

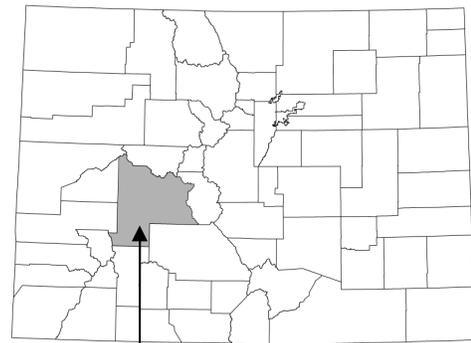
FLOOD INSURANCE STUDY



GUNNISON COUNTY, COLORADO AND INCORPORATED AREAS

<i>Community Name</i>	<i>Community Number</i>
CRESTED BUTTE, TOWN OF GUNNISON COUNTY (UNINCORPORATED AREAS)	080079 080078
GUNNISON, CITY OF	080080
MARBLE, TOWN OF	080197
MT. CRESTED BUTTE, TOWN OF *	080306
PITKIN, TOWN OF	080293

* No Special Flood Hazard Areas Identified



Gunnison County

Effective: May 16, 2013



Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
08051CV000A

**NOTICE TO
FLOOD INSURANCE STUDY USERS**

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) report may not contain all data available within the Community Map Repository. Please contact the Community Map Repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current FIS report components.

Selected Flood Insurance Rate Map panels for this community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross-sections). In addition, former flood hazard designations have been changed as follows:

<u>Old Zones</u>	<u>New Zone</u>
A1 and A3	AE
B	X
C	X

Initial Countywide FIS Effective Date: May 16, 2013

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FLOOD INSURANCE STUDY
GUNNISON COUNTY, COLORADO AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and supersedes the FIS reports and/or Flood Insurance Rate Maps (FIRMs)/Flood Boundary and Floodway Maps in the geographic area of Gunnison County, Colorado, including the City of Gunnison and the Towns of Crested Butte, Mount Crested Butte, Marble, and Pitkin, and unincorporated areas of Gunnison County (hereinafter referred to collectively as Gunnison County) and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates. This information will also be used by Gunnison County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that the Town of Mt. Crested Butte has no Special Flood Hazard Areas identified.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The initial countywide FIS was prepared by incorporating data from the City of Gunnison and the unincorporated areas of Gunnison County (References 1 and 2). Information on the authority and acknowledgements as compiled from their previously printed individual FIS reports is shown below.

City of Gunnison

The hydrologic and hydraulic analyses for the original study for the City of Gunnison were performed by Engineering Consultants, Inc. and reviewed by Camp Dresser & McKee Inc. for the Federal Insurance Administration, under Contract No. EMW-0046. The study was completed in August 1980 (Reference 3).

Gunnison County (Unincorporated Areas)

The hydrologic and hydraulic analyses for the original study of the unincorporated areas of Gunnison County were performed by the U.S. Army Corps of Engineers (USACE), Sacramento District, for FEMA, as reported in Flood Hazard Information Report, North Fork Gunnison River, Hotchkiss to Somerset, Colorado, 1980 (Reference 4) and Engineering Consultants, Inc., as reported in Floodplain Information Report, Gunnison River/Tomichi Creek, Gunnison, Colorado, 1976 (Reference 5).

There were no previously printed Flood Insurance Studies for the Towns of Crested Butte, Marble, Mt. Crested Butte, and Pitkin.

For the initial countywide FIS, the hydraulic analyses for the East River, the Gunnison River and the Slate River were performed by PBS&J for FEMA (Reference 6). This work was completed in 2010. Additionally, an existing data study (XDS) for the Crystal River was incorporated (Reference 7). This study was completed in 2004 by Icon Engineering, Inc. for the Colorado Water Conservation Board (CWCB). The revised hydraulic analysis for Tomichi Creek was performed by Michael Baker Jr., Inc. for FEMA under contract number HSFEHQ-04-D-0025, task order number HSFE08-09-J-0023 (Reference 8). This study was completed in March 2011.

The digital base mapping information was provided by the USDA Data Gateway, Federal Center, 501 W. Felix St., Bldg. 23, P.O. Box 6567, Fort Worth, Texas. It was downloaded from their website, www.datagateway.nrcs.usda.gov. These files were compiled by remote-sensing methods and meet or exceed National Map Accuracy Standards at the original compilation scale of 1:12,000. The primary digital orthophotoquad (DOQ) is a 1-meter ground resolution, quarter-quadrangle (3.75-minute of latitude and 3.75-minute of longitude) image cast on the Universal Transverse Mercator Projection (UTM) on the North American Datum of 1983 (NAD83).

1.3 Coordination

For the countywide FIS, the initial Consultation Coordination Officer (CCO) meeting was held on January 29, 2008, and attended by representatives of FEMA, CWCB, Baker, Gunnison County, City of Gunnison, Towns of Crested Butte, Marble, and Pitkin, and the study contractor.

The results of the study were reviewed at the final CCO meeting held on January 11, 2012, and attended by representatives of FEMA, CWCB, Gunnison County, City of Gunnison, Towns of Crested Butte and Mt. Crested Butte, and the study contractor. All issues raised at that meeting have been addressed.

The countywide FIS was prepared by incorporating data from the City of Gunnison and the unincorporated areas of Gunnison County (References 1 and 2). Information on the coordination of the original studies as compiled from their previously printed individual FIS reports is shown below.

City of Gunnison

An initial coordination meeting was held on June 25, 1979, attended by the city and county officials, representatives of FEMA, CWCB, and Camp Dresser & McKee Inc. The purpose of the meeting was to discuss the nature of the study, the scope and limits of work, and flood information currently available concerning the community.

A second coordination meeting was held on October 24, 1979, attended by Gunnison's City Engineer and Public Works Director and Camp Dresser & McKee Inc. Camp Dresser & McKee Inc. informed the city of their intentions and solicited any information on new developments or existing problems in the study area.

A legal notice was placed in the Gunnison County Times one day a week for three consecutive weeks, beginning October 22, 1979, to notify all interested persons of the beginning of the study and its objectives and to solicit any relevant facts and technical data concerning local flood hazards.

Federal, State, and local agencies were contacted regarding the availability of any reports, studies, or investigations which may contain some information relative to flooding problems in the community. Information was received from FEMA and CWCB.

During the course of the study, the results of hydrologic analyses and flood elevations and boundaries, prepared by Engineering Consultants, Inc. (Reference 3) for the City of Gunnison, Gunnison County and CWCB, were reviewed. As a result of the review and coordination with FEMA and CWCB, the information supplied was used in the FIS.

Gunnison County (Unincorporated Areas)

On September 27, 1988 the results of the Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the community and FEMA.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Gunnison County, Colorado including the City of Gunnison and the Towns of Crested Butte, Mount Crested Butte, Marble, Pitkin, and unincorporated areas of Gunnison County.

The streams studied by detailed methods are presented in Table 1.

Table 1 – Streams Studied by Detailed Methods

<u>Stream</u>	<u>Limits of Detailed Study</u>
Clark Stream	From just upstream of Colorado State Highway 135 to approximately 710 feet upstream of Colorado State Highway 135.
Crystal River	From approximately 500 feet downstream of Gunnison County Road 3 to approximately 1,200 feet upstream of White House Mountain Drive. Approximately 4.5 miles in length.
East River	From its confluence with the Gunnison River to the confluence with the Slate River. Approximately 12.6 miles in length.
Gunnison River	From the McCabee Bridge to the confluence with the East and Taylor Rivers. Approximately 15.8 miles in length.
North Fork Gunnison River	From the Gunnison county boundary to approximately 0.9 mile above Somerset bridge. Approximately 3.2 miles in length.
Slate River	From the confluence with the East River to just downstream of Gunnison County Road 317. Approximately 9.4 miles in length.
Tomichi Creek	From the confluence with the Gunnison River to approximately 7 miles upstream.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through 2010.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by FEMA and Gunnison County.

The following are streams for which only approximate flood hazards are presented: Alder Creek; Alkali Creek; Anthracite Creek; Beaver Creek; Big Blue Creek; Cabin Creek; Carbonate Creek; Cebolla Creek; Cement Creek; Cimarron River; Cochetopa Creek; Crystal River; Dry Gulch; East Fork Little Blue River; East Muddy Creek; East River; East Willow Creek; Farris Creek; Gold Basin Creek; Goose Creek; Gunnison River; Hot Springs Creek; Houston Creek; Indian Creek; Lake Fork Gunnison River; Lake Gulch; Lee Creek; Little Cimaron River; Long Draw; Meridian Lake; Middle Fork Powderhorn; Milkranch Gulch, North Fork Gunnison River; Ohio Creek; Pine Creek; Poison Draw; Quartz Creek; Razor Creek; Sheep Creek; Slate River; South Beaver Creek; Steuben Creek; Taylor River; Tomichi Creek; Washington Gulch; West Muddy Creek; Willow Creek; Willow Creek 2; Willow Creek 3; Yeager Creek; and several other unnamed streams.

2.2 Community Description

Gunnison County is located in southwestern Colorado and is bordered by Saguache and Hinsdale Counties to the south; Chaffee County to the east; Pitkin and Mesa Counties to the north; and Delta, Montrose, and Ouray Counties to the west.

The Gunnison River, formed by the confluence of the Taylor and East Rivers at Almont, has a well-developed stream pattern with inflowing tributaries from different directions. The larger of these tributaries contributing to the flooding problems in the study area include Ohio and Tomichi Creeks.

The North Fork Gunnison River is formed by the confluence of Muddy and Anthracite Creeks near Paonia Dam. From its source to its mouth near Lazear, the stream flows approximately 30 miles on a southwesterly course.

The average altitude of the Gunnison River Basin above the study area is relatively high, ranging in elevation from approximately 7,600 feet above mean sea level at the Tomichi Creek confluence with the Gunnison River to over 14,000 feet at the high peaks of the Continental Divide.

The terrain of the basin is mostly mountainous with some broad plains in the stream valleys between hills. These plains vary in width and are in excess of 2 miles at certain locations. Alluvial lands on the floodplains along streams consist primarily of material recently deposited by the streams. The texture is widely variable and commonly has very cobbly or stony areas interspersed throughout.

Vegetation varies considerably according to elevation in the basin. Vegetation below the 8,000 elevation consists of semi-arid growth such as pinion pine, juniper, and sage with sparse grass growth. Thick strands of cottonwood thrive along the rivers. Increased precipitation supports dense pine and aspen forests above this elevation to timberline.

Rock outcrops and tundra grasses predominate on the high mountain peaks where climatic conditions are too severe for forest growth.

A number of irrigation ditches convey water across natural drainage boundaries into adjacent basins. The Larkspur Ditch conveys water from the headwaters of the Tomichi Creek in the Colorado River Basin across the continental divide at Marshall Pass and into Poncha Creek Basin.

The climate of the study area includes low precipitation, low humidity, abundant sunshine, a wide daily temperature range, and generally low winds. The surrounding mountains act as a barrier, preventing the northern cold air or eastern storms from penetrating the Upper Gunnison River Valley.

Summers are cool in the study area with average high temperatures of 80° F. Temperatures for summer nights usually drop below 50° F. Temperatures have ranged from -47° F in the winter to 96° F in the summer. The mean annual maximum temperature is 52° F, and the mean annual minimum temperature is 17.5° F.

A prominent college in Gunnison, Colorado, is Western State College, with an enrollment of nearly 2,300 students. Retail trade and services, including most of the tourist-related services; provide the largest number of jobs in the area. A major ski area, Crested Butte, is located 30 miles north of Gunnison. Agricultural employment is on the decline, with mining limited to a few small operations, and the tourist industry expected to grow.

The population from the 2000 and 2010 U.S. Censuses of Gunnison County and its incorporated communities included in this Flood Insurance Study are listed below (References 9 and 10):

<u>Community</u>	<u>2000 Population</u>	<u>2010 Population</u>
Crested Butte, Town of	1,529	1,487
Gunnison, City of	5,409	5,854
Gunnison, County (Unincorporated Areas)	13,956	15,324
Marble, Town of	105	131
Mt. Crested Butte, Town of	707	801
Pitkin, Town of	124	66

The Town of Crested Butte is located in central Gunnison County and sits at an elevation of 8,885 feet. Crested Butte is approximately 28 miles north of the City of Gunnison and 231 miles southwest of Denver. The ski area resort in Mt. Crested butte is just 3 miles north of town. The town was incorporated in 1880 and is designated a National Historic District.

The City of Gunnison is located in south-central Gunnison County at the confluence of the Gunnison River and Tomichi Creek. It is approximately 196 miles from Denver and 126 miles from Grand Junction. It sits at an elevation of 7,703 feet above sea level. It was established in 1874 and incorporated in 1880.

The Town of Marble is located in north western Gunnison County. Incorporated in 1899 the town is located in a valley of the upper Crystal River along the Elk Mountains. Unlike most of Gunnison County, the town is located on the north side of McClure Pass and is thus somewhat separated geographically from the rest of the county. The town is noted as the location of the historic Yule Marble quarry which began operations in the late 19th Century.

The Town of Mt. Crested Butte is located in central Gunnison County. It is situated approximately 3 miles north of the Town of Crested Butte and 30 miles north of the City of Gunnison. The town sits at an elevation of 9,375 feet above sea level. It is home to the Crested Butte Mountain Resort.

The Town of Pitkin is located in southeastern Gunnison County, just 28 miles northeast of the City of Gunnison on the Quartz Creek. Founded in 1879, Pitkin sits at an elevation of 9,242 feet. The town was originally named Quartzville and was Colorado's first mining camp west of the Continental Divide.

2.3 Principal Flood Problems

While slopes are steeper in the upper drainage basins, the dense vegetation in these areas serves to reduce rainfall runoff. A greater percentage of runoff is permitted by the sparse vegetation of the foothills and pastureland at the lower elevations. Consequently, the majority of the flood problems in the study area are caused by rapid snowmelt. This type of flooding has a duration runoff, which results in a continuous rise in water level.

Flood potential also exists from long and short duration rainstorms. Floods from short duration rainstorms are characterized by high peaks and small volumes. The potential for the most severe flooding is created by the combination of rapid snowmelt with long duration rainfall.

Flooding also occurs during the winter months from ice jamming. This is confined to the northwestern area of the county.

Detailed information on floods before the turn of the century is very limited. Information on historical flooding is based on newspaper accounts and interviews with longtime residents of the area. Generally, high flows are contained in-channel, and extensive overbank flooding is infrequent. Large floods occurred in Gunnison on the Gunnison River in 1917, 1918, 1920, 1921, 1957, 1984, and 1985. These floods have caused major damage by disrupting highway and railroad traffic and communication services, drowning livestock, and destroying agricultural lands, roads, bridges, and buildings.

Gage reading at the Gunnison River near Somerset Gage, Hydrologic Unit 14020004 (period of record: 1897-1933, 1934 to present day), and North Fork near Paona Gage (period of record: 1922 to 1932), indicate flood damage along the North Fork Gunnison River and the Gunnison River in 1928, 1929, 1932, 1957, 1973, 1984, and 1985.

Generally speaking, most streams in Western Colorado have experienced high peak runoff rates during years of high temperature, combined with snowpack containing high water content, usually occurring in May. An exception to this has been in the San Juan Mountains, where rainstorms have produced peak flows.

Flooding problems on the Gunnison River and its tributaries are aggravated by human alterations in the floodplain that restrict channel dynamics, alter riparian vegetation and hamper natural flooding functions of the river system.

The City of Crested Butte has had no major reported history of floods. In August of 2000, minor flooding of roads and small creeks were reported.

The City of Gunnison has experienced some major flood events. In July of 2004 water was reported one to two feet deep flowing across Highway 50, 2 miles southeast of Gunnison. During the same storm event, a section of County Road 72 washed out along Tomichi Creek near Highway 50. In August of 1999 a similar flooding event occurred 8 miles southeast of Gunnison. Heavy rains estimated at over 2.5 inches per hour resulted in flash flooding over at least 5 sections of U.S. Highway 50, in some instances up to 5 feet deep. In the spring of 1984 flooding along the Tomichi Creek exceeded the 0.2 percent annual chance flood event.

The City of Marble has experienced historic flooding a number of times. Carbonate Creek, located near the Town of Marble, has a history of rainstorm floods and large mud debris flows. During the August 8, 1941 flood event, a structure, the Horace Williams House, was documented to have moved over 30 feet off of its original foundation as a result of the flooding. Additionally, high water from the July 31, 1945 storm took out several bridges along the Crystal River from Marble to Carbondale (Reference 11). Flooding along the Crystal River and in the Town of Marble has been best documented in 1941 and 1945. However there have been historic flood events along the Crystal River that have also occurred in 1917, 1938, 1949, 1952, 1953, 1957, 1965, 1971, and 1973 (Reference 11).

The City of Marble has reported minor flash floods in August of 1997 and 1999 as well as September of 1999. The heavy rains caused flooding of a 100 yard section of the road in some cases 2 feet deep. The event left mud and debris 2 feet deep on the road after the waters had receded. In the case of an additional event the heavy rains caused a rockslide damaging 2 vehicles (Reference 12).

2.4 Flood Protection Measures

Currently Gunnison County and the City of Gunnison monitor the Gunnison River and its tributaries during the spring runoff and provide snag removal as needed to prevent flooding issues at bridge crossings. In addition, they participate in flood prevention activities including the CRS program, open space protection in the floodplains, and other ongoing floodplain management activities.

The construction of the Taylor Park Reservoir near Taylor Park (completed in September 1937) has reduced the peak flows approximately 28 percent near Taylor Park on the Gunnison River, although its primary function is to supply water for irrigation purposes.

Paonia Dam and Reservoir, a multiple-purpose project built by the U.S. Water and Power Resources Service on Muddy Creek, just upstream from the junction of Muddy Creek and Anthracite Creek, became operational in 1961. Affording 21,000 acre-feet of storage capacity, the facility is operated by the North Fork Water Conservancy District to provide flood control during periods of high snowmelt runoff.

Other than the aforementioned structures, there is very little natural or manmade flood protection within Gunnison County.

Gunnison County is provided some protection from floods through flood warning and forecasting by the National Oceanic and Atmospheric Administration (NOAA), National Weather Service.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent annual chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

Peak discharges for the various recurrence intervals for Tomichi Creek (at Parlin) and the Gunnison River were taken from data prepared by Engineering Consultants, Inc. for the Gunnison River Basin near Gunnison, Colorado (Reference 3). Streamflow data obtained from 51 measuring stations located within the Gunnison River Basin and in nearby basin were used in this analysis. The source of the data is the official U.S. Geological Survey

(USGS) Water Supply Papers (Reference 13). The peak flow figures for the four different frequencies used in the analysis of the two streams mentioned previously were those obtained from the Regional Log-Pearson Type III Analyses (Reference 14).

Peak discharges for the various recurrence intervals for North Fork Gunnison River were taken from data prepared by the USACE, Sacramento District. A flow-frequency analysis was made for four index points on the North Fork Gunnison River, with the upstream gaging station being the USGS gaging station near Somerset (Hydrologic Unit 14020004; period of record: 1897 to 1933, 1934 to present day), and downstream points that reflect significant inflow. The source of the gaging data was the official USGS Water Supply Papers (Reference 13).

Flow-frequency curves were developed from generalized frequency relationships estimated from a regional-frequency analysis of gaging stations, North Fork Gunnison River near Paonia gage (period of record: 1922-1932); Gunnison River below Gunnison Tunnel gage (Hydrologic Unit 14020002; period of record: 1903 to present day); and Gunnison River near Grand Junction gage (Hydrological Unit 14020005; period of record: October 1894 to December 1895, October 1896 to September 1899, October 1901 to October 1906, October 1916 to current year).

The variation of the quantity of the peak flood within the study reaches was studied. From the analysis, it was concluded that the runoff yield during peak flow from the low lying areas is small. This result supports the conclusion that snowmelt from upper elevations is the major contributor to the peak flows.

The 10-, 2-, 1- and 0.2%-annual chance discharges for the Slate River, the East River, the Gunnison River, and Tomichi Creek were taken from data prepared by Tetra Tech for the USACE, CWCB, and Gunnison County (Reference 15). Flow-frequency analyses were completed with nearby gage data using the REGFREQ (Regional Frequency Computation Program) and HEC-FFA (Hydrologic Engineering Center – Flood Frequency Analysis) computer programs. Both programs use the Log Pearson Type III distribution assumption to perform calculations and estimate percent change exceedence values based on annual peak information. REGFREQ has the ability to estimate the correlation between two gages, while HEC-FFA includes the ability to test for high and low outliers in the data.

Discharges along the Crystal River were calculated using the PEAKFQ computer program (Reference 16) which performs statistical flood frequency analyses of annual peak discharges following procedures recommended in Bulletin 17-B of the Interagency Advisory Committee on Water Data (1982). The analysis for the Crystal River incorporates USGS gage information with over 46 years of record along the Crystal River (1956 to 2001). Peak flood discharges were determined using annual peak flow data from the Placita and Avalanche Creek gages, located just downstream of the Town of Marble. The calculated peak flood discharges were adjusted at various locations along the study reach based on the guidelines provided in the Manual for Estimating Characteristics of Natural Flow Streams in Colorado, Technical Manual No. 1 (Reference 17).

Peak discharge-drainage area relationships for streams studied in detail are shown in Table 2.

Table 2 – Summary of Discharges

<u>Flooding Source and Location</u>	<u>Drainage Area (Square Miles)</u>	<u>Peak Discharges (cfs)</u>			
		<u>10-Percent Annual Chance</u>	<u>2-Percent Annual Chance</u>	<u>1-Percent Annual Chance</u>	<u>0.2-Percent Annual Chance</u>
Clark Stream At Confluence with the Gunnison River	-- ¹	-- ¹	-- ¹	1,358	-- ¹
Crystal River					
At Confluence with Rapid Creek	93.05	1,994	2,445	2,625	3,028
At Confluence with Milton Creek	83.65	1,833	2,248	2,413	2,783
At Town of Marble	73.59	1,657	2,031	2,181	2,515
At Upstream Limit of Study	53.32	1,284	1,575	1,691	1,950
East River					
At Confluence with the Gunnison River	289	-- ¹	-- ¹	4,599	-- ¹
At Confluence with Alkali Creek	238	-- ¹	-- ¹	4,589	-- ¹
At Confluence with Cement Creek	160	-- ¹	-- ¹	4,464	-- ¹
Gunnison River					
Confluence with Antelope Creek	1,570	5,762	7,967	8,930	11,256
At Town of Almont	766	-- ¹	-- ¹	8,683	-- ¹
North Fork Gunnison River Near Somerset (Hydrologic Unit 14020004)	531	5,600	8,000	9,200	11,300
Slate River					
At Confluence with the East River	70	-- ¹	-- ¹	1,684	-- ¹
Tomichi Creek					
At Confluence with the Gunnison River	1,061	1,524	2,227	2,534	3,264
At Parlin	427	716	874	924	1,017

¹ Data not available

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the Flood Insurance Rate Map (FIRM) represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data table in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

Water-surface elevations for the 10-, 2-, 1-, and 0.2-percent annual chance flood events for the sources studied were computed using the USACE HEC-2 and HEC-RAS step-backwater programs (References 18 and 19). Cross Sections for the Gunnison River were digitized from orthophoto contour maps flown in May 1978 (Reference 20) and May 1980 (Reference 21), coupled with appropriate field verification. For Clark Stream, Crystal River, East River, Gunnison River and Slate River, the cross sections were taken from photogrammetric base mapping flown in 2003 (Reference 22). North Fork Gunnison River basic input was from field survey data furnished by the CWCB and Gunnison County. Tomichi Creek cross sections were based on survey data and supplemented with two foot topographic contour data (Reference 8). All bridges and culverts were measured in the field to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analysis are shown on the Flood Profiles (Exhibit 1). Cross section locations are also shown on the FIRM (Exhibit 2).

The starting water-surface elevations for the Gunnison River were based on discharge rating curves for the Gunnison River near Gunnison gaging stations and utilization of the slope area method (Reference 5). The starting water-surface elevation for the North Fork Gunnison River was based on information provided by the CWCB and the Commissioner of Gunnison County (Reference 4).

The starting water-surface elevations for the Clark Stream, Crystal River, East River, and Slate River were based on the normal depth slope method in HEC-RAS. For the extended Gunnison River study the starting water-surface elevation was based on the known water surface at the tie in. The downstream boundary conditions for Tomichi Creek were set to known water surface elevations that were obtained at a location just upstream of the physical confluence with the Gunnison River (Reference 8).

Channel and overbank roughness coefficients (Manning's "n" values) used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the stream and floodplain areas. Roughness coefficients were assigned as follows in Table 3:

Table 3 – Manning’s “n” Values

<u>Flooding Source</u>	<u>Channel</u>	<u>Overbanks</u>
Clark Stream	0.040	0.050 – 0.100
Crystal River	0.035	0.050 – 0.060
Gunnison River	0.040	0.04 – 0.100
North Fork Gunnison Creek	0.030 – 0.039	0.032 – 0.085
Slate River	0.035 – 0.040	0.035 – 0.100
Tomichi Creek	0.035	0.030 – 0.060

The hydraulic analyses for this Flood Insurance Study are based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of the North American Vertical Datum of 1988 (NAVD88), many FIS reports and FIRMs are being prepared using the NAVD88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. Elevation Reference Marks (ERMs) shown on the FIRM represent those used during the preparation of this and previous FIS reports. Users should be aware that these ERM elevations may have changed since the publication of this FIS report. To obtain up-to-date elevation information on National Geodetic Survey (NGS) ERMs shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov. Map users should seek verification of non-NGS ERM monument elevations when using these elevations for construction or floodplain management purposes. It is important to note that adjacent communities may be referenced to NGVD. This may result in differences in Base Flood Elevations (BFEs) across the corporate limits between communities.

