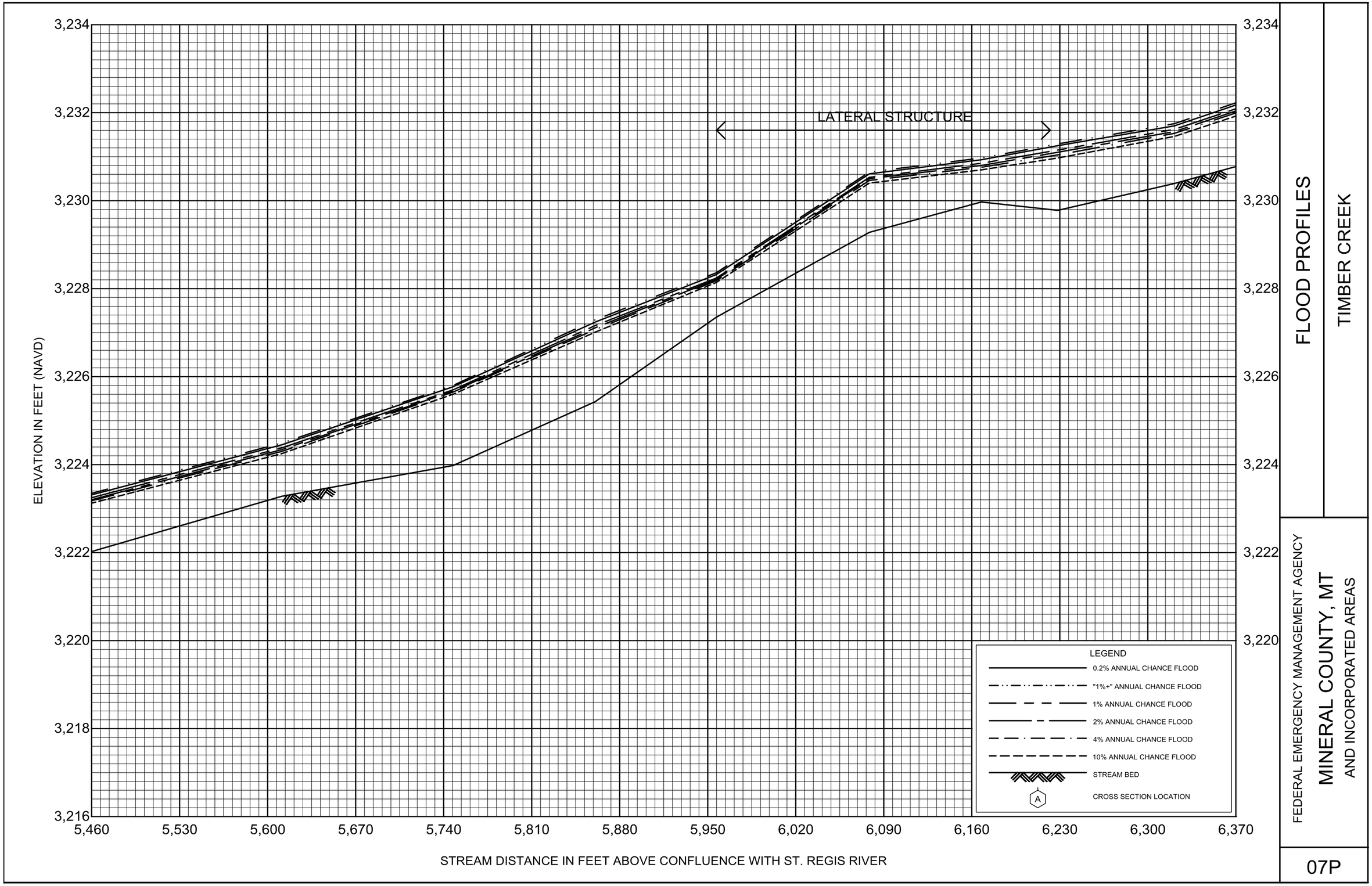

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

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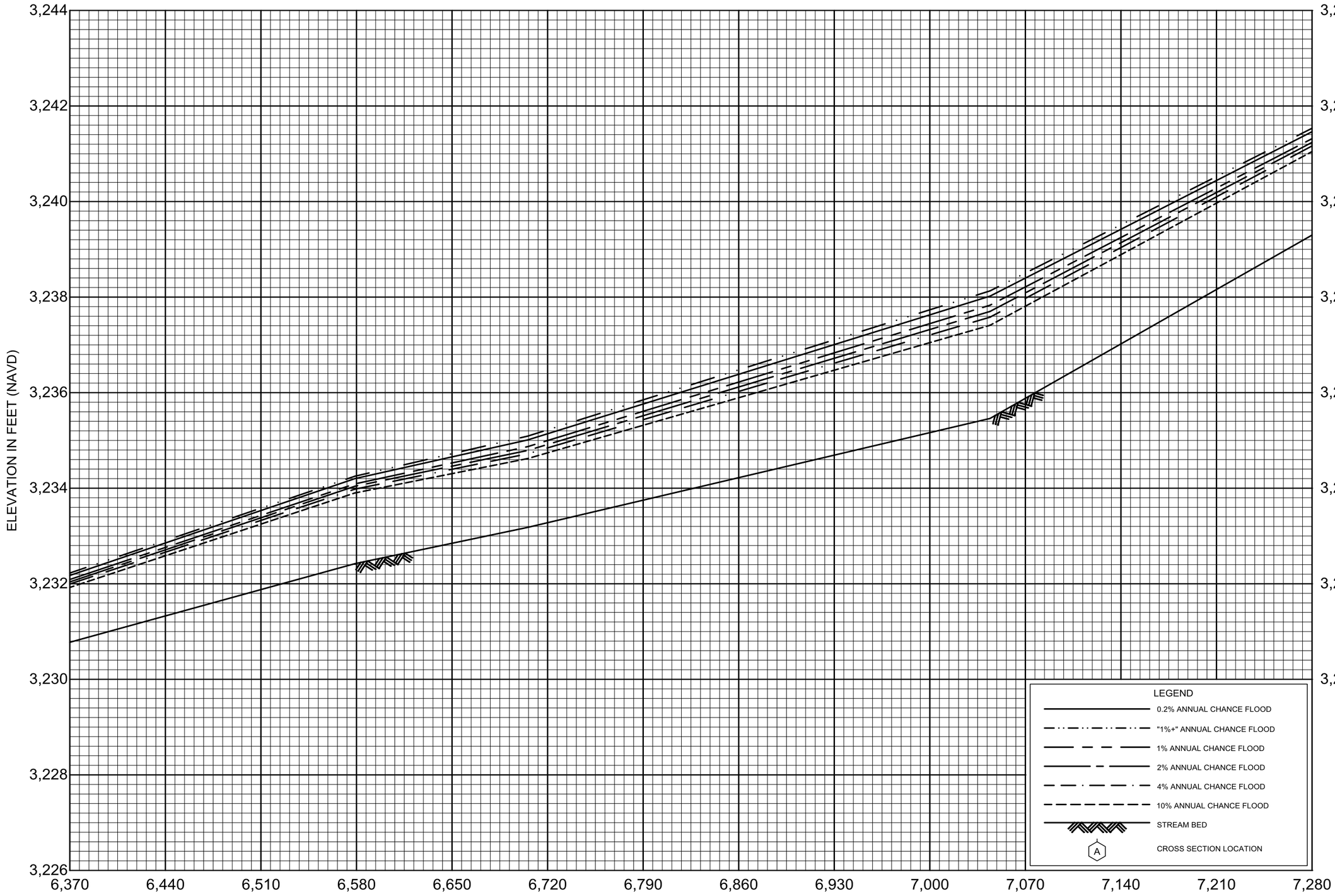

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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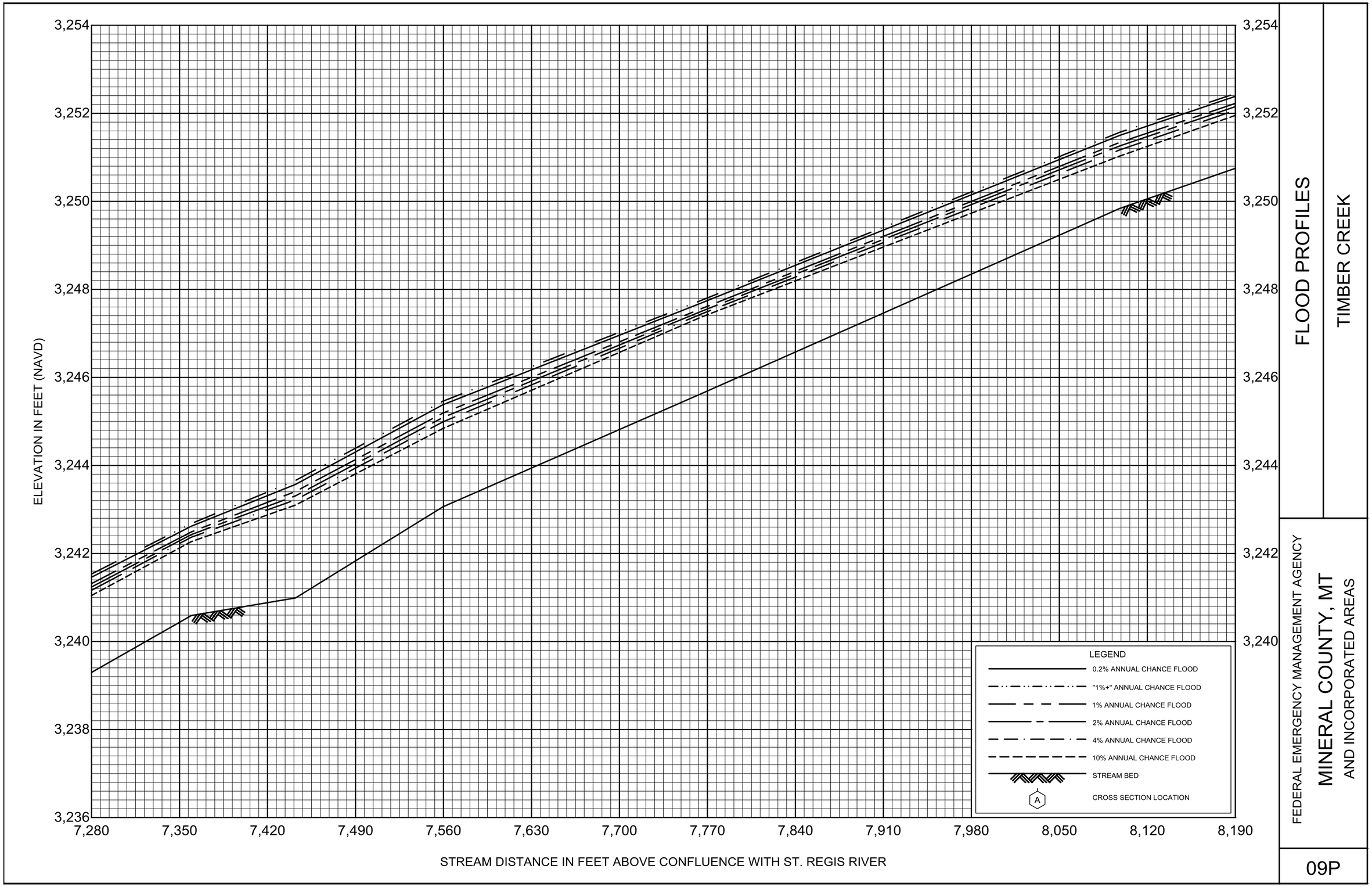

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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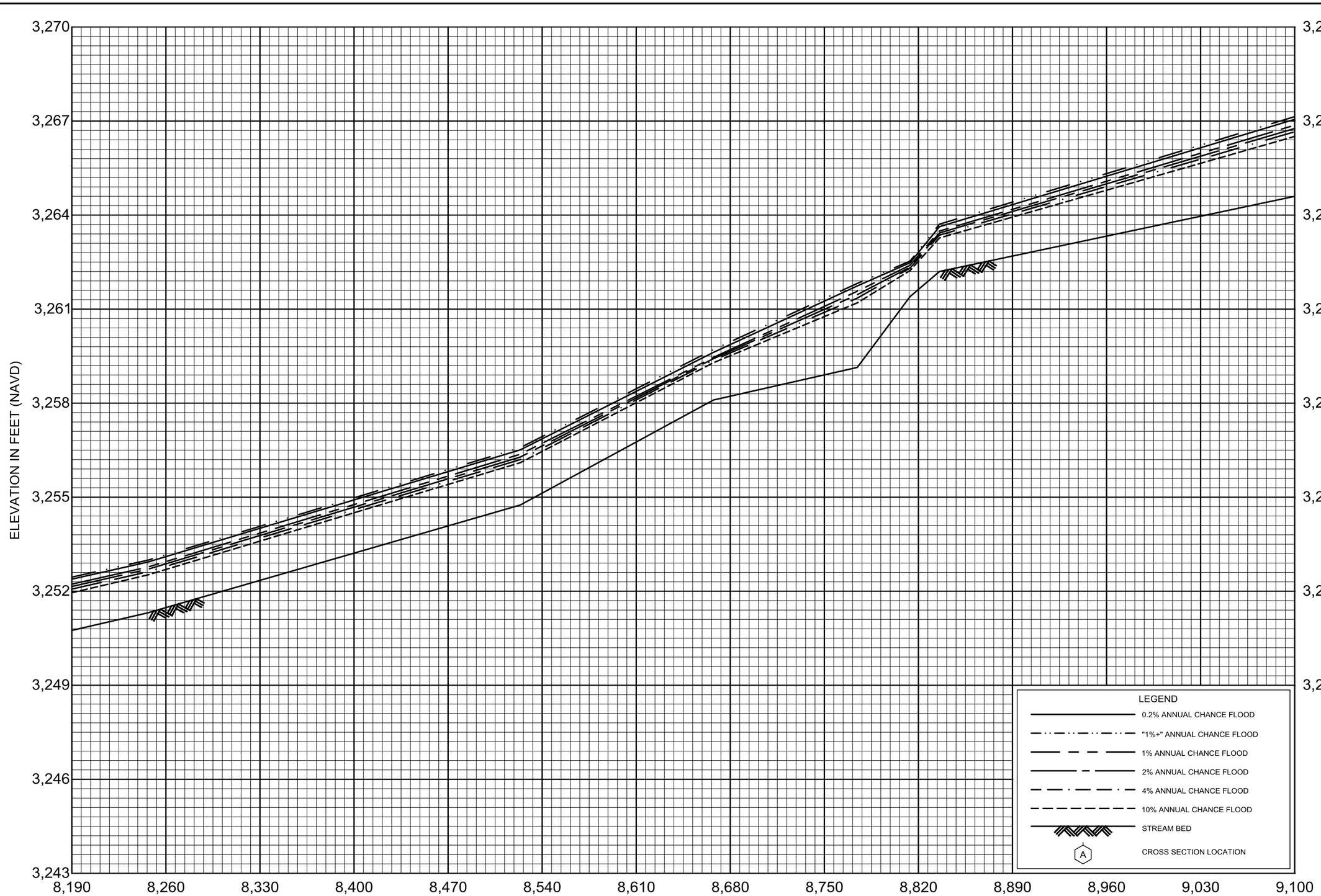

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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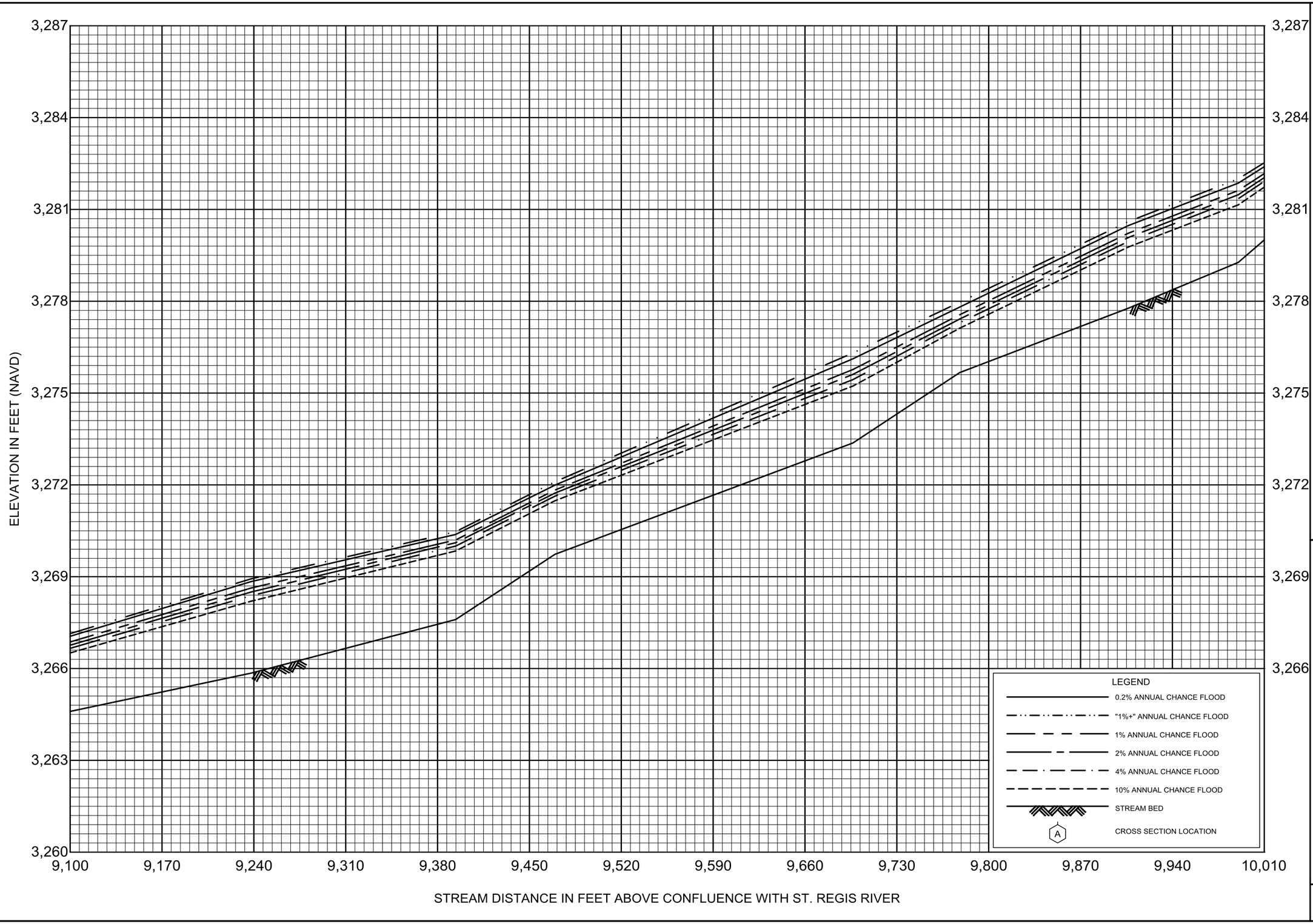

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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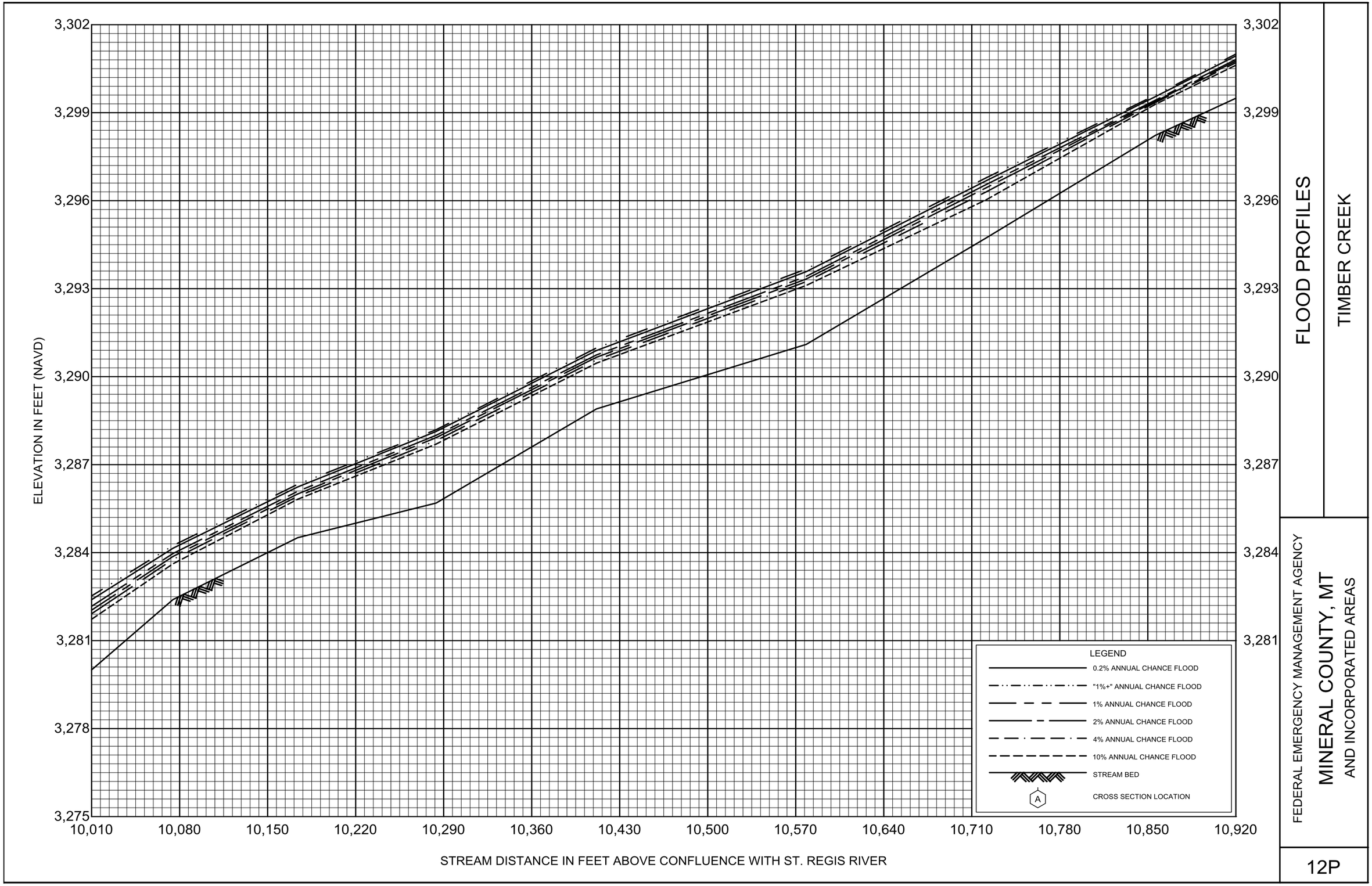

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

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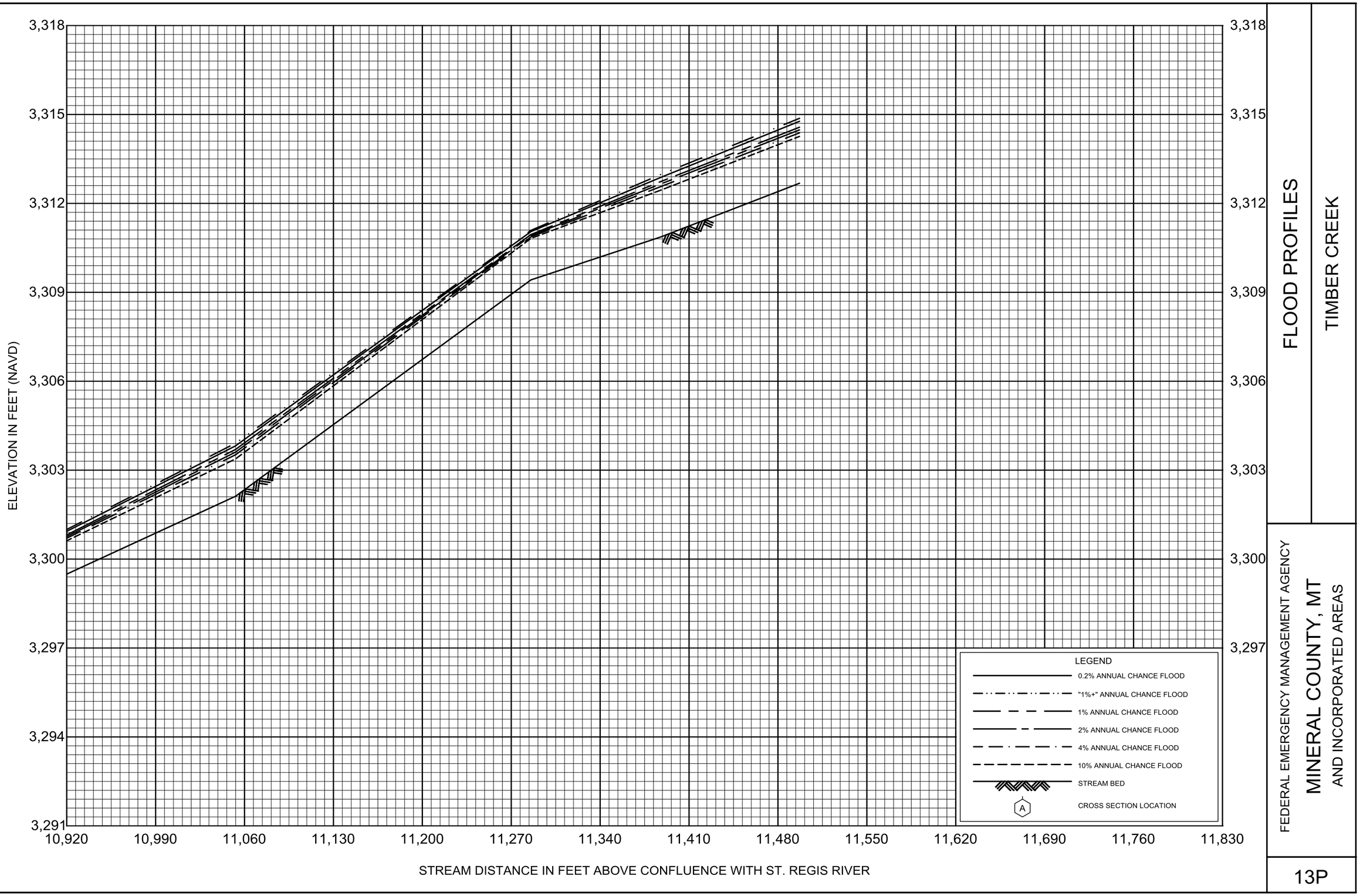

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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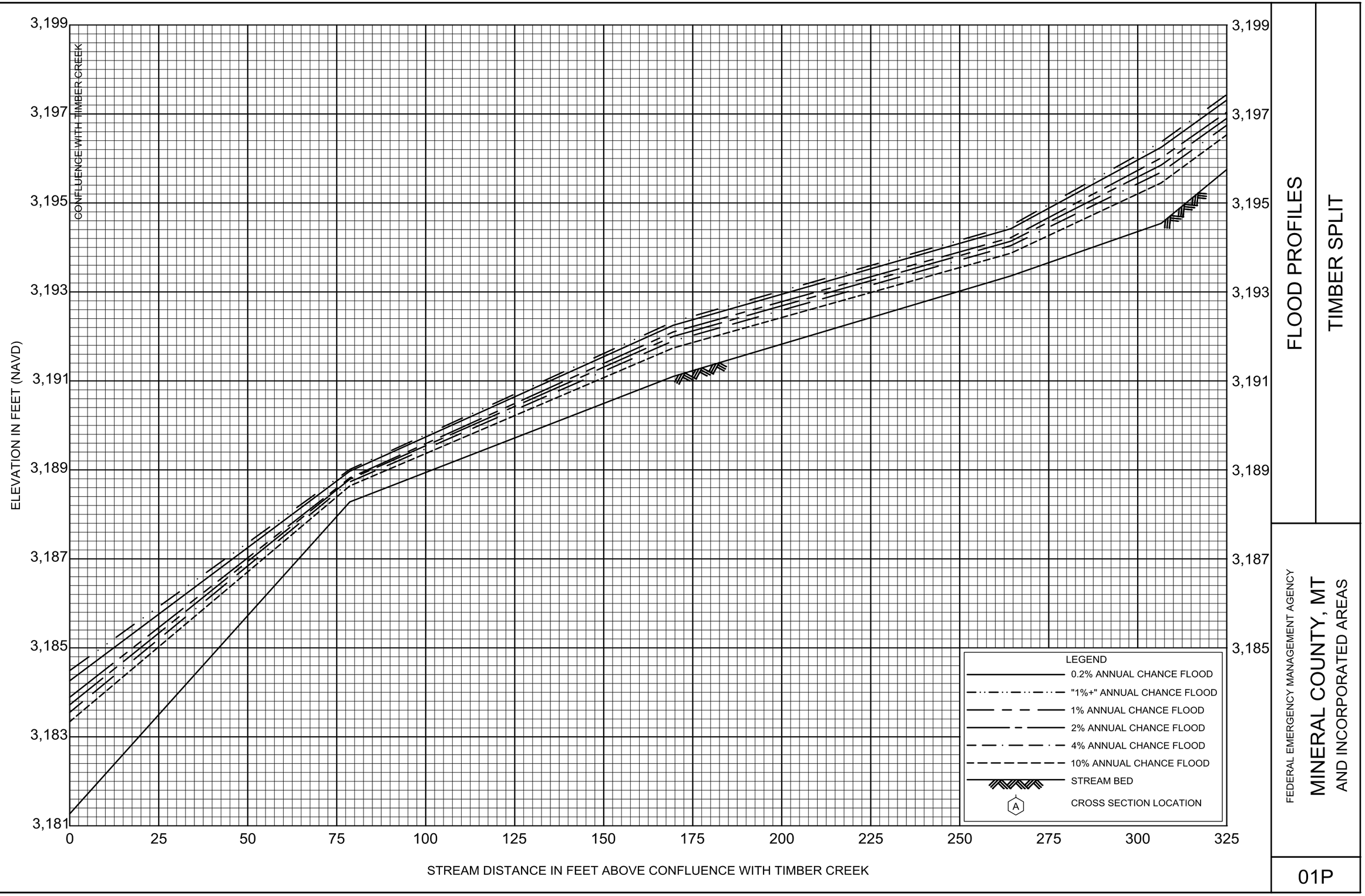

FLOOD PROFILES

TIMBER SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

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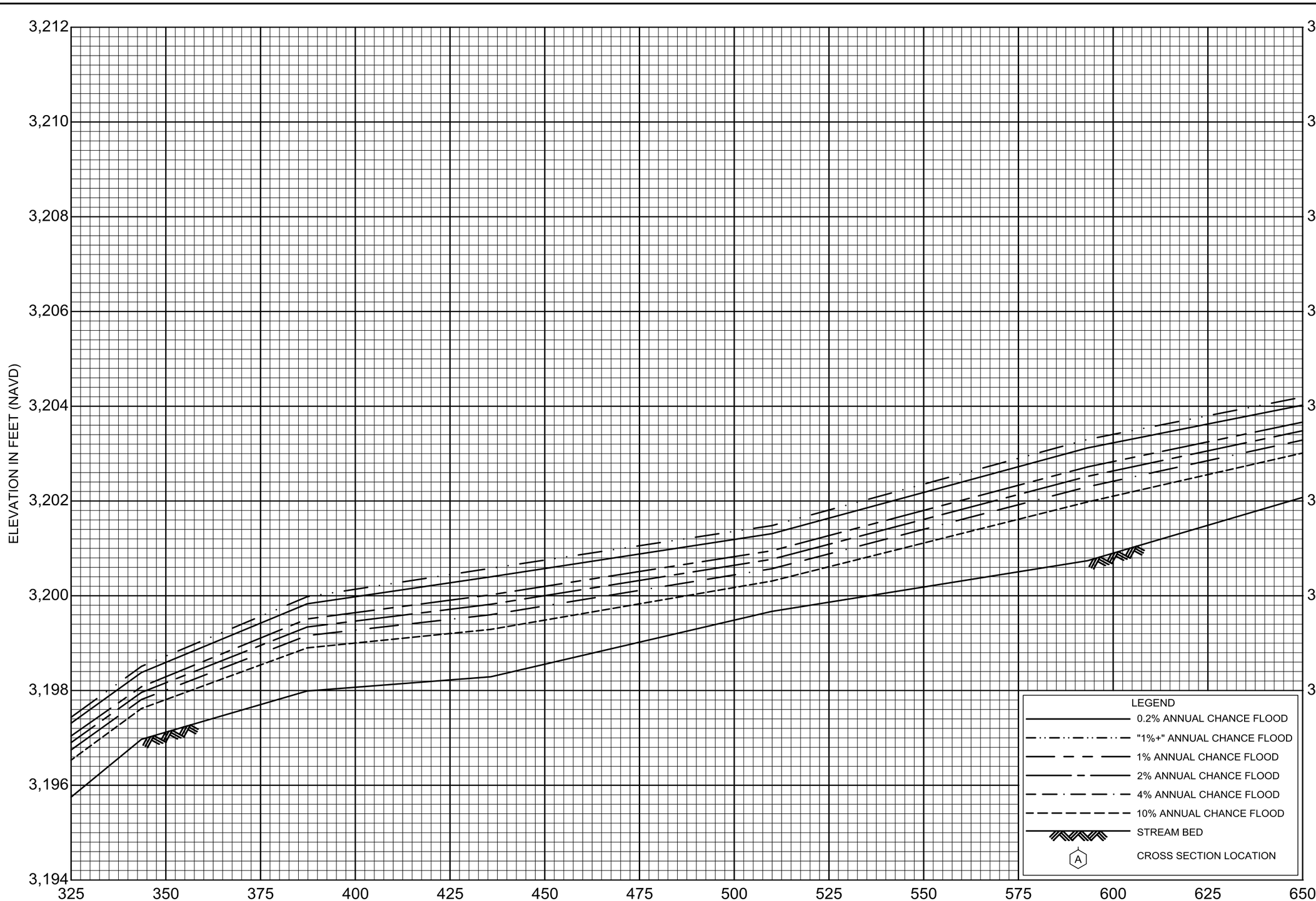

FLOOD PROFILES

TIMBER SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

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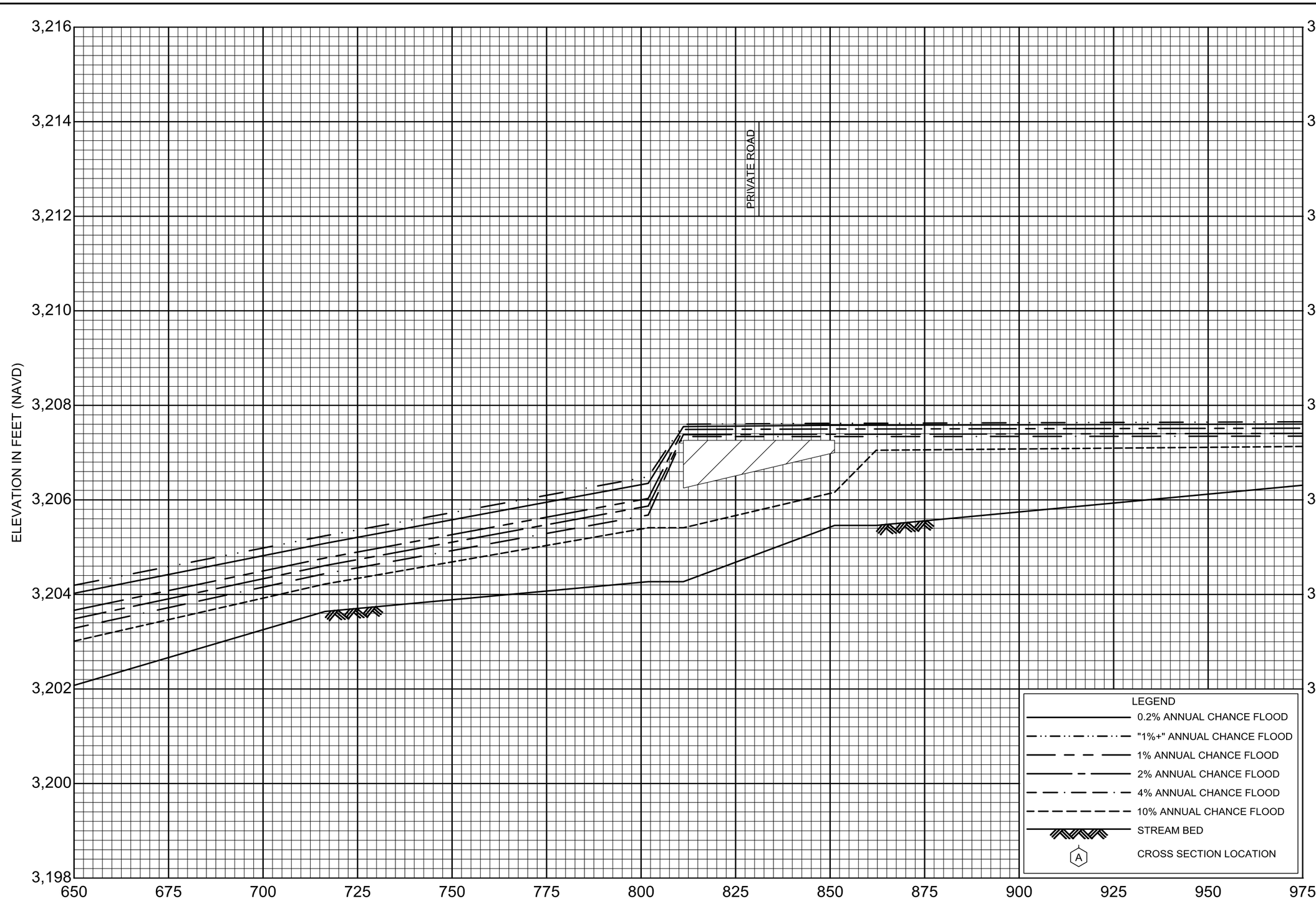

FLOOD PROFILES

TIMBER SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

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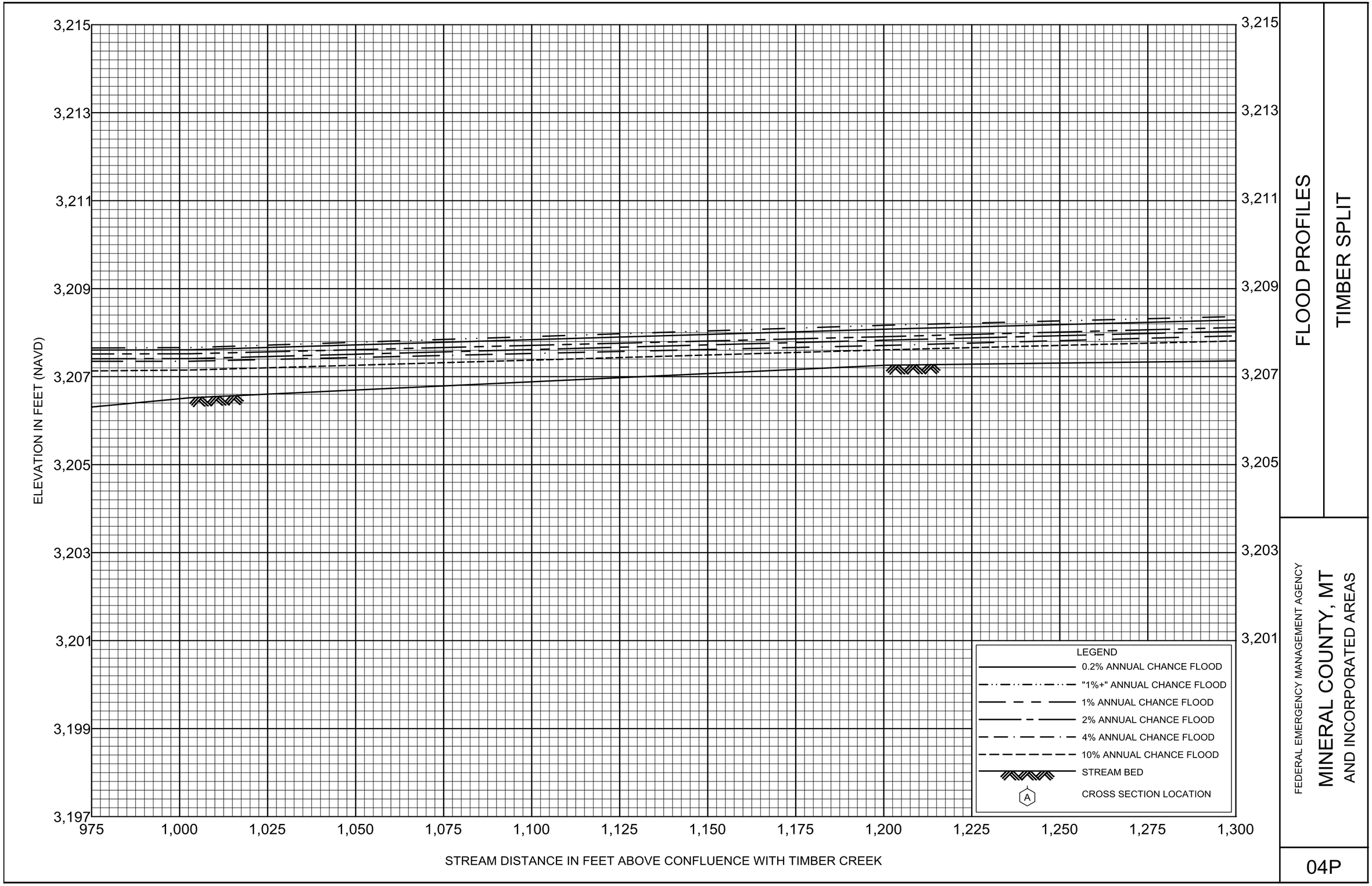

FLOOD PROFILES

TIMBER SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

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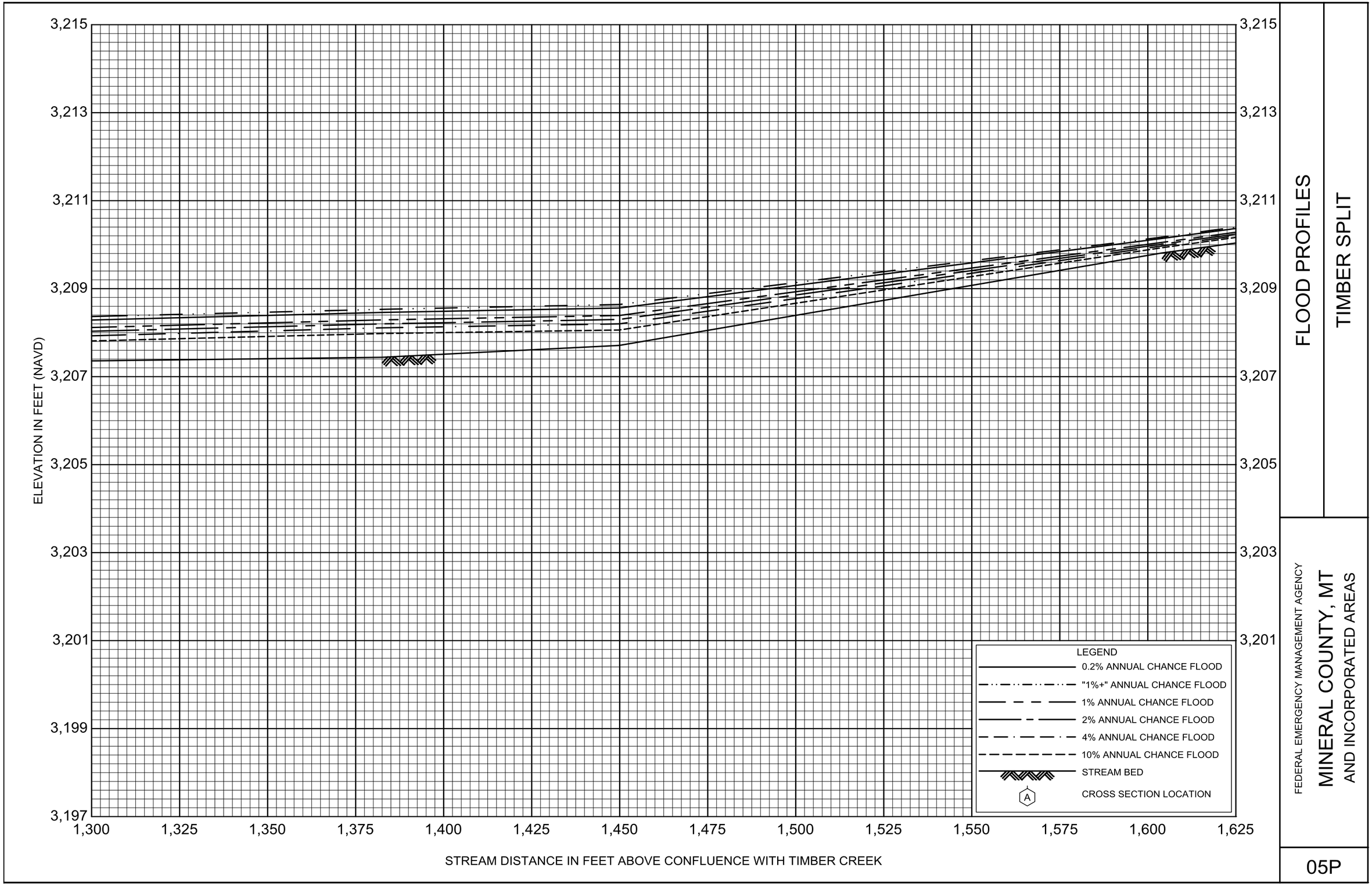

FLOOD PROFILES

TIMBER SPLIT

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

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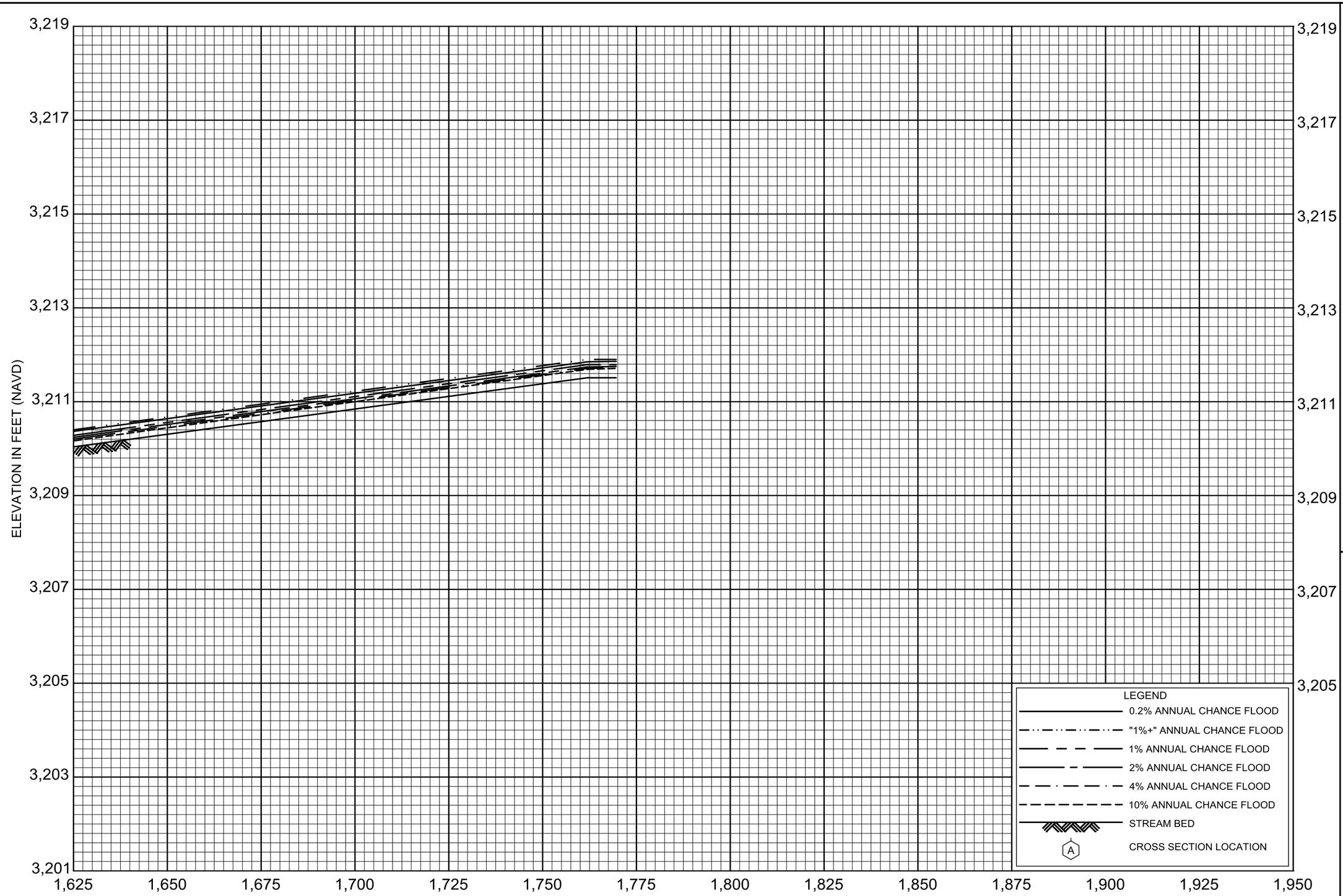

FLOOD PROFILES

TIMBER SPLIT

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MINERAL COUNTY, MT
AND INCORPORATED AREAS

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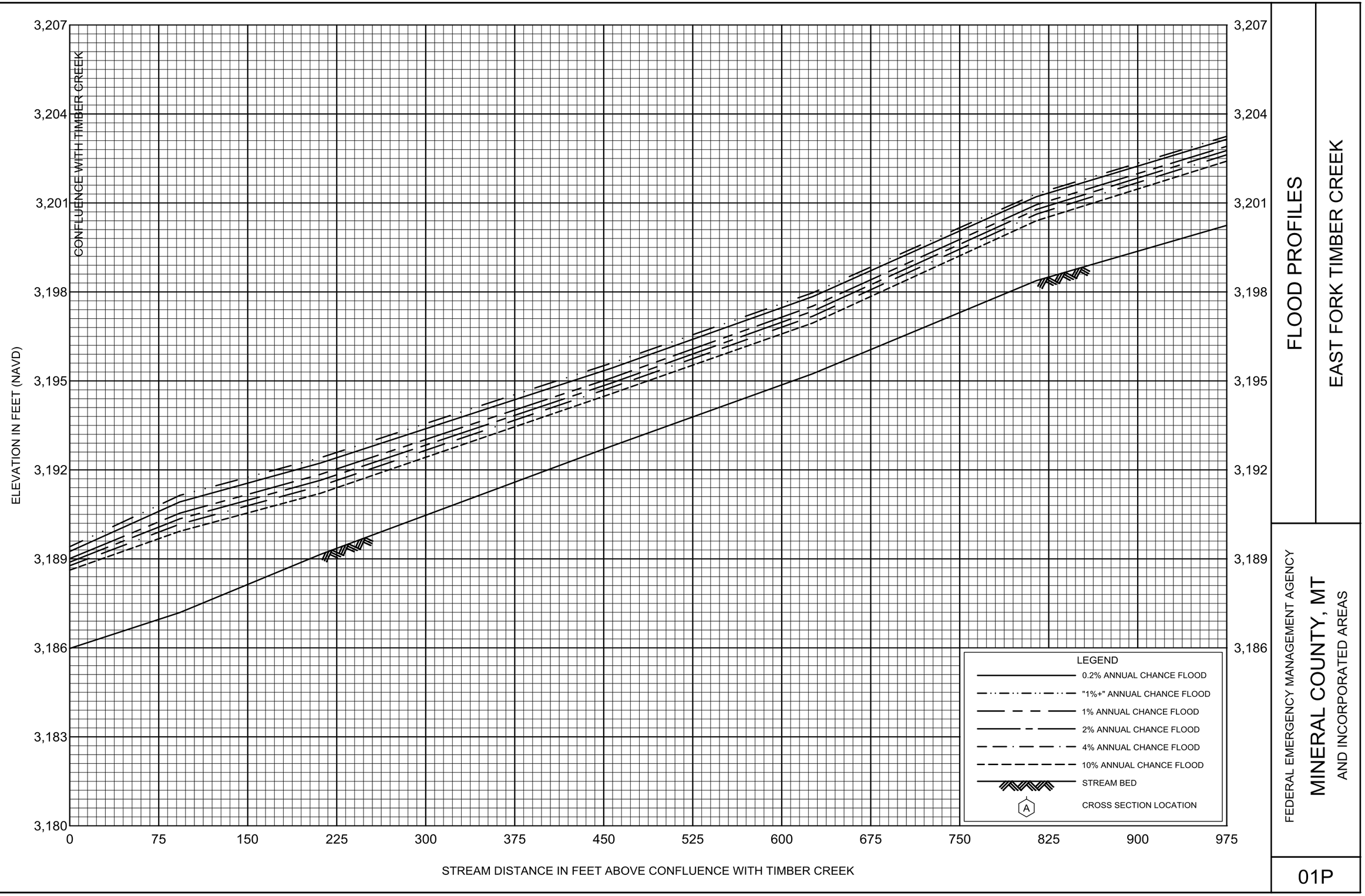

FLOOD PROFILES

EAST FORK TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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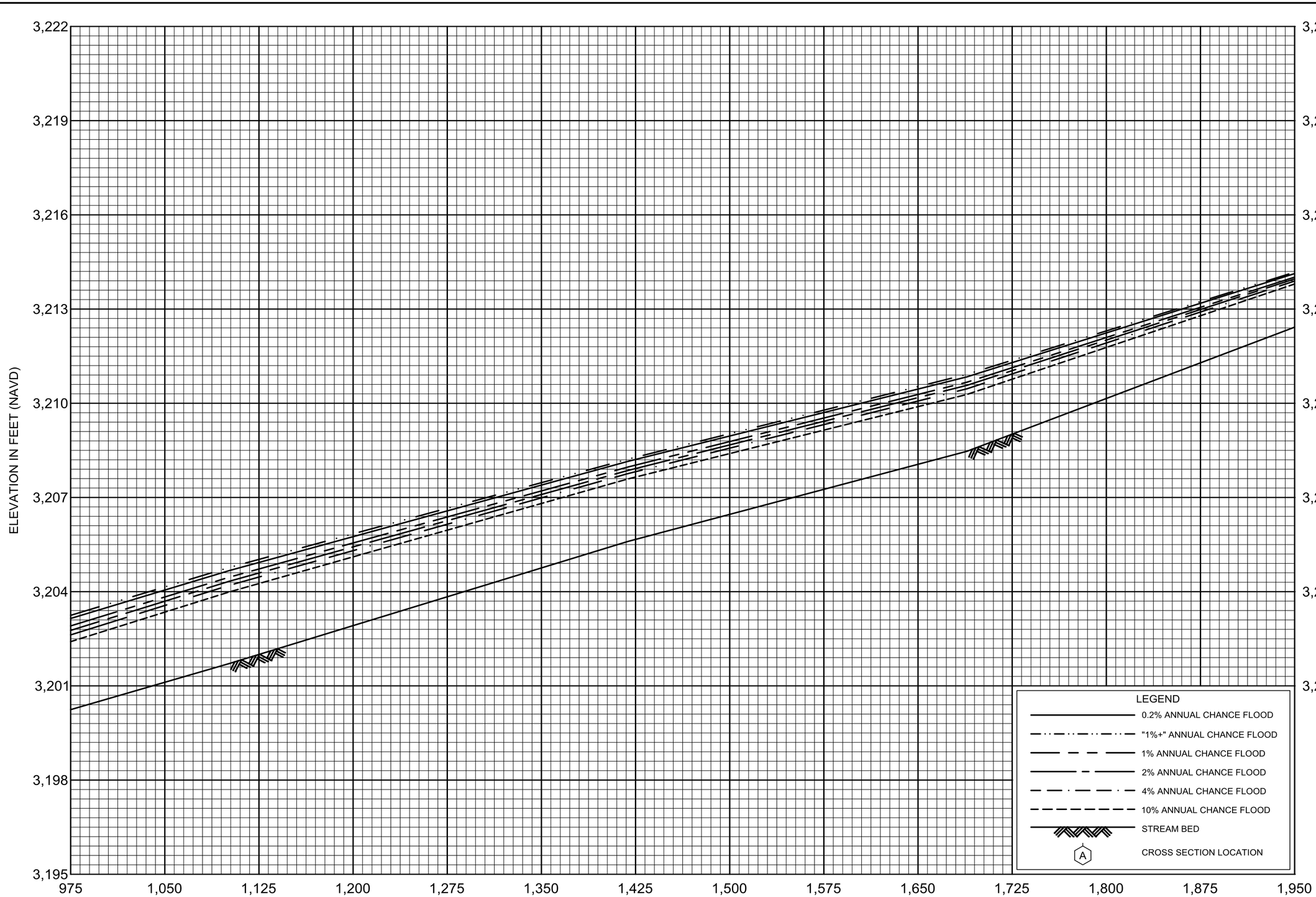

FLOOD PROFILES

EAST FORK TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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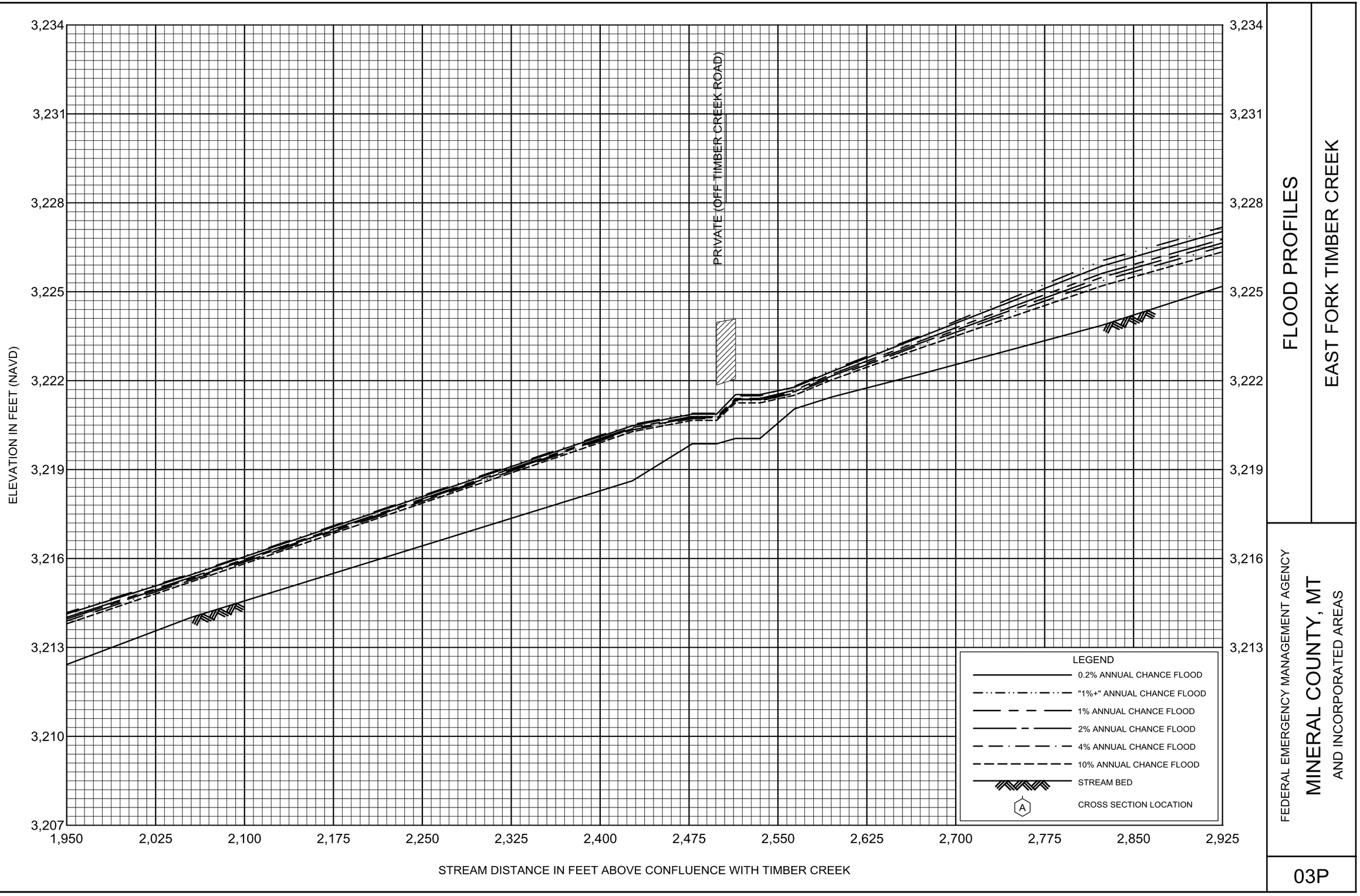

FLOOD PROFILES

EAST FORK TIMBER CREEK

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MINERAL COUNTY, MT

AND INCORPORATED AREAS

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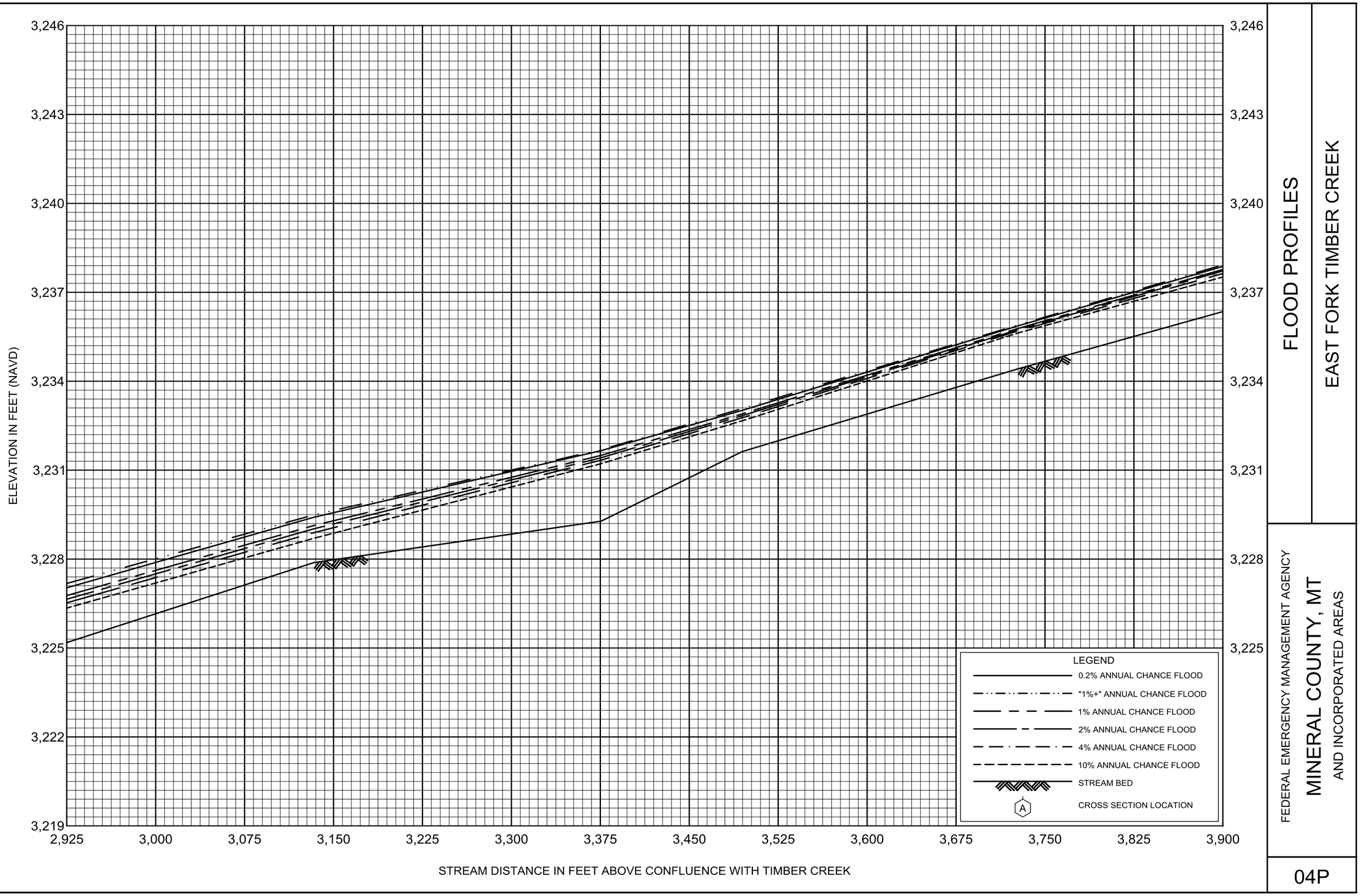

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EAST FORK TIMBER CREEK

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AND INCORPORATED AREAS

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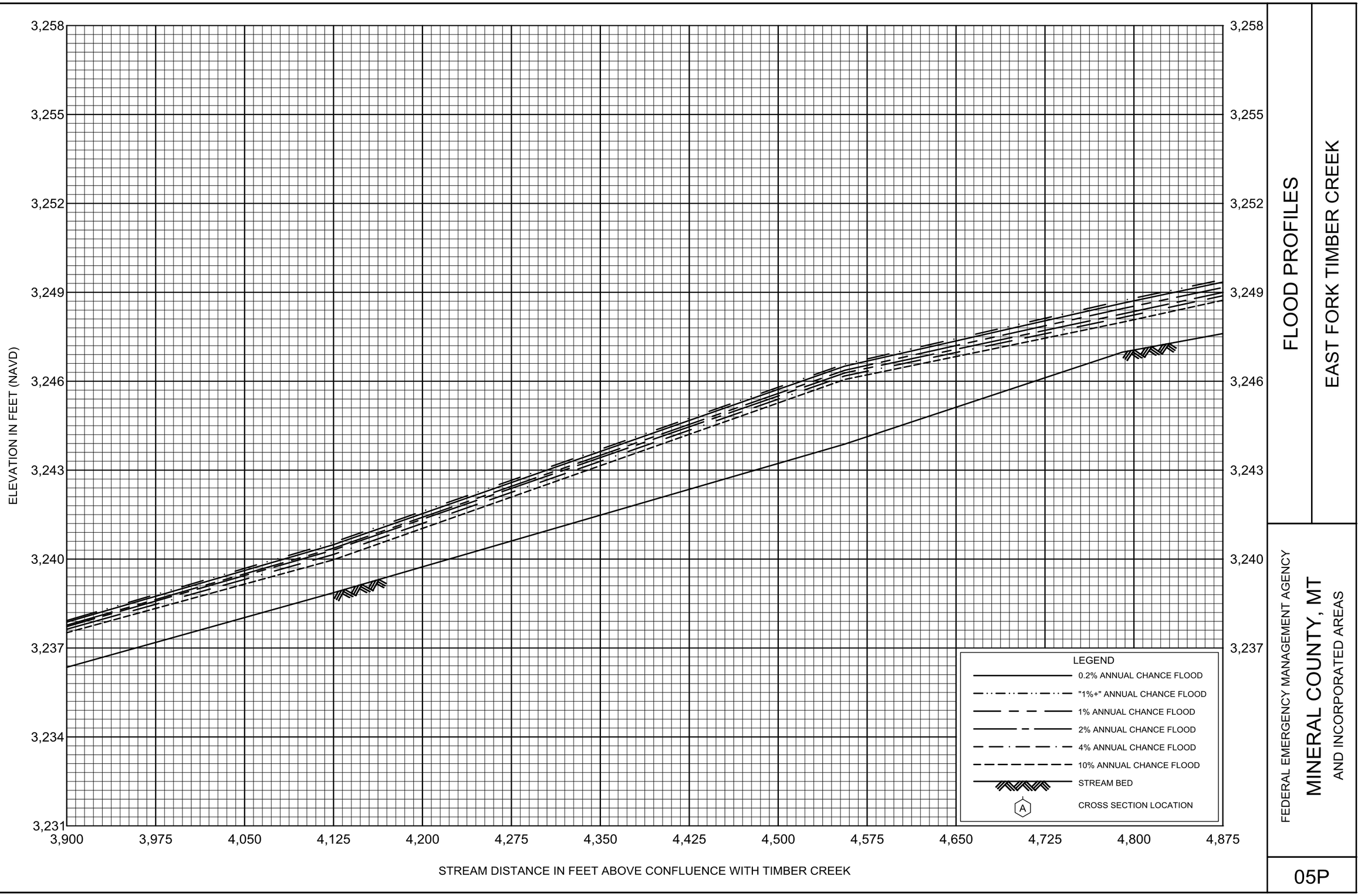

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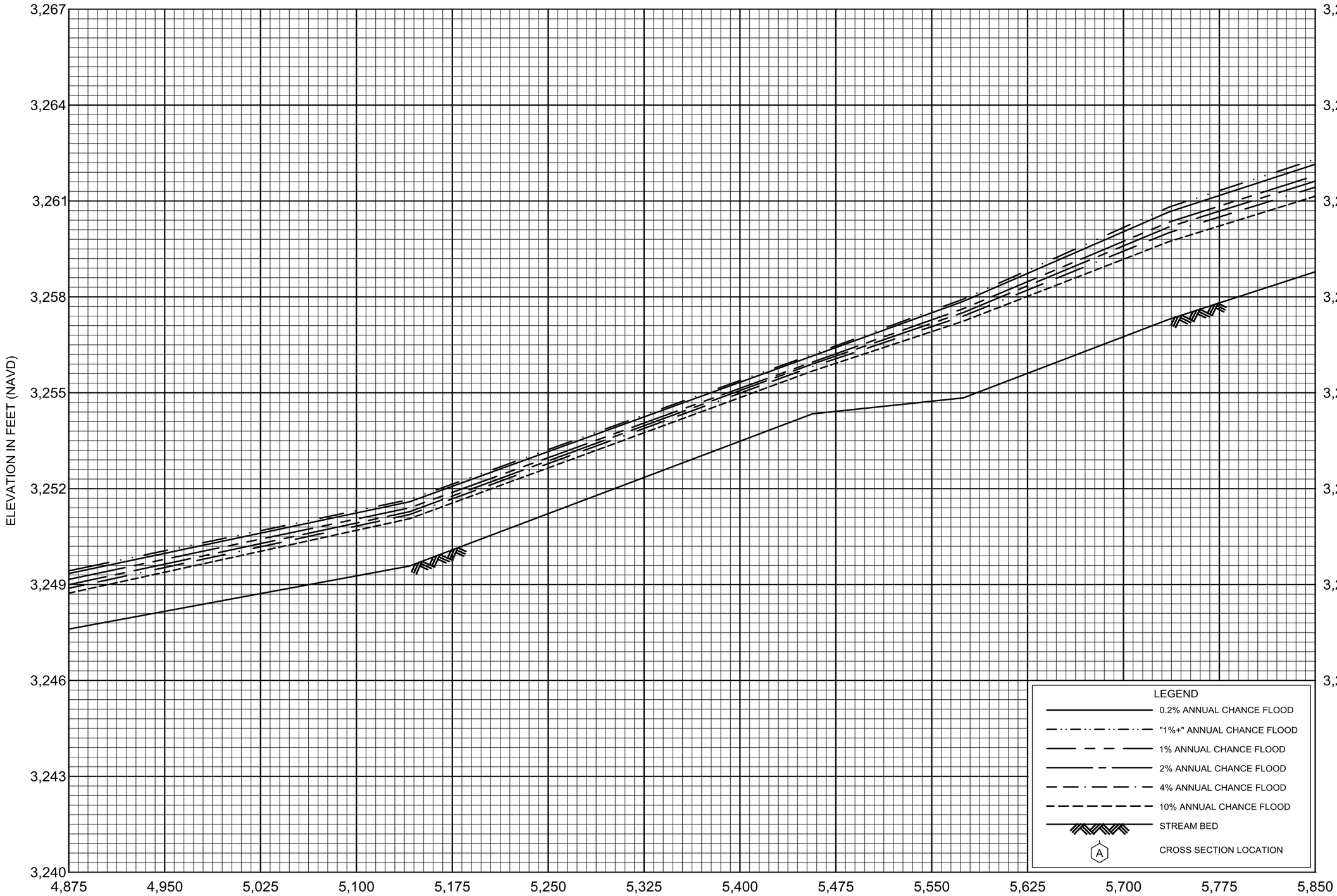

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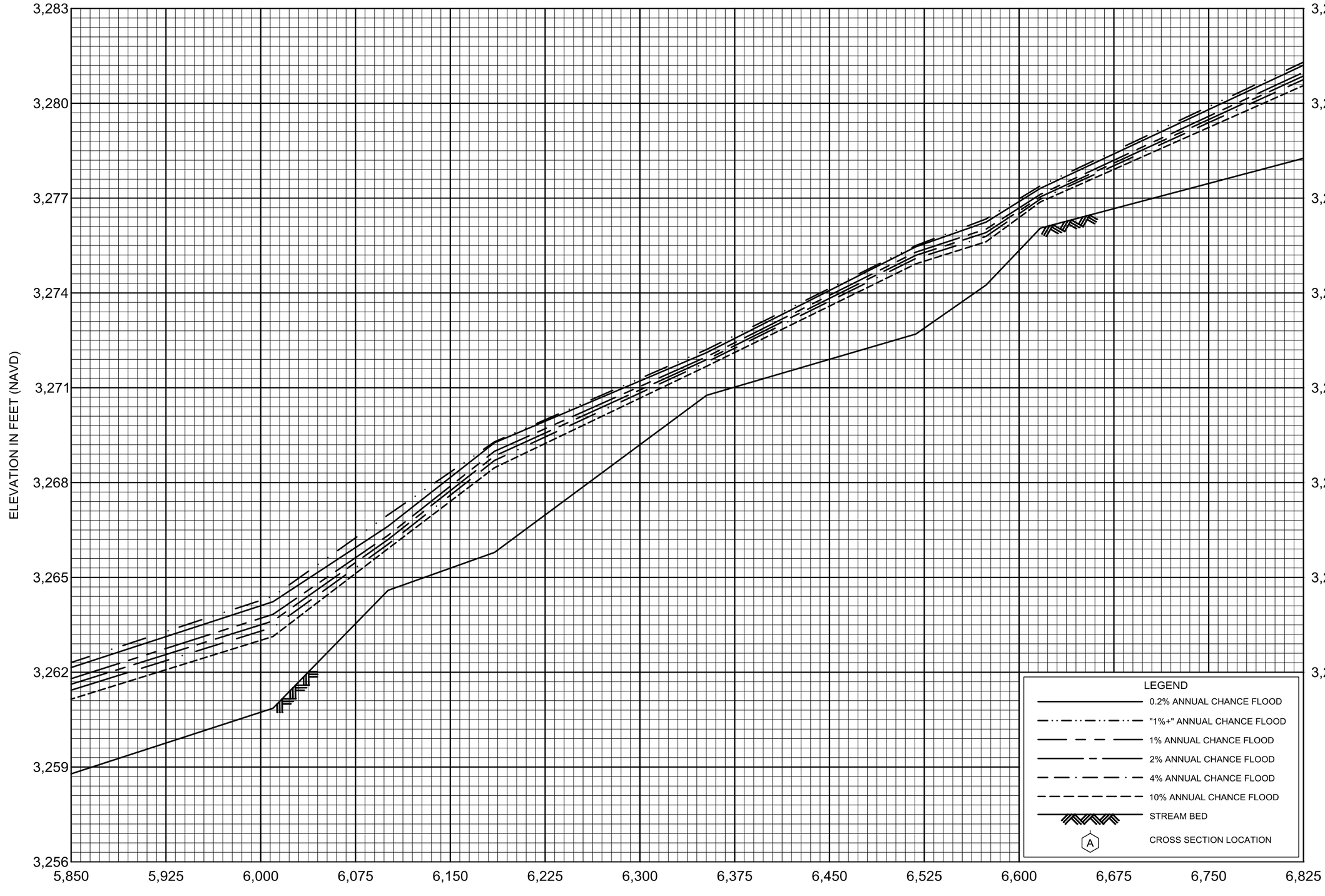

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EAST FORK TIMBER CREEK

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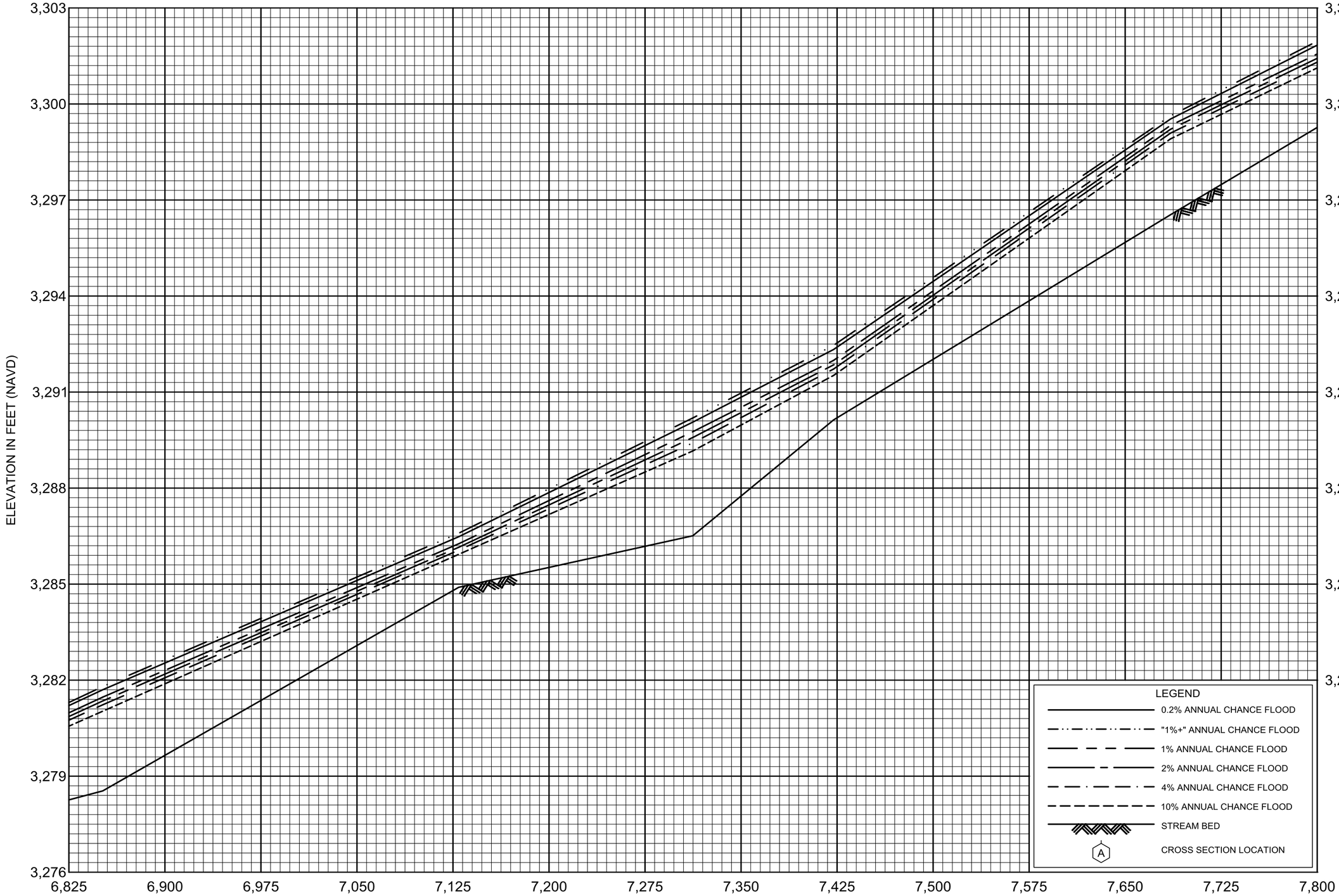

FLOOD PROFILES

EAST FORK TIMBER CREEK

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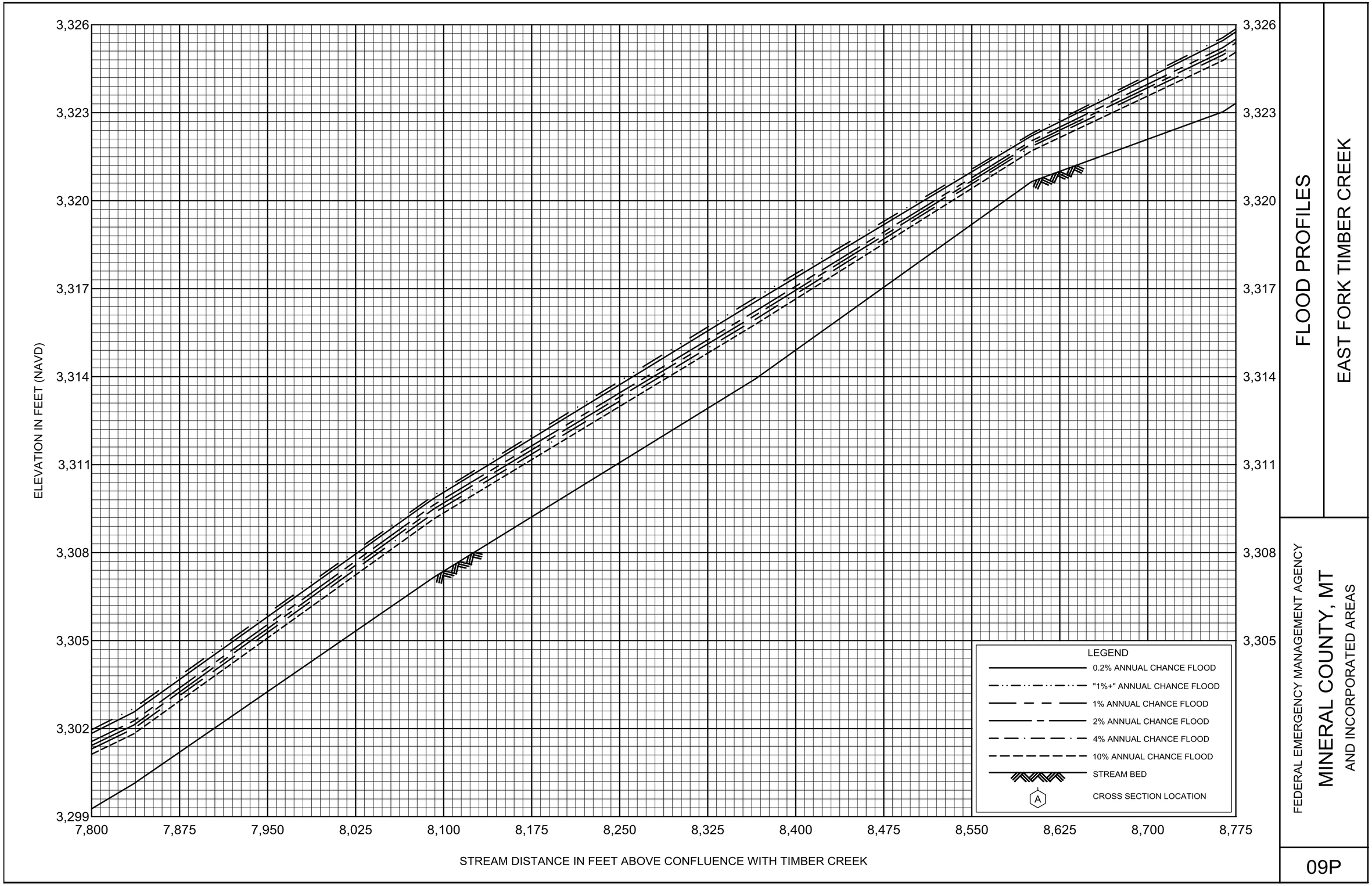

FLOOD PROFILES

EAST FORK TIMBER CREEK

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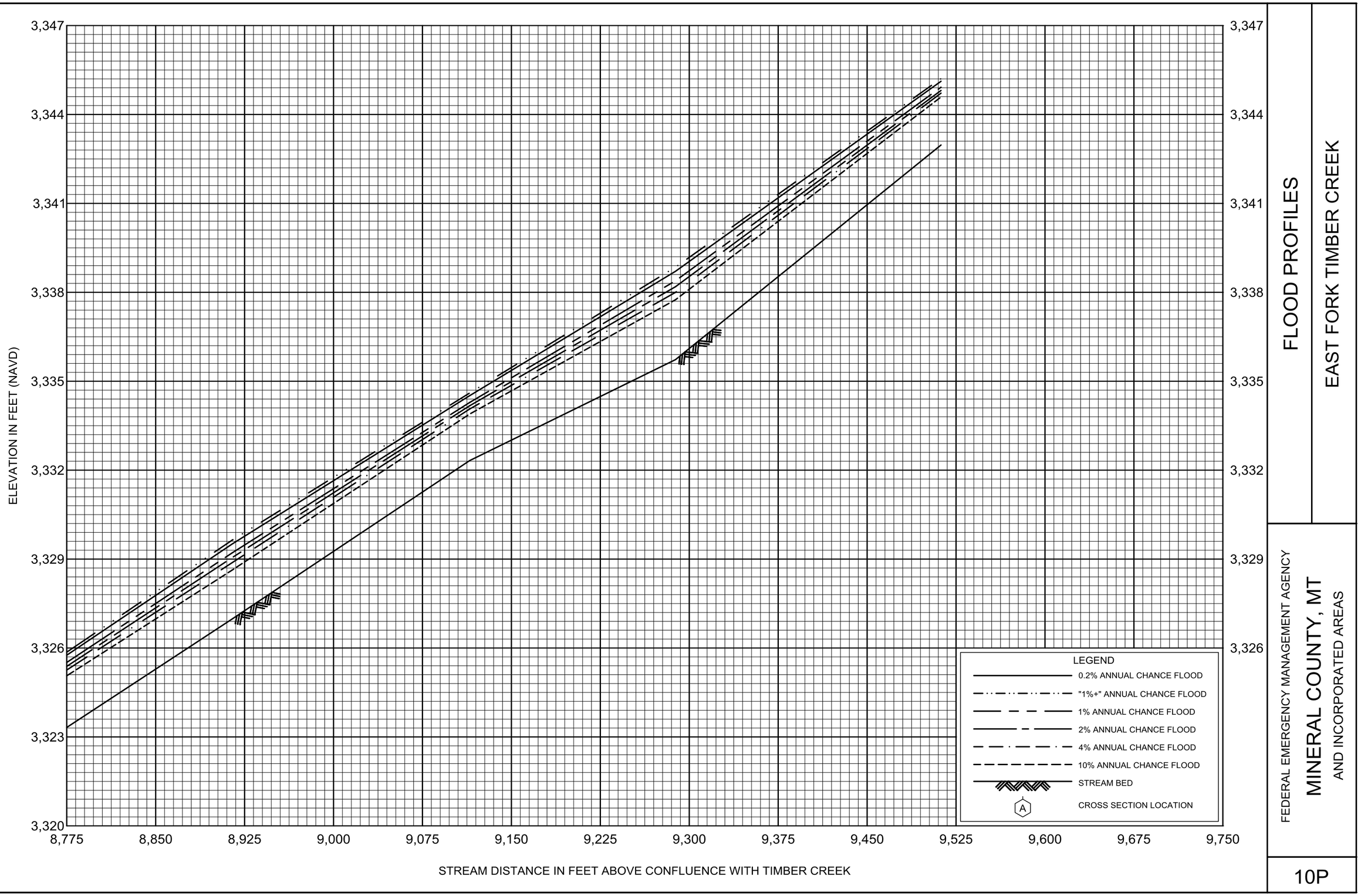

FLOOD PROFILES

EAST FORK TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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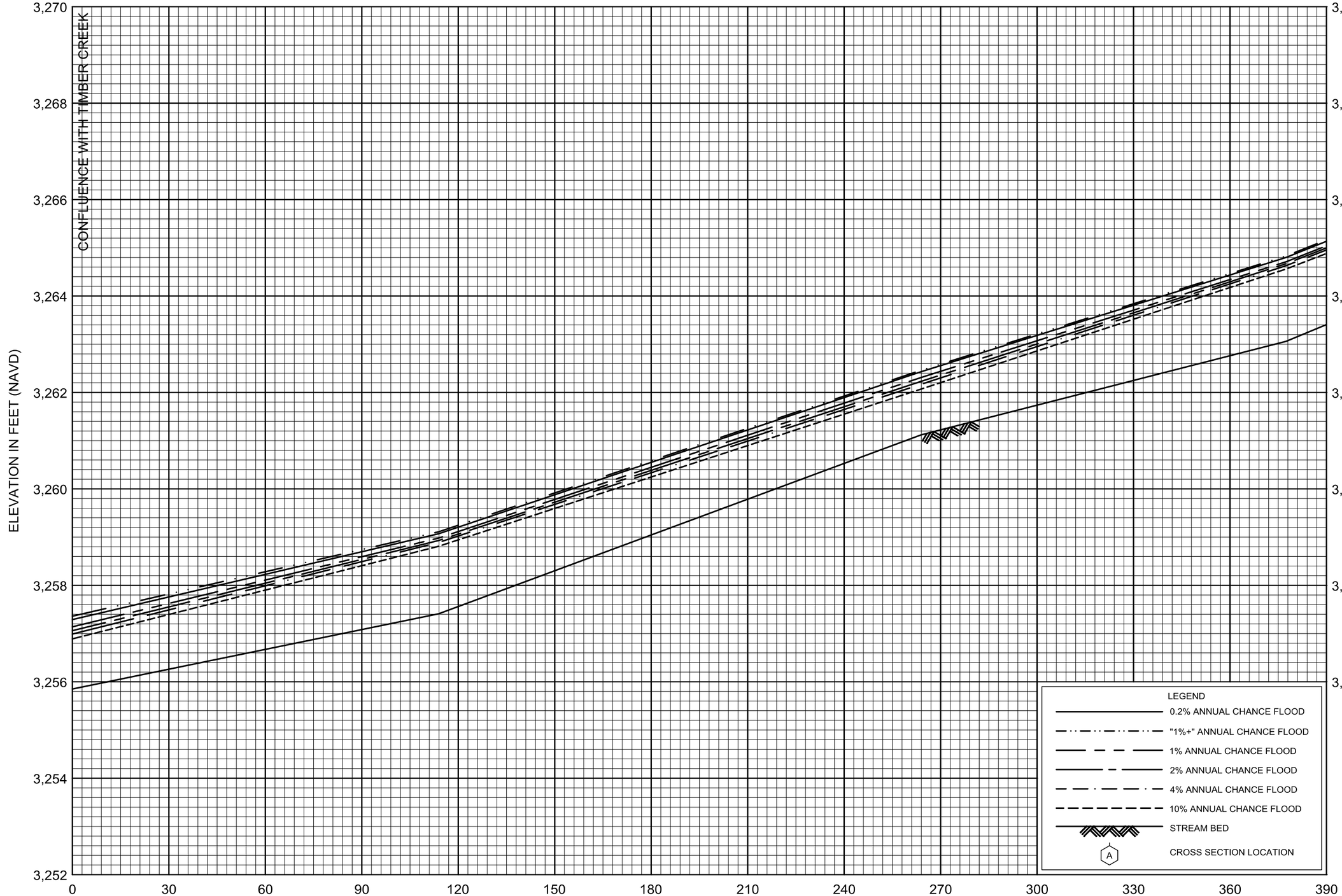

FLOOD PROFILES

WEST FORK TIMBER CREEK

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MINERAL COUNTY, MT

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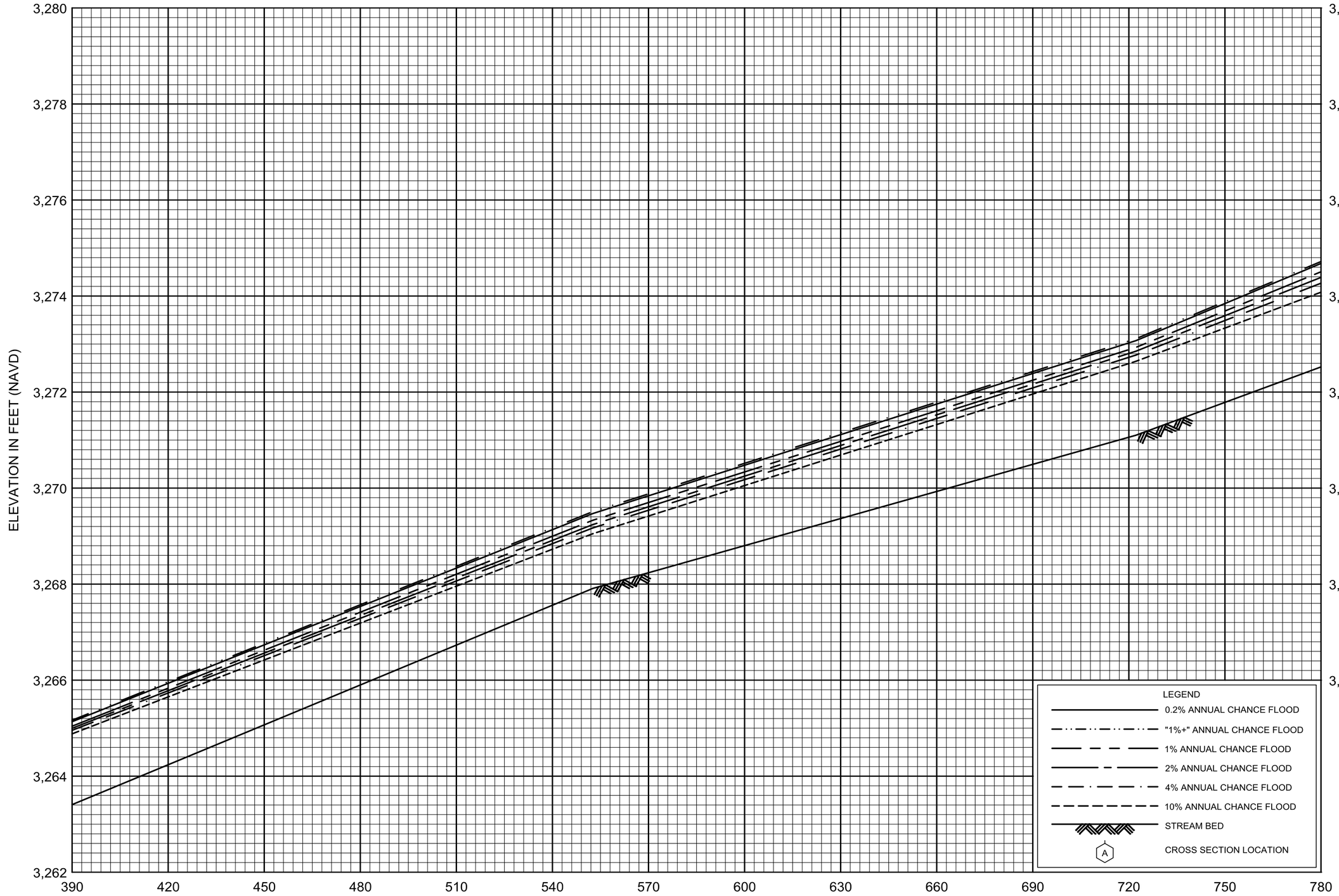

FLOOD PROFILES

WEST FORK TIMBER CREEK

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MINERAL COUNTY, MT

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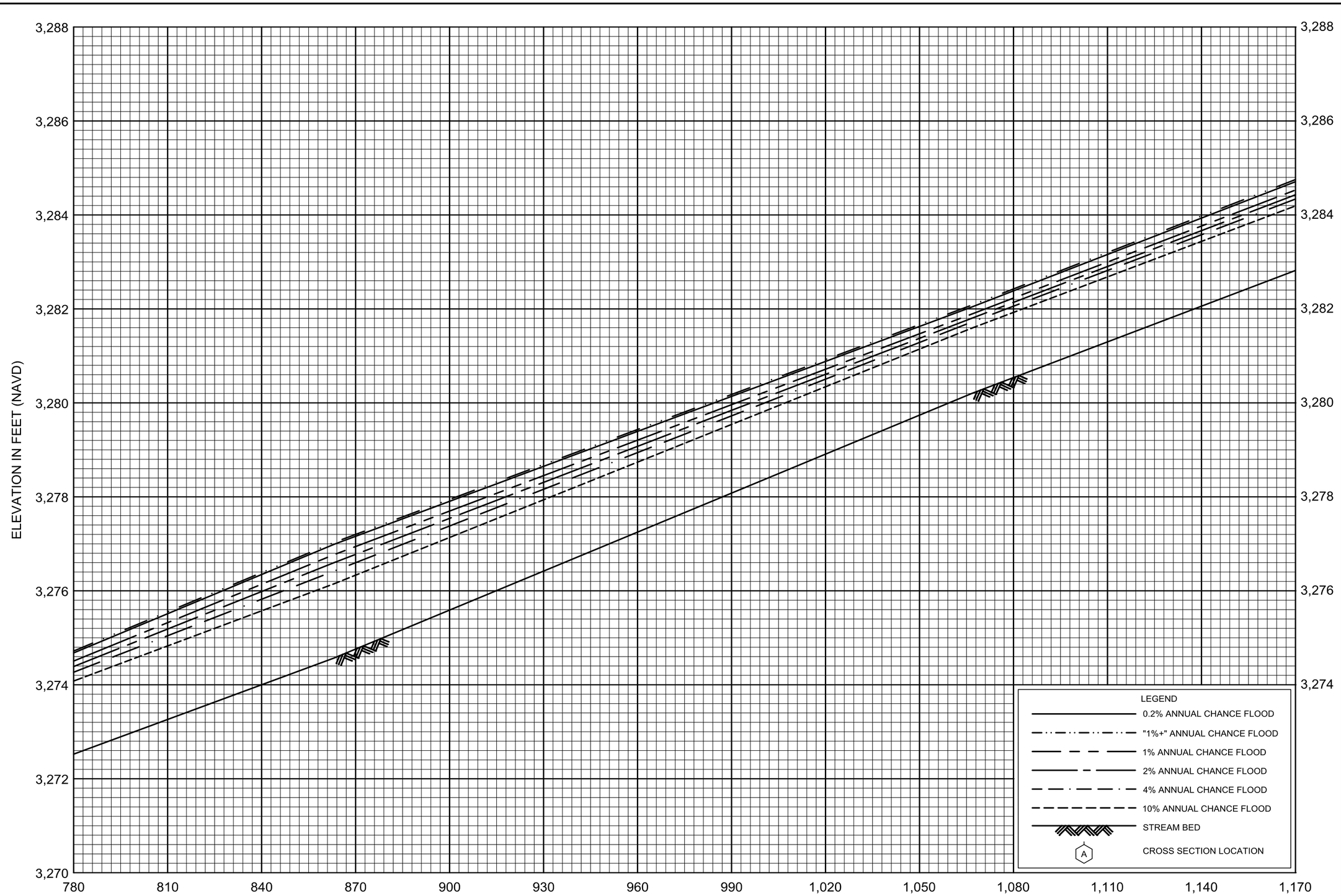

FLOOD PROFILES

WEST FORK TIMBER CREEK

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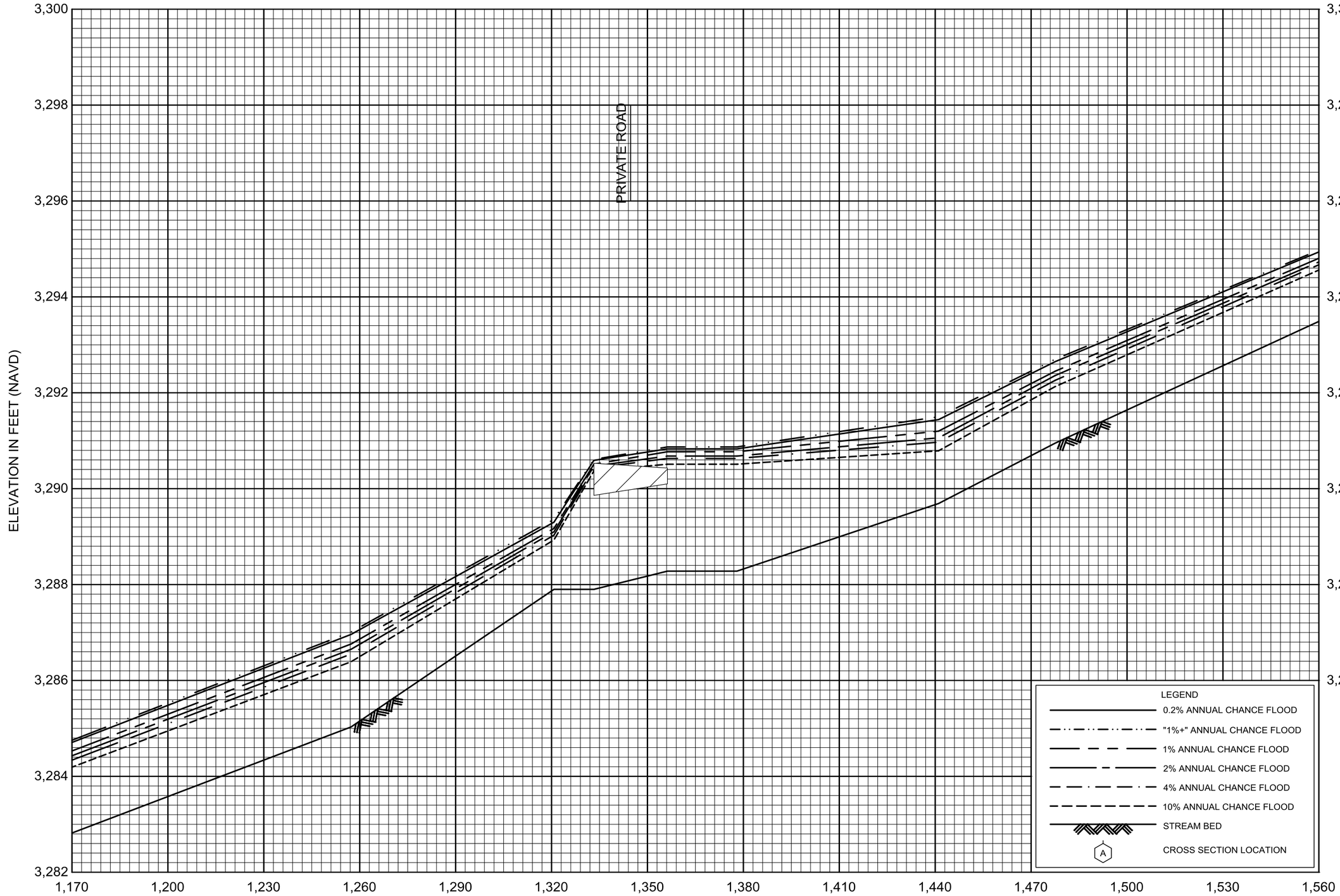

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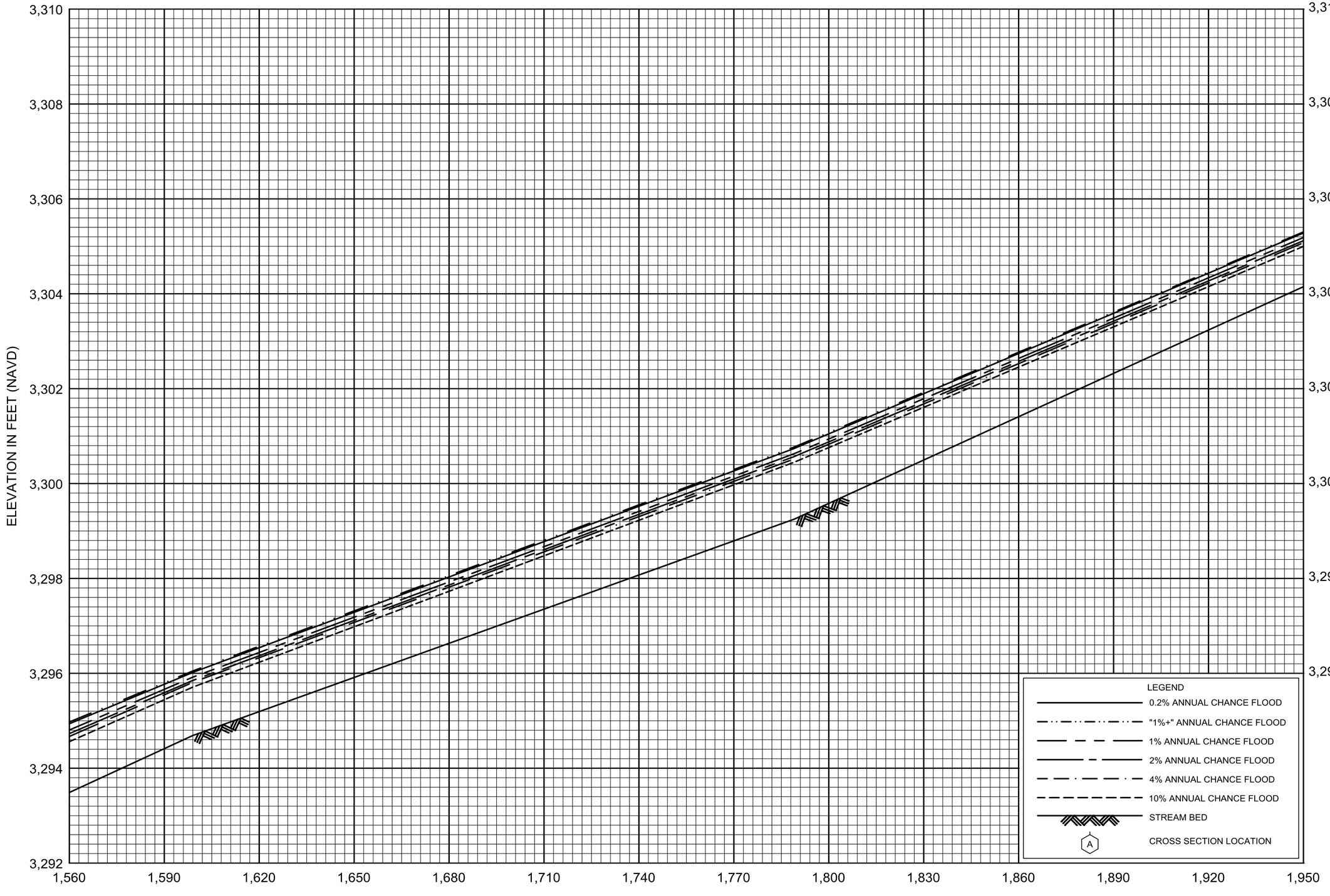
MINERAL COUNTY, MT

AND INCORPORATED AREAS

04P



FLOOD PROFILES

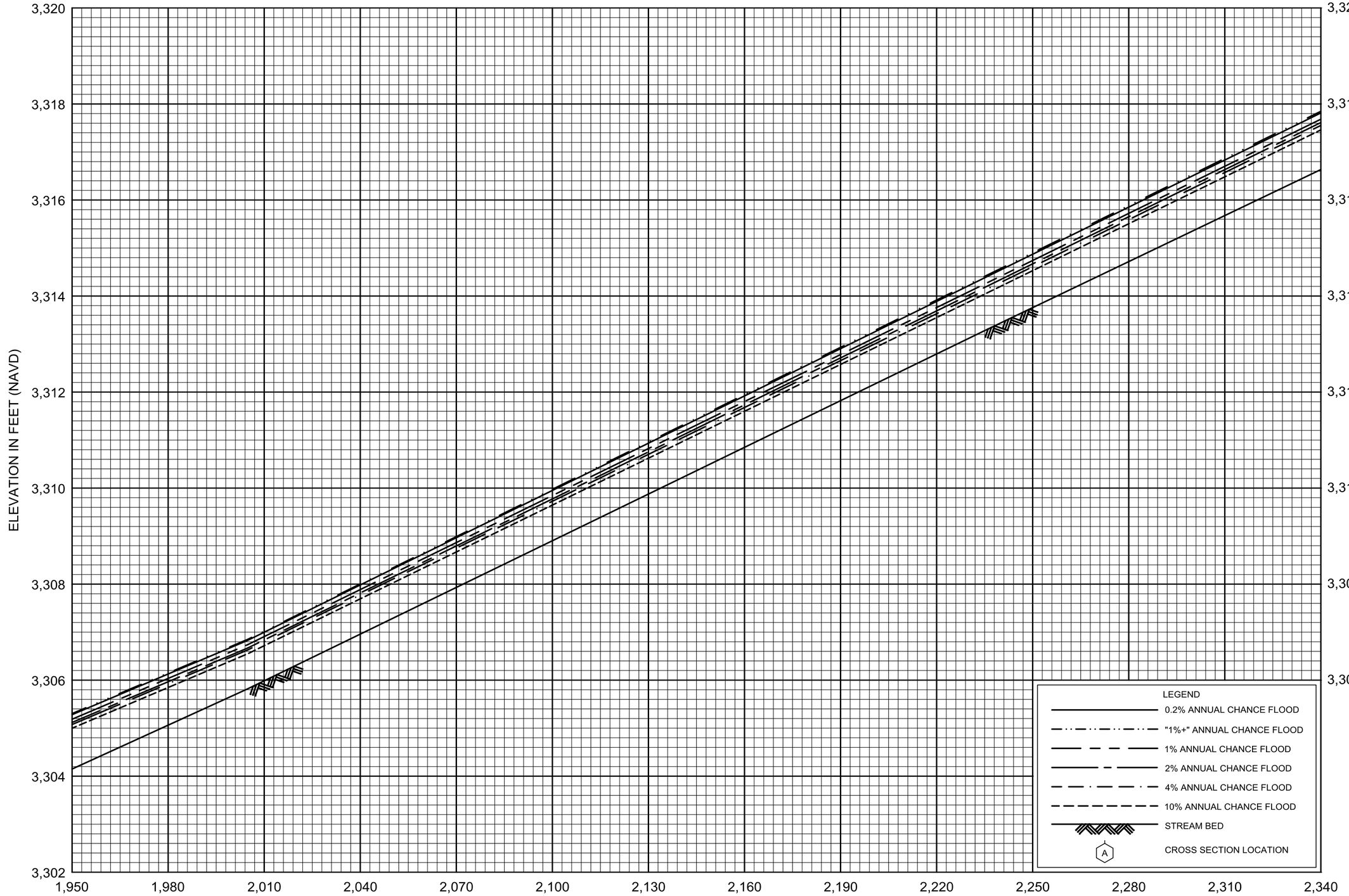
WEST FORK TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

05P



FLOOD PROFILES

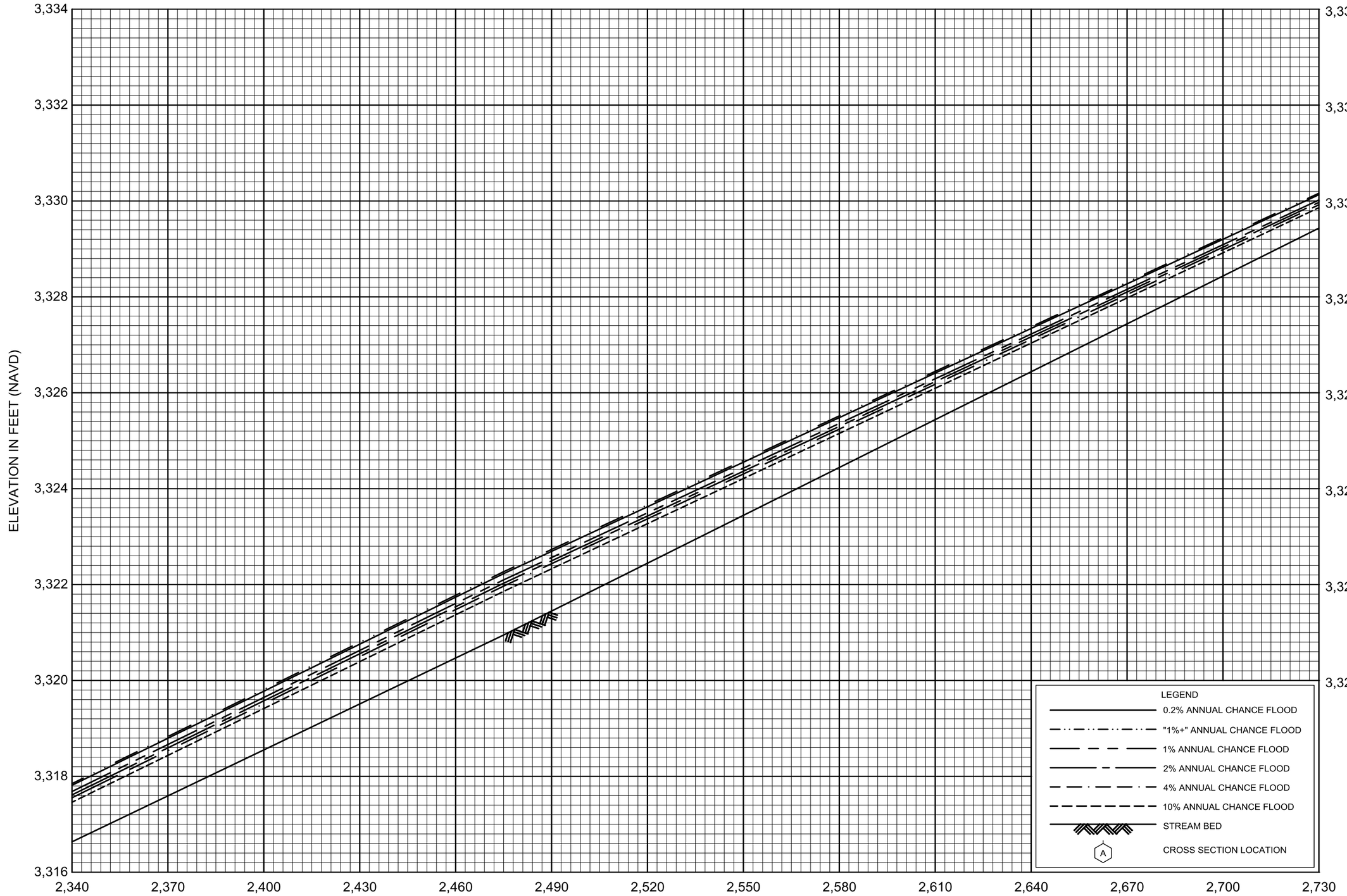
WEST FORK TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

06P



FLOOD PROFILES

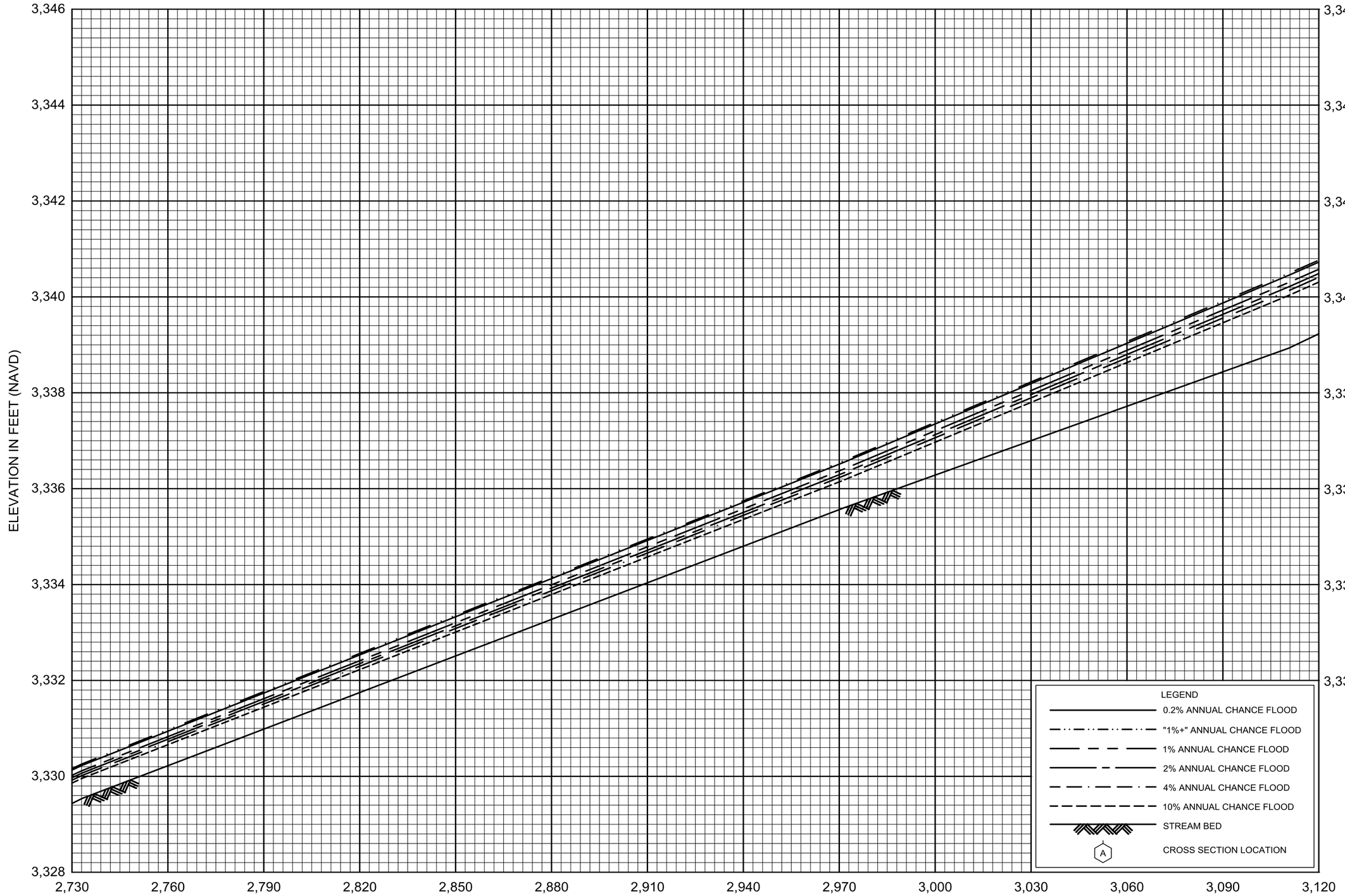
WEST FORK TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

07P



FLOOD PROFILES

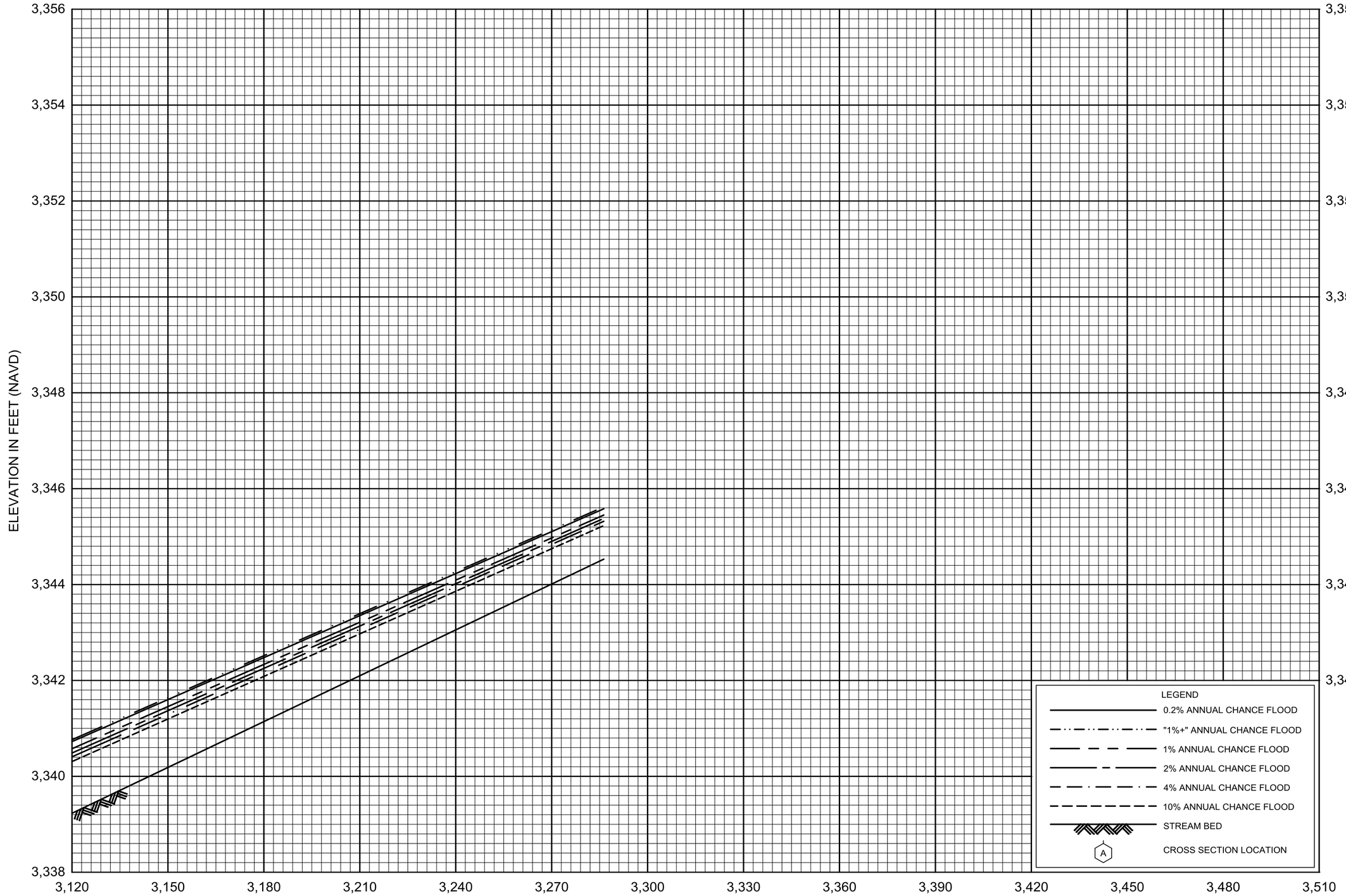
WEST FORK TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

08P



FLOOD PROFILES

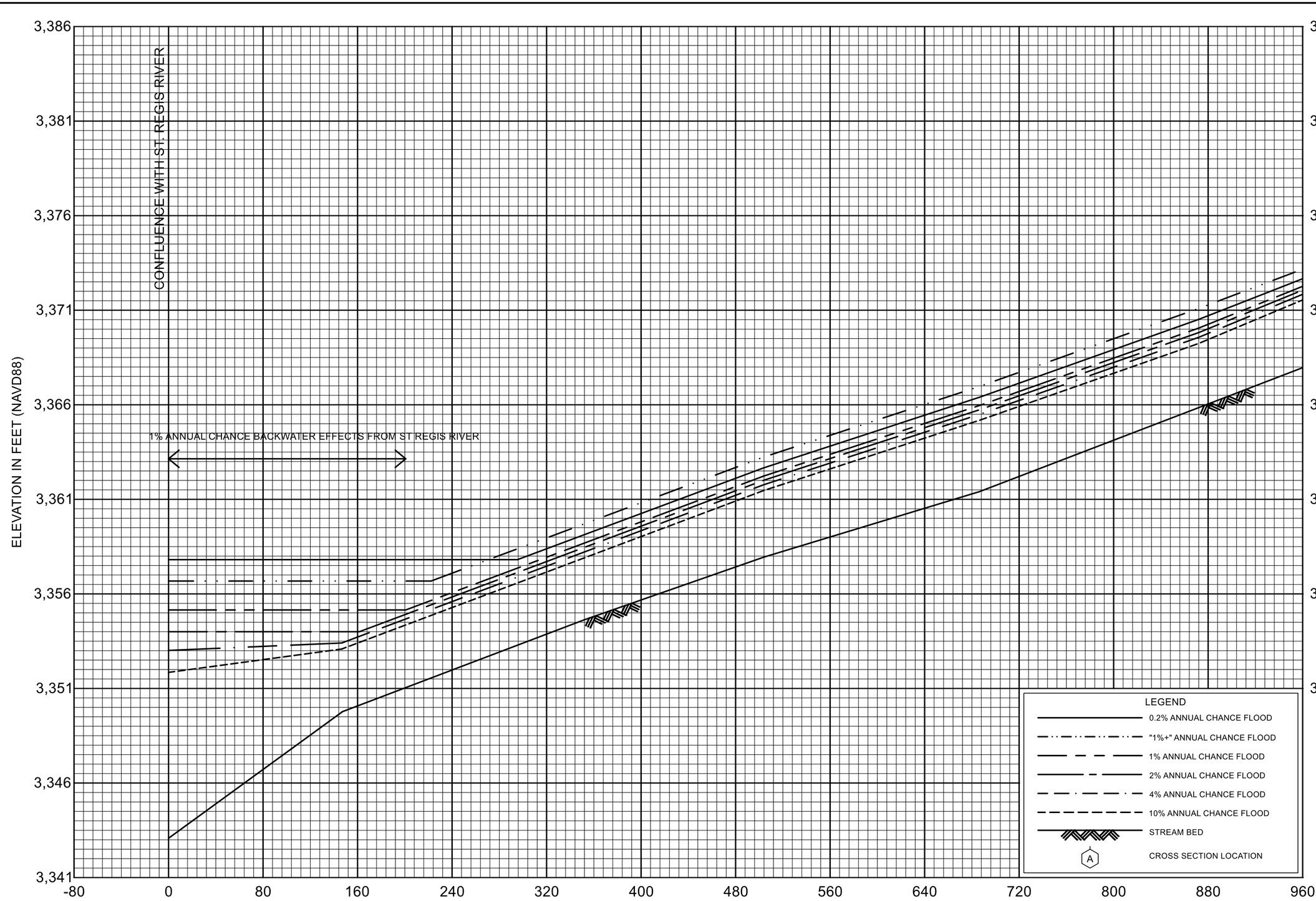
WEST FORK TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

09P



FLOOD PROFILES

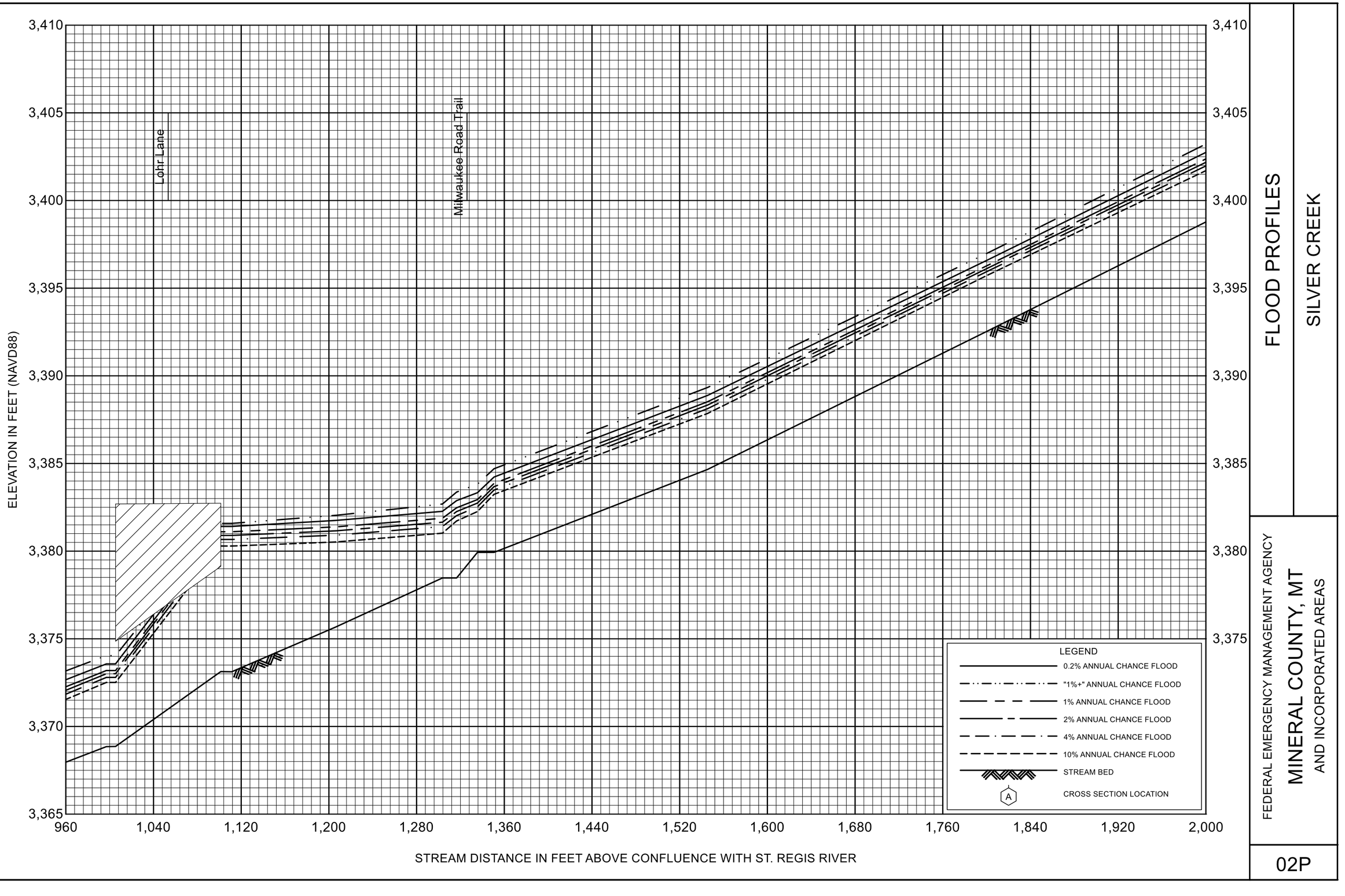
SILVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

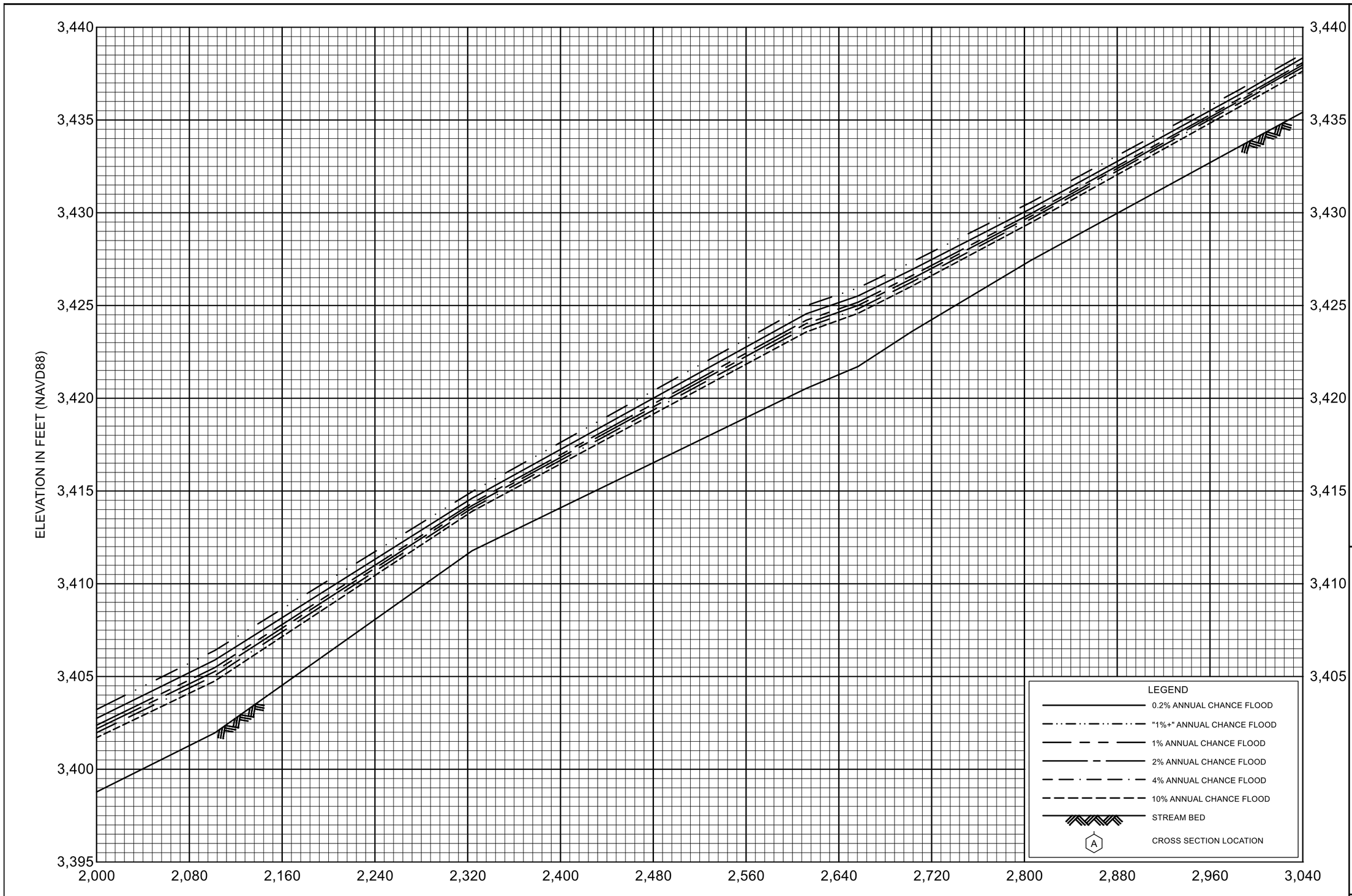
SILVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

