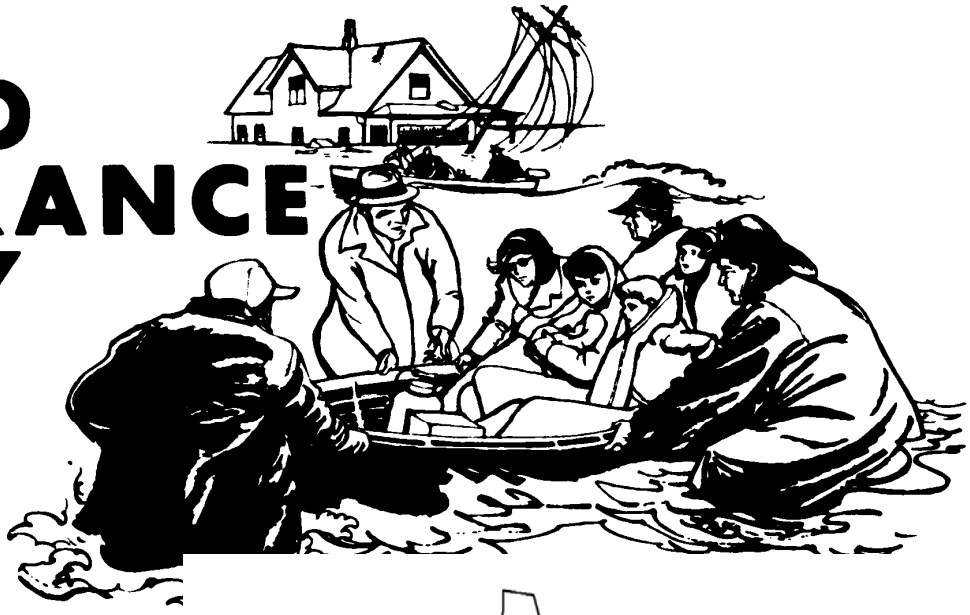
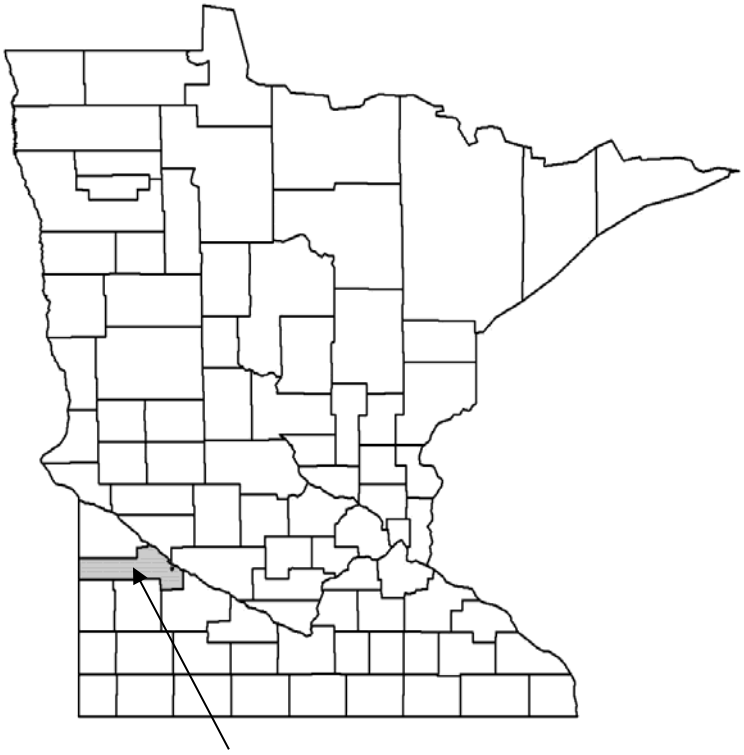
FLOOD INSURANCE STUDY



YELLOW MEDICINE COUNTY, MINNESOTA

AND

INCORPORATED AREAS



Yellow Medicine County

Community Name	*Community Number*
CANBY, CITY OF	270545
*CLARKFIELD, CITY OF	270764
*ECHO, CITY OF	275251
GRANITE FALLS, CITY OF	270068
HANLEY FALLS, CITY OF	270574
*HAZEL RUN, CITY OF	275253
PORTER, CITY OF	270547
*ST. LEO, CITY OF	275252
UPPER SIOUX COMMUNITY	270779
WOOD LAKE, CITY OF	270615
YELLOW MEDICINE COUNTY (UNINCORPORATED AREAS)	270544

*No Special Flood Hazard Areas Identified

Revised
Preliminary:
August 29, 2016

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
27173CV000A

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. 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 zone designations have been changed as follows:

Old Zone(s)	New Zone
A1 through A30	AE
B	X
C	X

Initial Countywide FIS Effective Date: To Be Determined

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Exhibit 2 - Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
YELLOW MEDICINE COUNTY, MINNESOTA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This FIS revises and updates information on the existence and severity of flood hazards in the geographic area of Yellow Medicine County, including the Cities of Canby, Clarkfield, Echo, Granite Falls, Hanley Falls, Hazel Run, Porter, St. Leo, and Wood Lake; the Upper Sioux Community, and the unincorporated areas of Yellow Medicine County (referred to collectively herein as Yellow Medicine 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 NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that the City of Granite Falls is geographically located in Chippewa and Yellow Medicine Counties. The City of Granite Falls is included in its entirety in this FIS report.

Please note that on the effective date of this study, the Cities of Clarkfield, Echo, Hazel Run, and St. Leo have no identified Special Flood Hazard Areas (SFHA). This does not preclude future determinations of SFHAs that could be necessitated by changed conditions affecting the community (i.e., annexation of new lands) or the availability of new scientific or technical data about flood hazards.

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.

Precountywide Analyses

Information on the authority and acknowledgements for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, is shown below:

Canby, City of:	The hydrologic and hydraulic analyses for Canby Creek for the December 1, 1982, FIS report were performed by Barr Engineering, for the Federal Insurance Administration (FIA), under Contract No. EMW-C-0322. The work was completed in August 1981 (FIA, 1982).
Granite Falls, City of:	The hydrologic and hydraulic analyses for the Minnesota River and the Minnesota River Overflow Channel for the December 1979, FIS report were performed by Barr Engineering, for the FIA, under Contract No. H-3799. The work was completed in December 1977 (FIA, 1979).
Upper Sioux Community:	The hydrologic and hydraulic analyses for the Minnesota River for the September 3, 2003, FIS report were taken from the FIS for Yellow Medicine County (Unincorporated Areas), performed by Barr Engineering, for FEMA, under Contract No. H-3799. The work was completed in May 1977 (FEMA 2003).
Yellow Medicine County (Unincorporated Areas):	The hydrologic and hydraulic analyses for Canby Creek, Lazarus Creek, the Minnesota River, and the Minnesota River Overflow for the May 1978, FIS report were performed by Barr Engineering, for the FIA, under Contract No. H-3799. The work was completed in May 1977 (FIA, 1978).

The Cities of Clarkfield, Echo, Hanley Falls, Hazel Run, Porter, St. Leo, and Wood Lake have no previously printed FIS reports.

This Countywide FIS Report

The hydrologic and hydraulic analyses for Tenmile Creek in this countywide study were performed by Black & Veatch, for FEMA, under Contract No. EMC-2001-CO-0057. This work was completed in December 2003.

The hydrologic and hydraulic analyses for Florida Creek, Florida Creek Tributary, the Lac Qui Parle River, Lazarus Creek, the Minnesota River, and the Yellow Medicine River were prepared by the U.S. Army Corps of Engineers (USACE) utilizing existing data from a joint Natural Resources Conservation Service (NRCS) and USACE study PL87-639 and new field surveys. This work was completed in 2002.

The hydrologic and hydraulic analyses for Canby Creek were performed by the Minnesota Department of Natural Resources (MDNR). This work was completed in January 2015.

The hydrologic analysis for the Minnesota River Overflow Channel was completed by the USACE. The work was completed in 2002. The hydraulic analysis for the Minnesota River Overflow was completed by the Strategic Alliance for Risk Reduction (STARR). This work was completed in July 2006.

The hydrologic and hydraulic analyses for Spring Creek and the Yellow Medicine River, approximate studies, were performed by the MDNR. The work was completed in August 2006.

Base Map information shown on this FIRM was provided in digital format by USDA-FSA Aerial Photography Field Office. This information was produced at a scale of 1:12,000, with a resolution of 1-meter per pixel, dated September 2013. The projection used in the preparation of this map is Universal Transverse Mercator (UTM) zone 15, and the horizontal datum used was North American Datum of 1983 (NAD 83), Geodetic Reference System (GRS) 1980 spheroid.

1.3 Coordination

An initial meeting is held with representatives from FEMA, the community, and the study contractor to explain the nature and purpose of a FIS, and to identify the streams to be studied or restudied. A final meeting is held with representatives from FEMA, the community, and the study contractor to review the results of the study.

Precountywide Analyses

The initial and final meeting dates for previous FIS reports for Yellow Medicine County and its communities are listed in the following table:

Table 1 – Previous Meetings

Community	FIS Date	Initial Meeting	Final Meeting
Canby, City of	December 1, 1982	March 2, 1981	April 5, 1982
Granite Falls, City of	December 1979	January 1977	November 1, 1978
Upper Sioux Community	September 3, 2003	*	September 26, 2002
Yellow Medicine County (Unincorporated Areas)	May 1978	February 1975 November 1976	September 28, 1977

*Data Not Available

This Countywide FIS Report

The initial Consultation Coordination Officer (CCO) meeting for this countywide study was held on March 20, 2002, at the Montevideo Community Center with representatives of FEMA, Black & Veatch, PBS&J, the MDNR, and Yellow Medicine County. The purpose of an initial CCO meeting is to discuss the scope of the FIS. Coordination with city officials and Federal, State, and regional agencies produced information relating to floodplain regulations, available community maps, flood history, and hydrologic data.

The results of the study were reviewed at the final meeting held on November 3, 2004 and attended by representatives of FEMA, the study contractor, MDNR, and the communities. No concerns were identified and appeal period was initiated.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Yellow Medicine County, including the incorporated communities listed in Section 1.1. Those areas studied by detailed methods in Yellow Medicine County were chosen with consideration given to all known flood hazards and areas of projected development or proposed construction through 2001.

The following streams were studied by detailed methods in this FIS report:

Canby Creek	Minnesota River
Florida Creek	Minnesota River Overflow Channel
Florida Creek Tributary	Tenmile Creek
Lac Qui Parle River	Yellow Medicine River
Lazarus Creek	

The limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

Revised hydrologic and hydraulic analyses were performed for all streams studied by approximate methods. The following table shows the streams and reaches that were studied in detail for this initial countywide FIS Report.

Table 2 – Detailed Streams and Reaches

Flooding Source	Downstream Limit of Detailed Study	Upstream Limit of Detailed Study
Canby Creek	Confluence with Lazarus Creek	Approximately 1,600 feet upstream of U.S. Highway 75
Florida Creek	Northern county boundary	Approximately 50 feet upstream of County Road 14
Florida Creek Tributary	Northern county boundary	Approximately 6,260 feet upstream of County Road 14
Lac Qui Parle River	Northern county boundary	Approximately 6,750 feet upstream of State Highway 68
Lazarus Creek	Confluence with the Lac Qui Parle River	Approximately 6,300 feet upstream of County Road E2
Minnesota River	Approximately 31,000 feet downstream of State Highway 67	Approximately 1,600 feet upstream of U.S. Highway 59/212
Minnesota River Overflow Channel	Convergence with Minnesota River	Divergence from Minnesota River
Tenmile Creek	Approximately 113,370 feet upstream of the confluence with the Lac Qui Parle River	Approximately 117,050 feet upstream of the confluence with the Lac Qui Parle River
Yellow Medicine River	Approximately 36,700 feet downstream of County Road 8	Approximately 3,400 feet upstream of the southern county boundary

Also, for this countywide FIS, the FIS report and FIRM were converted to countywide format, and the flooding information for the entire county, including both incorporated and unincorporated areas, is shown. Also, the vertical datum was converted from the National Geodetic Vertical Datum of 1929 (NGVD) to the North American Vertical Datum of 1988 (NAVD). In addition, the Universal Transverse Mercator coordinates, previously referenced to the North American Datum of 1927 (NAD 27), are now referenced to the NAD 83.

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

2.2 Community Description

Yellow Medicine County, established by Minnesota Statutes in 1871, had a 2014 population of 10,109 (U.S. Census Bureau, 2015). The county is located in west-central Minnesota, on the South Dakota-Minnesota border, in a predominantly agricultural area. U.S. Highways 212 and 75 provide access to and from the county. Yellow Medicine County is bordered on the north by Lac Qui Parle and Chippewa Counties, Minnesota; on the east by Renville County, Minnesota; on the south by Redwood, Lyon, and Lincoln Counties, Minnesota; and, on the west by Duel County, South Dakota.

The topography of Yellow Medicine County varies. Most areas of the county are relatively flat, with elevations varying from approximately 1,050 to 1,100 feet, except along the Minnesota River Valley. The topography in the western part of the county is primarily rolling hills, and many small streams originate there. The topography in the center of the county has almost no relief, which creates shallow stream valleys and, in periods of flooding, causes streams in the area to experience crossover flow. Near the eastern end of the county, streams drop at a steep grade to the Minnesota River Valley floor, forming V-shaped valleys with streambeds well below the adjacent land surface. The Minnesota River flows in a well-defined valley approximately 50 feet below the adjacent land surface. Streams in the county generally drain from southwest to northeast towards the Minnesota River.

The climate classification in Yellow Medicine County is dry continental, with seasonal variations in temperature ranging from 24 degrees Fahrenheit (°F) in January to 84°F in July. The average annual precipitation is approximately 25 inches with 41 inches of snowfall (Yellow Medicine County, 2010).

Vegetation throughout the county is predominantly agricultural, including row grain and forage crops. Scattered woodlands, grass areas, and marshlands are found in farm, park, and open-space areas as well as along the creek and river valleys.

The soil, for the most part is good black prairie till. Underlying the glacial drift, which covers the entire county, is an irregular layer of igneous gneiss rock which crops out along the Minnesota River in the east end (Yellow Medicine County, 2010).

Floodplain development is primarily agricultural, with the heaviest concentration occurring along the Minnesota River, particularly in the vicinity of the City of Granite Falls.

The Upper Sioux Community is a federally recognized Indian Reservation located in western Minnesota in Yellow Medicine County. It is located on the Minnesota River, approximately 5 miles south of the City of Granite Falls. The community contains 755 acres, 90 percent of which is tribally owned.

2.3 Principal Flood Problems

Severe flooding along streams in Yellow Medicine County is caused primarily by spring snowmelt runoff. Restrictive characteristics of manmade structures and general characteristics of floodplains cause large areas to be inundated in the central portions of the county. Historic floods, such as those that occurred in 1919, 1951, and 1969, were recorded in some detail. Historic floods were recorded by the U.S. Geological Survey (USGS) at gages located at Montevideo, New Ulm, Ortonville, Mankato, Jordan, and various sites along the Minnesota River. The Montevideo gage is located within the study area of the Minnesota River. The greatest flood recorded at these gages was in April 1969 and approximated the 1-percent-annual-chance flood. Roads, bridges, parkland areas, and agricultural lands primarily incurred the flood damage. Damage claims for the spring and summer flood of 1969 in Yellow Medicine County were $37,683, with the majority of losses occurring in the City of Granite Falls. Damage to rural residences was not excessive because of sparse development in the unincorporated areas of the county. There was also County-wide flooding recorded in 1997 and 2001.

2.4 Flood Protection Measures

Yellow Medicine County has not adopted any State-approved floodplain management measures. However, the county adopted a zoning and shoreland management ordinance in 1970, with a floodway district provided on the zoning map. The floodway district does not preclude floodplain development, but guides the type and extent of future development permitted in the floodplain so that it is consistent with the flood potential.

Existing flood protection measures on the Minnesota River include a flood wall and dike (Granite Falls Levee system) that protects the City of Granite Falls from floods slightly larger than the maximum flood of record; the Granite Falls dam; and the Chippewa Diversion and Lac Qui Parle Reservoir, which are USACE flood control structures in Lac Qui Parle County. The Granite Falls Levee system has not been certified to protect from the 1-percent-annual-chance flood, and as such is currently shown as not providing protection. The latter two structures reduce the flood potential along the Minnesota River in Yellow Medicine County.

A watershed protection and flood prevention project for the Canby Creek watershed consists of three floodwater-retarding structures as well as various

channel stabilization measures. Overbank flooding from the 1-percent-annual-chance flood event on Canby Creek will be controlled.

The structure R-4A on County Ditch No. 19 provides the City of Canby with protection from the 1-percent-annual-chance flood event from County Ditch No. 19.

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-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 peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

Precountywide Analyses

The Soil Conservation Service (SCS) was the primary source of information for defining the discharge-frequency relationship used in determining the 10-, 2-, 1-, and 0.2-percent-annual-chance discharges for Canby Creek (within the City of Canby). The SCS provided technical assistance to the Yellow Medicine and Lincoln County Soil and Water Conservation District in the development of a watershed work plan for Canby Creek and County Ditch No. 19. For this FIS, the SCS revised their Canby Creek TR-20 model (SCS, 1961) to incorporate the upstream reservoir R-6; their analysis found a 34% reduction in the 1-percent-annual-chance discharge resulting from the implementation of structure R-6 from pre-project conditions. The 10-, 2-, and 1-percent-annual-chance discharges determined by the SCS analysis were used in the Canby Creek FIS. The 0.2-percent-annual-chance discharge was determined by extrapolation of the

flood discharges for frequencies up to 100-years on log-probability paper (U.S. Water Resources Council, 1977).

Gaging station records for the Minnesota River at both Montevideo and Mankato, Minnesota, provided the principal source of data for defining the discharge-frequency relationship used in the study. The discharge-frequency relationships for the Minnesota River at Montevideo and Mankato are based on 33 years of record (1937-1969) and 68 years of record (1902-1969), respectively. The USACE provided the discharge-frequency relationship for the Minnesota River at Montevideo based on log-Pearson Type III (U.S. Water Resources Council, 1967) analysis of the gage records published in *Water Resources Data for Minnesota, Part 1, Surface Water Resources* (USGS, 1969). The log-Pearson analysis used an assigned regional skewness of -0.15. The discharge-frequency relationship for Montevideo is based on an administrative agreement between USACE, St. Paul District, and USGS, on July 8, 1971.

The 33 years of record at Montevideo were correlated statistically to 67 years at Mankato, resulting in an adjusted record of 45 years. The 1-percent-annual-chance flood discharge for the Minnesota River at New Ulm, Minnesota, was established by the administrative agreement between the USGS and USACE, St. Paul District, using the drainage area ratio method. The frequency-discharge relationship for the Minnesota River in Yellow Medicine County was transferred downstream from Montevideo using a drainage area ratio to the following powers:

Frequency	Exponent
10-percent-annual-chance	1.22
2-percent-annual-chance	1.07
1-percent-annual-chance	1.04
0.2-percent-annual-chance	1.06

The principal source of data for Canby Creek, Lazarus Creek, and the Minnesota River Overflow in the unincorporated areas of Yellow Medicine County was the SCS in St. Paul, Minnesota. The discharge-frequency data received from the SCS were developed through the use of TR-20 (SCS, 1961) and methods described in the *National Engineering Handbook* (SCS, 1972). The TR-20 computer program uses the physical characteristics of the watershed to predict the flood discharge that would occur from a rainfall event of a selected frequency. Runoff depth for a given rainfall depth was determined based on soil type, land use, land treatment, and general hydrologic conditions in the watershed. The frequency-discharge data received from the SCS were transferred upstream through the detailed study areas using the drainage area ratio.

This Countywide FIS Report

For this countywide study, the hydrology for Tenmile Creek was developed using the region of influence similarity method as described in State of Minnesota regression equations (USGS, 1997).

The hydrology for Florida Creek, Florida Creek Tributary, the Lac Qui Parle River, Lazarus Creek, the Minnesota River, and the Yellow Medicine River was developed using the SCS TR-20 computer program along with field reconnaissance (SCS, 1961).

In 2001, the USACE, St. Paul District, developed frequency distributions for peak flood flows and peak water-surface elevations (WSELs) for numerous locations on the main stem of the Minnesota River from the confluence with the Mississippi River upstream to Big Stone Lake at the City of Ortonville, Minnesota (USACE, 2001). Statistical analyses using the USACE, HEC computer program, HEC-FFA (Flood Frequency Analysis) (HEC, 1992), were conducted for the period of record flows at USGS streamflow gages on the Mississippi River at the City of St. Paul and the Minnesota River at the Cities of Mankato and Jordan. The resulting gage discharge-frequency relationships were then used to develop general relations methodology for determining frequency distributions for other locations on the main stem Minnesota River downstream of the City of Montevideo, Minnesota.

The flood discharges for the Minnesota River Overflow Channel were calculated by creating a rating curve across Dike Road for the flow distribution between the Minnesota River and the Minnesota River Overflow Channel.

The hydrology for Canby Creek was developed using the SCS TR-20 computer program (SCS, 1983).

Peak discharge-drainage area relationships for streams studied by detailed methods in Yellow Medicine County are shown in Table 1.

Table 3 - Summary of Discharges

		Peak Discharges (cubic feet per second)			
Flooding Source and Location	Drainage Area (square miles)	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
CANBY CREEK					
Just upstream of U.S. Highway 75	25.8	355	366	370	*
FLORIDA CREEK					
Just downstream of the northern county boundary	86.2	800	2,000	2,600	4,200
Just downstream of County Road 14	78.1	730	1,750	2,250	3,550

Table 3 – Summary of Discharges (*continued*)

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
FLORIDA CREEK TRIBUTARY					
Just downstream of the northern county boundary	6.3	230	560	740	1,200
Just upstream of County Road 14	5.7	250	620	820	1,350
LAC QUI PARLE RIVER					
Approximately 5,000 feet downstream of the confluence of Lazarus Creek	317.3	2,000	4,600	5,800	9,200
Just upstream of County Road 33	174.3	580	1,250	1,550	2,200
Just upstream of County Road 3	167.9	900	2,300	2,900	4,100
Just upstream of County Road 29	158.0	900	2,350	3,200	5,700
LAZARUS CREEK					
Just upstream of confluence with the Lac Qui Parle River	134.7	1,580	3,800	4,850	7,700
Just downstream of County Road 74 (Lac Qui Parle County)	119.0	1,160	2,850	3,600	5,600
Just downstream of County Road 61 (Lac Qui Parle County)	115.2	1,200	3,000	3,800	6,100
Approximately 1,100 feet downstream of Township Road 55	90.2	1,180	2,800	3,600	5,700
Just downstream of County Road 13	51.5	880	2,050	2,650	4,250
Just upstream of County Road 13	36.1	550	1,350	1,750	2,850
MINNESOTA RIVER					
Below Yellow Medicine River	7,660	16,500	41,000	53,000	82,000
At Oak Street	6,370	12,500	30,500	39,000	55,000
Above Minnesota River Overflow Channel	6,370	12,500	35,000	47,000	74,000
At Highway 212	6,180	12,000	34,000	45,000	72,000
MINNESOTA RIVER OVERFLOW CHANNEL					
At divergence from the Minnesota River	6,370	0	4,500	8,000	19,000
TENMILE CREEK					
At 100th Street (Lac Qui Parle County)	8.78	*	*	5,000	*
YELLOW MEDICINE RIVER					
Just above U.S. Highway 59	14.09	5,500	11,900	14,900	23,000

*Data Not Available

Note: Drainage areas for the Yellow Medicine River and Minnesota River were obtained from USGS at www.nwis.waterdata.usgs.gov

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 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.

Precountywide Analyses

Cross sections for the backwater analyses of Canby Creek were obtained from *Flood Hazards Analyses, City of Canby and Vicinity* (SCS, 1973). Supplemental cross sectional information was obtained by field survey in 1980 to reflect modification to the floodplain subsequent to the SCS analysis.

Water surface elevations (WSELs) for Canby Creek for floods of the selected recurrence intervals were computed through the use of the USACE, HEC computer program, HEC-2 (HEC, 1979). Flood profiles were drawn showing computed WSELs for floods of the selected recurrence intervals.

Starting WSELs for Canby Creek were obtained from *Flood Hazards Analyses, City of Canby and Vicinity* (SCS, 1973) and the Yellow Medicine County Flood Insurance Study (FIA, 1978). WSELs for the various recurrence intervals at the Lake Sylvan Dam were computed through the use of the HEC-2 computer program (HEC, 1979).

Photogrammetric methods were used to obtain data for the dry portions of the cross sections for the Minnesota River, Canby Creek (unincorporated areas of Yellow Medicine County), Lazarus Creek, and the Minnesota River Overflow Channel. Data for the wet portions of the cross sections, elevations, bridge and culvert dimensions, and other channel obstructions were field surveyed. Cross sections for the analysis were located at close intervals upstream and downstream of bridges, culverts, and other obstructions in order to compute significant backwater effects of these structures. Additional cross sections were located to reflect significant variations in the stream valley topography.

WSELs of floods of the selected recurrence intervals along the Minnesota River, Canby Creek (unincorporated areas of Yellow Medicine County), Lazarus Creek, and the Minnesota River Overflow Channel were determined utilizing HEC-2 (HEC, 1979).

Starting WSELs for the selected frequencies for the Minnesota River, the Minnesota River Overflow Channel, and Canby Creek (unincorporated areas of Yellow Medicine County) were calculated using the slope-area method in HEC-2 (HEC, 1979). Starting WSELs for Lazarus Creek were obtained from the data developed in the backwater analysis of Canby Creek.

Flood level for the approximate studies of the Yellow Medicine River and Spring Creek area based on a field review of the study area and aerial photography of the 1969 flood (Mark Hurd Aerial Survey Inc., 1969). The approximate study on Florida Creek and approximately 0.5 miles of an unnamed tributary was based on field review of the creek; the 100-year flood elevations at various locations along the creek were provided by the SCS (SCS, 1971). The elevations provided by the SCS for Florida Creek were developed using TR-20 (SCS, 1973).

This Countywide FIS Report

For this countywide revision, the cross sections used for the Tenmile Creek study were obtained using available digital contour maps (USGS, 1965). Hydraulic structure field surveys were limited to culvert size, invert elevation, and top of road elevation. The WSELs for Tenmile Creek were determined using the USACE, HEC computer program, HEC-RAS (River Analysis System), Versions 2.2 and 3.1.1 (HEC, 1998; HEC, 2003). The starting WSEL for Tenmile Creek was calculated on the assumption of normal depth.

The cross sections used for Florida Creek, Florida Creek Tributary, the Lac Qui Parle River, Lazarus Creek, and the Yellow Medicine River were determined using the USACE HEC-2 models produced in the previous joint SCS-USACE Minnesota River Basin study, PL87-639. These HEC-2 models were then imported into the USACE, HEC computer program, HEC-RAS, Version 3.1.1 (HEC, 2003) and updated with new field survey data as needed to reflect any change in conditions. The starting WSELs were calculated using a normal depth assumption.