For this revision, a vertical datum conversion was completed for each studied reach. The range of conversion factors was prohibitively high; therefore, a standard conversion factor was not applied for the entire community. The Profile Panel and FDT conversion from NGVD29 to NAVD88 was carried out in accordance to the procedure outlined in the FEMA document Map Modernization – Guidelines and Specifications for Flood Hazard

Mapping Partners Appendix B: Guidance for Converting to the North American Vertical Datum of 1988.

Using the multiple conversion factor approach, an average conversion factor for each flooding source was developed by establishing separate conversion factors at the upstream end, at the downstream end and at an intermediate point of the studied reach. From this data, the average conversion factors for each reach were developed. In some cases, it was necessary to divide each reach into multiple sections in order for the maximum offset from the average conversion factor to be less than or equal to 0.25 feet.

For the recently studied reaches of Tomichi Creek, Clark Stream, the Crystal River, the Slate River, the East River and the Gunnison River a datum conversion was not necessary since the studies were completed in the NAVD88 datum.

For more information on NAVD88, see the FEMA publication entitled *Converting the National Flood Insurance Program to the North American Vertical Datum of 1988* (FEMA, June 1992), or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration, Rockville, Maryland 20910 (Internet address <http://www.ngs.noaa.gov>).

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access this data.

Conversion factors for each studied reach are shown in Table 4.

Table 4 – Datum Conversion Factors

<u>Stream/Reach</u>	<u>Conversion from NGVD29 to NAVD88 (feet)</u>	<u>Begin Station</u>	<u>End Station</u>
Gunnison River	4.969	Station 0 at McCabee Bridge	Station 39,888.25 at Highway 135
North Fork Gunnison River	4.865	Entire Reach	

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides 1-percent annual chance flood elevations and delineations of the 1- and 0.2-percent annual chance floodplain boundaries and 1-percent annual chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles and Floodway Data Table. Users should reference the data presented in the FIS report as well as additional information that may be available at the local map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent annual chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:2,400, 1:6,000, and 1:24,000, with contour intervals of 2, 5, 20 and 40 feet (References 20, 21, and 22).

The 1- and 0.2-percent annual chance floodplain boundaries are shown on the FIRM. On this map, the 1-percent annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE); and the 0.2-percent annual chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent annual chance floodplain boundaries are close together, only the 1-percent annual chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent annual chance floodplain boundary is shown on the FIRM.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent annual chance floodplain is divided into a floodway and a floodway fringe. The floodway is the

channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent annual chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the floodplain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 5).

As shown on the Flood Insurance Rate Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 1-percent-annual-chance flood plain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 1-percent annual chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent annual chance flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

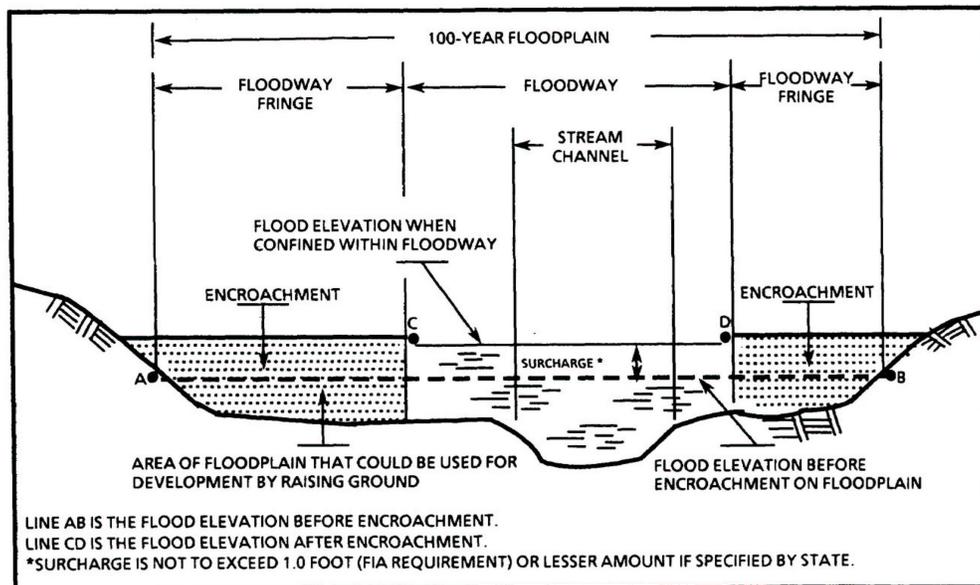


Figure 1 – Floodway Schematic

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CRYSTAL RIVER								
A	0	38	207	12.7	7,689.0	7,689.0	7,689.5	0.5
B	505	36	202	14.2	7,694.2	7,694.2	7,694.2	0.0
C	547	47	258	11.5	7,695.9	7,695.9	7,695.9	0.0
D	1,750	50	208	11.6	7,705.8	7,705.8	7,706.1	0.3
E	2,755	72	254	11.6	7,718.4	7,718.4	7,718.4	0.0
F	3,790	60	230	12.0	7,733.8	7,733.8	7,733.8	0.0
G	4,728	68	234	10.9	7,751.3	7,751.3	7,751.3	0.0
H	6,179	68	328	8.8	7,771.5	7,771.5	7,771.7	0.2
I	7,123	63	278	8.7	7,776.7	7,776.7	7,777.4	0.7
J	8,048	206	280	9.7	7,782.3	7,782.3	7,783.3	1.0
K	8,077	65	336	8.1	7,783.9	7,783.9	7,783.9	0.0
L	9,536	140	398	8.0	7,790.0	7,790.0	7,790.4	0.4
M	11,147	187	465	4.7	7,800.9	7,800.9	7,801.4	0.5
N	12,820	46	191	11.4	7,823.9	7,823.9	7,824.3	0.4
O	13,779	63	226	11.9	7,839.6	7,839.6	7,839.6	0.0
P	14,921	87	249	11.9	7,865.4	7,865.4	7,865.6	0.2
Q	15,909	56	237	13.0	7,893.0	7,893.0	7,893.0	0.0
R	16,407	60	216	11.5	7,900.9	7,900.9	7,900.9	0.0
S	18,067	70	228	11.8	7,918.9	7,918.9	7,918.9	0.0
T	18,542	41	195	13.7	7,926.6	7,926.6	7,926.6	0.0
U	18,578	47	251	11.1	7,929.2	7,929.2	7,929.2	0.0
V	19,905	89	476	3.6	7,931.3	7,931.3	7,932.3	1.0

¹Feet Above Confluence with Taylor River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

**GUNNISON COUNTY, CO
AND INCORPORATED AREAS**

FLOODWAY DATA

CRYSTAL RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CRYSTAL RIVER (CONTINUED)								
W	21,874	185	475	3.7	7,936.1	7,936.1	7,936.7	0.6
X	23,204	55	319	5.8	7,944.0	7,944.0	7,944.2	0.2
Y	23,230	52	290	6.7	7,944.1	7,944.1	7,944.2	1.0
Z	24,407	64	208	1.3	7,958.7	7,958.7	7,958.7	0.0

¹Feet Above Confluence with Taylor River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

**GUNNISON COUNTY, CO
AND INCORPORATED AREAS**

FLOODWAY DATA

CRYSTAL RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
GUNNISON RIVER								
A	120	136/60	780	5.5	7,649.5	7,649.5	7,650.5	1.0
B	170	136/60	785	5.5	7,649.5	7,649.5	7,650.5	1.0
C	210	112/60	512	8.4	7,650.9	7,650.9	7,650.9	0.0
D	290	107/50	390	11.0	7,651.6	7,651.6	7,651.6	0.0
E	450	122/60	555	7.8	7,651.9	7,651.9	7,652.3	0.4
F	680	120/68	491	8.8	7,654.0	7,654.0	7,654.0	0.0
G	1,000	111/72	410	10.5	7,656.9	7,656.9	7,656.9	0.0
H	1,385	100/60	467	9.2	7,659.3	7,659.3	7,659.3	0.0
I	1,615	105/55	570	7.5	7,661.1	7,661.1	7,661.1	0.0
J	1,945	109/60	523	8.2	7,661.7	7,661.7	7,661.7	0.0
K	2,395	157/80	725	12.3	7,662.9	7,662.9	7,662.9	0.0
L	2,770	288/120	998	9.2	7,665.7	7,665.7	7,665.9	0.2
M	3,265	250/120	1140	8.1	7,668.3	7,668.3	7,668.5	0.2
N	3,590	223/142	1151	7.8	7,669.9	7,669.9	7,669.9	0.0
O	4,265	328/284	1035	11.6	7,673.2	7,673.2	7,673.2	0.0
P	5,045	520/475	1651	7.6	7,676.2	7,676.2	7,676.8	0.6

¹Feet Above McCabe's Lane / County Road 32

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

**GUNNISON COUNTY, CO
AND INCORPORATED AREAS**

FLOODWAY DATA

GUNNISON RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
TOMICHI CREEK								
A	1,267	83	441	5.8	7,609.6	7,609.6	7,609.6	0.0
B	2,458	92	447	5.7	7,613.3	7,613.3	7,613.6	0.3
C	3,592	193	561	4.5	7,616.2	7,616.2	7,616.7	0.5
D	5,715	342	509	5.0	7,620.6	7,620.6	7,620.8	0.2
E	7,161	302	696	3.6	7,623.1	7,623.1	7,623.5	0.4
F	8,490	441	816	3.1	7,627.6	7,627.6	7,628.0	0.3
G	9,763	1,000	1,461	1.7	7,631.2	7,631.2	7,631.4	0.2
H	13,970	519	642	4.0	7,642.3	7,642.3	7,642.7	0.4
I	15,717	451	697	3.6	7,647.5	7,647.5	7,648.0	0.5
J	19,346	1,091	1,748	1.5	7,653.7	7,653.7	7,653.8	0.2
K	20,582	1,307	1,413	1.8	7,655.5	7,655.5	7,655.7	0.2
L	22,529	1,134	1,446	1.8	7,659.0	7,659.0	7,659.4	0.4
M	23,816	950	919	2.8	7,662.5	7,662.5	7,662.7	0.1
N	25,981	657	489	5.2	7,667.0	7,667.0	7,667.1	0.1
O	27,025	642	1,227	2.1	7,670.8	7,670.8	7,670.9	0.1
P	28,987	606	885	2.9	7,675.1	7,675.1	7,675.3	0.2
Q	31,381	918	1,342	1.9	7,681.0	7,681.0	7,681.2	0.1
R	33,361	344	797	3.2	7,684.7	7,684.7	7,684.9	0.2
S	35,271	498	708	3.6	7,690.4	7,690.4	7,690.6	0.2
T	36,717	99	357	7.1	7,693.8	7,693.8	7,694.3	0.5
U	39,312	290	977	2.6	7,698.5	7,698.5	7,699.5	1.0
V	44,698	135	448	5.7	7,706.3	7,706.3	7,707.1	0.8

¹Feet Above Confluence with Gunnison River

TABLES

FEDERAL EMERGENCY MANAGEMENT AGENCY

**GUNNISON COUNTY, CO
AND INCORPORATED AREAS**

FLOODWAY DATA

TOMICHI CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
TOMICHI CREEK (CONTINUED)								
W	47,649	317	855	3.0	7,713.0	7,713.0	7,714.0	1.0
X	50,231	234	1,035	2.5	7,719.7	7,719.7	7,720.5	0.8

¹Feet Above Confluence with Gunnison River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

**GUNNISON COUNTY, CO
AND INCORPORATED AREAS**

FLOODWAY DATA

TOMICHI CREEK

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance risk zone that corresponds to the 1-percent annual chance floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or base flood depths are shown within this zone.

Zone AE

Zone AE is the flood insurance risk zone that corresponds to the 1-percent annual chance floodplains that are determined in the FIS by detailed methods. In most instances, whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance risk zone that corresponds to areas outside the 0.2-percent annual chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent annual chance flooding where average depths are less than 1 foot, areas of 1-percent annual chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent annual chance flood by levees. No BFEs or base flood depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications. For flood insurance applications, the map designates flood insurance risk zones as described in Section 5.0 and, in the 1-percent annual chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use the zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent annual chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The current FIRM presents flooding information for the entire geographic area of Gunnison County. Previously, separate FIRMs were prepared for each identified flood prone incorporated community and for the unincorporated areas of the county. Historical data relating to the maps prepared for each community are presented in Table 6.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE	INITIAL FIRM EFFECTIVE DATE	FIRM REVISION DATE
Crested Butte, Town of	June 14, 1974	June 4, 1976	September 4, 1985	none
Gunnison County (Unincorporated Areas)	January 3, 1975	August 9, 1977	September 29, 1989	none
Gunnison, City of	March 22, 1974	December 26, 1975	April 18, 1983	September 18, 1985
Marble, Town of	June 17, 1977	N/A	October 1, 1990	none
Mt. Crested Butte, Town of *	N/A	N/A	N/A	none
Pitkin, Town of	July 20, 1978	N/A	May 16, 2013	none

*No Special Flood Hazard Areas Identified

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

**GUNNISON COUNTY, CO.
AND INCORPORATED AREAS**

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

A hydraulic analysis of the Gunnison River from upstream of Highway 135 near Almont to the confluence with East River, East River from the confluence with Gunnison River upstream to the confluence with the Slate River, and Slate River from the confluence with the East River upstream to County Road 317 at Crested Butte, was completed by PBS&J for CWCB in February 2010 (Reference 6). This study tied into the effective study on the Gunnison River. The hydrology used for the hydraulic analysis was taken from the Gunnison County Flood Hydrology report completed by Tetra Tech, Inc. in 2004 (Reference 15).

A hydraulic analysis of Tomichi Creek in Gunnison County and the City of Gunnison was performed by Michael Baker Jr., Inc., for FEMA. This study was completed in March 2011 (Reference 8).

In August 2004, Icon Engineering, Inc. prepared a Floodplain Information Report on the Crystal River in the vicinity of Marble for CWCB (Reference 7).

FEMA previously published a FIS report for the City of Gunnison and the unincorporated areas of Gunnison County and FIRMs/FHBMs for the City of Gunnison, Towns of Marble and Pitkin, and unincorporated areas of Gunnison County.

This FIS report either supersedes or is compatible with all previous studies on streams studied in this report and should be considered authoritative for purposes of the NFIP. Table 7 contains all Letters of Map Change (LOMCs) that have been incorporated into the FIS since the original effective date.

Table 7 – Summary of LOMCs

<u>Type of LOMC</u>	<u>Case Number</u>	<u>Effective Date</u>	<u>Project Identifier</u>
LOMR	09-08-0466P	October 15, 2010	DMC Proj. 0643 – Gunnison Rising

8.0 LOCATION OF DATA

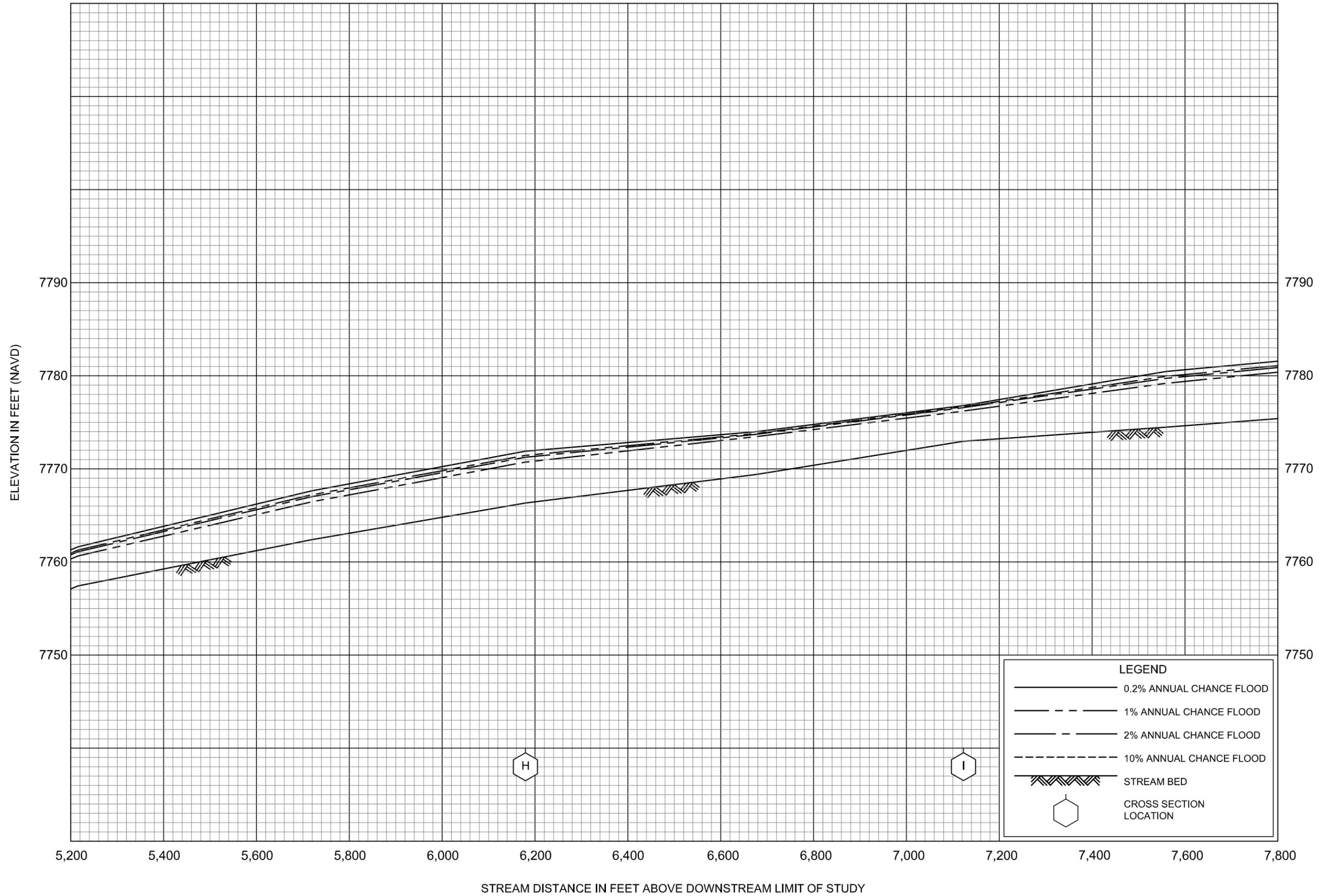
Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Flood Insurance and Mitigation Division, FEMA, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267.

9.0 BIBLIOGRAPHY AND REFERENCES

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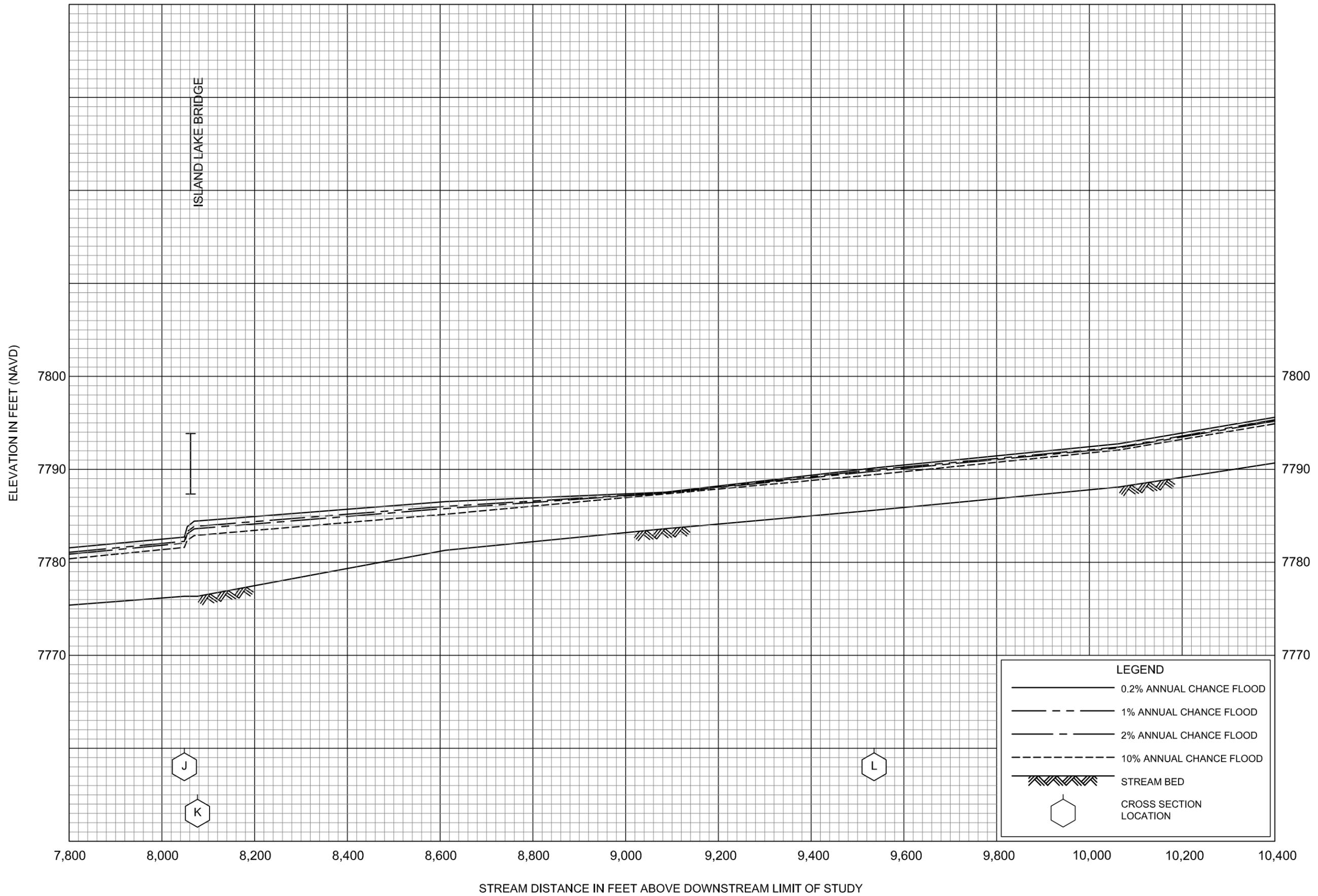
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FLOOD PROFILES
CRYSTAL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
GUNNISON COUNTY, CO
AND INCORPORATED AREAS