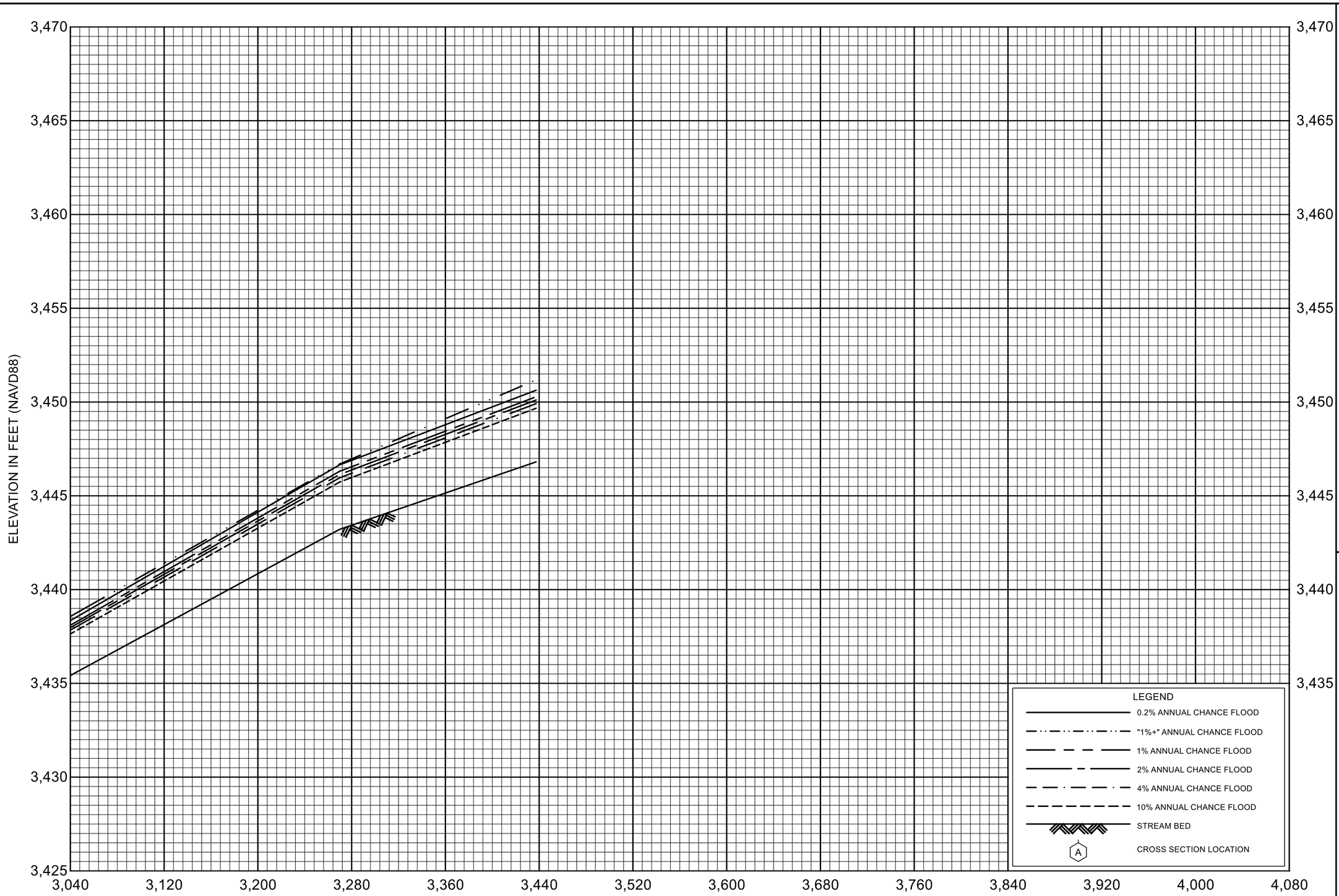
SILVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

03P



FLOOD PROFILES

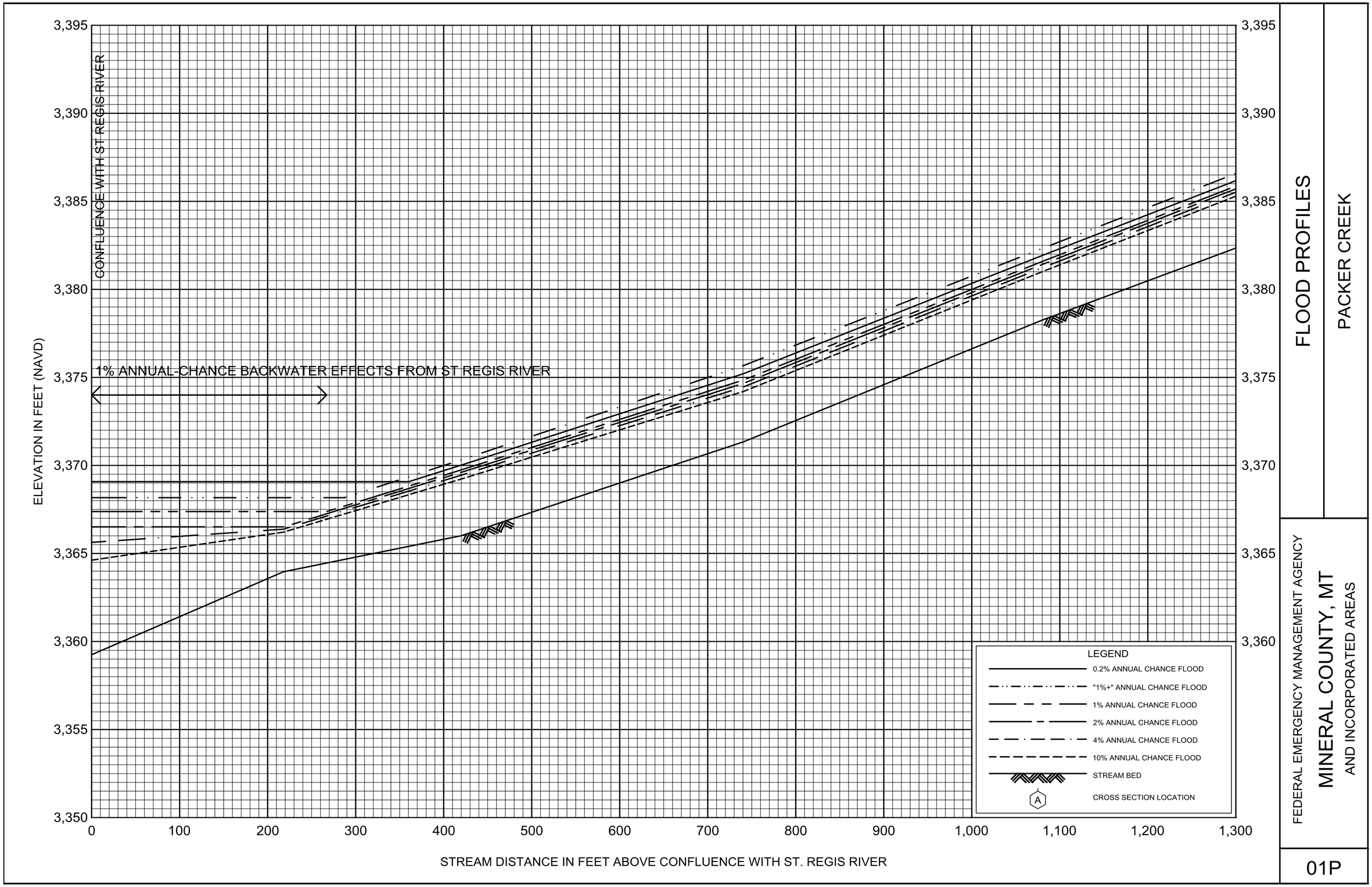
SILVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

04P



FLOOD PROFILES

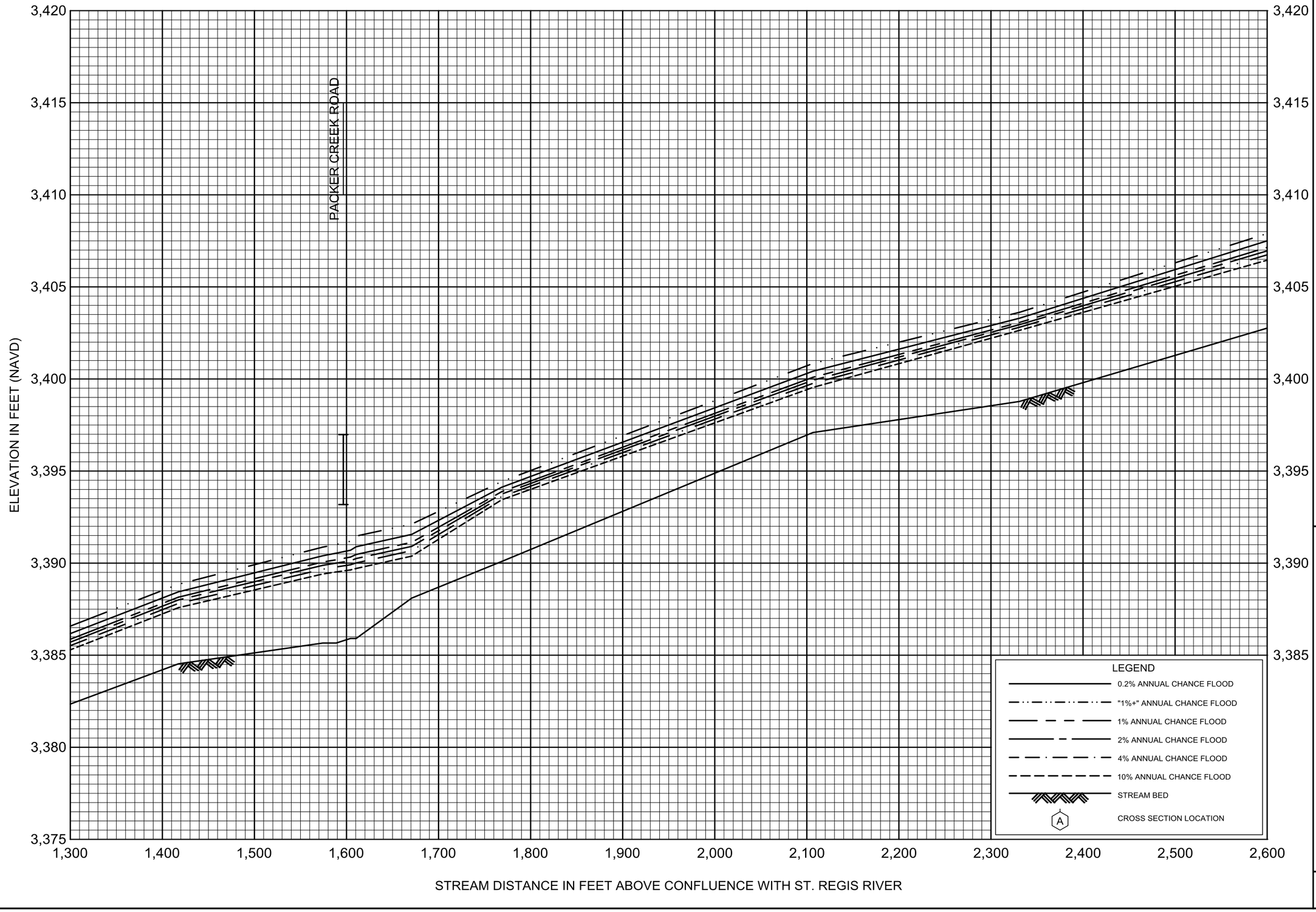
PACKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

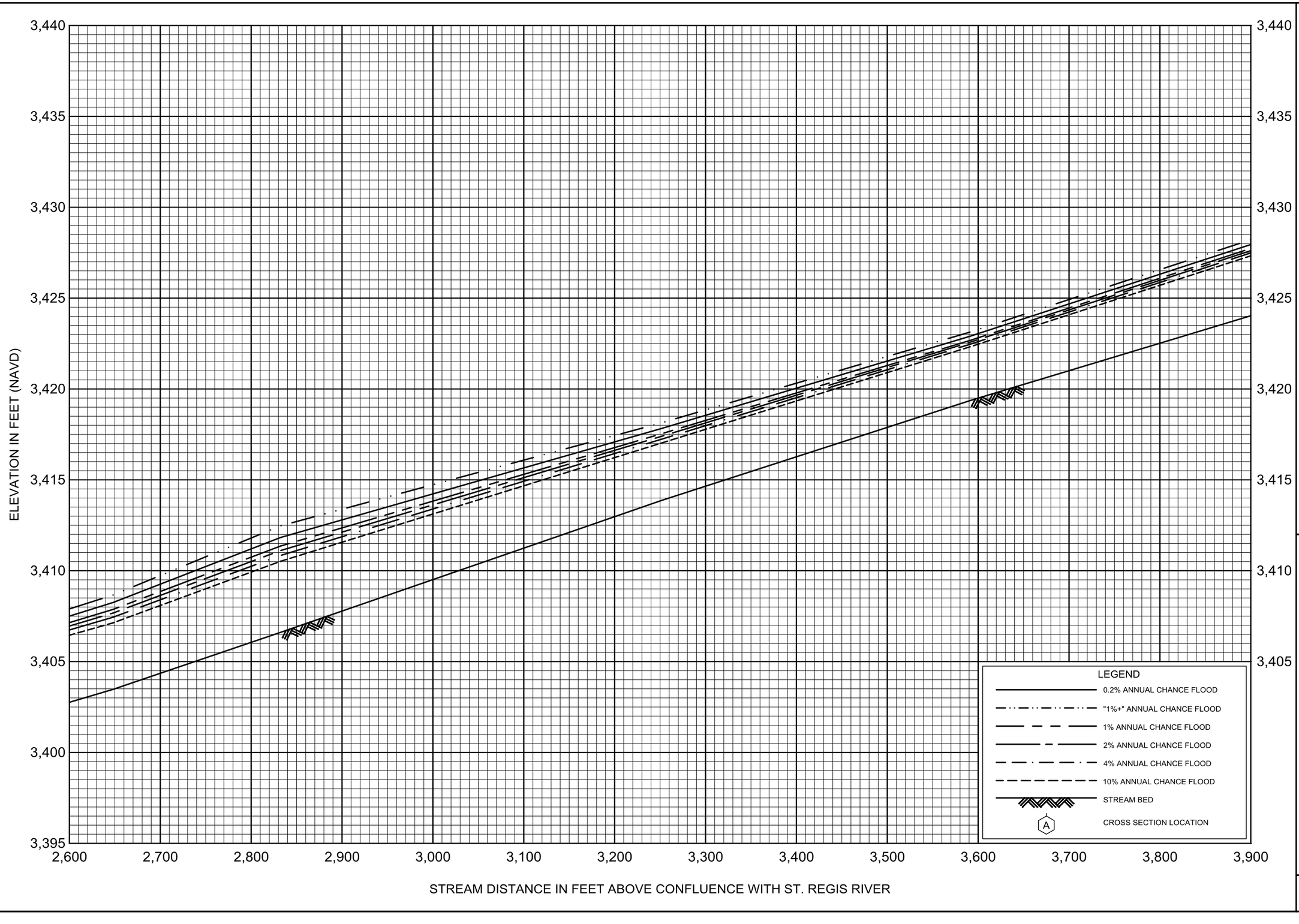
PACKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

PACKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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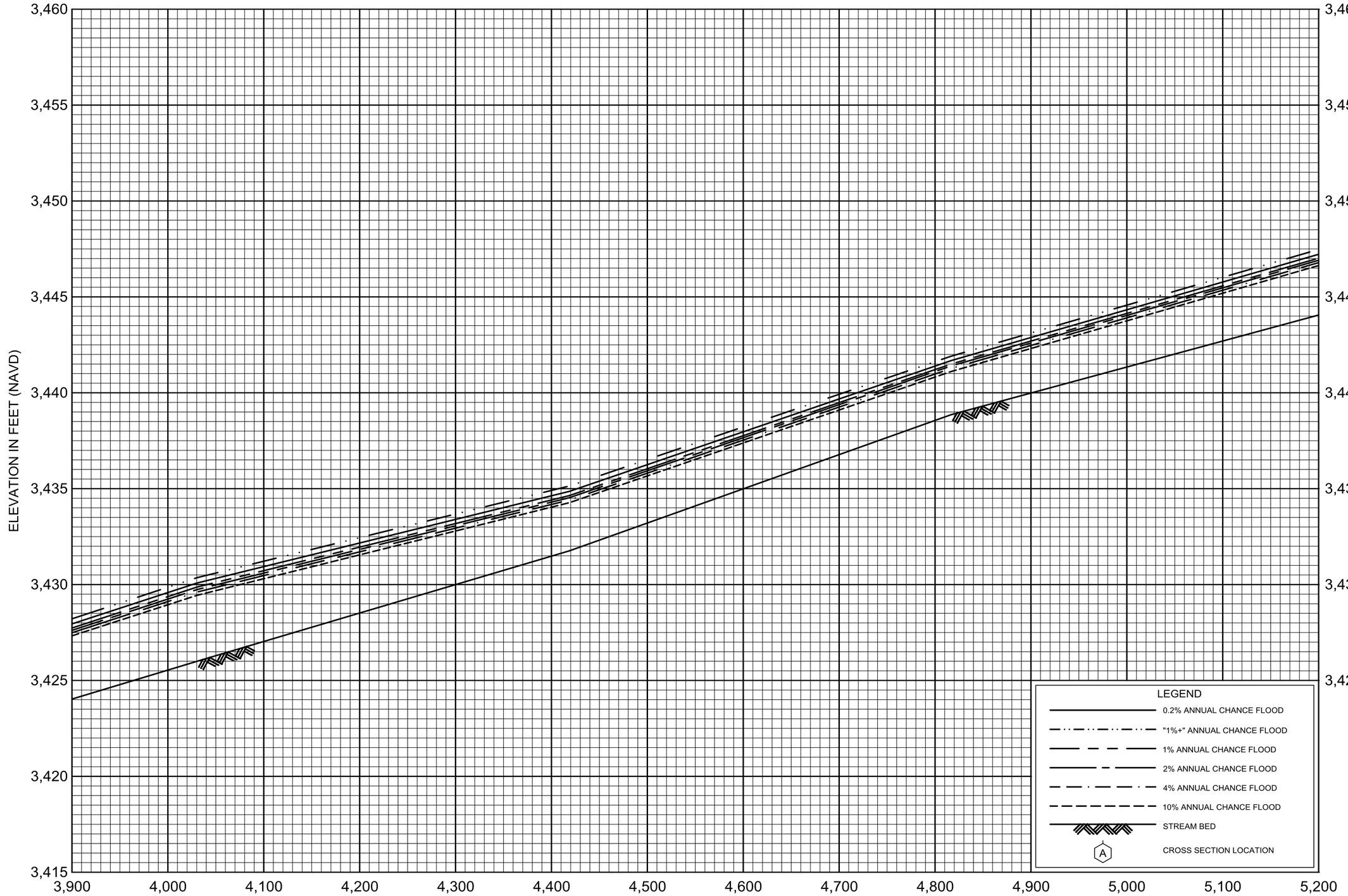

FLOOD PROFILES

PACKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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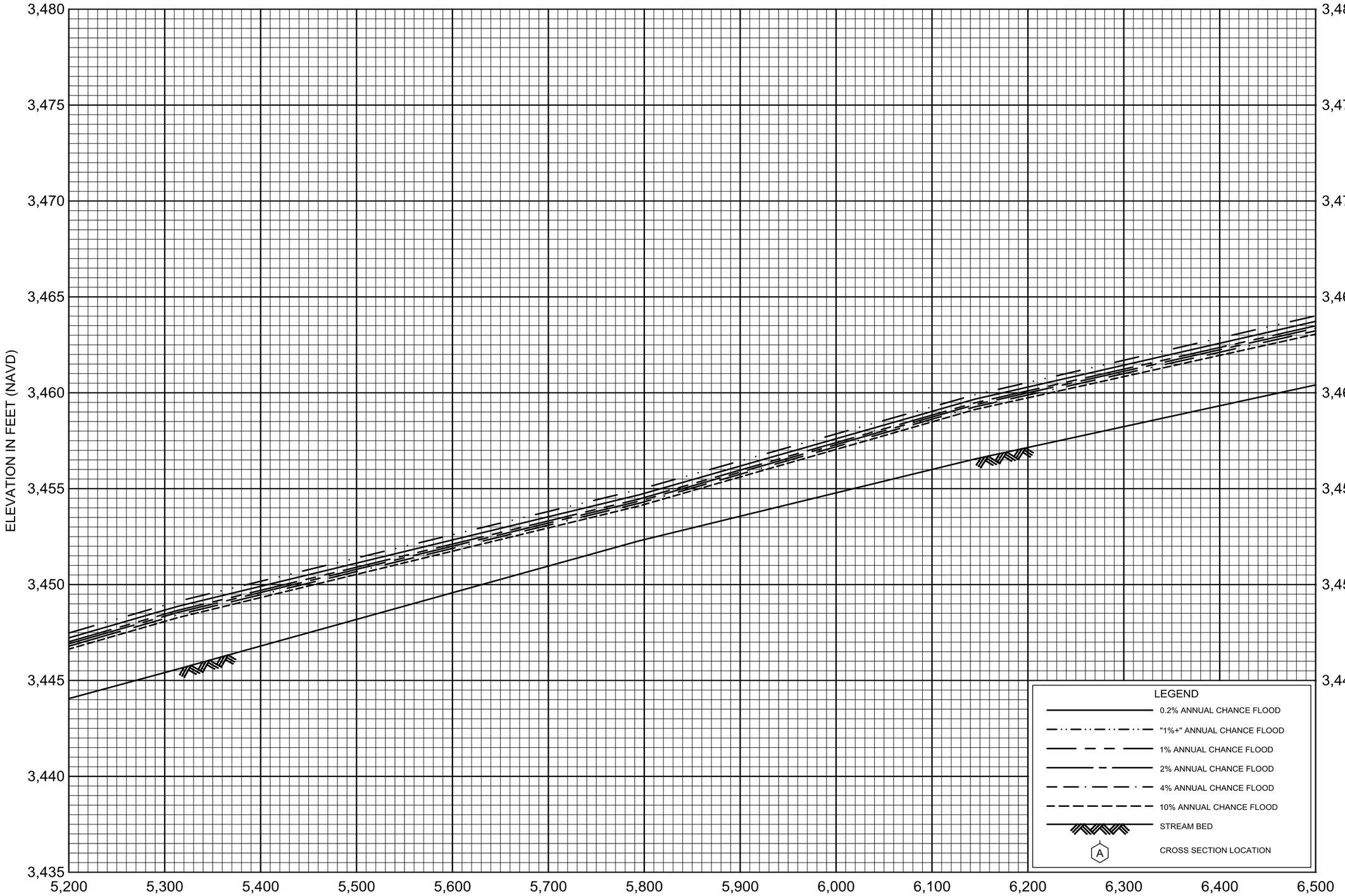


FLOOD PROFILES

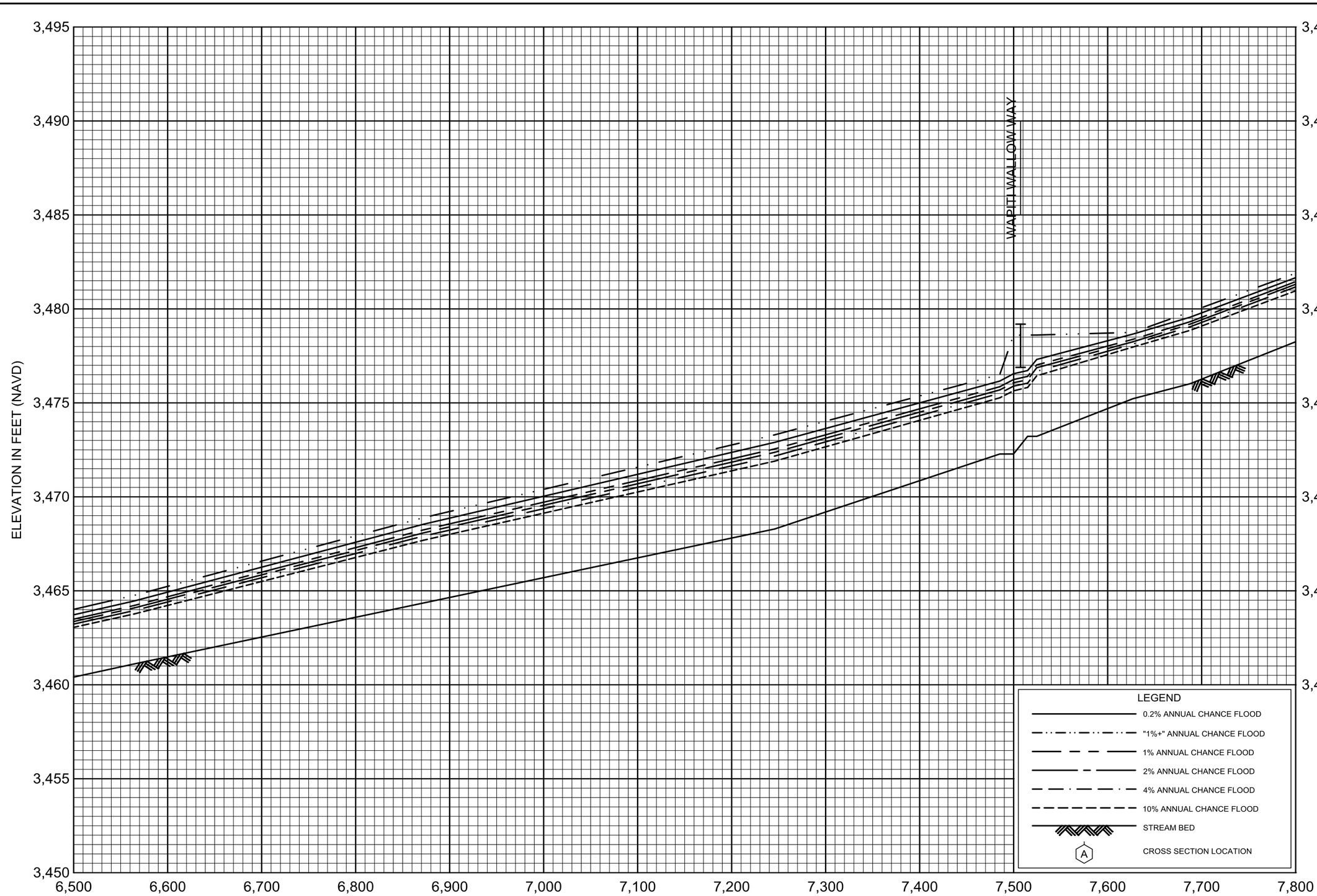
PACKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

05P



FLOOD PROFILES

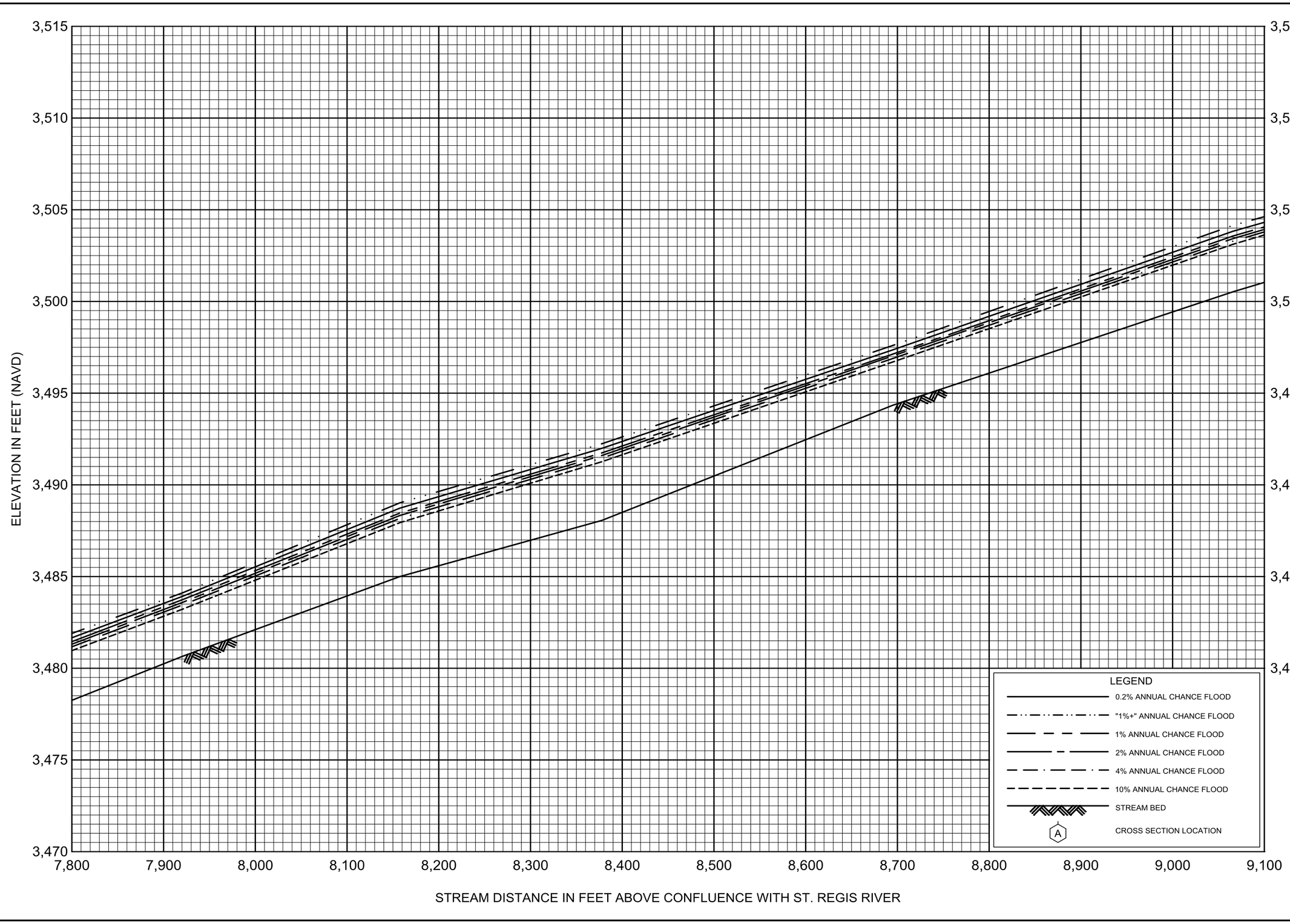
PACKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

06P



FLOOD PROFILES

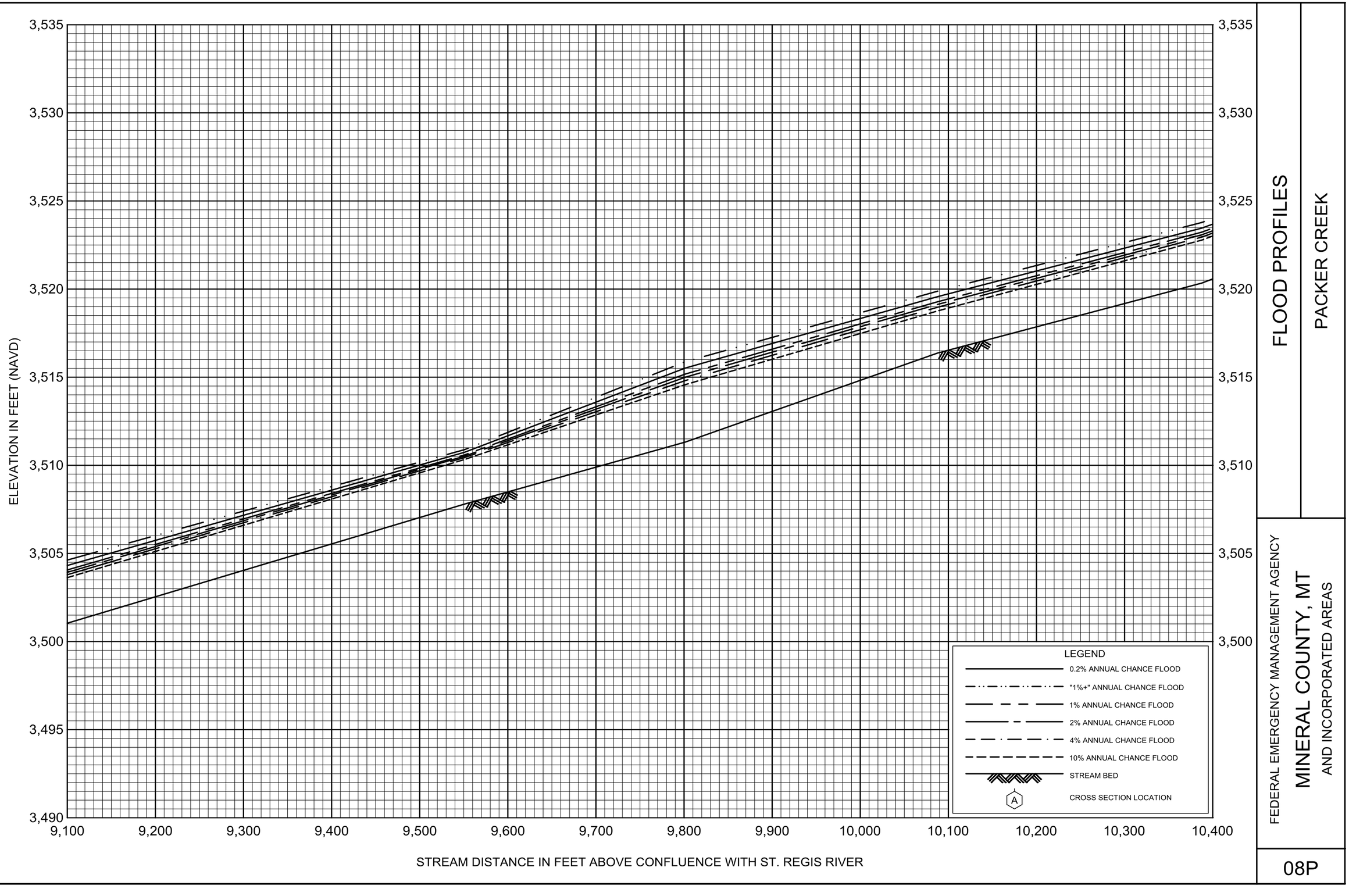
PACKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

07P



FLOOD PROFILES

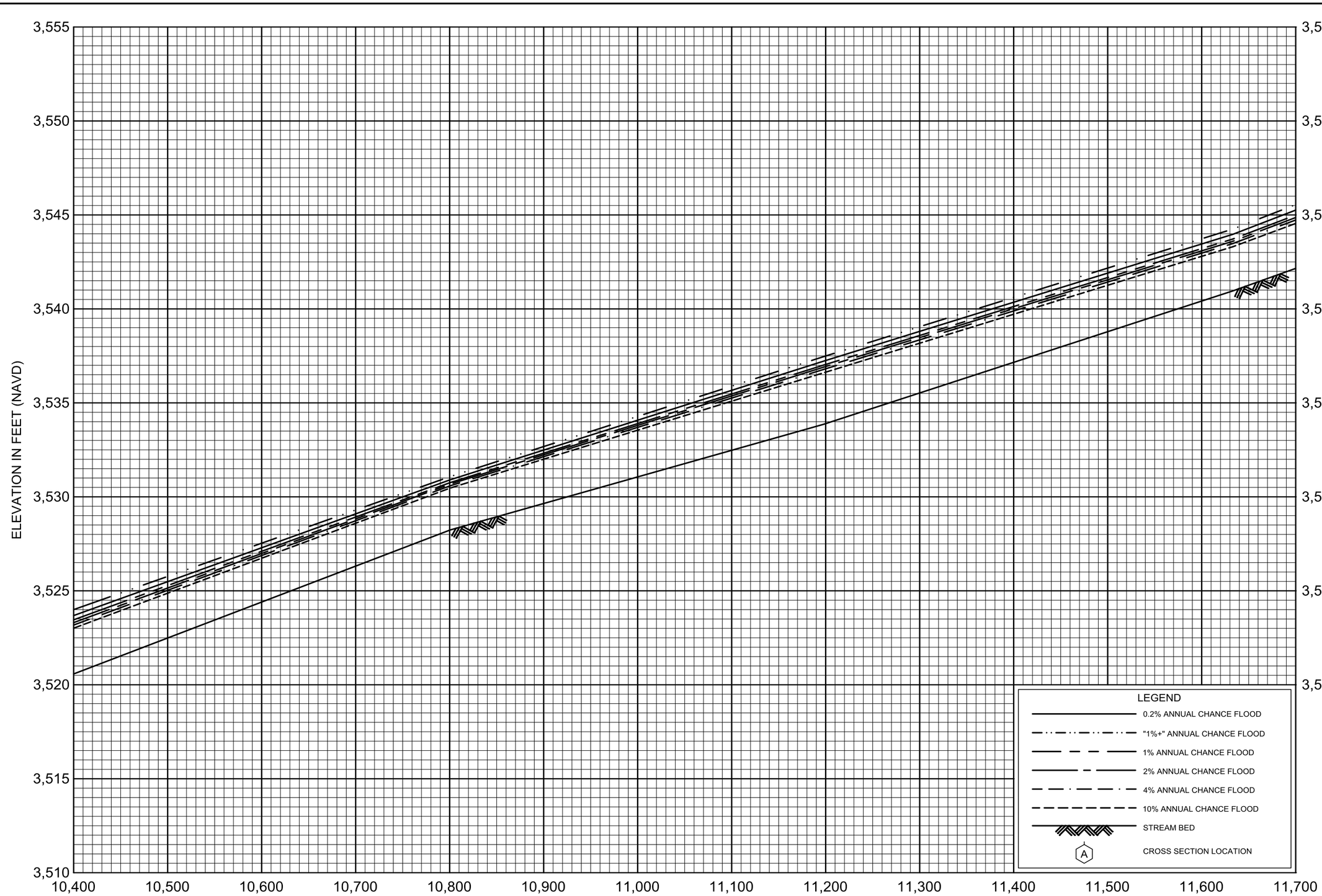
PACKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

08P



FLOOD PROFILES

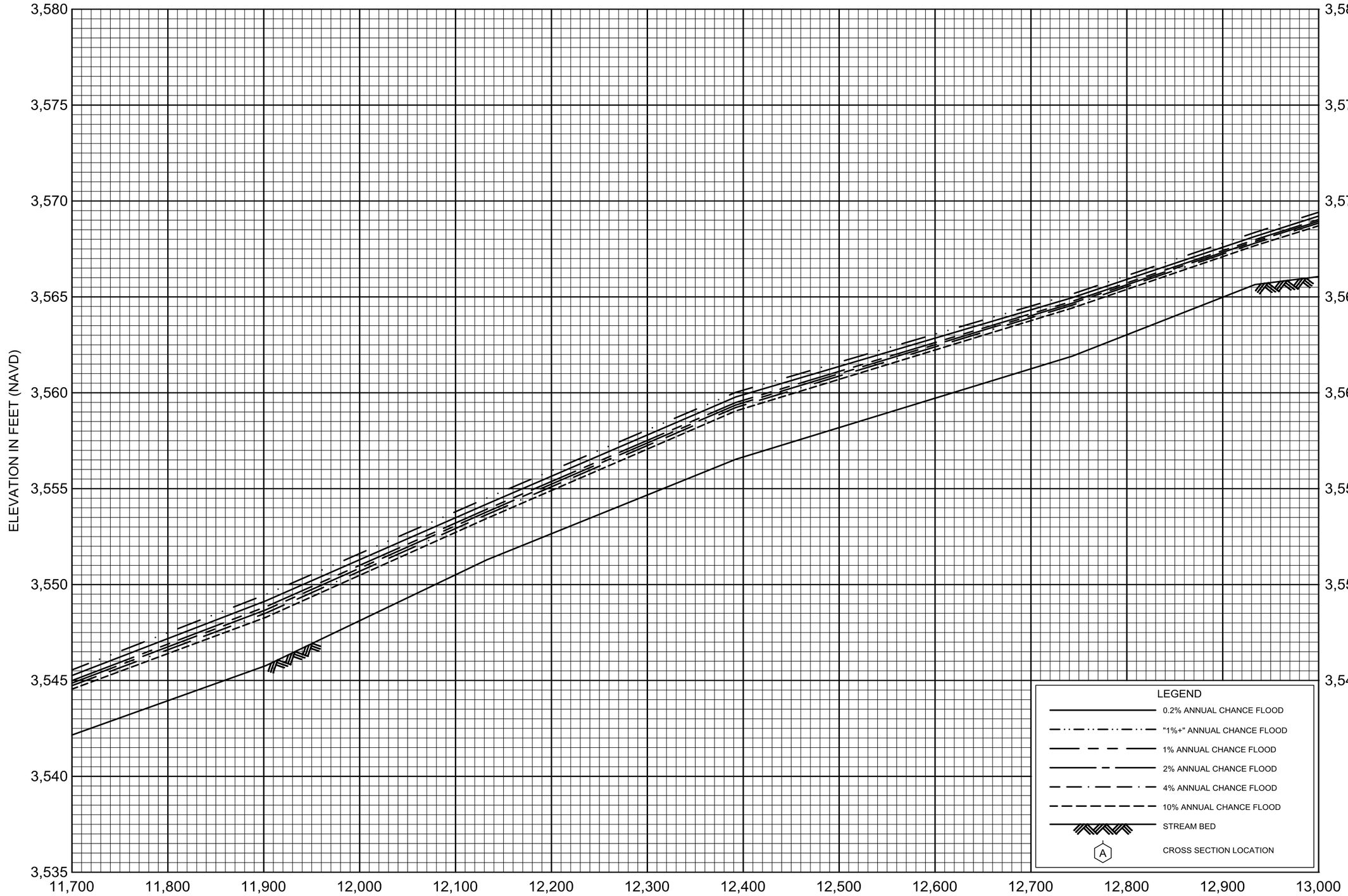
PACKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

09P



FLOOD PROFILES

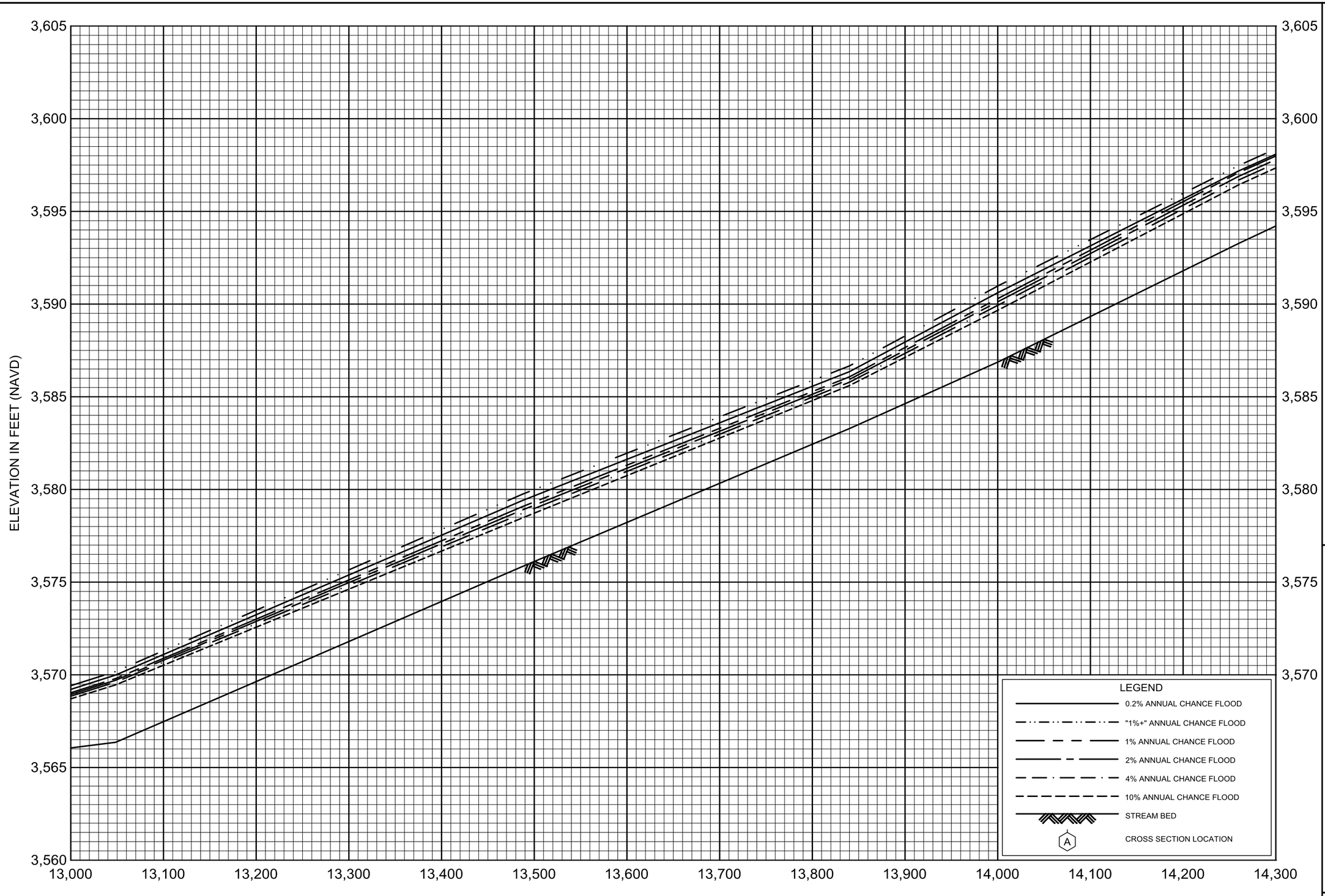
PACKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

10P



FLOOD PROFILES

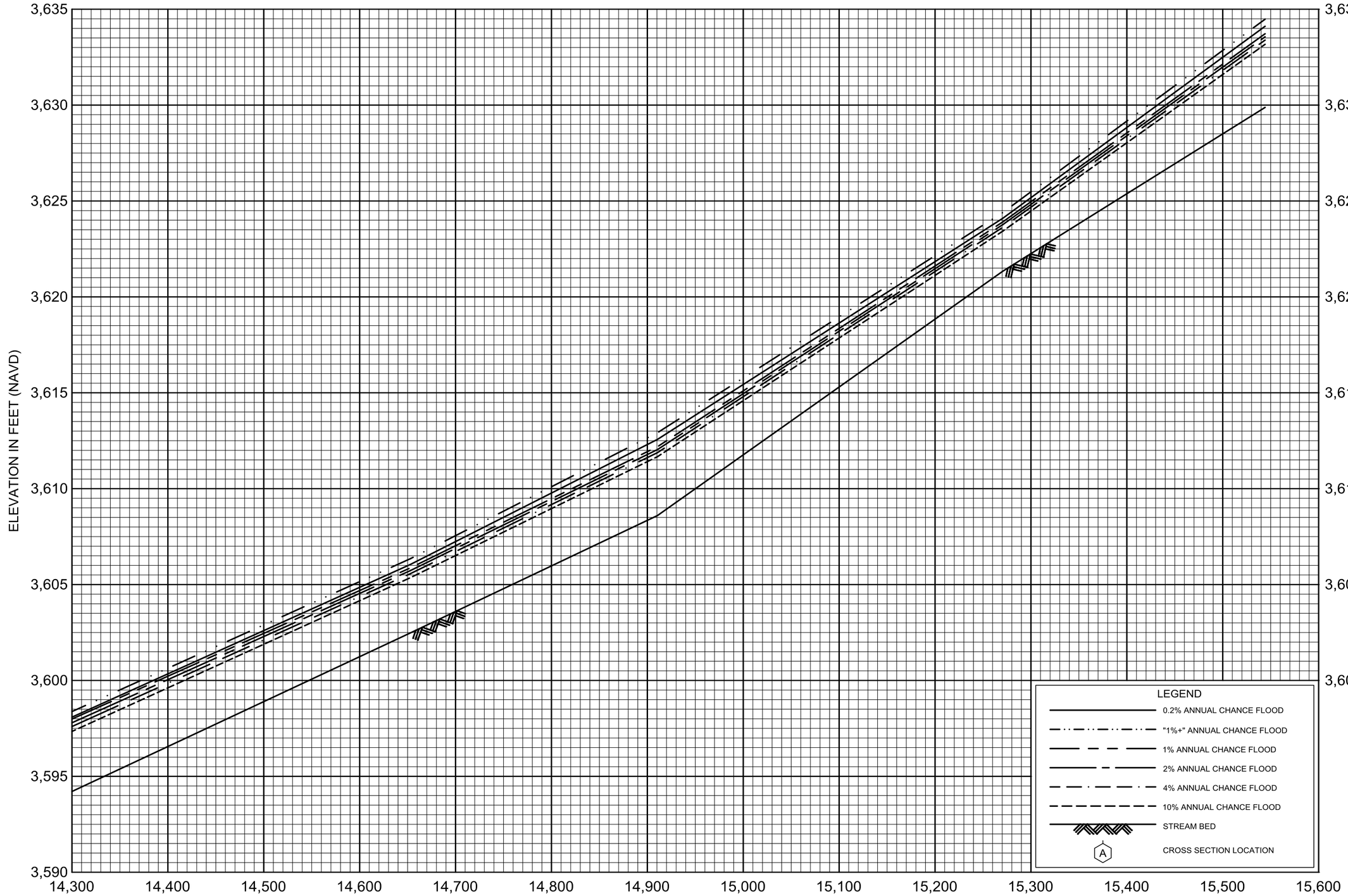
PACKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

11P



FLOOD PROFILES

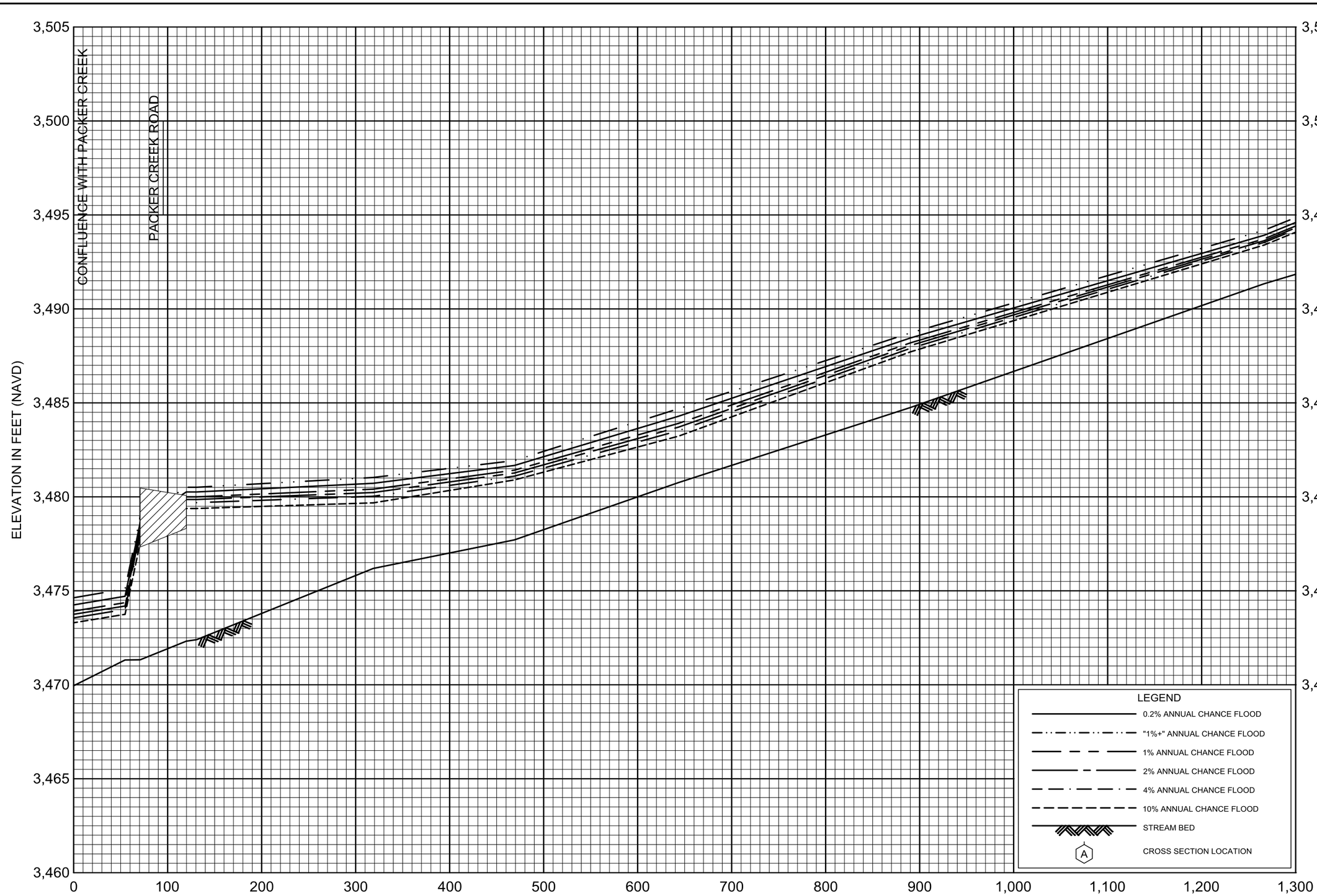
PACKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

12P



FLOOD PROFILES

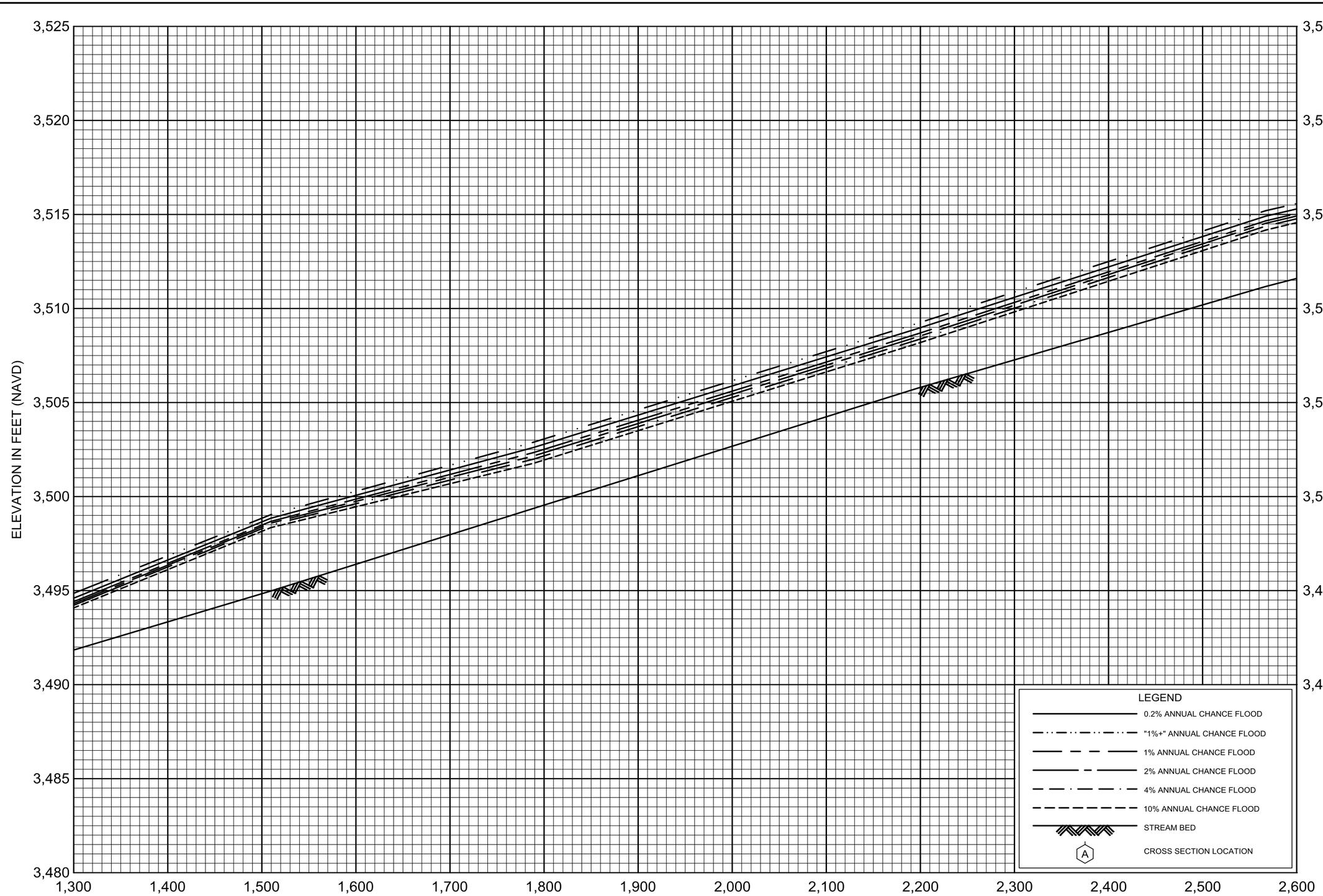
EFORK PACKER CR

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

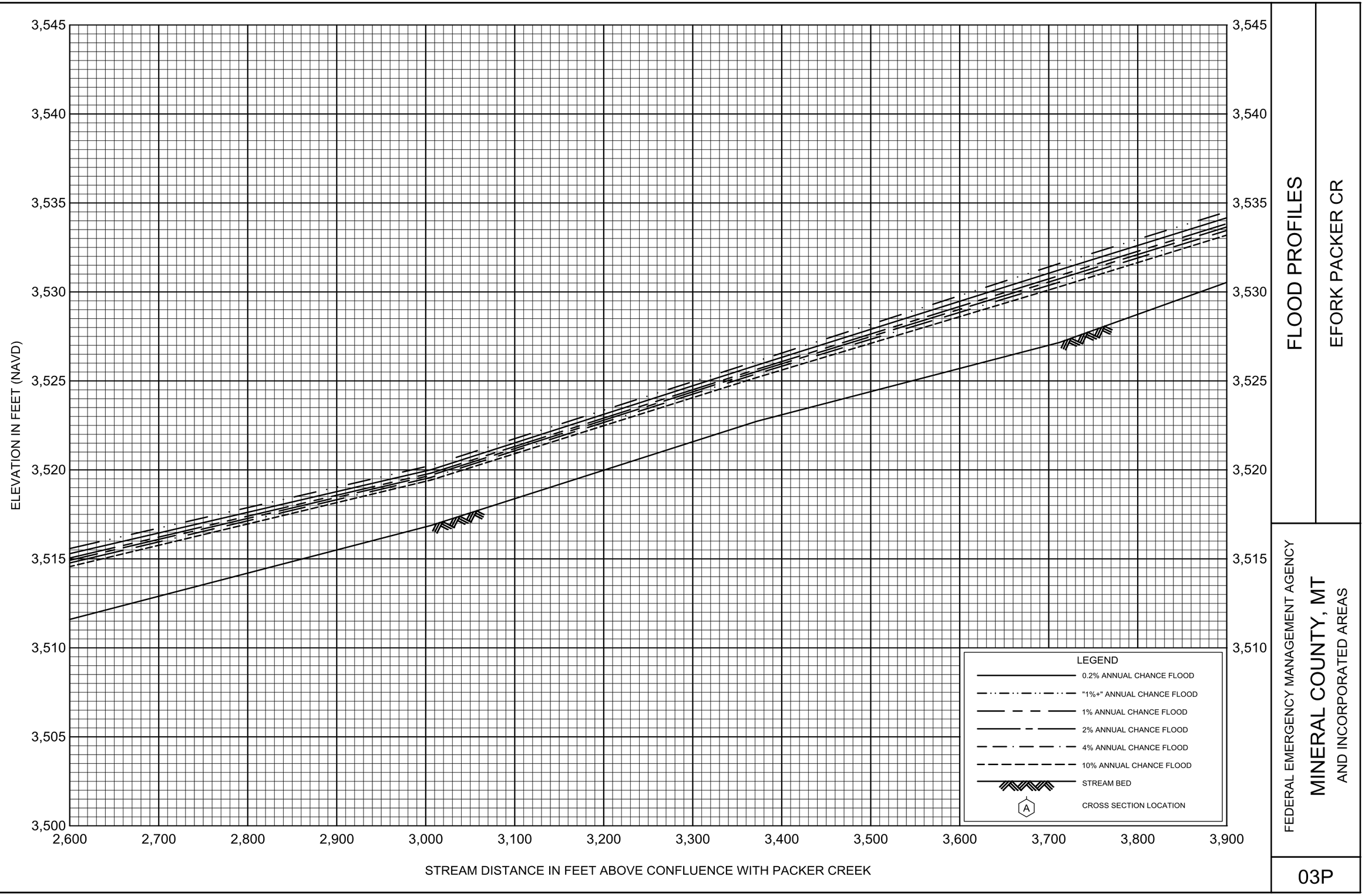
EFORK PACKER CR

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

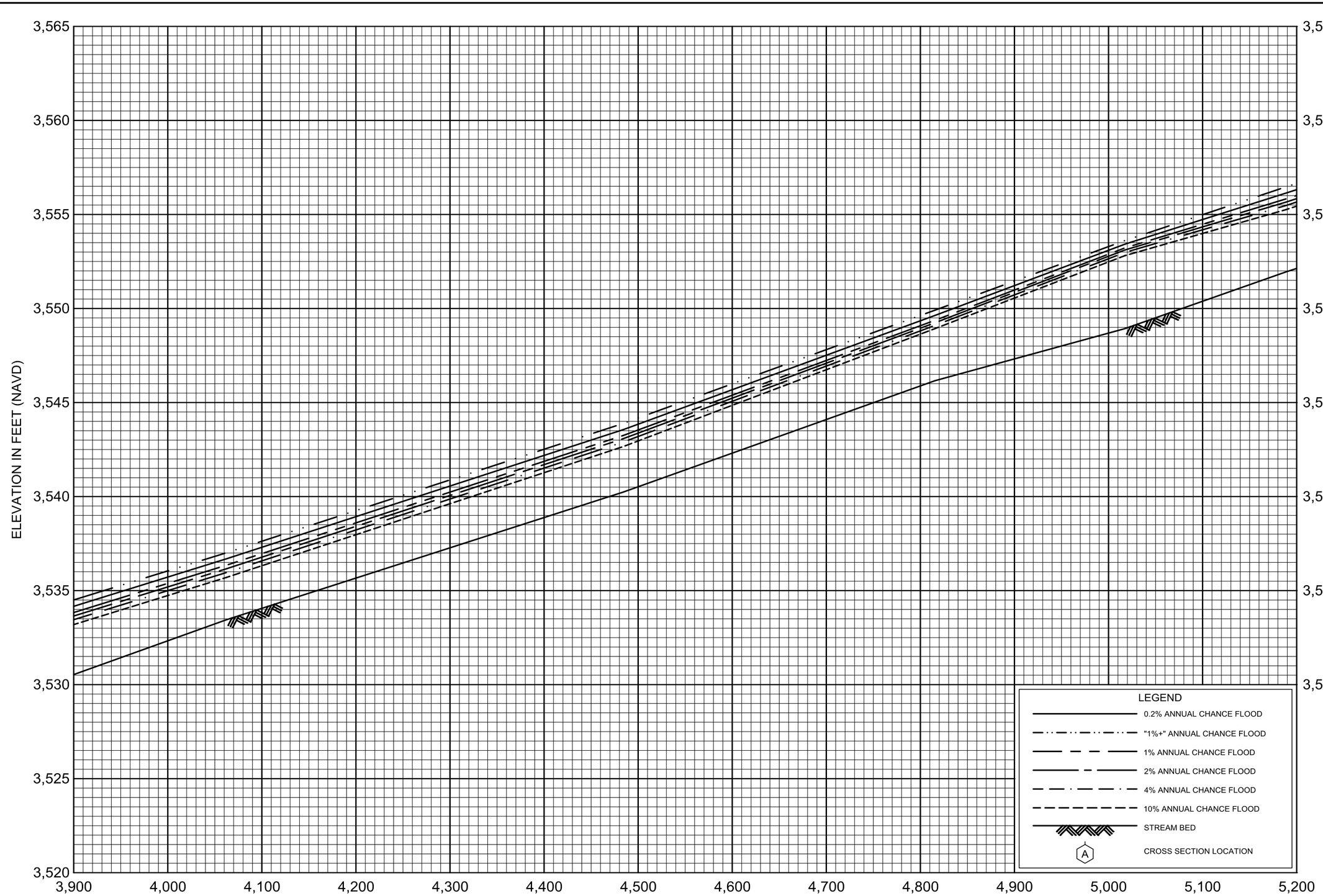
EFORK PACKER CR

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

03P



FLOOD PROFILES

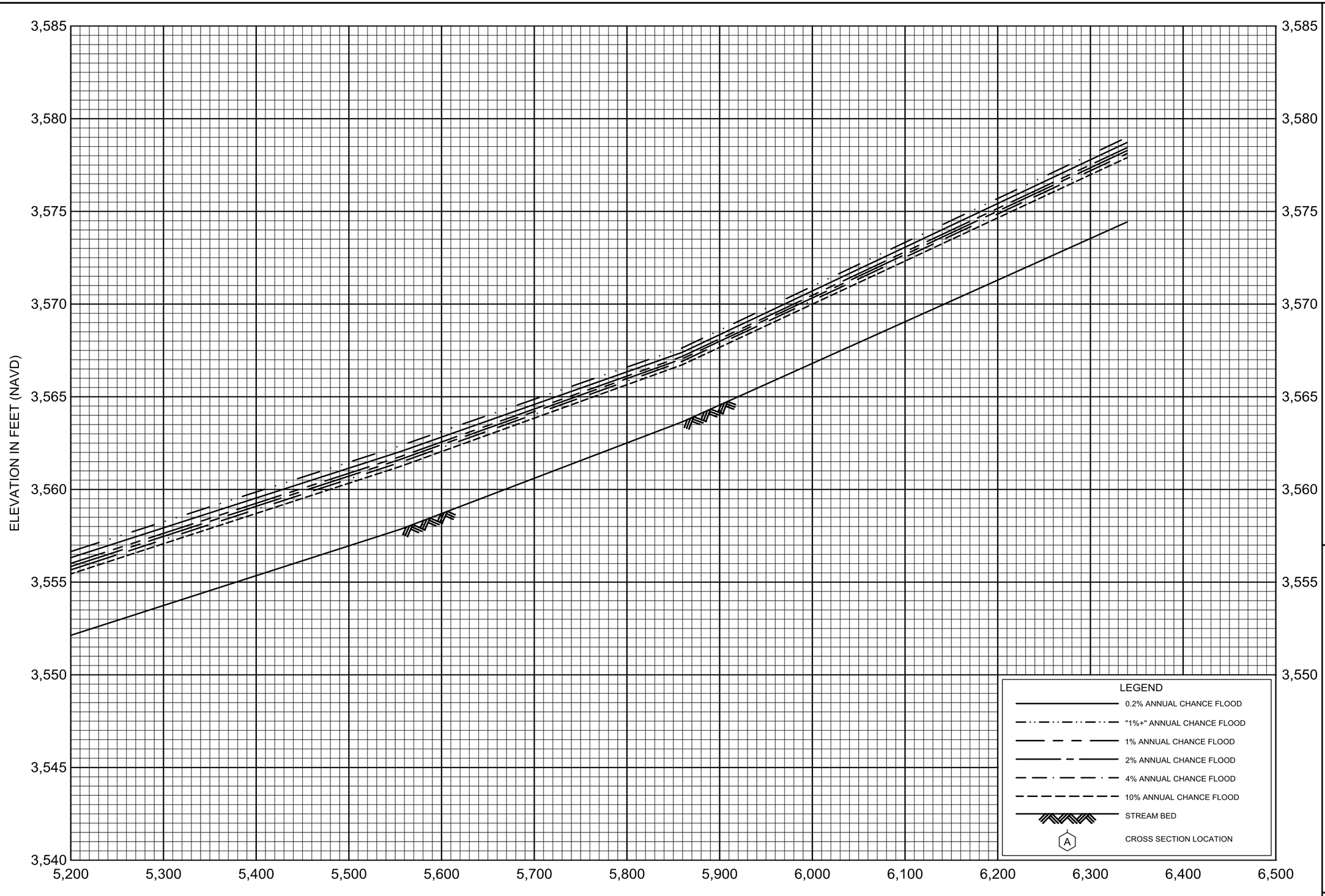
EFORK PACKER CR

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

04P



FLOOD PROFILES

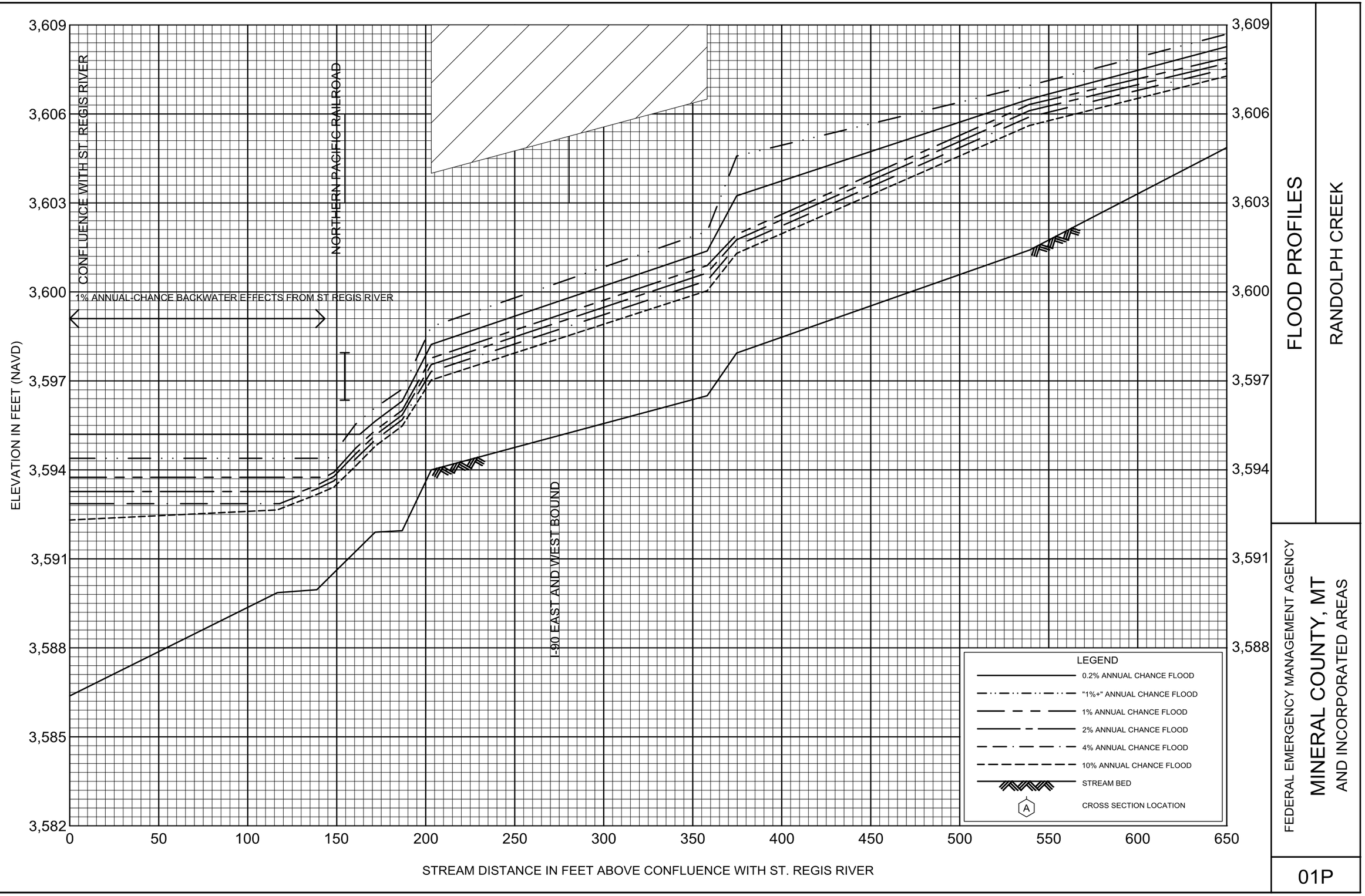
EFORK PACKER CR

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

05P



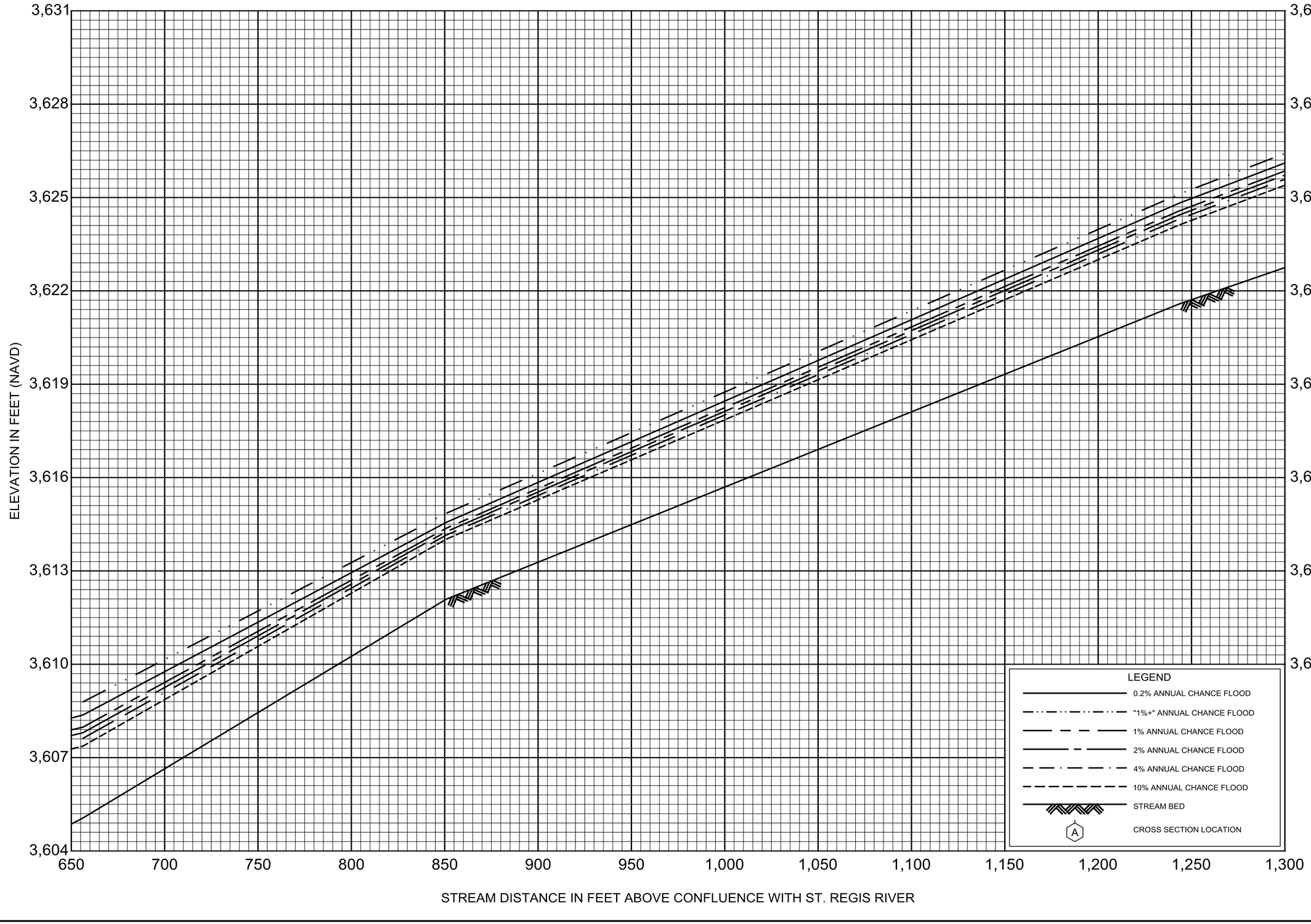
FLOOD PROFILES

RANDOLPH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

01P



FLOOD PROFILES

RANDOLPH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

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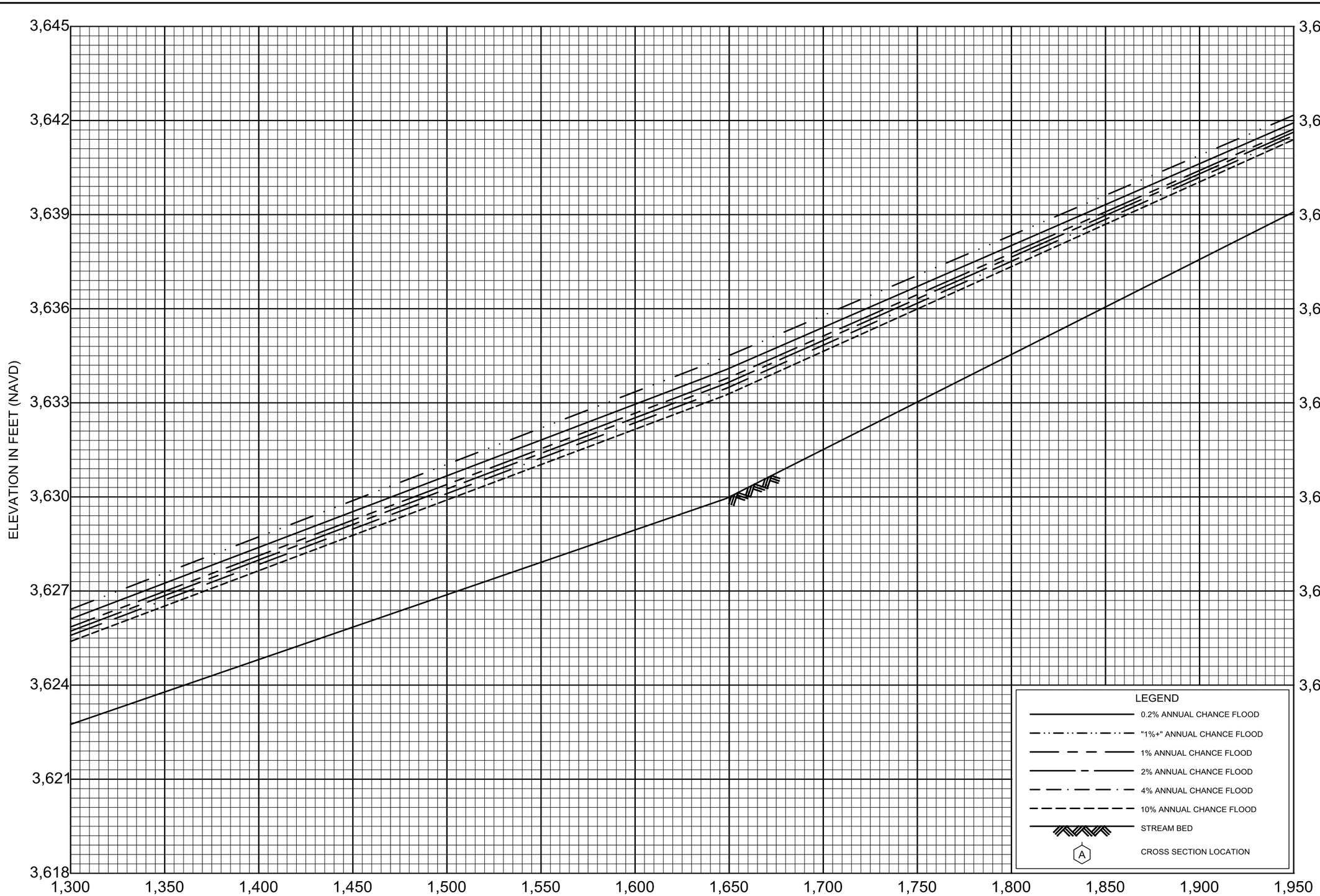

FLOOD PROFILES

RANDOLPH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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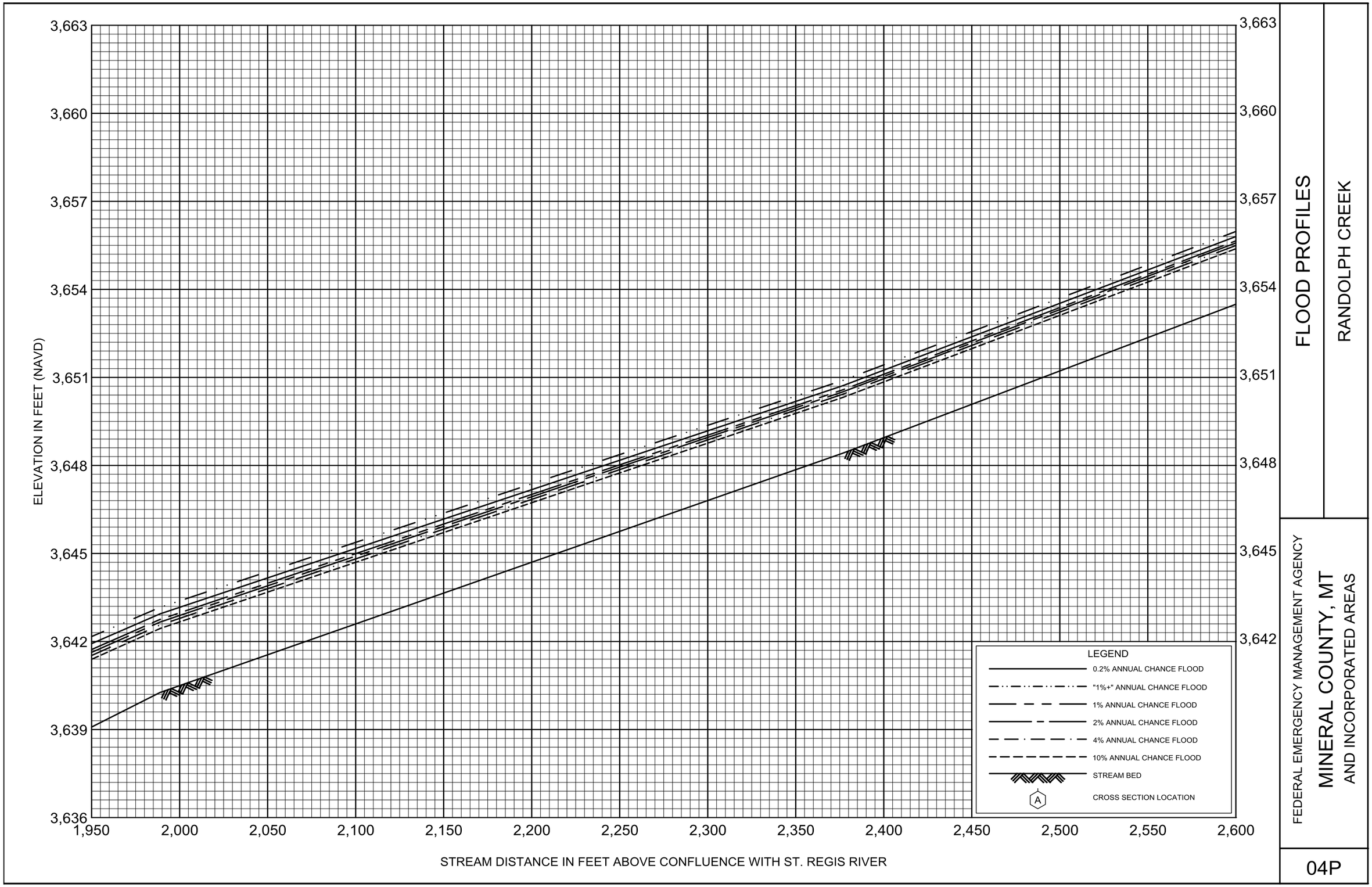

FLOOD PROFILES

RANDOLPH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

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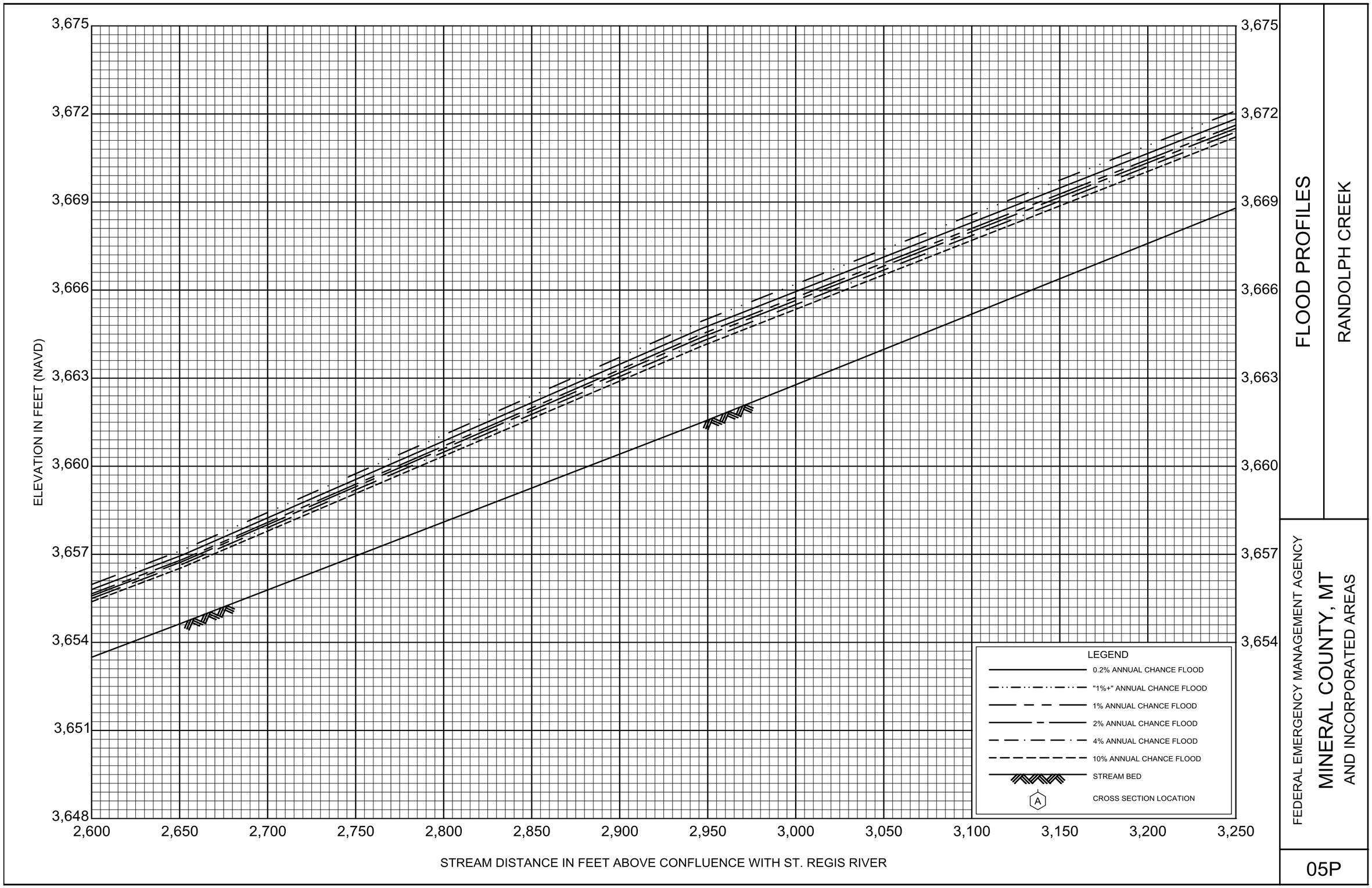


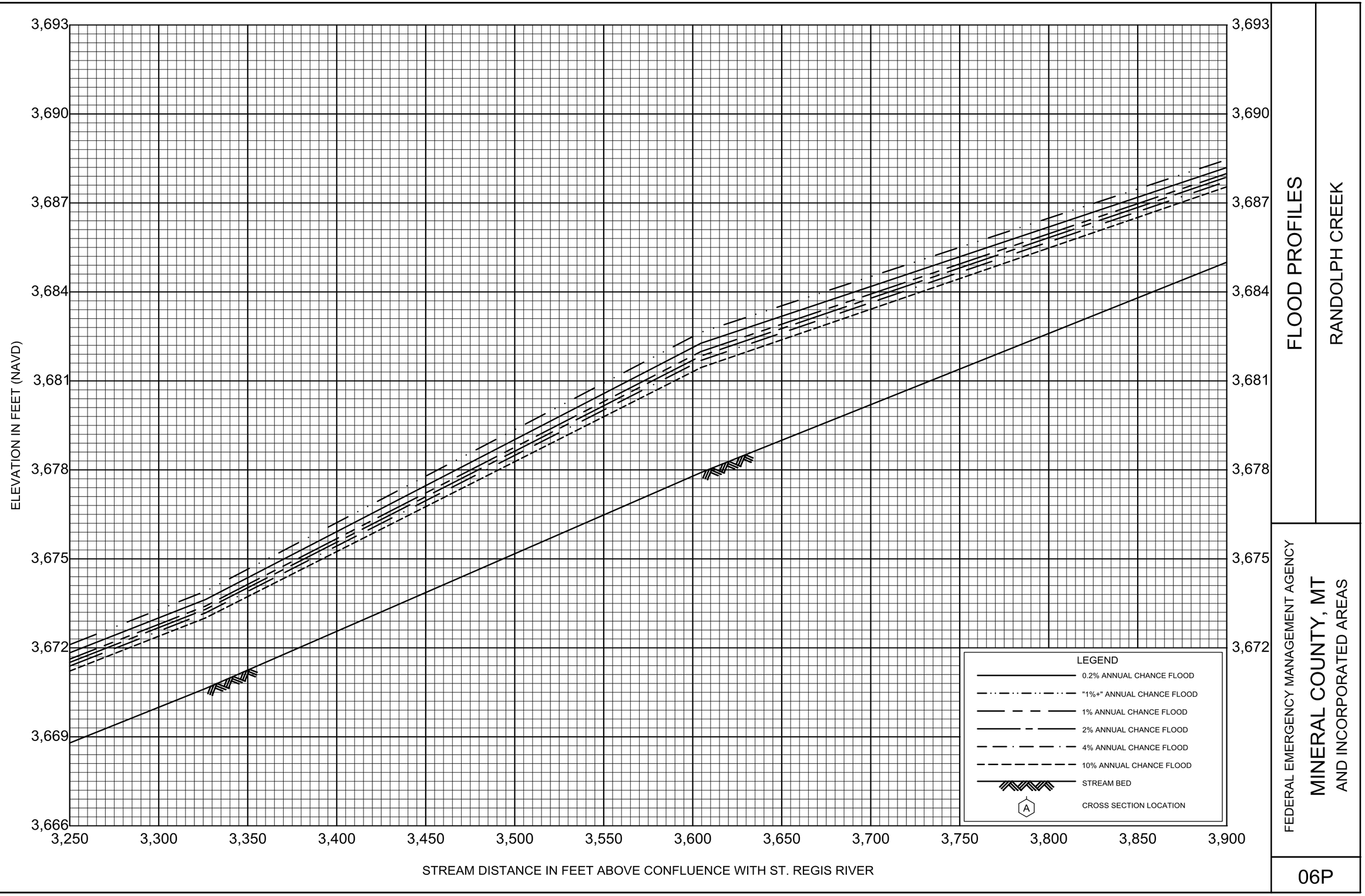
FLOOD PROFILES

RANDOLPH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

05P



FLOOD PROFILES

RANDOLPH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

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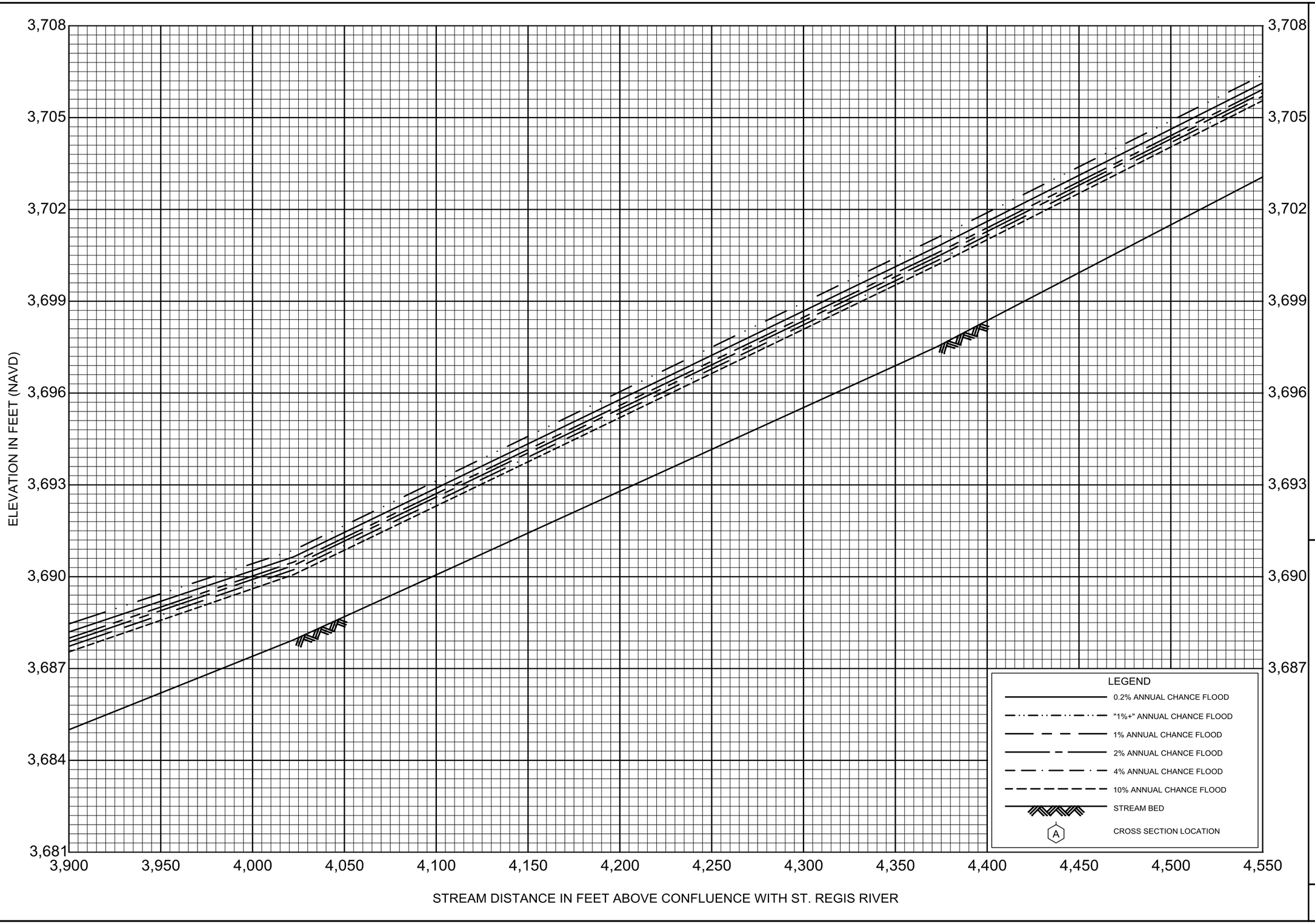


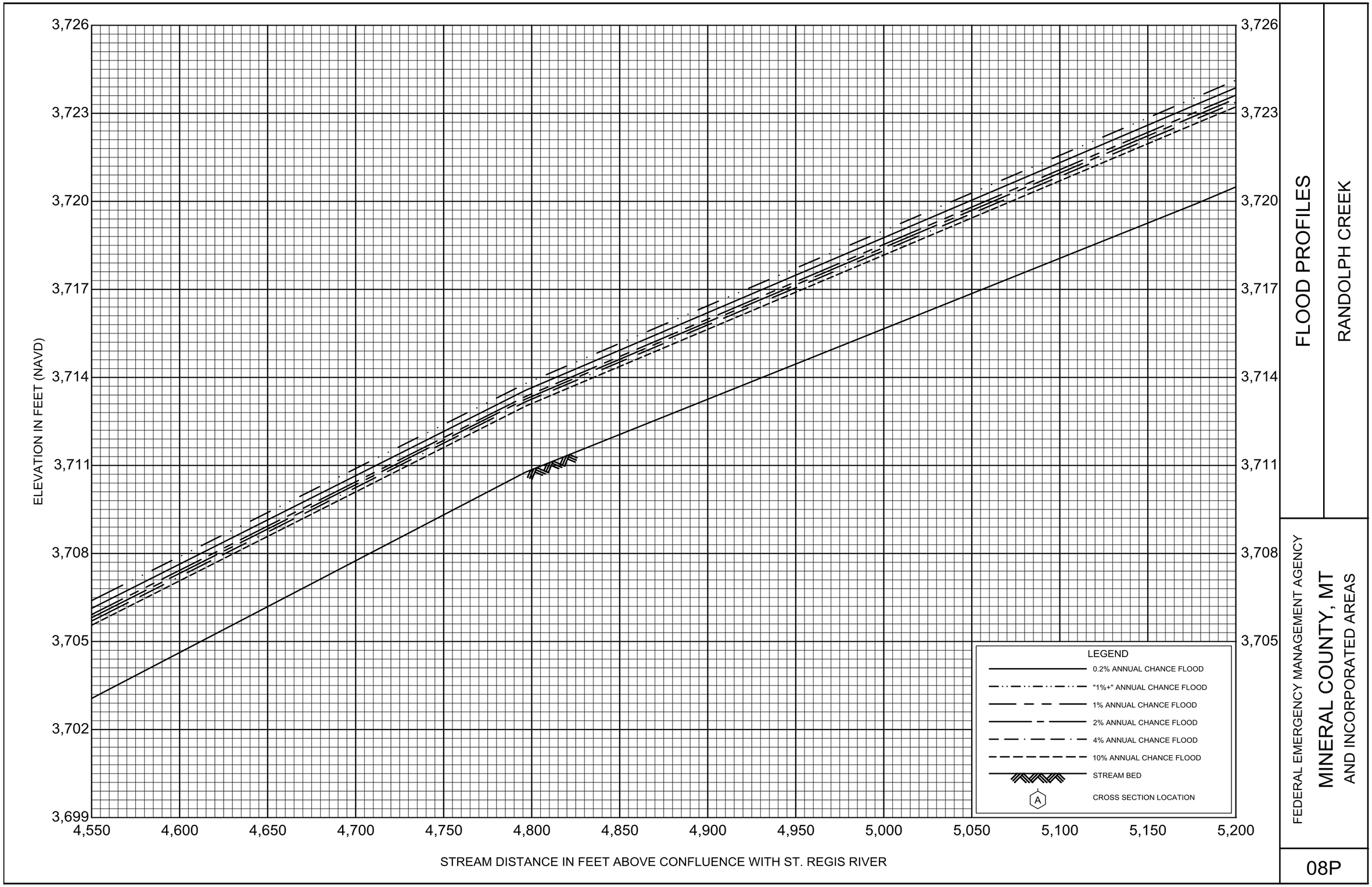
FLOOD PROFILES

RANDOLPH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

07P



FLOOD PROFILES

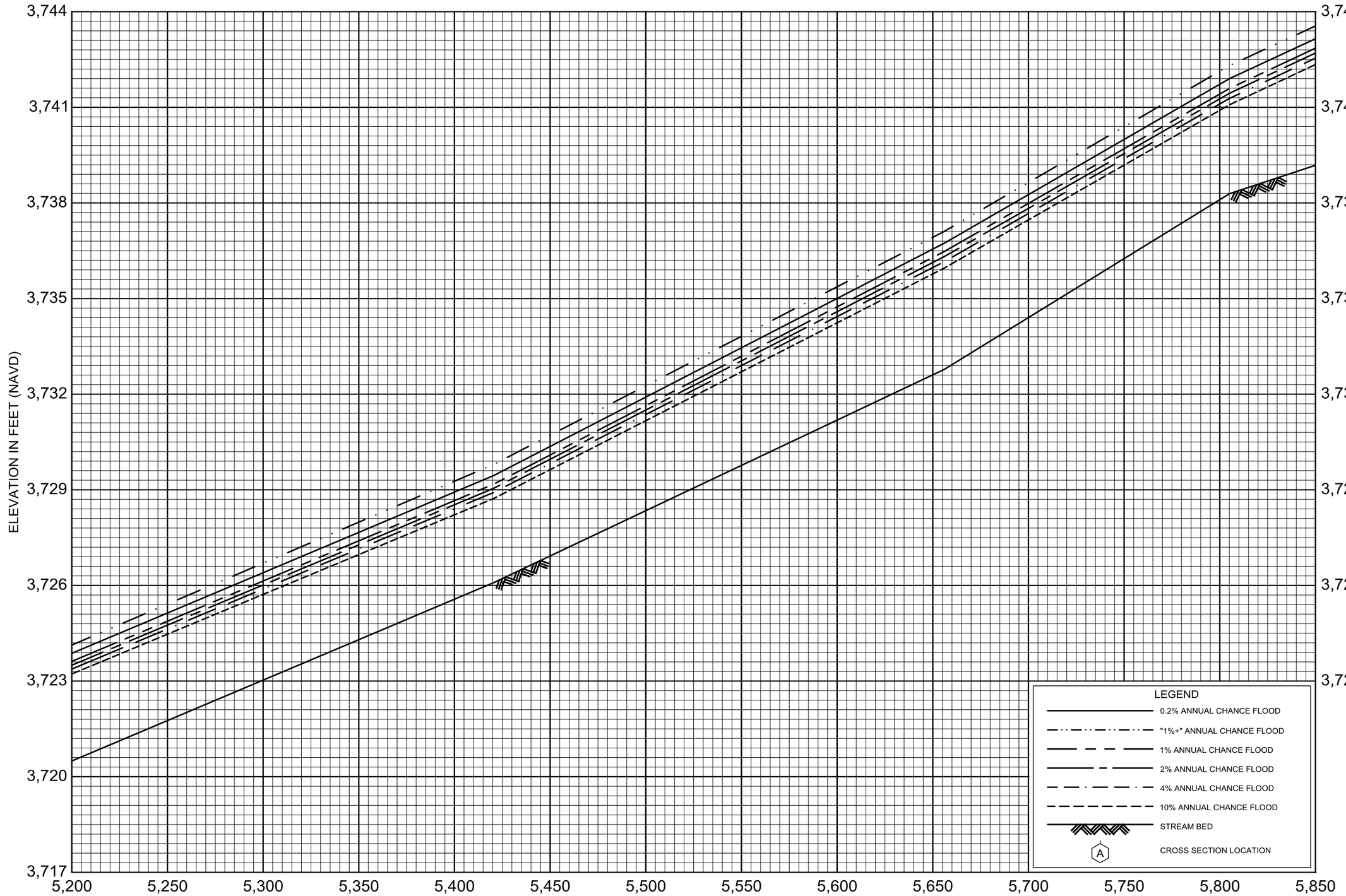
RANDOLPH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

08P



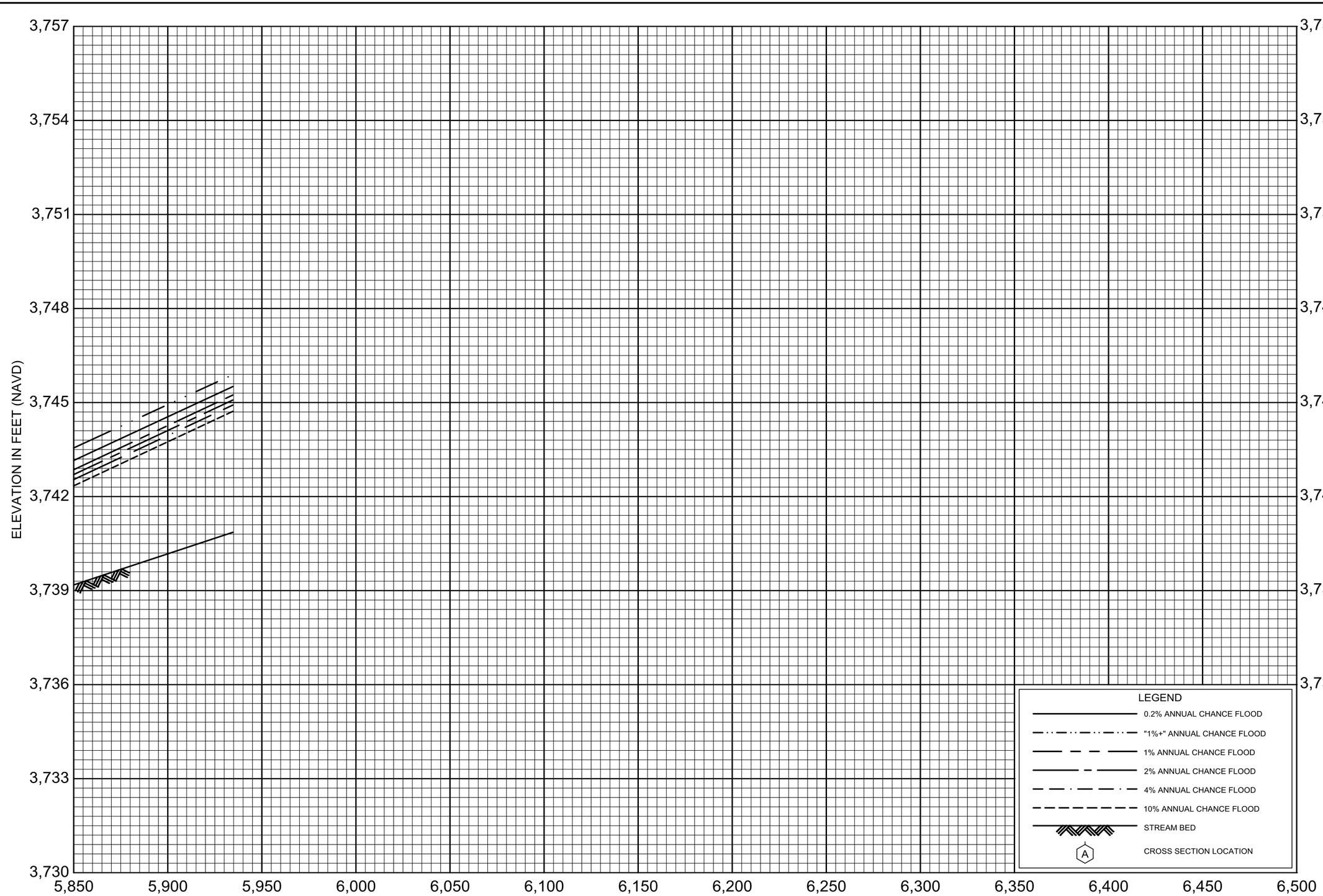
FLOOD PROFILES

RANDOLPH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

09P



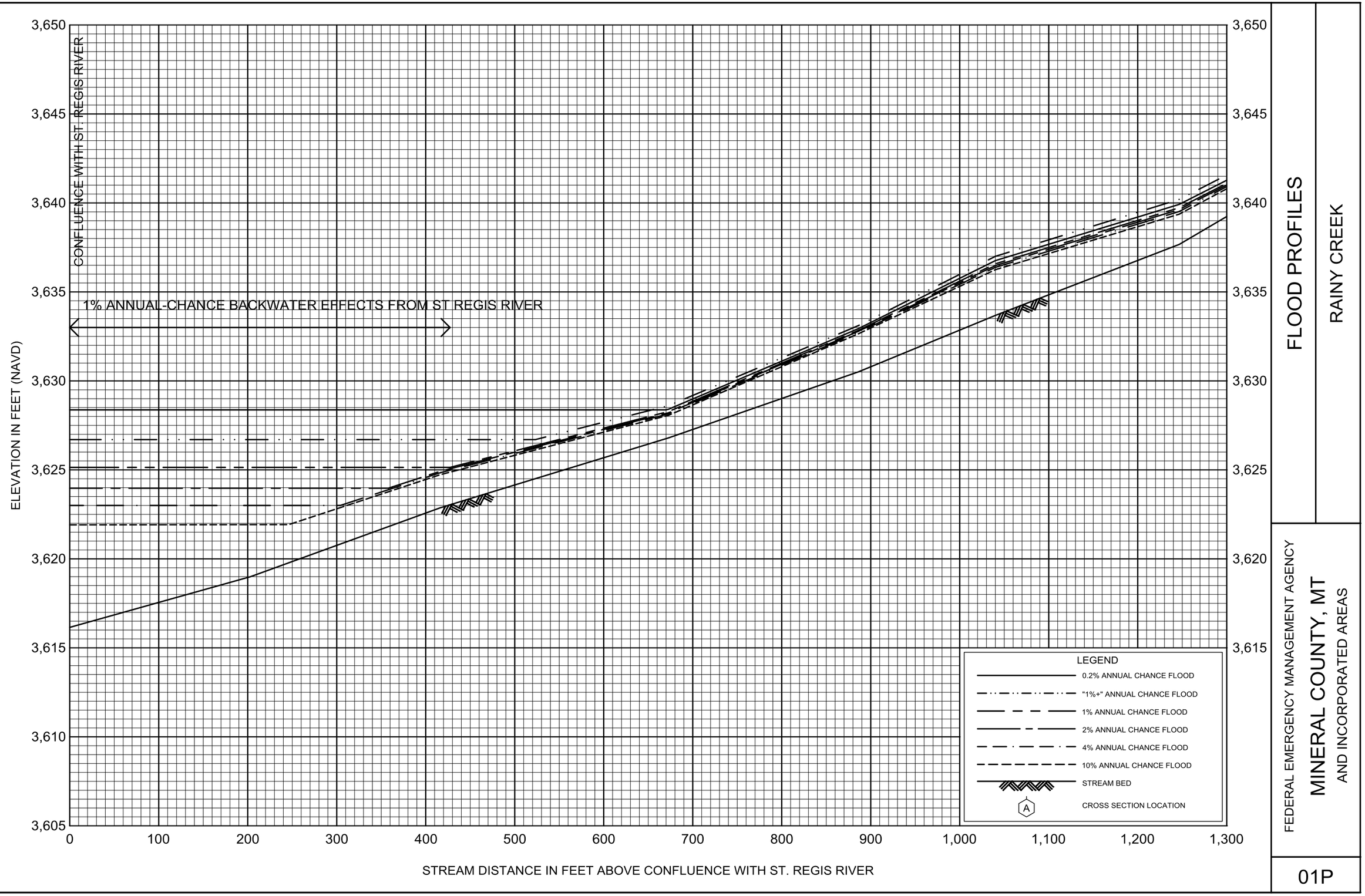
FLOOD PROFILES

RANDOLPH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

10P



FLOOD PROFILES

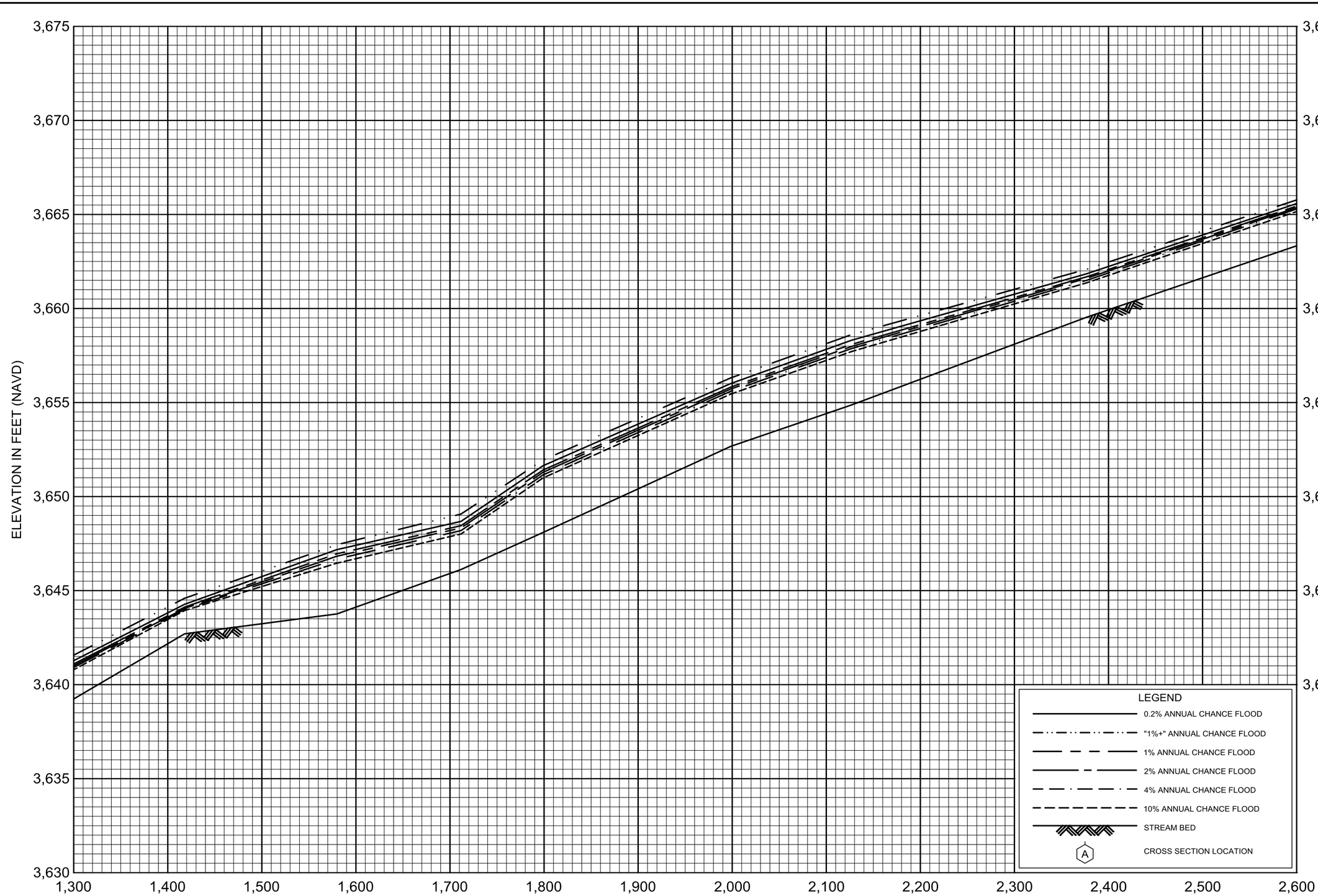
RAINY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

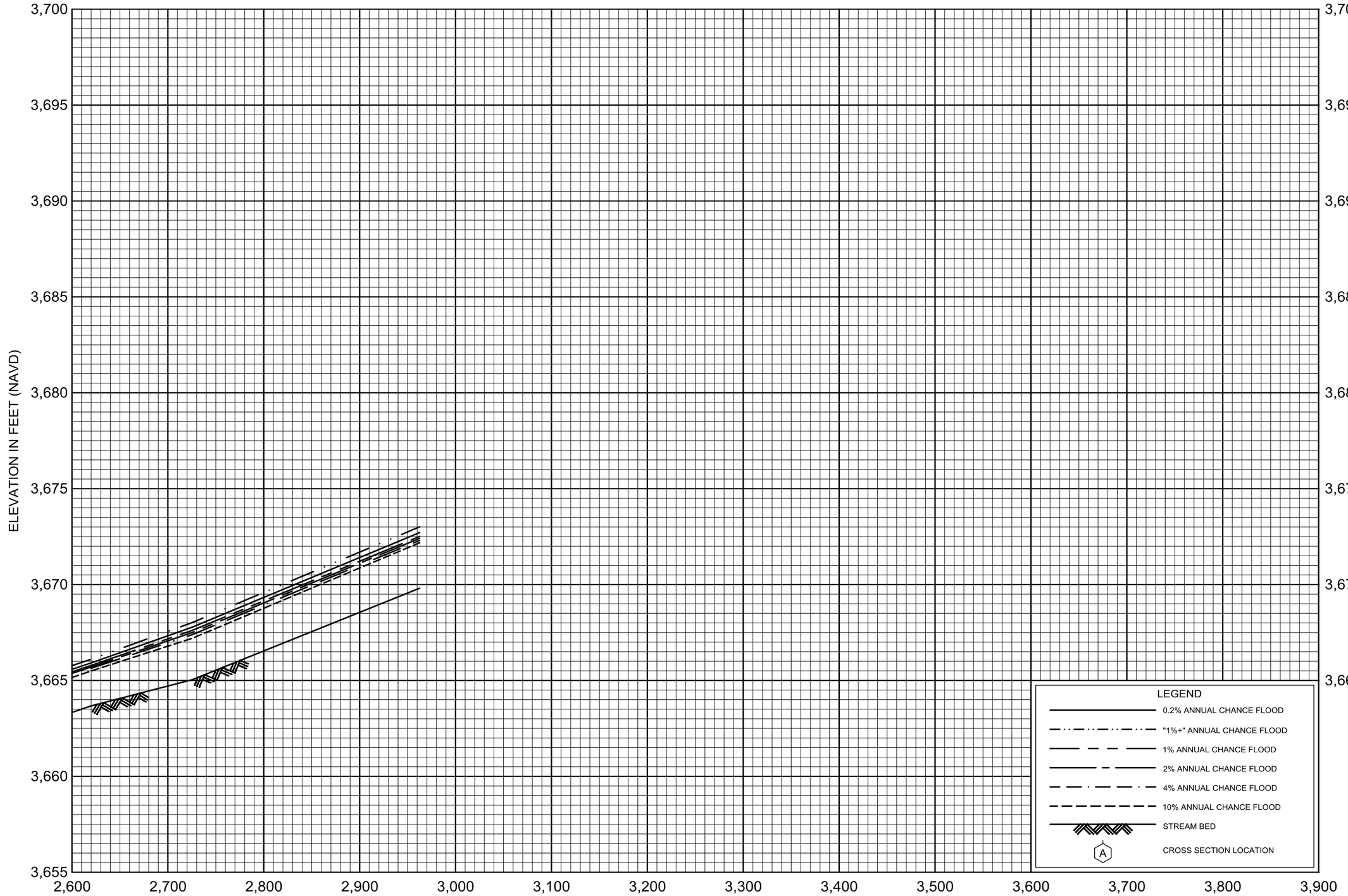
RAINY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

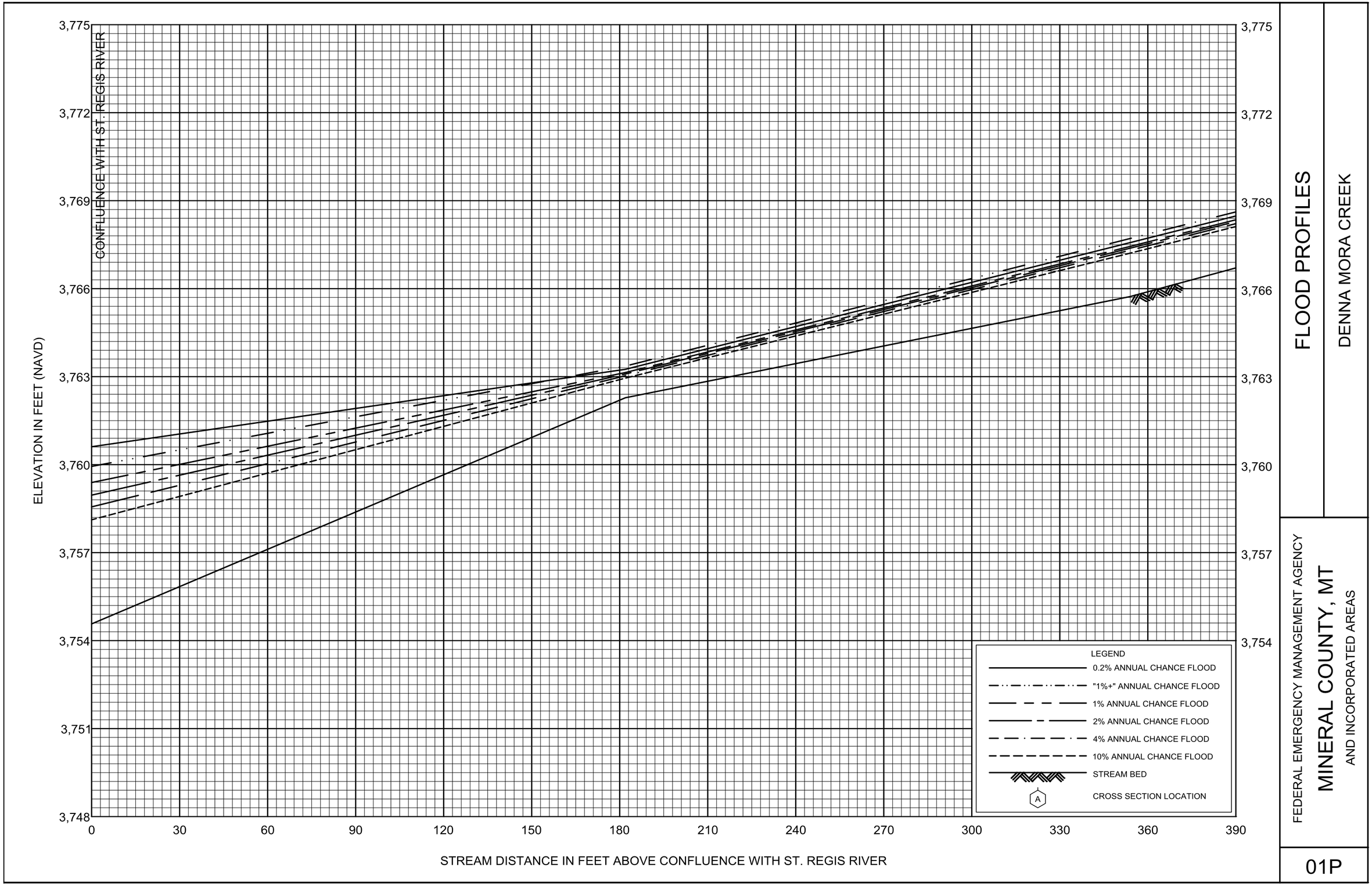
RAINY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

03P



FLOOD PROFILES

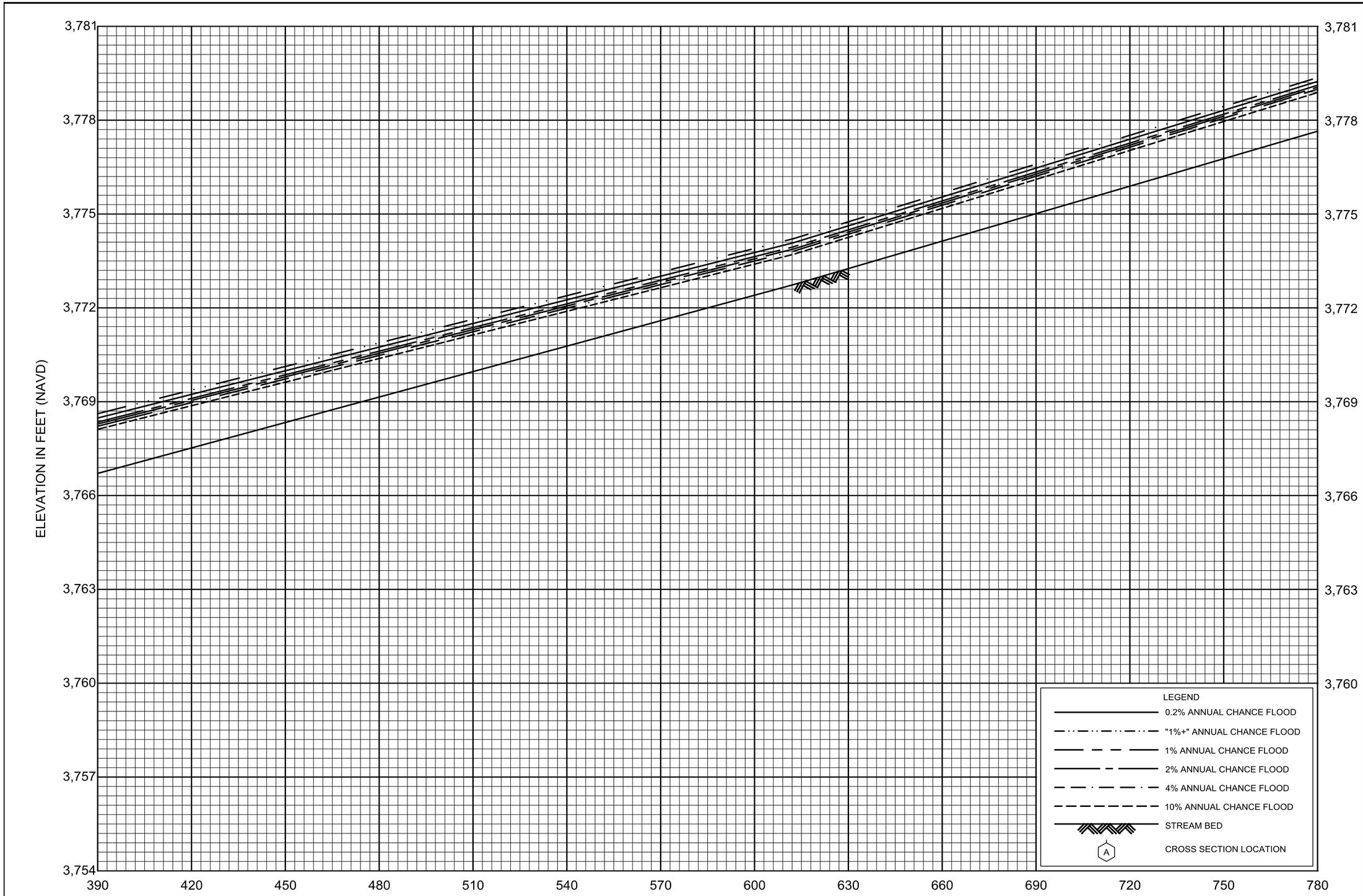
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

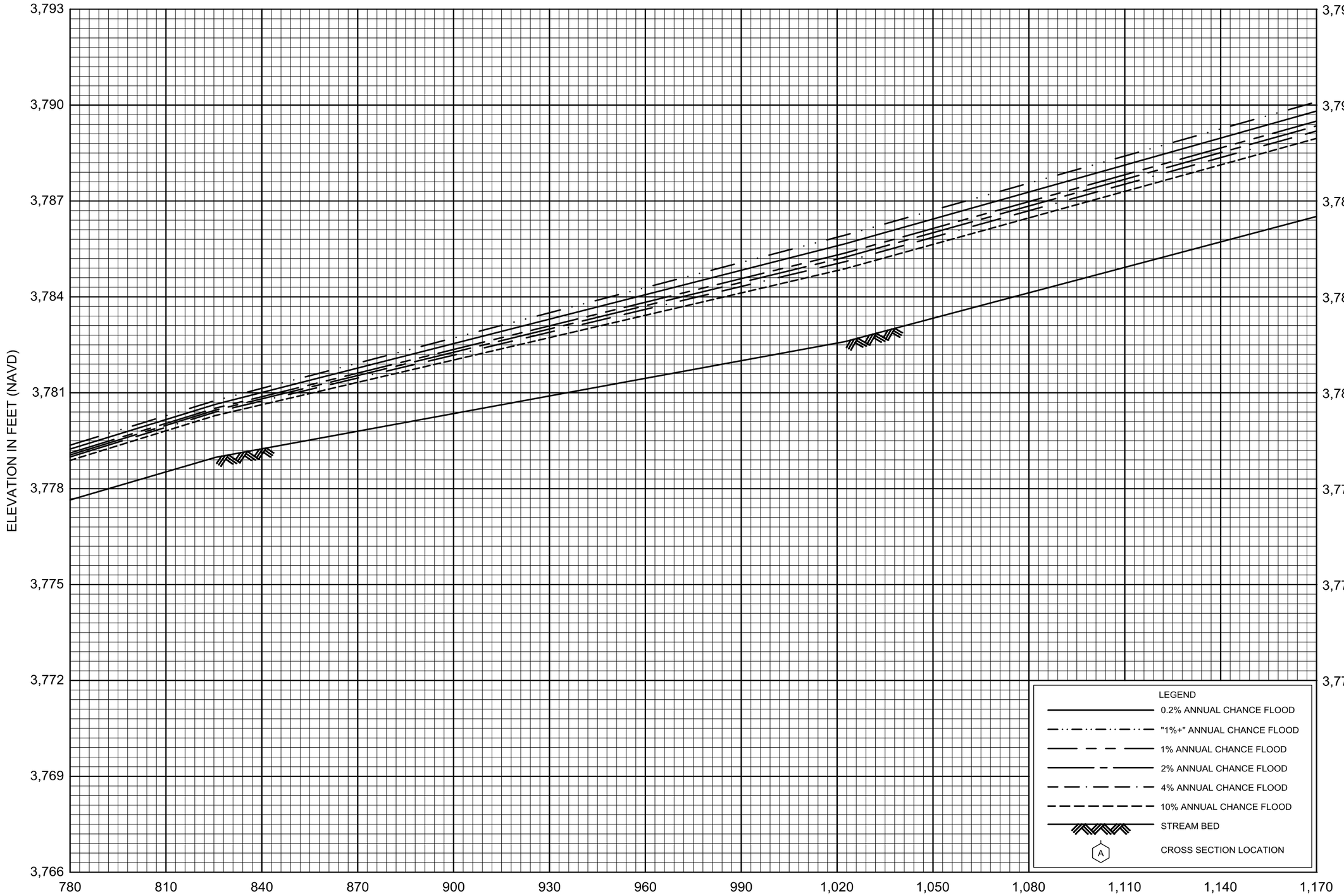
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

