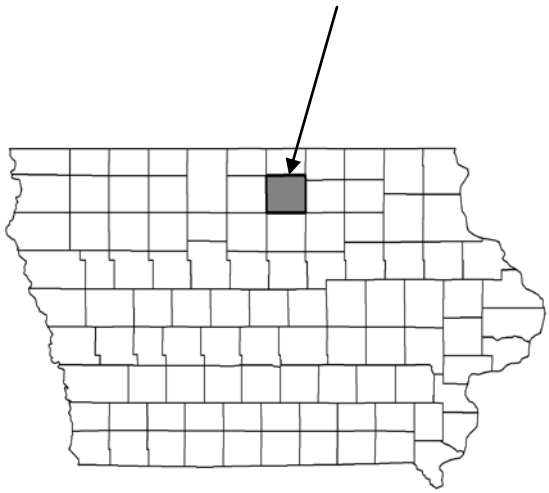
FLOOD INSURANCE STUDY

CERRO GORDO COUNTY
IOWA
AND INCORPORATED AREAS

Community Name	Community Number
Cerro Gordo County (Unincorporated Areas)	190853
Clear Lake, City of	190059
Dougherty, City of	190689
Mason City, City of	190060
*Meservey, City of	190777
Nora Springs, City of	190384
Plymouth, City of	190061
Rock Falls, City of	190351
Rockwell, City of	190352
Swaledale, City of	190809
Thornton, City of	190062
Ventura, City of	190674

* No special flood hazard areas identified.

Cerro Gordo County



Effective
May 16, 2012

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
19033CV000A

NOTICE TO

FLOOD INSURANCE STUDY USERS

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

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

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

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

Initial Countywide FIS Effective Date: May 16, 2012

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CLEAR CREEK	07P – 08P
IDEAL CREEK	09P – 10P
MASON CREEK	11P – 14P
TRIBUTARY M1	15P
TRIBUTARY M1-1	16P
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PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map Panels

FLOOD INSURANCE STUDY

CERRO GORDO COUNTY AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and supersedes the FIS reports, Flood Insurance Rate Maps (FIRMs), Flood Boundary and Floodway Maps in the geographic area of Cerro Gordo County, Iowa including: Cities of Clear Lake, Dougherty, Mason City, Meservey, Nora Springs, Plymouth, Rock Falls, Rockwell, Swaledale, Thornton and Ventura, and Cerro Gordo Unincorporated Areas (hereinafter referred to collectively as Cerro Gordo County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates. This information will also be used by Cerro Gordo County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

The City of Meservey is a community with no special flood hazard areas identified.

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

1.2 Authority and Acknowledgments

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

They hydrologic and hydraulic analyses for this study were performed by Fuller, Mossbarger, Scott and May Engineers, Inc. (FMSM) (currently Stantec Consulting Services Inc.) (Stantec) for the Federal Emergency Management Agency (FEMA) under Contract No. EMK-2001-CO-2018, Task Order No. HST-0040. This work was completed in November 2009.

Information pertaining to the authority and acknowledgements for each of the previously effective FIS reports for communities within Cerro Gordo County was compiled for this FIS report and is shown below.

City of Clear Lake The previously effective FIS for the City of Clear Lake is dated August, 1987. The hydrologic and hydraulic analyses for the study were performed by DeWild, Grant, Reckert and Associates Company, Limited, for the Federal

Insurance Administration (FIA) under Contract No. EMW-84-R-1625. This study was completed in March 1986 (Reference 1).

City of Mason City

The previously effective FIS for the City of Mason City is dated March 16, 1995. Detailed study streams including Calmus, Ideal and Mason Creeks and Mason Tributary M1 and Tributary M1-1 were originally studied in a FIS published in 1980 for the City of Mason. The 1980 detailed study was performed by Stanley Consultants, Inc., for the FIA, under Contract No. H-4005. This study was completed in March 1978. The hydrologic and hydraulic analyses of Willow Creek and Cheslea Creek have been revised in the 1995 FIS. The revision was performed by the U.S. Army Corps of Engineers (USACE), Rock Island District under Interagency Agreement No. EMW 92-E-3839, Project Order No. 4. The work was completed in May 1993 (Reference 2).

Countywide Study

New detailed hydrologic and hydraulic study has been performed by FMSM/Stantec for four streams in Cerro Gordo County including Cheslea Creek, Clear Creek, Willows Creek and Winnebago River under Contract No. EMK-2001-CO-2018. Floodplain and floodway have been delineated using two-foot contours based on the engineering results. This work was completed in October 2009 (Reference 3 and 4).

New approximate hydrologic and hydraulic analyses in Cerro Gordo County were performed for this study by Black and Veatch for FEMA under Contract No. EMK-2001-CO-2019. This study was completed in 2007 using the Nebraska Flood Area Calculation tool (N-FACT) (Reference 5) and methodology described in Water-Resources Investigation Report 00-4233 (WRIR 00-4233). Methodology is documented in "Hydrologic and Hydraulic Analyses Performed Using Nebraska Department of Natural Resources N-FACT" by Black & Vetch dated September 2007 (Reference 6). All zone A floodplain resulting from this study was delineated by Black and Veatch using 10-foot contour data.

For the Cities of Dougherty, Meservey, Nora Springs, Plymouth, Rock Falls, Rockwell, Swaledale, Thornton and Ventura and Cerro Gordo, Unincorporated Areas, an FIS report has not been previously published. The previously effective FIRMs for those areas originated from Flood Hazard Boundary Maps (FHBMs) that were converted by letters to FIRMs.

Redelineation of the previously effective flood hazard information for this FIS report, correction to the North American Vertical Datum of 1988, and conversion of the unincorporated and incorporated areas of Cerro Gordo County into the countywide

format was performed by Stantec for the FEMA under Contract No. EMK-2001-CO-2018, Task Order No. HST-0040.

The basemap used in this countywide DFIRM production includes political boundary map and road centerline map provided by Cerro Gordo County GIS department, USGS 30-Meter National Elevation Data (NED) Digital Elevation Models (DEMs), LiDAR data captured in November 2008 with a contour interval of 2 feet, 2008 NAIP orthophotography provided by the United States Department of Agriculture - FSA Aerial Photography Field Office. The coordinate system used for the production of this DFIRM is Iowa State Plane North 1401 Feet, North American Datum 1983, Lambert Conformal Conic Projection. Differences in the datum and projection system used in the production of DFIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on this DFIRM.

1.3 Coordination

The purpose of an initial CCO meeting is to discuss the scope of proposed FIS efforts in the community.

The results of the study were reviewed at the final CCO meeting held on July 7, 2010, and attended by representatives of FEMA, Cerro Gordo County, affected communities, and the study contractor. All problems raised at that meeting have been addressed.

The dates of the initial and final CCO meetings held for the previous FIS reports covering the incorporated and unincorporated areas of Cerro Gordo County, Iowa are shown in Table 1.

TABLE 1. CCO MEETING DATES FOR PRE-COUNTYWIDE FIS

COMMUNITY NAME	INITIAL CCO DATE	FINAL CCO DATE
Clear Lake, City of	April 16,1984	September 23,1986
Mason City, City of	April 1976	May 1993

Source: References 1-2

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Cerro Gordo County, Iowa.