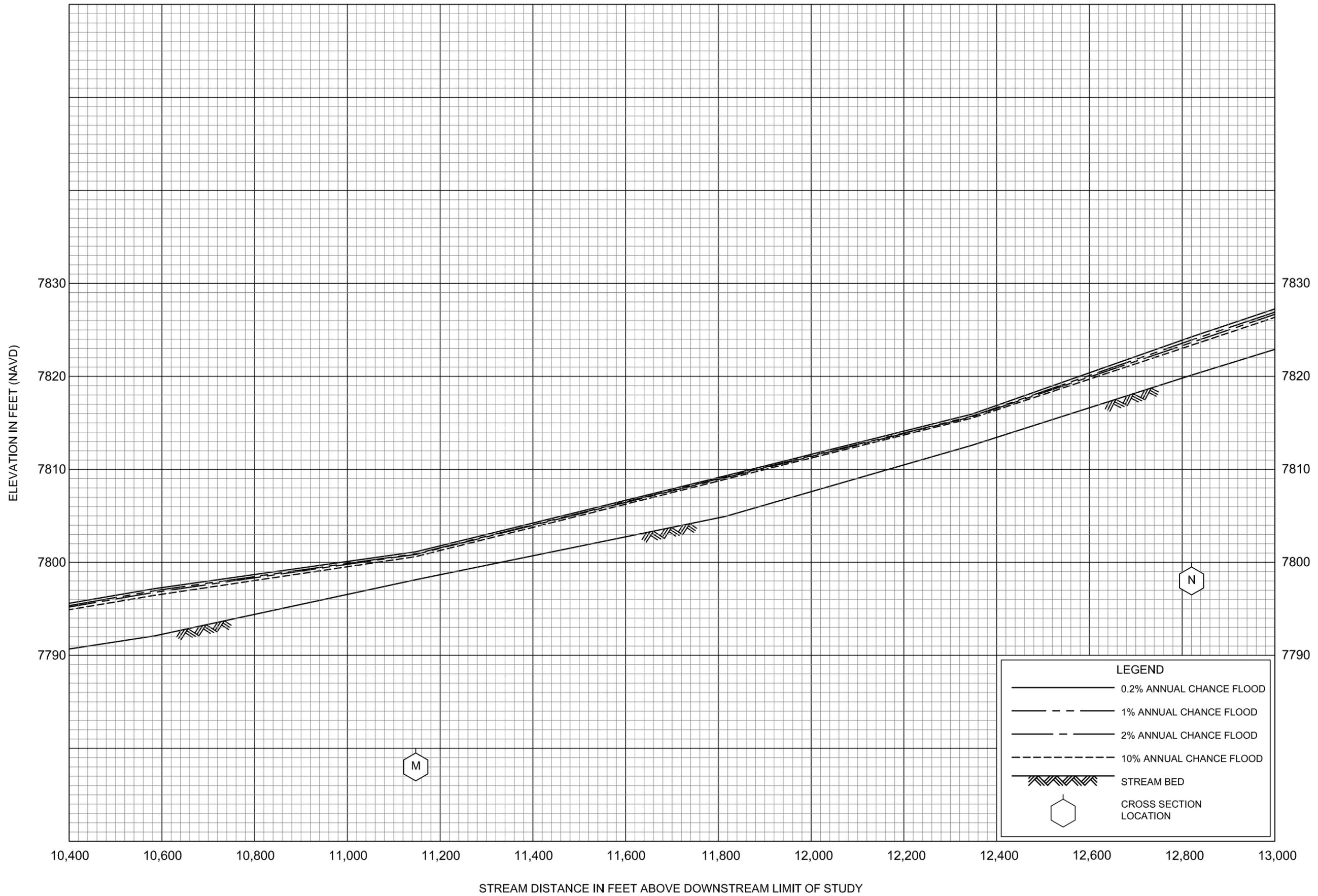


FLOOD PROFILES

CRYSTAL RIVER

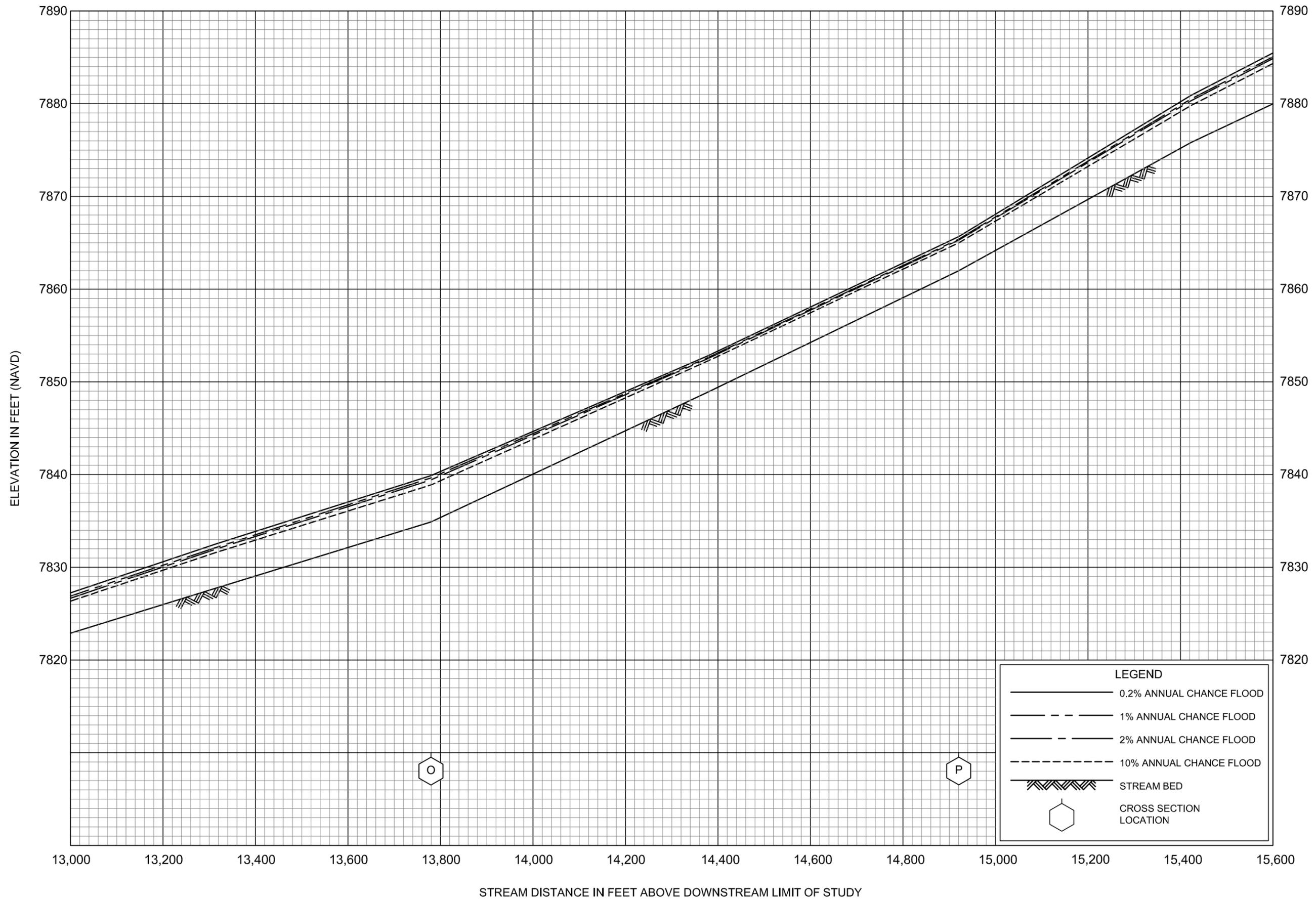
FEDERAL EMERGENCY MANAGEMENT AGENCY

GUNNISON COUNTY, CO
AND INCORPORATED AREAS



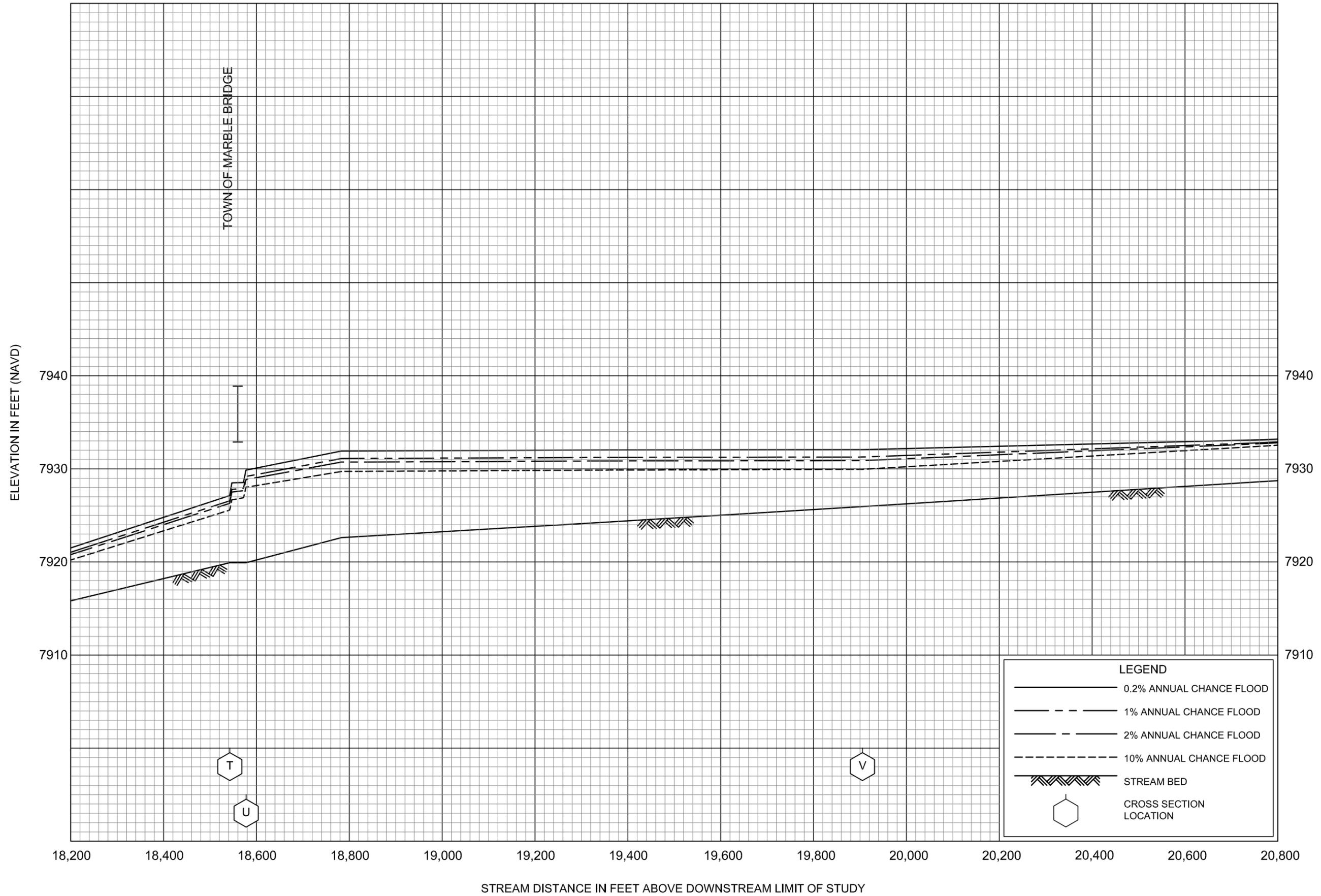
FLOOD PROFILES
CRYSTAL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
GUNNISON COUNTY, CO
AND INCORPORATED AREAS



FLOOD PROFILES
CRYSTAL RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
GUNNISON COUNTY, CO
AND INCORPORATED AREAS

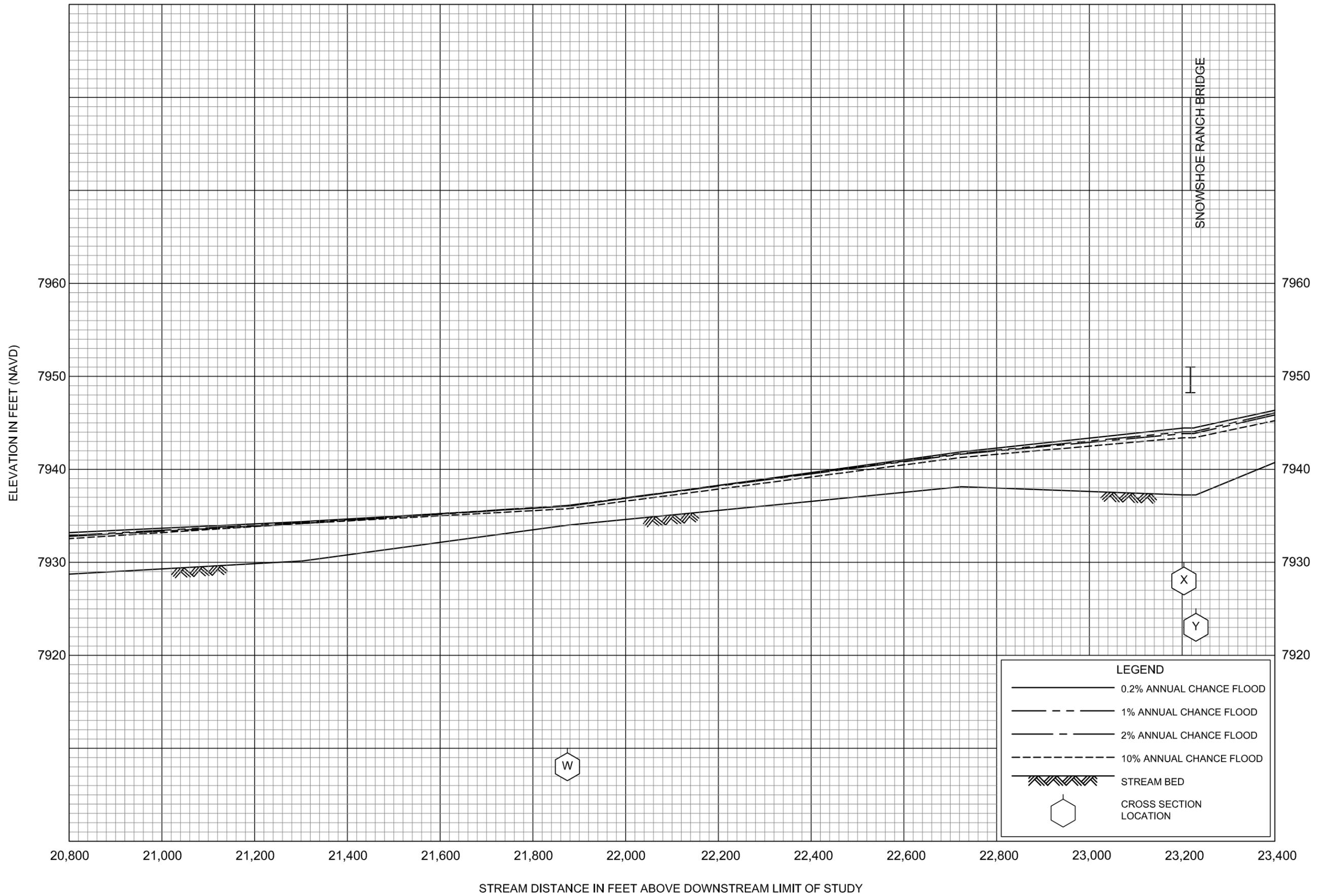


FLOOD PROFILES

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AND INCORPORATED AREAS

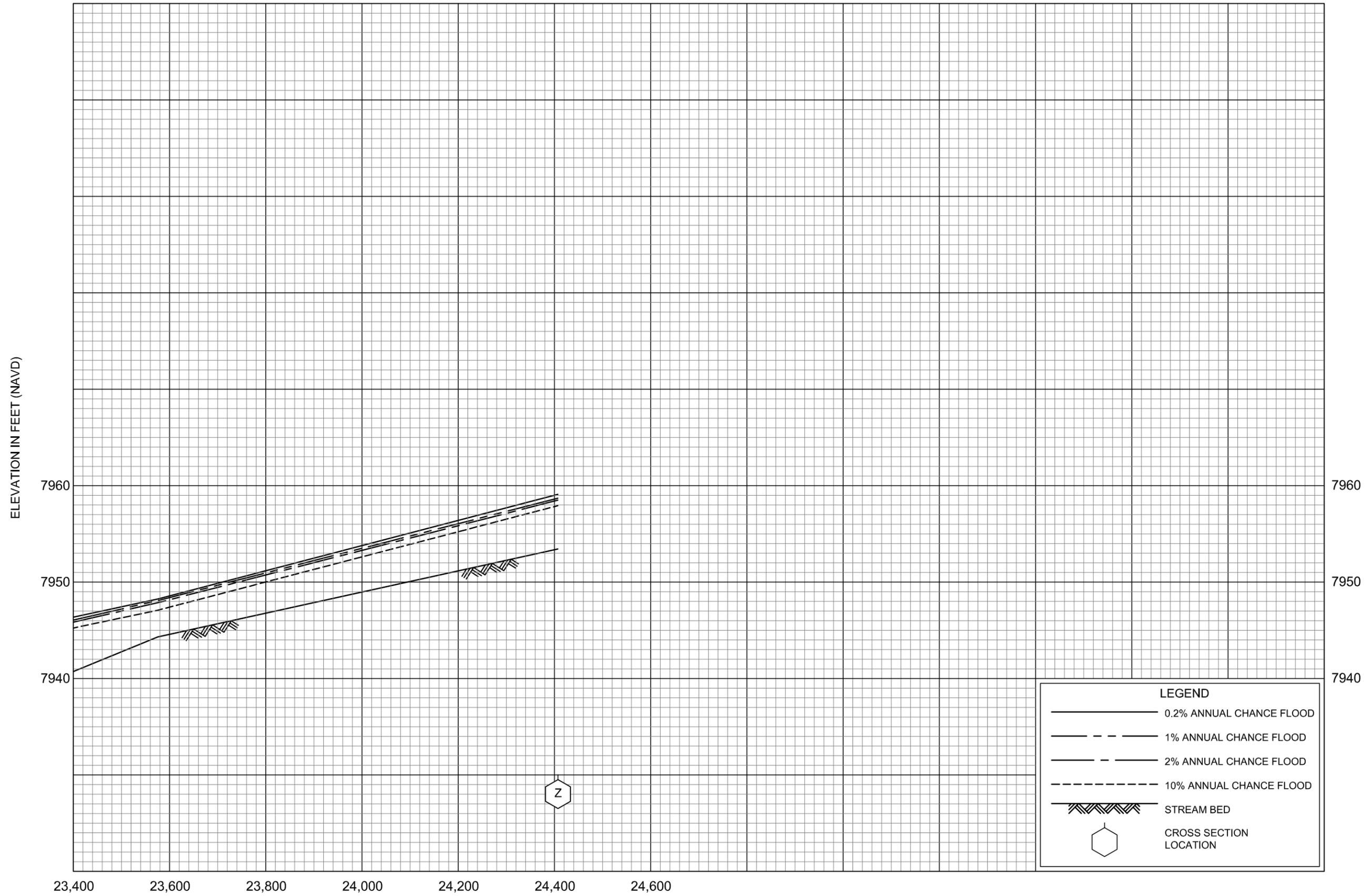


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CRYSTAL RIVER

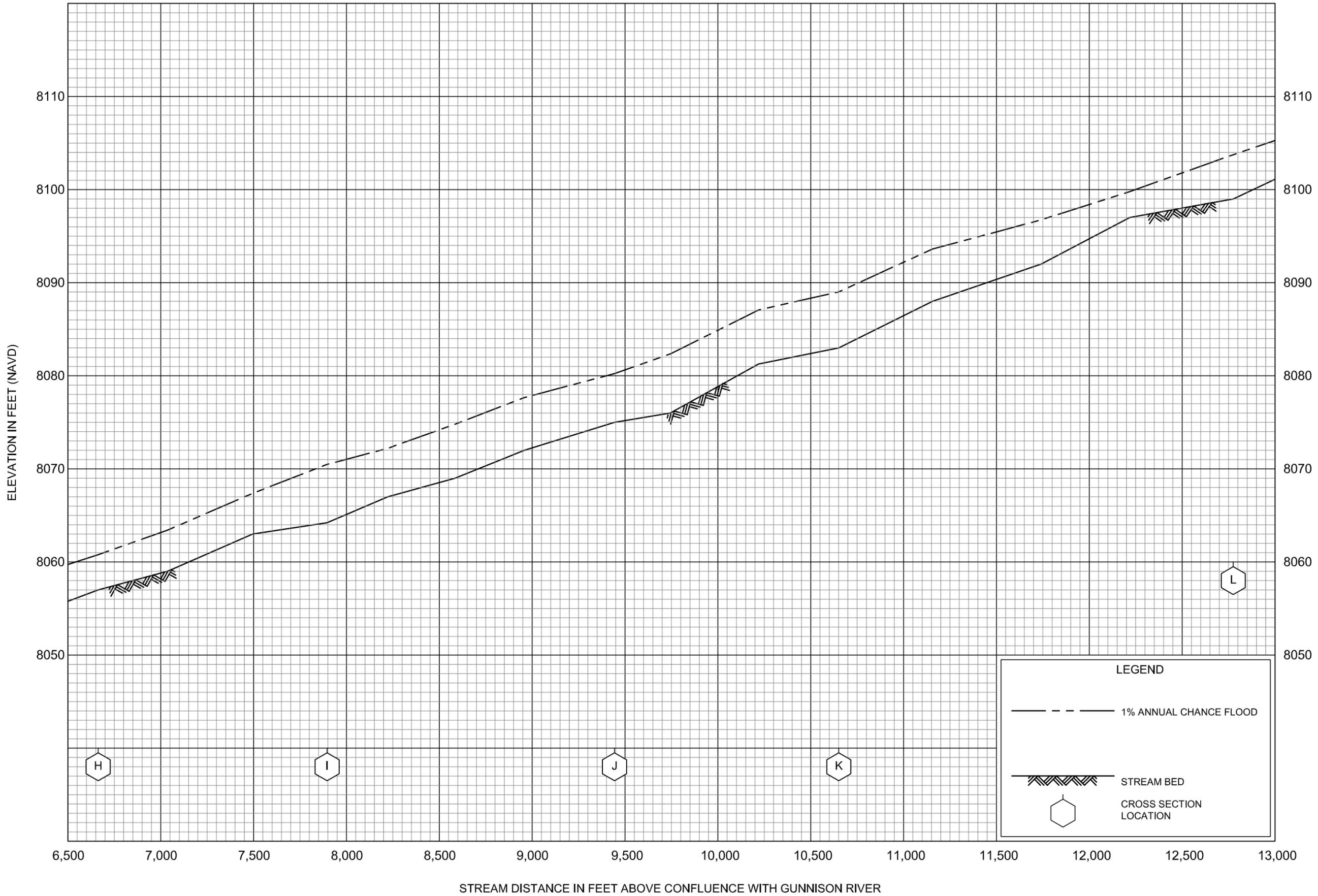
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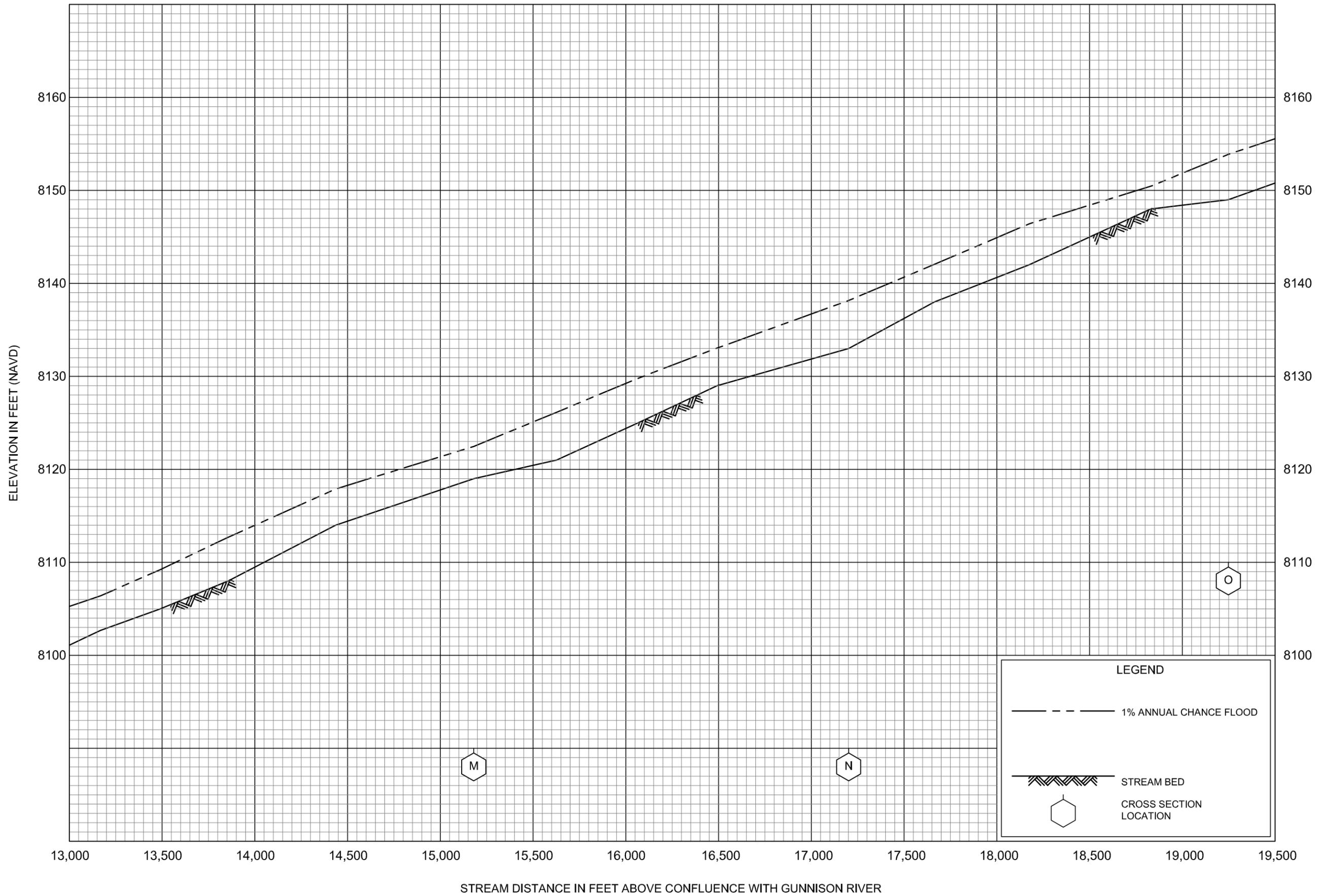
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FLOOD PROFILES
EAST RIVER