02P



FLOOD PROFILES

DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

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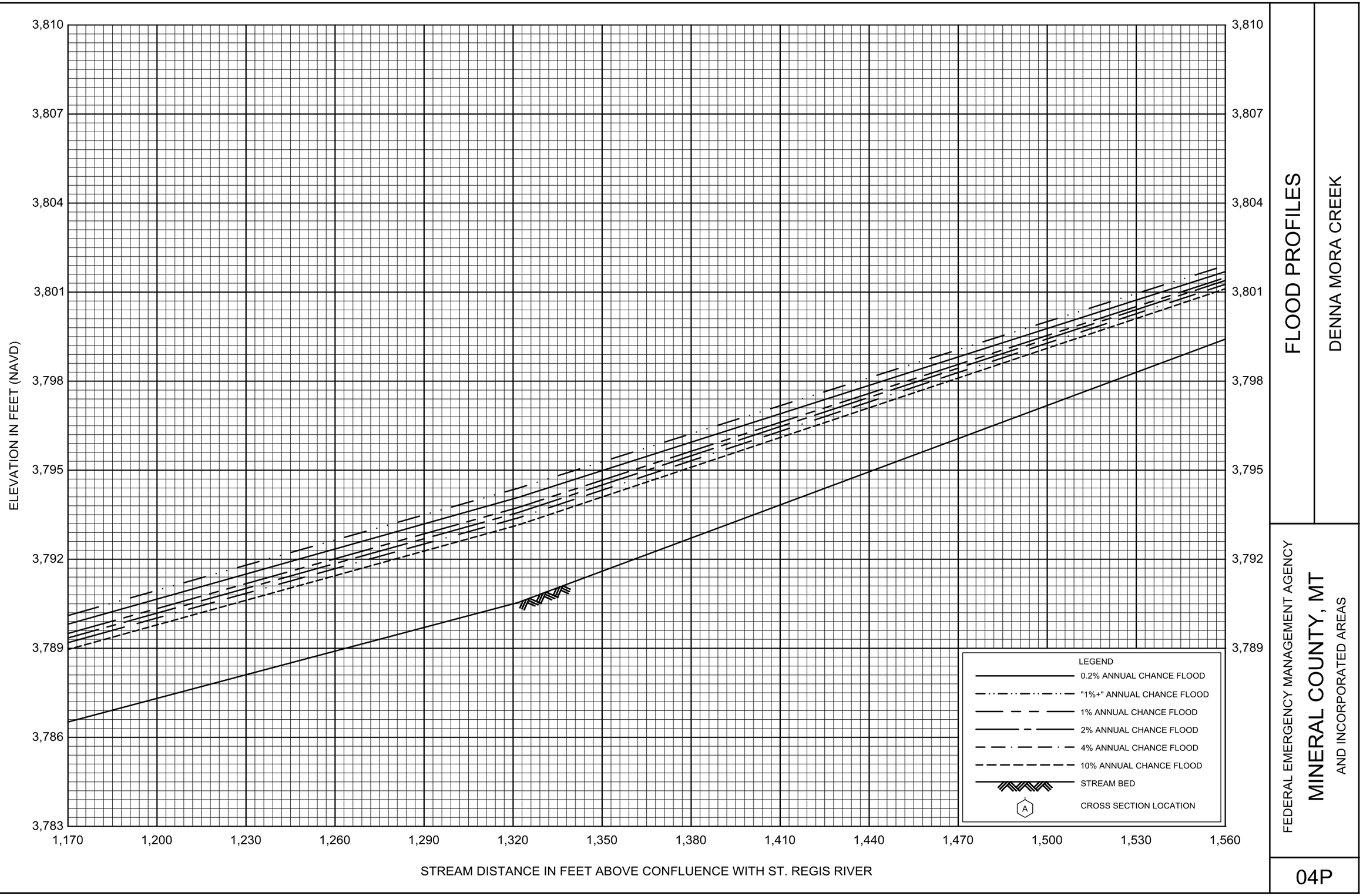


FLOOD PROFILES

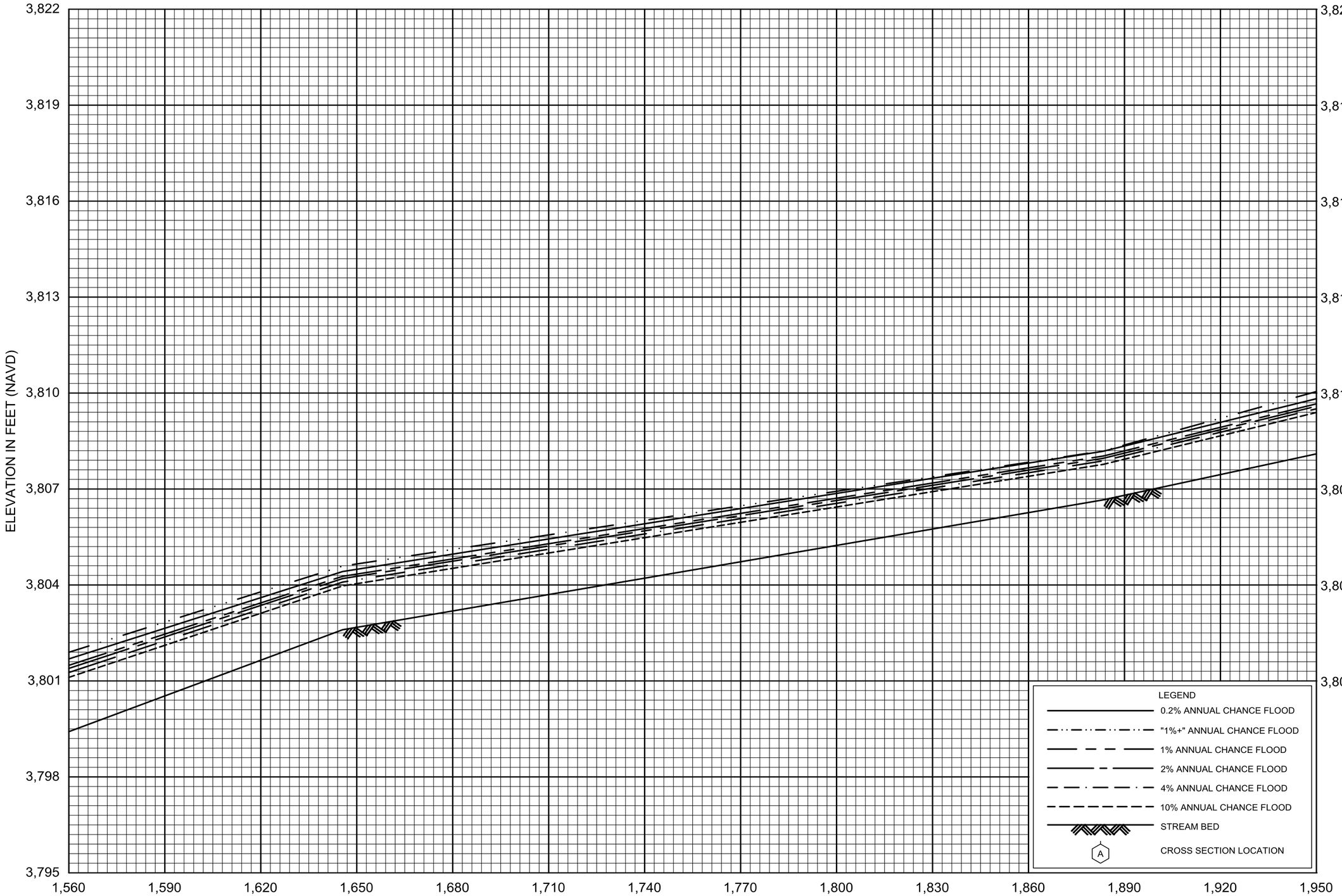
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

04P



FLOOD PROFILES

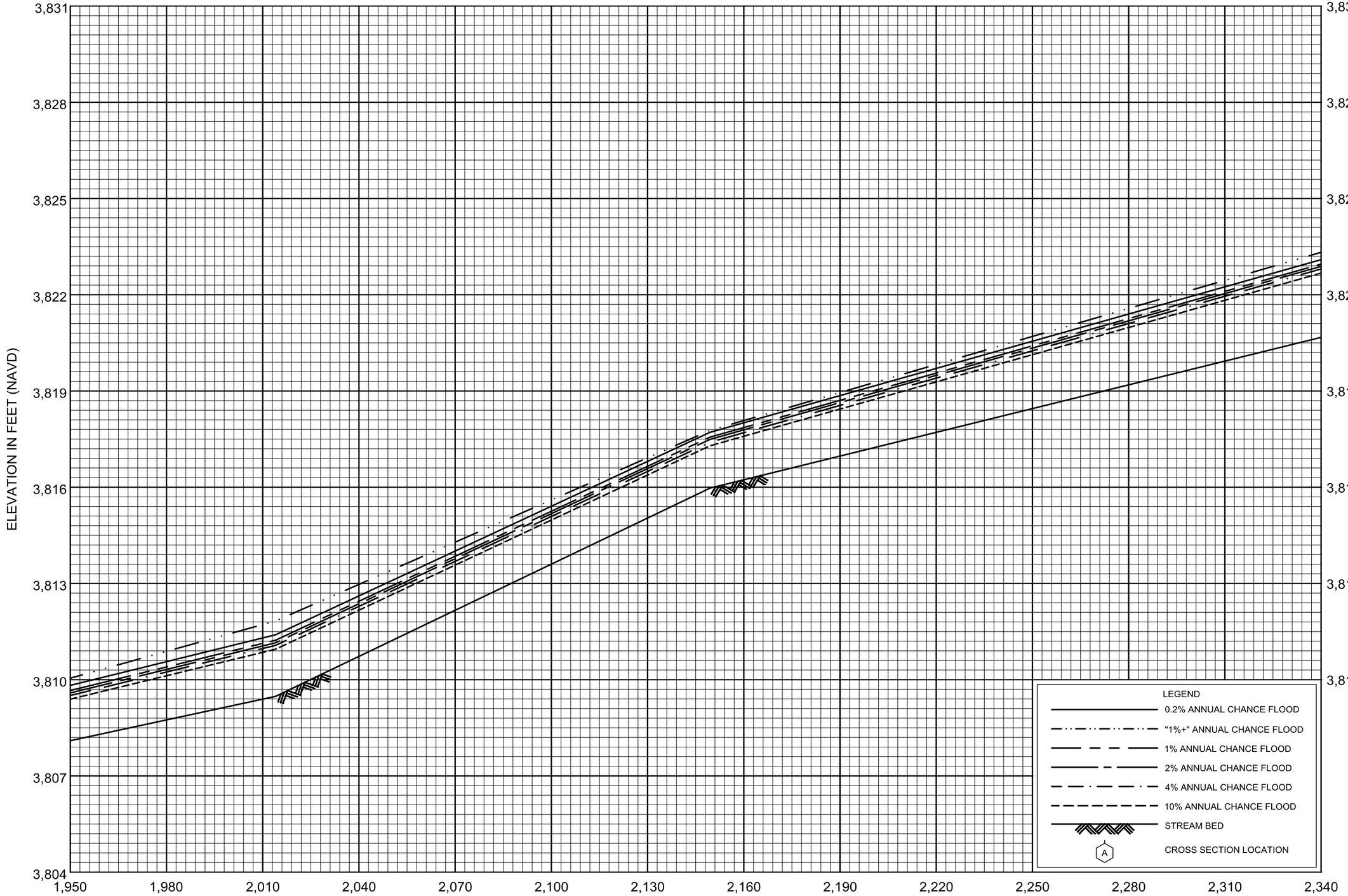
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

05P



FLOOD PROFILES

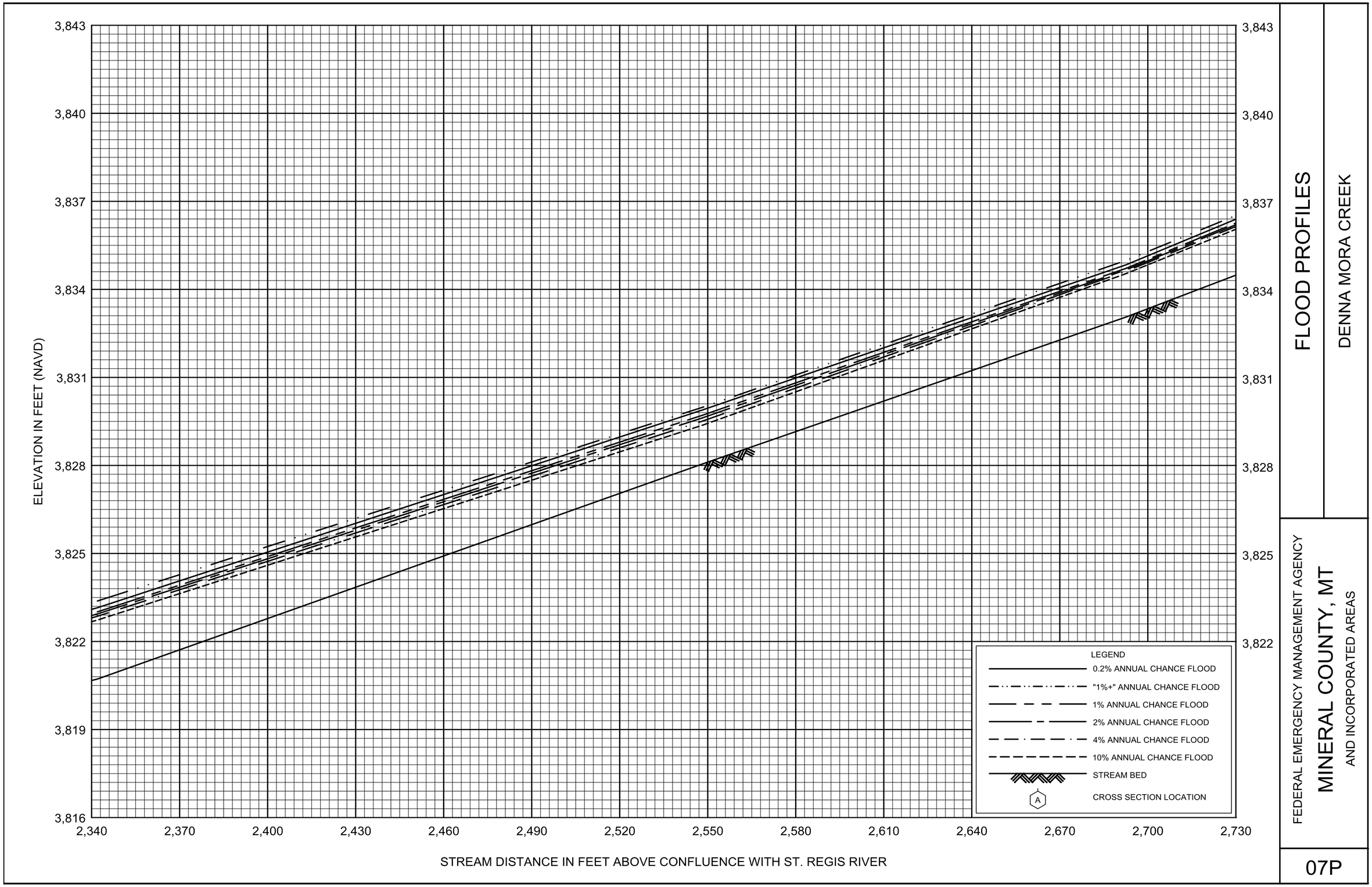
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

06P



FLOOD PROFILES

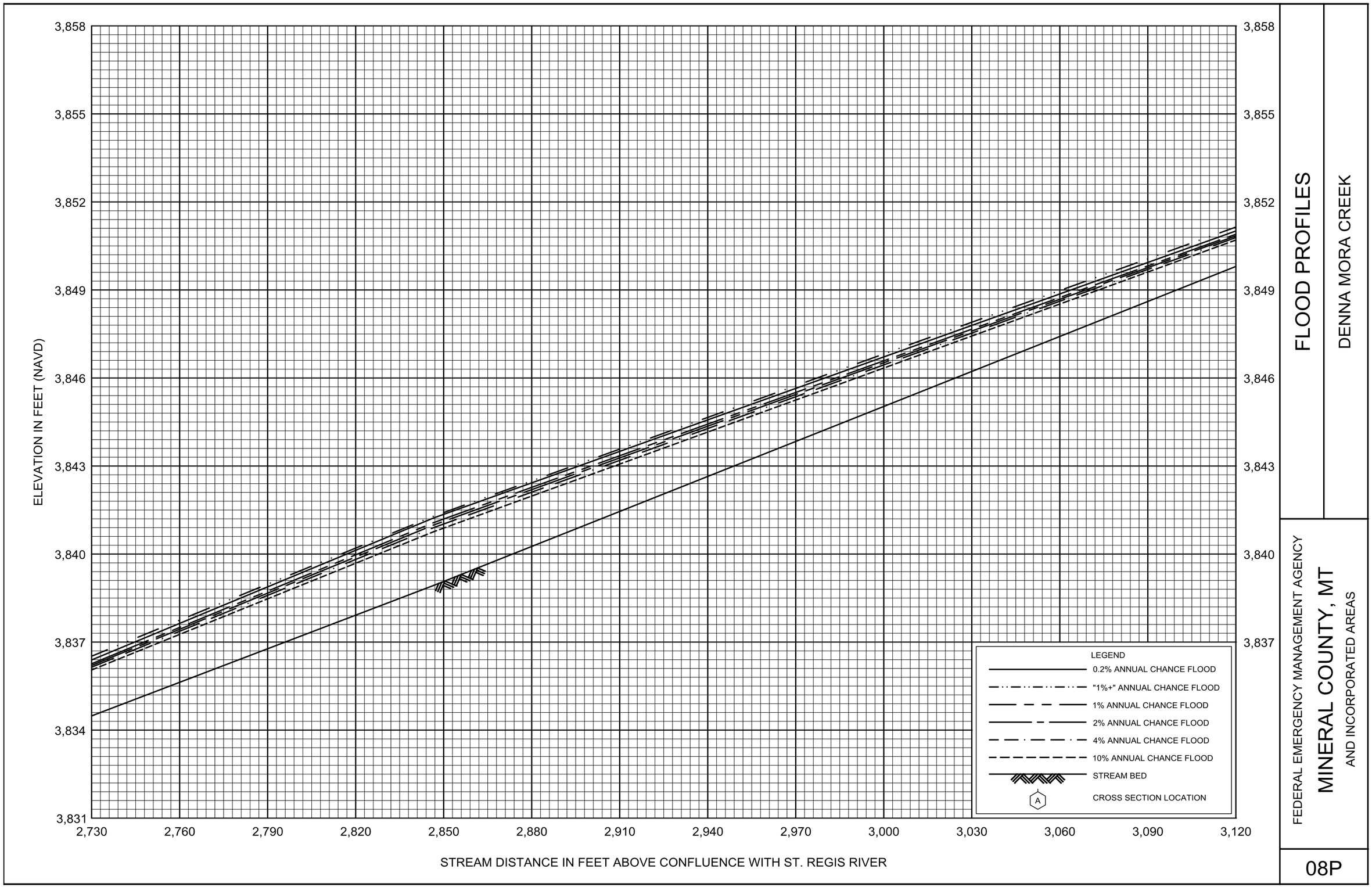
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

07P



FLOOD PROFILES

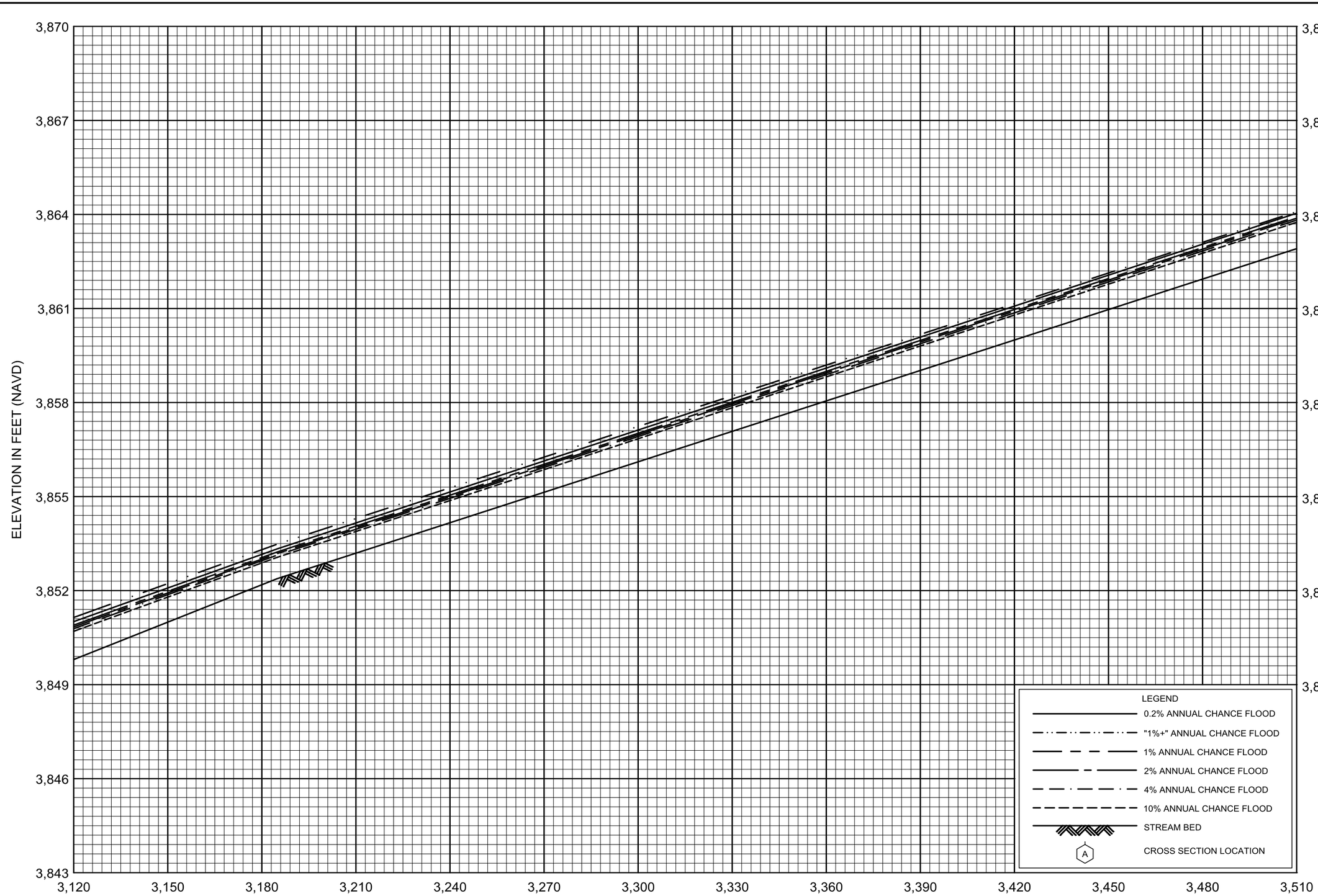
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

08P



FLOOD PROFILES

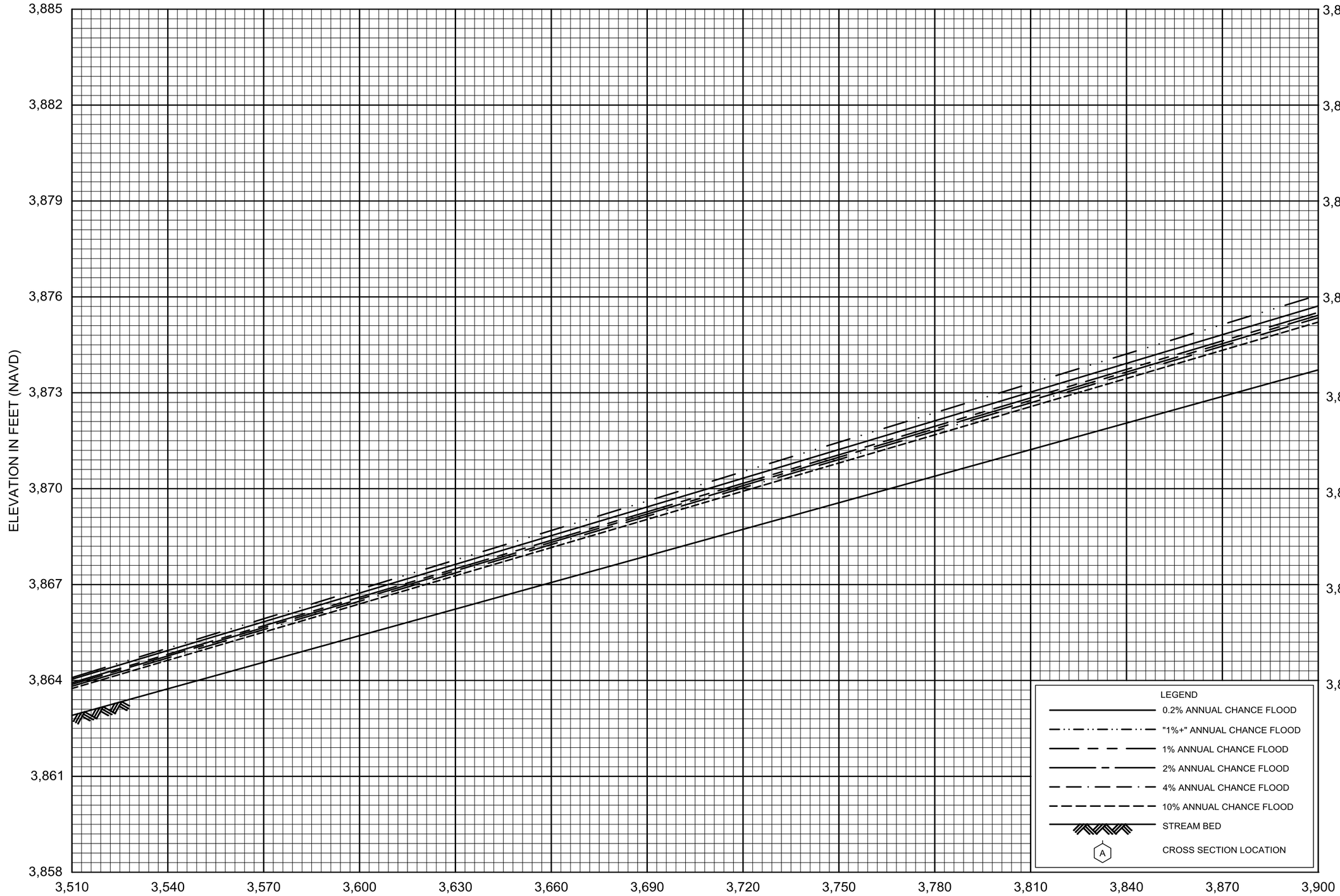
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

09P



FLOOD PROFILES

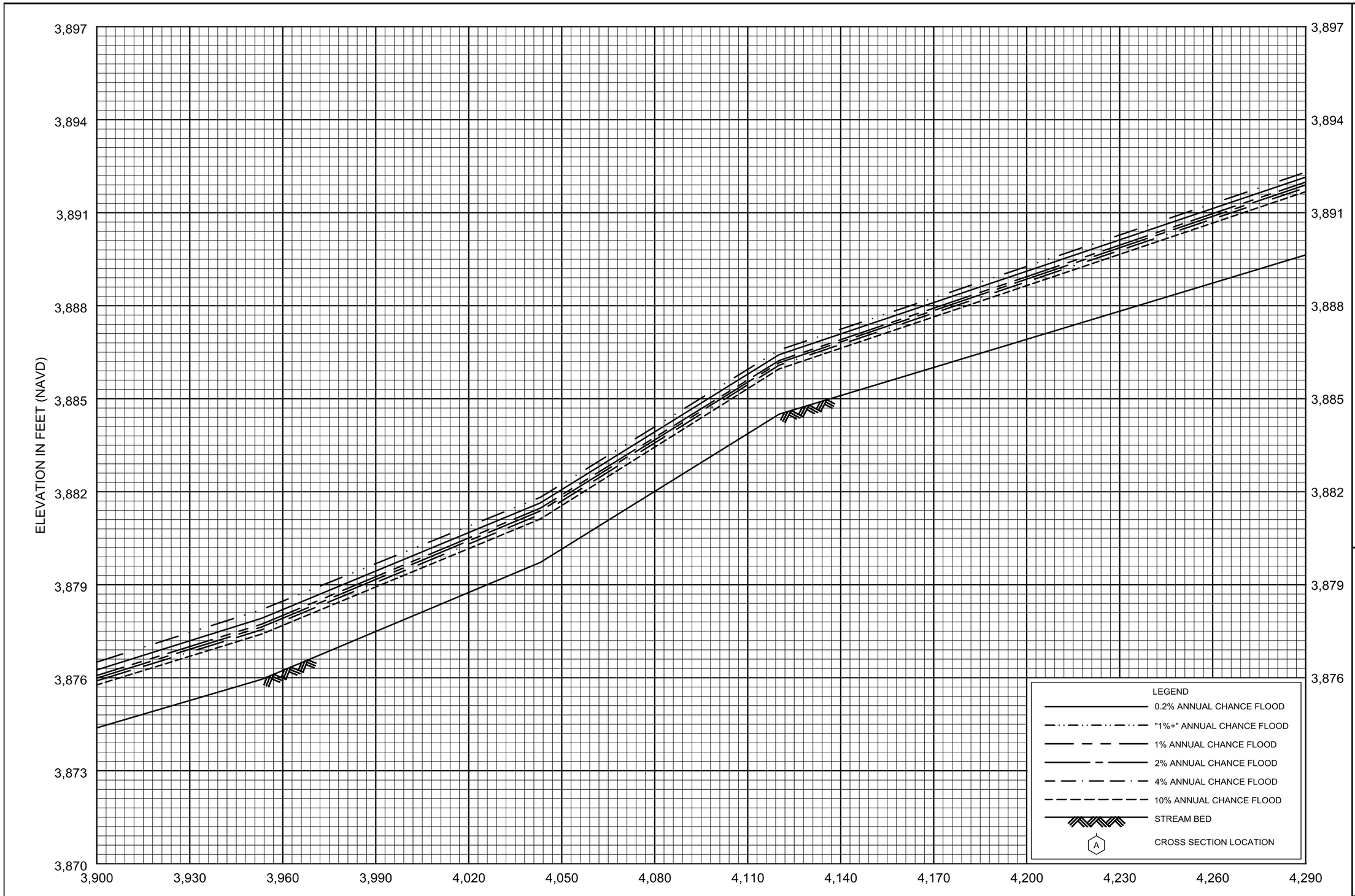
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

10P



FLOOD PROFILES

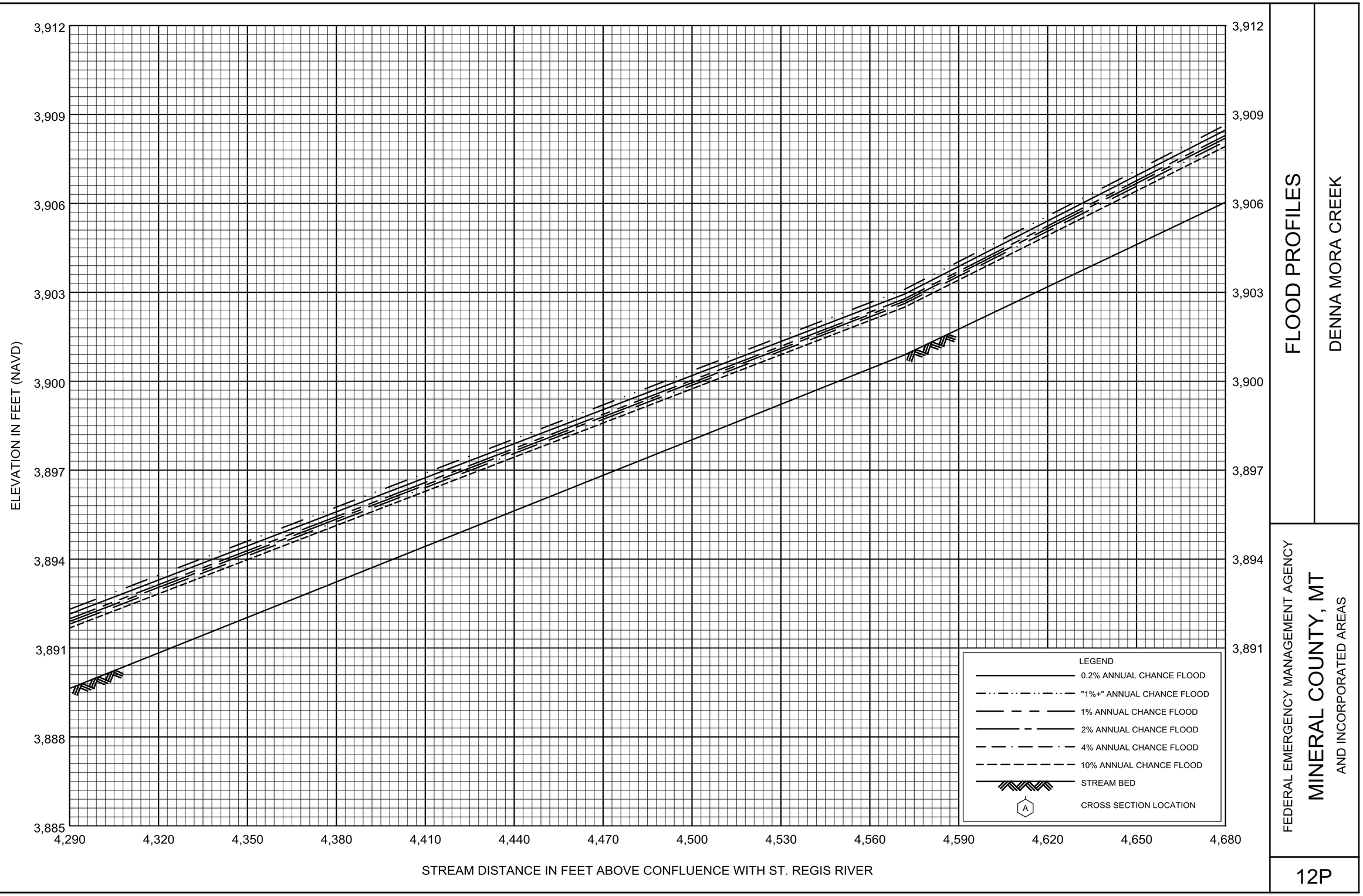
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

11P



FLOOD PROFILES

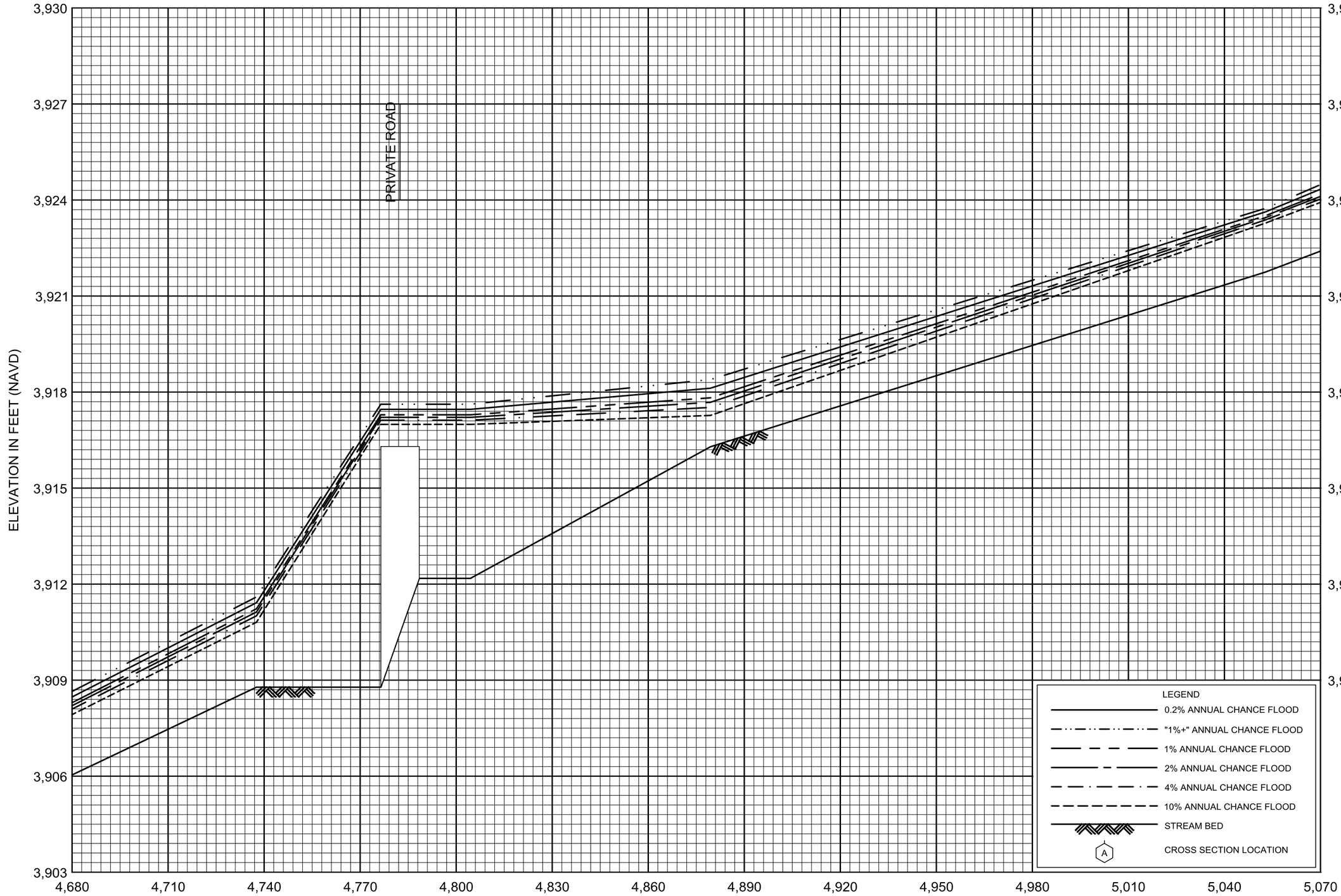
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

12P



FLOOD PROFILES

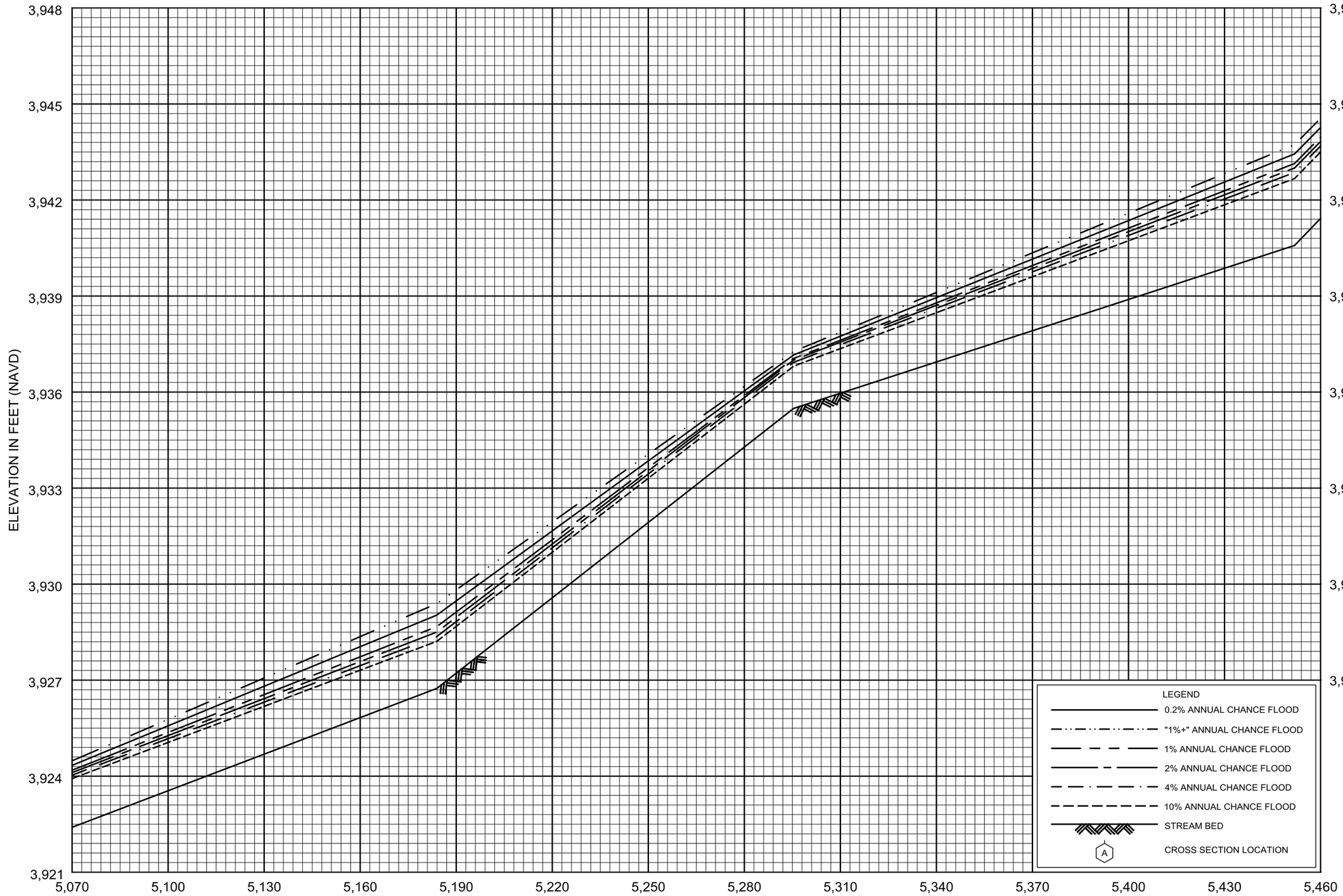
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

13P



FLOOD PROFILES

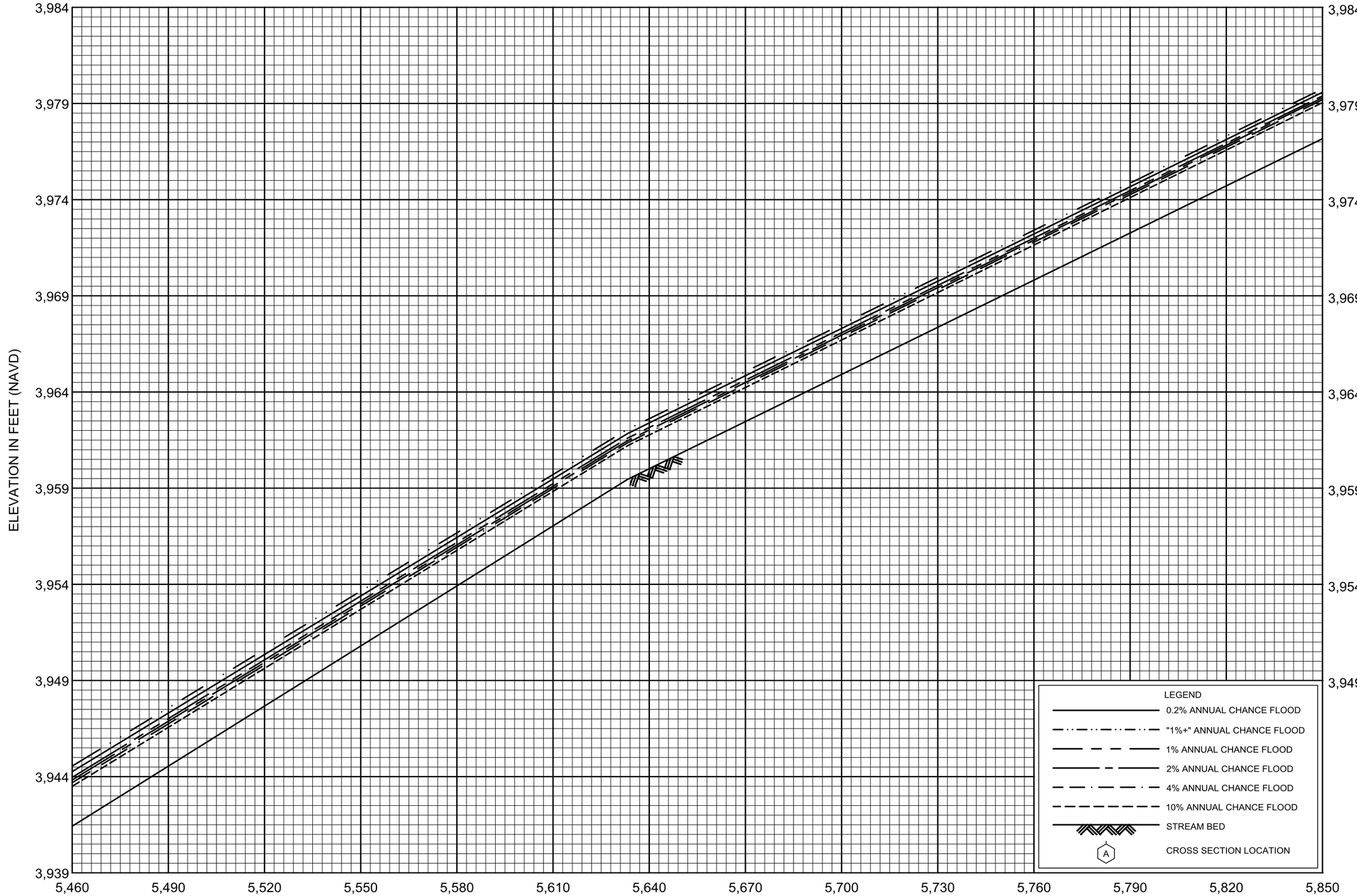
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

14P



FLOOD PROFILES

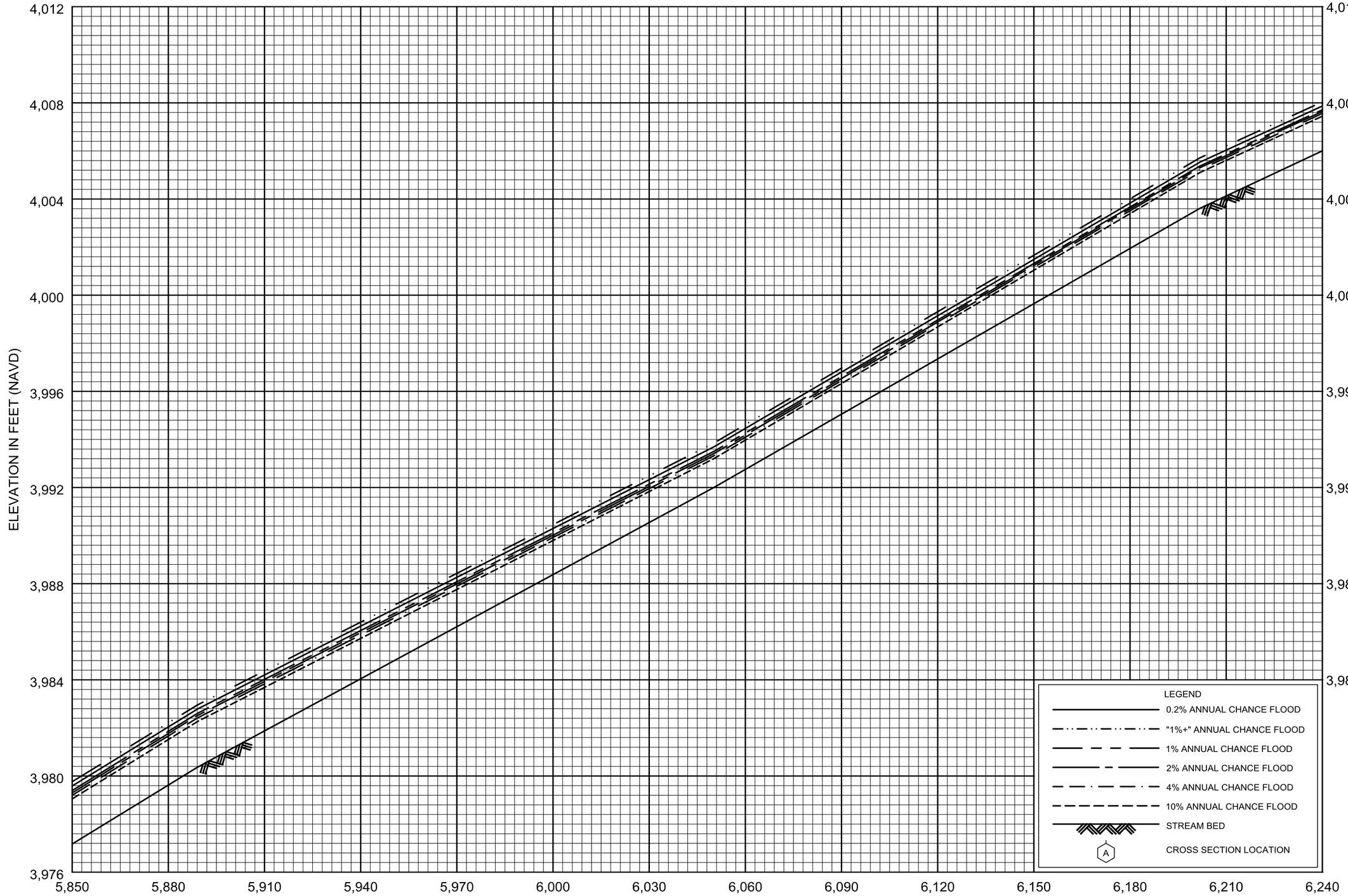
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

15P



FLOOD PROFILES

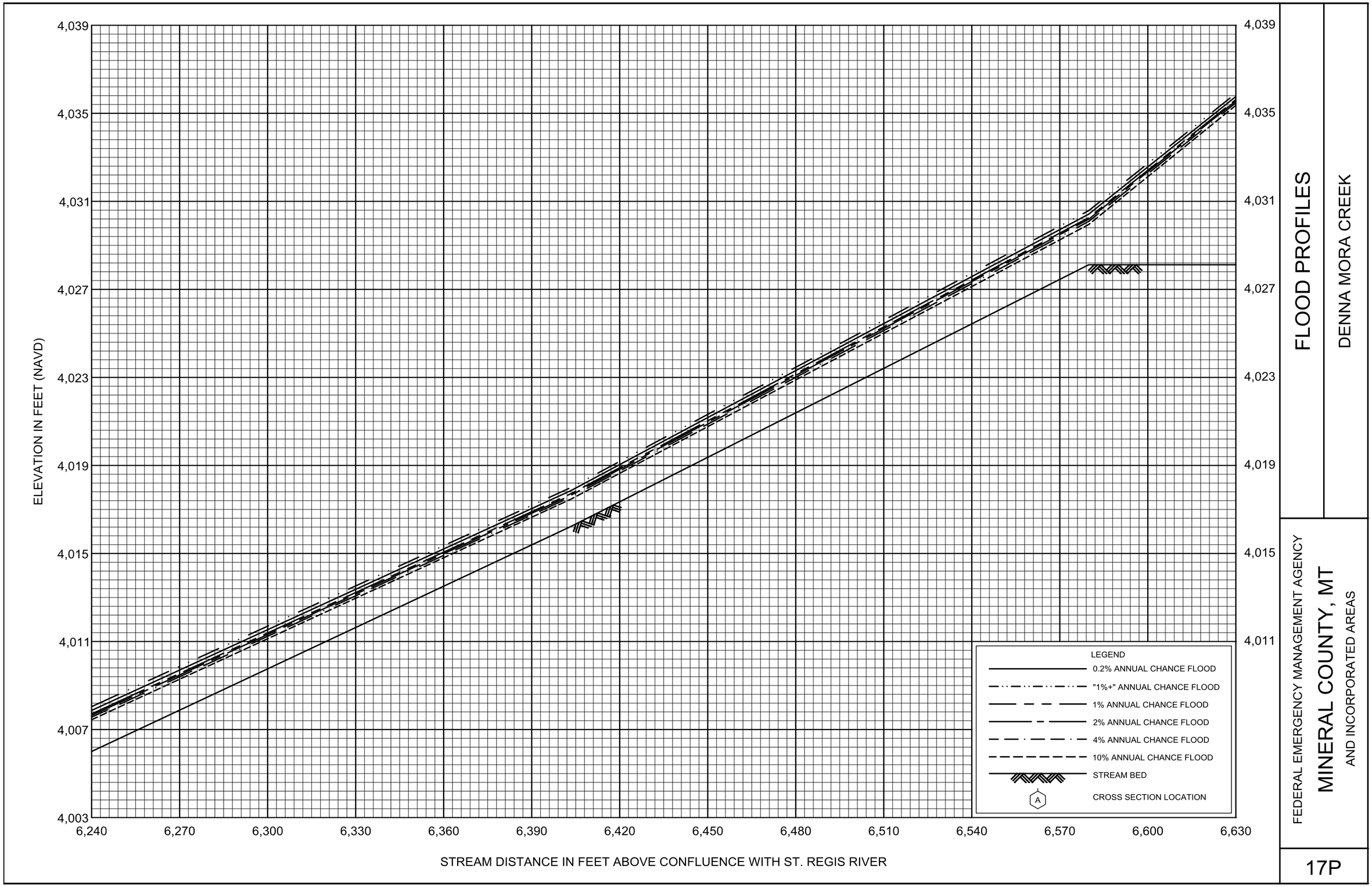
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

16P



FLOOD PROFILES

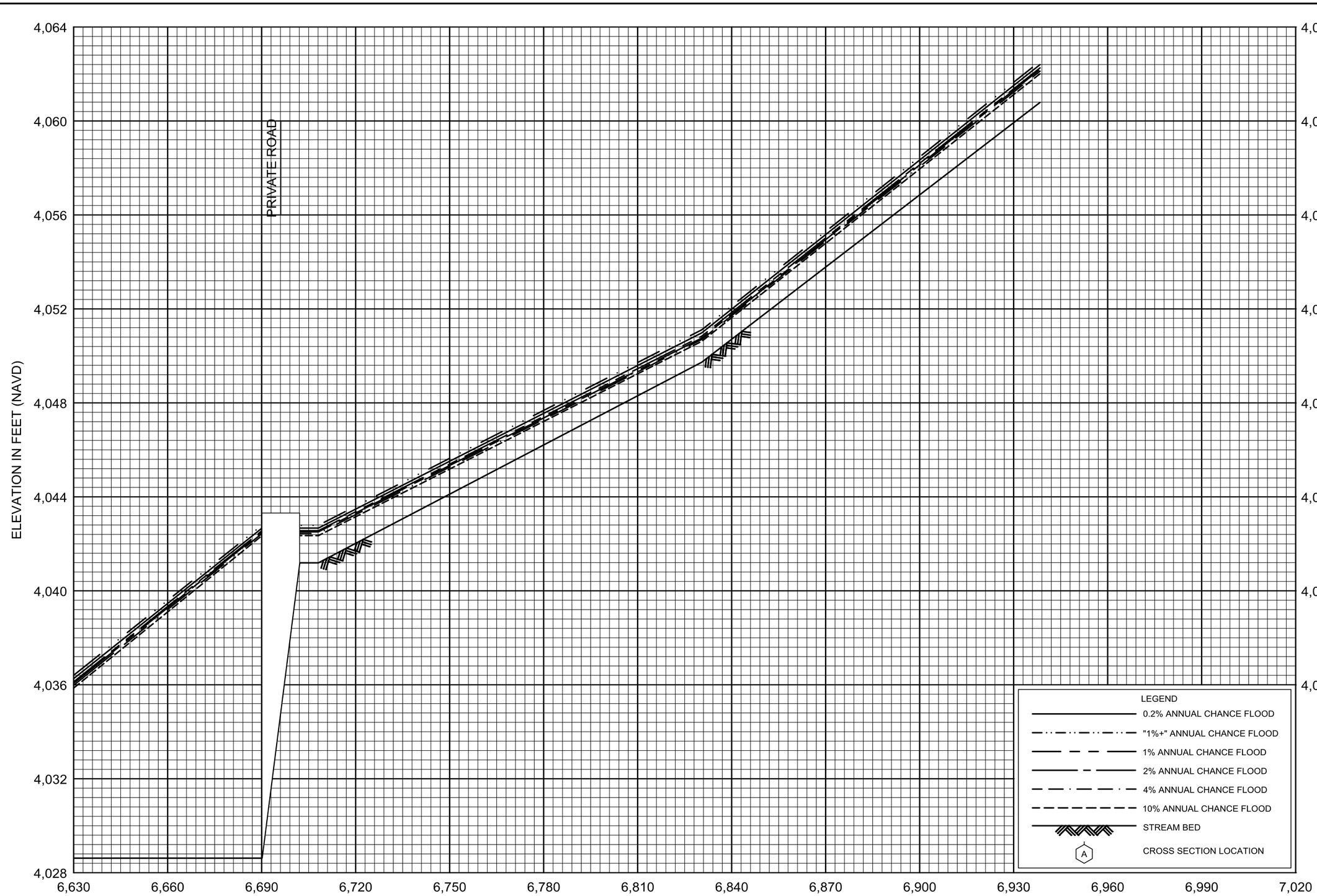
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

17P



FLOOD PROFILES

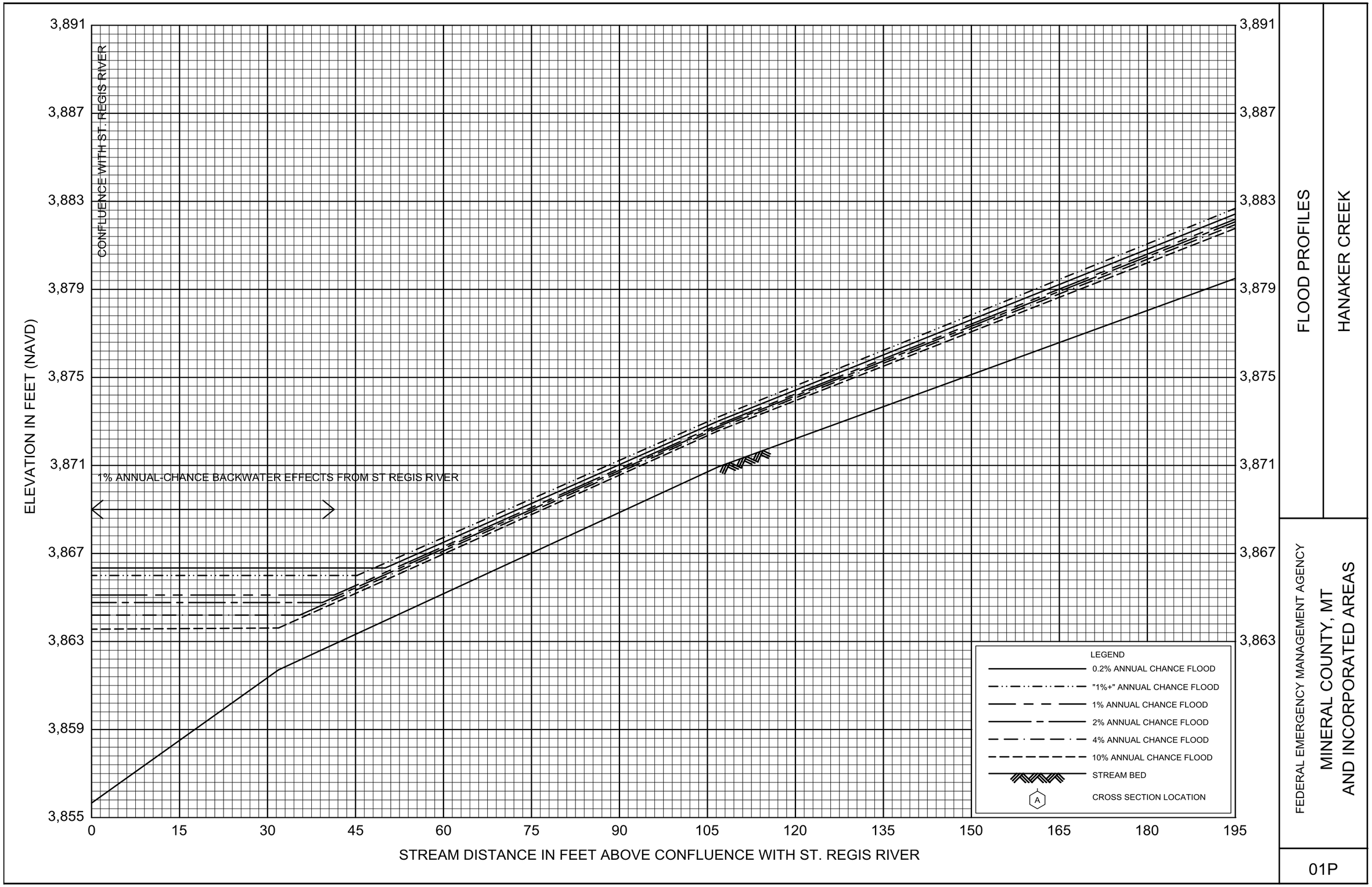
DENNA MORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT

AND INCORPORATED AREAS

18P



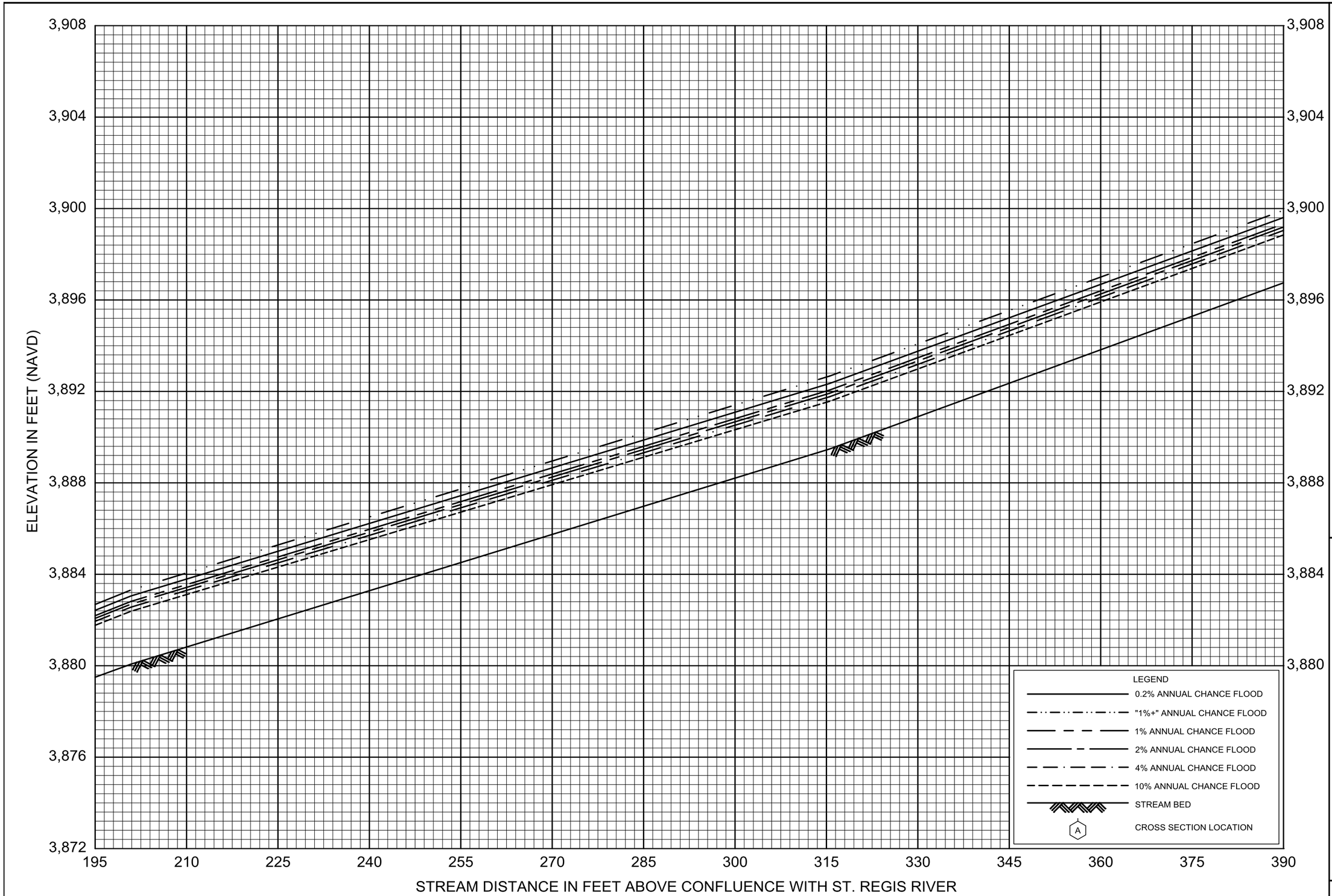
FLOOD PROFILES

HANAKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

01P



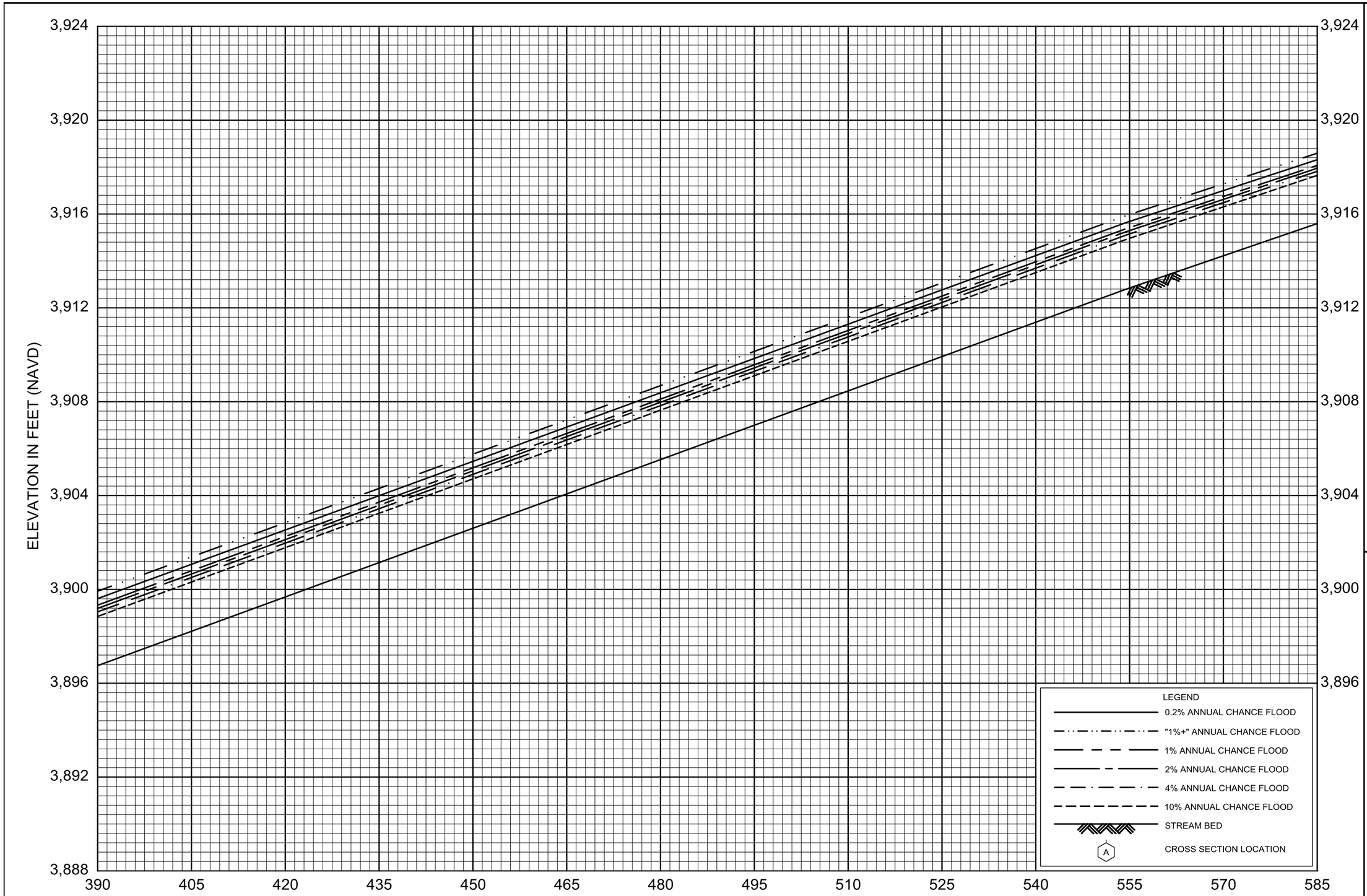
FLOOD PROFILES

HANAKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

02P



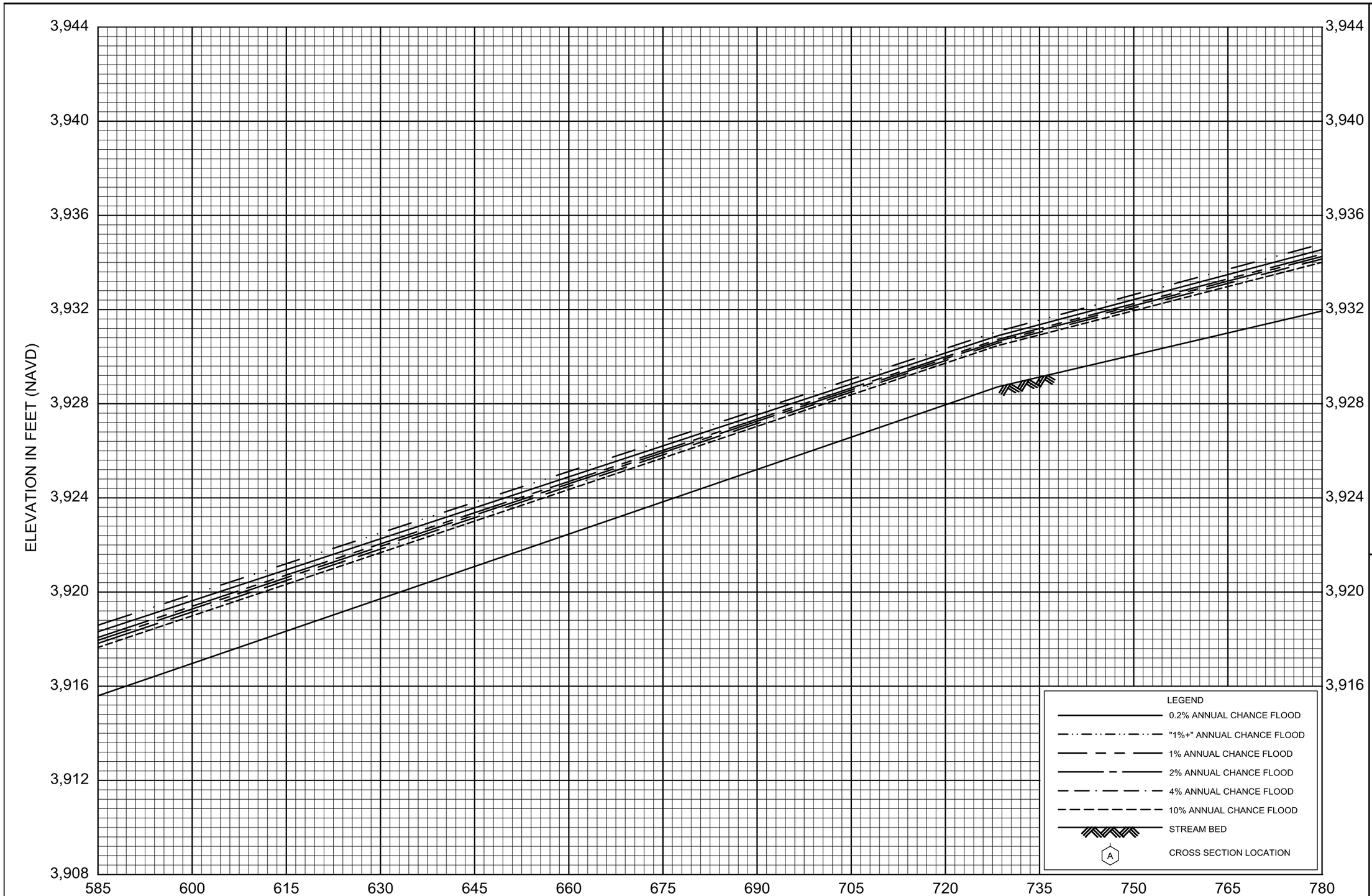
FLOOD PROFILES

HANAKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

03P



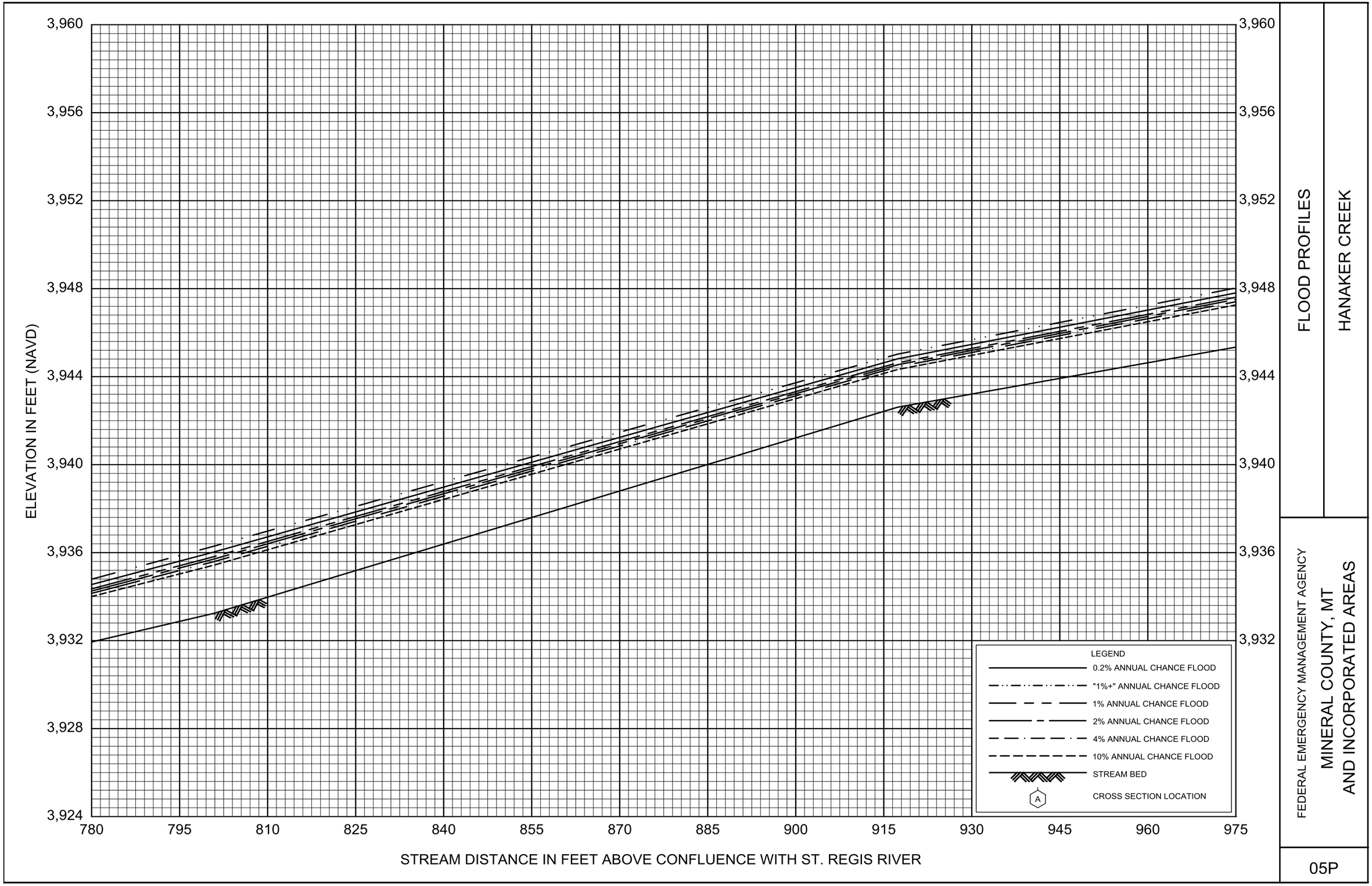
FLOOD PROFILES

HANAKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

04P



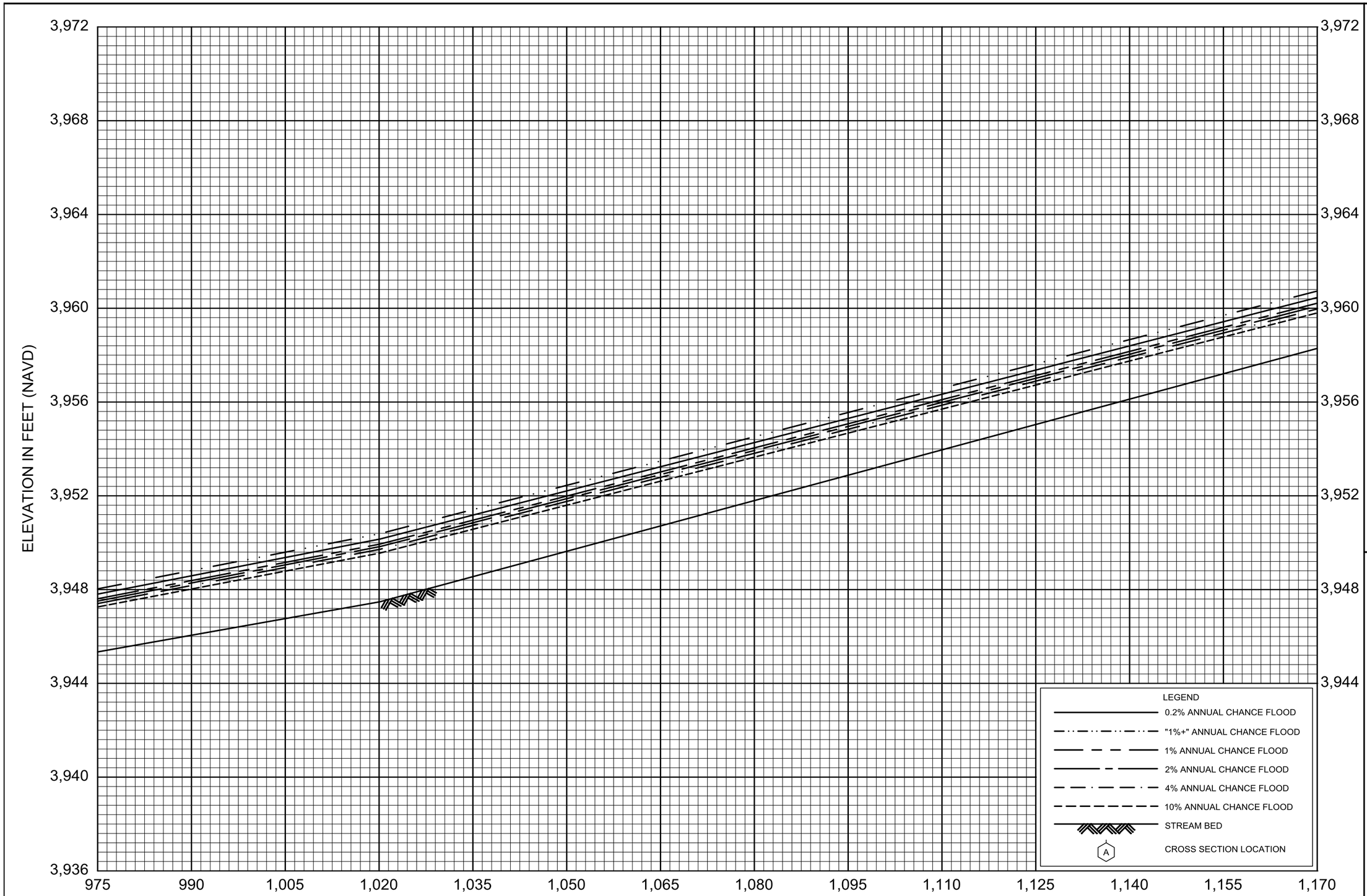
FLOOD PROFILES

HANAKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

05P



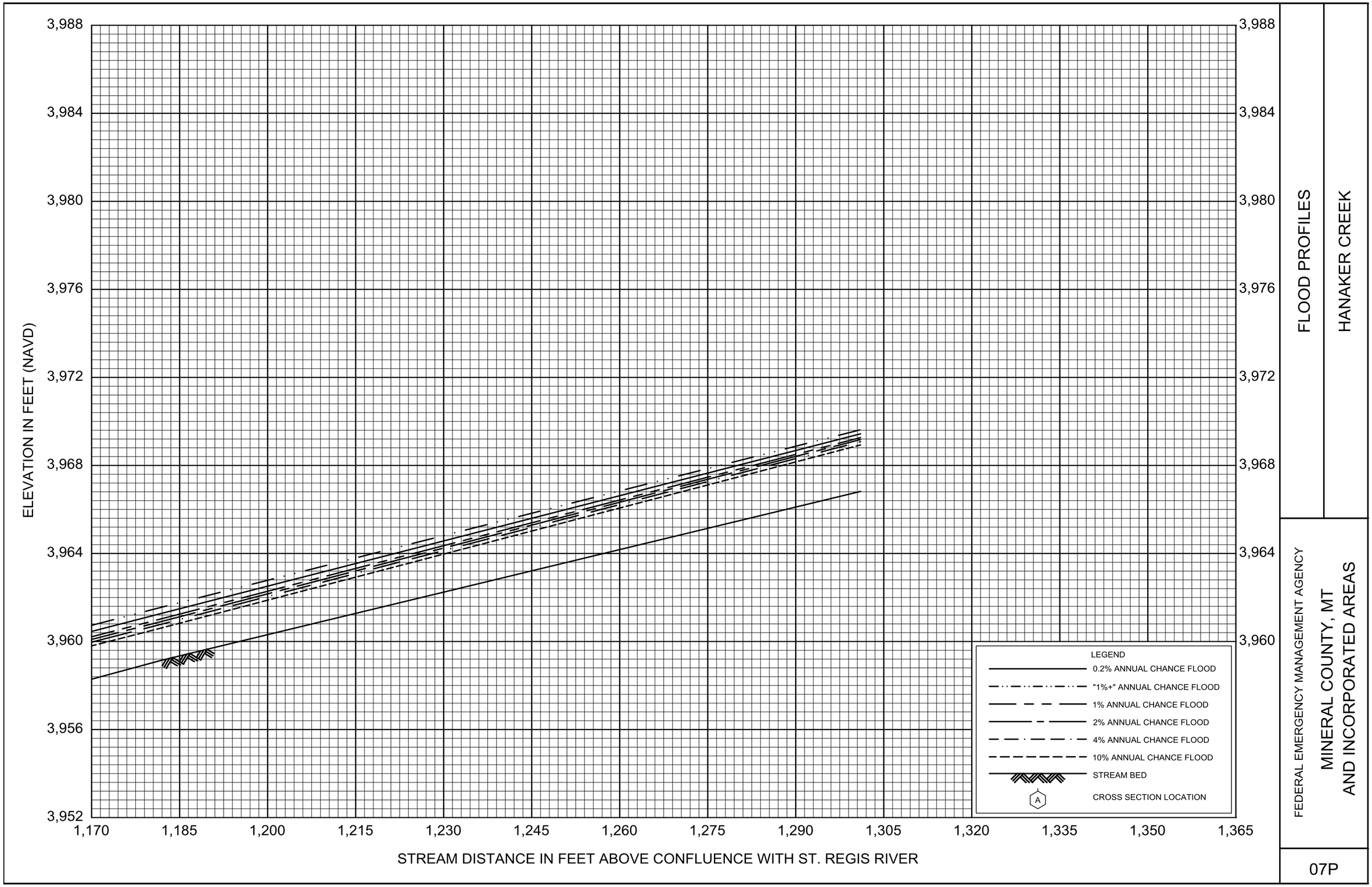
FLOOD PROFILES

HANAKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

06P



FLOOD PROFILES

HANAKER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MINERAL COUNTY, MT
AND INCORPORATED AREAS

07P

APPENDIX D – MODEL REVIEW

Quality Management: Floodplain Studies

Project Name:	**St. Regis River Tributaries**	**Project Number:**	**4036.21530.01**
Modelers:	**Josh Robbins; Drew Vance**	**Client:**	**MT DNRC**
Review:	**Greg Gabel**	**Date:**	**July 31st through Sept 4th**
Senior Review:	**Wade Irion**	**Date:**	**9/4/2018**

All items listed below have been carefully reviewed and verified to be complete.

Reviewer Signature and Date*:

9-5-2018

DOWL Modeler Signature and Date*:

Josh Robbins

Digitally signed by: Josh Robbins
DN: CN = Josh Robbins email = jrobbins@dowl.com C = AD
Date: 2018.09.05 15:02:09 -07'00'

	1. Hydraulic Modeling
Completed	**Checklist Element**
☒	1. Model developed to target cross section spacing of approximately 300-500 feet. Cross section spacing has been reviewed – distance along the floodplain is less than 550 feet (centerline or overbank distance).
☒	2. Cross sections near structures are placed at locations following the HEC-RAS guidance.
☒	3. Cross sections extend beyond the flood boundary of the 0.2% annual chance event. Cross sections are adequate length to map the flood boundaries between cross sections.
☒	4. Bank stations are appropriate for each cross section and there is continuity throughout the model. (Bank stations located below 100YR WSEL to allow for encroachment).
☒	5. Contraction and expansion coefficients have been selected for cross sections throughout the model as well as cross sections associated with structures. Exceptions to the standard values have been documented.
☒	6. If any work effort is required to process bathymetric data, the process has been documented.
☒	7. Appropriate roughness values have been assigned for the extent of the model (Manning's "n").
☒	8. HEC-RAS set to search for "Multiple Critical Depths."
☒	9. Entrance loss coefficients have been selected for each culvert crossing.
☒	10. Manning's roughness coefficient for culverts are appropriate for the material.
☒	11. The downstream boundary condition has been selected and is appropriate.
☒	12. The bridge modeling approach is assigned correctly for each crossing. Where the ratio of EGL to the (Existing Ground)/(Low Chord Elev.) is greater than 1.2, the Pressure/Weir method has been selected. Use Yarnell and momentum when there are piers impacting the flow.
☒	13. Ineffective flows near structures are approximately located at a 1:1 expansion upstream and 2:1 expansion downstream.
☒	14. Ineffective flows have been entered throughout the model and are located at the correct elevation. (There is continuity of flow between cross sections for each profile).
☒	15. Ineffective flows and blocked obstructions have been documented throughout the model.

☒	16. Flow profiles do not default to critical depth or there is a reasonable explanation for the flow reaching critical depth.
☒	17. The model has been calibrated.
N/A	18. All floodway surcharges are less than or equal to 0.5 feet. Negative surcharges have been documented.
☒	19. Stationing of the model matches the distance along the stream profile baseline.
☒	20. Split flow paths have been identified and a floodway has been developed for the split reach if necessary.
☒	21. Lateral weir coefficients are appropriate and have been documented.
☒	22. Cross section letters are spaced appropriately and visually appealing on work maps.
☒	23. The model includes results for the 'Multiple Profiles' and 'Floodway' plans.
☒	24. If necessary, the model includes an 'Optimized' plan that uses the Flow Optimization Routine to calculate flow changes and a 'Hard Entered' plan where the resulting flow changes have been manually input.
☒	25. Metadata has been validated.
☒	26. DFIRM Database tables are consistent with Hydraulic Model, FWDTs, and Profile Plots.
	2. Floodway Data Tables (FWDTs)
Completed	**Checklist Element**
N/A	27. Footnote has been completed to document the stationing reference location. (E.G. Feet above the confluence with Beaverhead River)
N/A	28. If necessary, include footnote "Floodway top width includes width of high ground area".
N/A	29. Stationing and letter of each cross section match the hydraulic model and length along the profile baseline.
N/A	30. Floodway "Width", "Section Area", and "Mean Velocity" values are the same as the hydraulic model output.
N/A	31. "Increase" column in FWDTs is equal to the difference between the "Without Floodway" and "With Floodway" columns in the FWDTs. There are no rounding errors.
	3. Profile Plots
Completed	**Checklist Element**
☒	32. Set the vertical and horizontal scales that will be used for each flooding source.
☒	33. Label the beginning and end of each profile ("Divergence from..", "Convergence with…", etc) **N/A**
☒	34. Check the labels and symbols for bridges and culverts.
☒	35. Stationing of lettered cross sections and features (bridges, etc.) match the hydraulic model.
☒	36. Profiles show the backwater influence from other flooding sources. **N/A**
☒	37. Location of lateral weirs has been annotated.
☒	38. Water surface profiles have been extended to Stream Station 0.

	4. Floodplain Mapping: To be completed for the floodplain mapping task.
Completed	Checklist Element
N/A	39. Floodway is mapped over the profile baseline.
N/A	40. Floodway widths in FWDTs are within the allowed tolerance of the actual width of GIS data. Document the comparison to include in the QAQC submittal.
N/A	41. Large “arms” of ineffective flow area have been delineated using the BFE at point of intersection with the main flow area.
N/A	42. Features have been “cleaned up” to minimum level of detail for the FIRM panels. (Very narrow backwater arms, narrow areas of flood fringe, etc.) Compass Guidance: Eliminate SFHA areas where the width is less than 1/32 graphic of an inch.
N/A	43. Flood hazard boundary polygons do not overlap.
N/A	44. Features are singlepart as described in the topology rules in the FIRM Database Technical Reference.
N/A	45. VERSION_ID consistent across all FIRM Database Tables.
N/A	46. All FIRM Database Tables are consistent with corresponding deliverables.
N/A	47. Islands that are less than 0.5 acre in size and less than two feet above base flood elevation are included in the SFHA.
N/A	48. Identify structures added and removed from flood hazard area.

Quality Management: Floodplain Mapping

Project Name:	**St. Regis River Tributaries**	**Project Number:**	**4036.21530.01**
Publisher:	**Drew Vance**	**Client:**	**MT DNRC**
Review:	**Josh Robbins**	**Date:**	**3/27/2019-4/1/2019**
Senior Review:	**Greg Gabel**	**Date:**	**4/1/2019**

All items listed below have been carefully reviewed and verified to be complete.

Reviewer Signature and Date*: Josh Robbins 4/1/2019

DOWL Modeler Signature and Date*: Drew Vance 4/1/2019

Reviewer	Publisher	Checklist Element
		1. General
☒	☒	1. Features have been "cleaned up" to minimum level of detail for the FIRM panels. (Very narrow backwater arms, narrow areas of flood fringe, etc.) 2. Compass Guidance: Eliminate SFHA areas where the width is less than 5% of map scale (25 ft)
☒	☒	3. Large "arms" of ineffective flow area have been delineated using the BFE at point of intersection with the main flow area.
☒	☒	4. Floodway is mapped over the profile baseline.
☒	☒	5. For structures that are overtopped, the overtopping is illustrated in the flood boundaries.
☒	☒	6. Disconnected flow areas and areas of ponding have been removed from the flood boundaries.
☒	☒	7. Floodway widths in FWDTs are within the allowed tolerance of the actual width of GIS data. Document the comparison to include in the QAQC submittal.
☒	☒	8. Flood hazard boundary polygons do not overlap.
☒	☒	9. Features are singlepart as described in the topology rules in the FIRM Database Technical Reference.
☒	☒	10. VERSION_ID consistent across all FIRM Database Tables.
☒	☒	11. All FIRM Database Tables are consistent with corresponding deliverables.
☒	☒	12. Complete Flood Boundary Standards Audit report
		2. Changes Since Last FIRM (CSLF)
☒	☒	13. Identify SFHA and non-SFHA areas that are added and removed.
☒	☒	14. Identify structures added and removed from flood hazard area.

Quality Management: Workmaps

Project Name:	**St. Regis River Tributaries**	**Project Number:**	**4036.21531.01**
Publisher:	**Drew Vance**	**Client:**	**MT DNRC**
Review:	**Josh Robbins**	**Date:**	**4/1/2019**
Senior Review:	**Greg Gabel**	**Date:**	**4/1/2019**

All items listed below have been carefully reviewed and verified to be complete.

Reviewer Signature and Date*: Josh Robbins 4/1/2019

DOWL Publisher Signature and Date*: Drew Vance 4/1/2019

Reviewer	Publisher	Checklist Element
		1. General
☒	☒	1. Title maps: "[Stream Name] Hydraulics Workmaps"
☒	☒	2. Index page: i) Do not display contours ii) Include location markers: major roads, nearby streams/rivers, political boundaries. iii) Label all streams if scale allows iv) Display modeled river junctions
☒	☒	3. Use Base Map data from MIP: i) Water line features ii) Transportation lines iii) Ortho imagery iv) Political boundaries (i.e. city, county, etc.)
☒	☒	4. Orient maps so that all pages have the North arrow pointing up.
☒	☒	5. Add major landmarks and political boundaries to the locator map (i.e. major roads, city limits, county boundary, etc.)
☒	☒	6. Label contours.
☒	☒	7. For studies with multiple reaches, display only one color of profile baseline in the legend with a note that reads "Varies by Color."
☒	☒	8. Include date on maps.
☒	☒	9. Label the proposed flood hazard areas in the legend as "1% AC (100 yr)" and "0.2% AC (500 yr)"

APPENDIX E – HEC-RAS MODEL DOCUMENTATION

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
Little Joe Creek	15612	
Little Joe Creek	15286	
Little Joe Creek	14949	Left side ineffective - hydraulically disconnected
Little Joe Creek	14657	
Little Joe Creek	14346	
Little Joe Creek	14060	Left side ineffective - related to natural constriction upstream
Little Joe Creek	13771	
Little Joe Creek	13306	
Little Joe Creek	13055	
Little Joe Creek	12638	
Little Joe Creek	12334	
Little Joe Creek	12028	
Little Joe Creek	11652	
Little Joe Creek	11392	
Little Joe Creek	11237	
Little Joe Creek	10848	
Little Joe Creek	10474	
Little Joe Creek	10225	
Little Joe Creek	9894	
Little Joe Creek	9396	
Little Joe Creek	9038	
Little Joe Creek	8739	Ineffective areas related to structure
Little Joe Creek	8665	Ineffective areas related to structure
Little Joe Creek	8358	
Little Joe Creek	8050	Right side ineffective - hydraulically disconnected
Little Joe Creek	7850	Right side ineffective - hydraulically disconnected
Little Joe Creek	7467	
Little Joe Creek	7027	
Little Joe Creek	6577	
Little Joe Creek	6113	
Little Joe Creek	5676	
Little Joe Creek	5228	
Little Joe Creek	4701	
Little Joe Creek	4287	Left side ineffective - hydraulically disconnected
Little Joe Creek	3865	Left side ineffective - hydraulically disconnected
Little Joe Creek	3531	Left side ineffective - hydraulically disconnected
Little Joe Creek	3161	Left side ineffective - hydraulically disconnected
Little Joe Creek	2724	Left side ineffective - hydraulically disconnected
Little Joe Creek	2264	Left side ineffective - hydraulically disconnected
Little Joe Creek	1774	Left side ineffective - hydraulically disconnected
Little Joe Creek	1361	
Little Joe Creek	1000	
Little Joe Creek	566	Ineffective areas related to structure
Little Joe Creek	265	Ineffective areas related to structure
Little Joe Creek	113	Ineffective areas related to structure
Little Joe Creek	54	Ineffective areas related to structure
Little Joe Creek	49.57	Ineffective areas related to structure
East Fork Twelvemile Creek	17884	
East Fork Twelvemile Creek	17772	
East Fork Twelvemile Creek	17659	
East Fork Twelvemile Creek	17304	
East Fork Twelvemile Creek	17002	
East Fork Twelvemile Creek	16748	
East Fork Twelvemile Creek	16466	
East Fork Twelvemile Creek	16246	
East Fork Twelvemile Creek	15967	
East Fork Twelvemile Creek	15574	
East Fork Twelvemile Creek	15094	
East Fork Twelvemile Creek	14925	
East Fork Twelvemile Creek	14699	Left side ineffective - hydraulically disconnected
East Fork Twelvemile Creek	14500	Left side ineffective - hydraulically disconnected
East Fork Twelvemile Creek	14352	Left side ineffective - hydraulically disconnected
East Fork Twelvemile Creek	14150	

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
East Fork Twelvemile Creek	13962	
East Fork Twelvemile Creek	13567	
East Fork Twelvemile Creek	13246	
East Fork Twelvemile Creek	12770	
East Fork Twelvemile Creek	12472	
East Fork Twelvemile Creek	12088	
East Fork Twelvemile Creek	11885	
East Fork Twelvemile Creek	11765	
East Fork Twelvemile Creek	11655	
East Fork Twelvemile Creek	11441	
East Fork Twelvemile Creek	11117	
East Fork Twelvemile Creek	10709	
East Fork Twelvemile Creek	10329	
East Fork Twelvemile Creek	10085	
East Fork Twelvemile Creek	9762	
East Fork Twelvemile Creek	9365	
East Fork Twelvemile Creek	9058	
East Fork Twelvemile Creek	8870	
East Fork Twelvemile Creek	8822	
East Fork Twelvemile Creek	8716	Ineffective areas related to structure
East Fork Twelvemile Creek	8653	Ineffective area related to structure
East Fork Twelvemile Creek	8523	
East Fork Twelvemile Creek	8415	
East Fork Twelvemile Creek	8105	
East Fork Twelvemile Creek	7761	
East Fork Twelvemile Creek	7419	
East Fork Twelvemile Creek	7144	
East Fork Twelvemile Creek	6854	
East Fork Twelvemile Creek	6773	
East Fork Twelvemile Creek	6726	
East Fork Twelvemile Creek	6699	
East Fork Twelvemile Creek	6680	
East Fork Twelvemile Creek	6618	Ineffective areas related to structure
East Fork Twelvemile Creek	6539	Ineffective areas related to structure
East Fork Twelvemile Creek	6391	
East Fork Twelvemile Creek	6162	
East Fork Twelvemile Creek	6003	
East Fork Twelvemile Creek	5527	
East Fork Twelvemile Creek	5399	
East Fork Twelvemile Creek	5117	
East Fork Twelvemile Creek	4856	
East Fork Twelvemile Creek	4519	
East Fork Twelvemile Creek	4082	
East Fork Twelvemile Creek	3813	
East Fork Twelvemile Creek	3544	
East Fork Twelvemile Creek	3306	
East Fork Twelvemile Creek	2986	
East Fork Twelvemile Creek	2843	
East Fork Twelvemile Creek	2774	
East Fork Twelvemile Creek	2701	
East Fork Twelvemile Creek	2348	
East Fork Twelvemile Creek	2026	
East Fork Twelvemile Creek	1780	
East Fork Twelvemile Creek	1577	
East Fork Twelvemile Creek	1287	
East Fork Twelvemile Creek	1166	
East Fork Twelvemile Creek	1049	
East Fork Twelvemile Creek	995	
East Fork Twelvemile Creek	961	
East Fork Twelvemile Creek	942	
East Fork Twelvemile Creek	910	
East Fork Twelvemile Creek	857	
East Fork Twelvemile Creek	769	

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
East Fork Twelvemile Creek	657	
East Fork Twelvemile Creek	477	
East Fork Twelvemile Creek	179.1	
Rock Creek	9651	
Rock Creek	9241	
Rock Creek	8797	Left side ineffective - hydraulically disconnected
Rock Creek	8480	
Rock Creek	8147	Left side ineffective - hydraulically disconnected
Rock Creek	7839	
Rock Creek	7474	Left side ineffective - hydraulically disconnected
Rock Creek	7252	Right side ineffective - hydraulically disconnected
Rock Creek	7149	
Rock Creek	6990	
Rock Creek	6870	Right side ineffective - hydraulically disconnected
Rock Creek	6717	Right side ineffective - hydraulically disconnected
Rock Creek	6578	Right side ineffective - hydraulically disconnected
Rock Creek	6240	Right side ineffective - hydraulically disconnected
Rock Creek	5847	Left side ineffective - hydraulically disconnected
Rock Creek	5513	Right side ineffective - hydraulically disconnected
Rock Creek	5344	Right side ineffective - hydraulically disconnected
Rock Creek	5153	Right side ineffective - hydraulically disconnected
Rock Creek	4750	Right side ineffective - hydraulically disconnected
Rock Creek	4392	
Rock Creek	4048	Left side ineffective - hydraulically disconnected
Rock Creek	3726	
Rock Creek	3358	Left side ineffective - hydraulically disconnected
Rock Creek	2937	
Rock Creek	2626	
Rock Creek	2324	Left side ineffective - hydraulically disconnected
Rock Creek	2061	
Rock Creek	1962	
Rock Creek	1855	
Rock Creek	1637	Ineffective areas related to structure
Rock Creek	1573	Ineffective areas related to structure
Rock Creek	1436	Left side ineffective - hydraulically disconnected
Rock Creek	1261	Left side ineffective - hydraulically disconnected
Rock Creek	1100	Left side ineffective - hydraulically disconnected
Rock Creek	975	
Rock Creek	838	Left side ineffective - hydraulically disconnected
Rock Creek	707	Ineffective areas related to structure
Rock Creek	645	Ineffective areas related to structure
Rock Creek	559	Ineffective area related to structure
Rock Creek	439	Ineffective area related to structure
Rock Creek	323	Ineffective area related to structure
Rock Creek	223.18	Ineffective area related to structure
Twelvemile Creek	19639	
Twelvemile Creek	19245	
Twelvemile Creek	18955	
Twelvemile Creek	18712	
Twelvemile Creek	18247	
Twelvemile Creek	17815	
Twelvemile Creek	17334	
Twelvemile Creek	17229	
Twelvemile Creek	17113	
Twelvemile Creek	16941	
Twelvemile Creek	16639	
Twelvemile Creek	16245	Right side ineffective - hydraulically disconnected
Twelvemile Creek	15979	
Twelvemile Creek	15688	
Twelvemile Creek	15396	
Twelvemile Creek	14989	
Twelvemile Creek	14515	
Twelvemile Creek	14068	

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
Twelvemile Creek	13935	
Twelvemile Creek	13821	
Twelvemile Creek	13685	Ineffective areas related to structure
Twelvemile Creek	13621	Ineffective areas related to structure
Twelvemile Creek	13319	Right side ineffective - hydraulically disconnected
Twelvemile Creek	13023	
Twelvemile Creek	12753	
Twelvemile Creek	12345	Left side ineffective - hydraulically disconnected
Twelvemile Creek	12140	
Twelvemile Creek	11861	
Twelvemile Creek	11665	
Twelvemile Creek	11560	
Twelvemile Creek	11504	
Twelvemile Creek	11326	
Twelvemile Creek	11043	
Twelvemile Creek	10597	
Twelvemile Creek	10149	
Twelvemile Creek	9684	
Twelvemile Creek	9224	
Twelvemile Creek	8742	
Twelvemile Creek	8129	
Twelvemile Creek	7759	
Twelvemile Creek	7326	
Twelvemile Creek	6931	
Twelvemile Creek	6768	
Twelvemile Creek	6739	
Twelvemile Creek	6524	
Twelvemile Creek	6053	
Twelvemile Creek	5634	
Twelvemile Creek	5197	
Twelvemile Creek	4764	
Twelvemile Creek	4387	
Twelvemile Creek	4127	
Twelvemile Creek	3922	
Twelvemile Creek	3595	
Twelvemile Creek	3409	
Twelvemile Creek	3299	
Twelvemile Creek	3154	
Twelvemile Creek	2853	
Twelvemile Creek	2461	Right side ineffective - hydraulically disconnected
Twelvemile Creek	2310	Right side ineffective - hydraulically disconnected
Twelvemile Creek	2117	Right side ineffective - hydraulically disconnected
Twelvemile Creek	1987	Right side ineffective - hydraulically disconnected
Twelvemile Creek	1822	
Twelvemile Creek	1538	
Twelvemile Creek	1182	
Twelvemile Creek	757	
Twelvemile Creek	406	Ineffective areas related to structure
Twelvemile Creek	182.05	Ineffective areas related to structure
East Fork Twin Creek	1108	
East Fork Twin Creek	1053	Ineffective areas related to structure
East Fork Twin Creek	1017	
East Fork Twin Creek	946	
East Fork Twin Creek	695	
East Fork Twin Creek	403	Blocked obstructions - buildings
East Fork Twin Creek	169.72	
West Fork Twin Creek	5803	
West Fork Twin Creek	5682	Right side ineffective - hydraulically disconnected
West Fork Twin Creek	5450	
West Fork Twin Creek	5147	
West Fork Twin Creek	5029	
Twin Creek	4898	
Twin Creek	4798	

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
Twin Creek	4526	
Twin Creek	4376	
Twin Creek	4143	
Twin Creek	4023	
Twin Creek	3984	
Twin Creek	3808	
Twin Creek	3659	Right side ineffective - hydraulically disconnected
Twin Creek	3567	Right side ineffective - hydraulically disconnected
Twin Creek	3351	Right side ineffective - hydraulically disconnected
Twin Creek	3026	Right side ineffective - hydraulically disconnected
Twin Creek	2963	Right side ineffective - hydraulically disconnected
Twin Creek	2893	Right side ineffective - hydraulically disconnected
Twin Creek	2806	Right side ineffective - hydraulically disconnected
Twin Creek	2670	Ineffective areas related to structure
Twin Creek	2623	Ineffective areas related to structure
Twin Creek	2387	Right side ineffective - hydraulically disconnected. Blocked obstructions - buildings
Twin Creek	2079	Right side ineffective - hydraulically disconnected. Blocked obstruction - buildings
Twin Creek	1911	Right side ineffective - hydraulically disconnected. Blocked obstruction - buildings
Twin Creek	1640	Ineffective areas related to structure
Twin Creek	1568	Ineffective area related to structure
Twin Creek	1564	Ineffective areas related to structure
Twin Creek	1046	Ineffective areas related to structure
Twin Creek	1019	Ineffective areas related to structure
Twin Creek	938	Ineffective areas related to structure
Twin Creek	471.76	Ineffective areas related to structure
Deer Creek	3434	Right side ineffective - hydraulically disconnected
Deer Creek	3217	Right side ineffective - hydraulically disconnected
Deer Creek	3001	Right side ineffective - hydraulically disconnected
Deer Creek	2666	Right side ineffective - hydraulically disconnected
Deer Creek	2328	Left side ineffective - hydraulically disconnected
Deer Creek	2161	
Deer Creek	1917	Right side ineffective - hydraulically disconnected
Deer Creek	1730	Right side ineffective - hydraulically disconnected
Deer Creek	1482	
Deer Creek	1104	
Deer Creek	728	
Deer Creek	365	
Deer Creek	113.86	Right side ineffective - hydraulically disconnected
Big Creek	15103	Left side ineffective - hydraulically disconnected
Big Creek	14733	
Big Creek	14468	
Big Creek	14052	
Big Creek	13723	
Big Creek	13322	
Big Creek	12847	
Big Creek	12578	
Big Creek	12218	
Big Creek	11725	
Big Creek	11450	Left side ineffective - hydraulically disconnected
Big Creek	11014	Left side ineffective - hydraulically disconnected
Big Creek	10806	Ineffective areas related to structure
Big Creek	10753	Ineffective areas related to structure
Big Creek	10628	
Big Creek	10392	
Big Creek	10116	
Big Creek	9817	Right side ineffective - hydraulically disconnected
Big Creek	9478	
Big Creek	9174	
Big Creek	8880	Right side ineffective - hydraulically disconnected
Big Creek	8445	Right side ineffective - hydraulically disconnected

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
Big Creek	8021	Right side ineffective - hydraulically disconnected
Big Creek	7554	Right side ineffective - hydraulically disconnected
Big Creek	7148	
Big Creek	6777	
Big Creek	6315	
Big Creek	5810	
Big Creek	5425	Right side ineffective - hydraulically disconnected
Big Creek	5066	
Big Creek	4690	Ineffective areas related to structure
Big Creek	4627	Ineffective areas related to structure
Big Creek	4360	Right side ineffective - hydraulically disconnected
Big Creek	3955	
Big Creek	3632	Left side ineffective - hydraulically disconnected
Big Creek	3381	
Big Creek	2996	
Big Creek	2676	
Big Creek	2319	
Big Creek	1972	
Big Creek	1705	
Big Creek	1349	Left side ineffective - hydraulically disconnected
Big Creek	995	
Big Creek	733	Left side ineffective - hydraulically disconnected
Big Creek	545	
Big Creek	328	Ineffective area related to structure
Big Creek	286	Ineffective area related to structure
Big Creek	234	Ineffective areas related to structure
Big Creek	188	Ineffective areas related to structure
Big Creek	126	Ineffective area related to structure
Big Creek	48.95	
Savenac Creek	19402	Left side ineffective - hydraulically disconnected
Savenac Creek	19150	Left side ineffective - hydraulically disconnected
Savenac Creek	18761	
Savenac Creek	18542	Right side ineffective - hydraulically disconnected
Savenac Creek	18077	Left side ineffective - hydraulically disconnected
Savenac Creek	17852	Left side ineffective - hydraulically disconnected
Savenac Creek	17547	Left side ineffective - hydraulically disconnected
Savenac Creek	17194	Left side ineffective - hydraulically disconnected
Savenac Creek	17041	Left side ineffective - hydraulically disconnected
Savenac Creek	16863	Left side ineffective - hydraulically disconnected
Savenac Creek	16738	Left side ineffective - hydraulically disconnected
Savenac Creek	16531	Left side ineffective - hydraulically disconnected
Savenac Creek	16159	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Savenac Creek	15748	Left side ineffective - hydraulically disconnected
Savenac Creek	15420	Left side ineffective - hydraulically disconnected
Savenac Creek	15039	Left side ineffective - hydraulically disconnected
Savenac Creek	14722	Right side ineffective - hydraulically disconnected
Savenac Creek	14358	
Savenac Creek	13904	
Savenac Creek	13693	
Savenac Creek	13464	
Savenac Creek	13210	
Savenac Creek	12776	Right side ineffective - hydraulically disconnected
Savenac Creek	12460	
Savenac Creek	12231	Right side ineffective - hydraulically disconnected
Savenac Creek	12035	Right side ineffective - hydraulically disconnected
Savenac Creek	11681	Left side ineffective - hydraulically disconnected
Savenac Creek	11493	Left side ineffective - hydraulically disconnected
Savenac Creek	11236	
Savenac Creek	10987	
Savenac Creek	10718	Left side ineffective - hydraulically disconnected
Savenac Creek	10532	
Savenac Creek	10267	Left side ineffective - hydraulically disconnected

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
Savenac Creek	9807	
Savenac Creek	9457	Left side ineffective - hydraulically disconnected
Savenac Creek	9263	
Savenac Creek	8829	
Savenac Creek	8536	
Savenac Creek	8185	
Savenac Creek	7931	
Savenac Creek	7589	
Savenac Creek	7325	
Savenac Creek	6924	Right side ineffective - hydraulically disconnected
Savenac Creek	6698	Right side ineffective - hydraulically disconnected
Savenac Creek	6435	Left side ineffective - hydraulically disconnected
Savenac Creek	6042	
Savenac Creek	5850	
Savenac Creek	5755	Right side ineffective - hydraulically disconnected
Savenac Creek	5597	
Savenac Creek	5521	Ineffective areas related to structure
Savenac Creek	5477	Ineffective areas related to structure
Savenac Creek	5362	Right side ineffective - hydraulically disconnected
Savenac Creek	5188	Right side ineffective - hydraulically disconnected
Savenac Creek	5013	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Savenac Creek	4835	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Savenac Creek	4665	Left side ineffective - hydraulically disconnected. Blocked obstruction - depression with standing water
Savenac Creek	4479	Left side ineffective - hydraulically disconnected
Savenac Creek	4400	Left side ineffective - hydraulically disconnected
Savenac Creek	4286	Left side ineffective - hydraulically disconnected
Savenac Creek	4128	Ineffective areas related to structure
Savenac Creek	4081	Ineffective areas related to structure
Savenac Creek	3993	Ineffective area related to structure
Savenac Creek	3822	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Savenac Creek	3684	
Savenac Creek	3572	
Savenac Creek	3402	
Savenac Creek	3100	Right side ineffective - hydraulically disconnected
Savenac Creek	2936	Right side ineffective - hydraulically disconnected
Savenac Creek	2829	Right side ineffective - hydraulically disconnected
Savenac Creek	2546	
Savenac Creek	2323	
Savenac Creek	2126	
Savenac Creek	1910	
Savenac Creek	1673	Left side ineffective - hydraulically disconnected
Savenac Creek	1573	Left side ineffective - hydraulically disconnected
Savenac Creek	1470	Left side ineffective - hydraulically disconnected
Savenac Creek	1268	Left side ineffective - hydraulically disconnected
Savenac Creek	1159	Left side ineffective - hydraulically disconnected
Savenac Creek	1034	Left side ineffective - hydraulically disconnected
Savenac Creek	965	Left side ineffective - hydraulically disconnected
Savenac Creek	735	Left side ineffective - hydraulically disconnected
Savenac Creek	289	Ineffective areas related to structure
Savenac Creek	225	Ineffective areas related to structure
Savenac Creek	37.42	Ineffective areas related to structure
West Fork Timber Creek	3286	
West Fork Timber Creek	3111	
West Fork Timber Creek	2971	
West Fork Timber Creek	2733	
West Fork Timber Creek	2475	
West Fork Timber Creek	2234	
West Fork Timber Creek	2005	
West Fork Timber Creek	1789	Left side ineefective - hydraulically disconnected

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
West Fork Timber Creek	1599	
West Fork Timber Creek	1478	
West Fork Timber Creek	1441	Ineffective areas related to structure
West Fork Timber Creek	1321	Ineffective areas related to structure
West Fork Timber Creek	1257	Left side ineffective - hydraulically disconnected
West Fork Timber Creek	1067	Left side ineffective - hydraulically disconnected
West Fork Timber Creek	863	
West Fork Timber Creek	722	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
West Fork Timber Creek	553	
West Fork Timber Creek	377	Right side ineffective - hydraulically disconnected
West Fork Timber Creek	264	
West Fork Timber Creek	113.9	Right side ineffective - hydraulically disconnected
East Fork Timber Creek	9512	
East Fork Timber Creek	9288	
East Fork Timber Creek	9115	
East Fork Timber Creek	8915	
East Fork Timber Creek	8764	
East Fork Timber Creek	8601	
East Fork Timber Creek	8366	Left side ineffective - hydraulically disconnected
East Fork Timber Creek	8092	
East Fork Timber Creek	7836	
East Fork Timber Creek	7685	
East Fork Timber Creek	7422	
East Fork Timber Creek	7312	
East Fork Timber Creek	7129	Left side ineffective - hydraulically disconnected
East Fork Timber Creek	6851	Right side ineffective - hydraulically disconnected
East Fork Timber Creek	6617	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
East Fork Timber Creek	6574	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
East Fork Timber Creek	6518	Left side ineefective - hydraulically disconnected
East Fork Timber Creek	6353	Right side ineffective - hydraulically disconnected
East Fork Timber Creek	6185	Right side ineffective - hydraulically disconnected
East Fork Timber Creek	6101	Right side ineffective - hydraulically disconnected
East Fork Timber Creek	6010	
East Fork Timber Creek	5736	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
East Fork Timber Creek	5575	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
East Fork Timber Creek	5457	Left side ineefective - hydraulically disconnected
East Fork Timber Creek	5142	
East Fork Timber Creek	4790	Right side ineffective - hydraulically disconnected
East Fork Timber Creek	4556	Right side ineffective - hydraulically disconnected
East Fork Timber Creek	4124	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
East Fork Timber Creek	3727	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
East Fork Timber Creek	3495	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
East Fork Timber Creek	3376	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
East Fork Timber Creek	3133	Left side ineffective - hydraulically disconnected
East Fork Timber Creek	2823	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
East Fork Timber Creek	2668	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
East Fork Timber Creek	2596	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
East Fork Timber Creek	2564	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected. Ineffective areas related to structure.
East Fork Timber Creek	2535	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected. Ineffective areas related to structure.

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
East Fork Timber Creek	2478	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected. Ineffective areas related to structure.
East Fork Timber Creek	2427	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected. Ineffective areas related to structure.
East Fork Timber Creek	2055	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
East Fork Timber Creek	1689	
East Fork Timber Creek	1419	
East Fork Timber Creek	1101	
East Fork Timber Creek	815	
East Fork Timber Creek	626	
East Fork Timber Creek	457	Left side ineefective - hydraulically disconnected
East Fork Timber Creek	211	
East Fork Timber Creek	92.75	
Timber Split	1770	
Timber Split	1762	
Timber Split	1604	
Timber Split	1450	
Timber Split	1383	
Timber Split	1201	
Timber Split	1003	Right side ineffective - hydraulically disconnected
Timber Split	862	Ineffective areas related to structure
Timber Split	802	Ineffective areas related to structure
Timber Split	716	Ineffective areas related to structure
Timber Split	593	
Timber Split	510	
Timber Split	436	
Timber Split	387	
Timber Split	344	
Timber Split	307	
Timber Split	264	
Timber Split	170	
Timber Split	78.67	
Timber Split	264	
Timber Creek	11497	
Timber Creek	11388	
Timber Creek	11285	
Timber Creek	11053	
Timber Creek	10856	
Timber Creek	10721	
Timber Creek	10578	Right side ineffective - hydraulically disconnected
Timber Creek	10411	Right side ineffective - hydraulically disconnected
Timber Creek	10284	
Timber Creek	10174	
Timber Creek	10075	
Timber Creek	9990	
Timber Creek	9906	
Timber Creek	9778	Right side ineffective - hydraulically disconnected
Timber Creek	9697	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	9469	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	9394	Right side ineffective - hydraulically disconnected
Timber Creek	9238	Right side ineffective - hydraulically disconnected
Timber Creek	8836	
Timber Creek	8814	
Timber Creek	8774	
Timber Creek	8667	Left side ineffective - hydraulically disconnected
Timber Creek	8524	
Timber Creek	8246	
Timber Creek	8098	
Timber Creek	7765	
Timber Creek	7560	

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
Timber Creek	7442	Right side ineffective - hydraulically disconnected
Timber Creek	7359	Right side ineffective - hydraulically disconnected
Timber Creek	7044	
Timber Creek	6705	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	6579	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	6321	Left side ineffective - hydraulically disconnected
Timber Creek	6228	Left side ineffective - hydraulically disconnected
Timber Creek	6224	Left side ineffective - hydraulically disconnected
Timber Creek	6168	Left side ineffective - hydraulically disconnected
Timber Creek	6078	Left side ineffective - hydraulically disconnected
Timber Creek	5957	Left side ineffective - hydraulically disconnected
Timber Creek	5860	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	5747	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	5611	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	5319	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	5023	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	4832	
Timber Creek	4826	
Timber Creek	4572	
Timber Creek	4359	
Timber Creek	4356	
Timber Creek	4185	
Timber Creek	4029	
Timber Creek	3970	Ineffective areas related to structure
Timber Creek	3933	Ineffective areas related to structure
Timber Creek	3897	
Timber Creek	3732	Left side ineffective - hydraulically disconnected
Timber Creek	3554	Left side ineffective - hydraulically disconnected
Timber Creek	3363	
Timber Creek	3282	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	3055	Right side ineffective - hydraulically disconnected
Timber Creek	2953	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	2859	Right side ineffective - hydraulically disconnected
Timber Creek	2754	Right side ineffective - hydraulically disconnected
Timber Creek	2666	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	2587	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Timber Creek	2427	
Timber Creek	2224	
Timber Creek	2055	
Timber Creek	1803	
Timber Creek	1630	
Timber Creek	1476	
Timber Creek	1321	
Timber Creek	1287	
Timber Creek	1268	
Timber Creek	1248	
Timber Creek	1179	
Timber Creek	1127	
Timber Creek	1054	Ineffective areas related to structure
Timber Creek	1038	Ineffective areas related to structure
Timber Creek	1022	
Timber Creek	943	

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
Timber Creek	898	
Timber Creek	787	
Timber Creek	721	
Timber Creek	672	
Timber Creek	595	Right Side ineffective - hydraulically disconnected
Timber Creek	541	
Timber Creek	486	Ineffective areas related to structure
Timber Creek	411	Ineffective areas related to structure
Timber Creek	398	Ineffective areas related to structure
Timber Creek	285	Ineffective areas related to structure
Timber Creek	269	Ineffective areas related to structure
Timber Creek	151.14	Ineffective areas related to structure
SilverCreek	3437	
SilverCreek	3270	Right side ineffective - hydraulically disconnected
SilverCreek	2985	
SilverCreek	2805	
SilverCreek	2703	
SilverCreek	2657	
SilverCreek	2612	
SilverCreek	2324	Right side ineffective - hydraulically disconnected
Silver Creek	2102	
Silver Creek	1801	
Silver Creek	1545	
Silver Creek	1351	Right side ineffective - hydraulically disconnected
Silver Creek	1304	
Silver Creek	1206	
Silver Creek	1111	Ineffective areas related to structure
Silver Creek	997	Ineffective areas related to structure
Silver Creek	872	Left side ineffective - hydraulically disconnected
Silver Creek	687	
Silver Creek	504	
Silver Creek	352	
Silver Creek	146.64	
East Fork Packer Creek	6340	
East Fork Packer Creek	5859	
East Fork Packer Creek	5556	
East Fork Packer Creek	5189	
East Fork Packer Creek	5017	
East Fork Packer Creek	4815	
East Fork Packer Creek	4484	
East Fork Packer Creek	4062	
East Fork Packer Creek	3712	Left side ineffective - hydraulically disconnected
East Fork Packer Creek	3372	Left side ineffective - hydraulically disconnected
East Fork Packer Creek	3006	Right side ineffective - hydraulically disconnected
East Fork Packer Creek	2567	
East Fork Packer Creek	2197	
East Fork Packer Creek	1789	Blocked obstruction - building
East Fork Packer Creek	1510	Right side ineffective - hydraulically disconnected
East Fork Packer Creek	1267	Right side ineffective - hydraulically disconnected. Blocked obstruction - building
East Fork Packer Creek	891	Blocked obstruction - building
East Fork Packer Creek	644	Right side ineffective - hydraulically disconnected
East Fork Packer Creek	469	Right side ineffective - hydraulically disconnected
East Fork Packer Creek	319	Right side ineffective - hydraulically disconnected
East Fork Packer Creek	131	Ineffective areas related to structure
East Fork Packer Creek	54.68	Ineffective area related to structure
West Fork Packer Creek	15544	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	15271	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
West Fork Packer Creek	14911	
West Fork Packer Creek	14653	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	14260	Right side ineffectives - hydraulically disconnected
West Fork Packer Creek	14002	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	13840	Left side ineffective - hydraulically disconnected

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
West Fork Packer Creek	13488	
West Fork Packer Creek	13049	
West Fork Packer Creek	12933	
West Fork Packer Creek	12743	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
West Fork Packer Creek	12392	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	12133	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	11902	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	11633	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	11198	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	10801	
West Fork Packer Creek	10388	
West Fork Packer Creek	10088	Right side ineffective - hydraulically disconnected
West Fork Packer Creek	9802	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	9551	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	9066	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	8695	Left side ineffective - hydraulically disconnected. Blocked obstruction - building
West Fork Packer Creek	8378	Blocked obstructions - buildings
West Fork Packer Creek	8158	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	7921	
West Fork Packer Creek	7688	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	7627	Left side ineffective - hydraulically disconnected
West Fork Packer Creek	7525	Ineffective areas related to structure
West Fork Packer Creek	7485	Ineffective areas related to structure
Packer Creek	7246	Left side ineffective - hydraulically disconnected
Packer Creek	6872	Left side ineffectives - hydraulically disconnected
Packer Creek	6565	
Packer Creek	6145	
Packer Creek	5795	Right side ineffective - hydraulically disconnected
Packer Creek	5314	
Packer Creek	4817	
Packer Creek	4419	
Packer Creek	4030	Right side ineffective - hydraulically disconnected
Packer Creek	3591	
Packer Creek	3251	
Packer Creek	2832	Left side ineffective - hydraulically disconnected
Packer Creek	2648	Left side ineffective - hydraulically disconnected
Packer Creek	2331	
Packer Creek	2107	
Packer Creek	1769	
Packer Creek	1671	
Packer Creek	1611	Ineffective area related to structure
Packer Creek	1569	Ineffective area related to structure
Packer Creek	1417	
Packer Creek	1080	Right side ineffective - hydraulically disconnected
Packer Creek	741	
Packer Creek	420	Blocked obstruction - building
Packer Creek	217.93	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.
Randolph Creek	5935	
Randolph Creek	5805	
Randolph Creek	5656	Right side ineffective - hydraulically disconnected
Randolph Creek	5421	
Randolph Creek	5178	
Randolph Creek	4796	
Randolph Creek	4373	
Randolph Creek	4022	
Randolph Creek	3605	
Randolph Creek	3326	
Randolph Creek	2947	
Randolph Creek	2652	
Randolph Creek	2377	
Randolph Creek	1989	

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
Randolph Creek	1648	
Randolph Creek	1243	
Randolph Creek	851	
Randolph Creek	656	
Randolph Creek	539	
Randolph Creek	375	Ineffective areas related to structure
Randolph Creek	187	Ineffective areas related to structure
Randolph Creek	172	Ineffective areas related to structure
Randolph Creek	138.82	Ineffective areas related to structure
Rainy Creek	2963	
Rainy Creek	2725	
Rainy Creek	2620	
Rainy Creek	2377	
Rainy Creek	2127	
Rainy Creek	1998	
Rainy Creek	1799	
Rainy Creek	1712	
Rainy Creek	1580	
Rainy Creek	1418	Left side ineffective - hydraulically disconnected
Rainy Creek	1247	
Rainy Creek	1040	Left side ineffective - hydraulically disconnected
Rainy Creek	886	
Rainy Creek	673	Left side ineffective - hydraulically disconnected
Rainy Creek	416	
Rainy Creek	203.19	
Denna Mora Creek	6938	
Denna Mora Creek	6830	
Denna Mora Creek	6708	
Denna Mora Creek	6580	
Denna Mora Creek	6403	
Denna Mora Creek	6202	
Denna Mora Creek	6050	
Denna Mora Creek	5889	
Denna Mora Creek	5633	
Denna Mora Creek	5452	
Denna Mora Creek	5295	
Denna Mora Creek	5184	
Denna Mora Creek	5053	
Denna Mora Creek	4880	
Denna Mora Creek	4805	Ineffective areas related to structure
Denna Mora Creek	4738	
Denna Mora Creek	4572	
Denna Mora Creek	4290	
Denna Mora Creek	4120	
Denna Mora Creek	4043	
Denna Mora Creek	3953	
Denna Mora Creek	3509	
Denna Mora Creek	3185	Left side ineffective - hydraulically disconnected
Denna Mora Creek	2847	
Denna Mora Creek	2693	Left side ineffective - hydraulically disconnected
Denna Mora Creek	2548	Left side ineffective - hydraulically disconnected
Denna Mora Creek	2342	Left side ineffective - hydraulically disconnected
Denna Mora Creek	2149	
Denna Mora Creek	2014	
Denna Mora Creek	1883	
Denna Mora Creek	1646	
Denna Mora Creek	1322	
Denna Mora Creek	1022	Right side ineffective - hydraulically disconnected
Denna Mora Creek	826	Right side ineffective - hydraulically disconnected
Denna Mora Creek	612	
Denna Mora Creek	354	
Denna Mora Creek	181.92	Left side ineffective - hydraulically disconnected. Right side ineffective - hydraulically disconnected.