For this FIS report, data from each of the previously effective FIS reports and FIRMs were compiled into FEMA's countywide format. Analyses described herein refer collectively to the new approximate and detailed analyses, leverage information, and previous study efforts detailed in References 1 through 6, unless otherwise noted.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, areas of projected development, and proposed construction. Approximate methods of analysis were used to study those areas having low development potential and/or minimal flood hazards as identified at the initial CCO meetings identified

in Table 1. The scope and methods of study were proposed to and agreed upon by FEMA and the County of Cerro Gordo. Flooding sources studied by detailed methods are summarized in Table 2.

TABLE 2. LIMITS OF DETAILED STUDY

STREAM	STUDY LENGTH (MILES)	LIMITS OF DETAILED STUDY	STUDY SOURCE
Calmus Creek	2.7	From mouth to approximately 1 mile upstream of Chicago and Northwestern Railroad	Previous FIS
Cheslea Creek	1.0	From mouth to Chicago Milwaukee St Paul And Pacific Railroad	New Study
Cheslea Creek	1.5	From Chicago Milwaukee St Paul And Pacific Railroad to approximately 500 feet upstream of MC Kinley Avenue	Previous FIS
Clear Creek	1.4	From mouth to Main Avenue	New Study
Clear Creek	2.5	From Main Avenue to outlet At Clear Lake	Previous FIS
Ideal Creek	2.7	From mouth to approximately 0.7 Mile upstream of 12th Street	Previous FIS
Mason Creek	4.3	From mouth to approximately 700 feet upstream of Chicago And Northwestern Railroad	Previous FIS
Tributary M1	0.6	From Mouth to approximately 500 feet downstream of Fair Meadow	Previous FIS
Tributary M1-1	0.4	From mouth to approximately 1,800 feet upstream of Mouth	Previous FIS
Willow Creek	8	From mouth to State Highway 122.	Previous FIS
Willow Creek	8.3	From State Highway 122 to a driveway approximately 700 feet downstream of 7th Avenue	New Study
Willow Creek	0.5	From a driveway that is approximately 700 feet downstream of 7th Avenue to approximately 800 feet upstream of 20th Street	Previous FIS
Winnebago River	5.7	From Chicago Milwaukee St Paul And Pacific Railroad to approximately 1.6 Mile upstream of 13th Street	New Study

Source: Reference 1-4

Flooding resources studied by approximate methods include Ackley, Bailey, Beaver, Beaverdam, Beemis, Blair, Boylan, Calmus, Cheslea, Clear, Coldwater, East Branch Beaverdam, Flay, Galls, Ideal, Lillibridge, Little Beaver, Little Lime, Mason, Plymouth, Rapid Rock and Rock Falls, Spring, West Branch Beaverdam, Wharam, and Willow Creeks and Shell Rock River, West Fork Cedar River and Winnebago River.

This countywide FIS also incorporated the determination of letters issued by FEMA resulting in map changes (Letters of Map Change, or LOMCs). All LOMCs in Cerro Gordo County for which information could be found are summarized in the Summary of Map Amendment (SOMA) included in the Technical Support Data Notebook (TSDN) associated with this FIS. No LOMRs have been incorporated into the revised FIRM panels during the production period, as shown in Table 3. Copies of the SOMA may be obtained from the Community Map Repository. Copies of the TSDN may be obtained from FEMA.

TABLE 3 SUMMARY OF LOMRS INCORPORATED

CID	FLOODING SOURCE	CASE NUMBER	DATE ISSUED	NEW PANEL
N/A	-	-	-	-

2.2 Community Description

Cerro Gordo County, Iowa is located in north central Iowa. Cerro Gordo is bounded on the north by Worth County, on the northeast by Mitchell, on the east by Floyd, on the southeast by Butler County, on the south by Franklin County, on the southwest by Wright County, on the West by Hancock County and on the Northwest by Winnebago County.

The topography of Iowa is rolling prairie and changes in elevation are small across the state varying from 1,675 feet in the northwest to 477 feet in the southeast. The topography was formed mainly from outwash plains from the glaciers to the north and east. The northeastern part of the state has some rugged terrain. Much of the rolling terrain of Iowa is in agricultural land while the eastern portion has some forested areas.

According to U.S. Census Bureau statistics, the 2008 population estimate for Cerro Gordo County was 43,786. The majority of the population is located in Mason City with a population of 27,337 in 2008 (http://factfinder.census.gov/servlet/SAFFPopulation).

The climate of Cerro Gordo County is sub humid mid-continental with an average annual precipitation of 30 inches. An average of 70 percent of the year's total rain falls from April to September. The mean temperature is 45 degrees Fahrenheit (°F), with the coldest and warmest months being January with an average temperature of 14 °F and July with an average temperature of 71 °F. Temperatures range from about -35 °F to 108 °F between the winter and summer months (Reference 1 and 2).

City of Dougherty is located in southeast part of Cerro Gordo County. The 2000 population was reported to be 80 according to U.S. Bureau Statics.

City of Mason City is surrounded by unincorporated Cerro Gordo County in north central Iowa. The population is about in 29,172 in 2000 according to U.S. Bureau Statics. The major stream systems in the City of Mason City include Winnebago River, Mason Creek, Ideal Creek, Willow Creek, Calmus Creek and Mason Creek and its tributaries.

City of Clear Lake is located in western Cerro Gordo County. The 2000 population of Clear Lake was reported to be 8,161 according to U.S. Bureau Statics. The economy of Clear Lake is predominantly agriculture oriented business, industry and recreational.

City of Meservey is located in southwest Cerro Gordo County. The 2000 population was reported to be 252 according to U.S. Bureau Statics.

City of Nora Spring is located in southeast Cerro Gordo County. The 2000 population was reported to be 1,532 according to U.S. Bureau Statics.

City of Plymouth is located in northern Cerro Gordo County. The 2000 population was reported to be 429 according to U.S. Bureau Statics.

City of Rock Falls is located in northeastern Cerro Gordo County. The 2000 population was reported to be 170 according to U.S. Bureau Statics.

City of Rockwell is located in south central part of Cerro Gordo County. The 2000 population was reported to be 989 according to U.S. Bureau Statics.

City of Swaledale is located in south central part Cerro Gordo County. The 2000 population was reported to be 174 according to U.S. Bureau Statics.

City of Thornton is located in southwest Cerro Gordo County. The 2000 population was reported to be 422 according to U.S. Bureau Statics.

City of Ventura is located in western Cerro Gordo County. The 2000 population was reported to be 670 according to U.S. Bureau Statics.

2.3 Principal Flood Problems

The history of flooding along the streams in Cerro Gordo County indicates that flooding is capable of occurring during any season. The majority of the floods generally occur in the spring or early summer as a result of heavy rainfall and/or snowmelt.

Because much of the topography of the City of Clear Lake is relatively flat, flooding depths are relatively shallow (generally less than three feet). Flooding occurs along the shoreline of Clear Lake and in the low-lying areas along Willow Creek and Clear Creek. Shallow flooding in various low-lying areas of Clear Lake also occurs when storm drainage systems become overloaded or backed up by the receiving drainage course (Reference 1).

In Mason City, the floodplains of the Winnebago River, Willow Creek and Cheslea Creek had undergone extensive development for residential, industrial, and recreational uses by the time of previous FIS. Poor floodplain management practices have allowed continuing construction in known flood-prone areas along these streams. To further complicate the problem, bridges, dams, fills and levees have encroached on the natural flood-carrying capacity of these streams. The results of the poor floodplain management practices as well as the encroachment onto the streams are that many residential and industrial areas are subject to more severe flooding.

