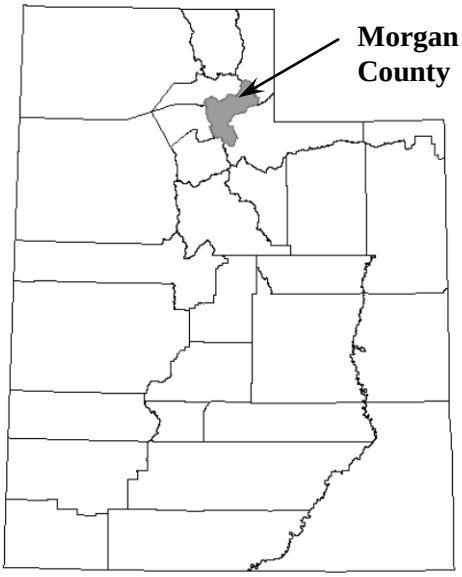
FLOOD INSURANCE STUDY

MORGAN COUNTY, UTAH
AND INCORPORATED AREAS

Community Name	Community Number
Morgan City, City of	490093
Morgan County (Unincorporated Areas)	490092



REVISED:

PRELIMINARY
MARCH 25, 2016

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
49029CV000B

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) 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. It is advisable to 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 at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision (LOMR) 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.

This FIS report was revised on _____. Users should refer to Section 10.0, Revisions Description, for further information. Section 10.0 is intended to present the most up-to-date information for specific portions of this FIS report. Therefore, users of this FIS report should be aware that the information presented in Section 10.0 supersedes information in Sections 1.0 through 9.0 of this FIS report.

Initial Countywide Effective Date: April 19, 2010

Revised Countywide Effective Date: _____

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
MORGAN COUNTY, UTAH AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Morgan County, including Morgan City and the unincorporated areas of Morgan County (referred to collectively herein as Morgan 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 and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

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 FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

Information on the authority and acknowledgments for each of the previously printed FISs and FIRMs for communities within Morgan County was compiled and is shown below.

Morgan City	The hydrologic and hydraulic analyses for the original study were performed by Simons, Li and Associates, Inc., for the Federal Emergency Management Agency (FEMA), under contract No. EMW-84-C-1629. This study was completed in February 1986 (Reference 1).
Morgan County, Unincorporated Areas	The hydrologic and hydraulic analyses for the original study were performed by the U.S. Geological Survey (USGS), Water Resources Division, Utah District for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-85-E-1823. This work was completed in January 1989 (Reference 2).

Additional refinement of approximate hydrologic and hydraulic analyses were performed by Stantec Consulting Inc. (study contractor) for the Utah Department of Public Safety, Division of Emergency Management (Utah DEM) under Utah Contract No. 056457, and

FEMA under Contract No. EMD-2007-GR-0786. This work, which was completed in October 2009, covered unprotected flooding sources affecting Morgan County.

In addition to incorporating the two previously existing FISs for communities within Morgan County, the initial countywide study effective 2010 included new approximate studies, inclusion of all other effective profiles and incorporation of approved Letters of Map Changes (LOMCs). The vertical datum was shifted to North American Vertical Datum of 1988 (NAVD88). The digital floodplain data was merged into a single, updated digital FIRM. The FIRM included 2006 NAIP 1 meter orthophotography, 2- and 5-meter Digital Elevation Models (DEM), 1:24,000 political boundaries, road centerlines with street names, railroads with names, airports, rivers, lakes, streams, bridges and other hydraulic structures and elevation reference marks. All digital information was obtained from the Utah Automated Geographic Reference Center (AGRC) in projection NAD 1983 UTM Zone 12N.

1.3 Coordination

The purpose of an initial Consultation Coordination Officer's (CCO's) meeting is to discuss the scope of the FIS. A final CCO meeting is held to review the results of the study. The dates of the initial and final CCO meeting held for the previous FISs for Morgan County and the incorporated communities within its boundaries are shown in TABLE 1 (References 1-2).

TABLE 1 ─ Morgan County CCO Meetings

Community Name	Initial CCO Date	Final CCO Date
Morgan City	April 17, 1984	January 30, 1986
Morgan County, Unincorporated Areas	August 17, 1988	December 6, 1989

Two initial CCO meetings for the 2010 countywide study were held on March 30, 2006 and May 16, 2007 and were attended by representatives of FEMA, the Utah Division of Homeland Security (HLS), the study contractor and other local participants.

The results of the study were reviewed at the final CCO meeting held on June 4, 2009, and attended by representatives of Morgan County, Morgan City, Utah HLS and FEMA. All problems raised at that meeting have been addressed.

AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Morgan County, Utah, including the incorporated communities listed in Section 1.1.

The flooding sources studied by detailed methods are shown in TABLE 2. The limits of the detailed studies are described from upstream to downstream.

TABLE 2 ─ Limits of Detailed Studies

Flooding Source	Limits of Detailed Study
Cottonwood Creek	From Cottonwood Canyon Road crossing downstream to the confluence with the Weber River
Deep Creek	From a point approximately 3.1 miles upstream of the confluence with the Weber River to the confluence with the Weber River
East Canyon Creek	From confluence with Hardscrabble Creek downstream to confluence with the Weber River
East Canyon Creek (Above Reservoir)	From approximately 930 feet upstream of the confluence of Big Dutch Hollow Creek to East Canyon Creek Reservoir
Weber River	From approximately 1,000 feet upstream of I-84 crossing to the confluence with Cottonwood Creek

Approximate analyses are usually used to study areas having a low development potential or minimal flood hazards. Streams previously studied by approximate analyses are Big Hollow Creek, Black Hawk Canyon Creek, Cedar Canyon Creek, Cottonwood Canyon Creek, Dalton Creek, Deep Creek Tributary 1, Dry Creek, Dry Creek 2, Dry Fork Creek, Enterprise Ditch, Francis Canyon Creek, Gordon Creek, Guilder Sleeve Creek, Hardscrabble Creek, Hell Canyon Creek, Line Creek, Little Dutch Hollow Creek, Little Emigration Canyon Creek, Little Hollow Creek, Lost Creek, North Fork Dry Creek, North Fork Deep Creek, Roswells Canyon Creek, Schuster Creek, Sheep Canyon Creek, Sheep Creek, Smith Creek, South Fork Francis Canyon Creek, Spring Hollow Creek, Taggart Hollow Creek, Tom Condies Creek, Trail Creek, Tributary to Dry Creek and Willow Creek. Reserviors studied by approximate analyses are East Canyon Creek Reserviors, Lost Creek Reservior. These approximate studies were restudied as part of the 2010 countywide study.

The 2010 countywide study also incorporated the determination of letters issued by FEMA resulting in map revisions (Letter of Map Revision (LOMR)) and map amendments (Letter of Map Amendment (LOMA)), as shown in TABLE 3.

TABLE 3 ─ Letters of Map Changes

Community	Flood Source(s) and Project Identifier	Date Issued	Type
Morgan County (Unincorporated Areas)	Levee - Dry Creek from approximately 90 feet downstream of I-84 to 1,970 feet upstream Gordon Creek Canal - from approximately140 feet downstream of I-84 to approximately 1300 feet upstream	Feb. 27, 2009	LOMR

Morgan County (Unincorporated Areas)	Unnamed Drainage associated with Spring Hollow Creek - from its confluence with Enterprise Ditch to its confluence with Spring Hollow Creek	Apr. 13, 2000	LOMR

Letters of Map Amendment (LOMAs) incorporated in this study are summarized in the Summary of Map Actions (SOMA) included in the Technical Support Data Notebook (TSDN) associated with this FIS update. Copies of the SOMA may be obtained from the Community Map Repository. Copies of the TSDN may be obtained from FEMA.

2.2 Community Description

Morgan County is located in north-central Utah in the mountains of the Wasatch Range and is bounded on the north by Weber and Rich counties, on the east by Summit County, on the south by Salt Lake County, and on the west by Davis County. The sole incorporated community, Morgan City, is the county seat and is located approximately 50 miles north-northeast of Salt Lake City and approximately 24 miles southeast of Ogden. According to U.S. Census Bureau figures, the population of Morgan City increased from 2,635 in 2000 to 3,687 in 2010, and the population of Morgan County increased from 4,917 in 1980 to 9,469 in 2010 (Reference 3).

Morgan County is a rural area of broad valleys bordered by mountains. The valleys consist of cultivated and livestock-grazing lands with several unincorporated communities and many residential homes scattered throughout the area. Interstate Highway 84 and State Highways 65 and 66 serve the residents of the area. The climate is characteristically semi-arid continental. The mean annual temperature is approximately 45°F, and the average annual precipitation is approximately 20 inches (Reference 4).

The Weber River flows northwesterly through the study area. The total Weber River drainage area upstream (southeast) from Morgan City is approximately 1,100 square miles. At the point where the Weber River exits the northwest corner of the study area, the entire drainage area includes an additional 500 square miles to bring the total drainage area to approximately 1,600 square miles. East Canyon Creek, draining approximately 237 square miles in the southern part of the county, flows northwesterly to enter the Weber River just upstream of the unincorporated community of Milton. Deep Creek, with a drainage area of approximately 20 square miles, flows generally northward to enter the Weber River at Milton. Cottonwood Creek flows west-southwesterly to enter the Weber River at the unincorporated community of Mountain Green and has a drainage area of approximately 45 square miles.

2.3 Principal Flood Problems

Historically, the maximum floods of record have occurred during the April through June snowmelt period and have resulted in prolonged periods of high flows varying from a few days to more than a month. Cloudburst type floods and floods resulting from combined general rain storms and melting snow are also not uncommon. Principal floods of record at USGS gaging stations 10133500, Weber River at Devils Slide; 10134500, East Canyon Creek near Morgan (0.5 mile below East Canyon Reservoir); and 10136500, Weber River at Gateway (2.2 miles west of Mountain Green) are shown in TABLE 4.

TABLE 4 ─ Maximum Floods of Record

Flooding Source & Location	Date	Flow (cfs)
East Canyon Creek		
Near Morgan, Utah	1936	412
(USGS gage no. 10134500)	1937	397
	1952	872
	1975	380
	1983	726
	1984	395
	1986	360
	2011	350
Weber River		
At Devils Slide		
(USGS gage no. 10133500)	1907	4,620
	1909	5,120
	1917	4,120
	1920	5,500
	1921	3,810
	1922	4,140
	1936	2,180
	1950	3,450
	1952	4,700
At Gateway	1890	5,460
(USGS gage no. 10136500)	1892	5,760
	1893	7,280
	1896	7,980
	1897	5,340
	1921	5,500
	1922	6,720
	1923	5,380
	1936	4,380
	1937	3,230
	1952	7,600
	1975	3,420
	1983	5,970
	1984	5,080
	1986	6,160
	2011	4,950

Since 1896 on East Canyon Creek and 1931 on the Weber River, reservoir operation has been an increasingly important factor in reducing flood damage in the study area. However, flood waters on the Weber River and its tributaries still cause extensive damage to channels, roads, bridges, culverts, sewer and water systems, and other public and private property. Recently, reservoir operation has reduced the flood damage below the reservoirs to a minimum, with the exception of the 1983 flood (Reference 5). The 1983 flood flows are estimated to be about the same or higher as compared to the 1952

flood (Reference 6). It was estimated that the 1952 flood flows from the Weber River at Morgan are approximately 6,000 cubic feet per second (cfs) and from East Canyon Creek at Morgan are approximately a 50-year event (Reference 6). Main flood problems that occurred due to the 1983 flood were basement flooding, damage to sewer systems, and threats to the electric substations. Total estimated damage was $300,000 and $50,000 for privately owned dikes and volunteer time.

2.4 Flood Protection Measures

Four dams and reservoirs in the Weber River basin above Morgan City provide significant regulation of flow on the Weber River and its tributaries. Existing reservoirs include Rockport Reservoir (completed in 1957), on the Weber River (usable capacity of 60,860 acre-feet); Echo Reservoir (constructed in 1931), on the Weber River (capacity of 73,940 acre-feet); Lost Creek Reservoir, on Lost Creek (completed in 1966), (active capacity of 20,010 acre-feet); East Canyon Creek Reservoir (completed in 1966), on East Canyon Creek (active capacity of 48,110 acre-feet) (Reference 7).

The U.S. Army Corps of Engineers (COE) studied the area approximately 25 years ago and was considering constructing dikes through most of Morgan City along the Weber River (Reference 8). These dikes were not constructed.

Temporary dikes have been constructed by private interests along the Weber River during past floods. These temporary dikes have no significant effects on the 100- and 500-year floods. On Deep Creek, a few hundred feet of dikes have been constructed below the bridge over Morgan Valley Drive (SR 591).

Levee construction has taken place on Dry Creek and Gordon Creek. These levee systems are accredited and therefore provide protection from the 1-percent-annual-chance flood. Areas not protected by a levee on Dry Creek still see flooding during major floods. For all accredited levee systems, the area landward of the levee system that is identified as being protected by the levee system from the base (1-percent-annual-chance) flood will continue to be mapped as Zone X (shaded), with the following note applied to the affected FIRM panel(s):

> Note: This area is shown as being protected from the 1-percent-annual-chance or greater flood hazard by a levee system. Overtopping or failure of any levee system is possible. For additional information, see the "Accredited Levee Note" in Notes to Users.

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- or 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 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 one year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance (100-year) 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 peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

This FIS report includes information from previously published FIS reports as well as new information. Unless indicated otherwise, the information provided in this section was obtained from the previously published FIS reports for Morgan County.

Peak discharge estimates were developed using a number of methods of hydrologic analysis. For the detailed studies, peak discharge estimates were primarily developed using magnitude and frequency analyses of streamflow records. These techniques were used at the following stream gages. East Canyon Creek below diversions near Morgan (USGS gage no. 10135500) using five years of peak discharge data, East Canyon Creek near Morgan (USGS gage no. 10134500) using peak discharge data from 1967 to 1984, Weber River at Devils Slide (USGS gauge no. 10133500) using peak discharge data greater than 50 years in length, Weber River at Gateway (USGS gauge no. 10136500) using peak discharge data greater than 50 years in length, Weber River near Morgan (USGS gauge no. 10136000) using peak discharge data five years in length.

Because of the relatively short periods of record at many of the gaging stations, and changes due to reservoir operations, several other methods of hydrologic analysis were used to check the results obtained. Those methods include: the application of regional relationships between basin characteristics and streamflow characteristics as developed in a USGS report Methods for Estimating Peak Discharge and Flood Boundaries of Streams in Utah (Reference 9). Since none of the gaging records at the East Canyon Creek gage were unregulated, the natural flow curve was derived using the peak flow-drainage area relationships. Values for peak flows were transferred from the East Canyon Creek gage to Morgan using the peak flow-drainage area relationships (Reference 7). The records were analyzed in a manner to reflect the effect of reservoir storage on high flows. For the Weber River at the Gateway gaging station (approximately ten miles downstream from Morgan), gaging records for the 1967 through 1984 period were analyzed by using regression analysis to determine the 10-year peak flow. The upper portion of the frequency curve was derived using the natural flow curve from historical record to determine the flow at the 500-year recurrence interval.

Peak discharges for the 10-, 2-, 1- and 0.2-percent-annual-chance flooding events and the drainage area for each of the streams studied in detail are shown in TABLE 5.

TABLE 5 ─ Summary of Peak Discharges

Flooding Source and Location	Drainage Area (Sq. Miles)	Peak Discharges (cfs) 10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Cottonwood Creek					
At confluence with Weber River	45.0	310	430	480	605
Deep Creek					
At Confluence with Weber River	20.0	*	*	580	*
At Morgan Valley Dr. Bridge	20.0	*	*	678	*
Above North Fork	11.9	*	*	403	*
East Canyon Creek					
At Confluence with Weber River	245	470	635	705	860
At Morgan City	150.0	620	1,095	1,415	2,545
Above East Canyon Reservoir	113.0	*	*	1,100	*
Above Big Dutch Hollow	91.1	*	*	906	*
Weber River					
Below Cottonwood Creek	1,610.0	*	*	8,200	*
Above Cottonwood Creek	1,540.0	4,565	6,630	7,455	9,255
Above East Canyon Creek	1,210.0	4,035	5,860	6,590	8,185
At Morgan City	1,215.0	3,700	5,295	6,370	10,205

*Data not available

Hydrologic calculations for the approximate streams that were restudied for the 2010 countywide study were primarily performed using the regression equations presented in United States Geologic Survey (USGS) - Methods for Estimated Magnitude and Frequency of Peak Flows for Natural Streams in Utah, 2007 (Reference 10). Discharges were estimated for ungaged streams and at sites on gaged streams where stream gages were not present. These streams included: Big Dutch Hollow Creek, Big Hollow Creek, Black Hawk Canyon Creek, Cedar Canyon Creek, Cottonwood Canyon Creek, Cottonwood Creek, Dalton Creek, Deep Creek Tributary 1, Dry Creek, Dry Creek 2, Dry Fork Creek, East Canyon Creek, Enterprise Ditch, Francis Canyon Creek, Gateway Canal Tributary 4, Gordon Creek, Guilder Sleeve Creek, Hardscrabble Creek, Hell Canyon Creek, Line Creek, Little Dutch Hollow, Little Emigration Canyon Creek, Little Hollow Creek, Lost Creek, North Fork Deep Creek, North Fork Dry Creek, Roswells Canyon Creek, Schuster Creek, Sheep Creek, Smith Creek, South Fork Francis Creek, Spring Hollow Creek, Taggart Hollow Creek, Tom Condies Creek, Trail Creek, Tributary to Dry Creek, Weber River, and Willow Creek.

Approximate methods were used to determine the 1-percent-annual-chance flood boundaries for East Canyon Creek Reservior and Lost Creek Reservior. Flood information supplied by the U.S. Bureau of Reclamation in Provo, Utah was used to confirm these flood boundaries.

For the 2010 countywide study, the one-percent-annual-chance flood flows on the Weber River and East Canyon Creek approximate study stream locations (below their respective reservoirs) were taken from discharge tables in *Weber River and East Canyon Creek Hydrology Report for City of Morgan* by Simons, Li & Associates, Inc. (Reference 7). The one-percent-annual-chance flood flows for Lost Creek were calculated from a flood

frequency analysis performed using historical stream gage data on Lost Creek (USGS Gages 10133000 and 10132500) and the *U.S. Geological Survey's Statistical Software Package (PEAKFQ)*. This program automates flood frequency analyses and is based on the methods described in *Guidelines for Determining Flood Flow Frequencies, Bulletin 17B, U.S. Water Resource Council, March 1982* (Reference 11). Gage data prior to 1964 was considered unregulated flow for Lost Creek and used to develop a natural flow curve to extend and develop the upper portion of the frequency curve for Lost Creek to determine the 1- and 0.2-percent-annual-chance recurrence intervals. The 1-percent-annual-chance flows at the USGS gage stations were transferred to the desired location on Lost Creek by interpolating between the downstream and upstream gaged sites (Reference 12). USGS gaging station 1013500 is located on Hardscrabble Creek (a tributary to East Canyon Creek) and has 29 years of flow record and was used in the approximate hydrologic analysis of Hardscrabble Creek.

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 Tables 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.

Cross-section data for the detailed backwater analysis of the Weber River, East Canyon Creek, Deep Creek, and Cottonwood Creek were field surveyed above and below bridges, culverts, and diversion and drop structures. Road profiles were also field surveyed to compute the backwater effects of these hydraulic structures. Additional valley cross-sections were surveyed between the structures to define extremes in channel conveyance. Several cross-sections were synthesized from surveyed valley cross-sections to improve the definition of the water-surface elevation profiles. All hydraulic structures were field surveyed to obtain elevation data and structural geometry.

Cross-sections for the detailed backwater analyses of the Weber River and East Canyon Creek within Morgan City were obtained from aerial mappings, flown in November, 1984 (Reference 13). The below-water sections were obtained by field measurement.

Cross-section data used in the new approximate studies of the 2010 countywide FIS were extracted from 2- and 5-meter auto-correlated DEMs of Morgan County acquired from the Utah AGRC (Reference 14). Two- and 5-meter DEMs were used on Cottonwood Creek, Deep Creek, East Canyon Creek, and the Weber River and 5-meter DEMs were used at all other locations.

Detail-studied streams that were not restudied as part of the current map update may include a "profile base line" on the maps. This "profile base line" provides a link to the flood profiles included in the FIS report. The detail-studied stream centerline may have been digitized or redelineated as part of this revision. The "profile base lines" for these streams were based on the best available data at the time of their study and are depicted as they were on the previous FIRMs. In some cases where improved topographic data

was used to redelineate floodplain boundaries, the "profile base line" may deviate significantly from the channel centerline or may be outside the SFHA.

Roughness coefficients (Manning's "n") were used to compute the hydraulic conveyance of each cross-section and to compute friction losses between adjacent sections. Roughness factors were chosen by engineering judgment and were based on field observations of streams and floodplains. Separate overbank and channel roughness values were selected for each stream reach. TABLE 6 shows the channel and overbank "n" values typical for early summer conditions for the flooding sources studied by detailed methods.

TABLE 6 – Manning's "n" Values

Flooding Source	Channel "n" Values	Overbank "n" Values
Cottonwood Creek	0.035 - 0.045	0.03 – 0.08
Deep Creek	0.040 - 0.050	0.050 - 0.070
East Canyon Creek	0.035 - 0.045	0.03 - 0.08
Weber River	0.025 - 0.045	0.03 - 0.14

Water-surface elevations (WSE) for the 1-percent-annual-chance flood on each stream studied by detailed methods were computed by the Water Surface Profile (WSPRO) step-backwater computer program developed by the USGS for the Federal Highway Administration (Reference 15).

In stream reaches of supercritical flow, the flood profiles were plotted at critical depth. The starting water-surface elevation for each step-backwater run made in an unobstructed channel was determined by slope-conveyance method for subcritical flow and by critical depth method for supercritical flow (Reference 16). At hydraulic structures, the methods of computing the starting water-surface elevations were flow through bridge contraction (Reference 16), flow through culvert (Reference 17), and flow over road (Reference 18). The starting water-surface used for Cottonwood Creek was the 1-percent-annual-chance computed water-surface elevation of the Weber River at the confluence with Cottonwood Creek. The methods for determining starting water-surface elevations used in each hydraulic model are described in TABLE 7.

TABLE 7 – Starting Water-Surface Elevations

Flooding Source	Method for Determining Starting WSE
Cottonwood Creek	Normal depth slope of 0.04081 ft/ft
Deep Creek	Slope-conveyance method
East Canyon Creek	Normal depth slope of 0.00267 ft/ft
Weber River	Obtained from Weber River base flood elevation

Water-surface elevations of floods of the selected recurrence intervals were computed through the use of three step-backwater computer programs. The U.S. Army Corps of

Engineers (USACE) HEC-2 computer program (Reference 19) , the USACE HEC-RAS computer program version 4.0 (Reference 20) and WSPRO (Reference 15) were used to calculate water-surface profiles for steady, gradually varied flow based on the solution of the one-dimensional energy equation. The USACE HEC-2 computer program was used to calculate water-surface elevations along East Canyon Creek and the Weber River within Morgan City as a part of the community's July 1987 Flood Insurance Study (Reference 1). The WSPRO computer program was used to calculate water-surface elevations for the remaining streams previously studied by approximate methods. The approximate models were completed within the Unincorporated Areas of Morgan County as a part of the community's September 1990 FIS (Reference 2).

Water-surface elevations of the 1-percent-annual-chance flood for the streams restudied by approximate analyses were computed using the USACE HEC-RAS version 4.0 computer program. Roughness factors for these streams were determined based on visual observation of aerial photography with 1.0-foot pixel resolution imagery collected by the AGRC during 2006-2007 (Reference 21). Separate overbank and channel roughness values were selected for each stream reach. Starting water-surface elevations were determined using the normal depth routine in the HEC-RAS computer program, with the downstream gradient for each stream estimated though the use of USGS topographic maps.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles (Exhibit 1) are, therefore, considered valid only if hydraulic structures remain unobstructed, operate properly and do not fail, and if channel and overbank conditions remain essentially the same as ascertained during this study.

Flood profiles were drawn showing the computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. In cases where two or more profiles are close together, due to limitations of the profile scale, only the higher profile has been shown.

All elevations are referenced from North American Vertical Datum of 1988 (NAVD88) as described in more detail in the next section; elevation reference marks used in the study are shown on the maps.

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 NAVD88 as the referenced vertical datum.

Effective information for the 2010 FIS report was converted from NGVD29 to NAVD88 based on data presented in TABLE 8. The average conversion for each stream was applied to convert all effective Base Flood Elevations (BFEs) on that associated stream. Structure and ground elevations in the community must therefore be referenced to

NAVD88. It is important to note that adjacent communities in other counties not presented in this FIS may be referenced to NGVD29. This may result in differences in BFEs across the corporate limits between communities.

TABLE 8 – Datum Conversion Calculation

Stream Name	Minimum Conversion	Maximum Conversion	Average Conversion	Maximum Offset
Cottonwood Creek	+3.48	+3.63	+3.56	0.08
Weber River	+3.48	+3.73	+3.61	0.13
Deep Creek	+3.69	+3.70	+3.70	0.01
East Canyon Creek at Morgan City	+3.70	+3.72	+3.71	0.01
East Canyon Creek Above Reservoir	+3.99	+4.00	+4.00	0.00

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the NGVD29 and NAVD88, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

Vertical Network Branch, N/CG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

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 TSDN associated with this FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks 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.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides l-percent-annual-chance (100-year) flood elevations and delineations of the 1- and 0.2-percent-annual-chance (500-year) floodplain boundaries and l-percent-annual-chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of this FIS report, including Flood Profiles, Floodway Data Tables, and Summary of Stillwater Elevations Table. Users should reference the data presented in this 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 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance (500-year) 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 a scale of 1:2,400 (enlarged to a scale of 1:1,200), with a contour interval of 40 feet. Within Morgan City, floodplain boundaries were interpolated using topographic maps at a scale of 1:4,800 with a contour interval of two feet. 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 l-percent-annual-chance floodplain boundary is shown on the FIRM. Approximate floodplain boundaries were interpolated using 2- and 5-meter auto-correlated DEMs acquired from the Utah AGRC (Reference 14).

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 l-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 l-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 floodway presented in this FIS report and on the FIRM was computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross-sections. Between cross-sections, the floodway boundaries were interpolated. The results of the floodway computations have been tabulated for selected cross-sections and can be seen in TABLE 9. In cases where the floodway and l-percent-annual-chance floodplain boundaries are either closing together or collinear, only the floodway boundary has been shown.

Floodways were computed for portions of the Weber River (between cross-sections N and AS) and East Canyon Creek (between cross-sections B and U) for the 1987 Morgan City FIS (Reference 1). Those areas of floodway which extend into Morgan County have been included in this study. Several floodway widths on the Weber River and East Canyon Creek either extend into Morgan City or lie entirely within Morgan City.

The area between the floodway and l-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 l-percent-annual-chance flood 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.

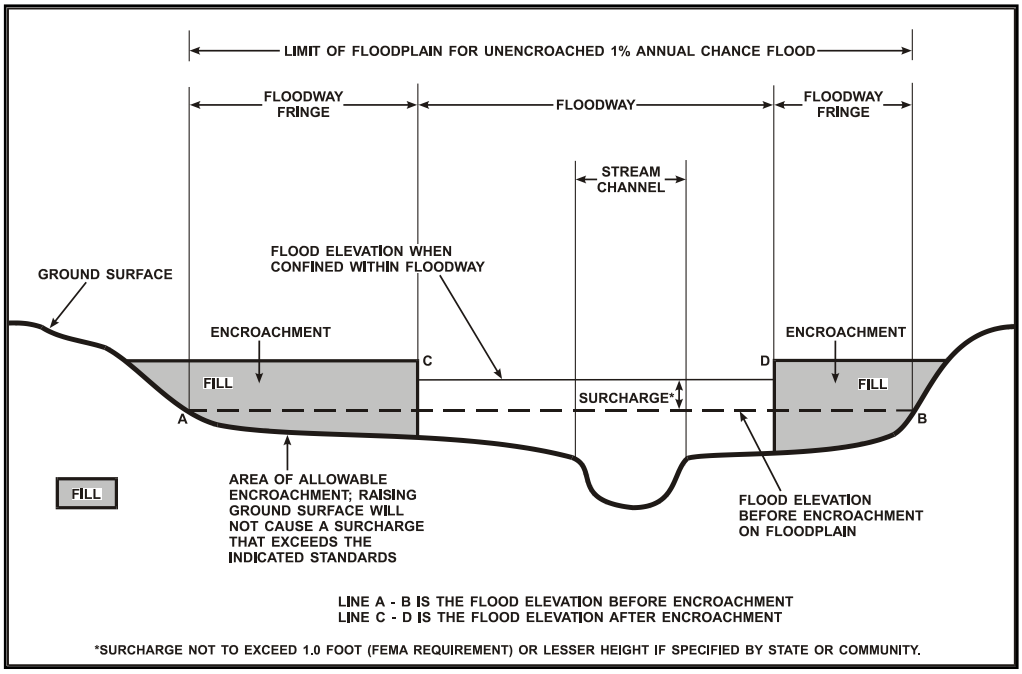

FIGURE 1 – Floodway Schematic

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 AH

Zone AH is the flood insurance risk zone that corresponds to the areas of 1-percent-annualchance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole foot BFEs derived from the detailed hydraulic analysis are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance risk zone that corresponds to the areas of 1-percent-annualchance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot base flood depths derived from the detailed hydraulic analyses are shown within this zone.