Cross sections for the Minnesota River were obtained using aerial photographs. The below-water sections were obtained by field measurements. For previous studies, the WSELs for the floods of the selected recurrence intervals were computed through the use of the USACE, HEC computer program, HEC-2 (HEC, 1976). The HEC-2 models were calibrated to the 1969 Minnesota River flood (FEMA, 1988). For this study, the water-surface profiles were developed using the USACE, HEC computer program, HEC-RAS, Version 3.1.1 (HEC, 2003). The data from the HEC-2 models was converted to HEC-RAS using the HEC-2 data import option. The HEC-RAS models were then calibrated to match the previously published profiles. The HEC-RAS models were then run using the revised hydrology for this study. The starting WSELs were obtained from the

adjacent hydraulic model from the USACE Minnesota River study in Redwood County (FEMA, 2013).

Cross section geometry for the Minnesota River Overflow Channel and Canby Creek was obtained from the previous HEC-2 hydraulic models. Water surface profiles were developed for both flooding sources using HEC-RAS, Version 3.1.3 (HEC, 2005). The starting WSELs were calculated using a normal depth assumption.

Effective flow areas of the floodplain, cross sections, loss coefficients, and overbank roughness coefficients (Manning's "n") were assigned to each cross section based on field inspection. Manning's "n" for Tenmile Creek were also based on review of aerial photography. The range of Manning's "n" coefficients for each stream are shown in the following tabulation.

Stream	Channel	Overbanks
Canby Creek	0.025 - 0.045	0.035 - 0.080
Florida Creek	0.022 - 0.100	0.023 - 0.120
Florida Creek Tributary	0.039 - 0.104	0.050 - 0.090
Lac Qui Parle River	0.020 - 0.065	0.020 - 0.100
Lazarus Creek	0.030 - 0.085	0.024 - 0.150
Minnesota River	0.020 - 0.050	0.045 - 0.110
Minnesota River Overflow Channel	0.020 - 0.035	0.035 - 0.150
Tenmile Creek	0.035 - 0.035	0.035 - 0.035
Yellow Medicine River	0.030 - 0.060	0.025 - 0.130

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the FIRM (Exhibit 2).

The hydraulic analyses for this study were 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 NGVD. With the finalization of the NAVD, many FIS reports and FIRMs are being prepared using NAVD as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD. Structure and ground elevations in the community must, therefore, be

referenced to NAVD. 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 the communities.

The National Oceanic and Atmospheric Administration (NOAA) computer program, VERTCON, (NOAA, 2016) was used to convert all vertical data in this countywide study from NGVD to NAVD. Conversions were done at the location of each cross section along the streams. This results in a rolling conversion factor for each stream. The average conversion factor is 0.643 feet. For more information on NAVD, see the FEMA publication entitled *Converting the National Flood Insurance Program to the North American Vertical Datum of 1988*, or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, NOAA, Silver Spring, Maryland 20910 (Internet address http://www.ngs.noaa.gov). The datum conversion factors are listed in Table 4.

Table 4- Vertical Datum Conversion (from NGVD to NAVD)

Quad Name	Corner	Latitude	Longitude	Conversion Factor (feet)
Brandt	SE	44.625	-96.500	0.823
Canby NW	SE	44.625	-96.375	0.787
Gary	SE	44.750	-96.375	0.732
Lake Francis	SE	44.750	-96.500	0.794
Boyd	SE	44.750	-95.875	0.597
Canby	SE	44.625	-96.250	0.715
Canby NW	SE	44.625	-96.375	0.787
Clarkfield	SE	44.750	-95.750	0.594
Clarkfield NE	SE	44.875	-95.750	0.554
Dawson SW	SE	44.750	-96.125	0.630
Gary	SE	44.750	-96.375	0.732
Gary SE	SE	44.750	-96.250	0.666
Granite Falls	SE	44.750	-95.500	0.558
Hazel Run	SE	44.750	-95.625	0.581
Lone Tree Lake	SE	44.625	-95.375	0.538
Minneota NW	SE	44.625	-95.875	0.633
Minnesota Falls	SE	44.750	-95.375	0.551
Montevideo	SE	44.875	-95.625	0.528
Normania	SE	44.625	-95.750	0.627
Porter	SE	44.625	-96.125	0.663
Providence	SE	44.750	-96.000	0.607
Saint Leo	SE	44.625	-96.000	0.643
Tenmile Lake	SE	44.875	-95.875	0.571
Wood Lake	SE	44.625	-95.500	0.561
Wood Lake NW	SE	44.625	-95.625	0.594
			Average:	0.643

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 these data.

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, Floodway Data Table, and Summary of Stillwater Elevations 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 Floodplain 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 of Canby Creek were interpolated using topographic maps at a scale of 1:4,800, with 2-foot contour intervals. Between cross sections, the floodplain boundaries for Florida Creek, Florida Creek Tributary, the Lac Qui Parle River, Lazarus Creek, the Minnesota River, the Minnesota River Overflow Channel, and the Yellow Medicine River were interpolated using topographic maps compiled from aerial photographs taken as part of a previous Minnesota River Basin Study effort in 1980. The topographic maps were completed for the major floodplains with a 4-foot primary contour interval and 2-foot interpolated contours at a scale of 1:6,000 (SCS, undated). For Tenmile Creek, the floodplain boundaries were interpolated using USGS 7.5 minute topography at a 1:24,000 scale, with 10-foot contour intervals (USGS, 1965).

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). 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 (Exhibit 2).

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 foot, provided that hazardous velocities are not produced. In Minnesota, however, floodplain encroachment is limited by Minnesota Regulations to that which would cause a 0.5-foot increase in flood heights above pre-floodway conditions at any point (MNDNR, 1977). Floodways having no more than 0.5-foot surcharge were delineated for this FIS. The floodway can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this FIS report and on the FIRM were 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 (Table 5). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

For Canby Creek the floodway was not computed but was mapped to be nearly coincident with the 1-percent-annual-chance floodplain as the 1-percent-annual-chance flood is contained within the natural channel for most areas.

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)
CANBY CREEK								
A	1,560	*	*	*	1,146.0	1,145.0[2]	*	*
B	3,486	*	*	*	1,146.9	1,146.9	*	*
C	6,180	*	*	*	1,149.6	1,149.6	*	*
D	8,944	*	*	*	1,152.8	1,152.8	*	*
E	12,762	*	*	*	1,156.7	1,156.7	*	*
F	14,792	*	*	*	1,160.4	1,160.4	*	*
G	18,238	*	*	*	1,167.3	1,167.3	*	*
H	19,560	*	*	*	1,171.3	1,171.3	*	*
I	21,915	*	*	*	1,176.0	1,176.0	*	*
J	23,482	*	*	*	1,182.6	1,182.6	*	*
K	28,262	*	*	*	1,196.2	1,196.2	*	*
L	29,862	*	*	*	1,199.7	1,199.7	*	*
M	31,772	*	*	*	1,206.7	1,206.7	*	*
N	34,776	*	*	*	1,214.2	1,214.2	*	*
O	37,562	*	*	*	1,223.0	1,223.0	*	*
P	39,502	*	*	*	1,229.9	1,229.9	*	*
Q	40,087	*	*	*	1,230.1	1,230.1	*	*

[1]Feet above Lazarus Creek
[2]Elevation computed without consideration of backwater effects from Lazarus Creek
*Data not available

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

YELLOW MEDICINE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

CANBY 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)
LAZARUS CREEK								
A-D*								
E	95,836	257	1,533	2.8	1,136.6	1,136.6	1,136.7	0.1
F	102,283	437	2,189	3.0	1,140.0	1,140.0	1,140.3	0.3
G	105,583	280	1,575	3.4	1,141.8	1,141.8	1,142.1	0.3
H	113,203	524	2,155	3.1	1,145.0	1,145.0	1,145.3	0.3
I	115,131	1,285	4,199	1.2	1,146.2	1,146.2	1,146.6	0.4
J	121,662	1,030	1,633	3.7	1,151.6	1,151.6	1,151.8	0.2
K-U*								

[1] Feet above the confluence with the Lac Qui Parle River
* Data not available – floodway not computed

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

YELLOW MEDICINE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

LAZARUS CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MINNESOTA RIVER								
A	232.690	650/1,531	30,239	4.7	877.0	877.0	877.1	0.1
B	233.523	400/2,156	30,639	4.4	877.3	877.3	877.4	0.1
C	234.205	1,950/2,177	34,409	3.1	877.8	877.8	877.8	0.0
D	234.849	100/2,248	30,814	4.1	878.1	878.1	878.2	0.1
E	235.914	800/2,615	40,548	2.7	878.5	878.5	878.7	0.2
F	236.975	2,600/2,861	30,663	3.5	878.9	878.9	879.0	0.1
G	238.514	1,950/3,791	37,292	4.1	882.0	882.0	882.2	0.2
H	239.215	2,250/3,027	38,386	2.2	882.3	882.3	882.6	0.3
I	240.224	1,500/3,886	61,998	1.3	882.5	882.5	882.7	0.2
J	241.910	3,280/4,227	60,047	1.5	882.6	882.6	882.9	0.3
K	243.373	2,000/4,940	64,623	1.4	882.7	882.7	883.0	0.3
L	244.765	4,450/4,723	44,901	2.4	882.8	882.8	883.1	0.3
M	246.800	700/5,022	42,560	3.0	883.6	883.6	883.8	0.2
N	248.750	300/1,048	12,124	4.9	885.2	885.2	885.5	0.3
O	249.882	200/319	7,151	6.7	887.0	887.0	887.3	0.3
P	251.592	200/348	4,828	10.4	894.7	894.7	894.9	0.2
Q	252.801	160/490	7,892	4.9	897.8	897.8	898.0	0.2
R	253.212	70/391	5,989	6.5	901.4	901.4	901.6	0.2
S	253.248	50/266	4,896	8.0	901.6	901.6	901.8	0.2
T	253.354	150/413	5,588	7.0	902.6	902.6	902.8	0.2
U	253.663	310/457	5,838	7.5	911.9	911.9	912.1	0.2
V	253.966	1,040/1,175	12,357	4.1	913.4	913.4	913.6	0.2

[1] Miles above the confluence with the Mississippi River
[2] Total width within county/Total width

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

YELLOW MEDICINE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

MINNESOTA RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
MINNESOTA RIVER (CONTINUED)								
W	254.582	750/1,099	7,622	7.1	915.8	915.8	916.1	0.3
X	254.937	310/1,264	9,037	5.8	917.2	917.2	917.5	0.3
Y	255.350	1,730/2,540[3]	6,639	7.7	918.0	918.0	918.4	0.4
Z	255.937	1,120/1,542	10,747	6.6	920.4	920.4	920.7	0.3
AA	256.818	600/4,596	31,174	2.0	922.2	922.2	922.5	0.3
AB	257.617	1,250/2,834	33,140	2.4	922.9	922.9	923.3	0.4
AC	259.223	510/3,355	32,064	3.1	923.7	923.7	923.7	0.0
AD	260.460	2,000/2,209	20,845	4.9	924.7	924.7	924.8	0.1
AE	261.214	2,650/3,077	33,907	3.0	925.2	925.2	925.4	0.2
AF	262.685	200/2,714	43,310	2.0	926.6	926.6	926.8	0.2
AG	263.735	2,200/3,036	31,795	3.2	927.2	927.2	927.4	0.2
AH	264.984	350/2,951	37,889	2.4	928.3	928.3	928.6	0.3
AI	266.336	3,180/3,438	40,020	3.2	929.1	929.1	929.4	0.3
AJ	267.296	240/2,357	29,001	3.4	930.0	930.0	930.4	0.4
AK	268.266	700/4,957	46,236	2.9	930.6	930.6	931.0	0.4
AL	269.601	2,190/3,908	34,138	4.4	931.7	931.7	932.0	0.3
AM	271.157	200/328	6,524	7.3	933.1	933.1	933.5	0.4

[1] Miles above confluence with the Mississippi River
[2] Total width within county/Total width
[3] Floodway width includes combined widths with the Minnesota River Overflow Channel

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

YELLOW MEDICINE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

MINNESOTA 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)
MINNESOTA RIVER OVERFLOW CHANNEL								
A	941	241	1,245	6.4	897.1	896.1[2]	896.8	0.7
B	1,721	162	1,128	7.1	899.9	899.9	899.9	0.0
C	2,220	309	3,115	2.6	900.9	900.9	900.9	0.0
D	3,201	390	1,835	4.4	901.0	901.0	901.0	0.0
E	5,216	441	1,670	4.8	907.1	907.1	907.1	0.0
F	8,327	452	2,785	2.9	914.8	914.8	914.9	0.1
G	9,003	326	2,657	3.0	915.0	915.0	915.0	0.0
H	9,491	557	6,433	1.2	915.1	915.1	915.2	0.1
I	10,171	507	3,054	2.6	915.1	915.1	915.1	0.0
J	11,193	457	2,174	3.7	915.7	915.7	915.8	0.1
K	12,792	764	2,106	3.8	918.6	918.6	918.6	0.0
L	15,773	910	5,456	1.5	919.9	919.9	919.9	0.0
M	17,013	1,000	7,401	1.1	920.0	920.0	920.0	0.0
N	18,533	1,377	10,244	0.8	920.1	920.1	920.1	0.0
O	20,013	2,562	15,305	0.5	920.2	920.2	920.2	0.0

[1] Feet above convergence with the Minnesota River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

YELLOW MEDICINE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

MINNESOTA RIVER OVERFLOW CHANNEL

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)
YELLOW MEDICINE RIVER								
A-N*								
O	76,328	3,425	7,880	6.9	1,094.1	1,094.1	1,094.1	0.0

[1] Feet above Limit of Detailed Study (Limit of Detailed Study is approximately 36,700 feet downstream of County Road 8)
* Data not available – floodway not computed

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

YELLOW MEDICINE COUNTY, MN
AND INCORPORATED AREAS

FLOODWAY DATA

YELLOW MEDICINE RIVER

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 WSEL of the 1-percent-annual-chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

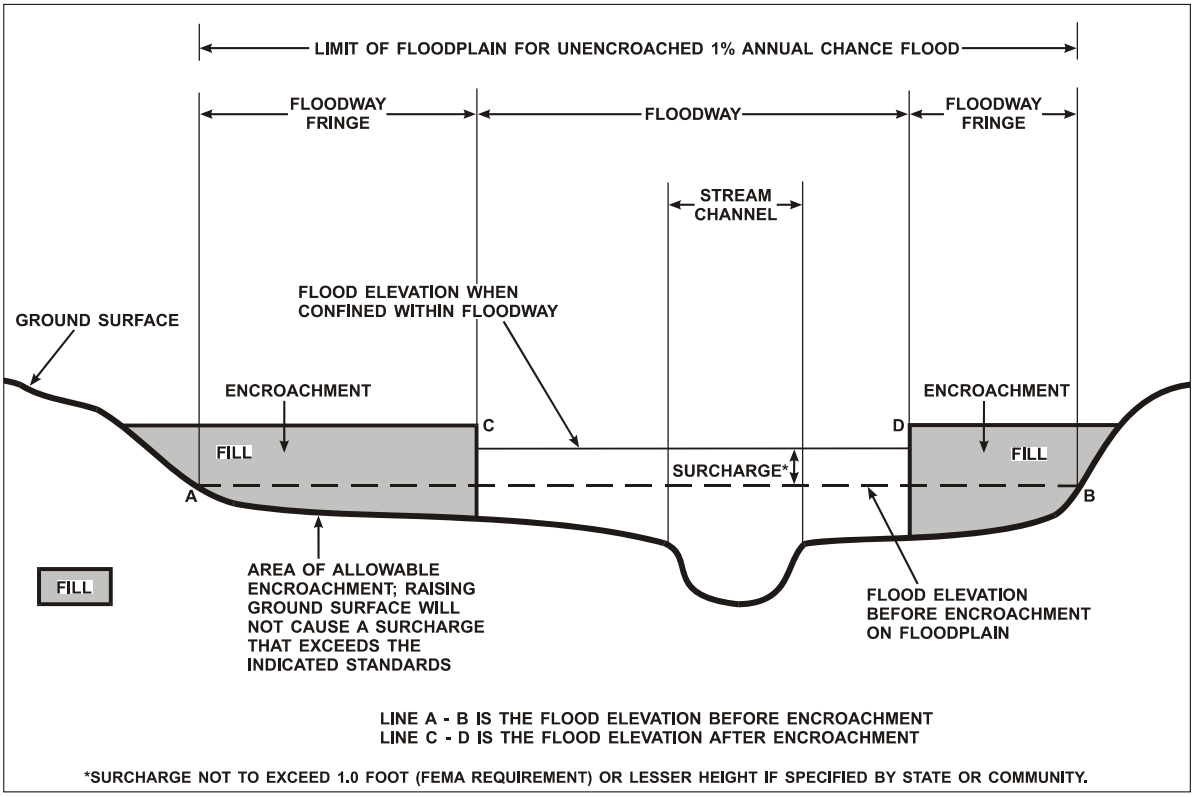


Figure 1 - Floodway Schematic

There were no floodways computed for Florida Creek, Florida Creek Tributary, the Lac Qui Parle River, Tenmile Creek, and the majority of the Yellow Medicine River.

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 BFE 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 countywide FIRM presents flooding information for the entire geographic area of Yellow Medicine County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps, where applicable. Historical data relating to the maps prepared for each community are presented in Table 6.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDAY MAP REVISION DATE	FIRM EFFECTIVE DATE	FIRM REVISION DATE
Canby, City of	April 5, 1974	None	June 1, 1983	None
[1,2,3]Clarkfield, City of	N/A	N/A	N/A	
[1,2,3]Echo, City of	N/A	N/A	N/A	
Granite Falls, City of	November 16, 1973	May 7, 1976	April 1, 1977	June 4, 1980
[2,3]Hanley Falls, City of	N/A	N/A	N/A	
[1,2,3]Hazel Run, City of	N/A	N/A	N/A	
[2]Porter, City of	June 28, 1974	July 9, 1976	None	
[1,2,3]St. Leo, City of	N/A	N/A	N/A	
Upper Sioux Community	September 3, 2003	None	September 3, 2003	None
[2]Wood Lake, City of	January 17, 1975	None	N/A	
Yellow Medicine County (Unincorporated Areas)	August 19, 1977	None	November 15, 1978	None

[1]No Special Flood Hazard Areas Identified
[3]This community does not have map history prior to this first countywide date
[2]This Community did not have a FIRM prior to the first countywide FIRM for Yellow Medicine County

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

YELLOW MEDICINE COUNTY, MN
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

This 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.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Federal Insurance and Mitigation Division, 536 South Clark Street, Sixth Floor, Chicago, Illinois 60605.

9.0 BIBLIOGRAPHY AND REFERENCES

Federal Emergency Management Agency, Flood Insurance Study, Upper Sioux Community, Yellow Medicine County, Minnesota, September 3, 2003.

Federal Insurance Administration, Flood Insurance Study, Yellow Medicine County, Minnesota (Unincorporated Areas), Flood Insurance Study Report, May 1978; Flood Insurance Rate Map, November 15, 1978.

Federal Insurance Administration, Flood Insurance Study, City of Granite Falls, Yellow Medicine and Chippewa Counties, Minnesota, Flood Insurance Study Report, December 1979; Flood Insurance Rate Map, June 4, 1980.

Federal Insurance Administration, Flood Insurance Study, City of Canby, Yellow Medicine County, Minnesota, Flood Insurance Study, December 1, 1982; Flood Insurance Rate Map, June 1, 1983.

Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, U.S. Army Corps of Engineers, Davis, California, November 1976.

Hydrologic Engineering Center, HEC-FFA Flood Frequency Analysis, U.S. Army Corps of Engineers, Davis, California, 1992.

Hydrologic Engineering Center, HEC-RAS River Analysis System, Version 2.2, U.S. Army Corps of Engineers, Davis, California, September 1998.

Hydrologic Engineering Center, HEC-RAS River Analysis System, Version 3.1.1, U.S. Army Corps of Engineers, Davis, California, May 2003.

Hydrologic Engineering Center, HEC-RAS River Analysis System, Version 3.1.3, U.S. Army Corps of Engineers, Davis, California, May 2005.

Minnesota Department of Natural Resources, Division of Water, Hydrologic Atlas of Minnesota, Bulletin No. 10, St. Paul, Minnesota, April 1959.

Minnesota Department of Natural Resources, Division of Waters, Technical Report No. 6, The Regulatory Floodway in Flood Plain Management, September 1977.

National Oceanic and Atmospheric Administration, VERTCON Orthometric Height Conversion, Retrieved January 27, 2016.

Soil Conservation Service, National Engineering Handbook, 1972

Soil Conservation Service, Engineering Division, Central Technical Unit, Technical Release No. 20, Computer Program for Project Formulation, Hydrology, U.S. Department of Agriculture, May 1961.

Soil Conservation Service, Engineering Division, Central Technical Unit, Technical Release No. 20, Computer Program for Project Formulation, Hydrology, U.S. Department of Agriculture, 1973.

Soil Conservation Service, Engineering Division, Central Technical Unit, Technical Release No. 20, Computer Program for Project Formulation, Hydrology, U.S. Department of Agriculture, 1983.

Soil Conservation Service, Flood Hazard Analyses, City of Canby and Vicinity, U.S. Department of Agriculture, February 1973.

Soil Conservation Service, Topographical Map, Scale 1:4,800, Contour Interval 2 feet, undated.

U.S. Census Bureau, American Fact Finder, Yellow Medicine County, Minnesota, 2014. Retrieved August 13, 2015, from http://www.quickfacts.census.gov.

U.S. Geological Survey, 7.5 Minute Topographic Map, Scale 1:24,000, Contour Interval 10 feet: Boyd, Minnesota, 1965.

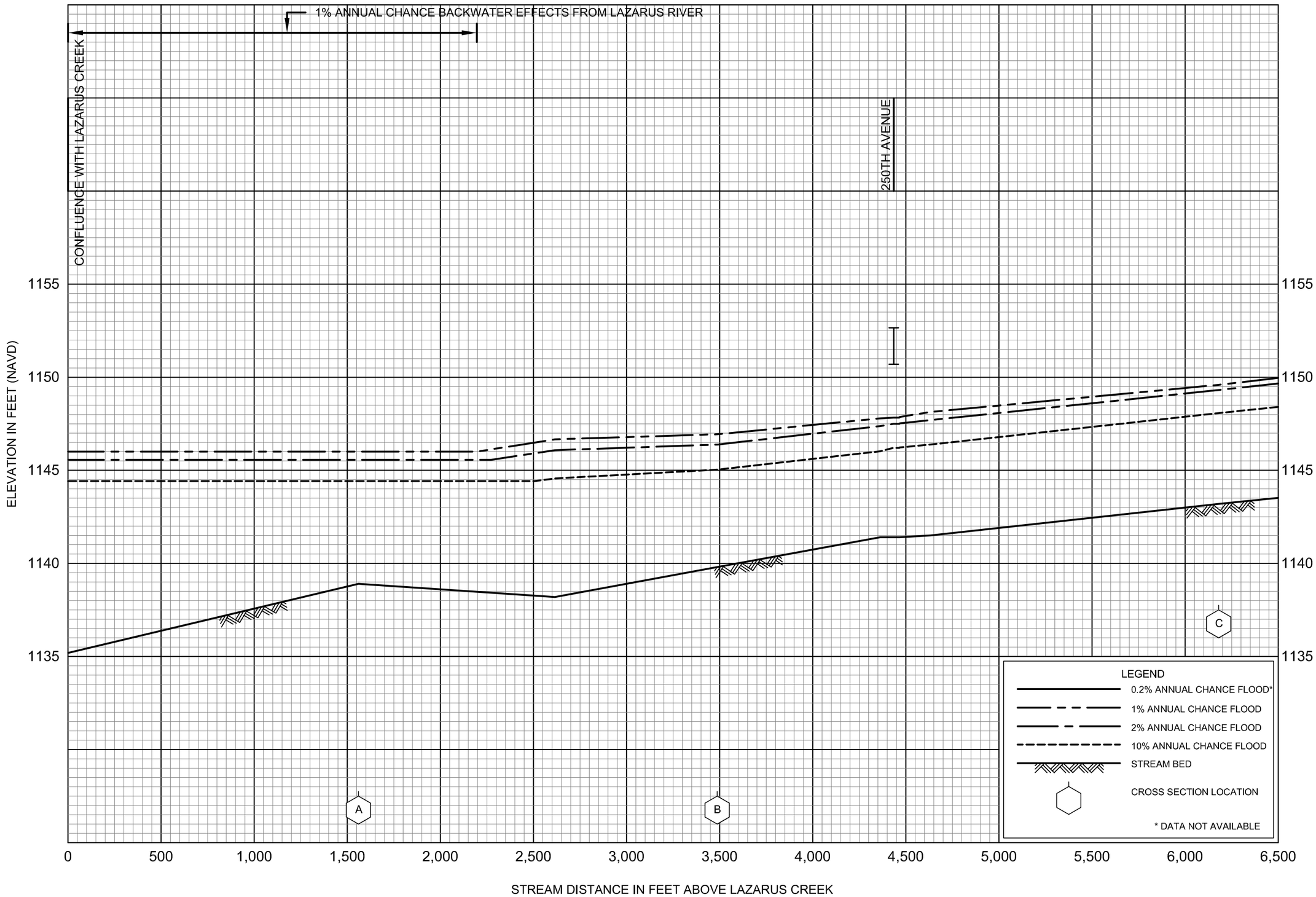
U.S. Geological Survey, Water-Resources Investigations Report 97-4249, Techniques for Estimating Peak Flow on Small Streams in Minnesota, 1997.

U.S. Geological Survey, Water Resources Data for Minnesota, Part 1, Surface Water Resources, Part 2, Water Quality Records, 1969.

U.S. Water Resources Council, Bulletin 15, A Uniform Technique for Determining Flood Flow Frequencies, December 1967.

U.S. Water Resources Council, Bulletin 17A, Guidelines for Determining Flood Flow Frequencies, December 1977.