EXPLANATION OF INEFFECTIVE AND BLOCKED FLOWS		
Flooding Source	Cross-Section	Reason for Ineffective Flow Limits and/or Blocked Obstructions
Hanaker Creek	1301	
Hanaker Creek	1182	
Hanaker Creek	1020	
Hanaker Creek	917	
Hanaker Creek	801	Left side ineffective - hydraulically disconnected
Hanaker Creek	728	Left side ineffective - hydraulically disconnected
Hanaker Creek	554	
Hanaker Creek	316	
Hanaker Creek	201	
Hanaker Creek	107	
Hanaker Creek	31.86	

Critical Depths - 1% Annual Chance Flood Event		
Flooding Source	Cross-Section	Reason for Critical Depth
Little Joe Creek	15612	
Little Joe Creek	15286	
Little Joe Creek	14949	
Little Joe Creek	14657	
Little Joe Creek	14346	
Little Joe Creek	14060	
Little Joe Creek	13771	
Little Joe Creek	13306	
Little Joe Creek	13055	
Little Joe Creek	12638	
Little Joe Creek	12334	
Little Joe Creek	12028	
Little Joe Creek	11652	
Little Joe Creek	11392	
Little Joe Creek	11237	
Little Joe Creek	10848	
Little Joe Creek	10474	
Little Joe Creek	10225	
Little Joe Creek	9894	
Little Joe Creek	9396	
Little Joe Creek	9038	
Little Joe Creek	8739	
Little Joe Creek	8665	
Little Joe Creek	8358	
Little Joe Creek	8050	
Little Joe Creek	7850	
Little Joe Creek	7467	
Little Joe Creek	7027	
Little Joe Creek	6577	
Little Joe Creek	6113	
Little Joe Creek	5676	
Little Joe Creek	5228	
Little Joe Creek	4701	
Little Joe Creek	4287	
Little Joe Creek	3865	
Little Joe Creek	3531	
Little Joe Creek	3161	
Little Joe Creek	2724	
Little Joe Creek	2264	
Little Joe Creek	1774	
Little Joe Creek	1361	
Little Joe Creek	1000	
Little Joe Creek	566	
Little Joe Creek	265	
Little Joe Creek	113	
Little Joe Creek	54	
Little Joe Creek	49.57	
East Fork Twelvemile Creek	17884	
East Fork Twelvemile Creek	17772	Critical: Grade break - transition to steep slope (~12%). Critical depth is reasonable.
East Fork Twelvemile Creek	17659	
East Fork Twelvemile Creek	17304	
East Fork Twelvemile Creek	17002	
East Fork Twelvemile Creek	16748	
East Fork Twelvemile Creek	16466	
East Fork Twelvemile Creek	16246	
East Fork Twelvemile Creek	15967	
East Fork Twelvemile Creek	15574	
East Fork Twelvemile Creek	15094	
East Fork Twelvemile Creek	14925	
East Fork Twelvemile Creek	14699	
East Fork Twelvemile Creek	14500	
East Fork Twelvemile Creek	14352	
East Fork Twelvemile Creek	14150	
East Fork Twelvemile Creek	13962	
East Fork Twelvemile Creek	13567	
East Fork Twelvemile Creek	13246	
East Fork Twelvemile Creek	12770	
East Fork Twelvemile Creek	12472	
East Fork Twelvemile Creek	12088	
East Fork Twelvemile Creek	11885	
East Fork Twelvemile Creek	11765	Critical: Flood flows transition from right overbank to narrow, deep channel. Critical depth is reasonable at transition.
East Fork Twelvemile Creek	11655	
East Fork Twelvemile Creek	11441	
East Fork Twelvemile Creek	11117	

Critical Depths - 1% Annual Chance Flood Event		
Flooding Source	Cross-Section	Reason for Critical Depth
East Fork Twelvemile Creek	10709	
East Fork Twelvemile Creek	10329	
East Fork Twelvemile Creek	10085	
East Fork Twelvemile Creek	9762	
East Fork Twelvemile Creek	9365	
East Fork Twelvemile Creek	9058	
East Fork Twelvemile Creek	8870	
East Fork Twelvemile Creek	8822	
East Fork Twelvemile Creek	8716	
East Fork Twelvemile Creek	8653	
East Fork Twelvemile Creek	8523	
East Fork Twelvemile Creek	8415	
East Fork Twelvemile Creek	8105	
East Fork Twelvemile Creek	7761	
East Fork Twelvemile Creek	7419	
East Fork Twelvemile Creek	7144	
East Fork Twelvemile Creek	6854	
East Fork Twelvemile Creek	6773	
East Fork Twelvemile Creek	6726	
East Fork Twelvemile Creek	6699	
East Fork Twelvemile Creek	6680	
East Fork Twelvemile Creek	6618	
East Fork Twelvemile Creek	6539	
East Fork Twelvemile Creek	6391	
East Fork Twelvemile Creek	6162	
East Fork Twelvemile Creek	6003	
East Fork Twelvemile Creek	5527	
East Fork Twelvemile Creek	5399	
East Fork Twelvemile Creek	5117	
East Fork Twelvemile Creek	4856	
East Fork Twelvemile Creek	4519	
East Fork Twelvemile Creek	4082	
East Fork Twelvemile Creek	3813	
East Fork Twelvemile Creek	3544	
East Fork Twelvemile Creek	3306	
East Fork Twelvemile Creek	2986	
East Fork Twelvemile Creek	2843	
East Fork Twelvemile Creek	2774	
East Fork Twelvemile Creek	2701	
East Fork Twelvemile Creek	2348	
East Fork Twelvemile Creek	2026	
East Fork Twelvemile Creek	1780	
East Fork Twelvemile Creek	1577	
East Fork Twelvemile Creek	1287	
East Fork Twelvemile Creek	1166	
East Fork Twelvemile Creek	1049	
East Fork Twelvemile Creek	995	
East Fork Twelvemile Creek	961	
East Fork Twelvemile Creek	942	
East Fork Twelvemile Creek	910	
East Fork Twelvemile Creek	857	Critical: Downstream of structure that develops significant backwater. Critical depth is reasonable.
East Fork Twelvemile Creek	769	
East Fork Twelvemile Creek	657	
East Fork Twelvemile Creek	477	
East Fork Twelvemile Creek	179.1	Critical: Transition from shallow, wide flooding to narrow channel. Critical depth is reasonable.
Rock Creek	9651	
Rock Creek	9241	
Rock Creek	8797	
Rock Creek	8480	
Rock Creek	8147	
Rock Creek	7839	
Rock Creek	7474	
Rock Creek	7252	
Rock Creek	7149	
Rock Creek	6990	Critical: Flood flows pass through narrow, steep channel. Critical depth is reasonable.
Rock Creek	6870	
Rock Creek	6717	
Rock Creek	6578	
Rock Creek	6240	
Rock Creek	5847	
Rock Creek	5513	
Rock Creek	5344	
Rock Creek	5153	

Critical Depths - 1% Annual Chance Flood Event		
Flooding Source	Cross-Section	Reason for Critical Depth
Rock Creek	4750	
Rock Creek	4392	
Rock Creek	4048	
Rock Creek	3726	
Rock Creek	3358	
Rock Creek	2937	
Rock Creek	2626	
Rock Creek	2324	
Rock Creek	2061	
Rock Creek	1962	
Rock Creek	1855	
Rock Creek	1637	
Rock Creek	1573	
Rock Creek	1436	
Rock Creek	1261	
Rock Creek	1100	
Rock Creek	975	
Rock Creek	838	
Rock Creek	707	
Rock Creek	645	
Rock Creek	559	
Rock Creek	439	
Rock Creek	323	Critical: Flood flows pass through narrow, steep channel. Critical depth is reasonable.
Rock Creek	223.18	
Twelvemile Creek	19639	
Twelvemile Creek	19245	
Twelvemile Creek	18955	
Twelvemile Creek	18712	
Twelvemile Creek	18247	
Twelvemile Creek	17815	
Twelvemile Creek	17334	
Twelvemile Creek	17229	
Twelvemile Creek	17113	
Twelvemile Creek	16941	
Twelvemile Creek	16639	
Twelvemile Creek	16245	
Twelvemile Creek	15979	
Twelvemile Creek	15688	
Twelvemile Creek	15396	
Twelvemile Creek	14989	
Twelvemile Creek	14515	
Twelvemile Creek	14068	
Twelvemile Creek	13935	
Twelvemile Creek	13821	
Twelvemile Creek	13685	
Twelvemile Creek	13621	
Twelvemile Creek	13319	
Twelvemile Creek	13023	Critical: Grade break.
Twelvemile Creek	12753	
Twelvemile Creek	12345	
Twelvemile Creek	12140	
Twelvemile Creek	11861	
Twelvemile Creek	11665	
Twelvemile Creek	11560	
Twelvemile Creek	11504	
Twelvemile Creek	11326	
Twelvemile Creek	11043	
Twelvemile Creek	10597	
Twelvemile Creek	10149	
Twelvemile Creek	9684	
Twelvemile Creek	9224	
Twelvemile Creek	8742	
Twelvemile Creek	8129	
Twelvemile Creek	7759	
Twelvemile Creek	7326	
Twelvemile Creek	6931	
Twelvemile Creek	6768	
Twelvemile Creek	6739	
Twelvemile Creek	6524	
Twelvemile Creek	6053	
Twelvemile Creek	5634	
Twelvemile Creek	5197	
Twelvemile Creek	4764	
Twelvemile Creek	4387	
Twelvemile Creek	4127	

Critical Depths - 1% Annual Chance Flood Event		
Flooding Source	Cross-Section	Reason for Critical Depth
Twelvemile Creek	3922	
Twelvemile Creek	3595	
Twelvemile Creek	3409	
Twelvemile Creek	3299	
Twelvemile Creek	3154	
Twelvemile Creek	2853	
Twelvemile Creek	2461	
Twelvemile Creek	2310	
Twelvemile Creek	2117	
Twelvemile Creek	1987	
Twelvemile Creek	1822	
Twelvemile Creek	1538	
Twelvemile Creek	1182	
Twelvemile Creek	757	
Twelvemile Creek	406	
Twelvemile Creek	182.05	
East Fork Twin Creek	1108	
East Fork Twin Creek	1053	
East Fork Twin Creek	1017	
East Fork Twin Creek	946	
East Fork Twin Creek	695	
East Fork Twin Creek	403	
East Fork Twin Creek	169.72	Critical: Transition with flood flows in the right overbank to all flood flows being conveyed in confined channel. Velocities increase significantly, critical depth is reasonable.
West Fork Twin Creek	5803	
West Fork Twin Creek	5682	
West Fork Twin Creek	5450	
West Fork Twin Creek	5147	
West Fork Twin Creek	5029	
Twin Creek	4898	
Twin Creek	4798	
Twin Creek	4526	
Twin Creek	4376	
Twin Creek	4143	
Twin Creek	4023	
Twin Creek	3984	
Twin Creek	3808	
Twin Creek	3659	
Twin Creek	3567	
Twin Creek	3351	
Twin Creek	3026	
Twin Creek	2963	
Twin Creek	2893	
Twin Creek	2806	
Twin Creek	2670	
Twin Creek	2623	
Twin Creek	2387	
Twin Creek	2079	
Twin Creek	1911	
Twin Creek	1640	
Twin Creek	1568	
Twin Creek	1564	
Twin Creek	1046	
Twin Creek	1019	
Twin Creek	938	
Twin Creek	471.76	
Deer Creek	3434	
Deer Creek	3217	
Deer Creek	3001	
Deer Creek	2666	
Deer Creek	2328	
Deer Creek	2161	
Deer Creek	1917	
Deer Creek	1730	
Deer Creek	1482	
Deer Creek	1104	
Deer Creek	728	
Deer Creek	365	
Deer Creek	113.86	
Big Creek	15103	
Big Creek	14733	
Big Creek	14468	
Big Creek	14052	
Big Creek	13723	
Big Creek	13322	

Critical Depths - 1% Annual Chance Flood Event		
Flooding Source	Cross-Section	Reason for Critical Depth
Big Creek	12847	
Big Creek	12578	
Big Creek	12218	
Big Creek	11725	
Big Creek	11450	
Big Creek	11014	
Big Creek	10806	
Big Creek	10753	
Big Creek	10628	
Big Creek	10392	
Big Creek	10116	
Big Creek	9817	
Big Creek	9478	
Big Creek	9174	
Big Creek	8880	
Big Creek	8445	
Big Creek	8021	
Big Creek	7554	
Big Creek	7148	
Big Creek	6777	
Big Creek	6315	
Big Creek	5810	
Big Creek	5425	
Big Creek	5066	
Big Creek	4690	
Big Creek	4627	
Big Creek	4360	
Big Creek	3955	
Big Creek	3632	
Big Creek	3381	
Big Creek	2996	
Big Creek	2676	
Big Creek	2319	
Big Creek	1972	
Big Creek	1705	
Big Creek	1349	
Big Creek	995	
Big Creek	733	
Big Creek	545	
Big Creek	328	
Big Creek	286	
Big Creek	234	
Big Creek	188	
Big Creek	126	
Big Creek	48.95	
Savenac Creek	19402	
Savenac Creek	19150	
Savenac Creek	18761	
Savenac Creek	18542	
Savenac Creek	18077	
Savenac Creek	17852	
Savenac Creek	17547	
Savenac Creek	17194	
Savenac Creek	17041	
Savenac Creek	16863	
Savenac Creek	16738	
Savenac Creek	16531	
Savenac Creek	16159	
Savenac Creek	15748	
Savenac Creek	15420	
Savenac Creek	15039	
Savenac Creek	14722	
Savenac Creek	14358	
Savenac Creek	13904	
Savenac Creek	13693	
Savenac Creek	13464	
Savenac Creek	13210	
Savenac Creek	12776	
Savenac Creek	12460	
Savenac Creek	12231	
Savenac Creek	12035	
Savenac Creek	11681	
Savenac Creek	11493	
Savenac Creek	11236	
Savenac Creek	10987	

Critical Depths - 1% Annual Chance Flood Event		
Flooding Source	Cross-Section	Reason for Critical Depth
Savenac Creek	10718	
Savenac Creek	10532	
Savenac Creek	10267	
Savenac Creek	9807	
Savenac Creek	9457	
Savenac Creek	9263	
Savenac Creek	8829	
Savenac Creek	8536	
Savenac Creek	8185	
Savenac Creek	7931	
Savenac Creek	7589	
Savenac Creek	7325	
Savenac Creek	6924	
Savenac Creek	6698	
Savenac Creek	6435	
Savenac Creek	6042	
Savenac Creek	5850	
Savenac Creek	5755	
Savenac Creek	5597	
Savenac Creek	5521	
Savenac Creek	5477	
Savenac Creek	5362	
Savenac Creek	5188	
Savenac Creek	5013	
Savenac Creek	4835	
Savenac Creek	4665	
Savenac Creek	4479	
Savenac Creek	4400	
Savenac Creek	4286	
Savenac Creek	4128	
Savenac Creek	4081	
Savenac Creek	3993	
Savenac Creek	3822	
Savenac Creek	3684	
Savenac Creek	3572	
Savenac Creek	3402	
Savenac Creek	3100	
Savenac Creek	2936	
Savenac Creek	2829	
Savenac Creek	2546	
Savenac Creek	2323	
Savenac Creek	2126	
Savenac Creek	1910	
Savenac Creek	1673	
Savenac Creek	1573	
Savenac Creek	1470	
Savenac Creek	1268	
Savenac Creek	1159	
Savenac Creek	1034	
Savenac Creek	965	
Savenac Creek	735	
Savenac Creek	289	
Savenac Creek	225	
Savenac Creek	37.42	
West Fork Timber Creek	3286	
West Fork Timber Creek	3111	
West Fork Timber Creek	2971	
West Fork Timber Creek	2733	
West Fork Timber Creek	2475	
West Fork Timber Creek	2234	
West Fork Timber Creek	2005	
West Fork Timber Creek	1789	
West Fork Timber Creek	1599	
West Fork Timber Creek	1478	
West Fork Timber Creek	1441	
West Fork Timber Creek	1321	
West Fork Timber Creek	1257	
West Fork Timber Creek	1067	
West Fork Timber Creek	863	
West Fork Timber Creek	722	
West Fork Timber Creek	553	
West Fork Timber Creek	377	
West Fork Timber Creek	264	
West Fork Timber Creek	113.9	
East Fork Timber Creek	9512	

Critical Depths - 1% Annual Chance Flood Event		
Flooding Source	Cross-Section	Reason for Critical Depth
East Fork Timber Creek	9288	
East Fork Timber Creek	9115	
East Fork Timber Creek	8915	
East Fork Timber Creek	8764	
East Fork Timber Creek	8601	
East Fork Timber Creek	8366	
East Fork Timber Creek	8092	
East Fork Timber Creek	7836	
East Fork Timber Creek	7685	
East Fork Timber Creek	7422	
East Fork Timber Creek	7312	
East Fork Timber Creek	7129	
East Fork Timber Creek	6851	
East Fork Timber Creek	6617	
East Fork Timber Creek	6574	
East Fork Timber Creek	6518	
East Fork Timber Creek	6353	
East Fork Timber Creek	6185	
East Fork Timber Creek	6101	Critical: Grade break to steeper slope. Flood flows also transition to steep, narrow channel. Flood flows accelerate at this lcoation - Critical depth is reasonable.
East Fork Timber Creek	6010	
East Fork Timber Creek	5736	
East Fork Timber Creek	5575	
East Fork Timber Creek	5457	
East Fork Timber Creek	5142	
East Fork Timber Creek	4790	
East Fork Timber Creek	4556	
East Fork Timber Creek	4124	
East Fork Timber Creek	3727	
East Fork Timber Creek	3495	
East Fork Timber Creek	3376	
East Fork Timber Creek	3133	
East Fork Timber Creek	2823	
East Fork Timber Creek	2668	
East Fork Timber Creek	2596	
East Fork Timber Creek	2564	
East Fork Timber Creek	2535	
East Fork Timber Creek	2478	
East Fork Timber Creek	2427	
East Fork Timber Creek	2055	
East Fork Timber Creek	1689	
East Fork Timber Creek	1419	
East Fork Timber Creek	1101	
East Fork Timber Creek	815	
East Fork Timber Creek	626	
East Fork Timber Creek	457	
East Fork Timber Creek	211	
East Fork Timber Creek	92.75	
Timber Split	1770	
Timber Split	1762	
Timber Split	1604	
Timber Split	1450	
Timber Split	1383	
Timber Split	1201	
Timber Split	1003	
Timber Split	862	
Timber Split	802	
Timber Split	716	
Timber Split	593	
Timber Split	510	
Timber Split	436	
Timber Split	387	
Timber Split	344	
Timber Split	307	
Timber Split	264	
Timber Split	170	
Timber Split	78.67	Critical: Slope increases from upstream cross section and velocities increase. Critical depth is reasonable
Timber Creek	11497	
Timber Creek	11388	
Timber Creek	11285	
Timber Creek	11053	
Timber Creek	10856	
Timber Creek	10721	Critical: Flood flows are near critical in upper reach. Slightly steeper slope causes flow to accelerate and reach critical. Critical depth is reasonable.
Timber Creek	10578	

Critical Depths - 1% Annual Chance Flood Event		
Flooding Source	Cross-Section	Reason for Critical Depth
Timber Creek	10411	
Timber Creek	10284	
Timber Creek	10174	
Timber Creek	10075	
Timber Creek	9990	
Timber Creek	9906	
Timber Creek	9778	
Timber Creek	9697	
Timber Creek	9469	
Timber Creek	9394	
Timber Creek	9238	
Timber Creek	8836	
Timber Creek	8814	Critical: Grade break to steeper slope. Flow accelerates and reaches critical. Critical depth is reasonable.
Timber Creek	8774	
Timber Creek	8667	
Timber Creek	8524	
Timber Creek	8246	
Timber Creek	8098	
Timber Creek	7765	
Timber Creek	7560	
Timber Creek	7442	
Timber Creek	7359	
Timber Creek	7044	Critical: Located at the base of a steep slope. Velocities increase significantly. Critical depth is reasonable.
Timber Creek	6705	
Timber Creek	6579	
Timber Creek	6321	
Timber Creek	6228	
Timber Creek	6224	
Timber Creek	6168	
Timber Creek	6078	
Timber Creek	5957	
Timber Creek	5860	
Timber Creek	5747	Critical: Located at the base of a steep slope. Velocities increase significantly. Critical depth is reasonable.
Timber Creek	5611	
Timber Creek	5319	
Timber Creek	5023	
Timber Creek	4832	
Timber Creek	4826	
Timber Creek	4572	
Timber Creek	4359	
Timber Creek	4356	
Timber Creek	4185	
Timber Creek	4029	
Timber Creek	3970	
Timber Creek	3933	
Timber Creek	3897	
Timber Creek	3732	
Timber Creek	3554	
Timber Creek	3363	
Timber Creek	3282	
Timber Creek	3055	
Timber Creek	2953	
Timber Creek	2859	
Timber Creek	2754	
Timber Creek	2666	
Timber Creek	2587	
Timber Creek	2427	
Timber Creek	2224	
Timber Creek	2055	
Timber Creek	1803	
Timber Creek	1630	
Timber Creek	1476	
Timber Creek	1321	
Timber Creek	1287	
Timber Creek	1268	
Timber Creek	1248	
Timber Creek	1179	
Timber Creek	1127	
Timber Creek	1054	
Timber Creek	1038	
Timber Creek	1022	Critical: Located downstream of structure with drawdown. Critical Depth is reasonable.
Timber Creek	943	
Timber Creek	898	

Critical Depths - 1% Annual Chance Flood Event		
Flooding Source	Cross-Section	Reason for Critical Depth
Timber Creek	787	
Timber Creek	721	
Timber Creek	672	
Timber Creek	595	
Timber Creek	541	
Timber Creek	486	
Timber Creek	411	
Timber Creek	398	
Timber Creek	285	
Timber Creek	269	
Timber Creek	151.14	
SilverCreek	3437	
SilverCreek	3270	
SilverCreek	2985	
SilverCreek	2805	
SilverCreek	2703	
SilverCreek	2657	
SilverCreek	2612	
SilverCreek	2324	
SilverCreek	2102	
SilverCreek	1801	
SilverCreek	1545	
SilverCreek	1351	
SilverCreek	1304	
SilverCreek	1206	
SilverCreek	1111	
SilverCreek	997	
SilverCreek	872	
SilverCreek	687	
SilverCreek	504	
SilverCreek	352	
SilverCreek	146.64	
East Fork Packer Creek	6340	
East Fork Packer Creek	5859	
East Fork Packer Creek	5556	
East Fork Packer Creek	5189	
East Fork Packer Creek	5017	
East Fork Packer Creek	4815	
East Fork Packer Creek	4484	
East Fork Packer Creek	4062	
East Fork Packer Creek	3712	
East Fork Packer Creek	3372	
East Fork Packer Creek	3006	
East Fork Packer Creek	2567	
East Fork Packer Creek	2197	
East Fork Packer Creek	1789	
East Fork Packer Creek	1510	
East Fork Packer Creek	1267	
East Fork Packer Creek	891	
East Fork Packer Creek	644	
East Fork Packer Creek	469	
East Fork Packer Creek	319	
East Fork Packer Creek	131	
East Fork Packer Creek	54.68	
West Fork Packer Creek	15544	
West Fork Packer Creek	15271	
West Fork Packer Creek	14911	
West Fork Packer Creek	14653	
West Fork Packer Creek	14260	
West Fork Packer Creek	14002	
West Fork Packer Creek	13840	
West Fork Packer Creek	13488	
West Fork Packer Creek	13049	
West Fork Packer Creek	12933	
West Fork Packer Creek	12743	
West Fork Packer Creek	12392	
West Fork Packer Creek	12133	
West Fork Packer Creek	11902	
West Fork Packer Creek	11633	
West Fork Packer Creek	11198	
West Fork Packer Creek	10801	
West Fork Packer Creek	10388	
West Fork Packer Creek	10088	
West Fork Packer Creek	9802	
West Fork Packer Creek	9551	

Critical Depths - 1% Annual Chance Flood Event		
Flooding Source	Cross-Section	Reason for Critical Depth
West Fork Packer Creek	9066	
West Fork Packer Creek	8695	
West Fork Packer Creek	8378	
West Fork Packer Creek	8158	
West Fork Packer Creek	7921	
West Fork Packer Creek	7688	
West Fork Packer Creek	7627	
West Fork Packer Creek	7525	
West Fork Packer Creek	7485	
Packer Creek	7246	
Packer Creek	6872	
Packer Creek	6565	
Packer Creek	6145	
Packer Creek	5795	
Packer Creek	5314	
Packer Creek	4817	
Packer Creek	4419	
Packer Creek	4030	
Packer Creek	3591	
Packer Creek	3251	
Packer Creek	2832	
Packer Creek	2648	
Packer Creek	2331	
Packer Creek	2107	
Packer Creek	1769	
Packer Creek	1671	
Packer Creek	1611	
Packer Creek	1569	
Packer Creek	1417	
Packer Creek	1080	
Packer Creek	741	
Packer Creek	420	
Packer Creek	217.93	
Randolph Creek	5935	
Randolph Creek	5805	
Randolph Creek	5656	
Randolph Creek	5421	
Randolph Creek	5178	
Randolph Creek	4796	
Randolph Creek	4373	
Randolph Creek	4022	
Randolph Creek	3605	
Randolph Creek	3326	
Randolph Creek	2947	
Randolph Creek	2652	
Randolph Creek	2377	
Randolph Creek	1989	
Randolph Creek	1648	
Randolph Creek	1243	
Randolph Creek	851	
Randolph Creek	656	
Randolph Creek	539	
Randolph Creek	375	Critical: Drawdown where flow transitions into steep culvert crossing. Critical depth is reasonable.
Randolph Creek	187	
Randolph Creek	172	
Randolph Creek	138.82	
Rainy Creek	2963	
Rainy Creek	2725	
Rainy Creek	2620	
Rainy Creek	2377	
Rainy Creek	2127	
Rainy Creek	1998	
Rainy Creek	1799	
Rainy Creek	1712	
Rainy Creek	1580	
Rainy Creek	1418	
Rainy Creek	1247	
Rainy Creek	1040	
Rainy Creek	886	
Rainy Creek	673	
Rainy Creek	416	
Rainy Creek	203.19	
Denna Mora Creek	6938	
Denna Mora Creek	6830	
Denna Mora Creek	6708	

Critical Depths - 1% Annual Chance Flood Event		
Flooding Source	**Cross-Section**	**Reason for Critical Depth**
Denna Mora Creek	6580	
Denna Mora Creek	6403	
Denna Mora Creek	6202	
Denna Mora Creek	6050	
Denna Mora Creek	5889	
Denna Mora Creek	5633	Critical: Grade break - steep slope (8%) transitions to steeper slope (10%). Critical depth is reasonable at grade break.
Denna Mora Creek	5452	
Denna Mora Creek	5295	
Denna Mora Creek	5184	
Denna Mora Creek	5053	
Denna Mora Creek	4880	
Denna Mora Creek	4805	
Denna Mora Creek	4738	
Denna Mora Creek	4572	
Denna Mora Creek	4290	
Denna Mora Creek	4120	
Denna Mora Creek	4043	Critical: Flood flows accelerate down steeper segment that transitions through narrow, confined channel.
Denna Mora Creek	3953	
Denna Mora Creek	3509	
Denna Mora Creek	3185	
Denna Mora Creek	2847	
Denna Mora Creek	2693	
Denna Mora Creek	2548	
Denna Mora Creek	2342	
Denna Mora Creek	2149	
Denna Mora Creek	2014	
Denna Mora Creek	1883	
Denna Mora Creek	1646	
Denna Mora Creek	1322	
Denna Mora Creek	1022	
Denna Mora Creek	826	
Denna Mora Creek	612	
Denna Mora Creek	354	
Denna Mora Creek	181.92	
Hanaker Creek	1301	
Hanaker Creek	1182	
Hanaker Creek	1020	
Hanaker Creek	917	
Hanaker Creek	801	
Hanaker Creek	728	
Hanaker Creek	554	
Hanaker Creek	316	
Hanaker Creek	201	
Hanaker Creek	107	
Hanaker Creek	31.86	

APPENDIX F – HEC-RAS MODEL OUTPUTS

HEC-RAS Plan: MultipleProfiles River: Little Joe Creek Reach: Little Joe Creek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Little Joe Creek	49.57	10-year	816.00	2649.01	2651.40	2650.67	2651.63	0.015570	3.88	214.03	661.42	0.49
Little Joe Creek	49.57	25-year	958.00	2649.01	2651.59	2650.79	2651.85	0.015584	4.13	235.70	700.58	0.50
Little Joe Creek	49.57	50-year	1080.00	2649.01	2651.75	2650.92	2652.04	0.015579	4.33	253.37	738.13	0.50
Little Joe Creek	49.57	100-year	1200.00	2649.01	2651.90	2651.02	2652.22	0.015574	4.52	269.99	768.16	0.51
Little Joe Creek	49.57	500-year	1440.00	2649.01	2652.19	2651.21	2652.55	0.015572	4.86	301.32	827.66	0.52
Little Joe Creek	49.57	1% +	1872.00	2649.01	2652.65	2651.56	2653.10	0.015581	5.39	352.77	1000.33	0.53
Little Joe Creek	54	10-year	816.00	2648.98	2651.44	2650.90	2651.77	0.023384	4.66	179.24	317.84	0.59
Little Joe Creek	54	25-year	958.00	2648.98	2651.63	2651.05	2652.00	0.023307	4.96	197.96	367.00	0.60
Little Joe Creek	54	50-year	1080.00	2648.98	2651.78	2651.17	2652.19	0.023221	5.19	213.25	393.34	0.61
Little Joe Creek	54	100-year	1200.00	2648.98	2651.93	2651.30	2652.37	0.023172	5.40	227.55	426.16	0.61
Little Joe Creek	54	500-year	1440.00	2648.98	2652.20	2651.52	2652.71	0.023072	5.80	254.59	508.35	0.62
Little Joe Creek	54	1% +	1872.00	2648.98	2652.65	2651.89	2653.27	0.022970	6.41	298.94	625.74	0.64
Little Joe Creek	81		Bridge									
Little Joe Creek	113	10-year	816.00	2650.97	2655.01	2653.25	2655.23	0.008140	3.82	220.00	791.10	0.38
Little Joe Creek	113	25-year	958.00	2650.97	2655.31	2653.48	2655.57	0.008208	4.07	244.03	833.82	0.38
Little Joe Creek	113	50-year	1080.00	2650.97	2655.55	2653.64	2655.83	0.008262	4.27	264.15	855.63	0.39
Little Joe Creek	113	100-year	1200.00	2650.97	2655.77	2653.86	2656.08	0.008349	4.47	283.24	867.60	0.40
Little Joe Creek	113	500-year	1440.00	2650.97	2656.19	2654.20	2656.53	0.008443	4.80	319.75	903.24	0.41
Little Joe Creek	113	1% +	1872.00	2650.97	2656.85	2654.77	2657.26	0.008585	5.31	380.42	963.03	0.42
Little Joe Creek	265	10-year	816.00	2653.41	2656.86	2656.18	2657.43	0.026050	6.06	134.83	253.30	0.65
Little Joe Creek	265	25-year	958.00	2653.41	2657.14	2656.41	2657.78	0.025572	6.42	151.54	314.54	0.66
Little Joe Creek	265	50-year	1080.00	2653.41	2657.37	2656.62	2658.05	0.025108	6.68	169.47	411.25	0.66
Little Joe Creek	265	100-year	1200.00	2653.41	2657.58	2656.80	2658.30	0.024449	6.88	188.89	474.94	0.66
Little Joe Creek	265	500-year	1440.00	2653.41	2657.96	2657.19	2658.72	0.023134	7.19	227.22	644.43	0.65
Little Joe Creek	265	1% +	1872.00	2653.41	2658.58	2658.00	2659.39	0.021030	7.58	293.08	909.34	0.64
Little Joe Creek	566	10-year	816.00	2657.60	2661.05	2660.04	2661.19	0.007162	3.33	314.03	586.50	0.35
Little Joe Creek	566	25-year	958.00	2657.60	2661.29	2660.20	2661.44	0.006895	3.45	356.14	610.66	0.35
Little Joe Creek	566	50-year	1080.00	2657.60	2661.49	2660.32	2661.64	0.006723	3.55	390.05	631.95	0.35
Little Joe Creek	566	100-year	1200.00	2657.60	2661.66	2660.48	2661.82	0.006664	3.66	421.10	649.85	0.35
Little Joe Creek	566	500-year	1440.00	2657.60	2661.99	2660.66	2662.16	0.006595	3.87	480.36	770.06	0.35
Little Joe Creek	566	1% +	1872.00	2657.60	2662.49	2660.97	2662.69	0.006514	4.18	576.04	885.78	0.36
Little Joe Creek	1000	10-year	816.00	2663.70	2666.54	2666.22	2666.89	0.030628	5.61	184.82	140.50	0.69
Little Joe Creek	1000	25-year	958.00	2663.70	2666.67	2666.46	2667.06	0.031651	5.93	202.95	141.34	0.70
Little Joe Creek	1000	50-year	1080.00	2663.70	2666.78	2666.56	2667.20	0.032121	6.17	218.24	142.06	0.72
Little Joe Creek	1000	100-year	1200.00	2663.70	2666.89	2666.63	2667.34	0.031777	6.34	234.34	142.80	0.72
Little Joe Creek	1000	500-year	1440.00	2663.70	2667.11	2666.81	2667.60	0.030986	6.63	265.43	144.01	0.72
Little Joe Creek	1000	1% +	1872.00	2663.70	2667.47	2667.09	2668.04	0.029754	7.07	317.65	146.03	0.72
Little Joe Creek	1361	10-year	816.00	2670.13	2673.44	2672.36	2673.72	0.012789	4.35	208.99	152.64	0.46
Little Joe Creek	1361	25-year	958.00	2670.13	2673.66	2672.56	2673.97	0.012765	4.58	249.69	199.30	0.47
Little Joe Creek	1361	50-year	1080.00	2670.13	2673.83	2672.72	2674.15	0.012751	4.74	283.20	208.16	0.47
Little Joe Creek	1361	100-year	1200.00	2670.13	2673.97	2672.87	2674.31	0.012907	4.91	314.15	223.20	0.48
Little Joe Creek	1361	500-year	1440.00	2670.13	2674.22	2673.38	2674.58	0.013130	5.20	373.35	253.44	0.49
Little Joe Creek	1361	1% +	1872.00	2670.13	2674.60	2673.93	2674.98	0.013363	5.61	477.57	305.56	0.50
Little Joe Creek	1774	10-year	816.00	2675.11	2679.04	2678.10	2679.30	0.014319	4.47	225.66	143.81	0.45
Little Joe Creek	1774	25-year	958.00	2675.11	2679.27	2678.32	2679.55	0.014337	4.70	259.98	185.47	0.46
Little Joe Creek	1774	50-year	1080.00	2675.11	2679.45	2678.49	2679.74	0.014420	4.88	289.09	205.09	0.46
Little Joe Creek	1774	100-year	1200.00	2675.11	2679.61	2678.65	2679.92	0.014298	5.01	317.54	248.93	0.47
Little Joe Creek	1774	500-year	1440.00	2675.11	2679.92	2678.89	2680.25	0.014364	5.31	376.43	300.09	0.47
Little Joe Creek	1774	1% +	1872.00	2675.11	2680.35	2679.39	2680.71	0.014326	5.68	464.55	346.88	0.48
Little Joe Creek	2264	10-year	816.00	2681.27	2684.86	2683.59	2685.12	0.009994	4.15	208.89	254.64	0.42
Little Joe Creek	2264	25-year	958.00	2681.27	2685.13	2683.79	2685.42	0.010162	4.42	231.74	279.45	0.43
Little Joe Creek	2264	50-year	1080.00	2681.27	2685.35	2683.96	2685.67	0.010249	4.63	250.91	296.33	0.43
Little Joe Creek	2264	100-year	1200.00	2681.27	2685.55	2684.13	2685.90	0.010483	4.86	270.36	332.79	0.44
Little Joe Creek	2264	500-year	1440.00	2681.27	2685.91	2684.43	2686.30	0.010643	5.21	307.39	353.50	0.45
Little Joe Creek	2264	1% +	1872.00	2681.27	2686.46	2684.93	2686.94	0.011215	5.81	373.35	396.86	0.47
Little Joe Creek	2724	10-year	816.00	2689.31	2691.70	2691.22	2691.97	0.024454	4.61	207.29	149.44	0.60
Little Joe Creek	2724	25-year	958.00	2689.31	2691.90	2691.34	2692.18	0.023137	4.80	233.53	153.69	0.59
Little Joe Creek	2724	50-year	1080.00	2689.31	2692.06	2691.45	2692.36	0.022329	4.96	254.87	157.03	0.59
Little Joe Creek	2724	100-year	1200.00	2689.31	2692.22	2691.55	2692.54	0.021181	5.07	277.15	160.57	0.58
Little Joe Creek	2724	500-year	1440.00	2689.31	2692.51	2691.74	2692.86	0.020072	5.33	316.74	166.67	0.58
Little Joe Creek	2724	1% +	1872.00	2689.31	2693.00	2692.06	2693.40	0.018120	5.68	386.38	178.86	0.57
Little Joe Creek	3161	10-year	816.00	2694.89	2699.05	2698.05	2699.34	0.012340	4.67	223.79	179.22	0.46
Little Joe Creek	3161	25-year	958.00	2694.89	2699.24	2698.39	2699.56	0.012833	4.96	253.30	209.60	0.47
Little Joe Creek	3161	50-year	1080.00	2694.89	2699.40	2698.70	2699.74	0.013158	5.17	279.41	255.93	0.48
Little Joe Creek	3161	100-year	1200.00	2694.89	2699.54	2698.82	2699.91	0.013720	5.42	305.81	297.13	0.50
Little Joe Creek	3161	500-year	1440.00	2694.89	2699.78	2699.16	2700.18	0.014146	5.74	350.71	344.99	0.51
Little Joe Creek	3161	1% +	1872.00	2694.89	2700.15	2699.43	2700.60	0.014989	6.27	419.99	369.42	0.53
Little Joe Creek	3531	10-year	816.00	2699.27	2703.60	2702.64	2703.90	0.012196	4.69	216.00	161.52	0.47
Little Joe Creek	3531	25-year	958.00	2699.27	2703.84	2702.93	2704.15	0.011951	4.87	248.82	172.81	0.47
Little Joe Creek	3531	50-year	1080.00	2699.27	2704.03	2703.02	2704.35	0.011759	5.01	275.10	192.71	0.47
Little Joe Creek	3531	100-year	1200.00	2699.27	2704.21	2703.39	2704.54	0.011383	5.09	301.65	214.02	0.46
Little Joe Creek	3531	500-year	1440.00	2699.27	2704.51	2703.69	2704.86	0.011361	5.36	345.19	244.28	0.47
Little Joe Creek	3531	1% +	1872.00	2699.27	2705.00	2704.06	2705.39	0.011265	5.76	417.89	267.20	0.48
Little Joe Creek	3865	10-year	816.00	2703.37	2708.03	2706.99	2708.37	0.014614	4.75	180.86	124.57	0.50
Little Joe Creek	3865	25-year	958.00	2703.37	2708.26	2707.22	2708.65	0.015073	5.09	202.07	138.13	0.51
Little Joe Creek	3865	50-year	1080.00	2703.37	2708.44	2707.40	2708.87	0.015467	5.35	218.73	147.38	0.52
Little Joe Creek	3865	100-year	1200.00	2703.37	2708.59	2707.58	2709.06	0.016025	5.61	233.24	150.76	0.54
Little Joe Creek	3865	500-year	1440.00	2703.37	2708.91	2707.93	2709.44	0.016384	6.02	265.47	170.84	0.55
Little Joe Creek	3865	1% +	1872.00	2703.37	2709.40	2708.50	2710.03	0.016982	6.66	323.20	196.61	0.57
Little Joe Creek	4287	10-year	816.00	2708.45	2712.33	2711.41	2712.47	0.006883	3.39	281.44	174.95	0.36

HEC-RAS Plan: MultipleProfiles River: Little Joe Creek Reach: Little Joe Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Little Joe Creek	4287	25-year	958.00	2708.45	2712.57	2711.52	2712.73	0.006658	3.50	319.87	183.84	0.35
Little Joe Creek	4287	50-year	1080.00	2708.45	2712.77	2711.65	2712.93	0.006513	3.60	352.07	197.70	0.35
Little Joe Creek	4287	100-year	1200.00	2708.45	2712.95	2711.73	2713.12	0.006359	3.68	383.48	203.02	0.35
Little Joe Creek	4287	500-year	1440.00	2708.45	2713.28	2711.91	2713.46	0.006168	3.84	441.25	211.56	0.35
Little Joe Creek	4287	1% +	1872.00	2708.45	2713.81	2712.20	2714.02	0.005926	4.10	536.44	223.06	0.35
Little Joe Creek	4701	10-year	816.00	2714.08	2716.90	2716.41	2717.18	0.021721	4.45	206.09	142.29	0.57
Little Joe Creek	4701	25-year	958.00	2714.08	2717.06	2716.60	2717.37	0.022130	4.74	228.81	145.03	0.58
Little Joe Creek	4701	50-year	1080.00	2714.08	2717.19	2716.69	2717.53	0.022322	4.95	247.80	147.27	0.59
Little Joe Creek	4701	100-year	1200.00	2714.08	2717.30	2716.80	2717.67	0.022606	5.16	265.28	149.26	0.60
Little Joe Creek	4701	500-year	1440.00	2714.08	2717.53	2717.01	2717.95	0.022776	5.52	299.86	153.03	0.61
Little Joe Creek	4701	1% +	1872.00	2714.08	2717.91	2717.29	2718.41	0.022758	6.06	359.41	160.32	0.63
Little Joe Creek	5228	10-year	816.00	2721.04	2724.54	2723.54	2724.73	0.010098	3.91	248.67	115.41	0.40
Little Joe Creek	5228	25-year	958.00	2721.04	2724.78	2723.67	2724.99	0.010114	4.11	275.96	116.45	0.41
Little Joe Creek	5228	50-year	1080.00	2721.04	2724.97	2723.87	2725.19	0.010169	4.29	298.34	118.30	0.41
Little Joe Creek	5228	100-year	1200.00	2721.04	2725.15	2723.96	2725.39	0.010192	4.44	320.47	126.94	0.42
Little Joe Creek	5228	500-year	1440.00	2721.04	2725.48	2724.16	2725.75	0.010316	4.74	364.33	147.56	0.43
Little Joe Creek	5228	1% +	1872.00	2721.04	2726.02	2724.52	2726.33	0.010610	5.24	455.19	177.80	0.44
Little Joe Creek	5676	10-year	816.00	2726.85	2729.93	2729.23	2730.15	0.014754	4.46	254.53	159.86	0.49
Little Joe Creek	5676	25-year	958.00	2726.85	2730.13	2729.27	2730.36	0.014452	4.64	286.07	161.42	0.49
Little Joe Creek	5676	50-year	1080.00	2726.85	2730.29	2729.56	2730.53	0.014203	4.77	312.02	162.64	0.49
Little Joe Creek	5676	100-year	1200.00	2726.85	2730.44	2729.61	2730.69	0.013970	4.89	336.72	163.78	0.49
Little Joe Creek	5676	500-year	1440.00	2726.85	2730.73	2729.64	2731.00	0.013469	5.09	384.83	166.01	0.49
Little Joe Creek	5676	1% +	1872.00	2726.85	2731.21	2730.17	2731.51	0.012748	5.41	466.05	169.68	0.48
Little Joe Creek	6113	10-year	816.00	2730.85	2735.93	2734.40	2736.50	0.013822	6.16	138.47	37.06	0.51
Little Joe Creek	6113	25-year	958.00	2730.85	2736.25	2734.79	2736.92	0.014939	6.70	150.42	38.16	0.54
Little Joe Creek	6113	50-year	1080.00	2730.85	2736.49	2735.05	2737.25	0.015951	7.16	159.69	38.96	0.56
Little Joe Creek	6113	100-year	1200.00	2730.85	2736.71	2735.33	2737.56	0.016883	7.58	168.40	39.69	0.58
Little Joe Creek	6113	500-year	1440.00	2730.85	2737.10	2735.76	2738.14	0.018776	8.38	184.21	41.02	0.62
Little Joe Creek	6113	1% +	1872.00	2730.85	2737.68	2736.60	2739.07	0.022300	9.75	208.49	43.00	0.69
Little Joe Creek	6577	10-year	816.00	2737.88	2741.88	2740.88	2742.12	0.010598	4.27	233.49	108.47	0.43
Little Joe Creek	6577	25-year	958.00	2737.88	2742.22	2741.05	2742.47	0.009638	4.36	270.89	112.54	0.41
Little Joe Creek	6577	50-year	1080.00	2737.88	2742.50	2741.21	2742.75	0.008988	4.43	302.71	116.29	0.40
Little Joe Creek	6577	100-year	1200.00	2737.88	2742.76	2741.35	2743.01	0.008476	4.50	333.36	119.71	0.40
Little Joe Creek	6577	500-year	1440.00	2737.88	2743.25	2741.61	2743.51	0.007654	4.62	393.08	124.86	0.38
Little Joe Creek	6577	1% +	1872.00	2737.88	2744.06	2741.99	2744.33	0.006621	4.80	513.60	211.39	0.37
Little Joe Creek	7027	10-year	816.00	2743.00	2746.28	2745.03	2746.39	0.008511	3.02	340.23	241.90	0.36
Little Joe Creek	7027	25-year	958.00	2743.00	2746.47	2745.18	2746.58	0.008661	3.16	385.12	255.53	0.36
Little Joe Creek	7027	50-year	1080.00	2743.00	2746.61	2745.25	2746.74	0.008675	3.24	423.81	268.50	0.37
Little Joe Creek	7027	100-year	1200.00	2743.00	2746.74	2745.25	2746.87	0.008639	3.35	459.52	283.19	0.37
Little Joe Creek	7027	500-year	1440.00	2743.00	2747.00	2745.76	2747.14	0.008461	3.53	535.25	299.27	0.37
Little Joe Creek	7027	1% +	1872.00	2743.00	2747.42	2746.18	2747.57	0.007855	3.74	665.81	335.46	0.37
Little Joe Creek	7467	10-year	816.00	2746.99	2750.52	2749.75	2750.80	0.018035	4.99	218.82	145.39	0.54
Little Joe Creek	7467	25-year	958.00	2746.99	2750.71	2749.94	2751.01	0.018385	5.28	247.11	157.72	0.55
Little Joe Creek	7467	50-year	1080.00	2746.99	2750.85	2750.01	2751.18	0.018879	5.53	270.62	171.64	0.57
Little Joe Creek	7467	100-year	1200.00	2746.99	2751.01	2750.37	2751.37	0.019604	5.84	300.06	196.06	0.58
Little Joe Creek	7467	500-year	1440.00	2746.99	2751.25	2750.61	2751.66	0.020956	6.33	350.15	228.63	0.61
Little Joe Creek	7467	1% +	1872.00	2746.99	2751.51	2751.05	2751.99	0.023768	7.09	413.88	265.32	0.66
Little Joe Creek	7850	10-year	816.00	2751.03	2755.21	2754.41	2755.40	0.009181	4.15	311.21	241.28	0.39
Little Joe Creek	7850	25-year	958.00	2751.03	2755.44	2754.65	2755.63	0.009202	4.33	369.77	288.50	0.40
Little Joe Creek	7850	50-year	1080.00	2751.03	2755.61	2754.81	2755.80	0.009038	4.42	421.56	320.39	0.40
Little Joe Creek	7850	100-year	1200.00	2751.03	2755.76	2754.92	2755.95	0.008692	4.45	474.00	354.53	0.39
Little Joe Creek	7850	500-year	1440.00	2751.03	2756.02	2755.14	2756.20	0.008284	4.53	569.74	391.09	0.39
Little Joe Creek	7850	1% +	1872.00	2751.03	2756.44	2755.59	2756.62	0.007919	4.71	746.97	444.40	0.38
Little Joe Creek	8050	10-year	816.00	2754.16	2757.88	2757.88	2758.33	0.024638	6.35	214.99	218.69	0.65
Little Joe Creek	8050	25-year	958.00	2754.16	2758.06	2757.99	2758.48	0.023321	6.42	254.27	231.75	0.64
Little Joe Creek	8050	50-year	1080.00	2754.16	2758.18	2758.10	2758.60	0.022962	6.53	284.00	243.22	0.63
Little Joe Creek	8050	100-year	1200.00	2754.16	2758.28	2758.17	2758.72	0.023581	6.75	308.24	258.38	0.65
Little Joe Creek	8050	500-year	1440.00	2754.16	2758.47	2758.33	2758.93	0.024174	7.09	361.39	300.28	0.66
Little Joe Creek	8050	1% +	1872.00	2754.16	2758.78	2758.62	2759.25	0.023843	7.44	464.77	379.24	0.66
Little Joe Creek	8358	10-year	816.00	2758.37	2762.08	2761.32	2762.22	0.007806	3.79	371.31	304.99	0.37
Little Joe Creek	8358	25-year	958.00	2758.37	2762.22	2761.48	2762.37	0.008103	3.98	415.17	308.73	0.38
Little Joe Creek	8358	50-year	1080.00	2758.37	2762.34	2761.61	2762.49	0.008237	4.10	451.40	309.59	0.39
Little Joe Creek	8358	100-year	1200.00	2758.37	2762.46	2761.87	2762.62	0.008165	4.18	489.09	310.46	0.39
Little Joe Creek	8358	500-year	1440.00	2758.37	2762.68	2762.01	2762.85	0.008107	4.34	558.70	313.59	0.39
Little Joe Creek	8358	1% +	1872.00	2758.37	2763.01	2762.24	2763.20	0.008385	4.66	664.07	323.52	0.40
Little Joe Creek	8665	10-year	816.00	2763.01	2765.72	2765.07	2766.16	0.023363	5.42	158.53	195.42	0.62
Little Joe Creek	8665	25-year	958.00	2763.01	2765.93	2765.27	2766.43	0.023602	5.77	176.65	198.85	0.63
Little Joe Creek	8665	50-year	1080.00	2763.01	2766.09	2765.40	2766.65	0.024110	6.07	190.37	202.17	0.64
Little Joe Creek	8665	100-year	1200.00	2763.01	2766.22	2765.67	2766.83	0.025274	6.40	201.22	206.46	0.66
Little Joe Creek	8665	500-year	1440.00	2763.01	2766.46	2765.98	2767.19	0.027430	7.03	222.18	223.68	0.70
Little Joe Creek	8665	1% +	1872.00	2763.01	2766.88	2766.42	2767.79	0.029414	7.92	259.90	237.41	0.74
Little Joe Creek	8708		Culvert									
Little Joe Creek	8739	10-year	816.00	2763.20	2768.08	2765.98	2768.49	0.008382	5.11	159.61	233.21	0.41
Little Joe Creek	8739	25-year	958.00	2763.20	2769.13	2766.27	2769.51	0.005914	4.91	195.12	248.81	0.36
Little Joe Creek	8739	50-year	1080.00	2763.20	2770.20	2766.52	2770.25	0.000712	1.86	692.60	265.63	0.13
Little Joe Creek	8739	100-year	1200.00	2763.20	2770.55	2766.75	2770.60	0.000735	1.96	738.11	277.08	0.13
Little Joe Creek	8739	500-year	1440.00	2763.20	2770.99	2767.20	2771.05	0.000826	2.16	802.32	314.43	0.14
Little Joe Creek	8739	1% +	1872.00	2763.20	2771.58	2767.91	2771.63	0.000617	1.95	1106.82	316.58	0.12
Little Joe Creek	9038	10-year	816.00	2767.06	2769.83	2768.46	2769.86	0.002754	1.94	596.65	340.36	0.21
Little Joe Creek	9038	25-year	958.00	2767.06	2770.36	2768.57	2770.38	0.001638	1.69	777.85	343.38	0.17

HEC-RAS Plan: MultipleProfiles River: Little Joe Creek Reach: Little Joe Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Little Joe Creek	9038	50-year	1080.00	2767.06	2770.53	2768.66	2770.56	0.001650	1.76	836.52	344.18	0.17
Little Joe Creek	9038	100-year	1200.00	2767.06	2770.86	2768.70	2770.89	0.001349	1.70	951.40	345.77	0.16
Little Joe Creek	9038	500-year	1440.00	2767.06	2771.32	2768.83	2771.35	0.001184	1.73	1109.75	347.76	0.15
Little Joe Creek	9038	1% +	1872.00	2767.06	2771.85	2769.01	2771.89	0.001215	1.90	1295.38	349.93	0.16
Little Joe Creek	9396	10-year	816.00	2770.61	2772.80	2772.80	2773.42	0.055051	7.01	144.28	112.13	0.90
Little Joe Creek	9396	25-year	958.00	2770.61	2772.95	2772.95	2773.63	0.055311	7.39	161.10	115.26	0.92
Little Joe Creek	9396	50-year	1080.00	2770.61	2773.08	2773.08	2773.80	0.054427	7.64	176.19	120.06	0.92
Little Joe Creek	9396	100-year	1200.00	2770.61	2773.18	2773.18	2773.95	0.055372	7.95	188.80	124.80	0.93
Little Joe Creek	9396	500-year	1440.00	2770.61	2773.37	2773.37	2774.25	0.056908	8.52	214.26	138.13	0.96
Little Joe Creek	9396	1% +	1872.00	2770.61	2773.95	2773.95	2774.65	0.036928	7.89	342.09	287.67	0.80
Little Joe Creek	9894	10-year	816.00	2777.08	2780.20	2779.39	2780.29	0.006342	3.13	418.50	340.43	0.33
Little Joe Creek	9894	25-year	958.00	2777.08	2780.40	2779.47	2780.49	0.006331	3.27	488.39	366.99	0.33
Little Joe Creek	9894	50-year	1080.00	2777.08	2780.53	2779.57	2780.62	0.006318	3.35	535.31	370.61	0.33
Little Joe Creek	9894	100-year	1200.00	2777.08	2780.65	2779.64	2780.75	0.006251	3.42	582.78	377.27	0.33
Little Joe Creek	9894	500-year	1440.00	2777.08	2780.88	2779.74	2780.98	0.006128	3.55	670.16	384.62	0.33
Little Joe Creek	9894	1% +	1872.00	2777.08	2781.14	2780.05	2781.27	0.007128	4.01	772.26	412.27	0.36
Little Joe Creek	10225	10-year	816.00	2782.25	2784.24	2784.20	2784.68	0.051239	6.50	190.94	228.88	0.86
Little Joe Creek	10225	25-year	958.00	2782.25	2784.37	2784.36	2784.82	0.049441	6.70	221.62	241.01	0.86
Little Joe Creek	10225	50-year	1080.00	2782.25	2784.46	2784.36	2784.93	0.049070	6.88	243.48	252.05	0.86
Little Joe Creek	10225	100-year	1200.00	2782.25	2784.54	2784.36	2785.03	0.049470	7.10	263.98	257.19	0.87
Little Joe Creek	10225	500-year	1440.00	2782.25	2784.69	2784.69	2785.20	0.048690	7.37	302.38	262.12	0.88
Little Joe Creek	10225	1% +	1872.00	2782.25	2785.06	2784.89	2785.51	0.036241	7.05	399.81	264.40	0.77
Little Joe Creek	10474	10-year	816.00	2784.22	2787.59	2786.27	2787.69	0.005223	3.07	389.01	212.56	0.30
Little Joe Creek	10474	25-year	958.00	2784.22	2787.78	2786.25	2787.89	0.005411	3.25	429.90	217.59	0.31
Little Joe Creek	10474	50-year	1080.00	2784.22	2787.94	2786.60	2788.05	0.005555	3.40	463.57	222.97	0.32
Little Joe Creek	10474	100-year	1200.00	2784.22	2788.10	2786.81	2788.22	0.005696	3.54	498.61	240.58	0.33
Little Joe Creek	10474	500-year	1440.00	2784.22	2788.36	2787.00	2788.49	0.005998	3.81	558.81	256.45	0.34
Little Joe Creek	10474	1% +	1872.00	2784.22	2788.69	2787.27	2788.86	0.006916	4.31	638.35	282.80	0.37
Little Joe Creek	10848	10-year	816.00	2788.67	2791.49	2791.49	2792.22	0.039031	7.04	135.73	129.81	0.79
Little Joe Creek	10848	25-year	958.00	2788.67	2791.75	2791.75	2792.46	0.034809	7.11	170.85	170.10	0.76
Little Joe Creek	10848	50-year	1080.00	2788.67	2791.90	2791.90	2792.63	0.034409	7.33	196.47	197.56	0.77
Little Joe Creek	10848	100-year	1200.00	2788.67	2792.08	2792.08	2792.77	0.031471	7.30	231.39	227.42	0.74
Little Joe Creek	10848	500-year	1440.00	2788.67	2792.40	2792.40	2793.02	0.026485	7.17	308.88	275.48	0.69
Little Joe Creek	10848	1% +	1872.00	2788.67	2792.72	2792.64	2793.36	0.026472	7.61	390.81	293.64	0.70
Little Joe Creek	11237	10-year	816.00	2793.52	2797.60	2796.00	2797.82	0.007331	3.89	243.59	123.11	0.37
Little Joe Creek	11237	25-year	958.00	2793.52	2797.83	2796.24	2798.08	0.007832	4.20	273.94	144.77	0.38
Little Joe Creek	11237	50-year	1080.00	2793.52	2798.03	2796.47	2798.30	0.008011	4.39	304.16	158.31	0.39
Little Joe Creek	11237	100-year	1200.00	2793.52	2798.20	2796.67	2798.49	0.008565	4.67	332.83	179.27	0.41
Little Joe Creek	11237	500-year	1440.00	2793.52	2798.41	2797.02	2798.76	0.009595	5.12	372.32	181.65	0.43
Little Joe Creek	11237	1% +	1872.00	2793.52	2798.85	2797.54	2799.25	0.010144	5.61	452.57	185.40	0.45
Little Joe Creek	11392	10-year	816.00	2795.73	2799.24	2798.91	2800.29	0.039699	8.23	101.73	36.74	0.83
Little Joe Creek	11392	25-year	958.00	2795.73	2799.51	2799.23	2800.72	0.041094	8.86	111.75	37.77	0.85
Little Joe Creek	11392	50-year	1080.00	2795.73	2799.69	2799.48	2801.06	0.043609	9.45	118.63	38.42	0.89
Little Joe Creek	11392	100-year	1200.00	2795.73	2799.92	2799.73	2801.39	0.043396	9.82	127.44	39.09	0.89
Little Joe Creek	11392	500-year	1440.00	2795.73	2800.24	2800.20	2802.01	0.046954	10.79	140.15	39.83	0.94
Little Joe Creek	11392	1% +	1872.00	2795.73	2800.91	2800.91	2803.05	0.046834	11.92	167.38	41.90	0.96
Little Joe Creek	11652	10-year	816.00	2798.80	2803.58	2801.70	2803.82	0.006582	4.04	218.89	65.59	0.35
Little Joe Creek	11652	25-year	958.00	2798.80	2803.98	2801.96	2804.25	0.006453	4.26	245.56	67.51	0.36
Little Joe Creek	11652	50-year	1080.00	2798.80	2804.32	2802.15	2804.60	0.006298	4.42	268.70	69.35	0.36
Little Joe Creek	11652	100-year	1200.00	2798.80	2804.62	2802.32	2804.92	0.006252	4.58	289.54	70.94	0.36
Little Joe Creek	11652	500-year	1440.00	2798.80	2805.23	2802.65	2805.57	0.006087	4.88	336.31	92.62	0.36
Little Joe Creek	11652	1% +	1872.00	2798.80	2806.13	2803.23	2806.51	0.005798	5.26	425.20	113.59	0.36
Little Joe Creek	12028	10-year	816.00	2805.15	2807.55	2806.82	2807.82	0.019955	4.66	206.51	121.43	0.56
Little Joe Creek	12028	25-year	958.00	2805.15	2807.80	2806.99	2808.09	0.018527	4.83	237.20	125.53	0.55
Little Joe Creek	12028	50-year	1080.00	2805.15	2808.02	2807.14	2808.31	0.017516	4.98	265.94	137.18	0.54
Little Joe Creek	12028	100-year	1200.00	2805.15	2808.25	2807.27	2808.55	0.016763	5.15	298.10	141.87	0.54
Little Joe Creek	12028	500-year	1440.00	2805.15	2808.63	2807.53	2808.94	0.014436	5.20	353.13	144.62	0.51
Little Joe Creek	12028	1% +	1872.00	2805.15	2809.26	2807.88	2809.58	0.012197	5.37	449.54	168.87	0.48
Little Joe Creek	12334	10-year	816.00	2807.93	2811.88	2810.56	2812.20	0.010642	4.71	199.53	82.24	0.44
Little Joe Creek	12334	25-year	958.00	2807.93	2812.12	2810.81	2812.49	0.011324	5.08	219.61	85.26	0.46
Little Joe Creek	12334	50-year	1080.00	2807.93	2812.32	2810.97	2812.72	0.011849	5.37	236.67	92.30	0.47
Little Joe Creek	12334	100-year	1200.00	2807.93	2812.50	2811.18	2812.94	0.012158	5.61	254.60	98.05	0.48
Little Joe Creek	12334	500-year	1440.00	2807.93	2812.78	2811.45	2813.30	0.013595	6.19	282.90	109.71	0.52
Little Joe Creek	12334	1% +	1872.00	2807.93	2813.22	2812.15	2813.86	0.015469	7.03	340.55	152.12	0.56
Little Joe Creek	12638	10-year	816.00	2811.50	2815.68	2814.64	2816.15	0.015801	5.62	162.75	69.50	0.54
Little Joe Creek	12638	25-year	958.00	2811.50	2816.01	2814.94	2816.51	0.015368	5.89	186.06	73.17	0.54
Little Joe Creek	12638	50-year	1080.00	2811.50	2816.27	2815.17	2816.80	0.015085	6.10	205.47	76.32	0.54
Little Joe Creek	12638	100-year	1200.00	2811.50	2816.50	2815.42	2817.06	0.014969	6.31	223.42	79.01	0.54
Little Joe Creek	12638	500-year	1440.00	2811.50	2816.96	2815.82	2817.56	0.014369	6.62	261.10	84.57	0.54
Little Joe Creek	12638	1% +	1872.00	2811.50	2817.66	2816.39	2818.34	0.013974	7.16	333.43	115.88	0.54
Little Joe Creek	13055	10-year	816.00	2819.54	2822.17	2821.28	2822.44	0.014352	4.27	199.05	91.22	0.48
Little Joe Creek	13055	25-year	958.00	2819.54	2822.40	2821.44	2822.71	0.014305	4.54	220.93	92.80	0.49
Little Joe Creek	13055	50-year	1080.00	2819.54	2822.60	2821.58	2822.94	0.014258	4.75	239.29	95.16	0.50
Little Joe Creek	13055	100-year	1200.00	2819.54	2822.78	2821.73	2823.15	0.014148	4.93	256.86	96.09	0.50
Little Joe Creek	13055	500-year	1440.00	2819.54	2823.11	2821.97	2823.53	0.014175	5.29	289.99	106.40	0.51
Little Joe Creek	13055	1% +	1872.00	2819.54	2823.69	2822.38	2824.19	0.013972	5.83	368.44	160.01	0.52
Little Joe Creek	13306	10-year	816.00	2822.65	2826.24	2825.63	2826.54	0.018666	5.40	217.23	135.46	0.56
Little Joe Creek	13306	25-year	958.00	2822.65	2826.47	2825.80	2826.78	0.018522	5.65	250.74	164.82	0.56
Little Joe Creek	13306	50-year	1080.00	2822.65	2826.67	2825.93	2827.00	0.018465	5.89	286.13	181.13	0.57
Little Joe Creek	13306	100-year	1200.00	2822.65	2826.82	2826.05	2827.16	0.018108	6.00	314.08	189.94	0.57
Little Joe Creek	13306	500-year	1440.00	2822.65	2827.11	2826.32	2827.45	0.017148	6.16	371.00	206.67	0.56

HEC-RAS Plan: MultipleProfiles River: Little Joe Creek Reach: Little Joe Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Little Joe Creek	13306	1% +	1872.00	2822.65	2827.60	2826.83	2827.94	0.015958	6.44	477.83	227.63	0.55
Little Joe Creek	13771	10-year	816.00	2830.32	2832.63	2831.77	2832.73	0.012445	3.51	341.62	261.22	0.44
Little Joe Creek	13771	25-year	958.00	2830.32	2832.78	2831.91	2832.89	0.012311	3.67	382.55	286.39	0.44
Little Joe Creek	13771	50-year	1080.00	2830.32	2832.90	2831.95	2833.02	0.012050	3.77	420.21	303.43	0.44
Little Joe Creek	13771	100-year	1200.00	2830.32	2833.01	2832.05	2833.13	0.012109	3.89	452.35	310.27	0.44
Little Joe Creek	13771	500-year	1440.00	2830.32	2833.20	2832.37	2833.34	0.012382	4.14	512.24	325.23	0.45
Little Joe Creek	13771	1% +	1872.00	2830.32	2833.52	2832.57	2833.68	0.012635	4.52	627.00	370.73	0.47
Little Joe Creek	14060	10-year	816.00	2832.86	2836.37	2835.95	2836.61	0.015153	4.97	257.81	331.95	0.51
Little Joe Creek	14060	25-year	958.00	2832.86	2836.53	2836.11	2836.79	0.015487	5.22	290.95	340.27	0.52
Little Joe Creek	14060	50-year	1080.00	2832.86	2836.65	2836.23	2836.93	0.015911	5.43	316.26	345.67	0.53
Little Joe Creek	14060	100-year	1200.00	2832.86	2836.78	2836.30	2837.06	0.016062	5.59	341.93	350.62	0.54
Little Joe Creek	14060	500-year	1440.00	2832.86	2837.03	2836.48	2837.33	0.016347	5.92	397.51	361.31	0.55
Little Joe Creek	14060	1% +	1872.00	2832.86	2837.40	2836.75	2837.73	0.016419	6.34	483.18	374.81	0.56
Little Joe Creek	14346	10-year	816.00	2837.19	2839.87	2838.82	2839.97	0.009308	3.39	338.82	195.30	0.39
Little Joe Creek	14346	25-year	958.00	2837.19	2840.06	2838.82	2840.17	0.009238	3.55	375.12	195.92	0.39
Little Joe Creek	14346	50-year	1080.00	2837.19	2840.21	2839.23	2840.33	0.009169	3.68	404.96	196.53	0.39
Little Joe Creek	14346	100-year	1200.00	2837.19	2840.35	2839.29	2840.48	0.009173	3.80	432.21	197.16	0.40
Little Joe Creek	14346	500-year	1440.00	2837.19	2840.62	2839.43	2840.76	0.009079	4.01	485.41	198.28	0.40
Little Joe Creek	14346	1% +	1872.00	2837.19	2841.03	2839.66	2841.21	0.009278	4.41	569.08	216.00	0.41
Little Joe Creek	14657	10-year	816.00	2840.72	2843.98	2843.69	2844.48	0.024000	6.10	178.73	141.65	0.64
Little Joe Creek	14657	25-year	958.00	2840.72	2844.17	2844.04	2844.69	0.024466	6.42	205.01	145.15	0.65
Little Joe Creek	14657	50-year	1080.00	2840.72	2844.30	2844.16	2844.85	0.024708	6.65	225.22	145.78	0.66
Little Joe Creek	14657	100-year	1200.00	2840.72	2844.44	2844.27	2845.00	0.024768	6.84	244.47	146.28	0.67
Little Joe Creek	14657	500-year	1440.00	2840.72	2844.68	2844.47	2845.29	0.024943	7.20	280.02	147.39	0.68
Little Joe Creek	14657	1% +	1872.00	2840.72	2845.10	2844.78	2845.75	0.024326	7.66	342.00	149.60	0.68
Little Joe Creek	14949	10-year	816.00	2844.69	2848.17	2847.10	2848.33	0.008232	3.59	271.93	155.24	0.38
Little Joe Creek	14949	25-year	958.00	2844.69	2848.41	2847.25	2848.59	0.008248	3.79	302.96	159.02	0.38
Little Joe Creek	14949	50-year	1080.00	2844.69	2848.60	2847.38	2848.80	0.008344	3.97	327.47	162.35	0.39
Little Joe Creek	14949	100-year	1200.00	2844.69	2848.77	2847.50	2848.99	0.008462	4.14	350.74	167.25	0.39
Little Joe Creek	14949	500-year	1440.00	2844.69	2849.12	2847.70	2849.37	0.008769	4.49	402.19	198.47	0.41
Little Joe Creek	14949	1% +	1872.00	2844.69	2849.60	2848.04	2849.90	0.009126	4.96	484.18	210.85	0.42
Little Joe Creek	15286	10-year	816.00	2850.52	2852.83	2852.43	2853.31	0.032131	5.52	149.47	81.56	0.70
Little Joe Creek	15286	25-year	958.00	2850.52	2853.04	2852.62	2853.57	0.031742	5.86	166.20	84.31	0.70
Little Joe Creek	15286	50-year	1080.00	2850.52	2853.21	2852.73	2853.78	0.031075	6.10	180.75	85.91	0.71
Little Joe Creek	15286	100-year	1200.00	2850.52	2853.37	2852.88	2853.99	0.030237	6.30	195.26	87.50	0.70
Little Joe Creek	15286	500-year	1440.00	2850.52	2853.70	2853.16	2854.38	0.028509	6.65	229.16	131.58	0.70
Little Joe Creek	15286	1% +	1872.00	2850.52	2854.17	2853.59	2854.93	0.026756	7.14	300.42	167.13	0.69
Little Joe Creek	15612	10-year	816.00	2857.74	2861.01	2860.46	2861.45	0.019947	5.64	176.16	116.52	0.59
Little Joe Creek	15612	25-year	958.00	2857.74	2861.23	2860.74	2861.72	0.020213	5.97	204.09	132.20	0.60
Little Joe Creek	15612	50-year	1080.00	2857.74	2861.40	2860.92	2861.91	0.020415	6.20	225.95	135.49	0.61
Little Joe Creek	15612	100-year	1200.00	2857.74	2861.54	2861.14	2862.07	0.020680	6.42	245.25	138.04	0.61
Little Joe Creek	15612	500-year	1440.00	2857.74	2861.79	2861.45	2862.38	0.021289	6.83	280.66	142.24	0.63
Little Joe Creek	15612	1% +	1872.00	2857.74	2862.20	2861.82	2862.88	0.022270	7.51	341.97	156.25	0.66

HEC-RAS Plan: MultipleProfiles

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
EFork Twelvemile	EFork Twelvemile	179.1	10-year	96.000	3062.410	3063.7270	3064	3064	0	4.67	24.00	42	1
EFork Twelvemile	EFork Twelvemile	179.1	25-year	124.000	3062.410	3063.8650	3064	3064	0	4.96	30.30	49	1
EFork Twelvemile	EFork Twelvemile	179.1	50-year	148.000	3062.410	3063.9700	3064	3064	0	5.17	35.74	55	1
EFork Twelvemile	EFork Twelvemile	179.1	100-year	173.000	3062.410	3064.0650	3064	3064	0	5.36	41.13	58	1
EFork Twelvemile	EFork Twelvemile	179.1	500-year	231.000	3062.410	3064.2380	3064	3065	0	5.88	51.53	63	1
EFork Twelvemile	EFork Twelvemile	179.1	1% plus	270.000	3062.410	3064.3470	3064	3065	0	6.14	58.54	66	1
EFork Twelvemile	EFork Twelvemile	477	10-year	96.000	3066.970	3068.6130	3068	3069	0	1.00	128.63	275	0
EFork Twelvemile	EFork Twelvemile	477	25-year	124.000	3066.970	3068.7050	3068	3069	0	1.08	155.24	300	0
EFork Twelvemile	EFork Twelvemile	477	50-year	148.000	3066.970	3068.7760	3068	3069	0	1.14	177.17	322	0
EFork Twelvemile	EFork Twelvemile	477	100-year	173.000	3066.970	3068.8440	3068	3069	0	1.19	199.89	345	0
EFork Twelvemile	EFork Twelvemile	477	500-year	231.000	3066.970	3068.9900	3068	3069	0	1.29	253.27	378	0
EFork Twelvemile	EFork Twelvemile	477	1% plus	270.000	3066.970	3069.0720	3068	3069	0	1.34	284.64	384	0
EFork Twelvemile	EFork Twelvemile	657	10-year	96.000	3071.370	3071.9830	3072	3072	0	2.83	43.68	186	1
EFork Twelvemile	EFork Twelvemile	657	25-year	124.000	3071.370	3072.0340	3072	3072	0	2.89	53.41	195	1
EFork Twelvemile	EFork Twelvemile	657	50-year	148.000	3071.370	3072.0740	3072	3072	0	2.95	61.05	202	1
EFork Twelvemile	EFork Twelvemile	657	100-year	173.000	3071.370	3072.1120	3072	3072	0	3.02	68.62	212	1
EFork Twelvemile	EFork Twelvemile	657	500-year	231.000	3071.370	3072.1840	3072	3072	0	3.25	83.38	228	1
EFork Twelvemile	EFork Twelvemile	657	1% plus	270.000	3071.370	3072.2220	3072	3072	0	3.42	91.46	234	1
EFork Twelvemile	EFork Twelvemile	769	10-year	96.000	3073.420	3075.1670	3075	3075	0	1.91	86.14	157	0
EFork Twelvemile	EFork Twelvemile	769	25-year	124.000	3073.420	3075.2890	3075	3075	0	2.07	103.35	166	0
EFork Twelvemile	EFork Twelvemile	769	50-year	148.000	3073.420	3075.3800	3075	3075	0	2.18	116.48	182	0
EFork Twelvemile	EFork Twelvemile	769	100-year	173.000	3073.420	3075.4660	3075	3076	0	2.29	129.22	193	0
EFork Twelvemile	EFork Twelvemile	769	500-year	231.000	3073.420	3075.6560	3075	3076	0	2.51	159.31	227	0
EFork Twelvemile	EFork Twelvemile	769	1% plus	270.000	3073.420	3075.7660	3075	3076	0	2.62	178.05	240	0
EFork Twelvemile	EFork Twelvemile	857	10-year	96.000	3075.490	3077.0650	3077	3077	0	4.94	20.57	37	1
EFork Twelvemile	EFork Twelvemile	857	25-year	124.000	3075.490	3077.2360	3077	3078	0	5.51	24.38	51	1
EFork Twelvemile	EFork Twelvemile	857	50-year	148.000	3075.490	3077.3590	3077	3078	0	5.87	29.22	59	1
EFork Twelvemile	EFork Twelvemile	857	100-year	173.000	3075.490	3077.4770	3077	3078	0	6.23	33.00	84	1
EFork Twelvemile	EFork Twelvemile	857	500-year	231.000	3075.490	3077.7190	3078	3078	0	5.93	58.80	98	1
EFork Twelvemile	EFork Twelvemile	857	1% plus	270.000	3075.490	3077.8240	3078	3078	0	6.28	65.96	102	1
EFork Twelvemile	EFork Twelvemile	893		Bridge									
EFork Twelvemile	EFork Twelvemile	910	10-year	96.000	3076.090	3079.3730	3078	3080	0	4.00	29.65	17	0
EFork Twelvemile	EFork Twelvemile	910	25-year	124.000	3076.090	3079.5800	3079	3080	0	4.72	33.36	23	0
EFork Twelvemile	EFork Twelvemile	910	50-year	148.000	3076.090	3079.6260	3079	3080	0	5.52	34.23	29	1
EFork Twelvemile	EFork Twelvemile	910	100-year	173.000	3076.090	3079.6420	3079	3080	0	6.42	34.54	30	1
EFork Twelvemile	EFork Twelvemile	910	500-year	231.000	3076.090	3080.8130	3080	3081	0	3.76	148.76	152	0
EFork Twelvemile	EFork Twelvemile	910	1% plus	270.000	3076.090	3080.9210	3080	3081	0	4.01	165.44	157	0
EFork Twelvemile	EFork Twelvemile	942	10-year	96.000	3077.080	3080.0820	3079	3080	0	3.10	38.05	27	0
EFork Twelvemile	EFork Twelvemile	942	25-year	124.000	3077.080	3080.4230	3079	3081	0	3.33	48.74	55	0
EFork Twelvemile	EFork Twelvemile	942	50-year	148.000	3077.080	3080.6730	3080	3081	0	3.51	58.39	87	0
EFork Twelvemile	EFork Twelvemile	942	100-year	173.000	3077.080	3080.9300	3080	3081	0	3.66	71.83	104	0
EFork Twelvemile	EFork Twelvemile	942	500-year	231.000	3077.080	3081.1850	3080	3081	0	3.72	121.50	115	0
EFork Twelvemile	EFork Twelvemile	942	1% plus	270.000	3077.080	3081.3240	3080	3081	0	3.91	137.95	119	0
EFork Twelvemile	EFork Twelvemile	961	10-year	96.000	3078.850	3080.4920	3080	3081	0	3.43	33.17	43	1
EFork Twelvemile	EFork Twelvemile	961	25-year	124.000	3078.850	3080.7920	3080	3081	0	3.48	43.58	77	0
EFork Twelvemile	EFork Twelvemile	961	50-year	148.000	3078.850	3081.0420	3080	3081	0	3.13	74.26	91	0
EFork Twelvemile	EFork Twelvemile	961	100-year	173.000	3078.850	3081.2950	3081	3081	0	2.97	98.09	102	0
EFork Twelvemile	EFork Twelvemile	961	500-year	231.000	3078.850	3081.5010	3081	3082	0	3.34	119.59	108	0
EFork Twelvemile	EFork Twelvemile	961	1% plus	270.000	3078.850	3081.6500	3081	3082	0	3.46	135.83	110	0
EFork Twelvemile	EFork Twelvemile	985		Bridge									
EFork Twelvemile	EFork Twelvemile	995	10-year	96.000	3078.240	3081.3240	3080	3081	0	3.38	32.06	46	0
EFork Twelvemile	EFork Twelvemile	995	25-year	124.000	3078.240	3081.4910	3081	3082	0	3.87	42.66	67	0
EFork Twelvemile	EFork Twelvemile	995	50-year	148.000	3078.240	3081.6080	3081	3082	0	4.18	50.76	72	0
EFork Twelvemile	EFork Twelvemile	995	100-year	173.000	3078.240	3081.7030	3081	3082	0	4.49	57.76	75	0
EFork Twelvemile	EFork Twelvemile	995	500-year	231.000	3078.240	3082.5610	3082	3083	0	2.97	137.98	111	0
EFork Twelvemile	EFork Twelvemile	995	1% plus	270.000	3078.240	3082.6770	3082	3083	0	3.18	150.97	112	0
EFork Twelvemile	EFork Twelvemile	1049	10-year	96.000	3080.710	3082.3500	3082	3082	0	2.13	54.74	53	0
EFork Twelvemile	EFork Twelvemile	1049	25-year	124.000	3080.710	3082.5800	3082	3083	0	2.22	67.12	54	0
EFork Twelvemile	EFork Twelvemile	1049	50-year	148.000	3080.710	3082.7390	3082	3083	0	2.34	75.79	55	0
EFork Twelvemile	EFork Twelvemile	1049	100-year	173.000	3080.710	3082.8880	3082	3083	0	2.45	84.00	55	0
EFork Twelvemile	EFork Twelvemile	1049	500-year	231.000	3080.710	3083.1220	3082	3083	0	2.83	97.10	68	0
EFork Twelvemile	EFork Twelvemile	1049	1% plus	270.000	3080.710	3083.2760	3082	3083	0	3.03	105.92	80	0
EFork Twelvemile	EFork Twelvemile	1166	10-year	96.000	3081.880	3084.7910	3085	3085	0	4.20	34.93	59	1
EFork Twelvemile	EFork Twelvemile	1166	25-year	124.000	3081.880	3084.9150	3085	3085	0	4.68	42.27	60	1
EFork Twelvemile	EFork Twelvemile	1166	50-year	148.000	3081.880	3085.0340	3085	3085	0	4.88	49.52	62	1
EFork Twelvemile	EFork Twelvemile	1166	100-year	173.000	3081.880	3085.1550	3085	3085	0	5.02	57.05	63	1
EFork Twelvemile	EFork Twelvemile	1166	500-year	231.000	3081.880	3085.4710	3085	3086	0	5.01	77.27	65	1
EFork Twelvemile	EFork Twelvemile	1166	1% plus	270.000	3081.880	3085.6480	3085	3086	0	5.09	88.88	66	1
EFork Twelvemile	EFork Twelvemile	1287	10-year	96.000	3087.020	3089.3620	3089	3090	0	3.79	28.27	22	1
EFork Twelvemile	EFork Twelvemile	1287	25-year	124.000	3087.020	3089.6450	3089	3090	0	4.11	34.83	24	1
EFork Twelvemile	EFork Twelvemile	1287	50-year	148.000	3087.020	3089.8270	3089	3090	0	4.43	39.38	26	1
EFork Twelvemile	EFork Twelvemile	1287	100-year	173.000	3087.020	3089.9920	3089	3090	0	4.75	43.72	27	1
EFork Twelvemile	EFork Twelvemile	1287	500-year	231.000	3087.020	3090.2510	3090	3091	0	5.60	51.03	30	1
EFork Twelvemile	EFork Twelvemile	1287	1% plus	270.000	3087.020	3090.4190	3090	3091	0	6.09	56.33	33	1
EFork Twelvemile	EFork Twelvemile	1577	10-year	96.000	3096.790	3099.1870	3098	3099	0	2.66	46.31	52	0
EFork Twelvemile	EFork Twelvemile	1577	25-year	124.000	3096.790	3099.3720	3099	3099	0	2.86	55.95	53	0
EFork Twelvemile	EFork Twelvemile	1577	50-year	148.000	3096.790	3099.5370	3099	3100	0	2.94	64.75	54	0
EFork Twelvemile	EFork Twelvemile	1577	100-year	173.000	3096.790	3099.6990	3099	3100	0	3.02	73.55	55	0
EFork Twelvemile	EFork Twelvemile	1577	500-year	231.000	3096.790	3100.0890	3099	3100	0	3.07	95.64	58	0
EFork Twelvemile	EFork Twelvemile	1577	1% plus	270.000	3096.790	3100.3160	3099	3100	0	3.14	109.14	61	0
EFork Twelvemile	EFork Twelvemile	1780	10-year	96.000	3100.750	3103.4980	3102	3104	0	3.16	33.17	19	0
EFork Twelvemile	EFork Twelvemile	1780	25-year	124.000	3100.750	3103.7830	3103	3104	0	3.56	38.96	21	0
EFork Twelvemile	EFork Twelvemile	1780	50-year	148.000	3100.750	3103.9730	3103	3104	0	3.91	43.08	22	0
EFork Twelvemile	EFork Twelvemile	1780	100-year	173.000	3100.750	3104.1480	3103	3104	0	4.24	47.04	23	0
EFork Twelvemile	EFork Twelvemile	1780	500-year	231.000	3100.750	3104.4540	3103	3105	0	5.02	54.30	24	0
EFork Twelvemile	EFork Twelvemile	1780	1% plus	270.000	3100.750	3104.6420	3104	3105	0	5.48	58.97	25	1
EFork Twelvemile	EFork Twelvemile	2026	10-year	96.000	3105.670	3108.4300	3108	3109	0	3.55	28.21	17	0
EFork Twelvemile	EFork Twelvemile	2026	25-year	124.000	3105.670	3108.7840	3108	3109	0	3.83	34.46	18	0
EFork Twelvemile	EFork Twelvemile	2026	50-year	148.000	3105.670	3109.0720	3108	3109	0	4.03	39.83	19	0
EFork Twelvemile	EFork Twelvemile	2026	100-year	173.000	3105.670	3109.3490	3108	3110	0	4.21	45.24	20	0
EFork Twelvemile	EFork Twelvemile	2026	500-year	231.000	3105.670	3109.9530	3109	3110	0	4.54	57.81	22	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
EFork Twelvemile	EFork Twelvemile	2026	1% plus	270.000	3105.670	3110.3080	3109	3111	0	4.75	65.72	23	0
EFork Twelvemile	EFork Twelvemile	2348	10-year	96.000	3114.500	3117.0750	3116	3117	0	3.98	26.18	16	0
EFork Twelvemile	EFork Twelvemile	2348	25-year	124.000	3114.500	3117.3510	3117	3118	0	4.47	30.74	17	1
EFork Twelvemile	EFork Twelvemile	2348	50-year	148.000	3114.500	3117.5540	3117	3118	0	4.86	34.27	18	1
EFork Twelvemile	EFork Twelvemile	2348	100-year	173.000	3114.500	3117.7500	3117	3118	0	5.22	37.81	18	1
EFork Twelvemile	EFork Twelvemile	2348	500-year	231.000	3114.500	3118.1390	3117	3119	0	5.97	45.18	20	1
EFork Twelvemile	EFork Twelvemile	2348	1% plus	270.000	3114.500	3118.3860	3118	3119	0	6.39	50.10	20	1
EFork Twelvemile	EFork Twelvemile	2701	10-year	96.000	3122.360	3125.3840	3124	3126	0	3.29	30.90	18	0
EFork Twelvemile	EFork Twelvemile	2701	25-year	124.000	3122.360	3125.7490	3125	3126	0	3.58	37.58	19	0
EFork Twelvemile	EFork Twelvemile	2701	50-year	148.000	3122.360	3126.0340	3125	3126	0	3.79	43.13	20	0
EFork Twelvemile	EFork Twelvemile	2701	100-year	173.000	3122.360	3126.3060	3125	3127	0	4.00	48.71	21	0
EFork Twelvemile	EFork Twelvemile	2701	500-year	231.000	3122.360	3126.8800	3125	3127	0	4.39	61.39	23	0
EFork Twelvemile	EFork Twelvemile	2701	1% plus	270.000	3122.360	3127.2180	3126	3128	0	4.62	69.44	25	0
EFork Twelvemile	EFork Twelvemile	2774	10-year	96.000	3125.030	3127.4150	3127	3128	0	5.18	19.55	13	1
EFork Twelvemile	EFork Twelvemile	2774	25-year	124.000	3125.030	3127.6980	3127	3128	0	5.74	23.31	14	1
EFork Twelvemile	EFork Twelvemile	2774	50-year	148.000	3125.030	3127.9190	3128	3128	0	6.15	26.41	14	1
EFork Twelvemile	EFork Twelvemile	2774	100-year	173.000	3125.030	3128.1340	3128	3129	0	6.53	29.60	15	1
EFork Twelvemile	EFork Twelvemile	2774	500-year	231.000	3125.030	3128.5840	3128	3129	0	7.26	36.82	17	1
EFork Twelvemile	EFork Twelvemile	2774	1% plus	270.000	3125.030	3128.8620	3128	3130	0	7.66	41.61	18	1
EFork Twelvemile	EFork Twelvemile	2843	10-year	96.000	3126.790	3130.1200	3129	3130	0	4.02	26.44	14	0
EFork Twelvemile	EFork Twelvemile	2843	25-year	124.000	3126.790	3130.4880	3129	3131	0	4.43	32.04	16	0
EFork Twelvemile	EFork Twelvemile	2843	50-year	148.000	3126.790	3130.7660	3130	3131	0	4.73	36.61	17	0
EFork Twelvemile	EFork Twelvemile	2843	100-year	173.000	3126.790	3131.0310	3130	3131	0	5.02	41.22	18	0
EFork Twelvemile	EFork Twelvemile	2843	500-year	231.000	3126.790	3131.5710	3130	3132	0	5.58	51.39	20	0
EFork Twelvemile	EFork Twelvemile	2843	1% plus	270.000	3126.790	3131.8910	3131	3132	0	5.91	57.84	21	1
EFork Twelvemile	EFork Twelvemile	2986	10-year	96.000	3132.210	3135.1030	3135	3136	0	5.42	19.13	12	1
EFork Twelvemile	EFork Twelvemile	2986	25-year	124.000	3132.210	3135.4420	3135	3136	0	5.94	23.22	13	1
EFork Twelvemile	EFork Twelvemile	2986	50-year	148.000	3132.210	3135.7040	3135	3136	0	6.32	26.63	13	1
EFork Twelvemile	EFork Twelvemile	2986	100-year	173.000	3132.210	3135.9560	3135	3137	0	6.67	30.08	14	1
EFork Twelvemile	EFork Twelvemile	2986	500-year	231.000	3132.210	3136.4740	3136	3137	0	7.36	37.83	16	1
EFork Twelvemile	EFork Twelvemile	2986	1% plus	270.000	3132.210	3136.7860	3136	3138	0	7.76	42.93	17	1
EFork Twelvemile	EFork Twelvemile	3306	10-year	96.000	3144.210	3147.3240	3147	3148	0	3.98	27.36	16	0
EFork Twelvemile	EFork Twelvemile	3306	25-year	124.000	3144.210	3147.6600	3147	3148	0	4.38	32.91	17	0
EFork Twelvemile	EFork Twelvemile	3306	50-year	148.000	3144.210	3147.9200	3147	3148	0	4.67	37.40	18	0
EFork Twelvemile	EFork Twelvemile	3306	100-year	173.000	3144.210	3148.1710	3147	3149	0	4.94	41.89	18	0
EFork Twelvemile	EFork Twelvemile	3306	500-year	231.000	3144.210	3148.6920	3148	3149	0	5.49	51.67	19	1
EFork Twelvemile	EFork Twelvemile	3306	1% plus	270.000	3144.210	3149.0060	3148	3149	0	5.81	57.85	20	1
EFork Twelvemile	EFork Twelvemile	3544	10-year	96.000	3154.450	3156.6240	3156	3157	0	4.89	21.79	21	1
EFork Twelvemile	EFork Twelvemile	3544	25-year	124.000	3154.450	3156.8670	3157	3157	0	5.30	26.98	22	1
EFork Twelvemile	EFork Twelvemile	3544	50-year	148.000	3154.450	3157.0540	3157	3158	0	5.60	31.24	23	1
EFork Twelvemile	EFork Twelvemile	3544	100-year	173.000	3154.450	3157.2390	3157	3158	0	5.89	35.73	26	1
EFork Twelvemile	EFork Twelvemile	3544	500-year	231.000	3154.450	3157.6160	3157	3158	0	6.40	46.17	29	1
EFork Twelvemile	EFork Twelvemile	3544	1% plus	270.000	3154.450	3157.8420	3158	3158	0	6.68	53.05	31	1
EFork Twelvemile	EFork Twelvemile	3813	10-year	96.000	3165.140	3167.4470	3167	3168	0	3.05	31.65	24	0
EFork Twelvemile	EFork Twelvemile	3813	25-year	124.000	3165.140	3167.6730	3167	3168	0	3.39	37.24	26	0
EFork Twelvemile	EFork Twelvemile	3813	50-year	148.000	3165.140	3167.8490	3167	3168	0	3.64	41.99	28	0
EFork Twelvemile	EFork Twelvemile	3813	100-year	173.000	3165.140	3168.0170	3167	3168	0	3.87	46.88	30	0
EFork Twelvemile	EFork Twelvemile	3813	500-year	231.000	3165.140	3168.3560	3168	3169	0	4.36	57.65	34	1
EFork Twelvemile	EFork Twelvemile	3813	1% plus	270.000	3165.140	3168.5570	3168	3169	0	4.63	65.05	41	1
EFork Twelvemile	EFork Twelvemile	4082	10-year	96.000	3175.590	3176.9200	3177	3177	0	3.19	42.62	84	1
EFork Twelvemile	EFork Twelvemile	4082	25-year	124.000	3175.590	3177.0500	3177	3177	0	3.38	54.85	103	1
EFork Twelvemile	EFork Twelvemile	4082	50-year	148.000	3175.590	3177.1380	3177	3177	0	3.49	64.11	107	1
EFork Twelvemile	EFork Twelvemile	4082	100-year	173.000	3175.590	3177.2230	3177	3177	0	3.59	73.28	110	1
EFork Twelvemile	EFork Twelvemile	4082	500-year	231.000	3175.590	3177.4040	3177	3178	0	3.76	94.60	126	1
EFork Twelvemile	EFork Twelvemile	4082	1% plus	270.000	3175.590	3177.5120	3177	3178	0	3.85	109.00	140	1
EFork Twelvemile	EFork Twelvemile	4519	10-year	96.000	3183.420	3185.6140	3185	3186	0	1.71	85.38	97	0
EFork Twelvemile	EFork Twelvemile	4519	25-year	124.000	3183.420	3185.7640	3185	3186	0	1.87	100.48	104	0
EFork Twelvemile	EFork Twelvemile	4519	50-year	148.000	3183.420	3185.8780	3185	3186	0	2.00	112.60	110	0
EFork Twelvemile	EFork Twelvemile	4519	100-year	173.000	3183.420	3185.9870	3185	3186	0	2.12	124.72	112	0
EFork Twelvemile	EFork Twelvemile	4519	500-year	231.000	3183.420	3186.2060	3185	3186	0	2.37	149.65	117	0
EFork Twelvemile	EFork Twelvemile	4519	1% plus	270.000	3183.420	3186.3350	3185	3186	0	2.52	165.22	121	0
EFork Twelvemile	EFork Twelvemile	4856	10-year	96.000	3189.550	3191.7210	3191	3192	0	4.22	25.72	21	1
EFork Twelvemile	EFork Twelvemile	4856	25-year	124.000	3189.550	3191.9690	3191	3192	0	4.63	32.37	36	1
EFork Twelvemile	EFork Twelvemile	4856	50-year	148.000	3189.550	3192.1520	3192	3192	0	4.89	40.11	49	1
EFork Twelvemile	EFork Twelvemile	4856	100-year	173.000	3189.550	3192.3180	3192	3193	0	5.11	49.82	64	1
EFork Twelvemile	EFork Twelvemile	4856	500-year	231.000	3189.550	3192.6180	3192	3193	0	5.37	72.71	88	1
EFork Twelvemile	EFork Twelvemile	4856	1% plus	270.000	3189.550	3192.7800	3193	3193	0	5.47	89.12	117	1
EFork Twelvemile	EFork Twelvemile	5117	10-year	96.000	3197.500	3199.1030	3199	3199	0	2.20	66.53	86	0
EFork Twelvemile	EFork Twelvemile	5117	25-year	124.000	3197.500	3199.2630	3199	3199	0	2.37	80.76	91	0
EFork Twelvemile	EFork Twelvemile	5117	50-year	148.000	3197.500	3199.3800	3199	3199	0	2.49	91.42	92	0
EFork Twelvemile	EFork Twelvemile	5117	100-year	173.000	3197.500	3199.4930	3199	3200	0	2.61	102.00	94	0
EFork Twelvemile	EFork Twelvemile	5117	500-year	231.000	3197.500	3199.7180	3199	3200	0	2.91	123.85	100	0
EFork Twelvemile	EFork Twelvemile	5117	1% plus	270.000	3197.500	3199.8430	3199	3200	0	3.10	136.54	103	0
EFork Twelvemile	EFork Twelvemile	5399	10-year	96.000	3201.300	3203.8420	3203	3204	0	2.54	41.68	37	0
EFork Twelvemile	EFork Twelvemile	5399	25-year	124.000	3201.300	3204.0630	3203	3204	0	2.84	50.30	41	0
EFork Twelvemile	EFork Twelvemile	5399	50-year	148.000	3201.300	3204.2310	3203	3204	0	3.05	58.35	55	0
EFork Twelvemile	EFork Twelvemile	5399	100-year	173.000	3201.300	3204.3820	3203	3205	0	3.25	68.13	76	0
EFork Twelvemile	EFork Twelvemile	5399	500-year	231.000	3201.300	3204.7000	3204	3205	0	3.57	95.56	97	0
EFork Twelvemile	EFork Twelvemile	5399	1% plus	270.000	3201.300	3204.8720	3204	3205	0	3.71	112.92	104	0
EFork Twelvemile	EFork Twelvemile	5527	10-year	96.000	3204.880	3206.8090	3207	3207	0	3.41	36.85	57	1
EFork Twelvemile	EFork Twelvemile	5527	25-year	124.000	3204.880	3207.0030	3207	3207	0	3.54	48.76	66	1
EFork Twelvemile	EFork Twelvemile	5527	50-year	148.000	3204.880	3207.1460	3207	3207	0	3.63	58.70	72	1
EFork Twelvemile	EFork Twelvemile	5527	100-year	173.000	3204.880	3207.2810	3207	3207	0	3.72	68.82	82	1
EFork Twelvemile	EFork Twelvemile	5527	500-year	231.000	3204.880	3207.5380	3207	3208	0	3.95	92.62	99	1
EFork Twelvemile	EFork Twelvemile	5527	1% plus	270.000	3204.880	3207.6760	3207	3208	0	4.11	106.69	105	1
EFork Twelvemile	EFork Twelvemile	6003	10-year	96.000	3217.300	3218.8980	3218	3219	0	2.34	62.96	91	0
EFork Twelvemile	EFork Twelvemile	6003	25-year	124.000	3217.300	3219.0350	3219	3219	0	2.60	76.32	111	0
EFork Twelvemile	EFork Twelvemile	6003	50-year	148.000	3217.300	3219.1350	3219	3219	0	2.78	88.11	122	0
EFork Twelvemile	EFork Twelvemile	6003	100-year	173.000	3217.300	3219.2310	3219	3219	0	2.95	100.11	126	0
EFork Twelvemile	EFork Twelvemile	6003	500-year	231.000	3217.300	3219.4110	3219	3220	0	3.23	123.09	130	0
EFork Twelvemile	EFork Twelvemile	6003	1% plus	270.000	3217.300	3219.5240	3219	3220	0	3.37	137.93	131	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
EFork Twelvemile	EFork Twelvemile	6162	10-year	96.000	3221.160	3223.1460	3223	3223	0	4.41	29.34	50	1
EFork Twelvemile	EFork Twelvemile	6162	25-year	124.000	3221.160	3223.3440	3223	3224	0	4.55	40.11	60	1
EFork Twelvemile	EFork Twelvemile	6162	50-year	148.000	3221.160	3223.4870	3223	3224	0	4.66	49.26	67	1
EFork Twelvemile	EFork Twelvemile	6162	100-year	173.000	3221.160	3223.6170	3223	3224	0	4.77	58.27	73	1
EFork Twelvemile	EFork Twelvemile	6162	500-year	231.000	3221.160	3223.8590	3224	3224	0	5.05	79.04	103	1
EFork Twelvemile	EFork Twelvemile	6162	1% plus	270.000	3221.160	3223.9880	3224	3224	0	5.25	93.26	114	1
EFork Twelvemile	EFork Twelvemile	6391	10-year	96.000	3230.610	3232.1490	3232	3232	0	2.76	54.05	68	0
EFork Twelvemile	EFork Twelvemile	6391	25-year	124.000	3230.610	3232.2800	3232	3232	0	3.06	63.22	71	0
EFork Twelvemile	EFork Twelvemile	6391	50-year	148.000	3230.610	3232.3790	3232	3232	0	3.29	70.30	73	0
EFork Twelvemile	EFork Twelvemile	6391	100-year	173.000	3230.610	3232.4760	3232	3233	0	3.49	77.44	74	0
EFork Twelvemile	EFork Twelvemile	6391	500-year	231.000	3230.610	3232.6830	3232	3233	0	3.87	92.90	76	1
EFork Twelvemile	EFork Twelvemile	6391	1% plus	270.000	3230.610	3232.8150	3232	3233	0	4.07	102.92	77	1
EFork Twelvemile	EFork Twelvemile	6539	10-year	96.000	3235.700	3237.8090	3237	3238	0	4.30	22.81	38	1
EFork Twelvemile	EFork Twelvemile	6539	25-year	124.000	3235.700	3238.0480	3238	3238	0	4.67	28.00	45	1
EFork Twelvemile	EFork Twelvemile	6539	50-year	148.000	3235.700	3238.2280	3238	3239	0	4.95	32.10	50	1
EFork Twelvemile	EFork Twelvemile	6539	100-year	173.000	3235.700	3238.3510	3238	3239	0	5.10	41.61	53	1
EFork Twelvemile	EFork Twelvemile	6539	500-year	231.000	3235.700	3238.6490	3238	3239	0	5.60	54.61	68	1
EFork Twelvemile	EFork Twelvemile	6539	1% plus	270.000	3235.700	3238.8170	3239	3239	0	5.91	63.59	88	1
EFork Twelvemile	EFork Twelvemile	6580		Culvert									
EFork Twelvemile	EFork Twelvemile	6618	10-year	96.000	3237.640	3242.1910	3240	3242	0	1.34	76.04	58	0
EFork Twelvemile	EFork Twelvemile	6618	25-year	124.000	3237.640	3243.0450	3240	3243	0	1.29	101.66	79	0
EFork Twelvemile	EFork Twelvemile	6618	50-year	148.000	3237.640	3243.9880	3240	3244	0	1.20	129.92	95	0
EFork Twelvemile	EFork Twelvemile	6618	100-year	173.000	3237.640	3244.7280	3240	3245	0	1.16	175.45	105	0
EFork Twelvemile	EFork Twelvemile	6618	500-year	231.000	3237.640	3245.3740	3241	3245	0	1.21	237.10	111	0
EFork Twelvemile	EFork Twelvemile	6618	1% plus	270.000	3237.640	3245.6560	3241	3246	0	1.31	255.73	113	0
EFork Twelvemile	EFork Twelvemile	6680	10-year	96.000	3240.520	3242.7290	3242	3243	0	2.58	41.33	36	0
EFork Twelvemile	EFork Twelvemile	6680	25-year	124.000	3240.520	3243.3720	3242	3243	0	2.17	66.80	43	0
EFork Twelvemile	EFork Twelvemile	6680	50-year	148.000	3240.520	3244.1750	3242	3244	0	1.70	105.21	52	0
EFork Twelvemile	EFork Twelvemile	6680	100-year	173.000	3240.520	3244.8590	3242	3245	0	1.48	142.57	57	0
EFork Twelvemile	EFork Twelvemile	6680	500-year	231.000	3240.520	3245.4950	3243	3246	0	1.57	180.52	62	0
EFork Twelvemile	EFork Twelvemile	6680	1% plus	270.000	3240.520	3245.7870	3243	3246	0	1.67	198.80	63	0
EFork Twelvemile	EFork Twelvemile	6699	10-year	96.000	3242.490	3244.1370	3244	3244	0	4.45	27.99	55	1
EFork Twelvemile	EFork Twelvemile	6699	25-year	124.000	3242.490	3244.2390	3244	3245	0	4.81	33.74	58	1
EFork Twelvemile	EFork Twelvemile	6699	50-year	148.000	3242.490	3244.3550	3244	3245	0	4.79	40.58	60	1
EFork Twelvemile	EFork Twelvemile	6699	100-year	173.000	3242.490	3244.9770	3244	3245	0	2.70	82.97	73	0
EFork Twelvemile	EFork Twelvemile	6699	500-year	231.000	3242.490	3245.5920	3245	3246	0	2.22	128.88	76	0
EFork Twelvemile	EFork Twelvemile	6699	1% plus	270.000	3242.490	3245.8840	3245	3246	0	2.17	151.23	77	0
EFork Twelvemile	EFork Twelvemile	6726	10-year	96.000	3242.910	3245.3010	3244	3245	0	1.72	71.25	71	0
EFork Twelvemile	EFork Twelvemile	6726	25-year	124.000	3242.910	3245.4860	3244	3246	0	1.91	85.20	78	0
EFork Twelvemile	EFork Twelvemile	6726	50-year	148.000	3242.910	3245.6060	3245	3246	0	2.05	94.69	81	0
EFork Twelvemile	EFork Twelvemile	6726	100-year	173.000	3242.910	3245.6610	3245	3246	0	2.29	99.20	81	0
EFork Twelvemile	EFork Twelvemile	6726	500-year	231.000	3242.910	3246.0150	3245	3246	0	2.35	129.17	88	0
EFork Twelvemile	EFork Twelvemile	6726	1% plus	270.000	3242.910	3246.2430	3245	3246	0	2.35	149.47	89	0
EFork Twelvemile	EFork Twelvemile	6773	10-year	96.000	3244.680	3246.4170	3246	3247	0	2.70	46.26	68	0
EFork Twelvemile	EFork Twelvemile	6773	25-year	124.000	3244.680	3246.5970	3246	3247	0	2.75	58.77	71	0
EFork Twelvemile	EFork Twelvemile	6773	50-year	148.000	3244.680	3246.7390	3246	3247	0	2.80	69.20	75	0
EFork Twelvemile	EFork Twelvemile	6773	100-year	173.000	3244.680	3246.8940	3246	3247	0	2.81	81.31	81	0
EFork Twelvemile	EFork Twelvemile	6773	500-year	231.000	3244.680	3247.1200	3247	3247	0	3.00	99.76	82	0
EFork Twelvemile	EFork Twelvemile	6773	1% plus	270.000	3244.680	3247.2610	3247	3247	0	3.10	111.44	83	0
EFork Twelvemile	EFork Twelvemile	6854	10-year	96.000	3247.480	3249.9340	3249	3250	0	2.79	40.75	32	0
EFork Twelvemile	EFork Twelvemile	6854	25-year	124.000	3247.480	3250.1210	3249	3250	0	3.16	46.94	34	0
EFork Twelvemile	EFork Twelvemile	6854	50-year	148.000	3247.480	3250.2580	3249	3250	0	3.44	51.63	35	0
EFork Twelvemile	EFork Twelvemile	6854	100-year	173.000	3247.480	3250.3730	3250	3251	0	3.74	55.71	36	0
EFork Twelvemile	EFork Twelvemile	6854	500-year	231.000	3247.480	3250.6660	3250	3251	0	4.21	66.40	37	0
EFork Twelvemile	EFork Twelvemile	6854	1% plus	270.000	3247.480	3250.8320	3250	3251	0	4.50	72.69	38	0
EFork Twelvemile	EFork Twelvemile	7144	10-year	96.000	3262.320	3265.1950	3265	3265	0	4.03	23.95	16	1
EFork Twelvemile	EFork Twelvemile	7144	25-year	124.000	3262.320	3265.5520	3265	3266	0	4.23	30.45	23	1
EFork Twelvemile	EFork Twelvemile	7144	50-year	148.000	3262.320	3265.8120	3265	3266	0	4.36	37.06	28	1
EFork Twelvemile	EFork Twelvemile	7144	100-year	173.000	3262.320	3266.0600	3265	3266	0	4.43	44.51	32	0
EFork Twelvemile	EFork Twelvemile	7144	500-year	231.000	3262.320	3266.4720	3266	3267	0	4.72	60.03	42	0
EFork Twelvemile	EFork Twelvemile	7144	1% plus	270.000	3262.320	3266.7050	3266	3267	0	4.85	70.25	45	0
EFork Twelvemile	EFork Twelvemile	7419	10-year	96.000	3275.830	3279.3600	3278	3280	0	3.21	33.51	20	0
EFork Twelvemile	EFork Twelvemile	7419	25-year	124.000	3275.830	3279.6480	3278	3280	0	3.61	39.54	22	0
EFork Twelvemile	EFork Twelvemile	7419	50-year	148.000	3275.830	3279.8590	3279	3280	0	3.92	44.42	24	0
EFork Twelvemile	EFork Twelvemile	7419	100-year	173.000	3275.830	3280.0610	3279	3280	0	4.25	50.38	32	0
EFork Twelvemile	EFork Twelvemile	7419	500-year	231.000	3275.830	3280.4770	3279	3281	0	4.75	69.06	59	0
EFork Twelvemile	EFork Twelvemile	7419	1% plus	270.000	3275.830	3280.6430	3280	3281	0	4.98	79.03	61	0
EFork Twelvemile	EFork Twelvemile	7761	10-year	96.000	3293.120	3294.9060	3294	3295	0	3.11	31.09	25	0
EFork Twelvemile	EFork Twelvemile	7761	25-year	124.000	3293.120	3295.1860	3295	3295	0	3.30	38.36	27	0
EFork Twelvemile	EFork Twelvemile	7761	50-year	148.000	3293.120	3295.4060	3295	3296	0	3.44	44.67	31	0
EFork Twelvemile	EFork Twelvemile	7761	100-year	173.000	3293.120	3295.6250	3295	3296	0	3.54	51.89	36	0
EFork Twelvemile	EFork Twelvemile	7761	500-year	231.000	3293.120	3296.0080	3295	3296	0	3.82	67.80	47	0
EFork Twelvemile	EFork Twelvemile	7761	1% plus	270.000	3293.120	3296.2250	3295	3296	0	3.98	78.70	54	0
EFork Twelvemile	EFork Twelvemile	8105	10-year	96.000	3299.160	3301.3600	3300	3301	0	1.92	70.75	76	0
EFork Twelvemile	EFork Twelvemile	8105	25-year	124.000	3299.160	3301.5570	3301	3302	0	2.09	86.50	82	0
EFork Twelvemile	EFork Twelvemile	8105	50-year	148.000	3299.160	3301.7060	3301	3302	0	2.22	98.88	85	0
EFork Twelvemile	EFork Twelvemile	8105	100-year	173.000	3299.160	3301.8410	3301	3302	0	2.34	110.53	87	0
EFork Twelvemile	EFork Twelvemile	8105	500-year	231.000	3299.160	3302.1350	3301	3302	0	2.55	136.53	90	0
EFork Twelvemile	EFork Twelvemile	8105	1% plus	270.000	3299.160	3302.3160	3301	3302	0	2.68	152.84	91	0
EFork Twelvemile	EFork Twelvemile	8415	10-year	96.000	3304.530	3306.7270	3306	3307	0	4.73	21.92	20	1
EFork Twelvemile	EFork Twelvemile	8415	25-year	124.000	3304.530	3306.9680	3307	3307	0	5.15	26.95	26	1
EFork Twelvemile	EFork Twelvemile	8415	50-year	148.000	3304.530	3307.1390	3307	3308	0	5.50	32.99	41	1
EFork Twelvemile	EFork Twelvemile	8415	100-year	173.000	3304.530	3307.3010	3307	3308	0	5.68	39.74	43	1
EFork Twelvemile	EFork Twelvemile	8415	500-year	231.000	3304.530	3307.5840	3308	3308	0	6.17	53.19	52	1
EFork Twelvemile	EFork Twelvemile	8415	1% plus	270.000	3304.530	3307.7470	3308	3308	0	6.44	62.36	62	1
EFork Twelvemile	EFork Twelvemile	8523	10-year	96.000	3307.410	3309.4840	3308	3310	0	1.99	66.92	52	0
EFork Twelvemile	EFork Twelvemile	8523	25-year	124.000	3307.410	3309.7270	3309	3310	0	2.19	79.88	55	0
EFork Twelvemile	EFork Twelvemile	8523	50-year	148.000	3307.410	3309.9150	3309	3310	0	2.32	90.36	56	0
EFork Twelvemile	EFork Twelvemile	8523	100-year	173.000	3307.410	3310.0810	3309	3310	0	2.48	99.80	58	0
EFork Twelvemile	EFork Twelvemile	8523	500-year	231.000	3307.410	3310.4320	3309	3311	0	2.79	120.70	61	0
EFork Twelvemile	EFork Twelvemile	8523	1% plus	270.000	3307.410	3310.6390	3309	3311	0	2.97	133.55	63	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
EFork Twelvemile	EFork Twelvemile	8653	10-year	96.000	3309.880	3312.3450	3312	3313	0	4.62	20.89	16	1
EFork Twelvemile	EFork Twelvemile	8653	25-year	124.000	3309.880	3312.5690	3312	3313	0	5.15	24.95	20	1
EFork Twelvemile	EFork Twelvemile	8653	50-year	148.000	3309.880	3312.7320	3312	3313	0	5.56	28.57	24	1
EFork Twelvemile	EFork Twelvemile	8653	100-year	173.000	3309.880	3312.9060	3313	3313	0	5.85	33.31	34	1
EFork Twelvemile	EFork Twelvemile	8653	500-year	231.000	3309.880	3313.2520	3313	3314	0	6.32	45.99	45	1
EFork Twelvemile	EFork Twelvemile	8653	1% plus	270.000	3309.880	3313.4530	3313	3314	0	6.55	54.60	55	1
EFork Twelvemile	EFork Twelvemile	8684		Culvert									
EFork Twelvemile	EFork Twelvemile	8716	10-year	96.000	3312.560	3316.4450	3315	3316	0	1.94	60.73	116	0
EFork Twelvemile	EFork Twelvemile	8716	25-year	124.000	3312.560	3317.1810	3315	3317	0	1.94	79.12	151	0
EFork Twelvemile	EFork Twelvemile	8716	50-year	148.000	3312.560	3317.5590	3315	3318	0	0.81	312.00	164	0
EFork Twelvemile	EFork Twelvemile	8716	100-year	173.000	3312.560	3317.8050	3315	3318	0	0.95	346.53	172	0
EFork Twelvemile	EFork Twelvemile	8716	500-year	231.000	3312.560	3318.1760	3315	3318	0	1.08	399.72	175	0
EFork Twelvemile	EFork Twelvemile	8716	1% plus	270.000	3312.560	3318.3760	3316	3318	0	1.16	428.60	176	0
EFork Twelvemile	EFork Twelvemile	8822	10-year	96.000	3314.410	3317.0750	3316	3317	0	2.25	48.45	43	0
EFork Twelvemile	EFork Twelvemile	8822	25-year	124.000	3314.410	3317.6200	3316	3318	0	2.09	75.12	53	0
EFork Twelvemile	EFork Twelvemile	8822	50-year	148.000	3314.410	3317.6740	3316	3318	0	2.43	78.00	54	0
EFork Twelvemile	EFork Twelvemile	8822	100-year	173.000	3314.410	3317.9420	3316	3318	0	2.46	92.79	56	0
EFork Twelvemile	EFork Twelvemile	8822	500-year	231.000	3314.410	3318.3300	3317	3318	0	2.74	115.59	61	0
EFork Twelvemile	EFork Twelvemile	8822	1% plus	270.000	3314.410	3318.5440	3317	3319	0	2.92	129.00	64	0
EFork Twelvemile	EFork Twelvemile	8870	10-year	96.000	3315.580	3317.7790	3317	3318	0	3.53	30.27	28	1
EFork Twelvemile	EFork Twelvemile	8870	25-year	124.000	3315.580	3318.0680	3317	3318	0	3.72	38.73	31	0
EFork Twelvemile	EFork Twelvemile	8870	50-year	148.000	3315.580	3318.2290	3318	3318	0	4.00	43.85	32	1
EFork Twelvemile	EFork Twelvemile	8870	100-year	173.000	3315.580	3318.4320	3318	3319	0	4.14	50.58	34	0
EFork Twelvemile	EFork Twelvemile	8870	500-year	231.000	3315.580	3318.8140	3318	3319	0	4.51	65.88	49	0
EFork Twelvemile	EFork Twelvemile	8870	1% plus	270.000	3315.580	3319.0330	3318	3319	0	4.76	77.83	56	1
EFork Twelvemile	EFork Twelvemile	9058	10-year	96.000	3320.310	3323.1580	3322	3323	0	3.95	27.83	17	0
EFork Twelvemile	EFork Twelvemile	9058	25-year	124.000	3320.310	3323.4130	3323	3324	0	4.50	32.27	18	0
EFork Twelvemile	EFork Twelvemile	9058	50-year	148.000	3320.310	3323.6660	3323	3324	0	4.81	36.98	19	1
EFork Twelvemile	EFork Twelvemile	9058	100-year	173.000	3320.310	3323.8580	3323	3324	0	5.19	40.82	21	1
EFork Twelvemile	EFork Twelvemile	9058	500-year	231.000	3320.310	3324.2760	3323	3325	0	5.89	49.96	23	1
EFork Twelvemile	EFork Twelvemile	9058	1% plus	270.000	3320.310	3324.5340	3324	3325	0	6.25	56.01	24	1
EFork Twelvemile	EFork Twelvemile	9365	10-year	96.000	3329.480	3332.1800	3332	3332	0	3.86	26.88	23	1
EFork Twelvemile	EFork Twelvemile	9365	25-year	124.000	3329.480	3332.5050	3332	3333	0	4.06	35.13	28	1
EFork Twelvemile	EFork Twelvemile	9365	50-year	148.000	3329.480	3332.7130	3332	3333	0	4.29	41.02	29	1
EFork Twelvemile	EFork Twelvemile	9365	100-year	173.000	3329.480	3332.9400	3332	3333	0	4.42	47.83	31	0
EFork Twelvemile	EFork Twelvemile	9365	500-year	231.000	3329.480	3333.3860	3333	3334	0	4.75	62.32	34	0
EFork Twelvemile	EFork Twelvemile	9365	1% plus	270.000	3329.480	3333.6460	3333	3334	0	4.95	71.48	36	0
EFork Twelvemile	EFork Twelvemile	9762	10-year	96.000	3338.340	3340.4050	3340	3340	0	2.23	68.54	85	0
EFork Twelvemile	EFork Twelvemile	9762	25-year	124.000	3338.340	3340.5840	3340	3341	0	2.46	86.15	111	0
EFork Twelvemile	EFork Twelvemile	9762	50-year	148.000	3338.340	3340.7120	3340	3341	0	2.57	100.59	114	0
EFork Twelvemile	EFork Twelvemile	9762	100-year	173.000	3338.340	3340.8140	3340	3341	0	2.69	112.40	115	0
EFork Twelvemile	EFork Twelvemile	9762	500-year	231.000	3338.340	3341.0410	3340	3341	0	2.90	138.70	117	0
EFork Twelvemile	EFork Twelvemile	9762	1% plus	270.000	3338.340	3341.1820	3340	3341	0	3.01	155.27	118	0
EFork Twelvemile	EFork Twelvemile	10085	10-year	96.000	3346.450	3347.9750	3348	3348	0	3.90	31.29	44	1
EFork Twelvemile	EFork Twelvemile	10085	25-year	124.000	3346.450	3348.1660	3348	3348	0	4.10	40.15	48	1
EFork Twelvemile	EFork Twelvemile	10085	50-year	148.000	3346.450	3348.2830	3348	3349	0	4.36	45.94	50	1
EFork Twelvemile	EFork Twelvemile	10085	100-year	173.000	3346.450	3348.4090	3348	3349	0	4.56	52.56	59	1
EFork Twelvemile	EFork Twelvemile	10085	500-year	231.000	3346.450	3348.6420	3348	3349	0	5.02	67.02	65	1
EFork Twelvemile	EFork Twelvemile	10085	1% plus	270.000	3346.450	3348.7720	3349	3349	0	5.30	75.67	69	1
EFork Twelvemile	EFork Twelvemile	10329	10-year	96.000	3350.920	3353.4260	3352	3354	0	2.28	46.02	35	0
EFork Twelvemile	EFork Twelvemile	10329	25-year	124.000	3350.920	3353.6600	3353	3354	0	2.56	54.53	40	0
EFork Twelvemile	EFork Twelvemile	10329	50-year	148.000	3350.920	3353.8530	3353	3354	0	2.74	63.26	52	0
EFork Twelvemile	EFork Twelvemile	10329	100-year	173.000	3350.920	3354.0210	3353	3354	0	2.91	72.48	57	0
EFork Twelvemile	EFork Twelvemile	10329	500-year	231.000	3350.920	3354.3710	3353	3355	0	3.23	95.69	75	0
EFork Twelvemile	EFork Twelvemile	10329	1% plus	270.000	3350.920	3354.5690	3353	3355	0	3.38	111.19	81	0
EFork Twelvemile	EFork Twelvemile	10709	10-year	96.000	3358.700	3360.9390	3361	3361	0	3.48	28.24	27	1
EFork Twelvemile	EFork Twelvemile	10709	25-year	124.000	3358.700	3361.1790	3361	3361	0	3.73	35.00	30	1
EFork Twelvemile	EFork Twelvemile	10709	50-year	148.000	3358.700	3361.3500	3361	3362	0	3.95	40.34	33	1
EFork Twelvemile	EFork Twelvemile	10709	100-year	173.000	3358.700	3361.5150	3361	3362	0	4.14	46.07	36	1
EFork Twelvemile	EFork Twelvemile	10709	500-year	231.000	3358.700	3361.8500	3361	3362	0	4.56	59.87	48	1
EFork Twelvemile	EFork Twelvemile	10709	1% plus	270.000	3358.700	3362.0250	3361	3362	0	4.80	68.41	50	1
EFork Twelvemile	EFork Twelvemile	11117	10-year	96.000	3369.360	3372.1270	3371	3372	0	2.90	35.79	29	0
EFork Twelvemile	EFork Twelvemile	11117	25-year	124.000	3369.360	3372.3540	3371	3373	0	3.26	42.51	31	0
EFork Twelvemile	EFork Twelvemile	11117	50-year	148.000	3369.360	3372.5380	3372	3373	0	3.50	48.40	33	0
EFork Twelvemile	EFork Twelvemile	11117	100-year	173.000	3369.360	3372.7180	3372	3373	0	3.74	55.15	48	0
EFork Twelvemile	EFork Twelvemile	11117	500-year	231.000	3369.360	3373.0620	3372	3373	0	4.16	75.82	70	0
EFork Twelvemile	EFork Twelvemile	11117	1% plus	270.000	3369.360	3373.2470	3372	3373	0	4.34	89.53	78	0
EFork Twelvemile	EFork Twelvemile	11441	10-year	96.000	3381.080	3382.7060	3383	3383	0	4.38	29.90	48	1
EFork Twelvemile	EFork Twelvemile	11441	25-year	124.000	3381.080	3382.9040	3383	3383	0	4.53	40.43	62	1
EFork Twelvemile	EFork Twelvemile	11441	50-year	148.000	3381.080	3383.0360	3383	3383	0	4.68	49.19	69	1
EFork Twelvemile	EFork Twelvemile	11441	100-year	173.000	3381.080	3383.1550	3383	3383	0	4.76	57.66	73	1
EFork Twelvemile	EFork Twelvemile	11441	500-year	231.000	3381.080	3383.3930	3383	3384	0	5.03	76.38	81	1
EFork Twelvemile	EFork Twelvemile	11441	1% plus	270.000	3381.080	3383.5180	3383	3384	0	5.22	86.64	83	1
EFork Twelvemile	EFork Twelvemile	11655	10-year	96.000	3382.340	3385.3910	3384	3385	0	1.60	102.81	137	0
EFork Twelvemile	EFork Twelvemile	11655	25-year	124.000	3382.340	3385.5840	3384	3386	0	1.73	131.87	167	0
EFork Twelvemile	EFork Twelvemile	11655	50-year	148.000	3382.340	3385.7200	3385	3386	0	1.81	155.60	181	0
EFork Twelvemile	EFork Twelvemile	11655	100-year	173.000	3382.340	3385.8410	3385	3386	0	1.89	178.24	201	0
EFork Twelvemile	EFork Twelvemile	11655	500-year	231.000	3382.340	3386.0960	3385	3386	0	2.04	232.78	227	0
EFork Twelvemile	EFork Twelvemile	11655	1% plus	270.000	3382.340	3386.2290	3385	3386	0	2.11	263.49	231	0
EFork Twelvemile	EFork Twelvemile	11765	10-year	96.000	3385.760	3386.8760	3387	3388	1	8.41	13.72	22	2
EFork Twelvemile	EFork Twelvemile	11765	25-year	124.000	3385.760	3387.4350	3387	3388	0	5.00	43.12	100	1
EFork Twelvemile	EFork Twelvemile	11765	50-year	148.000	3385.760	3387.5120	3388	3388	0	5.26	51.32	110	1
EFork Twelvemile	EFork Twelvemile	11765	100-year	173.000	3385.760	3387.5880	3388	3388	0	5.46	60.00	121	1
EFork Twelvemile	EFork Twelvemile	11765	500-year	231.000	3385.760	3387.7920	3388	3388	0	5.54	89.08	167	1
EFork Twelvemile	EFork Twelvemile	11765	1% plus	270.000	3385.760	3387.8620	3388	3388	0	5.77	101.39	186	1
EFork Twelvemile	EFork Twelvemile	11885	10-year	96.000	3387.920	3390.4240	3390	3390	0	1.87	130.44	238	0
EFork Twelvemile	EFork Twelvemile	11885	25-year	124.000	3387.920	3390.4410	3390	3390	0	2.34	134.53	241	0
EFork Twelvemile	EFork Twelvemile	11885	50-year	148.000	3387.920	3390.5270	3390	3391	0	2.40	155.94	253	0
EFork Twelvemile	EFork Twelvemile	11885	100-year	173.000	3387.920	3390.6070	3390	3391	0	2.45	176.35	260	0
EFork Twelvemile	EFork Twelvemile	11885	500-year	231.000	3387.920	3390.7570	3390	3391	0	2.63	216.30	277	0
EFork Twelvemile	EFork Twelvemile	11885	1% plus	270.000	3387.920	3390.8560	3390	3391	0	2.70	244.40	286	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
EFork Twelvemile	EFork Twelvemile	12088	10-year	96.000	3393.950	3395.1650	3395	3395	0	4.27	43.98	127	1
EFork Twelvemile	EFork Twelvemile	12088	25-year	124.000	3393.950	3395.2550	3395	3395	0	4.45	56.47	146	1
EFork Twelvemile	EFork Twelvemile	12088	50-year	148.000	3393.950	3395.3130	3395	3395	0	4.64	65.40	162	1
EFork Twelvemile	EFork Twelvemile	12088	100-year	173.000	3393.950	3395.3790	3395	3396	0	4.84	76.96	187	1
EFork Twelvemile	EFork Twelvemile	12088	500-year	231.000	3393.950	3395.5130	3395	3396	0	4.87	103.87	214	1
EFork Twelvemile	EFork Twelvemile	12088	1% plus	270.000	3393.950	3395.5780	3395	3396	0	4.98	118.12	228	1
EFork Twelvemile	EFork Twelvemile	12472	10-year	96.000	3404.960	3406.4510	3406	3406	0	1.75	92.83	136	0
EFork Twelvemile	EFork Twelvemile	12472	25-year	124.000	3404.960	3406.5750	3406	3407	0	1.91	110.65	156	0
EFork Twelvemile	EFork Twelvemile	12472	50-year	148.000	3404.960	3406.6790	3406	3407	0	2.03	128.44	183	0
EFork Twelvemile	EFork Twelvemile	12472	100-year	173.000	3404.960	3406.7680	3406	3407	0	2.12	145.50	198	0
EFork Twelvemile	EFork Twelvemile	12472	500-year	231.000	3404.960	3406.9210	3406	3407	0	2.35	177.49	225	0
EFork Twelvemile	EFork Twelvemile	12472	1% plus	270.000	3404.960	3407.0280	3406	3407	0	2.48	203.28	251	0
EFork Twelvemile	EFork Twelvemile	12770	10-year	96.000	3413.510	3414.3750	3414	3414	0	3.13	46.29	127	1
EFork Twelvemile	EFork Twelvemile	12770	25-year	124.000	3413.510	3414.4670	3414	3415	0	3.31	58.46	137	1
EFork Twelvemile	EFork Twelvemile	12770	50-year	148.000	3413.510	3414.5340	3414	3415	0	3.46	68.03	147	1
EFork Twelvemile	EFork Twelvemile	12770	100-year	173.000	3413.510	3414.5940	3414	3415	0	3.60	77.09	152	1
EFork Twelvemile	EFork Twelvemile	12770	500-year	231.000	3413.510	3414.7450	3415	3415	0	3.74	101.38	170	1
EFork Twelvemile	EFork Twelvemile	12770	1% plus	270.000	3413.510	3414.8290	3415	3415	0	3.87	116.04	180	1
EFork Twelvemile	EFork Twelvemile	13246	10-year	96.000	3424.890	3427.0440	3427	3427	0	2.21	78.77	126	0
EFork Twelvemile	EFork Twelvemile	13246	25-year	124.000	3424.890	3427.1750	3427	3427	0	2.38	95.46	129	0
EFork Twelvemile	EFork Twelvemile	13246	50-year	148.000	3424.890	3427.2760	3427	3427	0	2.49	108.47	130	0
EFork Twelvemile	EFork Twelvemile	13246	100-year	173.000	3424.890	3427.3740	3427	3427	0	2.60	121.21	131	0
EFork Twelvemile	EFork Twelvemile	13246	500-year	231.000	3424.890	3427.5580	3427	3428	0	2.87	146.02	143	0
EFork Twelvemile	EFork Twelvemile	13246	1% plus	270.000	3424.890	3427.6950	3427	3428	0	3.04	166.27	151	0
EFork Twelvemile	EFork Twelvemile	13567	10-year	96.000	3433.620	3435.1380	3435	3435	0	4.59	27.34	42	1
EFork Twelvemile	EFork Twelvemile	13567	25-year	124.000	3433.620	3435.3140	3435	3436	0	4.89	35.23	47	1
EFork Twelvemile	EFork Twelvemile	13567	50-year	148.000	3433.620	3435.4380	3435	3436	0	5.12	41.30	51	1
EFork Twelvemile	EFork Twelvemile	13567	100-year	173.000	3433.620	3435.5570	3435	3436	0	5.36	47.79	60	1
EFork Twelvemile	EFork Twelvemile	13567	500-year	231.000	3433.620	3435.8410	3436	3436	0	5.63	69.67	91	1
EFork Twelvemile	EFork Twelvemile	13567	1% plus	270.000	3433.620	3435.9860	3436	3436	0	5.75	83.46	99	1
EFork Twelvemile	EFork Twelvemile	13962	10-year	96.000	3445.190	3446.8690	3446	3447	0	2.42	55.57	54	0
EFork Twelvemile	EFork Twelvemile	13962	25-year	124.000	3445.190	3447.0790	3446	3447	0	2.68	68.02	64	0
EFork Twelvemile	EFork Twelvemile	13962	50-year	148.000	3445.190	3447.2280	3446	3447	0	2.85	78.12	69	0
EFork Twelvemile	EFork Twelvemile	13962	100-year	173.000	3445.190	3447.3610	3447	3447	0	2.99	87.35	70	0
EFork Twelvemile	EFork Twelvemile	13962	500-year	231.000	3445.190	3447.6150	3447	3448	0	3.33	105.27	71	0
EFork Twelvemile	EFork Twelvemile	13962	1% plus	270.000	3445.190	3447.7650	3447	3448	0	3.54	116.11	73	0
EFork Twelvemile	EFork Twelvemile	14150	10-year	96.000	3451.540	3452.3160	3452	3452	0	1.56	56.32	114	0
EFork Twelvemile	EFork Twelvemile	14150	25-year	124.000	3451.540	3452.4340	3452	3452	0	1.71	70.24	121	0
EFork Twelvemile	EFork Twelvemile	14150	50-year	148.000	3451.540	3452.5140	3452	3453	0	1.81	80.38	129	0
EFork Twelvemile	EFork Twelvemile	14150	100-year	173.000	3451.540	3452.5890	3452	3453	0	1.90	90.12	133	0
EFork Twelvemile	EFork Twelvemile	14150	500-year	231.000	3451.540	3452.7640	3452	3453	0	2.05	113.97	139	0
EFork Twelvemile	EFork Twelvemile	14150	1% plus	270.000	3451.540	3452.8780	3452	3453	0	2.13	130.11	145	0
EFork Twelvemile	EFork Twelvemile	14352	10-year	96.000	3458.760	3460.1190	3459	3460	0	1.62	65.57	100	0
EFork Twelvemile	EFork Twelvemile	14352	25-year	124.000	3458.760	3460.2620	3460	3460	0	1.83	76.43	108	0
EFork Twelvemile	EFork Twelvemile	14352	50-year	148.000	3458.760	3460.3700	3460	3460	0	1.99	85.39	120	0
EFork Twelvemile	EFork Twelvemile	14352	100-year	173.000	3458.760	3460.5130	3460	3461	0	2.17	98.82	132	0
EFork Twelvemile	EFork Twelvemile	14352	500-year	231.000	3458.760	3460.6880	3460	3461	0	2.46	116.92	150	0
EFork Twelvemile	EFork Twelvemile	14352	1% plus	270.000	3458.760	3460.7910	3460	3461	0	2.65	128.78	165	0
EFork Twelvemile	EFork Twelvemile	14500	10-year	96.000	3464.530	3466.1020	3466	3466	0	2.88	34.19	59	1
EFork Twelvemile	EFork Twelvemile	14500	25-year	124.000	3464.530	3466.2900	3466	3466	0	3.03	44.07	77	0
EFork Twelvemile	EFork Twelvemile	14500	50-year	148.000	3464.530	3466.4260	3466	3467	0	3.15	52.80	97	0
EFork Twelvemile	EFork Twelvemile	14500	100-year	173.000	3464.530	3466.5520	3466	3467	0	3.24	63.75	119	0
EFork Twelvemile	EFork Twelvemile	14500	500-year	231.000	3464.530	3466.7830	3466	3467	0	3.34	89.65	145	0
EFork Twelvemile	EFork Twelvemile	14500	1% plus	270.000	3464.530	3466.9130	3466	3467	0	3.37	105.13	155	0
EFork Twelvemile	EFork Twelvemile	14699	10-year	96.000	3474.010	3475.3000	3475	3475	0	1.72	67.06	114	0
EFork Twelvemile	EFork Twelvemile	14699	25-year	124.000	3474.010	3475.4170	3475	3475	0	1.91	79.73	139	0
EFork Twelvemile	EFork Twelvemile	14699	50-year	148.000	3474.010	3475.5070	3475	3476	0	2.04	90.10	151	0
EFork Twelvemile	EFork Twelvemile	14699	100-year	173.000	3474.010	3475.5930	3475	3476	0	2.17	100.60	168	0
EFork Twelvemile	EFork Twelvemile	14699	500-year	231.000	3474.010	3475.7430	3475	3476	0	2.44	121.72	198	0
EFork Twelvemile	EFork Twelvemile	14699	1% plus	270.000	3474.010	3475.8240	3475	3476	0	2.60	133.97	208	0
EFork Twelvemile	EFork Twelvemile	14925	10-year	96.000	3481.500	3483.0430	3483	3483	0	2.17	59.82	111	0
EFork Twelvemile	EFork Twelvemile	14925	25-year	124.000	3481.500	3483.1700	3483	3483	0	2.25	74.11	114	0
EFork Twelvemile	EFork Twelvemile	14925	50-year	148.000	3481.500	3483.2640	3483	3483	0	2.32	85.01	116	0
EFork Twelvemile	EFork Twelvemile	14925	100-year	173.000	3481.500	3483.3580	3483	3483	0	2.38	96.01	118	0
EFork Twelvemile	EFork Twelvemile	14925	500-year	231.000	3481.500	3483.5580	3483	3484	0	2.50	120.15	123	0
EFork Twelvemile	EFork Twelvemile	14925	1% plus	270.000	3481.500	3483.6830	3483	3484	0	2.57	135.55	125	0
EFork Twelvemile	EFork Twelvemile	15094	10-year	96.000	3488.950	3491.1480	3491	3491	0	3.06	35.88	40	0
EFork Twelvemile	EFork Twelvemile	15094	25-year	124.000	3488.950	3491.3100	3491	3491	0	3.44	43.09	51	0
EFork Twelvemile	EFork Twelvemile	15094	50-year	148.000	3488.950	3491.4260	3491	3492	0	3.70	49.28	57	0
EFork Twelvemile	EFork Twelvemile	15094	100-year	173.000	3488.950	3491.5290	3491	3492	0	3.95	55.51	63	0
EFork Twelvemile	EFork Twelvemile	15094	500-year	231.000	3488.950	3491.7140	3491	3492	0	4.45	68.06	74	1
EFork Twelvemile	EFork Twelvemile	15094	1% plus	270.000	3488.950	3491.8160	3492	3492	0	4.75	75.77	78	1
EFork Twelvemile	EFork Twelvemile	15574	10-year	96.000	3512.060	3513.0280	3513	3513	0	1.29	77.05	174	0
EFork Twelvemile	EFork Twelvemile	15574	25-year	124.000	3512.060	3513.1410	3513	3513	0	1.42	99.42	209	0
EFork Twelvemile	EFork Twelvemile	15574	50-year	148.000	3512.060	3513.2210	3513	3513	0	1.48	116.49	219	0
EFork Twelvemile	EFork Twelvemile	15574	100-year	173.000	3512.060	3513.2890	3513	3513	0	1.53	131.55	227	0
EFork Twelvemile	EFork Twelvemile	15574	500-year	231.000	3512.060	3513.4270	3513	3513	0	1.64	163.80	239	0
EFork Twelvemile	EFork Twelvemile	15574	1% plus	270.000	3512.060	3513.5170	3513	3514	0	1.70	185.82	250	0
EFork Twelvemile	EFork Twelvemile	15967	10-year	96.000	3530.370	3532.3020	3532	3532	0	2.24	52.97	95	0
EFork Twelvemile	EFork Twelvemile	15967	25-year	124.000	3530.370	3532.4000	3532	3532	0	2.49	62.77	103	0
EFork Twelvemile	EFork Twelvemile	15967	50-year	148.000	3530.370	3532.4560	3532	3533	0	2.74	68.58	107	0
EFork Twelvemile	EFork Twelvemile	15967	100-year	173.000	3530.370	3532.5140	3532	3533	0	2.95	75.01	112	1
EFork Twelvemile	EFork Twelvemile	15967	500-year	231.000	3530.370	3532.6300	3532	3533	0	3.35	88.47	120	1
EFork Twelvemile	EFork Twelvemile	15967	1% plus	270.000	3530.370	3532.6850	3532	3533	0	3.64	95.19	123	1
EFork Twelvemile	EFork Twelvemile	16246	10-year	96.000	3545.120	3546.5130	3546	3547	0	1.92	59.59	90	0
EFork Twelvemile	EFork Twelvemile	16246	25-year	124.000	3545.120	3546.6460	3546	3547	0	2.04	71.67	92	0
EFork Twelvemile	EFork Twelvemile	16246	50-year	148.000	3545.120	3546.7610	3546	3547	0	2.10	82.38	93	0
EFork Twelvemile	EFork Twelvemile	16246	100-year	173.000	3545.120	3546.8680	3546	3547	0	2.18	92.45	95	0
EFork Twelvemile	EFork Twelvemile	16246	500-year	231.000	3545.120	3547.0930	3546	3547	0	2.35	114.12	98	0
EFork Twelvemile	EFork Twelvemile	16246	1% plus	270.000	3545.120	3547.2450	3547	3547	0	2.44	129.32	102	0
EFork Twelvemile	EFork Twelvemile	16466	10-year	96.000	3554.260	3556.2870	3556	3556	0	2.73	46.21	57	0
EFork Twelvemile	EFork Twelvemile	16466	25-year	124.000	3554.260	3556.4350	3556	3557	0	3.01	55.07	64	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
EFork Twelvemile	EFork Twelvemile	16466	50-year	148.000	3554.260	3556.5240	3556	3557	0	3.26	61.19	73	0
EFork Twelvemile	EFork Twelvemile	16466	100-year	173.000	3554.260	3556.6150	3556	3557	0	3.47	68.23	82	0
EFork Twelvemile	EFork Twelvemile	16466	500-year	231.000	3554.260	3556.8270	3556	3557	0	3.91	87.69	100	0
EFork Twelvemile	EFork Twelvemile	16466	1% plus	270.000	3554.260	3556.9220	3556	3557	0	4.16	97.32	102	1
EFork Twelvemile	EFork Twelvemile	16748	10-year	96.000	3569.460	3571.3670	3571	3572	0	3.21	33.85	29	0
EFork Twelvemile	EFork Twelvemile	16748	25-year	124.000	3569.460	3571.6120	3571	3572	0	3.44	41.13	31	0
EFork Twelvemile	EFork Twelvemile	16748	50-year	148.000	3569.460	3571.8220	3571	3572	0	3.57	47.74	32	0
EFork Twelvemile	EFork Twelvemile	16748	100-year	173.000	3569.460	3572.0110	3571	3572	0	3.72	54.00	34	0
EFork Twelvemile	EFork Twelvemile	16748	500-year	231.000	3569.460	3572.3790	3572	3573	0	4.01	71.30	77	0
EFork Twelvemile	EFork Twelvemile	16748	1% plus	270.000	3569.460	3572.5670	3572	3573	0	4.12	87.48	91	0
EFork Twelvemile	EFork Twelvemile	17002	10-year	96.000	3586.020	3587.9290	3587	3588	0	3.31	33.18	41	0
EFork Twelvemile	EFork Twelvemile	17002	25-year	124.000	3586.020	3588.0950	3588	3588	0	3.66	40.73	50	1
EFork Twelvemile	EFork Twelvemile	17002	50-year	148.000	3586.020	3588.1980	3588	3588	0	3.97	46.14	55	1
EFork Twelvemile	EFork Twelvemile	17002	100-year	173.000	3586.020	3588.3040	3588	3589	0	4.21	52.22	62	1
EFork Twelvemile	EFork Twelvemile	17002	500-year	231.000	3586.020	3588.5620	3588	3589	0	4.74	74.15	98	1
EFork Twelvemile	EFork Twelvemile	17002	1% plus	270.000	3586.020	3588.6560	3589	3589	0	5.00	84.29	114	1
EFork Twelvemile	EFork Twelvemile	17304	10-year	96.000	3609.510	3610.8770	3611	3611	0	2.80	43.86	70	0
EFork Twelvemile	EFork Twelvemile	17304	25-year	124.000	3609.510	3611.0060	3611	3611	0	2.94	53.02	72	0
EFork Twelvemile	EFork Twelvemile	17304	50-year	148.000	3609.510	3611.1160	3611	3611	0	3.02	61.03	74	0
EFork Twelvemile	EFork Twelvemile	17304	100-year	173.000	3609.510	3611.2160	3611	3611	0	3.12	68.44	75	0
EFork Twelvemile	EFork Twelvemile	17304	500-year	231.000	3609.510	3611.4220	3611	3612	0	3.34	84.32	79	0
EFork Twelvemile	EFork Twelvemile	17304	1% plus	270.000	3609.510	3611.5500	3611	3612	0	3.46	94.47	80	0
EFork Twelvemile	EFork Twelvemile	17659	10-year	96.000	3637.010	3638.8640	3638	3639	0	3.34	33.66	34	1
EFork Twelvemile	EFork Twelvemile	17659	25-year	124.000	3637.010	3639.0570	3639	3639	0	3.77	40.55	40	1
EFork Twelvemile	EFork Twelvemile	17659	50-year	148.000	3637.010	3639.1650	3639	3639	0	4.10	44.95	42	1
EFork Twelvemile	EFork Twelvemile	17659	100-year	173.000	3637.010	3639.3020	3639	3640	0	4.43	51.41	50	1
EFork Twelvemile	EFork Twelvemile	17659	500-year	231.000	3637.010	3639.5030	3639	3640	0	4.92	61.71	52	1
EFork Twelvemile	EFork Twelvemile	17659	1% plus	270.000	3637.010	3639.6140	3639	3640	0	5.22	67.57	53	1
EFork Twelvemile	EFork Twelvemile	17772	10-year	96.000	3650.360	3652.5180	3653	3653	0	5.33	23.57	34	1
EFork Twelvemile	EFork Twelvemile	17772	25-year	124.000	3650.360	3652.6990	3653	3653	0	5.62	30.16	39	1
EFork Twelvemile	EFork Twelvemile	17772	50-year	148.000	3650.360	3652.8260	3653	3653	0	5.84	35.28	41	1
EFork Twelvemile	EFork Twelvemile	17772	100-year	173.000	3650.360	3652.9550	3653	3653	0	6.05	41.00	47	1
EFork Twelvemile	EFork Twelvemile	17772	500-year	231.000	3650.360	3653.1730	3653	3654	0	6.50	51.68	51	1
EFork Twelvemile	EFork Twelvemile	17772	1% plus	270.000	3650.360	3653.3230	3653	3654	0	6.61	59.63	54	1
EFork Twelvemile	EFork Twelvemile	17884	10-year	96.000	3659.900	3661.7900	3661	3662	0	2.62	43.21	44	0
EFork Twelvemile	EFork Twelvemile	17884	25-year	124.000	3659.900	3661.9580	3661	3662	0	2.87	50.60	44	0
EFork Twelvemile	EFork Twelvemile	17884	50-year	148.000	3659.900	3662.0910	3661	3662	0	3.04	56.57	45	0
EFork Twelvemile	EFork Twelvemile	17884	100-year	173.000	3659.900	3662.2190	3662	3662	0	3.21	62.37	46	0
EFork Twelvemile	EFork Twelvemile	17884	500-year	231.000	3659.900	3662.4930	3662	3663	0	3.54	75.02	47	0
EFork Twelvemile	EFork Twelvemile	17884	1% plus	270.000	3659.900	3662.6430	3662	3663	0	3.77	82.06	47	0
Rock Creek	Rock Creek	223.18	10-year	123.000	2962.130	2964.1100	2963	2964	0	1.82	88.73	202	0
Rock Creek	Rock Creek	223.18	25-year	159.000	2962.130	2964.3590	2963	2964	0	1.91	113.42	227	0
Rock Creek	Rock Creek	223.18	50-year	190.000	2962.130	2964.5460	2964	2965	0	1.95	132.82	239	0
Rock Creek	Rock Creek	223.18	100-year	223.000	2962.130	2964.7380	2964	2965	0	1.99	153.25	258	0
Rock Creek	Rock Creek	223.18	500-year	298.000	2962.130	2965.1580	2964	2965	0	2.04	200.02	323	0
Rock Creek	Rock Creek	223.18	1% plus	348.000	2962.130	2965.5100	2964	2966	0	1.95	239.97	353	0
Rock Creek	Rock Creek	323	10-year	123.000	2963.410	2965.2770	2965	2966	0	6.46	19.14	149	1
Rock Creek	Rock Creek	323	25-year	159.000	2963.410	2965.5380	2966	2966	0	6.96	23.28	195	1
Rock Creek	Rock Creek	323	50-year	190.000	2963.410	2965.7340	2966	2967	0	7.37	26.62	233	1
Rock Creek	Rock Creek	323	100-year	223.000	2963.410	2965.9560	2966	2967	0	7.63	30.65	287	1
Rock Creek	Rock Creek	323	500-year	298.000	2963.410	2966.3810	2966	2967	0	8.25	39.14	370	1
Rock Creek	Rock Creek	323	1% plus	348.000	2963.410	2966.6110	2967	2968	0	8.70	44.28	400	1
Rock Creek	Rock Creek	439	10-year	123.000	2965.560	2967.6890	2967	2968	0	2.35	59.77	459	0
Rock Creek	Rock Creek	439	25-year	159.000	2965.560	2967.9640	2967	2968	0	2.53	73.76	486	0
Rock Creek	Rock Creek	439	50-year	190.000	2965.560	2968.1820	2967	2968	0	2.65	85.48	493	0
Rock Creek	Rock Creek	439	100-year	223.000	2965.560	2968.3880	2967	2968	0	2.77	96.66	499	0
Rock Creek	Rock Creek	439	500-year	298.000	2965.560	2968.8290	2968	2969	0	2.97	120.70	518	0
Rock Creek	Rock Creek	439	1% plus	348.000	2965.560	2969.1090	2968	2969	0	3.08	136.07	532	0
Rock Creek	Rock Creek	559	10-year	123.000	2967.570	2968.8530	2968	2969	0	2.64	55.21	579	0
Rock Creek	Rock Creek	559	25-year	159.000	2967.570	2969.0530	2969	2969	0	2.78	67.78	584	0
Rock Creek	Rock Creek	559	50-year	190.000	2967.570	2969.2110	2969	2969	0	2.89	77.89	587	0
Rock Creek	Rock Creek	559	100-year	223.000	2967.570	2969.3740	2969	2969	0	2.98	88.46	593	0
Rock Creek	Rock Creek	559	500-year	298.000	2967.570	2969.7220	2969	2970	0	3.17	111.43	596	0
Rock Creek	Rock Creek	559	1% plus	348.000	2967.570	2969.9440	2969	2970	0	3.27	126.38	599	0
Rock Creek	Rock Creek	645	10-year	123.000	2967.640	2969.6910	2969	2970	0	2.06	64.09	619	0
Rock Creek	Rock Creek	645	25-year	159.000	2967.640	2969.8830	2969	2970	0	2.35	73.83	656	0
Rock Creek	Rock Creek	645	50-year	190.000	2967.640	2970.0310	2969	2970	0	2.56	81.85	671	0
Rock Creek	Rock Creek	645	100-year	223.000	2967.640	2970.1810	2969	2970	0	2.76	90.34	690	0
Rock Creek	Rock Creek	645	500-year	298.000	2967.640	2970.4940	2969	2971	0	3.10	109.10	724	0
Rock Creek	Rock Creek	645	1% plus	348.000	2967.640	2970.6880	2970	2971	0	3.28	121.00	726	0
Rock Creek	Rock Creek	680		Bridge									
Rock Creek	Rock Creek	707	10-year	123.000	2967.730	2969.7870	2969	2970	0	1.90	66.99	644	0
Rock Creek	Rock Creek	707	25-year	159.000	2967.730	2970.0740	2969	2970	0	2.01	82.24	688	0
Rock Creek	Rock Creek	707	50-year	190.000	2967.730	2970.3280	2969	2970	0	2.06	95.88	703	0
Rock Creek	Rock Creek	707	100-year	223.000	2967.730	2970.6130	2969	2971	0	2.08	111.19	716	0
Rock Creek	Rock Creek	707	500-year	298.000	2967.730	2971.3180	2970	2971	0	2.07	149.10	726	0
Rock Creek	Rock Creek	707	1% plus	348.000	2967.730	2971.8380	2970	2972	0	2.03	177.05	729	0
Rock Creek	Rock Creek	838	10-year	123.000	2969.570	2970.9310	2970	2971	0	2.43	54.11	72	0
Rock Creek	Rock Creek	838	25-year	159.000	2969.570	2971.1060	2971	2971	0	2.64	65.20	75	0
Rock Creek	Rock Creek	838	50-year	190.000	2969.570	2971.2510	2971	2971	0	2.77	74.58	78	0
Rock Creek	Rock Creek	838	100-year	223.000	2969.570	2971.4160	2971	2972	0	2.85	85.88	88	0
Rock Creek	Rock Creek	838	500-year	298.000	2969.570	2971.8660	2971	2972	0	2.80	122.52	108	0
Rock Creek	Rock Creek	838	1% plus	348.000	2969.570	2972.2490	2971	2972	0	2.65	157.81	119	0
Rock Creek	Rock Creek	975	10-year	123.000	2971.040	2972.7450	2972	2973	0	2.41	53.87	54	0
Rock Creek	Rock Creek	975	25-year	159.000	2971.040	2972.9210	2972	2973	0	2.66	63.92	59	0
Rock Creek	Rock Creek	975	50-year	190.000	2971.040	2973.0480	2972	2973	0	2.87	71.93	71	0
Rock Creek	Rock Creek	975	100-year	223.000	2971.040	2973.1630	2973	2973	0	3.08	80.99	85	0
Rock Creek	Rock Creek	975	500-year	298.000	2971.040	2973.3440	2973	2974	0	3.57	99.37	118	0
Rock Creek	Rock Creek	975	1% plus	348.000	2971.040	2973.4440	2973	2974	0	3.84	111.60	129	0
Rock Creek	Rock Creek	1100	10-year	123.000	2973.610	2974.4380	2974	2974	0	1.67	91.43	168	0
Rock Creek	Rock Creek	1100	25-year	159.000	2973.610	2974.5630	2974	2975	0	1.77	112.88	175	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Rock Creek	Rock Creek	1100	50-year	190.000	2973.610	2974.6690	2974	2975	0	1.84	131.71	182	0
Rock Creek	Rock Creek	1100	100-year	223.000	2973.610	2974.7740	2974	2975	0	1.91	151.25	190	0
Rock Creek	Rock Creek	1100	500-year	298.000	2973.610	2974.9910	2974	2975	0	2.03	194.18	208	0
Rock Creek	Rock Creek	1100	1% plus	348.000	2973.610	2975.1150	2974	2975	0	2.11	220.34	250	0
Rock Creek	Rock Creek	1261	10-year	123.000	2976.470	2977.0650	2977	2977	0	1.23	57.11	439	0
Rock Creek	Rock Creek	1261	25-year	159.000	2976.470	2977.1650	2977	2977	0	1.40	66.03	458	0
Rock Creek	Rock Creek	1261	50-year	190.000	2976.470	2977.2290	2977	2977	0	1.67	72.18	463	0
Rock Creek	Rock Creek	1261	100-year	223.000	2976.470	2977.2900	2977	2977	0	1.96	78.34	467	1
Rock Creek	Rock Creek	1261	500-year	298.000	2976.470	2977.4100	2977	2978	0	2.55	90.91	477	1
Rock Creek	Rock Creek	1261	1% plus	348.000	2976.470	2977.4960	2977	2978	0	2.97	100.75	485	1
Rock Creek	Rock Creek	1436	10-year	123.000	2977.710	2979.8770	2979	2980	0	2.83	52.84	567	0
Rock Creek	Rock Creek	1436	25-year	159.000	2977.710	2980.1180	2979	2980	0	3.05	65.19	597	0
Rock Creek	Rock Creek	1436	50-year	190.000	2977.710	2980.3040	2980	2980	0	3.23	75.54	614	0
Rock Creek	Rock Creek	1436	100-year	223.000	2977.710	2980.4650	2980	2981	0	3.38	84.76	648	0
Rock Creek	Rock Creek	1436	500-year	298.000	2977.710	2980.7900	2980	2981	0	3.69	105.43	689	0
Rock Creek	Rock Creek	1436	1% plus	348.000	2977.710	2980.9780	2980	2981	0	3.86	118.14	690	0
Rock Creek	Rock Creek	1573	10-year	123.000	2979.730	2981.7760	2981	2982	0	2.77	45.95	302	0
Rock Creek	Rock Creek	1573	25-year	159.000	2979.730	2982.0010	2981	2982	0	3.10	54.19	340	0
Rock Creek	Rock Creek	1573	50-year	190.000	2979.730	2982.1760	2981	2982	0	3.33	60.81	348	0
Rock Creek	Rock Creek	1573	100-year	223.000	2979.730	2982.3440	2981	2983	0	3.55	67.26	361	0
Rock Creek	Rock Creek	1573	500-year	298.000	2979.730	2982.6780	2982	2983	0	3.99	80.25	376	0
Rock Creek	Rock Creek	1573	1% plus	348.000	2979.730	2982.8740	2982	2983	0	4.26	87.85	388	0
Rock Creek	Rock Creek	1613		Culvert									
Rock Creek	Rock Creek	1637	10-year	123.000	2980.550	2983.2880	2983	2984	0	4.16	30.60	121	1
Rock Creek	Rock Creek	1637	25-year	159.000	2980.550	2983.9360	2983	2984	0	3.83	43.13	173	0
Rock Creek	Rock Creek	1637	50-year	190.000	2980.550	2984.4360	2983	2985	0	3.73	52.80	222	0
Rock Creek	Rock Creek	1637	100-year	223.000	2980.550	2984.9830	2983	2985	0	3.65	63.38	265	0
Rock Creek	Rock Creek	1637	500-year	298.000	2980.550	2986.1840	2984	2986	0	3.56	86.60	311	0
Rock Creek	Rock Creek	1637	1% plus	348.000	2980.550	2986.9740	2984	2987	0	3.53	101.88	327	0
Rock Creek	Rock Creek	1855	10-year	123.000	2985.180	2986.3620	2986	2986	0	1.26	70.01	71	0
Rock Creek	Rock Creek	1855	25-year	159.000	2985.180	2986.5080	2986	2987	0	1.56	81.38	80	0
Rock Creek	Rock Creek	1855	50-year	190.000	2985.180	2986.6570	2986	2987	0	1.76	93.62	83	0
Rock Creek	Rock Creek	1855	100-year	223.000	2985.180	2986.8430	2986	2987	0	1.91	109.86	93	0
Rock Creek	Rock Creek	1855	500-year	298.000	2985.180	2987.4280	2986	2987	0	1.96	172.98	120	0
Rock Creek	Rock Creek	1855	1% plus	348.000	2985.180	2987.9250	2986	2988	0	1.83	235.73	130	0
Rock Creek	Rock Creek	1962	10-year	123.000	2985.510	2987.4960	2987	2988	0	2.80	53.52	49	0
Rock Creek	Rock Creek	1962	25-year	159.000	2985.510	2987.7240	2987	2988	0	2.97	65.15	53	0
Rock Creek	Rock Creek	1962	50-year	190.000	2985.510	2987.8700	2987	2988	0	3.19	73.04	55	0
Rock Creek	Rock Creek	1962	100-year	223.000	2985.510	2988.0000	2987	2988	0	3.43	80.30	57	0
Rock Creek	Rock Creek	1962	500-year	298.000	2985.510	2988.2540	2987	2988	0	3.91	95.87	67	0
Rock Creek	Rock Creek	1962	1% plus	348.000	2985.510	2988.4700	2988	2989	0	4.04	111.56	78	0
Rock Creek	Rock Creek	2061	10-year	123.000	2986.950	2989.3260	2989	2990	0	3.95	38.64	57	1
Rock Creek	Rock Creek	2061	25-year	159.000	2986.950	2989.5080	2989	2990	0	4.24	50.63	75	1
Rock Creek	Rock Creek	2061	50-year	190.000	2986.950	2989.6440	2989	2990	0	4.43	62.00	94	1
Rock Creek	Rock Creek	2061	100-year	223.000	2986.950	2989.7840	2990	2990	0	4.51	75.89	102	1
Rock Creek	Rock Creek	2061	500-year	298.000	2986.950	2990.0350	2990	2990	0	4.60	102.50	110	1
Rock Creek	Rock Creek	2061	1% plus	348.000	2986.950	2990.1660	2990	2990	0	4.73	117.21	114	1
Rock Creek	Rock Creek	2324	10-year	123.000	2990.960	2993.6020	2993	2994	0	3.18	41.28	28	0
Rock Creek	Rock Creek	2324	25-year	159.000	2990.960	2993.8650	2993	2994	0	3.54	50.40	42	0
Rock Creek	Rock Creek	2324	50-year	190.000	2990.960	2994.0600	2993	2994	0	3.83	60.48	61	0
Rock Creek	Rock Creek	2324	100-year	223.000	2990.960	2994.1990	2993	2994	0	4.10	69.16	64	0
Rock Creek	Rock Creek	2324	500-year	298.000	2990.960	2994.4530	2994	2995	0	4.63	85.73	66	0
Rock Creek	Rock Creek	2324	1% plus	348.000	2990.960	2994.6100	2994	2995	0	4.90	96.29	71	1
Rock Creek	Rock Creek	2626	10-year	123.000	2996.080	2998.3680	2998	2999	0	4.39	35.71	41	1
Rock Creek	Rock Creek	2626	25-year	159.000	2996.080	2998.6110	2998	2999	0	4.58	46.48	47	1
Rock Creek	Rock Creek	2626	50-year	190.000	2996.080	2998.8000	2998	2999	0	4.68	55.76	51	1
Rock Creek	Rock Creek	2626	100-year	223.000	2996.080	2998.9790	2999	2999	0	4.79	65.14	54	1
Rock Creek	Rock Creek	2626	500-year	298.000	2996.080	2999.3480	2999	3000	0	5.01	86.77	62	1
Rock Creek	Rock Creek	2626	1% plus	348.000	2996.080	2999.5450	2999	3000	0	5.16	99.39	66	1
Rock Creek	Rock Creek	2937	10-year	123.000	3001.460	3003.8190	3003	3004	0	3.12	52.55	66	0
Rock Creek	Rock Creek	2937	25-year	159.000	3001.460	3004.0020	3003	3004	0	3.41	65.69	79	0
Rock Creek	Rock Creek	2937	50-year	190.000	3001.460	3004.1220	3004	3004	0	3.63	75.50	85	0
Rock Creek	Rock Creek	2937	100-year	223.000	3001.460	3004.2390	3004	3004	0	3.82	85.83	95	0
Rock Creek	Rock Creek	2937	500-year	298.000	3001.460	3004.4610	3004	3005	0	4.17	109.05	110	0
Rock Creek	Rock Creek	2937	1% plus	348.000	3001.460	3004.5950	3004	3005	0	4.34	124.43	121	0
Rock Creek	Rock Creek	3358	10-year	123.000	3010.080	3011.8720	3012	3012	0	4.39	29.02	35	1
Rock Creek	Rock Creek	3358	25-year	159.000	3010.080	3012.0980	3012	3012	0	4.73	35.97	38	1
Rock Creek	Rock Creek	3358	50-year	190.000	3010.080	3012.2730	3012	3013	0	4.97	41.70	41	1
Rock Creek	Rock Creek	3358	100-year	223.000	3010.080	3012.4350	3012	3013	0	5.22	47.19	43	1
Rock Creek	Rock Creek	3358	500-year	298.000	3010.080	3012.7560	3012	3013	0	5.75	58.55	47	1
Rock Creek	Rock Creek	3358	1% plus	348.000	3010.080	3012.9380	3013	3013	0	6.09	65.28	49	1
Rock Creek	Rock Creek	3726	10-year	123.000	3017.440	3019.2760	3019	3019	0	2.42	52.85	55	0
Rock Creek	Rock Creek	3726	25-year	159.000	3017.440	3019.4510	3019	3020	0	2.68	62.61	57	0
Rock Creek	Rock Creek	3726	50-year	190.000	3017.440	3019.5870	3019	3020	0	2.88	70.38	58	0
Rock Creek	Rock Creek	3726	100-year	223.000	3017.440	3019.7240	3019	3020	0	3.06	78.40	59	0
Rock Creek	Rock Creek	3726	500-year	298.000	3017.440	3020.0090	3019	3020	0	3.39	95.56	61	0
Rock Creek	Rock Creek	3726	1% plus	348.000	3017.440	3020.1900	3019	3020	0	3.57	106.74	63	0
Rock Creek	Rock Creek	4048	10-year	123.000	3024.110	3026.0210	3026	3026	0	5.09	35.42	57	1
Rock Creek	Rock Creek	4048	25-year	159.000	3024.110	3026.1770	3026	3026	0	5.33	43.33	59	1
Rock Creek	Rock Creek	4048	50-year	190.000	3024.110	3026.2980	3026	3027	0	5.53	49.53	60	1
Rock Creek	Rock Creek	4048	100-year	223.000	3024.110	3026.4110	3026	3027	0	5.75	55.41	61	1
Rock Creek	Rock Creek	4048	500-year	298.000	3024.110	3026.6400	3026	3027	0	6.22	67.50	64	1
Rock Creek	Rock Creek	4048	1% plus	348.000	3024.110	3026.7710	3027	3027	0	6.54	74.55	66	1
Rock Creek	Rock Creek	4392	10-year	123.000	3030.010	3032.7730	3032	3033	0	3.07	47.89	46	0
Rock Creek	Rock Creek	4392	25-year	159.000	3030.010	3032.9930	3032	3033	0	3.37	58.28	48	0
Rock Creek	Rock Creek	4392	50-year	190.000	3030.010	3033.1600	3032	3033	0	3.59	66.46	50	0
Rock Creek	Rock Creek	4392	100-year	223.000	3030.010	3033.3260	3033	3034	0	3.79	74.94	52	0
Rock Creek	Rock Creek	4392	500-year	298.000	3030.010	3033.6600	3033	3034	0	4.16	92.98	56	0
Rock Creek	Rock Creek	4392	1% plus	348.000	3030.010	3033.8610	3033	3034	0	4.37	104.48	58	0
Rock Creek	Rock Creek	4750	10-year	123.000	3037.310	3039.3940	3039	3040	0	5.70	23.27	31	1
Rock Creek	Rock Creek	4750	25-year	159.000	3037.310	3039.6600	3039	3040	0	6.17	28.97	36	1