Zone D

Zone D is the flood insurance risk zone that corresponds to an area where the flood hazard is undetermined. In most instances, these areas are sparsely populated.

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 that 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.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS-SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Cottonwood Creek								
A	1,468	54	248	1.9	4,840.2	4,840.2	4,840.2	0.0
B	2,178	48	150	3.2	4,841.7	4,841.7	4,841.8	0.1
C	3,312	38	73	6.5	4,850.9	4,850.9	4,850.9	0.0
D	4,283	41	72	6.7	4,858.7	4,858.7	4,858.7	0.0
E	5,541	67	94	5.1	4,873.0	4,873.0	4,873.0	0.0
F	7,061	52	107	4.5	4,889.0	4,889.0	4,889.1	0.1
G	8,047	121	146	3.3	4,900.6	4,900.6	4,900.6	0.0
H	8,963	109	142	3.4	4,913.0	4,913.0	4,913.1	0.1
I	10,593	81	105	4.6	4,933.5	4,933.5	4,933.5	0.0
J	11,585	99	108	4.4	4,947.9	4,947.9	4,948.0	0.1
K	13,206	172	111	4.3	4,970.8	4,970.8	4,970.8	0.0
L	14,740	163	110	4.4	4,999.3	4,999.3	4,999.3	0.0
M	15,593	191	105	4.6	5,019.0	5,019.0	5,019.0	0.0
N	16,622	112	92	5.2	5,042.7	5,042.7	5,042.7	0.0
O	17,703	132	93	5.2	5,068.6	5,068.6	5,068.6	0.0
P	18,771	70	81	6.0	5,093.5	5,093.5	5,093.5	0.0
Q	19,659	176	95	5.1	5,114.1	5,114.1	5,114.1	0.0
R	20,648	177	97	5.0	5,136.3	5,136.3	5,136.3	0.0

[1]Feet above confluence with Weber River

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
MORGAN COUNTY, UT
AND INCORPORATED AREAS

FLOODWAY DATA

COTTONWOOD CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS-SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
East Canyon Creek								
A	3,807	64	277	2.6	5,014.1	5,014.1	5,014.3	0.2
B	4,862	48	151	4.7	5,016.0	5,016.0	5,016.8	0.8
C	6,205	35	163	4.3	5,018.2	5,018.2	5,019.2	1.0
D	7,001	45	266	2.7	5,019.2	5,019.2	5,020.2	1.0
E	8,235	42	187	3.8	5,021.1	5,021.1	5,021.5	0.4
F	8,652	47	203	3.5	5,022.1	5,022.1	5,022.3	0.2
G	10,451	43	198	3.6	5,026.8	5,026.8	5,026.8	0.0
H	11,595	38	178	4.0	5,029.1	5,029.1	5,029.1	0.0
I	12,744	33	149	4.7	5,034.5	5,034.5	5,034.5	0.0
J	13,490	28	122	5.8	5,037.0	5,037.0	5,037.1	0.1
K	14,560	35	180	3.9	5,040.3	5,040.3	5,040.9	0.6
L	15,662	37	180	3.9	5,042.9	5,042.9	5,043.5	0.6
M	16,894	41	198	3.6	5,044.6	5,044.6	5,045.3	0.7
N	18,115	252	385	1.8	5,046.2	5,046.2	5,047.1	0.9
O	18,872	35	145	4.9	5,048.1	5,048.1	5,048.9	0.8
P	19,704	163	293	2.4	5,050.4	5,050.4	5,051.3	0.9
Q	20,700	37	206	3.4	5,053.1	5,053.1	5,053.9	0.8
R	21,733	40	172	4.1	5,055.7	5,055.7	5,055.9	0.2
S	22,487	34	142	5.0	5,058.7	5,058.7	5,058.8	0.1
T	23,851	44	207	3.4	5,062.2	5,062.2	5,062.3	0.1
U	24,982	52	189	3.7	5,064.4	5,064.4	5,064.5	0.1
V	26,048	363	503	1.4	5,067.9	5,067.9	5,068.6	0.7
W	27,037	242	264	2.7	5,070.5	5,070.5	5,071.2	0.7
X	28,082	230	367	1.9	5,074.2	5,074.2	5,074.9	0.7
Y	29,165	248	363	1.9	5,077.0	5,077.0	5,077.8	0.8

[1]Feet above confluence with Weber River

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
MORGAN COUNTY, UT
AND INCORPORATED AREAS

FLOODWAY DATA

EAST CANYON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS-SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
East Canyon Creek cont'd								
Z	30,171	43	157	4.5	5,080.5	5,080.5	5,081.4	0.9
AA	31,081	41	144	4.9	5,083.8	5,083.8	5,083.9	0.1
AB	32,065	42	156	4.5	5,087.6	5,087.6	5,087.7	0.1
AC	33,093	40	163	4.3	5,091.6	5,091.6	5,091.7	0.1
AD	33,913	21	86	8.2	5,094.8	5,094.8	5,094.8	0.0
AE	35,129	37	123	5.7	5,099.9	5,099.9	5,100.5	0.6
AF	35,877	50	207	3.4	5,103.0	5,103.0	5,103.1	0.1
AG	36,917	57	179	4.0	5,106.9	5,106.9	5,106.9	0.0
AH	37,888	45	182	3.9	5,111.2	5,111.2	5,111.2	0.0
AI	38,913	41	172	4.1	5,115.1	5,115.1	5,115.1	0.0
AJ	39,974	35	82	8.6	5,121.3	5,121.3	5,121.3	0.0
AK	40,946	40	140	5.1	5,126.6	5,126.6	5,127.6	1.0
AL	41,931	48	157	4.5	5,132.2	5,132.2	5,133.1	0.9
AM	42,779	35	121	5.8	5,134.9	5,134.9	5,135.1	0.2
AN	44,195	39	155	4.6	5,142.1	5,142.1	5,142.1	0.0
AO	45,255	38	134	5.3	5,148.7	5,148.7	5,148.7	0.0
AP	46,569	35	86	8.2	5,155.5	5,155.5	5,155.5	0.0
AQ	47,601	31	102	6.9	5,163.7	5,163.7	5,164.1	0.4

[1]Feet above confluence with Weber River

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
MORGAN COUNTY, UT
AND INCORPORATED AREAS

FLOODWAY DATA

EAST CANYON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS-SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Weber River								
A-J[2]								
K	43,830	775	1,557	4.8	4,980.1	4,980.1	4,980.5	0.4
L	44,777	425	1,134	6.6	4,984.4	4,984.4	4,984.6	0.2
M	45,893	498	1,545	4.8	4,987.4	4,987.4	4,988.0	0.6
N	46,914	317	1,189	6.3	4,991.4	4,991.4	4,991.5	0.1
O	47,977	182	1,170	6.4	4,993.1	4,993.1	4,994.1	1.0
P	49,038	503	955	7.8	4,996.8	4,996.8	4,996.8	0.0
Q	49,942	717	1,410	5.3	4,999.9	4,999.9	5,000.4	0.5
R	51,573	827	1,450	5.1	5,006.1	5,006.1	5,006.4	0.3
S	52,477	644	1,013	6.5	5,009.0	5,009.0	5,009.0	0.0
T	53,462	249	850	7.8	5,013.0	5,013.0	5,013.4	0.4
U	54,521	425	1,161	5.7	5,018.2	5,018.2	5,018.8	0.6
V	55,615	134	773	8.5	5,022.7	5,022.7	5,023.6	0.9
W	56,596	116	721	9.1	5,025.7	5,025.7	5,026.3	0.6
X	57,292	108	605	10.9	5,029.1	5,029.1	5,029.1	0.0
Y	58,386	192	726	9.1	5,034.9	5,034.9	5,035.0	0.1
Z	59,677	638	1,292	5.1	5,039.5	5,039.5	5,040.1	0.6
AA	61,376	567	1,695	3.9	5,046.7	5,046.7	5,047.6	0.9
AB	62,726	568	1,419	4.6	5,052.0	5,052.0	5,053.0	1.0
AC	63,634	444	1,423	4.6	5,055.7	5,055.7	5,056.6	0.9
AD	65,031	124	1,026	6.4	5,061.3	5,061.3	5,062.2	0.9
AE	65,749	127	895	7.4	5,063.3	5,063.3	5,064.1	0.8
AF	66,562	522	972	6.8	5,067.4	5,067.4	5,067.4	0.0
AG	68,120	421	973	6.8	5,072.6	5,072.6	5,072.9	0.3
AH	68,955	350	1,195	5.5	5,075.3	5,075.3	5,076.3	1.0
AI	70,114	522	1,132	5.8	5,079.3	5,079.3	5,079.5	0.2

[1]Feet above confluence of Cottonwood Creek

[2]Floodway not computed

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS

FLOODWAY DATA

WEBER RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS-SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Weber River cont'd								
AJ	71,394	599	1,216	5.4	5,083.2	5,083.2	5,083.6	0.4
AK	72,084	600	1,142	5.8	5,085.3	5,085.3	5,085.8	0.5
AL	73,856	600	1,167	5.7	5,091.2	5,091.2	5,091.2	0.0
AM	74,793	631	1,717	3.8	5,094.1	5,094.1	5,094.8	0.7
AN	75,798	450	1,494	4.4	5,097.4	5,097.4	5,098.4	1.0
AO	76,852	345	1,042	6.3	5,100.5	5,100.5	5,101.1	0.6
AP	77,700	600	1,807	3.7	5,103.5	5,103.5	5,104.2	0.7
AQ	78,731	500	1,483	4.4	5,106.2	5,106.2	5,106.9	0.7
AR	79,786	700	2,206	3.0	5,109.5	5,109.5	5,110.2	0.7
AS	80,554	635	1,652	4.0	5,111.2	5,111.2	5,112.0	0.8
AT	81,523	451	1,528	4.3	5,115.1	5,115.1	5,116.0	0.9
AU	82,892	320	1,243	5.3	5,119.5	5,119.5	5,120.1	0.6
AV	83,856	437	1,427	4.6	5,123.1	5,123.1	5,123.6	0.5
AW	84,803	365	1,351	4.9	5,126.6	5,126.6	5,126.7	0.1
AX	86,371	850	2,250	2.9	5,129.7	5,129.7	5,130.7	1.0
AY	87,945	750	1,857	3.6	5,134.4	5,134.4	5,135.2	0.8
AZ	88,596	600	3,191	5.1	5,137.4	5,137.4	5,138.0	0.6
BA	89,855	592	3,707	4.9	5,141.1	5,141.1	5,141.9	0.8
BB	91,055	400	1,014	6.5	5,145.4	5,145.4	5,145.7	0.3
BC	92,835	264	993	6.6	5,151.1	5,151.1	5,152.0	0.9
BD	93,641	250	1,030	6.4	5,153.2	5,153.2	5,154.1	0.9
BE	94,944	445	1,581	4.2	5,160.7	5,160.7	5,160.7	0.0

[1]Feet above confluence of Cottonwood Creek

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY
MORGAN COUNTY, UT
AND INCORPORATED AREAS

FLOODWAY DATA

WEBER RIVER

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 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 Morgan County. Previously, separate FIRMs were prepared for each identified floodprone incorporated community and the unincorporated areas of the county. Historical data relating to the maps prepared for each community are presented in TABLE 10.

7.0 OTHER STUDIES

This FIS incorporates all previously published FISs and FIRMs for the areas within Morgan County.

This FIS report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for purposes of the National Flood Insurance Program.

Weber River Hydrology, Davis and Weber Counties, Utah was prepared in 1979 by Gingery Associates, Inc. (Reference 22). The flood frequency information in this report was considered to be the best analysis of flow on the Weber River since the last phase of reservoir regulation was completed in 1967 on Lost Creek Reservoir. The analysis was based on a frequency distribution for regulated flow from 1967 through 1977 and unregulated flow prior to 1930 at the Gateway and Plain City gages.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FIRM EFFECTIVE DATE	FIRM REVISION DATE(S)
Morgan City, City of	June 28, 1974	April 16, 1976	July 16, 1987	None
Morgan County (Unincorporated Areas)	October 18, 1974	February 14, 1978	September 28, 1990	None

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UTAH
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

The COE prepared a 1961 report, Design Memorandum No. 1, Weber River, Utah-Channel Improvement Morgan to Ogden which developed peak flows for the Weber River for the 10-, 2-, and 1-percent-annual-chance recurrence intervals at Echo, Morgan, Gateway, and Plain City (Reference 8). The report does not adequately reflect recent flow conditions and in particular, recent reservoir operation, which regulates flow in the Weber River within the Morgan City study.

The COE published a 1971 Report on Reservoir Regulation for Flood Control--Weber Basin Reservoirs (Reference 23). This report gives general design information, reservoir capacities, spillway capacities, arid general operation guidelines for the major reservoirs which regulate flow on both the Weber River and East Canyon Creek. The operational information is applicable to flood frequency analysis for the Morgan City study.

Wasatch Front and Central Utah Flood Control Study was prepared by Vaughn Hansen Associates for the COE (Reference 24). This report was a reconnaissance level flood control study and, therefore, did not contain detailed background information on hydrology. Values for the 2- and 1-percent-annual-chance recurrence interval discharges at Morgan were given as 4,900 cfs and 6,000 cfs, respectively.

The Bureau of Reclamation published Dam Failure Inundation Study, Echo Dam, Weber River Project, Utah in 1984 (Reference 25). Echo Dam is located approximately 16 miles upstream of Morgan City. Regional hydrology was used to determine the inflow design flood. The results were used only for comparison, due to the general nature of the hydrology analysis.

Flood Insurance Studies were published for the surrounding Counties of Davis (Reference 26), Salt Lake (Reference 27), Summit (Reference 28), and Weber (Reference 29). This study agrees with the above-mentioned Flood Insurance Studies.

A Flood Hazard Boundary Map was published for Morgan City (Reference 30) and unincorporated areas of Morgan County, Utah (Reference 31). Because of the more detailed and current nature of the hydrologic analysis, this Flood Insurance Study supersedes the data presented on the Flood Hazard Boundary Maps on the Weber River, East Canyon Creek, Deep Creek, and Cottonwood Creek.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Federal Insurance and Mitigation Division, Federal Emergency Management Agency, Denver Federal Center, Building 710, Box 25267, Denver, CO 80255-0267.

9.0 BIBLIOGRAPHY AND REFERENCES

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10.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the previous FIS report and FIRM were printed. Future revisions may be made that do not result in the republishing of the FIS report. All users are advised to contact the Community Map Repository to obtain the most up-to-date flood hazard data.

10.1 Minor Revisions

All minor revisions to this Flood Insurance Study that occurred before the creation of the first digital Countywide FIS in 2010 are described in the relevant sections of this document.

10.2 Physical Map Revision (PMR) (20XX)

For this countywide PMR and FIS update, an initial CCO meeting was held on February 28, 2012, and was attended by representatives of the community, the study contractor, and FEMA. The final CCO meeting was held on _____, and was attended by representatives of the community, the study contractor, and FEMA.

For this PMR and FIS update, URS Corporation, prime engineering contractor for the Utah Division of Emergency Management Cooperative Technical Partner (CTP) conducted 21 miles of detailed study along Cottonwood Creek, East Canyon Creek, and the Weber River. This work was completed in December 2014 under Contract No: EMD-2011-GR-1187. Detailed descriptions of the streams studied as part of this revision are listed in Table 2 – Limits of Detailed Studies.

This restudy affected 21 FIRM panels, which include an orthophotography base map (2011 1-meter USDA National Agricultural Imagery Program).

Base map information shown on this FIRM was derived from multiple sources. This information was compiled from the U.S. Geological Survey, 1989, Utah Automated Geographic Reference Center (AGRC), 2011, Morgan County Information Systems, 2012, National Geodetic Survey, 2004, FEMA existing DFIRM data, 2010, USDA and Farm Service Agency Aerial Photography Field Office, 2011.

The hydrologic analyses for the restudies on East Canyon Creek and the Weber River were performed using the available peak annual runoff data from USGS, and a Log Pearson Type III analysis (LPIII) using methodology outlined in the Morgan County PMR Study Hydrology Report (Reference 32). A detailed hydrologic analysis for Cottonwood Creek, where gage data was not available, was completed using the Regression Equation Method. Results of all hydrologic analyses are included in Table 5 – Summary of Peak Discharges.

The Army Corps of Engineers Hydraulic Engineering Center's River Analysis Program (HEC-RAS) v4.1 was selected to analyze channel hydraulic capacity and to determine the water-surface profiles along with HEC-GeoRAS, an ArcGIS based pre- and post-processor for HEC-RAS, as described in the Morgan County PMR Study Hydraulics Report (Reference 33).

Detailed study areas include the 10-, 2-, 1-, and 0.2-percent-annual-chance flows and includes a floodway analysis. A detailed survey was performed of all encountered structures along the detailed study reaches.

Roughness coefficients (Manning's "n" values) used in the hydraulic computations are shown in Table 6 – Manning's "n" values, and were based on field inspection of stream channels and overbank areas and adjusted based upon land use and ground cover determined from aerial photography.

Contraction and expansion coefficients of 0.1 and 0.3, respectively, are used for cross-sections with no structures, while cross-sections influenced by flow contraction and expansion caused by bridges or other conveyance structures are assigned a contraction coefficient of 0.3 and an expansion coefficient of 0.5.

Table 7 – Starting Water-Surface Elevations, Table 9 – Floodway Data, and Exhibit 1 – Flood Profiles, were revised to reflect changes as a result of this restudy.

The floodways calculated for the restudied streams reflect the minimum width allowed by encroachment of the 1-percent-annual-chance floodplain on either overbank, until a maximum floodplain elevation surcharge of 1 foot is created.

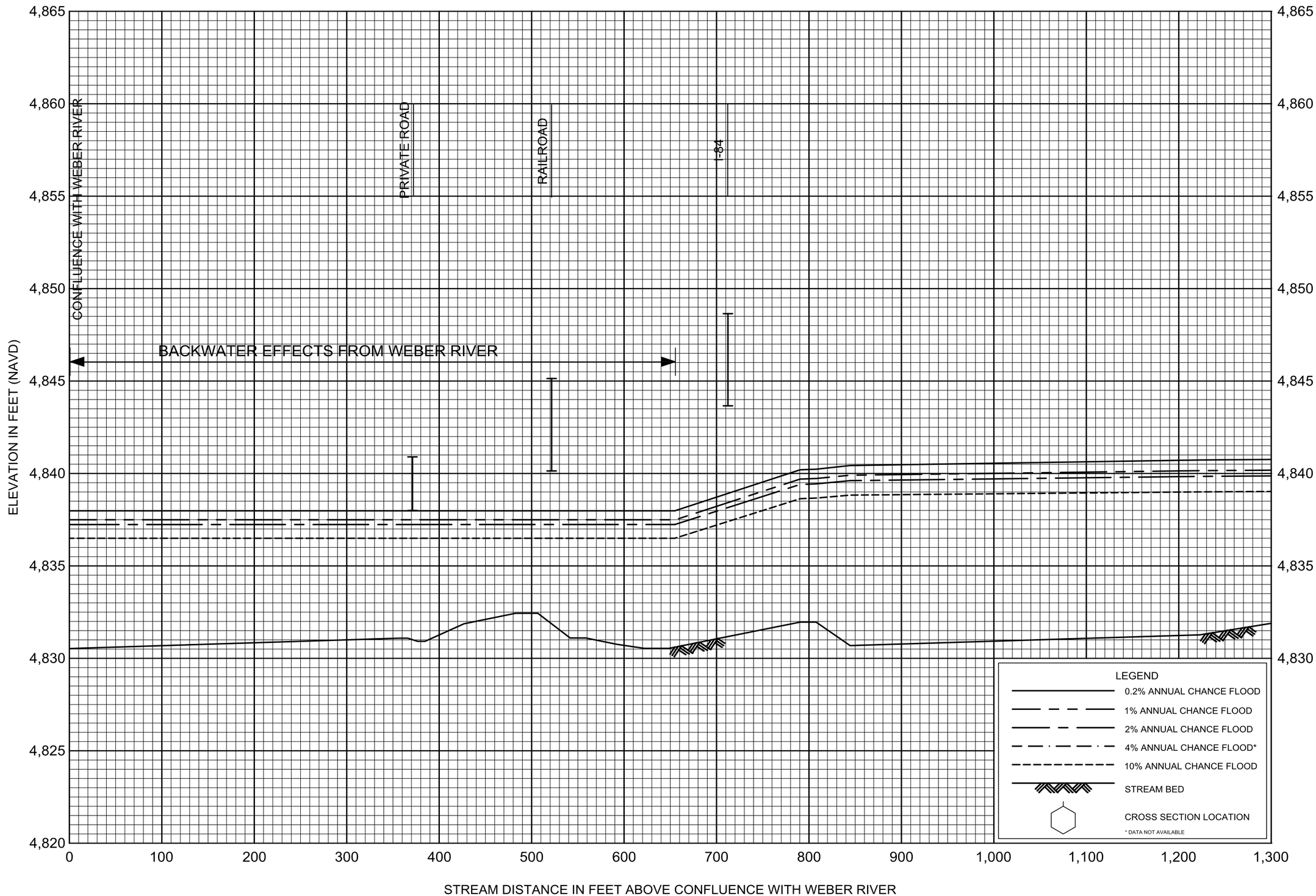
Floodplain boundaries were delineated using LiDAR obtained by FEMA and the State of Utah in 2011.

A First Order Approximation (FOA) Analysis was performed on the approximate Zone A floodplains located on the updated panels that were reissued as part of this PMR. The FOA was performed using a comparative, mostly automated approach to assess the validity of the floodplains that are not based on an existing or available engineering model, as outlined in the FOA procedures manual (Reference 34). All of the Zone A floodplains on the reissued panels were successfully validated through the FOA approach and were therefore left unchanged on the FIRMs (Reference 35).

The following LOMR was incorporated in this revision since it was located on a FIRM panel affected by this restudy:

Case Number	Community	Flooding Source(s)/ Project Identifier	Effective Date	Type
15-08-0603P*	Morgan County (Unincorporated Areas)	Gordon Creek	8/24/2015	LOMR

*Although a portion of LOMR 15-08-0603P falls within the scope of this map revision, panel 49029C0100C was not revised. Therefore, users must continue to refer to the annotated FIRM attachment for this LOMR for FIRM panel 49029C0100C.



FLOOD PROFILES

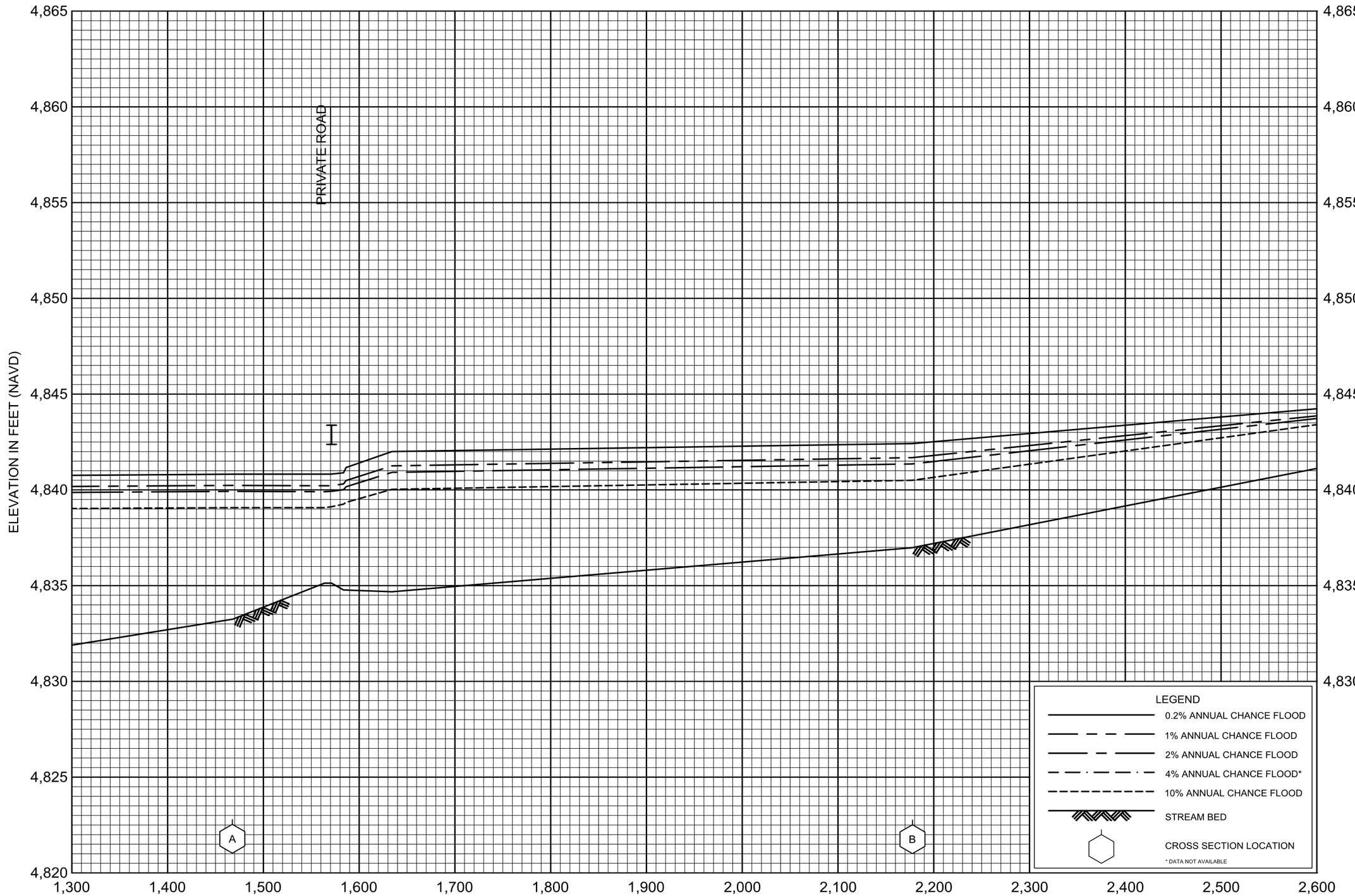
COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS

01P



FLOOD PROFILES

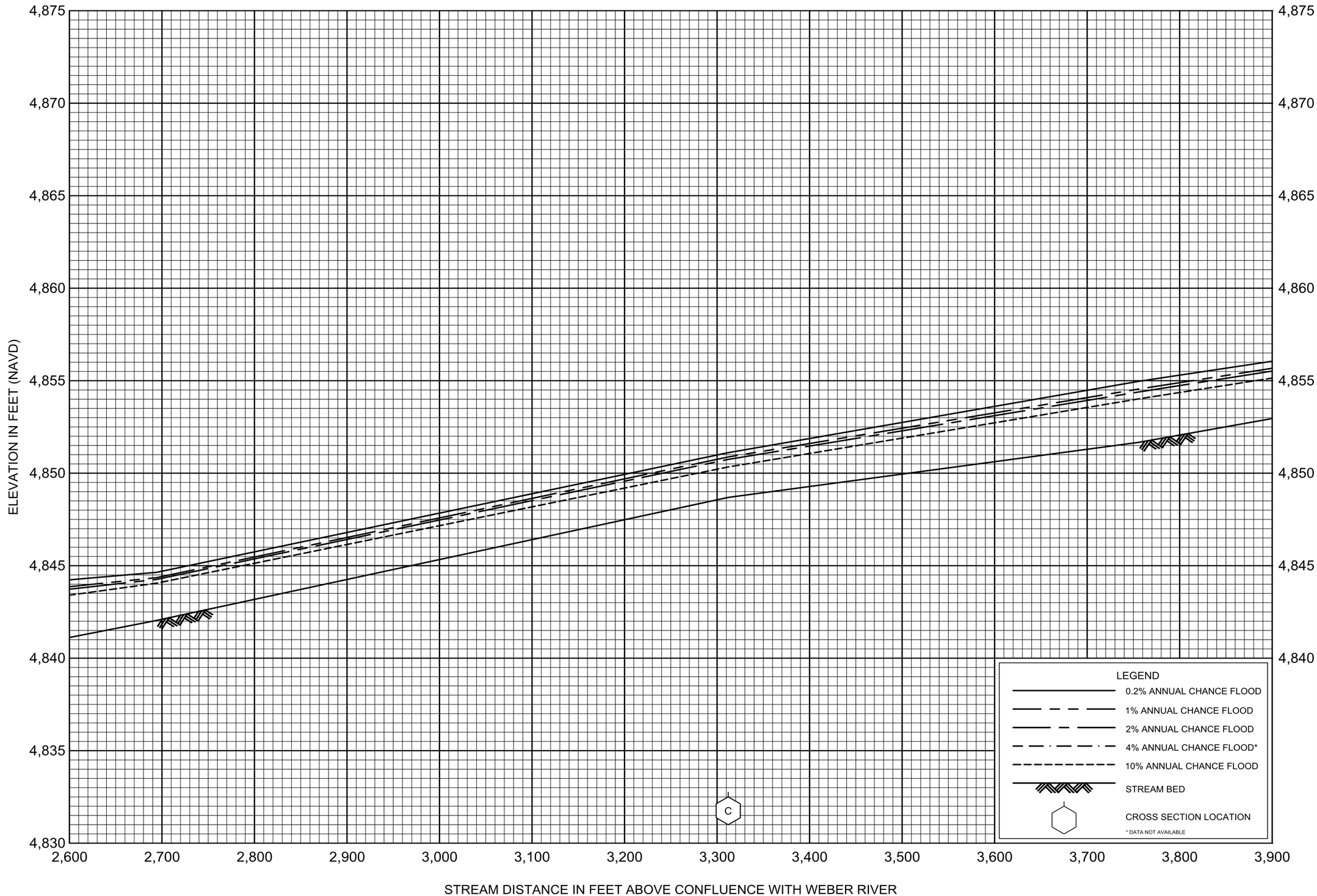
COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS

02P



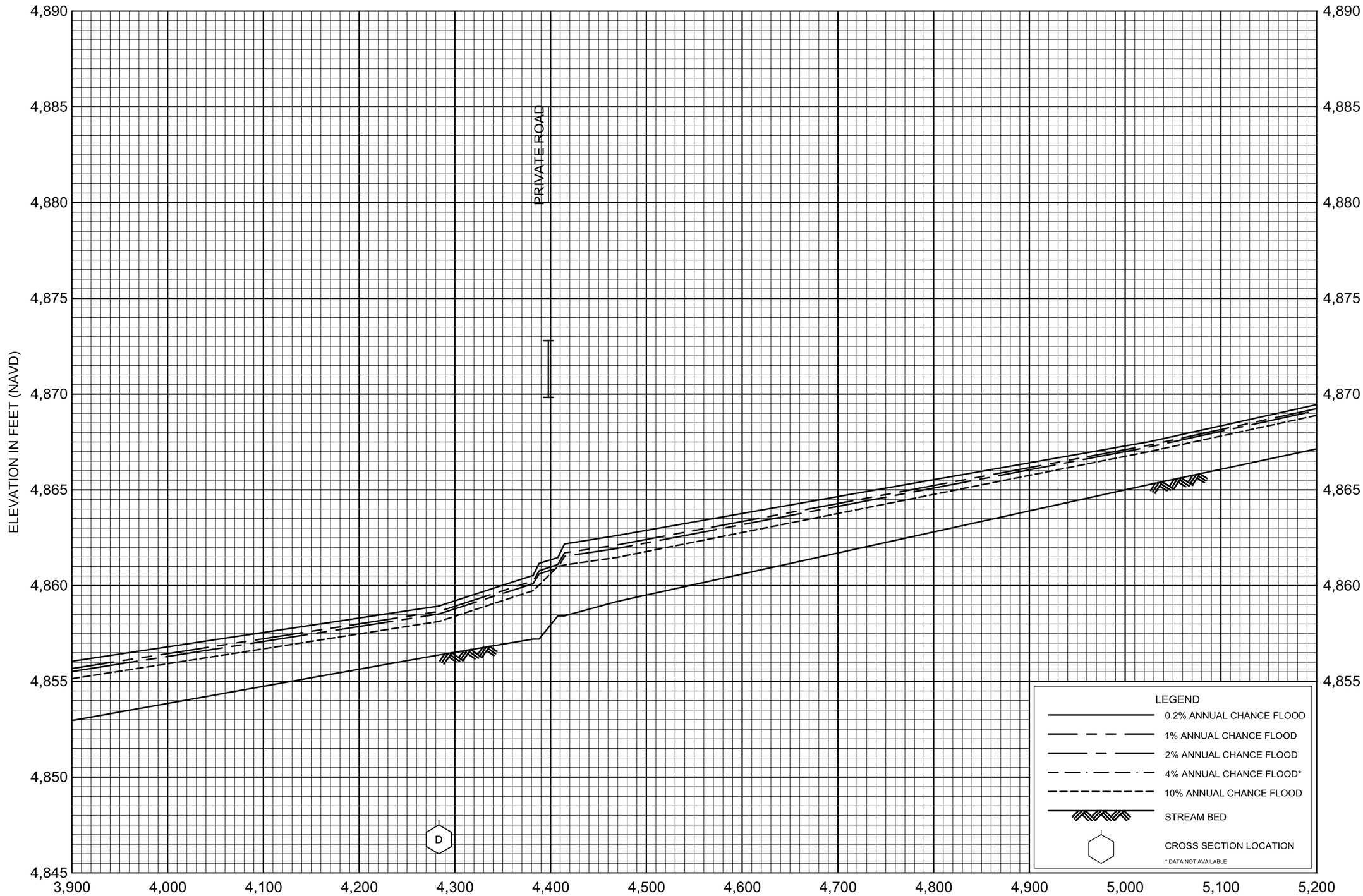
FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



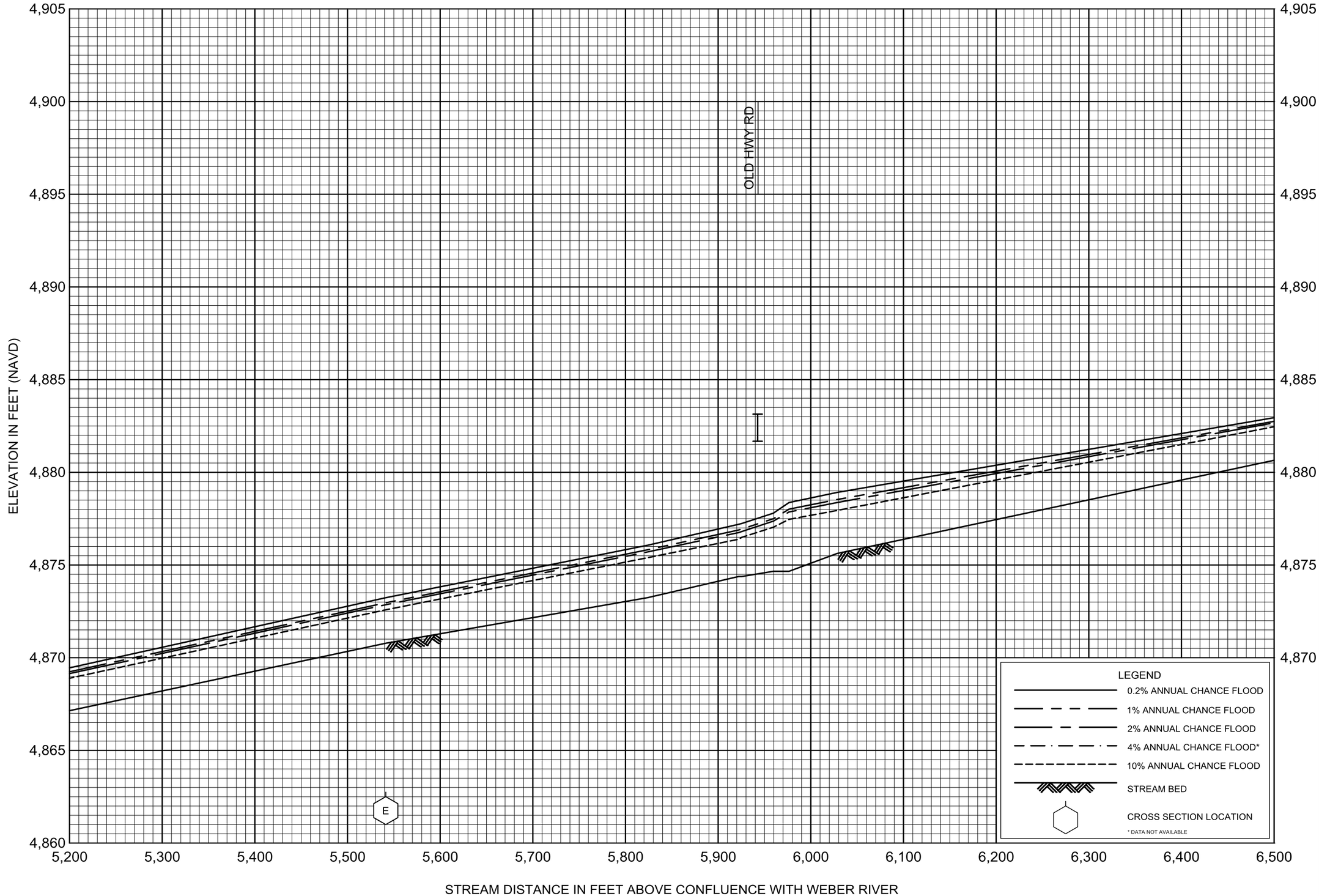
FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



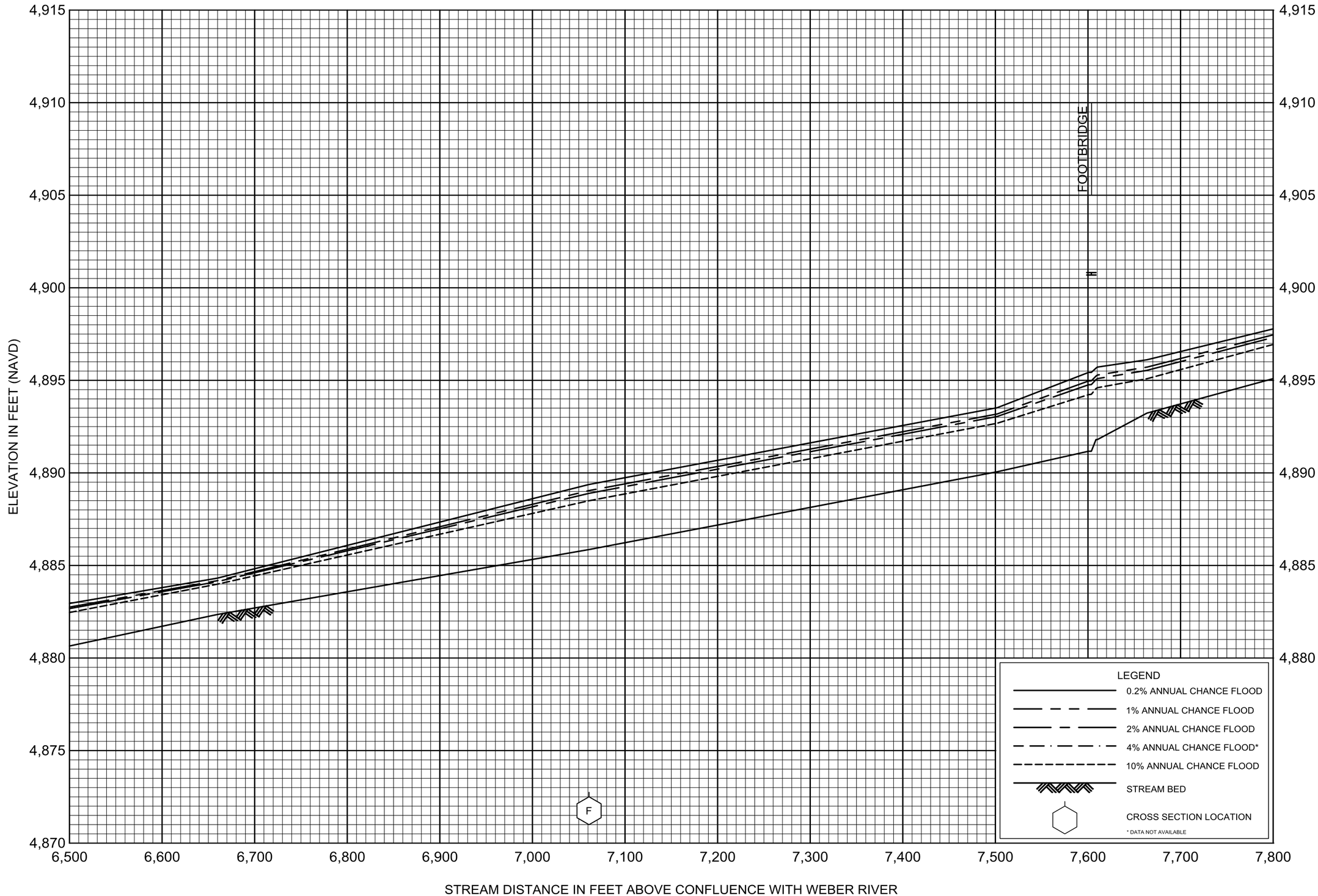
FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



FLOOD PROFILES

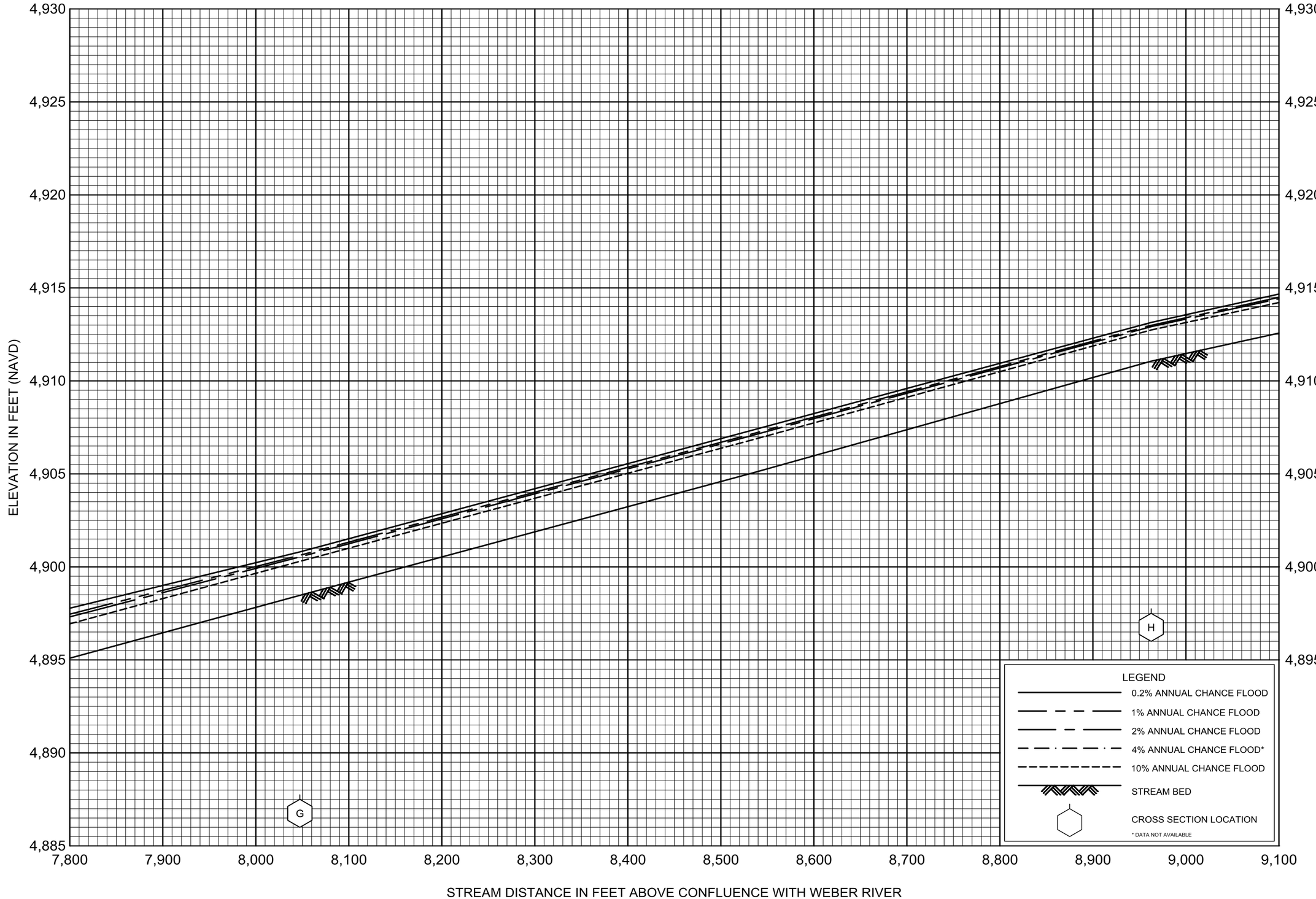
COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS

06P



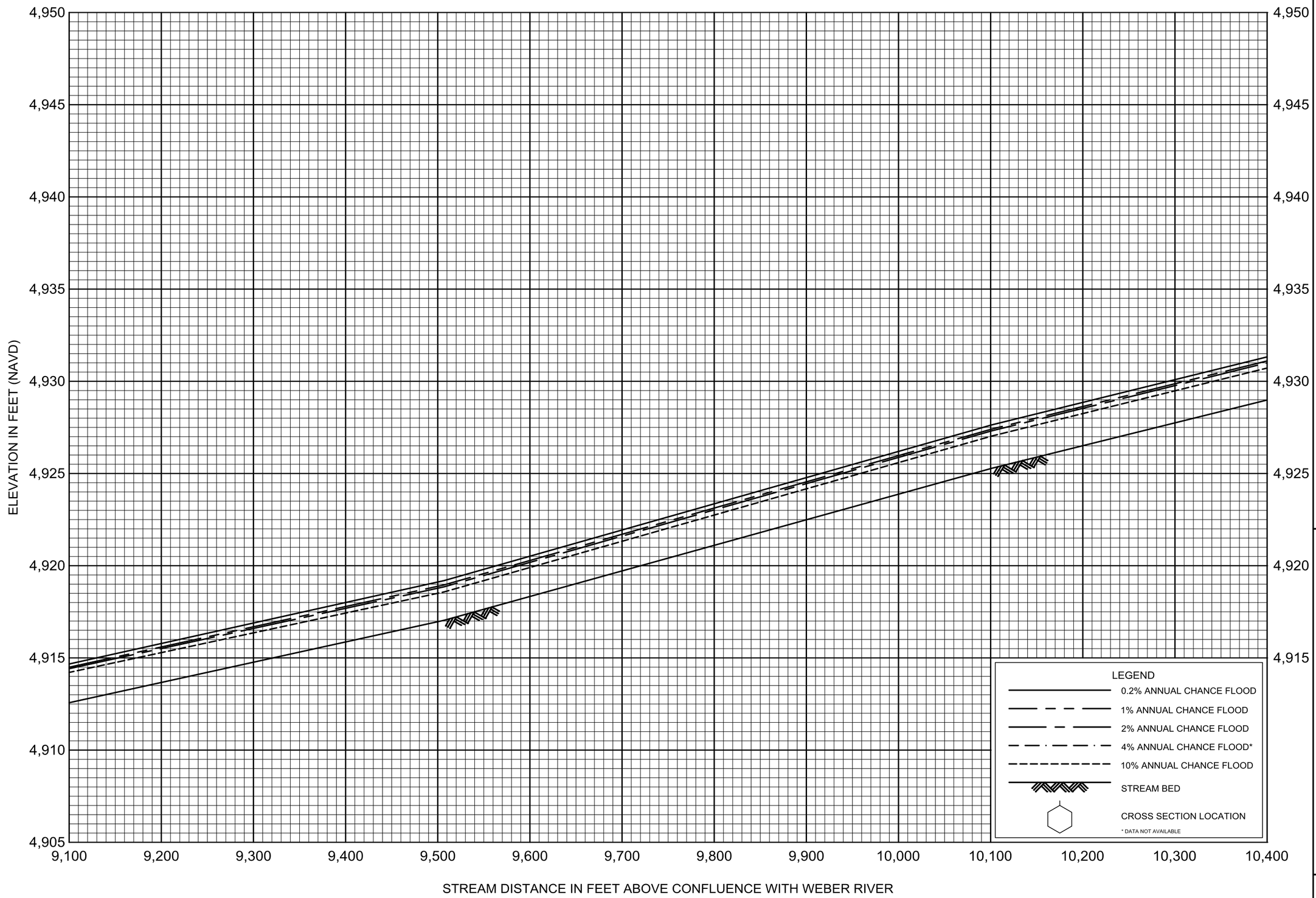
FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



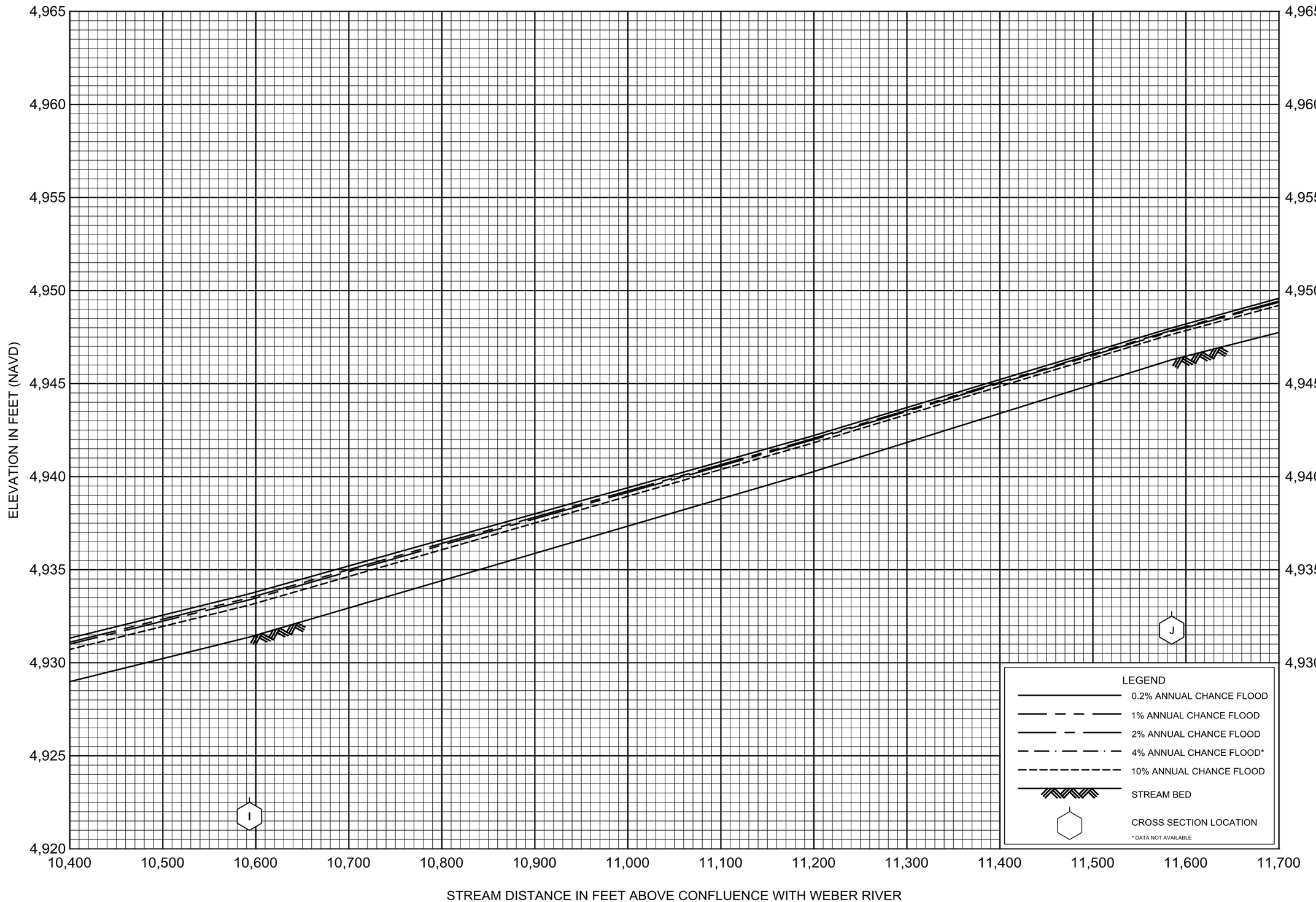
FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



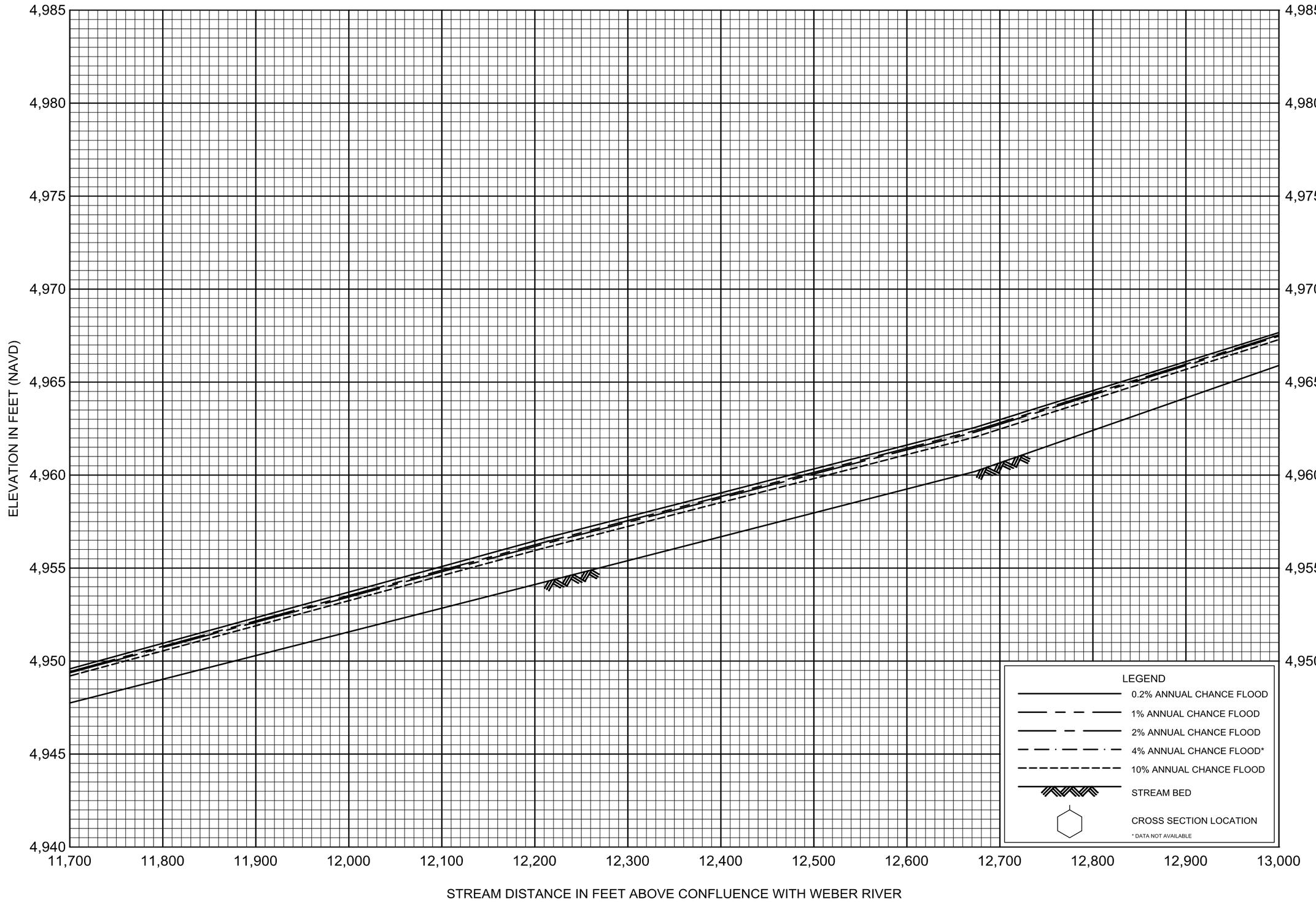
FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