Willow Creek is the stream most adversely affected from encroachment. Two low head dams, one located near East State Street and the other near South Pennsylvania Avenue, and an abandoned railroad bridge located upstream from Cheslea Creek considerably restrict the flow of water. The dam near South Pennsylvania Avenue raises the 1-percent annual chance profile by several feet for about a 2 mile reach of the stream and is the major cause of the extent of the flooding problems along Willow Creek (Reference 2).

For the Winnebago River, flood discharges and elevations are recorded on the USGS streamflow gages located upstream from the 13th street bridge. High water marks have also been recorded for some floods at various locations in the City. Major floods recorded at the USGS gage are listed in Table 4 in the order of magnitude of their occurrence. The

flood of record is about a 4-percent annual chance flood. Floods on the Winnebago River causing significant damage in Mason City occurred in 1933, 1954, 1961 and 1965. Although damaging floods have occurred prior to 1933, little data are available to describe the severity. Although the later floods were of lesser magnitude, more homes were damaged than in previous floods due to the development of the floodplain for residential uses (Reference 2).

TABLE 4 WINNEBAGO RIVER FLOOD HISTORY TABLE

DATE OF FLOOD CREST	ELEVATION (NAVD 88)	DISCHARGE (CFS)
March 30, 1933	1085.28	10,800
March 27, 1961	1084.38	10,500
April 11, 1965	1083.85	9,700
April 6, 1965	1083.28	9,000
August 31, 1962	1082.64	8,510
April 7, 1951	1082.02	7,560
March 29, 1962	1081.38	7,200
June 21, 1954	1081.43	7,060

Source: Reference 2

In 1933, flooding was caused by rain that fell on a heavy snow cover. The 1933 flood was the flood of record at the time of the 1995 FIS. In 1954, a 5-inch rain caused record flooding along Willow and Cheslea Creeks. The 1961 and 1965 flood were of a smaller magnitude by more homes were damaged than previous floods because of development in the floodplain for residential use.

In June 2008, another significant flood occurred in Iowa. This flood was a hydrological event involving most of the rivers in eastern Iowa beginning around June 8, 2008 and ending about July 1. Flooding continued on the Upper Mississippi River in the southeastern portion of the state for several more days (http://en.wikipedia.org/wiki/Iowa_flood_of_2008).

At the time of the previous FIS, Calmus Creek had not suffered from severe flooding problems because water is retained by a pond and lowland areas along the lower reach of the stream. Mason Creek and Ideal Creek have not posed flooding problems because little development existed along these stream at the time of the previous FIS.

2.4 Flood Protection Measures

After the 1954 flood, flood protection measures along Willow Creek within the City of Mason City were discussed in length. Suggestions for improvement included straightening the stream channel, increasing the opening of the 1st Street Bridge and constructing levees on the north and east sides of the creek near Pierce Avenue. In 1963, The City of Mason City straightened a 2,000 foot reach of Willow Creek, upstream from Pierce Avenue and constructed two levees. One is located on the north and east bank of Willow Creek between 1st Street and Pierce Avenue and the other is located on the west

bank along Crescent Drive. During the same year, a levee was constructed along the Winnebago River to protect the north bank between Hampshire Avenue and 12th Street. These three levees provide protection from about a 10-percent annual chance flood. Other flood protection measures have been taken prior to the 1995 FIS. One of these includes the construction of a levee by the city to protect the old wastewater treatment plant located on the south bank of the Winnebago River, east of Kentucky Avenue from about a 10-year flood. The Armour Company meat packaging plant also rerouted the Calmus Creek from the Winnebago River to the Chicago and North Western railroad bridge and constructed a levee to provide protection from about a 10-percent annual chance flood.

In City of Clear Lake, no significant flood protection measures existed that would significantly affect flooding conditions on Willow Creek or Clear Creek by the time of the 1980 FIS. The outlet structure on Clear Lake serves to maintain the lake level on Clear Lake primarily for recreational purposes. Clear Lake also serves to detain a major portion of the runoff that enters the lake due to the large size of Clear Lake in comparison to its drainage area.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in Cerro Gordo County, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for these studies. 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 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 the original 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. Peak discharges of the detailed study streams for the 10-, 2-, 1-, and 0.2-percent annual chance flood events are shown in Table 5.

TABLE 5. SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE (CFS) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
Calmus Creek					
Mouth	25.5	900	1,440	1,700	2,380
Cheslea Creek					
Confluence with Winnebago River	12.6	1,410	2,180	2,550	3,410
Just upstream of 1st Street	12.5	1,400	2,170	2,540	3,400
Just upstream of 5th Street	12.3	1,390	2,150	2,520	3,360
Just upstream of Chicago, Milwaukee, St. Paul, and Pacific Railroad	11.6	1,320[1]	2,040[1]	2,400[1]	3,200[1]
Just upstream of Terminal Railroad	10.9	1,380	2,140	2,500	3,320
Downstream of Confluence with Cheslea Creek Trib 6	7.5	1,160	1,800	2,100	2,800
Clear Creek					
Confluence with Willow Creek	29.1	430	670	770	1,020
Downstream of 40th Street	28.7	420	650	750	990
At Iowa Terminal Railroad	24.1	N/A	N/A	650	N/A
At Interstate 35	23.4	N/A	N/A	650	N/A
At 12th Avenue South	22.2	N/A	N/A	500	N/A
At Clear Lake outlet structure	21.8	N/A	N/A	240	N/A
Ideal Creek					
Mouth	11	520	840	990	1370
Approximately 2800 ft Downstream of 12th St. NE	8.5	440	710	840	1,170
Mason Creek					
Mouth	8.7	440	720	850	1,180
Above Confluence with Tributary M1	2.2	180	290	350	490
Tributary M1					
Mouth	3.5	240	400	480	700
Tributary M1-1					
Mouth	1.4	180	220	260	350
Willow Creek					
Mouth	105	2,150	3,310	3,990	5,600
At USGS Gage 05460100	78.6	1,150	2,250	2,610	3,500
Upstream of Confluence with Crane Creek	58.5	1,060	1,850	2,150	2,860
Downstream of Confluence with Clear Creek	55.2	1,040	1,780	2,070	2,760

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ. MI.)	PEAK DISCHARGE (CFS) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
Upstream of Confluence with Clear Creek	26.1	690	1,080	1,250	1,660
Approximately 800 feet upstream of 20th Street	23.1	640	1,000	1,150	1,530
At U.S. Highway 18	20.1	900[2]	1,510[2]	1,820[2]	2,600[2]
Winnebago River					
Chicago Milwaukee St Paul And Pacific Railroad	661	7,060	11,270	13,220	18,200
Downstream of Willow Creek Confluence	623	7,150	11,390	13,380	18,460
Gage 05459500	526	7,200	11,500	13,500	18,700
Approximately 1.6 mile upstream of 13th Street.	493	6,640	10,560	12,410	17,170

[1] Flows at these locations are smaller than upstream flows due to storage areas accounted for during modeling
[2] Flows at these locations are higher than downstream flows because they were from the previous FIS

a. Countywide Study

- **New Detailed Study**

For all the new detailed study stream sections, flow change locations were chosen at confluences, upstream of regulatory structures, and at additional locations such that the increase in flow was less than 50% between flow changes. Drainage areas for selected flow change locations were delineated based on 10-foot USGS topographic mapping and verified using Natural Resources Conservation Service (NRCS) Hydrologic Unit Code (HUC) - 14 data. Three methods were used in the calculation of peak flows: HEC-HMS program (Version 3.2) developed by USACE; Regression Equations and Gage Analysis.