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Rock Creek	Rock Creek	4750	50-year	190.000	3037.310	3039.8570	3040	3040	0	6.49	33.83	38	1
Rock Creek	Rock Creek	4750	100-year	223.000	3037.310	3040.0390	3040	3041	0	6.82	38.65	41	1
Rock Creek	Rock Creek	4750	500-year	298.000	3037.310	3040.3900	3040	3041	0	7.48	49.06	46	1
Rock Creek	Rock Creek	4750	1% plus	348.000	3037.310	3040.5900	3041	3041	0	7.87	55.62	49	1
Rock Creek	Rock Creek	5153	10-year	123.000	3045.660	3048.0460	3047	3048	0	3.04	41.35	45	0
Rock Creek	Rock Creek	5153	25-year	159.000	3045.660	3048.3170	3047	3048	0	3.37	49.07	51	0
Rock Creek	Rock Creek	5153	50-year	190.000	3045.660	3048.5210	3048	3049	0	3.63	55.32	57	0
Rock Creek	Rock Creek	5153	100-year	223.000	3045.660	3048.7270	3048	3049	0	3.86	61.97	62	0
Rock Creek	Rock Creek	5153	500-year	298.000	3045.660	3049.1420	3048	3049	0	4.30	76.57	74	0
Rock Creek	Rock Creek	5153	1% plus	348.000	3045.660	3049.3880	3048	3050	0	4.55	85.98	80	0
Rock Creek	Rock Creek	5344	10-year	123.000	3048.680	3051.4110	3051	3052	0	4.72	26.09	17	1
Rock Creek	Rock Creek	5344	25-year	159.000	3048.680	3051.6740	3051	3052	0	5.20	30.81	19	1
Rock Creek	Rock Creek	5344	50-year	190.000	3048.680	3051.8810	3051	3052	0	5.56	34.82	20	1
Rock Creek	Rock Creek	5344	100-year	223.000	3048.680	3052.0770	3052	3053	0	5.92	38.90	24	1
Rock Creek	Rock Creek	5344	500-year	298.000	3048.680	3052.4660	3052	3053	0	6.62	48.41	35	1
Rock Creek	Rock Creek	5344	1% plus	348.000	3048.680	3052.6940	3052	3053	0	6.99	54.80	38	1
Rock Creek	Rock Creek	5513	10-year	123.000	3053.490	3055.9960	3055	3056	0	4.53	31.92	70	1
Rock Creek	Rock Creek	5513	25-year	159.000	3053.490	3056.2570	3056	3057	0	4.89	40.54	86	1
Rock Creek	Rock Creek	5513	50-year	190.000	3053.490	3056.4530	3056	3057	0	5.14	47.63	96	1
Rock Creek	Rock Creek	5513	100-year	223.000	3053.490	3056.6450	3056	3057	0	5.34	54.94	105	1
Rock Creek	Rock Creek	5513	500-year	298.000	3053.490	3057.0350	3057	3057	0	5.71	70.87	147	1
Rock Creek	Rock Creek	5513	1% plus	348.000	3053.490	3057.2630	3057	3058	0	5.94	80.84	154	1
Rock Creek	Rock Creek	5847	10-year	123.000	3058.770	3061.6630	3061	3062	0	3.57	34.82	20	0
Rock Creek	Rock Creek	5847	25-year	159.000	3058.770	3061.9830	3061	3062	0	3.98	40.88	26	0
Rock Creek	Rock Creek	5847	50-year	190.000	3058.770	3062.2220	3061	3063	0	4.31	45.63	34	0
Rock Creek	Rock Creek	5847	100-year	223.000	3058.770	3062.4460	3061	3063	0	4.64	50.34	39	0
Rock Creek	Rock Creek	5847	500-year	298.000	3058.770	3062.8840	3062	3063	0	5.30	60.31	50	1
Rock Creek	Rock Creek	5847	1% plus	348.000	3058.770	3063.1470	3062	3064	0	5.68	66.77	92	1
Rock Creek	Rock Creek	6240	10-year	123.000	3065.890	3068.0760	3068	3068	0	4.00	31.22	21	1
Rock Creek	Rock Creek	6240	25-year	159.000	3065.890	3068.3730	3068	3069	0	4.36	37.73	23	1
Rock Creek	Rock Creek	6240	50-year	190.000	3065.890	3068.6120	3068	3069	0	4.60	43.35	24	1
Rock Creek	Rock Creek	6240	100-year	223.000	3065.890	3068.8500	3068	3069	0	4.82	49.25	25	1
Rock Creek	Rock Creek	6240	500-year	298.000	3065.890	3069.3430	3068	3070	0	5.24	62.36	33	1
Rock Creek	Rock Creek	6240	1% plus	348.000	3065.890	3069.6360	3069	3070	0	5.48	70.78	47	1
Rock Creek	Rock Creek	6578	10-year	123.000	3072.770	3075.0290	3074	3075	0	3.02	41.23	32	0
Rock Creek	Rock Creek	6578	25-year	159.000	3072.770	3075.3070	3074	3075	0	3.38	48.23	35	0
Rock Creek	Rock Creek	6578	50-year	190.000	3072.770	3075.5120	3075	3076	0	3.66	53.60	37	0
Rock Creek	Rock Creek	6578	100-year	223.000	3072.770	3075.7130	3075	3076	0	3.94	59.01	38	0
Rock Creek	Rock Creek	6578	500-year	298.000	3072.770	3076.1160	3075	3076	0	4.49	70.31	42	0
Rock Creek	Rock Creek	6578	1% plus	348.000	3072.770	3076.3590	3075	3077	0	4.81	77.40	44	0
Rock Creek	Rock Creek	6717	10-year	123.000	3076.750	3078.9030	3078	3079	0	4.07	31.29	25	1
Rock Creek	Rock Creek	6717	25-year	159.000	3076.750	3079.1660	3079	3079	0	4.42	38.09	30	1
Rock Creek	Rock Creek	6717	50-year	190.000	3076.750	3079.3800	3079	3080	0	4.65	44.03	34	1
Rock Creek	Rock Creek	6717	100-year	223.000	3076.750	3079.5890	3079	3080	0	4.88	50.17	37	1
Rock Creek	Rock Creek	6717	500-year	298.000	3076.750	3080.0180	3079	3080	0	5.31	63.64	45	1
Rock Creek	Rock Creek	6717	1% plus	348.000	3076.750	3080.2760	3080	3081	0	5.56	72.46	52	1
Rock Creek	Rock Creek	6870	10-year	123.000	3080.390	3082.1920	3081	3082	0	2.45	59.55	53	0
Rock Creek	Rock Creek	6870	25-year	159.000	3080.390	3082.3960	3082	3082	0	2.68	70.41	59	0
Rock Creek	Rock Creek	6870	50-year	190.000	3080.390	3082.5570	3082	3083	0	2.86	79.19	62	0
Rock Creek	Rock Creek	6870	100-year	223.000	3080.390	3082.7180	3082	3083	0	3.02	88.10	64	0
Rock Creek	Rock Creek	6870	500-year	298.000	3080.390	3083.0600	3082	3083	0	3.33	107.54	72	0
Rock Creek	Rock Creek	6870	1% plus	348.000	3080.390	3083.2710	3082	3083	0	3.50	119.83	81	0
Rock Creek	Rock Creek	6990	10-year	123.000	3082.660	3084.9630	3085	3085	0	5.86	25.18	28	1
Rock Creek	Rock Creek	6990	25-year	159.000	3082.660	3085.1770	3085	3086	0	6.34	31.56	32	1
Rock Creek	Rock Creek	6990	50-year	190.000	3082.660	3085.3790	3085	3086	0	6.46	39.25	45	1
Rock Creek	Rock Creek	6990	100-year	223.000	3082.660	3085.5660	3086	3086	0	6.59	48.29	51	1
Rock Creek	Rock Creek	6990	500-year	298.000	3082.660	3085.8640	3086	3086	0	7.08	65.02	61	1
Rock Creek	Rock Creek	6990	1% plus	348.000	3082.660	3086.0700	3086	3087	0	7.18	78.14	65	1
Rock Creek	Rock Creek	7149	10-year	123.000	3087.630	3089.5190	3089	3090	0	2.71	59.83	61	0
Rock Creek	Rock Creek	7149	25-year	159.000	3087.630	3089.7180	3089	3090	0	2.93	72.52	66	0
Rock Creek	Rock Creek	7149	50-year	190.000	3087.630	3089.8560	3089	3090	0	3.13	81.96	70	0
Rock Creek	Rock Creek	7149	100-year	223.000	3087.630	3089.9950	3089	3090	0	3.31	91.91	74	0
Rock Creek	Rock Creek	7149	500-year	298.000	3087.630	3090.3230	3090	3090	0	3.71	121.15	104	0
Rock Creek	Rock Creek	7149	1% plus	348.000	3087.630	3090.4590	3090	3091	0	3.90	135.63	109	0
Rock Creek	Rock Creek	7252	10-year	123.000	3089.000	3091.2700	3091	3092	0	5.23	26.95	24	1
Rock Creek	Rock Creek	7252	25-year	159.000	3089.000	3091.4630	3091	3092	0	5.87	31.81	29	1
Rock Creek	Rock Creek	7252	50-year	190.000	3089.000	3091.6220	3091	3092	0	6.32	36.38	40	1
Rock Creek	Rock Creek	7252	100-year	223.000	3089.000	3091.7710	3092	3092	0	6.70	42.33	52	1
Rock Creek	Rock Creek	7252	500-year	298.000	3089.000	3092.0860	3092	3093	0	7.28	59.04	76	1
Rock Creek	Rock Creek	7252	1% plus	348.000	3089.000	3092.3750	3092	3093	0	6.83	77.39	95	1
Rock Creek	Rock Creek	7474	10-year	123.000	3092.490	3095.4060	3095	3096	0	3.19	46.70	39	0
Rock Creek	Rock Creek	7474	25-year	159.000	3092.490	3095.6940	3095	3096	0	3.40	58.45	42	0
Rock Creek	Rock Creek	7474	50-year	190.000	3092.490	3095.9070	3095	3096	0	3.57	67.60	48	0
Rock Creek	Rock Creek	7474	100-year	223.000	3092.490	3096.1100	3095	3096	0	3.74	76.55	53	0
Rock Creek	Rock Creek	7474	500-year	298.000	3092.490	3096.5120	3096	3097	0	4.15	96.40	75	0
Rock Creek	Rock Creek	7474	1% plus	348.000	3092.490	3096.6270	3096	3097	0	4.59	102.52	83	0
Rock Creek	Rock Creek	7839	10-year	123.000	3099.380	3101.8350	3101	3102	0	4.22	30.12	20	1
Rock Creek	Rock Creek	7839	25-year	159.000	3099.380	3102.0670	3102	3102	0	4.78	34.80	21	1
Rock Creek	Rock Creek	7839	50-year	190.000	3099.380	3102.2520	3102	3103	0	5.17	38.70	21	1
Rock Creek	Rock Creek	7839	100-year	223.000	3099.380	3102.4410	3102	3103	0	5.54	42.80	22	1
Rock Creek	Rock Creek	7839	500-year	298.000	3099.380	3102.8780	3102	3103	0	6.12	52.76	24	1
Rock Creek	Rock Creek	7839	1% plus	348.000	3099.380	3103.2890	3103	3104	0	6.11	63.66	28	1
Rock Creek	Rock Creek	8147	10-year	123.000	3107.570	3110.2410	3110	3110	0	3.87	36.18	37	1
Rock Creek	Rock Creek	8147	25-year	159.000	3107.570	3110.4970	3110	3111	0	4.12	46.31	41	1
Rock Creek	Rock Creek	8147	50-year	190.000	3107.570	3110.6880	3110	3111	0	4.31	54.52	45	1
Rock Creek	Rock Creek	8147	100-year	223.000	3107.570	3110.8720	3110	3111	0	4.49	63.30	51	1
Rock Creek	Rock Creek	8147	500-year	298.000	3107.570	3111.2080	3111	3112	0	4.87	83.66	76	1
Rock Creek	Rock Creek	8147	1% plus	348.000	3107.570	3111.3390	3111	3112	0	5.21	92.66	79	1
Rock Creek	Rock Creek	8480	10-year	123.000	3114.480	3117.7700	3117	3118	0	3.60	39.96	28	0
Rock Creek	Rock Creek	8480	25-year	159.000	3114.480	3118.0100	3117	3118	0	4.05	46.98	30	0
Rock Creek	Rock Creek	8480	50-year	190.000	3114.480	3118.2000	3117	3118	0	4.38	52.84	32	0
Rock Creek	Rock Creek	8480	100-year	223.000	3114.480	3118.3850	3118	3119	0	4.69	58.78	33	1

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Rock Creek	Rock Creek	8480	500-year	298.000	3114.480	3118.7710	3118	3119	0	5.28	72.16	36	1
Rock Creek	Rock Creek	8480	1% plus	348.000	3114.480	3119.0550	3118	3119	0	5.47	83.02	41	1
Rock Creek	Rock Creek	8797	10-year	123.000	3122.540	3125.6020	3125	3126	0	4.68	27.95	21	1
Rock Creek	Rock Creek	8797	25-year	159.000	3122.540	3125.9360	3125	3126	0	5.02	35.50	24	1
Rock Creek	Rock Creek	8797	50-year	190.000	3122.540	3126.1930	3126	3127	0	5.32	42.86	40	1
Rock Creek	Rock Creek	8797	100-year	223.000	3122.540	3126.4040	3126	3127	0	5.52	50.80	45	1
Rock Creek	Rock Creek	8797	500-year	298.000	3122.540	3126.8050	3126	3127	0	5.88	66.83	52	1
Rock Creek	Rock Creek	8797	1% plus	348.000	3122.540	3127.0050	3127	3127	0	6.19	75.28	55	1
Rock Creek	Rock Creek	9241	10-year	123.000	3132.260	3135.1570	3135	3135	0	4.27	31.85	21	1
Rock Creek	Rock Creek	9241	25-year	159.000	3132.260	3135.4310	3135	3136	0	4.75	40.79	43	1
Rock Creek	Rock Creek	9241	50-year	190.000	3132.260	3135.6190	3135	3136	0	5.01	50.56	59	1
Rock Creek	Rock Creek	9241	100-year	223.000	3132.260	3135.7750	3135	3136	0	5.26	60.10	64	1
Rock Creek	Rock Creek	9241	500-year	298.000	3132.260	3136.0630	3136	3136	0	5.70	79.78	72	1
Rock Creek	Rock Creek	9241	1% plus	348.000	3132.260	3136.2640	3136	3137	0	5.87	96.58	91	1
Rock Creek	Rock Creek	9651	10-year	123.000	3140.020	3142.6680	3142	3143	0	4.06	34.00	32	1
Rock Creek	Rock Creek	9651	25-year	159.000	3140.020	3142.9550	3142	3143	0	4.32	47.78	59	1
Rock Creek	Rock Creek	9651	50-year	190.000	3140.020	3143.1300	3142	3143	0	4.53	58.95	70	1
Rock Creek	Rock Creek	9651	100-year	223.000	3140.020	3143.3020	3143	3144	0	4.71	72.50	91	1
Rock Creek	Rock Creek	9651	500-year	298.000	3140.020	3143.5700	3143	3144	0	4.93	97.19	94	1
Rock Creek	Rock Creek	9651	1% plus	348.000	3140.020	3143.7110	3143	3144	0	5.13	110.85	99	1
Twelvemile Creek	Lower	160.79	10-year	658.000	2938.250	2942.7920	2942	2943	0	6.12	110.44	223	1
Twelvemile Creek	Lower	160.79	25-year	801.000	2938.250	2943.1170	2942	2944	0	6.61	125.19	227	1
Twelvemile Creek	Lower	160.79	50-year	922.000	2938.250	2943.3730	2943	2944	0	6.98	136.80	231	1
Twelvemile Creek	Lower	160.79	100-year	1040.000	2938.250	2943.6100	2943	2944	0	7.32	147.55	248	1
Twelvemile Creek	Lower	160.79	500-year	1310.000	2938.250	2944.1120	2943	2945	0	8.01	170.32	325	1
Twelvemile Creek	Lower	160.79	1% plus	1622.000	2938.250	2944.6440	2944	2946	0	8.71	194.49	396	1
Twelvemile Creek	Lower	182	10-year	658.000	2938.280	2943.0160	2942	2944	0	6.13	107.81	154	1
Twelvemile Creek	Lower	182	25-year	801.000	2938.280	2943.3210	2942	2944	0	6.80	118.42	172	1
Twelvemile Creek	Lower	182	50-year	922.000	2938.280	2943.5570	2943	2944	0	7.32	126.65	176	1
Twelvemile Creek	Lower	182	100-year	1040.000	2938.280	2943.7730	2943	2945	0	7.80	134.14	181	1
Twelvemile Creek	Lower	182	500-year	1310.000	2938.280	2944.2170	2943	2945	0	8.81	149.58	199	1
Twelvemile Creek	Lower	182	1% plus	1622.000	2938.280	2944.6710	2944	2946	0	9.87	165.38	220	1
Twelvemile Creek	Lower	296		Culvert									
Twelvemile Creek	Lower	406	10-year	658.000	2942.860	2951.1330	2947	2951	0	3.64	196.45	80	0
Twelvemile Creek	Lower	406	25-year	801.000	2942.860	2952.0490	2947	2952	0	3.94	221.20	88	0
Twelvemile Creek	Lower	406	50-year	922.000	2942.860	2952.7740	2947	2953	0	4.17	240.78	108	0
Twelvemile Creek	Lower	406	100-year	1040.000	2942.860	2953.4450	2948	2954	0	4.37	258.91	135	0
Twelvemile Creek	Lower	406	500-year	1310.000	2942.860	2954.8840	2948	2955	0	4.79	297.80	147	0
Twelvemile Creek	Lower	406	1% plus	1622.000	2942.860	2956.4280	2949	2957	0	5.21	339.53	161	0
Twelvemile Creek	Lower	757	10-year	658.000	2945.280	2951.4460	2947	2951	0	1.11	932.78	215	0
Twelvemile Creek	Lower	757	25-year	801.000	2945.280	2952.3820	2948	2952	0	1.11	1136.59	220	0
Twelvemile Creek	Lower	757	50-year	922.000	2945.280	2953.1270	2948	2953	0	1.12	1302.06	224	0
Twelvemile Creek	Lower	757	100-year	1040.000	2945.280	2953.8190	2948	2954	0	1.13	1458.53	228	0
Twelvemile Creek	Lower	757	500-year	1310.000	2945.280	2955.3080	2948	2955	0	1.16	1802.83	234	0
Twelvemile Creek	Lower	757	1% plus	1622.000	2945.280	2956.9090	2948	2957	0	1.19	2183.31	242	0
Twelvemile Creek	Lower	1182	10-year	658.000	2950.310	2952.1060	2952	2953	0	7.67	144.03	140	1
Twelvemile Creek	Lower	1182	25-year	801.000	2950.310	2952.2610	2952	2953	0	8.16	165.93	144	1
Twelvemile Creek	Lower	1182	50-year	922.000	2950.310	2953.1280	2952	2953	0	5.46	327.87	219	1
Twelvemile Creek	Lower	1182	100-year	1040.000	2950.310	2953.8710	2953	2954	0	3.98	491.64	222	0
Twelvemile Creek	Lower	1182	500-year	1310.000	2950.310	2955.3630	2953	2955	0	2.89	826.90	228	0
Twelvemile Creek	Lower	1182	1% plus	1622.000	2950.310	2956.9550	2953	2957	0	2.44	1194.62	234	0
Twelvemile Creek	Lower	1538	10-year	658.000	2952.450	2954.4700	2952	2955	0	1.80	486.13	212	0
Twelvemile Creek	Lower	1538	25-year	801.000	2952.450	2954.7710	2952	2955	0	2.08	552.77	229	0
Twelvemile Creek	Lower	1538	50-year	922.000	2952.450	2954.8990	2953	2955	0	2.36	582.28	233	0
Twelvemile Creek	Lower	1538	100-year	1040.000	2952.450	2955.0470	2953	2955	0	2.54	616.82	234	0
Twelvemile Creek	Lower	1538	500-year	1310.000	2952.450	2955.8790	2953	2956	0	2.51	812.82	237	0
Twelvemile Creek	Lower	1538	1% plus	1622.000	2952.450	2957.2100	2953	2957	0	2.31	1132.20	243	0
Twelvemile Creek	Lower	1822	10-year	658.000	2953.910	2955.6390	2955	2956	0	6.23	159.05	341	1
Twelvemile Creek	Lower	1822	25-year	801.000	2953.910	2955.9420	2956	2956	0	6.10	209.90	373	1
Twelvemile Creek	Lower	1822	50-year	922.000	2953.910	2956.1900	2956	2957	0	5.96	257.27	380	1
Twelvemile Creek	Lower	1822	100-year	1040.000	2953.910	2956.3550	2956	2957	0	5.97	289.63	385	1
Twelvemile Creek	Lower	1822	500-year	1310.000	2953.910	2956.7140	2956	2957	0	6.03	363.42	401	1
Twelvemile Creek	Lower	1822	1% plus	1622.000	2953.910	2957.6060	2956	2958	0	5.00	573.49	433	0
Twelvemile Creek	Lower	1987	10-year	658.000	2955.310	2957.9230	2957	2958	0	3.97	260.14	667	0
Twelvemile Creek	Lower	1987	25-year	801.000	2955.310	2958.0940	2957	2958	0	4.43	286.81	677	1
Twelvemile Creek	Lower	1987	50-year	922.000	2955.310	2958.2180	2957	2958	0	4.79	306.26	680	1
Twelvemile Creek	Lower	1987	100-year	1040.000	2955.310	2958.3340	2957	2959	0	5.11	324.98	683	1
Twelvemile Creek	Lower	1987	500-year	1310.000	2955.310	2958.5760	2958	2959	0	5.75	364.71	686	1
Twelvemile Creek	Lower	1987	1% plus	1622.000	2955.310	2958.7870	2958	2959	0	6.49	399.41	687	1
Twelvemile Creek	Lower	2117	10-year	658.000	2956.450	2958.9280	2959	2960	0	6.61	107.25	258	1
Twelvemile Creek	Lower	2117	25-year	801.000	2956.450	2959.1690	2959	2960	0	7.13	126.05	301	1
Twelvemile Creek	Lower	2117	50-year	922.000	2956.450	2959.3530	2959	2960	0	7.52	142.15	336	1
Twelvemile Creek	Lower	2117	100-year	1040.000	2956.450	2959.5170	2959	2960	0	7.85	157.49	369	1
Twelvemile Creek	Lower	2117	500-year	1310.000	2956.450	2959.8430	2960	2961	0	8.55	189.11	424	1
Twelvemile Creek	Lower	2117	1% plus	1622.000	2956.450	2960.1840	2960	2961	0	9.22	223.43	462	1
Twelvemile Creek	Lower	2310	10-year	658.000	2957.390	2960.9990	2960	2961	0	3.86	279.97	265	0
Twelvemile Creek	Lower	2310	25-year	801.000	2957.390	2961.3100	2960	2961	0	4.07	323.37	291	0
Twelvemile Creek	Lower	2310	50-year	922.000	2957.390	2961.5510	2960	2962	0	4.24	357.28	301	0
Twelvemile Creek	Lower	2310	100-year	1040.000	2957.390	2961.7830	2960	2962	0	4.44	390.99	338	0
Twelvemile Creek	Lower	2310	500-year	1310.000	2957.390	2962.2490	2961	2962	0	4.82	462.41	406	0
Twelvemile Creek	Lower	2310	1% plus	1622.000	2957.390	2962.7060	2961	2963	0	5.13	535.12	561	0
Twelvemile Creek	Lower	2461	10-year	658.000	2958.610	2961.7990	2961	2962	0	2.87	275.24	238	0
Twelvemile Creek	Lower	2461	25-year	801.000	2958.610	2962.0950	2961	2962	0	3.08	314.03	276	0
Twelvemile Creek	Lower	2461	50-year	922.000	2958.610	2962.3300	2961	2962	0	3.23	345.45	291	0
Twelvemile Creek	Lower	2461	100-year	1040.000	2958.610	2962.5670	2961	2963	0	3.38	377.80	312	0
Twelvemile Creek	Lower	2461	500-year	1310.000	2958.610	2963.0480	2961	2963	0	3.72	449.59	401	0
Twelvemile Creek	Lower	2461	1% plus	1622.000	2958.610	2963.4980	2961	2964	0	3.99	520.16	475	0
Twelvemile Creek	Middle	2853	10-year	577.000	2963.130	2965.2230	2964	2965	0	3.55	209.29	145	0
Twelvemile Creek	Middle	2853	25-year	702.000	2963.130	2965.4350	2965	2966	0	3.73	239.93	145	0
Twelvemile Creek	Middle	2853	50-year	808.000	2963.130	2965.6050	2965	2966	0	3.86	264.69	145	0
Twelvemile Creek	Middle	2853	100-year	915.000	2963.130	2965.7730	2965	2966	0	3.98	289.00	145	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Twelvemile Creek	Middle	2853	500-year	1150.000	2963.130	2966.1520	2965	2966	0	4.16	344.25	146	0
Twelvemile Creek	Middle	2853	1% plus	1427.000	2963.130	2966.5230	2965	2967	0	4.43	398.64	147	0
Twelvemile Creek	Middle	3147		Lat Struct									
Twelvemile Creek	Middle	3154	10-year	577.000	2965.420	2969.2720	2968	2970	0	5.07	138.39	88	0
Twelvemile Creek	Middle	3154	25-year	702.000	2965.420	2969.5190	2968	2970	0	5.53	161.09	93	1
Twelvemile Creek	Middle	3154	50-year	808.000	2965.420	2969.7030	2969	2970	0	5.85	178.47	95	1
Twelvemile Creek	Middle	3154	100-year	915.000	2965.420	2969.8670	2969	2970	0	6.17	194.05	96	1
Twelvemile Creek	Middle	3154	500-year	1150.000	2965.420	2970.1640	2970	2971	0	6.88	222.99	99	1
Twelvemile Creek	Middle	3154	1% plus	1427.000	2965.420	2970.5110	2970	2971	0	7.48	258.11	103	1
Twelvemile Creek	Middle	3299	10-year	577.000	2968.100	2971.1320	2970	2971	0	3.90	189.48	91	0
Twelvemile Creek	Middle	3299	25-year	702.000	2968.100	2971.4520	2970	2972	0	4.12	218.96	93	0
Twelvemile Creek	Middle	3299	50-year	808.000	2968.100	2971.6910	2970	2972	0	4.31	241.45	95	0
Twelvemile Creek	Middle	3299	100-year	915.000	2968.100	2971.9180	2971	2972	0	4.49	263.35	97	0
Twelvemile Creek	Middle	3299	500-year	1150.000	2968.100	2972.3730	2971	2973	0	4.85	308.56	102	0
Twelvemile Creek	Middle	3299	1% plus	1427.000	2968.100	2972.8400	2971	2973	0	5.27	357.62	109	0
Twelvemile Creek	Middle	3409	10-year	577.000	2969.740	2972.5340	2972	2973	0	4.70	146.15	85	1
Twelvemile Creek	Middle	3409	25-year	702.000	2969.740	2972.7960	2972	2973	0	4.97	168.59	87	1
Twelvemile Creek	Middle	3409	50-year	808.000	2969.740	2973.0060	2972	2973	0	5.17	186.94	88	1
Twelvemile Creek	Middle	3409	100-year	915.000	2969.740	2973.2080	2972	2974	0	5.35	204.86	89	1
Twelvemile Creek	Middle	3409	500-year	1150.000	2969.740	2973.6220	2973	2974	0	5.71	242.29	92	1
Twelvemile Creek	Middle	3409	1% plus	1427.000	2969.740	2974.0730	2973	2975	0	6.05	284.11	94	1
Twelvemile Creek	Middle	3595	10-year	577.000	2970.690	2975.2190	2974	2976	0	4.95	117.51	34	0
Twelvemile Creek	Middle	3595	25-year	702.000	2970.690	2975.5520	2974	2976	0	5.51	129.01	35	0
Twelvemile Creek	Middle	3595	50-year	808.000	2970.690	2975.8060	2974	2976	0	5.96	137.96	36	1
Twelvemile Creek	Middle	3595	100-year	915.000	2970.690	2976.0390	2975	2977	0	6.39	146.35	36	1
Twelvemile Creek	Middle	3595	500-year	1150.000	2970.690	2976.4910	2975	2977	0	7.27	162.97	37	1
Twelvemile Creek	Middle	3595	1% plus	1427.000	2970.690	2976.9370	2976	2978	0	8.24	179.89	39	1
Twelvemile Creek	Middle	3922	10-year	577.000	2974.060	2978.5510	2977	2979	0	4.32	138.79	45	0
Twelvemile Creek	Middle	3922	25-year	702.000	2974.060	2979.0350	2977	2979	0	4.60	161.23	48	0
Twelvemile Creek	Middle	3922	50-year	808.000	2974.060	2979.4120	2977	2980	0	4.82	179.68	50	0
Twelvemile Creek	Middle	3922	100-year	915.000	2974.060	2979.7680	2978	2980	0	5.02	197.90	52	0
Twelvemile Creek	Middle	3922	500-year	1150.000	2974.060	2980.4870	2978	2981	0	5.40	238.86	62	0
Twelvemile Creek	Middle	3922	1% plus	1427.000	2974.060	2981.2350	2979	2982	0	5.76	291.29	78	0
Twelvemile Creek	Middle	4127	10-year	577.000	2976.470	2980.4400	2979	2981	0	3.87	153.84	67	0
Twelvemile Creek	Middle	4127	25-year	702.000	2976.470	2980.8430	2979	2981	0	4.08	182.93	82	0
Twelvemile Creek	Middle	4127	50-year	808.000	2976.470	2981.1660	2979	2981	0	4.20	211.26	90	0
Twelvemile Creek	Middle	4127	100-year	915.000	2976.470	2981.4750	2980	2982	0	4.29	239.33	92	0
Twelvemile Creek	Middle	4127	500-year	1150.000	2976.470	2982.1150	2980	2982	0	4.43	298.94	95	0
Twelvemile Creek	Middle	4127	1% plus	1427.000	2976.470	2982.7940	2981	2983	0	4.58	364.12	98	0
Twelvemile Creek	Middle	4387	10-year	577.000	2979.110	2983.4380	2982	2984	0	5.29	111.93	43	1
Twelvemile Creek	Middle	4387	25-year	702.000	2979.110	2983.7530	2983	2984	0	5.81	125.93	47	1
Twelvemile Creek	Middle	4387	50-year	808.000	2979.110	2983.9880	2983	2985	0	6.23	137.69	53	1
Twelvemile Creek	Middle	4387	100-year	915.000	2979.110	2984.1930	2983	2985	0	6.67	149.61	63	1
Twelvemile Creek	Middle	4387	500-year	1150.000	2979.110	2984.5860	2984	2985	0	7.42	174.64	64	1
Twelvemile Creek	Middle	4387	1% plus	1427.000	2979.110	2985.0200	2984	2986	0	8.11	202.98	66	1
Twelvemile Creek	Middle	4764	10-year	577.000	2983.560	2987.8620	2986	2988	0	3.83	152.73	56	0
Twelvemile Creek	Middle	4764	25-year	702.000	2983.560	2988.2750	2986	2989	0	4.09	176.36	59	0
Twelvemile Creek	Middle	4764	50-year	808.000	2983.560	2988.6000	2987	2989	0	4.29	195.73	61	0
Twelvemile Creek	Middle	4764	100-year	915.000	2983.560	2988.9170	2987	2989	0	4.46	215.23	62	0
Twelvemile Creek	Middle	4764	500-year	1150.000	2983.560	2989.5170	2987	2990	0	4.84	253.48	65	0
Twelvemile Creek	Middle	4764	1% plus	1427.000	2983.560	2990.1280	2988	2991	0	5.24	294.40	69	0
Twelvemile Creek	Middle	5197	10-year	577.000	2988.230	2992.1580	2991	2992	0	4.54	128.21	48	0
Twelvemile Creek	Middle	5197	25-year	702.000	2988.230	2992.5070	2991	2993	0	4.92	145.77	52	0
Twelvemile Creek	Middle	5197	50-year	808.000	2988.230	2992.7820	2991	2993	0	5.21	160.25	53	0
Twelvemile Creek	Middle	5197	100-year	915.000	2988.230	2993.0400	2992	2993	0	5.47	174.25	55	0
Twelvemile Creek	Middle	5197	500-year	1150.000	2988.230	2993.5770	2992	2994	0	5.96	204.54	58	0
Twelvemile Creek	Middle	5197	1% plus	1427.000	2988.230	2994.1570	2993	2995	0	6.44	238.70	60	1
Twelvemile Creek	Middle	5634	10-year	577.000	2992.480	2996.9930	2995	2997	0	4.39	133.74	43	0
Twelvemile Creek	Middle	5634	25-year	702.000	2992.480	2997.4040	2996	2998	0	4.75	152.06	46	0
Twelvemile Creek	Middle	5634	50-year	808.000	2992.480	2997.7190	2996	2998	0	5.03	166.72	47	0
Twelvemile Creek	Middle	5634	100-year	915.000	2992.480	2998.0220	2996	2998	0	5.28	181.51	50	0
Twelvemile Creek	Middle	5634	500-year	1150.000	2992.480	2998.6110	2997	2999	0	5.80	212.67	56	0
Twelvemile Creek	Middle	5634	1% plus	1427.000	2992.480	2999.2130	2997	3000	0	6.32	248.18	61	0
Twelvemile Creek	Middle	6053	10-year	577.000	2996.590	3001.4950	3000	3002	0	5.16	112.46	32	0
Twelvemile Creek	Middle	6053	25-year	702.000	2996.590	3001.9480	3000	3002	0	5.61	127.60	36	0
Twelvemile Creek	Middle	6053	50-year	808.000	2996.590	3002.3010	3000	3003	0	5.94	141.12	41	0
Twelvemile Creek	Middle	6053	100-year	915.000	2996.590	3002.6270	3001	3003	0	6.23	154.54	42	0
Twelvemile Creek	Middle	6053	500-year	1150.000	2996.590	3003.2810	3001	3004	0	6.80	182.64	44	1
Twelvemile Creek	Middle	6053	1% plus	1427.000	2996.590	3003.9570	3002	3005	0	7.38	213.14	46	1
Twelvemile Creek	Middle	6524	10-year	577.000	3001.850	3006.1590	3005	3006	0	3.74	174.80	72	0
Twelvemile Creek	Middle	6524	25-year	702.000	3001.850	3006.5680	3005	3007	0	3.93	204.81	75	0
Twelvemile Creek	Middle	6524	50-year	808.000	3001.850	3006.8910	3005	3007	0	4.08	229.14	76	0
Twelvemile Creek	Middle	6524	100-year	915.000	3001.850	3007.1950	3005	3007	0	4.21	252.64	78	0
Twelvemile Creek	Middle	6524	500-year	1150.000	3001.850	3007.8150	3006	3008	0	4.48	301.84	81	0
Twelvemile Creek	Middle	6524	1% plus	1427.000	3001.850	3008.4800	3006	3009	0	4.75	356.69	84	0
Twelvemile Creek	Middle	6739	10-year	577.000	3005.060	3008.5220	3008	3009	0	5.58	103.65	41	1
Twelvemile Creek	Middle	6739	25-year	702.000	3005.060	3008.8190	3008	3009	0	6.09	116.04	42	1
Twelvemile Creek	Middle	6739	50-year	808.000	3005.060	3009.0540	3008	3010	0	6.48	126.09	43	1
Twelvemile Creek	Middle	6739	100-year	915.000	3005.060	3009.2800	3008	3010	0	6.84	135.91	44	1
Twelvemile Creek	Middle	6739	500-year	1150.000	3005.060	3009.7420	3009	3011	0	7.53	156.52	45	1
Twelvemile Creek	Middle	6739	1% plus	1427.000	3005.060	3010.2440	3009	3011	0	8.21	180.00	51	1
Twelvemile Creek	Middle	6755		Bridge									
Twelvemile Creek	Middle	6768	10-year	577.000	3006.710	3009.2850	3009	3010	0	5.06	115.73	60	1
Twelvemile Creek	Middle	6768	25-year	702.000	3006.710	3009.6020	3009	3010	0	5.34	134.98	61	1
Twelvemile Creek	Middle	6768	50-year	808.000	3006.710	3009.8600	3009	3010	0	5.53	150.97	63	1
Twelvemile Creek	Middle	6768	100-year	915.000	3006.710	3010.1230	3009	3011	0	5.68	167.58	64	1
Twelvemile Creek	Middle	6768	500-year	1150.000	3006.710	3010.6800	3010	3011	0	5.94	203.60	66	1
Twelvemile Creek	Middle	6768	1% plus	1427.000	3006.710	3011.2800	3010	3012	0	6.22	243.49	67	1
Twelvemile Creek	Middle	6931	10-year	577.000	3006.910	3011.5100	3010	3012	0	3.68	195.50	111	0
Twelvemile Creek	Middle	6931	25-year	702.000	3006.910	3011.8110	3011	3012	0	3.91	235.26	150	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Twelvemile Creek	Middle	6931	50-year	808.000	3006.910	3012.0450	3011	3012	0	4.09	273.62	176	0
Twelvemile Creek	Middle	6931	100-year	915.000	3006.910	3012.2560	3011	3012	0	4.19	312.14	188	0
Twelvemile Creek	Middle	6931	500-year	1150.000	3006.910	3012.6800	3011	3013	0	4.31	392.84	195	0
Twelvemile Creek	Middle	6931	1% plus	1427.000	3006.910	3013.1680	3012	3013	0	4.38	492.25	210	0
Twelvemile Creek	Middle	7326	10-year	577.000	3011.330	3014.7600	3013	3015	0	3.53	165.33	76	0
Twelvemile Creek	Middle	7326	25-year	702.000	3011.330	3015.0580	3014	3015	0	3.82	190.17	86	0
Twelvemile Creek	Middle	7326	50-year	808.000	3011.330	3015.2940	3014	3016	0	4.03	210.89	91	0
Twelvemile Creek	Middle	7326	100-year	915.000	3011.330	3015.4910	3014	3016	0	4.25	229.15	94	0
Twelvemile Creek	Middle	7326	500-year	1150.000	3011.330	3015.8490	3014	3016	0	4.74	264.03	100	0
Twelvemile Creek	Middle	7326	1% plus	1427.000	3011.330	3016.2020	3015	3017	0	5.26	300.13	104	0
Twelvemile Creek	Middle	7759	10-year	577.000	3018.170	3020.7810	3020	3021	0	5.15	185.20	187	1
Twelvemile Creek	Middle	7759	25-year	702.000	3018.170	3020.9880	3020	3021	0	5.30	226.38	207	1
Twelvemile Creek	Middle	7759	50-year	808.000	3018.170	3021.1290	3021	3021	0	5.37	256.04	214	1
Twelvemile Creek	Middle	7759	100-year	915.000	3018.170	3021.2770	3021	3022	0	5.37	288.22	222	1
Twelvemile Creek	Middle	7759	500-year	1150.000	3018.170	3021.5990	3021	3022	0	5.36	362.46	235	1
Twelvemile Creek	Middle	7759	1% plus	1427.000	3018.170	3021.9320	3021	3022	0	5.34	441.93	241	1
Twelvemile Creek	Middle	8129	10-year	577.000	3022.660	3025.3870	3024	3025	0	3.02	242.11	141	0
Twelvemile Creek	Middle	8129	25-year	702.000	3022.660	3025.6070	3024	3026	0	3.27	273.97	149	0
Twelvemile Creek	Middle	8129	50-year	808.000	3022.660	3025.7670	3025	3026	0	3.48	298.41	162	0
Twelvemile Creek	Middle	8129	100-year	915.000	3022.660	3025.9050	3025	3026	0	3.68	322.87	190	0
Twelvemile Creek	Middle	8129	500-year	1150.000	3022.660	3026.1520	3025	3026	0	4.08	372.73	216	0
Twelvemile Creek	Middle	8129	1% plus	1427.000	3022.660	3026.3960	3025	3027	0	4.49	429.51	252	0
Twelvemile Creek	Middle	8742	10-year	577.000	3028.410	3031.5990	3031	3032	0	4.23	174.17	150	0
Twelvemile Creek	Middle	8742	25-year	702.000	3028.410	3031.8410	3031	3032	0	4.41	213.14	167	0
Twelvemile Creek	Middle	8742	50-year	808.000	3028.410	3032.0280	3031	3032	0	4.51	245.01	174	0
Twelvemile Creek	Middle	8742	100-year	915.000	3028.410	3032.2080	3031	3032	0	4.59	276.77	179	0
Twelvemile Creek	Middle	8742	500-year	1150.000	3028.410	3032.5670	3032	3033	0	4.76	344.03	191	0
Twelvemile Creek	Middle	8742	1% plus	1427.000	3028.410	3032.9170	3032	3033	0	4.91	411.28	193	0
Twelvemile Creek	Middle	9224	10-year	577.000	3033.020	3036.4880	3035	3037	0	2.81	242.28	166	0
Twelvemile Creek	Middle	9224	25-year	702.000	3033.020	3036.7080	3036	3037	0	3.03	280.15	173	0
Twelvemile Creek	Middle	9224	50-year	808.000	3033.020	3036.8630	3036	3037	0	3.20	306.95	174	0
Twelvemile Creek	Middle	9224	100-year	915.000	3033.020	3037.0050	3036	3037	0	3.36	331.74	174	0
Twelvemile Creek	Middle	9224	500-year	1150.000	3033.020	3037.2950	3036	3037	0	3.67	383.59	184	0
Twelvemile Creek	Middle	9224	1% plus	1427.000	3033.020	3037.5890	3036	3038	0	4.00	439.03	193	0
Twelvemile Creek	Middle	9684	10-year	577.000	3037.930	3040.7730	3040	3041	0	3.84	206.24	158	0
Twelvemile Creek	Middle	9684	25-year	702.000	3037.930	3040.9940	3040	3041	0	4.00	242.68	171	0
Twelvemile Creek	Middle	9684	50-year	808.000	3037.930	3041.1670	3040	3041	0	4.13	273.58	184	0
Twelvemile Creek	Middle	9684	100-year	915.000	3037.930	3041.3270	3040	3041	0	4.23	303.42	190	0
Twelvemile Creek	Middle	9684	500-year	1150.000	3037.930	3041.6360	3041	3042	0	4.43	363.72	197	0
Twelvemile Creek	Middle	9684	1% plus	1427.000	3037.930	3041.9470	3041	3042	0	4.59	426.12	204	0
Twelvemile Creek	Middle	10149	10-year	577.000	3043.660	3047.0480	3046	3047	0	3.61	220.28	166	0
Twelvemile Creek	Middle	10149	25-year	702.000	3043.660	3047.2320	3046	3047	0	3.89	251.80	180	0
Twelvemile Creek	Middle	10149	50-year	808.000	3043.660	3047.3780	3047	3048	0	4.11	278.86	190	0
Twelvemile Creek	Middle	10149	100-year	915.000	3043.660	3047.5270	3047	3048	0	4.35	307.56	195	0
Twelvemile Creek	Middle	10149	500-year	1150.000	3043.660	3047.7680	3047	3048	0	4.71	355.17	200	0
Twelvemile Creek	Middle	10149	1% plus	1427.000	3043.660	3048.0100	3047	3048	0	5.11	404.46	208	1
Twelvemile Creek	Middle	10597	10-year	577.000	3050.120	3052.3390	3051	3052	0	3.25	211.66	146	0
Twelvemile Creek	Middle	10597	25-year	702.000	3050.120	3052.5810	3052	3053	0	3.48	248.15	155	0
Twelvemile Creek	Middle	10597	50-year	808.000	3050.120	3052.7640	3052	3053	0	3.65	277.26	165	0
Twelvemile Creek	Middle	10597	100-year	915.000	3050.120	3052.9370	3052	3053	0	3.78	306.36	173	0
Twelvemile Creek	Middle	10597	500-year	1150.000	3050.120	3053.2800	3052	3053	0	4.12	371.79	207	0
Twelvemile Creek	Middle	10597	1% plus	1427.000	3050.120	3053.6040	3052	3054	0	4.37	440.25	216	0
Twelvemile Creek	Middle	11043	10-year	577.000	3055.410	3057.5560	3057	3058	0	2.98	243.49	253	0
Twelvemile Creek	Middle	11043	25-year	702.000	3055.410	3057.7880	3057	3058	0	3.30	297.02	295	0
Twelvemile Creek	Middle	11043	50-year	808.000	3055.410	3057.9200	3057	3058	0	3.43	330.01	300	0
Twelvemile Creek	Middle	11043	100-year	915.000	3055.410	3058.0340	3057	3058	0	3.55	358.55	303	0
Twelvemile Creek	Middle	11043	500-year	1150.000	3055.410	3058.2820	3057	3058	0	3.75	421.87	309	0
Twelvemile Creek	Middle	11043	1% plus	1427.000	3055.410	3058.5350	3057	3059	0	4.02	487.76	318	0
Twelvemile Creek	Upper	11326.35	10-year	511.000	3057.610	3060.7210	3060	3061	0	3.65	185.27	146	0
Twelvemile Creek	Upper	11326.35	25-year	622.000	3057.610	3060.9620	3060	3061	0	3.86	214.80	169	0
Twelvemile Creek	Upper	11326.35	50-year	715.000	3057.610	3061.1220	3060	3061	0	4.07	236.48	188	0
Twelvemile Creek	Upper	11326.35	100-year	809.000	3057.610	3061.2830	3060	3061	0	4.31	259.95	206	0
Twelvemile Creek	Upper	11326.35	500-year	1010.000	3057.610	3061.5400	3061	3062	0	4.69	299.02	217	0
Twelvemile Creek	Upper	11326.35	1% plus	1262.000	3057.610	3061.8420	3061	3062	0	5.07	347.01	230	0
Twelvemile Creek	Upper	11504	10-year	511.000	3059.320	3063.2430	3063	3064	0	6.24	86.83	55	1
Twelvemile Creek	Upper	11504	25-year	621.926	3059.320	3063.5220	3063	3064	0	6.86	97.69	61	1
Twelvemile Creek	Upper	11504	50-year	713.877	3059.320	3063.7520	3063	3065	0	7.27	107.18	71	1
Twelvemile Creek	Upper	11504	100-year	803.018	3059.320	3063.9770	3063	3065	0	7.58	116.99	84	1
Twelvemile Creek	Upper	11504	500-year	962.552	3059.320	3064.2480	3064	3065	0	7.68	163.98	91	1
Twelvemile Creek	Upper	11504	1% plus	1203.691	3059.320	3064.6320	3064	3065	0	8.19	200.00	98	1
Twelvemile Creek	Upper	11532		Bridge									
Twelvemile Creek	Upper	11560	10-year	511.000	3060.210	3064.7080	3063	3065	0	3.92	140.20	51	0
Twelvemile Creek	Upper	11560	25-year	621.926	3060.210	3064.9230	3063	3065	0	4.47	151.34	53	0
Twelvemile Creek	Upper	11560	50-year	713.877	3060.210	3065.2080	3064	3066	0	4.71	166.56	54	0
Twelvemile Creek	Upper	11560	100-year	803.018	3060.210	3065.6530	3064	3066	0	4.69	191.23	57	0
Twelvemile Creek	Upper	11560	500-year	962.552	3060.210	3066.8060	3064	3067	0	4.33	263.10	77	0
Twelvemile Creek	Upper	11560	1% plus	1203.691	3060.210	3066.9130	3065	3067	0	5.28	270.72	79	0
Twelvemile Creek	Upper	11640		Lat Struct									
Twelvemile Creek	Upper	11665	10-year	511.000	3061.270	3065.7050	3065	3066	0	4.76	117.40	51	0
Twelvemile Creek	Upper	11665	25-year	622.000	3061.270	3066.0420	3065	3066	0	5.16	135.74	60	0
Twelvemile Creek	Upper	11665	50-year	715.000	3061.270	3066.3200	3065	3067	0	5.37	152.94	63	0
Twelvemile Creek	Upper	11665	100-year	809.000	3061.270	3066.6380	3065	3067	0	5.45	173.66	67	0
Twelvemile Creek	Upper	11665	500-year	1010.000	3061.270	3067.4620	3066	3068	0	5.26	234.16	88	0
Twelvemile Creek	Upper	11665	1% plus	1262.000	3061.270	3067.7900	3066	3068	0	5.93	265.50	102	0
Twelvemile Creek	Upper	11861	10-year	511.000	3065.050	3068.6740	3068	3069	0	4.59	134.65	87	1
Twelvemile Creek	Upper	11861	25-year	622.000	3065.050	3068.9700	3068	3069	0	4.74	160.78	89	1
Twelvemile Creek	Upper	11861	50-year	715.000	3065.050	3069.1800	3069	3069	0	4.91	179.60	90	1
Twelvemile Creek	Upper	11861	100-year	809.000	3065.050	3069.3620	3069	3070	0	5.10	196.20	92	1
Twelvemile Creek	Upper	11861	500-year	1010.000	3065.050	3069.6950	3069	3070	0	5.53	227.18	94	1
Twelvemile Creek	Upper	11861	1% plus	1262.000	3065.050	3070.1810	3069	3071	0	5.76	273.73	97	1

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Twelvemile Creek	Upper	12140	10-year	511.000	3070.040	3073.3790	3073	3074	0	4.83	164.12	140	1
Twelvemile Creek	Upper	12140	25-year	622.000	3070.040	3073.5500	3073	3074	0	5.15	188.50	145	1
Twelvemile Creek	Upper	12140	50-year	715.000	3070.040	3073.7050	3073	3074	0	5.34	211.72	154	1
Twelvemile Creek	Upper	12140	100-year	809.000	3070.040	3073.8500	3073	3074	0	5.46	234.38	158	1
Twelvemile Creek	Upper	12140	500-year	1010.000	3070.040	3074.1510	3074	3074	0	5.62	283.13	164	1
Twelvemile Creek	Upper	12140	1% plus	1262.000	3070.040	3074.4410	3074	3075	0	5.93	330.96	167	1
Twelvemile Creek	Upper	12345	10-year	511.000	3074.000	3077.2460	3077	3078	0	5.33	114.98	112	1
Twelvemile Creek	Upper	12345	25-year	622.000	3074.000	3077.4730	3077	3078	0	5.59	143.35	140	1
Twelvemile Creek	Upper	12345	50-year	715.000	3074.000	3077.6170	3077	3078	0	5.79	164.08	147	1
Twelvemile Creek	Upper	12345	100-year	809.000	3074.000	3077.7400	3078	3078	0	5.99	182.38	152	1
Twelvemile Creek	Upper	12345	500-year	1010.000	3074.000	3077.9560	3078	3078	0	6.44	216.01	160	1
Twelvemile Creek	Upper	12345	1% plus	1262.000	3074.000	3078.2240	3078	3079	0	6.77	260.44	171	1
Twelvemile Creek	Upper	12753	10-year	511.000	3083.000	3084.3110	3084	3084	0	2.13	284.79	327	0
Twelvemile Creek	Upper	12753	25-year	622.000	3083.000	3084.4660	3084	3085	0	2.35	337.50	357	0
Twelvemile Creek	Upper	12753	50-year	715.000	3083.000	3084.5660	3084	3085	0	2.47	373.86	368	0
Twelvemile Creek	Upper	12753	100-year	809.000	3083.000	3084.6570	3084	3085	0	2.57	407.82	374	0
Twelvemile Creek	Upper	12753	500-year	1010.000	3083.000	3084.8490	3084	3085	0	2.74	480.67	387	0
Twelvemile Creek	Upper	12753	1% plus	1262.000	3083.000	3085.0520	3084	3085	0	2.96	560.53	395	0
Twelvemile Creek	Upper	13023	10-year	511.000	3085.050	3087.5960	3088	3088	0	3.33	125.10	173	0
Twelvemile Creek	Upper	13023	25-year	622.000	3085.050	3087.7090	3088	3088	0	3.45	145.62	191	0
Twelvemile Creek	Upper	13023	50-year	715.000	3085.050	3087.7890	3088	3088	0	3.58	161.45	207	0
Twelvemile Creek	Upper	13023	100-year	809.000	3085.050	3087.8640	3088	3088	0	3.69	177.79	232	0
Twelvemile Creek	Upper	13023	500-year	1010.000	3085.050	3087.9960	3088	3088	0	3.90	211.16	258	0
Twelvemile Creek	Upper	13023	1% plus	1262.000	3085.050	3088.1380	3088	3089	0	4.07	248.28	266	0
Twelvemile Creek	Upper	13319	10-year	511.000	3089.530	3092.4680	3092	3093	0	5.45	120.80	137	1
Twelvemile Creek	Upper	13319	25-year	622.000	3089.530	3092.6400	3092	3093	0	5.84	138.95	157	1
Twelvemile Creek	Upper	13319	50-year	715.000	3089.530	3092.7810	3093	3093	0	6.05	155.08	176	1
Twelvemile Creek	Upper	13319	100-year	809.000	3089.530	3092.9280	3093	3093	0	6.32	172.98	203	1
Twelvemile Creek	Upper	13319	500-year	1010.000	3089.530	3093.1840	3093	3094	0	6.75	208.40	247	1
Twelvemile Creek	Upper	13319	1% plus	1262.000	3089.530	3093.4310	3093	3094	0	7.22	246.81	267	1
Twelvemile Creek	Upper	13621	10-year	511.000	3093.640	3097.2980	3096	3098	0	4.16	124.10	72	0
Twelvemile Creek	Upper	13621	25-year	622.000	3093.640	3097.6160	3096	3098	0	4.50	139.73	81	0
Twelvemile Creek	Upper	13621	50-year	715.000	3093.640	3097.8360	3097	3098	0	4.80	150.67	82	0
Twelvemile Creek	Upper	13621	100-year	809.000	3093.640	3098.0650	3097	3098	0	5.05	162.16	84	0
Twelvemile Creek	Upper	13621	500-year	1010.000	3093.640	3098.4790	3097	3099	0	5.60	183.37	88	0
Twelvemile Creek	Upper	13621	1% plus	1262.000	3093.640	3098.9370	3098	3100	0	6.19	208.27	109	1
Twelvemile Creek	Upper	13658		Bridge									
Twelvemile Creek	Upper	13685	10-year	511.000	3095.040	3098.4470	3097	3099	0	3.59	143.51	56	0
Twelvemile Creek	Upper	13685	25-year	622.000	3095.040	3099.1940	3097	3099	0	3.42	184.60	95	0
Twelvemile Creek	Upper	13685	50-year	715.000	3095.040	3099.4440	3097	3100	0	3.66	198.32	114	0
Twelvemile Creek	Upper	13685	100-year	809.000	3095.040	3099.7910	3098	3100	0	3.78	217.39	146	0
Twelvemile Creek	Upper	13685	500-year	1010.000	3095.040	3101.1270	3098	3101	0	3.53	290.89	198	0
Twelvemile Creek	Upper	13685	1% plus	1262.000	3095.040	3101.3820	3098	3102	0	4.21	304.91	215	0
Twelvemile Creek	Upper	13821	10-year	511.000	3097.290	3100.1520	3100	3100	0	4.59	137.66	130	1
Twelvemile Creek	Upper	13821	25-year	622.000	3097.290	3100.4180	3100	3101	0	4.63	176.17	169	1
Twelvemile Creek	Upper	13821	50-year	715.000	3097.290	3100.6480	3100	3101	0	4.53	217.26	190	1
Twelvemile Creek	Upper	13821	100-year	809.000	3097.290	3100.8950	3100	3101	0	4.36	266.17	204	0
Twelvemile Creek	Upper	13821	500-year	1010.000	3097.290	3101.7810	3101	3102	0	3.22	474.68	253	0
Twelvemile Creek	Upper	13821	1% plus	1262.000	3097.290	3102.1930	3101	3102	0	3.25	579.93	257	0
Twelvemile Creek	Upper	13935	10-year	511.000	3099.900	3102.1560	3102	3102	0	3.51	185.01	138	0
Twelvemile Creek	Upper	13935	25-year	622.000	3099.900	3102.3240	3102	3102	0	3.82	208.70	144	0
Twelvemile Creek	Upper	13935	50-year	715.000	3099.900	3102.4290	3102	3103	0	4.12	223.99	148	0
Twelvemile Creek	Upper	13935	100-year	809.000	3099.900	3102.5140	3102	3103	0	4.43	236.75	151	1
Twelvemile Creek	Upper	13935	500-year	1010.000	3099.900	3102.6370	3102	3103	0	5.14	255.63	155	1
Twelvemile Creek	Upper	13935	1% plus	1262.000	3099.900	3102.9400	3102	3103	0	5.44	304.62	168	1
Twelvemile Creek	Upper	14068	10-year	511.000	3102.070	3104.5430	3104	3105	0	4.85	112.47	108	1
Twelvemile Creek	Upper	14068	25-year	622.000	3102.070	3104.7540	3104	3105	0	5.09	138.29	139	1
Twelvemile Creek	Upper	14068	50-year	715.000	3102.070	3104.9220	3105	3105	0	5.19	162.54	149	1
Twelvemile Creek	Upper	14068	100-year	809.000	3102.070	3105.0840	3105	3105	0	5.25	187.36	161	1
Twelvemile Creek	Upper	14068	500-year	1010.000	3102.070	3105.4060	3105	3106	0	5.34	246.50	209	1
Twelvemile Creek	Upper	14068	1% plus	1262.000	3102.070	3105.6540	3105	3106	0	5.67	301.74	233	1
Twelvemile Creek	Upper	14515	10-year	511.000	3110.530	3113.2970	3113	3113	0	3.78	178.58	131	0
Twelvemile Creek	Upper	14515	25-year	622.000	3110.530	3113.5190	3113	3114	0	4.13	210.87	162	0
Twelvemile Creek	Upper	14515	50-year	715.000	3110.530	3113.6490	3113	3114	0	4.38	233.17	181	0
Twelvemile Creek	Upper	14515	100-year	809.000	3110.530	3113.7590	3113	3114	0	4.63	253.94	196	1
Twelvemile Creek	Upper	14515	500-year	1010.000	3110.530	3113.9520	3113	3114	0	5.14	295.40	232	1
Twelvemile Creek	Upper	14515	1% plus	1262.000	3110.530	3114.2590	3113	3115	0	5.55	375.42	284	1
Twelvemile Creek	Upper	14989	10-year	511.000	3117.220	3119.7880	3119	3120	0	3.95	173.64	160	0
Twelvemile Creek	Upper	14989	25-year	622.000	3117.220	3120.0100	3119	3120	0	4.11	212.04	187	0
Twelvemile Creek	Upper	14989	50-year	715.000	3117.220	3120.1740	3120	3120	0	4.22	244.26	206	0
Twelvemile Creek	Upper	14989	100-year	809.000	3117.220	3120.3430	3120	3121	0	4.32	280.51	222	0
Twelvemile Creek	Upper	14989	500-year	1010.000	3117.220	3120.6290	3120	3121	0	4.42	345.77	235	0
Twelvemile Creek	Upper	14989	1% plus	1262.000	3117.220	3120.9110	3120	3121	0	4.63	413.44	246	0
Twelvemile Creek	Upper	15396	10-year	511.000	3123.130	3126.2490	3126	3127	0	4.71	119.88	68	1
Twelvemile Creek	Upper	15396	25-year	622.000	3123.130	3126.4660	3126	3127	0	5.17	135.70	79	1
Twelvemile Creek	Upper	15396	50-year	715.000	3123.130	3126.6250	3126	3127	0	5.52	148.58	82	1
Twelvemile Creek	Upper	15396	100-year	809.000	3123.130	3126.7670	3126	3127	0	5.86	160.42	85	1
Twelvemile Creek	Upper	15396	500-year	1010.000	3123.130	3127.0020	3126	3128	0	6.60	181.08	93	1
Twelvemile Creek	Upper	15396	1% plus	1262.000	3123.130	3127.3060	3127	3128	0	7.27	212.42	112	1
Twelvemile Creek	Upper	15688	10-year	511.000	3128.740	3131.3900	3131	3132	0	4.56	192.49	208	1
Twelvemile Creek	Upper	15688	25-year	622.000	3128.740	3131.6020	3131	3132	0	4.60	238.46	231	0
Twelvemile Creek	Upper	15688	50-year	715.000	3128.740	3131.7500	3131	3132	0	4.59	273.10	235	0
Twelvemile Creek	Upper	15688	100-year	809.000	3128.740	3131.8920	3131	3132	0	4.59	306.74	240	0
Twelvemile Creek	Upper	15688	500-year	1010.000	3128.740	3132.1770	3132	3132	0	4.59	376.30	247	0
Twelvemile Creek	Upper	15688	1% plus	1262.000	3128.740	3132.4810	3132	3133	0	4.66	451.94	250	0
Twelvemile Creek	Upper	15979	10-year	511.000	3132.450	3136.3200	3135	3137	0	5.91	100.46	55	1
Twelvemile Creek	Upper	15979	25-year	622.000	3132.450	3136.5300	3136	3137	0	6.62	112.99	66	1
Twelvemile Creek	Upper	15979	50-year	715.000	3132.450	3136.6560	3136	3137	0	7.24	121.76	73	1
Twelvemile Creek	Upper	15979	100-year	809.000	3132.450	3136.7720	3136	3138	0	7.83	130.68	78	1
Twelvemile Creek	Upper	15979	500-year	1010.000	3132.450	3137.1520	3137	3138	0	8.38	164.06	95	1
Twelvemile Creek	Upper	15979	1% plus	1262.000	3132.450	3137.5150	3138	3139	0	8.94	200.52	109	1

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Twelvemile Creek	Upper	16245	10-year	511.000	3136.200	3140.1690	3139	3140	0	4.34	122.58	45	0
Twelvemile Creek	Upper	16245	25-year	622.000	3136.200	3140.5990	3139	3141	0	4.62	142.28	49	0
Twelvemile Creek	Upper	16245	50-year	715.000	3136.200	3140.9380	3139	3141	0	4.81	160.81	58	0
Twelvemile Creek	Upper	16245	100-year	809.000	3136.200	3141.2490	3139	3142	0	4.98	180.11	65	0
Twelvemile Creek	Upper	16245	500-year	1010.000	3136.200	3141.7410	3140	3142	0	5.45	214.39	90	0
Twelvemile Creek	Upper	16245	1% plus	1262.000	3136.200	3142.2660	3140	3143	0	6.01	257.91	131	0
Twelvemile Creek	Upper	16639	10-year	511.000	3143.640	3146.2560	3146	3147	0	5.70	118.95	93	1
Twelvemile Creek	Upper	16639	25-year	622.000	3143.640	3146.4800	3146	3147	0	5.99	140.91	104	1
Twelvemile Creek	Upper	16639	50-year	715.000	3143.640	3146.6490	3146	3147	0	6.20	159.79	118	1
Twelvemile Creek	Upper	16639	100-year	809.000	3143.640	3146.8140	3146	3147	0	6.36	180.10	128	1
Twelvemile Creek	Upper	16639	500-year	1010.000	3143.640	3147.1920	3147	3148	0	6.43	236.67	177	1
Twelvemile Creek	Upper	16639	1% plus	1262.000	3143.640	3147.6650	3147	3148	0	6.48	332.27	211	1
Twelvemile Creek	Upper	16941	10-year	511.000	3148.870	3151.5650	3151	3152	0	3.36	204.43	161	0
Twelvemile Creek	Upper	16941	25-year	622.000	3148.870	3151.7610	3151	3152	0	3.57	236.69	169	0
Twelvemile Creek	Upper	16941	50-year	715.000	3148.870	3151.9080	3151	3152	0	3.74	261.90	175	0
Twelvemile Creek	Upper	16941	100-year	809.000	3148.870	3152.0430	3151	3152	0	3.89	286.25	185	0
Twelvemile Creek	Upper	16941	500-year	1010.000	3148.870	3152.2750	3151	3152	0	4.27	331.33	210	0
Twelvemile Creek	Upper	16941	1% plus	1262.000	3148.870	3152.5150	3152	3153	0	4.67	384.57	233	0
Twelvemile Creek	Upper	17113	10-year	511.000	3151.470	3153.7330	3153	3154	0	3.52	224.90	246	0
Twelvemile Creek	Upper	17113	25-year	622.000	3151.470	3153.9090	3153	3154	0	3.71	270.10	263	0
Twelvemile Creek	Upper	17113	50-year	715.000	3151.470	3154.0320	3154	3154	0	3.78	302.90	270	0
Twelvemile Creek	Upper	17113	100-year	809.000	3151.470	3154.1490	3154	3154	0	3.84	334.73	275	0
Twelvemile Creek	Upper	17113	500-year	1010.000	3151.470	3154.3920	3154	3155	0	3.96	403.32	293	0
Twelvemile Creek	Upper	17113	1% plus	1262.000	3151.470	3154.6850	3154	3155	0	4.16	497.50	337	0
Twelvemile Creek	Upper	17229	10-year	511.000	3153.670	3156.0930	3156	3156	0	5.50	119.18	133	1
Twelvemile Creek	Upper	17229	25-year	622.000	3153.670	3156.2480	3156	3157	0	5.92	141.62	156	1
Twelvemile Creek	Upper	17229	50-year	715.000	3153.670	3156.3390	3156	3157	0	6.33	156.68	177	1
Twelvemile Creek	Upper	17229	100-year	809.000	3153.670	3156.4240	3156	3157	0	6.74	172.39	192	1
Twelvemile Creek	Upper	17229	500-year	1010.000	3153.670	3156.7040	3157	3157	0	6.81	230.90	221	1
Twelvemile Creek	Upper	17229	1% plus	1262.000	3153.670	3156.8750	3157	3157	0	7.29	270.33	239	1
Twelvemile Creek	Upper	17334	10-year	511.000	3154.860	3158.4360	3158	3159	0	4.53	184.11	143	0
Twelvemile Creek	Upper	17334	25-year	622.000	3154.860	3158.6560	3158	3159	0	4.76	217.87	163	0
Twelvemile Creek	Upper	17334	50-year	715.000	3154.860	3158.8270	3158	3159	0	4.88	246.88	176	0
Twelvemile Creek	Upper	17334	100-year	809.000	3154.860	3158.9880	3158	3159	0	5.00	276.39	191	0
Twelvemile Creek	Upper	17334	500-year	1010.000	3154.860	3159.2170	3159	3159	0	5.45	323.32	220	1
Twelvemile Creek	Upper	17334	1% plus	1262.000	3154.860	3159.5000	3159	3160	0	5.84	388.79	250	1
Twelvemile Creek	Upper	17815	10-year	511.000	3163.790	3166.6670	3166	3167	0	5.27	130.33	103	1
Twelvemile Creek	Upper	17815	25-year	622.000	3163.790	3166.8650	3166	3167	0	5.57	150.97	105	1
Twelvemile Creek	Upper	17815	50-year	715.000	3163.790	3167.0060	3167	3167	0	5.84	165.96	107	1
Twelvemile Creek	Upper	17815	100-year	809.000	3163.790	3167.1360	3167	3168	0	6.10	180.14	114	1
Twelvemile Creek	Upper	17815	500-year	1010.000	3163.790	3167.4730	3167	3168	0	6.31	221.58	136	1
Twelvemile Creek	Upper	17815	1% plus	1262.000	3163.790	3167.8160	3167	3168	0	6.65	274.07	164	1
Twelvemile Creek	Upper	18247	10-year	511.000	3171.180	3173.9820	3173	3174	0	3.78	202.97	179	0
Twelvemile Creek	Upper	18247	25-year	622.000	3171.180	3174.1790	3174	3174	0	3.98	239.19	188	0
Twelvemile Creek	Upper	18247	50-year	715.000	3171.180	3174.3370	3174	3174	0	4.11	269.58	197	0
Twelvemile Creek	Upper	18247	100-year	809.000	3171.180	3174.4880	3174	3175	0	4.24	300.18	209	0
Twelvemile Creek	Upper	18247	500-year	1010.000	3171.180	3174.7400	3174	3175	0	4.58	357.04	242	0
Twelvemile Creek	Upper	18247	1% plus	1262.000	3171.180	3174.9990	3174	3175	0	4.83	421.19	253	0
Twelvemile Creek	Upper	18712	10-year	511.000	3179.100	3181.8850	3182	3182	0	5.90	119.33	106	1
Twelvemile Creek	Upper	18712	25-year	622.000	3179.100	3182.0800	3182	3183	0	6.26	140.66	113	1
Twelvemile Creek	Upper	18712	50-year	715.000	3179.100	3182.2180	3182	3183	0	6.55	156.69	118	1
Twelvemile Creek	Upper	18712	100-year	809.000	3179.100	3182.3530	3182	3183	0	6.85	173.15	127	1
Twelvemile Creek	Upper	18712	500-year	1010.000	3179.100	3182.6530	3182	3183	0	7.13	212.90	138	1
Twelvemile Creek	Upper	18712	1% plus	1262.000	3179.100	3182.9190	3183	3184	0	7.58	249.96	140	1
Twelvemile Creek	Upper	18955	10-year	511.000	3184.670	3187.3740	3187	3188	0	4.04	194.04	190	1
Twelvemile Creek	Upper	18955	25-year	622.000	3184.670	3187.5630	3187	3188	0	4.25	231.20	203	1
Twelvemile Creek	Upper	18955	50-year	715.000	3184.670	3187.7130	3187	3188	0	4.39	262.51	212	1
Twelvemile Creek	Upper	18955	100-year	809.000	3184.670	3187.8390	3187	3188	0	4.47	289.48	215	1
Twelvemile Creek	Upper	18955	500-year	1010.000	3184.670	3188.0510	3187	3188	0	4.75	335.48	220	1
Twelvemile Creek	Upper	18955	1% plus	1262.000	3184.670	3188.3100	3188	3189	0	4.99	393.31	228	1
Twelvemile Creek	Upper	19245	10-year	511.000	3190.660	3192.8740	3193	3193	0	4.01	185.31	202	1
Twelvemile Creek	Upper	19245	25-year	622.000	3190.660	3193.0100	3193	3193	0	4.24	212.99	206	1
Twelvemile Creek	Upper	19245	50-year	715.000	3190.660	3193.1110	3193	3193	0	4.43	233.94	211	1
Twelvemile Creek	Upper	19245	100-year	809.000	3190.660	3193.1980	3193	3193	0	4.64	252.65	219	1
Twelvemile Creek	Upper	19245	500-year	1010.000	3190.660	3193.4010	3193	3194	0	4.91	298.35	229	1
Twelvemile Creek	Upper	19245	1% plus	1262.000	3190.660	3193.6070	3193	3194	0	5.26	345.98	234	1
Twelvemile Creek	Upper	19639	10-year	511.000	3197.530	3200.9430	3201	3201	0	4.86	177.56	192	1
Twelvemile Creek	Upper	19639	25-year	622.000	3197.530	3201.1230	3201	3201	0	5.11	214.13	210	1
Twelvemile Creek	Upper	19639	50-year	715.000	3197.530	3201.2460	3201	3201	0	5.25	240.47	219	1
Twelvemile Creek	Upper	19639	100-year	809.000	3197.530	3201.3670	3201	3202	0	5.34	267.60	231	1
Twelvemile Creek	Upper	19639	500-year	1010.000	3197.530	3201.6000	3201	3202	0	5.67	323.97	250	1
Twelvemile Creek	Upper	19639	1% plus	1262.000	3197.530	3201.8290	3201	3202	0	5.92	382.40	262	1

HEC-RAS Plan: MultipleProfiles

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
EForkTwinCreek	EForkTwinCreek	169.72	10-Year	58.000	3091.490	3092.9190	3093	3093	0	4.64	13.24	22	1
EForkTwinCreek	EForkTwinCreek	169.72	25-Year	77.000	3091.490	3093.0750	3093	3093	0	4.97	16.93	25	1
EForkTwinCreek	EForkTwinCreek	169.72	50-Year	93.000	3091.490	3093.1920	3093	3094	0	5.19	19.89	26	1
EForkTwinCreek	EForkTwinCreek	169.72	100-Year	110.000	3091.490	3093.4130	3093	3094	0	4.85	25.94	29	1
EForkTwinCreek	EForkTwinCreek	169.72	500-Year	150.000	3091.490	3093.7810	3094	3094	0	4.70	37.54	33	1
EForkTwinCreek	EForkTwinCreek	169.72	1%+	172.000	3091.490	3093.9990	3094	3094	0	4.54	45.05	36	1
EForkTwinCreek	EForkTwinCreek	403	10-Year	58.000	3101.810	3103.9210	3103	3104	0	1.72	37.85	39	0
EForkTwinCreek	EForkTwinCreek	403	25-Year	77.000	3101.810	3104.1330	3103	3104	0	1.90	47.16	49	0
EForkTwinCreek	EForkTwinCreek	403	50-Year	93.000	3101.810	3104.2880	3103	3104	0	2.04	56.52	67	0
EForkTwinCreek	EForkTwinCreek	403	100-Year	110.000	3101.810	3104.3770	3103	3104	0	2.22	62.64	70	0
EForkTwinCreek	EForkTwinCreek	403	500-Year	150.000	3101.810	3104.5810	3104	3105	0	2.55	77.56	77	0
EForkTwinCreek	EForkTwinCreek	403	1%+	172.000	3101.810	3104.6560	3104	3105	0	2.74	83.47	79	0
EForkTwinCreek	EForkTwinCreek	695	10-Year	58.000	3110.960	3112.9360	3112	3113	0	2.85	22.20	33	0
EForkTwinCreek	EForkTwinCreek	695	25-Year	77.000	3110.960	3113.1160	3113	3113	0	3.04	29.64	56	0
EForkTwinCreek	EForkTwinCreek	695	50-Year	93.000	3110.960	3113.2260	3113	3113	0	3.11	36.71	72	0
EForkTwinCreek	EForkTwinCreek	695	100-Year	110.000	3110.960	3113.3550	3113	3113	0	3.01	47.26	85	0
EForkTwinCreek	EForkTwinCreek	695	500-Year	150.000	3110.960	3113.5500	3113	3114	0	2.92	64.04	87	0
EForkTwinCreek	EForkTwinCreek	695	1%+	172.000	3110.960	3113.6550	3113	3114	0	2.86	73.23	88	0
EForkTwinCreek	EForkTwinCreek	946	10-Year	58.000	3118.480	3120.2560	3119	3120	0	1.55	40.24	45	0
EForkTwinCreek	EForkTwinCreek	946	25-Year	77.000	3118.480	3120.4430	3120	3120	0	1.71	49.84	54	0
EForkTwinCreek	EForkTwinCreek	946	50-Year	93.000	3118.480	3120.5630	3120	3121	0	1.83	56.45	57	0
EForkTwinCreek	EForkTwinCreek	946	100-Year	110.000	3118.480	3120.6480	3120	3121	0	1.99	61.33	58	0
EForkTwinCreek	EForkTwinCreek	946	500-Year	150.000	3118.480	3120.8320	3120	3121	0	2.28	72.53	67	0
EForkTwinCreek	EForkTwinCreek	946	1%+	172.000	3118.480	3120.9070	3120	3121	0	2.44	77.75	74	0
EForkTwinCreek	EForkTwinCreek	1017	10-Year	58.000	3122.420	3123.3920	3123	3124	0	3.88	15.39	34	1
EForkTwinCreek	EForkTwinCreek	1017	25-Year	77.000	3122.420	3123.5180	3124	3124	0	4.05	20.27	43	1
EForkTwinCreek	EForkTwinCreek	1017	50-Year	93.000	3122.420	3123.6120	3124	3124	0	4.05	24.77	50	1
EForkTwinCreek	EForkTwinCreek	1017	100-Year	110.000	3122.420	3123.7020	3124	3124	0	4.09	30.05	69	1
EForkTwinCreek	EForkTwinCreek	1017	500-Year	150.000	3122.420	3123.8910	3124	3124	0	3.78	44.40	80	1
EForkTwinCreek	EForkTwinCreek	1017	1%+	172.000	3122.420	3123.9880	3124	3124	0	3.64	52.57	89	1
EForkTwinCreek	EForkTwinCreek	1031		Culvert									
EForkTwinCreek	EForkTwinCreek	1053	10-Year	58.000	3123.920	3127.9620	3125	3128	0	0.16	361.36	163	0
EForkTwinCreek	EForkTwinCreek	1053	25-Year	77.000	3123.920	3128.0840	3125	3128	0	0.20	381.45	166	0
EForkTwinCreek	EForkTwinCreek	1053	50-Year	93.000	3123.920	3128.1370	3125	3128	0	0.23	390.36	168	0
EForkTwinCreek	EForkTwinCreek	1053	100-Year	110.000	3123.920	3128.1980	3125	3128	0	0.27	400.60	170	0
EForkTwinCreek	EForkTwinCreek	1053	500-Year	150.000	3123.920	3128.2620	3126	3128	0	0.36	411.61	172	0
EForkTwinCreek	EForkTwinCreek	1053	1%+	172.000	3123.920	3128.2850	3126	3128	0	0.41	415.56	174	0
EForkTwinCreek	EForkTwinCreek	1108	10-Year	58.000	3123.150	3127.9660	3125	3128	0	0.29	208.12	116	0
EForkTwinCreek	EForkTwinCreek	1108	25-Year	77.000	3123.150	3128.0910	3125	3128	0	0.36	222.62	117	0
EForkTwinCreek	EForkTwinCreek	1108	50-Year	93.000	3123.150	3128.1460	3125	3128	0	0.42	229.13	118	0
EForkTwinCreek	EForkTwinCreek	1108	100-Year	110.000	3123.150	3128.2090	3126	3128	0	0.49	236.57	119	0
EForkTwinCreek	EForkTwinCreek	1108	500-Year	150.000	3123.150	3128.2810	3126	3128	0	0.64	245.20	120	0
EForkTwinCreek	EForkTwinCreek	1108	1%+	172.000	3123.150	3128.3100	3126	3128	0	0.72	248.61	121	0
Twin Creek	Lower	471.76	10-Year	178.000	3033.050	3034.9030	3034	3035	0	2.57	89.55	110	0
Twin Creek	Lower	471.76	25-Year	226.000	3033.050	3035.0890	3034	3035	0	2.79	107.12	121	0
Twin Creek	Lower	471.76	50-Year	267.000	3033.050	3035.2330	3035	3035	0	2.96	121.12	132	0
Twin Creek	Lower	471.76	100-Year	310.000	3033.050	3035.3730	3035	3035	0	3.12	135.03	150	0
Twin Creek	Lower	471.76	500-Year	407.000	3033.050	3035.6600	3035	3036	0	3.43	164.78	189	0
Twin Creek	Lower	471.76	1%+	484.000	3033.050	3035.8620	3035	3036	0	3.64	186.17	224	0
Twin Creek	Lower	938	10-Year	178.000	3035.000	3037.2660	3036	3037	0	2.98	59.78	353	0
Twin Creek	Lower	938	25-Year	226.000	3035.000	3037.4910	3037	3038	0	3.31	68.61	392	0
Twin Creek	Lower	938	50-Year	267.000	3035.000	3037.6660	3037	3038	0	3.57	75.86	427	0
Twin Creek	Lower	938	100-Year	310.000	3035.000	3037.8330	3037	3038	0	3.81	83.11	458	0
Twin Creek	Lower	938	500-Year	407.000	3035.000	3038.1680	3037	3038	0	4.31	98.42	541	0
Twin Creek	Lower	938	1%+	484.000	3035.000	3038.4060	3037	3039	0	4.65	109.70	613	0
Twin Creek	Lower	988		Bridge									
Twin Creek	Lower	1019	10-Year	178.000	3035.500	3037.8870	3037	3038	0	3.51	50.71	458	0
Twin Creek	Lower	1019	25-Year	226.000	3035.500	3038.1690	3037	3038	0	3.85	59.07	531	0
Twin Creek	Lower	1019	50-Year	267.000	3035.500	3038.3830	3037	3039	0	4.12	65.78	592	0
Twin Creek	Lower	1019	100-Year	310.000	3035.500	3038.5860	3038	3039	0	4.39	72.49	671	0
Twin Creek	Lower	1019	500-Year	407.000	3035.500	3039.0070	3038	3039	0	4.90	87.37	861	1
Twin Creek	Lower	1019	1%+	484.000	3035.500	3039.3060	3038	3040	0	5.27	99.63	1027	1
Twin Creek	Lower	1046	10-Year	178.000	3035.500	3038.1990	3037	3038	0	2.10	122.42	406	0
Twin Creek	Lower	1046	25-Year	226.000	3035.500	3038.5320	3037	3039	0	2.18	150.88	459	0
Twin Creek	Lower	1046	50-Year	267.000	3035.500	3038.7920	3037	3039	0	2.24	175.64	598	0
Twin Creek	Lower	1046	100-Year	310.000	3035.500	3039.0450	3038	3039	0	2.29	201.45	687	0
Twin Creek	Lower	1046	500-Year	407.000	3035.500	3039.5670	3038	3040	0	2.41	254.76	764	0
Twin Creek	Lower	1046	1%+	484.000	3035.500	3039.9510	3038	3040	0	2.47	293.89	858	0
Twin Creek	Lower	1326		Culvert									
Twin Creek	Lower	1564	10-Year	178.000	3038.580	3042.4980	3040	3043	0	1.63	134.24	204	0
Twin Creek	Lower	1564	25-Year	226.000	3038.580	3042.7070	3041	3043	0	1.82	152.87	220	0
Twin Creek	Lower	1564	50-Year	267.000	3038.580	3042.8590	3041	3043	0	1.97	166.42	228	0
Twin Creek	Lower	1564	100-Year	310.000	3038.580	3043.0040	3041	3043	0	2.12	179.51	238	0
Twin Creek	Lower	1564	500-Year	407.000	3038.580	3043.3230	3041	3043	0	2.37	208.34	255	0
Twin Creek	Lower	1564	1%+	484.000	3038.580	3043.5720	3042	3044	0	2.53	230.97	273	0
Twin Creek	Lower	1568	10-Year	178.000	3038.420	3042.5000	3040	3043	0	1.72	123.39	106	0
Twin Creek	Lower	1568	25-Year	226.000	3038.420	3042.7100	3040	3043	0	1.93	148.33	129	0
Twin Creek	Lower	1568	50-Year	267.000	3038.420	3042.8620	3040	3043	0	2.08	168.58	140	0
Twin Creek	Lower	1568	100-Year	310.000	3038.420	3043.0080	3041	3043	0	2.20	189.44	147	0
Twin Creek	Lower	1568	500-Year	407.000	3038.420	3043.3320	3041	3043	0	2.38	239.41	170	0
Twin Creek	Lower	1568	1%+	484.000	3038.420	3043.5940	3041	3044	0	2.44	284.37	215	0
Twin Creek	Lower	1600		Culvert									
Twin Creek	Lower	1640	10-Year	178.000	3038.260	3044.3680	3040	3044	0	0.94	192.02	101	0
Twin Creek	Lower	1640	25-Year	226.000	3038.260	3045.6160	3041	3046	0	0.77	380.42	411	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Twin Creek	Lower	1640	50-Year	267.000	3038.260	3045.9030	3041	3046	0	0.81	448.13	480	0
Twin Creek	Lower	1640	100-Year	310.000	3038.260	3045.9360	3041	3046	0	0.92	456.06	498	0
Twin Creek	Lower	1640	500-Year	407.000	3038.260	3046.2730	3041	3046	0	1.05	539.45	624	0
Twin Creek	Lower	1640	1%+	484.000	3038.260	3046.4750	3042	3046	0	1.15	590.60	639	0
Twin Creek	Lower	1775		Lat Struct									
Twin Creek	Lower	1911	10-Year	178.000	3040.720	3044.3950	3042	3044	0	0.26	412.12	258	0
Twin Creek	Lower	1911	25-Year	226.000	3040.720	3045.6300	3042	3046	0	0.20	701.26	351	0
Twin Creek	Lower	1911	50-Year	267.000	3040.720	3045.9160	3042	3046	0	0.22	779.84	378	0
Twin Creek	Lower	1911	100-Year	310.000	3040.720	3045.9530	3043	3046	0	0.25	790.42	379	0
Twin Creek	Lower	1911	500-Year	407.000	3040.720	3046.2940	3043	3046	0	0.30	889.27	385	0
Twin Creek	Lower	1911	1%+	484.000	3040.720	3046.4990	3043	3047	0	0.33	948.95	389	0
Twin Creek	Lower	2079	10-Year	178.000	3040.620	3044.4010	3043	3044	0	1.52	133.82	87	0
Twin Creek	Lower	2079	25-Year	226.000	3040.620	3045.6320	3043	3046	0	0.99	254.10	200	0
Twin Creek	Lower	2079	50-Year	267.000	3040.620	3045.9180	3043	3046	0	1.04	285.57	212	0
Twin Creek	Lower	2079	100-Year	310.000	3040.620	3045.9550	3043	3046	0	1.18	289.66	213	0
Twin Creek	Lower	2079	500-Year	407.000	3040.620	3046.2960	3044	3046	0	1.37	327.35	222	0
Twin Creek	Lower	2079	1%+	484.000	3040.620	3046.5010	3044	3047	0	1.52	350.07	226	0
Twin Creek	Lower	2387	10-Year	178.000	3041.960	3045.0020	3044	3045	0	4.35	43.07	24	1
Twin Creek	Lower	2387	25-Year	226.000	3041.960	3045.7090	3044	3046	0	4.07	61.87	29	0
Twin Creek	Lower	2387	50-Year	267.000	3041.960	3045.9730	3045	3046	0	4.36	69.85	71	0
Twin Creek	Lower	2387	100-Year	310.000	3041.960	3046.0250	3045	3046	0	4.97	71.48	93	0
Twin Creek	Lower	2387	500-Year	407.000	3041.960	3046.3450	3045	3047	0	5.82	82.13	116	1
Twin Creek	Lower	2387	1%+	484.000	3041.960	3046.5340	3046	3047	0	6.49	89.30	125	1
Twin Creek	Lower	2623	10-Year	178.000	3043.300	3046.5190	3045	3047	0	3.43	55.29	82	0
Twin Creek	Lower	2623	25-Year	226.000	3043.300	3046.8490	3046	3047	0	3.76	64.84	91	0
Twin Creek	Lower	2623	50-Year	267.000	3043.300	3047.1250	3046	3047	0	3.97	72.95	94	0
Twin Creek	Lower	2623	100-Year	310.000	3043.300	3047.3820	3046	3048	0	4.19	80.51	96	0
Twin Creek	Lower	2623	500-Year	407.000	3043.300	3047.9040	3046	3048	0	4.64	95.90	100	0
Twin Creek	Lower	2623	1%+	484.000	3043.300	3048.2740	3047	3049	0	4.96	106.79	103	0
Twin Creek	Lower	2649		Bridge									
Twin Creek	Lower	2670	10-Year	178.000	3042.910	3046.9140	3044	3047	0	1.42	128.33	90	0
Twin Creek	Lower	2670	25-Year	226.000	3042.910	3047.3090	3044	3047	0	1.62	143.05	99	0
Twin Creek	Lower	2670	50-Year	267.000	3042.910	3047.6680	3045	3048	0	1.75	156.49	108	0
Twin Creek	Lower	2670	100-Year	310.000	3042.910	3047.6850	3045	3048	0	2.02	157.13	108	0
Twin Creek	Lower	2670	500-Year	407.000	3042.910	3048.7850	3045	3049	0	2.10	198.33	135	0
Twin Creek	Lower	2670	1%+	484.000	3042.910	3049.5420	3045	3050	0	2.19	226.70	160	0
Twin Creek	Lower	2806	10-Year	178.000	3046.350	3047.2000	3047	3047	0	2.58	64.43	88	1
Twin Creek	Lower	2806	25-Year	226.000	3046.350	3047.6290	3047	3048	0	2.32	109.91	139	0
Twin Creek	Lower	2806	50-Year	267.000	3046.350	3047.9600	3047	3048	0	1.95	158.29	151	0
Twin Creek	Lower	2806	100-Year	310.000	3046.350	3048.0560	3047	3048	0	2.07	172.75	153	0
Twin Creek	Lower	2806	500-Year	407.000	3046.350	3049.0070	3047	3049	0	1.38	321.17	176	0
Twin Creek	Lower	2806	1%+	484.000	3046.350	3049.7210	3048	3050	0	1.18	436.89	203	0
Twin Creek	Lower	2893	10-Year	178.000	3047.050	3048.3110	3048	3048	0	1.53	137.35	254	0
Twin Creek	Lower	2893	25-Year	226.000	3047.050	3048.3960	3048	3048	0	1.65	159.55	263	0
Twin Creek	Lower	2893	50-Year	267.000	3047.050	3048.4860	3048	3049	0	1.66	183.56	267	0
Twin Creek	Lower	2893	100-Year	310.000	3047.050	3048.5750	3048	3049	0	1.67	207.53	270	0
Twin Creek	Lower	2893	500-Year	407.000	3047.050	3049.1440	3048	3049	0	1.13	361.86	291	0
Twin Creek	Lower	2893	1%+	484.000	3047.050	3049.7880	3048	3050	0	0.84	538.21	306	0
Twin Creek	Lower	2963	10-Year	178.000	3047.820	3048.7830	3048	3049	0	2.00	74.99	113	0
Twin Creek	Lower	2963	25-Year	226.000	3047.820	3048.8900	3049	3049	0	2.24	87.24	152	0
Twin Creek	Lower	2963	50-Year	267.000	3047.820	3048.9690	3049	3049	0	2.53	99.80	194	0
Twin Creek	Lower	2963	100-Year	310.000	3047.820	3049.0330	3049	3049	0	2.70	111.79	220	0
Twin Creek	Lower	2963	500-Year	407.000	3047.820	3049.2800	3049	3049	0	2.51	173.10	339	0
Twin Creek	Lower	2963	1%+	484.000	3047.820	3049.8340	3049	3050	0	1.46	322.13	363	0
Twin Creek	Lower	3026	10-Year	178.000	3048.280	3049.4750	3049	3050	0	1.92	97.98	230	0
Twin Creek	Lower	3026	25-Year	226.000	3048.280	3049.6140	3049	3050	0	2.05	119.92	286	0
Twin Creek	Lower	3026	50-Year	267.000	3048.280	3049.7290	3049	3050	0	2.11	143.08	342	0
Twin Creek	Lower	3026	100-Year	310.000	3048.280	3049.8210	3049	3050	0	2.19	165.55	414	0
Twin Creek	Lower	3026	500-Year	407.000	3048.280	3049.9310	3049	3050	0	2.47	198.79	460	0
Twin Creek	Lower	3026	1%+	484.000	3048.280	3050.0500	3049	3050	0	2.44	235.86	465	0
Twin Creek	Lower	3351	10-Year	178.000	3052.580	3053.5040	3053	3054	0	1.93	91.62	511	0
Twin Creek	Lower	3351	25-Year	226.000	3052.580	3053.5610	3053	3054	0	2.05	105.81	519	0
Twin Creek	Lower	3351	50-Year	267.000	3052.580	3053.5970	3053	3054	0	2.19	114.99	530	0
Twin Creek	Lower	3351	100-Year	310.000	3052.580	3053.6460	3054	3054	0	2.29	127.94	555	0
Twin Creek	Lower	3351	500-Year	407.000	3052.580	3053.7670	3054	3054	0	2.29	160.08	580	0
Twin Creek	Lower	3351	1%+	484.000	3052.580	3053.8040	3054	3054	0	2.53	170.27	584	0
Twin Creek	Lower	3567	10-Year	178.000	3055.060	3056.0450	3056	3056	0	2.47	78.86	380	1
Twin Creek	Lower	3567	25-Year	226.000	3055.060	3056.1290	3056	3056	0	2.70	90.62	384	1
Twin Creek	Lower	3567	50-Year	267.000	3055.060	3056.2090	3056	3056	0	2.81	101.80	386	1
Twin Creek	Lower	3567	100-Year	310.000	3055.060	3056.2760	3056	3056	0	2.97	111.18	388	1
Twin Creek	Lower	3567	500-Year	407.000	3055.060	3056.3500	3056	3057	0	3.55	121.66	392	1
Twin Creek	Lower	3567	1%+	484.000	3055.060	3056.4820	3056	3057	0	3.63	140.53	397	1
Twin Creek	Lower	3659	10-Year	178.000	3055.430	3058.0780	3058	3058	0	4.09	66.90	321	1
Twin Creek	Lower	3659	25-Year	226.000	3055.430	3058.2160	3058	3058	0	4.26	81.33	326	1
Twin Creek	Lower	3659	50-Year	267.000	3055.430	3058.3060	3058	3059	0	4.46	90.92	330	1
Twin Creek	Lower	3659	100-Year	310.000	3055.430	3058.4010	3058	3059	0	4.60	101.10	334	1
Twin Creek	Lower	3659	500-Year	407.000	3055.430	3058.6330	3058	3059	0	4.66	126.15	343	1
Twin Creek	Lower	3659	1%+	484.000	3055.430	3058.7450	3058	3059	0	4.97	138.32	347	1
Twin Creek	Lower	3808	10-Year	178.000	3059.590	3061.3070	3061	3061	0	2.17	77.33	67	0
Twin Creek	Lower	3808	25-Year	226.000	3059.590	3061.4800	3061	3062	0	2.38	89.18	70	0
Twin Creek	Lower	3808	50-Year	267.000	3059.590	3061.6670	3061	3062	0	2.57	103.41	84	0
Twin Creek	Lower	3808	100-Year	310.000	3059.590	3061.8180	3061	3062	0	2.75	117.88	113	0
Twin Creek	Lower	3808	500-Year	407.000	3059.590	3061.9950	3061	3062	0	3.08	138.22	117	0
Twin Creek	Lower	3808	1%+	484.000	3059.590	3062.1770	3061	3062	0	3.14	160.05	122	0
Twin Creek	Lower	3883	10-Year	178.000	3060.010	3062.7310	3062	3063	0	1.90	104.07	84	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Twin Creek	Lower	3883	25-Year	226.000	3060.010	3062.9500	3062	3063	0	2.04	122.95	88	0
Twin Creek	Lower	3883	50-Year	267.000	3060.010	3063.1310	3062	3063	0	2.12	139.35	93	0
Twin Creek	Lower	3883	100-Year	310.000	3060.010	3063.2990	3062	3063	0	2.20	155.37	97	0
Twin Creek	Lower	3883	500-Year	407.000	3060.010	3063.5990	3062	3064	0	2.41	185.83	106	0
Twin Creek	Lower	3883	1%+	484.000	3060.010	3063.7840	3063	3064	0	2.58	205.89	111	0
Twin Creek	Lower	3984	10-Year	178.000	3062.740	3064.9770	3064	3065	0	3.29	60.69	71	0
Twin Creek	Lower	3984	25-Year	226.000	3062.740	3065.1680	3065	3065	0	3.42	74.70	79	0
Twin Creek	Lower	3984	50-Year	267.000	3062.740	3065.2970	3065	3065	0	3.51	84.51	82	0
Twin Creek	Lower	3984	100-Year	310.000	3062.740	3065.4260	3065	3066	0	3.60	94.36	86	0
Twin Creek	Lower	3984	500-Year	407.000	3062.740	3065.7110	3065	3066	0	3.70	116.85	94	0
Twin Creek	Lower	3984	1%+	484.000	3062.740	3065.9270	3065	3066	0	3.81	135.72	106	0
Twin Creek	Lower	4004		Culvert									
Twin Creek	Lower	4023	10-Year	178.000	3063.630	3066.3120	3066	3066	0	2.59	82.91	93	0
Twin Creek	Lower	4023	25-Year	226.000	3063.630	3066.4590	3066	3067	0	2.97	98.57	112	0
Twin Creek	Lower	4023	50-Year	267.000	3063.630	3066.5840	3066	3067	0	3.00	112.73	114	0
Twin Creek	Lower	4023	100-Year	310.000	3063.630	3066.7240	3066	3067	0	2.97	129.09	120	0
Twin Creek	Lower	4023	500-Year	407.000	3063.630	3066.8920	3066	3067	0	3.32	149.85	125	0
Twin Creek	Lower	4023	1%+	484.000	3063.630	3067.0540	3066	3067	0	3.37	170.26	127	0
Twin Creek	Lower	4082	10-Year	178.000	3065.060	3067.3500	3067	3067	0	1.53	132.53	129	0
Twin Creek	Lower	4082	25-Year	226.000	3065.060	3067.5440	3067	3068	0	1.59	157.68	131	0
Twin Creek	Lower	4082	50-Year	267.000	3065.060	3067.6610	3067	3068	0	1.68	173.11	132	0
Twin Creek	Lower	4082	100-Year	310.000	3065.060	3067.7750	3067	3068	0	1.76	188.13	132	0
Twin Creek	Lower	4082	500-Year	407.000	3065.060	3068.0260	3067	3068	0	1.91	221.58	134	0
Twin Creek	Lower	4082	1%+	484.000	3065.060	3068.1920	3067	3068	0	2.03	243.96	136	0
Twin Creek	Lower	4143	10-Year	178.000	3066.770	3068.6870	3068	3069	0	2.75	80.51	92	0
Twin Creek	Lower	4143	25-Year	226.000	3066.770	3068.8150	3068	3069	0	2.99	92.36	93	0
Twin Creek	Lower	4143	50-Year	267.000	3066.770	3068.9390	3068	3069	0	3.09	104.13	97	0
Twin Creek	Lower	4143	100-Year	310.000	3066.770	3069.0990	3069	3069	0	3.41	121.34	118	0
Twin Creek	Lower	4143	500-Year	407.000	3066.770	3069.3260	3069	3069	0	3.54	148.55	121	0
Twin Creek	Lower	4143	1%+	484.000	3066.770	3069.4950	3069	3070	0	3.64	169.13	123	0
Twin Creek	Lower	4376	10-Year	178.000	3071.100	3074.6090	3073	3075	0	2.44	91.30	54	0
Twin Creek	Lower	4376	25-Year	226.000	3071.100	3074.9250	3073	3075	0	2.64	109.41	60	0
Twin Creek	Lower	4376	50-Year	267.000	3071.100	3075.1370	3073	3075	0	2.81	122.64	64	0
Twin Creek	Lower	4376	100-Year	310.000	3071.100	3075.3750	3074	3075	0	2.92	138.32	68	0
Twin Creek	Lower	4376	500-Year	407.000	3071.100	3075.7520	3074	3076	0	3.24	164.42	71	0
Twin Creek	Lower	4376	1%+	484.000	3071.100	3076.0070	3074	3076	0	3.47	184.98	89	0
Twin Creek	Lower	4526	10-Year	178.000	3075.890	3078.7800	3078	3079	0	4.55	44.65	41	1
Twin Creek	Lower	4526	25-Year	226.000	3075.890	3079.0620	3079	3079	0	4.73	59.10	71	1
Twin Creek	Lower	4526	50-Year	267.000	3075.890	3079.2790	3079	3080	0	4.73	79.63	115	1
Twin Creek	Lower	4526	100-Year	310.000	3075.890	3079.4310	3079	3080	0	4.77	99.15	138	1
Twin Creek	Lower	4526	500-Year	407.000	3075.890	3079.7560	3079	3080	0	4.55	149.91	169	0
Twin Creek	Lower	4526	1%+	484.000	3075.890	3079.9580	3080	3080	0	4.40	184.50	173	0
Twin Creek	Lower	4798	10-Year	178.000	3082.710	3086.2830	3085	3086	0	2.06	130.14	144	0
Twin Creek	Lower	4798	25-Year	226.000	3082.710	3086.4860	3085	3087	0	2.20	161.33	159	0
Twin Creek	Lower	4798	50-Year	267.000	3082.710	3086.6080	3086	3087	0	2.33	181.12	164	0
Twin Creek	Lower	4798	100-Year	310.000	3082.710	3086.7190	3086	3087	0	2.44	199.53	166	0
Twin Creek	Lower	4798	500-Year	407.000	3082.710	3086.9060	3086	3087	0	2.73	230.98	171	0
Twin Creek	Lower	4798	1%+	484.000	3082.710	3087.0250	3086	3087	0	2.95	251.58	173	0
Twin Creek	Lower	4898	10-Year	178.000	3084.220	3087.6660	3087	3088	0	2.06	109.64	82	0
Twin Creek	Lower	4898	25-Year	226.000	3084.220	3087.9080	3087	3088	0	2.24	130.16	88	0
Twin Creek	Lower	4898	50-Year	267.000	3084.220	3088.0860	3087	3088	0	2.37	146.27	92	0
Twin Creek	Lower	4898	100-Year	310.000	3084.220	3088.2620	3087	3088	0	2.53	162.99	101	0
Twin Creek	Lower	4898	500-Year	407.000	3084.220	3088.5970	3087	3089	0	2.77	197.70	109	0
Twin Creek	Lower	4898	1%+	484.000	3084.220	3088.8350	3087	3089	0	2.96	225.09	121	0
Twin Creek	WForkTwinCreek	5029	10-Year	129.000	3088.760	3090.8390	3090	3091	0	3.83	39.86	36	1
Twin Creek	WForkTwinCreek	5029	25-Year	165.000	3088.760	3091.0850	3091	3091	0	4.01	49.01	38	1
Twin Creek	WForkTwinCreek	5029	50-Year	195.000	3088.760	3091.2730	3091	3091	0	4.16	56.40	41	1
Twin Creek	WForkTwinCreek	5029	100-Year	226.000	3088.760	3091.4830	3091	3092	0	4.21	65.63	47	0
Twin Creek	WForkTwinCreek	5029	500-Year	297.000	3088.760	3091.8350	3091	3092	0	4.49	85.90	76	0
Twin Creek	WForkTwinCreek	5029	1%+	353.000	3088.760	3092.0950	3091	3092	0	4.63	109.45	109	0
Twin Creek	WForkTwinCreek	5147	10-Year	129.000	3092.770	3095.4560	3095	3096	0	2.44	85.14	136	0
Twin Creek	WForkTwinCreek	5147	25-Year	165.000	3092.770	3095.6010	3095	3096	0	2.56	105.69	146	0
Twin Creek	WForkTwinCreek	5147	50-Year	195.000	3092.770	3095.7050	3095	3096	0	2.64	120.95	148	0
Twin Creek	WForkTwinCreek	5147	100-Year	226.000	3092.770	3095.7980	3095	3096	0	2.73	135.00	152	0
Twin Creek	WForkTwinCreek	5147	500-Year	297.000	3092.770	3096.0050	3096	3096	0	2.85	167.93	169	0
Twin Creek	WForkTwinCreek	5147	1%+	353.000	3092.770	3096.1590	3096	3096	0	2.94	194.70	180	0
Twin Creek	WForkTwinCreek	5450	10-Year	129.000	3101.300	3102.7730	3102	3103	0	1.66	104.08	176	0
Twin Creek	WForkTwinCreek	5450	25-Year	165.000	3101.300	3102.8890	3102	3103	0	1.76	125.48	198	0
Twin Creek	WForkTwinCreek	5450	50-Year	195.000	3101.300	3102.9830	3102	3103	0	1.86	144.68	212	0
Twin Creek	WForkTwinCreek	5450	100-Year	226.000	3101.300	3103.0670	3102	3103	0	1.92	163.02	219	0
Twin Creek	WForkTwinCreek	5450	500-Year	297.000	3101.300	3103.2180	3103	3103	0	2.06	196.63	228	0
Twin Creek	WForkTwinCreek	5450	1%+	353.000	3101.300	3103.3280	3103	3103	0	2.16	222.25	238	0
Twin Creek	WForkTwinCreek	5682	10-Year	129.000	3106.050	3108.1580	3108	3108	0	1.87	67.17	80	0
Twin Creek	WForkTwinCreek	5682	25-Year	165.000	3106.050	3108.3100	3108	3108	0	2.03	80.24	90	0
Twin Creek	WForkTwinCreek	5682	50-Year	195.000	3106.050	3108.4250	3108	3109	0	2.13	91.46	107	0
Twin Creek	WForkTwinCreek	5682	100-Year	226.000	3106.050	3108.5230	3108	3109	0	2.24	102.54	125	0
Twin Creek	WForkTwinCreek	5682	500-Year	297.000	3106.050	3108.7260	3108	3109	0	2.41	128.49	153	0
Twin Creek	WForkTwinCreek	5682	1%+	353.000	3106.050	3108.8540	3108	3109	0	2.51	145.35	160	0
Twin Creek	WForkTwinCreek	5803	10-Year	129.000	3108.960	3110.8980	3110	3111	0	2.07	70.76	65	0
Twin Creek	WForkTwinCreek	5803	25-Year	165.000	3108.960	3111.0930	3110	3111	0	2.24	83.77	68	0
Twin Creek	WForkTwinCreek	5803	50-Year	195.000	3108.960	3111.2330	3110	3111	0	2.37	93.47	70	0
Twin Creek	WForkTwinCreek	5803	100-Year	226.000	3108.960	3111.3920	3111	3111	0	2.51	105.77	91	0
Twin Creek	WForkTwinCreek	5803	500-Year	297.000	3108.960	3111.6620	3111	3112	0	2.79	131.95	101	0
Twin Creek	WForkTwinCreek	5803	1%+	353.000	3108.960	3111.8310	3111	3112	0	2.95	149.58	107	0