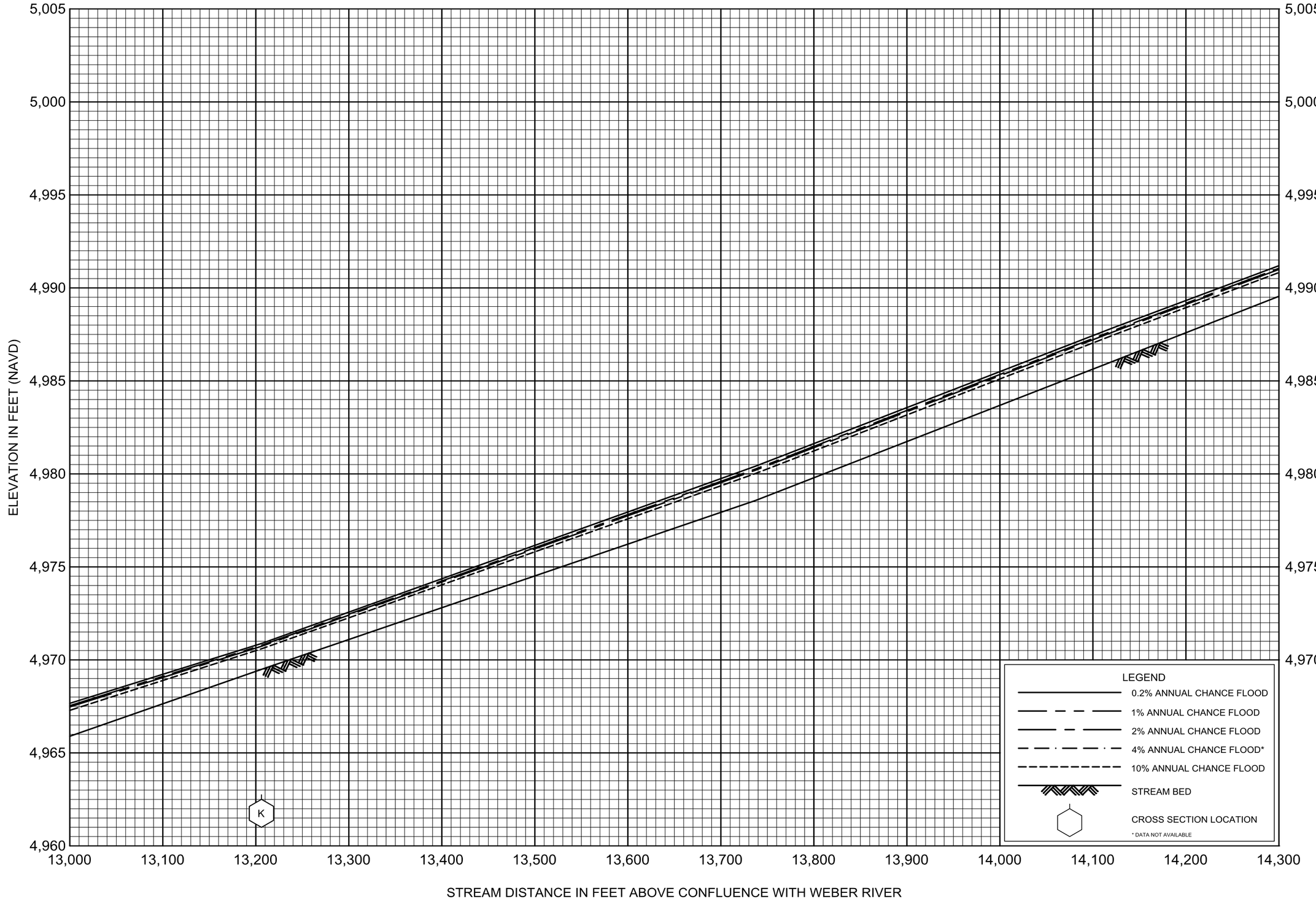
FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



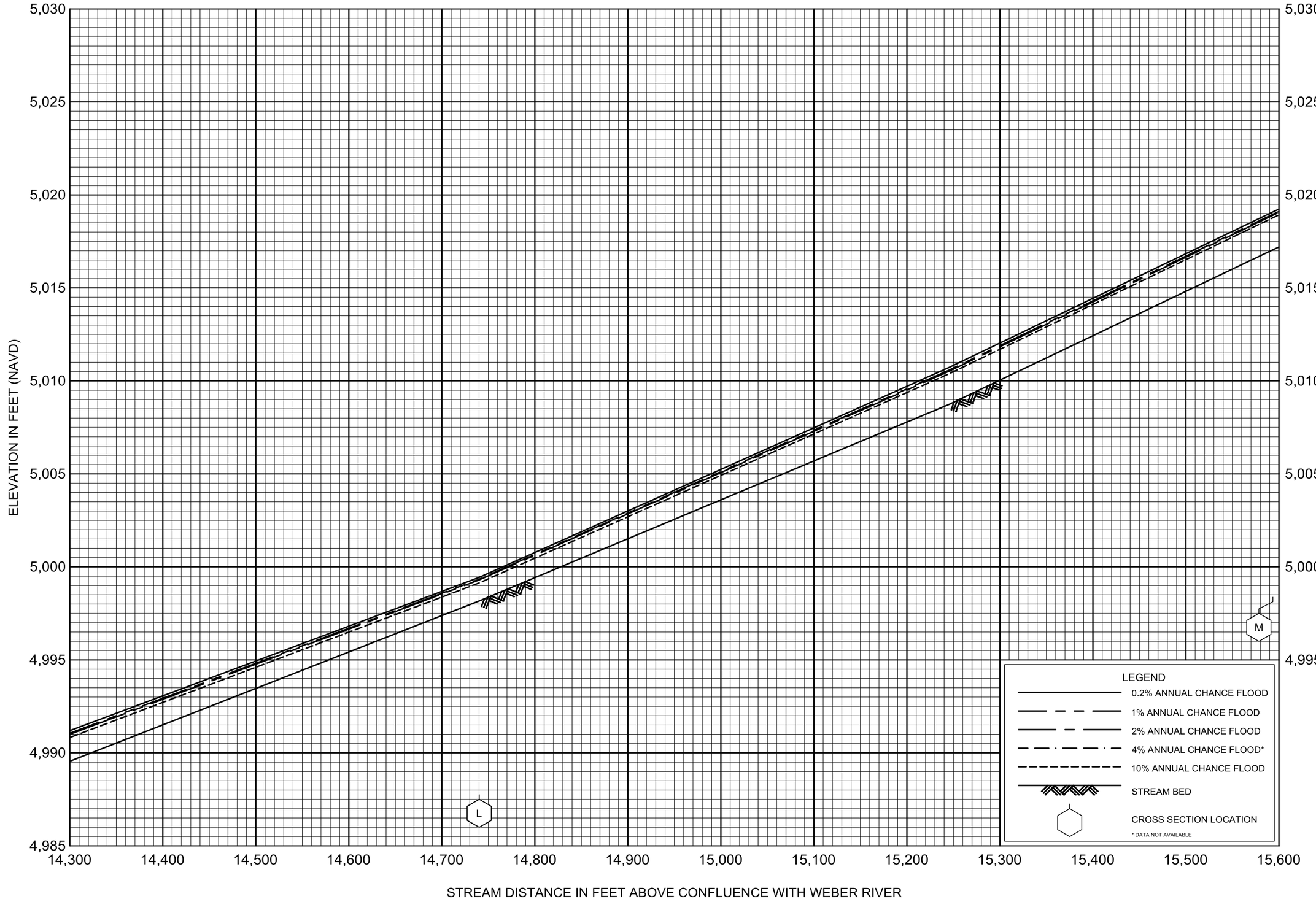
FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



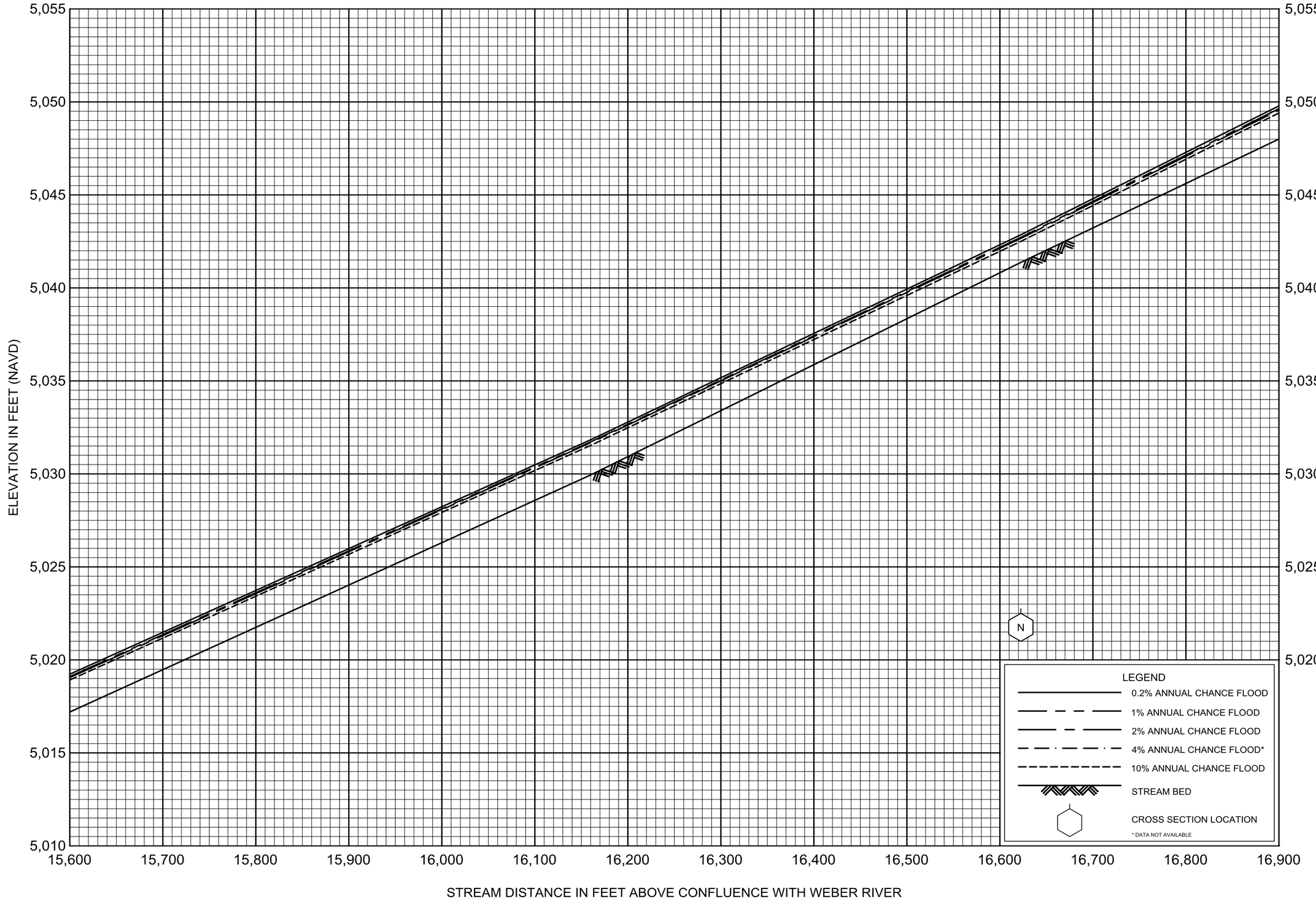
FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

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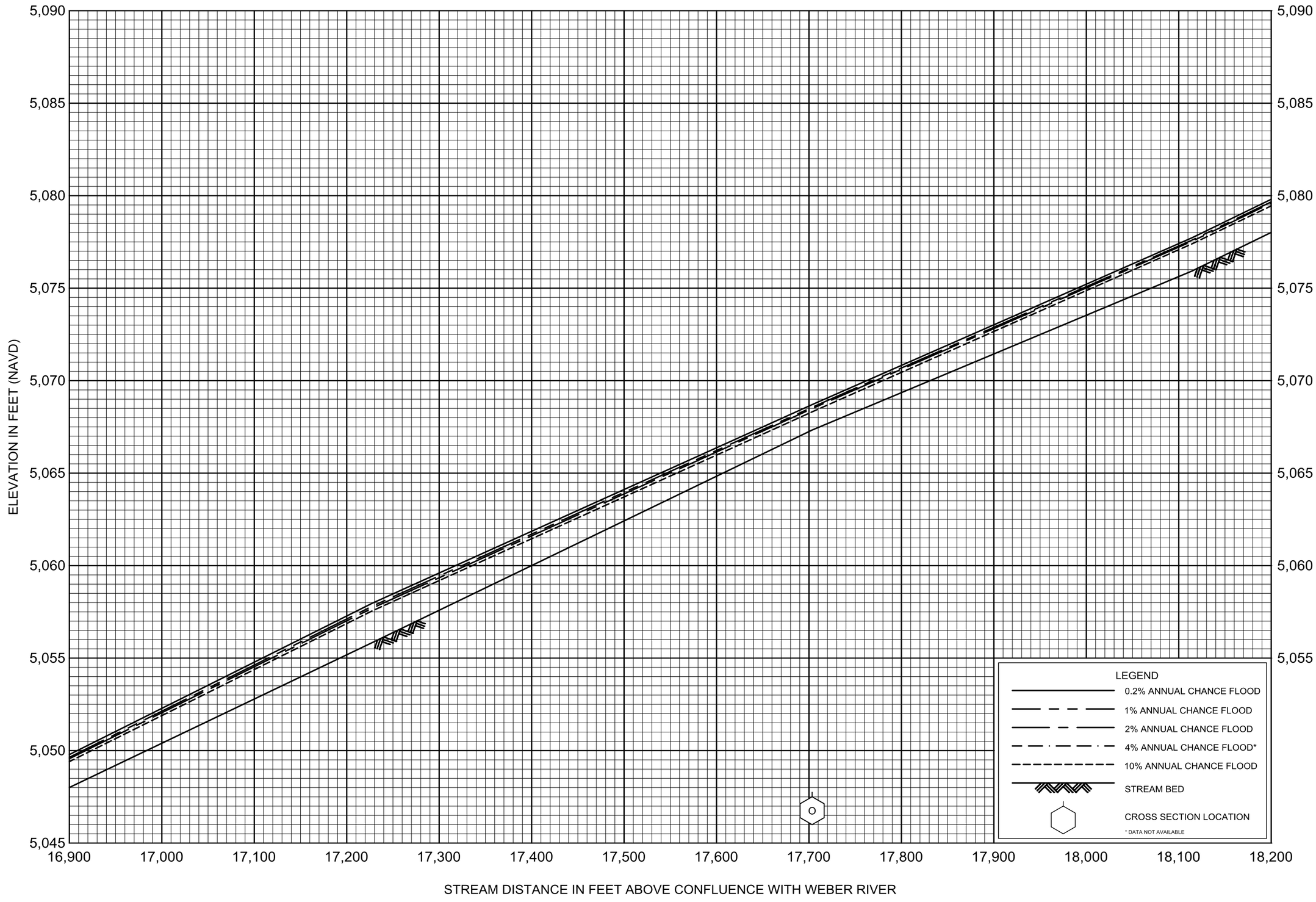

FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

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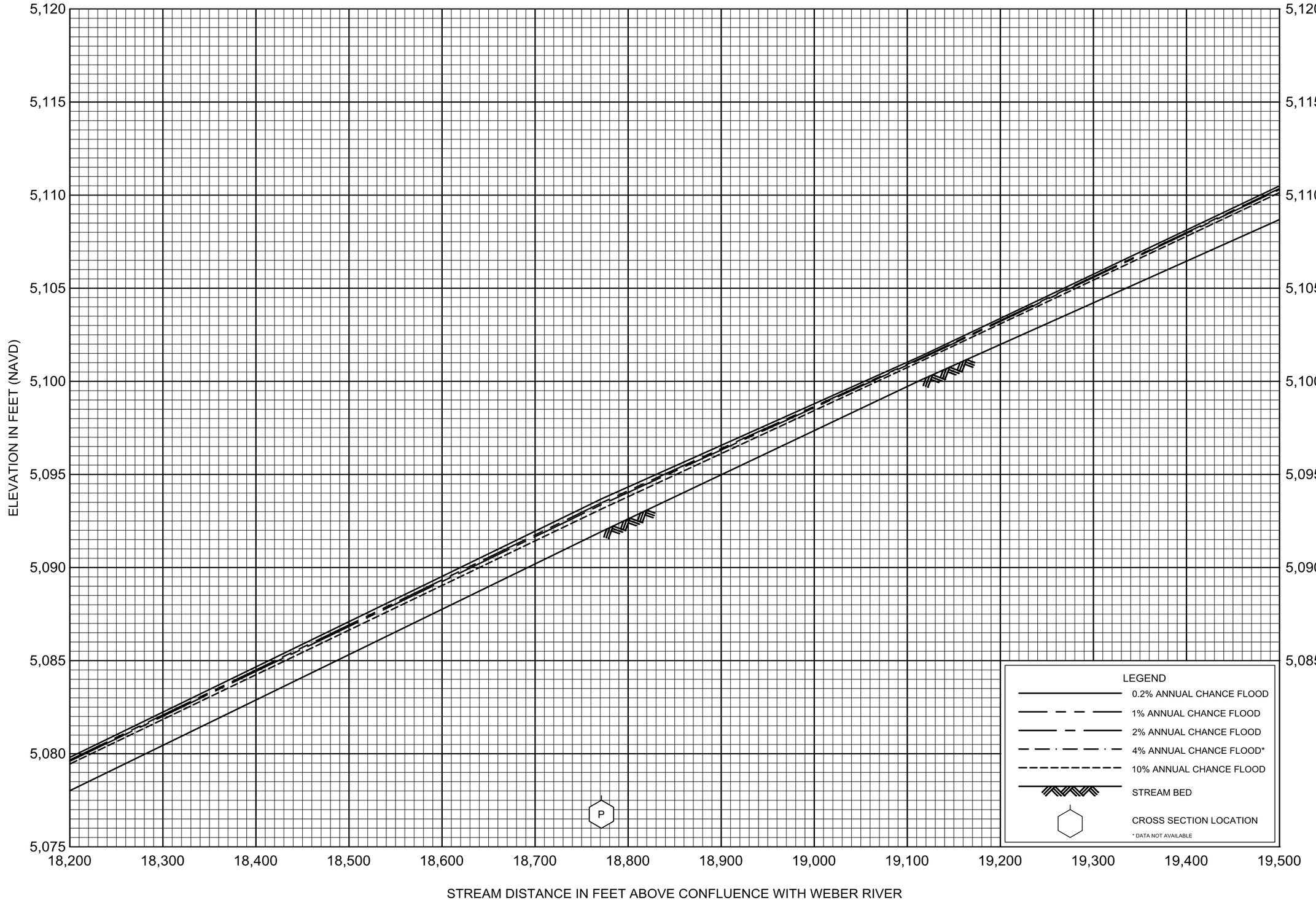


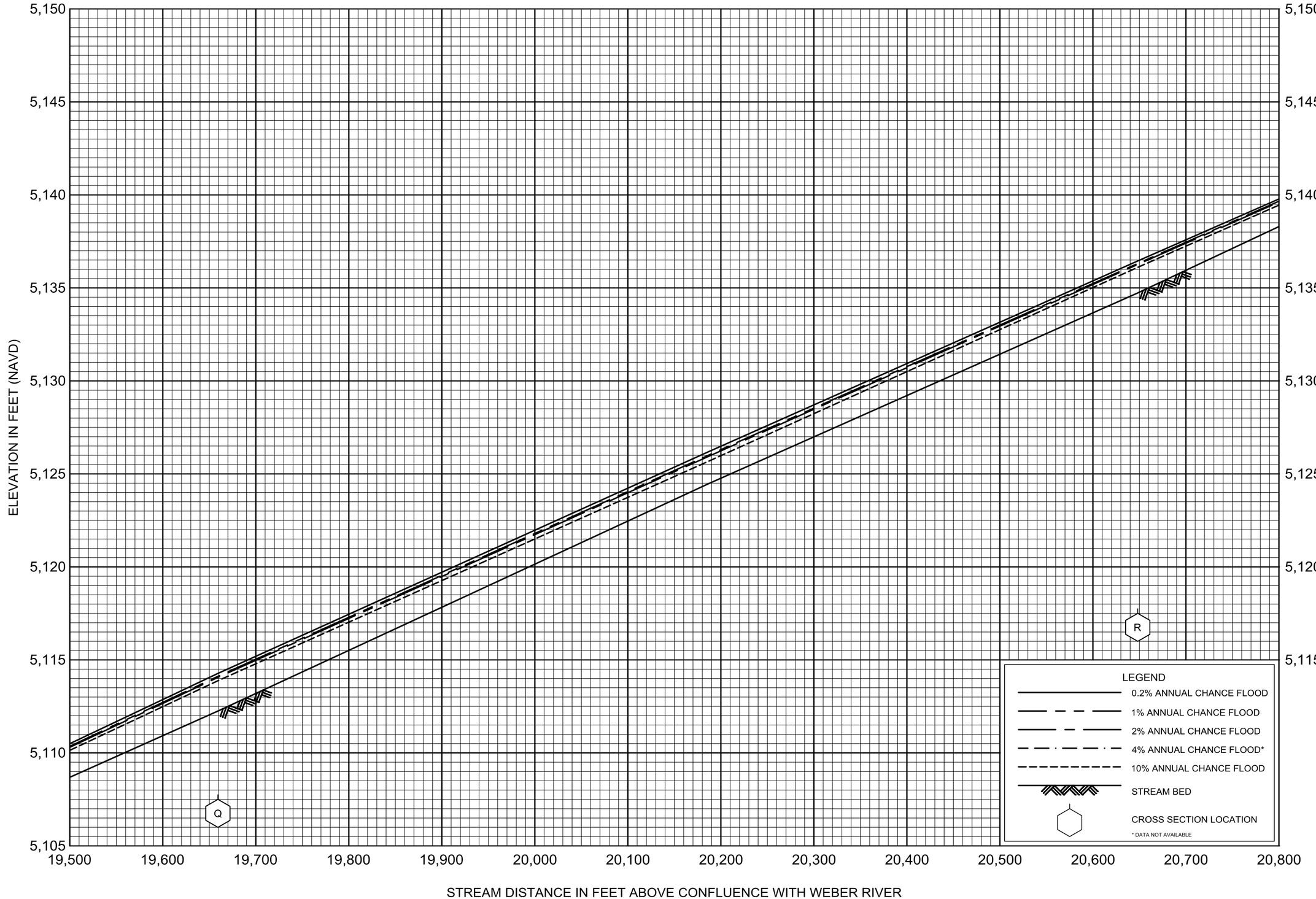
FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



FLOOD PROFILES

COTTONWOOD CREEK

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MORGAN COUNTY, UT

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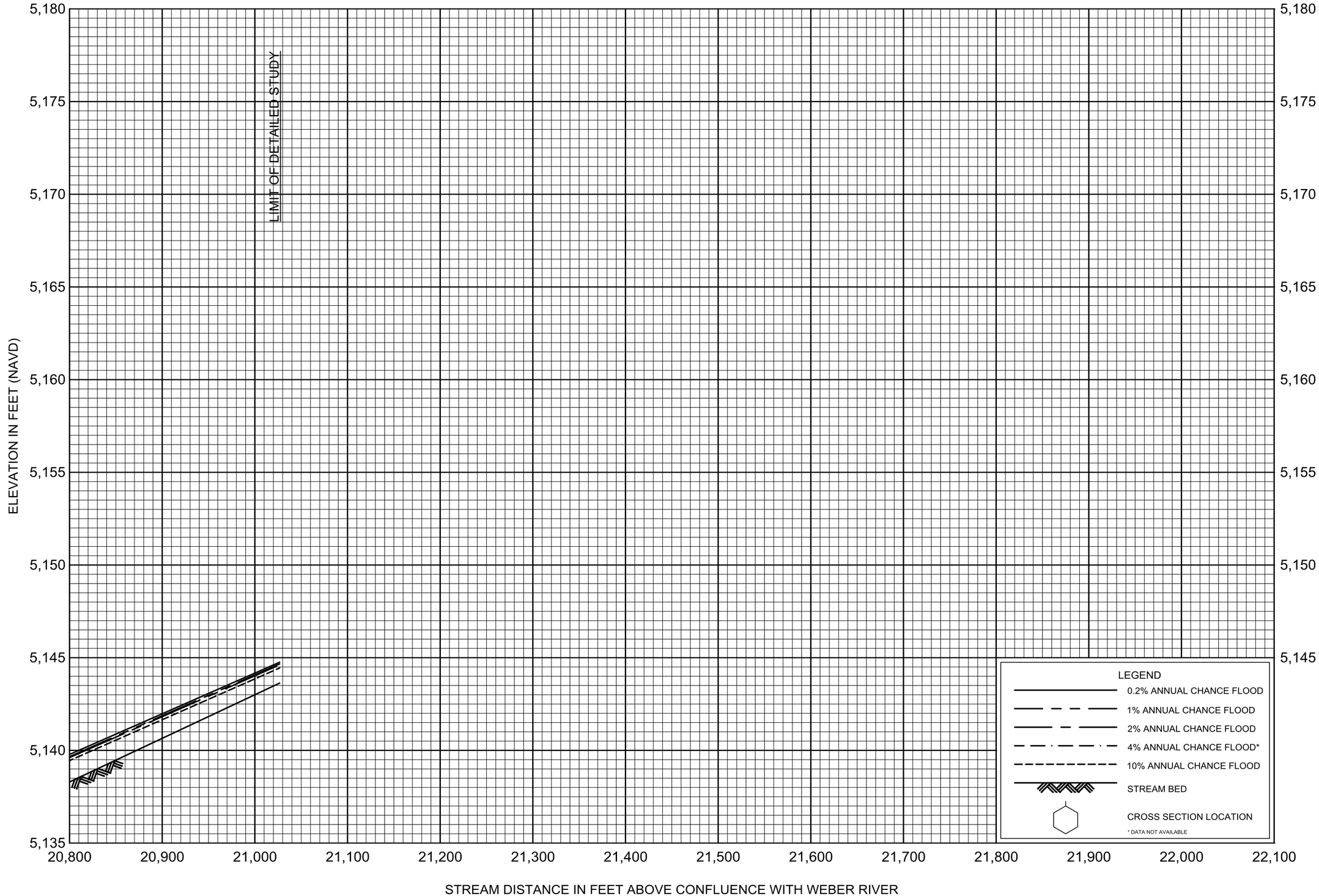