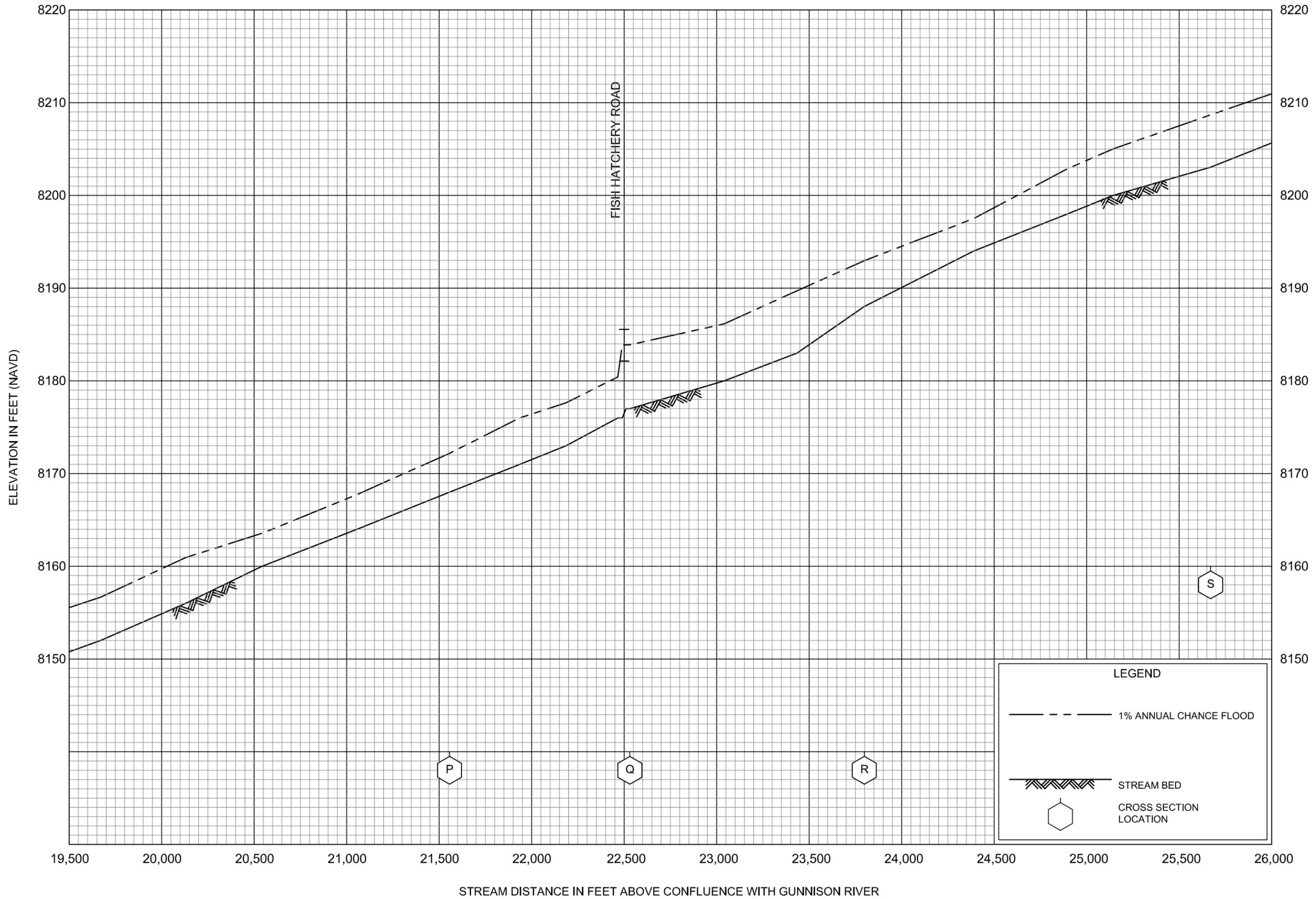
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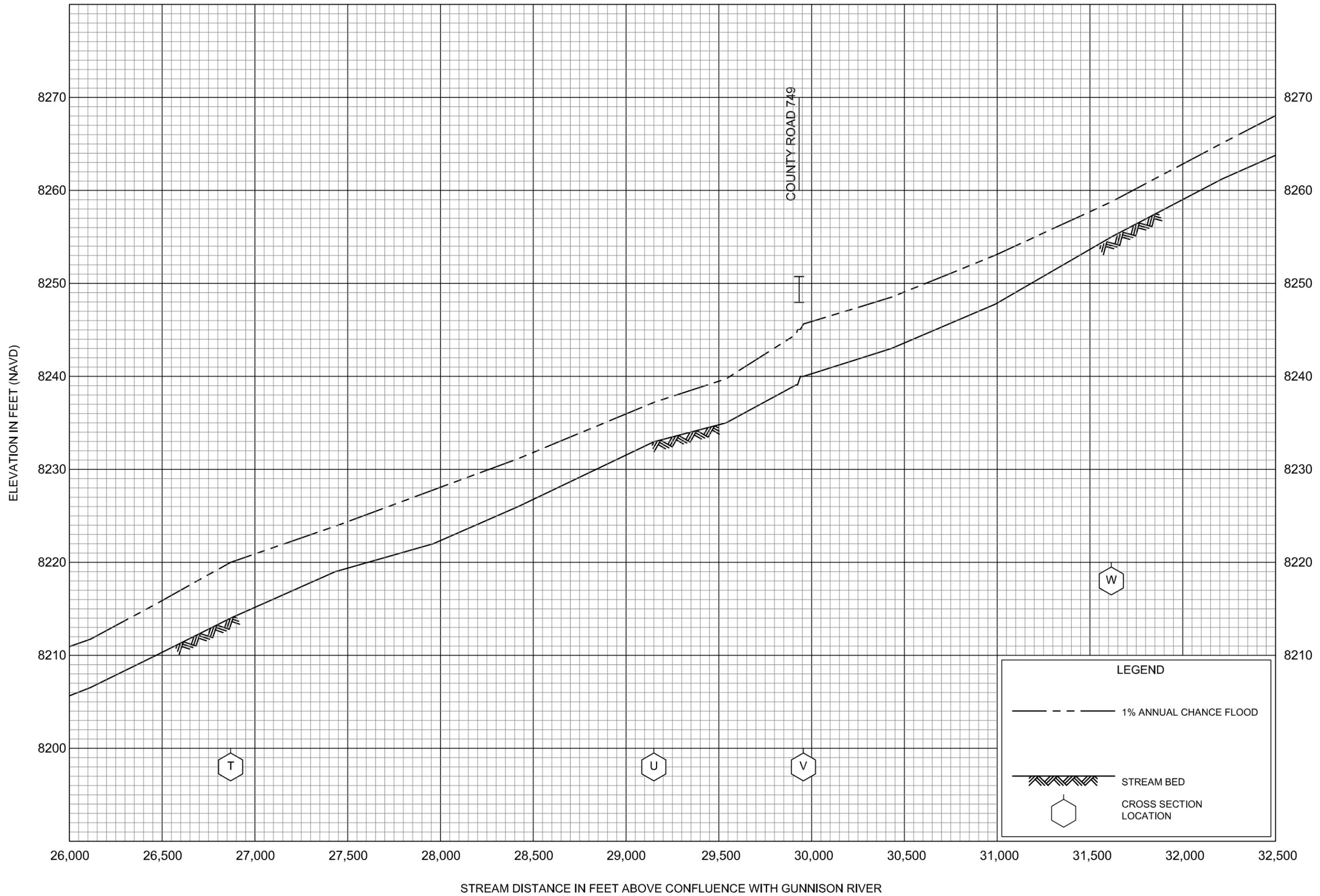


FLOOD PROFILES

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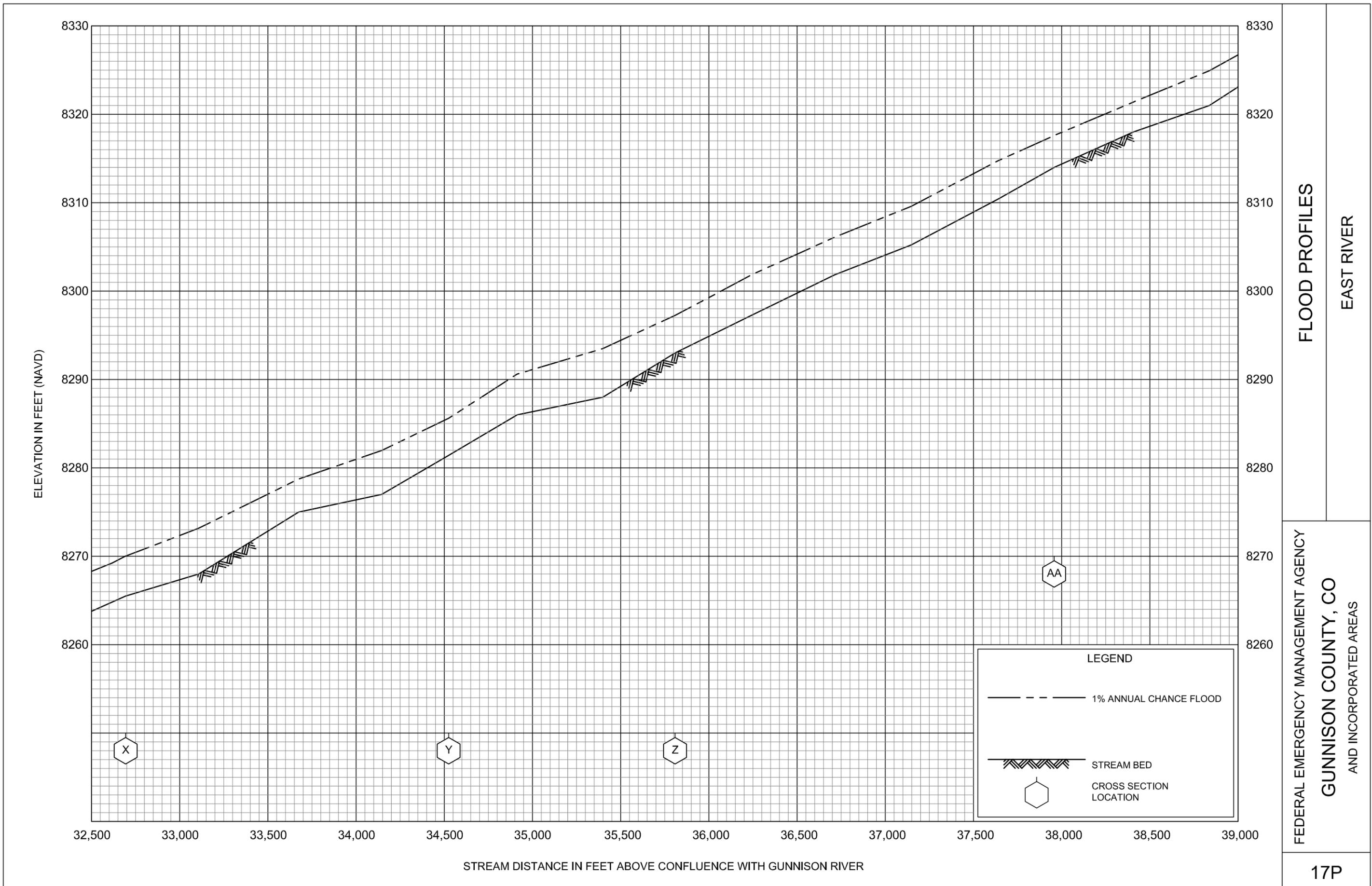


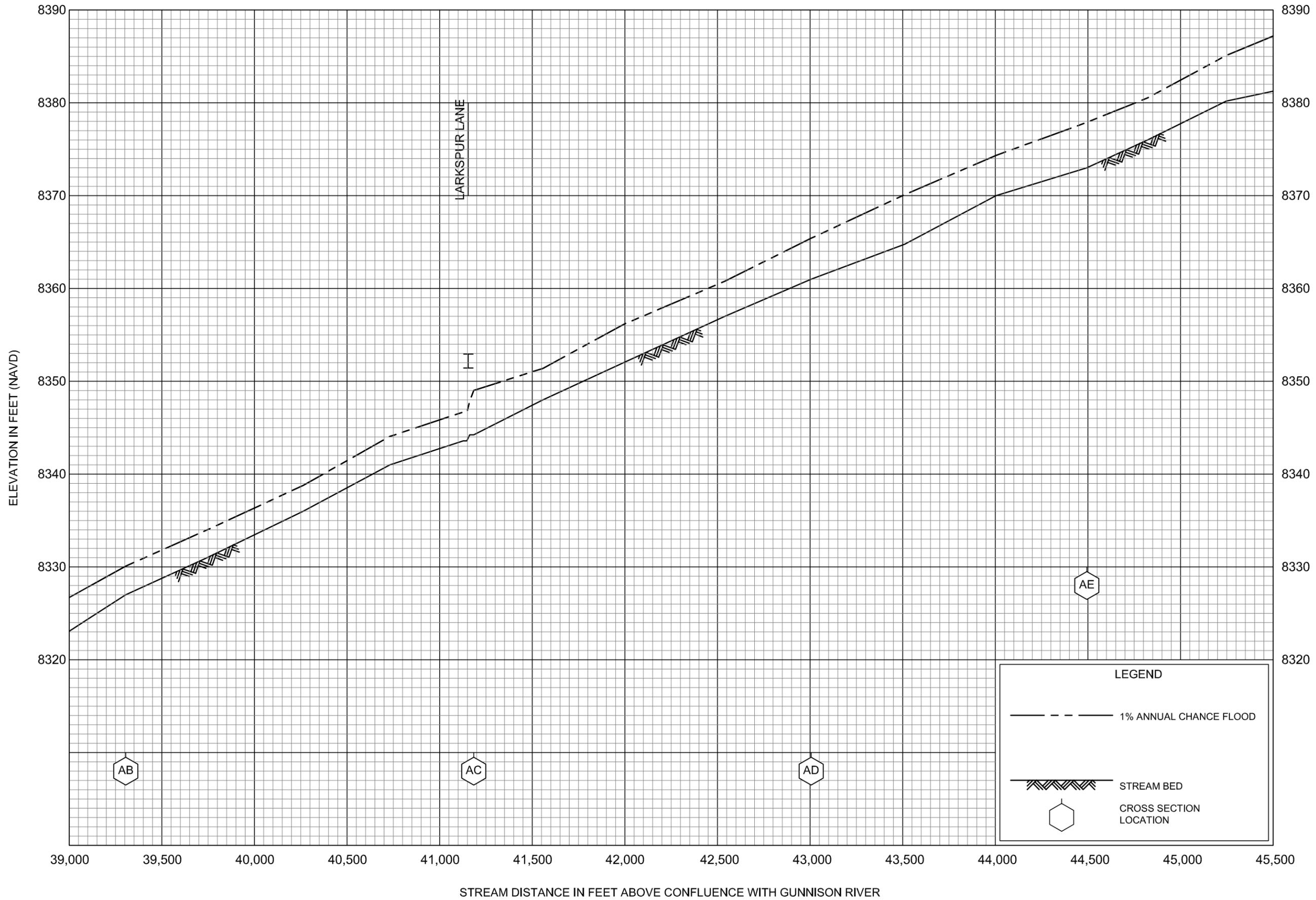
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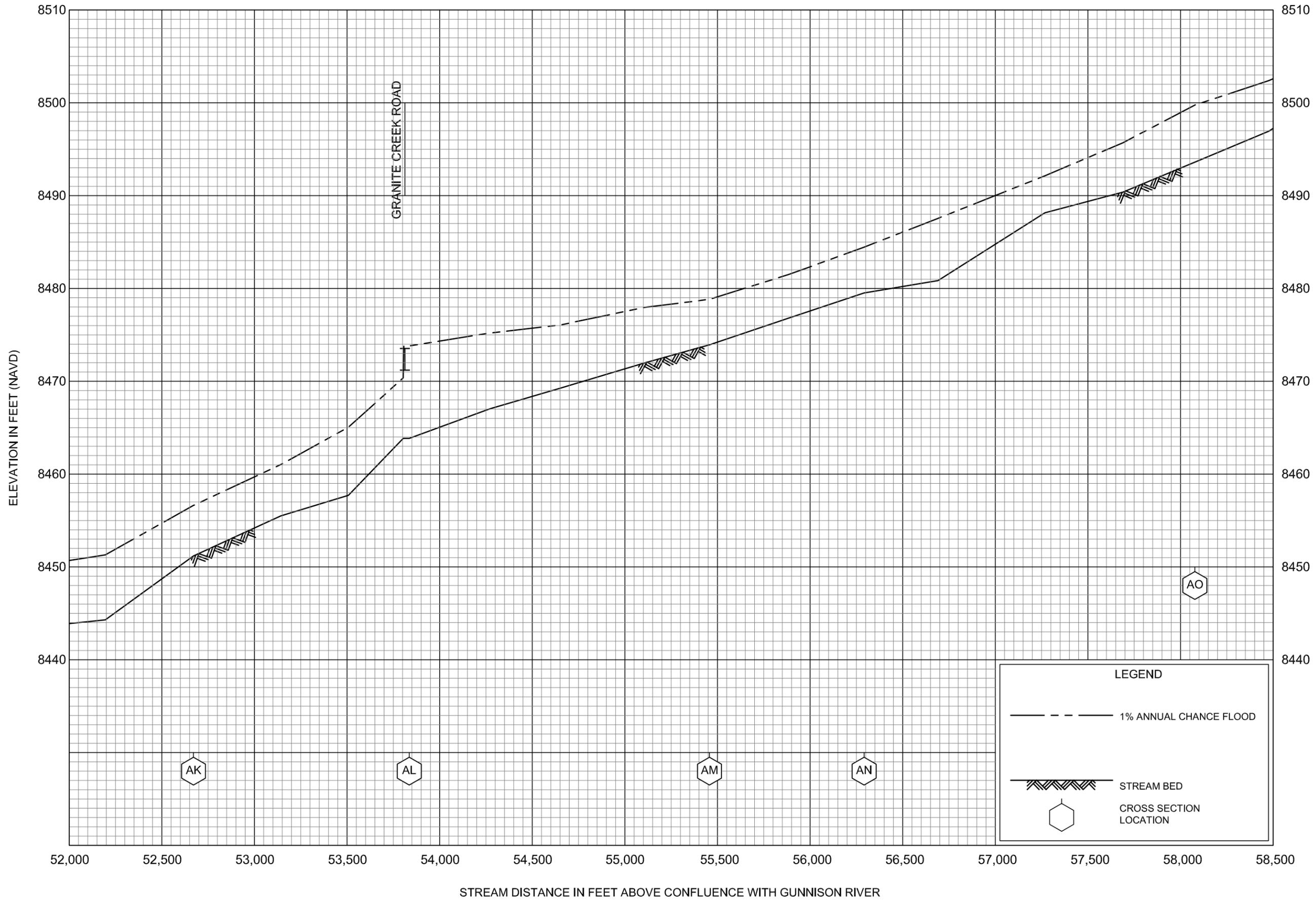




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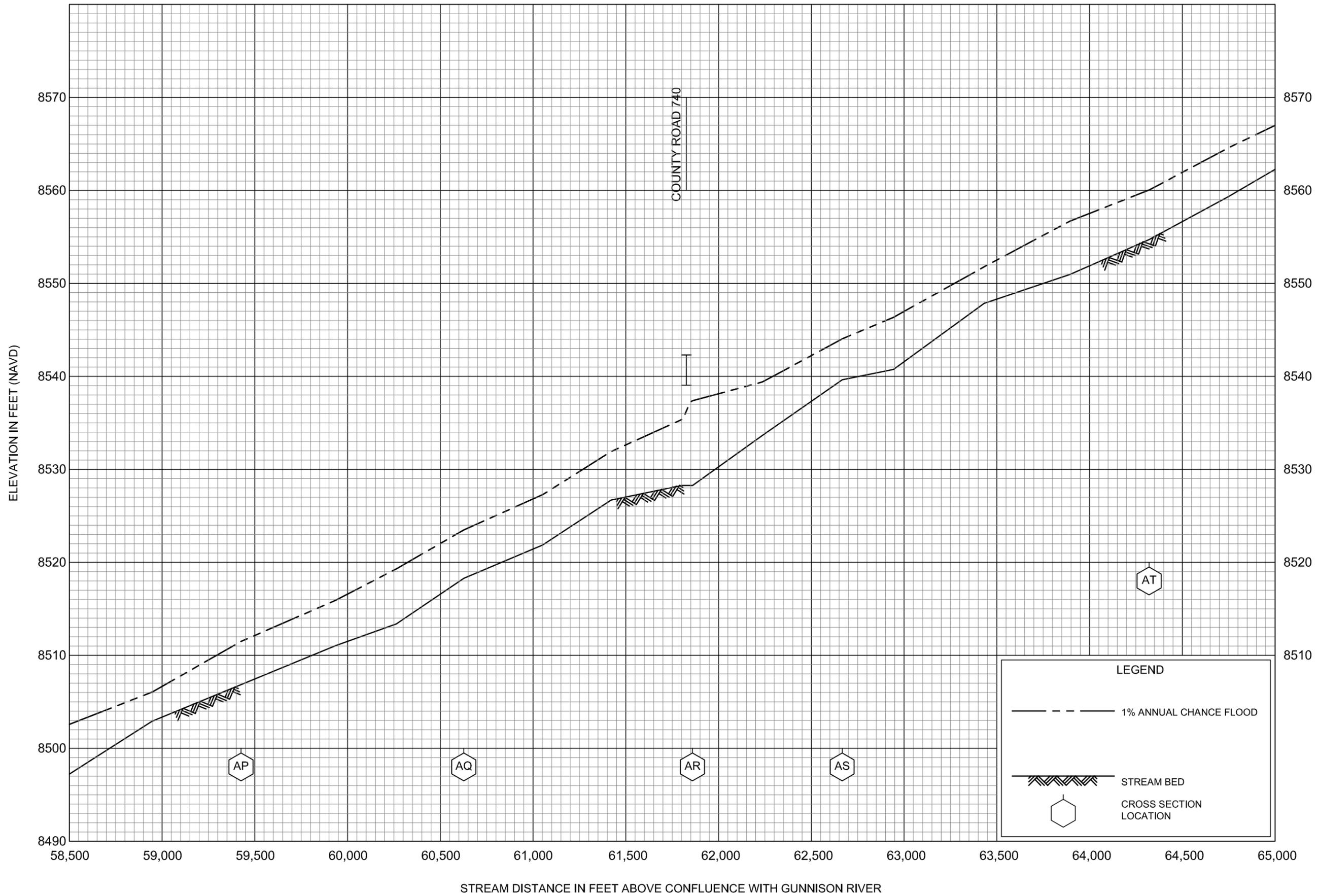
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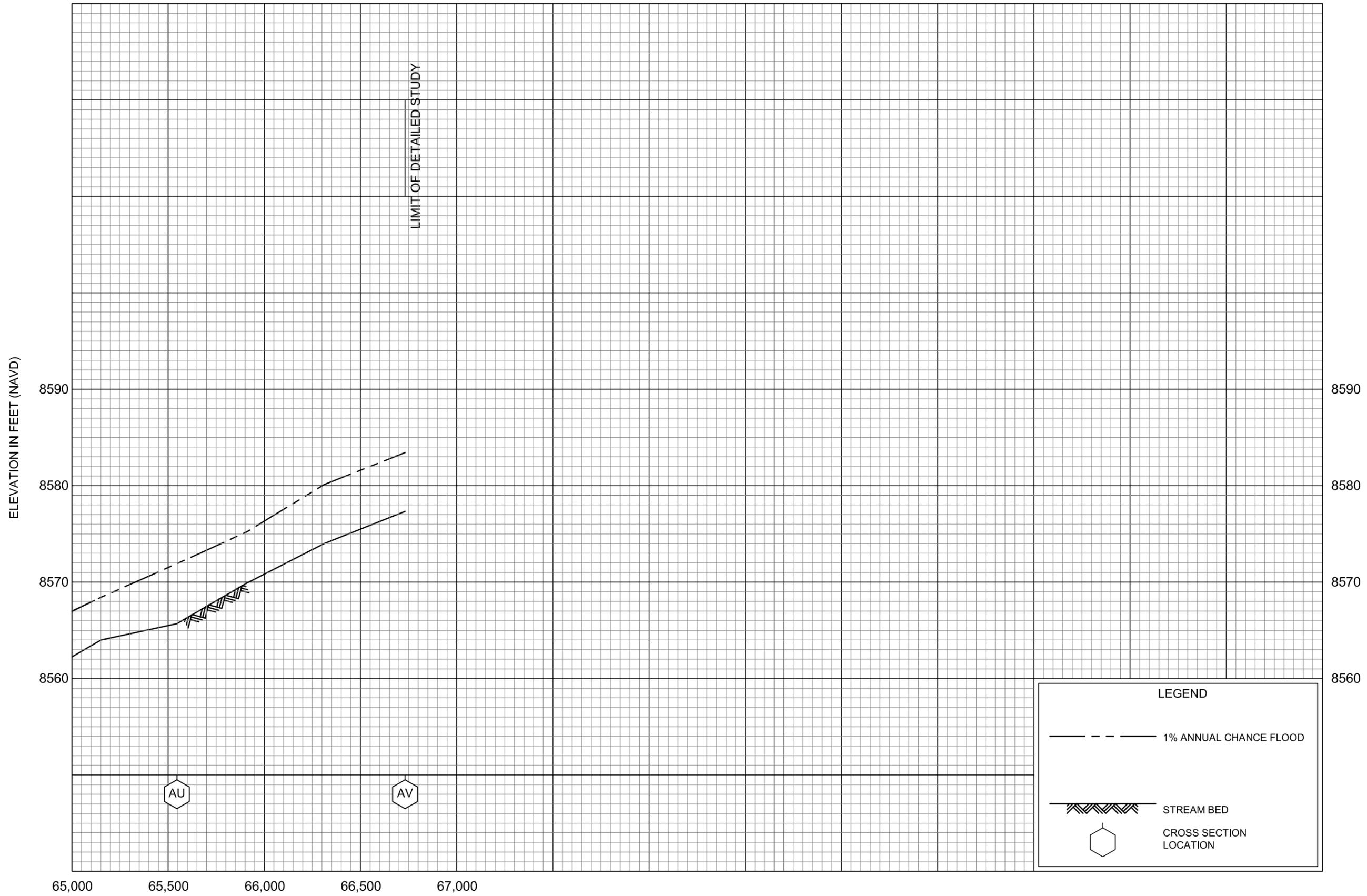