Yellow Medicine County, Minnesota, History of Yellow Medicine County, Minnesota, 2010



FLOOD PROFILES

CANBY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

YELLOW MEDICINE COUNTY, MN

AND INCORPORATED AREAS

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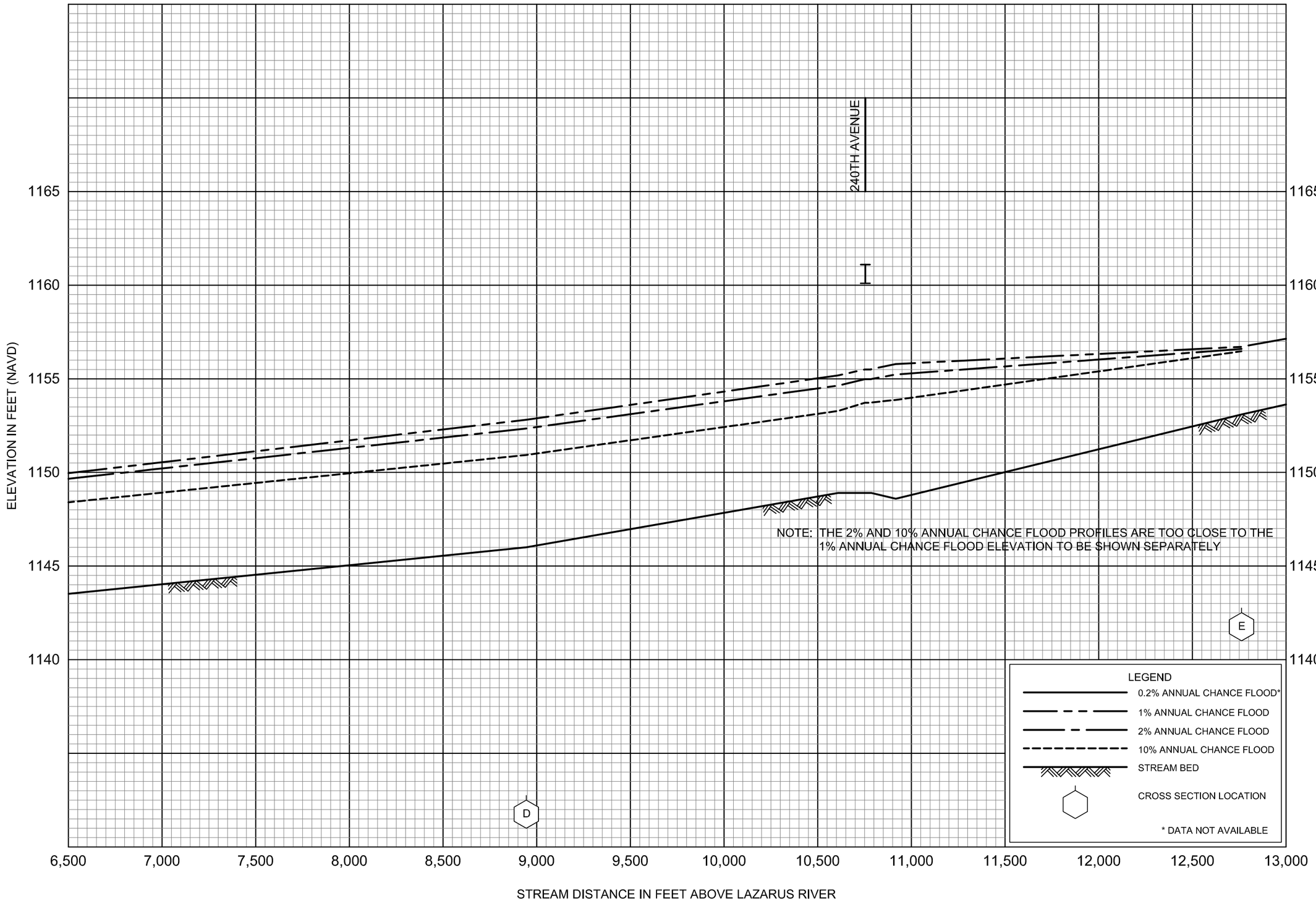

FLOOD PROFILES

CANBY CREEK

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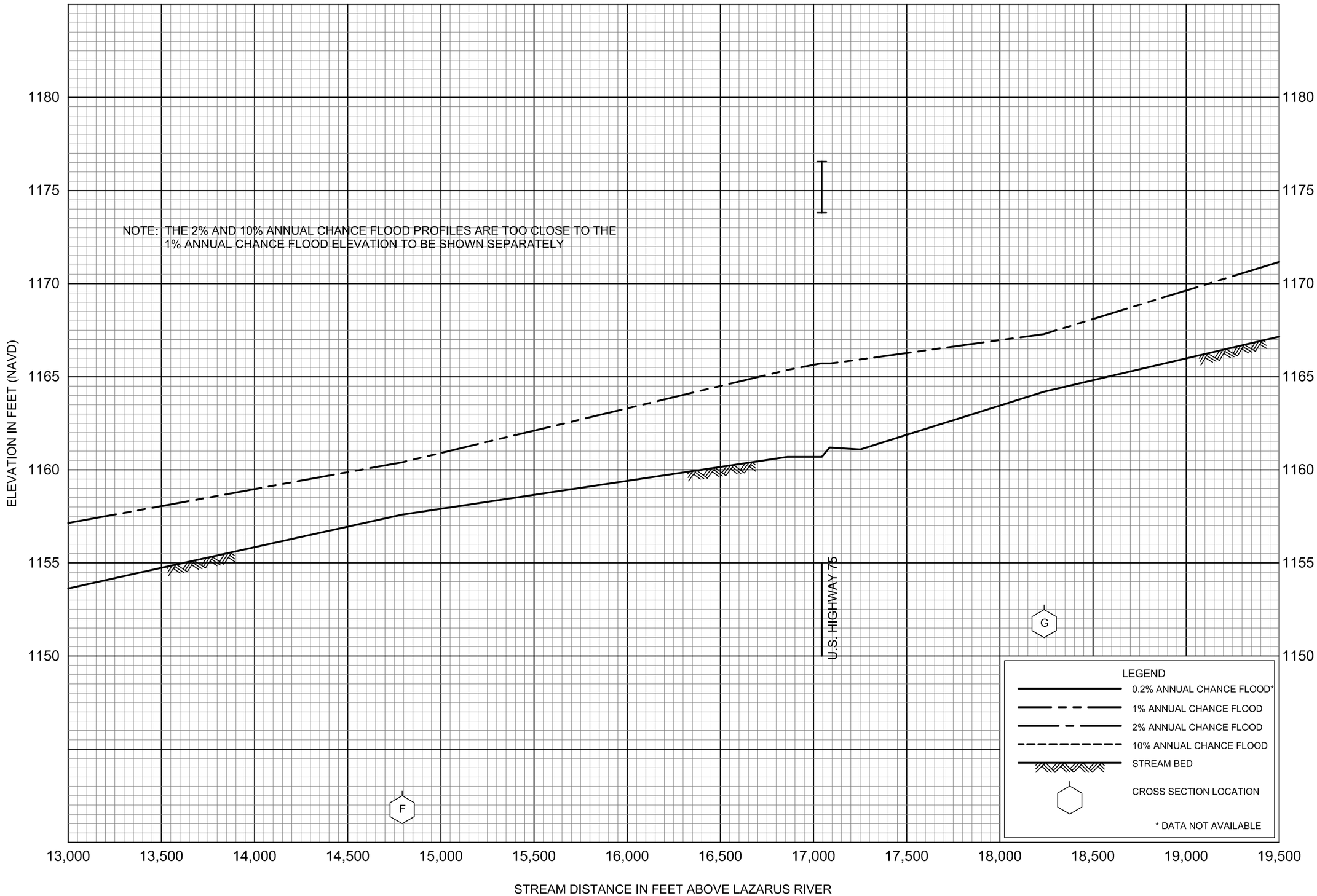

FLOOD PROFILES

CANBY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

YELLOW MEDICINE COUNTY, MN

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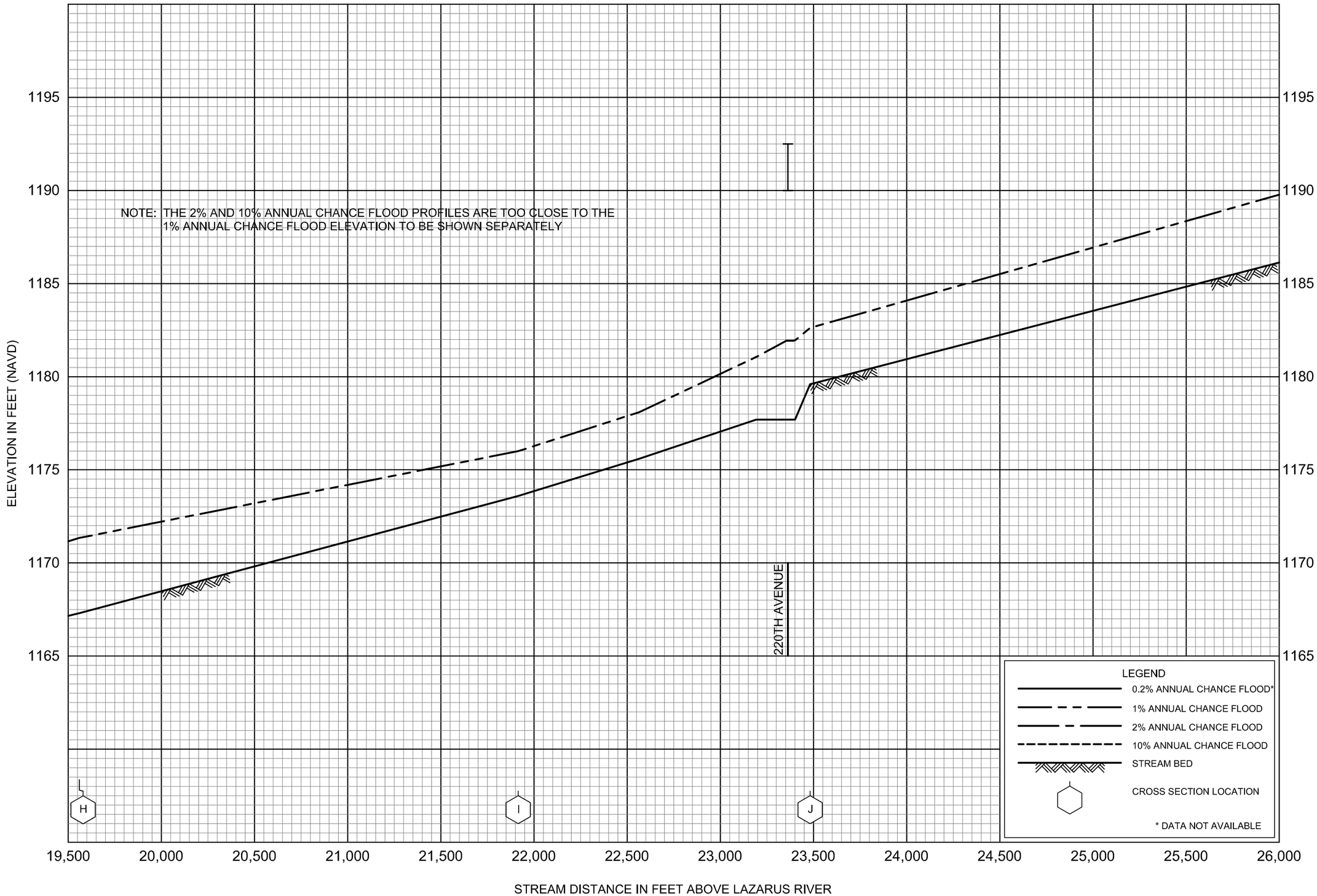

FLOOD PROFILES

CANBY CREEK

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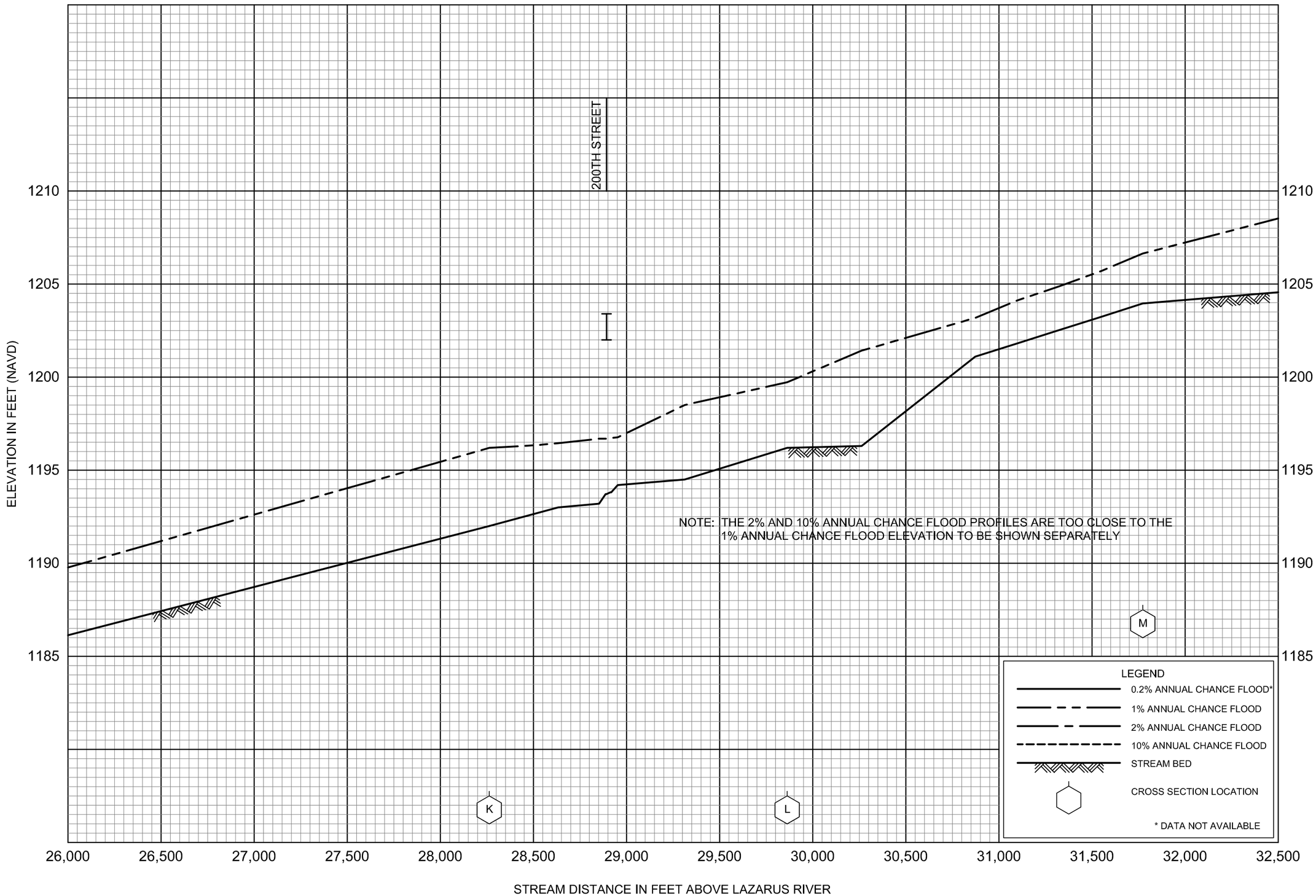

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CANBY CREEK

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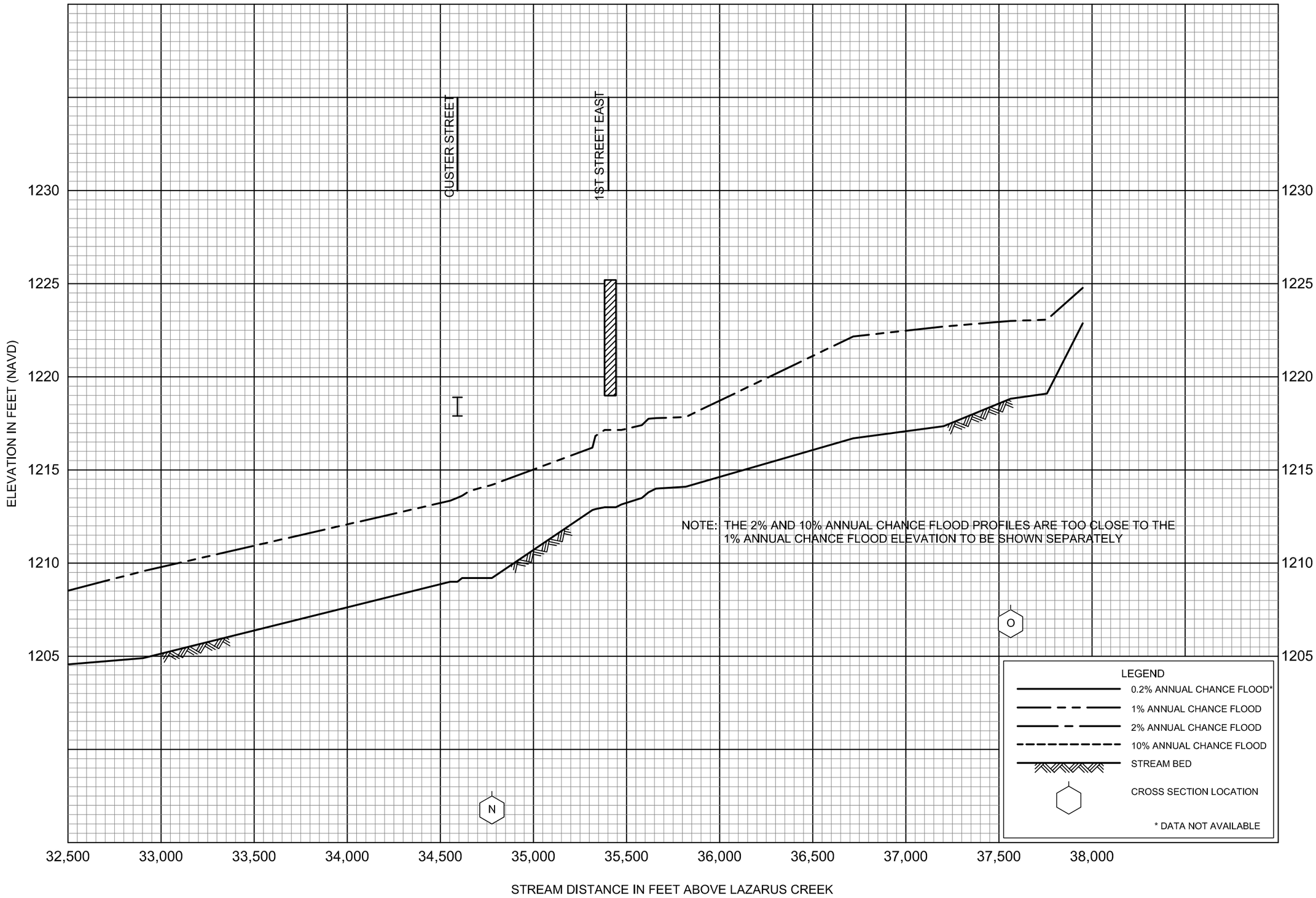

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CANBY CREEK

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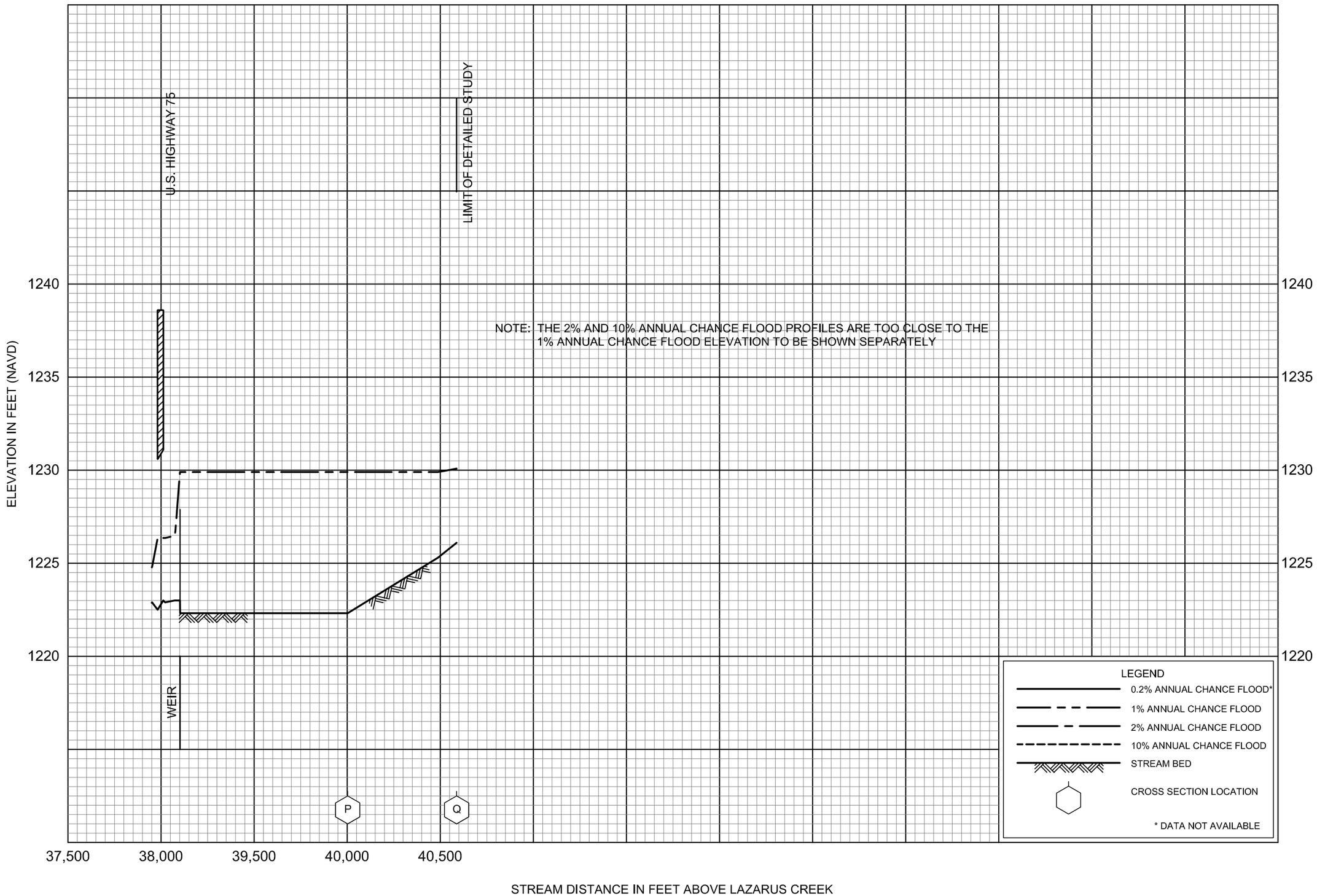

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CANBY CREEK

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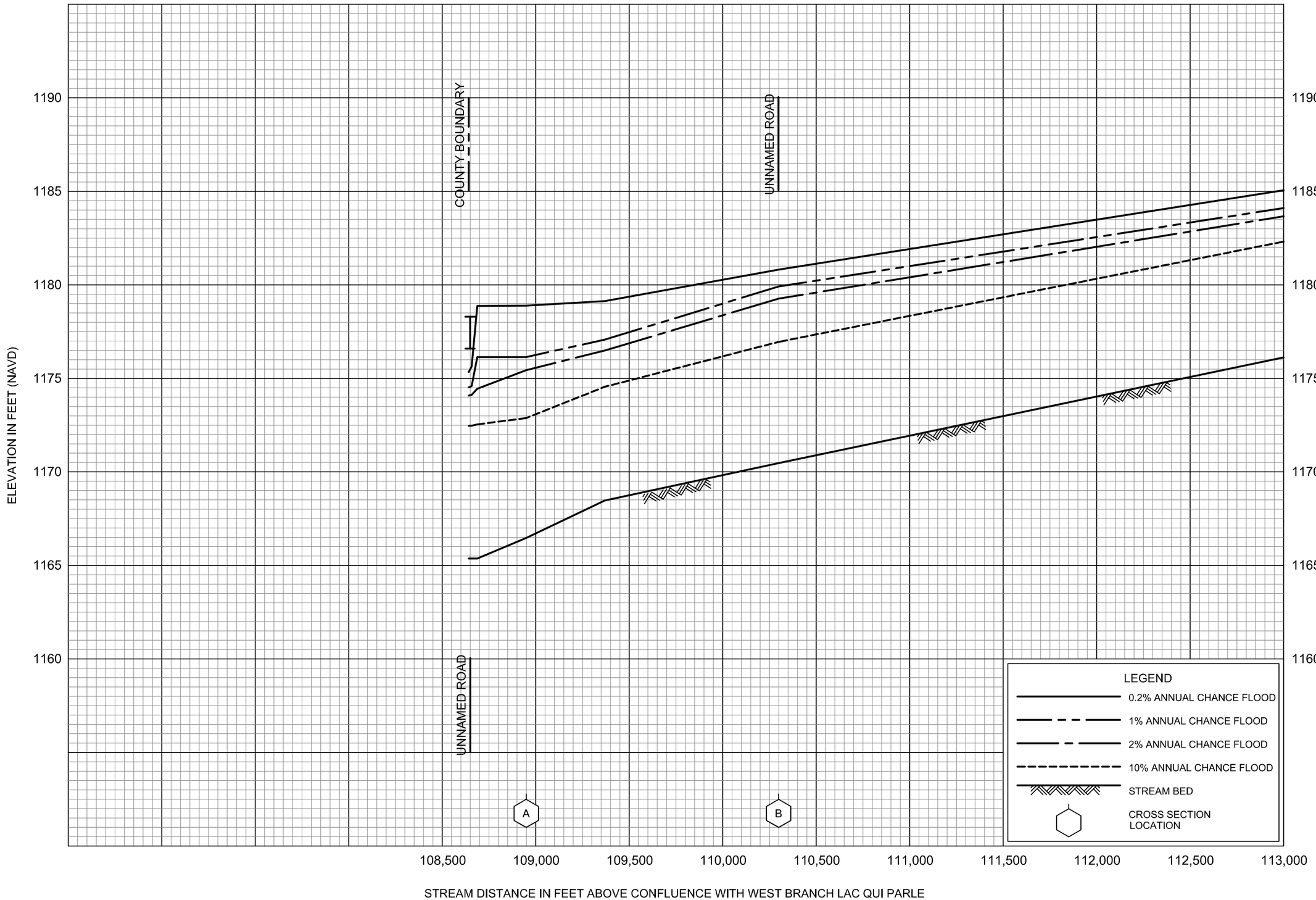

FLOOD PROFILES

FLORIDA CREEK

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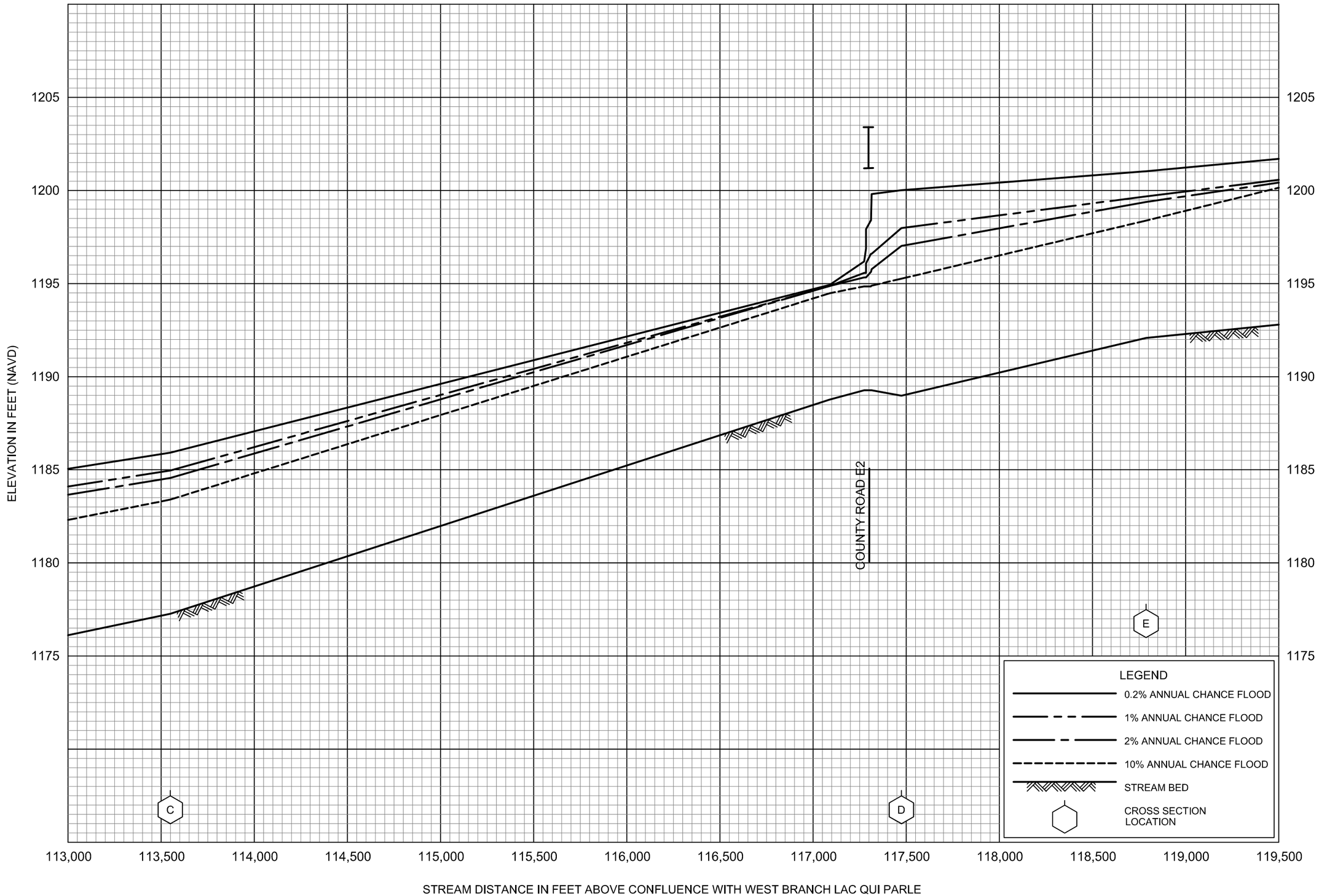