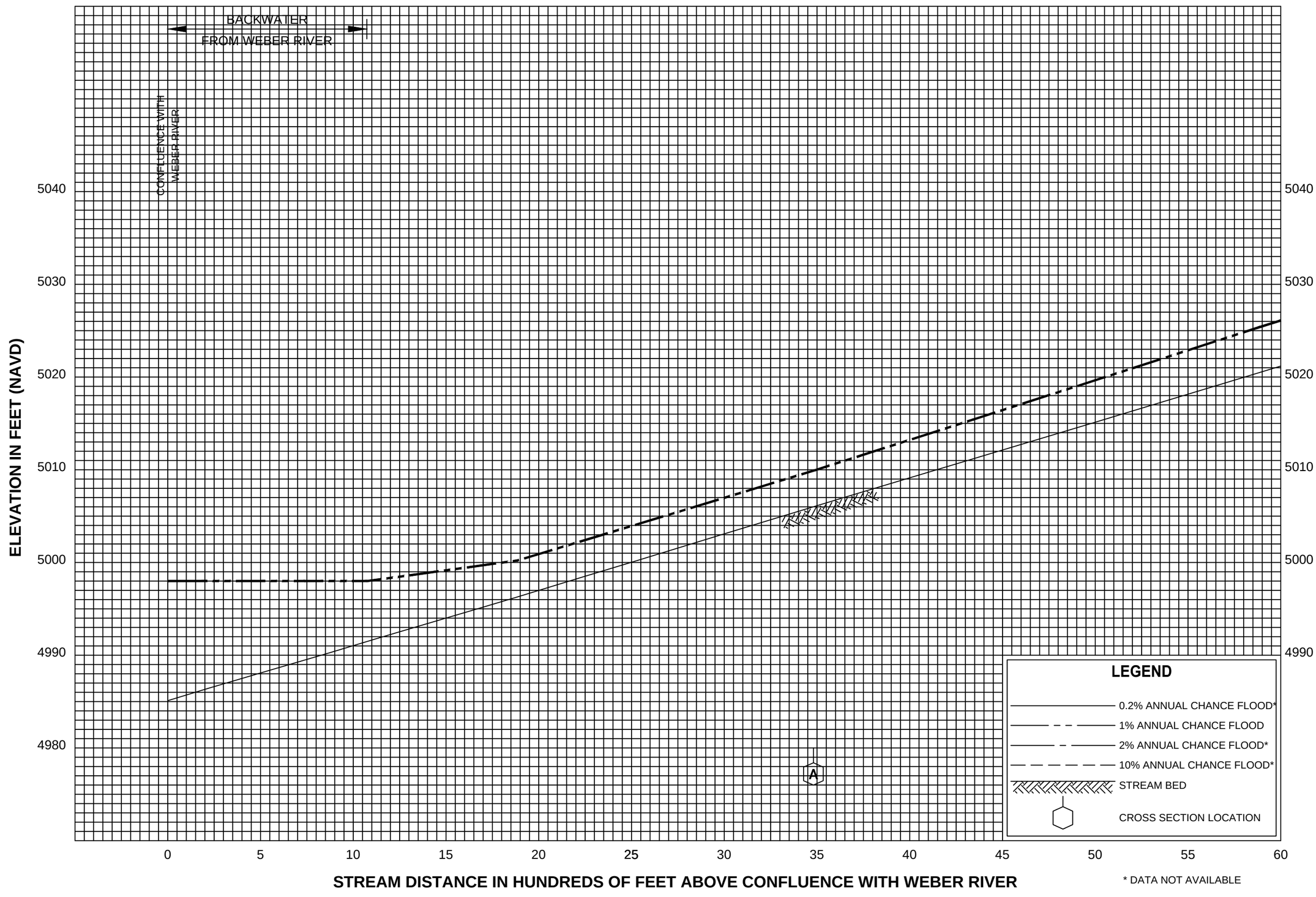
FLOOD PROFILES

COTTONWOOD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



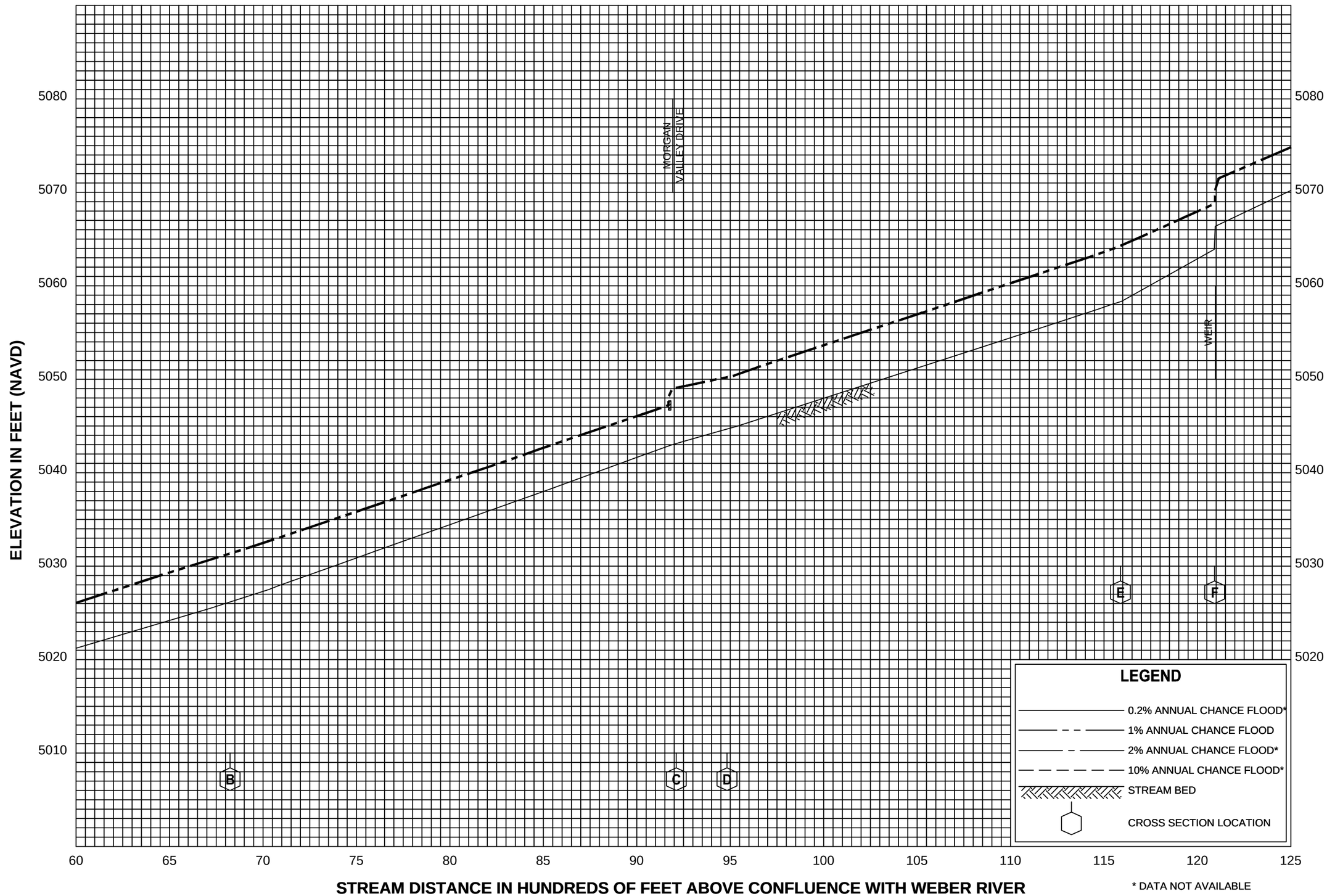
FLOOD PROFILES

DEEP CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UTAH

AND INCORPORATED AREAS



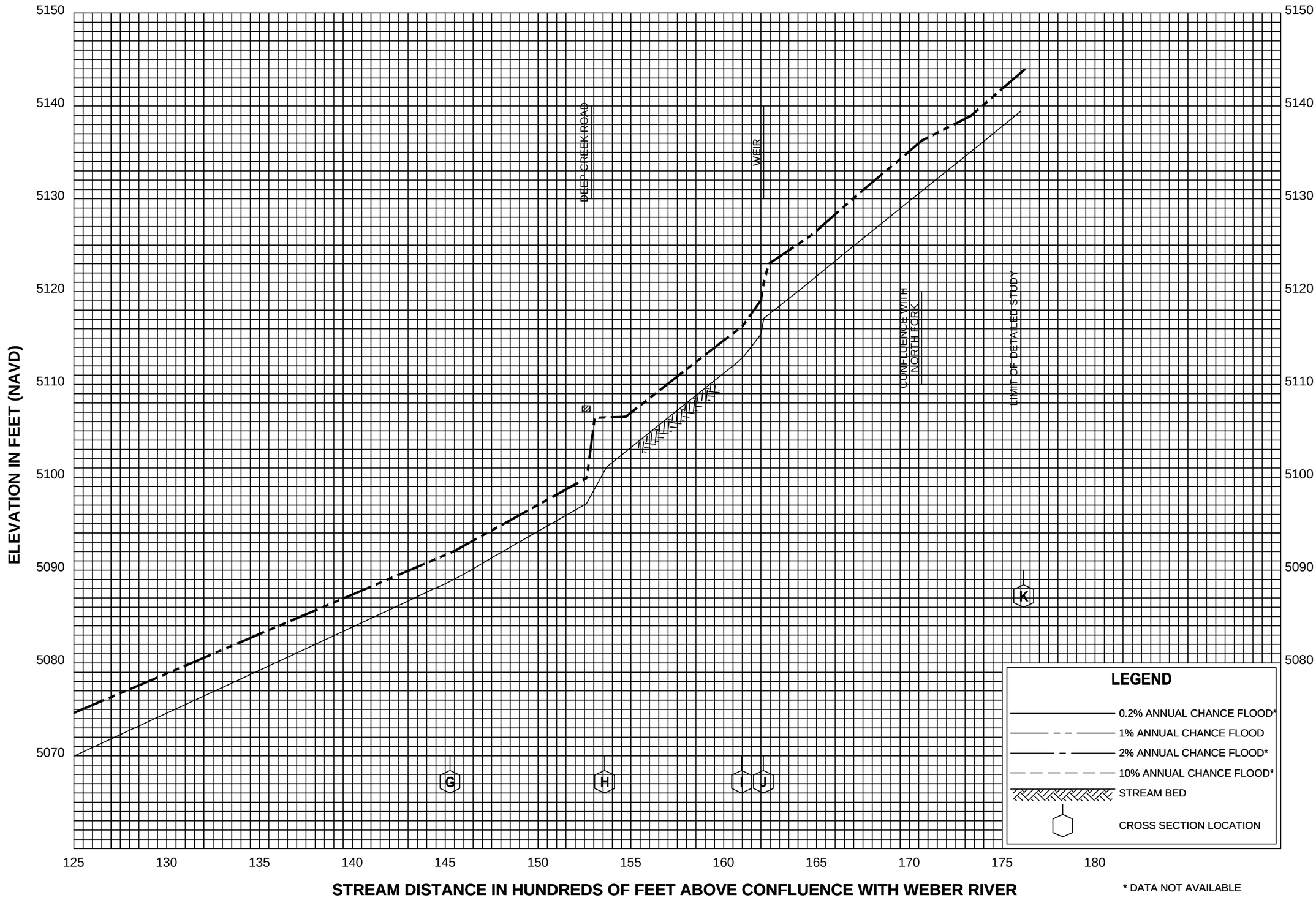
FLOOD PROFILES

DEEP CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UTAH

AND INCORPORATED AREAS



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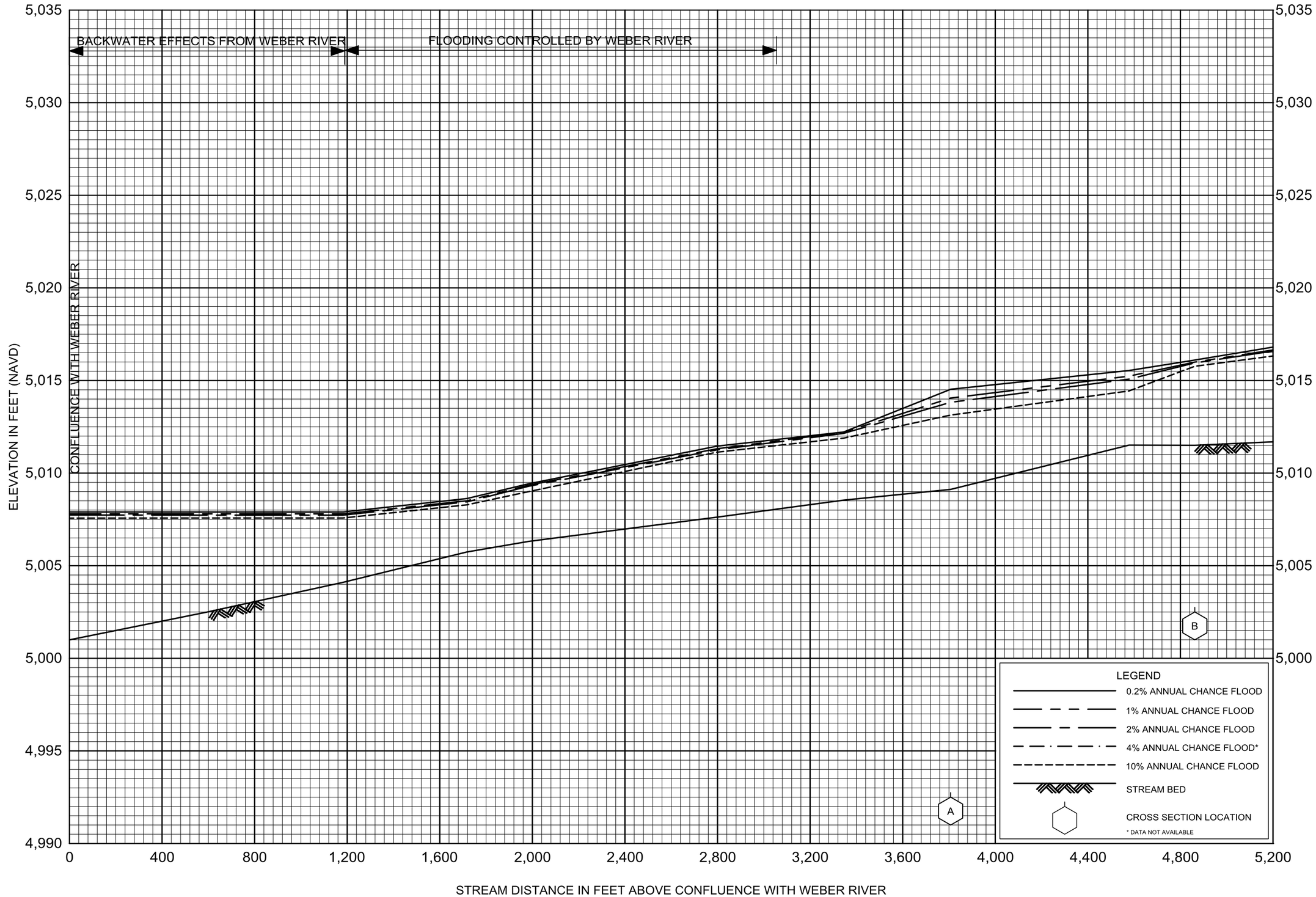
FLOOD PROFILES

DEEP CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UTAH

AND INCORPORATED AREAS



FLOOD PROFILES

EAST CANYON CREEK

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MORGAN COUNTY, UT

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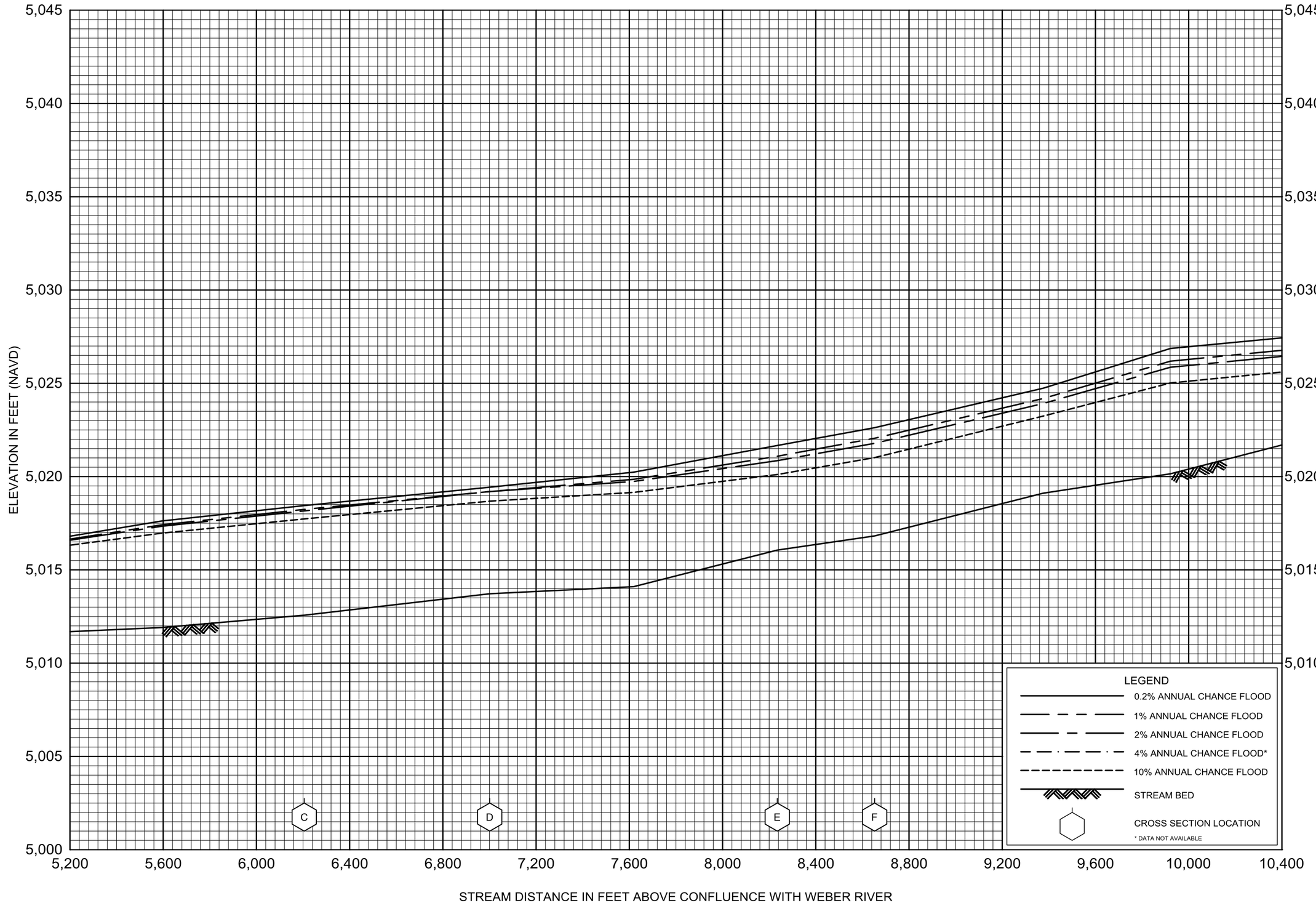

FLOOD PROFILES

EAST CANYON CREEK

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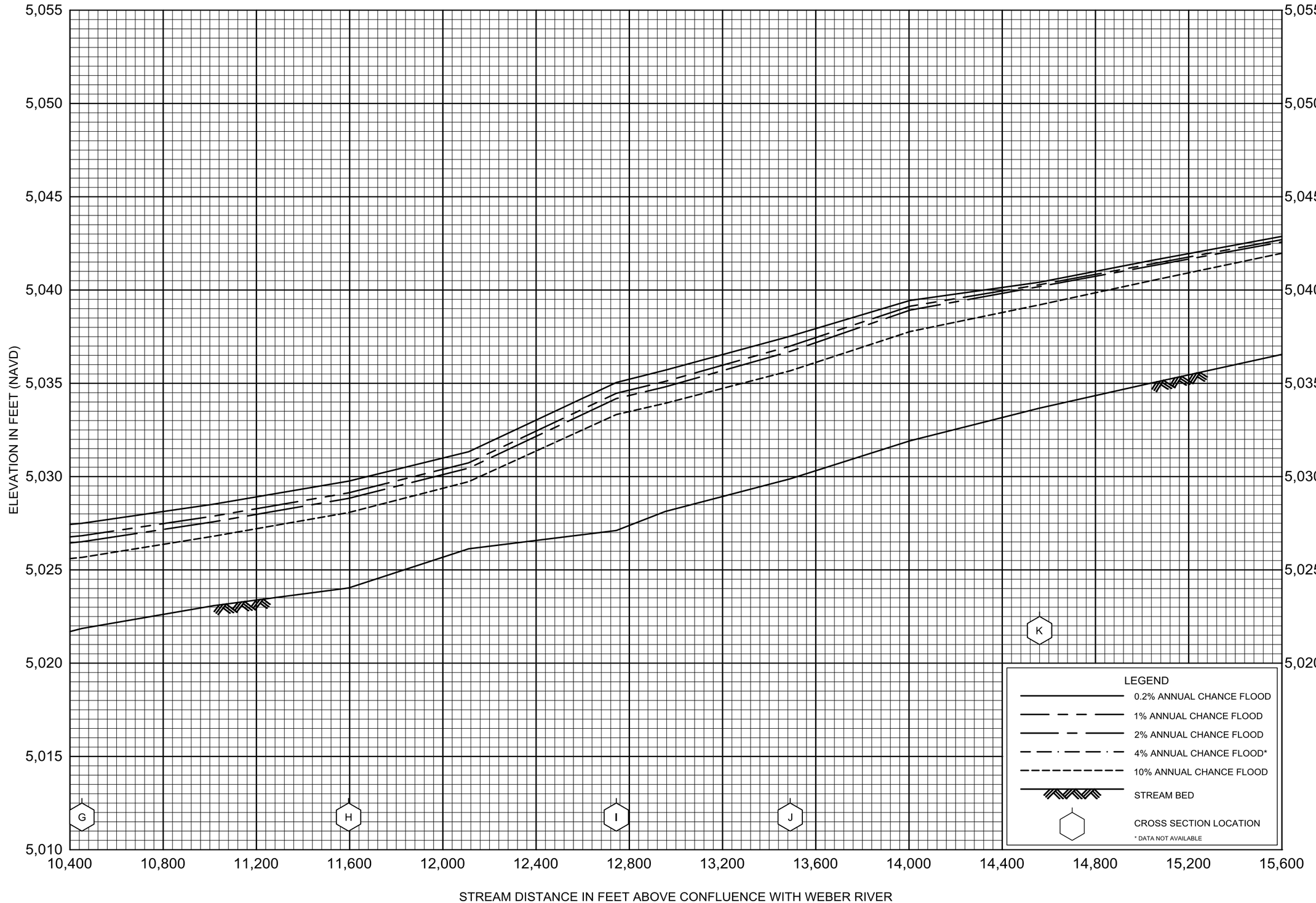

FLOOD PROFILES

EAST CANYON CREEK

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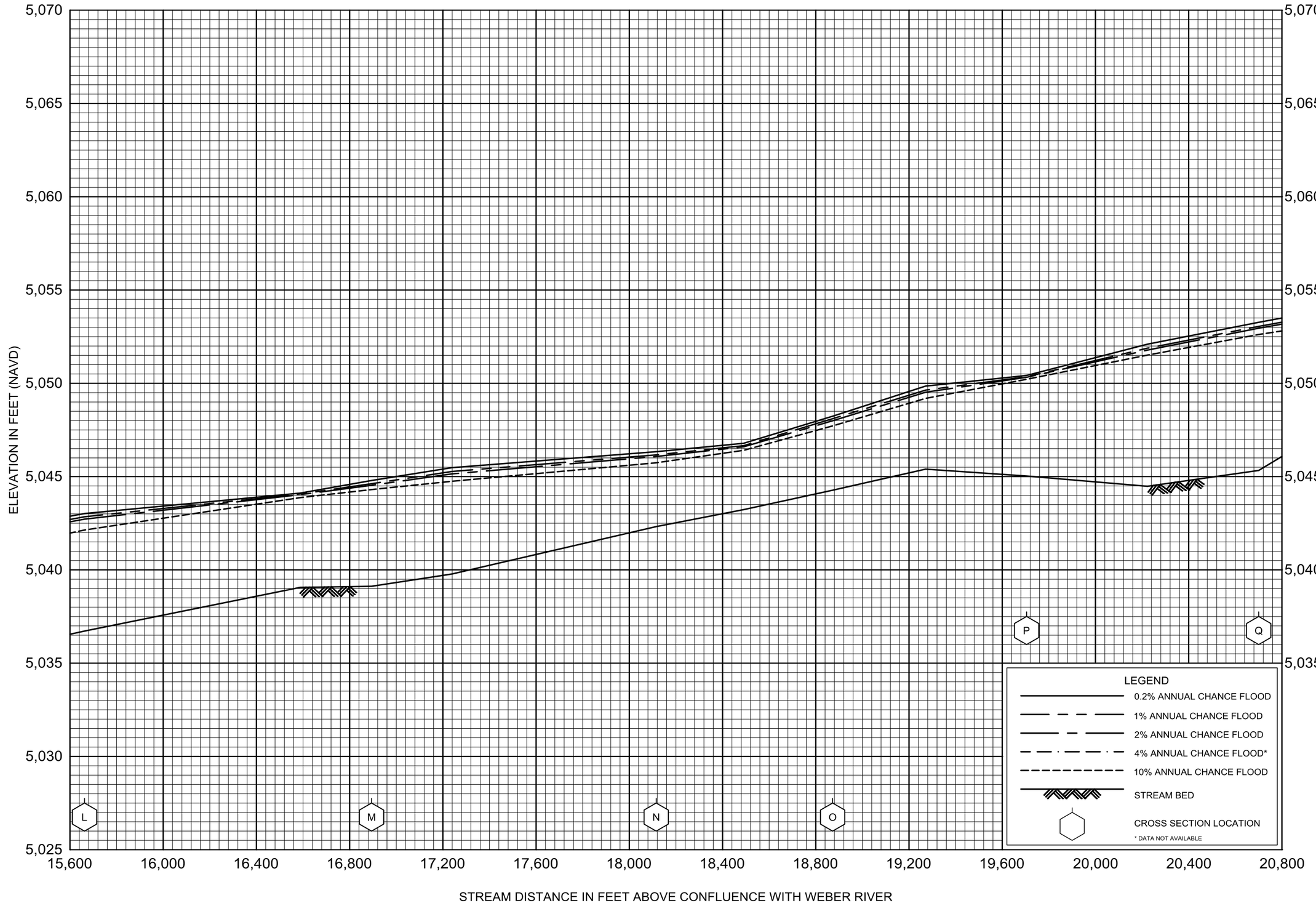

FLOOD PROFILES

EAST CANYON CREEK

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MORGAN COUNTY, UT

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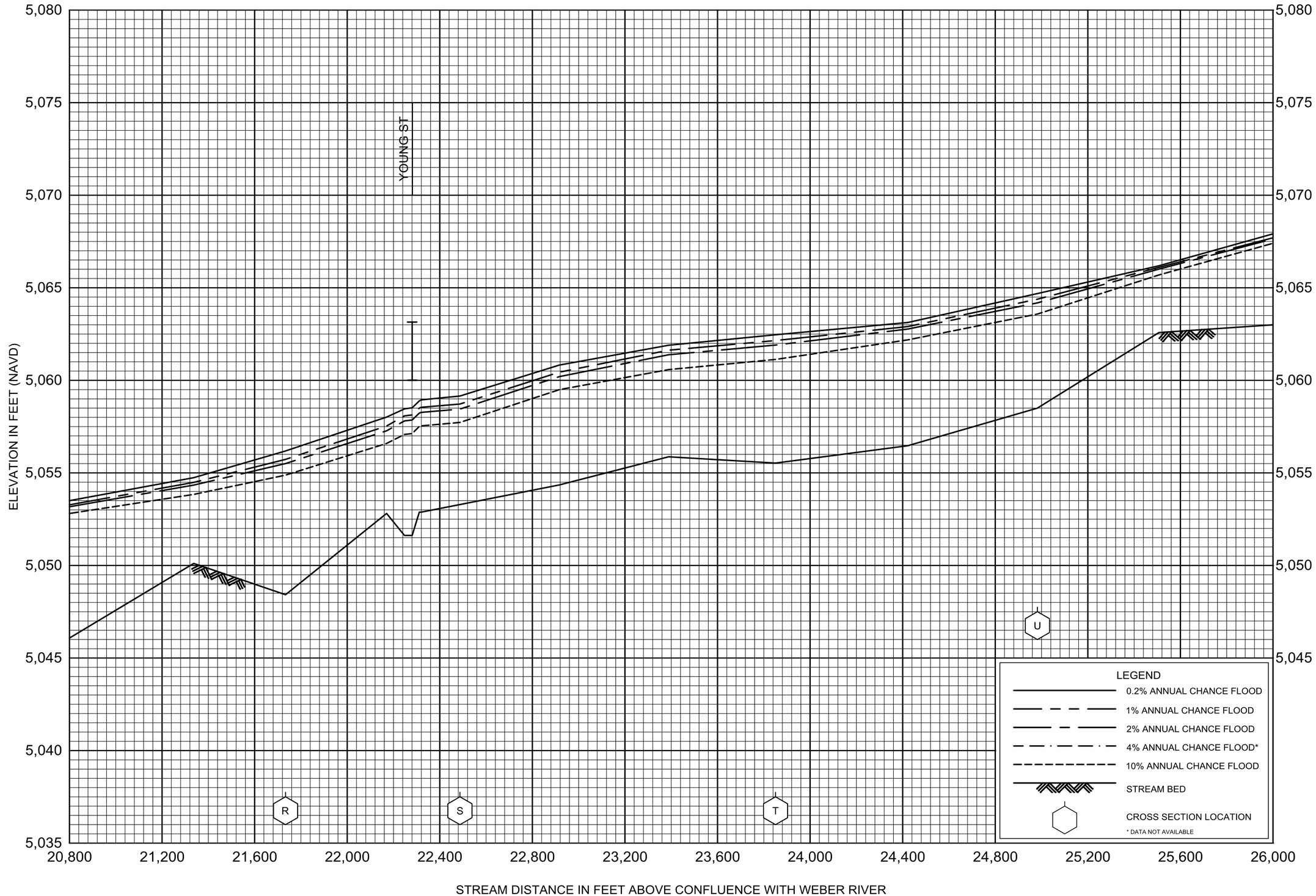