HEC-RAS Plan: MultipleProfiles River: Deer Creek Reach: Deer Creek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Deer Creek	113.86	10-year	369.00	3051.03	3054.13	3053.24	3054.39	0.025338	4.10	95.27	53.36	0.47
Deer Creek	113.86	25-year	441.00	3051.03	3054.38	3053.43	3054.67	0.025330	4.39	109.08	58.45	0.48
Deer Creek	113.86	50-year	501.00	3051.03	3054.57	3053.59	3054.89	0.025372	4.60	120.88	64.73	0.49
Deer Creek	113.86	100-year	561.00	3051.03	3054.74	3053.73	3055.08	0.025343	4.79	132.54	68.11	0.49
Deer Creek	113.86	500-year	687.00	3051.03	3055.08	3054.03	3055.47	0.025332	5.15	157.00	90.08	0.50
Deer Creek	113.86	1% plus	875.00	3051.03	3055.52	3054.38	3055.97	0.025336	5.61	194.80	126.51	0.51
Deer Creek	365	10-year	369.00	3060.15	3062.43	3061.92	3062.79	0.045936	4.78	78.54	50.26	0.62
Deer Creek	365	25-year	441.00	3060.15	3062.64	3062.11	3063.04	0.045581	5.11	89.59	56.01	0.63
Deer Creek	365	50-year	501.00	3060.15	3062.80	3062.24	3063.24	0.045225	5.35	98.94	59.90	0.63
Deer Creek	365	100-year	561.00	3060.15	3062.95	3062.38	3063.43	0.045046	5.58	108.62	71.06	0.64
Deer Creek	365	500-year	687.00	3060.15	3063.24	3062.68	3063.77	0.044475	5.98	131.68	87.18	0.65
Deer Creek	365	1% plus	875.00	3060.15	3063.60	3063.07	3064.20	0.043537	6.44	163.61	89.66	0.65
Deer Creek	728	10-year	369.00	3068.00	3071.20	3070.17	3071.32	0.014166	3.05	171.43	145.21	0.35
Deer Creek	728	25-year	441.00	3068.00	3071.39	3070.36	3071.52	0.014089	3.21	200.84	157.50	0.36
Deer Creek	728	50-year	501.00	3068.00	3071.55	3070.52	3071.68	0.014039	3.33	225.81	169.18	0.36
Deer Creek	728	100-year	561.00	3068.00	3071.68	3070.64	3071.82	0.013921	3.43	249.78	176.13	0.36
Deer Creek	728	500-year	687.00	3068.00	3071.94	3070.88	3072.09	0.013834	3.63	297.18	190.12	0.36
Deer Creek	728	1% plus	875.00	3068.00	3072.27	3071.23	3072.42	0.013732	3.86	358.91	192.18	0.37
Deer Creek	1104	10-year	369.00	3076.96	3079.50	3078.94	3079.78	0.040557	4.29	86.29	53.83	0.57
Deer Creek	1104	25-year	441.00	3076.96	3079.68	3079.11	3080.02	0.041175	4.63	96.80	59.66	0.59
Deer Creek	1104	50-year	501.00	3076.96	3079.83	3079.22	3080.20	0.041572	4.88	105.48	61.33	0.60
Deer Creek	1104	100-year	561.00	3076.96	3079.96	3079.34	3080.36	0.042437	5.13	113.41	63.08	0.61
Deer Creek	1104	500-year	687.00	3076.96	3080.21	3079.59	3080.69	0.043377	5.58	129.69	64.41	0.63
Deer Creek	1104	1% plus	875.00	3076.96	3080.54	3079.94	3081.12	0.045026	6.18	151.38	66.10	0.65
Deer Creek	1482	10-year	369.00	3085.69	3089.14	3088.25	3089.27	0.017009	3.09	140.77	96.35	0.38
Deer Creek	1482	25-year	441.00	3085.69	3089.34	3088.43	3089.49	0.016816	3.27	160.82	98.25	0.38
Deer Creek	1482	50-year	501.00	3085.69	3089.50	3088.60	3089.67	0.016665	3.41	176.66	99.29	0.39
Deer Creek	1482	100-year	561.00	3085.69	3089.66	3088.70	3089.83	0.016442	3.53	192.25	100.47	0.39
Deer Creek	1482	500-year	687.00	3085.69	3089.96	3088.89	3090.15	0.016221	3.78	222.55	102.71	0.39
Deer Creek	1482	1% plus	875.00	3085.69	3090.37	3089.15	3090.59	0.015827	4.08	265.56	106.11	0.40
Deer Creek	1730	10-year	369.00	3091.80	3094.69	3094.11	3094.94	0.032050	4.21	107.38	119.90	0.52
Deer Creek	1730	25-year	441.00	3091.80	3094.88	3094.27	3095.15	0.032461	4.49	123.08	125.88	0.53
Deer Creek	1730	50-year	501.00	3091.80	3095.02	3094.39	3095.31	0.032688	4.70	135.68	129.96	0.54
Deer Creek	1730	100-year	561.00	3091.80	3095.15	3094.47	3095.47	0.033041	4.89	147.54	133.12	0.55
Deer Creek	1730	500-year	687.00	3091.80	3095.40	3094.80	3095.76	0.033295	5.24	171.96	140.56	0.56
Deer Creek	1730	1% plus	875.00	3091.80	3095.74	3095.10	3096.15	0.033619	5.70	206.72	154.68	0.57
Deer Creek	1917	10-year	369.00	3095.72	3098.83	3097.82	3098.95	0.015247	2.76	139.00	133.62	0.36
Deer Creek	1917	25-year	441.00	3095.72	3099.04	3097.99	3099.17	0.015213	2.96	156.22	142.51	0.36
Deer Creek	1917	50-year	501.00	3095.72	3099.20	3098.09	3099.34	0.015172	3.10	169.93	159.83	0.37
Deer Creek	1917	100-year	561.00	3095.72	3099.35	3098.22	3099.51	0.015171	3.24	182.94	177.28	0.37
Deer Creek	1917	500-year	687.00	3095.72	3099.64	3098.41	3099.83	0.015252	3.51	208.43	183.60	0.38
Deer Creek	1917	1% plus	875.00	3095.72	3100.04	3098.67	3100.26	0.015332	3.86	243.71	199.88	0.39
Deer Creek	2161	10-year	369.00	3101.12	3103.79	3103.10	3103.99	0.029146	4.01	115.26	69.06	0.50
Deer Creek	2161	25-year	441.00	3101.12	3104.00	3103.24	3104.23	0.029314	4.29	129.82	72.35	0.51
Deer Creek	2161	50-year	501.00	3101.12	3104.16	3103.33	3104.41	0.029482	4.51	141.55	75.43	0.52
Deer Creek	2161	100-year	561.00	3101.12	3104.31	3103.45	3104.58	0.029537	4.70	153.38	80.02	0.52
Deer Creek	2161	500-year	687.00	3101.12	3104.61	3103.65	3104.91	0.029486	5.06	177.40	83.15	0.53
Deer Creek	2161	1% plus	875.00	3101.12	3105.00	3103.97	3105.36	0.029408	5.52	216.26	104.49	0.54
Deer Creek	2328	10-year	369.00	3106.33	3108.79	3108.15	3109.03	0.031122	3.98	98.33	59.72	0.51
Deer Creek	2328	25-year	441.00	3106.33	3109.00	3108.29	3109.27	0.030991	4.26	110.88	61.72	0.52
Deer Creek	2328	50-year	501.00	3106.33	3109.17	3108.41	3109.46	0.030757	4.46	121.07	67.57	0.52
Deer Creek	2328	100-year	561.00	3106.33	3109.32	3108.55	3109.64	0.030933	4.67	130.93	76.80	0.53
Deer Creek	2328	500-year	687.00	3106.33	3109.60	3108.75	3109.98	0.031024	5.05	152.58	88.89	0.54
Deer Creek	2328	1% plus	875.00	3106.33	3109.98	3109.09	3110.42	0.031023	5.51	182.55	106.55	0.55
Deer Creek	2666	10-year	369.00	3113.83	3117.41	3116.58	3117.60	0.021077	4.23	145.38	101.88	0.45
Deer Creek	2666	25-year	441.00	3113.83	3117.62	3116.74	3117.82	0.021058	4.43	166.67	106.98	0.45
Deer Creek	2666	50-year	501.00	3113.83	3117.78	3116.85	3117.98	0.021049	4.58	183.17	111.41	0.45
Deer Creek	2666	100-year	561.00	3113.83	3117.93	3116.98	3118.14	0.020883	4.71	199.58	116.04	0.46
Deer Creek	2666	500-year	687.00	3113.83	3118.23	3117.28	3118.46	0.020687	4.97	232.26	124.75	0.46
Deer Creek	2666	1% plus	875.00	3113.83	3118.62	3117.66	3118.87	0.020516	5.30	276.02	142.77	0.47
Deer Creek	3001	10-year	369.00	3122.53	3125.28	3124.62	3125.43	0.026111	4.05	140.93	133.44	0.47
Deer Creek	3001	25-year	441.00	3122.53	3125.47	3124.69	3125.65	0.026089	4.28	160.70	144.38	0.48
Deer Creek	3001	50-year	501.00	3122.53	3125.62	3124.86	3125.81	0.026069	4.45	176.32	161.99	0.49
Deer Creek	3001	100-year	561.00	3122.53	3125.76	3124.92	3125.95	0.026245	4.62	191.05	170.94	0.49
Deer Creek	3001	500-year	687.00	3122.53	3126.03	3125.16	3126.24	0.026306	4.92	221.94	209.67	0.50
Deer Creek	3001	1% plus	875.00	3122.53	3126.43	3125.38	3126.67	0.026655	5.38	271.39	237.37	0.51
Deer Creek	3217	10-year	369.00	3126.40	3129.86	3128.81	3129.99	0.017450	3.61	169.84	243.93	0.40
Deer Creek	3217	25-year	441.00	3126.40	3130.06	3128.97	3130.20	0.017458	3.81	196.53	251.49	0.40
Deer Creek	3217	50-year	501.00	3126.40	3130.21	3128.99	3130.35	0.017383	3.93	215.84	256.04	0.41
Deer Creek	3217	100-year	561.00	3126.40	3130.35	3129.38	3130.50	0.017269	4.04	234.37	258.93	0.41
Deer Creek	3217	500-year	687.00	3126.40	3130.61	3129.75	3130.77	0.017194	4.26	270.28	264.17	0.41
Deer Creek	3217	1% plus	875.00	3126.40	3130.99	3129.95	3131.17	0.016740	4.52	322.74	274.65	0.42
Deer Creek	3434	10-year	369.00	3131.94	3134.76	3134.13	3135.04	0.031975	4.67	110.85	88.62	0.53
Deer Creek	3434	25-year	441.00	3131.94	3134.95	3134.33	3135.26	0.031843	4.91	128.20	89.47	0.54
Deer Creek	3434	50-year	501.00	3131.94	3135.10	3134.68	3135.42	0.032134	5.12	141.05	90.15	0.55
Deer Creek	3434	100-year	561.00	3131.94	3135.23	3134.77	3135.57	0.032468	5.31	153.08	90.80	0.55
Deer Creek	3434	500-year	687.00	3131.94	3135.49	3134.99	3135.86	0.032803	5.66	177.18	100.05	0.56
Deer Creek	3434	1% plus	875.00	3131.94	3135.83	3135.26	3136.26	0.033789	6.15	208.70	130.78	0.58

HEC-RAS Plan: MultipleProfiles River: Savenac Creek Reach: Savenac Creek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Savenac Creek	31.90	10-year	209.000	3080.210	3081.9530	3082	3082	0	3.61	60.10	275	1
Savenac Creek	31.90	25-year	262.000	3080.210	3082.1490	3082	3082	0	3.94	69.08	292	1
Savenac Creek	31.90	50-year	307.000	3080.210	3082.3040	3082	3083	0	4.19	76.17	309	1
Savenac Creek	31.90	100-year	353.000	3080.210	3082.4530	3082	3083	0	4.43	82.98	319	1
Savenac Creek	31.90	500-year	456.000	3080.210	3082.7610	3082	3083	0	4.90	97.06	340	1
Savenac Creek	31.90	1% plus	551.000	3080.210	3083.0200	3082	3083	0	5.28	108.89	361	1
Savenac Creek	37	10-year	209.000	3080.300	3082.0130	3082	3083	0	6.30	33.60	177	1
Savenac Creek	37	25-year	262.000	3080.300	3082.2240	3082	3083	0	6.74	39.60	248	1
Savenac Creek	37	50-year	307.000	3080.300	3082.3860	3082	3083	0	7.10	44.22	287	1
Savenac Creek	37	100-year	353.000	3080.300	3082.5370	3083	3083	0	7.46	48.51	308	1
Savenac Creek	37	500-year	456.000	3080.300	3082.8620	3083	3084	0	8.12	57.74	335	1
Savenac Creek	37	1% plus	551.000	3080.300	3083.1390	3083	3084	0	8.65	65.61	355	1
Savenac Creek	141		Culvert									
Savenac Creek	225	10-year	209.000	3083.100	3088.5410	3085	3089	0	1.62	130.43	36	0
Savenac Creek	225	25-year	262.000	3083.100	3089.3690	3085	3089	0	1.68	161.11	39	0
Savenac Creek	225	50-year	307.000	3083.100	3090.0360	3086	3090	0	1.72	187.71	41	0
Savenac Creek	225	100-year	353.000	3083.100	3090.6660	3086	3091	0	1.76	214.65	47	0
Savenac Creek	225	500-year	456.000	3083.100	3091.9650	3086	3092	0	1.84	272.26	344	0
Savenac Creek	225	1% plus	551.000	3083.100	3093.7680	3087	3094	0	1.75	352.37	571	0
Savenac Creek	255		Culvert									
Savenac Creek	289	10-year	209.000	3084.040	3089.0590	3086	3089	0	1.76	125.79	31	0
Savenac Creek	289	25-year	262.000	3084.040	3089.9610	3086	3090	0	1.83	154.39	193	0
Savenac Creek	289	50-year	307.000	3084.040	3090.6870	3086	3091	0	1.88	178.70	283	0
Savenac Creek	289	100-year	353.000	3084.040	3091.3770	3086	3091	0	1.93	202.55	372	0
Savenac Creek	289	500-year	456.000	3084.040	3092.8100	3087	3093	0	2.04	253.67	460	0
Savenac Creek	289	1% plus	551.000	3084.040	3094.8990	3087	3095	0	0.61	2247.95	788	0
Savenac Creek	735	10-year	209.000	3086.940	3089.3750	3088	3089	0	1.33	238.40	113	0
Savenac Creek	735	25-year	262.000	3086.940	3090.2190	3088	3090	0	1.32	366.14	186	0
Savenac Creek	735	50-year	307.000	3086.940	3090.9010	3088	3091	0	1.17	501.57	207	0
Savenac Creek	735	100-year	353.000	3086.940	3091.5630	3088	3092	0	1.04	639.30	209	0
Savenac Creek	735	500-year	456.000	3086.940	3092.9660	3088	3093	0	0.90	936.89	215	0
Savenac Creek	735	1% plus	551.000	3086.940	3094.9110	3088	3095	0	0.73	1375.63	246	0
Savenac Creek	965	10-year	209.000	3088.020	3089.6270	3090	3090	0	6.00	34.91	187	1
Savenac Creek	965	25-year	262.000	3088.020	3090.2810	3090	3091	0	4.71	56.57	239	1
Savenac Creek	965	50-year	307.000	3088.020	3090.9030	3090	3091	0	4.06	78.43	290	0
Savenac Creek	965	100-year	353.000	3088.020	3091.5320	3090	3092	0	3.66	101.89	351	0
Savenac Creek	965	500-year	456.000	3088.020	3092.9630	3090	3093	0	2.56	284.82	397	0
Savenac Creek	965	1% plus	551.000	3088.020	3094.9210	3091	3095	0	0.53	2017.08	410	0
Savenac Creek	1034	10-year	209.000	3088.820	3090.9320	3090	3091	0	3.76	56.64	346	0
Savenac Creek	1034	25-year	262.000	3088.820	3091.0420	3090	3091	0	4.45	60.25	359	1
Savenac Creek	1034	50-year	307.000	3088.820	3091.3300	3091	3092	0	4.54	69.97	408	1
Savenac Creek	1034	100-year	353.000	3088.820	3091.7800	3091	3092	0	4.33	86.02	423	0
Savenac Creek	1034	500-year	456.000	3088.820	3092.9820	3091	3093	0	3.75	141.33	542	0
Savenac Creek	1034	1% plus	551.000	3088.820	3094.9240	3091	3095	0	0.44	2491.24	552	0
Savenac Creek	1159	10-year	209.000	3090.080	3091.9060	3091	3092	0	3.56	59.22	332	1
Savenac Creek	1159	25-year	262.000	3090.080	3092.1720	3091	3092	0	3.79	69.93	382	0
Savenac Creek	1159	50-year	307.000	3090.080	3092.3650	3092	3093	0	4.01	77.83	407	1
Savenac Creek	1159	100-year	353.000	3090.080	3092.5860	3092	3093	0	4.15	87.06	434	0
Savenac Creek	1159	500-year	456.000	3090.080	3093.3690	3092	3094	0	3.92	122.45	464	0
Savenac Creek	1159	1% plus	551.000	3090.080	3094.8330	3092	3095	0	3.10	202.59	515	0
Savenac Creek	1268	10-year	209.000	3091.680	3093.0620	3093	3093	0	3.58	81.74	379	1
Savenac Creek	1268	25-year	262.000	3091.680	3093.2400	3093	3093	0	3.78	97.52	385	1
Savenac Creek	1268	50-year	307.000	3091.680	3093.3970	3093	3094	0	3.87	111.70	389	1
Savenac Creek	1268	100-year	353.000	3091.680	3093.5550	3093	3094	0	3.96	125.94	394	1
Savenac Creek	1268	500-year	456.000	3091.680	3094.0020	3093	3094	0	3.88	167.20	406	0
Savenac Creek	1268	1% plus	551.000	3091.680	3095.0830	3093	3095	0	2.94	271.17	456	0
Savenac Creek	1470	10-year	209.000	3091.700	3094.3530	3093	3094	0	2.85	76.21	289	0
Savenac Creek	1470	25-year	262.000	3091.700	3094.5570	3094	3095	0	3.21	87.84	331	0
Savenac Creek	1470	50-year	307.000	3091.700	3094.7050	3094	3095	0	3.48	98.09	342	0
Savenac Creek	1470	100-year	353.000	3091.700	3094.8440	3094	3095	0	3.71	108.02	346	0
Savenac Creek	1470	500-year	456.000	3091.700	3095.1150	3094	3095	0	4.17	127.74	348	0
Savenac Creek	1470	1% plus	551.000	3091.700	3095.5660	3094	3096	0	4.10	160.86	350	0
Savenac Creek	1573	10-year	209.000	3091.370	3094.6580	3093	3095	0	2.61	84.21	195	0
Savenac Creek	1573	25-year	262.000	3091.370	3094.9050	3093	3095	0	2.98	93.58	199	0
Savenac Creek	1573	50-year	307.000	3091.370	3095.0810	3093	3095	0	3.29	100.62	204	0
Savenac Creek	1573	100-year	353.000	3091.370	3095.2420	3094	3095	0	3.58	107.59	214	0
Savenac Creek	1573	500-year	456.000	3091.370	3095.5550	3094	3096	0	4.18	121.50	228	0
Savenac Creek	1573	1% plus	551.000	3091.370	3095.9220	3094	3096	0	4.52	138.13	272	0
Savenac Creek	1673	10-year	209.000	3093.170	3094.9230	3095	3095	0	4.96	42.73	108	1
Savenac Creek	1673	25-year	262.000	3093.170	3095.2020	3095	3096	0	5.18	51.94	137	1
Savenac Creek	1673	50-year	307.000	3093.170	3095.4060	3095	3096	0	5.39	59.01	166	1
Savenac Creek	1673	100-year	353.000	3093.170	3095.5960	3095	3096	0	5.61	65.80	216	1
Savenac Creek	1673	500-year	456.000	3093.170	3095.9630	3095	3097	0	6.09	79.67	268	1
Savenac Creek	1673	1% plus	551.000	3093.170	3096.3210	3096	3097	0	6.33	94.28	309	1
Savenac Creek	1910	10-year	209.000	3092.770	3096.3690	3095	3096	0	2.74	77.00	107	0

HEC-RAS Plan: MultipleProfiles River: Savenac Creek Reach: Savenac Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Savenac Creek	1910	25-year	262.000	3092.770	3096.6850	3095	3097	0	3.08	86.49	113	0
Savenac Creek	1910	50-year	307.000	3092.770	3096.9240	3095	3097	0	3.34	93.93	116	0
Savenac Creek	1910	100-year	353.000	3092.770	3097.1540	3095	3097	0	3.59	101.29	118	0
Savenac Creek	1910	500-year	456.000	3092.770	3097.6150	3096	3098	0	4.09	116.70	139	0
Savenac Creek	1910	1% plus	551.000	3092.770	3097.9800	3096	3098	0	4.52	129.53	155	0
Savenac Creek	2126	10-year	209.000	3094.370	3097.0710	3096	3097	0	4.37	48.48	25	1
Savenac Creek	2126	25-year	262.000	3094.370	3097.4140	3097	3098	0	4.70	57.17	26	1
Savenac Creek	2126	50-year	307.000	3094.370	3097.6770	3097	3098	0	4.95	64.10	27	1
Savenac Creek	2126	100-year	353.000	3094.370	3097.9250	3097	3098	0	5.20	70.93	28	1
Savenac Creek	2126	500-year	456.000	3094.370	3098.4230	3097	3099	0	5.69	85.42	30	1
Savenac Creek	2126	1% plus	551.000	3094.370	3098.8260	3098	3099	0	6.10	97.80	31	1
Savenac Creek	2323	10-year	209.000	3095.590	3098.7310	3098	3099	0	4.57	53.77	36	1
Savenac Creek	2323	25-year	262.000	3095.590	3099.0130	3098	3099	0	4.94	64.05	37	1
Savenac Creek	2323	50-year	307.000	3095.590	3099.2460	3099	3100	0	5.19	72.88	38	1
Savenac Creek	2323	100-year	353.000	3095.590	3099.4690	3099	3100	0	5.41	81.57	40	1
Savenac Creek	2323	500-year	456.000	3095.590	3099.9370	3099	3100	0	5.85	100.75	43	1
Savenac Creek	2323	1% plus	551.000	3095.590	3100.3370	3099	3101	0	6.16	118.40	45	1
Savenac Creek	2546	10-year	209.000	3097.230	3100.3880	3099	3101	0	4.21	52.59	50	0
Savenac Creek	2546	25-year	262.000	3097.230	3100.6990	3100	3101	0	4.66	60.69	53	0
Savenac Creek	2546	50-year	307.000	3097.230	3100.9290	3100	3101	0	5.02	66.96	56	1
Savenac Creek	2546	100-year	353.000	3097.230	3101.1510	3100	3102	0	5.35	73.25	58	1
Savenac Creek	2546	500-year	456.000	3097.230	3101.6030	3100	3102	0	6.00	86.65	62	1
Savenac Creek	2546	1% plus	551.000	3097.230	3101.9660	3101	3103	0	6.53	98.05	66	1
Savenac Creek	2829	10-year	209.000	3099.640	3102.4510	3102	3103	0	4.33	51.14	33	1
Savenac Creek	2829	25-year	262.000	3099.640	3102.7650	3102	3103	0	4.61	62.04	50	1
Savenac Creek	2829	50-year	307.000	3099.640	3103.0170	3102	3103	0	4.80	71.50	57	1
Savenac Creek	2829	100-year	353.000	3099.640	3103.2520	3102	3104	0	4.99	80.96	67	1
Savenac Creek	2829	500-year	456.000	3099.640	3103.7430	3103	3104	0	5.33	102.94	84	1
Savenac Creek	2829	1% plus	551.000	3099.640	3104.1150	3103	3105	0	5.64	121.36	106	1
Savenac Creek	2936	10-year	209.000	3101.630	3103.5390	3103	3104	0	4.11	54.18	72	1
Savenac Creek	2936	25-year	262.000	3101.630	3103.7850	3103	3104	0	4.40	65.86	80	1
Savenac Creek	2936	50-year	307.000	3101.630	3103.9840	3103	3104	0	4.57	76.04	83	1
Savenac Creek	2936	100-year	353.000	3101.630	3104.1800	3104	3105	0	4.72	86.42	86	1
Savenac Creek	2936	500-year	456.000	3101.630	3104.5980	3104	3105	0	4.98	109.87	93	1
Savenac Creek	2936	1% plus	551.000	3101.630	3104.9440	3104	3105	0	5.19	130.97	101	1
Savenac Creek	3100	10-year	209.000	3103.540	3105.4330	3105	3106	0	3.93	66.77	60	1
Savenac Creek	3100	25-year	262.000	3103.540	3105.6160	3105	3106	0	4.26	77.90	61	1
Savenac Creek	3100	50-year	307.000	3103.540	3105.7510	3105	3106	0	4.53	86.14	68	1
Savenac Creek	3100	100-year	353.000	3103.540	3105.8870	3105	3106	0	4.76	94.53	70	1
Savenac Creek	3100	500-year	456.000	3103.540	3106.1670	3106	3107	0	5.23	111.98	79	1
Savenac Creek	3100	1% plus	551.000	3103.540	3106.4100	3106	3107	0	5.59	127.37	92	1
Savenac Creek	3402	10-year	209.000	3104.780	3107.2980	3106	3107	0	2.77	90.10	62	0
Savenac Creek	3402	25-year	262.000	3104.780	3107.5370	3107	3108	0	3.05	105.23	65	0
Savenac Creek	3402	50-year	307.000	3104.780	3107.7190	3107	3108	0	3.25	117.17	66	0
Savenac Creek	3402	100-year	353.000	3104.780	3107.8880	3107	3108	0	3.45	128.44	67	0
Savenac Creek	3402	500-year	456.000	3104.780	3108.2450	3107	3108	0	3.83	153.09	71	0
Savenac Creek	3402	1% plus	551.000	3104.780	3108.5350	3107	3109	0	4.15	174.64	76	0
Savenac Creek	3572	10-year	209.000	3106.770	3108.5720	3108	3109	0	4.64	55.93	75	1
Savenac Creek	3572	25-year	262.000	3106.770	3108.7970	3109	3109	0	4.54	72.90	76	1
Savenac Creek	3572	50-year	307.000	3106.770	3108.9690	3109	3109	0	4.52	86.06	77	1
Savenac Creek	3572	100-year	353.000	3106.770	3109.1340	3109	3109	0	4.52	98.78	78	1
Savenac Creek	3572	500-year	456.000	3106.770	3109.4730	3109	3110	0	4.58	125.45	79	1
Savenac Creek	3572	1% plus	551.000	3106.770	3109.7600	3109	3110	0	4.67	148.42	81	1
Savenac Creek	3684	10-year	209.000	3108.070	3111.1410	3110	3111	0	4.28	51.78	35	0
Savenac Creek	3684	25-year	262.000	3108.070	3111.3150	3110	3112	0	4.95	59.24	52	1
Savenac Creek	3684	50-year	307.000	3108.070	3111.4380	3111	3112	0	5.45	66.03	59	1
Savenac Creek	3684	100-year	353.000	3108.070	3111.5540	3111	3112	0	5.93	73.31	68	1
Savenac Creek	3684	500-year	456.000	3108.070	3111.7610	3112	3112	0	6.83	89.26	84	1
Savenac Creek	3684	1% plus	551.000	3108.070	3112.0260	3112	3113	0	7.04	114.34	106	1
Savenac Creek	3822	10-year	209.000	3111.140	3112.8600	3112	3113	0	2.03	126.63	139	0
Savenac Creek	3822	25-year	262.000	3111.140	3113.0850	3112	3113	0	2.07	156.31	171	0
Savenac Creek	3822	50-year	307.000	3111.140	3113.2830	3112	3113	0	2.18	184.25	241	0
Savenac Creek	3822	100-year	353.000	3111.140	3113.4480	3112	3113	0	2.20	208.93	296	0
Savenac Creek	3822	500-year	456.000	3111.140	3113.7580	3113	3114	0	2.29	256.42	385	0
Savenac Creek	3822	1% plus	551.000	3111.140	3113.9810	3113	3114	0	2.44	291.69	463	0
Savenac Creek	3993	10-year	209.000	3112.160	3114.2490	3114	3114	0	2.23	126.24	282	0
Savenac Creek	3993	25-year	262.000	3112.160	3114.3770	3114	3114	0	2.46	143.33	326	0
Savenac Creek	3993	50-year	307.000	3112.160	3114.5130	3114	3115	0	2.55	161.89	357	0
Savenac Creek	3993	100-year	353.000	3112.160	3114.6090	3114	3115	0	2.69	175.08	367	0
Savenac Creek	3993	500-year	456.000	3112.160	3114.8320	3114	3115	0	2.91	206.39	395	0
Savenac Creek	3993	1% plus	551.000	3112.160	3115.0360	3114	3115	0	3.05	235.21	423	0
Savenac Creek	4081	10-year	209.000	3113.970	3115.2510	3115	3115	0	2.94	96.10	229	0
Savenac Creek	4081	25-year	262.000	3113.970	3115.3990	3115	3115	0	3.08	113.15	238	0
Savenac Creek	4081	50-year	307.000	3113.970	3115.5050	3115	3116	0	3.22	125.28	242	0
Savenac Creek	4081	100-year	353.000	3113.970	3115.6080	3115	3116	0	3.36	137.12	245	0
Savenac Creek	4081	500-year	456.000	3113.970	3115.8220	3115	3116	0	3.62	161.69	259	0
Savenac Creek	4081	1% plus	551.000	3113.970	3115.9990	3115	3116	0	3.85	182.13	289	0

HEC-RAS Plan: MultipleProfiles River: Savenac Creek Reach: Savenac Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Savenac Creek	4105		Bridge									
Savenac Creek	4128	10-year	209.000	3113.670	3117.1360	3115	3117	0	0.82	317.34	162	0
Savenac Creek	4128	25-year	262.000	3113.670	3117.2620	3115	3117	0	0.98	331.29	177	0
Savenac Creek	4128	50-year	307.000	3113.670	3117.3910	3115	3117	0	1.08	365.26	196	0
Savenac Creek	4128	100-year	353.000	3113.670	3117.5150	3115	3118	0	1.19	382.10	221	0
Savenac Creek	4128	500-year	456.000	3113.670	3117.7730	3116	3118	0	1.33	442.80	320	0
Savenac Creek	4128	1% plus	551.000	3113.670	3117.9770	3116	3118	0	1.47	488.48	370	0
Savenac Creek	4286	10-year	209.000	3113.550	3117.2190	3115	3117	0	1.39	179.27	110	0
Savenac Creek	4286	25-year	262.000	3113.550	3117.3740	3115	3117	0	1.62	196.45	113	0
Savenac Creek	4286	50-year	307.000	3113.550	3117.5180	3116	3118	0	1.77	212.91	122	0
Savenac Creek	4286	100-year	353.000	3113.550	3117.6590	3116	3118	0	1.92	229.30	147	0
Savenac Creek	4286	500-year	456.000	3113.550	3117.9390	3116	3118	0	2.23	264.89	188	0
Savenac Creek	4286	1% plus	551.000	3113.550	3118.1630	3116	3118	0	2.45	296.20	229	0
Savenac Creek	4400	10-year	209.000	3113.550	3117.3890	3115	3117	0	2.31	103.41	44	0
Savenac Creek	4400	25-year	262.000	3113.550	3117.5850	3116	3118	0	2.70	113.16	60	0
Savenac Creek	4400	50-year	307.000	3113.550	3117.7530	3116	3118	0	2.98	123.79	67	0
Savenac Creek	4400	100-year	353.000	3113.550	3117.9160	3116	3118	0	3.24	135.37	74	0
Savenac Creek	4400	500-year	456.000	3113.550	3118.2420	3116	3118	0	3.69	160.33	82	0
Savenac Creek	4400	1% plus	551.000	3113.550	3118.4970	3117	3119	0	4.06	180.64	97	0
Savenac Creek	4479	10-year	209.000	3115.280	3117.6420	3117	3118	0	3.97	71.47	55	1
Savenac Creek	4479	25-year	262.000	3115.280	3117.8880	3117	3118	0	4.30	85.87	62	1
Savenac Creek	4479	50-year	307.000	3115.280	3118.0870	3117	3118	0	4.50	98.88	68	1
Savenac Creek	4479	100-year	353.000	3115.280	3118.2770	3118	3119	0	4.67	112.26	73	1
Savenac Creek	4479	500-year	456.000	3115.280	3118.6390	3118	3119	0	5.07	142.45	93	1
Savenac Creek	4479	1% plus	551.000	3115.280	3118.9250	3118	3119	0	5.38	170.43	103	1
Savenac Creek	4665	10-year	209.000	3118.430	3119.8120	3120	3120	0	3.69	107.73	191	1
Savenac Creek	4665	25-year	262.000	3118.430	3119.9560	3120	3120	0	3.74	133.77	222	1
Savenac Creek	4665	50-year	307.000	3118.430	3120.0650	3120	3120	0	3.80	156.04	245	1
Savenac Creek	4665	100-year	353.000	3118.430	3120.1760	3120	3120	0	3.86	181.24	270	1
Savenac Creek	4665	500-year	456.000	3118.430	3120.4190	3120	3121	0	3.92	242.13	290	1
Savenac Creek	4665	1% plus	551.000	3118.430	3120.6130	3120	3121	0	3.88	292.68	307	1
Savenac Creek	4835	10-year	209.000	3121.110	3123.7980	3123	3124	0	5.03	44.34	509	1
Savenac Creek	4835	25-year	262.000	3121.110	3123.8910	3123	3124	0	6.05	46.54	516	1
Savenac Creek	4835	50-year	307.000	3121.110	3123.9410	3124	3125	0	6.93	47.74	519	1
Savenac Creek	4835	100-year	353.000	3121.110	3123.9500	3124	3125	0	7.94	47.96	519	1
Savenac Creek	4835	500-year	456.000	3121.110	3124.1030	3124	3125	0	9.61	51.72	532	1
Savenac Creek	4835	1% plus	551.000	3121.110	3124.7930	3125	3126	0	8.90	73.44	625	1
Savenac Creek	5013	10-year	209.000	3124.310	3127.5950	3126	3128	0	2.99	78.27	79	0
Savenac Creek	5013	25-year	262.000	3124.310	3127.9900	3127	3128	0	3.12	98.73	86	0
Savenac Creek	5013	50-year	307.000	3124.310	3128.2980	3127	3128	0	3.21	115.59	94	0
Savenac Creek	5013	100-year	353.000	3124.310	3128.6000	3127	3129	0	3.27	132.66	104	0
Savenac Creek	5013	500-year	456.000	3124.310	3129.1900	3127	3129	0	3.45	168.10	122	0
Savenac Creek	5013	1% plus	551.000	3124.310	3129.4730	3128	3130	0	3.80	199.48	142	0
Savenac Creek	5188	10-year	209.000	3127.910	3130.6230	3130	3131	0	4.03	53.80	31	0
Savenac Creek	5188	25-year	262.000	3127.910	3130.8620	3130	3131	0	4.50	61.53	33	1
Savenac Creek	5188	50-year	307.000	3127.910	3131.0460	3130	3131	0	4.84	67.83	36	1
Savenac Creek	5188	100-year	353.000	3127.910	3131.2180	3130	3132	0	5.17	74.01	46	1
Savenac Creek	5188	500-year	456.000	3127.910	3131.6020	3131	3132	0	5.73	88.83	75	1
Savenac Creek	5188	1% plus	551.000	3127.910	3131.9970	3131	3133	0	6.03	106.70	126	1
Savenac Creek	5362	10-year	209.000	3131.110	3134.9280	3134	3135	0	3.91	56.28	32	0
Savenac Creek	5362	25-year	262.000	3131.110	3135.2850	3134	3136	0	4.21	68.48	36	0
Savenac Creek	5362	50-year	307.000	3131.110	3135.5530	3134	3136	0	4.44	78.55	39	0
Savenac Creek	5362	100-year	353.000	3131.110	3135.8050	3134	3136	0	4.64	88.75	48	0
Savenac Creek	5362	500-year	456.000	3131.110	3136.2800	3135	3137	0	5.06	109.90	72	0
Savenac Creek	5362	1% plus	551.000	3131.110	3136.6250	3135	3137	0	5.43	125.93	110	0
Savenac Creek	5477	10-year	209.000	3133.900	3136.9630	3136	3137	0	2.99	70.38	30	0
Savenac Creek	5477	25-year	262.000	3133.900	3137.3150	3136	3137	0	3.28	81.23	31	0
Savenac Creek	5477	50-year	307.000	3133.900	3137.5850	3136	3138	0	3.49	89.83	32	0
Savenac Creek	5477	100-year	353.000	3133.900	3137.8380	3136	3138	0	3.70	98.09	33	0
Savenac Creek	5477	500-year	456.000	3133.900	3138.3400	3137	3139	0	4.13	115.04	35	0
Savenac Creek	5477	1% plus	551.000	3133.900	3138.7440	3137	3139	0	4.48	129.09	36	0
Savenac Creek	5500		Culvert									
Savenac Creek	5521	10-year	209.000	3134.980	3137.4790	3137	3138	0	5.28	39.56	23	1
Savenac Creek	5521	25-year	262.000	3134.980	3138.0810	3137	3138	0	4.88	54.39	26	1
Savenac Creek	5521	50-year	307.000	3134.980	3138.5480	3138	3139	0	4.72	67.04	28	1
Savenac Creek	5521	100-year	353.000	3134.980	3139.0190	3138	3139	0	4.60	80.81	30	0
Savenac Creek	5521	500-year	456.000	3134.980	3140.1740	3138	3140	0	4.26	120.83	40	0
Savenac Creek	5521	1% plus	551.000	3134.980	3141.4520	3138	3142	0	3.75	173.48	61	0
Savenac Creek	5597	10-year	209.000	3136.720	3140.0540	3139	3140	0	3.24	67.70	35	0
Savenac Creek	5597	25-year	262.000	3136.720	3140.2590	3139	3140	0	3.71	75.18	38	0
Savenac Creek	5597	50-year	307.000	3136.720	3140.4460	3139	3141	0	4.02	82.38	40	0
Savenac Creek	5597	100-year	353.000	3136.720	3140.6540	3139	3141	0	4.28	90.89	45	0
Savenac Creek	5597	500-year	456.000	3136.720	3141.2470	3140	3142	0	4.45	120.06	53	0
Savenac Creek	5597	1% plus	551.000	3136.720	3142.0800	3140	3142	0	4.11	173.16	71	0

HEC-RAS Plan: MultipleProfiles River: Savenac Creek Reach: Savenac Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Savenac Creek	5755	10-year	209.000	3139.970	3142.8850	3142	3143	0	3.76	58.04	30	0
Savenac Creek	5755	25-year	262.000	3139.970	3143.2570	3142	3144	0	4.01	69.42	32	0
Savenac Creek	5755	50-year	307.000	3139.970	3143.5270	3142	3144	0	4.23	78.10	35	0
Savenac Creek	5755	100-year	353.000	3139.970	3143.7750	3143	3144	0	4.45	86.42	47	0
Savenac Creek	5755	500-year	456.000	3139.970	3144.1830	3143	3145	0	5.03	100.62	77	0
Savenac Creek	5755	1% plus	551.000	3139.970	3144.4110	3143	3145	0	5.68	108.84	105	1
Savenac Creek	5850	10-year	209.000	3143.490	3145.7700	3145	3146	0	4.97	43.54	28	1
Savenac Creek	5850	25-year	262.000	3143.490	3146.0140	3146	3146	0	5.46	50.52	30	1
Savenac Creek	5850	50-year	307.000	3143.490	3146.2200	3146	3147	0	5.78	57.01	33	1
Savenac Creek	5850	100-year	353.000	3143.490	3146.4220	3146	3147	0	6.05	64.40	41	1
Savenac Creek	5850	500-year	456.000	3143.490	3146.8720	3146	3147	0	6.40	85.96	54	1
Savenac Creek	5850	1% plus	551.000	3143.490	3147.2760	3147	3148	0	6.52	109.33	63	1
Savenac Creek	6042	10-year	209.000	3147.360	3150.6280	3149	3151	0	3.31	80.34	71	0
Savenac Creek	6042	25-year	262.000	3147.360	3150.9270	3150	3151	0	3.53	105.07	95	0
Savenac Creek	6042	50-year	307.000	3147.360	3151.1560	3150	3151	0	3.71	129.17	116	0
Savenac Creek	6042	100-year	353.000	3147.360	3151.3290	3150	3152	0	3.82	149.63	119	0
Savenac Creek	6042	500-year	456.000	3147.360	3151.6560	3151	3152	0	4.07	189.15	138	0
Savenac Creek	6042	1% plus	551.000	3147.360	3151.9110	3151	3152	0	4.31	221.38	172	0
Savenac Creek	6435	10-year	209.000	3154.870	3157.5920	3157	3158	0	3.48	108.76	98	0
Savenac Creek	6435	25-year	262.000	3154.870	3157.7830	3157	3158	0	3.67	127.76	101	0
Savenac Creek	6435	50-year	307.000	3154.870	3157.9380	3157	3158	0	3.79	143.43	108	0
Savenac Creek	6435	100-year	353.000	3154.870	3158.0750	3157	3158	0	3.94	157.54	112	0
Savenac Creek	6435	500-year	456.000	3154.870	3158.3590	3158	3158	0	4.22	187.41	124	0
Savenac Creek	6435	1% plus	551.000	3154.870	3158.6160	3158	3159	0	4.40	214.85	146	0
Savenac Creek	6698	10-year	209.000	3159.210	3162.1550	3161	3162	0	2.68	105.78	91	0
Savenac Creek	6698	25-year	262.000	3159.210	3162.4180	3161	3163	0	2.97	128.94	111	0
Savenac Creek	6698	50-year	307.000	3159.210	3162.5800	3161	3163	0	3.16	144.59	121	0
Savenac Creek	6698	100-year	353.000	3159.210	3162.7390	3162	3163	0	3.31	160.51	127	0
Savenac Creek	6698	500-year	456.000	3159.210	3163.0520	3162	3163	0	3.61	194.05	142	0
Savenac Creek	6698	1% plus	551.000	3159.210	3163.3090	3162	3163	0	3.88	226.10	170	0
Savenac Creek	6924	10-year	209.000	3163.970	3166.7880	3167	3167	0	5.93	46.72	63	1
Savenac Creek	6924	25-year	262.000	3163.970	3167.0110	3167	3167	0	6.08	60.41	77	1
Savenac Creek	6924	50-year	307.000	3163.970	3167.1690	3167	3168	0	6.24	70.93	85	1
Savenac Creek	6924	100-year	353.000	3163.970	3167.3070	3167	3168	0	6.42	80.77	90	1
Savenac Creek	6924	500-year	456.000	3163.970	3167.5770	3167	3168	0	6.70	100.55	96	1
Savenac Creek	6924	1% plus	551.000	3163.970	3167.8130	3168	3168	0	6.89	118.76	106	1
Savenac Creek	7325	10-year	209.000	3170.990	3173.9220	3173	3174	0	3.23	76.98	55	0
Savenac Creek	7325	25-year	262.000	3170.990	3174.1600	3173	3174	0	3.56	91.00	63	0
Savenac Creek	7325	50-year	307.000	3170.990	3174.3370	3173	3175	0	3.79	102.81	71	0
Savenac Creek	7325	100-year	353.000	3170.990	3174.5010	3174	3175	0	3.98	115.51	85	0
Savenac Creek	7325	500-year	456.000	3170.990	3174.8510	3174	3175	0	4.42	152.75	129	0
Savenac Creek	7325	1% plus	551.000	3170.990	3175.0620	3174	3175	0	4.69	181.28	138	0
Savenac Creek	7589	10-year	209.000	3174.960	3177.7120	3177	3178	0	5.35	50.84	52	1
Savenac Creek	7589	25-year	262.000	3174.960	3177.9790	3178	3178	0	5.52	65.96	63	1
Savenac Creek	7589	50-year	307.000	3174.960	3178.1690	3178	3179	0	5.66	79.03	76	1
Savenac Creek	7589	100-year	353.000	3174.960	3178.3320	3178	3179	0	5.80	93.33	95	1
Savenac Creek	7589	500-year	456.000	3174.960	3178.6620	3178	3179	0	5.90	132.26	133	1
Savenac Creek	7589	1% plus	551.000	3174.960	3178.8780	3179	3179	0	6.04	161.94	139	1
Savenac Creek	7931	10-year	209.000	3179.900	3183.2100	3182	3183	0	3.34	91.59	139	0
Savenac Creek	7931	25-year	262.000	3179.900	3183.3860	3183	3184	0	3.57	117.55	155	0
Savenac Creek	7931	50-year	307.000	3179.900	3183.5100	3183	3184	0	3.71	137.40	165	0
Savenac Creek	7931	100-year	353.000	3179.900	3183.6220	3183	3184	0	3.82	156.36	173	0
Savenac Creek	7931	500-year	456.000	3179.900	3183.8270	3183	3184	0	4.12	193.06	186	0
Savenac Creek	7931	1% plus	551.000	3179.900	3183.9920	3184	3184	0	4.32	223.71	196	0
Savenac Creek	8185	10-year	209.000	3184.340	3186.9970	3187	3187	0	4.67	44.99	30	1
Savenac Creek	8185	25-year	262.000	3184.340	3187.2300	3187	3188	0	5.11	52.20	32	1
Savenac Creek	8185	50-year	307.000	3184.340	3187.3900	3187	3188	0	5.49	57.49	34	1
Savenac Creek	8185	100-year	353.000	3184.340	3187.5360	3187	3188	0	5.86	62.52	35	1
Savenac Creek	8185	500-year	456.000	3184.340	3187.8560	3187	3188	0	6.50	74.14	37	1
Savenac Creek	8185	1% plus	551.000	3184.340	3188.0900	3188	3189	0	7.11	82.96	38	1
Savenac Creek	8536	10-year	209.000	3190.190	3192.9960	3192	3193	0	3.01	77.57	63	0
Savenac Creek	8536	25-year	262.000	3190.190	3193.2350	3192	3193	0	3.24	94.25	76	0
Savenac Creek	8536	50-year	307.000	3190.190	3193.4260	3193	3194	0	3.39	110.55	99	0
Savenac Creek	8536	100-year	353.000	3190.190	3193.5990	3193	3194	0	3.50	129.09	114	0
Savenac Creek	8536	500-year	456.000	3190.190	3193.9090	3193	3194	0	3.71	170.41	161	0
Savenac Creek	8536	1% plus	551.000	3190.190	3194.1660	3193	3194	0	3.82	217.61	201	0
Savenac Creek	8829	10-year	209.000	3192.690	3196.3640	3195	3197	0	3.96	64.75	61	0
Savenac Creek	8829	25-year	262.000	3192.690	3196.6040	3196	3197	0	4.26	80.57	71	0
Savenac Creek	8829	50-year	307.000	3192.690	3196.7740	3196	3197	0	4.49	93.26	79	0
Savenac Creek	8829	100-year	353.000	3192.690	3196.9230	3196	3197	0	4.71	105.73	90	0
Savenac Creek	8829	500-year	456.000	3192.690	3197.2300	3197	3198	0	5.19	139.13	128	1
Savenac Creek	8829	1% plus	551.000	3192.690	3197.4140	3197	3198	0	5.49	163.81	140	1
Savenac Creek	9263	10-year	209.000	3198.560	3201.5090	3201	3202	0	3.22	105.89	140	0
Savenac Creek	9263	25-year	262.000	3198.560	3201.7010	3201	3202	0	3.32	135.89	174	0
Savenac Creek	9263	50-year	307.000	3198.560	3201.8320	3201	3202	0	3.39	160.29	195	0
Savenac Creek	9263	100-year	353.000	3198.560	3201.9530	3201	3202	0	3.42	184.51	207	0
Savenac Creek	9263	500-year	456.000	3198.560	3202.2280	3202	3202	0	3.52	245.12	230	0

HEC-RAS Plan: MultipleProfiles River: Savenac Creek Reach: Savenac Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Savenac Creek	9263	1% plus	551.000	3198.560	3202.4000	3202	3202	0	3.58	284.83	233	0
Savenac Creek	9457	10-year	209.000	3201.220	3204.2390	3204	3205	0	4.98	53.97	52	1
Savenac Creek	9457	25-year	262.000	3201.220	3204.4140	3204	3205	0	5.52	63.62	59	1
Savenac Creek	9457	50-year	307.000	3201.220	3204.5340	3204	3205	0	5.95	71.00	65	1
Savenac Creek	9457	100-year	353.000	3201.220	3204.6370	3204	3205	0	6.46	78.20	76	1
Savenac Creek	9457	500-year	456.000	3201.220	3204.8970	3205	3205	0	7.05	101.56	101	1
Savenac Creek	9457	1% plus	551.000	3201.220	3205.0800	3205	3206	0	7.45	121.46	120	1
Savenac Creek	9807	10-year	209.000	3206.340	3210.0260	3209	3210	0	4.26	56.34	61	0
Savenac Creek	9807	25-year	262.000	3206.340	3210.3730	3209	3211	0	4.52	78.41	106	0
Savenac Creek	9807	50-year	307.000	3206.340	3210.5890	3209	3211	0	4.61	99.23	120	0
Savenac Creek	9807	100-year	353.000	3206.340	3210.7900	3210	3211	0	4.63	120.60	134	0
Savenac Creek	9807	500-year	456.000	3206.340	3211.1230	3211	3211	0	4.85	160.51	159	0
Savenac Creek	9807	1% plus	551.000	3206.340	3211.3540	3211	3212	0	5.00	190.69	167	0
Savenac Creek	10267	10-year	209.000	3211.630	3215.0460	3214	3215	0	3.59	70.08	54	0
Savenac Creek	10267	25-year	262.000	3211.630	3215.3370	3214	3216	0	3.86	84.53	79	0
Savenac Creek	10267	50-year	307.000	3211.630	3215.5280	3214	3216	0	4.12	94.59	87	0
Savenac Creek	10267	100-year	353.000	3211.630	3215.6840	3215	3216	0	4.39	103.19	99	0
Savenac Creek	10267	500-year	456.000	3211.630	3216.0440	3215	3216	0	4.84	124.09	114	0
Savenac Creek	10267	1% plus	551.000	3211.630	3216.3370	3215	3217	0	5.23	142.57	128	0
Savenac Creek	10532	10-year	209.000	3215.270	3218.6740	3218	3219	0	4.97	45.37	33	1
Savenac Creek	10532	25-year	262.000	3215.270	3218.9550	3218	3219	0	5.37	56.77	50	1
Savenac Creek	10532	50-year	307.000	3215.270	3219.1780	3219	3220	0	5.55	70.12	67	1
Savenac Creek	10532	100-year	353.000	3215.270	3219.3900	3219	3220	0	5.63	86.20	85	1
Savenac Creek	10532	500-year	456.000	3215.270	3219.7440	3219	3220	0	5.78	121.38	115	1
Savenac Creek	10532	1% plus	551.000	3215.270	3220.0230	3220	3220	0	5.79	156.07	131	1
Savenac Creek	10718	10-year	209.000	3217.730	3221.8540	3221	3222	0	4.10	52.48	24	0
Savenac Creek	10718	25-year	262.000	3217.730	3222.1940	3221	3223	0	4.52	61.06	27	0
Savenac Creek	10718	50-year	307.000	3217.730	3222.4190	3221	3223	0	4.88	67.25	35	0
Savenac Creek	10718	100-year	353.000	3217.730	3222.6050	3221	3223	0	5.28	72.76	42	0
Savenac Creek	10718	500-year	456.000	3217.730	3222.9560	3222	3223	0	6.06	85.91	87	1
Savenac Creek	10718	1% plus	551.000	3217.730	3223.1850	3222	3224	0	6.76	97.95	145	1
Savenac Creek	10987	10-year	209.000	3220.500	3224.0770	3223	3224	0	2.54	119.26	134	0
Savenac Creek	10987	25-year	262.000	3220.500	3224.3420	3223	3224	0	2.55	161.26	171	0
Savenac Creek	10987	50-year	307.000	3220.500	3224.5430	3223	3225	0	2.54	197.78	196	0
Savenac Creek	10987	100-year	353.000	3220.500	3224.7380	3224	3225	0	2.52	238.12	214	0
Savenac Creek	10987	500-year	456.000	3220.500	3225.1040	3224	3225	0	2.47	323.16	251	0
Savenac Creek	10987	1% plus	551.000	3220.500	3225.3860	3224	3225	0	2.45	400.25	280	0
Savenac Creek	11236	10-year	209.000	3223.230	3225.9980	3225	3226	0	3.68	70.51	127	0
Savenac Creek	11236	25-year	262.000	3223.230	3226.1350	3225	3226	0	4.06	90.51	161	0
Savenac Creek	11236	50-year	307.000	3223.230	3226.2310	3226	3226	0	4.30	106.88	178	1
Savenac Creek	11236	100-year	353.000	3223.230	3226.3180	3226	3227	0	4.49	122.58	184	1
Savenac Creek	11236	500-year	456.000	3223.230	3226.4810	3226	3227	0	4.84	153.31	194	1
Savenac Creek	11236	1% plus	551.000	3223.230	3226.6320	3227	3227	0	5.00	183.51	208	1
Savenac Creek	11493	10-year	185.000	3225.630	3229.0970	3228	3229	0	3.56	57.37	100	0
Savenac Creek	11493	25-year	232.000	3225.630	3229.4050	3228	3230	0	3.85	69.81	135	0
Savenac Creek	11493	50-year	271.000	3225.630	3229.6180	3228	3230	0	4.10	80.34	171	0
Savenac Creek	11493	100-year	311.000	3225.630	3229.7960	3229	3230	0	4.30	90.70	187	0
Savenac Creek	11493	500-year	400.000	3225.630	3230.1300	3229	3230	0	4.70	111.58	216	0
Savenac Creek	11493	1% plus	485.000	3225.630	3230.3710	3229	3231	0	5.10	127.65	239	0
Savenac Creek	11681	10-year	185.000	3228.160	3231.1750	3231	3231	0	3.17	76.91	103	0
Savenac Creek	11681	25-year	232.000	3228.160	3231.4090	3231	3232	0	3.25	96.50	138	0
Savenac Creek	11681	50-year	271.000	3228.160	3231.5910	3231	3232	0	3.29	113.77	162	0
Savenac Creek	11681	100-year	311.000	3228.160	3231.7500	3231	3232	0	3.34	130.94	174	0
Savenac Creek	11681	500-year	400.000	3228.160	3232.0630	3231	3232	0	3.44	172.52	237	0
Savenac Creek	11681	1% plus	485.000	3228.160	3232.3240	3231	3232	0	3.48	217.36	267	0
Savenac Creek	12035	10-year	185.000	3231.410	3234.7430	3234	3235	0	3.28	63.57	58	0
Savenac Creek	12035	25-year	232.000	3231.410	3234.9550	3234	3235	0	3.64	77.21	71	0
Savenac Creek	12035	50-year	271.000	3231.410	3235.0950	3234	3235	0	3.93	88.23	87	0
Savenac Creek	12035	100-year	311.000	3231.410	3235.2270	3234	3235	0	4.16	100.50	99	0
Savenac Creek	12035	500-year	400.000	3231.410	3235.4680	3235	3236	0	4.60	126.36	115	0
Savenac Creek	12035	1% plus	485.000	3231.410	3235.6470	3235	3236	0	4.97	147.39	129	0
Savenac Creek	12231	10-year	185.000	3234.200	3236.4640	3236	3237	0	2.68	73.40	54	0
Savenac Creek	12231	25-year	232.000	3234.200	3236.7370	3236	3237	0	2.88	89.80	69	0
Savenac Creek	12231	50-year	271.000	3234.200	3236.9370	3236	3237	0	3.01	104.84	81	0
Savenac Creek	12231	100-year	311.000	3234.200	3237.1080	3236	3237	0	3.13	119.36	86	0
Savenac Creek	12231	500-year	400.000	3234.200	3237.4280	3236	3238	0	3.37	147.49	91	0
Savenac Creek	12231	1% plus	485.000	3234.200	3237.6940	3236	3238	0	3.58	173.22	110	0
Savenac Creek	12460	10-year	185.000	3236.510	3239.0970	3238	3239	0	4.20	47.21	41	1
Savenac Creek	12460	25-year	232.000	3236.510	3239.3150	3239	3240	0	4.61	56.89	48	1
Savenac Creek	12460	50-year	271.000	3236.510	3239.4720	3239	3240	0	4.89	64.78	52	1
Savenac Creek	12460	100-year	311.000	3236.510	3239.6190	3239	3240	0	5.13	72.66	55	1
Savenac Creek	12460	500-year	400.000	3236.510	3239.9130	3240	3240	0	5.58	89.76	61	1
Savenac Creek	12460	1% plus	485.000	3236.510	3240.1610	3240	3241	0	5.91	105.55	65	1
Savenac Creek	12776	10-year	185.000	3240.260	3243.1990	3242	3243	0	3.13	61.87	52	0
Savenac Creek	12776	25-year	232.000	3240.260	3243.5080	3242	3244	0	3.41	72.53	57	0
Savenac Creek	12776	50-year	271.000	3240.260	3243.7360	3242	3244	0	3.63	81.12	61	0

HEC-RAS Plan: MultipleProfiles River: Savenac Creek Reach: Savenac Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Savenac Creek	12776	100-year	311.000	3240.260	3243.9480	3243	3244	0	3.83	89.76	64	0
Savenac Creek	12776	500-year	400.000	3240.260	3244.3560	3243	3245	0	4.24	108.47	74	0
Savenac Creek	12776	1% plus	485.000	3240.260	3244.6810	3243	3245	0	4.58	125.98	81	0
Savenac Creek	13210	10-year	185.000	3244.430	3247.2310	3246	3247	0	3.53	57.91	41	0
Savenac Creek	13210	25-year	232.000	3244.430	3247.5300	3246	3248	0	3.80	71.89	66	0
Savenac Creek	13210	50-year	271.000	3244.430	3247.7460	3247	3248	0	3.97	85.63	128	0
Savenac Creek	13210	100-year	311.000	3244.430	3247.9410	3247	3248	0	4.08	102.96	153	0
Savenac Creek	13210	500-year	400.000	3244.430	3248.2980	3247	3249	0	4.20	146.35	204	0
Savenac Creek	13210	1% plus	485.000	3244.430	3248.5720	3248	3249	0	4.23	186.47	254	0
Savenac Creek	13464	10-year	185.000	3246.920	3248.9530	3248	3249	0	1.92	101.93	69	0
Savenac Creek	13464	25-year	232.000	3246.920	3249.2240	3248	3249	0	2.06	120.83	70	0
Savenac Creek	13464	50-year	271.000	3246.920	3249.4240	3248	3249	0	2.17	135.05	72	0
Savenac Creek	13464	100-year	311.000	3246.920	3249.6030	3248	3250	0	2.29	148.11	74	0
Savenac Creek	13464	500-year	400.000	3246.920	3249.9250	3248	3250	0	2.56	172.55	80	0
Savenac Creek	13464	1% plus	485.000	3246.920	3250.1770	3249	3250	0	2.81	193.20	83	0
Savenac Creek	13693	10-year	185.000	3249.430	3251.0870	3251	3251	0	4.65	39.79	39	1
Savenac Creek	13693	25-year	232.000	3249.430	3251.2370	3251	3252	0	5.08	45.82	41	1
Savenac Creek	13693	50-year	271.000	3249.430	3251.3660	3251	3252	0	5.34	51.27	43	1
Savenac Creek	13693	100-year	311.000	3249.430	3251.5060	3251	3252	0	5.51	57.50	46	1
Savenac Creek	13693	500-year	400.000	3249.430	3251.8250	3252	3252	0	5.73	72.75	50	1
Savenac Creek	13693	1% plus	485.000	3249.430	3252.1130	3252	3253	0	5.88	87.51	53	1
Savenac Creek	13904	10-year	185.000	3251.850	3254.8570	3254	3255	0	3.02	65.77	57	0
Savenac Creek	13904	25-year	232.000	3251.850	3255.1130	3254	3255	0	3.28	84.09	87	0
Savenac Creek	13904	50-year	271.000	3251.850	3255.2800	3254	3255	0	3.46	100.28	108	0
Savenac Creek	13904	100-year	311.000	3251.850	3255.4220	3254	3256	0	3.62	116.63	122	0
Savenac Creek	13904	500-year	400.000	3251.850	3255.6760	3255	3256	0	3.94	150.26	143	0
Savenac Creek	13904	1% plus	485.000	3251.850	3255.8850	3255	3256	0	4.20	182.73	170	0
Savenac Creek	14358	10-year	185.000	3257.440	3260.3840	3260	3261	0	4.18	55.56	76	1
Savenac Creek	14358	25-year	232.000	3257.440	3260.5940	3260	3261	0	4.34	73.24	92	1
Savenac Creek	14358	50-year	271.000	3257.440	3260.7400	3260	3261	0	4.46	87.99	107	1
Savenac Creek	14358	100-year	311.000	3257.440	3260.8680	3261	3261	0	4.52	102.49	116	1
Savenac Creek	14358	500-year	400.000	3257.440	3261.1160	3261	3261	0	4.66	132.43	126	1
Savenac Creek	14358	1% plus	485.000	3257.440	3261.3230	3261	3262	0	4.76	160.43	141	1
Savenac Creek	14722	10-year	185.000	3263.190	3265.6960	3265	3266	0	2.97	79.31	71	0
Savenac Creek	14722	25-year	232.000	3263.190	3265.8780	3265	3266	0	3.25	93.35	83	0
Savenac Creek	14722	50-year	271.000	3263.190	3266.0470	3265	3266	0	3.50	108.56	102	0
Savenac Creek	14722	100-year	311.000	3263.190	3266.1570	3265	3266	0	3.68	119.35	107	0
Savenac Creek	14722	500-year	400.000	3263.190	3266.3750	3266	3267	0	4.04	141.56	117	0
Savenac Creek	14722	1% plus	485.000	3263.190	3266.5520	3266	3267	0	4.34	160.67	124	0
Savenac Creek	15039	10-year	185.000	3266.530	3269.0920	3268	3269	0	2.82	65.86	45	0
Savenac Creek	15039	25-year	232.000	3266.530	3269.3250	3268	3269	0	3.06	76.72	48	0
Savenac Creek	15039	50-year	271.000	3266.530	3269.5130	3269	3270	0	3.22	85.99	50	0
Savenac Creek	15039	100-year	311.000	3266.530	3269.6770	3269	3270	0	3.40	94.41	53	0
Savenac Creek	15039	500-year	400.000	3266.530	3270.0070	3269	3270	0	3.74	112.36	56	0
Savenac Creek	15039	1% plus	485.000	3266.530	3270.2860	3269	3271	0	4.03	128.79	61	0
Savenac Creek	15420	10-year	185.000	3272.160	3274.9100	3275	3275	0	3.62	57.48	74	1
Savenac Creek	15420	25-year	232.000	3272.160	3275.0790	3275	3275	0	3.91	68.96	85	1
Savenac Creek	15420	50-year	271.000	3272.160	3275.1970	3275	3275	0	4.14	77.36	93	1
Savenac Creek	15420	100-year	311.000	3272.160	3275.3210	3275	3276	0	4.32	87.06	103	1
Savenac Creek	15420	500-year	400.000	3272.160	3275.5700	3275	3276	0	4.61	107.99	122	1
Savenac Creek	15420	1% plus	485.000	3272.160	3275.7970	3275	3276	0	4.86	128.88	168	1
Savenac Creek	15748	10-year	185.000	3275.500	3278.6140	3277	3279	0	2.56	73.78	91	0
Savenac Creek	15748	25-year	232.000	3275.500	3278.8780	3278	3279	0	2.82	85.33	182	0
Savenac Creek	15748	50-year	271.000	3275.500	3279.0740	3278	3279	0	3.02	94.43	248	0
Savenac Creek	15748	100-year	311.000	3275.500	3279.2520	3278	3279	0	3.21	103.12	322	0
Savenac Creek	15748	500-year	400.000	3275.500	3279.5960	3278	3280	0	3.60	121.17	400	0
Savenac Creek	15748	1% plus	485.000	3275.500	3279.8820	3278	3280	0	3.92	137.17	426	0
Savenac Creek	16159	10-year	185.000	3280.370	3282.5120	3282	3283	0	3.17	61.15	54	0
Savenac Creek	16159	25-year	232.000	3280.370	3282.7420	3282	3283	0	3.37	74.96	66	0
Savenac Creek	16159	50-year	271.000	3280.370	3282.9150	3282	3283	0	3.51	87.83	96	0
Savenac Creek	16159	100-year	311.000	3280.370	3283.0860	3282	3283	0	3.61	104.74	142	0
Savenac Creek	16159	500-year	400.000	3280.370	3283.3870	3283	3284	0	3.72	138.49	205	0
Savenac Creek	16159	1% plus	485.000	3280.370	3283.6520	3283	3284	0	3.81	170.97	268	0
Savenac Creek	16531	10-year	185.000	3284.680	3287.6620	3287	3288	0	3.80	57.33	98	0
Savenac Creek	16531	25-year	232.000	3284.680	3287.8810	3287	3288	0	4.18	69.74	124	0
Savenac Creek	16531	50-year	271.000	3284.680	3288.0300	3287	3288	0	4.43	80.05	148	0
Savenac Creek	16531	100-year	311.000	3284.680	3288.1570	3288	3288	0	4.69	90.64	184	0
Savenac Creek	16531	500-year	400.000	3284.680	3288.3900	3288	3289	0	5.29	117.88	270	1
Savenac Creek	16531	1% plus	485.000	3284.680	3288.5430	3288	3289	0	5.70	140.59	297	1
Savenac Creek	16738	10-year	185.000	3287.410	3290.0260	3289	3290	0	2.91	83.98	144	0
Savenac Creek	16738	25-year	232.000	3287.410	3290.2610	3289	3290	0	3.03	106.16	203	0
Savenac Creek	16738	50-year	271.000	3287.410	3290.4470	3290	3291	0	3.18	127.99	279	0
Savenac Creek	16738	100-year	311.000	3287.410	3290.5880	3290	3291	0	3.23	147.02	304	0
Savenac Creek	16738	500-year	400.000	3287.410	3290.8740	3290	3291	0	3.30	188.02	327	0
Savenac Creek	16738	1% plus	485.000	3287.410	3291.0920	3290	3291	0	3.42	220.51	341	0
Savenac Creek	16863	10-year	185.000	3288.790	3291.3790	3291	3292	0	3.63	63.50	66	0

HEC-RAS Plan: MultipleProfiles River: Savenac Creek Reach: Savenac Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Savenac Creek	16863	25-year	232.000	3288.790	3291.5700	3291	3292	0	3.94	76.81	74	0
Savenac Creek	16863	50-year	271.000	3288.790	3291.7300	3291	3292	0	4.10	89.09	93	0
Savenac Creek	16863	100-year	311.000	3288.790	3291.8450	3291	3292	0	4.32	98.23	120	0
Savenac Creek	16863	500-year	400.000	3288.790	3292.0690	3292	3292	0	4.78	116.88	140	1
Savenac Creek	16863	1% plus	485.000	3288.790	3292.2670	3292	3293	0	5.13	135.47	161	1
Savenac Creek	17041	10-year	185.000	3292.390	3294.4510	3294	3295	0	3.88	56.88	52	1
Savenac Creek	17041	25-year	232.000	3292.390	3294.6580	3294	3295	0	4.15	68.33	59	1
Savenac Creek	17041	50-year	271.000	3292.390	3294.7950	3294	3295	0	4.39	76.75	76	1
Savenac Creek	17041	100-year	311.000	3292.390	3294.9460	3294	3295	0	4.55	86.91	101	1
Savenac Creek	17041	500-year	400.000	3292.390	3295.2540	3295	3296	0	4.88	113.02	172	1
Savenac Creek	17041	1% plus	485.000	3292.390	3295.4950	3295	3296	0	5.13	137.93	227	1
Savenac Creek	17194	10-year	185.000	3294.420	3297.2210	3296	3297	0	3.20	58.06	70	0
Savenac Creek	17194	25-year	232.000	3294.420	3297.4270	3297	3298	0	3.54	66.31	83	0
Savenac Creek	17194	50-year	271.000	3294.420	3297.5920	3297	3298	0	3.78	73.35	89	0
Savenac Creek	17194	100-year	311.000	3294.420	3297.7330	3297	3298	0	4.03	79.64	101	0
Savenac Creek	17194	500-year	400.000	3294.420	3298.0260	3297	3298	0	4.50	93.73	122	1
Savenac Creek	17194	1% plus	485.000	3294.420	3298.2630	3297	3299	0	4.90	106.89	151	1
Savenac Creek	17547	10-year	185.000	3299.100	3301.6480	3301	3302	0	3.01	80.02	66	0
Savenac Creek	17547	25-year	232.000	3299.100	3301.8840	3301	3302	0	3.21	96.32	74	0
Savenac Creek	17547	50-year	271.000	3299.100	3302.0780	3301	3302	0	3.40	112.01	85	0
Savenac Creek	17547	100-year	311.000	3299.100	3302.2380	3301	3302	0	3.49	125.86	98	0
Savenac Creek	17547	500-year	400.000	3299.100	3302.5480	3301	3303	0	3.68	154.24	111	0
Savenac Creek	17547	1% plus	485.000	3299.100	3302.8290	3302	3303	0	3.85	182.45	149	0
Savenac Creek	17852	10-year	185.000	3304.930	3306.9290	3307	3307	0	4.19	52.91	169	1
Savenac Creek	17852	25-year	232.000	3304.930	3307.0610	3307	3307	0	4.51	65.93	191	1
Savenac Creek	17852	50-year	271.000	3304.930	3307.1710	3307	3307	0	4.66	78.80	207	1
Savenac Creek	17852	100-year	311.000	3304.930	3307.2490	3307	3308	0	4.88	89.02	225	1
Savenac Creek	17852	500-year	400.000	3304.930	3307.4070	3307	3308	0	5.23	112.64	249	1
Savenac Creek	17852	1% plus	485.000	3304.930	3307.5440	3307	3308	0	5.47	135.56	269	1
Savenac Creek	18077	10-year	185.000	3308.390	3311.0820	3310	3311	0	3.36	58.81	74	0
Savenac Creek	18077	25-year	232.000	3308.390	3311.3320	3310	3312	0	3.70	68.42	85	0
Savenac Creek	18077	50-year	271.000	3308.390	3311.4990	3311	3312	0	3.98	75.89	93	0
Savenac Creek	18077	100-year	311.000	3308.390	3311.6700	3311	3312	0	4.21	84.53	102	0
Savenac Creek	18077	500-year	400.000	3308.390	3311.9900	3311	3312	0	4.70	102.90	162	0
Savenac Creek	18077	1% plus	485.000	3308.390	3312.2370	3311	3313	0	5.09	120.92	232	1
Savenac Creek	18542	10-year	185.000	3315.590	3317.8020	3317	3318	0	3.83	48.56	98	1
Savenac Creek	18542	25-year	232.000	3315.590	3318.0670	3317	3318	0	4.13	57.00	120	1
Savenac Creek	18542	50-year	271.000	3315.590	3318.2850	3318	3319	0	4.32	64.58	148	1
Savenac Creek	18542	100-year	311.000	3315.590	3318.4710	3318	3319	0	4.52	74.20	197	1
Savenac Creek	18542	500-year	400.000	3315.590	3318.8290	3318	3319	0	4.79	98.48	238	1
Savenac Creek	18542	1% plus	485.000	3315.590	3319.1150	3318	3319	0	4.99	119.35	262	1
Savenac Creek	18761	10-year	185.000	3319.320	3321.6010	3321	3322	0	2.63	79.90	66	0
Savenac Creek	18761	25-year	232.000	3319.320	3321.8230	3321	3322	0	2.86	94.77	68	0
Savenac Creek	18761	50-year	271.000	3319.320	3321.9880	3321	3322	0	3.03	106.10	70	0
Savenac Creek	18761	100-year	311.000	3319.320	3322.1500	3321	3322	0	3.17	117.51	71	0
Savenac Creek	18761	500-year	400.000	3319.320	3322.4530	3321	3323	0	3.51	139.34	73	0
Savenac Creek	18761	1% plus	485.000	3319.320	3322.7030	3322	3323	0	3.80	157.97	76	0
Savenac Creek	19150	10-year	185.000	3329.470	3331.6090	3331	3332	0	4.21	58.51	69	1
Savenac Creek	19150	25-year	232.000	3329.470	3331.7920	3331	3332	0	4.53	72.34	81	1
Savenac Creek	19150	50-year	271.000	3329.470	3331.9260	3332	3332	0	4.73	83.49	86	1
Savenac Creek	19150	100-year	311.000	3329.470	3332.0460	3332	3332	0	4.93	94.12	91	1
Savenac Creek	19150	500-year	400.000	3329.470	3332.3150	3332	3333	0	5.21	121.03	114	1
Savenac Creek	19150	1% plus	485.000	3329.470	3332.5450	3332	3333	0	5.39	147.49	130	1
Savenac Creek	19402	10-year	185.000	3335.510	3337.7880	3337	3338	0	2.33	113.31	118	0
Savenac Creek	19402	25-year	232.000	3335.510	3337.9690	3337	3338	0	2.51	134.66	128	0
Savenac Creek	19402	50-year	271.000	3335.510	3338.1010	3337	3338	0	2.65	150.69	135	0
Savenac Creek	19402	100-year	311.000	3335.510	3338.2300	3337	3338	0	2.77	166.91	141	0
Savenac Creek	19402	500-year	400.000	3335.510	3338.4710	3337	3339	0	3.03	198.50	154	0
Savenac Creek	19402	1% plus	485.000	3335.510	3338.6680	3338	3339	0	3.27	225.76	179	0

HEC-RAS Plan: MultipleProfiles River: Big Creek Reach: Big Creek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Big Creek	43.67	10-Year	769.000	3086.780	3090.6960	3089	3091	0	4.42	174.97	61	0
Big Creek	43.67	25-Year	904.000	3086.780	3091.0050	3090	3091	0	4.71	194.47	65	0
Big Creek	43.67	50-Year	1020.000	3086.780	3091.2500	3090	3092	0	4.94	210.70	67	0
Big Creek	43.67	100-Year	1130.000	3086.780	3091.4730	3090	3092	0	5.14	225.80	69	0
Big Creek	43.67	500-Year	1370.000	3086.780	3091.9210	3090	3092	0	5.53	257.73	73	0
Big Creek	43.67	1%+	1763.000	3086.780	3092.5730	3091	3093	0	6.07	307.04	78	0
Big Creek	49	10-Year	769.000	3086.880	3090.7120	3090	3091	0	5.27	146.91	55	1
Big Creek	49	25-Year	904.000	3086.880	3091.0150	3090	3091	0	5.58	163.92	57	1
Big Creek	49	50-Year	1020.000	3086.880	3091.2550	3090	3092	0	5.84	177.91	60	1
Big Creek	49	100-Year	1130.000	3086.880	3091.4730	3090	3092	0	6.05	191.26	63	1
Big Creek	49	500-Year	1370.000	3086.880	3091.9130	3091	3093	0	6.48	219.82	67	1
Big Creek	49	1%+	1763.000	3086.880	3092.5520	3091	3093	0	7.06	265.06	74	1
Big Creek	83		Bridge									
Big Creek	126	10-Year	769.000	3088.430	3092.6990	3091	3093	0	4.19	189.77	65	0
Big Creek	126	25-Year	904.000	3088.430	3092.9650	3091	3093	0	4.54	207.15	66	0
Big Creek	126	50-Year	1020.000	3088.430	3093.1800	3092	3094	0	4.81	221.39	67	0
Big Creek	126	100-Year	1130.000	3088.430	3093.3780	3092	3094	0	5.04	234.73	68	0
Big Creek	126	500-Year	1370.000	3088.430	3093.7880	3092	3094	0	5.50	263.54	76	0
Big Creek	126	1%+	1763.000	3088.430	3094.4180	3093	3095	0	6.05	313.88	83	0
Big Creek	188	10-Year	769.000	3088.990	3093.2750	3092	3094	0	5.23	149.71	45	0
Big Creek	188	25-Year	904.000	3088.990	3093.5660	3092	3094	0	5.68	162.96	46	1
Big Creek	188	50-Year	1020.000	3088.990	3093.7980	3092	3094	0	6.04	173.75	47	1
Big Creek	188	100-Year	1130.000	3088.990	3094.0070	3093	3095	0	6.35	183.63	48	1
Big Creek	188	500-Year	1370.000	3088.990	3094.4330	3093	3095	0	6.98	204.22	49	1
Big Creek	188	1%+	1763.000	3088.990	3095.0450	3094	3096	0	7.89	235.06	51	1
Big Creek	216		Bridge									
Big Creek	234	10-Year	769.000	3089.210	3093.9280	3092	3094	0	4.45	175.61	55	0
Big Creek	234	25-Year	904.000	3089.210	3094.2810	3093	3095	0	4.74	195.15	57	0
Big Creek	234	50-Year	1020.000	3089.210	3094.5630	3093	3095	0	4.96	210.91	58	0
Big Creek	234	100-Year	1130.000	3089.210	3094.8170	3093	3095	0	5.16	225.05	59	0
Big Creek	234	500-Year	1370.000	3089.210	3095.3440	3093	3096	0	5.54	254.42	61	0
Big Creek	234	1%+	1763.000	3089.210	3096.1150	3094	3097	0	6.11	297.42	64	0
Big Creek	286	10-Year	769.000	3089.340	3094.3970	3093	3095	0	5.07	154.64	42	0
Big Creek	286	25-Year	904.000	3089.340	3094.7480	3093	3095	0	5.46	169.47	43	0
Big Creek	286	50-Year	1020.000	3089.340	3095.0280	3093	3096	0	5.78	181.62	44	0
Big Creek	286	100-Year	1130.000	3089.340	3095.2790	3093	3096	0	6.06	192.72	45	0
Big Creek	286	500-Year	1370.000	3089.340	3095.7950	3094	3096	0	6.60	216.09	46	0
Big Creek	286	1%+	1763.000	3089.340	3096.5500	3094	3097	0	7.38	251.71	48	1
Big Creek	307		Bridge									
Big Creek	328	10-Year	769.000	3089.930	3094.9240	3093	3095	0	4.90	161.05	45	0
Big Creek	328	25-Year	904.000	3089.930	3095.3010	3093	3096	0	5.24	178.24	46	0
Big Creek	328	50-Year	1020.000	3089.930	3095.6000	3094	3096	0	5.51	192.32	48	0
Big Creek	328	100-Year	1130.000	3089.930	3095.8690	3094	3096	0	5.75	205.25	49	0
Big Creek	328	500-Year	1370.000	3089.930	3096.4180	3094	3097	0	6.21	232.62	51	0
Big Creek	328	1%+	1763.000	3089.930	3097.2180	3095	3098	0	6.86	274.42	54	0
Big Creek	545	10-Year	769.000	3093.140	3097.2600	3096	3098	0	4.30	198.38	110	0
Big Creek	545	25-Year	904.000	3093.140	3097.6020	3096	3098	0	4.39	238.91	129	0
Big Creek	545	50-Year	1020.000	3093.140	3097.8770	3096	3098	0	4.44	275.15	135	0
Big Creek	545	100-Year	1130.000	3093.140	3098.1290	3097	3098	0	4.48	309.79	138	0
Big Creek	545	500-Year	1370.000	3093.140	3098.6380	3097	3099	0	4.51	381.24	142	0
Big Creek	545	1%+	1763.000	3093.140	3099.4150	3098	3100	0	4.61	499.90	170	0
Big Creek	733	10-Year	769.000	3095.320	3099.3240	3098	3100	0	4.28	235.87	169	0
Big Creek	733	25-Year	904.000	3095.320	3099.5290	3099	3100	0	4.49	267.31	179	0
Big Creek	733	50-Year	1020.000	3095.320	3099.6960	3099	3100	0	4.64	293.46	187	0
Big Creek	733	100-Year	1130.000	3095.320	3099.8500	3099	3100	0	4.76	318.03	210	0
Big Creek	733	500-Year	1370.000	3095.320	3100.1720	3099	3100	0	5.05	373.92	253	0
Big Creek	733	1%+	1763.000	3095.320	3100.7260	3100	3101	0	5.29	491.89	302	0
Big Creek	995	10-Year	769.000	3097.890	3102.2240	3101	3103	0	4.80	216.12	179	0
Big Creek	995	25-Year	904.000	3097.890	3102.4480	3101	3103	0	5.04	258.98	205	0
Big Creek	995	50-Year	1020.000	3097.890	3102.6170	3102	3103	0	5.17	293.96	210	0
Big Creek	995	100-Year	1130.000	3097.890	3102.7560	3102	3103	0	5.28	323.23	211	0
Big Creek	995	500-Year	1370.000	3097.890	3103.0520	3102	3103	0	5.45	385.79	212	0
Big Creek	995	1%+	1763.000	3097.890	3103.4520	3103	3104	0	5.76	471.22	214	0
Big Creek	1349	10-Year	769.000	3101.360	3105.6310	3104	3106	0	2.97	273.67	158	0
Big Creek	1349	25-Year	904.000	3101.360	3105.8550	3104	3106	0	3.12	309.48	163	0
Big Creek	1349	50-Year	1020.000	3101.360	3106.0150	3105	3106	0	3.27	335.97	168	0
Big Creek	1349	100-Year	1130.000	3101.360	3106.1590	3105	3106	0	3.41	360.49	173	0
Big Creek	1349	500-Year	1370.000	3101.360	3106.4360	3105	3107	0	3.67	409.61	181	0
Big Creek	1349	1%+	1763.000	3101.360	3106.8390	3105	3107	0	4.03	484.46	188	0
Big Creek	1705	10-Year	769.000	3106.460	3109.5890	3109	3110	0	5.03	179.01	156	1
Big Creek	1705	25-Year	904.000	3106.460	3109.7680	3109	3110	0	5.30	208.07	166	1
Big Creek	1705	50-Year	1020.000	3106.460	3109.9270	3109	3110	0	5.45	234.79	169	1
Big Creek	1705	100-Year	1130.000	3106.460	3110.0660	3110	3110	0	5.56	258.20	170	1
Big Creek	1705	500-Year	1370.000	3106.460	3110.3470	3110	3111	0	5.78	306.21	171	1

HEC-RAS Plan: MultipleProfiles River: Big Creek Reach: Big Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Big Creek	1705	1%+	1763.000	3106.460	3110.7530	3110	3111	0	6.10	376.13	173	1
Big Creek	1972	10-Year	769.000	3108.830	3113.1300	3112	3113	0	3.79	231.71	161	0
Big Creek	1972	25-Year	904.000	3108.830	3113.3300	3112	3114	0	3.98	264.45	167	0
Big Creek	1972	50-Year	1020.000	3108.830	3113.4740	3112	3114	0	4.15	288.84	175	0
Big Creek	1972	100-Year	1130.000	3108.830	3113.6000	3112	3114	0	4.30	311.58	184	0
Big Creek	1972	500-Year	1370.000	3108.830	3113.8540	3113	3114	0	4.60	360.28	197	0
Big Creek	1972	1%+	1763.000	3108.830	3114.2060	3113	3115	0	4.97	431.96	216	0
Big Creek	2319	10-Year	769.000	3112.840	3117.1030	3116	3117	0	4.06	190.02	93	0
Big Creek	2319	25-Year	904.000	3112.840	3117.3180	3116	3118	0	4.32	210.14	94	1
Big Creek	2319	50-Year	1020.000	3112.840	3117.4970	3117	3118	0	4.52	227.00	95	1
Big Creek	2319	100-Year	1130.000	3112.840	3117.6560	3117	3118	0	4.70	242.10	95	1
Big Creek	2319	500-Year	1370.000	3112.840	3117.9780	3117	3118	0	5.06	273.15	98	1
Big Creek	2319	1%+	1763.000	3112.840	3118.4220	3117	3119	0	5.61	323.94	136	1
Big Creek	2676	10-Year	769.000	3117.080	3121.2690	3120	3121	0	2.65	295.59	173	0
Big Creek	2676	25-Year	904.000	3117.080	3121.4580	3120	3122	0	2.81	328.61	176	0
Big Creek	2676	50-Year	1020.000	3117.080	3121.6120	3121	3122	0	2.93	355.34	181	0
Big Creek	2676	100-Year	1130.000	3117.080	3121.7530	3121	3122	0	3.04	380.09	184	0
Big Creek	2676	500-Year	1370.000	3117.080	3122.0470	3121	3122	0	3.25	432.14	211	0
Big Creek	2676	1%+	1763.000	3117.080	3122.4730	3121	3123	0	3.51	539.02	270	0
Big Creek	2996	10-Year	769.000	3121.080	3124.3430	3123	3125	0	4.25	205.01	211	0
Big Creek	2996	25-Year	904.000	3121.080	3124.5510	3123	3125	0	4.57	230.54	236	0
Big Creek	2996	50-Year	1020.000	3121.080	3124.7160	3124	3125	0	4.81	252.51	255	0
Big Creek	2996	100-Year	1130.000	3121.080	3124.8570	3124	3125	0	5.01	272.60	272	0
Big Creek	2996	500-Year	1370.000	3121.080	3125.1330	3124	3126	0	5.39	313.40	307	1
Big Creek	2996	1%+	1763.000	3121.080	3125.5200	3125	3126	0	5.99	379.33	346	1
Big Creek	3381	10-Year	769.000	3124.400	3128.0670	3127	3128	0	2.53	358.03	272	0
Big Creek	3381	25-Year	904.000	3124.400	3128.2610	3127	3128	0	2.63	407.22	289	0
Big Creek	3381	50-Year	1020.000	3124.400	3128.4180	3127	3129	0	2.71	447.70	300	0
Big Creek	3381	100-Year	1130.000	3124.400	3128.5550	3127	3129	0	2.78	483.14	313	0
Big Creek	3381	500-Year	1370.000	3124.400	3128.8320	3128	3129	0	2.93	556.16	367	0
Big Creek	3381	1%+	1763.000	3124.400	3129.2500	3128	3129	0	3.13	668.01	408	0
Big Creek	3632	10-Year	769.000	3128.040	3130.6830	3130	3131	0	4.16	200.00	198	1
Big Creek	3632	25-Year	904.000	3128.040	3130.8070	3130	3131	0	4.46	220.81	221	1
Big Creek	3632	50-Year	1020.000	3128.040	3130.9100	3130	3131	0	4.67	239.80	244	1
Big Creek	3632	100-Year	1130.000	3128.040	3131.0020	3131	3131	0	4.86	257.89	256	1
Big Creek	3632	500-Year	1370.000	3128.040	3131.1950	3131	3132	0	5.17	297.21	276	1
Big Creek	3632	1%+	1763.000	3128.040	3131.4770	3131	3132	0	5.62	357.93	315	1
Big Creek	3955	10-Year	769.000	3131.050	3134.0550	3133	3134	0	2.97	386.10	348	0
Big Creek	3955	25-Year	904.000	3131.050	3134.2120	3133	3134	0	3.07	444.09	386	0
Big Creek	3955	50-Year	1020.000	3131.050	3134.3320	3133	3134	0	3.15	491.53	405	0
Big Creek	3955	100-Year	1130.000	3131.050	3134.4540	3134	3135	0	3.23	542.22	422	0
Big Creek	3955	500-Year	1370.000	3131.050	3134.6470	3134	3135	0	3.37	624.47	434	0
Big Creek	3955	1%+	1763.000	3131.050	3134.9290	3134	3135	0	3.54	748.72	447	0
Big Creek	4360	10-Year	769.000	3134.160	3138.1030	3137	3138	0	4.56	239.89	202	0
Big Creek	4360	25-Year	904.000	3134.160	3138.2680	3138	3139	0	4.82	275.32	232	1
Big Creek	4360	50-Year	1020.000	3134.160	3138.3960	3138	3139	0	5.02	305.87	252	1
Big Creek	4360	100-Year	1130.000	3134.160	3138.5190	3138	3139	0	5.23	339.08	291	1
Big Creek	4360	500-Year	1370.000	3134.160	3138.7260	3138	3139	0	5.54	401.04	304	1
Big Creek	4360	1%+	1763.000	3134.160	3138.9900	3139	3139	0	5.94	482.23	322	1
Big Creek	4627	10-Year	769.000	3136.380	3141.2860	3140	3142	0	4.16	196.23	105	0
Big Creek	4627	25-Year	904.000	3136.380	3141.5610	3140	3142	0	4.48	216.88	138	0
Big Creek	4627	50-Year	1020.000	3136.380	3141.7780	3140	3142	0	4.73	233.68	201	0
Big Creek	4627	100-Year	1130.000	3136.380	3141.9740	3140	3142	0	4.93	249.09	237	0
Big Creek	4627	500-Year	1370.000	3136.380	3142.3380	3141	3143	0	5.39	277.70	266	0
Big Creek	4627	1%+	1763.000	3136.380	3142.8380	3141	3143	0	6.09	317.01	301	0
Big Creek	4660		Bridge									
Big Creek	4690	10-Year	769.000	3136.980	3142.1640	3140	3142	0	3.48	221.49	88	0
Big Creek	4690	25-Year	904.000	3136.980	3142.4780	3141	3143	0	3.73	243.53	107	0
Big Creek	4690	50-Year	1020.000	3136.980	3142.7290	3141	3143	0	3.92	261.38	116	0
Big Creek	4690	100-Year	1130.000	3136.980	3142.9570	3141	3143	0	4.10	277.67	147	0
Big Creek	4690	500-Year	1370.000	3136.980	3143.4080	3141	3144	0	4.46	310.23	203	0
Big Creek	4690	1%+	1763.000	3136.980	3144.0680	3142	3144	0	4.98	358.62	362	0
Big Creek	5066	10-Year	769.000	3142.050	3145.7450	3145	3146	0	3.74	226.32	160	0
Big Creek	5066	25-Year	904.000	3142.050	3145.9720	3145	3146	0	3.81	263.40	166	0
Big Creek	5066	50-Year	1020.000	3142.050	3146.1570	3145	3146	0	3.85	294.27	167	0
Big Creek	5066	100-Year	1130.000	3142.050	3146.3260	3145	3147	0	3.89	322.53	169	0
Big Creek	5066	500-Year	1370.000	3142.050	3146.6780	3146	3147	0	3.94	382.28	171	0
Big Creek	5066	1%+	1763.000	3142.050	3147.2140	3146	3147	0	4.02	474.68	174	0
Big Creek	5425	10-Year	769.000	3146.550	3150.0470	3149	3150	0	4.55	201.48	143	0
Big Creek	5425	25-Year	904.000	3146.550	3150.1960	3149	3150	0	4.84	224.25	161	0
Big Creek	5425	50-Year	1020.000	3146.550	3150.3050	3150	3151	0	5.09	242.32	180	1
Big Creek	5425	100-Year	1130.000	3146.550	3150.4150	3150	3151	0	5.34	262.31	206	1
Big Creek	5425	500-Year	1370.000	3146.550	3150.6240	3150	3151	0	5.85	307.61	251	1
Big Creek	5425	1%+	1763.000	3146.550	3150.8550	3150	3151	0	6.31	360.29	289	1

HEC-RAS Plan: MultipleProfiles River: Big Creek Reach: Big Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Big Creek	5810	10-Year	769.000	3149.400	3154.1980	3153	3154	0	3.91	198.51	69	0
Big Creek	5810	25-Year	904.000	3149.400	3154.4860	3153	3155	0	4.19	218.63	71	0
Big Creek	5810	50-Year	1020.000	3149.400	3154.7220	3153	3155	0	4.41	235.45	72	0
Big Creek	5810	100-Year	1130.000	3149.400	3154.9390	3153	3155	0	4.60	251.45	76	0
Big Creek	5810	500-Year	1370.000	3149.400	3155.3730	3154	3156	0	4.97	286.21	84	0
Big Creek	5810	1%+	1763.000	3149.400	3155.9140	3154	3156	0	5.58	338.30	111	0
Big Creek	6315	10-Year	769.000	3155.900	3159.8680	3159	3160	0	4.43	195.80	123	0
Big Creek	6315	25-Year	904.000	3155.900	3160.1040	3159	3160	0	4.58	226.94	139	0
Big Creek	6315	50-Year	1020.000	3155.900	3160.2890	3160	3161	0	4.69	253.99	152	0
Big Creek	6315	100-Year	1130.000	3155.900	3160.4560	3160	3161	0	4.76	280.71	168	0
Big Creek	6315	500-Year	1370.000	3155.900	3160.7720	3160	3161	0	4.90	335.29	179	0
Big Creek	6315	1%+	1763.000	3155.900	3161.2590	3160	3162	0	4.98	427.56	200	0
Big Creek	6777	10-Year	769.000	3163.010	3165.8590	3165	3166	0	3.00	325.02	262	0
Big Creek	6777	25-Year	904.000	3163.010	3166.0290	3165	3166	0	3.22	372.03	285	0
Big Creek	6777	50-Year	1020.000	3163.010	3166.1400	3165	3166	0	3.35	403.85	289	0
Big Creek	6777	100-Year	1130.000	3163.010	3166.2640	3165	3166	0	3.53	440.18	296	0
Big Creek	6777	500-Year	1370.000	3163.010	3166.4430	3165	3167	0	3.76	493.32	298	0
Big Creek	6777	1%+	1763.000	3163.010	3166.6830	3166	3167	0	4.16	565.03	300	0
Big Creek	7148	10-Year	769.000	3166.890	3169.9510	3169	3170	0	4.56	199.28	242	1
Big Creek	7148	25-Year	904.000	3166.890	3170.1630	3169	3170	0	4.82	225.17	255	1
Big Creek	7148	50-Year	1020.000	3166.890	3170.3130	3170	3171	0	5.08	244.62	264	1
Big Creek	7148	100-Year	1130.000	3166.890	3170.4860	3170	3171	0	5.26	268.32	291	1
Big Creek	7148	500-Year	1370.000	3166.890	3170.7740	3170	3171	0	5.74	311.70	324	1
Big Creek	7148	1%+	1763.000	3166.890	3171.1780	3170	3172	0	6.25	380.77	394	1
Big Creek	7554	10-Year	769.000	3171.170	3174.1790	3173	3174	0	2.57	384.68	328	0
Big Creek	7554	25-Year	904.000	3171.170	3174.3690	3173	3174	0	2.71	438.40	354	0
Big Creek	7554	50-Year	1020.000	3171.170	3174.5130	3173	3175	0	2.78	479.99	368	0
Big Creek	7554	100-Year	1130.000	3171.170	3174.6390	3173	3175	0	2.85	516.59	381	0
Big Creek	7554	500-Year	1370.000	3171.170	3174.9100	3174	3175	0	2.97	595.96	401	0
Big Creek	7554	1%+	1763.000	3171.170	3175.2950	3174	3175	0	3.18	709.37	454	0
Big Creek	8021	10-Year	769.000	3175.960	3178.5470	3178	3179	0	3.85	277.52	263	0
Big Creek	8021	25-Year	904.000	3175.960	3178.6950	3178	3179	0	4.06	317.35	275	0
Big Creek	8021	50-Year	1020.000	3175.960	3178.7960	3178	3179	0	4.22	345.17	279	0
Big Creek	8021	100-Year	1130.000	3175.960	3178.8870	3178	3179	0	4.37	370.93	284	0
Big Creek	8021	500-Year	1370.000	3175.960	3179.0600	3179	3179	0	4.68	420.76	290	1
Big Creek	8021	1%+	1763.000	3175.960	3179.3340	3179	3180	0	5.01	500.28	302	1
Big Creek	8445	10-Year	769.000	3179.140	3183.4130	3182	3184	0	4.31	191.10	116	0
Big Creek	8445	25-Year	904.000	3179.140	3183.6730	3182	3184	0	4.63	211.86	127	0
Big Creek	8445	50-Year	1020.000	3179.140	3183.8780	3182	3184	0	4.88	230.55	151	0
Big Creek	8445	100-Year	1130.000	3179.140	3184.0570	3183	3184	0	5.10	248.93	188	0
Big Creek	8445	500-Year	1370.000	3179.140	3184.4120	3183	3185	0	5.52	291.19	230	0
Big Creek	8445	1%+	1763.000	3179.140	3184.8660	3184	3185	0	6.15	366.01	293	1
Big Creek	8880	10-Year	769.000	3183.370	3187.3820	3186	3188	0	3.23	272.44	202	0
Big Creek	8880	25-Year	904.000	3183.370	3187.6480	3186	3188	0	3.36	328.31	250	0
Big Creek	8880	50-Year	1020.000	3183.370	3187.8390	3186	3188	0	3.43	374.09	267	0
Big Creek	8880	100-Year	1130.000	3183.370	3188.0070	3187	3188	0	3.49	417.34	284	0
Big Creek	8880	500-Year	1370.000	3183.370	3188.3410	3187	3189	0	3.60	512.57	330	0
Big Creek	8880	1%+	1763.000	3183.370	3188.8070	3187	3189	0	3.73	667.09	406	0
Big Creek	9174	10-Year	769.000	3186.740	3190.2130	3190	3190	0	4.67	306.80	314	0
Big Creek	9174	25-Year	904.000	3186.740	3190.3760	3190	3191	0	4.77	359.35	328	0
Big Creek	9174	50-Year	1020.000	3186.740	3190.4890	3190	3191	0	4.87	396.57	334	0
Big Creek	9174	100-Year	1130.000	3186.740	3190.5900	3190	3191	0	4.96	430.79	339	0
Big Creek	9174	500-Year	1370.000	3186.740	3190.8020	3190	3191	0	5.11	503.26	349	0
Big Creek	9174	1%+	1763.000	3186.740	3191.1020	3191	3191	0	5.28	608.79	353	0
Big Creek	9478	10-Year	769.000	3189.160	3192.8230	3192	3193	0	2.94	352.77	173	0
Big Creek	9478	25-Year	904.000	3189.160	3193.0150	3192	3193	0	3.14	386.23	176	0
Big Creek	9478	50-Year	1020.000	3189.160	3193.1640	3192	3193	0	3.31	412.79	180	0
Big Creek	9478	100-Year	1130.000	3189.160	3193.3030	3192	3193	0	3.45	438.03	184	0
Big Creek	9478	500-Year	1370.000	3189.160	3193.5710	3192	3194	0	3.75	488.15	192	0
Big Creek	9478	1%+	1763.000	3189.160	3194.0030	3192	3194	0	4.34	576.80	218	0
Big Creek	9817	10-Year	769.000	3192.420	3195.7690	3195	3196	0	5.63	151.79	70	1
Big Creek	9817	25-Year	904.000	3192.420	3196.0340	3195	3197	0	5.96	170.51	71	1
Big Creek	9817	50-Year	1020.000	3192.420	3196.2490	3196	3197	0	6.22	185.94	73	1
Big Creek	9817	100-Year	1130.000	3192.420	3196.4370	3196	3197	0	6.46	199.67	74	1
Big Creek	9817	500-Year	1370.000	3192.420	3196.8230	3196	3197	0	6.92	229.66	86	1
Big Creek	9817	1%+	1763.000	3192.420	3197.4550	3196	3198	0	7.40	283.59	106	1
Big Creek	10116	10-Year	769.000	3194.330	3199.2680	3197	3200	0	4.25	182.25	47	0
Big Creek	10116	25-Year	904.000	3194.330	3199.6250	3197	3200	0	4.58	201.58	60	0
Big Creek	10116	50-Year	1020.000	3194.330	3199.9050	3198	3200	0	4.85	219.31	66	0
Big Creek	10116	100-Year	1130.000	3194.330	3200.1540	3198	3201	0	5.07	236.58	73	0
Big Creek	10116	500-Year	1370.000	3194.330	3200.6460	3198	3201	0	5.51	277.91	97	0
Big Creek	10116	1%+	1763.000	3194.330	3201.2860	3199	3202	0	6.08	343.35	106	0
Big Creek	10392	10-Year	769.000	3196.490	3201.3150	3199	3202	0	4.08	199.48	67	0
Big Creek	10392	25-Year	904.000	3196.490	3201.7130	3200	3202	0	4.29	226.87	71	0
Big Creek	10392	50-Year	1020.000	3196.490	3202.0260	3200	3202	0	4.46	249.39	73	0
Big Creek	10392	100-Year	1130.000	3196.490	3202.3020	3200	3203	0	4.62	269.91	76	0

HEC-RAS Plan: MultipleProfiles River: Big Creek Reach: Big Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Big Creek	10392	500-Year	1370.000	3196.490	3202.8570	3200	3203	0	4.95	316.66	91	0
Big Creek	10392	1%+	1763.000	3196.490	3203.5990	3201	3204	0	5.46	409.03	153	0
Big Creek	10628	10-Year	769.000	3198.940	3203.1020	3201	3203	0	4.13	208.87	85	0
Big Creek	10628	25-Year	904.000	3198.940	3203.4540	3202	3204	0	4.31	239.48	91	0
Big Creek	10628	50-Year	1020.000	3198.940	3203.7390	3202	3204	0	4.45	266.43	100	0
Big Creek	10628	100-Year	1130.000	3198.940	3203.9940	3202	3204	0	4.57	293.08	109	0
Big Creek	10628	500-Year	1370.000	3198.940	3204.5230	3203	3205	0	4.75	354.93	126	0
Big Creek	10628	1%+	1763.000	3198.940	3205.2690	3203	3206	0	4.97	451.99	133	0
Big Creek	10753	10-Year	769.000	3199.850	3204.1030	3202	3204	0	4.22	185.84	58	0
Big Creek	10753	25-Year	904.000	3199.850	3204.4370	3203	3205	0	4.53	204.53	59	0
Big Creek	10753	50-Year	1020.000	3199.850	3204.7050	3203	3205	0	4.77	219.56	61	0
Big Creek	10753	100-Year	1130.000	3199.850	3204.9440	3203	3205	0	4.98	232.90	68	0
Big Creek	10753	500-Year	1370.000	3199.850	3205.4230	3203	3206	0	5.42	259.77	93	0
Big Creek	10753	1%+	1763.000	3199.850	3206.0980	3204	3207	0	6.10	297.53	117	0
Big Creek	10780		Bridge									
Big Creek	10806	10-Year	769.000	3200.080	3204.6980	3203	3205	0	4.80	161.50	44	0
Big Creek	10806	25-Year	904.000	3200.080	3205.0550	3203	3205	0	5.16	177.49	45	0
Big Creek	10806	50-Year	1020.000	3200.080	3205.3430	3203	3206	0	5.44	190.68	46	0
Big Creek	10806	100-Year	1130.000	3200.080	3205.6020	3204	3206	0	5.69	202.81	47	0
Big Creek	10806	500-Year	1370.000	3200.080	3206.1300	3204	3207	0	6.18	228.48	50	0
Big Creek	10806	1%+	1763.000	3200.080	3206.9080	3205	3208	0	6.87	267.78	58	0
Big Creek	11014	10-Year	769.000	3202.800	3206.8450	3205	3207	0	4.48	195.94	86	0
Big Creek	11014	25-Year	904.000	3202.800	3207.2130	3206	3208	0	4.62	228.76	92	0
Big Creek	11014	50-Year	1020.000	3202.800	3207.5140	3206	3208	0	4.73	257.52	100	0
Big Creek	11014	100-Year	1130.000	3202.800	3207.7850	3206	3208	0	4.81	285.22	103	0
Big Creek	11014	500-Year	1370.000	3202.800	3208.3360	3207	3209	0	4.93	343.08	107	0
Big Creek	11014	1%+	1763.000	3202.800	3209.1600	3207	3209	0	5.10	432.87	141	0
Big Creek	11450	10-Year	769.000	3208.020	3212.0370	3211	3212	0	5.38	151.33	77	1
Big Creek	11450	25-Year	904.000	3208.020	3212.2890	3211	3213	0	5.81	167.34	84	1
Big Creek	11450	50-Year	1020.000	3208.020	3212.4870	3211	3213	0	6.16	180.55	88	1
Big Creek	11450	100-Year	1130.000	3208.020	3212.6600	3212	3213	0	6.47	192.44	92	1
Big Creek	11450	500-Year	1370.000	3208.020	3212.9800	3212	3214	0	7.13	215.65	100	1
Big Creek	11450	1%+	1763.000	3208.020	3213.4500	3213	3214	0	8.07	252.51	111	1
Big Creek	11725	10-Year	769.000	3212.120	3215.9380	3215	3216	0	4.55	184.39	95	0
Big Creek	11725	25-Year	904.000	3212.120	3216.2680	3215	3217	0	4.76	219.92	125	0
Big Creek	11725	50-Year	1020.000	3212.120	3216.5080	3215	3217	0	4.86	250.49	130	0
Big Creek	11725	100-Year	1130.000	3212.120	3216.7230	3215	3217	0	4.94	278.80	141	0
Big Creek	11725	500-Year	1370.000	3212.120	3217.1570	3216	3218	0	5.09	338.47	157	0
Big Creek	11725	1%+	1763.000	3212.120	3217.7850	3216	3218	0	5.29	432.05	175	0
Big Creek	12218	10-Year	769.000	3219.800	3222.3550	3222	3222	0	3.72	283.83	203	0
Big Creek	12218	25-Year	904.000	3219.800	3222.5900	3222	3223	0	3.98	335.17	234	0
Big Creek	12218	50-Year	1020.000	3219.800	3222.7330	3222	3223	0	4.15	369.46	246	0
Big Creek	12218	100-Year	1130.000	3219.800	3222.8390	3222	3223	0	4.28	395.65	249	0
Big Creek	12218	500-Year	1370.000	3219.800	3223.0640	3222	3223	0	4.55	453.60	262	0
Big Creek	12218	1%+	1763.000	3219.800	3223.3970	3222	3224	0	4.89	543.04	277	0
Big Creek	12578	10-Year	769.000	3222.410	3226.2600	3225	3226	0	3.57	312.84	283	0
Big Creek	12578	25-Year	904.000	3222.410	3226.4770	3225	3227	0	3.73	379.25	325	0
Big Creek	12578	50-Year	1020.000	3222.410	3226.6080	3226	3227	0	3.80	422.41	330	0
Big Creek	12578	100-Year	1130.000	3222.410	3226.7190	3226	3227	0	3.87	458.87	331	0
Big Creek	12578	500-Year	1370.000	3222.410	3226.9470	3226	3227	0	4.00	534.29	332	0
Big Creek	12578	1%+	1763.000	3222.410	3227.2700	3226	3227	0	4.21	641.83	333	0
Big Creek	12847	10-Year	769.000	3224.710	3228.4610	3227	3229	0	3.52	272.39	125	0
Big Creek	12847	25-Year	904.000	3224.710	3228.6970	3227	3229	0	3.74	302.28	129	0
Big Creek	12847	50-Year	1020.000	3224.710	3228.8560	3227	3229	0	3.95	323.23	133	0
Big Creek	12847	100-Year	1130.000	3224.710	3229.0010	3227	3229	0	4.14	342.75	137	0
Big Creek	12847	500-Year	1370.000	3224.710	3229.2770	3228	3230	0	4.53	381.72	145	0
Big Creek	12847	1%+	1763.000	3224.710	3229.6790	3228	3230	0	5.09	441.46	150	0
Big Creek	13322	10-Year	769.000	3230.350	3232.8080	3232	3233	0	3.32	318.78	225	0
Big Creek	13322	25-Year	904.000	3230.350	3233.0000	3232	3233	0	3.42	362.87	233	0
Big Creek	13322	50-Year	1020.000	3230.350	3233.1650	3232	3233	0	3.47	401.77	240	0
Big Creek	13322	100-Year	1130.000	3230.350	3233.3220	3232	3233	0	3.55	439.92	244	0
Big Creek	13322	500-Year	1370.000	3230.350	3233.6320	3232	3234	0	3.66	516.53	250	0
Big Creek	13322	1%+	1763.000	3230.350	3234.0650	3233	3234	0	3.81	624.85	251	0
Big Creek	13723	10-Year	769.000	3233.600	3235.5310	3234	3236	0	1.77	415.70	195	0
Big Creek	13723	25-Year	904.000	3233.600	3235.7270	3234	3236	0	1.95	454.41	198	0
Big Creek	13723	50-Year	1020.000	3233.600	3235.8740	3234	3236	0	2.10	483.54	199	0
Big Creek	13723	100-Year	1130.000	3233.600	3236.0200	3234	3236	0	2.22	512.64	200	0
Big Creek	13723	500-Year	1370.000	3233.600	3236.3030	3235	3236	0	2.47	570.09	210	0
Big Creek	13723	1%+	1763.000	3233.600	3236.7500	3235	3237	0	2.92	668.25	224	0
Big Creek	14052	10-Year	769.000	3236.520	3238.3680	3238	3239	0	4.50	214.91	156	1
Big Creek	14052	25-Year	904.000	3236.520	3238.5630	3238	3239	0	4.63	245.48	159	1
Big Creek	14052	50-Year	1020.000	3236.520	3238.7260	3238	3239	0	4.72	271.82	165	1
Big Creek	14052	100-Year	1130.000	3236.520	3238.8650	3238	3239	0	4.82	295.22	171	1
Big Creek	14052	500-Year	1370.000	3236.520	3239.1600	3238	3239	0	5.01	348.01	186	1
Big Creek	14052	1%+	1763.000	3236.520	3239.6900	3239	3240	0	5.38	454.05	213	1

HEC-RAS Plan: MultipleProfiles River: Big Creek Reach: Big Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Big Creek	14468	10-Year	769.000	3240.110	3244.2140	3243	3244	0	3.88	256.87	176	0
Big Creek	14468	25-Year	904.000	3240.110	3244.4150	3243	3245	0	4.16	294.83	203	0
Big Creek	14468	50-Year	1020.000	3240.110	3244.5570	3243	3245	0	4.36	325.35	236	0
Big Creek	14468	100-Year	1130.000	3240.110	3244.7000	3244	3245	0	4.54	361.82	267	0
Big Creek	14468	500-Year	1370.000	3240.110	3244.9290	3244	3245	0	4.83	425.02	285	0
Big Creek	14468	1%+	1763.000	3240.110	3245.2610	3244	3246	0	5.17	521.57	297	0
Big Creek	14733	10-Year	769.000	3242.750	3246.5180	3245	3247	0	3.81	227.02	144	0
Big Creek	14733	25-Year	904.000	3242.750	3246.7800	3245	3247	0	3.99	268.20	178	0
Big Creek	14733	50-Year	1020.000	3242.750	3246.9720	3246	3247	0	4.13	305.55	204	0
Big Creek	14733	100-Year	1130.000	3242.750	3247.1440	3246	3247	0	4.24	342.26	226	0
Big Creek	14733	500-Year	1370.000	3242.750	3247.4450	3246	3248	0	4.49	414.59	254	0
Big Creek	14733	1%+	1763.000	3242.750	3247.8320	3247	3248	0	4.83	519.12	279	0
Big Creek	15103	10-Year	769.000	3246.400	3249.6120	3249	3250	0	3.14	286.68	133	0
Big Creek	15103	25-Year	904.000	3246.400	3249.8510	3249	3250	0	3.32	318.65	135	0
Big Creek	15103	50-Year	1020.000	3246.400	3250.0410	3249	3250	0	3.46	344.34	136	0
Big Creek	15103	100-Year	1130.000	3246.400	3250.2100	3249	3250	0	3.59	367.42	137	0
Big Creek	15103	500-Year	1370.000	3246.400	3250.5470	3249	3251	0	3.86	413.87	145	0
Big Creek	15103	1%+	1763.000	3246.400	3251.0190	3249	3251	0	4.29	480.45	158	0