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FLORIDA CREEK

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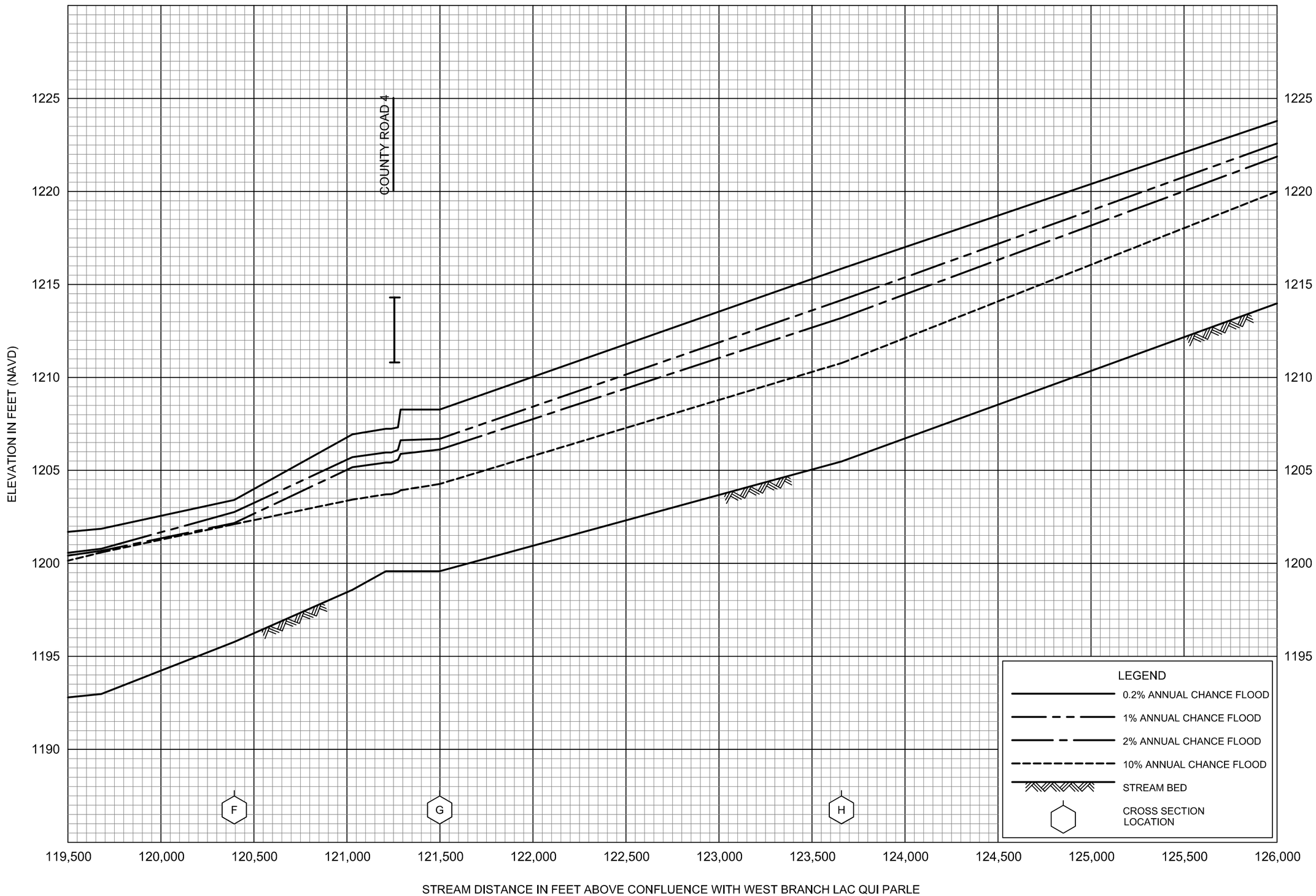

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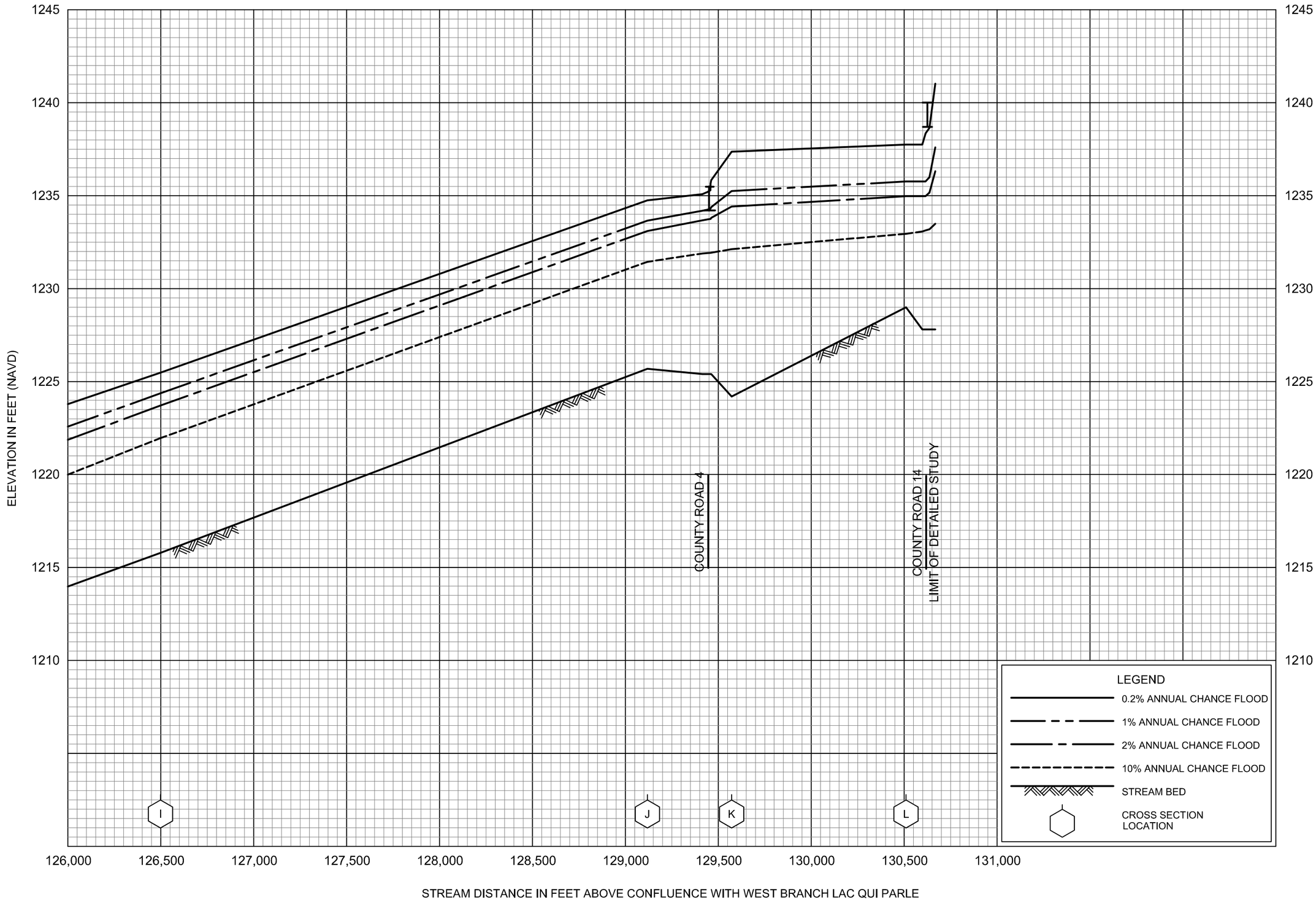

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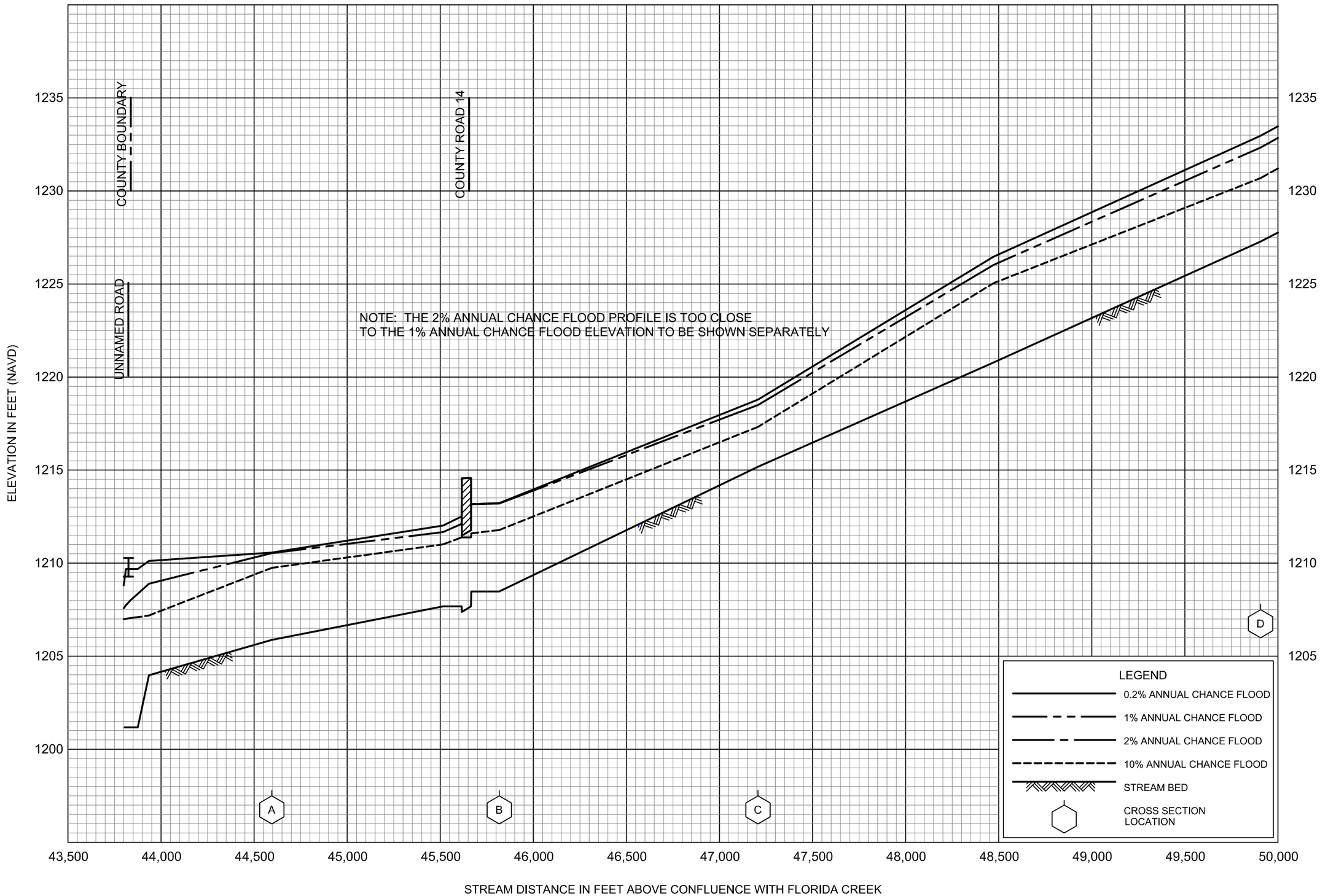

FLOOD PROFILES

FLORIDA CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

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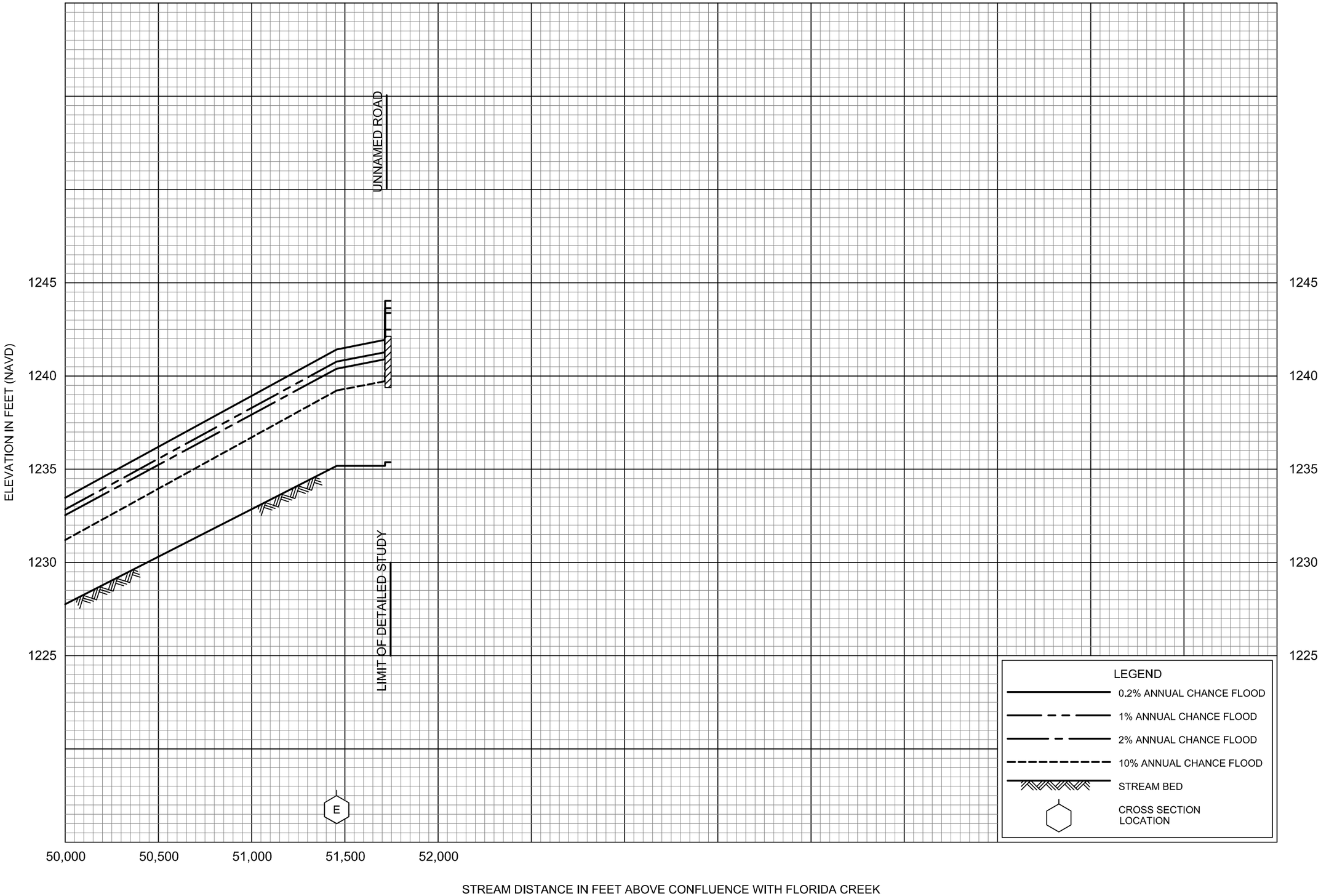

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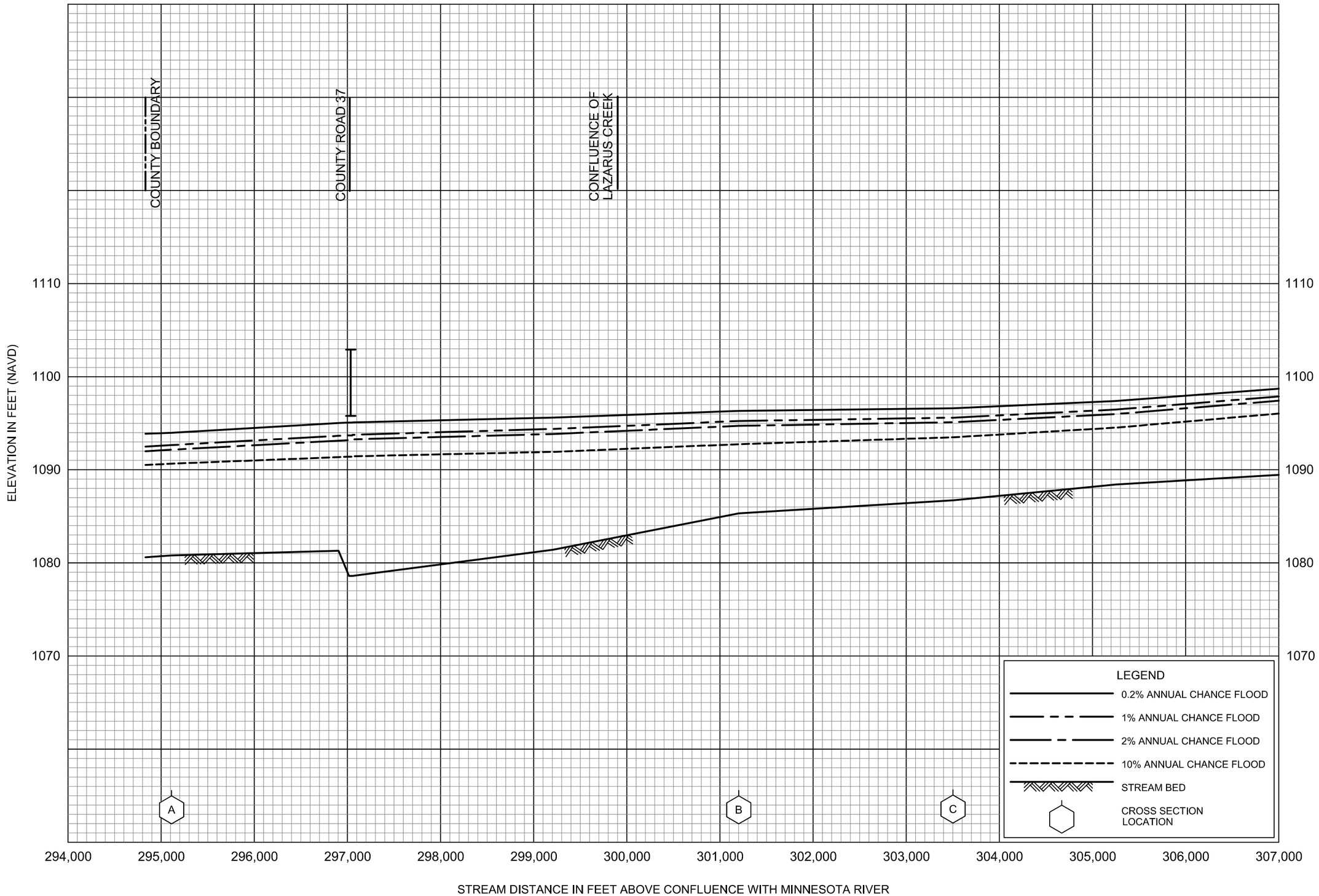

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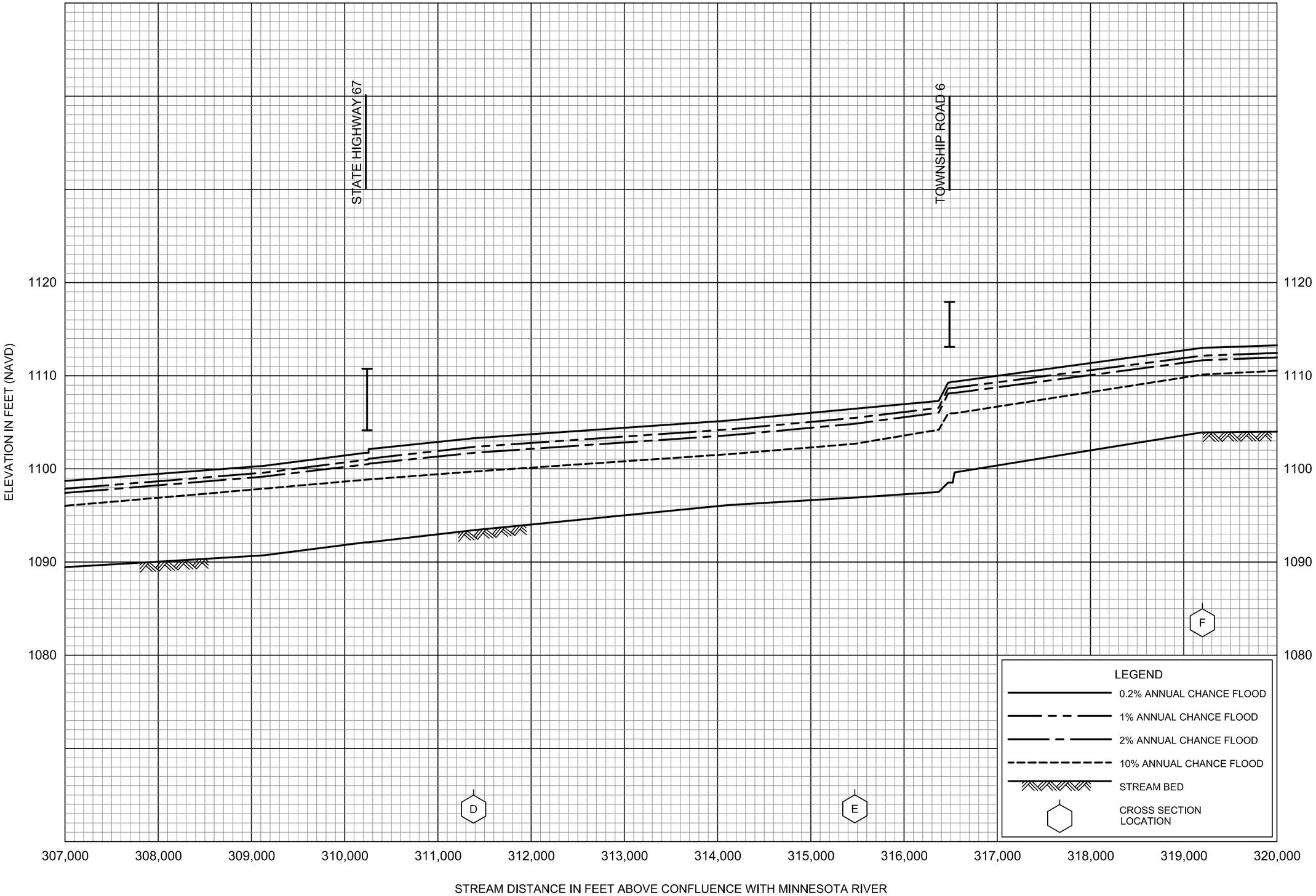

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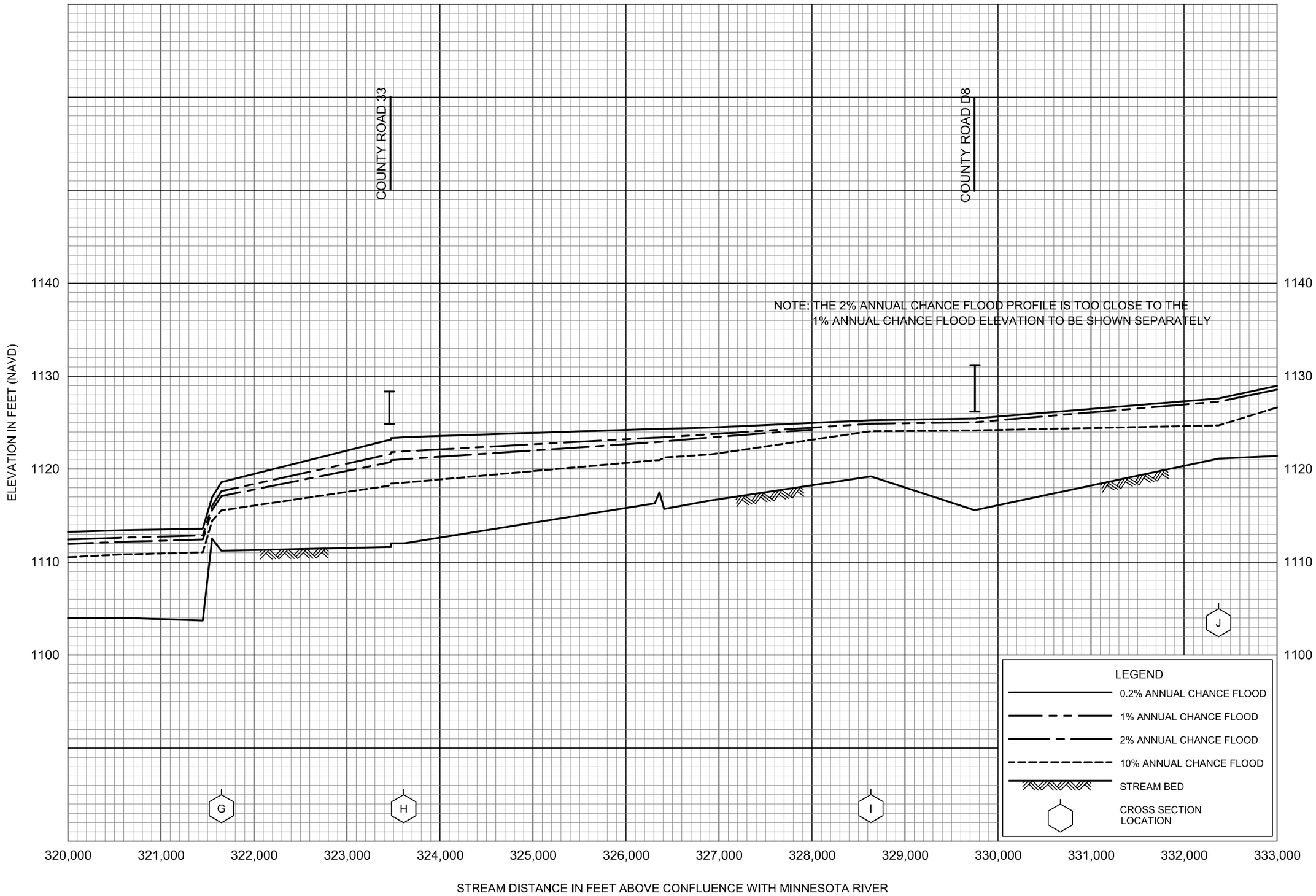