FLOOD PROFILES

EAST CANYON CREEK

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MORGAN COUNTY, UT

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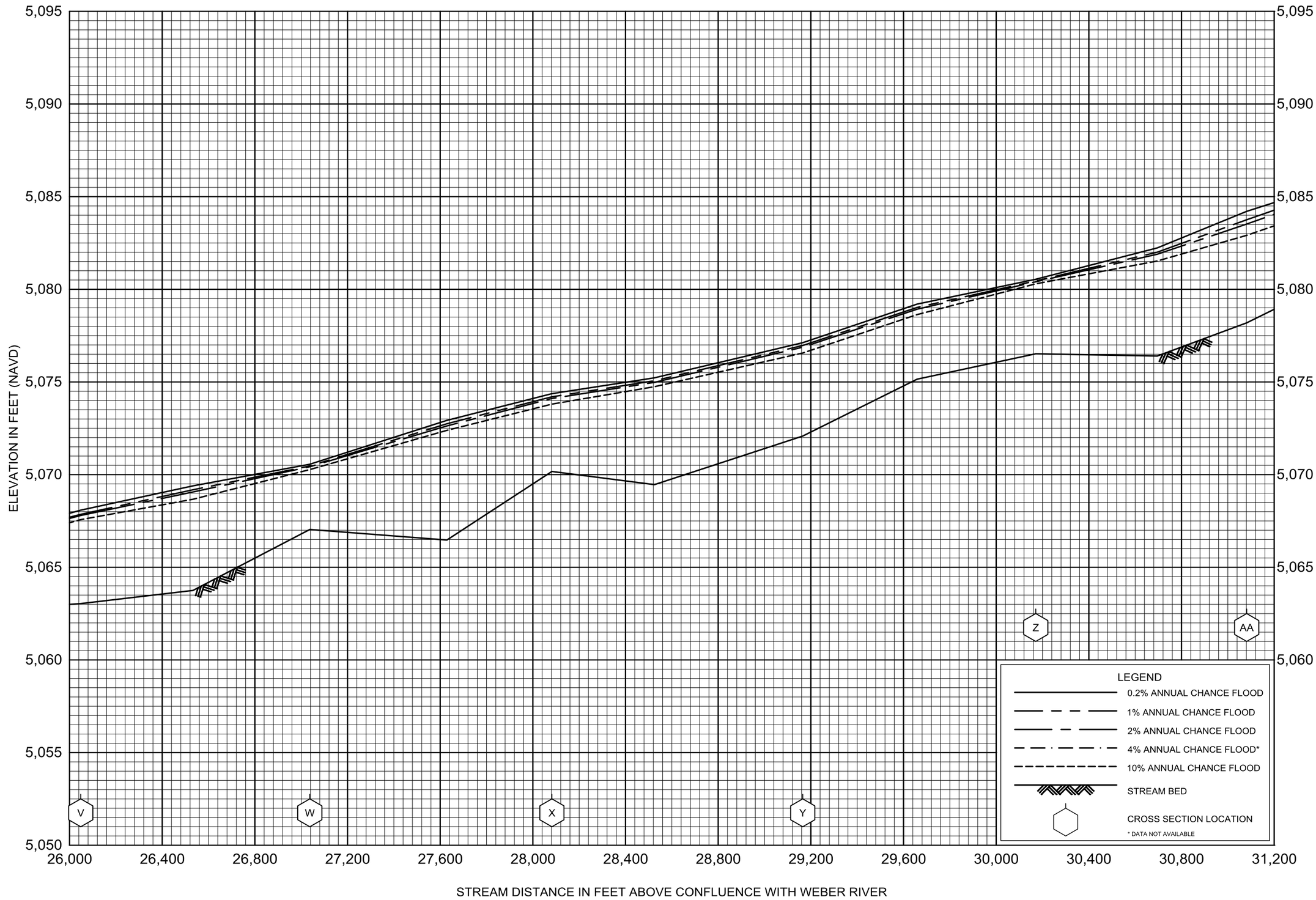

FLOOD PROFILES

EAST CANYON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

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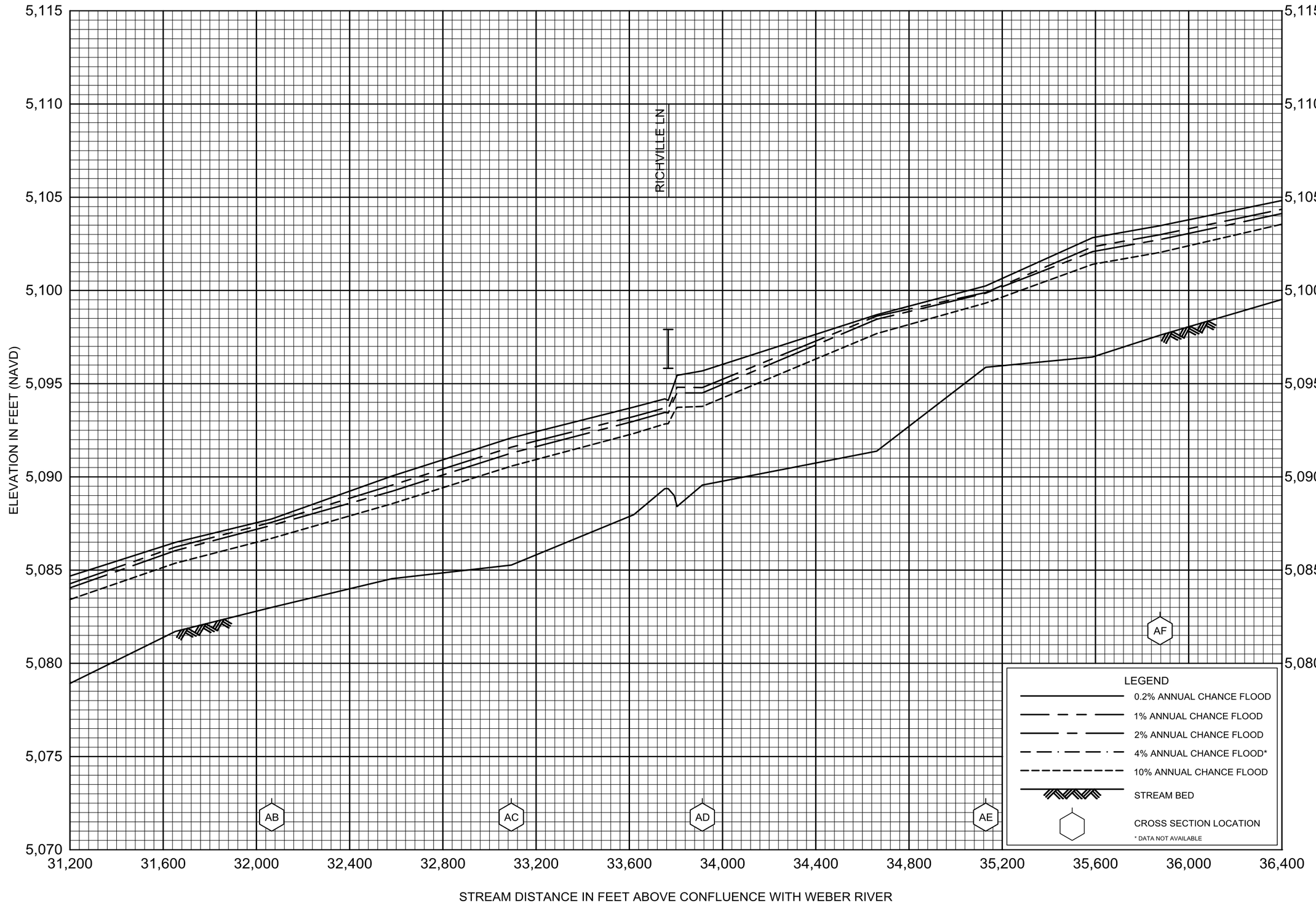

FLOOD PROFILES

EAST CANYON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

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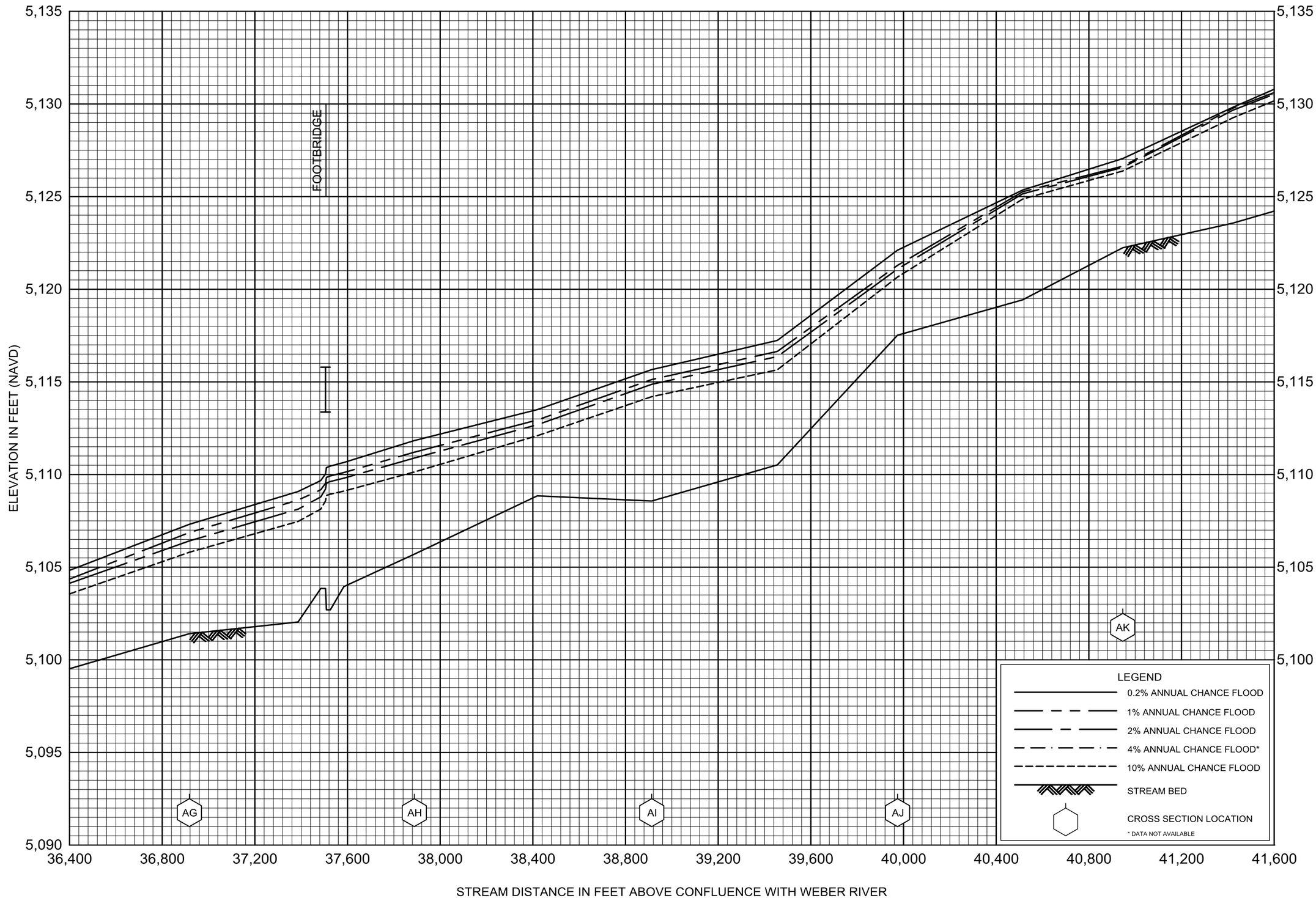


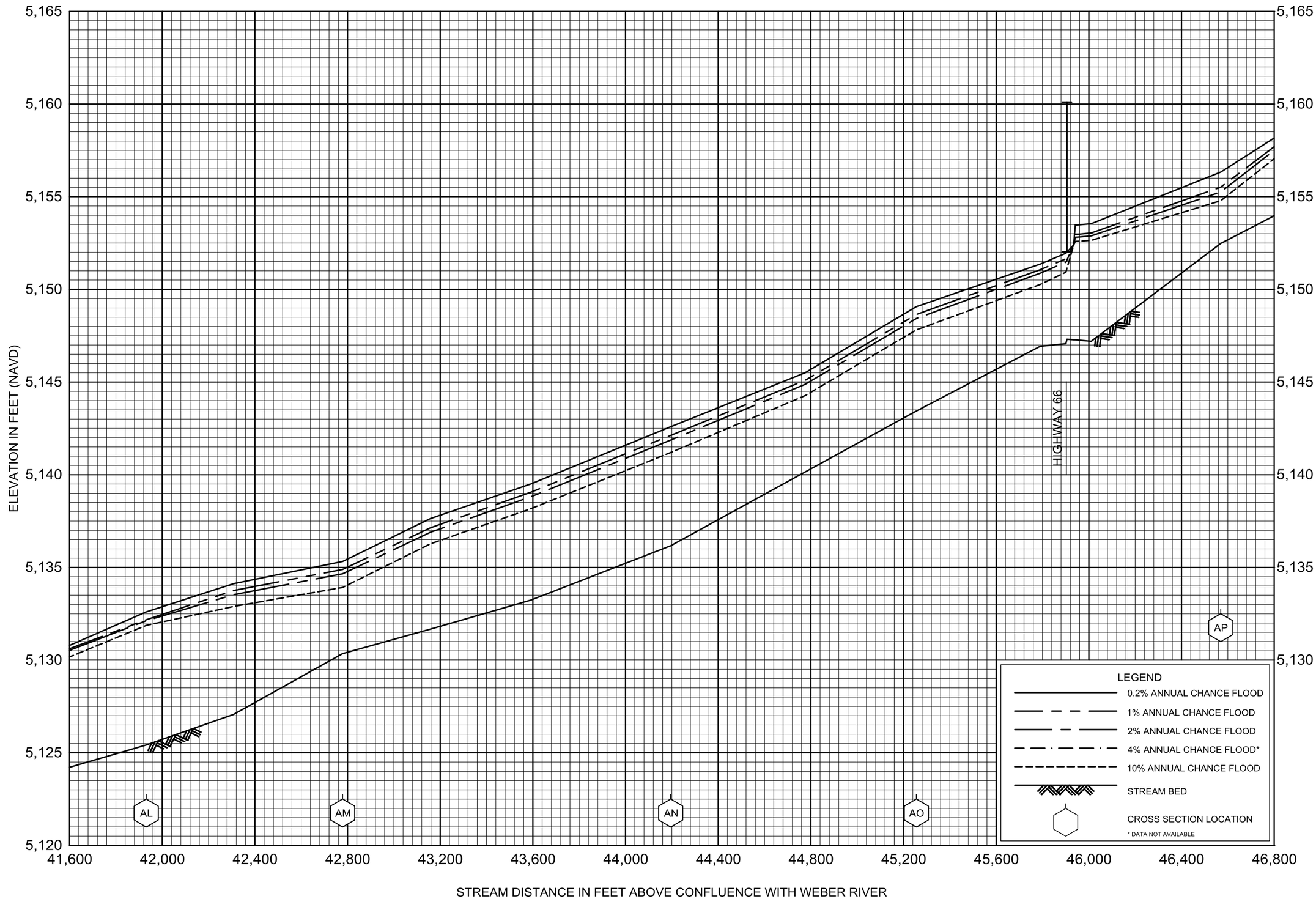
FLOOD PROFILES

EAST CANYON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



FLOOD PROFILES

EAST CANYON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

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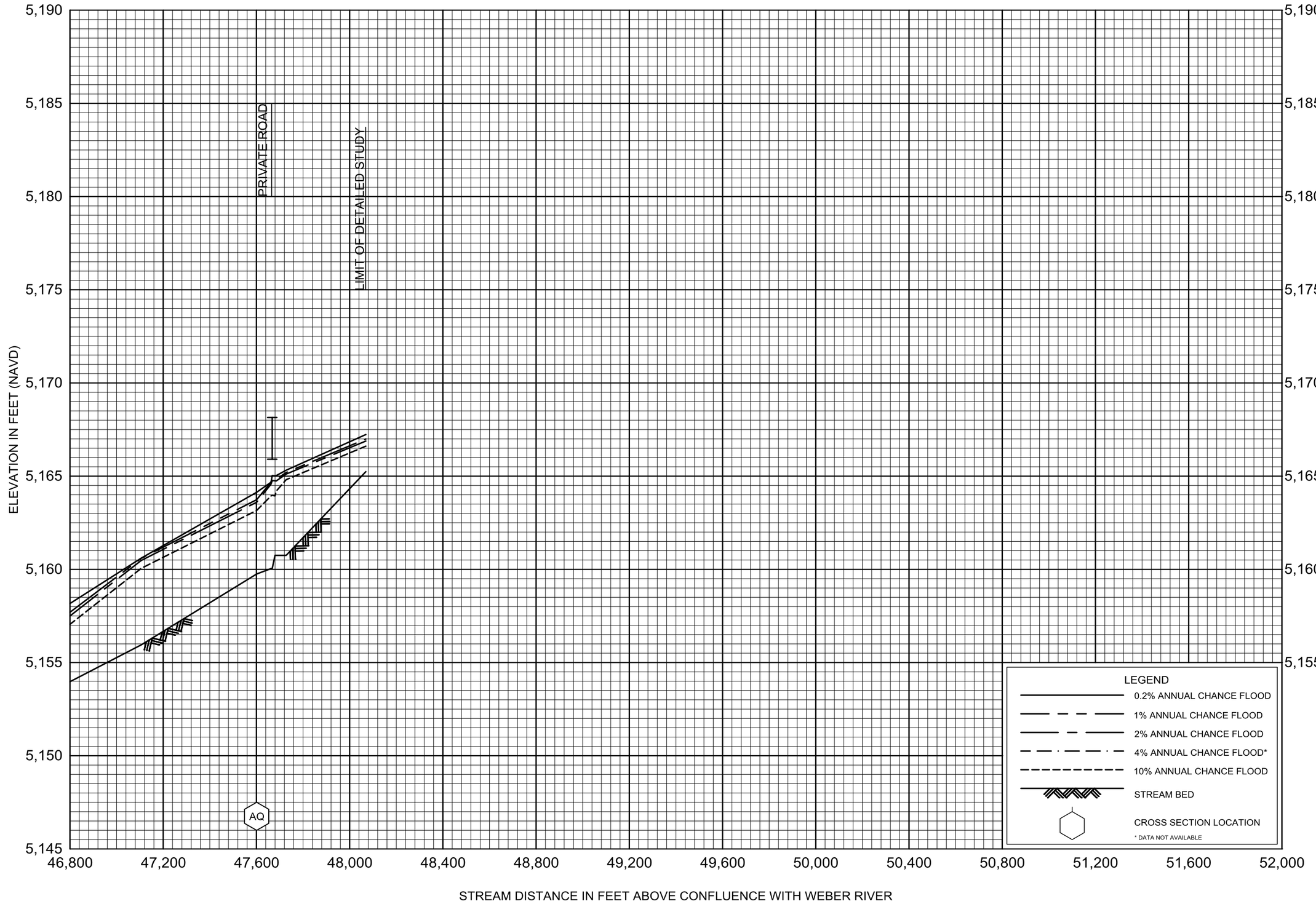


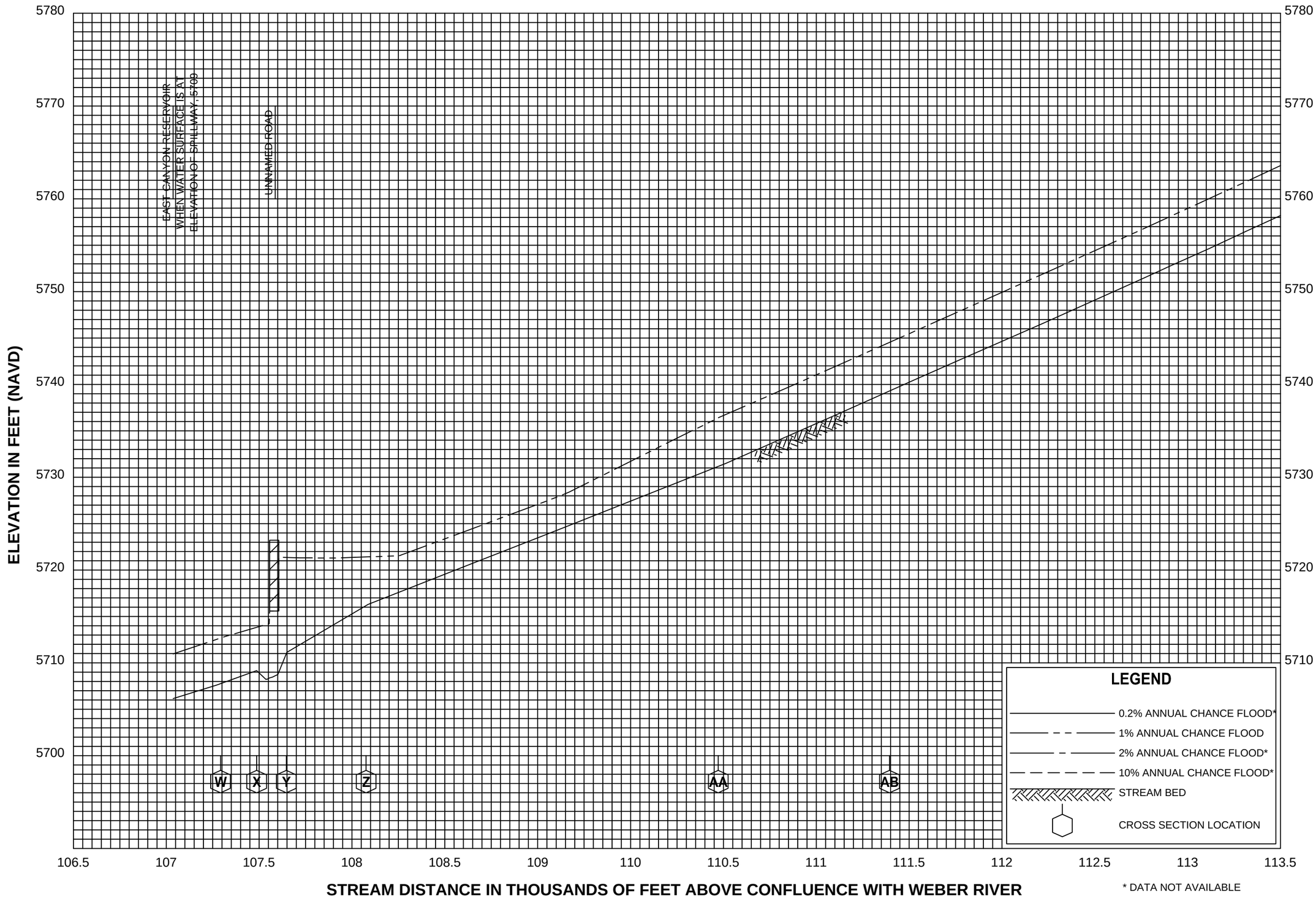
FLOOD PROFILES

EAST CANYON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UT

AND INCORPORATED AREAS



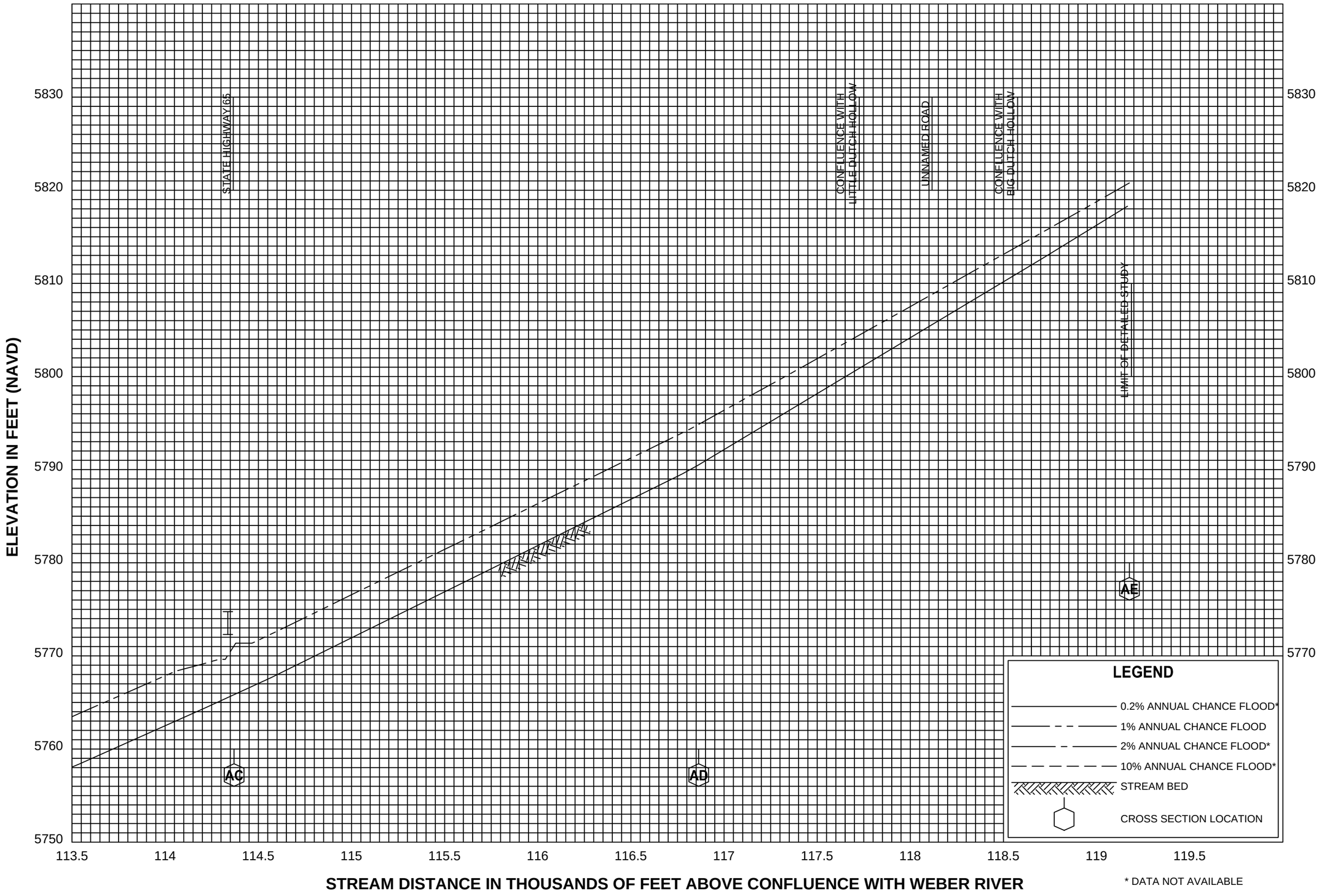
FLOOD PROFILES

EAST CANYON CREEK (ABOVE RESERVOIR)