HEC-RAS Plan: MultipleProfiles

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
East Fork Timber	East Fork	92.75	10-year	52.000	3187.190	3189.9310	3189	3190	0	2.33	22.82	17	0
East Fork Timber	East Fork	92.75	25-year	69.000	3187.190	3190.1720	3189	3190	0	2.66	27.25	19	0
East Fork Timber	East Fork	92.75	50-year	83.000	3187.190	3190.3530	3189	3190	0	2.88	30.86	21	0
East Fork Timber	East Fork	92.75	100-year	99.000	3187.190	3190.5370	3189	3191	0	3.11	34.73	22	0
East Fork Timber	East Fork	92.75	500-year	135.000	3187.190	3190.9170	3190	3191	0	3.50	43.31	24	0
East Fork Timber	East Fork	92.75	1% plus	154.000	3187.190	3191.1420	3190	3191	0	3.62	48.90	26	0
East Fork Timber	East Fork	211	10-year	52.000	3189.150	3191.2070	3191	3191	0	2.95	18.40	17	0
East Fork Timber	East Fork	211	25-year	69.000	3189.150	3191.4630	3191	3192	0	3.21	22.98	18	0
East Fork Timber	East Fork	211	50-year	83.000	3189.150	3191.6510	3191	3192	0	3.40	26.52	19	0
East Fork Timber	East Fork	211	100-year	99.000	3189.150	3191.8450	3191	3192	0	3.59	30.34	20	0
East Fork Timber	East Fork	211	500-year	135.000	3189.150	3192.2270	3191	3192	0	3.98	38.42	22	0
East Fork Timber	East Fork	211	1% plus	154.000	3189.150	3192.4050	3192	3193	0	4.15	42.47	23	0
East Fork Timber	East Fork	457	10-year	52.000	3192.800	3194.5700	3194	3195	0	2.41	21.93	20	0
East Fork Timber	East Fork	457	25-year	69.000	3192.800	3194.7780	3194	3195	0	2.72	26.16	23	0
East Fork Timber	East Fork	457	50-year	83.000	3192.800	3194.9320	3194	3195	0	2.94	29.45	25	0
East Fork Timber	East Fork	457	100-year	99.000	3192.800	3195.0960	3194	3195	0	3.15	33.08	27	0
East Fork Timber	East Fork	457	500-year	135.000	3192.800	3195.4330	3195	3196	0	3.55	41.00	31	0
East Fork Timber	East Fork	457	1% plus	154.000	3192.800	3195.5950	3195	3196	0	3.72	45.06	33	0
East Fork Timber	East Fork	626	10-year	52.000	3195.240	3196.9540	3196	3197	0	3.09	17.32	16	0
East Fork Timber	East Fork	626	25-year	69.000	3195.240	3197.1840	3197	3197	0	3.43	21.20	18	0
East Fork Timber	East Fork	626	50-year	83.000	3195.240	3197.3520	3197	3198	0	3.66	24.25	19	1
East Fork Timber	East Fork	626	100-year	99.000	3195.240	3197.5240	3197	3198	0	3.91	27.71	24	1
East Fork Timber	East Fork	626	500-year	135.000	3195.240	3197.8350	3197	3198	0	4.26	41.51	60	1
East Fork Timber	East Fork	626	1% plus	154.000	3195.240	3197.9660	3197	3198	0	4.35	49.60	66	1
East Fork Timber	East Fork	815	10-year	52.000	3198.380	3200.3960	3200	3201	0	3.17	16.81	18	0
East Fork Timber	East Fork	815	25-year	69.000	3198.380	3200.6190	3200	3201	0	3.53	21.47	23	0
East Fork Timber	East Fork	815	50-year	83.000	3198.380	3200.7760	3200	3201	0	3.76	25.38	27	1
East Fork Timber	East Fork	815	100-year	99.000	3198.380	3200.9390	3200	3201	0	3.99	30.57	37	1
East Fork Timber	East Fork	815	500-year	135.000	3198.380	3201.2100	3201	3201	0	4.36	42.32	51	1
East Fork Timber	East Fork	815	1% plus	154.000	3198.380	3201.3140	3201	3202	0	4.59	48.44	67	1
East Fork Timber	East Fork	1101	10-year	52.000	3201.710	3203.9870	3203	3204	0	2.40	26.12	39	0
East Fork Timber	East Fork	1101	25-year	69.000	3201.710	3204.1990	3203	3204	0	2.58	36.83	67	0
East Fork Timber	East Fork	1101	50-year	83.000	3201.710	3204.3290	3204	3204	0	2.68	46.34	79	0
East Fork Timber	East Fork	1101	100-year	99.000	3201.710	3204.4620	3204	3205	0	2.77	57.89	99	0
East Fork Timber	East Fork	1101	500-year	135.000	3201.710	3204.6670	3204	3205	0	2.91	80.50	120	0
East Fork Timber	East Fork	1101	1% plus	154.000	3201.710	3204.7660	3204	3205	0	2.93	92.62	126	0
East Fork Timber	East Fork	1419	10-year	52.000	3205.600	3207.5900	3207	3208	0	2.68	22.42	30	0
East Fork Timber	East Fork	1419	25-year	69.000	3205.600	3207.7560	3207	3208	0	2.97	28.61	43	0
East Fork Timber	East Fork	1419	50-year	83.000	3205.600	3207.8640	3207	3208	0	3.18	33.69	55	0
East Fork Timber	East Fork	1419	100-year	99.000	3205.600	3207.9670	3208	3208	0	3.39	39.99	67	0
East Fork Timber	East Fork	1419	500-year	135.000	3205.600	3208.1490	3208	3208	0	3.80	54.33	94	1
East Fork Timber	East Fork	1419	1% plus	154.000	3205.600	3208.2170	3208	3208	0	4.02	61.16	107	1
East Fork Timber	East Fork	1689	10-year	52.000	3208.470	3210.2800	3210	3210	0	1.89	27.55	35	0
East Fork Timber	East Fork	1689	25-year	69.000	3208.470	3210.4590	3210	3211	0	2.02	34.42	44	0
East Fork Timber	East Fork	1689	50-year	83.000	3208.470	3210.5730	3210	3211	0	2.14	41.78	92	0
East Fork Timber	East Fork	1689	100-year	99.000	3208.470	3210.6690	3210	3211	0	2.26	51.74	116	0
East Fork Timber	East Fork	1689	500-year	135.000	3208.470	3210.8430	3210	3211	0	2.44	75.61	161	0
East Fork Timber	East Fork	1689	1% plus	154.000	3208.470	3210.9150	3210	3211	0	2.50	87.54	170	0
East Fork Timber	East Fork	2055	10-year	52.000	3214.010	3215.2060	3215	3215	0	2.58	25.23	191	1
East Fork Timber	East Fork	2055	25-year	69.000	3214.010	3215.2730	3215	3215	0	2.55	31.69	230	1
East Fork Timber	East Fork	2055	50-year	83.000	3214.010	3215.3150	3215	3215	0	2.60	36.07	249	1
East Fork Timber	East Fork	2055	100-year	99.000	3214.010	3215.3630	3215	3215	0	2.66	41.46	278	1
East Fork Timber	East Fork	2055	500-year	135.000	3214.010	3215.4460	3215	3216	0	2.84	52.27	323	1
East Fork Timber	East Fork	2055	1% plus	154.000	3214.010	3215.4800	3215	3216	0	2.95	57.21	340	1
East Fork Timber	East Fork	2427	10-year	52.000	3218.620	3220.2750	3220	3220	0	1.92	38.81	562	0
East Fork Timber	East Fork	2427	25-year	69.000	3218.620	3220.3360	3220	3220	0	2.09	50.22	624	0
East Fork Timber	East Fork	2427	50-year	83.000	3218.620	3220.3770	3220	3220	0	2.16	59.85	664	0
East Fork Timber	East Fork	2427	100-year	99.000	3218.620	3220.4160	3220	3220	0	2.26	69.91	698	0
East Fork Timber	East Fork	2427	500-year	135.000	3218.620	3220.4830	3220	3221	0	2.38	89.80	738	0
East Fork Timber	East Fork	2427	1% plus	154.000	3218.620	3220.5170	3220	3221	0	2.42	100.55	756	0
East Fork Timber	East Fork	2478	10-year	52.000	3219.870	3220.6560	3220	3221	0	0.93	58.93	639	0
East Fork Timber	East Fork	2478	25-year	69.000	3219.870	3220.7170	3221	3221	0	0.94	73.07	687	0
East Fork Timber	East Fork	2478	50-year	83.000	3219.870	3220.7530	3221	3221	0	0.99	81.65	712	0
East Fork Timber	East Fork	2478	100-year	99.000	3219.870	3220.7910	3221	3221	0	1.04	91.03	736	0
East Fork Timber	East Fork	2478	500-year	135.000	3219.870	3220.8650	3221	3221	0	1.14	109.15	782	0
East Fork Timber	East Fork	2478	1% plus	154.000	3219.870	3220.8990	3221	3221	0	1.20	117.49	797	0
East Fork Timber	East Fork	2509		Culvert									
East Fork Timber	East Fork	2535	10-year	52.000	3220.050	3221.2510	3221	3221	0	1.94	35.97	255	0
East Fork Timber	East Fork	2535	25-year	69.000	3220.050	3221.3220	3221	3221	0	2.07	45.10	335	0
East Fork Timber	East Fork	2535	50-year	83.000	3220.050	3221.3550	3221	3221	0	2.28	50.07	377	0
East Fork Timber	East Fork	2535	100-year	99.000	3220.050	3221.3980	3221	3221	0	2.36	57.32	418	0
East Fork Timber	East Fork	2535	500-year	135.000	3220.050	3221.5340	3221	3222	0	2.27	85.62	551	0
East Fork Timber	East Fork	2535	1% plus	154.000	3220.050	3221.4930	3221	3222	0	2.86	76.30	519	1
East Fork Timber	East Fork	2564	10-year	52.000	3221.050	3221.5130	3221	3222	0	0.70	45.22	249	0
East Fork Timber	East Fork	2564	25-year	69.000	3221.050	3221.5810	3221	3222	0	0.81	56.03	279	0
East Fork Timber	East Fork	2564	50-year	83.000	3221.050	3221.6320	3221	3222	0	0.88	64.48	303	0
East Fork Timber	East Fork	2564	100-year	99.000	3221.050	3221.6800	3221	3222	0	0.97	73.14	333	0
East Fork Timber	East Fork	2564	500-year	135.000	3221.050	3221.7750	3222	3222	0	1.15	92.20	381	0
East Fork Timber	East Fork	2564	1% plus	154.000	3221.050	3221.8120	3222	3222	0	1.23	100.41	403	0
East Fork Timber	East Fork	2596	10-year	52.000	3221.450	3222.0280	3222	3222	0	1.49	27.92	167	0
East Fork Timber	East Fork	2596	25-year	69.000	3221.450	3222.1020	3222	3222	0	1.71	34.28	210	0
East Fork Timber	East Fork	2596	50-year	83.000	3221.450	3222.1570	3222	3222	0	1.86	40.38	245	0
East Fork Timber	East Fork	2596	100-year	99.000	3221.450	3222.2150	3222	3222	0	1.98	48.74	296	0
East Fork Timber	East Fork	2596	500-year	135.000	3221.450	3222.3090	3222	3222	0	2.19	65.20	353	0
East Fork Timber	East Fork	2596	1% plus	154.000	3221.450	3222.3590	3222	3222	0	2.30	75.20	386	0
East Fork Timber	East Fork	2668	10-year	52.000	3222.200	3223.0710	3223	3223	0	1.47	36.45	252	0
East Fork Timber	East Fork	2668	25-year	69.000	3222.200	3223.1760	3223	3223	0	1.53	47.90	364	0
East Fork Timber	East Fork	2668	50-year	83.000	3222.200	3223.2420	3223	3223	0	1.57	56.84	402	0
East Fork Timber	East Fork	2668	100-year	99.000	3222.200	3223.3140	3223	3223	0	1.67	67.35	447	0
East Fork Timber	East Fork	2668	500-year	135.000	3222.200	3223.4390	3223	3223	0	1.90	88.01	560	0
East Fork Timber	East Fork	2668	1% plus	154.000	3222.200	3223.4830	3223	3224	0	1.98	95.60	588	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
East Fork Timber	East Fork	2823	10-year	52.000	3223.870	3225.1950	3225	3225	0	1.99	25.47	420	0
East Fork Timber	East Fork	2823	25-year	69.000	3223.870	3225.3720	3225	3225	0	2.30	30.14	499	0
East Fork Timber	East Fork	2823	50-year	83.000	3223.870	3225.4880	3225	3226	0	2.51	33.55	618	0
East Fork Timber	East Fork	2823	100-year	99.000	3223.870	3225.6210	3225	3226	0	2.76	38.41	681	0
East Fork Timber	East Fork	2823	500-year	135.000	3223.870	3225.8700	3225	3226	0	3.27	51.04	749	0
East Fork Timber	East Fork	2823	1% plus	154.000	3223.870	3226.0540	3225	3226	0	3.76	66.48	802	1
East Fork Timber	East Fork	3133	10-year	52.000	3227.880	3228.7020	3228	3229	0	1.20	21.28	266	0
East Fork Timber	East Fork	3133	25-year	69.000	3227.880	3228.8910	3229	3229	0	1.27	30.11	299	0
East Fork Timber	East Fork	3133	50-year	83.000	3227.880	3229.0220	3229	3229	0	1.26	37.57	326	0
East Fork Timber	East Fork	3133	100-year	99.000	3227.880	3229.1330	3229	3229	0	1.35	45.07	353	0
East Fork Timber	East Fork	3133	500-year	135.000	3227.880	3229.4060	3229	3229	0	1.67	76.36	425	0
East Fork Timber	East Fork	3133	1% plus	154.000	3227.880	3229.4880	3229	3230	0	1.66	88.88	450	0
East Fork Timber	East Fork	3376	10-year	52.000	3229.280	3231.2210	3231	3231	0	2.12	28.56	217	0
East Fork Timber	East Fork	3376	25-year	69.000	3229.280	3231.3390	3231	3231	0	2.32	35.66	231	0
East Fork Timber	East Fork	3376	50-year	83.000	3229.280	3231.4160	3231	3231	0	2.50	41.04	243	0
East Fork Timber	East Fork	3376	100-year	99.000	3229.280	3231.4960	3231	3232	0	2.65	47.12	261	0
East Fork Timber	East Fork	3376	500-year	135.000	3229.280	3231.6570	3231	3232	0	2.90	61.81	304	0
East Fork Timber	East Fork	3376	1% plus	154.000	3229.280	3231.6890	3231	3232	0	3.16	64.90	308	0
East Fork Timber	East Fork	3495	10-year	52.000	3231.630	3232.6690	3233	3233	0	2.07	24.00	252	0
East Fork Timber	East Fork	3495	25-year	69.000	3231.630	3232.7680	3233	3233	0	2.02	33.37	305	0
East Fork Timber	East Fork	3495	50-year	83.000	3231.630	3232.8360	3233	3233	0	2.01	41.05	325	0
East Fork Timber	East Fork	3495	100-year	99.000	3231.630	3232.8950	3233	3233	0	2.06	48.01	342	0
East Fork Timber	East Fork	3495	500-year	135.000	3231.630	3233.0180	3233	3233	0	2.23	64.35	379	0
East Fork Timber	East Fork	3495	1% plus	154.000	3231.630	3233.0840	3233	3233	0	2.22	74.16	396	0
East Fork Timber	East Fork	3727	10-year	52.000	3234.410	3235.6230	3235	3236	0	1.59	35.22	149	0
East Fork Timber	East Fork	3727	25-year	69.000	3234.410	3235.6880	3235	3236	0	1.76	42.70	181	0
East Fork Timber	East Fork	3727	50-year	83.000	3234.410	3235.7270	3236	3236	0	1.88	47.50	206	0
East Fork Timber	East Fork	3727	100-year	99.000	3234.410	3235.7730	3236	3236	0	1.99	53.59	231	0
East Fork Timber	East Fork	3727	500-year	135.000	3234.410	3235.8570	3236	3236	0	2.18	66.00	287	0
East Fork Timber	East Fork	3727	1% plus	154.000	3234.410	3235.8850	3236	3236	0	2.32	70.54	316	0
East Fork Timber	East Fork	4124	10-year	52.000	3238.860	3239.9700	3240	3240	0	2.14	21.08	40	0
East Fork Timber	East Fork	4124	25-year	69.000	3238.860	3240.1530	3240	3240	0	2.25	30.76	78	0
East Fork Timber	East Fork	4124	50-year	83.000	3238.860	3240.3010	3240	3240	0	2.42	45.80	128	0
East Fork Timber	East Fork	4124	100-year	99.000	3238.860	3240.3640	3240	3240	0	2.52	53.82	139	0
East Fork Timber	East Fork	4124	500-year	135.000	3238.860	3240.4790	3240	3241	0	2.71	70.26	167	0
East Fork Timber	East Fork	4124	1% plus	154.000	3238.860	3240.5560	3240	3241	0	2.75	82.93	194	0
East Fork Timber	East Fork	4556	10-year	52.000	3243.880	3246.0560	3245	3246	0	2.29	30.20	114	0
East Fork Timber	East Fork	4556	25-year	69.000	3243.880	3246.1760	3246	3246	0	2.57	37.72	187	0
East Fork Timber	East Fork	4556	50-year	83.000	3243.880	3246.2800	3246	3246	0	2.76	45.51	261	0
East Fork Timber	East Fork	4556	100-year	99.000	3243.880	3246.3670	3246	3246	0	2.92	53.92	296	0
East Fork Timber	East Fork	4556	500-year	135.000	3243.880	3246.5110	3246	3247	0	3.19	71.89	344	0
East Fork Timber	East Fork	4556	1% plus	154.000	3243.880	3246.5830	3246	3247	0	3.40	81.88	370	0
East Fork Timber	East Fork	4790	10-year	52.000	3246.980	3247.9860	3248	3248	0	1.23	30.10	42	0
East Fork Timber	East Fork	4790	25-year	69.000	3246.980	3248.1490	3248	3248	0	1.38	37.31	46	0
East Fork Timber	East Fork	4790	50-year	83.000	3246.980	3248.2660	3248	3248	0	1.50	42.88	50	0
East Fork Timber	East Fork	4790	100-year	99.000	3246.980	3248.4450	3248	3248	0	1.78	53.59	73	0
East Fork Timber	East Fork	4790	500-year	135.000	3246.980	3248.6310	3248	3249	0	2.06	68.53	88	0
East Fork Timber	East Fork	4790	1% plus	154.000	3246.980	3248.7180	3248	3249	0	2.13	76.89	106	0
East Fork Timber	East Fork	5142	10-year	52.000	3249.580	3251.0580	3251	3251	0	2.59	28.82	99	0
East Fork Timber	East Fork	5142	25-year	69.000	3249.580	3251.1870	3251	3251	0	2.79	36.13	108	0
East Fork Timber	East Fork	5142	50-year	83.000	3249.580	3251.2810	3251	3251	0	2.92	42.02	116	0
East Fork Timber	East Fork	5142	100-year	99.000	3249.580	3251.3990	3251	3251	0	2.96	50.28	132	0
East Fork Timber	East Fork	5142	500-year	135.000	3249.580	3251.5850	3251	3252	0	3.22	65.11	158	0
East Fork Timber	East Fork	5142	1% plus	154.000	3249.580	3251.6550	3251	3252	0	3.40	71.69	178	0
East Fork Timber	East Fork	5457	10-year	52.000	3254.340	3255.6780	3255	3256	0	2.05	28.93	82	0
East Fork Timber	East Fork	5457	25-year	69.000	3254.340	3255.8150	3255	3256	0	2.23	38.66	119	0
East Fork Timber	East Fork	5457	50-year	83.000	3254.340	3255.9000	3255	3256	0	2.36	47.20	152	0
East Fork Timber	East Fork	5457	100-year	99.000	3254.340	3255.9590	3256	3256	0	2.55	55.46	203	0
East Fork Timber	East Fork	5457	500-year	135.000	3254.340	3256.1470	3256	3256	0	2.85	89.88	283	0
East Fork Timber	East Fork	5457	1% plus	154.000	3254.340	3256.1990	3256	3256	0	2.86	100.32	303	0
East Fork Timber	East Fork	5575	10-year	52.000	3254.840	3257.2430	3256	3257	0	2.42	23.68	58	0
East Fork Timber	East Fork	5575	25-year	69.000	3254.840	3257.4030	3257	3258	0	2.72	28.68	80	0
East Fork Timber	East Fork	5575	50-year	83.000	3254.840	3257.5120	3257	3258	0	2.94	32.97	99	0
East Fork Timber	East Fork	5575	100-year	99.000	3254.840	3257.6300	3257	3258	0	3.10	38.03	123	0
East Fork Timber	East Fork	5575	500-year	135.000	3254.840	3257.8590	3257	3258	0	3.50	49.25	201	0
East Fork Timber	East Fork	5575	1% plus	154.000	3254.840	3257.9300	3257	3258	0	3.74	53.35	215	0
East Fork Timber	East Fork	5736	10-year	52.000	3257.300	3259.7330	3259	3260	0	2.53	20.52	41	0
East Fork Timber	East Fork	5736	25-year	69.000	3257.300	3260.0050	3259	3260	0	2.82	25.21	52	0
East Fork Timber	East Fork	5736	50-year	83.000	3257.300	3260.1850	3259	3260	0	3.02	30.41	66	0
East Fork Timber	East Fork	5736	100-year	99.000	3257.300	3260.3430	3259	3260	0	3.24	36.40	79	0
East Fork Timber	East Fork	5736	500-year	135.000	3257.300	3260.6560	3260	3261	0	3.54	51.28	117	0
East Fork Timber	East Fork	5736	1% plus	154.000	3257.300	3260.8130	3260	3261	0	3.63	59.42	141	0
East Fork Timber	East Fork	6010	10-year	52.000	3260.860	3263.1300	3262	3263	0	1.72	30.31	20	0
East Fork Timber	East Fork	6010	25-year	69.000	3260.860	3263.4150	3262	3263	0	1.91	36.28	21	0
East Fork Timber	East Fork	6010	50-year	83.000	3260.860	3263.6170	3262	3264	0	2.05	40.68	22	0
East Fork Timber	East Fork	6010	100-year	99.000	3260.860	3263.8320	3262	3264	0	2.20	45.56	23	0
East Fork Timber	East Fork	6010	500-year	135.000	3260.860	3264.2270	3263	3264	0	2.53	54.94	24	0
East Fork Timber	East Fork	6010	1% plus	154.000	3260.860	3264.3990	3263	3265	0	2.70	59.22	25	0
East Fork Timber	East Fork	6101	10-year	52.000	3264.590	3265.9060	3266	3266	0	4.91	10.60	31	1
East Fork Timber	East Fork	6101	25-year	69.000	3264.590	3266.0470	3266	3267	0	5.48	12.63	34	1
East Fork Timber	East Fork	6101	50-year	83.000	3264.590	3266.2000	3266	3267	0	5.60	15.02	43	1
East Fork Timber	East Fork	6101	100-year	99.000	3264.590	3266.3320	3266	3267	0	5.90	17.22	55	1
East Fork Timber	East Fork	6101	500-year	135.000	3264.590	3266.6180	3267	3267	0	6.38	22.72	110	1
East Fork Timber	East Fork	6101	1% plus	154.000	3264.590	3266.9820	3267	3267	0	5.38	39.83	226	1
East Fork Timber	East Fork	6185	10-year	52.000	3265.790	3268.4740	3268	3269	0	1.75	29.76	66	0
East Fork Timber	East Fork	6185	25-year	69.000	3265.790	3268.7010	3268	3269	0	1.94	39.62	102	0
East Fork Timber	East Fork	6185	50-year	83.000	3265.790	3268.8390	3268	3269	0	2.09	48.22	137	0
East Fork Timber	East Fork	6185	100-year	99.000	3265.790	3268.9860	3268	3269	0	2.20	58.96	169	0
East Fork Timber	East Fork	6185	500-year	135.000	3265.790	3269.2570	3268	3269	0	2.38	81.03	255	0
East Fork Timber	East Fork	6185	1% plus	154.000	3265.790	3269.2920	3268	3269	0	2.64	84.08	259	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
East Fork Timber	East Fork	6353	10-year	52.000	3270.760	3271.6820	3271	3272	0	1.82	35.84	118	0
East Fork Timber	East Fork	6353	25-year	69.000	3270.760	3271.8100	3271	3272	0	2.02	49.41	183	0
East Fork Timber	East Fork	6353	50-year	83.000	3270.760	3271.8900	3272	3272	0	2.09	59.57	210	0
East Fork Timber	East Fork	6353	100-year	99.000	3270.760	3271.9800	3272	3272	0	2.23	72.31	234	0
East Fork Timber	East Fork	6353	500-year	135.000	3270.760	3272.1050	3272	3272	0	2.37	91.30	240	0
East Fork Timber	East Fork	6353	1% plus	154.000	3270.760	3272.2140	3272	3272	0	2.27	108.33	246	0
East Fork Timber	East Fork	6518	10-year	52.000	3272.700	3274.9210	3274	3275	0	1.74	32.20	94	0
East Fork Timber	East Fork	6518	25-year	69.000	3272.700	3275.0920	3274	3275	0	1.95	42.87	132	0
East Fork Timber	East Fork	6518	50-year	83.000	3272.700	3275.1890	3274	3275	0	2.12	52.56	170	0
East Fork Timber	East Fork	6518	100-year	99.000	3272.700	3275.2870	3274	3275	0	2.25	64.54	181	0
East Fork Timber	East Fork	6518	500-year	135.000	3272.700	3275.4610	3275	3276	0	2.52	87.81	216	0
East Fork Timber	East Fork	6518	1% plus	154.000	3272.700	3275.4970	3275	3276	0	2.76	93.19	221	0
East Fork Timber	East Fork	6574	10-year	52.000	3274.250	3275.6190	3275	3276	0	1.66	36.92	58	0
East Fork Timber	East Fork	6574	25-year	69.000	3274.250	3275.7920	3275	3276	0	1.81	47.26	82	0
East Fork Timber	East Fork	6574	50-year	83.000	3274.250	3275.9110	3275	3276	0	1.91	55.27	92	0
East Fork Timber	East Fork	6574	100-year	99.000	3274.250	3276.0210	3275	3276	0	2.03	62.96	96	0
East Fork Timber	East Fork	6574	500-year	135.000	3274.250	3276.2370	3276	3276	0	2.28	79.00	120	0
East Fork Timber	East Fork	6574	1% plus	154.000	3274.250	3276.3390	3276	3276	0	2.39	87.93	145	0
East Fork Timber	East Fork	6617	10-year	52.000	3276.050	3276.8780	3277	3277	0	2.99	18.61	45	1
East Fork Timber	East Fork	6617	25-year	69.000	3276.050	3276.9710	3277	3277	0	3.34	22.44	51	1
East Fork Timber	East Fork	6617	50-year	83.000	3276.050	3277.0380	3277	3277	0	3.59	25.38	57	1
East Fork Timber	East Fork	6617	100-year	99.000	3276.050	3277.1230	3277	3277	0	3.76	29.39	69	1
East Fork Timber	East Fork	6617	500-year	135.000	3276.050	3277.3070	3277	3278	0	4.04	40.07	96	1
East Fork Timber	East Fork	6617	1% plus	154.000	3276.050	3277.3900	3277	3278	0	4.14	45.44	107	1
East Fork Timber	East Fork	6851	10-year	52.000	3278.540	3281.0330	3280	3281	0	1.68	40.76	100	0
East Fork Timber	East Fork	6851	25-year	69.000	3278.540	3281.2290	3280	3281	0	1.84	57.54	129	0
East Fork Timber	East Fork	6851	50-year	83.000	3278.540	3281.3540	3280	3281	0	1.93	69.51	135	0
East Fork Timber	East Fork	6851	100-year	99.000	3278.540	3281.4730	3280	3282	0	2.03	81.30	141	0
East Fork Timber	East Fork	6851	500-year	135.000	3278.540	3281.6980	3281	3282	0	2.23	104.37	150	0
East Fork Timber	East Fork	6851	1% plus	154.000	3278.540	3281.8020	3281	3282	0	2.33	115.27	161	0
East Fork Timber	East Fork	7129	10-year	52.000	3284.900	3285.9300	3286	3286	0	3.63	14.36	27	1
East Fork Timber	East Fork	7129	25-year	69.000	3284.900	3286.0630	3286	3286	0	3.88	18.14	30	1
East Fork Timber	East Fork	7129	50-year	83.000	3284.900	3286.1540	3286	3286	0	4.10	20.91	31	1
East Fork Timber	East Fork	7129	100-year	99.000	3284.900	3286.2630	3286	3287	0	4.26	24.51	35	1
East Fork Timber	East Fork	7129	500-year	135.000	3284.900	3286.4830	3286	3287	0	4.55	33.06	41	1
East Fork Timber	East Fork	7129	1% plus	154.000	3284.900	3286.5900	3286	3287	0	4.65	37.74	48	1
East Fork Timber	East Fork	7312	10-year	52.000	3286.510	3289.1630	3288	3289	0	1.60	33.87	27	0
East Fork Timber	East Fork	7312	25-year	69.000	3286.510	3289.4100	3288	3289	0	1.81	41.46	36	0
East Fork Timber	East Fork	7312	50-year	83.000	3286.510	3289.5840	3288	3290	0	1.96	48.61	46	0
East Fork Timber	East Fork	7312	100-year	99.000	3286.510	3289.7550	3288	3290	0	2.12	57.26	56	0
East Fork Timber	East Fork	7312	500-year	135.000	3286.510	3290.0570	3289	3290	0	2.39	76.31	66	0
East Fork Timber	East Fork	7312	1% plus	154.000	3286.510	3290.1880	3289	3290	0	2.51	85.11	68	0
East Fork Timber	East Fork	7422	10-year	52.000	3290.130	3291.5230	3292	3292	0	5.08	10.23	13	1
East Fork Timber	East Fork	7422	25-year	69.000	3290.130	3291.7240	3292	3292	0	5.28	13.07	15	1
East Fork Timber	East Fork	7422	50-year	83.000	3290.130	3291.8460	3292	3292	0	5.55	15.01	17	1
East Fork Timber	East Fork	7422	100-year	99.000	3290.130	3291.9920	3292	3293	0	5.73	17.71	23	1
East Fork Timber	East Fork	7422	500-year	135.000	3290.130	3292.3290	3292	3293	0	5.64	29.33	41	1
East Fork Timber	East Fork	7422	1% plus	154.000	3290.130	3292.4550	3292	3293	0	5.70	34.64	43	1
East Fork Timber	East Fork	7685	10-year	52.000	3296.540	3298.9140	3298	3299	0	1.86	41.86	66	0
East Fork Timber	East Fork	7685	25-year	69.000	3296.540	3299.0850	3298	3299	0	2.01	53.57	70	0
East Fork Timber	East Fork	7685	50-year	83.000	3296.540	3299.2080	3299	3299	0	2.12	62.36	73	0
East Fork Timber	East Fork	7685	100-year	99.000	3296.540	3299.3280	3299	3299	0	2.24	71.77	85	0
East Fork Timber	East Fork	7685	500-year	135.000	3296.540	3299.5310	3299	3300	0	2.54	92.09	112	0
East Fork Timber	East Fork	7685	1% plus	154.000	3296.540	3299.6290	3299	3300	0	2.66	103.60	123	0
East Fork Timber	East Fork	7836	10-year	52.000	3300.120	3301.8180	3301	3302	0	3.49	14.91	15	1
East Fork Timber	East Fork	7836	25-year	69.000	3300.120	3301.9960	3302	3302	0	3.96	17.66	17	1
East Fork Timber	East Fork	7836	50-year	83.000	3300.120	3302.1240	3302	3302	0	4.29	20.48	30	1
East Fork Timber	East Fork	7836	100-year	99.000	3300.120	3302.2630	3302	3303	0	4.54	25.23	36	1
East Fork Timber	East Fork	7836	500-year	135.000	3300.120	3302.5640	3302	3303	0	4.77	37.64	49	1
East Fork Timber	East Fork	7836	1% plus	154.000	3300.120	3302.6920	3302	3303	0	4.90	44.27	53	1
East Fork Timber	East Fork	8092	10-year	52.000	3307.160	3309.1470	3309	3309	0	2.19	29.18	38	0
East Fork Timber	East Fork	8092	25-year	69.000	3307.160	3309.3450	3309	3309	0	2.39	37.28	44	0
East Fork Timber	East Fork	8092	50-year	83.000	3307.160	3309.4910	3309	3310	0	2.52	44.04	49	0
East Fork Timber	East Fork	8092	100-year	99.000	3307.160	3309.6280	3309	3310	0	2.67	51.89	65	0
East Fork Timber	East Fork	8092	500-year	135.000	3307.160	3309.8520	3309	3310	0	3.00	67.91	77	0
East Fork Timber	East Fork	8092	1% plus	154.000	3307.160	3309.9520	3309	3310	0	3.13	75.70	78	0
East Fork Timber	East Fork	8366	10-year	52.000	3313.930	3315.7850	3315	3316	0	2.90	17.91	17	0
East Fork Timber	East Fork	8366	25-year	69.000	3313.930	3315.9640	3315	3316	0	3.29	21.05	18	1
East Fork Timber	East Fork	8366	50-year	83.000	3313.930	3316.0950	3316	3316	0	3.58	23.46	19	1
East Fork Timber	East Fork	8366	100-year	99.000	3313.930	3316.2430	3316	3316	0	3.84	26.68	23	1
East Fork Timber	East Fork	8366	500-year	135.000	3313.930	3316.5620	3316	3317	0	4.24	35.02	29	1
East Fork Timber	East Fork	8366	1% plus	154.000	3313.930	3316.7040	3316	3317	0	4.44	40.12	42	1
East Fork Timber	East Fork	8601	10-year	52.000	3320.650	3321.7000	3321	3322	0	1.48	50.07	90	0
East Fork Timber	East Fork	8601	25-year	69.000	3320.650	3321.8530	3321	3322	0	1.65	65.28	107	0
East Fork Timber	East Fork	8601	50-year	83.000	3320.650	3321.9440	3321	3322	0	1.74	75.30	113	0
East Fork Timber	East Fork	8601	100-year	99.000	3320.650	3322.0390	3321	3322	0	1.84	86.29	119	0
East Fork Timber	East Fork	8601	500-year	135.000	3320.650	3322.2060	3322	3322	0	2.02	106.49	122	0
East Fork Timber	East Fork	8601	1% plus	154.000	3320.650	3322.2920	3322	3322	0	2.09	117.14	124	0
East Fork Timber	East Fork	8764	10-year	52.000	3323.030	3324.7840	3324	3325	0	2.45	21.40	19	0
East Fork Timber	East Fork	8764	25-year	69.000	3323.030	3324.9700	3324	3325	0	2.82	25.11	22	0
East Fork Timber	East Fork	8764	50-year	83.000	3323.030	3325.0910	3324	3325	0	3.11	28.27	29	0
East Fork Timber	East Fork	8764	100-year	99.000	3323.030	3325.2190	3325	3325	0	3.38	32.23	33	0
East Fork Timber	East Fork	8764	500-year	135.000	3323.030	3325.4600	3325	3326	0	3.90	41.97	45	0
East Fork Timber	East Fork	8764	1% plus	154.000	3323.030	3325.5600	3325	3326	0	4.13	46.60	47	1
East Fork Timber	East Fork	8915	10-year	52.000	3326.980	3328.6310	3328	3329	0	2.73	19.07	18	0
East Fork Timber	East Fork	8915	25-year	69.000	3326.980	3328.8760	3328	3329	0	2.91	24.19	27	0
East Fork Timber	East Fork	8915	50-year	83.000	3326.980	3329.0450	3328	3329	0	3.04	29.06	31	0
East Fork Timber	East Fork	8915	100-year	99.000	3326.980	3329.2100	3329	3329	0	3.19	34.91	41	0
East Fork Timber	East Fork	8915	500-year	135.000	3326.980	3329.5130	3329	3330	0	3.43	51.70	65	0
East Fork Timber	East Fork	8915	1% plus	154.000	3326.980	3329.6420	3329	3330	0	3.51	60.11	66	0
East Fork Timber	East Fork	9115	10-year	52.000	3332.320	3333.8940	3333	3334	0	2.25	24.20	32	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
East Fork Timber	East Fork	9115	25-year	69.000	3332.320	3334.0600	3333	3334	0	2.54	30.28	40	0
East Fork Timber	East Fork	9115	50-year	83.000	3332.320	3334.1680	3334	3334	0	2.75	34.84	43	0
East Fork Timber	East Fork	9115	100-year	99.000	3332.320	3334.2820	3334	3334	0	2.96	39.91	46	0
East Fork Timber	East Fork	9115	500-year	135.000	3332.320	3334.5060	3334	3335	0	3.35	50.89	53	0
East Fork Timber	East Fork	9115	1% plus	154.000	3332.320	3334.5990	3334	3335	0	3.54	55.89	55	0
East Fork Timber	East Fork	9288	10-year	52.000	3335.730	3337.7480	3337	3338	0	2.87	19.73	17	0
East Fork Timber	East Fork	9288	25-year	69.000	3335.730	3337.9990	3337	3338	0	3.19	24.18	18	0
East Fork Timber	East Fork	9288	50-year	83.000	3335.730	3338.1920	3337	3338	0	3.41	28.09	25	0
East Fork Timber	East Fork	9288	100-year	99.000	3335.730	3338.3930	3338	3339	0	3.66	34.94	43	0
East Fork Timber	East Fork	9288	500-year	135.000	3335.730	3338.7090	3338	3339	0	3.99	50.39	55	0
East Fork Timber	East Fork	9288	1% plus	154.000	3335.730	3338.8480	3338	3339	0	4.09	58.05	56	0
East Fork Timber	East Fork	9512	10-year	52.000	3342.970	3344.5900	3344	3345	0	2.56	28.77	53	1
East Fork Timber	East Fork	9512	25-year	69.000	3342.970	3344.7190	3344	3345	0	2.75	35.75	55	1
East Fork Timber	East Fork	9512	50-year	83.000	3342.970	3344.8130	3345	3345	0	2.89	40.95	56	1
East Fork Timber	East Fork	9512	100-year	99.000	3342.970	3344.9220	3345	3345	0	3.01	47.14	57	0
East Fork Timber	East Fork	9512	500-year	135.000	3342.970	3345.1220	3345	3345	0	3.31	58.80	60	1
East Fork Timber	East Fork	9512	1% plus	154.000	3342.970	3345.2090	3345	3345	0	3.49	64.08	61	1
Timber Creek	Lower Reach 1	147.22	10-year	123.000	3140.980	3142.4290	3142	3143	0	3.65	33.68	137	1
Timber Creek	Lower Reach 1	147.22	25-year	159.000	3140.980	3142.6160	3142	3143	0	4.05	39.28	169	1
Timber Creek	Lower Reach 1	147.22	50-year	190.000	3140.980	3142.7650	3142	3143	0	4.35	43.71	191	1
Timber Creek	Lower Reach 1	147.22	100-year	223.000	3140.980	3142.9120	3143	3143	0	4.63	48.12	215	1
Timber Creek	Lower Reach 1	147.22	500-year	299.000	3140.980	3143.2220	3143	3144	0	5.21	57.37	232	1
Timber Creek	Lower Reach 1	147.22	1% plus	348.000	3140.980	3143.4060	3143	3144	0	5.54	62.84	240	1
Timber Creek	Lower Reach 1	151	10-year	123.000	3141.110	3142.5360	3142	3143	0	4.22	29.15	205	1
Timber Creek	Lower Reach 1	151	25-year	159.000	3141.110	3142.7220	3142	3143	0	4.76	33.41	212	1
Timber Creek	Lower Reach 1	151	50-year	190.000	3141.110	3142.8680	3143	3143	0	5.17	36.77	214	1
Timber Creek	Lower Reach 1	151	100-year	223.000	3141.110	3143.0120	3143	3143	0	5.56	40.10	216	1
Timber Creek	Lower Reach 1	151	500-year	299.000	3141.110	3143.3140	3143	3144	0	6.36	47.03	219	1
Timber Creek	Lower Reach 1	151	1% plus	348.000	3141.110	3143.4910	3143	3144	0	6.81	51.11	224	1
Timber Creek	Lower Reach 1	221		Culvert									
Timber Creek	Lower Reach 1	269	10-year	123.000	3147.190	3149.4180	3149	3150	0	5.79	21.23	13	1
Timber Creek	Lower Reach 1	269	25-year	159.000	3147.190	3150.0430	3149	3151	0	5.43	29.48	14	1
Timber Creek	Lower Reach 1	269	50-year	190.000	3147.190	3150.5140	3150	3151	0	5.33	36.23	15	1
Timber Creek	Lower Reach 1	269	100-year	223.000	3147.190	3150.9640	3150	3151	0	5.31	43.10	16	1
Timber Creek	Lower Reach 1	269	500-year	299.000	3147.190	3151.8720	3150	3152	0	5.36	58.24	18	0
Timber Creek	Lower Reach 1	269	1% plus	348.000	3147.190	3152.5070	3151	3153	0	5.26	69.91	19	0
Timber Creek	Lower Reach 1	285	10-year	123.000	3147.030	3150.3360	3149	3151	0	3.73	32.95	17	0
Timber Creek	Lower Reach 1	285	25-year	159.000	3147.030	3150.7080	3150	3151	0	4.03	39.59	19	0
Timber Creek	Lower Reach 1	285	50-year	190.000	3147.030	3151.0650	3150	3151	0	4.13	46.45	20	0
Timber Creek	Lower Reach 1	285	100-year	223.000	3147.030	3151.4530	3150	3152	0	4.18	54.18	21	0
Timber Creek	Lower Reach 1	285	500-year	299.000	3147.030	3152.2830	3151	3153	0	4.27	70.78	25	0
Timber Creek	Lower Reach 1	285	1% plus	348.000	3147.030	3152.8480	3151	3153	0	4.27	82.09	27	0
Timber Creek	Lower Reach 1	339		Culvert									
Timber Creek	Lower Reach 1	398	10-year	123.000	3148.240	3150.6130	3151	3151	0	6.42	19.15	15	1
Timber Creek	Lower Reach 1	398	25-year	159.000	3148.240	3151.3250	3151	3152	0	5.15	31.08	19	1
Timber Creek	Lower Reach 1	398	50-year	190.000	3148.240	3151.8550	3151	3152	0	4.66	42.00	22	1
Timber Creek	Lower Reach 1	398	100-year	223.000	3148.240	3152.3770	3151	3153	0	4.28	54.20	25	0
Timber Creek	Lower Reach 1	398	500-year	299.000	3148.240	3153.5360	3152	3154	0	3.67	83.05	33	0
Timber Creek	Lower Reach 1	398	1% plus	348.000	3148.240	3154.2880	3152	3154	0	3.42	101.85	41	0
Timber Creek	Lower Reach 1	411	10-year	123.000	3148.690	3151.7070	3151	3152	0	3.10	39.63	23	0
Timber Creek	Lower Reach 1	411	25-year	159.000	3148.690	3151.9160	3151	3152	0	3.61	44.00	25	0
Timber Creek	Lower Reach 1	411	50-year	190.000	3148.690	3152.2240	3151	3152	0	3.76	50.48	29	0
Timber Creek	Lower Reach 1	411	100-year	223.000	3148.690	3152.5950	3151	3153	0	3.83	58.28	35	0
Timber Creek	Lower Reach 1	411	500-year	299.000	3148.690	3153.6120	3152	3154	0	3.76	79.62	50	0
Timber Creek	Lower Reach 1	411	1% plus	348.000	3148.690	3154.3400	3152	3155	0	3.67	94.91	61	0
Timber Creek	Lower Reach 1	447		Culvert									
Timber Creek	Lower Reach 1	486	10-year	123.000	3150.990	3152.7960	3152	3153	0	3.20	38.54	46	1
Timber Creek	Lower Reach 1	486	25-year	159.000	3150.990	3153.4250	3153	3154	0	2.57	63.40	52	0
Timber Creek	Lower Reach 1	486	50-year	190.000	3150.990	3153.8890	3153	3154	0	2.37	82.42	56	0
Timber Creek	Lower Reach 1	486	100-year	223.000	3150.990	3154.3250	3153	3154	0	2.28	100.30	60	0
Timber Creek	Lower Reach 1	486	500-year	299.000	3150.990	3155.2620	3153	3155	0	2.20	138.73	96	0
Timber Creek	Lower Reach 1	486	1% plus	348.000	3150.990	3156.0060	3153	3156	0	2.09	169.23	136	0
Timber Creek	Lower Reach 1	541	10-year	123.000	3150.920	3154.0890	3154	3154	0	3.21	42.24	55	1
Timber Creek	Lower Reach 1	541	25-year	159.000	3150.920	3154.1420	3154	3154	0	3.91	45.15	55	1
Timber Creek	Lower Reach 1	541	50-year	190.000	3150.920	3154.3370	3154	3155	0	3.84	56.00	56	1
Timber Creek	Lower Reach 1	541	100-year	223.000	3150.920	3154.6360	3154	3155	0	3.50	73.51	63	0
Timber Creek	Lower Reach 1	541	500-year	299.000	3150.920	3155.4390	3154	3156	0	2.86	131.80	83	0
Timber Creek	Lower Reach 1	541	1% plus	348.000	3150.920	3156.1270	3154	3156	0	2.38	197.53	108	0
Timber Creek	Lower Reach 1	595	10-year	123.000	3153.250	3155.2230	3155	3155	0	3.43	47.75	55	0
Timber Creek	Lower Reach 1	595	25-year	159.000	3153.250	3155.4620	3155	3156	0	3.53	61.57	70	0
Timber Creek	Lower Reach 1	595	50-year	190.000	3153.250	3155.5520	3155	3156	0	3.89	67.49	77	1
Timber Creek	Lower Reach 1	595	100-year	223.000	3153.250	3155.6260	3155	3156	0	4.31	72.80	84	1
Timber Creek	Lower Reach 1	595	500-year	299.000	3153.250	3155.9690	3155	3156	0	4.53	102.17	111	1
Timber Creek	Lower Reach 1	595	1% plus	348.000	3153.250	3156.3960	3156	3157	0	3.71	146.77	126	0
Timber Creek	Lower Reach 1	672	10-year	123.000	3154.580	3156.5180	3156	3157	0	2.95	49.65	47	0
Timber Creek	Lower Reach 1	672	25-year	159.000	3154.580	3156.6840	3156	3157	0	3.30	57.41	47	0
Timber Creek	Lower Reach 1	672	50-year	190.000	3154.580	3156.8500	3156	3157	0	3.47	65.34	48	0
Timber Creek	Lower Reach 1	672	100-year	223.000	3154.580	3157.0150	3156	3157	0	3.63	73.39	49	0
Timber Creek	Lower Reach 1	672	500-year	299.000	3154.580	3157.2940	3157	3158	0	4.12	87.27	51	0
Timber Creek	Lower Reach 1	672	1% plus	348.000	3154.580	3157.3430	3157	3158	0	4.66	89.77	51	1
Timber Creek	Lower Reach 1	721	10-year	123.000	3154.650	3157.2180	3157	3157	0	3.15	53.61	65	0
Timber Creek	Lower Reach 1	721	25-year	159.000	3154.650	3157.4130	3157	3158	0	3.32	66.45	67	0
Timber Creek	Lower Reach 1	721	50-year	190.000	3154.650	3157.5630	3157	3158	0	3.45	76.57	68	0
Timber Creek	Lower Reach 1	721	100-year	223.000	3154.650	3157.7180	3157	3158	0	3.56	87.21	70	0
Timber Creek	Lower Reach 1	721	500-year	299.000	3154.650	3158.0290	3157	3158	0	3.83	110.90	86	0
Timber Creek	Lower Reach 1	721	1% plus	348.000	3154.650	3158.2010	3158	3158	0	4.01	126.49	93	0
Timber Creek	Lower Reach 1	787	10-year	123.000	3155.430	3158.1820	3157	3158	0	3.60	37.98	35	0
Timber Creek	Lower Reach 1	787	25-year	159.000	3155.430	3158.3720	3158	3159	0	4.04	45.37	41	1
Timber Creek	Lower Reach 1	787	50-year	190.000	3155.430	3158.5070	3158	3159	0	4.34	50.92	41	1

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Timber Creek	Lower Reach 1	787	100-year	223.000	3155.430	3158.6430	3158	3159	0	4.61	56.56	42	1
Timber Creek	Lower Reach 1	787	500-year	299.000	3155.430	3158.9240	3159	3159	0	5.11	68.59	43	1
Timber Creek	Lower Reach 1	787	1% plus	348.000	3155.430	3159.0910	3159	3159	0	5.37	75.92	44	1
Timber Creek	Lower Reach 1	898	10-year	123.000	3158.130	3160.1390	3160	3160	0	3.39	37.80	31	1
Timber Creek	Lower Reach 1	898	25-year	159.000	3158.130	3160.3880	3160	3161	0	3.68	45.83	33	1
Timber Creek	Lower Reach 1	898	50-year	190.000	3158.130	3160.5670	3160	3161	0	3.93	51.86	34	1
Timber Creek	Lower Reach 1	898	100-year	223.000	3158.130	3160.7430	3160	3161	0	4.16	58.03	36	1
Timber Creek	Lower Reach 1	898	500-year	299.000	3158.130	3161.0870	3160	3161	0	4.66	70.71	38	1
Timber Creek	Lower Reach 1	898	1% plus	348.000	3158.130	3161.2810	3161	3162	0	4.95	78.05	38	1
Timber Creek	Lower Reach 1	943	10-year	123.000	3158.920	3160.9930	3161	3161	0	3.48	39.52	61	1
Timber Creek	Lower Reach 1	943	25-year	159.000	3158.920	3161.1960	3161	3161	0	3.49	53.36	71	0
Timber Creek	Lower Reach 1	943	50-year	190.000	3158.920	3161.3560	3161	3162	0	3.42	64.94	73	0
Timber Creek	Lower Reach 1	943	100-year	223.000	3158.920	3161.5120	3161	3162	0	3.36	76.46	74	0
Timber Creek	Lower Reach 1	943	500-year	299.000	3158.920	3161.8430	3161	3162	0	3.27	101.26	76	0
Timber Creek	Lower Reach 1	943	1% plus	348.000	3158.920	3162.0350	3161	3162	0	3.26	115.96	77	0
Timber Creek	Lower Reach 1	1022	10-year	123.000	3161.100	3162.9690	3163	3163	0	4.91	26.17	33	1
Timber Creek	Lower Reach 1	1022	25-year	159.000	3161.100	3163.1030	3163	3164	0	5.76	28.98	52	1
Timber Creek	Lower Reach 1	1022	50-year	190.000	3161.100	3163.1800	3163	3164	0	6.53	30.61	62	1
Timber Creek	Lower Reach 1	1022	100-year	223.000	3161.100	3163.2900	3163	3164	0	7.13	33.01	76	1
Timber Creek	Lower Reach 1	1022	500-year	299.000	3161.100	3163.6920	3164	3164	0	6.21	57.22	89	1
Timber Creek	Lower Reach 1	1022	1% plus	348.000	3161.100	3163.7960	3164	3164	0	6.57	62.69	91	1
Timber Creek	Lower Reach 1	1038		Culvert									
Timber Creek	Lower Reach 1	1054	10-year	123.000	3161.770	3163.7920	3164	3164	0	6.29	19.54	16	1
Timber Creek	Lower Reach 1	1054	25-year	159.000	3161.770	3164.0600	3164	3165	0	6.66	23.90	26	1
Timber Creek	Lower Reach 1	1054	50-year	190.000	3161.770	3164.7880	3164	3165	0	5.14	37.86	41	1
Timber Creek	Lower Reach 1	1054	100-year	223.000	3161.770	3165.4270	3164	3166	0	4.55	50.81	49	0
Timber Creek	Lower Reach 1	1054	500-year	299.000	3161.770	3166.6530	3165	3167	0	4.05	82.05	85	0
Timber Creek	Lower Reach 1	1054	1% plus	348.000	3161.770	3167.0880	3165	3167	0	4.11	97.49	93	0
Timber Creek	Lower Reach 1	1127	10-year	123.000	3162.750	3165.6620	3164	3166	0	2.45	51.10	27	0
Timber Creek	Lower Reach 1	1127	25-year	159.000	3162.750	3166.0030	3165	3166	0	2.71	60.81	30	0
Timber Creek	Lower Reach 1	1127	50-year	190.000	3162.750	3166.0980	3165	3166	0	3.11	63.66	30	0
Timber Creek	Lower Reach 1	1127	100-year	223.000	3162.750	3166.3730	3165	3167	0	3.26	72.36	33	0
Timber Creek	Lower Reach 1	1127	500-year	299.000	3162.750	3167.2160	3165	3167	0	3.24	103.15	40	0
Timber Creek	Lower Reach 1	1127	1% plus	348.000	3162.750	3167.6030	3165	3168	0	3.36	119.42	46	0
Timber Creek	Lower Reach 1	1179	10-year	123.000	3163.890	3166.0450	3165	3166	0	2.70	47.54	37	0
Timber Creek	Lower Reach 1	1179	25-year	159.000	3163.890	3166.3680	3165	3166	0	2.83	59.66	38	0
Timber Creek	Lower Reach 1	1179	50-year	190.000	3163.890	3166.5360	3166	3167	0	3.07	66.16	39	0
Timber Creek	Lower Reach 1	1179	100-year	223.000	3163.890	3166.7900	3166	3167	0	3.16	76.32	41	0
Timber Creek	Lower Reach 1	1179	500-year	299.000	3163.890	3167.5080	3166	3168	0	3.11	106.46	43	0
Timber Creek	Lower Reach 1	1179	1% plus	348.000	3163.890	3167.8770	3166	3168	0	3.17	122.81	45	0
Timber Creek	Lower Reach 1	1248	10-year	123.000	3164.590	3166.9240	3167	3167	0	3.64	41.14	35	0
Timber Creek	Lower Reach 1	1248	25-year	159.000	3164.590	3167.1530	3167	3167	0	3.93	51.39	58	1
Timber Creek	Lower Reach 1	1248	50-year	190.000	3164.590	3167.3350	3167	3168	0	4.06	62.92	68	0
Timber Creek	Lower Reach 1	1248	100-year	223.000	3164.590	3167.5210	3167	3168	0	4.12	76.89	81	0
Timber Creek	Lower Reach 1	1248	500-year	299.000	3164.590	3168.0100	3167	3168	0	3.78	119.62	91	0
Timber Creek	Lower Reach 1	1248	1% plus	348.000	3164.590	3168.3220	3167	3168	0	3.55	148.13	92	0
Timber Creek	Lower Reach 1	1268	10-year	123.000	3165.760	3167.3400	3167	3168	0	4.42	31.20	32	1
Timber Creek	Lower Reach 1	1268	25-year	159.000	3165.760	3167.5430	3167	3168	0	4.76	37.82	33	1
Timber Creek	Lower Reach 1	1268	50-year	190.000	3165.760	3167.6880	3167	3168	0	5.07	42.68	34	1
Timber Creek	Lower Reach 1	1268	100-year	223.000	3165.760	3167.8270	3168	3168	0	5.37	48.79	57	1
Timber Creek	Lower Reach 1	1268	500-year	299.000	3165.760	3168.1660	3168	3169	0	5.49	73.17	81	1
Timber Creek	Lower Reach 1	1268	1% plus	348.000	3165.760	3168.4240	3168	3169	0	5.30	95.70	90	1
Timber Creek	Lower Reach 1	1287	10-year	123.000	3166.280	3168.0270	3168	3168	0	4.72	28.85	34	1
Timber Creek	Lower Reach 1	1287	25-year	159.000	3166.280	3168.2080	3168	3169	0	5.20	35.62	44	1
Timber Creek	Lower Reach 1	1287	50-year	190.000	3166.280	3168.3690	3168	3169	0	5.44	44.46	59	1
Timber Creek	Lower Reach 1	1287	100-year	223.000	3166.280	3168.4960	3168	3169	0	5.64	51.98	59	1
Timber Creek	Lower Reach 1	1287	500-year	299.000	3166.280	3168.7310	3169	3169	0	6.10	66.63	65	1
Timber Creek	Lower Reach 1	1287	1% plus	348.000	3166.280	3168.8680	3169	3169	0	6.34	75.60	67	1
Timber Creek	Lower Reach 1	1321	10-year	123.000	3167.020	3169.2600	3169	3169	0	3.71	37.93	45	1
Timber Creek	Lower Reach 1	1321	25-year	159.000	3167.020	3169.4580	3169	3170	0	3.94	46.90	46	1
Timber Creek	Lower Reach 1	1321	50-year	190.000	3167.020	3169.5910	3169	3170	0	4.18	53.08	47	1
Timber Creek	Lower Reach 1	1321	100-year	223.000	3167.020	3169.7080	3169	3170	0	4.46	58.80	50	1
Timber Creek	Lower Reach 1	1321	500-year	299.000	3167.020	3169.9510	3170	3170	0	5.02	71.38	55	1
Timber Creek	Lower Reach 1	1321	1% plus	348.000	3167.020	3170.0830	3170	3170	0	5.35	78.93	59	1
Timber Creek	Lower Reach 1	1476	10-year	123.000	3169.190	3171.5030	3171	3172	0	2.74	56.84	47	0
Timber Creek	Lower Reach 1	1476	25-year	159.000	3169.190	3171.7190	3171	3172	0	3.03	67.14	49	0
Timber Creek	Lower Reach 1	1476	50-year	190.000	3169.190	3171.8940	3171	3172	0	3.23	75.85	50	0
Timber Creek	Lower Reach 1	1476	100-year	223.000	3169.190	3172.0710	3171	3172	0	3.41	84.88	52	0
Timber Creek	Lower Reach 1	1476	500-year	299.000	3169.190	3172.4180	3171	3173	0	3.76	103.25	53	0
Timber Creek	Lower Reach 1	1476	1% plus	348.000	3169.190	3172.6250	3172	3173	0	3.95	114.37	54	0
Timber Creek	Lower Reach 1	1630	10-year	123.000	3171.270	3173.3400	3173	3174	0	3.50	39.71	41	1
Timber Creek	Lower Reach 1	1630	25-year	159.000	3171.270	3173.5660	3173	3174	0	3.73	49.01	42	1
Timber Creek	Lower Reach 1	1630	50-year	190.000	3171.270	3173.7370	3173	3174	0	3.91	56.19	42	1
Timber Creek	Lower Reach 1	1630	100-year	223.000	3171.270	3173.8980	3173	3174	0	4.12	63.02	43	1
Timber Creek	Lower Reach 1	1630	500-year	299.000	3171.270	3174.2400	3174	3175	0	4.50	77.89	44	1
Timber Creek	Lower Reach 1	1630	1% plus	348.000	3171.270	3174.4370	3174	3175	0	4.72	86.69	45	1
Timber Creek	Lower Reach 1	1803	10-year	123.000	3174.170	3176.3780	3176	3177	0	3.09	40.17	29	0
Timber Creek	Lower Reach 1	1803	25-year	159.000	3174.170	3176.5870	3176	3177	0	3.49	46.21	29	0
Timber Creek	Lower Reach 1	1803	50-year	190.000	3174.170	3176.7550	3176	3177	0	3.78	51.12	30	0
Timber Creek	Lower Reach 1	1803	100-year	223.000	3174.170	3176.9230	3176	3177	0	4.06	56.13	30	1
Timber Creek	Lower Reach 1	1803	500-year	299.000	3174.170	3177.2640	3176	3178	0	4.63	66.51	31	1
Timber Creek	Lower Reach 1	1803	1% plus	348.000	3174.170	3177.4670	3177	3178	0	4.95	72.79	31	1
Timber Creek	Lower Reach 1	2055	10-year	123.000	3177.700	3180.2350	3180	3180	0	3.72	34.15	22	0
Timber Creek	Lower Reach 1	2055	25-year	159.000	3177.700	3180.5390	3180	3181	0	4.08	41.00	23	0
Timber Creek	Lower Reach 1	2055	50-year	190.000	3177.700	3180.7690	3180	3181	0	4.36	46.41	24	0
Timber Creek	Lower Reach 1	2055	100-year	223.000	3177.700	3180.9930	3180	3181	0	4.62	51.89	25	1
Timber Creek	Lower Reach 1	2055	500-year	299.000	3177.700	3181.4510	3181	3182	0	5.16	63.63	26	1
Timber Creek	Lower Reach 1	2055	1% plus	348.000	3177.700	3181.7130	3181	3182	0	5.46	70.65	27	1
Timber Creek	Lower Reach 1	2224	10-year	123.000	3180.420	3182.5110	3182	3183	0	2.62	55.30	46	0
Timber Creek	Lower Reach 1	2224	25-year	159.000	3180.420	3182.7570	3182	3183	0	2.82	66.63	46	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Timber Creek	Lower Reach 1	2224	50-year	190.000	3180.420	3182.9580	3182	3183	0	2.96	76.01	47	0
Timber Creek	Lower Reach 1	2224	100-year	223.000	3180.420	3183.1580	3182	3183	0	3.09	85.51	48	0
Timber Creek	Lower Reach 1	2224	500-year	299.000	3180.420	3183.5870	3182	3184	0	3.35	106.16	49	0
Timber Creek	Lower Reach 1	2224	1% plus	348.000	3180.420	3183.8440	3183	3184	0	3.49	118.80	50	0
Timber Creek	Lower Reach 2	2427	10-year	103.103	3183.140	3185.1850	3185	3185	0	3.53	32.79	32	1
Timber Creek	Lower Reach 2	2427	25-year	122.077	3183.140	3185.3090	3185	3186	0	3.76	36.83	33	1
Timber Creek	Lower Reach 2	2427	50-year	138.042	3183.140	3185.4080	3185	3186	0	3.93	40.10	33	1
Timber Creek	Lower Reach 2	2427	100-year	155.285	3183.140	3185.5090	3185	3186	0	4.10	43.45	34	1
Timber Creek	Lower Reach 2	2427	500-year	195.074	3183.140	3185.7500	3185	3186	0	4.38	51.71	35	1
Timber Creek	Lower Reach 2	2427	1% plus	225.010	3183.140	3185.9110	3185	3186	0	4.58	57.35	35	1
Timber Creek	Lower Reach 2	2587	10-year	103.103	3185.110	3187.5410	3187	3188	0	2.73	46.50	54	0
Timber Creek	Lower Reach 2	2587	25-year	122.077	3185.110	3187.6790	3187	3188	0	2.89	52.46	56	0
Timber Creek	Lower Reach 2	2587	50-year	138.042	3185.110	3187.7920	3187	3188	0	2.99	57.47	58	0
Timber Creek	Lower Reach 2	2587	100-year	155.285	3185.110	3187.9040	3187	3188	0	3.10	62.54	59	0
Timber Creek	Lower Reach 2	2587	500-year	195.074	3185.110	3188.1290	3187	3188	0	3.36	73.01	62	0
Timber Creek	Lower Reach 2	2587	1% plus	225.010	3185.110	3188.2870	3187	3188	0	3.52	80.59	64	0
Timber Creek	Lower Reach 2	2666	10-year	103.103	3185.720	3188.4650	3188	3189	0	4.02	27.80	18	0
Timber Creek	Lower Reach 2	2666	25-year	122.077	3185.720	3188.6150	3188	3189	0	4.38	30.63	19	1
Timber Creek	Lower Reach 2	2666	50-year	138.042	3185.720	3188.7310	3188	3189	0	4.66	32.88	20	1
Timber Creek	Lower Reach 2	2666	100-year	155.285	3185.720	3188.8410	3188	3189	0	4.96	35.09	20	1
Timber Creek	Lower Reach 2	2666	500-year	195.074	3185.720	3189.0740	3188	3190	0	5.57	39.95	21	1
Timber Creek	Lower Reach 2	2666	1% plus	225.010	3185.720	3189.2320	3189	3190	0	5.98	43.39	22	1
Timber Creek	Middle	2754	10-year	62.103	3188.080	3190.0490	3189	3190	0	3.25	19.10	13	0
Timber Creek	Middle	2754	25-year	70.077	3188.080	3190.2340	3189	3190	0	3.26	21.59	14	0
Timber Creek	Middle	2754	50-year	76.042	3188.080	3190.3780	3190	3191	0	3.25	23.60	14	0
Timber Creek	Middle	2754	100-year	83.285	3188.080	3190.5320	3190	3191	0	3.28	25.83	15	0
Timber Creek	Middle	2754	500-year	101.074	3188.080	3190.8640	3190	3191	0	3.38	30.87	16	0
Timber Creek	Middle	2754	1% plus	113.010	3188.080	3191.0870	3190	3191	0	3.42	34.47	17	0
Timber Creek	Middle	2859	10-year	62.103	3189.440	3191.7190	3191	3192	0	2.92	21.29	15	0
Timber Creek	Middle	2859	25-year	70.077	3189.440	3191.8040	3191	3192	0	3.11	22.57	15	0
Timber Creek	Middle	2859	50-year	76.042	3189.440	3191.8680	3191	3192	0	3.24	23.53	15	0
Timber Creek	Middle	2859	100-year	83.285	3189.440	3191.9510	3191	3192	0	3.38	24.82	16	0
Timber Creek	Middle	2859	500-year	101.074	3189.440	3192.1610	3191	3192	0	3.64	28.17	16	0
Timber Creek	Middle	2859	1% plus	113.010	3189.440	3192.2980	3191	3193	0	3.79	30.44	17	0
Timber Creek	Middle	2953	10-year	62.103	3191.280	3193.2730	3193	3193	0	3.19	20.14	19	1
Timber Creek	Middle	2953	25-year	70.077	3191.280	3193.3780	3193	3194	0	3.30	22.20	20	1
Timber Creek	Middle	2953	50-year	76.042	3191.280	3193.4520	3193	3194	0	3.38	23.68	20	0
Timber Creek	Middle	2953	100-year	83.285	3191.280	3193.5350	3193	3194	0	3.47	25.37	21	0
Timber Creek	Middle	2953	500-year	101.074	3191.280	3193.7240	3193	3194	0	3.70	29.43	23	1
Timber Creek	Middle	2953	1% plus	113.010	3191.280	3193.8410	3193	3194	0	3.84	32.18	24	1
Timber Creek	Middle	3055	10-year	62.103	3192.420	3194.5310	3194	3195	0	2.17	29.40	24	0
Timber Creek	Middle	3055	25-year	70.077	3192.420	3194.6260	3194	3195	0	2.29	31.68	24	0
Timber Creek	Middle	3055	50-year	76.042	3192.420	3194.6980	3194	3195	0	2.37	33.46	25	0
Timber Creek	Middle	3055	100-year	83.285	3192.420	3194.7840	3194	3195	0	2.46	35.63	26	0
Timber Creek	Middle	3055	500-year	101.074	3192.420	3194.9790	3194	3195	0	2.66	41.21	31	0
Timber Creek	Middle	3055	1% plus	113.010	3192.420	3195.0970	3194	3195	0	2.77	45.02	33	0
Timber Creek	Middle	3282	10-year	62.103	3195.760	3197.4880	3197	3198	0	3.81	18.65	27	1
Timber Creek	Middle	3282	25-year	70.077	3195.760	3197.5800	3197	3198	0	3.90	21.28	31	1
Timber Creek	Middle	3282	50-year	76.042	3195.760	3197.6350	3197	3198	0	3.97	22.98	31	1
Timber Creek	Middle	3282	100-year	83.285	3195.760	3197.7010	3197	3198	0	4.04	25.05	32	1
Timber Creek	Middle	3282	500-year	101.074	3195.760	3197.8530	3198	3198	0	4.19	29.95	33	1
Timber Creek	Middle	3282	1% plus	113.010	3195.760	3197.9430	3198	3198	0	4.29	33.00	34	1
Timber Creek	Middle	3363	10-year	62.103	3197.230	3199.2770	3199	3199	0	2.67	24.31	27	0
Timber Creek	Middle	3363	25-year	70.077	3197.230	3199.3520	3199	3199	0	2.82	26.47	31	0
Timber Creek	Middle	3363	50-year	76.042	3197.230	3199.4050	3199	3200	0	2.93	28.20	34	0
Timber Creek	Middle	3363	100-year	83.285	3197.230	3199.4630	3199	3200	0	3.05	30.27	37	0
Timber Creek	Middle	3363	500-year	101.074	3197.230	3199.5950	3199	3200	0	3.30	35.72	46	0
Timber Creek	Middle	3363	1% plus	113.010	3197.230	3199.6780	3199	3200	0	3.44	40.26	62	0
Timber Creek	Middle	3554	10-year	62.103	3201.260	3202.8180	3203	3203	0	2.41	32.93	74	1
Timber Creek	Middle	3554	25-year	70.077	3201.260	3202.8820	3203	3203	0	2.42	38.13	92	0
Timber Creek	Middle	3554	50-year	76.042	3201.260	3202.9250	3203	3203	0	2.47	42.37	104	0
Timber Creek	Middle	3554	100-year	83.285	3201.260	3202.9680	3203	3203	0	2.50	47.06	110	0
Timber Creek	Middle	3554	500-year	101.074	3201.260	3203.0540	3203	3203	0	2.56	57.16	125	0
Timber Creek	Middle	3554	1% plus	113.010	3201.260	3203.1070	3203	3203	0	2.60	63.92	138	0
Timber Creek	Middle	3732	10-year	62.103	3203.230	3204.8440	3204	3205	0	1.60	42.73	101	0
Timber Creek	Middle	3732	25-year	70.077	3203.230	3204.8940	3204	3205	0	1.68	46.23	109	0
Timber Creek	Middle	3732	50-year	76.042	3203.230	3204.9260	3204	3205	0	1.73	48.61	114	0
Timber Creek	Middle	3732	100-year	83.285	3203.230	3204.9610	3205	3205	0	1.79	51.22	116	0
Timber Creek	Middle	3732	500-year	101.074	3203.230	3205.0410	3205	3205	0	1.92	57.24	126	0
Timber Creek	Middle	3732	1% plus	113.010	3203.230	3205.0900	3205	3205	0	2.00	60.93	137	0
Timber Creek	Middle	3897	10-year	62.103	3206.540	3207.6470	3208	3208	0	4.63	13.41	20	1
Timber Creek	Middle	3897	25-year	70.077	3206.540	3207.7140	3208	3208	0	4.74	14.78	21	1
Timber Creek	Middle	3897	50-year	76.042	3206.540	3207.7340	3208	3208	0	5.01	15.19	21	1
Timber Creek	Middle	3897	100-year	83.285	3206.540	3207.7820	3208	3208	0	5.15	16.23	22	1
Timber Creek	Middle	3897	500-year	101.074	3206.540	3207.9100	3208	3208	0	5.37	19.04	23	1
Timber Creek	Middle	3897	1% plus	113.010	3206.540	3207.9750	3208	3208	0	5.59	20.48	24	1
Timber Creek	Middle	3933		Culvert									
Timber Creek	Middle	3970	10-year	62.103	3206.290	3210.1400	3208	3210	0	0.75	87.61	93	0
Timber Creek	Middle	3970	25-year	70.077	3206.290	3210.4500	3208	3210	0	0.74	99.45	127	0
Timber Creek	Middle	3970	50-year	76.042	3206.290	3210.6600	3208	3211	0	0.73	111.82	137	0
Timber Creek	Middle	3970	100-year	83.285	3206.290	3210.8220	3208	3211	0	0.75	118.39	145	0
Timber Creek	Middle	3970	500-year	101.074	3206.290	3211.0570	3208	3211	0	0.84	127.98	158	0
Timber Creek	Middle	3970	1% plus	113.010	3206.290	3211.1620	3208	3211	0	0.88	140.45	170	0
Timber Creek	Middle	4029	10-year	80.668	3207.270	3210.1860	3209	3210	0	1.87	45.77	27	0
Timber Creek	Middle	4029	25-year	101.084	3207.270	3210.4920	3209	3211	0	2.01	57.24	52	0
Timber Creek	Middle	4029	50-year	116.448	3207.270	3210.6980	3209	3211	0	2.05	69.63	67	0
Timber Creek	Middle	4029	100-year	131.218	3207.270	3210.8600	3209	3211	0	2.10	81.68	82	0
Timber Creek	Middle	4029	500-year	162.355	3207.270	3211.1010	3209	3211	0	2.21	104.08	106	0
Timber Creek	Middle	4029	1% plus	179.970	3207.270	3211.2070	3209	3211	0	2.28	115.93	117	0
Timber Creek	Middle	4185	10-year	81.530	3209.560	3211.2220	3211	3211	0	3.51	24.24	25	1

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Timber Creek	Middle	4185	25-year	105.515	3209.560	3211.4590	3211	3212	0	3.70	30.55	28	1
Timber Creek	Middle	4185	50-year	124.533	3209.560	3211.6040	3211	3212	0	3.89	35.02	39	1
Timber Creek	Middle	4185	100-year	144.168	3209.560	3211.7350	3211	3212	0	4.00	42.85	72	1
Timber Creek	Middle	4185	500-year	188.891	3209.560	3211.9570	3212	3212	0	4.01	62.21	110	1
Timber Creek	Middle	4185	1% plus	214.010	3209.560	3212.0560	3212	3212	0	3.97	75.28	150	0
Timber Creek	Middle	4356		Lat Struct									
Timber Creek	Middle	4359	10-year	82.000	3210.890	3213.1430	3212	3213	0	2.10	48.32	93	0
Timber Creek	Middle	4359	25-year	107.000	3210.890	3213.3080	3212	3213	0	2.22	68.07	142	0
Timber Creek	Middle	4359	50-year	127.954	3210.890	3213.4190	3213	3213	0	2.28	84.84	158	0
Timber Creek	Middle	4359	100-year	150.752	3210.890	3213.5130	3213	3214	0	2.33	100.27	169	0
Timber Creek	Middle	4359	500-year	203.904	3210.890	3213.6630	3213	3214	0	2.51	126.35	175	0
Timber Creek	Middle	4359	1% plus	234.268	3210.890	3213.7310	3213	3214	0	2.62	138.30	175	0
Timber Creek	Middle	4572	10-year	82.000	3211.300	3214.0820	3213	3214	0	1.91	54.31	90	0
Timber Creek	Middle	4572	25-year	107.000	3211.300	3214.2420	3213	3214	0	2.06	70.84	125	0
Timber Creek	Middle	4572	50-year	128.000	3211.300	3214.3430	3213	3214	0	2.15	84.78	155	0
Timber Creek	Middle	4572	100-year	151.000	3211.300	3214.4280	3213	3214	0	2.28	98.81	176	0
Timber Creek	Middle	4572	500-year	205.000	3211.300	3214.6030	3214	3215	0	2.42	134.21	228	0
Timber Creek	Middle	4572	1% plus	236.000	3211.300	3214.6800	3214	3215	0	2.49	152.19	237	0
Timber Creek	Middle	4826		Lat Struct									
Timber Creek	Middle	4832	10-year	82.000	3213.960	3215.9900	3216	3216	0	3.41	27.51	47	1
Timber Creek	Middle	4832	25-year	107.000	3213.960	3216.1660	3216	3216	0	3.63	36.42	54	1
Timber Creek	Middle	4832	50-year	128.000	3213.960	3216.2850	3216	3216	0	3.79	43.10	59	1
Timber Creek	Middle	4832	100-year	151.000	3213.960	3216.4150	3216	3217	0	3.89	51.36	67	1
Timber Creek	Middle	4832	500-year	205.000	3213.960	3216.6120	3216	3217	0	4.25	66.05	83	1
Timber Creek	Middle	4832	1% plus	236.000	3213.960	3216.7100	3216	3217	0	4.41	74.75	97	1
Timber Creek	Middle	5023	10-year	82.000	3215.710	3218.2060	3217	3218	0	1.97	52.70	95	0
Timber Creek	Middle	5023	25-year	107.000	3215.710	3218.3320	3218	3218	0	2.04	65.01	101	0
Timber Creek	Middle	5023	50-year	128.000	3215.710	3218.4250	3218	3218	0	2.10	74.68	106	0
Timber Creek	Middle	5023	100-year	151.000	3215.710	3218.5160	3218	3219	0	2.17	84.53	111	0
Timber Creek	Middle	5023	500-year	205.000	3215.710	3218.7120	3218	3219	0	2.29	108.33	131	0
Timber Creek	Middle	5023	1% plus	236.000	3215.710	3218.8140	3218	3219	0	2.36	122.85	153	0
Timber Creek	Middle	5319	10-year	82.000	3220.850	3222.0650	3222	3222	0	3.03	38.92	496	1
Timber Creek	Middle	5319	25-year	107.000	3220.850	3222.1250	3222	3222	0	3.12	51.07	534	1
Timber Creek	Middle	5319	50-year	128.000	3220.850	3222.1440	3222	3222	0	3.47	55.13	544	1
Timber Creek	Middle	5319	100-year	151.000	3220.850	3222.1920	3222	3222	0	3.42	66.90	580	1
Timber Creek	Middle	5319	500-year	205.000	3220.850	3222.2510	3222	3222	0	3.70	83.91	621	1
Timber Creek	Middle	5319	1% plus	236.000	3220.850	3222.2790	3222	3222	0	3.86	92.77	642	1
Timber Creek	Middle	5611	10-year	82.000	3223.280	3224.2520	3224	3224	0	0.87	101.70	528	0
Timber Creek	Middle	5611	25-year	107.000	3223.280	3224.2980	3224	3224	0	0.93	119.98	551	0
Timber Creek	Middle	5611	50-year	128.000	3223.280	3224.3410	3224	3224	0	0.94	137.67	575	0
Timber Creek	Middle	5611	100-year	151.000	3223.280	3224.3760	3224	3224	0	1.01	152.81	602	0
Timber Creek	Middle	5611	500-year	205.000	3223.280	3224.4510	3224	3224	0	1.08	185.38	645	0
Timber Creek	Middle	5611	1% plus	236.000	3223.280	3224.4920	3224	3225	0	1.11	203.25	659	0
Timber Creek	Middle	5747	10-year	82.000	3223.980	3225.6040	3226	3226	0	3.18	39.44	306	1
Timber Creek	Middle	5747	25-year	107.000	3223.980	3225.6480	3226	3226	0	3.39	47.98	326	1
Timber Creek	Middle	5747	50-year	128.000	3223.980	3225.6700	3226	3226	0	3.65	52.32	337	1
Timber Creek	Middle	5747	100-year	151.000	3223.980	3225.7020	3226	3226	0	3.78	59.20	356	1
Timber Creek	Middle	5747	500-year	205.000	3223.980	3225.7720	3226	3226	0	3.97	75.59	413	1
Timber Creek	Middle	5747	1% plus	236.000	3223.980	3225.8040	3226	3226	0	4.03	83.68	431	1
Timber Creek	Middle	5860	10-year	82.000	3225.430	3227.0100	3227	3227	0	1.53	77.15	406	0
Timber Creek	Middle	5860	25-year	107.000	3225.430	3227.0670	3227	3227	0	1.57	92.32	411	0
Timber Creek	Middle	5860	50-year	128.000	3225.430	3227.1130	3227	3227	0	1.58	104.93	416	0
Timber Creek	Middle	5860	100-year	151.000	3225.430	3227.1560	3227	3227	0	1.61	116.85	421	0
Timber Creek	Middle	5860	500-year	205.000	3225.430	3227.2430	3227	3227	0	1.71	141.35	436	0
Timber Creek	Middle	5860	1% plus	236.000	3225.430	3227.2870	3227	3227	0	1.76	154.01	455	0
Timber Creek	Middle	5957	10-year	82.000	3227.350	3228.1360	3228	3228	0	2.01	46.30	303	0
Timber Creek	Middle	5957	25-year	107.000	3227.350	3228.1830	3228	3228	0	2.14	55.83	326	1
Timber Creek	Middle	5957	50-year	128.000	3227.350	3228.2090	3228	3228	0	2.27	61.33	332	1
Timber Creek	Middle	5957	100-year	151.000	3227.350	3228.2420	3228	3228	0	2.35	68.41	347	1
Timber Creek	Middle	5957	500-year	205.000	3227.350	3228.3200	3228	3228	0	2.49	87.85	413	1
Timber Creek	Middle	5957	1% plus	236.000	3227.350	3228.3640	3228	3228	0	2.54	100.04	421	1
Timber Creek	Middle	6078	10-year	82.000	3229.280	3230.3970	3230	3230	0	1.34	70.24	456	0
Timber Creek	Middle	6078	25-year	107.000	3229.280	3230.4560	3230	3230	0	1.42	88.25	486	0
Timber Creek	Middle	6078	50-year	128.000	3229.280	3230.4960	3230	3231	0	1.45	100.96	489	0
Timber Creek	Middle	6078	100-year	151.000	3229.280	3230.5330	3230	3231	0	1.49	112.79	491	0
Timber Creek	Middle	6078	500-year	205.000	3229.280	3230.6130	3230	3231	0	1.60	138.39	493	0
Timber Creek	Middle	6078	1% plus	236.000	3229.280	3230.6470	3230	3231	0	1.67	149.63	494	0
Timber Creek	Middle	6168	10-year	82.000	3229.970	3230.6960	3230	3231	0	0.82	75.31	411	0
Timber Creek	Middle	6168	25-year	107.000	3229.970	3230.7550	3231	3231	0	0.89	88.90	458	0
Timber Creek	Middle	6168	50-year	128.000	3229.970	3230.7950	3231	3231	0	0.96	99.64	496	0
Timber Creek	Middle	6168	100-year	151.000	3229.970	3230.8490	3231	3231	0	1.05	115.98	525	0
Timber Creek	Middle	6168	500-year	205.000	3229.970	3230.9340	3231	3231	0	1.22	142.67	530	0
Timber Creek	Middle	6168	1% plus	236.000	3229.970	3230.9710	3231	3231	0	1.28	154.56	531	0
Timber Creek	Middle	6224		Lat Struct									
Timber Creek	Middle	6228	10-year	82.000	3229.780	3230.9740	3231	3231	0	1.74	57.83	307	0
Timber Creek	Middle	6228	25-year	107.000	3229.780	3231.0430	3231	3231	0	1.81	70.04	354	0
Timber Creek	Middle	6228	50-year	128.000	3229.780	3231.0990	3231	3231	0	1.88	80.74	381	0
Timber Creek	Middle	6228	100-year	151.000	3229.780	3231.1530	3231	3231	0	1.93	91.87	427	0
Timber Creek	Middle	6228	500-year	205.000	3229.780	3231.2490	3231	3231	0	2.05	113.33	483	0
Timber Creek	Middle	6228	1% plus	236.000	3229.780	3231.2930	3231	3231	0	2.13	123.97	510	0
Timber Creek	Middle	6321	10-year	82.000	3230.390	3231.4590	3231	3231	0	1.25	64.15	333	0
Timber Creek	Middle	6321	25-year	107.000	3230.390	3231.5290	3231	3232	0	1.30	78.37	363	0
Timber Creek	Middle	6321	50-year	128.000	3230.390	3231.5690	3231	3232	0	1.38	86.99	381	0
Timber Creek	Middle	6321	100-year	151.000	3230.390	3231.6170	3231	3232	0	1.43	97.70	419	0
Timber Creek	Middle	6321	500-year	205.000	3230.390	3231.7030	3231	3232	0	1.57	118.64	484	0
Timber Creek	Middle	6321	1% plus	236.000	3230.390	3231.7510	3231	3232	0	1.63	131.14	515	0
Timber Creek	Middle	6579	10-year	82.000	3232.420	3233.9000	3234	3234	0	1.81	56.32	227	0
Timber Creek	Middle	6579	25-year	107.000	3232.420	3233.9820	3234	3234	0	1.92	69.73	258	0
Timber Creek	Middle	6579	50-year	128.000	3232.420	3234.0400	3234	3234	0	1.98	80.00	290	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Timber Creek	Middle	6579	100-year	151.000	3232.420	3234.0850	3234	3234	0	2.07	88.46	304	0
Timber Creek	Middle	6579	500-year	205.000	3232.420	3234.1960	3234	3234	0	2.18	110.71	331	0
Timber Creek	Middle	6579	1% plus	236.000	3232.420	3234.2470	3234	3234	0	2.25	121.55	351	0
Timber Creek	Middle	6705	10-year	82.000	3233.180	3234.6220	3234	3235	0	1.19	67.02	171	0
Timber Creek	Middle	6705	25-year	107.000	3233.180	3234.7180	3234	3235	0	1.32	77.99	222	0
Timber Creek	Middle	6705	50-year	128.000	3233.180	3234.7900	3234	3235	0	1.42	86.56	241	0
Timber Creek	Middle	6705	100-year	151.000	3233.180	3234.8660	3234	3235	0	1.53	96.21	257	0
Timber Creek	Middle	6705	500-year	205.000	3233.180	3235.0090	3234	3235	0	1.75	115.64	293	0
Timber Creek	Middle	6705	1% plus	236.000	3233.180	3235.0860	3235	3235	0	1.86	127.12	312	0
Timber Creek	Middle	7044	10-year	82.000	3235.460	3237.4060	3237	3238	0	4.33	19.98	28	1
Timber Creek	Middle	7044	25-year	107.000	3235.460	3237.5830	3237	3238	0	4.65	26.02	42	1
Timber Creek	Middle	7044	50-year	128.000	3235.460	3237.7040	3238	3238	0	4.82	31.84	55	1
Timber Creek	Middle	7044	100-year	151.000	3235.460	3237.8260	3238	3238	0	4.78	38.97	61	1
Timber Creek	Middle	7044	500-year	205.000	3235.460	3238.0220	3238	3238	0	4.98	52.14	74	1
Timber Creek	Middle	7044	1% plus	236.000	3235.460	3238.1280	3238	3238	0	5.01	60.57	86	1
Timber Creek	Middle	7359	10-year	82.000	3240.590	3242.2720	3242	3242	0	1.94	52.45	119	0
Timber Creek	Middle	7359	25-year	107.000	3240.590	3242.3650	3242	3242	0	2.04	64.07	129	0
Timber Creek	Middle	7359	50-year	128.000	3240.590	3242.4320	3242	3242	0	2.12	73.03	139	0
Timber Creek	Middle	7359	100-year	151.000	3240.590	3242.4900	3242	3243	0	2.24	81.61	161	0
Timber Creek	Middle	7359	500-year	205.000	3240.590	3242.6180	3242	3243	0	2.41	104.28	190	0
Timber Creek	Middle	7359	1% plus	236.000	3240.590	3242.6750	3242	3243	0	2.51	115.25	205	0
Timber Creek	Middle	7442	10-year	82.000	3240.990	3243.1020	3243	3243	0	3.20	26.62	27	0
Timber Creek	Middle	7442	25-year	107.000	3240.990	3243.2240	3243	3243	0	3.76	30.28	34	1
Timber Creek	Middle	7442	50-year	128.000	3240.990	3243.3110	3243	3244	0	4.17	33.66	43	1
Timber Creek	Middle	7442	100-year	151.000	3240.990	3243.4120	3243	3244	0	4.46	38.33	50	1
Timber Creek	Middle	7442	500-year	205.000	3240.990	3243.5740	3244	3244	0	5.13	47.74	67	1
Timber Creek	Middle	7442	1% plus	236.000	3240.990	3243.6590	3244	3244	0	5.39	53.24	74	1
Timber Creek	Middle	7560	10-year	82.000	3243.060	3244.8370	3245	3245	0	2.34	46.03	92	0
Timber Creek	Middle	7560	25-year	107.000	3243.060	3244.9870	3245	3245	0	2.30	61.12	109	0
Timber Creek	Middle	7560	50-year	128.000	3243.060	3245.0890	3245	3245	0	2.30	73.02	130	0
Timber Creek	Middle	7560	100-year	151.000	3243.060	3245.1870	3245	3245	0	2.33	86.64	147	0
Timber Creek	Middle	7560	500-year	205.000	3243.060	3245.3830	3245	3245	0	2.42	117.96	168	0
Timber Creek	Middle	7560	1% plus	236.000	3243.060	3245.4630	3245	3246	0	2.46	131.60	174	0
Timber Creek	Middle	7765	10-year	82.000	3245.630	3247.3730	3247	3247	0	2.35	48.06	105	0
Timber Creek	Middle	7765	25-year	107.000	3245.630	3247.4440	3247	3248	0	2.67	55.56	109	0
Timber Creek	Middle	7765	50-year	128.000	3245.630	3247.5000	3247	3248	0	2.87	61.84	112	0
Timber Creek	Middle	7765	100-year	151.000	3245.630	3247.5590	3247	3248	0	3.05	68.45	114	0
Timber Creek	Middle	7765	500-year	205.000	3245.630	3247.6850	3247	3248	0	3.36	83.22	124	0
Timber Creek	Middle	7765	1% plus	236.000	3245.630	3247.7470	3248	3248	0	3.51	91.33	139	1
Timber Creek	Middle	8098	10-year	82.000	3249.840	3251.0290	3251	3251	0	1.78	51.29	91	0
Timber Creek	Middle	8098	25-year	107.000	3249.840	3251.1710	3251	3251	0	1.85	65.88	113	0
Timber Creek	Middle	8098	50-year	128.000	3249.840	3251.2610	3251	3251	0	1.91	76.87	140	0
Timber Creek	Middle	8098	100-year	151.000	3249.840	3251.3420	3251	3251	0	1.97	89.51	163	0
Timber Creek	Middle	8098	500-year	205.000	3249.840	3251.4950	3251	3252	0	2.10	115.64	179	0
Timber Creek	Middle	8098	1% plus	236.000	3249.840	3251.5720	3251	3252	0	2.15	129.65	187	0
Timber Creek	Middle	8246	10-year	82.000	3251.310	3252.5240	3252	3253	0	1.55	50.86	108	0
Timber Creek	Middle	8246	25-year	107.000	3251.310	3252.6180	3252	3253	0	1.74	61.41	118	0
Timber Creek	Middle	8246	50-year	128.000	3251.310	3252.6990	3252	3253	0	1.90	71.54	136	0
Timber Creek	Middle	8246	100-year	151.000	3251.310	3252.7740	3253	3253	0	2.06	82.69	155	0
Timber Creek	Middle	8246	500-year	205.000	3251.310	3252.9260	3253	3253	0	2.32	107.24	171	0
Timber Creek	Middle	8246	1% plus	236.000	3251.310	3252.9860	3253	3253	0	2.41	117.55	176	0
Timber Creek	Middle	8524	10-year	82.000	3254.750	3256.0960	3256	3256	0	1.81	57.19	122	0
Timber Creek	Middle	8524	25-year	107.000	3254.750	3256.2030	3256	3256	0	1.96	71.25	144	0
Timber Creek	Middle	8524	50-year	128.000	3254.750	3256.2820	3256	3256	0	2.05	83.16	158	0
Timber Creek	Middle	8524	100-year	151.000	3254.750	3256.3730	3256	3256	0	2.14	98.60	182	0
Timber Creek	Middle	8524	500-year	205.000	3254.750	3256.5140	3256	3257	0	2.30	125.14	194	0
Timber Creek	Middle	8524	1% plus	236.000	3254.750	3256.5810	3256	3257	0	2.41	138.23	199	0
Timber Creek	Upper	8667	10-year	56.000	3258.100	3259.2940	3259	3259	0	3.19	19.18	43	1
Timber Creek	Upper	8667	25-year	73.000	3258.100	3259.3720	3259	3260	0	3.65	22.48	49	1
Timber Creek	Upper	8667	50-year	87.000	3258.100	3259.4170	3259	3260	0	4.04	24.67	57	1
Timber Creek	Upper	8667	100-year	103.000	3258.100	3259.4610	3259	3260	0	4.47	27.17	66	1
Timber Creek	Upper	8667	500-year	138.000	3258.100	3259.6220	3260	3260	0	4.63	39.41	96	1
Timber Creek	Upper	8667	1% plus	161.000	3258.100	3259.7090	3260	3260	0	4.65	48.22	123	1
Timber Creek	Upper	8774	10-year	56.000	3259.140	3261.1990	3261	3261	0	2.16	34.02	64	0
Timber Creek	Upper	8774	25-year	73.000	3259.140	3261.3520	3261	3261	0	2.30	44.35	71	0
Timber Creek	Upper	8774	50-year	87.000	3259.140	3261.4620	3261	3262	0	2.39	52.86	84	0
Timber Creek	Upper	8774	100-year	103.000	3259.140	3261.5730	3261	3262	0	2.46	62.76	94	0
Timber Creek	Upper	8774	500-year	138.000	3259.140	3261.7360	3261	3262	0	2.72	79.21	107	0
Timber Creek	Upper	8774	1% plus	161.000	3259.140	3261.8190	3261	3262	0	2.88	88.33	111	0
Timber Creek	Upper	8814	10-year	56.000	3261.400	3262.2270	3262	3262	0	3.45	21.23	74	1
Timber Creek	Upper	8814	25-year	73.000	3261.400	3262.3050	3262	3262	0	3.64	27.37	82	1
Timber Creek	Upper	8814	50-year	87.000	3261.400	3262.3430	3262	3263	0	3.92	30.54	85	1
Timber Creek	Upper	8814	100-year	103.000	3261.400	3262.4000	3262	3263	0	4.00	35.56	88	1
Timber Creek	Upper	8814	500-year	138.000	3261.400	3262.4790	3262	3263	0	4.48	42.55	90	1
Timber Creek	Upper	8814	1% plus	161.000	3261.400	3262.5320	3263	3263	0	4.69	47.32	92	1
Timber Creek	Upper	8836	10-year	56.000	3262.200	3263.2700	3263	3263	0	3.14	23.82	47	1
Timber Creek	Upper	8836	25-year	73.000	3262.200	3263.3580	3263	3263	0	3.48	28.12	50	1
Timber Creek	Upper	8836	50-year	87.000	3262.200	3263.4320	3263	3264	0	3.67	32.10	57	1
Timber Creek	Upper	8836	100-year	103.000	3262.200	3263.4880	3263	3264	0	4.01	35.39	61	1
Timber Creek	Upper	8836	500-year	138.000	3262.200	3263.6280	3263	3264	0	4.37	45.48	83	1
Timber Creek	Upper	8836	1% plus	161.000	3262.200	3263.7050	3264	3264	0	4.56	52.53	101	1
Timber Creek	Upper	9238	10-year	56.000	3265.850	3268.2030	3267	3268	0	1.67	37.44	167	0
Timber Creek	Upper	9238	25-year	73.000	3265.850	3268.3770	3267	3268	0	1.82	46.70	199	0
Timber Creek	Upper	9238	50-year	87.000	3265.850	3268.4960	3268	3269	0	1.93	54.78	244	0
Timber Creek	Upper	9238	100-year	103.000	3265.850	3268.6260	3268	3269	0	2.03	65.59	301	0
Timber Creek	Upper	9238	500-year	138.000	3265.850	3268.8360	3268	3269	0	2.22	91.30	419	0
Timber Creek	Upper	9238	1% plus	161.000	3265.850	3268.9330	3268	3269	0	2.30	108.06	471	0
Timber Creek	Upper	9394	10-year	56.000	3267.600	3269.8440	3269	3270	0	3.38	18.67	52	1
Timber Creek	Upper	9394	25-year	73.000	3267.600	3270.0010	3270	3270	0	3.65	25.55	76	1
Timber Creek	Upper	9394	50-year	87.000	3267.600	3270.1050	3270	3270	0	3.74	31.83	90	1
Timber Creek	Upper	9394	100-year	103.000	3267.600	3270.1980	3270	3270	0	3.86	38.43	97	1

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Timber Creek	Upper	9394	500-year	138.000	3267.600	3270.3800	3270	3271	0	3.96	53.81	120	1
Timber Creek	Upper	9394	1% plus	161.000	3267.600	3270.4690	3270	3271	0	4.06	62.52	126	1
Timber Creek	Upper	9469	10-year	56.000	3269.730	3271.4760	3271	3272	0	2.80	23.16	61	0
Timber Creek	Upper	9469	25-year	73.000	3269.730	3271.6340	3271	3272	0	3.04	28.64	66	0
Timber Creek	Upper	9469	50-year	87.000	3269.730	3271.7260	3271	3272	0	3.30	31.99	70	0
Timber Creek	Upper	9469	100-year	103.000	3269.730	3271.8250	3271	3272	0	3.54	35.74	74	1
Timber Creek	Upper	9469	500-year	138.000	3269.730	3271.9940	3272	3272	0	4.05	42.59	106	1
Timber Creek	Upper	9469	1% plus	161.000	3269.730	3272.0960	3272	3272	0	4.33	47.09	119	1
Timber Creek	Upper	9697	10-year	56.000	3273.370	3275.2260	3275	3275	0	2.81	19.96	16	0
Timber Creek	Upper	9697	25-year	73.000	3273.370	3275.4380	3275	3276	0	3.11	23.52	18	0
Timber Creek	Upper	9697	50-year	87.000	3273.370	3275.6050	3275	3276	0	3.30	26.46	25	0
Timber Creek	Upper	9697	100-year	103.000	3273.370	3275.7740	3275	3276	0	3.52	29.55	31	0
Timber Creek	Upper	9697	500-year	138.000	3273.370	3276.1170	3275	3276	0	3.91	36.15	60	0
Timber Creek	Upper	9697	1% plus	161.000	3273.370	3276.3130	3275	3277	0	4.15	40.15	77	0
Timber Creek	Upper	9778	10-year	56.000	3275.670	3277.1180	3277	3277	0	3.75	15.23	18	1
Timber Creek	Upper	9778	25-year	73.000	3275.670	3277.2990	3277	3278	0	4.06	18.70	20	1
Timber Creek	Upper	9778	50-year	87.000	3275.670	3277.4200	3277	3278	0	4.33	21.28	22	1
Timber Creek	Upper	9778	100-year	103.000	3275.670	3277.5550	3277	3278	0	4.57	24.57	30	1
Timber Creek	Upper	9778	500-year	138.000	3275.670	3277.8130	3278	3278	0	4.93	33.07	68	1
Timber Creek	Upper	9778	1% plus	161.000	3275.670	3277.9690	3278	3278	0	5.07	39.58	83	1
Timber Creek	Upper	9906	10-year	56.000	3277.770	3279.7710	3279	3280	0	2.26	24.83	24	0
Timber Creek	Upper	9906	25-year	73.000	3277.770	3279.9470	3279	3280	0	2.54	29.38	28	0
Timber Creek	Upper	9906	50-year	87.000	3277.770	3280.0830	3279	3280	0	2.71	33.49	32	0
Timber Creek	Upper	9906	100-year	103.000	3277.770	3280.2210	3280	3280	0	2.89	38.28	37	0
Timber Creek	Upper	9906	500-year	138.000	3277.770	3280.4650	3280	3281	0	3.25	48.91	54	0
Timber Creek	Upper	9906	1% plus	161.000	3277.770	3280.6010	3280	3281	0	3.45	58.15	83	0
Timber Creek	Upper	9990	10-year	56.000	3279.270	3281.1520	3281	3281	0	3.80	14.93	14	1
Timber Creek	Upper	9990	25-year	73.000	3279.270	3281.3470	3281	3282	0	4.23	18.13	21	1
Timber Creek	Upper	9990	50-year	87.000	3279.270	3281.4810	3281	3282	0	4.52	21.45	30	1
Timber Creek	Upper	9990	100-year	103.000	3279.270	3281.6150	3281	3282	0	4.75	26.01	38	1
Timber Creek	Upper	9990	500-year	138.000	3279.270	3281.8640	3282	3282	0	5.04	37.16	50	1
Timber Creek	Upper	9990	1% plus	161.000	3279.270	3282.0030	3282	3282	0	5.14	44.26	53	1
Timber Creek	Upper	10075	10-year	56.000	3282.400	3283.6210	3283	3284	0	2.61	22.42	36	1
Timber Creek	Upper	10075	25-year	73.000	3282.400	3283.7650	3283	3284	0	2.80	28.10	44	1
Timber Creek	Upper	10075	50-year	87.000	3282.400	3283.8710	3284	3284	0	2.92	33.00	49	1
Timber Creek	Upper	10075	100-year	103.000	3282.400	3283.9730	3284	3284	0	3.07	38.27	54	1
Timber Creek	Upper	10075	500-year	138.000	3282.400	3284.1500	3284	3284	0	3.42	49.02	68	1
Timber Creek	Upper	10075	1% plus	161.000	3282.400	3284.2410	3284	3284	0	3.62	55.66	78	1
Timber Creek	Upper	10174	10-year	56.000	3284.510	3285.8190	3286	3286	0	2.27	31.76	61	0
Timber Creek	Upper	10174	25-year	73.000	3284.510	3285.9200	3286	3286	0	2.53	38.60	75	0
Timber Creek	Upper	10174	50-year	87.000	3284.510	3286.0030	3286	3286	0	2.71	45.34	87	0
Timber Creek	Upper	10174	100-year	103.000	3284.510	3286.0890	3286	3286	0	2.89	53.09	96	0
Timber Creek	Upper	10174	500-year	138.000	3284.510	3286.2350	3286	3286	0	3.06	68.04	110	0
Timber Creek	Upper	10174	1% plus	161.000	3284.510	3286.3280	3286	3286	0	3.15	78.96	126	0
Timber Creek	Upper	10284	10-year	56.000	3285.690	3287.7030	3287	3288	0	2.25	31.53	66	0
Timber Creek	Upper	10284	25-year	73.000	3285.690	3287.8210	3288	3288	0	2.42	39.77	75	0
Timber Creek	Upper	10284	50-year	87.000	3285.690	3287.9160	3288	3288	0	2.56	47.54	87	0
Timber Creek	Upper	10284	100-year	103.000	3285.690	3287.9970	3288	3288	0	2.69	54.96	97	0
Timber Creek	Upper	10284	500-year	138.000	3285.690	3288.1270	3288	3288	0	2.99	68.49	110	0
Timber Creek	Upper	10284	1% plus	161.000	3285.690	3288.1940	3288	3288	0	3.15	76.12	117	0
Timber Creek	Upper	10411	10-year	56.000	3288.900	3290.4610	3290	3291	0	3.44	20.16	72	1
Timber Creek	Upper	10411	25-year	73.000	3288.900	3290.5730	3290	3291	0	3.81	25.56	98	1
Timber Creek	Upper	10411	50-year	87.000	3288.900	3290.6570	3291	3291	0	4.05	30.91	114	1
Timber Creek	Upper	10411	100-year	103.000	3288.900	3290.7430	3291	3291	0	4.27	37.52	129	1
Timber Creek	Upper	10411	500-year	138.000	3288.900	3290.8910	3291	3291	0	4.46	51.04	154	1
Timber Creek	Upper	10411	1% plus	161.000	3288.900	3290.9810	3291	3291	0	4.59	61.14	175	1
Timber Creek	Upper	10578	10-year	56.000	3291.100	3293.1070	3293	3293	0	1.98	37.42	65	0
Timber Creek	Upper	10578	25-year	73.000	3291.100	3293.2370	3293	3293	0	2.13	46.50	85	0
Timber Creek	Upper	10578	50-year	87.000	3291.100	3293.3320	3293	3293	0	2.23	53.73	98	0
Timber Creek	Upper	10578	100-year	103.000	3291.100	3293.4240	3293	3293	0	2.35	61.58	114	0
Timber Creek	Upper	10578	500-year	138.000	3291.100	3293.5770	3293	3294	0	2.62	76.20	146	0
Timber Creek	Upper	10578	1% plus	161.000	3291.100	3293.6660	3293	3294	0	2.77	85.74	154	0
Timber Creek	Upper	10721	10-year	56.000	3294.730	3296.0300	3296	3296	0	5.00	11.38	19	1
Timber Creek	Upper	10721	25-year	73.000	3294.730	3296.2950	3296	3297	0	4.59	19.71	46	1
Timber Creek	Upper	10721	50-year	87.000	3294.730	3296.4360	3296	3297	0	4.44	27.57	68	1
Timber Creek	Upper	10721	100-year	103.000	3294.730	3296.5460	3297	3297	0	4.42	36.30	93	1
Timber Creek	Upper	10721	500-year	138.000	3294.730	3296.6770	3297	3297	0	4.76	49.95	117	1
Timber Creek	Upper	10721	1% plus	161.000	3294.730	3296.7760	3297	3297	0	4.71	62.58	136	1
Timber Creek	Upper	10856	10-year	56.000	3298.230	3299.2910	3299	3299	0	1.75	46.81	117	0
Timber Creek	Upper	10856	25-year	73.000	3298.230	3299.3460	3299	3299	0	2.02	53.32	122	0
Timber Creek	Upper	10856	50-year	87.000	3298.230	3299.3870	3299	3299	0	2.21	58.48	128	0
Timber Creek	Upper	10856	100-year	103.000	3298.230	3299.4330	3299	3299	0	2.38	64.49	134	0
Timber Creek	Upper	10856	500-year	138.000	3298.230	3299.5520	3299	3300	0	2.59	81.62	157	0
Timber Creek	Upper	10856	1% plus	161.000	3298.230	3299.5990	3299	3300	0	2.78	89.19	163	0
Timber Creek	Upper	11053	10-year	56.000	3302.120	3303.3790	3303	3304	0	3.92	18.67	51	1
Timber Creek	Upper	11053	25-year	73.000	3302.120	3303.5210	3303	3304	0	3.74	26.84	64	1
Timber Creek	Upper	11053	50-year	87.000	3302.120	3303.6110	3304	3304	0	3.69	33.11	74	1
Timber Creek	Upper	11053	100-year	103.000	3302.120	3303.6960	3304	3304	0	3.71	39.72	81	1
Timber Creek	Upper	11053	500-year	138.000	3302.120	3303.8190	3304	3304	0	4.06	50.83	97	1
Timber Creek	Upper	11053	1% plus	161.000	3302.120	3303.9080	3304	3304	0	4.10	59.74	104	1
Timber Creek	Upper	11285	10-year	56.000	3309.420	3310.8160	3311	3311	0	2.08	41.08	120	0
Timber Creek	Upper	11285	25-year	73.000	3309.420	3310.8690	3311	3311	0	2.41	47.75	130	0
Timber Creek	Upper	11285	50-year	87.000	3309.420	3310.9050	3311	3311	0	2.65	52.47	133	1
Timber Creek	Upper	11285	100-year	103.000	3309.420	3310.9450	3311	3311	0	2.86	57.87	135	1
Timber Creek	Upper	11285	500-year	138.000	3309.420	3311.0460	3311	3311	0	3.06	71.69	140	1
Timber Creek	Upper	11285	1% plus	161.000	3309.420	3311.0890	3311	3311	0	3.27	77.86	144	1
Timber Creek	Upper	11388	10-year	56.000	3310.870	3312.4470	3312	3312	0	2.19	36.43	76	0
Timber Creek	Upper	11388	25-year	73.000	3310.870	3312.5700	3312	3313	0	2.29	46.16	82	0
Timber Creek	Upper	11388	50-year	87.000	3310.870	3312.6610	3312	3313	0	2.39	53.80	87	0
Timber Creek	Upper	11388	100-year	103.000	3310.870	3312.7420	3312	3313	0	2.49	60.94	89	0
Timber Creek	Upper	11388	500-year	138.000	3310.870	3312.8760	3313	3313	0	2.76	73.44	98	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Timber Creek	Upper	11388	1% plus	161.000	3310.870	3312.9770	3313	3313	0	2.91	83.99	110	0
Timber Creek	Upper	11497	10-year	56.000	3312.680	3314.2640	3314	3314	0	2.62	21.81	28	0
Timber Creek	Upper	11497	25-year	73.000	3312.680	3314.3830	3314	3315	0	3.01	25.31	30	1
Timber Creek	Upper	11497	50-year	87.000	3312.680	3314.4750	3314	3315	0	3.28	28.17	35	1
Timber Creek	Upper	11497	100-year	103.000	3312.680	3314.5680	3314	3315	0	3.55	31.95	46	1
Timber Creek	Upper	11497	500-year	138.000	3312.680	3314.7660	3314	3315	0	3.92	41.73	52	1
Timber Creek	Upper	11497	1% plus	161.000	3312.680	3314.8690	3315	3315	0	4.16	47.34	59	1
Timber Split	Split West	78.67	10-year	20.897	3188.280	3188.6350	3189	3189	0	2.62	10.46	60	1
Timber Split	Split West	78.67	25-year	37.923	3188.280	3188.7270	3189	3189	0	3.17	16.35	66	1
Timber Split	Split West	78.67	50-year	52.958	3188.280	3188.7900	3189	3189	0	3.55	20.54	68	1
Timber Split	Split West	78.67	100-year	68.715	3188.280	3188.8170	3189	3189	0	4.24	22.45	72	1
Timber Split	Split West	78.67	500-year	104.926	3188.280	3188.9730	3189	3189	0	4.35	34.41	78	1
Timber Split	Split West	78.67	1% plus	123.990	3188.280	3189.0130	3189	3189	0	4.71	37.56	79	1
Timber Split	Split West	170	10-year	20.897	3191.100	3191.7440	3191	3192	0	1.15	26.10	101	0
Timber Split	Split West	170	25-year	37.923	3191.100	3191.9010	3192	3192	0	1.37	45.20	136	0
Timber Split	Split West	170	50-year	52.958	3191.100	3192.0030	3192	3192	0	1.50	59.49	146	0
Timber Split	Split West	170	100-year	68.715	3191.100	3192.1020	3192	3192	0	1.57	74.16	149	0
Timber Split	Split West	170	500-year	104.926	3191.100	3192.2510	3192	3192	0	1.82	96.53	150	0
Timber Split	Split West	170	1% plus	123.990	3191.100	3192.3320	3192	3192	0	1.90	108.60	151	0
Timber Split	Split West	264	10-year	20.897	3193.360	3193.8730	3194	3194	0	1.59	15.88	47	0
Timber Split	Split West	264	25-year	37.923	3193.360	3194.0430	3194	3194	0	2.06	25.80	65	1
Timber Split	Split West	264	50-year	52.958	3193.360	3194.1430	3194	3194	0	2.31	32.33	66	1
Timber Split	Split West	264	100-year	68.715	3193.360	3194.2170	3194	3194	0	2.61	37.21	67	1
Timber Split	Split West	264	500-year	104.926	3193.360	3194.4150	3194	3195	0	2.93	50.63	69	1
Timber Split	Split West	264	1% plus	123.990	3193.360	3194.4900	3194	3195	0	3.14	55.83	69	1
Timber Split	Split West	307	10-year	20.897	3194.540	3195.4460	3195	3196	0	1.98	10.82	18	0
Timber Split	Split West	307	25-year	37.923	3194.540	3195.6900	3195	3196	0	2.58	15.57	21	0
Timber Split	Split West	307	50-year	52.958	3194.540	3195.8490	3195	3196	0	3.02	19.20	25	1
Timber Split	Split West	307	100-year	68.715	3194.540	3196.0100	3196	3196	0	3.34	23.34	27	1
Timber Split	Split West	307	500-year	104.926	3194.540	3196.2480	3196	3196	0	4.12	30.17	30	1
Timber Split	Split West	307	1% plus	123.990	3194.540	3196.3690	3196	3197	0	4.41	33.87	31	1
Timber Split	Split West	344	10-year	20.897	3196.970	3197.6210	3198	3198	0	2.95	8.75	28	1
Timber Split	Split West	344	25-year	37.923	3196.970	3197.8080	3198	3198	0	3.35	14.12	29	1
Timber Split	Split West	344	50-year	52.958	3196.970	3197.9590	3198	3198	0	3.57	18.63	30	1
Timber Split	Split West	344	100-year	68.715	3196.970	3198.0840	3198	3198	0	3.86	22.44	31	1
Timber Split	Split West	344	500-year	104.926	3196.970	3198.3810	3198	3199	0	4.21	31.76	32	1
Timber Split	Split West	344	1% plus	123.990	3196.970	3198.5100	3198	3199	0	4.44	35.94	33	1
Timber Split	Split West	387	10-year	20.897	3197.990	3198.8970	3198	3199	0	1.33	18.49	28	0
Timber Split	Split West	387	25-year	37.923	3197.990	3199.1610	3199	3199	0	1.74	26.22	30	0
Timber Split	Split West	387	50-year	52.958	3197.990	3199.3440	3199	3199	0	2.03	31.87	31	0
Timber Split	Split West	387	100-year	68.715	3197.990	3199.5140	3199	3200	0	2.28	37.29	32	0
Timber Split	Split West	387	500-year	104.926	3197.990	3199.8260	3199	3200	0	2.78	47.75	35	0
Timber Split	Split West	387	1% plus	123.990	3197.990	3199.9840	3199	3200	0	3.01	53.47	38	0
Timber Split	Split West	436	10-year	20.897	3198.290	3199.2910	3199	3199	0	0.93	27.41	38	0
Timber Split	Split West	436	25-year	37.923	3198.290	3199.6020	3199	3200	0	1.20	39.56	40	0
Timber Split	Split West	436	50-year	52.958	3198.290	3199.8210	3199	3200	0	1.39	48.56	42	0
Timber Split	Split West	436	100-year	68.715	3198.290	3200.0190	3199	3200	0	1.55	56.97	43	0
Timber Split	Split West	436	500-year	104.926	3198.290	3200.3960	3199	3200	0	1.87	73.81	46	0
Timber Split	Split West	436	1% plus	123.990	3198.290	3200.5780	3199	3201	0	2.00	82.34	48	0
Timber Split	Split West	510	10-year	20.897	3199.670	3200.3110	3200	3200	0	2.53	8.62	20	1
Timber Split	Split West	510	25-year	37.923	3199.670	3200.5720	3200	3201	0	2.90	14.12	22	1
Timber Split	Split West	510	50-year	52.958	3199.670	3200.7660	3201	3201	0	3.15	18.52	23	1
Timber Split	Split West	510	100-year	68.715	3199.670	3200.9480	3201	3201	0	3.37	22.86	24	1
Timber Split	Split West	510	500-year	104.926	3199.670	3201.3110	3201	3202	0	3.78	32.24	27	1
Timber Split	Split West	510	1% plus	123.990	3199.670	3201.4760	3201	3202	0	3.97	36.85	29	1
Timber Split	Split West	593	10-year	20.897	3200.740	3201.9770	3201	3202	0	1.29	16.91	21	0
Timber Split	Split West	593	25-year	37.923	3200.740	3202.3010	3202	3202	0	1.70	24.17	24	0
Timber Split	Split West	593	50-year	52.958	3200.740	3202.5240	3202	3203	0	1.99	29.62	25	0
Timber Split	Split West	593	100-year	68.715	3200.740	3202.7230	3202	3203	0	2.24	34.80	27	0
Timber Split	Split West	593	500-year	104.926	3200.740	3203.1160	3202	3203	0	2.69	46.06	31	0
Timber Split	Split West	593	1% plus	123.990	3200.740	3203.2970	3202	3203	0	2.90	51.96	35	0
Timber Split	Split West	716	10-year	20.897	3203.640	3204.2160	3204	3204	0	2.54	8.22	25	1
Timber Split	Split West	716	25-year	37.923	3203.640	3204.4390	3204	3205	0	2.74	14.31	29	1
Timber Split	Split West	716	50-year	52.958	3203.640	3204.6080	3204	3205	0	2.89	19.24	30	1
Timber Split	Split West	716	100-year	68.715	3203.640	3204.7690	3205	3205	0	3.03	24.11	31	1
Timber Split	Split West	716	500-year	104.926	3203.640	3205.0840	3205	3205	0	3.33	34.51	35	1
Timber Split	Split West	716	1% plus	123.990	3203.640	3205.2380	3205	3205	0	3.44	40.06	52	1
Timber Split	Split West	802	10-year	20.897	3204.270	3205.4100	3205	3205	0	1.27	16.98	54	0
Timber Split	Split West	802	25-year	37.923	3204.270	3205.6810	3205	3206	0	1.72	22.91	71	0
Timber Split	Split West	802	50-year	52.958	3204.270	3205.8660	3205	3206	0	2.05	27.07	74	0
Timber Split	Split West	802	100-year	68.715	3204.270	3206.0320	3205	3206	0	2.34	30.88	76	0
Timber Split	Split West	802	500-year	104.926	3204.270	3206.3510	3206	3206	0	2.91	38.49	82	0
Timber Split	Split West	802	1% plus	123.990	3204.270	3206.4930	3206	3207	0	3.17	42.00	87	0
Timber Split	Split West	834		Culvert									
Timber Split	Split West	862	10-year	20.897	3205.460	3207.0540	3206	3207	0	0.69	29.15	183	0
Timber Split	Split West	862	25-year	37.923	3205.460	3207.3380	3206	3207	0	0.26	163.77	247	0
Timber Split	Split West	862	50-year	52.958	3205.460	3207.3850	3206	3207	0	0.34	175.48	253	0
Timber Split	Split West	862	100-year	68.715	3205.460	3207.5020	3207	3208	0	0.36	205.85	263	0
Timber Split	Split West	862	500-year	104.926	3205.460	3207.5770	3207	3208	0	0.48	225.82	266	0
Timber Split	Split West	862	1% plus	123.990	3205.460	3207.6170	3207	3208	0	0.54	236.36	267	0
Timber Split	Split West	1003	10-year	20.897	3206.520	3207.1510	3207	3207	0	0.74	38.19	124	0
Timber Split	Split West	1003	25-year	37.923	3206.520	3207.3510	3207	3207	0	0.77	64.17	134	0
Timber Split	Split West	1003	50-year	52.958	3206.520	3207.4050	3207	3207	0	0.95	71.49	136	0
Timber Split	Split West	1003	100-year	68.715	3206.520	3207.5210	3207	3208	0	0.99	87.61	140	0
Timber Split	Split West	1003	500-year	104.926	3206.520	3207.6110	3207	3208	0	1.30	100.09	145	0
Timber Split	Split West	1003	1% plus	123.990	3206.520	3207.6560	3207	3208	0	1.43	106.46	148	0
Timber Split	Split West	1201	10-year	20.897	3207.260	3207.6050	3207	3208	0	0.84	24.14	95	0
Timber Split	Split West	1201	25-year	37.923	3207.260	3207.7120	3208	3208	0	1.11	35.15	109	0
Timber Split	Split West	1201	50-year	52.958	3207.260	3207.8290	3208	3208	0	1.16	48.40	122	0
Timber Split	Split West	1201	100-year	68.715	3207.260	3207.9110	3208	3208	0	1.27	59.08	136	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Timber Split	Split West	1201	500-year	104.926	3207.260	3208.0830	3208	3208	0	1.41	83.27	146	0
Timber Split	Split West	1201	1% plus	123.990	3207.260	3208.1650	3208	3208	0	1.48	95.54	152	0
Timber Split	Split West	1383	10-year	20.897	3207.440	3207.9760	3208	3208	0	0.60	44.36	148	0
Timber Split	Split West	1383	25-year	37.923	3207.440	3208.1120	3208	3208	0	0.72	64.89	156	0
Timber Split	Split West	1383	50-year	52.958	3207.440	3208.2030	3208	3208	0	0.81	79.24	158	0
Timber Split	Split West	1383	100-year	68.715	3207.440	3208.2890	3208	3208	0	0.88	92.96	163	0
Timber Split	Split West	1383	500-year	104.926	3207.440	3208.4570	3208	3208	0	1.03	122.93	190	0
Timber Split	Split West	1383	1% plus	123.990	3207.440	3208.5310	3208	3209	0	1.09	136.94	206	0
Timber Split	Split West	1450	10-year	2.332	3207.710	3208.0600	3208	3208	0	0.45	5.15	35	0
Timber Split	Split West	1450	25-year	6.907	3207.710	3208.2000	3208	3208	0	0.63	10.94	48	0
Timber Split	Split West	1450	50-year	12.534	3207.710	3208.2970	3208	3208	0	0.79	16.42	67	0
Timber Split	Split West	1450	100-year	20.756	3207.710	3208.3870	3208	3208	0	0.98	23.47	101	0
Timber Split	Split West	1450	500-year	43.603	3207.710	3208.5630	3208	3209	0	1.18	45.85	136	0
Timber Split	Split West	1450	1% plus	56.981	3207.710	3208.6390	3208	3209	0	1.26	56.44	140	0
Timber Split	Split West	1604	10-year	1.470	3209.810	3209.9270	3210	3210	0	1.58	0.93	13	1
Timber Split	Split West	1604	25-year	2.486	3209.810	3209.9660	3210	3210	0	1.63	1.60	23	1
Timber Split	Split West	1604	50-year	4.467	3209.810	3210.0100	3210	3210	0	1.84	2.80	34	1
Timber Split	Split West	1604	100-year	7.832	3209.810	3210.0530	3210	3210	0	2.18	4.49	46	1
Timber Split	Split West	1604	500-year	17.109	3209.810	3210.1410	3210	3210	0	2.41	9.62	69	1
Timber Split	Split West	1604	1% plus	22.990	3209.810	3210.1670	3210	3210	0	2.75	11.48	76	1
Timber Split	Split West	1762	10-year	1.000	3211.510	3211.6890	3212	3212	0	0.39	2.55	23	0
Timber Split	Split West	1762	25-year	1.000	3211.510	3211.7090	3212	3212	0	0.34	3.06	28	0
Timber Split	Split West	1762	50-year	1.046	3211.510	3211.7440	3212	3212	0	0.27	4.21	39	0
Timber Split	Split West	1762	100-year	1.250	3211.510	3211.7850	3212	3212	0	0.24	6.00	46	0
Timber Split	Split West	1762	500-year	2.176	3211.510	3211.8540	3212	3212	0	0.27	9.74	74	0
Timber Split	Split West	1762	1% plus	2.872	3211.510	3211.8980	3212	3212	0	0.27	13.68	106	0
Timber Split	Split West	1770	10-year	1.000	3211.510	3211.7070	3212	3212	0	0.34	3.01	27	0
Timber Split	Split West	1770	25-year	1.000	3211.510	3211.7210	3212	3212	0	0.31	3.41	31	0
Timber Split	Split West	1770	50-year	1.000	3211.510	3211.7500	3212	3212	0	0.25	4.46	41	0
Timber Split	Split West	1770	100-year	1.000	3211.510	3211.7890	3212	3212	0	0.19	6.16	46	0
Timber Split	Split West	1770	500-year	1.000	3211.510	3211.8570	3212	3212	0	0.13	9.94	76	0
Timber Split	Split West	1770	1% plus	1.000	3211.510	3211.9000	3212	3212	0	0.10	13.95	111	0
West Fork Timber	West Fork	113.90	10-year	23.000	3257.410	3258.8140	3258	3259	0	1.85	13.29	36	0
West Fork Timber	West Fork	113.90	25-year	32.000	3257.410	3258.8920	3259	3259	0	2.22	16.14	37	0
West Fork Timber	West Fork	113.90	50-year	39.000	3257.410	3258.9310	3259	3259	0	2.53	17.60	38	1
West Fork Timber	West Fork	113.90	100-year	48.000	3257.410	3258.9790	3259	3259	0	2.88	19.57	43	1
West Fork Timber	West Fork	113.90	500-year	68.000	3257.410	3259.0740	3259	3259	0	3.50	23.76	48	1
West Fork Timber	West Fork	113.90	1% plus	74.000	3257.410	3259.1130	3259	3259	0	3.59	25.49	50	1
West Fork Timber	West Fork	264	10-year	23.000	3261.120	3262.0710	3262	3262	0	1.35	32.96	139	0
West Fork Timber	West Fork	264	25-year	32.000	3261.120	3262.1670	3262	3262	0	1.38	47.59	166	0
West Fork Timber	West Fork	264	50-year	39.000	3261.120	3262.2320	3262	3262	0	1.40	58.98	180	0
West Fork Timber	West Fork	264	100-year	48.000	3261.120	3262.3060	3262	3262	0	1.42	72.82	199	0
West Fork Timber	West Fork	264	500-year	68.000	3261.120	3262.4330	3262	3262	0	1.47	100.03	225	0
West Fork Timber	West Fork	264	1% plus	74.000	3261.120	3262.4620	3262	3262	0	1.50	106.73	229	0
West Fork Timber	West Fork	377	10-year	23.000	3263.060	3264.5560	3264	3265	0	2.39	14.37	48	0
West Fork Timber	West Fork	377	25-year	32.000	3263.060	3264.6300	3264	3265	0	2.83	18.40	60	1
West Fork Timber	West Fork	377	50-year	39.000	3263.060	3264.6720	3265	3265	0	3.16	21.09	66	1
West Fork Timber	West Fork	377	100-year	48.000	3263.060	3264.7130	3265	3265	0	3.56	23.86	71	1
West Fork Timber	West Fork	377	500-year	68.000	3263.060	3264.8040	3265	3265	0	4.18	30.79	79	1
West Fork Timber	West Fork	377	1% plus	74.000	3263.060	3264.8320	3265	3265	0	4.28	33.04	81	1
West Fork Timber	West Fork	553	10-year	23.000	3267.910	3269.0470	3269	3269	0	1.67	22.75	70	0
West Fork Timber	West Fork	553	25-year	32.000	3267.910	3269.1690	3269	3269	0	1.72	33.00	95	0
West Fork Timber	West Fork	553	50-year	39.000	3267.910	3269.2420	3269	3269	0	1.74	40.19	104	0
West Fork Timber	West Fork	553	100-year	48.000	3267.910	3269.3260	3269	3269	0	1.76	49.58	119	0
West Fork Timber	West Fork	553	500-year	68.000	3267.910	3269.4670	3269	3269	0	1.83	67.61	137	0
West Fork Timber	West Fork	553	1% plus	74.000	3267.910	3269.5050	3269	3270	0	1.87	72.96	148	0
West Fork Timber	West Fork	722	10-year	23.000	3271.100	3272.6400	3272	3273	0	2.10	11.05	24	0
West Fork Timber	West Fork	722	25-year	32.000	3271.100	3272.7710	3272	3273	0	2.53	13.55	35	0
West Fork Timber	West Fork	722	50-year	39.000	3271.100	3272.8460	3272	3273	0	2.84	15.53	41	0
West Fork Timber	West Fork	722	100-year	48.000	3271.100	3272.9250	3273	3273	0	3.21	18.37	57	1
West Fork Timber	West Fork	722	500-year	68.000	3271.100	3273.0660	3273	3273	0	3.76	26.60	92	1
West Fork Timber	West Fork	722	1% plus	74.000	3271.100	3273.1060	3273	3273	0	3.85	29.84	102	1
West Fork Timber	West Fork	863	10-year	23.000	3274.570	3276.1540	3276	3276	0	2.46	9.44	11	0
West Fork Timber	West Fork	863	25-year	32.000	3274.570	3276.4230	3276	3277	0	2.68	13.36	17	0
West Fork Timber	West Fork	863	50-year	39.000	3274.570	3276.5980	3276	3277	0	2.79	17.36	34	0
West Fork Timber	West Fork	863	100-year	48.000	3274.570	3276.7680	3276	3277	0	2.86	27.15	77	0
West Fork Timber	West Fork	863	500-year	68.000	3274.570	3276.9870	3276	3277	0	2.93	48.90	120	0
West Fork Timber	West Fork	863	1% plus	74.000	3274.570	3277.0340	3276	3277	0	2.96	54.64	125	0
West Fork Timber	West Fork	1067	10-year	23.000	3280.200	3281.5850	3281	3282	0	2.02	12.12	22	0
West Fork Timber	West Fork	1067	25-year	32.000	3280.200	3281.7210	3281	3282	0	2.33	15.64	29	0
West Fork Timber	West Fork	1067	50-year	39.000	3280.200	3281.8030	3281	3282	0	2.54	18.34	37	0
West Fork Timber	West Fork	1067	100-year	48.000	3280.200	3281.8890	3282	3282	0	2.79	21.91	51	0
West Fork Timber	West Fork	1067	500-year	68.000	3280.200	3282.0370	3282	3282	0	3.24	31.48	78	1
West Fork Timber	West Fork	1067	1% plus	74.000	3280.200	3282.0750	3282	3282	0	3.34	34.44	86	1
West Fork Timber	West Fork	1257	10-year	23.000	3285.030	3286.3900	3286	3286	0	1.90	13.37	28	0
West Fork Timber	West Fork	1257	25-year	32.000	3285.030	3286.5470	3286	3287	0	2.09	19.19	44	0
West Fork Timber	West Fork	1257	50-year	39.000	3285.030	3286.6520	3286	3287	0	2.19	24.51	56	0
West Fork Timber	West Fork	1257	100-year	48.000	3285.030	3286.7610	3286	3287	0	2.27	30.86	61	0
West Fork Timber	West Fork	1257	500-year	68.000	3285.030	3286.9590	3287	3287	0	2.43	44.37	75	0
West Fork Timber	West Fork	1257	1% plus	74.000	3285.030	3287.0080	3287	3287	0	2.47	47.81	77	0
West Fork Timber	West Fork	1321	10-year	23.000	3287.900	3288.9300	3289	3289	0	2.99	8.41	37	1
West Fork Timber	West Fork	1321	25-year	32.000	3287.900	3289.0330	3289	3289	0	3.44	10.76	42	1
West Fork Timber	West Fork	1321	50-year	39.000	3287.900	3289.1000	3289	3289	0	3.75	12.41	45	1
West Fork Timber	West Fork	1321	100-year	48.000	3287.900	3289.1680	3289	3289	0	4.14	14.24	47	1
West Fork Timber	West Fork	1321	500-year	68.000	3287.900	3289.3010	3289	3290	0	4.87	18.17	54	1
West Fork Timber	West Fork	1321	1% plus	74.000	3287.900	3289.3590	3289	3290	0	4.90	20.11	56	1
West Fork Timber	West Fork	1352		Culvert									
West Fork Timber	West Fork	1378	10-year	23.000	3288.280	3290.5110	3289	3291	0	0.88	34.31	78	0
West Fork Timber	West Fork	1378	25-year	32.000	3288.280	3290.6250	3289	3291	0	1.05	45.81	91	0
West Fork Timber	West Fork	1378	50-year	39.000	3288.280	3290.6810	3289	3291	0	1.13	55.47	95	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
West Fork Timber	West Fork	1378	100-year	48.000	3288.280	3290.7660	3290	3291	0	1.28	61.91	102	0
West Fork Timber	West Fork	1378	500-year	68.000	3288.280	3290.8270	3290	3291	0	1.63	73.17	106	0
West Fork Timber	West Fork	1378	1% plus	74.000	3288.280	3290.8710	3290	3291	0	1.69	77.10	107	0
West Fork Timber	West Fork	1441	10-year	23.000	3289.690	3290.7930	3291	3291	0	2.32	10.24	16	0
West Fork Timber	West Fork	1441	25-year	32.000	3289.690	3290.9690	3291	3291	0	2.58	13.48	21	0
West Fork Timber	West Fork	1441	50-year	39.000	3289.690	3291.0600	3291	3291	0	2.82	15.46	23	0
West Fork Timber	West Fork	1441	100-year	48.000	3289.690	3291.2020	3291	3291	0	2.97	18.90	25	0
West Fork Timber	West Fork	1441	500-year	68.000	3289.690	3291.4360	3291	3292	0	3.35	25.33	30	0
West Fork Timber	West Fork	1441	1% plus	74.000	3289.690	3291.4960	3291	3292	0	3.45	27.14	31	1
West Fork Timber	West Fork	1478	10-year	23.000	3290.950	3292.1250	3292	3292	0	2.29	13.69	31	0
West Fork Timber	West Fork	1478	25-year	32.000	3290.950	3292.2560	3292	3292	0	2.55	18.22	39	0
West Fork Timber	West Fork	1478	50-year	39.000	3290.950	3292.3550	3292	3292	0	2.65	22.33	49	0
West Fork Timber	West Fork	1478	100-year	48.000	3290.950	3292.4500	3292	3293	0	2.79	27.49	58	0
West Fork Timber	West Fork	1478	500-year	68.000	3290.950	3292.6490	3292	3293	0	2.94	41.25	78	0
West Fork Timber	West Fork	1478	1% plus	74.000	3290.950	3292.6960	3292	3293	0	2.98	45.04	82	0
West Fork Timber	West Fork	1599	10-year	23.000	3294.690	3295.7110	3296	3296	0	1.73	24.03	84	0
West Fork Timber	West Fork	1599	25-year	32.000	3294.690	3295.8050	3296	3296	0	1.87	32.76	102	0
West Fork Timber	West Fork	1599	50-year	39.000	3294.690	3295.8540	3296	3296	0	1.98	37.89	106	0
West Fork Timber	West Fork	1599	100-year	48.000	3294.690	3295.9160	3296	3296	0	2.07	44.59	109	0
West Fork Timber	West Fork	1599	500-year	68.000	3294.690	3296.0220	3296	3296	0	2.31	56.50	115	0
West Fork Timber	West Fork	1599	1% plus	74.000	3294.690	3296.0520	3296	3296	0	2.36	59.98	117	0
West Fork Timber	West Fork	1789	10-year	23.000	3299.250	3300.4510	3300	3300	0	1.74	23.09	99	0
West Fork Timber	West Fork	1789	25-year	32.000	3299.250	3300.5230	3300	3301	0	1.89	30.54	107	0
West Fork Timber	West Fork	1789	50-year	39.000	3299.250	3300.5740	3300	3301	0	1.94	36.04	111	0
West Fork Timber	West Fork	1789	100-year	48.000	3299.250	3300.6290	3300	3301	0	2.04	42.22	117	0
West Fork Timber	West Fork	1789	500-year	68.000	3299.250	3300.7400	3301	3301	0	2.16	55.14	127	0
West Fork Timber	West Fork	1789	1% plus	74.000	3299.250	3300.7690	3301	3301	0	2.20	58.55	131	0
West Fork Timber	West Fork	2005	10-year	23.000	3305.820	3306.5510	3306	3307	0	1.46	23.16	85	0
West Fork Timber	West Fork	2005	25-year	32.000	3305.820	3306.6290	3306	3307	0	1.62	30.36	100	0
West Fork Timber	West Fork	2005	50-year	39.000	3305.820	3306.6740	3306	3307	0	1.75	35.13	109	0
West Fork Timber	West Fork	2005	100-year	48.000	3305.820	3306.7350	3306	3307	0	1.88	42.12	124	0
West Fork Timber	West Fork	2005	500-year	68.000	3305.820	3306.8300	3307	3307	0	2.13	54.69	140	0
West Fork Timber	West Fork	2005	1% plus	74.000	3305.820	3306.8540	3307	3307	0	2.19	58.18	143	0
West Fork Timber	West Fork	2234	10-year	23.000	3313.260	3314.0210	3314	3314	0	1.44	20.81	63	0
West Fork Timber	West Fork	2234	25-year	32.000	3313.260	3314.1000	3314	3314	0	1.64	25.85	67	0
West Fork Timber	West Fork	2234	50-year	39.000	3313.260	3314.1600	3314	3314	0	1.75	29.95	70	0
West Fork Timber	West Fork	2234	100-year	48.000	3313.260	3314.2260	3314	3314	0	1.90	34.99	80	0
West Fork Timber	West Fork	2234	500-year	68.000	3313.260	3314.3550	3314	3314	0	2.12	45.59	84	0
West Fork Timber	West Fork	2234	1% plus	74.000	3313.260	3314.3890	3314	3314	0	2.18	48.50	86	0
West Fork Timber	West Fork	2475	10-year	23.000	3320.940	3321.8540	3322	3322	0	1.73	14.65	47	0
West Fork Timber	West Fork	2475	25-year	32.000	3320.940	3321.9550	3322	3322	0	1.93	19.72	52	0
West Fork Timber	West Fork	2475	50-year	39.000	3320.940	3322.0170	3322	3322	0	2.09	23.14	60	0
West Fork Timber	West Fork	2475	100-year	48.000	3320.940	3322.0910	3322	3322	0	2.23	27.78	65	0
West Fork Timber	West Fork	2475	500-year	68.000	3320.940	3322.2190	3322	3322	0	2.54	36.62	74	0
West Fork Timber	West Fork	2475	1% plus	74.000	3320.940	3322.2550	3322	3322	0	2.62	39.37	77	0
West Fork Timber	West Fork	2733	10-year	23.000	3329.540	3329.9590	3330	3330	0	1.13	26.49	98	0
West Fork Timber	West Fork	2733	25-year	32.000	3329.540	3330.0240	3330	3330	0	1.29	33.00	102	0
West Fork Timber	West Fork	2733	50-year	39.000	3329.540	3330.0710	3330	3330	0	1.38	37.79	103	0
West Fork Timber	West Fork	2733	100-year	48.000	3329.540	3330.1230	3330	3330	0	1.50	43.20	105	0
West Fork Timber	West Fork	2733	500-year	68.000	3329.540	3330.2330	3330	3330	0	1.69	54.95	109	0
West Fork Timber	West Fork	2733	1% plus	74.000	3329.540	3330.2630	3330	3330	0	1.74	58.21	110	0
West Fork Timber	West Fork	2971	10-year	23.000	3335.600	3336.1750	3336	3336	0	1.23	23.21	58	0
West Fork Timber	West Fork	2971	25-year	32.000	3335.600	3336.2690	3336	3336	0	1.42	28.91	63	0
West Fork Timber	West Fork	2971	50-year	39.000	3335.600	3336.3290	3336	3336	0	1.55	32.74	65	0
West Fork Timber	West Fork	2971	100-year	48.000	3335.600	3336.4110	3336	3336	0	1.71	38.34	72	0
West Fork Timber	West Fork	2971	500-year	68.000	3335.600	3336.5450	3336	3337	0	1.99	48.55	80	0
West Fork Timber	West Fork	2971	1% plus	74.000	3335.600	3336.5820	3336	3337	0	2.07	51.59	82	0
West Fork Timber	West Fork	3111	10-year	23.000	3338.930	3340.0310	3340	3340	0	2.10	15.22	47	0
West Fork Timber	West Fork	3111	25-year	32.000	3338.930	3340.1340	3340	3340	0	2.30	20.28	52	0
West Fork Timber	West Fork	3111	50-year	39.000	3338.930	3340.2090	3340	3340	0	2.41	24.64	65	0
West Fork Timber	West Fork	3111	100-year	48.000	3338.930	3340.2950	3340	3340	0	2.56	30.40	68	0
West Fork Timber	West Fork	3111	500-year	68.000	3338.930	3340.4500	3340	3341	0	2.76	41.82	78	0
West Fork Timber	West Fork	3111	1% plus	74.000	3338.930	3340.4910	3340	3341	0	2.80	45.08	81	0
West Fork Timber	West Fork	3286	10-year	23.000	3344.530	3345.2340	3345	3345	0	1.40	19.97	56	0
West Fork Timber	West Fork	3286	25-year	32.000	3344.530	3345.3230	3345	3345	0	1.57	25.04	58	0
West Fork Timber	West Fork	3286	50-year	39.000	3344.530	3345.3810	3345	3345	0	1.70	28.40	59	0
West Fork Timber	West Fork	3286	100-year	48.000	3344.530	3345.4520	3345	3345	0	1.84	32.66	61	0
West Fork Timber	West Fork	3286	500-year	68.000	3344.530	3345.5840	3345	3346	0	2.11	41.14	66	0
West Fork Timber	West Fork	3286	1% plus	74.000	3344.530	3345.6190	3345	3346	0	2.19	43.48	67	0

HEC-RAS Plan: Multiple_Profile River: SilverCreek Reach: SilverCreek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SilverCreek	146.64	10-Year	243.00	3349.76	3353.09	3351.96	3353.37	0.022527	4.31	57.75	23.07	0.45
SilverCreek	146.64	25-Year	292.00	3349.76	3353.41	3352.16	3353.73	0.022536	4.63	65.21	23.96	0.46
SilverCreek	146.64	50-Year	333.00	3349.76	3353.65	3352.35	3354.01	0.022541	4.87	71.21	24.65	0.47
SilverCreek	146.64	100-Year	374.00	3349.76	3353.89	3352.51	3354.28	0.022557	5.09	77.03	25.33	0.47
SilverCreek	146.64	500-Year	460.00	3349.76	3354.34	3352.86	3354.80	0.022530	5.50	88.83	26.66	0.48
SilverCreek	146.64	1%+	583.00	3349.76	3354.92	3353.31	3355.46	0.022520	6.02	104.81	28.24	0.49
SilverCreek	352	10-Year	243.00	3354.62	3357.90	3356.86	3358.21	0.024703	4.57	57.58	25.22	0.48
SilverCreek	352	25-Year	292.00	3354.62	3358.21	3357.12	3358.56	0.024670	4.89	65.55	26.31	0.49
SilverCreek	352	50-Year	333.00	3354.62	3358.45	3357.30	3358.84	0.024595	5.14	72.05	27.21	0.49
SilverCreek	352	100-Year	374.00	3354.62	3358.68	3357.47	3359.10	0.024544	5.36	78.37	28.06	0.50
SilverCreek	352	500-Year	460.00	3354.62	3359.12	3357.81	3359.61	0.024444	5.78	91.22	29.85	0.51
SilverCreek	352	1%+	583.00	3354.62	3359.69	3358.25	3360.26	0.024354	6.31	109.24	33.08	0.52
SilverCreek	504	10-Year	243.00	3357.94	3361.46	3360.38	3361.74	0.021798	4.29	61.24	28.34	0.45
SilverCreek	504	25-Year	292.00	3357.94	3361.77	3360.62	3362.08	0.021646	4.58	70.11	29.86	0.46
SilverCreek	504	50-Year	333.00	3357.94	3362.01	3360.79	3362.34	0.021530	4.79	77.29	31.01	0.46
SilverCreek	504	100-Year	374.00	3357.94	3362.23	3360.96	3362.59	0.021388	4.99	84.32	32.04	0.46
SilverCreek	504	500-Year	460.00	3357.94	3362.66	3361.33	3363.07	0.021129	5.35	98.68	34.38	0.47
SilverCreek	504	1%+	583.00	3357.94	3363.23	3361.75	3363.71	0.020997	5.83	125.66	59.95	0.48
SilverCreek	687	10-Year	243.00	3361.41	3365.18	3363.84	3365.43	0.018640	3.98	62.56	24.98	0.41
SilverCreek	687	25-Year	292.00	3361.41	3365.50	3364.09	3365.78	0.018952	4.30	70.61	26.47	0.42
SilverCreek	687	50-Year	333.00	3361.41	3365.74	3364.28	3366.05	0.019167	4.54	77.20	27.81	0.43
SilverCreek	687	100-Year	374.00	3361.41	3365.96	3364.44	3366.31	0.019395	4.76	83.62	29.05	0.44
SilverCreek	687	500-Year	460.00	3361.41	3366.40	3364.77	3366.81	0.019789	5.18	96.85	31.71	0.45
SilverCreek	687	1%+	583.00	3361.41	3366.97	3365.22	3367.45	0.019948	5.67	116.09	35.83	0.46
SilverCreek	872	10-Year	243.00	3365.85	3369.24	3368.21	3369.57	0.026946	4.61	53.62	21.53	0.49
SilverCreek	872	25-Year	292.00	3365.85	3369.57	3368.44	3369.94	0.026637	4.94	60.71	22.33	0.50
SilverCreek	872	50-Year	333.00	3365.85	3369.82	3368.62	3370.23	0.026469	5.19	66.40	22.98	0.50
SilverCreek	872	100-Year	374.00	3365.85	3370.06	3368.81	3370.51	0.026328	5.42	71.94	26.54	0.51
SilverCreek	872	500-Year	460.00	3365.85	3370.52	3369.13	3371.04	0.026165	5.86	83.07	38.56	0.52
SilverCreek	872	1%+	583.00	3365.85	3371.10	3369.61	3371.72	0.026289	6.43	97.92	61.43	0.53
SilverCreek	997	10-Year	243.00	3368.85	3372.51	3371.48	3372.80	0.024621	4.35	57.77	120.06	0.47
SilverCreek	997	25-Year	292.00	3368.85	3372.80	3371.69	3373.11	0.023923	4.59	76.53	182.72	0.47
SilverCreek	997	50-Year	333.00	3368.85	3373.01	3371.87	3373.32	0.022635	4.67	96.28	198.33	0.46
SilverCreek	997	100-Year	374.00	3368.85	3373.19	3372.02	3373.50	0.021399	4.72	115.60	205.25	0.46
SilverCreek	997	500-Year	460.00	3368.85	3373.57	3372.35	3373.85	0.018594	4.73	156.69	221.53	0.43
SilverCreek	997	1%+	583.00	3368.85	3374.04	3373.24	3374.28	0.015125	4.62	212.99	240.26	0.40
SilverCreek	1073		Culvert									
SilverCreek	1111	10-Year	243.00	3373.12	3380.29	3376.08	3380.35	0.002007	2.01	153.01	87.32	0.15
SilverCreek	1111	25-Year	292.00	3373.12	3380.67	3376.36	3380.73	0.002181	2.19	181.30	127.30	0.16
SilverCreek	1111	50-Year	333.00	3373.12	3380.90	3376.58	3380.97	0.002401	2.35	201.40	157.88	0.16
SilverCreek	1111	100-Year	374.00	3373.12	3381.11	3376.79	3381.19	0.002582	2.49	221.33	172.44	0.17
SilverCreek	1111	500-Year	460.00	3373.12	3381.41	3377.15	3381.52	0.003284	2.90	257.91	217.84	0.19
SilverCreek	1111	1%+	583.00	3373.12	3381.58	3377.64	3381.73	0.004522	3.46	281.85	224.14	0.23
SilverCreek	1206	10-Year	243.00	3375.67	3380.52	3377.73	3380.59	0.003145	2.10	131.59	61.11	0.18
SilverCreek	1206	25-Year	292.00	3375.67	3380.91	3377.94	3380.99	0.003242	2.27	157.55	69.15	0.19
SilverCreek	1206	50-Year	333.00	3375.67	3381.16	3378.08	3381.24	0.003369	2.39	174.88	70.46	0.19
SilverCreek	1206	100-Year	374.00	3375.67	3381.38	3378.24	3381.47	0.003489	2.51	190.89	71.31	0.20
SilverCreek	1206	500-Year	460.00	3375.67	3381.75	3378.52	3381.86	0.003913	2.79	217.62	75.06	0.21
SilverCreek	1206	1%+	583.00	3375.67	3382.04	3378.90	3382.19	0.005017	3.27	240.30	80.18	0.24
SilverCreek	1304	10-Year	243.00	3378.47	3381.03	3380.61	3381.53	0.059219	5.71	43.08	23.06	0.70
SilverCreek	1304	25-Year	292.00	3378.47	3381.40	3380.82	3381.91	0.047835	5.74	52.09	24.51	0.65
SilverCreek	1304	50-Year	333.00	3378.47	3381.65	3381.01	3382.18	0.044515	5.91	58.23	25.40	0.64
SilverCreek	1304	100-Year	374.00	3378.47	3381.87	3381.16	3382.44	0.042389	6.08	64.00	26.20	0.63
SilverCreek	1304	500-Year	460.00	3378.47	3382.27	3381.49	3382.91	0.040733	6.50	74.66	27.56	0.63
SilverCreek	1304	1%+	583.00	3378.47	3382.69	3381.94	3383.46	0.042733	7.20	86.45	29.11	0.66
SilverCreek	1325		Bridge									
SilverCreek	1351	10-Year	243.00	3379.93	3383.24	3382.12	3383.46	0.019188	3.75	66.66	30.72	0.42
SilverCreek	1351	25-Year	292.00	3379.93	3383.48	3382.32	3383.74	0.020127	4.08	74.34	32.13	0.43
SilverCreek	1351	50-Year	333.00	3379.93	3383.68	3382.48	3383.96	0.020676	4.33	80.68	33.31	0.44
SilverCreek	1351	100-Year	374.00	3379.93	3383.86	3382.62	3384.18	0.021085	4.55	86.96	34.57	0.45
SilverCreek	1351	500-Year	460.00	3379.93	3384.23	3382.92	3384.60	0.021653	4.96	100.01	37.41	0.47
SilverCreek	1351	1%+	583.00	3379.93	3384.70	3383.31	3385.14	0.022072	5.45	118.83	48.73	0.48
SilverCreek	1545	10-Year	243.00	3384.66	3387.85	3386.95	3388.15	0.030702	4.41	58.98	41.09	0.51
SilverCreek	1545	25-Year	292.00	3384.66	3388.13	3387.18	3388.45	0.029243	4.64	70.69	44.93	0.51
SilverCreek	1545	50-Year	333.00	3384.66	3388.33	3387.37	3388.67	0.028362	4.81	80.13	46.98	0.51
SilverCreek	1545	100-Year	374.00	3384.66	3388.52	3387.56	3388.88	0.027646	4.96	89.17	48.34	0.51
SilverCreek	1545	500-Year	460.00	3384.66	3388.88	3387.98	3389.27	0.026559	5.25	107.05	50.54	0.51
SilverCreek	1545	1%+	583.00	3384.66	3389.33	3388.35	3389.76	0.025559	5.60	130.34	52.31	0.51
SilverCreek	1801	10-Year	243.00	3392.57	3395.76	3395.01	3396.12	0.031387	4.99	58.80	37.47	0.54
SilverCreek	1801	25-Year	292.00	3392.57	3395.98	3395.20	3396.39	0.032812	5.39	67.47	39.38	0.56
SilverCreek	1801	50-Year	333.00	3392.57	3396.15	3395.51	3396.60	0.033757	5.68	74.33	40.35	0.57
SilverCreek	1801	100-Year	374.00	3392.57	3396.31	3395.69	3396.80	0.034583	5.95	80.87	41.25	0.58
SilverCreek	1801	500-Year	460.00	3392.57	3396.62	3396.02	3397.17	0.035976	6.45	93.89	42.98	0.61
SilverCreek	1801	1%+	583.00	3392.57	3397.02	3396.41	3397.66	0.037392	7.06	111.30	45.08	0.63
SilverCreek	2102	10-Year	243.00	3401.96	3404.76	3403.90	3405.05	0.028189	4.38	57.54	27.85	0.50
SilverCreek	2102	25-Year	292.00	3401.96	3405.05	3404.10	3405.38	0.027363	4.67	65.79	28.96	0.50
SilverCreek	2102	50-Year	333.00	3401.96	3405.27	3404.26	3405.63	0.026904	4.88	72.39	29.82	0.51
SilverCreek	2102	100-Year	374.00	3401.96	3405.48	3404.42	3405.87	0.026564	5.08	78.76	30.64	0.51
SilverCreek	2102	500-Year	460.00	3401.96	3405.89	3404.71	3406.34	0.026128	5.47	91.56	32.38	0.52
SilverCreek	2102	1%+	583.00	3401.96	3406.40	3405.13	3406.93	0.025862	5.97	108.89	34.88	0.52