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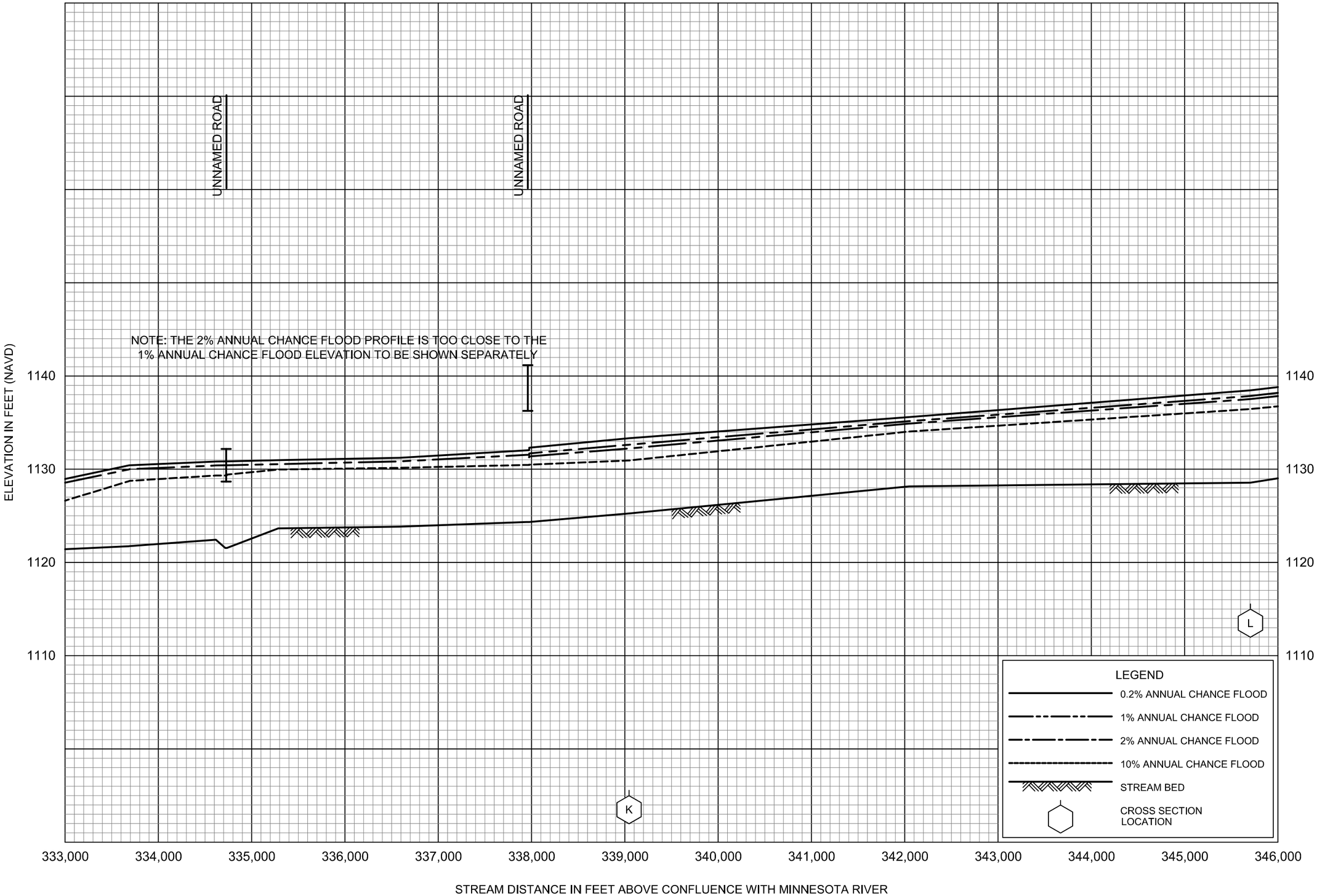

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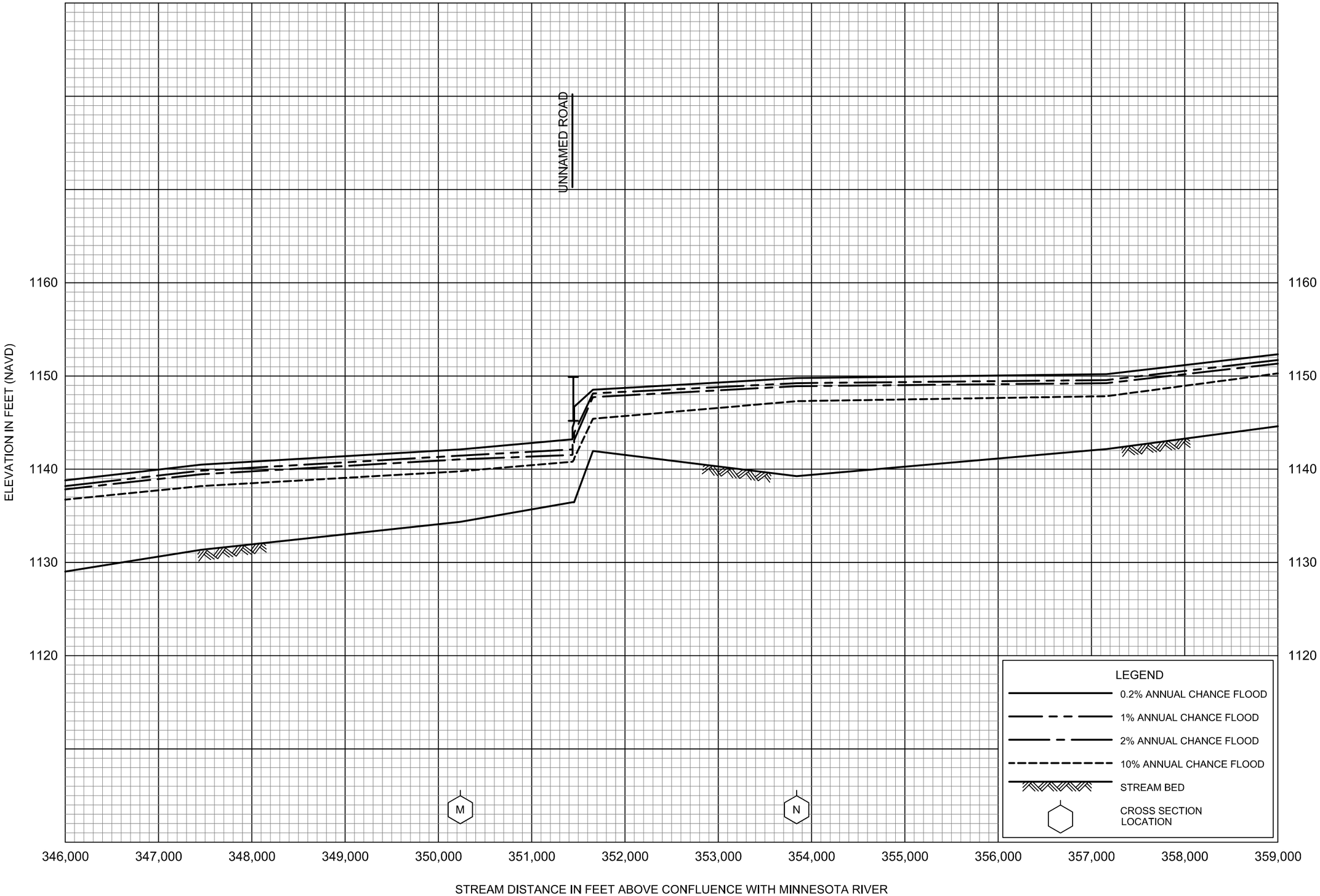

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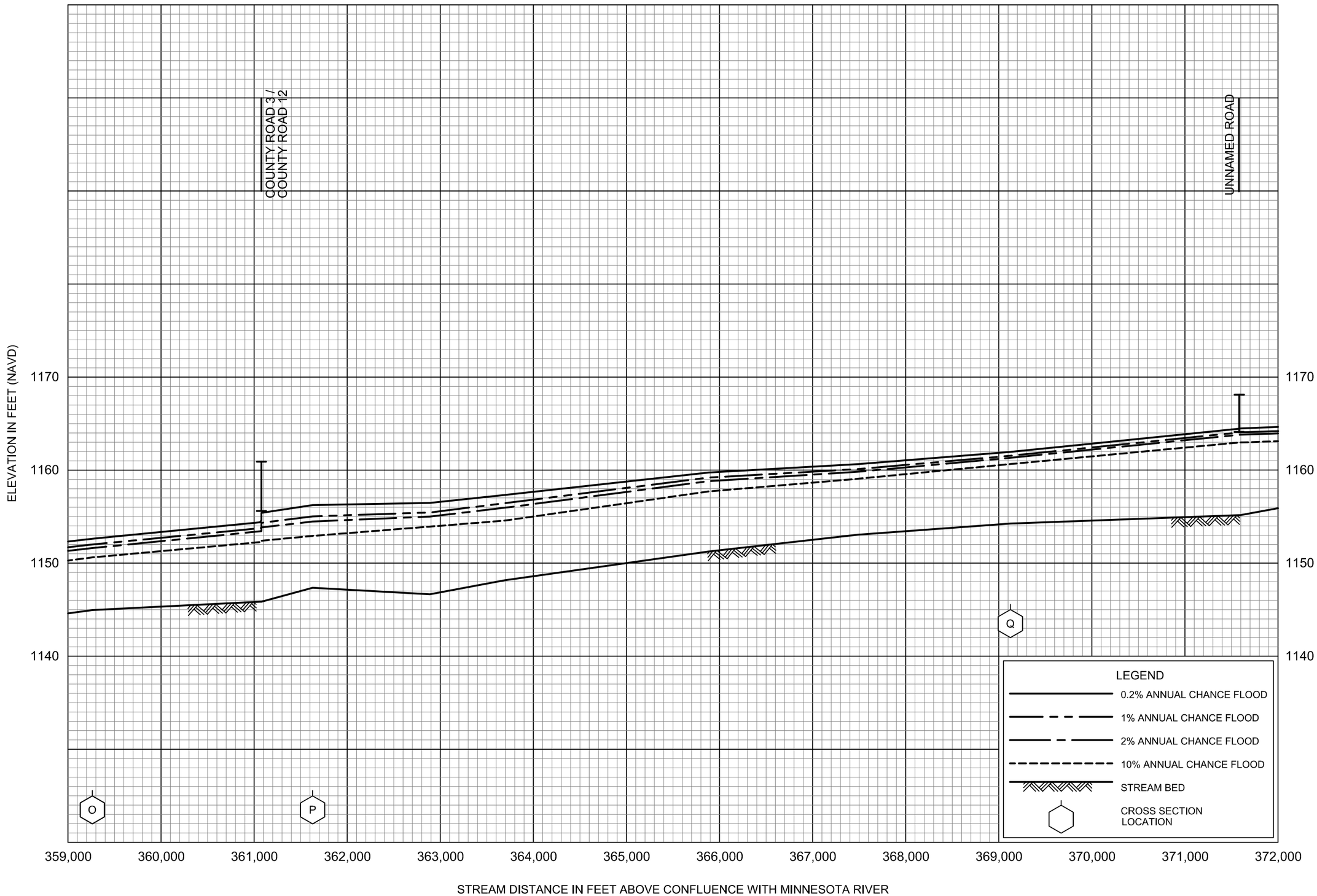

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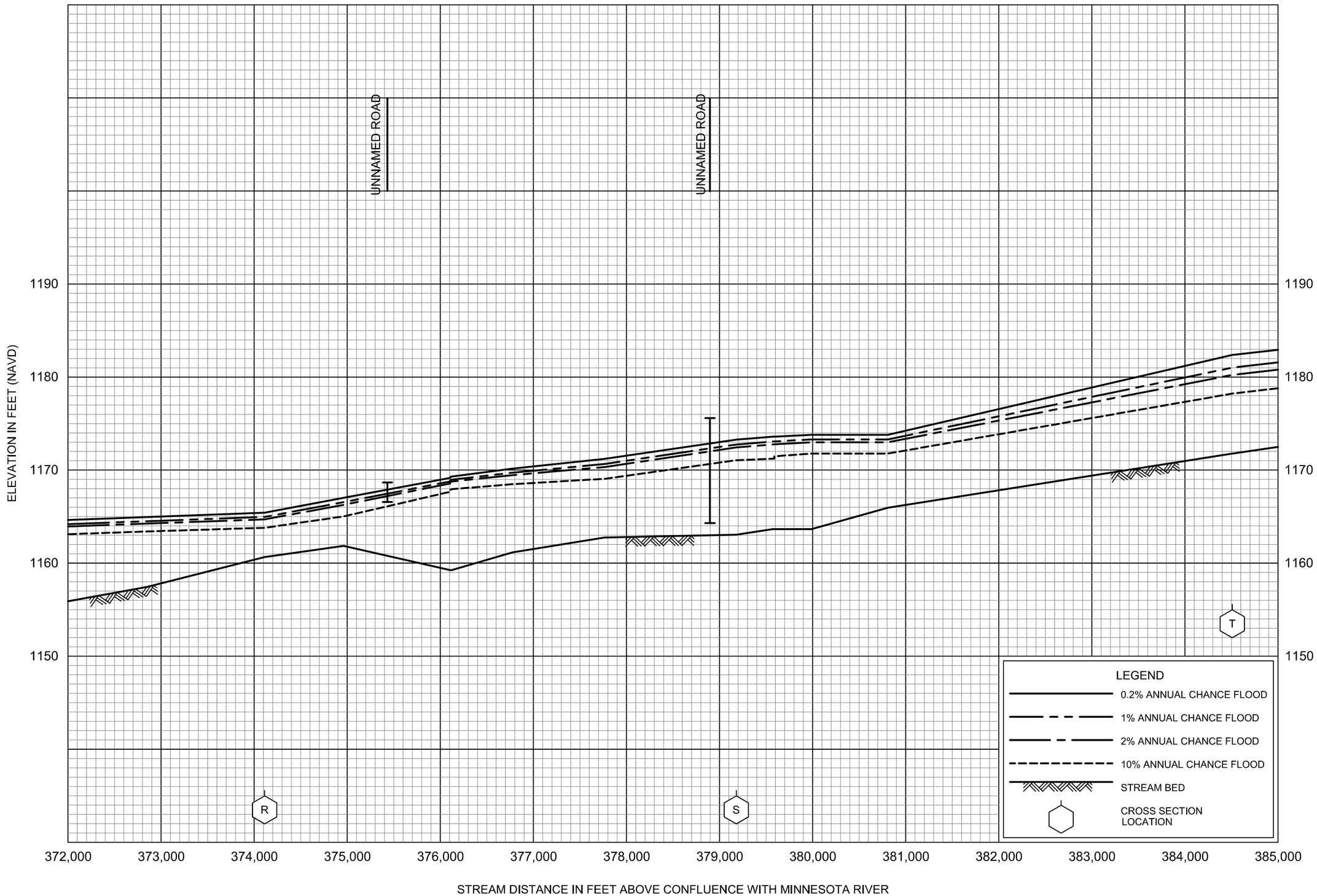

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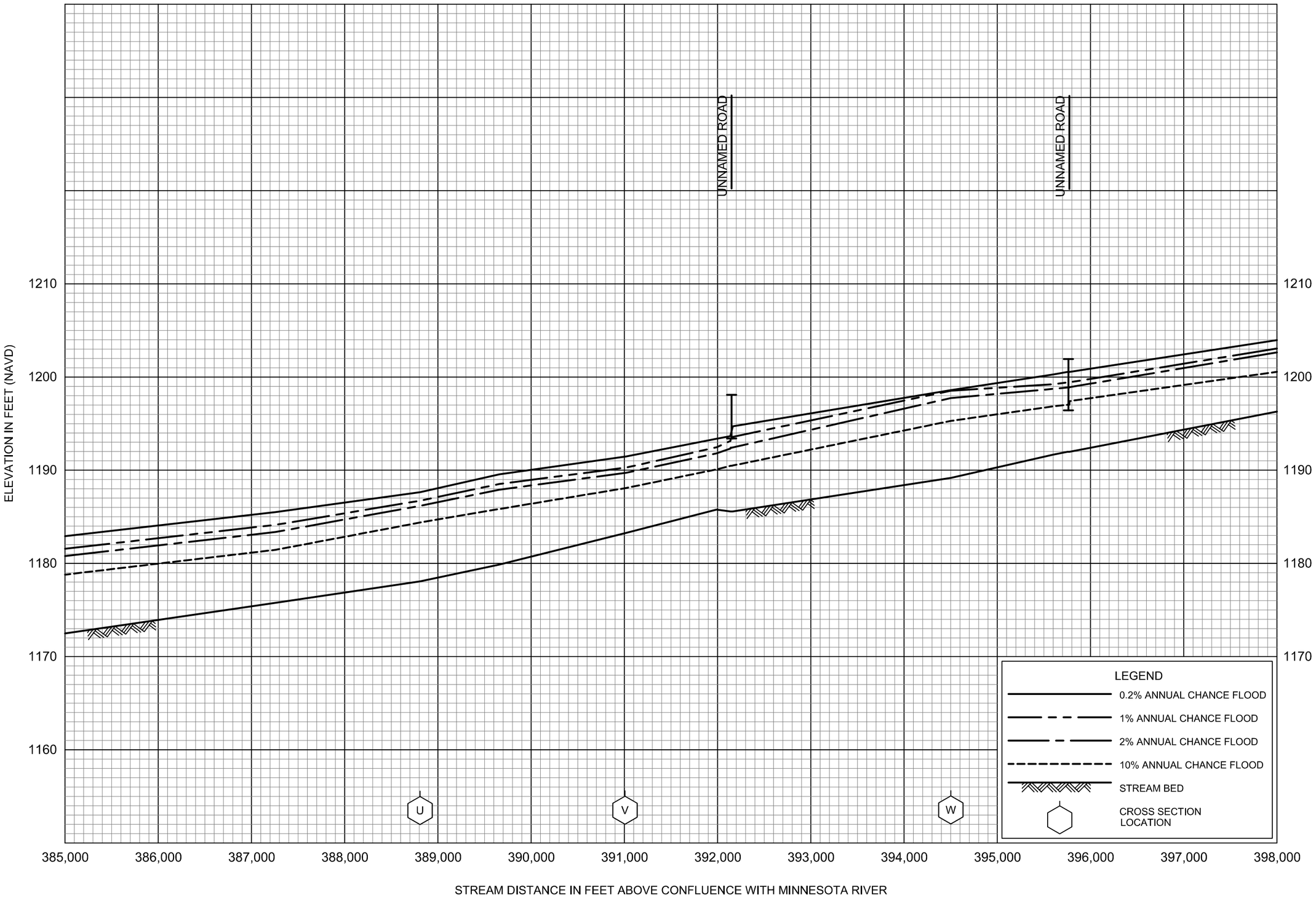

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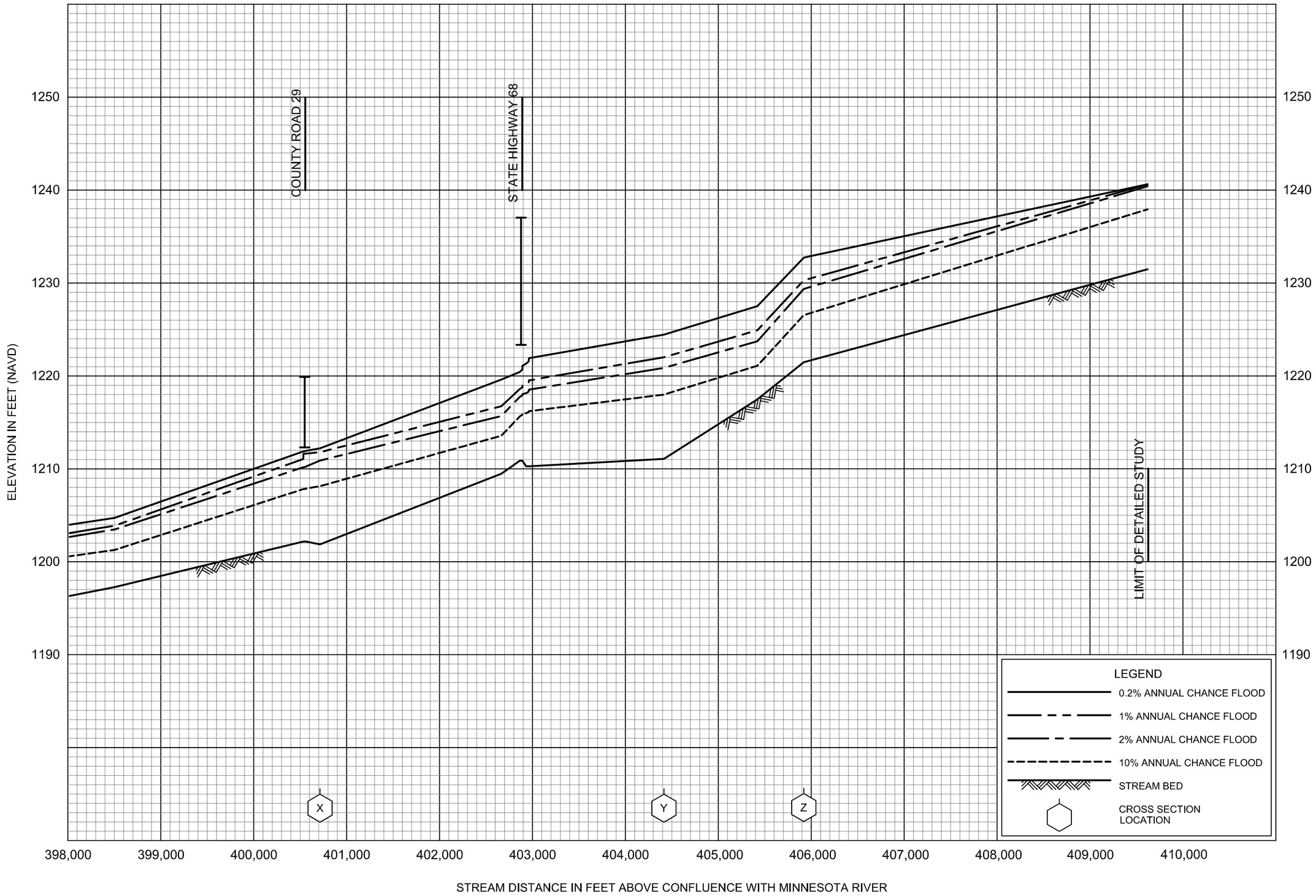

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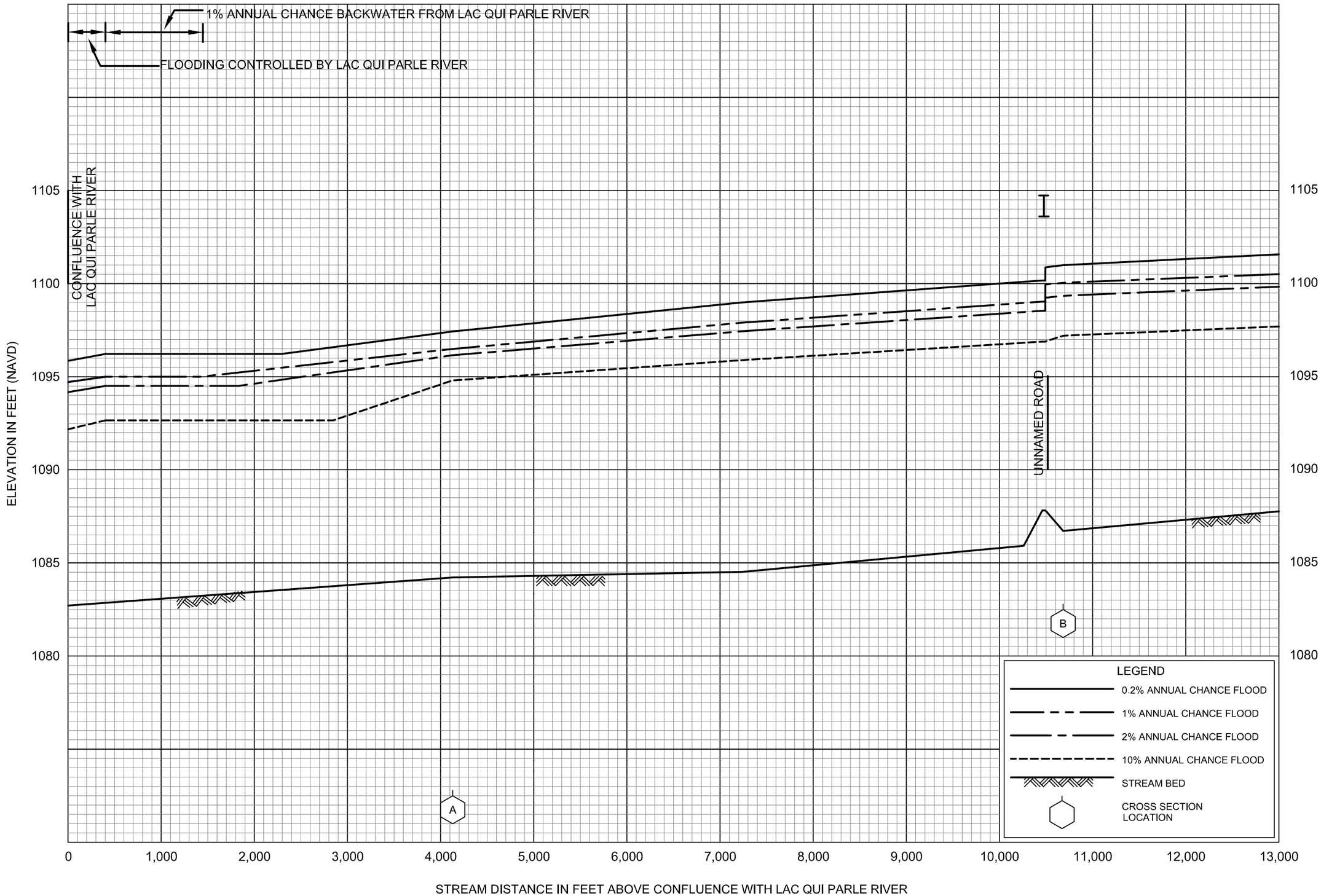