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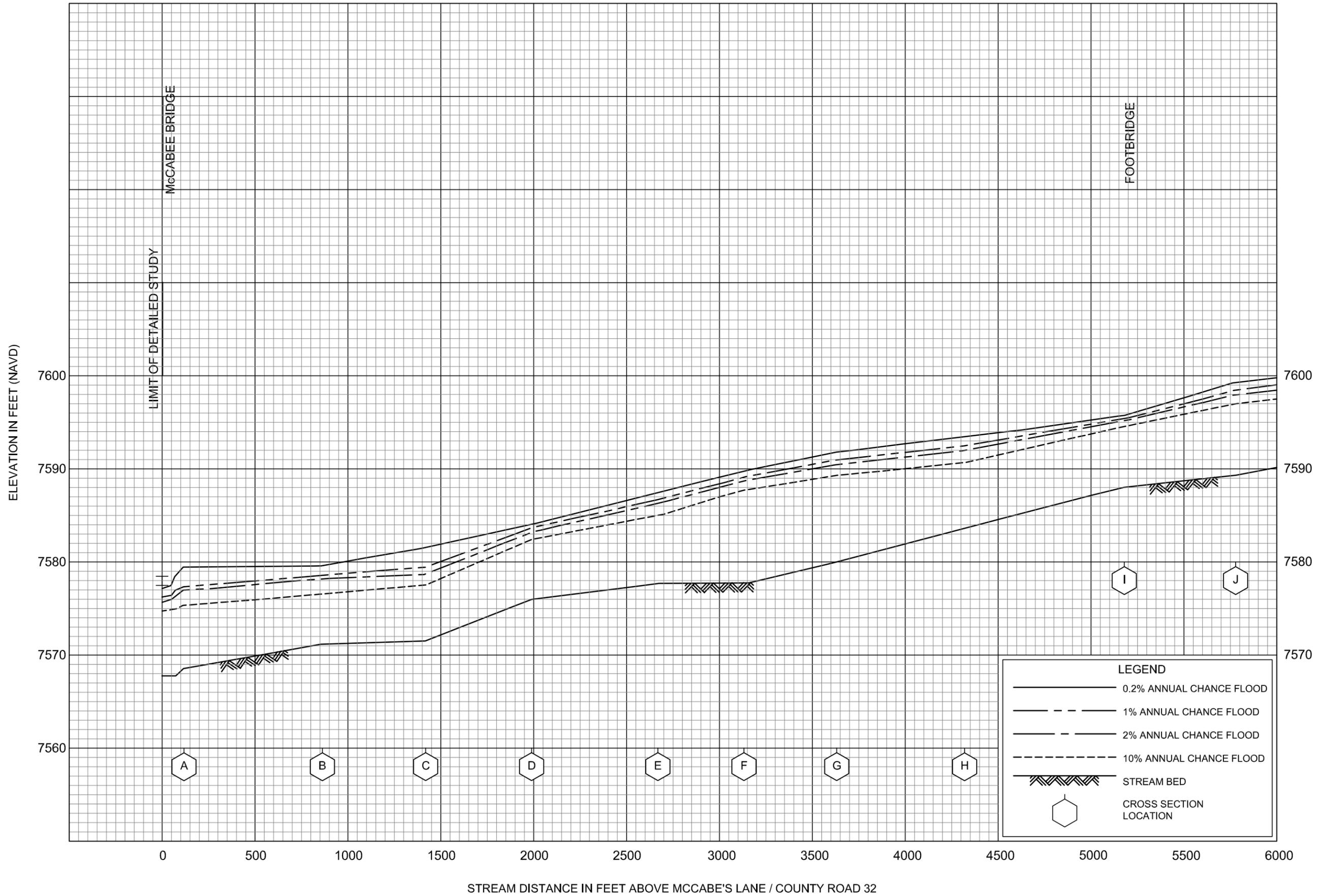


LEGEND

- 1% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

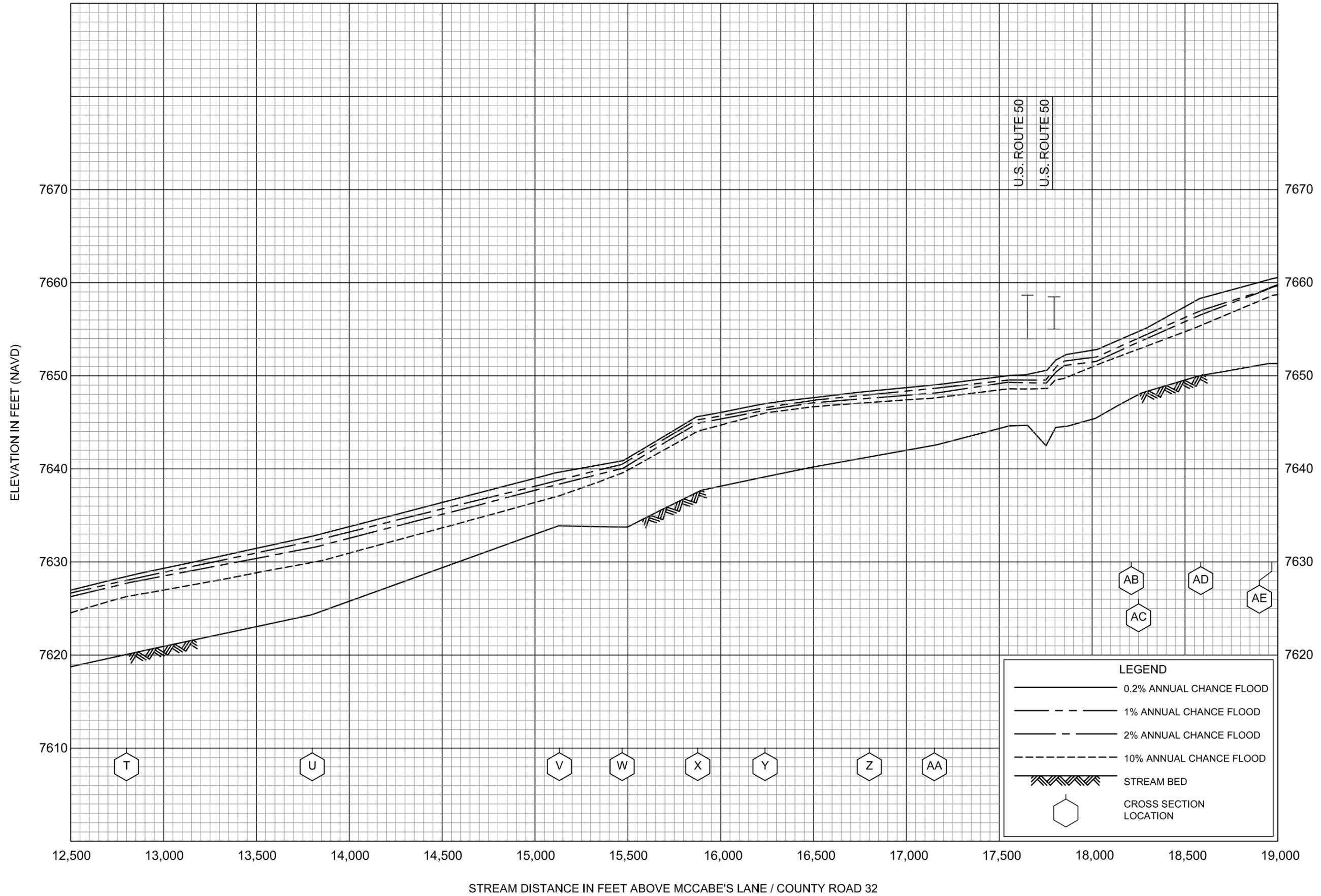
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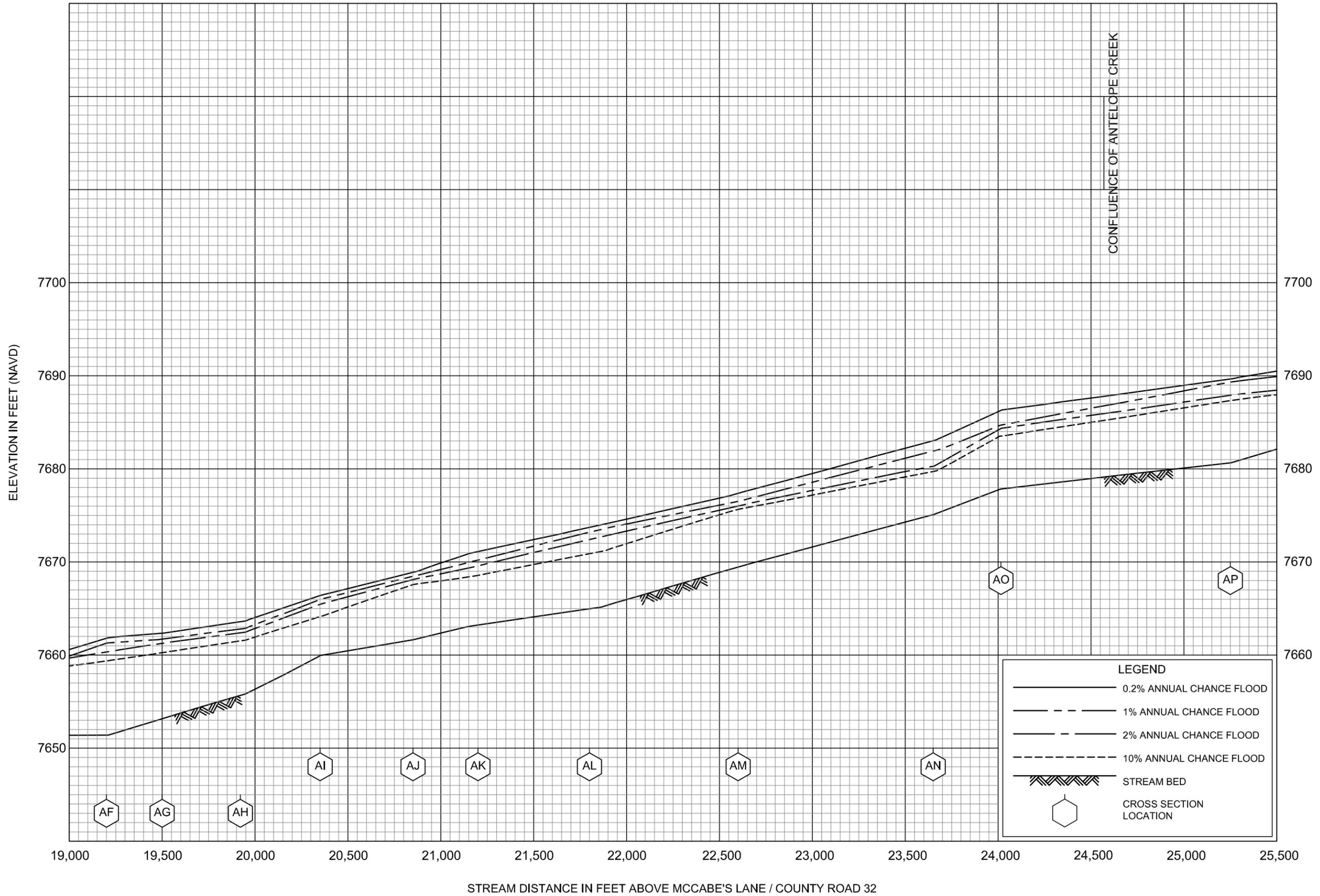
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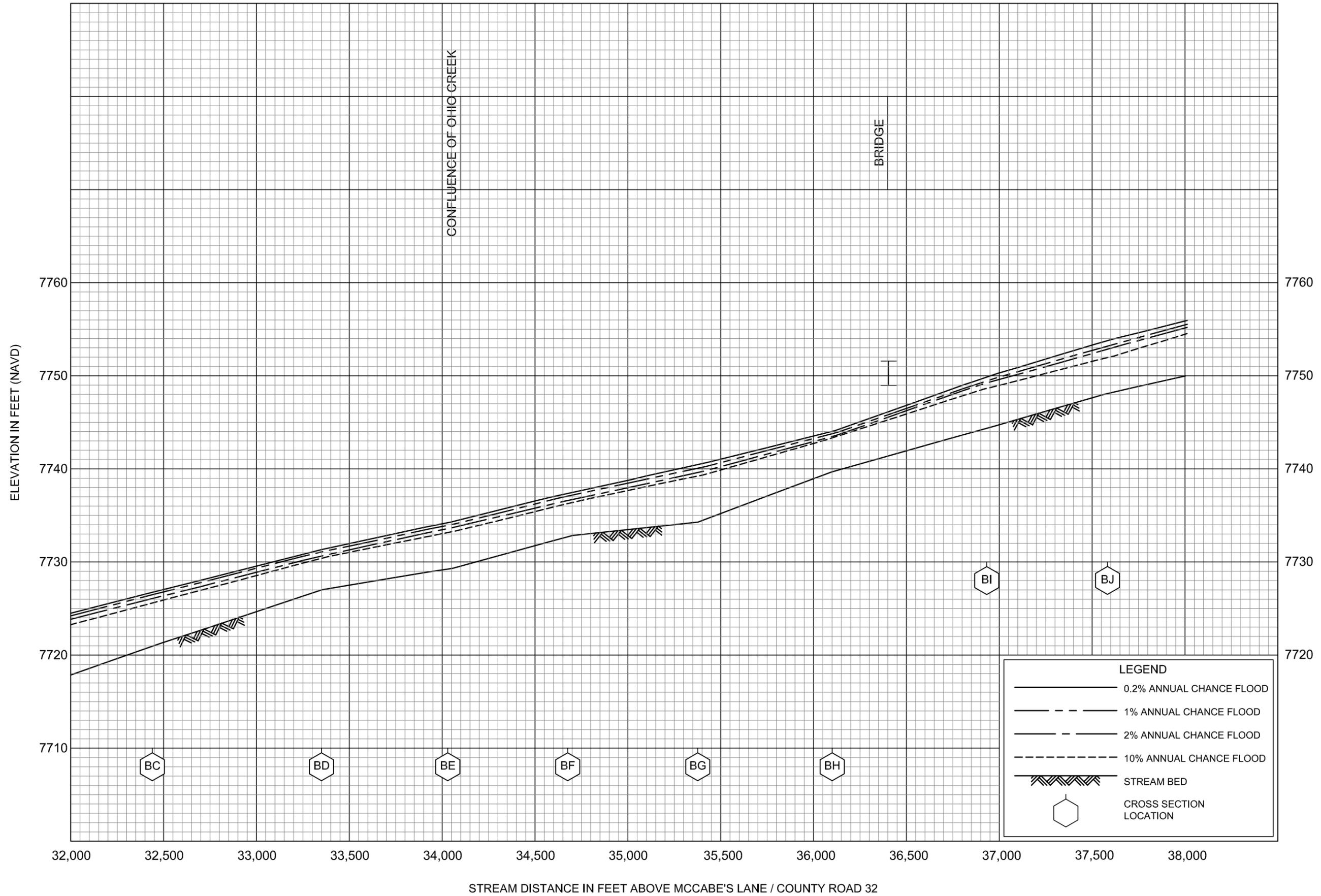
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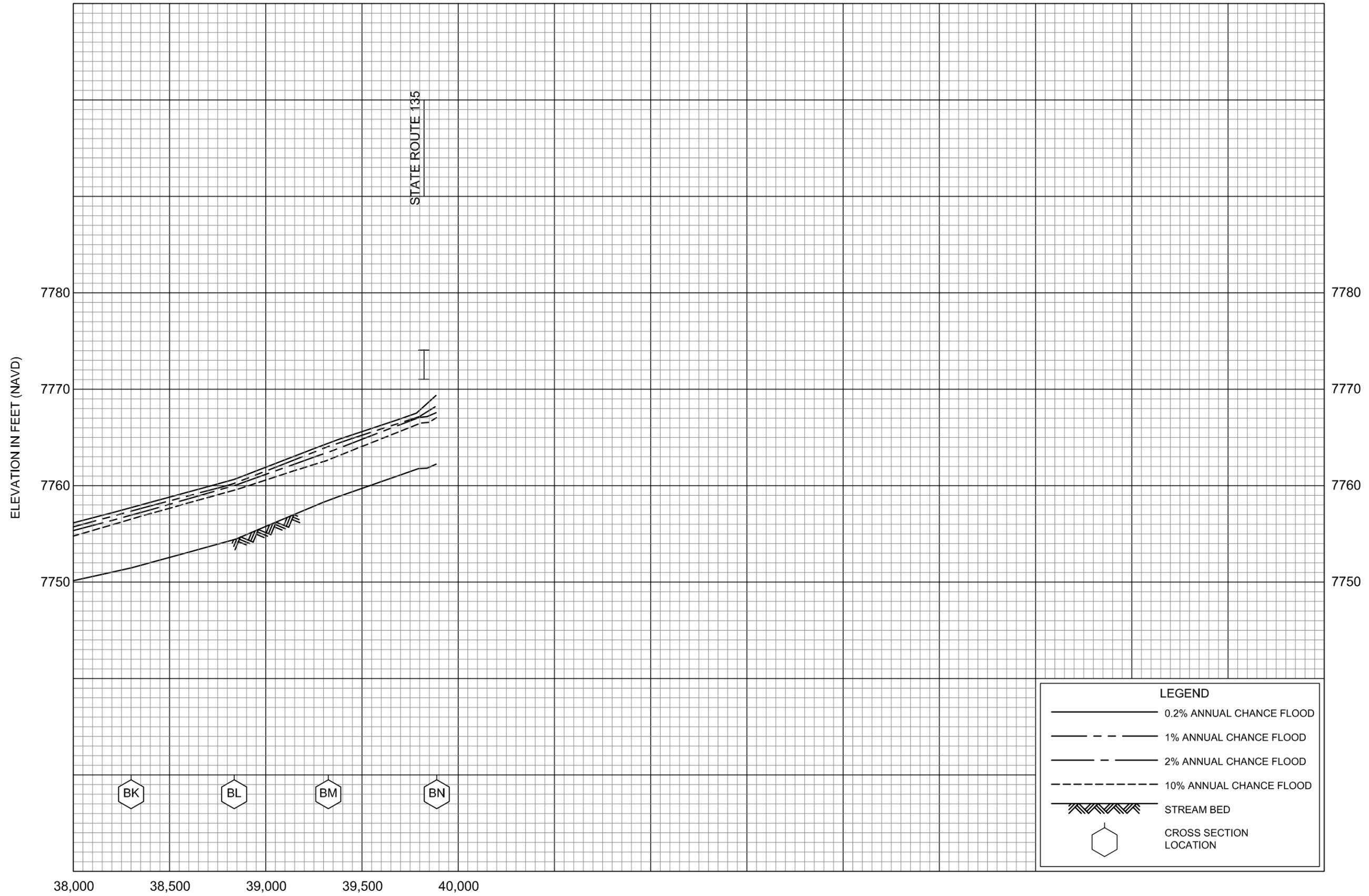
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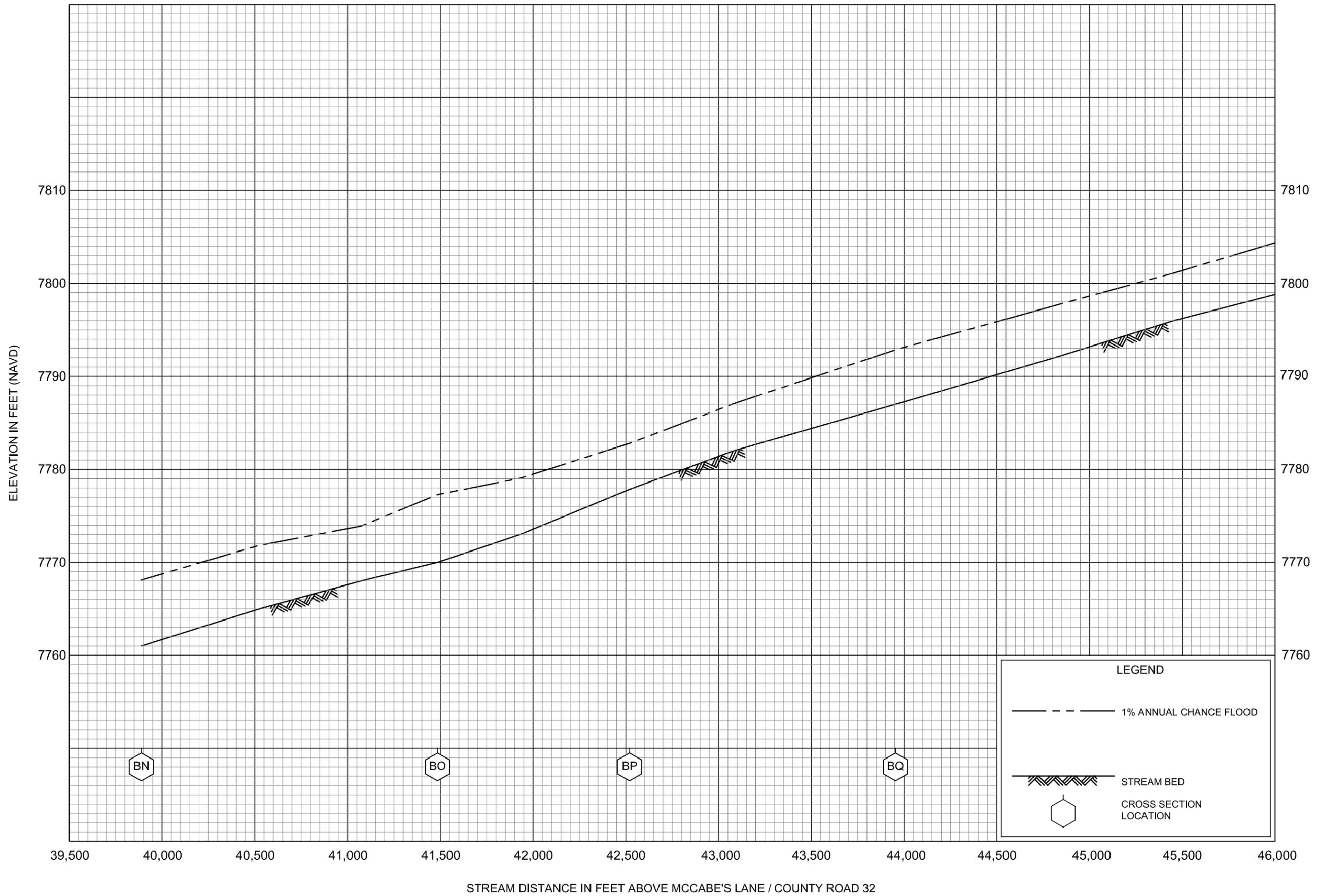
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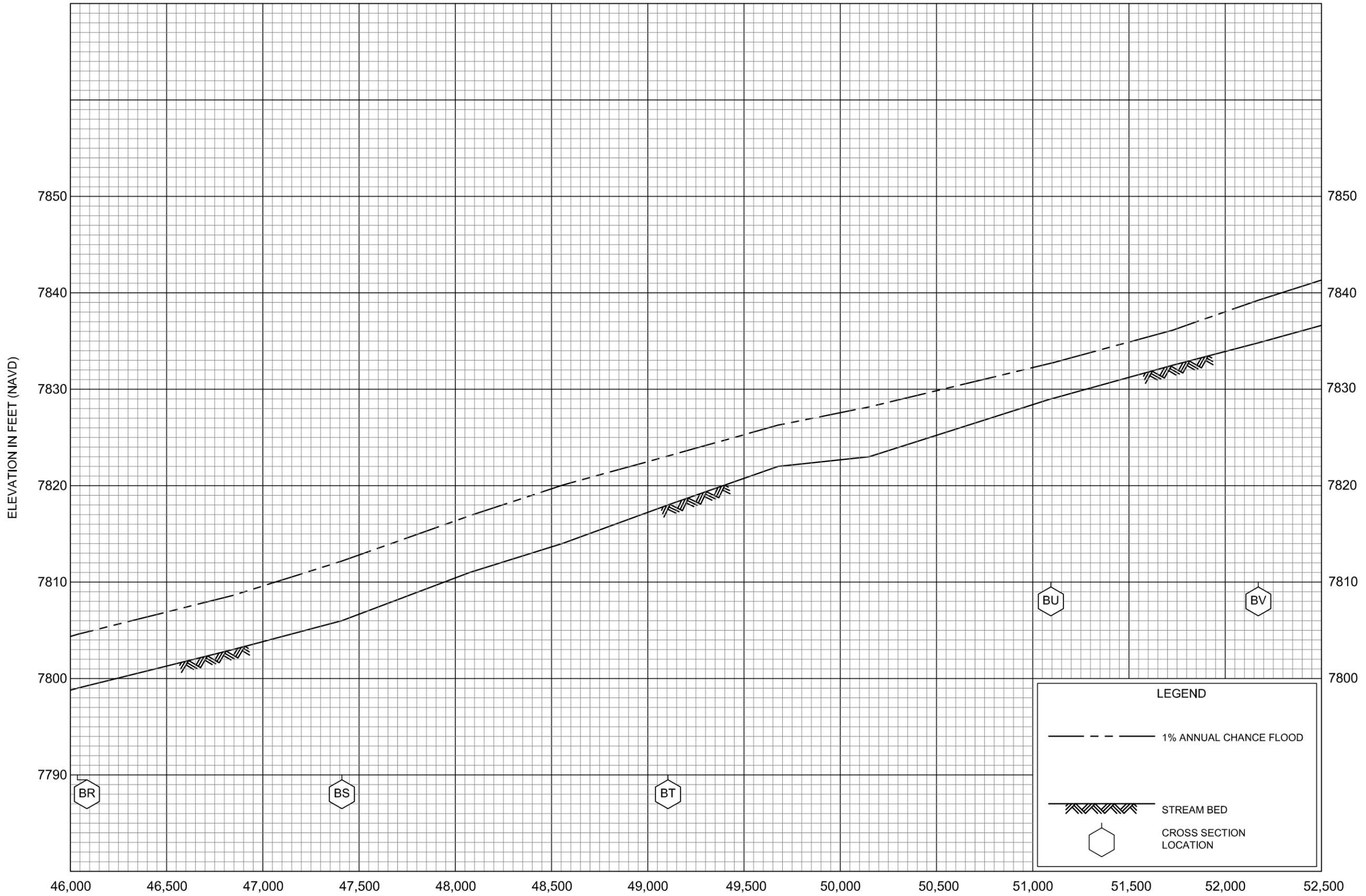
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STREAM DISTANCE IN FEET ABOVE MCCABE'S LANE / COUNTY ROAD 32