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UTAH

AND INCORPORATED AREAS



* DATA NOT AVAILABLE

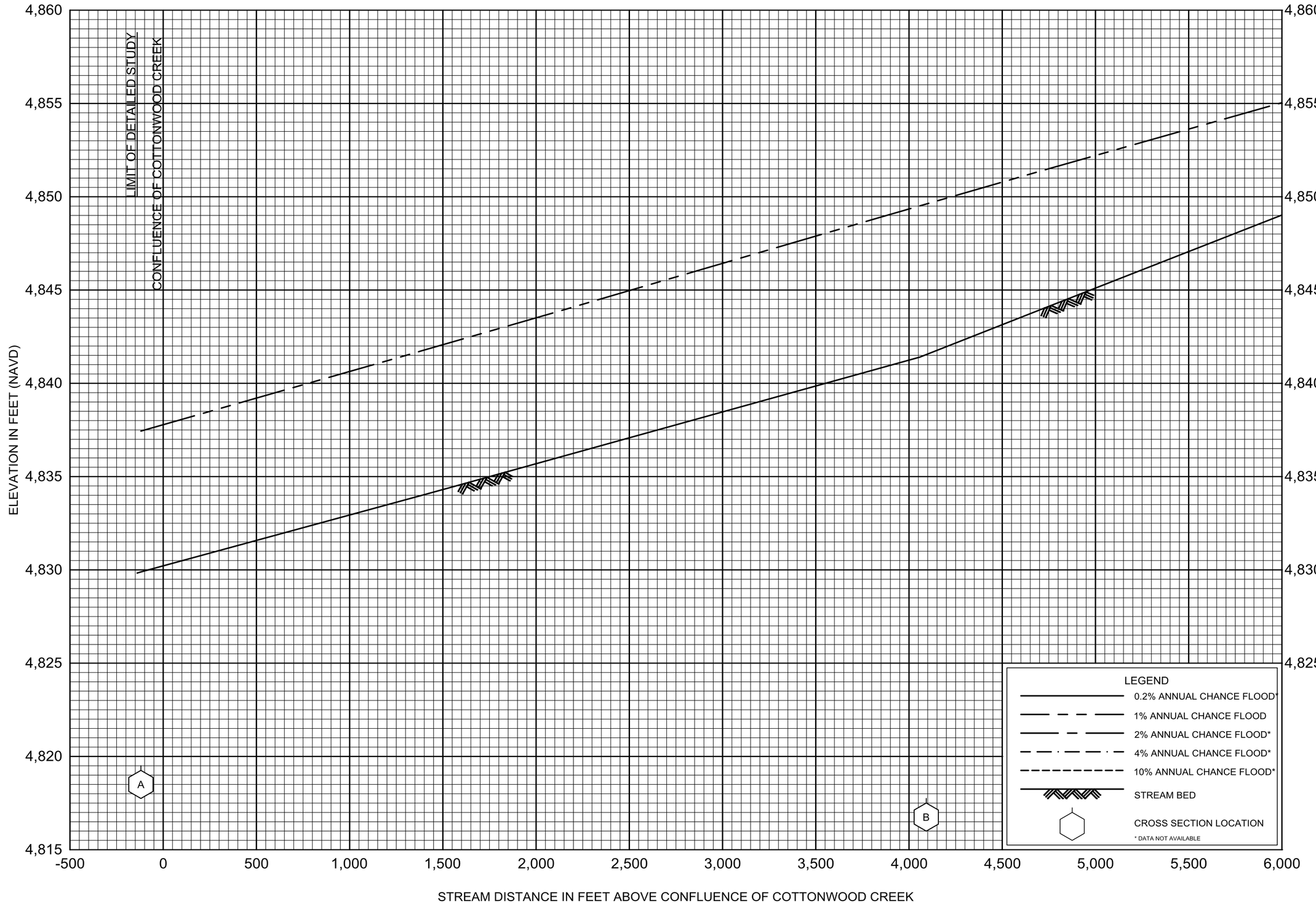
FLOOD PROFILES

EAST CANYON CREEK (ABOVE RESERVOIR)

FEDERAL EMERGENCY MANAGEMENT AGENCY

MORGAN COUNTY, UTAH

AND INCORPORATED AREAS



FLOOD PROFILES

WEBER RIVER

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MORGAN COUNTY, UT

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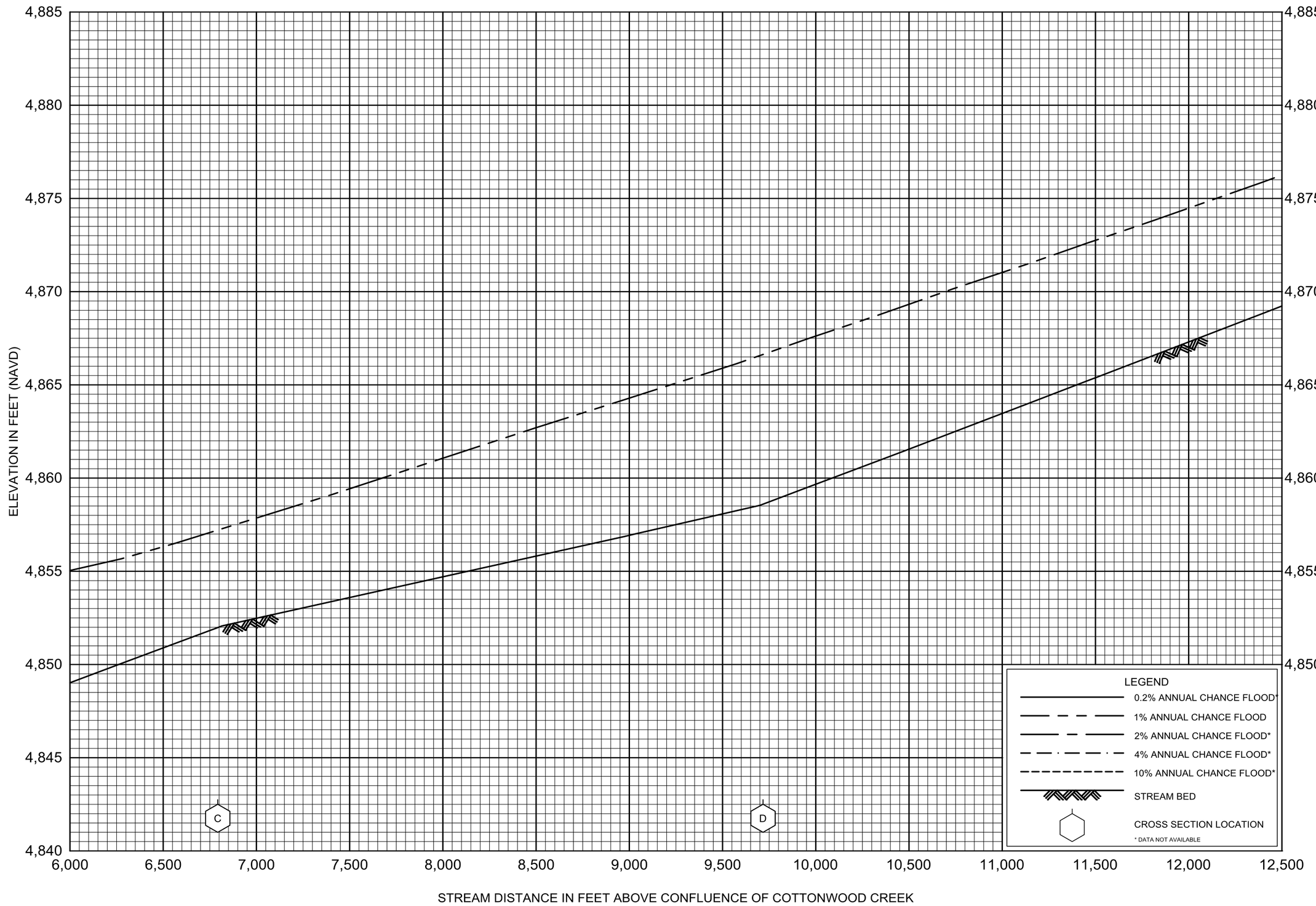

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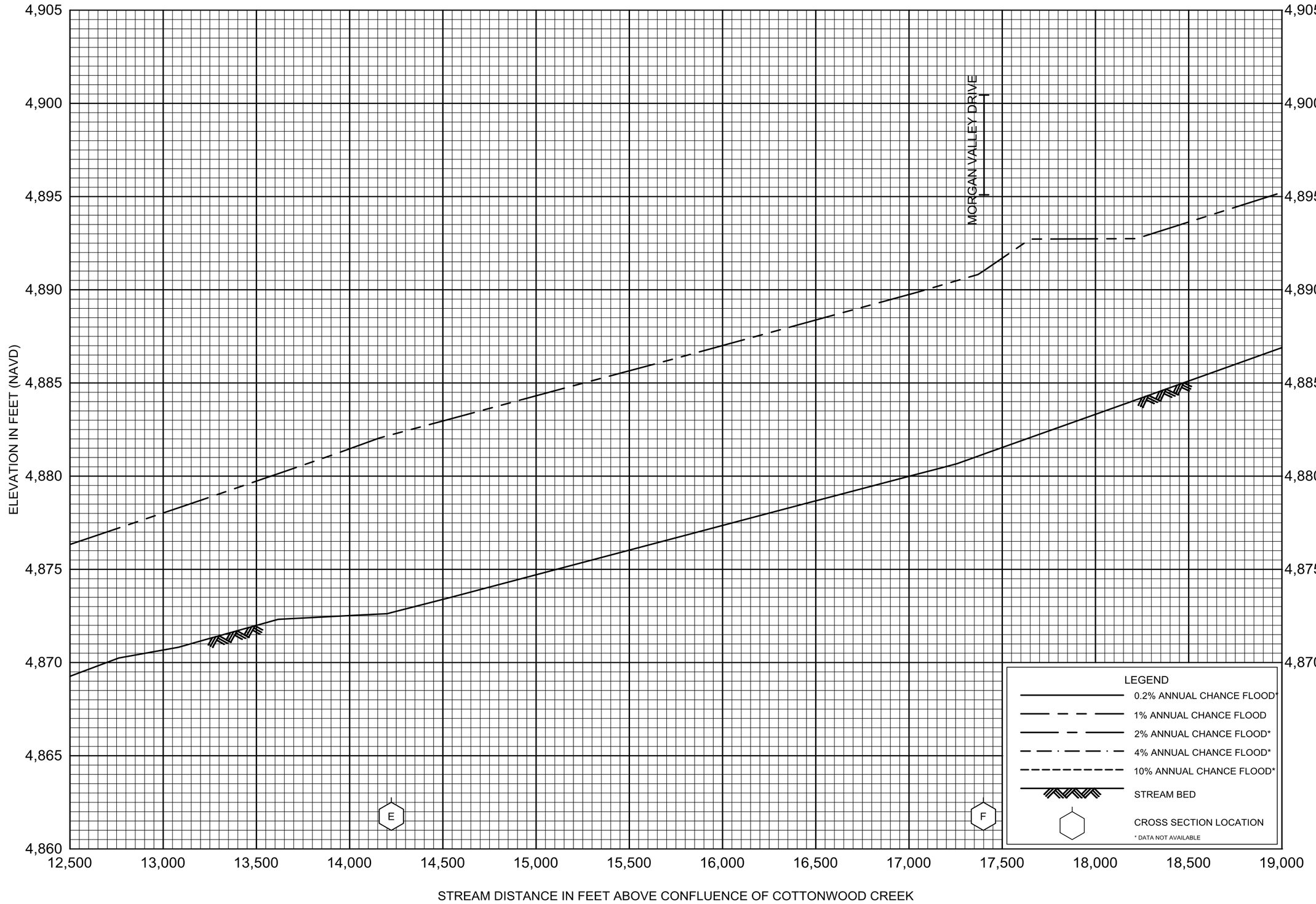

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MORGAN COUNTY, UT

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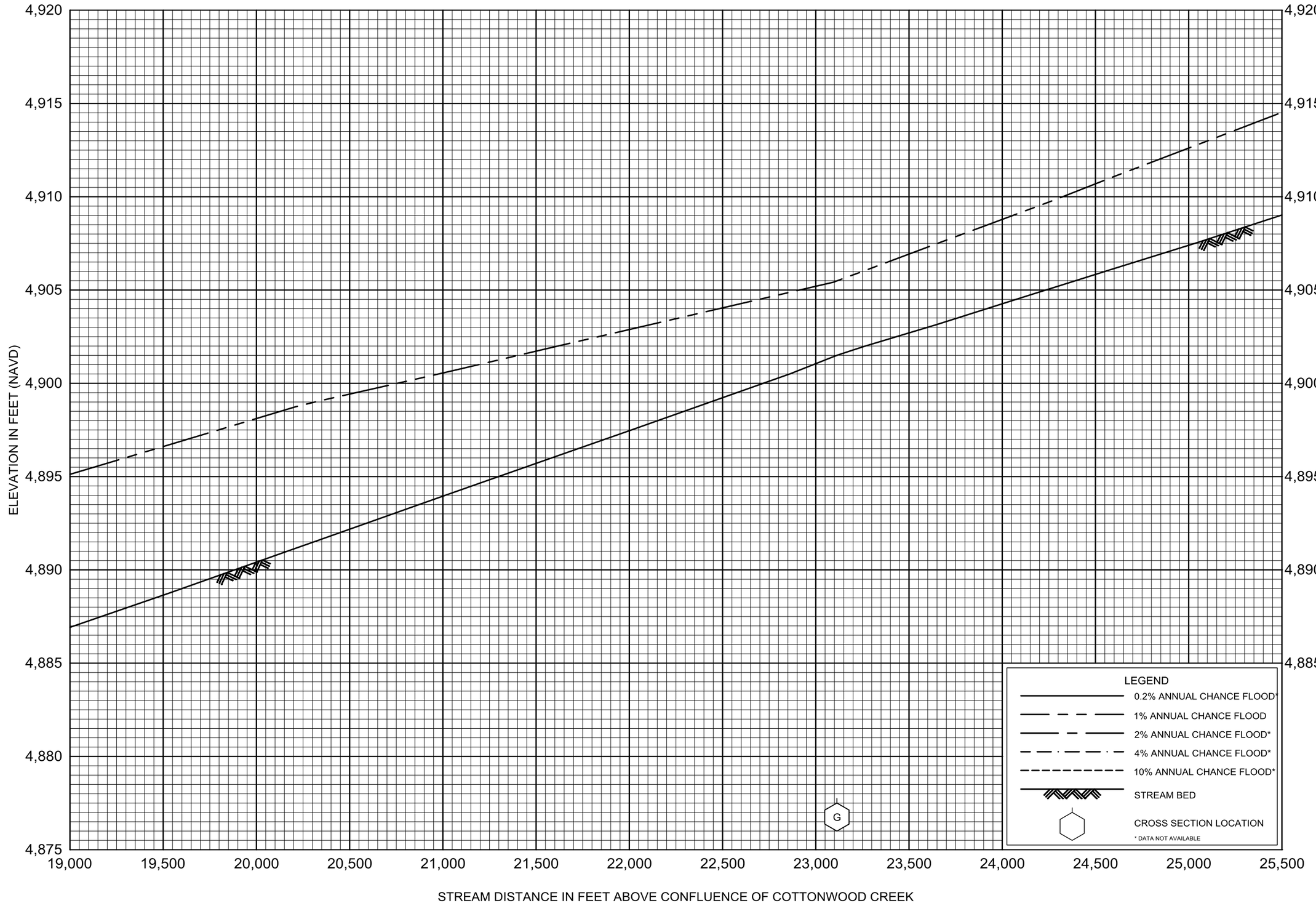

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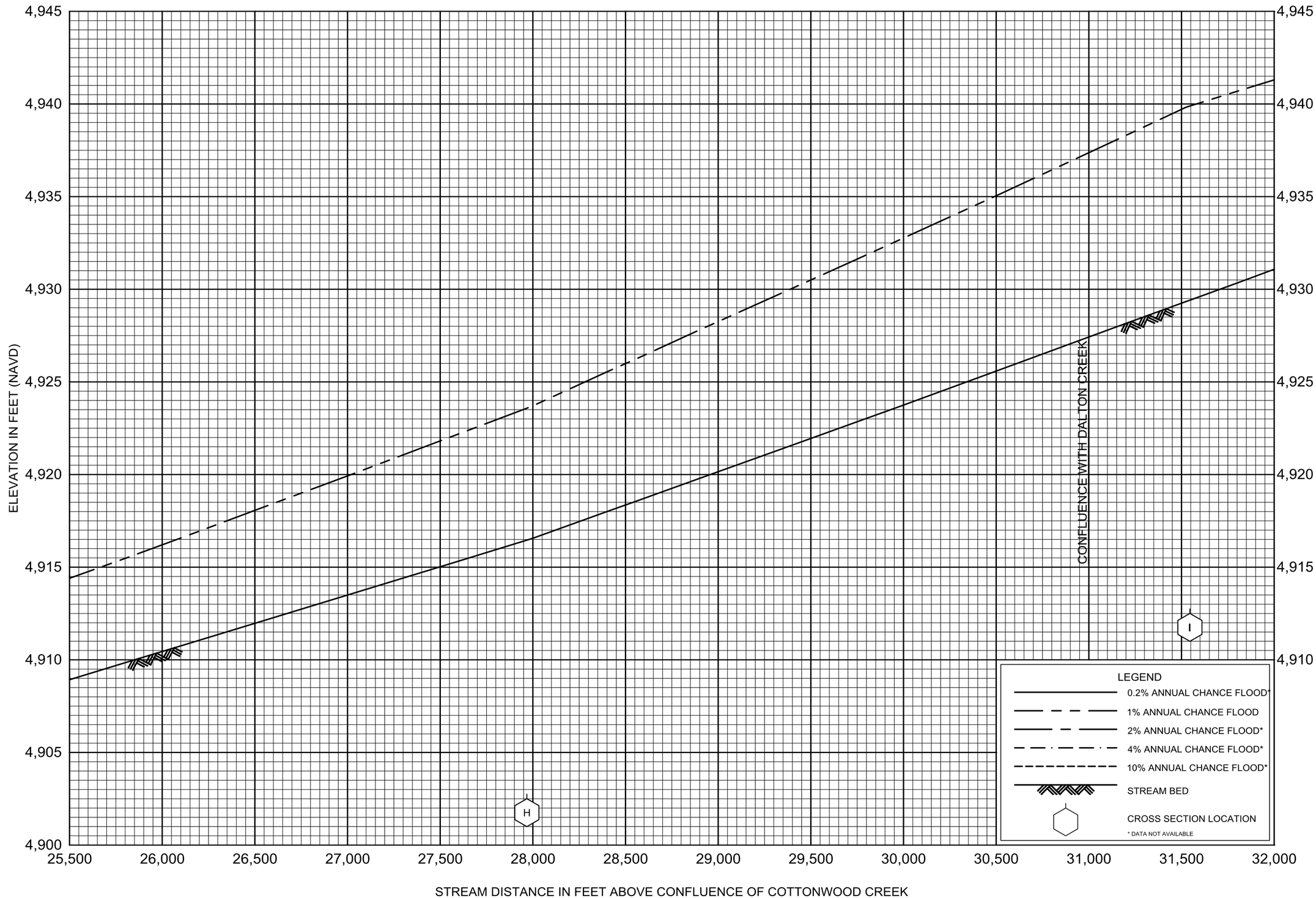

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MORGAN COUNTY, UT

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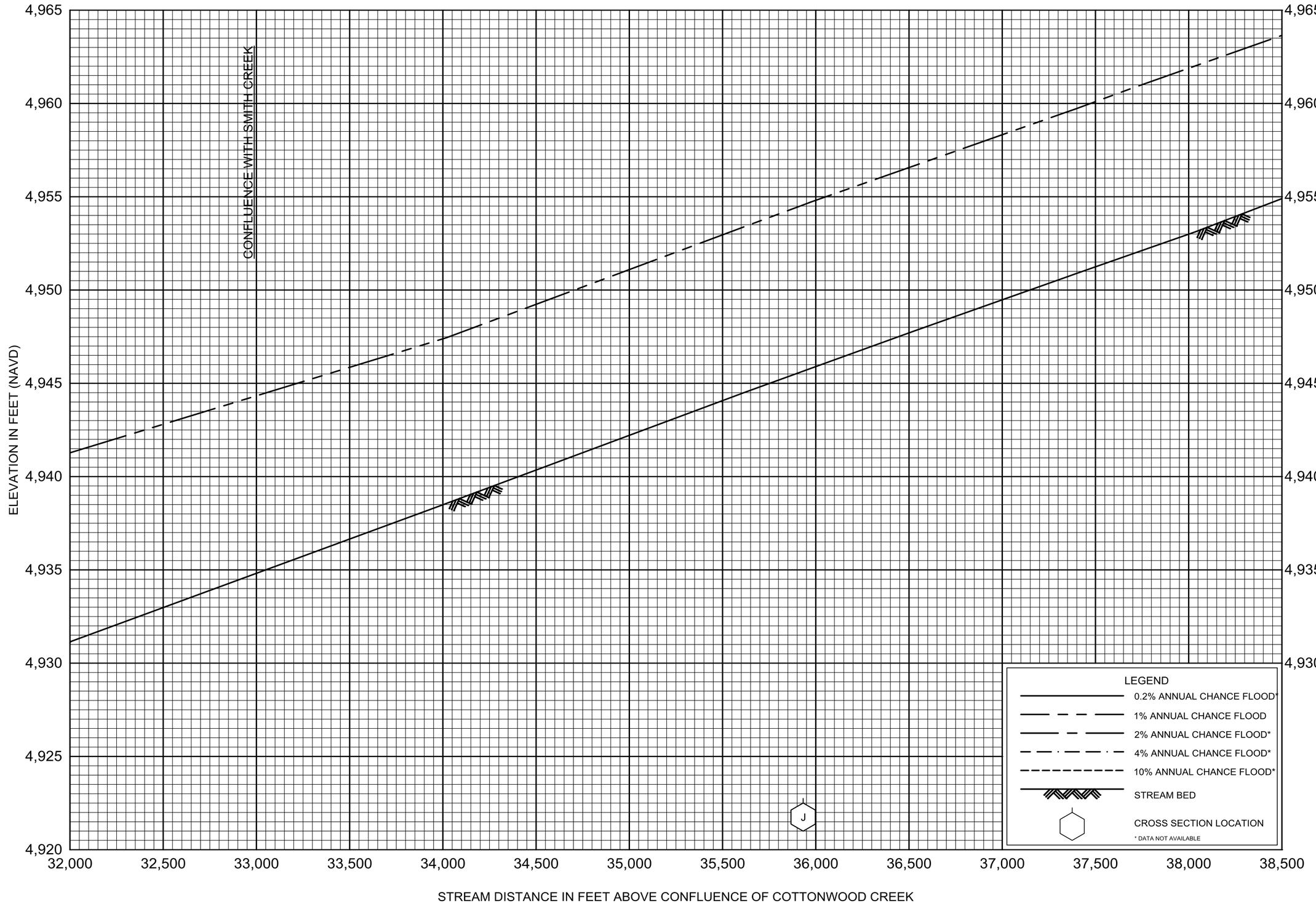

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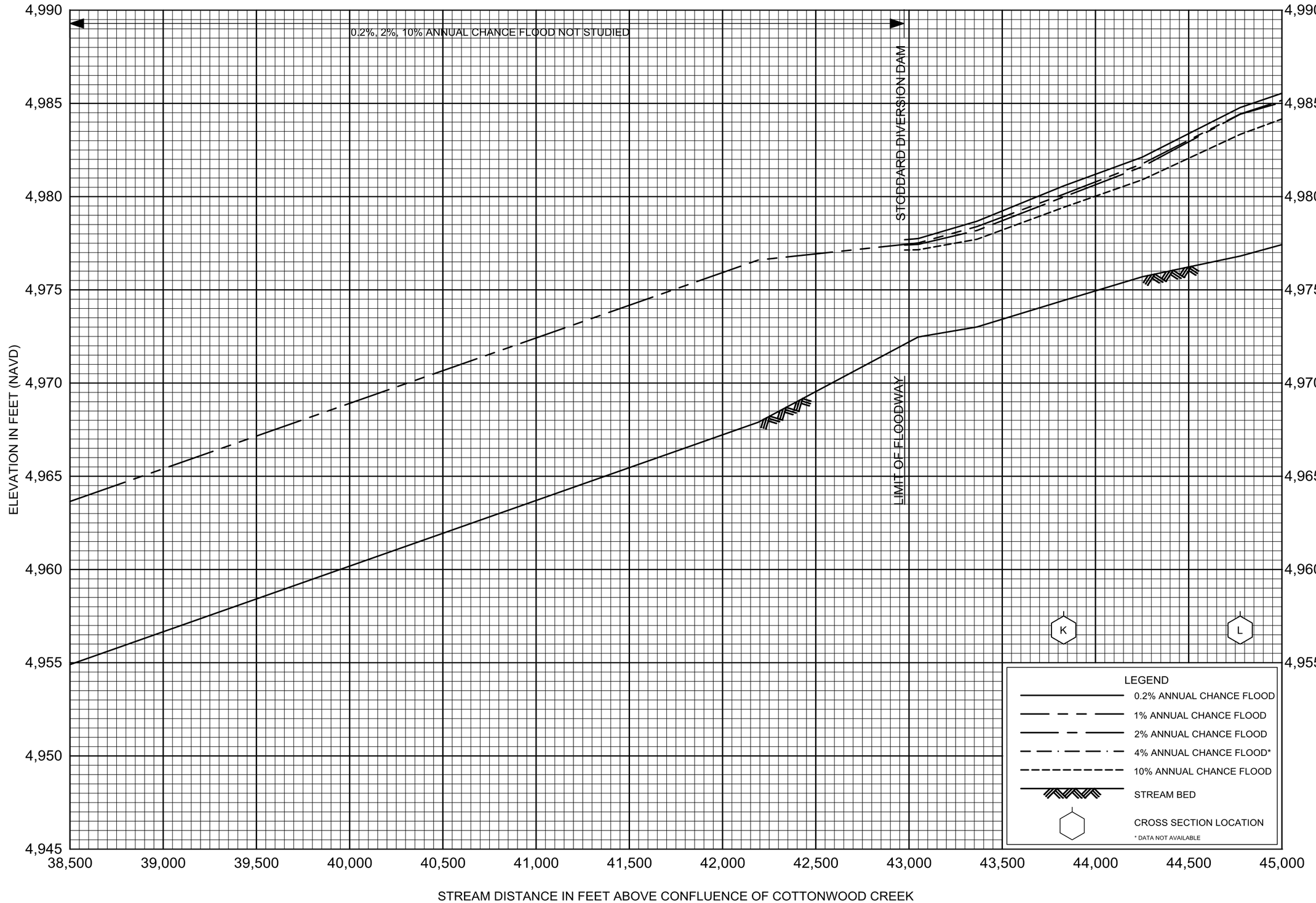