FLOOD PROFILES

LAZARUS CREEK

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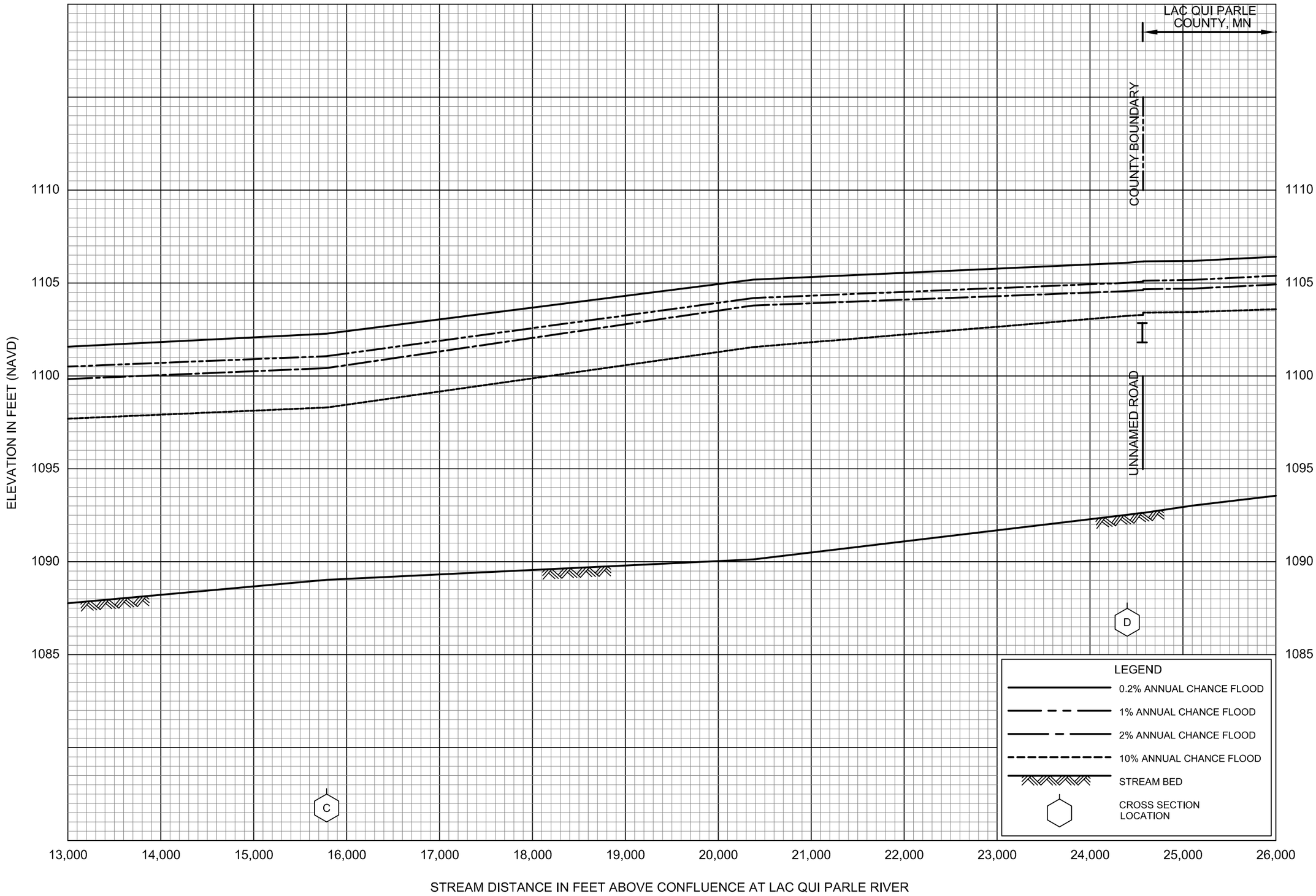

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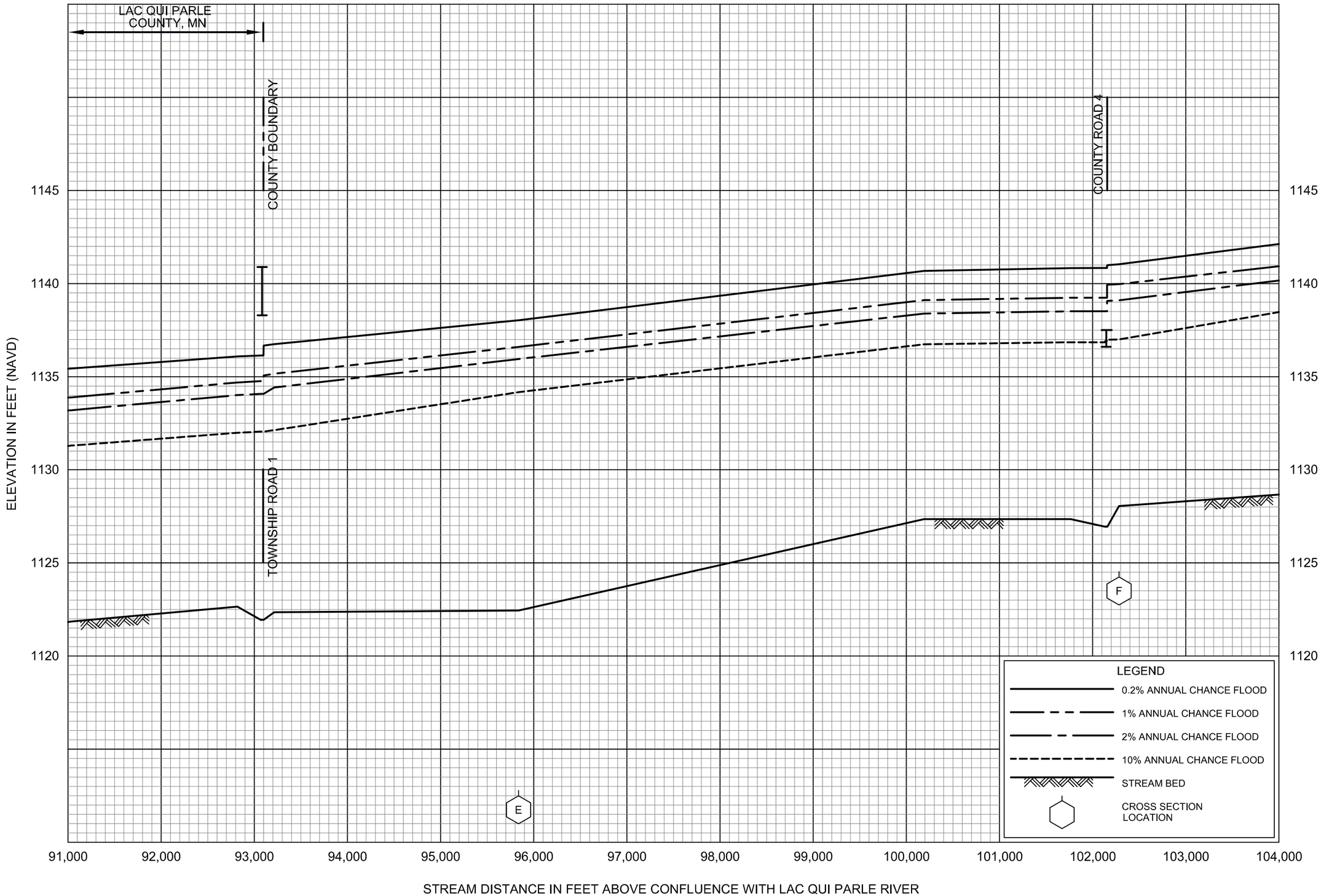

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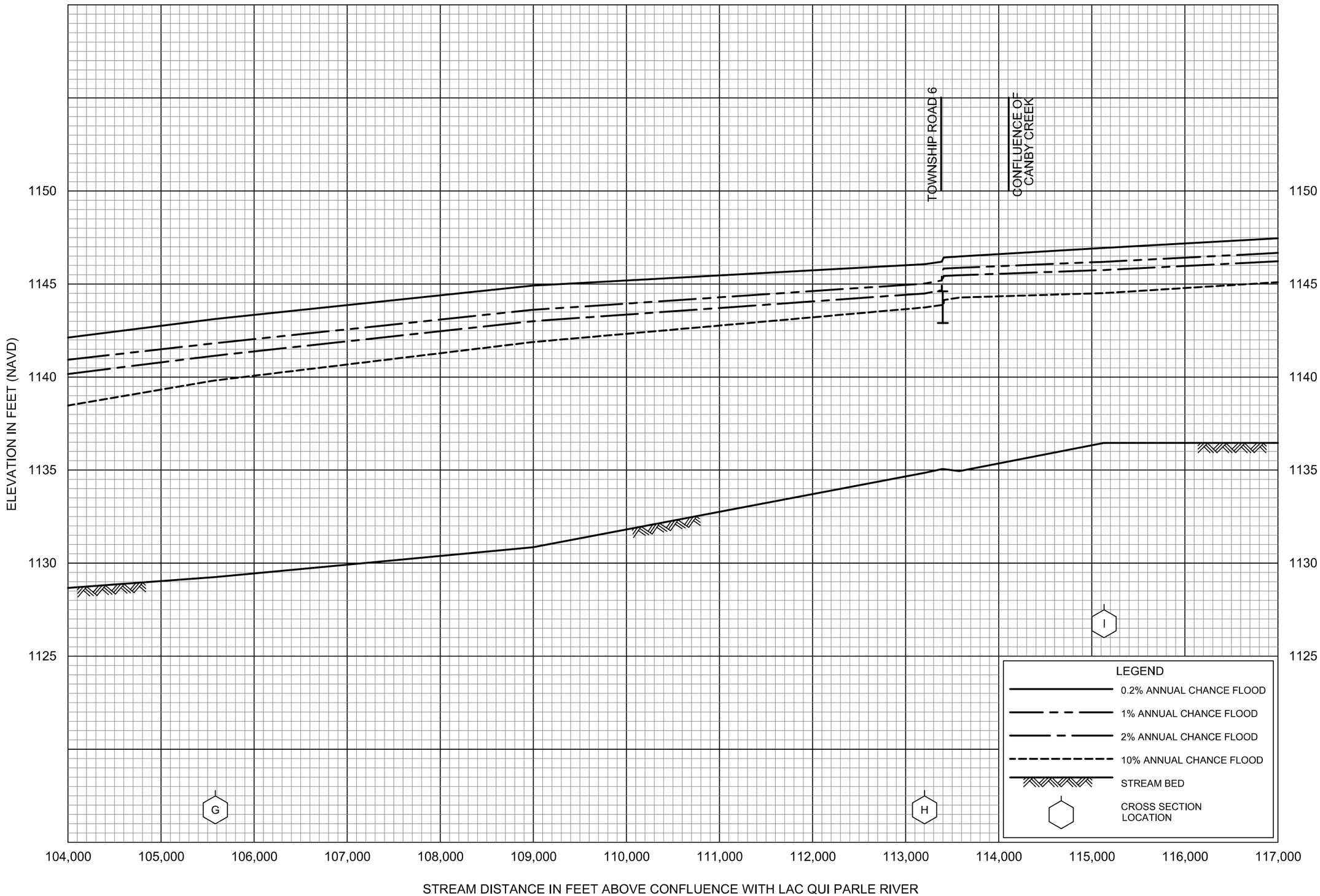

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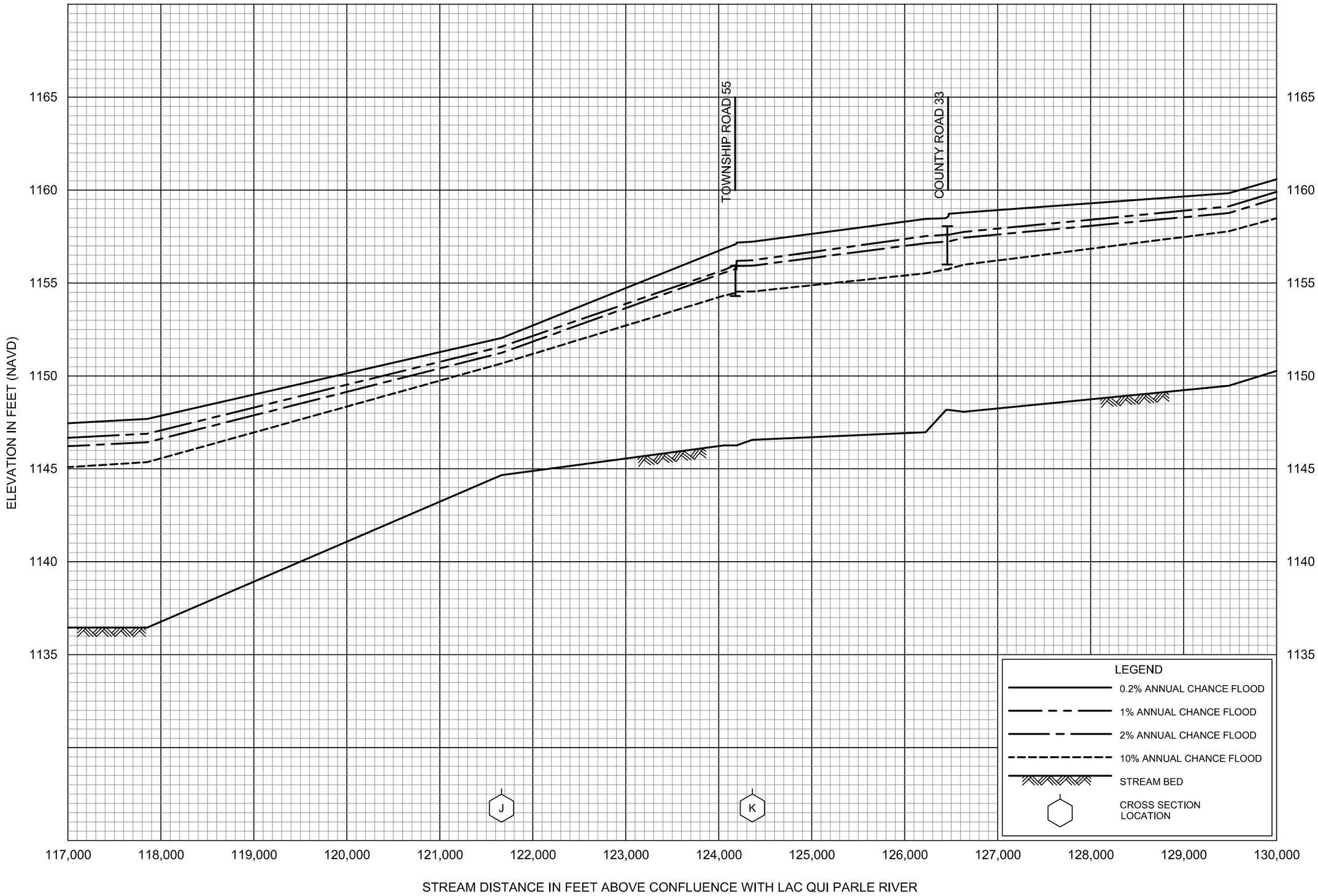

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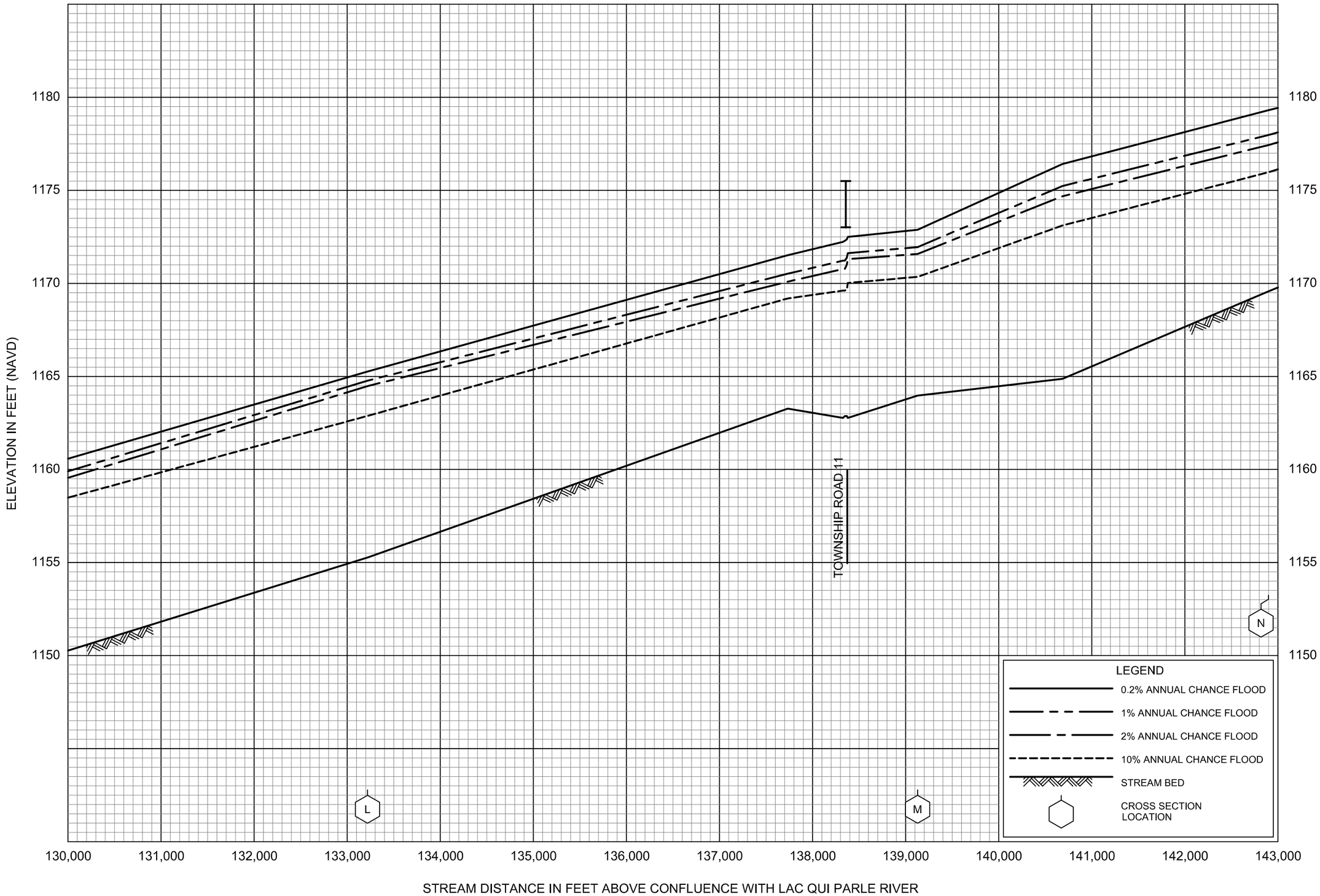

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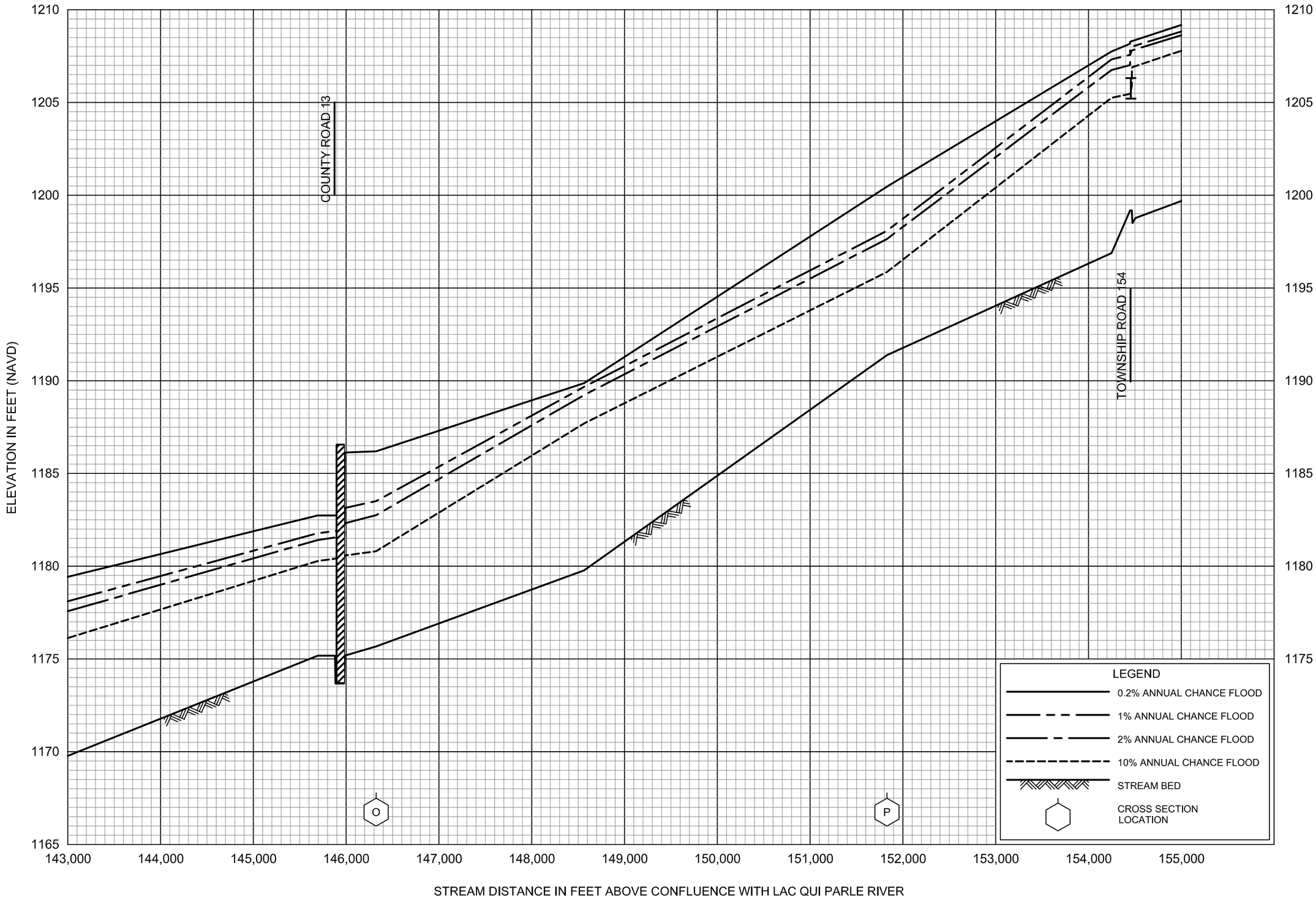

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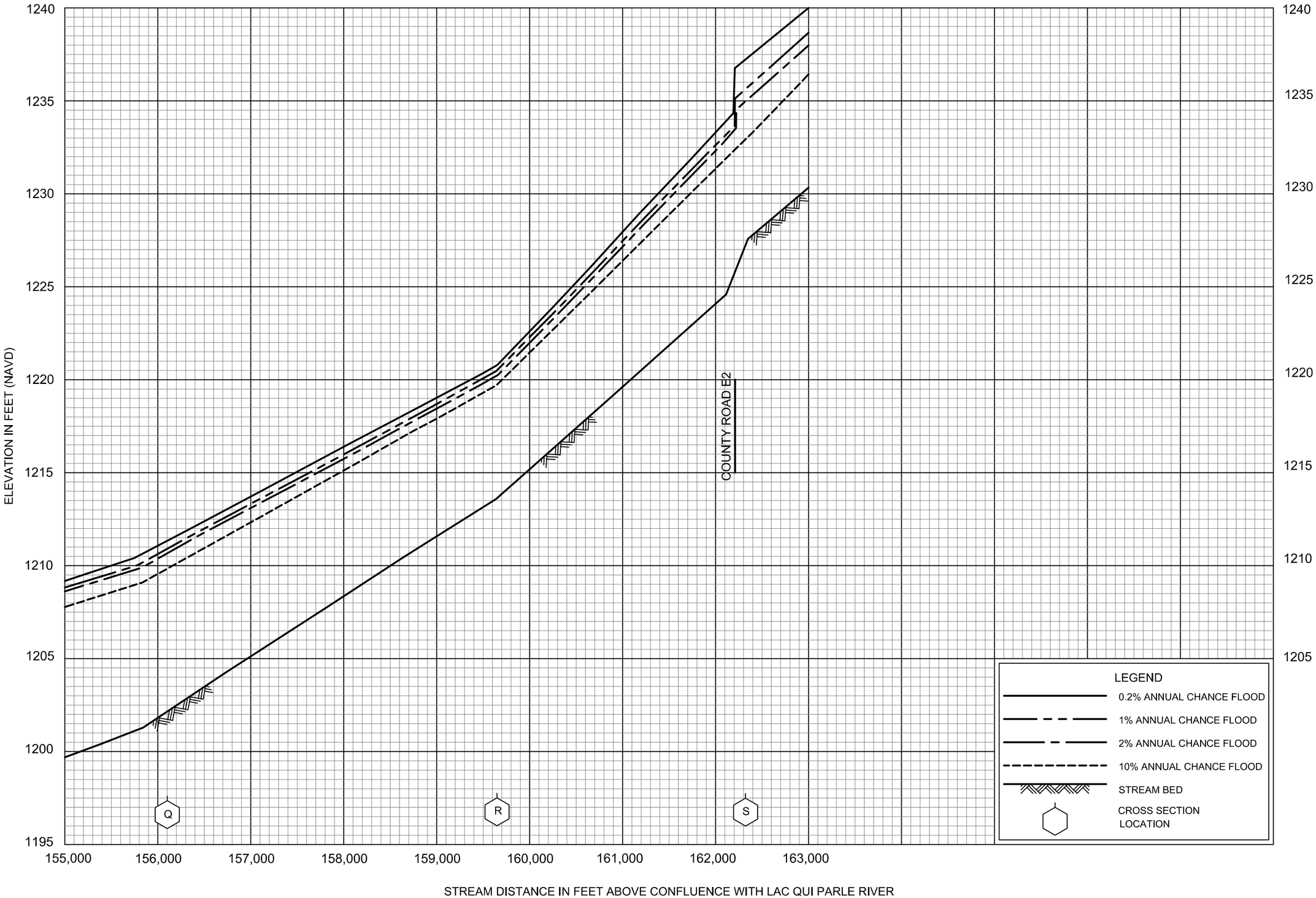

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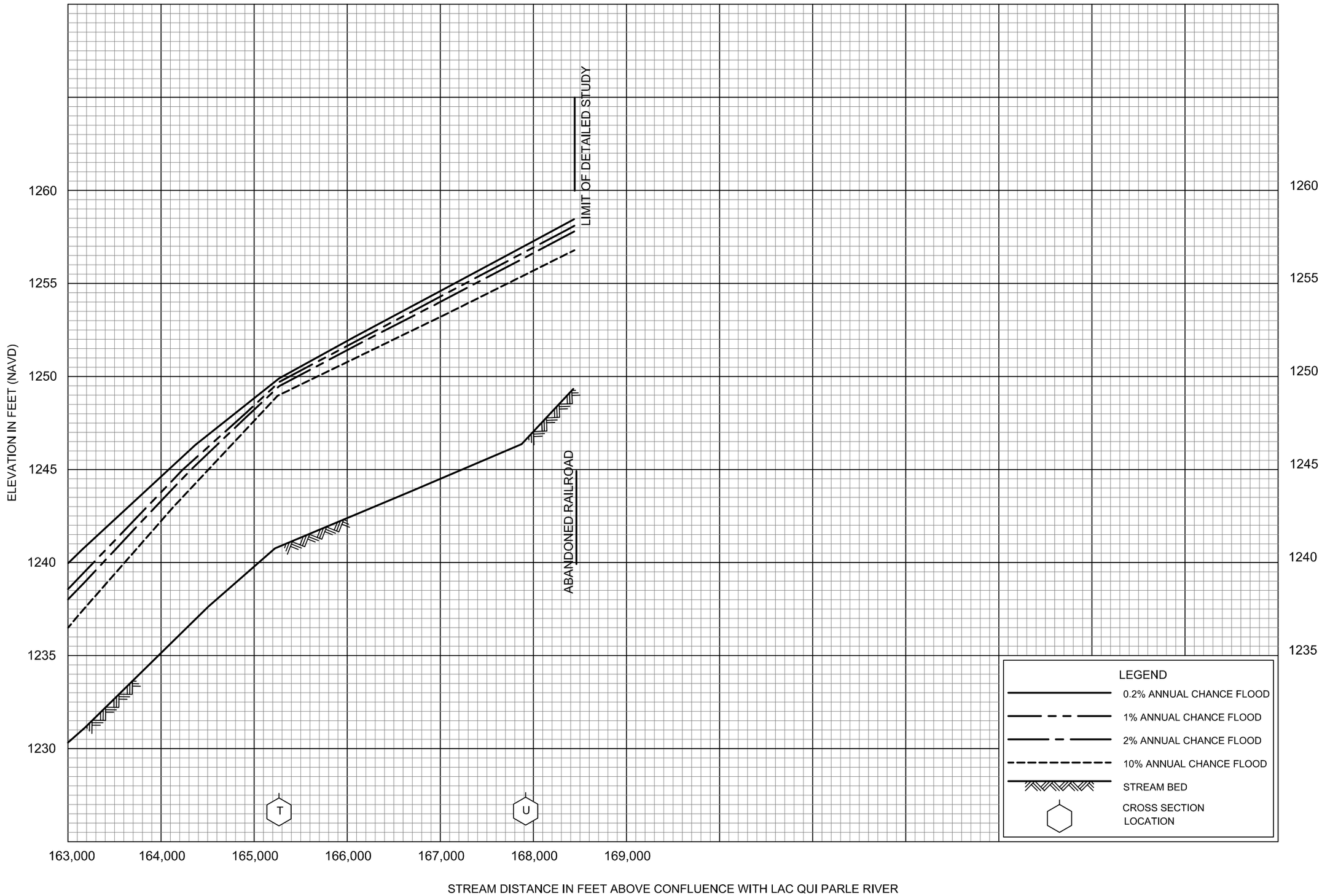