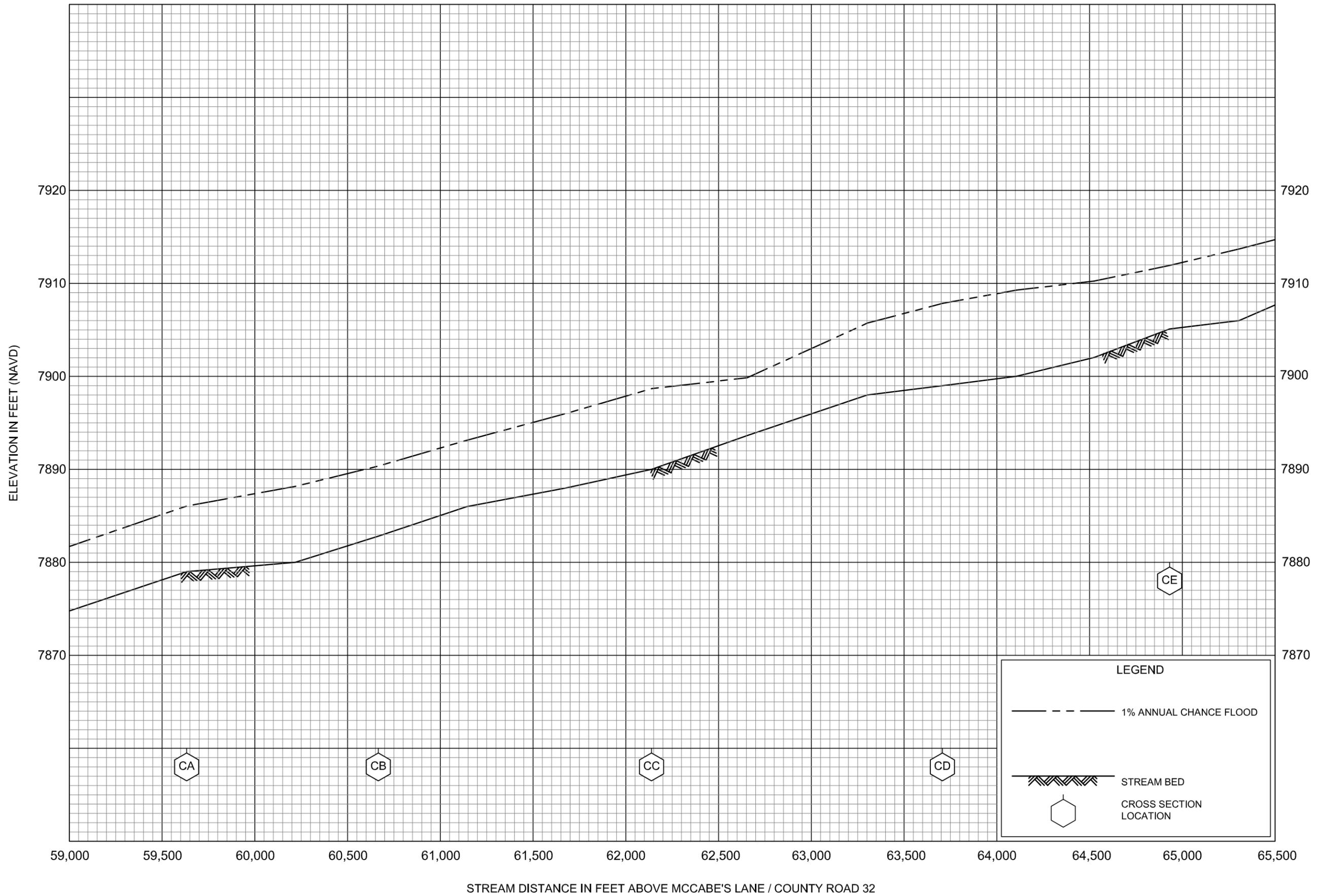
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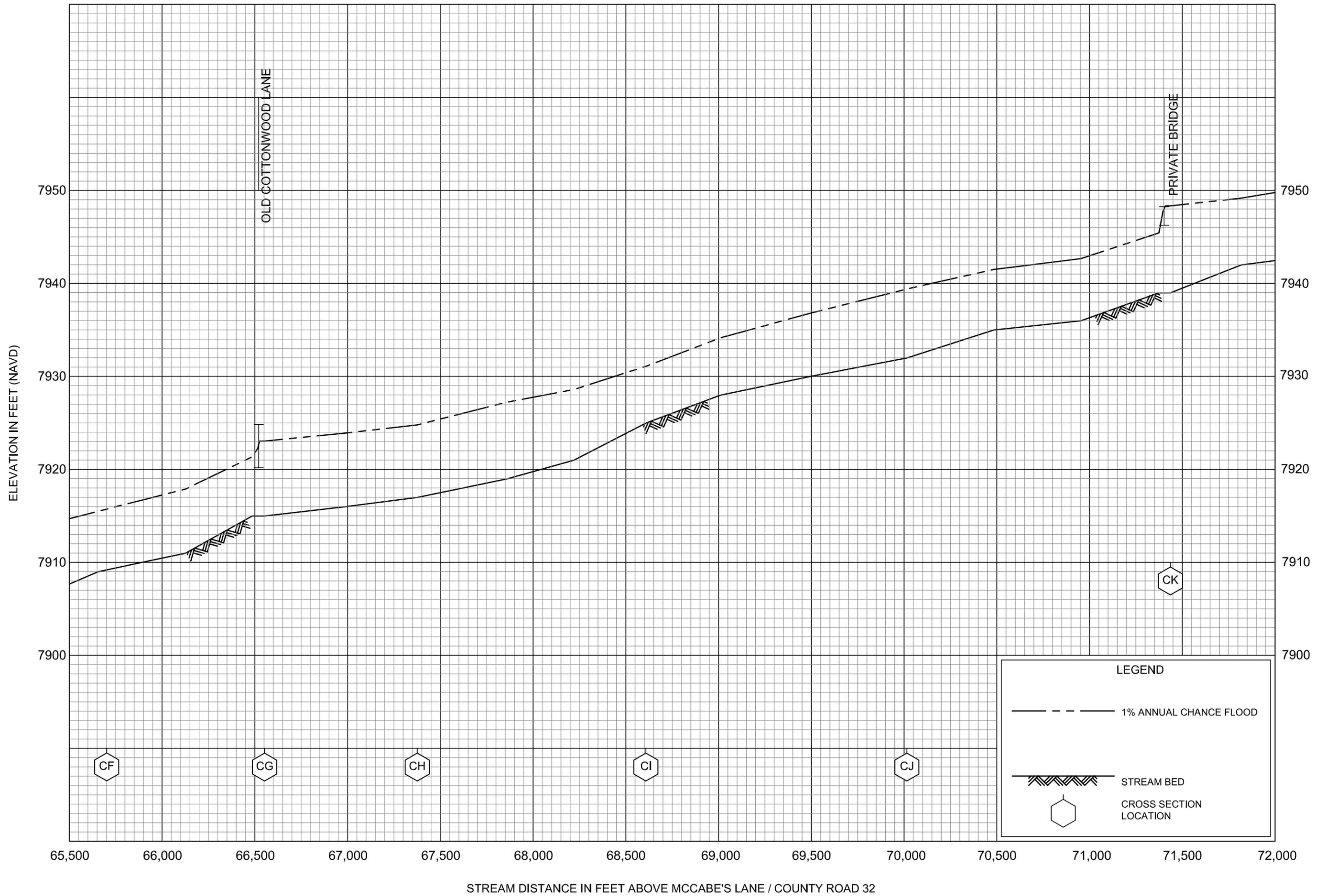
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AND GUNNISON RIVER**

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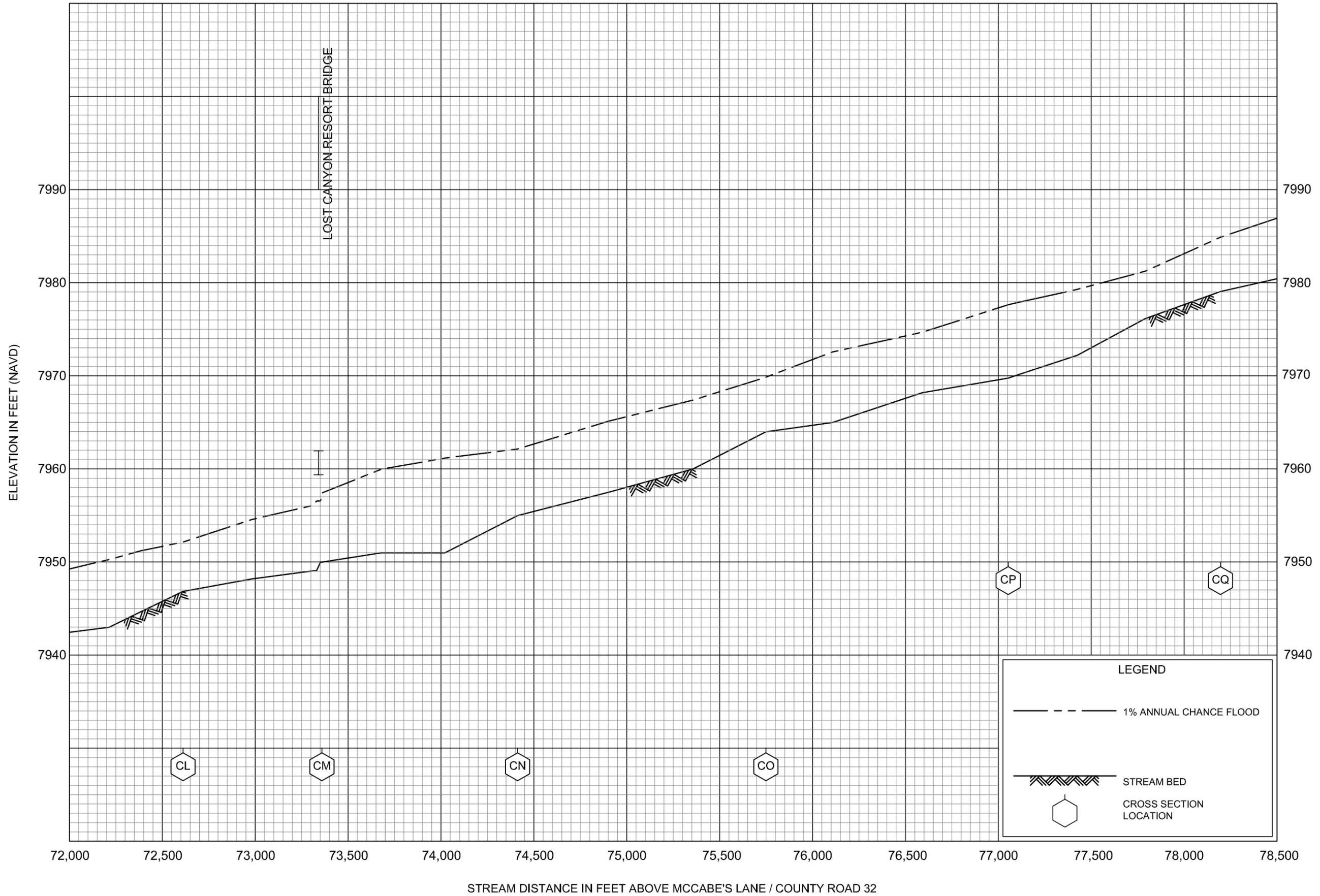
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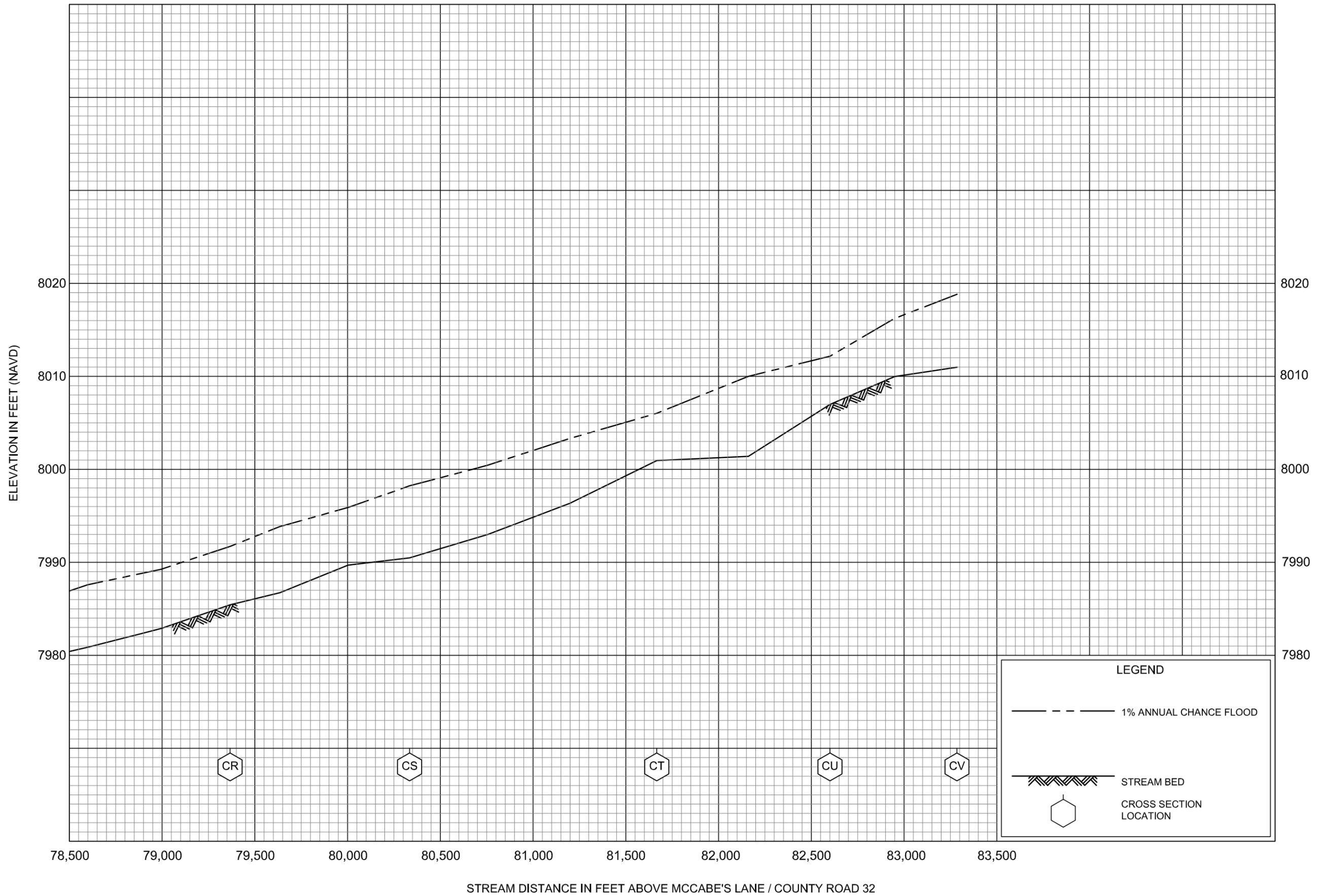
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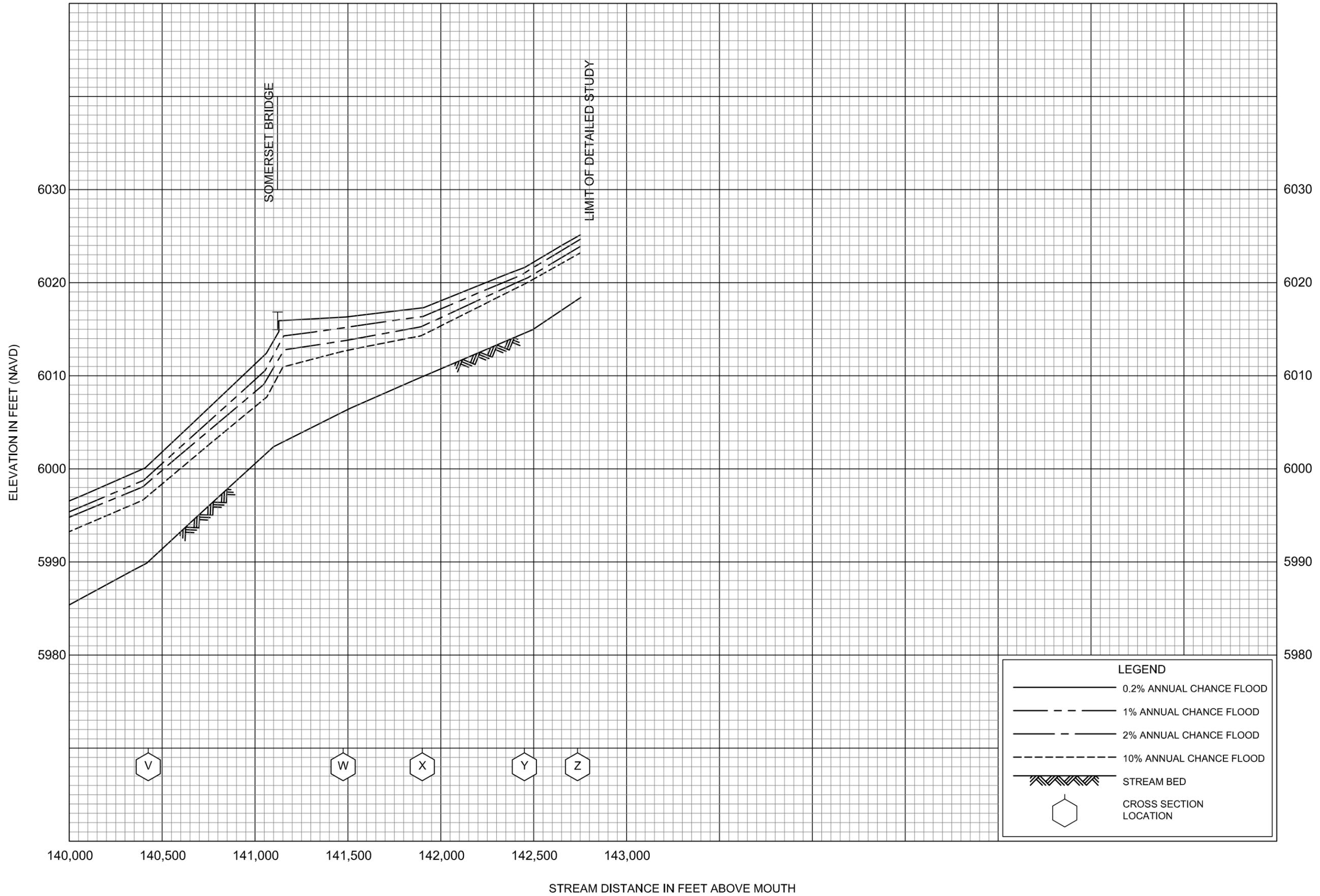
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GUNNISON RIVER**

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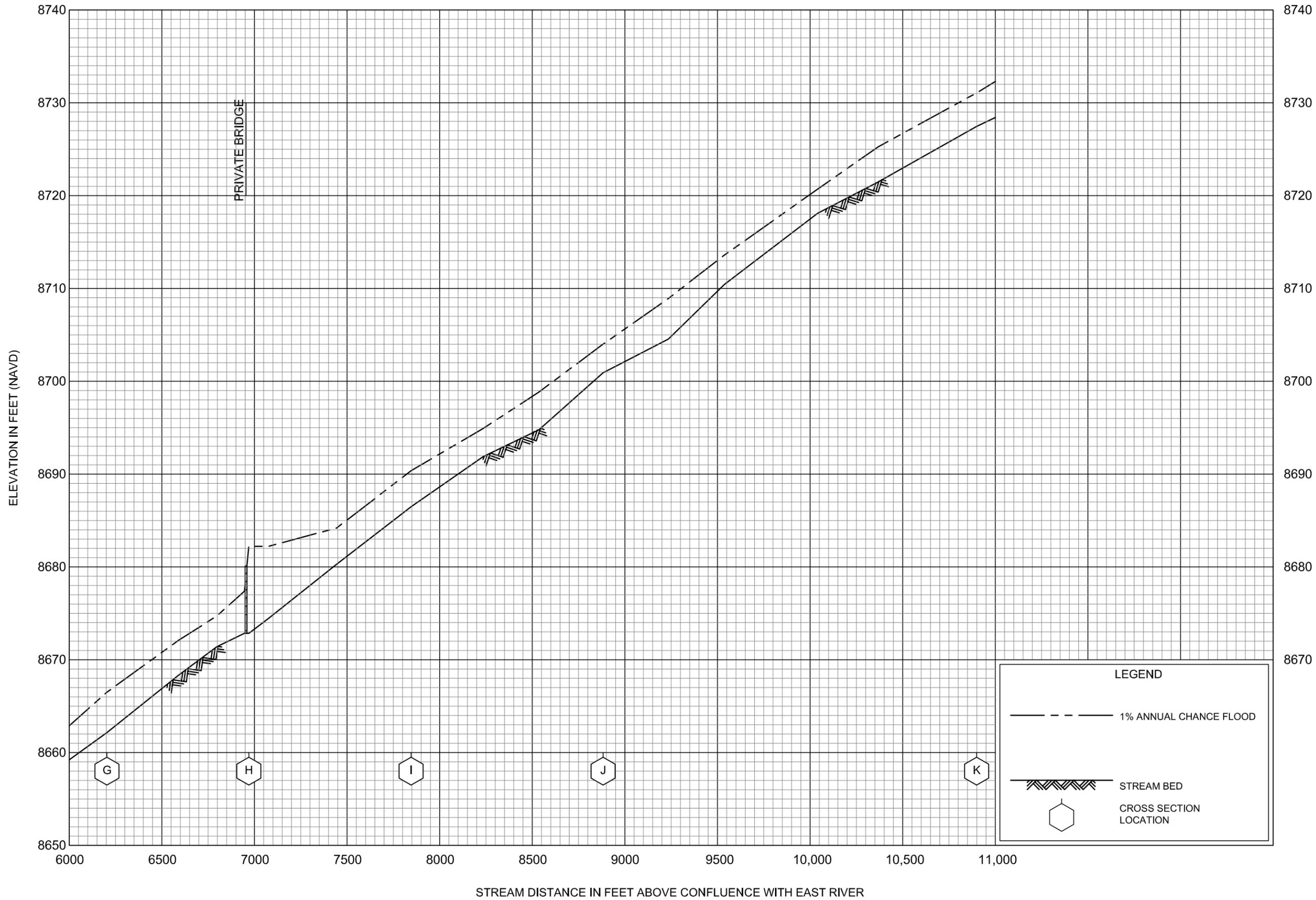


FLOOD PROFILES

NORTH FORK GUNNISON RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

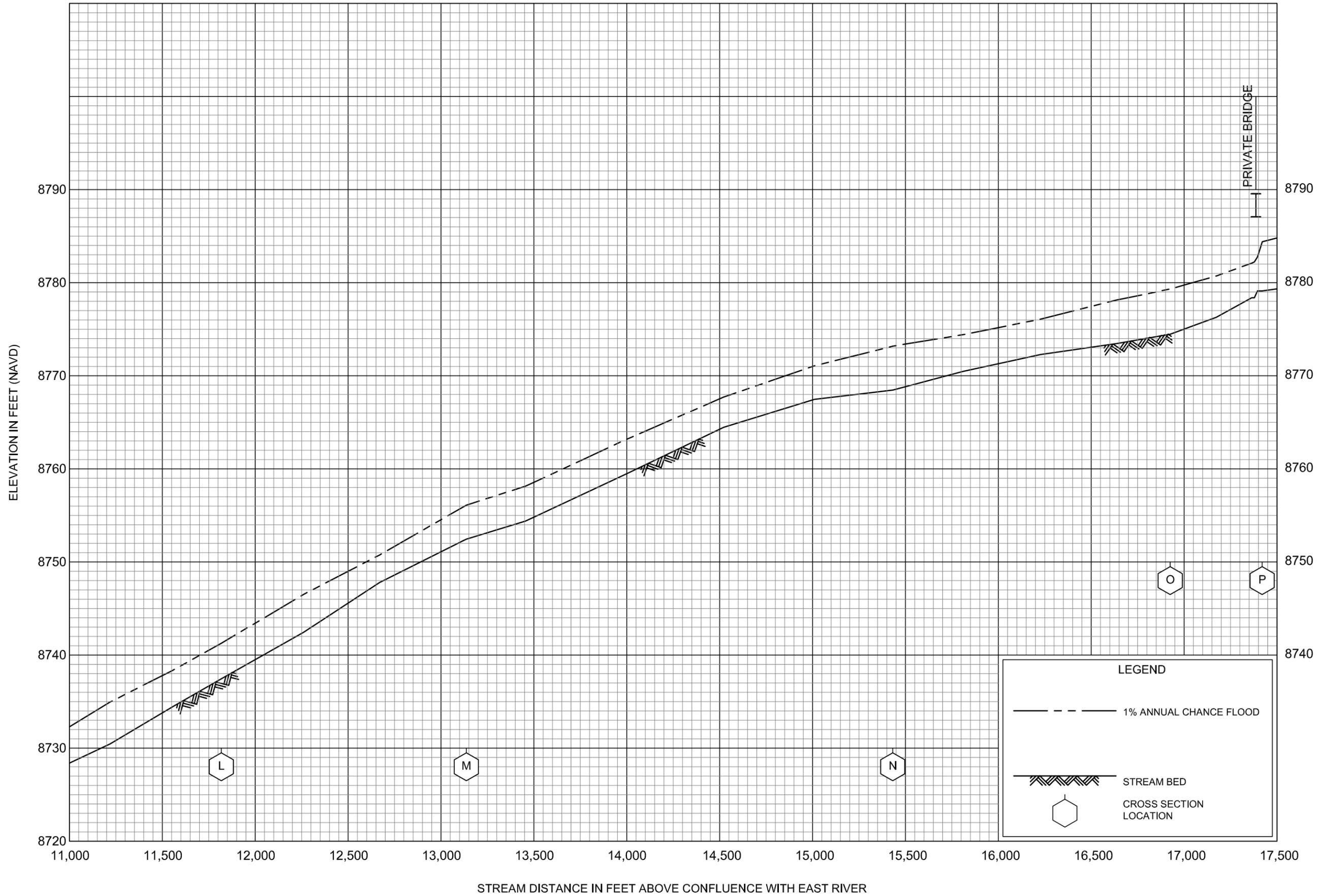
GUNNISON COUNTY, CO
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FLOOD PROFILES