HEC-RAS Plan: Multiple_Profile River: SilverCreek Reach: SilverCreek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SilverCreek	2324	10-Year	243.00	3411.78	3413.90	3413.63	3414.34	0.067985	5.35	47.01	37.85	0.74
SilverCreek	2324	25-Year	292.00	3411.78	3414.08	3413.80	3414.59	0.069412	5.78	52.89	44.58	0.76
SilverCreek	2324	50-Year	333.00	3411.78	3414.22	3413.96	3414.78	0.069847	6.09	57.79	61.03	0.77
SilverCreek	2324	100-Year	374.00	3411.78	3414.35	3414.09	3414.96	0.070003	6.37	62.62	67.34	0.78
SilverCreek	2324	500-Year	460.00	3411.78	3414.61	3414.35	3415.32	0.069511	6.87	72.73	83.84	0.79
SilverCreek	2324	1%+	583.00	3411.78	3414.97	3414.69	3415.79	0.067933	7.46	87.52	117.89	0.80
SilverCreek	2612	10-Year	243.00	3420.53	3423.58	3422.53	3423.78	0.019172	3.73	73.74	46.55	0.42
SilverCreek	2612	25-Year	292.00	3420.53	3423.83	3422.72	3424.06	0.019036	3.97	85.79	47.77	0.42
SilverCreek	2612	50-Year	333.00	3420.53	3424.03	3422.87	3424.27	0.019015	4.15	95.15	48.75	0.43
SilverCreek	2612	100-Year	374.00	3420.53	3424.21	3423.04	3424.47	0.019028	4.32	104.06	49.98	0.43
SilverCreek	2612	500-Year	460.00	3420.53	3424.55	3423.33	3424.85	0.019176	4.66	123.22	62.08	0.44
SilverCreek	2612	1%+	583.00	3420.53	3424.99	3423.78	3425.34	0.019404	5.07	151.90	67.28	0.45
SilverCreek	2657	10-Year	243.00	3421.71	3424.58	3423.84	3424.86	0.029665	4.33	62.00	37.48	0.51
SilverCreek	2657	25-Year	292.00	3421.71	3424.82	3424.04	3425.13	0.029578	4.63	71.26	39.72	0.52
SilverCreek	2657	50-Year	333.00	3421.71	3425.00	3424.19	3425.35	0.029469	4.85	78.79	41.27	0.52
SilverCreek	2657	100-Year	374.00	3421.71	3425.18	3424.35	3425.55	0.029388	5.06	86.07	42.59	0.53
SilverCreek	2657	500-Year	460.00	3421.71	3425.52	3424.64	3425.93	0.029162	5.43	100.95	45.23	0.54
SilverCreek	2657	1%+	583.00	3421.71	3425.95	3425.00	3426.43	0.028971	5.89	121.18	48.59	0.55
SilverCreek	2703	10-Year	243.00	3423.61	3426.05	3425.42	3426.30	0.031676	4.02	64.10	39.84	0.51
SilverCreek	2703	25-Year	292.00	3423.61	3426.28	3425.56	3426.55	0.031032	4.29	73.23	41.70	0.52
SilverCreek	2703	50-Year	333.00	3423.61	3426.45	3425.71	3426.75	0.030593	4.49	80.67	43.30	0.52
SilverCreek	2703	100-Year	374.00	3423.61	3426.62	3425.83	3426.94	0.030257	4.67	87.98	45.33	0.52
SilverCreek	2703	500-Year	460.00	3423.61	3426.94	3426.08	3427.31	0.029550	5.01	103.54	50.53	0.53
SilverCreek	2703	1%+	583.00	3423.61	3427.36	3426.39	3427.78	0.028472	5.40	125.36	54.27	0.53
SilverCreek	2805	10-Year	243.00	3427.43	3429.46	3428.52	3429.61	0.032836	3.82	91.89	69.41	0.52
SilverCreek	2805	25-Year	292.00	3427.43	3429.67	3428.66	3429.83	0.032956	4.13	106.79	77.61	0.53
SilverCreek	2805	50-Year	333.00	3427.43	3429.81	3428.76	3429.98	0.032540	4.31	118.13	80.69	0.53
SilverCreek	2805	100-Year	374.00	3427.43	3429.95	3428.89	3430.13	0.031749	4.44	129.58	83.36	0.53
SilverCreek	2805	500-Year	460.00	3427.43	3430.22	3429.08	3430.42	0.030886	4.73	153.06	91.03	0.53
SilverCreek	2805	1%+	583.00	3427.43	3430.56	3429.22	3430.79	0.030017	5.09	185.54	100.20	0.54
SilverCreek	2985	10-Year	243.00	3433.56	3435.70	3435.17	3435.87	0.037050	3.99	84.95	67.98	0.55
SilverCreek	2985	25-Year	292.00	3433.56	3435.90	3435.30	3436.09	0.036939	4.30	99.43	77.18	0.55
SilverCreek	2985	50-Year	333.00	3433.56	3436.02	3435.40	3436.23	0.037203	4.50	109.13	79.76	0.56
SilverCreek	2985	100-Year	374.00	3433.56	3436.14	3435.49	3436.36	0.037913	4.72	118.46	83.87	0.57
SilverCreek	2985	500-Year	460.00	3433.56	3436.36	3435.67	3436.62	0.038680	5.10	138.07	86.93	0.59
SilverCreek	2985	1%+	583.00	3433.56	3436.63	3435.99	3436.92	0.039031	5.50	161.17	87.63	0.60
SilverCreek	3270	10-Year	243.00	3443.21	3445.73	3445.07	3446.04	0.034183	4.50	58.12	47.06	0.54
SilverCreek	3270	25-Year	292.00	3443.21	3445.96	3445.27	3446.31	0.034597	4.84	66.10	58.90	0.56
SilverCreek	3270	50-Year	333.00	3443.21	3446.13	3445.43	3446.52	0.034785	5.09	72.65	64.25	0.56
SilverCreek	3270	100-Year	374.00	3443.21	3446.31	3445.57	3446.72	0.034591	5.30	79.35	68.03	0.57
SilverCreek	3270	500-Year	460.00	3443.21	3446.65	3445.84	3447.14	0.034946	5.77	94.06	90.27	0.58
SilverCreek	3270	1%+	583.00	3443.21	3446.69	3446.22	3447.45	0.053069	7.18	96.44	93.68	0.72
SilverCreek	3437	10-Year	243.00	3446.81	3449.67	3448.66	3449.83	0.015781	3.37	91.25	59.30	0.38
SilverCreek	3437	25-Year	292.00	3446.81	3449.91	3448.86	3450.08	0.015541	3.57	106.09	61.90	0.38
SilverCreek	3437	50-Year	333.00	3446.81	3450.11	3449.02	3450.29	0.015424	3.72	118.37	65.66	0.39
SilverCreek	3437	100-Year	374.00	3446.81	3450.28	3449.20	3450.47	0.015308	3.85	129.83	67.05	0.39
SilverCreek	3437	500-Year	460.00	3446.81	3450.63	3449.44	3450.84	0.014786	4.07	153.49	68.85	0.39
SilverCreek	3437	1%+	583.00	3446.81	3451.18	3449.71	3451.39	0.012774	4.18	192.27	71.22	0.37

HEC-RAS Plan: MultipleProfiles

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
EFork Packer Cr	East Fork	54.68	10-Year	214.000	3471.320	3473.7520	3473	3474	0	3.03	71.12	42	0
EFork Packer Cr	East Fork	54.68	25-Year	261.000	3471.320	3474.0060	3473	3474	0	3.23	81.95	52	0
EFork Packer Cr	East Fork	54.68	50-Year	300.000	3471.320	3474.1940	3473	3474	0	3.39	90.49	59	0
EFork Packer Cr	East Fork	54.68	100-Year	341.000	3471.320	3474.3710	3473	3475	0	3.55	99.64	67	0
EFork Packer Cr	East Fork	54.68	500-Year	427.000	3471.320	3474.7050	3474	3475	0	3.81	120.74	98	0
EFork Packer Cr	East Fork	54.68	1%+	532.000	3471.320	3475.0990	3474	3475	0	3.89	157.69	125	0
EFork Packer Cr	East Fork	96		Culvert									
EFork Packer Cr	East Fork	131	10-Year	214.000	3472.400	3479.3810	3475	3479	0	1.73	162.50	201	0
EFork Packer Cr	East Fork	131	25-Year	261.000	3472.400	3479.6880	3475	3480	0	1.97	191.21	233	0
EFork Packer Cr	East Fork	131	50-Year	300.000	3472.400	3479.8550	3476	3480	0	2.13	208.74	242	0
EFork Packer Cr	East Fork	131	100-Year	341.000	3472.400	3480.0020	3476	3480	0	2.30	224.35	257	0
EFork Packer Cr	East Fork	131	500-Year	427.000	3472.400	3480.2630	3476	3480	0	2.62	252.55	287	0
EFork Packer Cr	East Fork	131	1%+	532.000	3472.400	3480.5060	3477	3481	0	2.99	279.08	300	0
EFork Packer Cr	East Fork	319	10-Year	214.000	3476.190	3479.6790	3479	3480	0	3.18	85.17	139	0
EFork Packer Cr	East Fork	319	25-Year	261.000	3476.190	3480.0310	3479	3480	0	3.03	116.40	170	0
EFork Packer Cr	East Fork	319	50-Year	300.000	3476.190	3480.2290	3479	3480	0	3.07	136.26	193	0
EFork Packer Cr	East Fork	319	100-Year	341.000	3476.190	3480.4060	3479	3481	0	3.09	155.85	205	0
EFork Packer Cr	East Fork	319	500-Year	427.000	3476.190	3480.7220	3480	3481	0	3.10	195.19	230	0
EFork Packer Cr	East Fork	319	1%+	532.000	3476.190	3481.0280	3480	3481	0	3.12	235.55	238	0
EFork Packer Cr	East Fork	469	10-Year	214.000	3477.710	3480.8970	3480	3481	0	3.26	75.76	43	0
EFork Packer Cr	East Fork	469	25-Year	261.000	3477.710	3481.1030	3480	3481	0	3.60	85.17	50	0
EFork Packer Cr	East Fork	469	50-Year	300.000	3477.710	3481.2710	3480	3481	0	3.83	94.00	55	0
EFork Packer Cr	East Fork	469	100-Year	341.000	3477.710	3481.4200	3480	3482	0	4.07	102.38	58	0
EFork Packer Cr	East Fork	469	500-Year	427.000	3477.710	3481.6730	3480	3482	0	4.57	117.59	65	0
EFork Packer Cr	East Fork	469	1%+	532.000	3477.710	3481.9250	3481	3482	0	5.11	133.33	83	0
EFork Packer Cr	East Fork	644	10-Year	214.000	3480.760	3483.2270	3483	3484	0	6.02	39.98	33	1
EFork Packer Cr	East Fork	644	25-Year	261.000	3480.760	3483.5160	3483	3484	0	6.12	50.16	38	1
EFork Packer Cr	East Fork	644	50-Year	300.000	3480.760	3483.7120	3483	3484	0	6.25	57.97	42	1
EFork Packer Cr	East Fork	644	100-Year	341.000	3480.760	3483.9060	3484	3484	0	6.36	66.32	45	1
EFork Packer Cr	East Fork	644	500-Year	427.000	3480.760	3484.2920	3484	3485	0	6.57	85.84	71	1
EFork Packer Cr	East Fork	644	1%+	532.000	3480.760	3484.6860	3484	3485	0	6.77	110.88	94	1
EFork Packer Cr	East Fork	891	10-Year	214.000	3484.760	3487.7240	3487	3488	0	3.22	73.31	55	0
EFork Packer Cr	East Fork	891	25-Year	261.000	3484.760	3487.9130	3487	3488	0	3.47	83.99	58	0
EFork Packer Cr	East Fork	891	50-Year	300.000	3484.760	3488.0600	3487	3488	0	3.63	92.69	60	0
EFork Packer Cr	East Fork	891	100-Year	341.000	3484.760	3488.1980	3487	3488	0	3.79	101.17	62	0
EFork Packer Cr	East Fork	891	500-Year	427.000	3484.760	3488.4580	3488	3489	0	4.08	117.68	65	0
EFork Packer Cr	East Fork	891	1%+	532.000	3484.760	3488.7320	3488	3489	0	4.39	135.61	67	0
EFork Packer Cr	East Fork	1267	10-Year	214.000	3491.340	3493.3950	3493	3494	0	4.79	52.85	79	1
EFork Packer Cr	East Fork	1267	25-Year	261.000	3491.340	3493.5350	3493	3494	0	4.78	63.43	85	1
EFork Packer Cr	East Fork	1267	50-Year	300.000	3491.340	3493.6330	3494	3494	0	4.83	71.02	89	1
EFork Packer Cr	East Fork	1267	100-Year	341.000	3491.340	3493.7310	3494	3494	0	4.86	78.78	92	1
EFork Packer Cr	East Fork	1267	500-Year	427.000	3491.340	3493.9200	3494	3494	0	4.98	94.03	100	1
EFork Packer Cr	East Fork	1267	1%+	532.000	3491.340	3494.1900	3494	3495	0	5.24	120.70	139	1
EFork Packer Cr	East Fork	1510	10-Year	214.000	3494.980	3498.3510	3498	3499	0	3.46	78.88	149	0
EFork Packer Cr	East Fork	1510	25-Year	261.000	3494.980	3498.4880	3498	3499	0	3.78	93.47	172	0
EFork Packer Cr	East Fork	1510	50-Year	300.000	3494.980	3498.5850	3498	3499	0	3.99	105.13	188	0
EFork Packer Cr	East Fork	1510	100-Year	341.000	3494.980	3498.6760	3498	3499	0	4.18	116.35	196	0
EFork Packer Cr	East Fork	1510	500-Year	427.000	3494.980	3498.8500	3498	3499	0	4.52	139.32	211	1
EFork Packer Cr	East Fork	1510	1%+	532.000	3494.980	3499.0420	3499	3499	0	4.83	167.16	228	1
EFork Packer Cr	East Fork	1789	10-Year	214.000	3499.370	3501.7720	3501	3502	0	3.12	69.07	47	0
EFork Packer Cr	East Fork	1789	25-Year	261.000	3499.370	3501.9930	3501	3502	0	3.31	79.96	51	0
EFork Packer Cr	East Fork	1789	50-Year	300.000	3499.370	3502.1550	3501	3502	0	3.48	88.40	56	0
EFork Packer Cr	East Fork	1789	100-Year	341.000	3499.370	3502.3410	3501	3503	0	3.68	99.77	65	0
EFork Packer Cr	East Fork	1789	500-Year	427.000	3499.370	3502.6140	3502	3503	0	3.96	122.62	108	0
EFork Packer Cr	East Fork	1789	1%+	532.000	3499.370	3502.8870	3502	3503	0	4.26	155.13	133	0
EFork Packer Cr	East Fork	2197	10-Year	214.000	3505.760	3508.1420	3508	3508	0	4.35	50.06	32	1
EFork Packer Cr	East Fork	2197	25-Year	261.000	3505.760	3508.3320	3508	3509	0	4.76	56.41	35	1
EFork Packer Cr	East Fork	2197	50-Year	300.000	3505.760	3508.4850	3508	3509	0	5.05	61.88	36	1
EFork Packer Cr	East Fork	2197	100-Year	341.000	3505.760	3508.6510	3508	3509	0	5.28	68.55	47	1
EFork Packer Cr	East Fork	2197	500-Year	427.000	3505.760	3508.9320	3508	3509	0	5.74	85.20	70	1
EFork Packer Cr	East Fork	2197	1%+	532.000	3505.760	3509.2110	3509	3510	0	6.15	107.06	86	1
EFork Packer Cr	East Fork	2567	10-Year	214.000	3511.170	3514.1720	3513	3514	0	3.49	84.50	78	0
EFork Packer Cr	East Fork	2567	25-Year	261.000	3511.170	3514.3820	3514	3515	0	3.64	102.27	93	0
EFork Packer Cr	East Fork	2567	50-Year	300.000	3511.170	3514.5290	3514	3515	0	3.74	117.15	108	0
EFork Packer Cr	East Fork	2567	100-Year	341.000	3511.170	3514.6640	3514	3515	0	3.85	132.87	128	0
EFork Packer Cr	East Fork	2567	500-Year	427.000	3511.170	3514.9100	3514	3515	0	4.00	168.50	161	0
EFork Packer Cr	East Fork	2567	1%+	532.000	3511.170	3515.2040	3514	3515	0	4.26	219.16	180	0
EFork Packer Cr	East Fork	3006	10-Year	214.000	3516.880	3519.4300	3519	3520	0	3.48	90.32	97	0
EFork Packer Cr	East Fork	3006	25-Year	261.000	3516.880	3519.5830	3519	3520	0	3.70	105.64	103	0
EFork Packer Cr	East Fork	3006	50-Year	300.000	3516.880	3519.6950	3519	3520	0	3.85	117.30	113	0
EFork Packer Cr	East Fork	3006	100-Year	341.000	3516.880	3519.8160	3519	3520	0	4.00	130.74	124	0
EFork Packer Cr	East Fork	3006	500-Year	427.000	3516.880	3520.0140	3519	3520	0	4.28	153.86	133	0
EFork Packer Cr	East Fork	3006	1%+	532.000	3516.880	3520.2530	3520	3520	0	4.50	183.42	162	0
EFork Packer Cr	East Fork	3372	10-Year	214.000	3522.730	3525.1870	3525	3525	0	4.23	64.88	63	1
EFork Packer Cr	East Fork	3372	25-Year	261.000	3522.730	3525.3990	3525	3526	0	4.53	79.80	77	1
EFork Packer Cr	East Fork	3372	50-Year	300.000	3522.730	3525.5270	3525	3526	0	4.70	89.90	82	1
EFork Packer Cr	East Fork	3372	100-Year	341.000	3522.730	3525.6510	3525	3526	0	4.86	100.30	86	1
EFork Packer Cr	East Fork	3372	500-Year	427.000	3522.730	3525.8820	3525	3526	0	5.12	121.08	95	1
EFork Packer Cr	East Fork	3372	1%+	532.000	3522.730	3526.1080	3526	3526	0	5.47	143.61	116	1
EFork Packer Cr	East Fork	3712	10-Year	214.000	3527.160	3530.2930	3529	3531	0	3.68	60.45	34	0
EFork Packer Cr	East Fork	3712	25-Year	261.000	3527.160	3530.5530	3529	3531	0	3.99	69.95	39	0
EFork Packer Cr	East Fork	3712	50-Year	300.000	3527.160	3530.7390	3530	3531	0	4.24	77.46	46	0
EFork Packer Cr	East Fork	3712	100-Year	341.000	3527.160	3530.9160	3530	3531	0	4.48	85.22	52	0
EFork Packer Cr	East Fork	3712	500-Year	427.000	3527.160	3531.2390	3530	3532	0	4.93	101.14	66	0
EFork Packer Cr	East Fork	3712	1%+	532.000	3527.160	3531.5960	3530	3532	0	5.36	124.25	107	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
EFork Packer Cr	East Fork	4062	10-Year	214.000	3533.450	3535.7010	3535	3536	0	4.62	47.13	28	1
EFork Packer Cr	East Fork	4062	25-Year	261.000	3533.450	3535.9580	3535	3536	0	4.94	54.64	33	1
EFork Packer Cr	East Fork	4062	50-Year	300.000	3533.450	3536.1580	3535	3537	0	5.15	62.19	46	1
EFork Packer Cr	East Fork	4062	100-Year	341.000	3533.450	3536.3460	3536	3537	0	5.31	72.66	62	1
EFork Packer Cr	East Fork	4062	500-Year	427.000	3533.450	3536.6860	3536	3537	0	5.55	97.31	82	1
EFork Packer Cr	East Fork	4062	1%+	532.000	3533.450	3537.0090	3537	3537	0	5.77	125.05	94	1
EFork Packer Cr	East Fork	4484	10-Year	214.000	3540.240	3542.6610	3542	3543	0	3.42	63.73	34	0
EFork Packer Cr	East Fork	4484	25-Year	261.000	3540.240	3542.9030	3542	3543	0	3.72	72.13	35	0
EFork Packer Cr	East Fork	4484	50-Year	300.000	3540.240	3543.0840	3542	3543	0	3.95	78.59	36	0
EFork Packer Cr	East Fork	4484	100-Year	341.000	3540.240	3543.2540	3542	3544	0	4.18	84.80	37	0
EFork Packer Cr	East Fork	4484	500-Year	427.000	3540.240	3543.5630	3542	3544	0	4.65	96.48	38	0
EFork Packer Cr	East Fork	4484	1%+	532.000	3540.240	3543.8860	3543	3544	0	5.19	109.16	41	1
EFork Packer Cr	East Fork	4815	10-Year	214.000	3546.160	3548.9290	3549	3549	0	5.12	56.72	68	1
EFork Packer Cr	East Fork	4815	25-Year	261.000	3546.160	3549.1000	3549	3549	0	5.30	68.91	75	1
EFork Packer Cr	East Fork	4815	50-Year	300.000	3546.160	3549.2370	3549	3550	0	5.40	79.56	80	1
EFork Packer Cr	East Fork	4815	100-Year	341.000	3546.160	3549.3650	3549	3550	0	5.45	89.86	82	1
EFork Packer Cr	East Fork	4815	500-Year	427.000	3546.160	3549.6250	3549	3550	0	5.50	113.25	95	1
EFork Packer Cr	East Fork	4815	1%+	532.000	3546.160	3549.9100	3550	3550	0	5.50	140.93	99	1
EFork Packer Cr	East Fork	5017	10-Year	214.000	3548.930	3552.8100	3552	3553	0	3.75	88.51	81	0
EFork Packer Cr	East Fork	5017	25-Year	261.000	3548.930	3552.9810	3552	3553	0	3.98	102.98	90	0
EFork Packer Cr	East Fork	5017	50-Year	300.000	3548.930	3553.1110	3552	3553	0	4.19	115.16	98	0
EFork Packer Cr	East Fork	5017	100-Year	341.000	3548.930	3553.2240	3553	3553	0	4.38	126.70	107	0
EFork Packer Cr	East Fork	5017	500-Year	427.000	3548.930	3553.4210	3553	3554	0	4.76	149.05	119	0
EFork Packer Cr	East Fork	5017	1%+	532.000	3548.930	3553.6080	3553	3554	0	5.17	171.83	126	0
EFork Packer Cr	East Fork	5189	10-Year	214.000	3551.950	3555.2620	3555	3556	0	5.26	48.73	39	1
EFork Packer Cr	East Fork	5189	25-Year	261.000	3551.950	3555.4840	3555	3556	0	5.62	57.77	42	1
EFork Packer Cr	East Fork	5189	50-Year	300.000	3551.950	3555.6640	3555	3556	0	5.84	65.57	45	1
EFork Packer Cr	East Fork	5189	100-Year	341.000	3551.950	3555.8270	3555	3556	0	6.09	73.24	49	1
EFork Packer Cr	East Fork	5189	500-Year	427.000	3551.950	3556.1440	3556	3557	0	6.45	91.29	63	1
EFork Packer Cr	East Fork	5189	1%+	532.000	3551.950	3556.4660	3556	3557	0	6.85	115.81	84	1
EFork Packer Cr	East Fork	5556	10-Year	214.000	3557.860	3561.2490	3560	3561	0	3.44	75.51	66	0
EFork Packer Cr	East Fork	5556	25-Year	261.000	3557.860	3561.4730	3561	3562	0	3.64	92.07	80	0
EFork Packer Cr	East Fork	5556	50-Year	300.000	3557.860	3561.6300	3561	3562	0	3.80	104.97	84	0
EFork Packer Cr	East Fork	5556	100-Year	341.000	3557.860	3561.7780	3561	3562	0	3.91	117.51	86	0
EFork Packer Cr	East Fork	5556	500-Year	427.000	3557.860	3562.0470	3561	3562	0	4.15	141.13	90	0
EFork Packer Cr	East Fork	5556	1%+	532.000	3557.860	3562.3670	3562	3563	0	4.45	171.89	106	0
EFork Packer Cr	East Fork	5859	10-Year	214.000	3563.640	3566.7200	3566	3567	0	4.58	60.50	65	1
EFork Packer Cr	East Fork	5859	25-Year	261.000	3563.640	3566.9080	3566	3567	0	4.89	73.80	83	1
EFork Packer Cr	East Fork	5859	50-Year	300.000	3563.640	3567.0440	3567	3567	0	5.06	86.14	98	1
EFork Packer Cr	East Fork	5859	100-Year	341.000	3563.640	3567.1680	3567	3568	0	5.29	99.08	108	1
EFork Packer Cr	East Fork	5859	500-Year	427.000	3563.640	3567.3870	3567	3568	0	5.54	123.90	119	1
EFork Packer Cr	East Fork	5859	1%+	532.000	3563.640	3567.6310	3567	3568	0	5.71	154.24	128	1
EFork Packer Cr	East Fork	6340	10-Year	214.000	3574.430	3577.9030	3577	3578	0	3.54	86.71	86	0
EFork Packer Cr	East Fork	6340	25-Year	261.000	3574.430	3578.1220	3577	3578	0	3.71	106.01	89	0
EFork Packer Cr	East Fork	6340	50-Year	300.000	3574.430	3578.2780	3577	3578	0	3.86	120.05	91	0
EFork Packer Cr	East Fork	6340	100-Year	341.000	3574.430	3578.4390	3578	3579	0	3.97	134.94	93	0
EFork Packer Cr	East Fork	6340	500-Year	427.000	3574.430	3578.7170	3578	3579	0	4.24	161.43	97	0
EFork Packer Cr	East Fork	6340	1%+	532.000	3574.430	3578.9960	3578	3579	0	4.57	189.46	105	0
Packer Creek	Lower	217.93	10-Year	368.000	3363.960	3366.2110	3366	3366	0	3.83	114.04	104	1
Packer Creek	Lower	217.93	25-Year	441.000	3363.960	3366.3750	3366	3367	0	4.06	131.71	124	1
Packer Creek	Lower	217.93	50-Year	503.000	3363.960	3366.5020	3366	3367	0	4.23	146.42	135	1
Packer Creek	Lower	217.93	100-Year	565.000	3363.960	3366.6160	3366	3367	0	4.38	159.94	149	1
Packer Creek	Lower	217.93	500-Year	696.000	3363.960	3366.8340	3366	3367	0	4.66	187.70	186	1
Packer Creek	Lower	217.93	1%+	881.000	3363.960	3367.0520	3367	3367	0	4.94	235.13	203	1
Packer Creek	Lower	420	10-Year	368.000	3366.010	3369.2340	3368	3369	0	4.04	94.08	54	0
Packer Creek	Lower	420	25-Year	441.000	3366.010	3369.4530	3368	3370	0	4.38	108.83	84	0
Packer Creek	Lower	420	50-Year	503.000	3366.010	3369.6110	3369	3370	0	4.61	122.23	86	0
Packer Creek	Lower	420	100-Year	565.000	3366.010	3369.7520	3369	3370	0	4.82	134.42	87	1
Packer Creek	Lower	420	500-Year	696.000	3366.010	3370.0180	3369	3370	0	5.21	157.84	90	1
Packer Creek	Lower	420	1%+	881.000	3366.010	3370.3200	3370	3371	0	5.74	185.36	92	1
Packer Creek	Lower	741	10-Year	368.000	3371.340	3374.1950	3373	3375	0	4.50	82.74	41	1
Packer Creek	Lower	741	25-Year	441.000	3371.340	3374.4620	3374	3375	0	4.79	93.79	42	1
Packer Creek	Lower	741	50-Year	503.000	3371.340	3374.6640	3374	3375	0	5.04	102.32	43	1
Packer Creek	Lower	741	100-Year	565.000	3371.340	3374.8530	3374	3375	0	5.27	110.50	44	1
Packer Creek	Lower	741	500-Year	696.000	3371.340	3375.2140	3374	3376	0	5.71	128.88	57	1
Packer Creek	Lower	741	1%+	881.000	3371.340	3375.6710	3375	3376	0	6.20	157.96	74	1
Packer Creek	Lower	1080	10-Year	368.000	3378.260	3381.0070	3380	3381	0	5.20	77.12	47	1
Packer Creek	Lower	1080	25-Year	441.000	3378.260	3381.2310	3381	3382	0	5.58	88.06	50	1
Packer Creek	Lower	1080	50-Year	503.000	3378.260	3381.4160	3381	3382	0	5.85	97.63	57	1
Packer Creek	Lower	1080	100-Year	565.000	3378.260	3381.5920	3381	3382	0	6.08	107.20	65	1
Packer Creek	Lower	1080	500-Year	696.000	3378.260	3381.9290	3381	3383	0	6.50	127.29	80	1
Packer Creek	Lower	1080	1%+	881.000	3378.260	3382.3330	3382	3383	0	7.00	152.75	93	1
Packer Creek	Lower	1417	10-Year	368.000	3384.530	3387.5790	3387	3388	0	4.53	96.93	73	1
Packer Creek	Lower	1417	25-Year	441.000	3384.530	3387.8110	3387	3388	0	4.75	114.59	80	1
Packer Creek	Lower	1417	50-Year	503.000	3384.530	3387.9960	3387	3388	0	4.94	130.32	89	1
Packer Creek	Lower	1417	100-Year	565.000	3384.530	3388.1480	3388	3388	0	5.10	143.95	91	1
Packer Creek	Lower	1417	500-Year	696.000	3384.530	3388.4430	3388	3389	0	5.38	171.11	93	1
Packer Creek	Lower	1417	1%+	881.000	3384.530	3388.8470	3388	3389	0	5.79	213.23	118	1
Packer Creek	Lower	1574	10-Year	368.000	3385.660	3389.4080	3388	3390	0	3.79	106.08	43	0
Packer Creek	Lower	1574	25-Year	441.000	3385.660	3389.6690	3388	3390	0	4.15	116.59	45	0
Packer Creek	Lower	1574	50-Year	503.000	3385.660	3389.8750	3388	3390	0	4.43	124.92	47	0
Packer Creek	Lower	1574	100-Year	565.000	3385.660	3390.0560	3389	3390	0	4.70	132.24	48	0
Packer Creek	Lower	1574	500-Year	696.000	3385.660	3390.4020	3389	3391	0	5.25	146.31	50	0
Packer Creek	Lower	1574	1%+	881.000	3385.660	3390.8710	3389	3391	0	5.88	165.50	51	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Packer Creek	Lower	1596		Bridge									
Packer Creek	Lower	1611	10-Year	368.000	3385.910	3389.7130	3388	3390	0	3.61	111.37	42	0
Packer Creek	Lower	1611	25-Year	441.000	3385.910	3390.0130	3388	3390	0	3.92	123.86	48	0
Packer Creek	Lower	1611	50-Year	503.000	3385.910	3390.2510	3389	3391	0	4.15	133.94	54	0
Packer Creek	Lower	1611	100-Year	565.000	3385.910	3390.4680	3389	3391	0	4.38	143.19	56	0
Packer Creek	Lower	1611	500-Year	696.000	3385.910	3390.8940	3389	3391	0	4.80	161.71	58	0
Packer Creek	Lower	1611	1%+	881.000	3385.910	3391.4650	3389	3392	0	5.29	187.22	60	0
Packer Creek	Lower	1671	10-Year	368.000	3388.100	3390.3840	3390	3391	0	6.32	59.24	42	1
Packer Creek	Lower	1671	25-Year	441.000	3388.100	3390.6790	3390	3391	0	6.37	72.24	46	1
Packer Creek	Lower	1671	50-Year	503.000	3388.100	3390.9130	3391	3392	0	6.42	83.39	50	1
Packer Creek	Lower	1671	100-Year	565.000	3388.100	3391.1320	3391	3392	0	6.48	94.64	53	1
Packer Creek	Lower	1671	500-Year	696.000	3388.100	3391.5600	3391	3392	0	6.58	118.73	59	1
Packer Creek	Lower	1671	1%+	881.000	3388.100	3392.1230	3391	3393	0	6.67	154.21	67	1
Packer Creek	Lower	1769	10-Year	368.000	3390.090	3393.4350	3393	3394	0	4.62	86.83	55	1
Packer Creek	Lower	1769	25-Year	441.000	3390.090	3393.6120	3393	3394	0	5.08	97.00	60	1
Packer Creek	Lower	1769	50-Year	503.000	3390.090	3393.7500	3393	3394	0	5.42	105.48	63	1
Packer Creek	Lower	1769	100-Year	565.000	3390.090	3393.8800	3393	3394	0	5.73	113.78	65	1
Packer Creek	Lower	1769	500-Year	696.000	3390.090	3394.1210	3394	3395	0	6.38	131.22	89	1
Packer Creek	Lower	1769	1%+	881.000	3390.090	3394.4250	3394	3395	0	7.06	161.16	103	1
Packer Creek	Lower	2107	10-Year	368.000	3397.090	3399.5350	3399	3400	0	4.23	114.26	90	1
Packer Creek	Lower	2107	25-Year	441.000	3397.090	3399.7580	3399	3400	0	4.32	134.62	93	1
Packer Creek	Lower	2107	50-Year	503.000	3397.090	3399.9290	3399	3400	0	4.40	150.75	95	0
Packer Creek	Lower	2107	100-Year	565.000	3397.090	3400.0910	3399	3400	0	4.50	166.30	98	0
Packer Creek	Lower	2107	500-Year	696.000	3397.090	3400.4150	3400	3401	0	4.65	199.02	103	0
Packer Creek	Lower	2107	1%+	881.000	3397.090	3400.8360	3400	3401	0	4.96	244.38	115	0
Packer Creek	Lower	2331	10-Year	368.000	3398.780	3402.6410	3402	3403	0	4.33	120.03	112	0
Packer Creek	Lower	2331	25-Year	441.000	3398.780	3402.8060	3402	3403	0	4.62	138.83	116	0
Packer Creek	Lower	2331	50-Year	503.000	3398.780	3402.9450	3402	3403	0	4.82	155.29	121	0
Packer Creek	Lower	2331	100-Year	565.000	3398.780	3403.0670	3402	3403	0	4.98	170.07	122	0
Packer Creek	Lower	2331	500-Year	696.000	3398.780	3403.3000	3403	3404	0	5.28	198.53	123	0
Packer Creek	Lower	2331	1%+	881.000	3398.780	3403.6240	3403	3404	0	5.53	238.61	124	0
Packer Creek	Lower	2648	10-Year	368.000	3403.470	3407.1290	3406	3408	0	5.40	69.32	28	1
Packer Creek	Lower	2648	25-Year	441.000	3403.470	3407.4370	3407	3408	0	5.80	78.01	29	1
Packer Creek	Lower	2648	50-Year	503.000	3403.470	3407.6650	3407	3408	0	6.13	84.60	29	1
Packer Creek	Lower	2648	100-Year	565.000	3403.470	3407.8650	3407	3409	0	6.47	90.47	39	1
Packer Creek	Lower	2648	500-Year	696.000	3403.470	3408.2500	3407	3409	0	7.14	102.08	99	1
Packer Creek	Lower	2648	1%+	881.000	3403.470	3408.6600	3408	3410	0	8.11	114.81	147	1
Packer Creek	Lower	2832	10-Year	368.000	3406.610	3410.5200	3409	3411	0	4.98	74.91	29	1
Packer Creek	Lower	2832	25-Year	441.000	3406.610	3410.8440	3410	3411	0	5.35	84.51	32	1
Packer Creek	Lower	2832	50-Year	503.000	3406.610	3411.1060	3410	3412	0	5.61	94.27	40	1
Packer Creek	Lower	2832	100-Year	565.000	3406.610	3411.3550	3410	3412	0	5.82	105.69	49	1
Packer Creek	Lower	2832	500-Year	696.000	3406.610	3411.8320	3411	3412	0	6.13	129.76	61	1
Packer Creek	Lower	2832	1%+	881.000	3406.610	3412.4680	3411	3413	0	6.46	165.17	101	1
Packer Creek	Lower	3251	10-Year	368.000	3413.860	3417.0210	3416	3417	0	3.93	124.62	115	0
Packer Creek	Lower	3251	25-Year	441.000	3413.860	3417.2310	3416	3417	0	4.06	150.84	134	0
Packer Creek	Lower	3251	50-Year	503.000	3413.860	3417.3910	3417	3418	0	4.14	173.27	148	0
Packer Creek	Lower	3251	100-Year	565.000	3413.860	3417.5290	3417	3418	0	4.23	194.60	159	0
Packer Creek	Lower	3251	500-Year	696.000	3413.860	3417.8180	3417	3418	0	4.47	245.01	189	0
Packer Creek	Lower	3251	1%+	881.000	3413.860	3418.1280	3417	3418	0	4.65	306.75	211	0
Packer Creek	Lower	3591	10-Year	368.000	3419.360	3422.3160	3422	3423	0	4.54	116.69	121	1
Packer Creek	Lower	3591	25-Year	441.000	3419.360	3422.4590	3422	3423	0	4.83	134.35	125	1
Packer Creek	Lower	3591	50-Year	503.000	3419.360	3422.5670	3422	3423	0	5.06	148.07	129	1
Packer Creek	Lower	3591	100-Year	565.000	3419.360	3422.6720	3422	3423	0	5.27	161.79	136	1
Packer Creek	Lower	3591	500-Year	696.000	3419.360	3422.8990	3423	3423	0	5.57	195.55	168	1
Packer Creek	Lower	3591	1%+	881.000	3419.360	3423.1330	3423	3423	0	5.99	238.75	195	1
Packer Creek	Lower	4030	10-Year	368.000	3426.000	3429.4360	3429	3430	0	4.09	122.64	126	0
Packer Creek	Lower	4030	25-Year	441.000	3426.000	3429.6090	3429	3430	0	4.22	145.02	131	0
Packer Creek	Lower	4030	50-Year	503.000	3426.000	3429.7420	3429	3430	0	4.31	162.79	136	0
Packer Creek	Lower	4030	100-Year	565.000	3426.000	3429.8650	3429	3430	0	4.40	179.77	139	0
Packer Creek	Lower	4030	500-Year	696.000	3426.000	3430.0770	3430	3430	0	4.61	209.31	140	0
Packer Creek	Lower	4030	1%+	881.000	3426.000	3430.3560	3430	3431	0	4.83	248.71	143	0
Packer Creek	Lower	4419	10-Year	368.000	3431.760	3434.2660	3434	3434	0	3.12	167.83	131	0
Packer Creek	Lower	4419	25-Year	441.000	3431.760	3434.4140	3434	3435	0	3.31	187.25	132	0
Packer Creek	Lower	4419	50-Year	503.000	3431.760	3434.5290	3434	3435	0	3.47	202.45	133	0
Packer Creek	Lower	4419	100-Year	565.000	3431.760	3434.6390	3434	3435	0	3.61	217.08	133	0
Packer Creek	Lower	4419	500-Year	696.000	3431.760	3434.8640	3434	3435	0	3.86	247.21	135	0
Packer Creek	Lower	4419	1%+	881.000	3431.760	3435.1440	3434	3435	0	4.19	285.09	136	0
Packer Creek	Lower	4817	10-Year	368.000	3438.860	3441.1100	3441	3441	0	5.13	82.64	86	1
Packer Creek	Lower	4817	25-Year	441.000	3438.860	3441.2680	3441	3442	0	5.36	97.97	106	1
Packer Creek	Lower	4817	50-Year	503.000	3438.860	3441.3990	3441	3442	0	5.52	113.14	132	1
Packer Creek	Lower	4817	100-Year	565.000	3438.860	3441.5000	3441	3442	0	5.64	127.69	156	1
Packer Creek	Lower	4817	500-Year	696.000	3438.860	3441.6810	3442	3442	0	5.86	158.36	179	1
Packer Creek	Lower	4817	1%+	881.000	3438.860	3441.9050	3442	3442	0	6.04	199.79	189	1
Packer Creek	Lower	5314	10-Year	368.000	3445.600	3448.2750	3447	3448	0	2.76	204.97	165	0
Packer Creek	Lower	5314	25-Year	441.000	3445.600	3448.4300	3448	3449	0	2.91	230.76	167	0
Packer Creek	Lower	5314	50-Year	503.000	3445.600	3448.5470	3448	3449	0	3.03	250.28	168	0
Packer Creek	Lower	5314	100-Year	565.000	3445.600	3448.6570	3448	3449	0	3.14	268.75	168	0
Packer Creek	Lower	5314	500-Year	696.000	3445.600	3448.8690	3448	3449	0	3.35	304.59	170	0
Packer Creek	Lower	5314	1%+	881.000	3445.600	3449.1260	3448	3449	0	3.64	348.50	171	0
Packer Creek	Lower	5795	10-Year	368.000	3452.280	3454.0970	3454	3454	0	3.84	121.41	123	1
Packer Creek	Lower	5795	25-Year	441.000	3452.280	3454.2390	3454	3454	0	4.05	139.28	130	1
Packer Creek	Lower	5795	50-Year	503.000	3452.280	3454.3540	3454	3455	0	4.20	154.11	141	1
Packer Creek	Lower	5795	100-Year	565.000	3452.280	3454.4610	3454	3455	0	4.34	168.36	150	1
Packer Creek	Lower	5795	500-Year	696.000	3452.280	3454.6800	3454	3455	0	4.60	199.05	175	1
Packer Creek	Lower	5795	1%+	881.000	3452.280	3454.9640	3454	3455	0	4.87	241.76	199	1

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Packer Creek	Lower	6145	10-Year	368.000	3456.550	3459.1280	3458	3459	0	3.04	183.89	188	0
Packer Creek	Lower	6145	25-Year	441.000	3456.550	3459.2670	3459	3459	0	3.20	210.60	195	0
Packer Creek	Lower	6145	50-Year	503.000	3456.550	3459.3770	3459	3459	0	3.32	232.31	198	0
Packer Creek	Lower	6145	100-Year	565.000	3456.550	3459.4760	3459	3460	0	3.43	252.00	200	0
Packer Creek	Lower	6145	500-Year	696.000	3456.550	3459.6700	3459	3460	0	3.64	292.46	214	0
Packer Creek	Lower	6145	1%+	881.000	3456.550	3459.9000	3459	3460	0	3.89	342.49	221	0
Packer Creek	Lower	6565	10-Year	368.000	3461.110	3463.7730	3463	3464	0	3.63	115.37	93	0
Packer Creek	Lower	6565	25-Year	441.000	3461.110	3463.9510	3463	3464	0	3.87	132.72	101	0
Packer Creek	Lower	6565	50-Year	503.000	3461.110	3464.0910	3463	3464	0	4.04	147.29	108	0
Packer Creek	Lower	6565	100-Year	565.000	3461.110	3464.2150	3464	3464	0	4.20	161.03	112	0
Packer Creek	Lower	6565	500-Year	696.000	3461.110	3464.4550	3464	3465	0	4.51	188.28	116	0
Packer Creek	Lower	6565	1%+	881.000	3461.110	3464.7560	3464	3465	0	4.87	224.44	122	1
Packer Creek	Lower	6872	10-Year	368.000	3464.350	3467.6940	3467	3468	0	3.65	109.93	71	0
Packer Creek	Lower	6872	25-Year	441.000	3464.350	3467.9140	3467	3468	0	3.90	125.98	74	0
Packer Creek	Lower	6872	50-Year	503.000	3464.350	3468.0820	3467	3468	0	4.10	138.48	82	0
Packer Creek	Lower	6872	100-Year	565.000	3464.350	3468.2400	3467	3469	0	4.28	150.41	96	0
Packer Creek	Lower	6872	500-Year	696.000	3464.350	3468.5410	3467	3469	0	4.64	173.52	133	0
Packer Creek	Lower	6872	1%+	881.000	3464.350	3468.8850	3468	3469	0	4.99	230.20	174	0
Packer Creek	Lower	7246	10-Year	368.000	3468.290	3471.9020	3471	3472	0	4.11	97.76	103	0
Packer Creek	Lower	7246	25-Year	441.000	3468.290	3472.1670	3471	3472	0	4.39	114.67	119	0
Packer Creek	Lower	7246	50-Year	503.000	3468.290	3472.3660	3471	3473	0	4.57	128.31	126	0
Packer Creek	Lower	7246	100-Year	565.000	3468.290	3472.5480	3471	3473	0	4.74	141.15	132	0
Packer Creek	Lower	7246	500-Year	696.000	3468.290	3472.9000	3472	3473	0	5.05	167.20	142	0
Packer Creek	Lower	7246	1%+	881.000	3468.290	3473.2990	3472	3474	0	5.47	199.51	150	0
Packer Creek	West Fork	7485	10-Year	188.000	3472.280	3475.2700	3475	3476	0	4.47	42.41	25	1
Packer Creek	West Fork	7485	25-Year	228.000	3472.280	3475.5120	3475	3476	0	4.75	48.68	28	1
Packer Creek	West Fork	7485	50-Year	261.000	3472.280	3475.6870	3475	3476	0	4.96	53.45	33	1
Packer Creek	West Fork	7485	100-Year	295.000	3472.280	3475.8560	3475	3476	0	5.16	58.34	41	1
Packer Creek	West Fork	7485	500-Year	367.000	3472.280	3476.1560	3475	3477	0	5.51	68.15	56	1
Packer Creek	West Fork	7485	1%+	460.000	3472.280	3476.5120	3476	3477	0	5.70	81.66	75	1
Packer Creek	West Fork	7507		Bridge									
Packer Creek	West Fork	7525	10-Year	188.000	3473.220	3476.4400	3476	3477	0	3.77	56.89	64	0
Packer Creek	West Fork	7525	25-Year	228.000	3473.220	3476.6810	3476	3477	0	3.84	67.88	98	0
Packer Creek	West Fork	7525	50-Year	261.000	3473.220	3476.8710	3476	3477	0	3.88	76.78	101	0
Packer Creek	West Fork	7525	100-Year	295.000	3473.220	3477.0190	3476	3477	0	4.01	83.90	109	0
Packer Creek	West Fork	7525	500-Year	367.000	3473.220	3477.3130	3477	3478	0	4.28	98.84	121	0
Packer Creek	West Fork	7525	1%+	460.000	3473.220	3478.6140	3477	3479	0	1.64	317.15	163	0
Packer Creek	West Fork	7627	10-Year	188.000	3475.220	3477.9700	3478	3478	0	3.39	66.95	65	0
Packer Creek	West Fork	7627	25-Year	228.000	3475.220	3478.1270	3478	3478	0	3.64	75.56	68	0
Packer Creek	West Fork	7627	50-Year	261.000	3475.220	3478.2490	3478	3478	0	3.83	82.30	70	0
Packer Creek	West Fork	7627	100-Year	295.000	3475.220	3478.3810	3478	3479	0	3.98	89.69	78	0
Packer Creek	West Fork	7627	500-Year	367.000	3475.220	3478.6620	3478	3479	0	4.21	105.80	111	0
Packer Creek	West Fork	7627	1%+	460.000	3475.220	3478.7500	3478	3479	0	5.03	110.97	117	1
Packer Creek	West Fork	7688	10-Year	188.000	3476.020	3478.8610	3478	3479	0	3.73	58.43	45	0
Packer Creek	West Fork	7688	25-Year	228.000	3476.020	3479.0500	3478	3479	0	4.04	68.23	68	0
Packer Creek	West Fork	7688	50-Year	261.000	3476.020	3479.1850	3479	3479	0	4.24	77.64	82	0
Packer Creek	West Fork	7688	100-Year	295.000	3476.020	3479.3200	3479	3480	0	4.48	88.10	97	1
Packer Creek	West Fork	7688	500-Year	367.000	3476.020	3479.5610	3479	3480	0	4.68	107.73	107	1
Packer Creek	West Fork	7688	1%+	460.000	3476.020	3479.8400	3479	3480	0	4.87	131.18	130	1
Packer Creek	West Fork	7921	10-Year	188.000	3480.650	3483.2230	3483	3484	0	4.67	40.60	27	1
Packer Creek	West Fork	7921	25-Year	228.000	3480.650	3483.4490	3483	3484	0	4.97	49.23	49	1
Packer Creek	West Fork	7921	50-Year	261.000	3480.650	3483.5940	3483	3484	0	5.17	57.52	68	1
Packer Creek	West Fork	7921	100-Year	295.000	3480.650	3483.7360	3483	3484	0	5.27	68.16	86	1
Packer Creek	West Fork	7921	500-Year	367.000	3480.650	3483.9180	3484	3484	0	5.60	85.17	106	1
Packer Creek	West Fork	7921	1%+	460.000	3480.650	3484.1130	3484	3485	0	5.96	110.38	153	1
Packer Creek	West Fork	8158	10-Year	188.000	3485.000	3487.9440	3487	3488	0	4.04	48.59	39	0
Packer Creek	West Fork	8158	25-Year	228.000	3485.000	3488.1670	3487	3488	0	4.35	57.92	45	0
Packer Creek	West Fork	8158	50-Year	261.000	3485.000	3488.3260	3487	3489	0	4.57	65.09	55	1
Packer Creek	West Fork	8158	100-Year	295.000	3485.000	3488.4550	3488	3489	0	4.83	71.58	65	1
Packer Creek	West Fork	8158	500-Year	367.000	3485.000	3488.7280	3488	3489	0	5.22	88.54	93	1
Packer Creek	West Fork	8158	1%+	460.000	3485.000	3489.0230	3488	3489	0	5.61	113.06	131	1
Packer Creek	West Fork	8378	10-Year	188.000	3488.060	3491.2620	3491	3491	0	3.80	56.16	50	0
Packer Creek	West Fork	8378	25-Year	228.000	3488.060	3491.4590	3491	3492	0	3.93	66.66	57	0
Packer Creek	West Fork	8378	50-Year	261.000	3488.060	3491.6010	3491	3492	0	4.02	75.29	65	0
Packer Creek	West Fork	8378	100-Year	295.000	3488.060	3491.7430	3491	3492	0	4.06	85.80	82	0
Packer Creek	West Fork	8378	500-Year	367.000	3488.060	3491.9850	3491	3492	0	4.18	108.23	101	0
Packer Creek	West Fork	8378	1%+	460.000	3488.060	3492.2430	3492	3492	0	4.30	136.64	117	0
Packer Creek	West Fork	8695	10-Year	188.000	3494.340	3496.6970	3496	3497	0	4.53	41.98	87	1
Packer Creek	West Fork	8695	25-Year	228.000	3494.340	3496.8880	3496	3497	0	4.99	46.36	89	1
Packer Creek	West Fork	8695	50-Year	261.000	3494.340	3497.0250	3496	3497	0	5.36	49.56	91	1
Packer Creek	West Fork	8695	100-Year	295.000	3494.340	3497.1340	3497	3498	0	5.78	52.12	93	1
Packer Creek	West Fork	8695	500-Year	367.000	3494.340	3497.3600	3497	3498	0	6.54	57.58	96	1
Packer Creek	West Fork	8695	1%+	460.000	3494.340	3497.5950	3497	3498	0	7.48	63.41	102	1
Packer Creek	West Fork	9066	10-Year	188.000	3500.530	3503.1200	3503	3503	0	3.21	62.72	58	0
Packer Creek	West Fork	9066	25-Year	228.000	3500.530	3503.2930	3503	3503	0	3.30	73.06	61	0
Packer Creek	West Fork	9066	50-Year	261.000	3500.530	3503.4270	3503	3504	0	3.35	81.24	62	0
Packer Creek	West Fork	9066	100-Year	295.000	3500.530	3503.5670	3503	3504	0	3.38	89.91	63	0
Packer Creek	West Fork	9066	500-Year	367.000	3500.530	3503.8330	3503	3504	0	3.47	106.83	78	0
Packer Creek	West Fork	9066	1%+	460.000	3500.530	3504.1530	3503	3504	0	3.57	127.95	92	0
Packer Creek	West Fork	9551	10-Year	188.000	3507.800	3510.3250	3510	3510	0	3.54	65.60	96	0
Packer Creek	West Fork	9551	25-Year	228.000	3507.800	3510.4400	3510	3511	0	3.84	73.22	104	1
Packer Creek	West Fork	9551	50-Year	261.000	3507.800	3510.5230	3510	3511	0	4.08	78.72	113	1
Packer Creek	West Fork	9551	100-Year	295.000	3507.800	3510.5930	3510	3511	0	4.35	83.32	118	1
Packer Creek	West Fork	9551	500-Year	367.000	3507.800	3510.7380	3510	3511	0	4.82	93.08	130	1

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Packer Creek	West Fork	9551	1%+	460.000	3507.800	3510.8920	3511	3511	0	5.41	103.56	152	1
Packer Creek	West Fork	9802	10-Year	188.000	3511.320	3514.5760	3514	3515	0	4.34	49.70	35	1
Packer Creek	West Fork	9802	25-Year	228.000	3511.320	3514.8140	3514	3515	0	4.60	58.40	49	1
Packer Creek	West Fork	9802	50-Year	261.000	3511.320	3514.9970	3514	3515	0	4.78	65.64	68	1
Packer Creek	West Fork	9802	100-Year	295.000	3511.320	3515.1810	3514	3516	0	4.93	73.67	134	1
Packer Creek	West Fork	9802	500-Year	367.000	3511.320	3515.5240	3515	3516	0	5.25	92.28	186	1
Packer Creek	West Fork	9802	1%+	460.000	3511.320	3515.8810	3515	3516	0	5.51	116.93	196	1
Packer Creek	West Fork	10088	10-Year	188.000	3516.370	3518.7610	3518	3519	0	3.11	62.38	71	0
Packer Creek	West Fork	10088	25-Year	228.000	3516.370	3518.9700	3518	3519	0	3.35	71.05	76	0
Packer Creek	West Fork	10088	50-Year	261.000	3516.370	3519.1310	3518	3519	0	3.52	77.94	85	0
Packer Creek	West Fork	10088	100-Year	295.000	3516.370	3519.2810	3518	3519	0	3.71	85.38	117	0
Packer Creek	West Fork	10088	500-Year	367.000	3516.370	3519.5730	3519	3520	0	4.01	102.63	174	0
Packer Creek	West Fork	10088	1%+	460.000	3516.370	3519.8790	3519	3520	0	4.37	124.91	201	0
Packer Creek	West Fork	10388	10-Year	188.000	3520.340	3522.7780	3522	3523	0	3.78	70.53	70	0
Packer Creek	West Fork	10388	25-Year	228.000	3520.340	3522.9480	3523	3523	0	3.93	82.59	72	0
Packer Creek	West Fork	10388	50-Year	261.000	3520.340	3523.0830	3523	3523	0	4.05	92.46	75	0
Packer Creek	West Fork	10388	100-Year	295.000	3520.340	3523.2270	3523	3523	0	4.16	103.84	81	0
Packer Creek	West Fork	10388	500-Year	367.000	3520.340	3523.4640	3523	3524	0	4.36	123.64	86	0
Packer Creek	West Fork	10388	1%+	460.000	3520.340	3523.7800	3523	3524	0	4.62	156.10	117	0
Packer Creek	West Fork	10801	10-Year	188.000	3528.240	3530.4690	3530	3531	0	3.93	59.60	96	1
Packer Creek	West Fork	10801	25-Year	228.000	3528.240	3530.5910	3530	3531	0	4.18	72.53	116	1
Packer Creek	West Fork	10801	50-Year	261.000	3528.240	3530.6780	3531	3531	0	4.36	83.07	128	1
Packer Creek	West Fork	10801	100-Year	295.000	3528.240	3530.7550	3531	3531	0	4.54	93.31	139	1
Packer Creek	West Fork	10801	500-Year	367.000	3528.240	3530.9100	3531	3531	0	4.82	117.14	169	1
Packer Creek	West Fork	10801	1%+	460.000	3528.240	3531.0760	3531	3531	0	5.08	147.09	190	1
Packer Creek	West Fork	11198	10-Year	188.000	3533.860	3536.5950	3536	3537	0	3.54	68.84	68	0
Packer Creek	West Fork	11198	25-Year	228.000	3533.860	3536.7790	3536	3537	0	3.72	82.79	80	0
Packer Creek	West Fork	11198	50-Year	261.000	3533.860	3536.8980	3536	3537	0	3.84	92.47	82	0
Packer Creek	West Fork	11198	100-Year	295.000	3533.860	3537.0130	3537	3537	0	3.94	101.90	83	0
Packer Creek	West Fork	11198	500-Year	367.000	3533.860	3537.2240	3537	3537	0	4.16	119.46	88	0
Packer Creek	West Fork	11198	1%+	460.000	3533.860	3537.4550	3537	3538	0	4.42	139.44	110	0
Packer Creek	West Fork	11633	10-Year	188.000	3540.960	3543.3080	3543	3544	0	3.92	49.64	39	1
Packer Creek	West Fork	11633	25-Year	228.000	3540.960	3543.4780	3543	3544	0	4.24	56.37	40	1
Packer Creek	West Fork	11633	50-Year	261.000	3540.960	3543.6040	3543	3544	0	4.48	61.49	41	1
Packer Creek	West Fork	11633	100-Year	295.000	3540.960	3543.7220	3543	3544	0	4.72	66.42	43	1
Packer Creek	West Fork	11633	500-Year	367.000	3540.960	3543.9710	3543	3544	0	5.16	78.47	59	1
Packer Creek	West Fork	11633	1%+	460.000	3540.960	3544.2480	3544	3545	0	5.57	94.21	85	1
Packer Creek	West Fork	11902	10-Year	188.000	3545.770	3548.2940	3548	3549	0	3.64	52.09	31	0
Packer Creek	West Fork	11902	25-Year	228.000	3545.770	3548.5130	3548	3549	0	3.94	59.73	37	0
Packer Creek	West Fork	11902	50-Year	261.000	3545.770	3548.6810	3548	3549	0	4.14	66.18	40	0
Packer Creek	West Fork	11902	100-Year	295.000	3545.770	3548.8420	3548	3549	0	4.33	72.72	41	0
Packer Creek	West Fork	11902	500-Year	367.000	3545.770	3549.1470	3548	3549	0	4.69	85.92	45	0
Packer Creek	West Fork	11902	1%+	460.000	3545.770	3549.4750	3549	3550	0	5.11	101.02	60	1
Packer Creek	West Fork	12133	10-Year	188.000	3551.290	3553.4520	3553	3554	0	5.17	36.49	133	1
Packer Creek	West Fork	12133	25-Year	228.000	3551.290	3553.6460	3553	3554	0	5.55	41.49	165	1
Packer Creek	West Fork	12133	50-Year	261.000	3551.290	3553.7890	3553	3554	0	5.86	45.37	173	1
Packer Creek	West Fork	12133	100-Year	295.000	3551.290	3553.9270	3554	3555	0	6.15	49.22	214	1
Packer Creek	West Fork	12133	500-Year	367.000	3551.290	3554.1960	3554	3555	0	6.68	57.23	239	1
Packer Creek	West Fork	12133	1%+	460.000	3551.290	3554.5140	3554	3555	0	7.21	68.98	290	1
Packer Creek	West Fork	12392	10-Year	188.000	3556.530	3559.0520	3558	3559	0	3.10	72.66	435	0
Packer Creek	West Fork	12392	25-Year	228.000	3556.530	3559.2260	3559	3559	0	3.29	84.60	482	0
Packer Creek	West Fork	12392	50-Year	261.000	3556.530	3559.3610	3559	3560	0	3.42	94.43	502	0
Packer Creek	West Fork	12392	100-Year	295.000	3556.530	3559.4940	3559	3560	0	3.54	105.32	532	0
Packer Creek	West Fork	12392	500-Year	367.000	3556.530	3559.7750	3559	3560	0	3.79	135.96	603	0
Packer Creek	West Fork	12392	1%+	460.000	3556.530	3560.0180	3559	3560	0	3.95	169.32	639	0
Packer Creek	West Fork	12743	10-Year	188.000	3561.910	3564.4230	3564	3565	0	3.93	65.98	162	1
Packer Creek	West Fork	12743	25-Year	228.000	3561.910	3564.5710	3564	3565	0	4.17	77.50	173	1
Packer Creek	West Fork	12743	50-Year	261.000	3561.910	3564.6730	3564	3565	0	4.34	85.77	188	1
Packer Creek	West Fork	12743	100-Year	295.000	3561.910	3564.7700	3564	3565	0	4.49	94.05	197	1
Packer Creek	West Fork	12743	500-Year	367.000	3561.910	3564.9620	3565	3565	0	4.76	111.57	238	1
Packer Creek	West Fork	12743	1%+	460.000	3561.910	3565.1500	3565	3565	0	5.13	132.15	257	1
Packer Creek	West Fork	12933	10-Year	188.000	3565.640	3567.6670	3567	3568	0	2.69	97.63	120	0
Packer Creek	West Fork	12933	25-Year	228.000	3565.640	3567.7950	3567	3568	0	2.79	113.38	126	0
Packer Creek	West Fork	12933	50-Year	261.000	3565.640	3567.8900	3567	3568	0	2.88	125.56	131	0
Packer Creek	West Fork	12933	100-Year	295.000	3565.640	3567.9800	3567	3568	0	2.98	137.60	136	0
Packer Creek	West Fork	12933	500-Year	367.000	3565.640	3568.1540	3568	3568	0	3.18	162.76	157	0
Packer Creek	West Fork	12933	1%+	460.000	3565.640	3568.3580	3568	3568	0	3.37	197.23	174	0
Packer Creek	West Fork	13049	10-Year	188.000	3566.360	3569.4610	3569	3570	0	4.43	47.83	62	1
Packer Creek	West Fork	13049	25-Year	228.000	3566.360	3569.6050	3569	3570	0	4.84	57.63	70	1
Packer Creek	West Fork	13049	50-Year	261.000	3566.360	3569.7080	3569	3570	0	5.12	64.88	73	1
Packer Creek	West Fork	13049	100-Year	295.000	3566.360	3569.8020	3570	3570	0	5.37	71.87	75	1
Packer Creek	West Fork	13049	500-Year	367.000	3566.360	3569.9870	3570	3570	0	5.82	86.03	80	1
Packer Creek	West Fork	13049	1%+	460.000	3566.360	3570.1750	3570	3571	0	6.33	101.38	83	1
Packer Creek	West Fork	13488	10-Year	188.000	3575.850	3578.4700	3578	3579	0	3.28	69.52	48	0
Packer Creek	West Fork	13488	25-Year	228.000	3575.850	3578.7180	3578	3579	0	3.43	81.54	49	0
Packer Creek	West Fork	13488	50-Year	261.000	3575.850	3578.9030	3578	3579	0	3.56	90.70	50	0
Packer Creek	West Fork	13488	100-Year	295.000	3575.850	3579.0810	3578	3579	0	3.69	99.80	54	0
Packer Creek	West Fork	13488	500-Year	367.000	3575.850	3579.4080	3578	3580	0	3.94	122.26	82	0
Packer Creek	West Fork	13488	1%+	460.000	3575.850	3579.7450	3579	3580	0	4.16	152.11	93	0
Packer Creek	West Fork	13840	10-Year	188.000	3583.280	3585.6040	3585	3586	0	3.46	72.83	50	0
Packer Creek	West Fork	13840	25-Year	228.000	3583.280	3585.7830	3585	3586	0	3.75	81.92	51	0
Packer Creek	West Fork	13840	50-Year	261.000	3583.280	3585.9260	3585	3586	0	3.96	89.32	52	0
Packer Creek	West Fork	13840	100-Year	295.000	3583.280	3586.0670	3585	3586	0	4.14	96.81	53	0
Packer Creek	West Fork	13840	500-Year	367.000	3583.280	3586.3460	3585	3587	0	4.49	111.95	55	0
Packer Creek	West Fork	13840	1%+	460.000	3583.280	3586.6560	3586	3587	0	4.91	129.48	58	0

HEC-RAS Plan: MultipleProfiles (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Packer Creek	West Fork	14002	10-Year	188.000	3586.910	3589.7140	3589	3590	0	4.40	44.07	26	1
Packer Creek	West Fork	14002	25-Year	228.000	3586.910	3589.9780	3589	3590	0	4.73	51.66	35	1
Packer Creek	West Fork	14002	50-Year	261.000	3586.910	3590.1690	3589	3591	0	4.98	58.20	47	1
Packer Creek	West Fork	14002	100-Year	295.000	3586.910	3590.3420	3589	3591	0	5.22	65.65	58	1
Packer Creek	West Fork	14002	500-Year	367.000	3586.910	3590.6620	3590	3591	0	5.61	82.52	87	1
Packer Creek	West Fork	14002	1%+	460.000	3586.910	3591.0190	3590	3592	0	5.94	105.82	113	1
Packer Creek	West Fork	14260	10-Year	188.000	3593.280	3596.4380	3595	3597	0	3.86	55.86	92	0
Packer Creek	West Fork	14260	25-Year	228.000	3593.280	3596.7000	3596	3597	0	4.14	65.55	137	0
Packer Creek	West Fork	14260	50-Year	261.000	3593.280	3596.9040	3596	3597	0	4.34	73.78	175	0
Packer Creek	West Fork	14260	100-Year	295.000	3593.280	3597.1030	3596	3597	0	4.52	82.63	202	0
Packer Creek	West Fork	14260	500-Year	367.000	3593.280	3597.1880	3596	3597	0	4.38	136.80	205	0
Packer Creek	West Fork	14260	1%+	460.000	3593.280	3597.4840	3597	3598	0	4.64	165.67	211	0
Packer Creek	West Fork	14653	10-Year	188.000	3602.480	3605.3590	3605	3606	0	3.57	59.58	50	0
Packer Creek	West Fork	14653	25-Year	228.000	3602.480	3605.5680	3605	3606	0	3.79	70.35	53	0
Packer Creek	West Fork	14653	50-Year	261.000	3602.480	3605.7280	3605	3606	0	3.95	79.06	57	0
Packer Creek	West Fork	14653	100-Year	295.000	3602.480	3605.8740	3605	3606	0	4.11	87.52	59	0
Packer Creek	West Fork	14653	500-Year	367.000	3602.480	3606.0450	3605	3606	0	4.65	97.82	67	1
Packer Creek	West Fork	14653	1%+	460.000	3602.480	3606.3480	3606	3607	0	5.03	117.55	127	1
Packer Creek	West Fork	14911	10-Year	188.000	3608.600	3611.6700	3611	3612	0	4.18	63.28	47	0
Packer Creek	West Fork	14911	25-Year	228.000	3608.600	3611.8770	3611	3612	0	4.46	73.32	51	0
Packer Creek	West Fork	14911	50-Year	261.000	3608.600	3612.0350	3611	3612	0	4.65	81.57	53	0
Packer Creek	West Fork	14911	100-Year	295.000	3608.600	3612.1870	3612	3612	0	4.84	89.86	56	0
Packer Creek	West Fork	14911	500-Year	367.000	3608.600	3612.5680	3612	3613	0	4.96	112.13	61	0
Packer Creek	West Fork	14911	1%+	460.000	3608.600	3612.9210	3612	3613	0	5.31	134.91	68	0
Packer Creek	West Fork	15271	10-Year	188.000	3621.340	3623.4300	3623	3624	0	4.41	47.21	40	1
Packer Creek	West Fork	15271	25-Year	228.000	3621.340	3623.6270	3623	3624	0	4.68	55.55	44	1
Packer Creek	West Fork	15271	50-Year	261.000	3621.340	3623.7720	3623	3624	0	4.89	62.07	46	1
Packer Creek	West Fork	15271	100-Year	295.000	3621.340	3623.9130	3623	3624	0	5.09	68.65	48	1
Packer Creek	West Fork	15271	500-Year	367.000	3621.340	3624.1000	3624	3625	0	5.71	77.89	51	1
Packer Creek	West Fork	15271	1%+	460.000	3621.340	3624.4000	3624	3625	0	6.15	94.39	59	1
Packer Creek	West Fork	15544	10-Year	188.000	3629.880	3633.1730	3632	3633	0	4.12	51.89	35	0
Packer Creek	West Fork	15544	25-Year	228.000	3629.880	3633.3910	3633	3634	0	4.45	59.54	36	1
Packer Creek	West Fork	15544	50-Year	261.000	3629.880	3633.5580	3633	3634	0	4.69	65.58	37	1
Packer Creek	West Fork	15544	100-Year	295.000	3629.880	3633.7190	3633	3634	0	4.92	71.52	37	1
Packer Creek	West Fork	15544	500-Year	367.000	3629.880	3634.1080	3633	3634	0	5.18	86.54	45	1
Packer Creek	West Fork	15544	1%+	460.000	3629.880	3634.4810	3634	3635	0	5.65	101.74	54	1

HEC-RAS Plan: Multiple Profile River: RandolphCreek Reach: RandolphCreek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
RandolphCreek	116.60	10-Year	227.000	3589.860	3592.6520	3592	3593	0	3.64	78.12	132	0
RandolphCreek	116.60	25-Year	271.000	3589.860	3592.8290	3592	3593	0	3.87	92.81	155	0
RandolphCreek	116.60	50-Year	307.000	3589.860	3592.9450	3592	3593	0	4.02	102.68	166	0
RandolphCreek	116.60	100-Year	344.000	3589.860	3593.0570	3592	3593	0	4.16	112.19	168	0
RandolphCreek	116.60	500-Year	421.000	3589.860	3593.2720	3593	3594	0	4.42	130.48	174	0
RandolphCreek	116.60	1%+	537.000	3589.860	3593.5630	3593	3594	0	4.77	155.28	183	1
RandolphCreek	139	10-Year	227.000	3589.960	3593.1690	3592	3593	0	3.84	60.09	28	0
RandolphCreek	139	25-Year	271.000	3589.960	3593.3590	3592	3594	0	4.24	65.60	30	0
RandolphCreek	139	50-Year	307.000	3589.960	3593.4840	3592	3594	0	4.58	69.57	33	0
RandolphCreek	139	100-Year	344.000	3589.960	3593.6030	3593	3594	0	4.90	73.57	34	1
RandolphCreek	139	500-Year	421.000	3589.960	3593.8240	3593	3594	0	5.53	81.25	35	1
RandolphCreek	139	1%+	537.000	3589.960	3594.1100	3593	3595	0	6.38	91.53	38	1
RandolphCreek	154		Bridge									
RandolphCreek	172	10-Year	227.000	3591.900	3594.7990	3594	3595	0	4.62	49.64	30	1
RandolphCreek	172	25-Year	271.000	3591.900	3595.0090	3594	3595	0	4.93	56.04	31	1
RandolphCreek	172	50-Year	307.000	3591.900	3595.1710	3595	3596	0	5.16	61.24	33	1
RandolphCreek	172	100-Year	344.000	3591.900	3595.3310	3595	3596	0	5.37	66.55	34	1
RandolphCreek	172	500-Year	421.000	3591.900	3595.6430	3595	3596	0	5.74	78.80	45	1
RandolphCreek	172	1%+	537.000	3591.900	3596.0980	3595	3597	0	6.04	101.96	68	1
RandolphCreek	187	10-Year	227.000	3591.950	3595.4760	3595	3596	0	5.31	42.73	19	1
RandolphCreek	187	25-Year	271.000	3591.950	3595.6900	3595	3596	0	5.79	46.89	20	1
RandolphCreek	187	50-Year	307.000	3591.950	3595.8530	3595	3596	0	6.15	50.16	20	1
RandolphCreek	187	100-Year	344.000	3591.950	3596.0120	3595	3597	0	6.50	53.42	21	1
RandolphCreek	187	500-Year	421.000	3591.950	3596.3170	3596	3597	0	7.15	59.95	22	1
RandolphCreek	187	1%+	537.000	3591.950	3596.7200	3596	3598	0	8.03	69.01	40	1
RandolphCreek	285		Culvert									
RandolphCreek	375	10-Year	227.000	3597.940	3601.2980	3601	3602	0	7.62	30.78	19	1
RandolphCreek	375	25-Year	271.000	3597.940	3601.5590	3602	3603	0	7.95	36.09	21	1
RandolphCreek	375	50-Year	307.000	3597.940	3601.7580	3602	3603	0	8.19	40.41	22	1
RandolphCreek	375	100-Year	344.000	3597.940	3601.9440	3602	3603	0	8.44	44.67	23	1
RandolphCreek	375	500-Year	421.000	3597.940	3603.2390	3602	3604	0	6.40	80.19	31	1
RandolphCreek	375	1%+	537.000	3597.940	3604.5840	3603	3605	0	5.55	128.93	203	0
RandolphCreek	539	10-Year	227.000	3601.410	3605.6080	3604	3606	0	3.18	107.03	60	0
RandolphCreek	539	25-Year	271.000	3601.410	3605.8970	3604	3606	0	3.36	126.22	70	0
RandolphCreek	539	50-Year	307.000	3601.410	3606.1090	3604	3606	0	3.48	141.78	78	0
RandolphCreek	539	100-Year	344.000	3601.410	3606.3170	3605	3606	0	3.59	158.71	84	0
RandolphCreek	539	500-Year	421.000	3601.410	3606.4970	3605	3607	0	4.09	174.10	87	0
RandolphCreek	539	1%+	537.000	3601.410	3606.9610	3605	3607	0	4.36	216.58	96	0
RandolphCreek	656	10-Year	227.000	3605.060	3607.3740	3607	3608	0	5.08	49.15	30	1
RandolphCreek	656	25-Year	271.000	3605.060	3607.6210	3607	3608	0	5.34	56.88	32	1
RandolphCreek	656	50-Year	307.000	3605.060	3607.8020	3607	3608	0	5.57	63.05	35	1
RandolphCreek	656	100-Year	344.000	3605.060	3607.9790	3607	3608	0	5.76	69.53	38	1
RandolphCreek	656	500-Year	421.000	3605.060	3608.3720	3608	3609	0	6.01	86.05	47	1
RandolphCreek	656	1%+	537.000	3605.060	3608.7870	3608	3609	0	6.50	106.99	54	1
RandolphCreek	851	10-Year	227.000	3612.090	3614.0170	3613	3614	0	3.14	119.65	109	0
RandolphCreek	851	25-Year	271.000	3612.090	3614.1520	3613	3614	0	3.31	134.34	110	0
RandolphCreek	851	50-Year	307.000	3612.090	3614.2600	3614	3614	0	3.42	146.31	110	0
RandolphCreek	851	100-Year	344.000	3612.090	3614.3660	3614	3614	0	3.53	157.97	111	0
RandolphCreek	851	500-Year	421.000	3612.090	3614.5570	3614	3615	0	3.78	179.33	112	0
RandolphCreek	851	1%+	537.000	3612.090	3614.8510	3614	3615	0	4.03	212.58	114	0
RandolphCreek	1243	10-Year	227.000	3621.580	3624.1240	3623	3624	0	3.71	64.22	43	0
RandolphCreek	1243	25-Year	271.000	3621.580	3624.3080	3624	3625	0	3.99	72.38	47	0
RandolphCreek	1243	50-Year	307.000	3621.580	3624.4380	3624	3625	0	4.21	78.68	50	1
RandolphCreek	1243	100-Year	344.000	3621.580	3624.5660	3624	3625	0	4.41	85.36	55	1
RandolphCreek	1243	500-Year	421.000	3621.580	3624.8200	3624	3625	0	4.75	100.36	62	1
RandolphCreek	1243	1%+	537.000	3621.580	3625.1140	3624	3626	0	5.27	119.67	69	1
RandolphCreek	1648	10-Year	227.000	3629.950	3633.2500	3632	3633	0	3.81	86.87	74	0
RandolphCreek	1648	25-Year	271.000	3629.950	3633.4580	3633	3634	0	3.98	102.56	76	0
RandolphCreek	1648	50-Year	307.000	3629.950	3633.6170	3633	3634	0	4.10	114.86	78	0
RandolphCreek	1648	100-Year	344.000	3629.950	3633.7730	3633	3634	0	4.21	127.20	81	0
RandolphCreek	1648	500-Year	421.000	3629.950	3634.0580	3633	3634	0	4.45	150.92	85	0
RandolphCreek	1648	1%+	537.000	3629.950	3634.4740	3634	3635	0	4.72	189.06	101	0
RandolphCreek	1989	10-Year	227.000	3640.260	3642.4410	3642	3643	0	4.17	91.59	116	1
RandolphCreek	1989	25-Year	271.000	3640.260	3642.5640	3642	3643	0	4.38	106.25	122	1
RandolphCreek	1989	50-Year	307.000	3640.260	3642.6590	3642	3643	0	4.55	118.07	127	1
RandolphCreek	1989	100-Year	344.000	3640.260	3642.7470	3642	3643	0	4.70	129.46	131	1
RandolphCreek	1989	500-Year	421.000	3640.260	3642.9370	3643	3643	0	4.95	155.44	154	1
RandolphCreek	1989	1%+	537.000	3640.260	3643.1550	3643	3643	0	5.28	192.01	177	1
RandolphCreek	2377	10-Year	227.000	3648.420	3650.3240	3650	3650	0	1.95	181.35	250	0
RandolphCreek	2377	25-Year	271.000	3648.420	3650.4250	3650	3650	0	2.04	206.91	259	0
RandolphCreek	2377	50-Year	307.000	3648.420	3650.5060	3650	3651	0	2.11	228.50	267	0
RandolphCreek	2377	100-Year	344.000	3648.420	3650.5750	3650	3651	0	2.17	247.21	279	0
RandolphCreek	2377	500-Year	421.000	3648.420	3650.7240	3650	3651	0	2.29	290.26	295	0
RandolphCreek	2377	1%+	537.000	3648.420	3650.8960	3650	3651	0	2.43	341.35	299	0
RandolphCreek	2652	10-Year	227.000	3654.670	3656.5610	3656	3657	0	4.43	65.30	86	1

HEC-RAS Plan: Multiple Profile River: RandolphCreek Reach: RandolphCreek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
RandolphCreek	2652	25-Year	271.000	3654.670	3656.6730	3656	3657	0	4.76	75.22	93	1
RandolphCreek	2652	50-Year	307.000	3654.670	3656.7550	3657	3657	0	5.00	83.10	99	1
RandolphCreek	2652	100-Year	344.000	3654.670	3656.8330	3657	3657	0	5.24	91.13	107	1
RandolphCreek	2652	500-Year	421.000	3654.670	3656.9810	3657	3657	0	5.62	108.48	126	1
RandolphCreek	2652	1%+	537.000	3654.670	3657.1470	3657	3658	0	6.09	130.52	140	1
RandolphCreek	2947	10-Year	227.000	3661.490	3664.0910	3663	3664	0	2.85	104.29	106	0
RandolphCreek	2947	25-Year	271.000	3661.490	3664.2540	3663	3664	0	2.98	122.30	117	0
RandolphCreek	2947	50-Year	307.000	3661.490	3664.3860	3663	3665	0	3.09	139.27	138	0
RandolphCreek	2947	100-Year	344.000	3661.490	3664.4950	3664	3665	0	3.16	154.96	149	0
RandolphCreek	2947	500-Year	421.000	3661.490	3664.6930	3664	3665	0	3.32	186.60	171	0
RandolphCreek	2947	1%+	537.000	3661.490	3664.9370	3664	3665	0	3.49	230.88	196	0
RandolphCreek	3326	10-Year	227.000	3670.630	3673.0110	3673	3673	0	5.73	50.93	46	1
RandolphCreek	3326	25-Year	271.000	3670.630	3673.1760	3673	3674	0	6.10	58.69	48	1
RandolphCreek	3326	50-Year	307.000	3670.630	3673.3030	3673	3674	0	6.36	65.02	51	1
RandolphCreek	3326	100-Year	344.000	3670.630	3673.4090	3673	3674	0	6.67	70.49	53	1
RandolphCreek	3326	500-Year	421.000	3670.630	3673.6320	3673	3674	0	7.17	82.64	57	1
RandolphCreek	3326	1%+	537.000	3670.630	3673.9120	3674	3675	0	7.88	100.38	69	1
RandolphCreek	3605	10-Year	227.000	3677.910	3681.4490	3680	3682	0	3.77	86.86	69	0
RandolphCreek	3605	25-Year	271.000	3677.910	3681.6900	3681	3682	0	3.99	106.66	90	0
RandolphCreek	3605	50-Year	307.000	3677.910	3681.8390	3681	3682	0	4.10	120.24	91	0
RandolphCreek	3605	100-Year	344.000	3677.910	3681.9900	3681	3682	0	4.19	134.05	92	0
RandolphCreek	3605	500-Year	421.000	3677.910	3682.2650	3681	3682	0	4.39	159.76	95	0
RandolphCreek	3605	1%+	537.000	3677.910	3682.6440	3682	3683	0	4.62	196.62	99	0
RandolphCreek	4022	10-Year	227.000	3687.940	3690.0730	3689	3690	0	3.17	114.86	115	0
RandolphCreek	4022	25-Year	271.000	3687.940	3690.2300	3689	3690	0	3.33	133.71	126	0
RandolphCreek	4022	50-Year	307.000	3687.940	3690.3700	3689	3690	0	3.52	152.76	144	0
RandolphCreek	4022	100-Year	344.000	3687.940	3690.4760	3689	3691	0	3.67	168.43	148	0
RandolphCreek	4022	500-Year	421.000	3687.940	3690.6460	3690	3691	0	3.85	193.64	149	0
RandolphCreek	4022	1%+	537.000	3687.940	3690.8700	3690	3691	0	4.11	227.26	150	0
RandolphCreek	4373	10-Year	227.000	3697.510	3700.1750	3700	3700	0	4.37	79.53	68	1
RandolphCreek	4373	25-Year	271.000	3697.510	3700.3220	3700	3701	0	4.65	89.60	69	1
RandolphCreek	4373	50-Year	307.000	3697.510	3700.4460	3700	3701	0	4.80	98.24	70	1
RandolphCreek	4373	100-Year	344.000	3697.510	3700.5710	3700	3701	0	4.94	106.93	70	1
RandolphCreek	4373	500-Year	421.000	3697.510	3700.7800	3700	3701	0	5.30	121.79	71	1
RandolphCreek	4373	1%+	537.000	3697.510	3701.0730	3701	3701	0	5.74	142.98	74	1
RandolphCreek	4796	10-Year	227.000	3710.770	3713.0200	3712	3713	0	3.48	88.17	102	0
RandolphCreek	4796	25-Year	271.000	3710.770	3713.1690	3713	3713	0	3.62	103.89	109	0
RandolphCreek	4796	50-Year	307.000	3710.770	3713.2630	3713	3713	0	3.75	114.24	113	0
RandolphCreek	4796	100-Year	344.000	3710.770	3713.3490	3713	3713	0	3.87	124.05	115	0
RandolphCreek	4796	500-Year	421.000	3710.770	3713.5620	3713	3714	0	4.07	149.55	123	0
RandolphCreek	4796	1%+	537.000	3710.770	3713.7890	3713	3714	0	4.26	177.65	125	0
RandolphCreek	5178	10-Year	227.000	3719.930	3722.6730	3722	3723	0	3.66	89.15	81	0
RandolphCreek	5178	25-Year	271.000	3719.930	3722.8240	3722	3723	0	3.89	101.78	85	0
RandolphCreek	5178	50-Year	307.000	3719.930	3722.9440	3722	3723	0	4.04	112.13	88	0
RandolphCreek	5178	100-Year	344.000	3719.930	3723.0620	3722	3723	0	4.18	122.67	91	0
RandolphCreek	5178	500-Year	421.000	3719.930	3723.3090	3723	3724	0	4.55	146.16	104	0
RandolphCreek	5178	1%+	537.000	3719.930	3723.5630	3723	3724	0	4.93	172.70	105	1
RandolphCreek	5421	10-Year	227.000	3726.090	3728.7300	3728	3729	0	3.94	88.69	69	0
RandolphCreek	5421	25-Year	271.000	3726.090	3728.9150	3728	3729	0	4.13	101.55	71	0
RandolphCreek	5421	50-Year	307.000	3726.090	3729.0490	3728	3729	0	4.28	111.11	71	0
RandolphCreek	5421	100-Year	344.000	3726.090	3729.1780	3729	3729	0	4.43	120.35	72	0
RandolphCreek	5421	500-Year	421.000	3726.090	3729.4480	3729	3730	0	4.65	140.04	74	0
RandolphCreek	5421	1%+	537.000	3726.090	3729.7970	3729	3730	0	4.99	165.97	75	0
RandolphCreek	5656	10-Year	227.000	3732.780	3735.9630	3735	3736	0	4.99	51.95	34	1
RandolphCreek	5656	25-Year	271.000	3732.780	3736.1630	3736	3737	0	5.38	58.94	36	1
RandolphCreek	5656	50-Year	307.000	3732.780	3736.3210	3736	3737	0	5.64	64.69	37	1
RandolphCreek	5656	100-Year	344.000	3732.780	3736.4750	3736	3737	0	5.89	70.52	39	1
RandolphCreek	5656	500-Year	421.000	3732.780	3736.7370	3736	3737	0	6.44	80.99	42	1
RandolphCreek	5656	1%+	537.000	3732.780	3737.1100	3737	3738	0	7.08	97.03	54	1
RandolphCreek	5805	10-Year	227.000	3738.290	3741.0750	3741	3741	0	3.89	76.18	55	0
RandolphCreek	5805	25-Year	271.000	3738.290	3741.2830	3741	3741	0	4.07	87.85	57	0
RandolphCreek	5805	50-Year	307.000	3738.290	3741.4380	3741	3742	0	4.21	96.69	58	0
RandolphCreek	5805	100-Year	344.000	3738.290	3741.5880	3741	3742	0	4.35	105.44	59	0
RandolphCreek	5805	500-Year	421.000	3738.290	3741.8960	3741	3742	0	4.58	123.67	60	0
RandolphCreek	5805	1%+	537.000	3738.290	3742.3070	3741	3743	0	4.91	148.94	63	0
RandolphCreek	5935	10-Year	227.000	3740.860	3744.7220	3744	3745	0	4.37	55.53	30	1
RandolphCreek	5935	25-Year	271.000	3740.860	3744.9240	3744	3745	0	4.76	61.70	31	1
RandolphCreek	5935	50-Year	307.000	3740.860	3745.0830	3744	3745	0	5.05	66.69	32	1
RandolphCreek	5935	100-Year	344.000	3740.860	3745.2350	3744	3746	0	5.32	71.64	33	1
RandolphCreek	5935	500-Year	421.000	3740.860	3745.5120	3745	3746	0	5.86	81.04	35	1
RandolphCreek	5935	1%+	537.000	3740.860	3745.8910	3745	3747	0	6.55	94.55	37	1

HEC-RAS Plan: MultipleProfiles River: Rainy Creek Reach: Rainy Creek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Rainy Creek	203.19	10-year	183.000	3619.000	3621.2010	3621	3621	0	3.88	59.75	65	1
Rainy Creek	203.19	25-year	217.000	3619.000	3621.3480	3621	3622	0	4.10	70.27	80	1
Rainy Creek	203.19	50-year	245.000	3619.000	3621.4530	3621	3622	0	4.25	79.63	94	1
Rainy Creek	203.19	100-year	273.000	3619.000	3621.5340	3621	3622	0	4.37	87.54	104	1
Rainy Creek	203.19	500-year	331.000	3619.000	3621.6980	3621	3622	0	4.59	106.94	129	1
Rainy Creek	203.19	1% plus	426.000	3619.000	3621.8880	3622	3622	0	4.85	135.23	159	1
Rainy Creek	416	10-year	183.000	3622.870	3624.7320	3624	3625	0	2.43	83.73	103	0
Rainy Creek	416	25-year	217.000	3622.870	3624.8410	3624	3625	0	2.55	95.19	108	0
Rainy Creek	416	50-year	245.000	3622.870	3624.9240	3624	3625	0	2.64	104.30	113	0
Rainy Creek	416	100-year	273.000	3622.870	3624.9980	3624	3625	0	2.74	112.87	117	0
Rainy Creek	416	500-year	331.000	3622.870	3625.1530	3625	3625	0	2.92	131.90	126	0
Rainy Creek	416	1% plus	426.000	3622.870	3625.3400	3625	3625	0	3.17	156.13	133	0
Rainy Creek	673	10-year	183.000	3626.800	3628.0650	3628	3628	0	2.28	92.32	179	0
Rainy Creek	673	25-year	217.000	3626.800	3628.1470	3628	3628	0	2.42	101.90	183	0
Rainy Creek	673	50-year	245.000	3626.800	3628.2140	3628	3628	0	2.52	109.65	185	0
Rainy Creek	673	100-year	273.000	3626.800	3628.2810	3628	3628	0	2.61	117.46	188	0
Rainy Creek	673	500-year	331.000	3626.800	3628.4130	3628	3629	0	2.78	132.95	195	0
Rainy Creek	673	1% plus	426.000	3626.800	3628.6100	3628	3629	0	3.04	156.88	205	0
Rainy Creek	886	10-year	183.000	3630.510	3632.6450	3633	3633	0	4.79	51.01	82	1
Rainy Creek	886	25-year	217.000	3630.510	3632.7290	3633	3633	0	4.89	57.79	87	1
Rainy Creek	886	50-year	245.000	3630.510	3632.7870	3633	3633	0	5.03	62.52	89	1
Rainy Creek	886	100-year	273.000	3630.510	3632.8390	3633	3633	0	5.19	66.72	91	1
Rainy Creek	886	500-year	331.000	3630.510	3632.9430	3633	3633	0	5.46	75.25	96	1
Rainy Creek	886	1% plus	426.000	3630.510	3633.1060	3633	3633	0	5.80	88.67	103	1
Rainy Creek	1040	10-year	183.000	3633.680	3636.2450	3635	3636	0	3.48	55.49	54	0
Rainy Creek	1040	25-year	217.000	3633.680	3636.3810	3636	3637	0	3.76	63.52	73	0
Rainy Creek	1040	50-year	245.000	3633.680	3636.4830	3636	3637	0	3.94	70.62	85	0
Rainy Creek	1040	100-year	273.000	3633.680	3636.5810	3636	3637	0	4.08	77.64	90	0
Rainy Creek	1040	500-year	331.000	3633.680	3636.7570	3636	3637	0	4.36	90.99	99	1
Rainy Creek	1040	1% plus	426.000	3633.680	3636.9970	3637	3637	0	4.74	109.72	109	1
Rainy Creek	1247	10-year	183.000	3637.670	3639.3680	3639	3639	0	3.04	72.96	68	0
Rainy Creek	1247	25-year	217.000	3637.670	3639.5180	3639	3640	0	3.14	83.23	69	0
Rainy Creek	1247	50-year	245.000	3637.670	3639.6270	3639	3640	0	3.23	90.78	69	0
Rainy Creek	1247	100-year	273.000	3637.670	3639.7250	3639	3640	0	3.34	97.56	70	0
Rainy Creek	1247	500-year	331.000	3637.670	3639.9160	3639	3640	0	3.54	110.92	70	0
Rainy Creek	1247	1% plus	426.000	3637.670	3640.1950	3639	3640	0	3.84	130.55	71	0
Rainy Creek	1418	10-year	183.000	3642.700	3643.9390	3644	3644	0	4.30	41.36	54	1
Rainy Creek	1418	25-year	217.000	3642.700	3643.9960	3644	3644	0	4.71	44.44	55	1
Rainy Creek	1418	50-year	245.000	3642.700	3644.0460	3644	3645	0	4.99	47.14	55	1
Rainy Creek	1418	100-year	273.000	3642.700	3644.1150	3644	3645	0	5.10	50.98	56	1
Rainy Creek	1418	500-year	331.000	3642.700	3644.2700	3644	3645	0	5.20	59.75	57	1
Rainy Creek	1418	1% plus	426.000	3642.700	3644.5850	3645	3645	0	4.98	78.31	61	1
Rainy Creek	1580	10-year	183.000	3643.760	3646.4610	3645	3647	0	2.78	69.31	44	0
Rainy Creek	1580	25-year	217.000	3643.760	3646.6780	3645	3647	0	2.97	79.79	54	0
Rainy Creek	1580	50-year	245.000	3643.760	3646.8330	3645	3647	0	3.10	89.21	64	0
Rainy Creek	1580	100-year	273.000	3643.760	3646.9600	3646	3647	0	3.23	97.40	65	0
Rainy Creek	1580	500-year	331.000	3643.760	3647.1840	3646	3647	0	3.48	112.35	68	0
Rainy Creek	1580	1% plus	426.000	3643.760	3647.4380	3646	3648	0	3.94	130.83	81	0
Rainy Creek	1712	10-year	183.000	3646.120	3648.0100	3648	3649	0	6.37	29.70	25	1
Rainy Creek	1712	25-year	217.000	3646.120	3648.1890	3648	3649	0	6.63	34.33	27	1
Rainy Creek	1712	50-year	245.000	3646.120	3648.3250	3648	3649	0	6.82	38.06	28	1
Rainy Creek	1712	100-year	273.000	3646.120	3648.4470	3648	3649	0	7.03	41.54	29	1
Rainy Creek	1712	500-year	331.000	3646.120	3648.6830	3649	3649	0	7.39	48.72	31	1
Rainy Creek	1712	1% plus	426.000	3646.120	3649.0700	3649	3650	0	7.72	61.63	35	1
Rainy Creek	1799	10-year	183.000	3648.090	3650.9880	3650	3651	0	4.63	50.07	46	1
Rainy Creek	1799	25-year	217.000	3648.090	3651.1540	3651	3651	0	4.89	57.85	48	1
Rainy Creek	1799	50-year	245.000	3648.090	3651.2890	3651	3652	0	5.11	64.70	55	1
Rainy Creek	1799	100-year	273.000	3648.090	3651.4120	3651	3652	0	5.25	71.76	60	1
Rainy Creek	1799	500-year	331.000	3648.090	3651.6350	3651	3652	0	5.48	86.52	70	1
Rainy Creek	1799	1% plus	426.000	3648.090	3651.9390	3652	3652	0	5.86	114.10	100	1
Rainy Creek	1998	10-year	183.000	3652.670	3655.4490	3655	3656	0	5.55	45.12	48	1
Rainy Creek	1998	25-year	217.000	3652.670	3655.5970	3655	3656	0	5.68	52.37	50	1
Rainy Creek	1998	50-year	245.000	3652.670	3655.7200	3656	3656	0	5.73	58.68	53	1
Rainy Creek	1998	100-year	273.000	3652.670	3655.8210	3656	3656	0	5.88	64.08	55	1
Rainy Creek	1998	500-year	331.000	3652.670	3656.0070	3656	3656	0	6.19	74.90	61	1
Rainy Creek	1998	1% plus	426.000	3652.670	3656.3070	3656	3657	0	6.56	94.94	74	1
Rainy Creek	2127	10-year	183.000	3654.870	3657.7050	3657	3658	0	3.30	67.52	51	0
Rainy Creek	2127	25-year	217.000	3654.870	3657.8660	3657	3658	0	3.53	75.93	55	0
Rainy Creek	2127	50-year	245.000	3654.870	3657.9830	3657	3658	0	3.72	82.85	62	0
Rainy Creek	2127	100-year	273.000	3654.870	3658.0940	3657	3658	0	3.84	89.82	64	0
Rainy Creek	2127	500-year	331.000	3654.870	3658.3080	3658	3659	0	4.06	103.79	67	0
Rainy Creek	2127	1% plus	426.000	3654.870	3658.6090	3658	3659	0	4.35	124.57	71	0
Rainy Creek	2377	10-year	183.000	3659.540	3661.3690	3661	3662	0	3.79	65.48	85	1
Rainy Creek	2377	25-year	217.000	3659.540	3661.5000	3661	3662	0	3.84	77.00	91	1
Rainy Creek	2377	50-year	245.000	3659.540	3661.6050	3661	3662	0	3.87	86.81	95	1
Rainy Creek	2377	100-year	273.000	3659.540	3661.6920	3661	3662	0	3.95	95.63	107	1

HEC-RAS Plan: MultipleProfiles River: Rainy Creek Reach: Rainy Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Rainy Creek	2377	500-year	331.000	3659.540	3661.8530	3661	3662	0	4.09	113.38	113	1
Rainy Creek	2377	1% plus	426.000	3659.540	3662.0860	3662	3662	0	4.31	141.72	127	1
Rainy Creek	2620	10-year	183.000	3663.670	3665.4890	3665	3666	0	2.74	92.13	111	0
Rainy Creek	2620	25-year	217.000	3663.670	3665.6270	3665	3666	0	3.03	108.59	125	0
Rainy Creek	2620	50-year	245.000	3663.670	3665.6950	3665	3666	0	3.19	117.22	129	0
Rainy Creek	2620	100-year	273.000	3663.670	3665.7800	3665	3666	0	3.33	128.81	140	0
Rainy Creek	2620	500-year	331.000	3663.670	3665.9060	3665	3666	0	3.55	146.83	145	0
Rainy Creek	2620	1% plus	426.000	3663.670	3666.0950	3665	3666	0	3.85	175.05	152	0
Rainy Creek	2725	10-year	183.000	3665.040	3667.2010	3667	3668	0	4.94	39.79	32	1
Rainy Creek	2725	25-year	217.000	3665.040	3667.3850	3667	3668	0	5.15	45.94	35	1
Rainy Creek	2725	50-year	245.000	3665.040	3667.5020	3667	3668	0	5.38	50.10	36	1
Rainy Creek	2725	100-year	273.000	3665.040	3667.6070	3667	3668	0	5.62	54.00	38	1
Rainy Creek	2725	500-year	331.000	3665.040	3667.7820	3668	3668	0	6.12	61.02	41	1
Rainy Creek	2725	1% plus	426.000	3665.040	3668.0220	3668	3669	0	6.86	71.47	46	1
Rainy Creek	2963	10-year	183.000	3669.810	3672.1790	3672	3672	0	3.41	72.34	79	0
Rainy Creek	2963	25-year	217.000	3669.810	3672.3030	3672	3672	0	3.58	82.41	83	0
Rainy Creek	2963	50-year	245.000	3669.810	3672.4090	3672	3673	0	3.68	91.29	86	0
Rainy Creek	2963	100-year	273.000	3669.810	3672.5110	3672	3673	0	3.76	100.19	89	0
Rainy Creek	2963	500-year	331.000	3669.810	3672.7120	3672	3673	0	3.87	118.87	95	0
Rainy Creek	2963	1% plus	426.000	3669.810	3673.0060	3672	3673	0	4.02	147.79	102	0

HEC-RAS Plan: MultipleProfiles River: Denna Mora Creek Reach: Denna Mora Creek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Denna Mora Creek	181.92	10-year	54.000	3762.280	3762.9470	3763	3763	0	1.26	45.58	219	0
Denna Mora Creek	181.92	25-year	67.000	3762.280	3763.0280	3763	3763	0	1.43	52.79	226	0
Denna Mora Creek	181.92	50-year	77.000	3762.280	3763.0850	3763	3763	0	1.54	57.99	232	0
Denna Mora Creek	181.92	100-year	87.000	3762.280	3763.1380	3763	3763	0	1.64	62.97	236	0
Denna Mora Creek	181.92	500-year	110.000	3762.280	3763.2500	3763	3763	0	1.84	73.58	246	0
Denna Mora Creek	181.92	1% plus	136.000	3762.280	3763.3640	3763	3763	0	2.03	84.61	260	0
Denna Mora Creek	354	10-year	54.000	3765.730	3767.2140	3767	3767	0	2.02	33.59	53	0
Denna Mora Creek	354	25-year	67.000	3765.730	3767.3080	3767	3767	0	2.19	38.65	54	0
Denna Mora Creek	354	50-year	77.000	3765.730	3767.3750	3767	3767	0	2.31	42.30	54	0
Denna Mora Creek	354	100-year	87.000	3765.730	3767.4390	3767	3768	0	2.42	45.77	55	0
Denna Mora Creek	354	500-year	110.000	3765.730	3767.5730	3767	3768	0	2.64	53.15	56	0
Denna Mora Creek	354	1% plus	136.000	3765.730	3767.7120	3767	3768	0	2.87	60.97	57	0
Denna Mora Creek	612	10-year	54.000	3772.740	3773.7130	3773	3774	0	1.88	31.51	53	0
Denna Mora Creek	612	25-year	67.000	3772.740	3773.8110	3773	3774	0	2.04	36.81	56	0
Denna Mora Creek	612	50-year	77.000	3772.740	3773.8780	3773	3774	0	2.14	40.67	58	0
Denna Mora Creek	612	100-year	87.000	3772.740	3773.9500	3774	3774	0	2.25	45.17	69	0
Denna Mora Creek	612	500-year	110.000	3772.740	3774.0800	3774	3774	0	2.43	54.18	71	0
Denna Mora Creek	612	1% plus	136.000	3772.740	3774.2100	3774	3774	0	2.61	63.51	72	0
Denna Mora Creek	826	10-year	54.000	3778.980	3780.2920	3780	3780	0	2.49	25.96	83	0
Denna Mora Creek	826	25-year	67.000	3778.980	3780.3970	3780	3780	0	2.63	31.15	92	1
Denna Mora Creek	826	50-year	77.000	3778.980	3780.4600	3780	3781	0	2.77	34.59	96	1
Denna Mora Creek	826	100-year	87.000	3778.980	3780.5220	3780	3781	0	2.89	38.13	101	1
Denna Mora Creek	826	500-year	110.000	3778.980	3780.6430	3780	3781	0	3.16	45.52	110	1
Denna Mora Creek	826	1% plus	136.000	3778.980	3780.7610	3780	3781	0	3.41	53.40	121	1
Denna Mora Creek	1022	10-year	54.000	3782.600	3784.8830	3784	3785	0	2.57	21.82	15	0
Denna Mora Creek	1022	25-year	67.000	3782.600	3785.0960	3784	3785	0	2.82	25.13	19	0
Denna Mora Creek	1022	50-year	77.000	3782.600	3785.2410	3784	3785	0	3.00	27.53	24	0
Denna Mora Creek	1022	100-year	87.000	3782.600	3785.3740	3784	3786	0	3.16	29.83	29	0
Denna Mora Creek	1022	500-year	110.000	3782.600	3785.6570	3785	3786	0	3.50	35.08	33	0
Denna Mora Creek	1022	1% plus	136.000	3782.600	3785.9310	3785	3786	0	3.84	40.70	36	0
Denna Mora Creek	1322	10-year	54.000	3790.540	3793.1450	3793	3794	0	4.86	11.44	8	1
Denna Mora Creek	1322	25-year	67.000	3790.540	3793.3900	3793	3794	0	5.21	13.52	9	1
Denna Mora Creek	1322	50-year	77.000	3790.540	3793.5700	3793	3794	0	5.43	15.14	9	1
Denna Mora Creek	1322	100-year	87.000	3790.540	3793.7410	3793	3794	0	5.63	16.83	13	1
Denna Mora Creek	1322	500-year	110.000	3790.540	3794.0760	3794	3795	0	6.00	22.15	19	1
Denna Mora Creek	1322	1% plus	136.000	3790.540	3794.3910	3794	3795	0	6.25	30.35	30	1
Denna Mora Creek	1646	10-year	54.000	3802.600	3803.9700	3803	3804	0	1.72	40.54	90	0
Denna Mora Creek	1646	25-year	67.000	3802.600	3804.0930	3803	3804	0	1.89	47.53	99	0
Denna Mora Creek	1646	50-year	77.000	3802.600	3804.1960	3804	3804	0	2.03	53.80	109	0
Denna Mora Creek	1646	100-year	87.000	3802.600	3804.2670	3804	3804	0	2.13	58.23	116	0
Denna Mora Creek	1646	500-year	110.000	3802.600	3804.4210	3804	3804	0	2.32	67.97	128	0
Denna Mora Creek	1646	1% plus	136.000	3802.600	3804.5890	3804	3805	0	2.03	120.57	140	0
Denna Mora Creek	1883	10-year	54.000	3806.660	3807.7680	3807	3808	0	1.63	44.84	66	0
Denna Mora Creek	1883	25-year	67.000	3806.660	3807.8750	3807	3808	0	1.75	51.99	68	0
Denna Mora Creek	1883	50-year	77.000	3806.660	3807.9550	3807	3808	0	1.83	57.42	69	0
Denna Mora Creek	1883	100-year	87.000	3806.660	3808.0280	3807	3808	0	1.91	62.42	70	0
Denna Mora Creek	1883	500-year	110.000	3806.660	3808.1780	3808	3808	0	2.07	73.04	71	0
Denna Mora Creek	1883	1% plus	136.000	3806.660	3808.1920	3808	3808	0	2.53	74.01	71	0
Denna Mora Creek	2014	10-year	54.000	3809.480	3810.9480	3811	3811	0	3.94	14.67	17	1
Denna Mora Creek	2014	25-year	67.000	3809.480	3811.0740	3811	3811	0	4.35	16.82	18	1
Denna Mora Creek	2014	50-year	77.000	3809.480	3811.1530	3811	3811	0	4.66	18.23	18	1
Denna Mora Creek	2014	100-year	87.000	3809.480	3811.2330	3811	3812	0	4.93	19.71	19	1
Denna Mora Creek	2014	500-year	110.000	3809.480	3811.4030	3811	3812	0	5.46	23.03	20	1
Denna Mora Creek	2014	1% plus	136.000	3809.480	3811.8290	3811	3812	0	5.08	32.31	23	1
Denna Mora Creek	2149	10-year	54.000	3815.970	3817.2920	3817	3817	0	2.77	28.26	53	0
Denna Mora Creek	2149	25-year	67.000	3815.970	3817.4030	3817	3818	0	2.89	34.57	60	0
Denna Mora Creek	2149	50-year	77.000	3815.970	3817.4860	3817	3818	0	2.96	39.76	65	0
Denna Mora Creek	2149	100-year	87.000	3815.970	3817.5600	3817	3818	0	3.02	44.70	69	0
Denna Mora Creek	2149	500-year	110.000	3815.970	3817.7130	3817	3818	0	3.16	55.83	76	0
Denna Mora Creek	2149	1% plus	136.000	3815.970	3817.7650	3817	3818	0	3.72	59.95	80	1
Denna Mora Creek	2342	10-year	54.000	3820.720	3822.7250	3822	3823	0	2.72	23.88	136	0
Denna Mora Creek	2342	25-year	67.000	3820.720	3822.8550	3822	3823	0	2.97	29.41	148	0
Denna Mora Creek	2342	50-year	77.000	3820.720	3822.9390	3822	3823	0	3.16	33.84	159	0
Denna Mora Creek	2342	100-year	87.000	3820.720	3823.0080	3822	3823	0	3.30	37.85	160	0
Denna Mora Creek	2342	500-year	110.000	3820.720	3823.1460	3823	3823	0	3.60	45.96	164	0
Denna Mora Creek	2342	1% plus	136.000	3820.720	3823.3790	3823	3824	0	3.54	60.13	173	0
Denna Mora Creek	2548	10-year	54.000	3828.050	3829.3730	3829	3830	0	3.23	21.33	35	1
Denna Mora Creek	2548	25-year	67.000	3828.050	3829.5130	3829	3830	0	3.40	26.22	50	1
Denna Mora Creek	2548	50-year	77.000	3828.050	3829.6150	3829	3830	0	3.50	30.06	66	1
Denna Mora Creek	2548	100-year	87.000	3828.050	3829.7050	3829	3830	0	3.60	33.70	74	1
Denna Mora Creek	2548	500-year	110.000	3828.050	3829.8910	3830	3830	0	3.81	41.89	89	1
Denna Mora Creek	2548	1% plus	136.000	3828.050	3829.9770	3830	3830	0	4.41	46.01	95	1
Denna Mora Creek	2693	10-year	54.000	3833.060	3834.5400	3834	3835	0	2.27	39.78	131	0
Denna Mora Creek	2693	25-year	67.000	3833.060	3834.6170	3834	3835	0	2.44	46.46	136	0
Denna Mora Creek	2693	50-year	77.000	3833.060	3834.6700	3834	3835	0	2.56	51.40	143	0
Denna Mora Creek	2693	100-year	87.000	3833.060	3834.7220	3834	3835	0	2.66	56.32	146	0
Denna Mora Creek	2693	500-year	110.000	3833.060	3834.8380	3835	3835	0	2.88	67.82	155	0
Denna Mora Creek	2693	1% plus	136.000	3833.060	3834.9890	3835	3835	0	2.85	83.13	169	0
Denna Mora Creek	2847	10-year	54.000	3838.930	3840.7570	3841	3841	0	4.21	14.64	25	1
Denna Mora Creek	2847	25-year	67.000	3838.930	3840.8950	3841	3841	0	4.50	18.64	32	1
Denna Mora Creek	2847	50-year	77.000	3838.930	3840.9860	3841	3841	0	4.64	21.64	33	1
Denna Mora Creek	2847	100-year	87.000	3838.930	3841.0660	3841	3841	0	4.80	24.31	34	1

HEC-RAS Plan: MultipleProfiles River: Denna Mora Creek Reach: Denna Mora Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Denna Mora Creek	2847	500-year	110.000	3838.930	3841.2280	3841	3842	0	5.12	29.89	35	1
Denna Mora Creek	2847	1% plus	136.000	3838.930	3841.2900	3841	3842	0	5.96	32.07	35	1
Denna Mora Creek	3185	10-year	54.000	3852.380	3853.0560	3853	3853	0	1.40	54.31	137	0
Denna Mora Creek	3185	25-year	67.000	3852.380	3853.1290	3853	3853	0	1.53	62.26	141	0
Denna Mora Creek	3185	50-year	77.000	3852.380	3853.1800	3853	3853	0	1.62	67.88	145	0
Denna Mora Creek	3185	100-year	87.000	3852.380	3853.2300	3853	3853	0	1.71	73.41	146	0
Denna Mora Creek	3185	500-year	110.000	3852.380	3853.3330	3853	3853	0	1.87	84.97	148	0
Denna Mora Creek	3185	1% plus	136.000	3852.380	3853.4750	3853	3854	0	1.95	101.01	150	0
Denna Mora Creek	3509	10-year	54.000	3862.880	3863.7180	3864	3864	0	2.72	28.60	59	1
Denna Mora Creek	3509	25-year	67.000	3862.880	3863.7940	3864	3864	0	2.93	33.28	66	1
Denna Mora Creek	3509	50-year	77.000	3862.880	3863.8490	3864	3864	0	3.05	37.03	70	1
Denna Mora Creek	3509	100-year	87.000	3862.880	3863.8990	3864	3864	0	3.19	40.63	74	1
Denna Mora Creek	3509	500-year	110.000	3862.880	3864.0120	3864	3864	0	3.49	49.54	82	1
Denna Mora Creek	3509	1% plus	136.000	3862.880	3864.0590	3864	3864	0	4.02	53.45	85	1
Denna Mora Creek	3953	10-year	54.000	3875.950	3877.4130	3877	3877	0	2.23	30.85	37	0
Denna Mora Creek	3953	25-year	67.000	3875.950	3877.5480	3877	3878	0	2.41	35.95	39	0
Denna Mora Creek	3953	50-year	77.000	3875.950	3877.6410	3877	3878	0	2.54	39.60	40	0
Denna Mora Creek	3953	100-year	87.000	3875.950	3877.7310	3877	3878	0	2.65	43.25	41	0
Denna Mora Creek	3953	500-year	110.000	3875.950	3877.9200	3877	3878	0	2.88	51.51	52	0
Denna Mora Creek	3953	1% plus	136.000	3875.950	3878.1980	3877	3878	0	3.04	69.84	74	0
Denna Mora Creek	4043	10-year	54.000	3879.720	3881.1210	3881	3882	0	5.27	12.12	18	1
Denna Mora Creek	4043	25-year	67.000	3879.720	3881.2700	3881	3882	0	5.53	14.91	20	1
Denna Mora Creek	4043	50-year	77.000	3879.720	3881.3750	3881	3882	0	5.71	17.06	21	1
Denna Mora Creek	4043	100-year	87.000	3879.720	3881.4730	3881	3882	0	5.85	19.21	23	1
Denna Mora Creek	4043	500-year	110.000	3879.720	3881.6380	3882	3882	0	6.37	23.09	25	1
Denna Mora Creek	4043	1% plus	136.000	3879.720	3881.8180	3882	3882	0	6.77	27.75	27	1
Denna Mora Creek	4120	10-year	54.000	3884.500	3885.9620	3886	3886	0	2.86	24.67	36	0
Denna Mora Creek	4120	25-year	67.000	3884.500	3886.0760	3886	3886	0	3.09	28.83	37	1
Denna Mora Creek	4120	50-year	77.000	3884.500	3886.1560	3886	3886	0	3.26	31.85	39	1
Denna Mora Creek	4120	100-year	87.000	3884.500	3886.2290	3886	3886	0	3.41	34.71	40	1
Denna Mora Creek	4120	500-year	110.000	3884.500	3886.4180	3886	3887	0	3.70	42.93	51	1
Denna Mora Creek	4120	1% plus	136.000	3884.500	3886.5740	3886	3887	0	3.93	51.23	54	1
Denna Mora Creek	4290	10-year	54.000	3889.650	3891.6850	3891	3892	0	3.05	23.30	36	0
Denna Mora Creek	4290	25-year	67.000	3889.650	3891.8200	3892	3892	0	3.24	28.56	42	0
Denna Mora Creek	4290	50-year	77.000	3889.650	3891.9110	3892	3892	0	3.36	32.60	46	0
Denna Mora Creek	4290	100-year	87.000	3889.650	3891.9960	3892	3892	0	3.46	36.55	48	0
Denna Mora Creek	4290	500-year	110.000	3889.650	3892.1620	3892	3892	0	3.71	45.65	66	0
Denna Mora Creek	4290	1% plus	136.000	3889.650	3892.3150	3892	3892	0	3.94	56.67	75	1
Denna Mora Creek	4572	10-year	54.000	3900.890	3902.4970	3902	3903	0	2.49	27.56	37	0
Denna Mora Creek	4572	25-year	67.000	3900.890	3902.6170	3902	3903	0	2.67	32.29	41	0
Denna Mora Creek	4572	50-year	77.000	3900.890	3902.7030	3902	3903	0	2.79	35.93	44	0
Denna Mora Creek	4572	100-year	87.000	3900.890	3902.7840	3902	3903	0	2.91	39.70	48	0
Denna Mora Creek	4572	500-year	110.000	3900.890	3902.9410	3902	3903	0	3.09	47.71	53	0
Denna Mora Creek	4572	1% plus	136.000	3900.890	3903.0960	3903	3903	0	3.25	56.04	55	0
Denna Mora Creek	4738	10-year	54.000	3908.780	3910.8120	3910	3911	0	2.63	20.56	17	0
Denna Mora Creek	4738	25-year	67.000	3908.780	3911.0130	3910	3911	0	2.76	24.75	25	0
Denna Mora Creek	4738	50-year	77.000	3908.780	3911.1290	3910	3911	0	2.89	27.79	27	0
Denna Mora Creek	4738	100-year	87.000	3908.780	3911.2300	3910	3911	0	3.01	30.76	32	0
Denna Mora Creek	4738	500-year	110.000	3908.780	3911.4170	3911	3912	0	3.28	36.82	33	0
Denna Mora Creek	4738	1% plus	136.000	3908.780	3911.5990	3911	3912	0	3.54	43.00	35	0
Denna Mora Creek	4782		Inl Struct									
Denna Mora Creek	4805	10-year	54.000	3912.180	3916.9880	3914	3917	0	0.83	71.17	32	0
Denna Mora Creek	4805	25-year	67.000	3912.180	3917.1220	3914	3917	0	0.98	75.56	34	0
Denna Mora Creek	4805	50-year	77.000	3912.180	3917.2110	3914	3917	0	1.09	78.59	34	0
Denna Mora Creek	4805	100-year	87.000	3912.180	3917.2910	3914	3917	0	1.19	81.35	35	0
Denna Mora Creek	4805	500-year	110.000	3912.180	3917.4600	3914	3917	0	1.42	87.41	36	0
Denna Mora Creek	4805	1% plus	136.000	3912.180	3917.6200	3915	3918	0	1.65	93.36	39	0
Denna Mora Creek	4880	10-year	54.000	3916.290	3917.2680	3917	3917	0	3.60	14.99	22	1
Denna Mora Creek	4880	25-year	67.000	3916.290	3917.5160	3917	3918	0	3.26	20.70	25	1
Denna Mora Creek	4880	50-year	77.000	3916.290	3917.6770	3917	3918	0	3.16	25.02	31	1
Denna Mora Creek	4880	100-year	87.000	3916.290	3917.8230	3917	3918	0	3.09	30.03	37	0
Denna Mora Creek	4880	500-year	110.000	3916.290	3918.1180	3918	3918	0	2.96	42.70	51	0
Denna Mora Creek	4880	1% plus	136.000	3916.290	3918.3920	3918	3918	0	2.84	59.84	72	0
Denna Mora Creek	5053	10-year	54.000	3921.750	3923.2840	3923	3923	0	1.29	46.48	47	0
Denna Mora Creek	5053	25-year	67.000	3921.750	3923.3810	3923	3923	0	1.46	51.14	48	0
Denna Mora Creek	5053	50-year	77.000	3921.750	3923.4500	3923	3923	0	1.58	54.50	49	0
Denna Mora Creek	5053	100-year	87.000	3921.750	3923.5130	3923	3924	0	1.69	57.60	50	0
Denna Mora Creek	5053	500-year	110.000	3921.750	3923.6340	3923	3924	0	1.94	63.65	51	0
Denna Mora Creek	5053	1% plus	136.000	3921.750	3923.7400	3923	3924	0	2.22	69.14	52	0
Denna Mora Creek	5184	10-year	54.000	3926.740	3928.2090	3928	3929	0	5.39	10.56	13	1
Denna Mora Creek	5184	25-year	67.000	3926.740	3928.3570	3928	3929	0	5.74	12.51	14	1
Denna Mora Creek	5184	50-year	77.000	3926.740	3928.5040	3928	3929	0	5.75	14.60	15	1
Denna Mora Creek	5184	100-year	87.000	3926.740	3928.6740	3929	3929	0	5.62	17.21	16	1
Denna Mora Creek	5184	500-year	110.000	3926.740	3929.0310	3929	3929	0	5.42	23.25	18	1
Denna Mora Creek	5184	1% plus	136.000	3926.740	3929.3910	3929	3930	0	5.30	30.18	20	1
Denna Mora Creek	5295	10-year	54.000	3935.490	3936.8080	3936	3937	0	2.09	34.14	45	0
Denna Mora Creek	5295	25-year	67.000	3935.490	3936.9250	3936	3937	0	2.22	39.42	46	0
Denna Mora Creek	5295	50-year	77.000	3935.490	3936.9950	3937	3937	0	2.34	42.63	46	0
Denna Mora Creek	5295	100-year	87.000	3935.490	3937.0480	3937	3937	0	2.49	45.13	47	0
Denna Mora Creek	5295	500-year	110.000	3935.490	3937.1600	3937	3937	0	2.79	50.36	47	0
Denna Mora Creek	5295	1% plus	136.000	3935.490	3937.2670	3937	3937	0	3.12	55.48	48	0

HEC-RAS Plan: MultipleProfiles River: Denna Mora Creek Reach: Denna Mora Creek (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Denna Mora Creek	5452	10-year	54.000	3940.580	3942.6710	3942	3943	0	2.56	21.20	16	0
Denna Mora Creek	5452	25-year	67.000	3940.580	3942.8550	3942	3943	0	2.81	24.39	18	0
Denna Mora Creek	5452	50-year	77.000	3940.580	3942.9960	3942	3943	0	2.94	27.47	23	0
Denna Mora Creek	5452	100-year	87.000	3940.580	3943.1430	3942	3943	0	3.02	30.93	24	0
Denna Mora Creek	5452	500-year	110.000	3940.580	3943.4360	3942	3944	0	3.19	38.52	27	0
Denna Mora Creek	5452	1% plus	136.000	3940.580	3943.7270	3943	3944	0	3.35	47.04	32	0
Denna Mora Creek	5633	10-year	54.000	3959.460	3961.2100	3961	3962	0	5.52	9.88	11	1
Denna Mora Creek	5633	25-year	67.000	3959.460	3961.3570	3961	3962	0	5.93	11.55	12	1
Denna Mora Creek	5633	50-year	77.000	3959.460	3961.4720	3961	3962	0	6.15	12.95	12	1
Denna Mora Creek	5633	100-year	87.000	3959.460	3961.5990	3962	3962	0	6.26	14.56	13	1
Denna Mora Creek	5633	500-year	110.000	3959.460	3961.8420	3962	3962	0	6.58	17.94	15	1
Denna Mora Creek	5633	1% plus	136.000	3959.460	3962.0630	3962	3963	0	7.00	21.32	16	1
Denna Mora Creek	5889	10-year	54.000	3980.370	3982.2690	3982	3982	0	2.29	26.44	29	0
Denna Mora Creek	5889	25-year	67.000	3980.370	3982.4210	3982	3983	0	2.47	31.21	35	0
Denna Mora Creek	5889	50-year	77.000	3980.370	3982.5210	3982	3983	0	2.60	34.91	39	0
Denna Mora Creek	5889	100-year	87.000	3980.370	3982.6050	3982	3983	0	2.73	38.30	42	0
Denna Mora Creek	5889	500-year	110.000	3980.370	3982.7860	3982	3983	0	2.97	46.59	49	0
Denna Mora Creek	5889	1% plus	136.000	3980.370	3982.9550	3982	3983	0	3.16	54.97	51	0
Denna Mora Creek	6050	10-year	54.000	3992.010	3993.2110	3993	3993	0	3.71	14.80	20	1
Denna Mora Creek	6050	25-year	67.000	3992.010	3993.3290	3993	3994	0	4.00	17.16	21	1
Denna Mora Creek	6050	50-year	77.000	3992.010	3993.4190	3993	3994	0	4.18	19.07	22	1
Denna Mora Creek	6050	100-year	87.000	3992.010	3993.5130	3993	3994	0	4.30	21.18	23	1
Denna Mora Creek	6050	500-year	110.000	3992.010	3993.6960	3993	3994	0	4.58	25.74	26	1
Denna Mora Creek	6050	1% plus	136.000	3992.010	3993.8610	3994	3994	0	4.92	30.16	28	1
Denna Mora Creek	6202	10-year	54.000	4003.610	4005.1040	4005	4005	0	2.09	30.82	41	0
Denna Mora Creek	6202	25-year	67.000	4003.610	4005.2220	4005	4005	0	2.25	35.89	44	0
Denna Mora Creek	6202	50-year	77.000	4003.610	4005.3010	4005	4005	0	2.37	39.47	46	0
Denna Mora Creek	6202	100-year	87.000	4003.610	4005.3710	4005	4005	0	2.49	42.76	48	0
Denna Mora Creek	6202	500-year	110.000	4003.610	4005.5270	4005	4006	0	2.72	50.52	52	0
Denna Mora Creek	6202	1% plus	136.000	4003.610	4005.7100	4005	4006	0	2.95	61.61	63	0
Denna Mora Creek	6403	10-year	54.000	4016.230	4017.4670	4017	4018	0	2.95	22.71	38	1
Denna Mora Creek	6403	25-year	67.000	4016.230	4017.5730	4017	4018	0	3.15	26.98	42	1
Denna Mora Creek	6403	50-year	77.000	4016.230	4017.6470	4017	4018	0	3.26	30.14	44	1
Denna Mora Creek	6403	100-year	87.000	4016.230	4017.7170	4017	4018	0	3.33	33.21	45	1
Denna Mora Creek	6403	500-year	110.000	4016.230	4017.8600	4018	4018	0	3.50	39.69	46	1
Denna Mora Creek	6403	1% plus	136.000	4016.230	4017.9970	4018	4018	0	3.71	46.15	48	1
Denna Mora Creek	6580	10-year	54.000	4028.120	4029.9530	4030	4030	0	2.81	22.47	27	0
Denna Mora Creek	6580	25-year	67.000	4028.120	4030.0940	4030	4030	0	3.02	26.63	32	0
Denna Mora Creek	6580	50-year	77.000	4028.120	4030.1850	4030	4030	0	3.18	29.71	37	0
Denna Mora Creek	6580	100-year	87.000	4028.120	4030.2630	4030	4030	0	3.33	32.80	41	0
Denna Mora Creek	6580	500-year	110.000	4028.120	4030.4210	4030	4031	0	3.61	39.95	49	0
Denna Mora Creek	6580	1% plus	136.000	4028.120	4030.5770	4030	4031	0	3.84	48.05	54	0
Denna Mora Creek	6695		Inl Struct									
Denna Mora Creek	6708	10-year	54.000	4040.690	4041.8540	4041	4042	0	1.45	42.68	72	0
Denna Mora Creek	6708	25-year	67.000	4040.690	4041.9420	4042	4042	0	1.56	49.14	74	0
Denna Mora Creek	6708	50-year	77.000	4040.690	4042.0050	4042	4042	0	1.63	53.83	76	0
Denna Mora Creek	6708	100-year	87.000	4040.690	4042.0620	4042	4042	0	1.74	58.35	80	0
Denna Mora Creek	6708	500-year	110.000	4040.690	4042.1710	4042	4042	0	1.90	67.13	82	0
Denna Mora Creek	6708	1% plus	136.000	4040.690	4042.2890	4042	4042	0	2.05	77.00	85	0
Denna Mora Creek	6830	10-year	54.000	4049.230	4050.1180	4050	4050	0	3.51	15.60	28	1
Denna Mora Creek	6830	25-year	67.000	4049.230	4050.1990	4050	4050	0	3.84	17.81	33	1
Denna Mora Creek	6830	50-year	77.000	4049.230	4050.2570	4050	4051	0	4.06	19.43	34	1
Denna Mora Creek	6830	100-year	87.000	4049.230	4050.3360	4050	4051	0	4.14	21.69	37	1
Denna Mora Creek	6830	500-year	110.000	4049.230	4050.4790	4050	4051	0	4.42	25.97	40	1
Denna Mora Creek	6830	1% plus	136.000	4049.230	4050.6080	4050	4051	0	4.78	30.05	44	1
Denna Mora Creek	6938	10-year	54.000	4060.290	4061.5080	4061	4062	0	2.42	26.69	53	0
Denna Mora Creek	6938	25-year	67.000	4060.290	4061.6190	4061	4062	0	2.58	31.03	55	0
Denna Mora Creek	6938	50-year	77.000	4060.290	4061.6980	4061	4062	0	2.69	34.18	57	0
Denna Mora Creek	6938	100-year	87.000	4060.290	4061.7570	4061	4062	0	2.85	36.64	59	0
Denna Mora Creek	6938	500-year	110.000	4060.290	4061.8960	4061	4062	0	3.11	42.60	63	0
Denna Mora Creek	6938	1% plus	136.000	4060.290	4062.0440	4062	4062	0	3.33	49.38	68	0

HEC-RAS Plan: MultipleProfiles River: Hanaker Creek Reach: Hanaker Creek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Hanaker Creek	31.86	10-year	75.000	3861.710	3863.6130	3863	3864	0	3.96	21.79	21	1
Hanaker Creek	31.86	25-year	91.000	3861.710	3863.7670	3863	3864	0	4.22	25.21	23	1
Hanaker Creek	31.86	50-year	104.000	3861.710	3863.8810	3864	3864	0	4.41	27.91	24	1
Hanaker Creek	31.86	100-year	117.000	3861.710	3863.9870	3864	3864	0	4.58	30.54	25	1
Hanaker Creek	31.86	500-year	146.000	3861.710	3864.1990	3864	3865	0	4.92	36.17	28	1
Hanaker Creek	31.86	1% plus	183.000	3861.710	3864.4340	3864	3865	0	5.28	42.95	30	1
Hanaker Creek	107	10-year	75.000	3870.940	3872.5770	3873	3873	0	4.71	20.74	28	1
Hanaker Creek	107	25-year	91.000	3870.940	3872.6920	3873	3873	0	4.96	24.07	30	1
Hanaker Creek	107	50-year	104.000	3870.940	3872.7790	3873	3873	0	5.13	26.67	31	1
Hanaker Creek	107	100-year	117.000	3870.940	3872.8590	3873	3873	0	5.29	29.19	32	1
Hanaker Creek	107	500-year	146.000	3870.940	3873.0210	3873	3873	0	5.60	34.50	34	1
Hanaker Creek	107	1% plus	183.000	3870.940	3873.2050	3873	3874	0	5.94	40.84	36	1
Hanaker Creek	201	10-year	75.000	3880.070	3882.3840	3882	3883	0	3.77	21.63	17	1
Hanaker Creek	201	25-year	91.000	3880.070	3882.5630	3882	3883	0	4.06	24.86	19	1
Hanaker Creek	201	50-year	104.000	3880.070	3882.6940	3882	3883	0	4.27	27.40	20	1
Hanaker Creek	201	100-year	117.000	3880.070	3882.8140	3882	3883	0	4.46	29.87	21	1
Hanaker Creek	201	500-year	146.000	3880.070	3883.0530	3882	3883	0	4.84	35.13	23	1
Hanaker Creek	201	1% plus	183.000	3880.070	3883.3150	3883	3884	0	5.25	41.39	25	1
Hanaker Creek	316	10-year	75.000	3889.480	3891.5660	3891	3892	0	4.20	19.27	14	1
Hanaker Creek	316	25-year	91.000	3889.480	3891.7660	3891	3892	0	4.49	22.18	15	1
Hanaker Creek	316	50-year	104.000	3889.480	3891.9170	3891	3892	0	4.70	24.46	15	1
Hanaker Creek	316	100-year	117.000	3889.480	3892.0580	3892	3892	0	4.88	26.69	16	1
Hanaker Creek	316	500-year	146.000	3889.480	3892.3460	3892	3893	0	5.25	31.48	17	1
Hanaker Creek	316	1% plus	183.000	3889.480	3892.6700	3892	3893	0	5.66	37.32	19	1
Hanaker Creek	554	10-year	75.000	3912.790	3914.9080	3915	3915	0	4.64	17.62	13	1
Hanaker Creek	554	25-year	91.000	3912.790	3915.0960	3915	3915	0	5.00	20.14	14	1
Hanaker Creek	554	50-year	104.000	3912.790	3915.2380	3915	3916	0	5.26	22.18	15	1
Hanaker Creek	554	100-year	117.000	3912.790	3915.3680	3915	3916	0	5.50	24.13	15	1
Hanaker Creek	554	500-year	146.000	3912.790	3915.6290	3915	3916	0	5.96	28.39	17	1
Hanaker Creek	554	1% plus	183.000	3912.790	3915.9250	3916	3916	0	6.47	33.70	19	1
Hanaker Creek	728	10-year	75.000	3928.720	3930.4710	3930	3931	0	3.14	32.40	73	0
Hanaker Creek	728	25-year	91.000	3928.720	3930.5760	3930	3931	0	3.27	37.04	74	0
Hanaker Creek	728	50-year	104.000	3928.720	3930.6560	3930	3931	0	3.36	40.58	74	0
Hanaker Creek	728	100-year	117.000	3928.720	3930.7320	3930	3931	0	3.44	44.00	75	0
Hanaker Creek	728	500-year	146.000	3928.720	3930.8900	3930	3931	0	3.61	51.10	76	0
Hanaker Creek	728	1% plus	183.000	3928.720	3931.0750	3931	3931	0	3.81	59.45	77	0
Hanaker Creek	801	10-year	75.000	3933.240	3935.4320	3935	3936	0	3.63	23.08	28	0
Hanaker Creek	801	25-year	91.000	3933.240	3935.5920	3935	3936	0	3.94	26.12	32	1
Hanaker Creek	801	50-year	104.000	3933.240	3935.7090	3935	3936	0	4.18	28.46	35	1
Hanaker Creek	801	100-year	117.000	3933.240	3935.8170	3935	3936	0	4.40	30.69	37	1
Hanaker Creek	801	500-year	146.000	3933.240	3936.0280	3935	3936	0	4.84	35.32	46	1
Hanaker Creek	801	1% plus	183.000	3933.240	3936.2930	3936	3937	0	5.41	42.26	57	1
Hanaker Creek	917	10-year	75.000	3942.610	3944.3240	3944	3944	0	3.64	27.34	44	1
Hanaker Creek	917	25-year	91.000	3942.610	3944.4480	3944	3945	0	3.71	32.97	46	1
Hanaker Creek	917	50-year	104.000	3942.610	3944.5400	3944	3945	0	3.77	37.27	47	1
Hanaker Creek	917	100-year	117.000	3942.610	3944.6290	3944	3945	0	3.81	41.50	48	1
Hanaker Creek	917	500-year	146.000	3942.610	3944.8080	3945	3945	0	3.91	50.37	50	1
Hanaker Creek	917	1% plus	183.000	3942.610	3945.0220	3945	3945	0	4.00	61.41	53	0
Hanaker Creek	1020	10-year	75.000	3947.480	3949.5580	3949	3950	0	2.59	31.55	24	0
Hanaker Creek	1020	25-year	91.000	3947.480	3949.7190	3949	3950	0	2.83	35.43	25	0
Hanaker Creek	1020	50-year	104.000	3947.480	3949.8350	3949	3950	0	3.01	38.34	25	0
Hanaker Creek	1020	100-year	117.000	3947.480	3949.9410	3949	3950	0	3.18	41.06	26	0
Hanaker Creek	1020	500-year	146.000	3947.480	3950.1560	3949	3950	0	3.53	46.85	28	0
Hanaker Creek	1020	1% plus	183.000	3947.480	3950.3850	3949	3951	0	3.93	53.61	32	0
Hanaker Creek	1182	10-year	75.000	3959.140	3960.6090	3961	3961	0	4.93	16.90	21	1
Hanaker Creek	1182	25-year	91.000	3959.140	3960.7790	3961	3961	0	5.01	20.64	23	1
Hanaker Creek	1182	50-year	104.000	3959.140	3960.9030	3961	3961	0	5.09	23.59	24	1
Hanaker Creek	1182	100-year	117.000	3959.140	3961.0260	3961	3961	0	5.13	26.68	26	1
Hanaker Creek	1182	500-year	146.000	3959.140	3961.2700	3961	3962	0	5.25	33.41	29	1
Hanaker Creek	1182	1% plus	183.000	3959.140	3961.5510	3961	3962	0	5.38	42.18	33	1
Hanaker Creek	1301	10-year	75.000	3966.820	3968.9310	3968	3969	0	2.49	37.38	35	0
Hanaker Creek	1301	25-year	91.000	3966.820	3969.0800	3968	3969	0	2.72	42.89	39	0
Hanaker Creek	1301	50-year	104.000	3966.820	3969.1770	3968	3969	0	2.86	46.76	41	0
Hanaker Creek	1301	100-year	117.000	3966.820	3969.2650	3968	3969	0	3.01	50.36	42	0
Hanaker Creek	1301	500-year	146.000	3966.820	3969.4360	3969	3970	0	3.27	57.74	44	0
Hanaker Creek	1301	1% plus	183.000	3966.820	3969.6210	3969	3970	0	3.58	65.99	45	0