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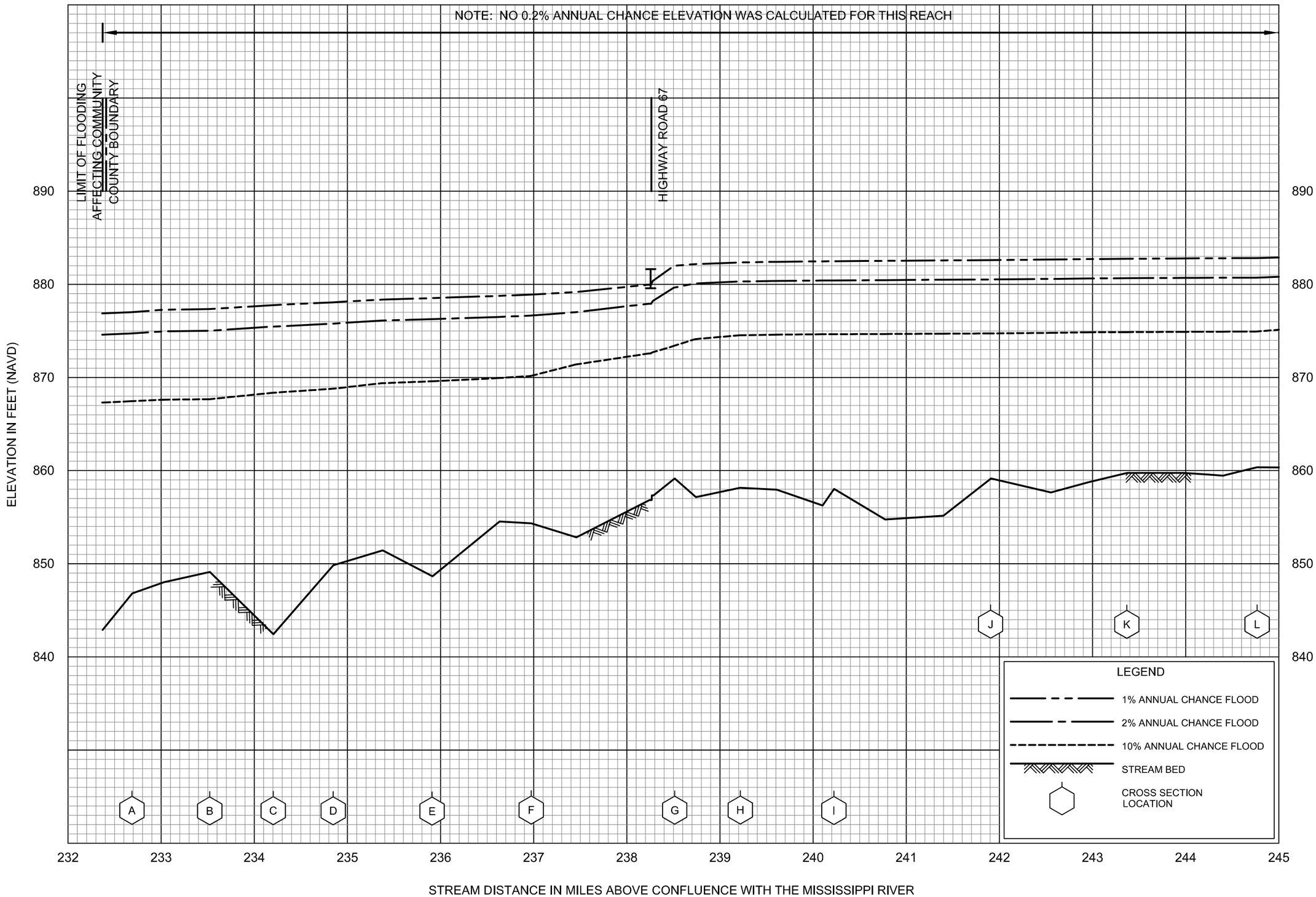

FLOOD PROFILES

MINNESOTA RIVER

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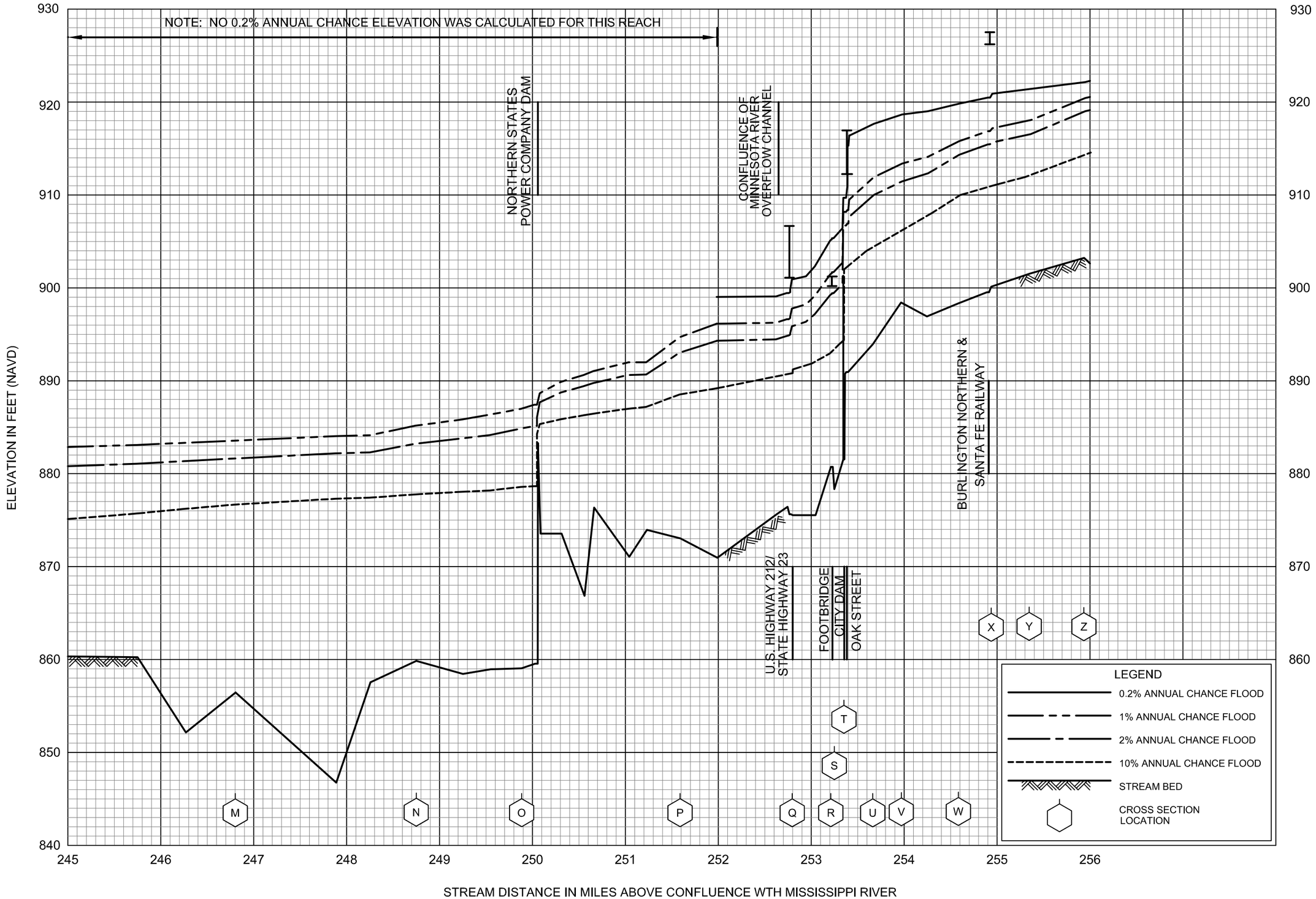

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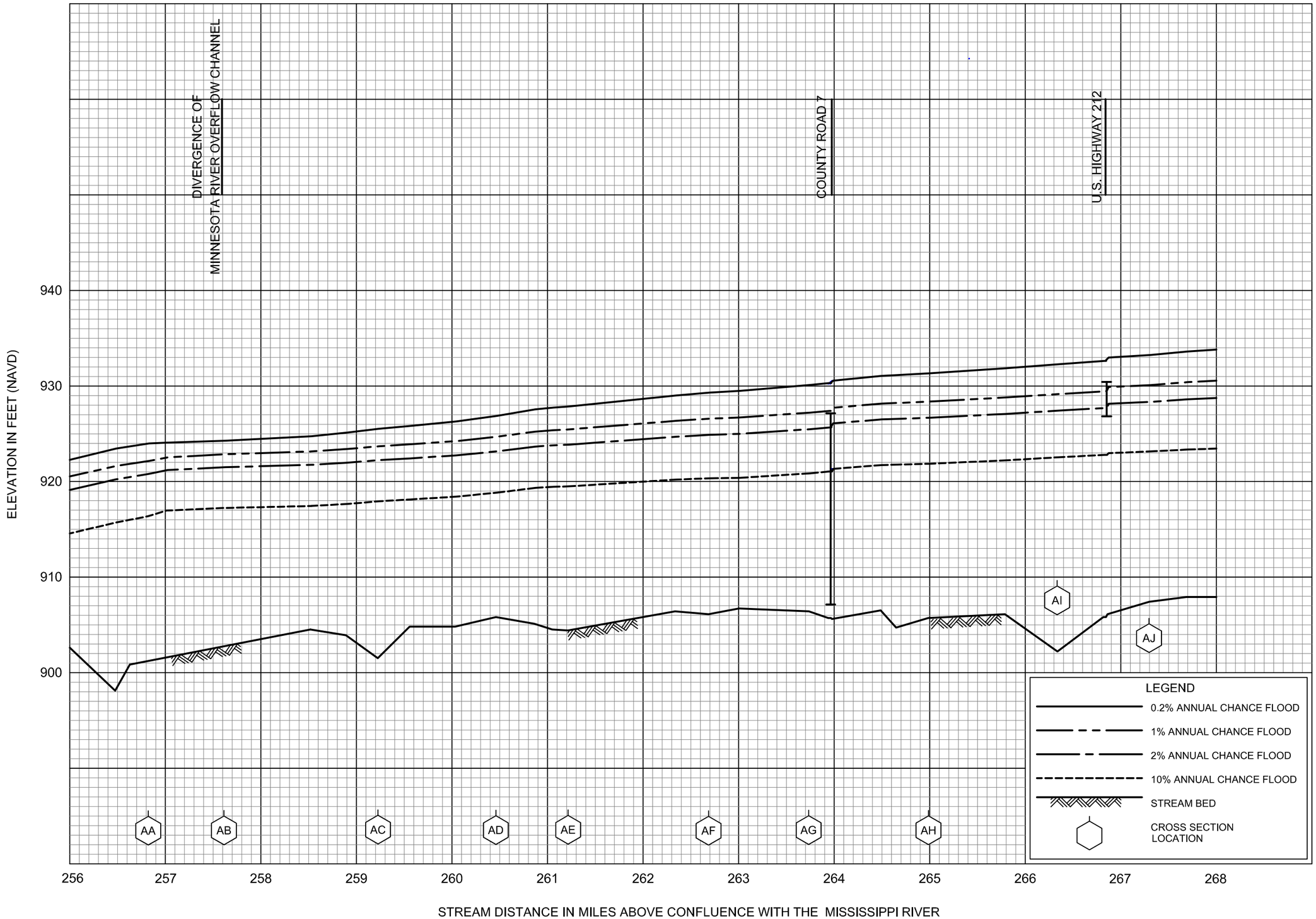

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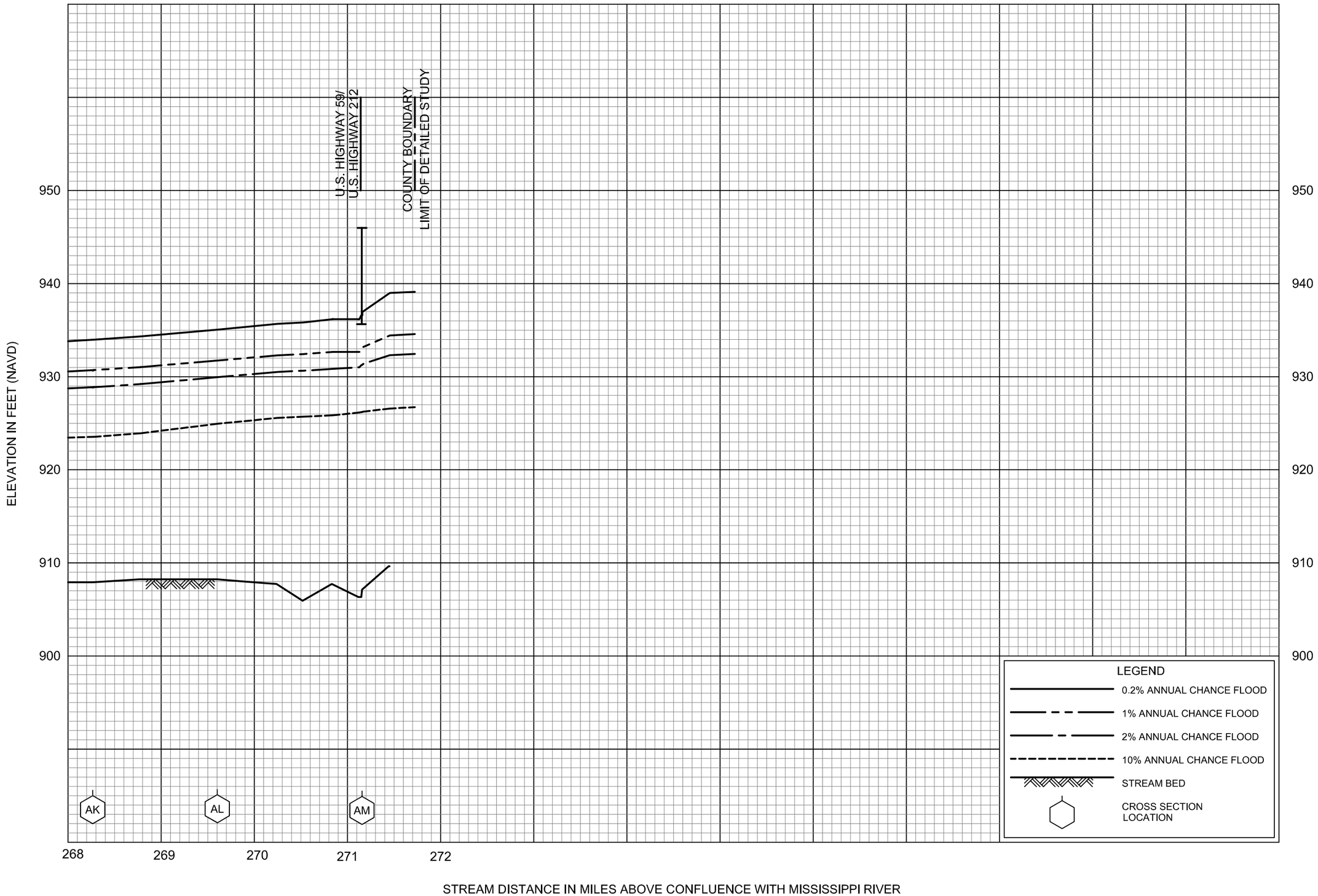

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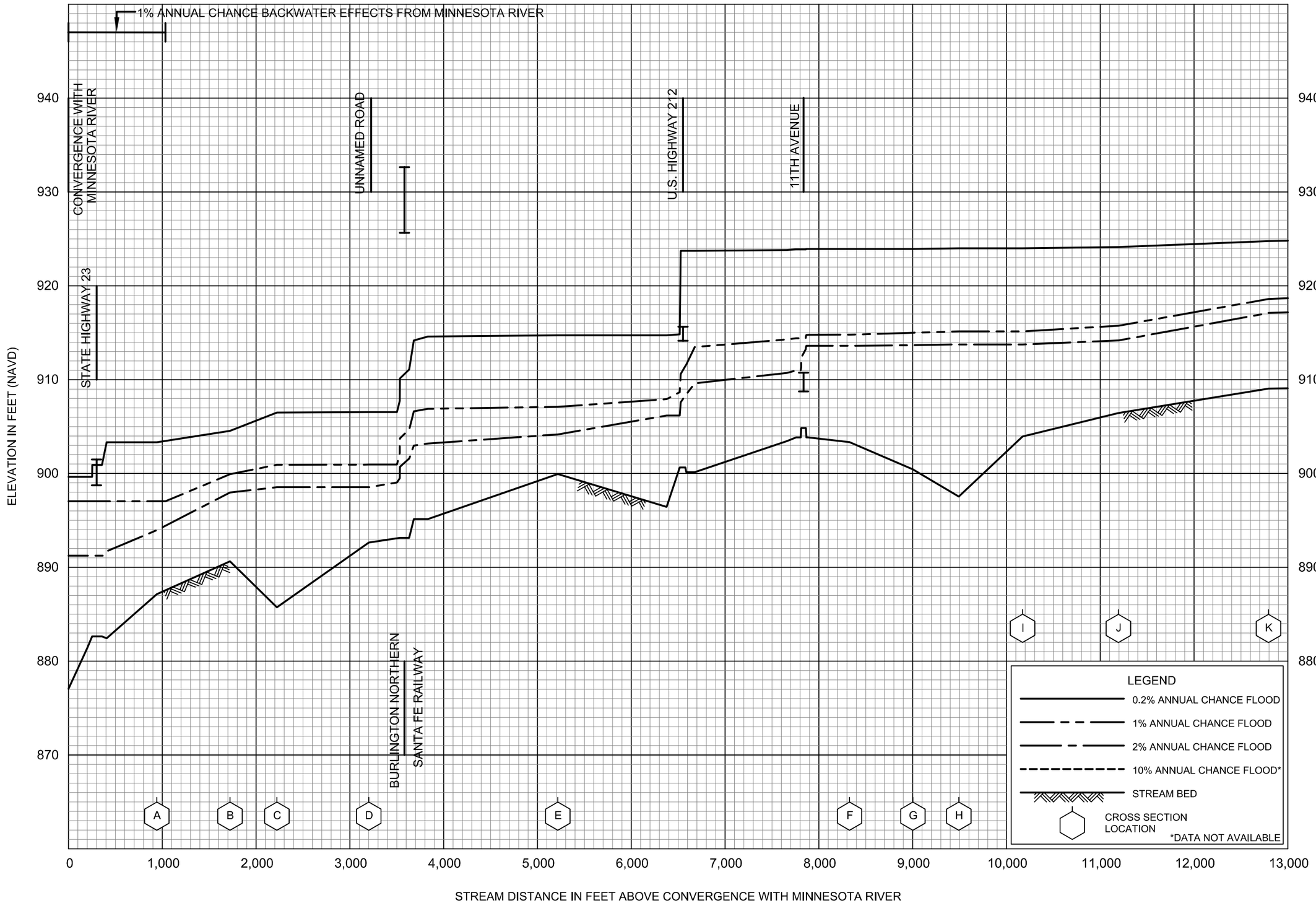

FLOOD PROFILES

MINNESOTA RIVER OVERFLOW CHANNEL

FEDERAL EMERGENCY MANAGEMENT AGENCY

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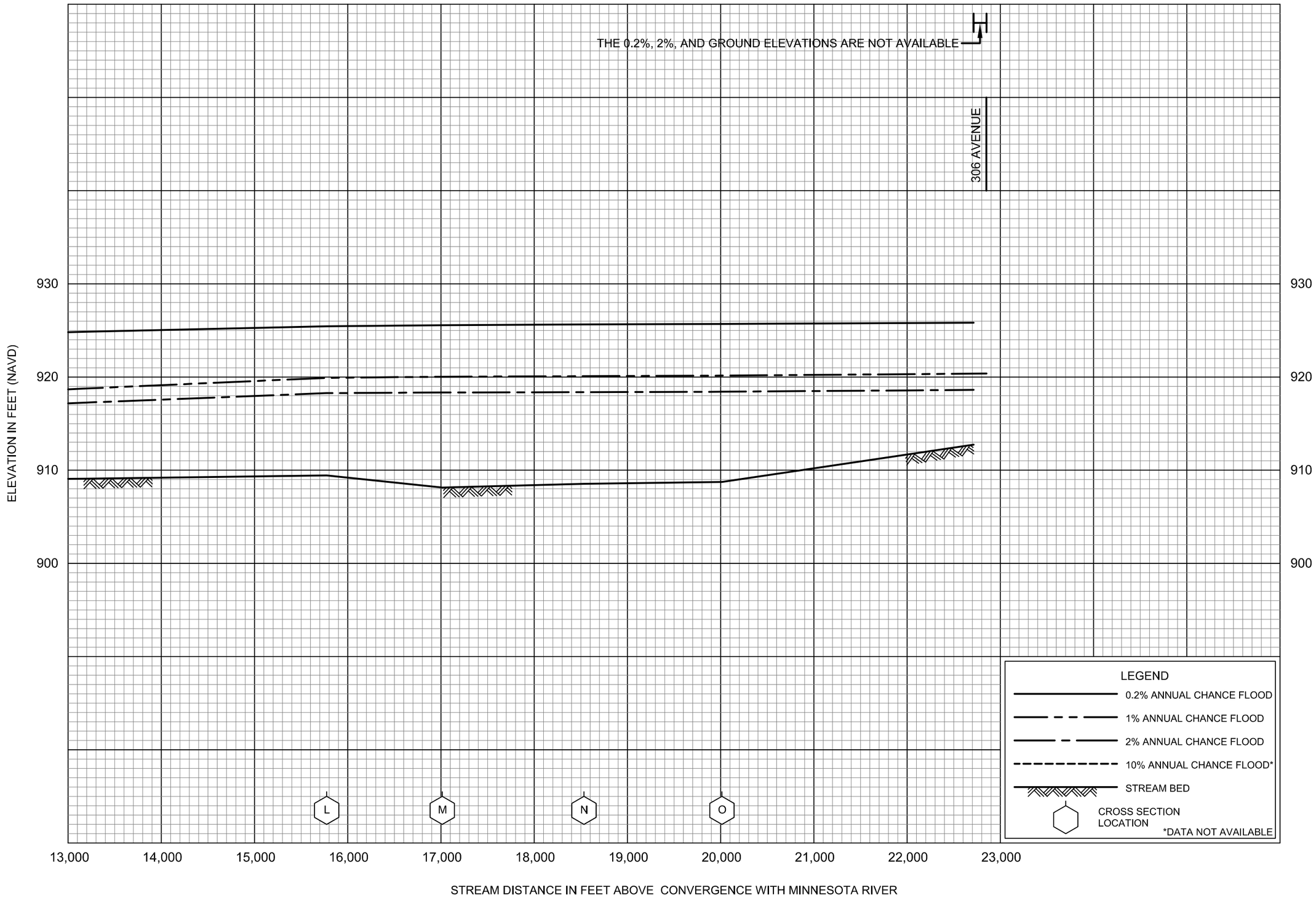

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MINNESOTA RIVER OVERFLOW CHANNEL

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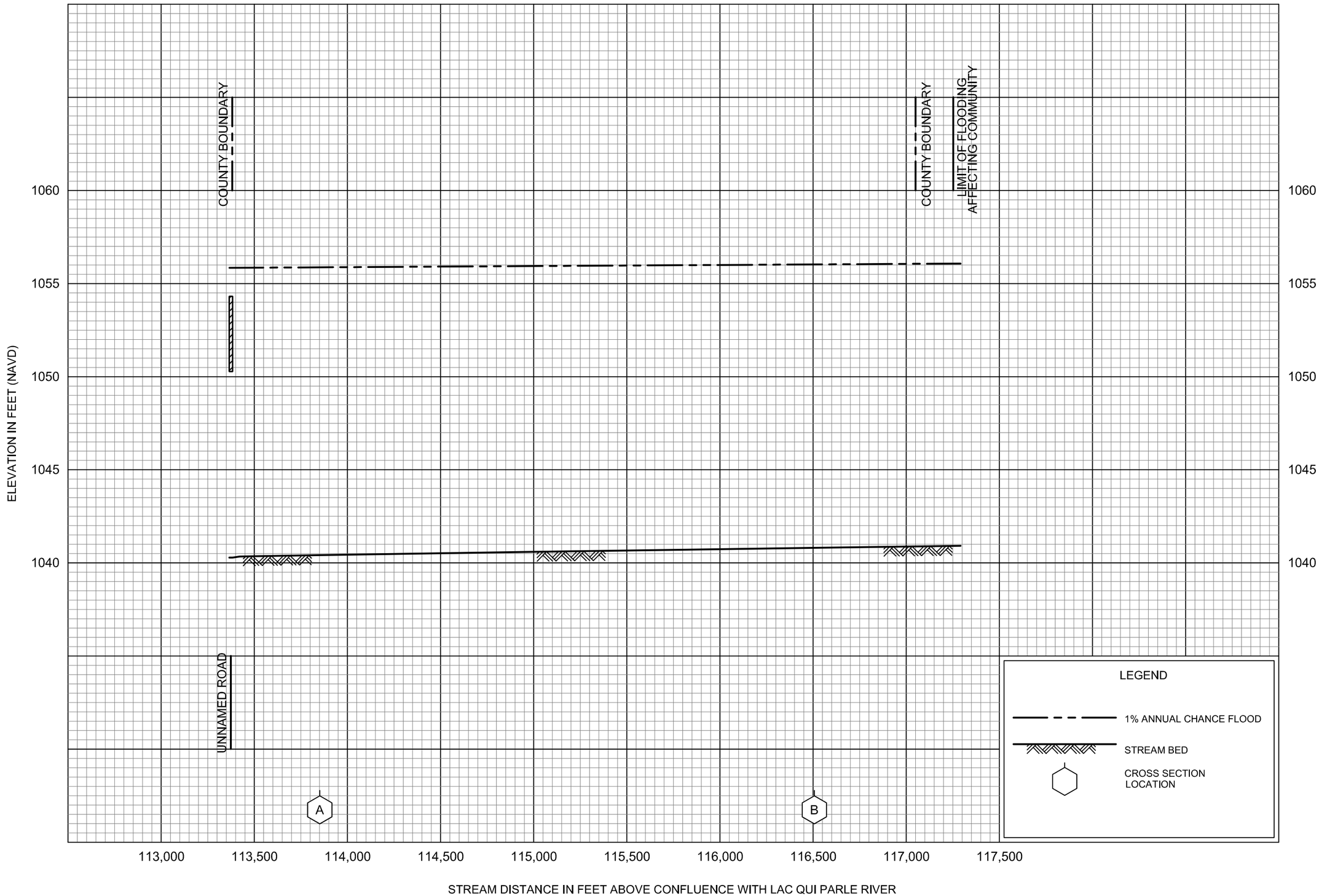
YELLOW MEDICINE COUNTY, MN