SLATE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
 GUNNISON COUNTY, CO
 AND INCORPORATED AREAS

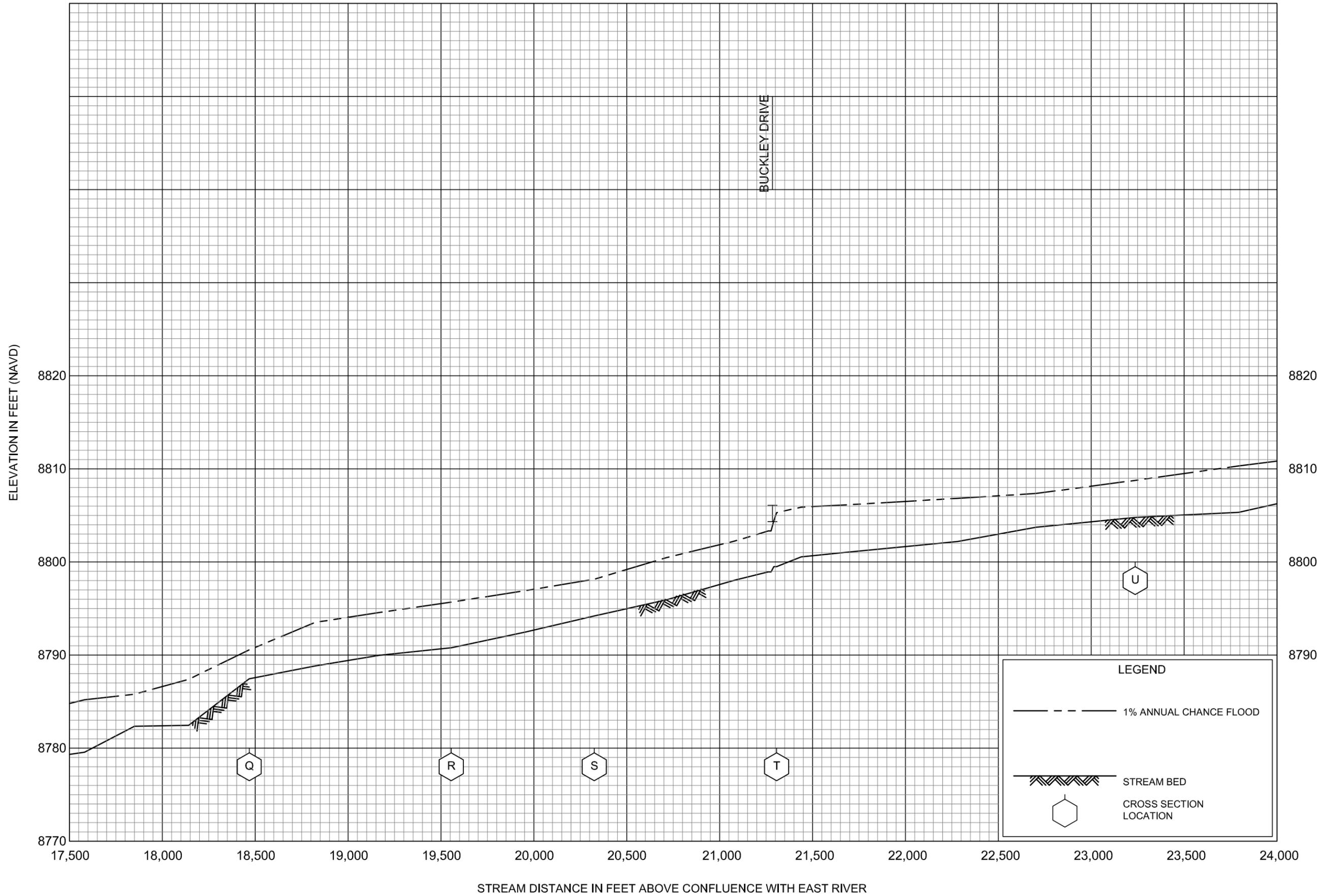


FLOOD PROFILES

SLATE RIVER

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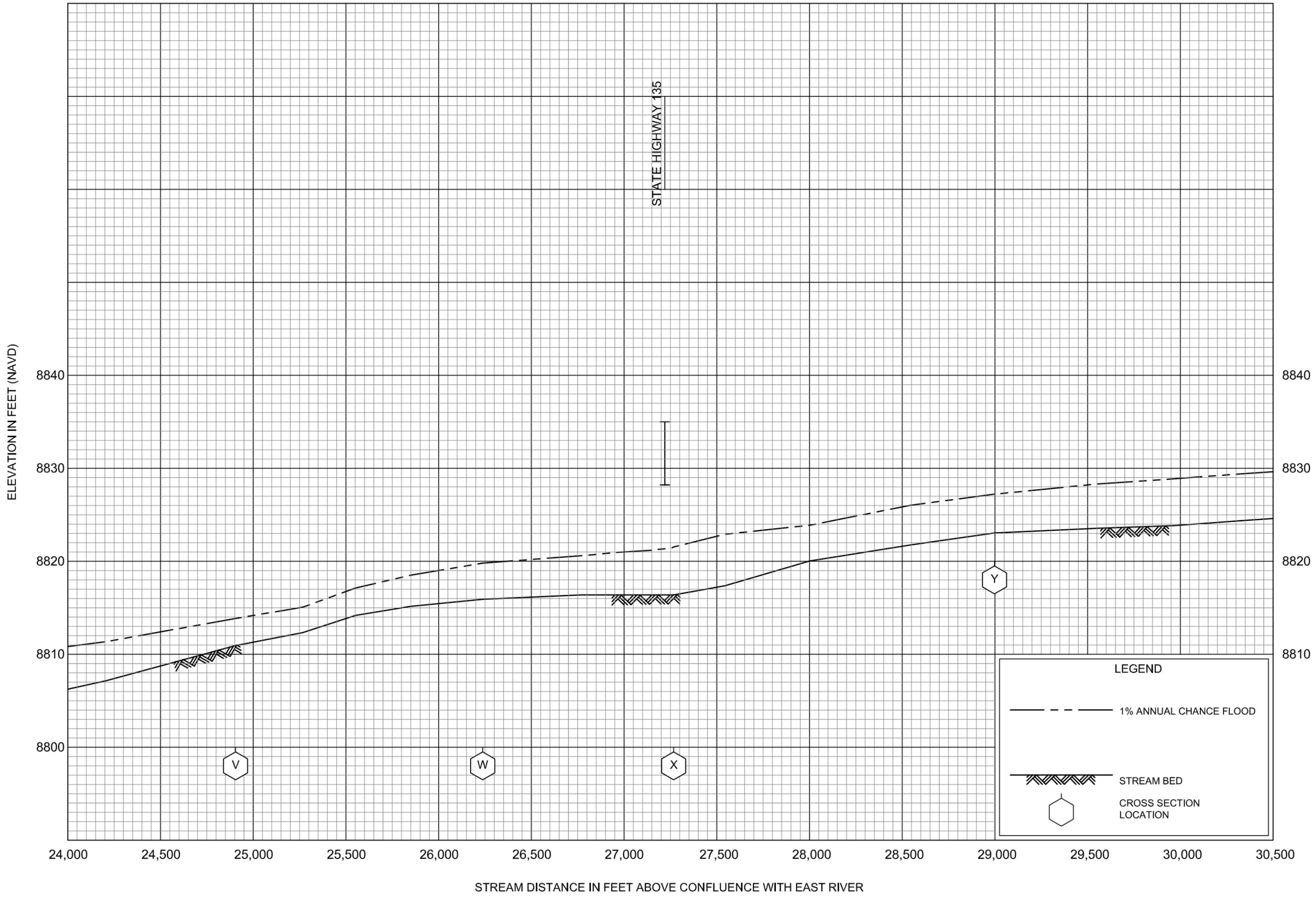


FLOOD PROFILES

SLATE RIVER

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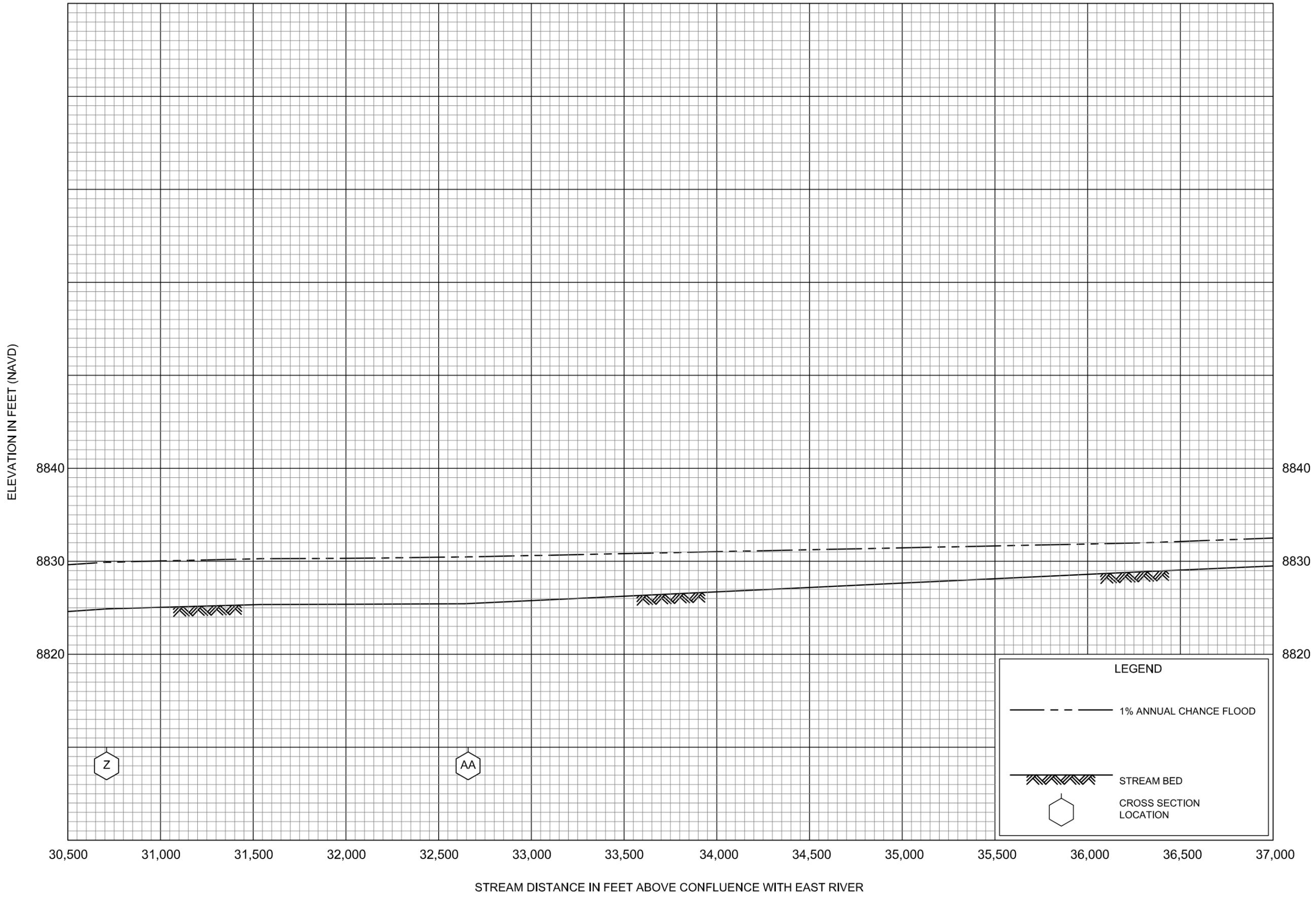


FLOOD PROFILES

SLATE RIVER

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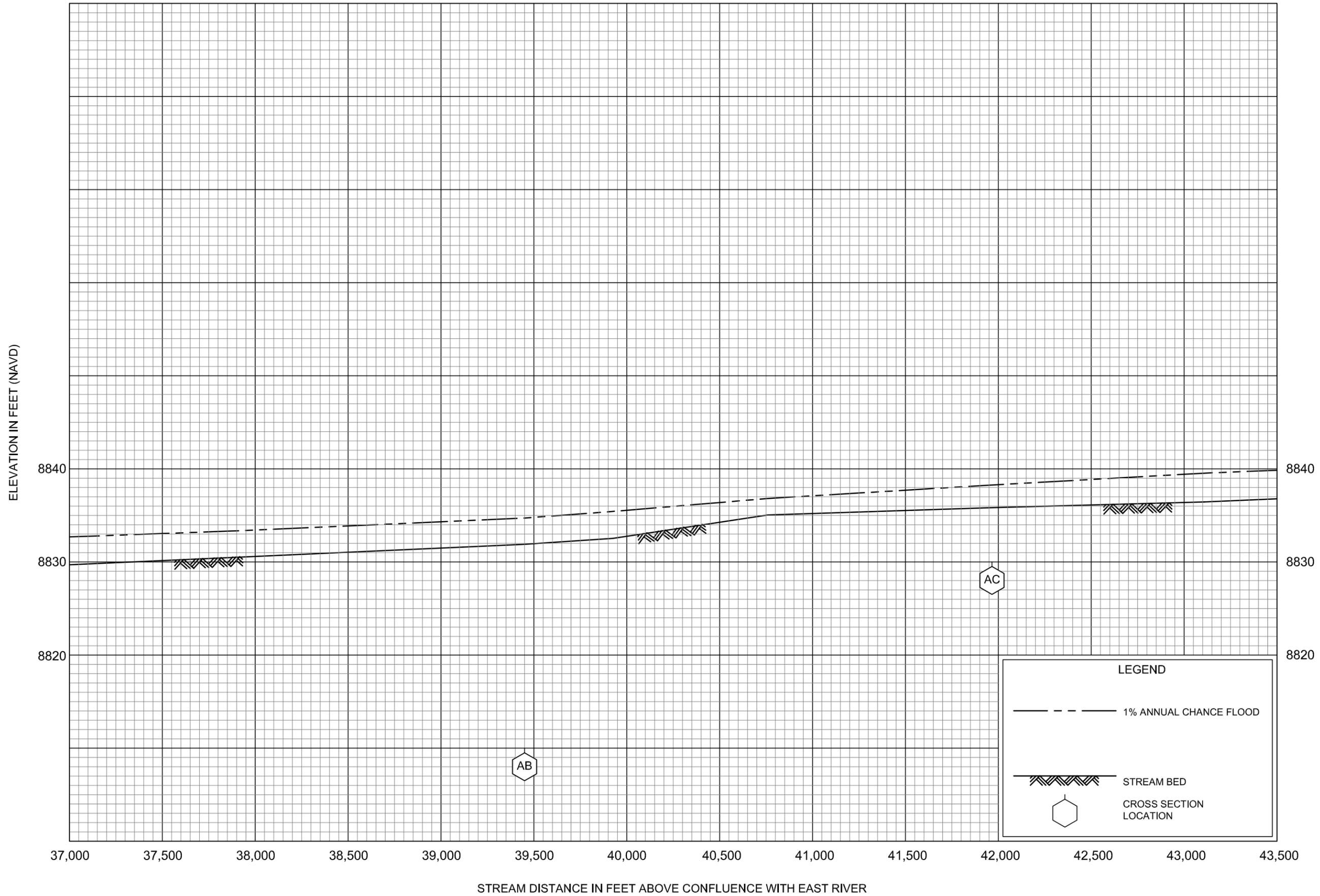


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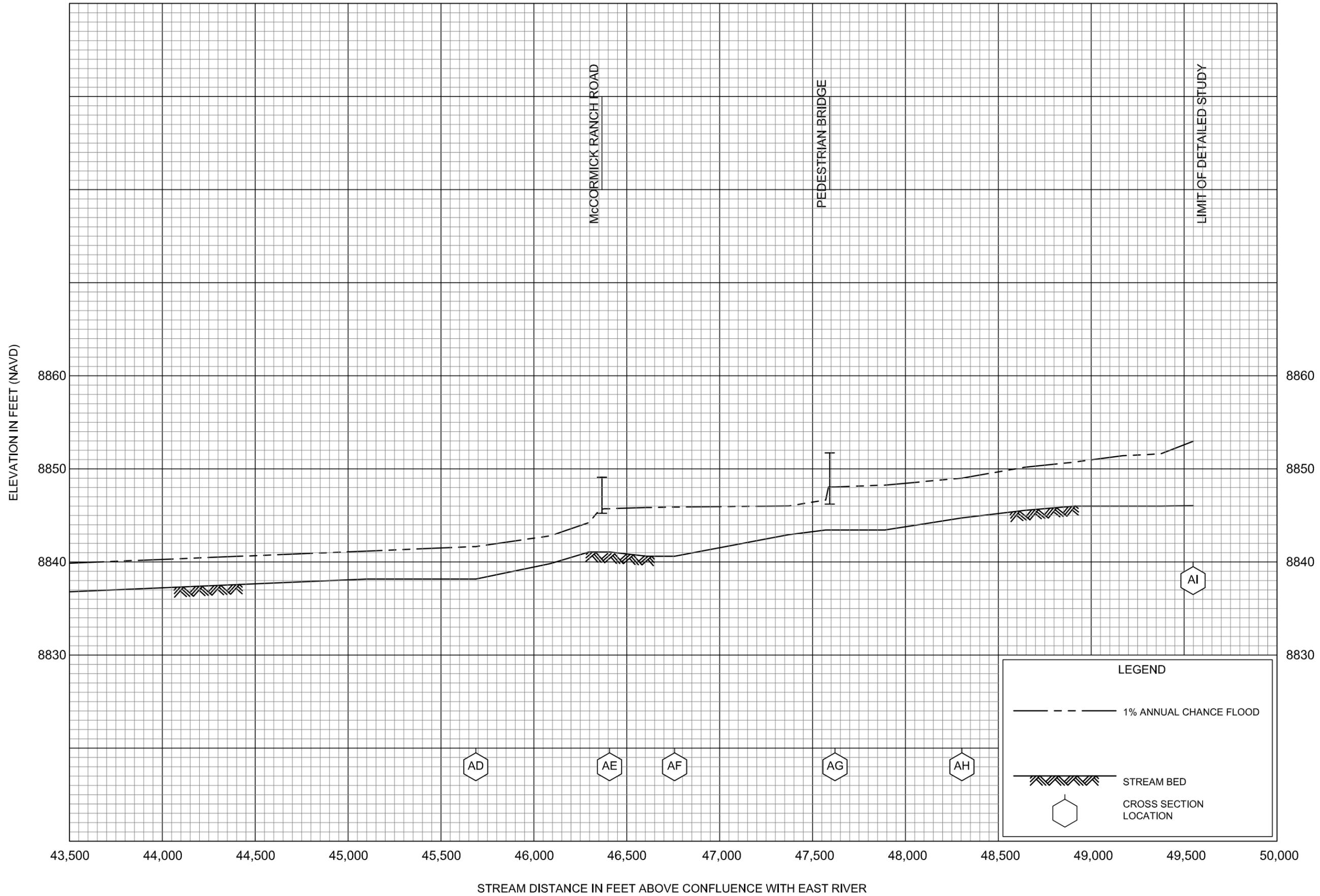
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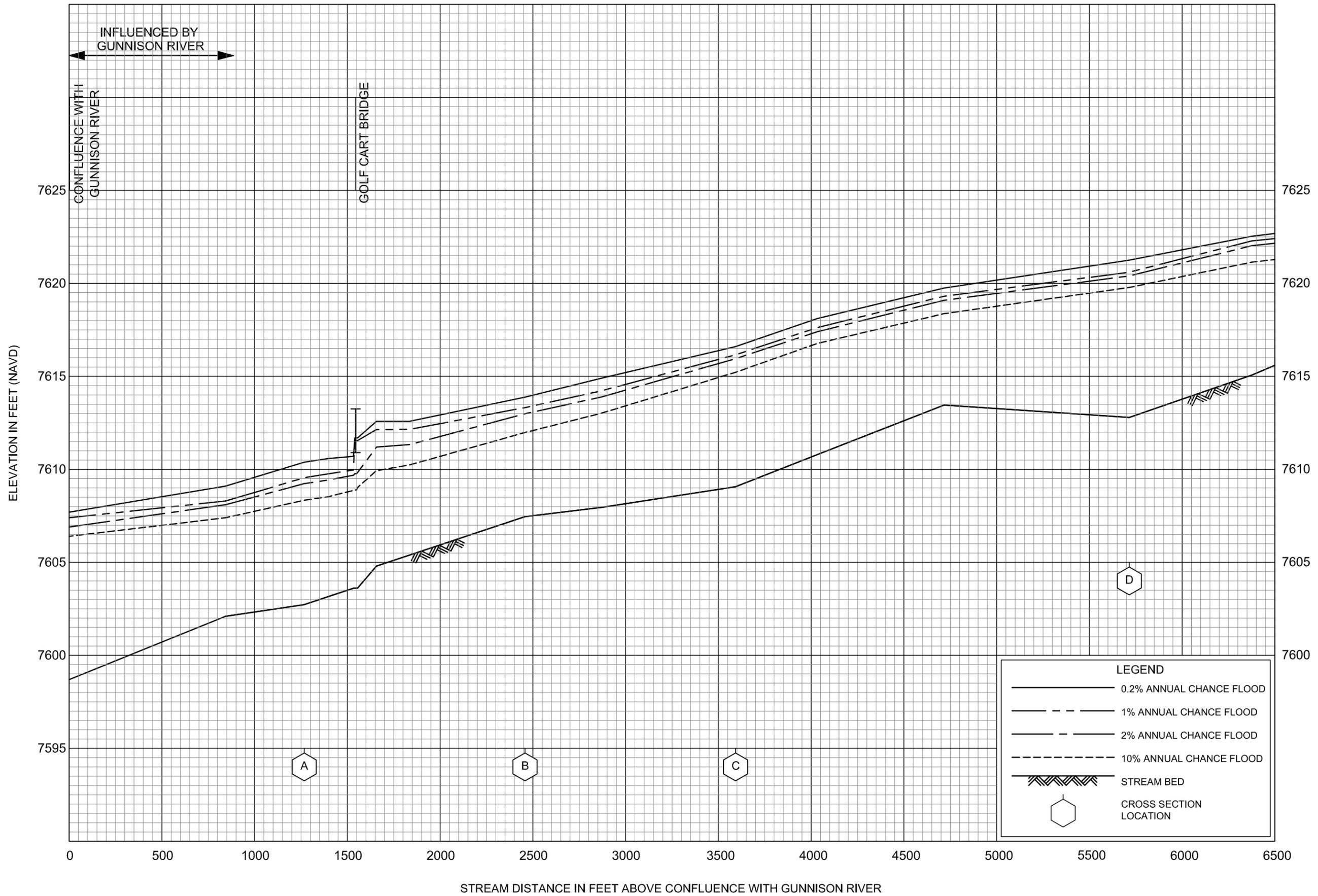
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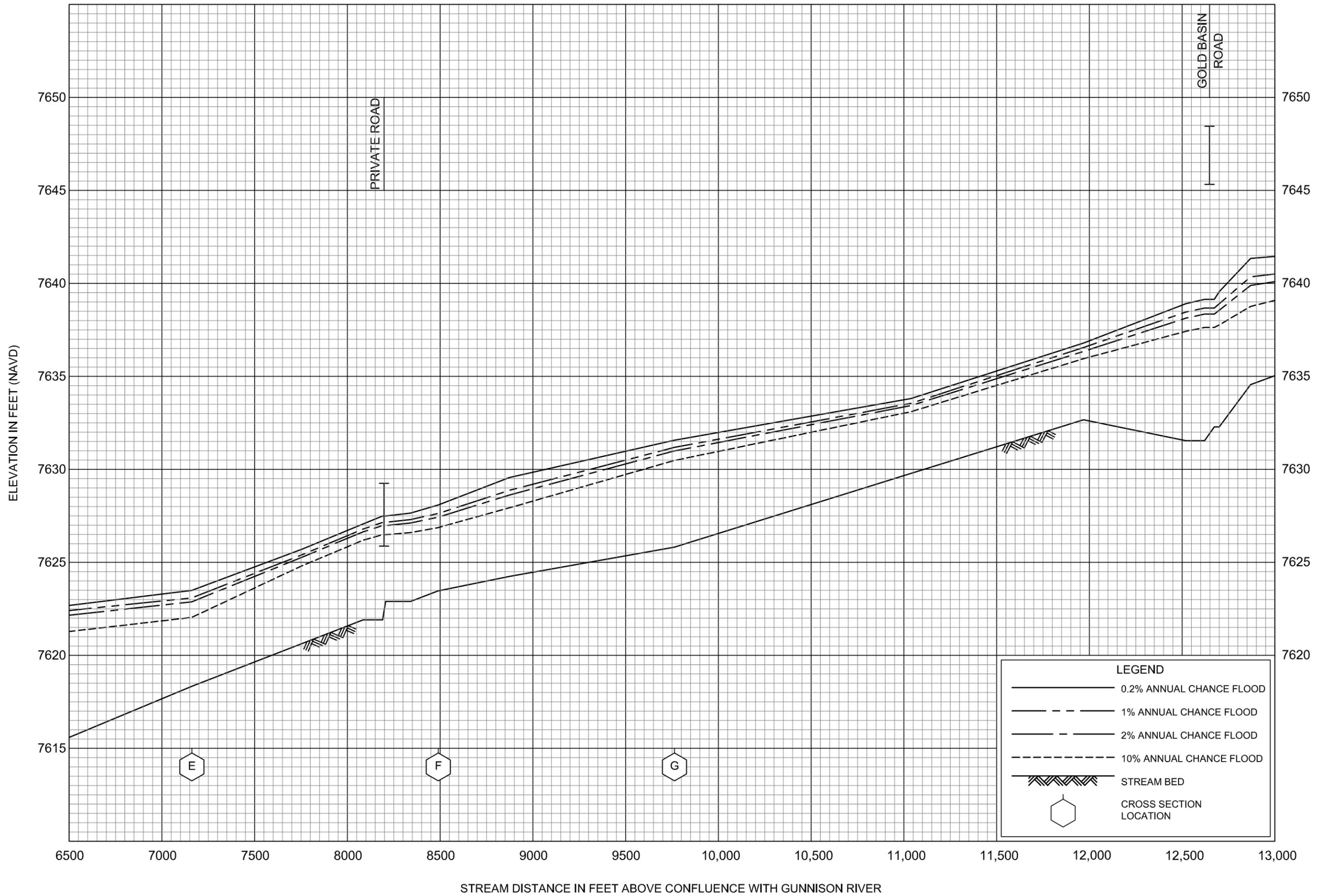