For Cheslea Creek, a HEC-HMS model was developed to determine peak discharges. To determine the curve number and time of concentration, the SCS TR-55 methodology was used. For these calculations, a land use coverage was developed based on aerial imagery from the National Aerial Imagery Program dated 2008 and NRCS soils data. A synthetic rainfall distribution was created based on NOAA Atlas 14 Volume 2 Appendix A.1. Rainfall depths were chosen from NOAA Atlas 14 for the 10-, 2-, and 1-percent-annual-chance storms for a 24-hour duration. The rainfall depth for the 0.2-percent-annual-chance storm was not available in NOAA Atlas 14 and was therefore extrapolated from the other rainfall depth data.

To account for storage within the Cheslea Creek HEC-HMS model, storage areas that could be identified based on the USGS topographic data were analyzed. Storms were assumed to be at normal pool at the beginning of the rainfall event. Normal pool elevations were calculated based on the USGS topographic data overlain on aerial photography. When the runoff volume in a sub-basin could be completely contained based on the available storage volume, the sub-basin was routed to a sink feature in HEC-

HMS. Otherwise, the storage areas were modeled as reservoirs. Since the actual configuration of the storage areas and their outlet structures was unknown, a weir equation was used to estimate outflow and the weir length was estimated based on aerial photography. Due to these storage areas, it is possible for peak flow to decrease moving downstream.

For Clear Creek, a regression equation method using drainage area as the variable was used. Regression Equations for Region 1 presented in USGS WRIR 00-4233 (Reference 5) were used. Regression equations are not applicable along regulated streams. Clear Creek is located downstream of Clear Lake which is regulated. The 1-percent-annual-chance discharge at the Clear Lake Outlet was calculated in the previously effective FIS report as 240 cfs for a drainage area of 21.8 square miles. The regional regression estimate for this drainage area would be approximately 1,108 cfs. One interpretation is that the lake reduces the peak discharge from that portion of the watershed for the 1-percent-annual-chance flood by approximately 78.3%. Although it is unlikely that the lake attenuates all flood events by the same percentage, in the absence of better data this was assumed to be true for the present update. The 78.3% reduction was assumed to apply for the first 21.8 square miles of area for each of the regression equation estimates at the lake's outlet structure. Then the additional area was calculated normally using the regression equations above with a portion of the drainage area downstream of the lake. The values were then added to the adjusted lake discharge to achieve a composite value that corresponds reasonably with the effective discharges along Clear Creek in the City of Clear Lake.

For Willow Creek, the discharge values calculated by the regression equations were adjusted based on gage data from Gage 05460100 (Willow Creek near Mason City, IA). To analyze data from the gage, the Hydraulic Engineering Center Statistical Software Package (HEC-SSP) computer program version 1.0 was used. The USACE has implemented Bulletin 17B procedures into this program. The gage along Willow Creek has approximately 41 years of data available. According to Bulletin 17B, statistical analyses are not sufficient to solely determine peak discharges. An equation in WRIR 00-4233 was used to improve the estimate of the gaged site using regression equations derived from nearby gages with longer periods of records. Based on inspection of the HEC-SSP analysis, however, the flow frequency estimates are valid only for the 10-percent-annual-chance exceedance.

Once the peak discharges for the Willow Creek gage site were adjusted, regression equations were used to calculate peak discharges at each of the selected flow change locations. These discharges were then adjusted by an equation presented in WRIR 00-4233 that calculates discharges for ungaged locations on gaged streams. It should be noted that the equation is only valid when the ratio of the drainage areas at the gaged site and the ungaged site are greater than 0.5. This was not the case for two of the discharge locations and so for these two locations, the regression equations were used. In addition, since the inspection of the HEC-SSP analysis showed that the flow frequency analysis would only be valid for the 10-percent-annual-chance discharge event, the other discharges were also calculated using the standard regional regression equations.

To determine peak flows for Winnebago River, the discharge record at Gage 0545900 (Winnebago River at Mason City, IA) was analyzed using methods presented in Bulletin 17B. To determine discharges at other points along the stream but not at the gage site, area weighting was used following methodology in WRIR-00-4233.

- **New Approximate Study**

Hydrologic analyses for the streams studied by approximate methods were performed using the Nebraska Department of Natural Resources N-FACT tool (Reference 6). Regional regression equations (Reference 7) are used in the Nebraska Program. Regression-weighted estimates for ungaged sites on gaged streams were used where applicable (Reference 7). To assist in mapping, a set of software tools called the Nebraska Flood Area Calculation Tools (N-FACT) was developed; N-FACT is an extension to ArcView and was written by members of the mapping team and modified to be applied to areas of Iowa.

b. Pre-Countywide Study

For the portion of Willow Creek within the City of Clear Lake, estimate for peak discharge – frequency data were derived from combining 90 percent of the estimates from regression equation II-1 with 10 percent of the estimates from regression equation I-2. These equations were published in Iowa Natural Resources Council Bulletin No. 11. The 90 and 10 percent weighting factors were chosen with consideration to the topography of the watershed and the location of the watershed with respect to the regional boundary line. The slope and drainage area of the watershed used in the regression equations were derived from topographic map at a scale of 1:24000 with a contour interval of 10 feet (Reference 1).

Peak discharges for the portion of Clear Creek studied in the 1987 FIS were estimated from U.S. Soil Conservation service Technical Release No. 55, "Urban Hydrology for Small Watersheds". During the detailed analysis of Clear Creek, the discharges were further adjusted to reflect the restrictions of the culverts along the ditch. The restrictions at the culverts caused ponding upstream for these structures and, therefore, attenuation of the flood peaks. Clear Lake was studied in detail in the 1987 FIS. To determine peak flood elevations for Clear Lake, two analyses were performed. Flood routing was performed through the reservoir using inflow hydrographs developed for a 24-hour storm. A peak annual stage frequency analysis was run for the 51-year record of the gaging station on Clear Lake. After review of the results it was decided to use the stage frequency analysis elevations, due to the fact that they are slightly higher and possibly more accurate (Reference 1). Peak Elevations of Clear Lake were shown in Table 6.

TABLE 6. SUMMARY OF STILL WATER PEAK ELEVATIONS

	PEAK ELEVATIONS (FEET NAVD88)			
FLOODING SOURCE	10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
Clear Lake	1227.82	1228.16	1228.28	1228.52

The sections of Willow Creek within the City of Mason City were studied in the 1995 FIS. Discharge-frequency relationships for these stream reaches were developed by the USACE Rock Island District. The frequency discharges were derived by synthetic procedures based on stream flow and adjacent streams of similar topography, watershed cover, and physical characteristics. Details of the methodologies follow.

The peak frequency discharges for the detailed study stream reaches of Mason Creek, Tributary M1, Tributary M1-1, Ideal Creek, and Calmus Creek were developed by modifying the Iowa Natural Resources Council regional relationships to coordinate with the USACE hydrology discussed above. These regional equations relate basin characteristics to stream flow data and were developed by computing frequency curves from gaging station data in the region using a Log-Pearson Type III distribution analysis. The regional equations were then derived by regressing each set of frequency discharges on several basin and climatic parameters. The 0.2-percent annual chance flood discharges were calculated by fitting the lower frequency discharges to a Log-Pearson Type III curve and extrapolating the 500-year value (Reference 2).