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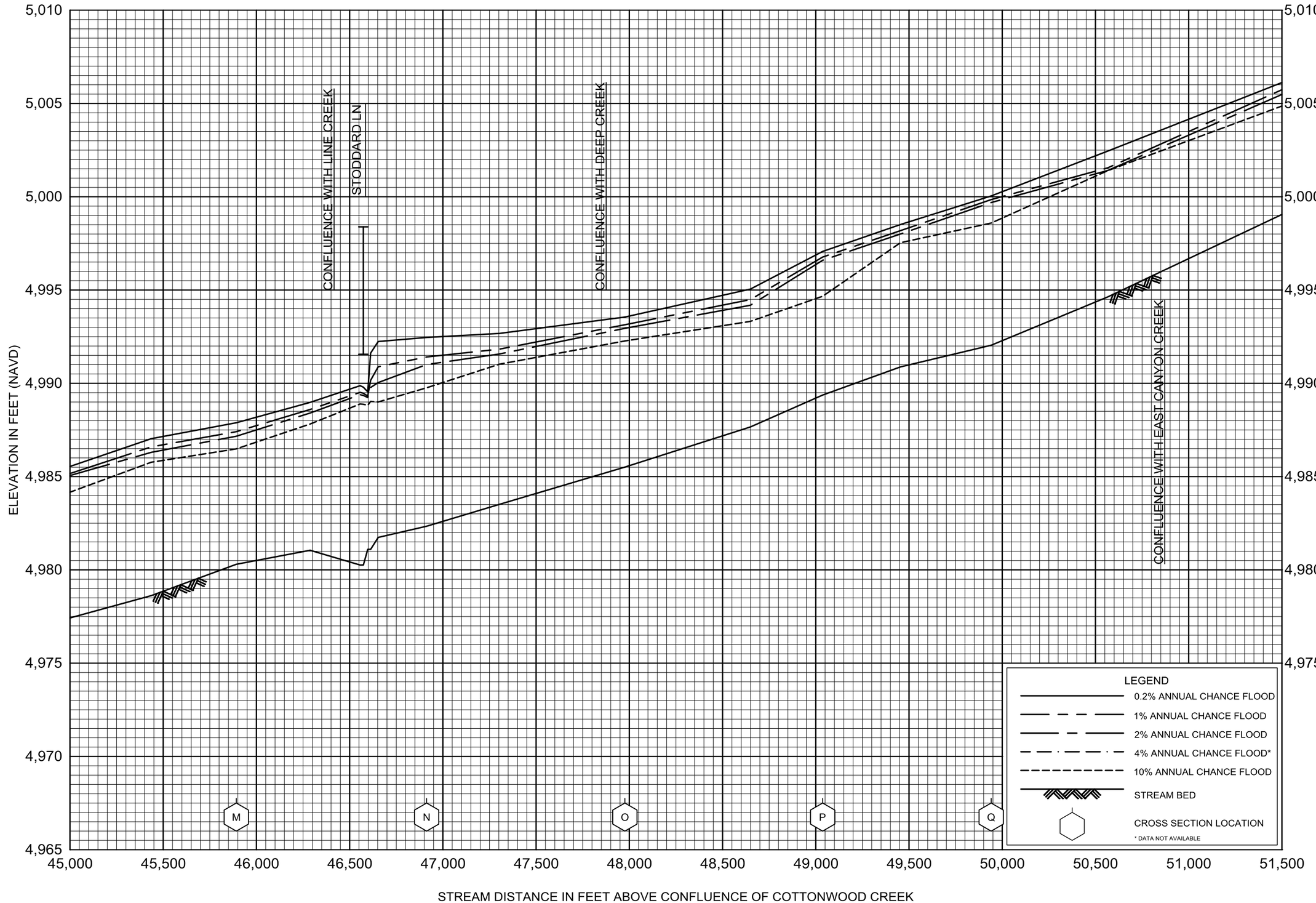

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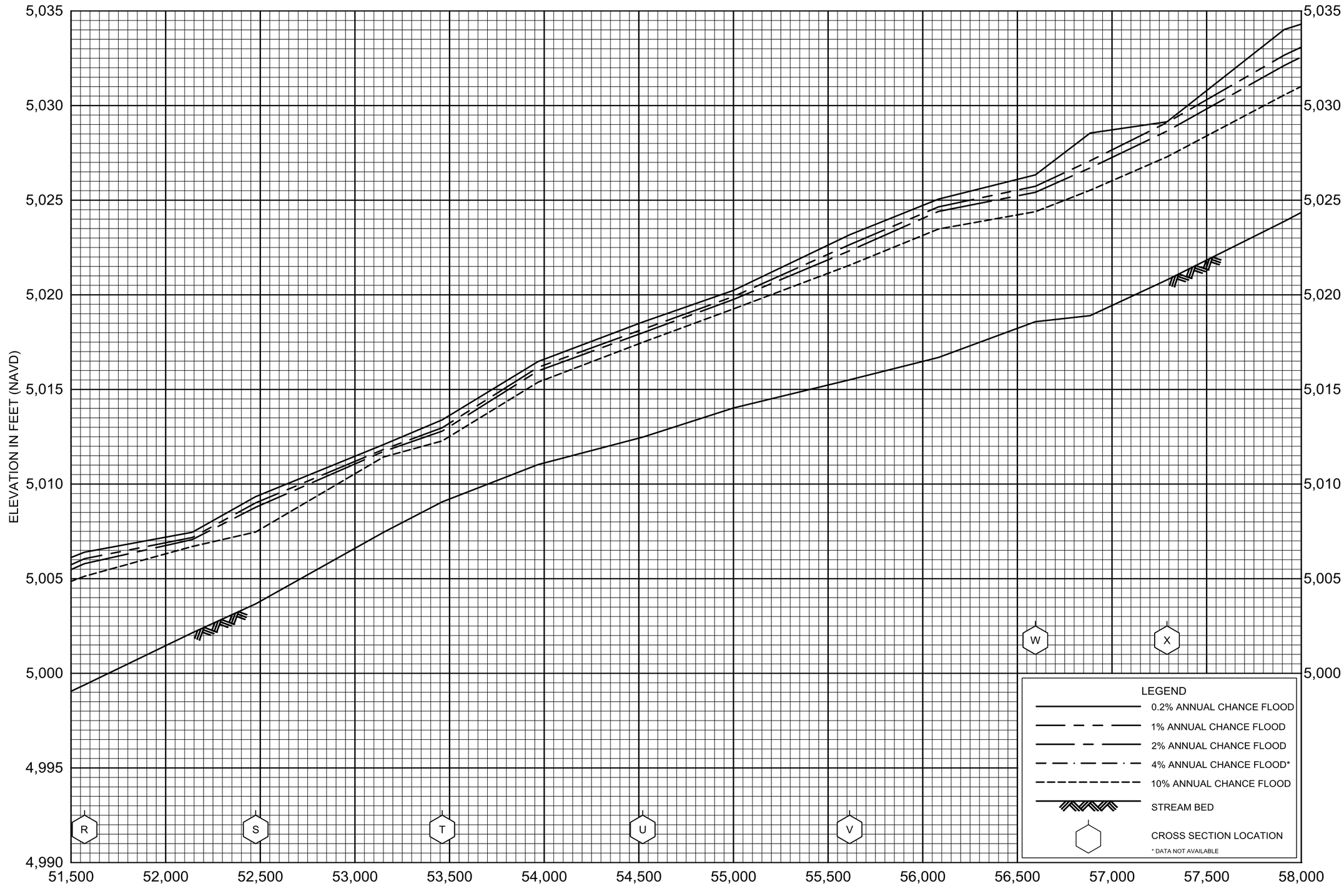

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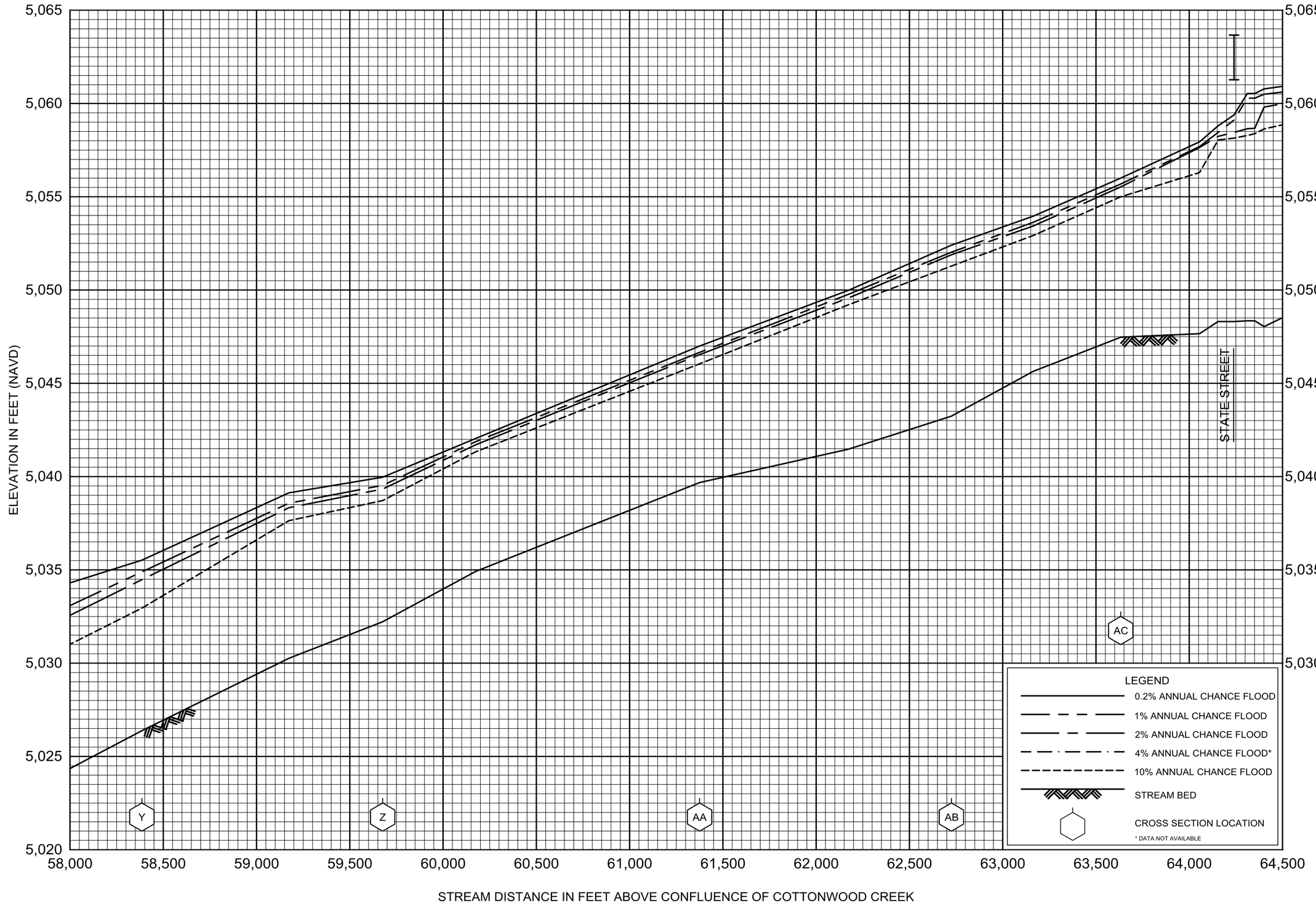

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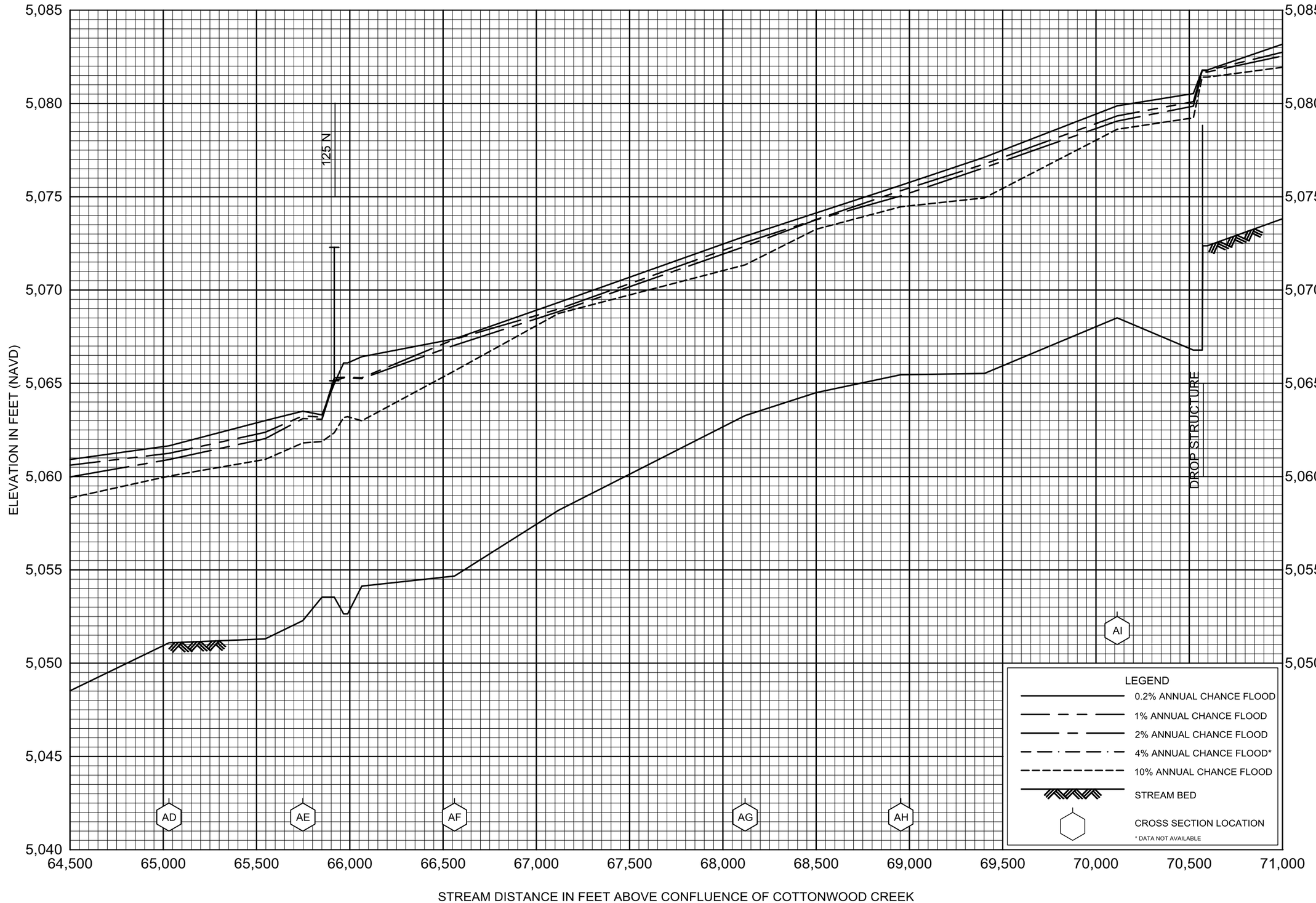

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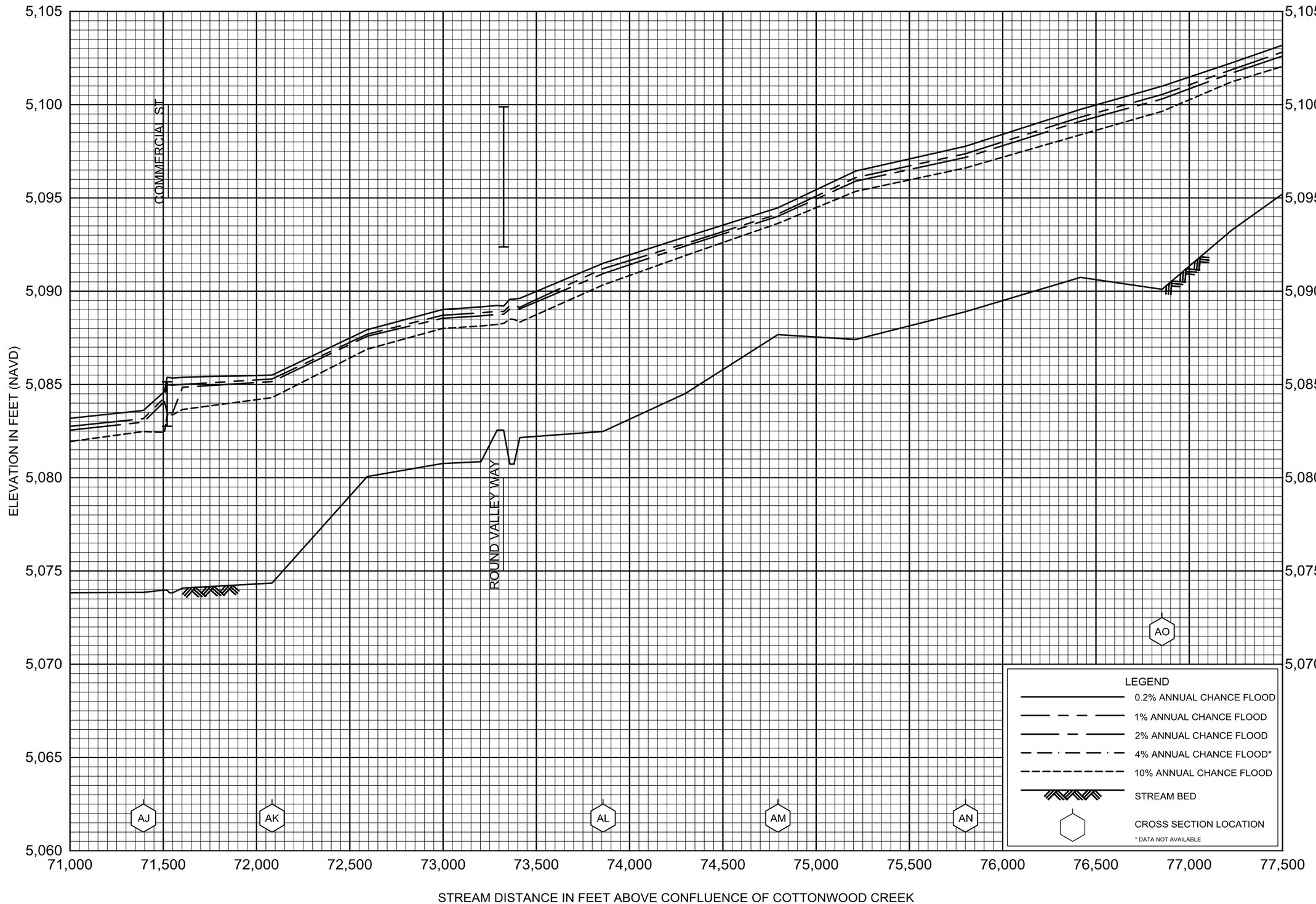

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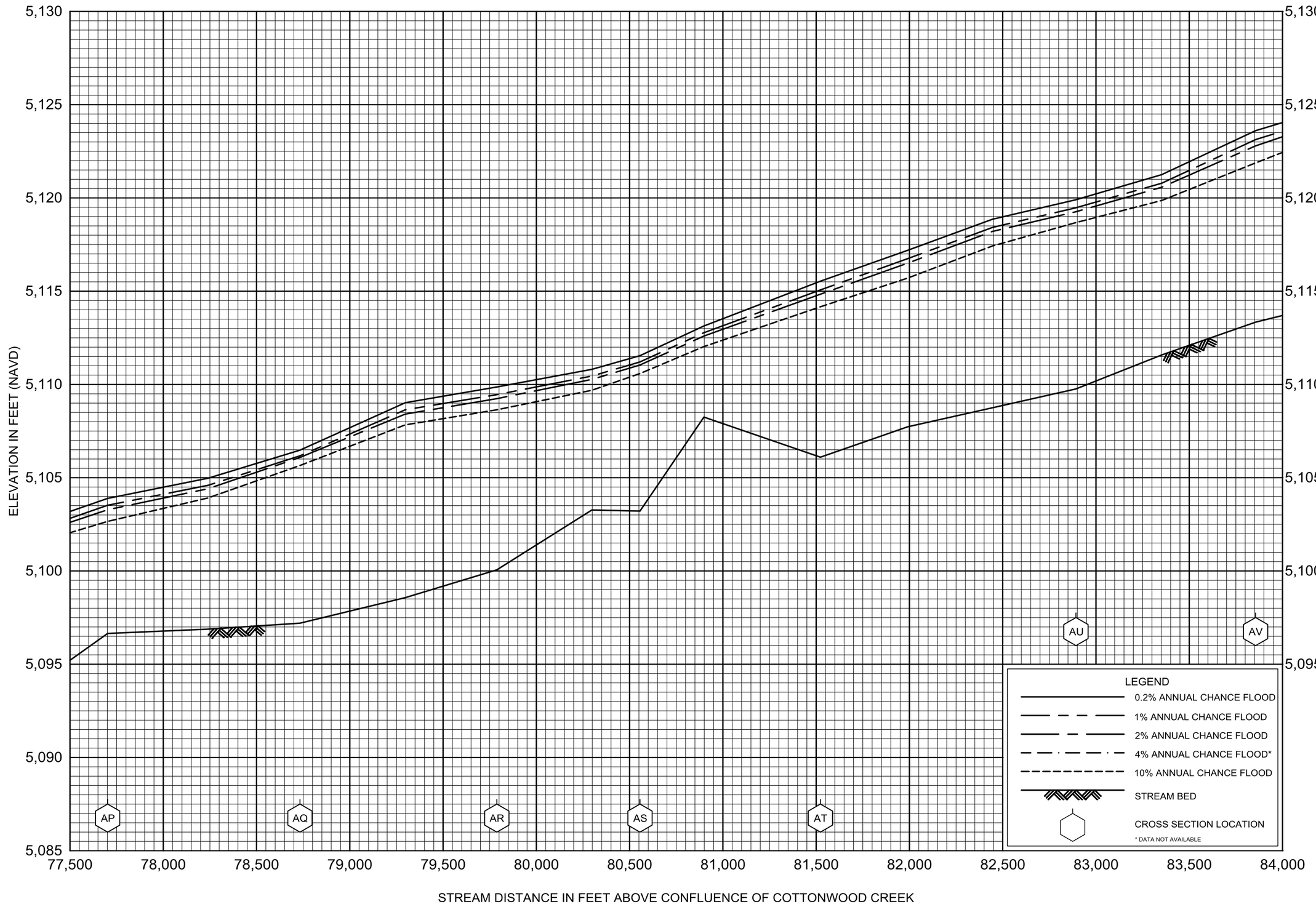

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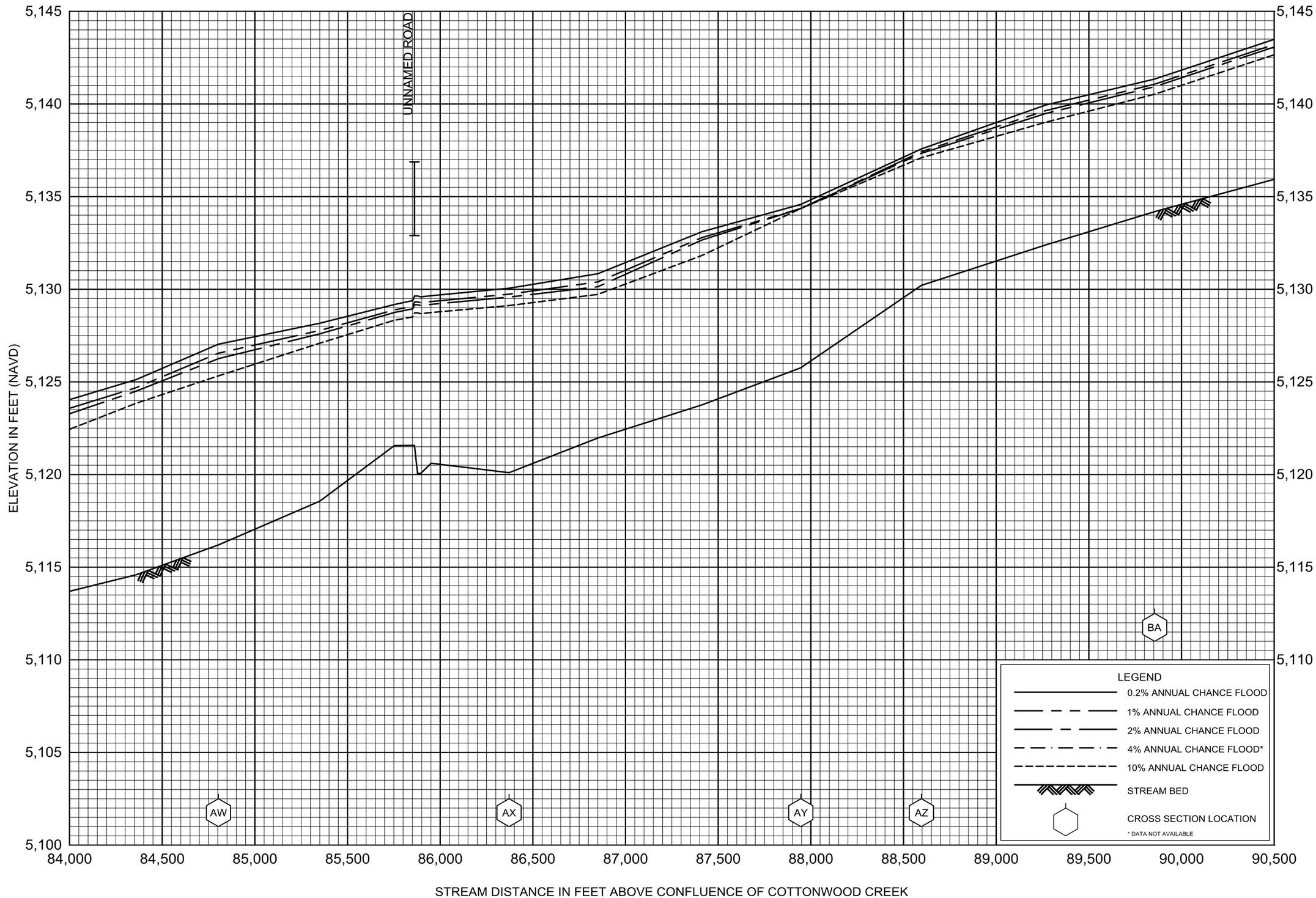

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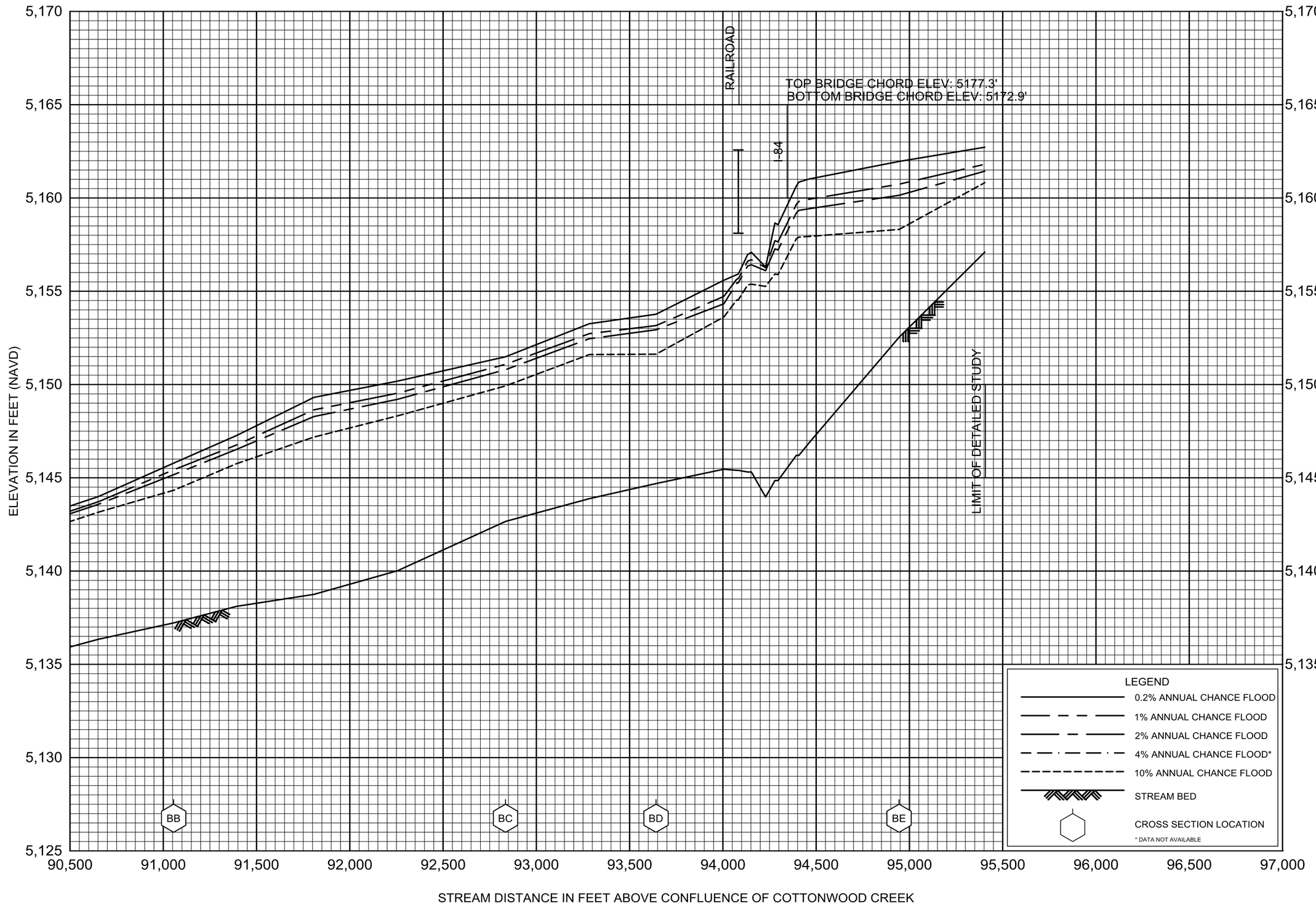

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