FLOOD PROFILES

TOMICHI CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

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AND INCORPORATED AREAS

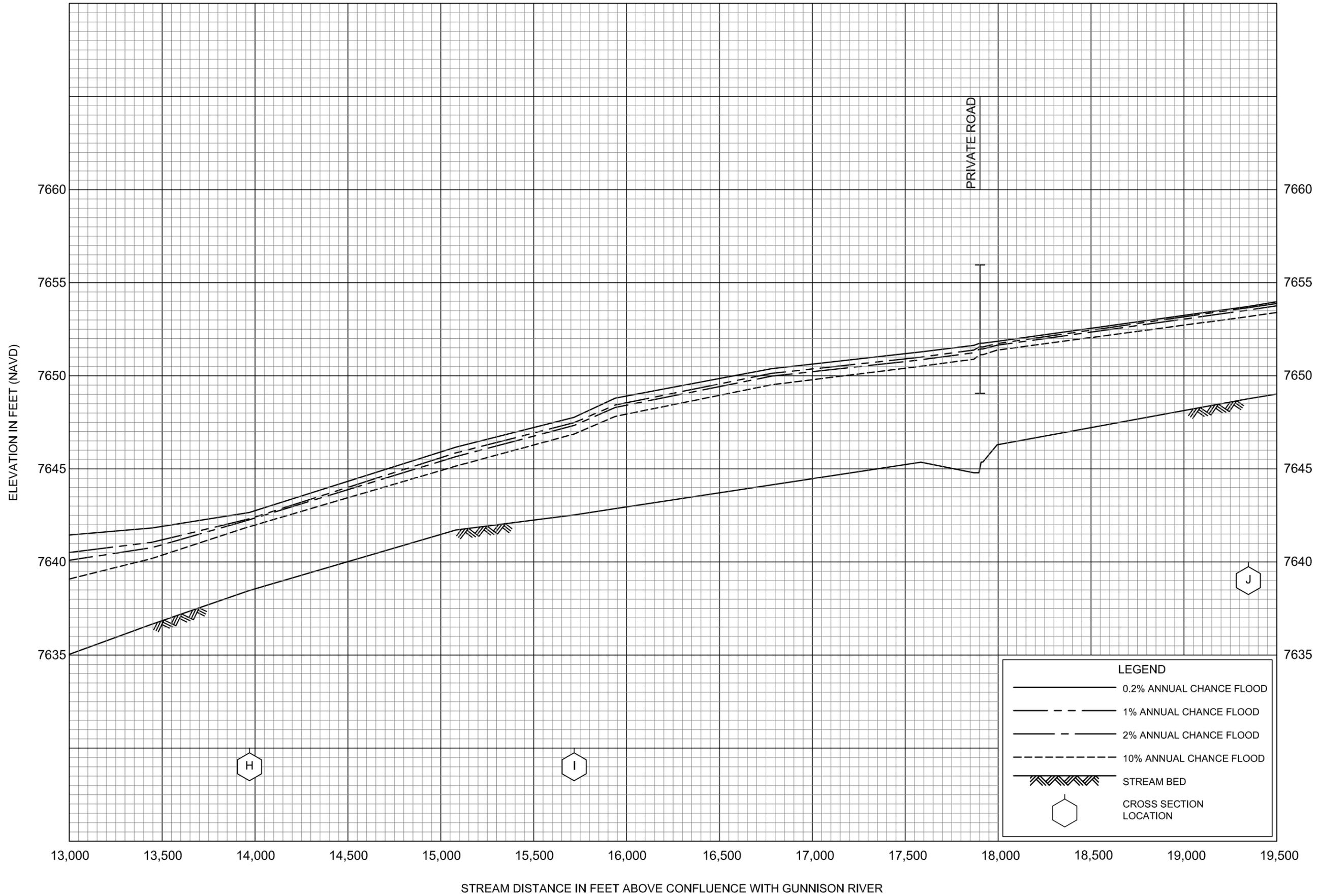


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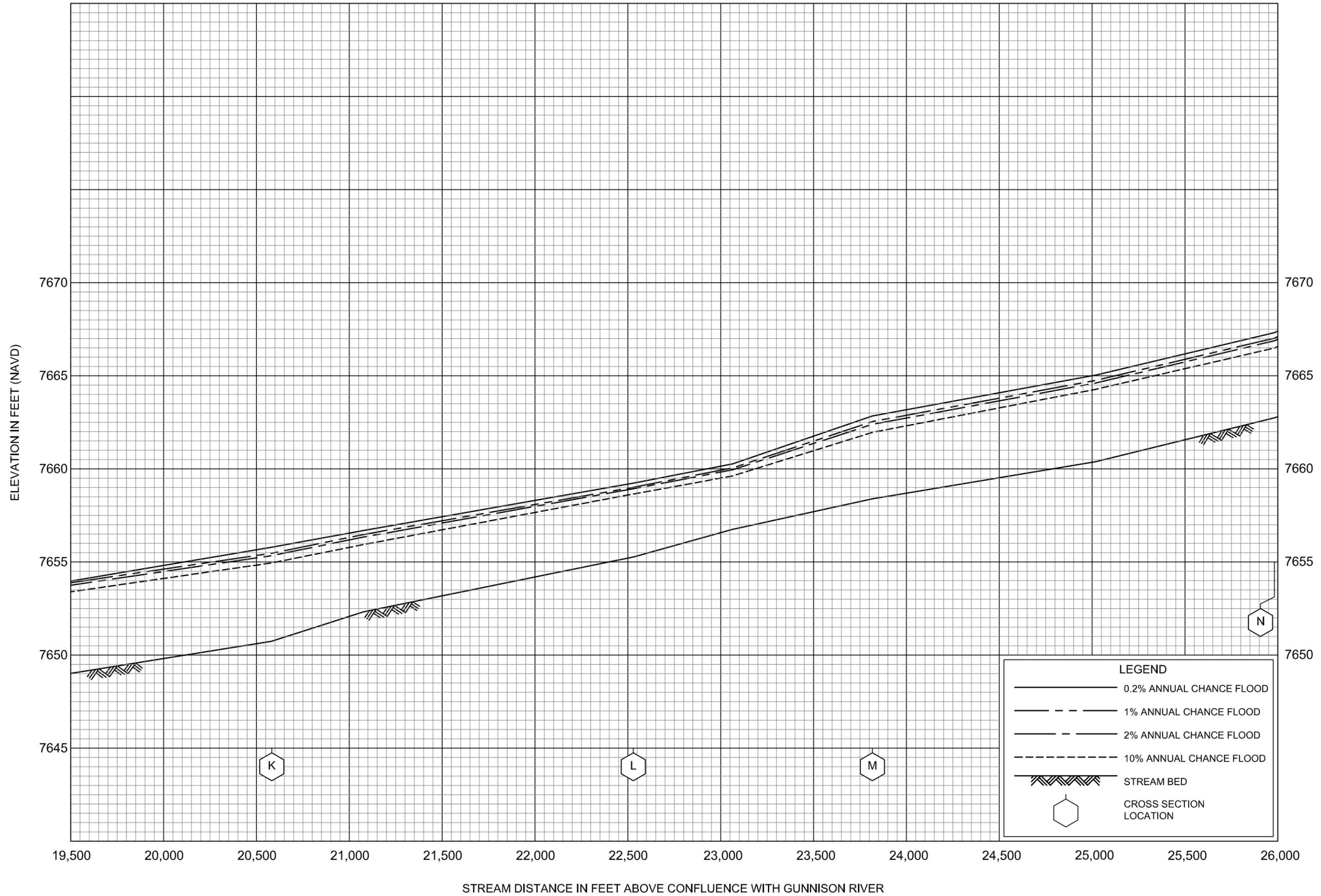


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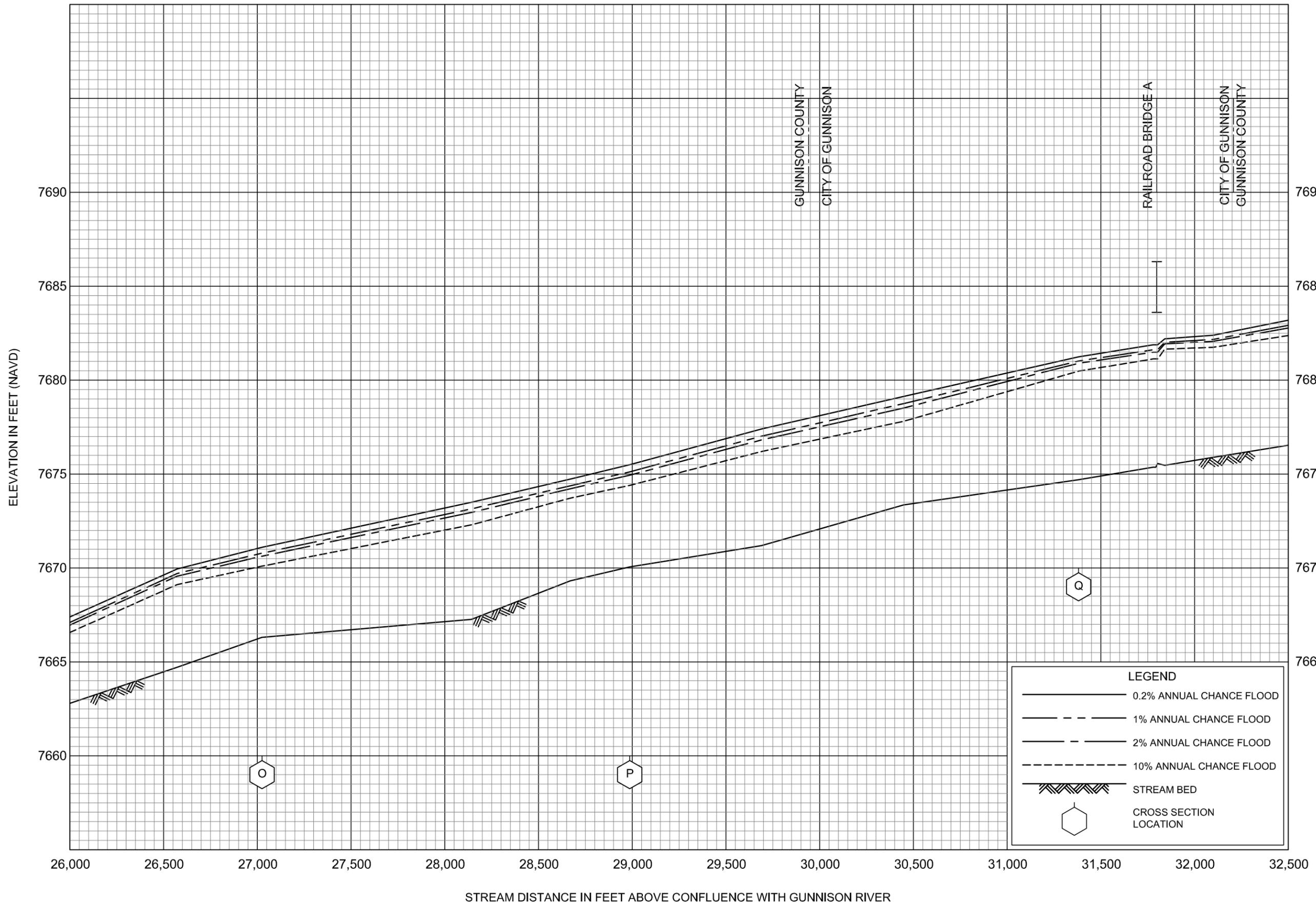
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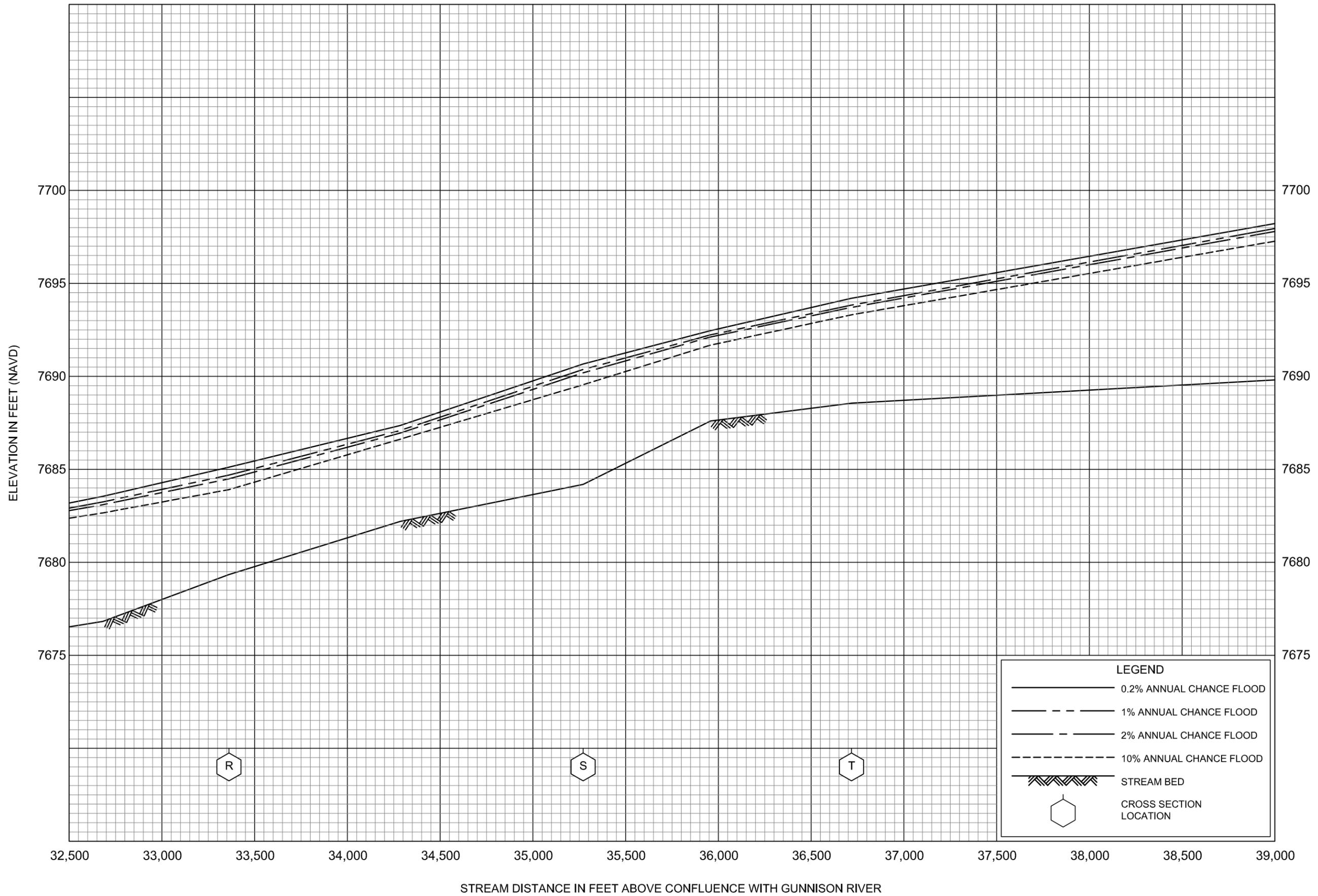
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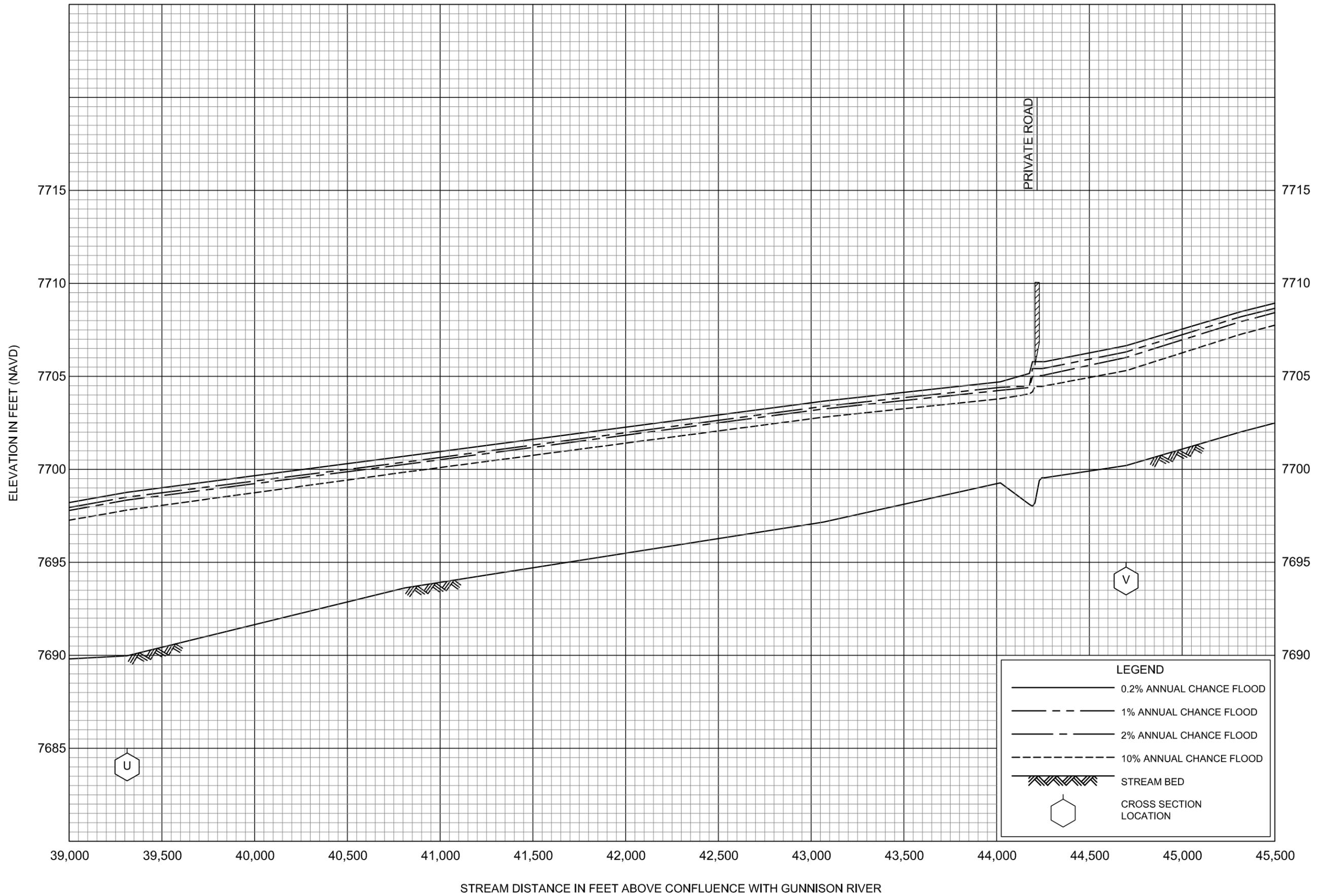


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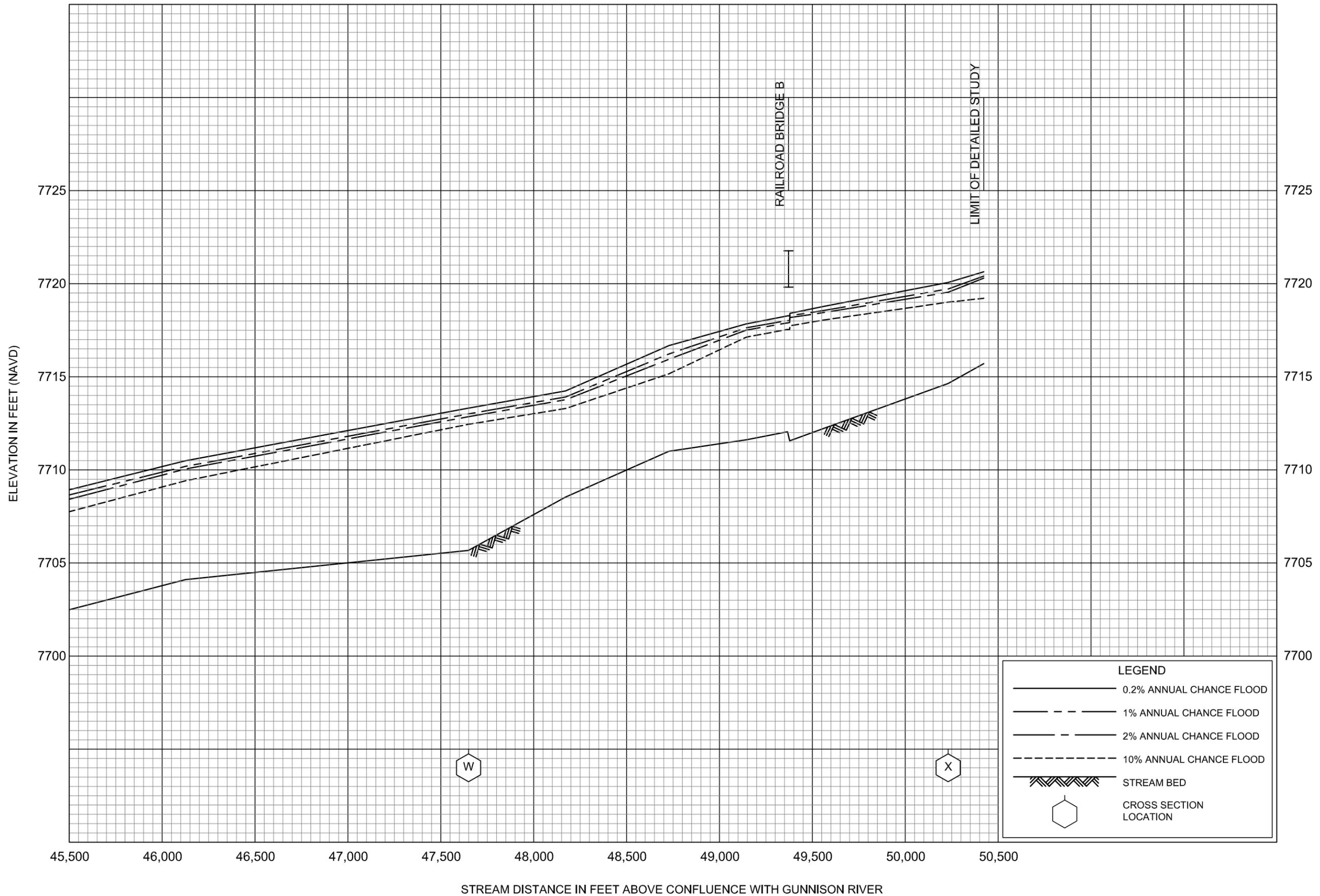


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