AND INCORPORATED AREAS



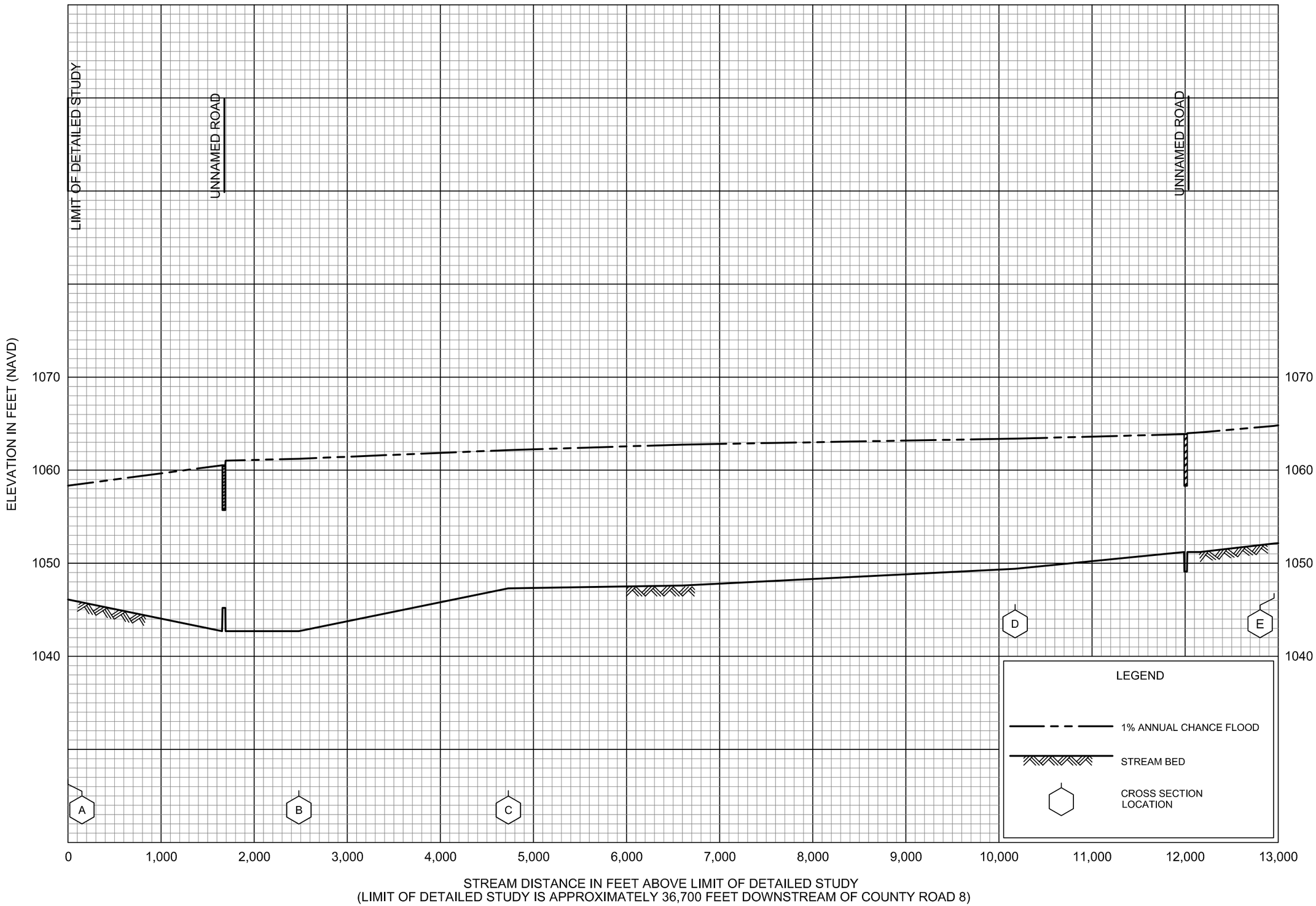
FLOOD PROFILES

TENMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

YELLOW MEDICINE COUNTY, MN

AND INCORPORATED AREAS



FLOOD PROFILES

YELLOW MEDICINE RIVER

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YELLOW MEDICINE COUNTY, MN

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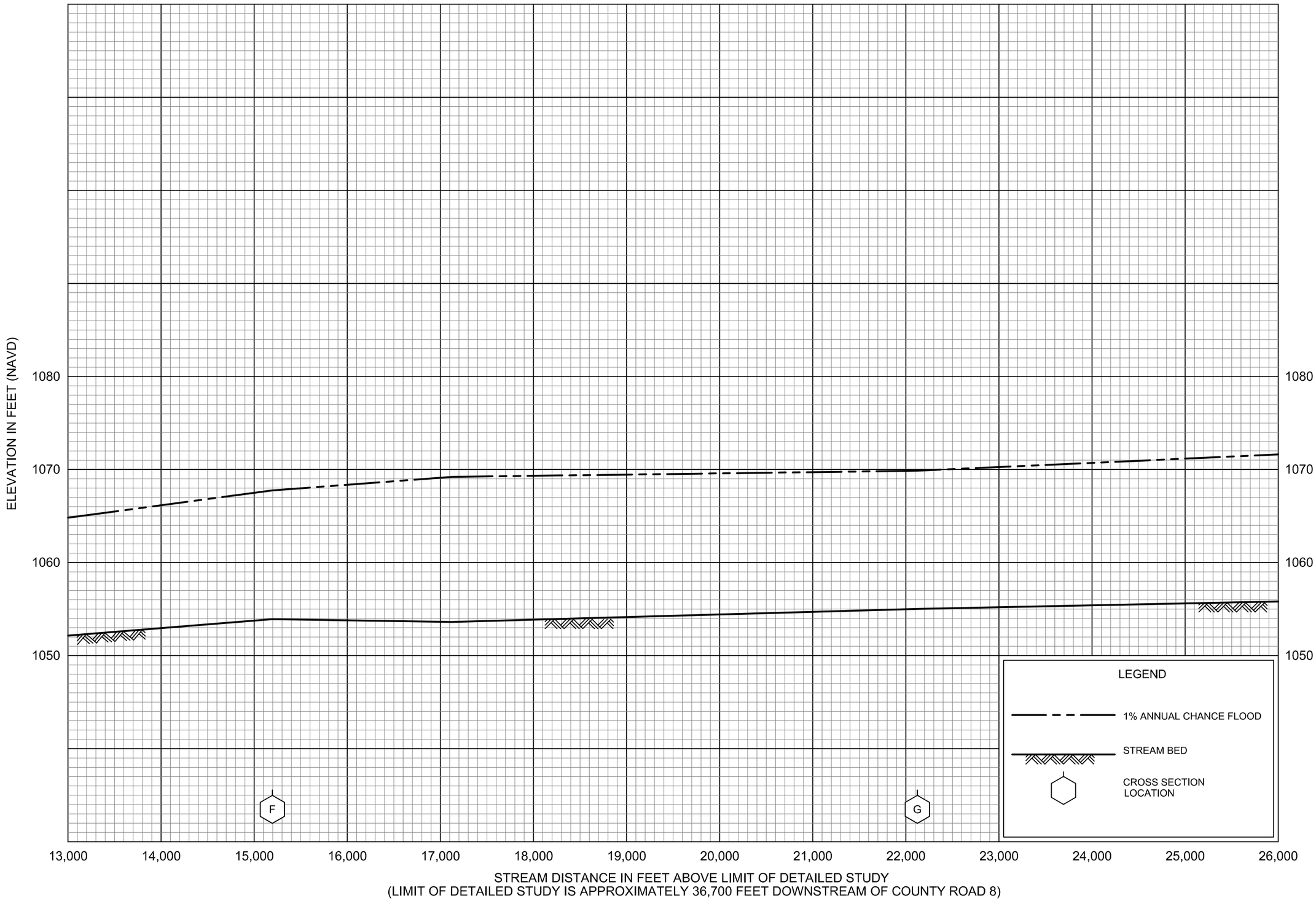

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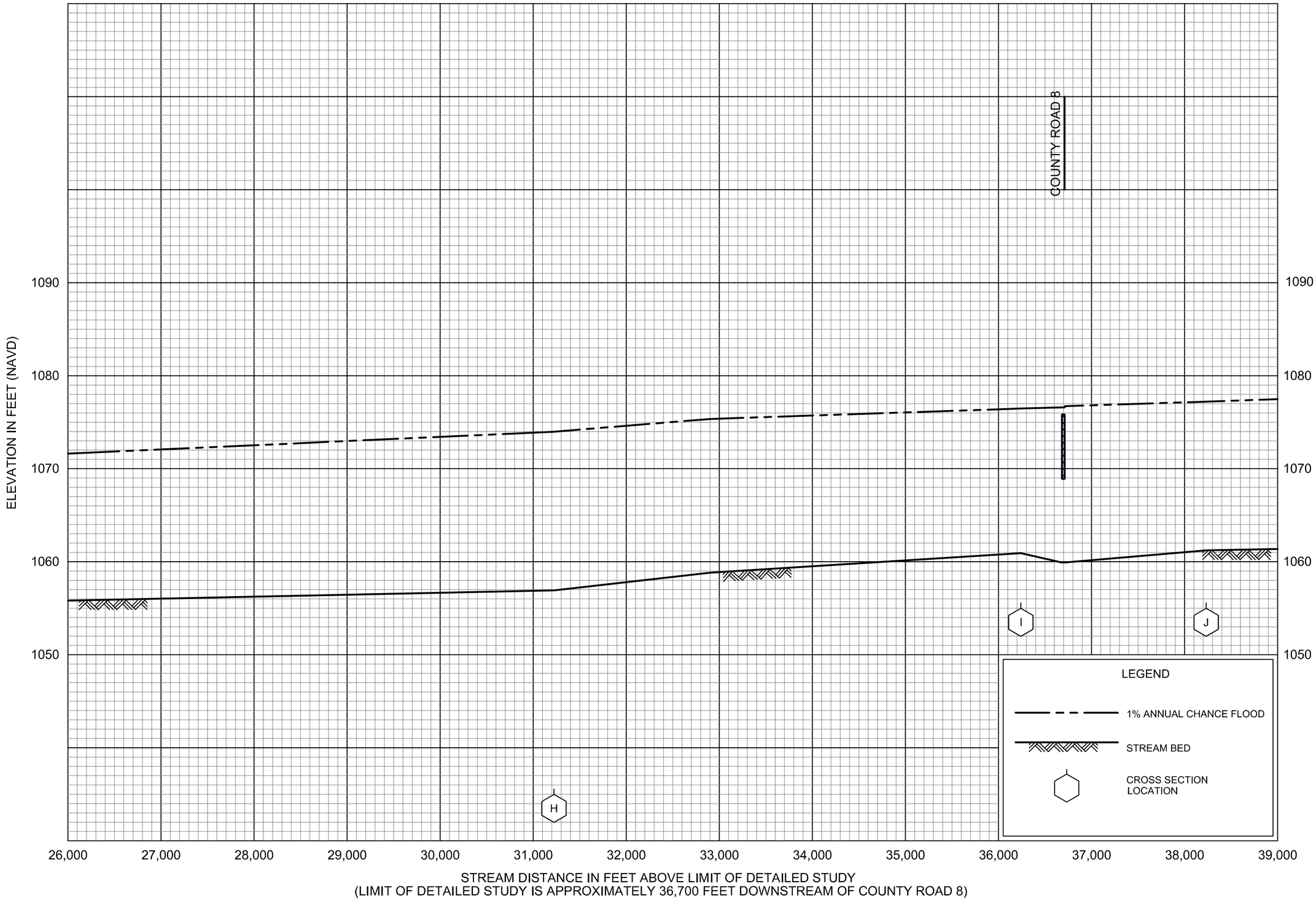

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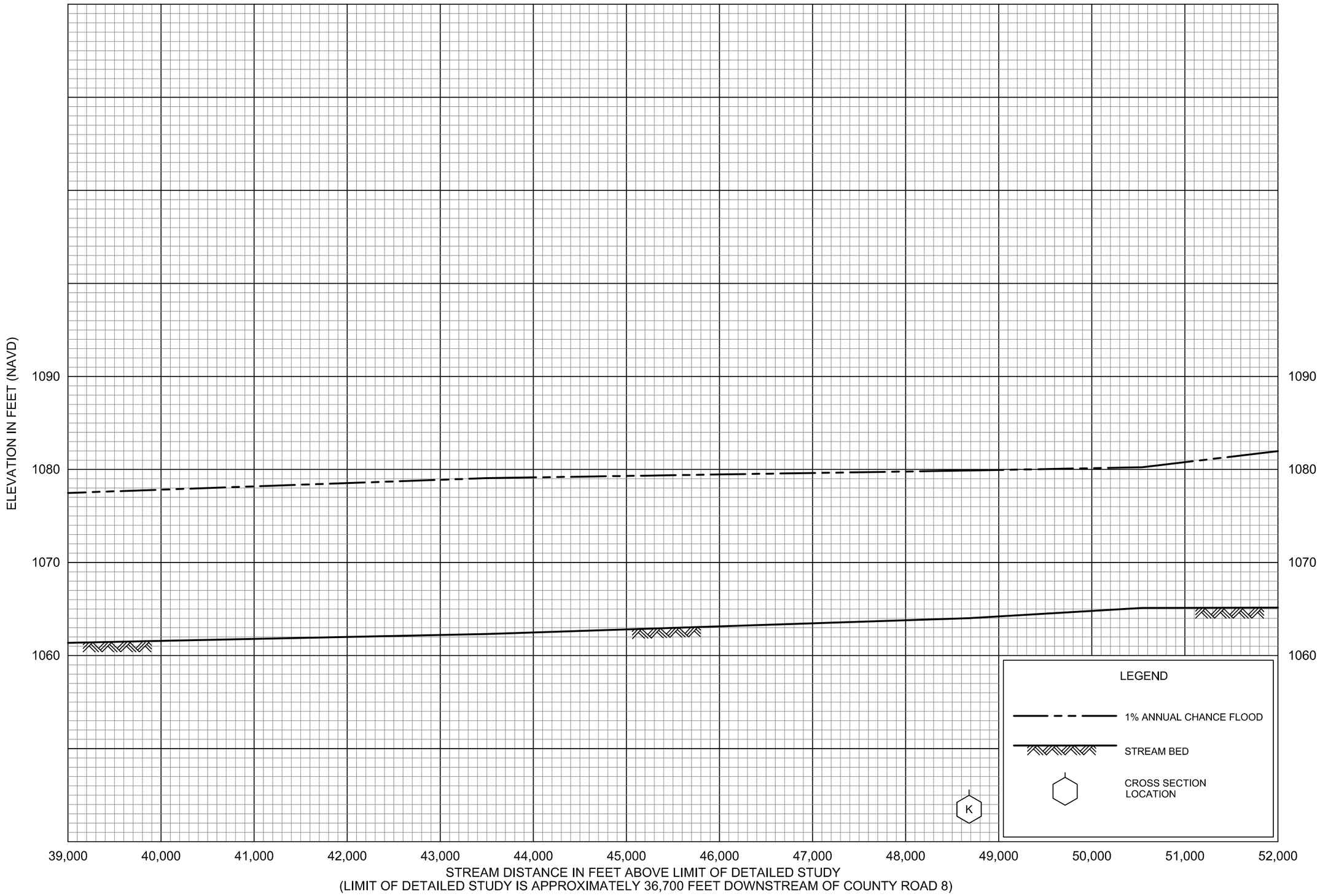

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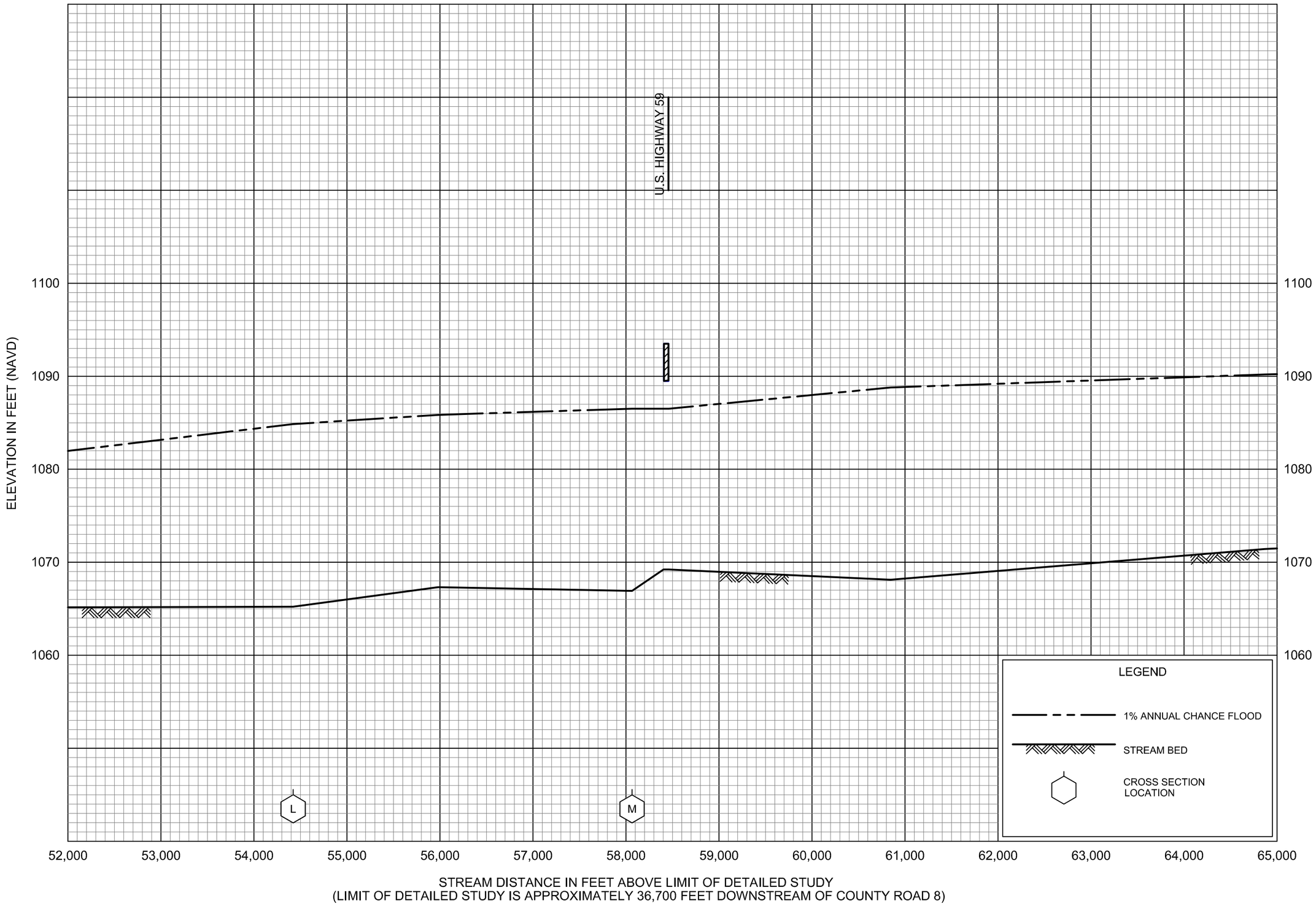

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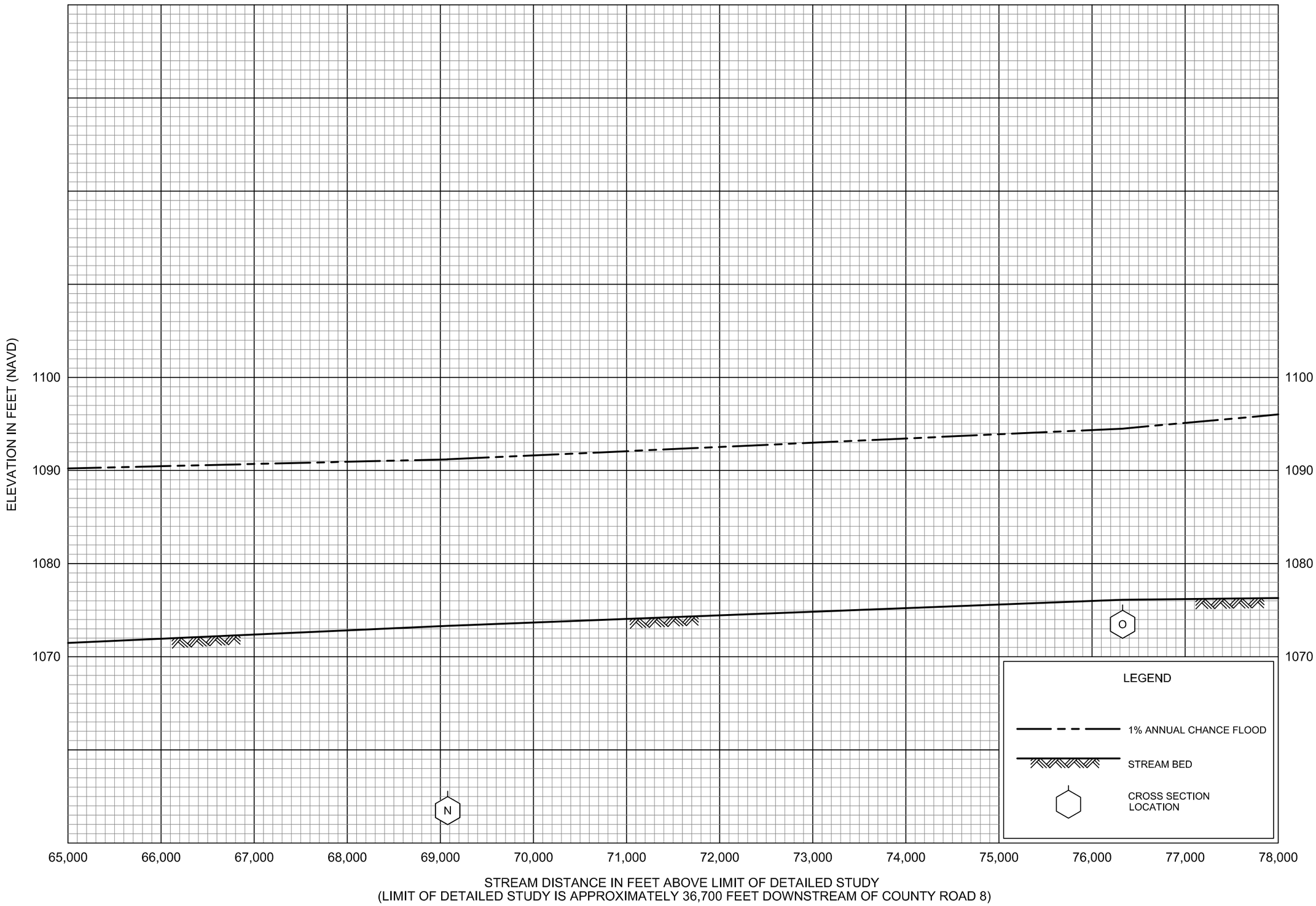

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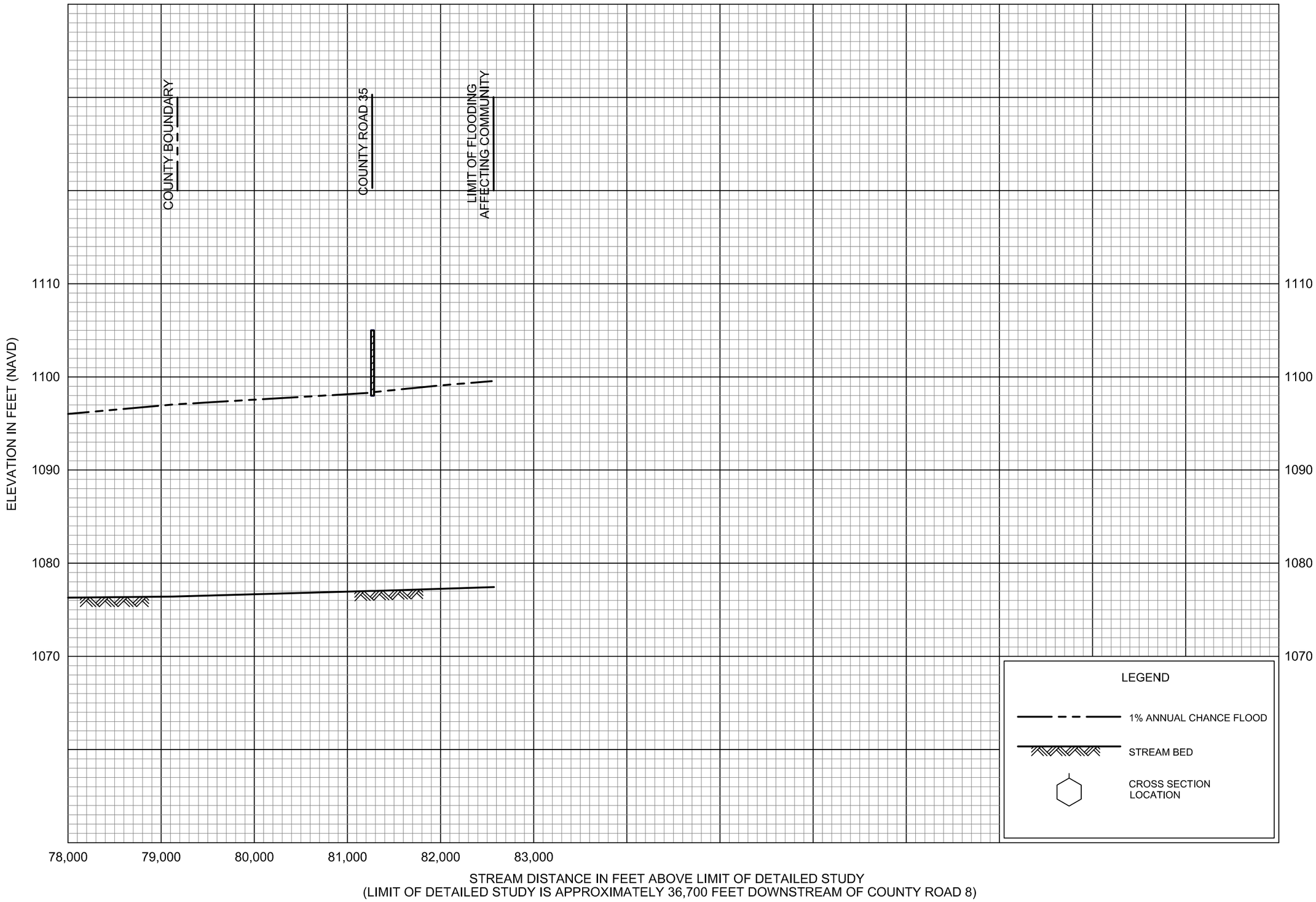

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