The discharge-frequency relationships of Cheslea Creek studied in the previous FIS were taken from the USACE Rock Island District's Flood Plain Information report. The frequency discharges were derived by synthetic procedures using the Clark Unit Hydrograph method (Reference 2).

The discharge frequency of Willow Creek within the City of Clear Lake is based on the hydrologic analysis of the flood damage reduction study of Willow Creek, Mason City Iowa. The USGS Regional Equations in Report 87-4132 'Method for Estimating the Magnitude and Frequency of Floods at Ungaged Sites on Unregulated Rural Streams in Iowa", O.G. Lara, 1987, and the modified drainage area were used to compute the peak discharges (Reference 2).

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.

Flood profiles were prepared for all streams studied by detailed methods and show computed water-surface elevations to an accuracy of 0.5 foot for floods of selected recurrence intervals. In cases where the 1-percent-annual-chance and 0.2-percent annual chance flood elevations are close together, only the 1-percent-annual-chance profile has been shown due to limitations of the map scale. For this countywide FIS, flood profiles have been consolidated in continuous stream reaches and adjusted to reflect the new vertical datum as described in Section 3.3.

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 DFIRM (Exhibit 2).

Detailed study streams that were not restudied as part of this map update may include a "profile baseline" on the maps. This "profile baseline" 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 baselines" 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 baseline" may deviate significantly from the channel centerline or may be outside the SFHA.

The hydraulic analyses for this FIS 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.

All elevations are referenced to NAVD88; elevation reference marks used in the study are shown on the maps.

a. Countywide Study

- **New Detailed Study**

As part of this FIS, new detailed hydraulic analyses were performed for Cheslea Creek, Clear Creek, Willow Creek, and Winnebago River using the USACE Hydraulic Engineering Center River Analysis System (HEC-RAS) computer program (Version 4.0.0).

Cross-sections for the new detailed reaches consist of surveyed channel sections and unsurveyed overbank sections. Unsurveyed overbank sections were extracted from a triangulated irregular network (TIN) developed from Light Detection and Ranging (LiDAR) data for Cerro Gordo County. The density of points collected supports the creation of two-foot contours. LiDAR data was collected by Wilson & Company, Inc., Engineers & Architects in November, 2008.

Manning's "n" values were based on visual observation of 2008 aerial photography (1 meter resolution) from the National Agriculture Imagery Program (NAIP), and standard, accepted values published in Open-Channel Hydraulics (Chow, 1959). Table 7 shows the channel and overbank "n" values for the flooding sources studied by detailed methods.

For Clear Creek and the Winnebago River, the starting water-surface elevations were determined using normal depth. For Willow Creek, the 1-percent-annual-chance starting water-surface elevation was taken from the effective profile for the City of Mason City just upstream of the U.S. Highway 18 Bridge. For the 10-, 2-, and 0.2-percent annual chance profiles, the starting water-surface elevations were determined using normal depth. For Cheslea Creek, starting water-surface elevations were determined using a rating curve for the low head dam located on Willow Creek just upstream of North Pierce Avenue. It was determined that the low head dam has a significant effect on water-surface elevations for Cheslea Creek downstream of the 1st Street Bridge, and therefore was incorporated into the model. For the floodway models, starting water-surface elevations were input as the 1-percent annual chance elevation plus one (1) foot.

- **New Approximate Study**

The new approximate 1-percent annual chance flood boundaries was developed using the Nebraska Department of Natural Resources N-FACT tool (Reference 6). A normal depth calculation based on Manning's equation was used in the N-FACT Program. The Manning's "n" values used were assumed based on typical flooding conditions of the streams. A Manning's "n" value of 0.050 was used throughout. A 10-meter digital elevation model was the basis of the existing grade elevations for the floodplain delineation (Reference 7).

b. Pre-Countywide Study

For the portion of Willow Creek and Clear Creek within the City of Clear Lake, channel and valley cross sections were based on field surveys. Elevation data and structural geometry of all bridges, dams, or culverts were obtained either from construction drawings or field surveys (Reference 1).

In Mason City, cross section data for the detailed study streams were obtained by two methods. For the Willow Creek and Cheslea Creek, cross section data were obtained from the USACE. The streambed, bridges, and other structures on the streams were field surveyed to obtain elevation data and structural geometry. Elevation data for the floodplain were obtained from 2-foot contour maps. The same sets of cross sections used in the hydraulic analysis of the flooding of Willow Creek and Cheslea Creek previously conducted by Stanley Consultants, Inc., were reused in the restudy performed by the USACE. The sections of the model representing the channel improvements on Cheslea Creek were obtained from Wallace Holland Kasler Schmitz and Company.

Starting water-surface elevations for the portion of Willow Creek and Clear Creek in the City of Clear Lake were determined from estimates computed using the slope-area method. For Willow Creek, water-surface elevations of floods of the selected recurrence intervals were computed through use of the USACE HEC-2 step-backwater computer program. For Clear Creek, the 1-percent annual chance flood elevations were estimated by calculating culvert hydraulics using standard analysis procedures and by projecting the water-surface profile using slope-area analysis at selected surveyed cross sections (Reference 1).

For Mason Creek and its tributaries, Ideal Creek and Calmus Creek, cross section data for the streambed and floodplain were obtained by field survey. Bridges and other structures were also surveyed to obtain structural geometry. At the mouth of all these five detailed study streams, starting water-surface elevations correspond to flood elevations of the main stem streams. Water-surface profiles for Willow Creek and Cheslea Creek within the City of Mason City were developed using the USACE HEC-2 step-backwater computer program. Water-surface profiles for the other detailed study streams were derived using a step-backwater model developed by Stanley Consultants, Inc. Water-surface profiles show the effects of the proposed bridges on 1st Street NW, over Willow Creek and 25th Street NW, over Calmus Creek, respectively.

In the 1980 and 1995 FIS for the City of Mason City, the starting water surface elevation at the mouth of Ideal, Mason and Willow Creeks was based on calculated backwater elevations from Winnebago River. Winnebago River was re-studied as a part of this FIS update. The water surface elevations of Winnebago River have decreased significantly at

the confluence with the tributaries compared to the previous FIS. However, a new study was not performed on Ideal, Mason and Willow Creeks to reflect this decreased backwater. Flood profiles on these streams near the confluence with Winnebago River have been adjusted manually based on the effective hydraulic model results.

Channel roughness factors (Manning's "n") were chosen based on engineering judgment and field observations and aerial photographs. They are shown in Table 7.

TABLE 7 –CHANNEL AND OVERBANK ROUGHNESS (MANNING'S "N") FACTORS

FLOODING SOURCE	CHANNEL "N" VALUES	OVERBANK "N" VALUES	STREAM SECTION
Calmus Creek	0.035 - 0.040	0.035 - 0.065	Previous Study (Reference 2)
Cheslea Creek	0.035 - 0.045	0.035 - 0.080	New Study
Cheslea Creek	0.032 - 0.040	0.055 - 0.095	Previous Study (Reference 2)
Clear Creek	0.045 - 0.060	0.035 - 0.060	New Study
Clear Creek	0.035 - 0.045	0.06 - 0.08	Previous Study (Reference 1)
Ideal Creek	0.035 - 0.040	0.035 - 0.065	Previous Study (Reference 2)
Mason Creek and Tributaries	0.035 - 0.065	0.035 - 0.065	Previous Study (Reference 2)
Willow Creek	0.045	0.035 - 0.060	New Study
Willow Creek	0.035 - 0.045	0.06 - 0.08	Previous Study (Reference 1)
Willow Creek	0.035 - 0.040	0.055 - 0.095	Previous Study (Reference 2)
Winnebago River	0.045 - 0.060	0.035 - 0.060	New Study

Source: Reference 1 through 3

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.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities may be referenced to NGVD29. This may result in differences in Base Flood Elevations (BFEs) across the corporate limits between the communities.

Effective information for this FIS was converted from NGVD 29 to NAVD88 based on data presented in Figure 1 and Table 8. An average conversion of -0.01 feet (NGVD29 –

0.01 = NAVD88) was applied uniformly across the county to convert all effective BFEs and other profile elevations NAVD88.

For more information on NAVD88, see the FEMA publication entitled *Converting the National Flood Insurance Program to the North American Vertical Datum of 1988* (FEMA, June 1992), or contact the Spatial Reference Division of the National Geodetic Survey, National Oceanic and Atmospheric Administration, Silver Springs Metro Center 3, 1315 East-West Highway, Silver Springs, Maryland 20910-3282, (301) 713-3242 (Internet address http://www.ngs.noaa.gov).

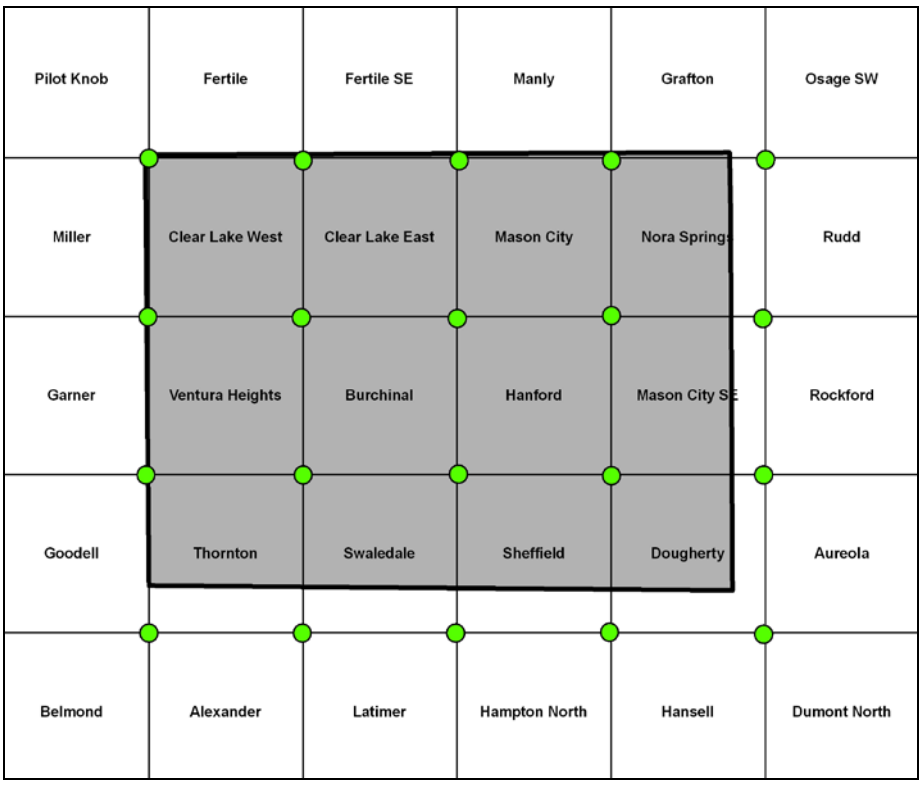

Figure 1. Vertical Datum Conversion

TABLE 8. VERTICAL DATUM ADJUSTMENT

QUADRANGLE NAME	CORNER	NAD 27 LONGITUDE (DEC. DEG)	NAD 27 LATITUDE (DEC. DEG)	CHANGE (FEET)
Hanford	SE	43.000	-93.125	-0.013
Burchinal	SE	43.000	-93.250	-0.079
Ventura Heights	SE	43.000	-93.375	-0.036
Mason City	SE	43.125	-93.125	-0.046
Clear Lake East	SE	43.125	-93.250	-0.066
Clear Lake West	SE	43.125	-93.375	-0.013
Manly	SE	43.250	-93.125	-0.062
Fertile SE	SE	43.250	-93.250	-0.052
Fertile	SE	43.250	-93.375	0.010
Sheffield	SE	42.875	-93.125	-0.010

TABLE 8. VERTICAL DATUM ADJUSTMENT (continued)

QUADRANGLE NAME	CORNER	NAD 27 LONGITUDE (DEC. DEG)	NAD 27 LATITUDE (DEC. DEG)	CHANGE (FEET)
Sheffield	SW	42.875	-93.250	-0.056
Thornton	SE	42.875	-93.375	-0.030
Goodell	SE	42.875	-93.500	0.000
Mason City SE	SE	43.000	-93.000	0.039
Ventura Heights	SW	43.000	-93.500	0.030
Rudd	SW	43.125	-93.000	0.010
Miller	SE	43.125	-93.500	0.072
Grafton	SE	43.250	-93.000	0.013
Pilot Knob	SE	43.250	-93.500	0.108
		Min		-0.079
		Max		0.108
		Average		-0.010
		Maximum Offset		-0.069

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 the FIS report and FIRMs for this community. Interested individuals may contact FEMA to access these data.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program 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 Tables and Summary of Stillwater Elevations Tables. 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.

For the detailed study reaches that were redelineated, the sources for the water surface elevation and floodway data were the 1980 Flood Insurance Study (FIS) for the City of Clear Lake, the 1995 FIS for the City of Mason City, and the 1980 FIS report for the City

of Mason. According to Iowa DNR, the 1995 FIS revision for the City of Mason City only pertained to Willow and Cheslea Creeks. The floodway data for the rest of the detailed study streams was taken from the 1980 FIS.

For Cerro Gordo County, the flood hazard areas for the detailed study reaches were created by using the following three methods: 1) redelineation based on new hydraulic study results using 2 foot contours, 2) redelineation based on effective detailed study results using 2 or 10 foot contours, and 3) digital conversion.

The topographic data that was used for the floodplain mapping task consisted of USGS 30-Meter National Elevation Data (NED) Digital Elevation Models (DEMs). From this dataset, ArcGIS software was used to extract 10-foot interval contours. In addition, 2 foot contours were developed from LiDAR data captured in late November 2008 for all the new detailed study stream reaches. This topographic data was used to delineate the floodplain for all the new detailed streams. As a guide for the process of floodplain mapping, Stantec used 2008 NAIP orthophotography provided by the United States Department of Agriculture - FSA Aerial Photography Field Office. This information was used as a check to ensure the topographic data aligned properly with the base map source that will ultimately be used in the DFIRM production.

The floodplain of Willow Creek and Cheslea Creek studied in the 1995 City of Mason City FIS were delineated using topographic mapping at a scale of 1:6000 with contour intervals of 2 feet. Hence, the floodplains of these two stream reach sections were digitized directly from the previous FIRM. The rest of the detailed study stream reaches in the 1995 and 1980 FIS were redelineated using the basemap described above.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE); and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards (shaded Zone X). 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. A 10-meter Digital Elevation Model (DEM) with a 10-foot contour interval was the basis for the floodplain delineation.

4.2 Floodways

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

without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The 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 (Table 9). 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 on the FIRMs. Portions of the floodway for Willow Creek lie outside the corporate limits.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water surface elevation of the 1-percent-annual-chance flood 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 2.

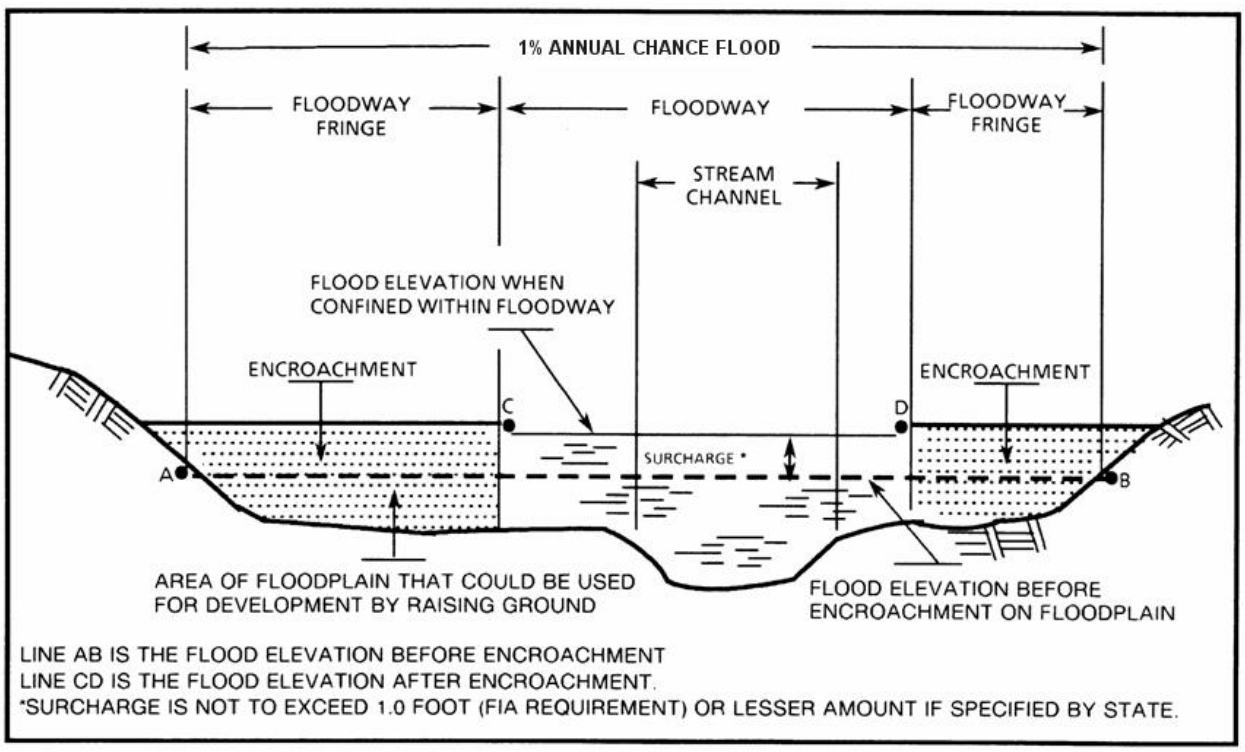

Figure 2. Floodway Schematic

As part of the conversion of this FIS to FEMA's Countywide Format, floodway widths for previously effective detailed studies were digitized from the previously effective FIRM and transferred onto the updated base mapping.

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE 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
CALMUS CREEK								
A	250	60	216	7.9	1089.8	1080.6[2]	1080.9	0.3
B	1,150	30	140	12.1	1092.5	1092.5	1092.8	0.3
C	1,270	20	161	10.6	1095.6	1095.6	1096.6	1.0
D	1,460	20	145	11.7	1097.5	1097.5	1098.4	0.9
E	1,580	27	231	7.4	1099.2	1099.2	1100.2	1.0
F	2,170	64	358	4.8	1101.2	1101.2	1102.2	1.0
G	2,328	149	781	2.2	1101.9	1101.9	1102.9	1.0
H	4,328	51	268	6.3	1109.2	1109.2	1110.2	1.0
I	4,913	50	309	5.5	1111.1	1111.1	1111.4	0.3
J	5,031	35	248	6.9	1111.5	1111.5	1112.2	0.7
K	5,556	63	423	4.0	1112.6	1112.6	1113.6	1.0
L	5,724	44	323	5.3	1112.6	1112.6	1113.6	1.0
M	6,699	126	322	5.3	1114.6	1114.6	1115.6	1.0
N	6,809	244	831	2.0	1115.9	1115.9	1116.9	1.0
O	6,909	76	387	4.4	1117.7	1117.7	1118.7	1.0
P	7,269	82	336	5.1	1118.1	1118.1	1118.7	0.6
Q	7,338	63	483	3.5	1118.5	1118.5	1118.7	0.2
R	7,389	450	4247	0.4	1122.9	1122.9	1123.1	0.2
S	7,889	1225	10664	0.2	1122.9	1122.9	1123.2	0.3
T	8,339	1340	10594	0.2	1122.9	1122.9	1123.2	0.3
U	8,579	149	1,591	1.1	1123.6	1123.6	1124.6	1.0
V	9,079	360	2,424	0.7	1123.6	1123.6	1124.6	1.0
W	9,754	499	3,502	0.5	1124.4	1124.4	1125.4	1.0
X	11,529	200	1228	1.4	1124.6	1124.6	1125.4	0.8

[1] FEET ABOVE CONFLUENCE WITH WINNEBAGO RIVER

[2] ELEVATIONS COMPUTED WITHOUT CONSIDERATION OF BACKWATER EFFECTS FROM WINNEBAGO RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE 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
CALMUS CREEK								
Y	11,614	200	1491	1.1	1124.6	1124.6	1125.5	0.9
Z	11,714	274	1872	0.9	1125.0	1125.0	1126.0	1.0
AA	14,014	225	1139	1.5	1125.4	1125.4	1126.4	1.0

[1] FEET ABOVE CONFLUENCE WITH WINNEBAGO RIVER

Table 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS

FLOODWAY DATA

CALMUS CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE 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
CHESLEA CREEK								
A	450	123	879	2.9	1118.4	1118.4	1119.1	0.7
B	900	127	929	2.8	1118.6	1118.6	1119.3	0.7
C	1,174	169	976	2.6	1123.5	1123.5	1123.5	0.0
D	1,698	255	688	3.7	1124.9	1124.9	1124.9	0.0
E	2,730	106	404	6.3	1126.6	1126.6	1126.9	0.3
F	3,074	87	483	5.3	1129.0	1129.0	1130.0	1.0
G	3,656	61	587	4.3	1131.8	1131.8	1132.4	0.6
H	4,317	88	655	3.9	1132.9	1132.9	1133.5	0.6
I	5,547	58	489	5.2	1134.0	1134.0	1135.0	1.0
J	6,050	1205	9322	0.1	1134.0[2]	1131.4	1131.6	0.2
K	6,450	1170	9049	0.1	1134.0[2]	1131.4	1131.6	0.2
L	6,760	845	6342	0.2	1134.0[2]	1131.4	1131.6	0.2
M	7,210	561	4334	0.3	1134.3	1134.3	1134.4	0.1
N	7,650	56	277	4.9	1134.6	1134.6	1134.6	0.0
O	7,830	49	187	7.2	1134.8	1134.8	1134.8	0.0
P	8,920	56	235	5.8	1138.9	1138.9	1139.8	0.9
Q	9,500	48	272	5.0	1141.6	1141.6	1141.7	0.1
R	9,960	56	292	4.6	1142.1	1142.1	1142.5	0.4
S	10,920	56	292	4.6	1143.4	1143.7	1144.3	0.6
T	11,490	56	372	3.6	1144.8	1144.8	1145.2	0.4
U	12,250	56	276	4.9	1145.3	1145.3	1145.9	0.6
V	13,135	56	252	5.3	1147.0	1147.0	1147.3	0.3
W	13,440	56	262	5.2	1147.7	1147.7	1148.1	0.4

[1] FEET ABOVE CONFLUENCE WITH WILLOW CREEK

[2] ELEVATIONS WERE UPDATED BY NEW DETAILED STUDY. ENCROACHMENT ANALYSIS RESULTS WERE FROM PREVIOUSLY EFFECTIVE FIS.

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE 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
CLEAR CREEK								
A	875	125	343	2.2	1179.8	1177.6[2]	1178.6	1.0
B	1,665	112	253	3.0	1179.8	1179.2[2]	1180.2	1.0
C	2,626	68	225	3.3	1181.5	1181.5	1182.5	1.0
D	3,981	90	304	2.5	1184.3	1184.3	1185.0	0.7
E	4,298	71	257	2.9	1184.9	1184.9	1185.5	0.6
F	5,818	62	252	3.0	1187.1	1187.1	1187.9	0.8
G	6,848	106	250	3.0	1189.5	1189.5	1189.9	0.4
H	7,074	70	247	3.0	1191.2	1191.2	1192.0	0.8

[1] FEET ABOVE CONFLUENCE WITH WILLOW CREEK
[2] ELEVATIONS COMPUTED WITHOUT CONSIDERATION OF BACKWATER EFFECTS FROM WILLOW CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE 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
IDEAL CREEK								
A	1,000	80	323	3.0	1065.4	1064.6[2]	1065.6	1.0
B	2,625	83	295	3.4	1066.9	1066.9	1067.9	1.0
C	3,635	83	299	3.3	1068.9	1068.9	1069.9	1.0
D	3,985	113	555	1.8	1070.2	1070.2	1070.7	0.5
E	6,925	82	310	3.2	1072.0	1072.0	1073.0	1.0
F	8,960	102	340	2.9	1074.1	1074.1	1075.1	1.0
G	10,435	97	283	3.5	1076.7	1076.7	1077.7	1.0
H	13,545	492	689	1.2	1078.0	1078.0	1079.0	1.0
I	14,055	751	2954	0.3	1080.8	1080.8	1081.8	1.0

[1] FEET ABOVE CONFLUENCE WITH WINNEBAGO RIVER
[2] ELEVATIONS COMPUTED WITHOUT CONSIDERATION OF BACKWATER EFFECTS FROM WINNEBAGO RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE 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
MASON CREEK								
A	1,835	70	176	4.8	1063.5	1063.5[2]	1063.6	0.1
B	2,065	70	327	2.6	1064.9	1064.9[2]	1065.6	0.7
C	2,615	70	170	5.0	1065.7	1065.7[2]	1066.1	0.4
D	8,965	67	199	4.2	1083.2	1083.2	1084.2	1.0
E	10,890	93	224	3.8	1089.6	1089.6	1090.6	1.0
F	14,295	26	100	3.5	1102.4	1102.4	1103.4	1.0
G	15,845	21	76	4.6	1111.5	1111.5	1112.5	1.0
H	16,045	137	807	0.4	1115.9	1115.9	1116.9	1.0
I	17,785	27	59	5.9	1123.0	1123.0	1123.1	0.1
J	18,140	54	63	5.6	1126.0	1126.0	1126.0	0.0
K	18,795	49	81	4.3	1130.4	1130.4	1130.6	0.2
L	19,095	235	1395	0.3	1134.8	1134.8	1135.8	1.0
M	20,255	21	40	8.8	1144.7	1144.7	1144.7	0.0
N	20,420	84	248	1.4	1147.4	1147.4	1148.4	1.0
O	21,080	25	63	5.6	1151.1	1151.5	1152.0	0.5
P	21,120	35	115	3.0	1151.8	1151.8	1152.8	1.0
Q	21,635	13	49	7.1	1154.3	1154.3	1154.5	0.2
R	21,675	26	113	3.1	1155.4	1155.4	1156.4	1.0
S	22,195	24	84	4.1	1156.6	1156.6	1157.6	1.0
T	22,475	145	741	0.5	1161.9	1161.9	1162.9	1.0

[1] FEET ABOVE CONFLUENCE WITH WINNEBAGO RIVER
[2] ELEVATIONS COMPUTED WITHOUT CONSIDERATION OF BACKWATER EFFECTS FROM WINNEBAGO RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
TRIBUTARY M1								
A	220[1]	27	92	5.2	1090.6	1090.6	1090.6	0.0
B	950[1]	23	87	5.5	1092.2	1092.2	1093.2	1.0
C	2,250[1]	32	89	5.4	1098.3	1098.3	1098.7	0.4
D	2,455[1]	81	195	2.5	1100.2	1100.2	1101.2	1.0
E	3,050[1]	33	58	8.3	1108.0	1108.0	1108.3	0.3
TRIBUTARY M1-1								
A	260[2]	17	45.0	5.8	1091.1	1091.1	1091.9	0.8
B	2,030[2]	29	51.0	5.1	1103.4	1103.4	1103.4	0.0

[1] FEET ABOVE CONFLUENCE WITH MASON CREEK
[2] FEET ABOVE CONFLUENCE WITH TRIBUTARY M1

Table 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS

FLOODWAY DATA

TRIBUTARY M1 & TRIBUTARY M1-1

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE 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
WILLOW CREEK								
A	1,480	66	381	10.5	1083.8	1082.1[2]	1083.1	1.0
B	2,140	70	505	7.9	1086.8	1086.8	1086.8	0.0
C	2,790	88	350	11.4	1089.6	1089.6	1089.6	0.0
D	3,200	79	498	8.0	1092.5	1092.5	1092.5	0.0
E	3,700	68	537	7.4	1094.3	1094.3	1094.3	0.0
F	3,860	93	357	11.2	1100.6	1100.6	1100.6	0.0
G	3,960	84	1023	3.9	1102.2	1102.2	1102.8	0.6
H	5,205	91	1076	3.7	1102.5	1102.5	1103.2	0.7
I	5,935	80	643	6.2	1102.6	1102.6	1103.4	0.8
J	6,265	82	689	5.8	1106.7	1106.7	1106.7	0.0
K	6,640	273	1172	3.4	1107.7	1107.7	1107.7	0.0
L	7,250	72	537	7.4	1107.9	1107.9	1107.9	0.0
M	7,610	99	831	4.8	1108.8	1108.8	1108.8	0.0
N	9,000	95	932	4.3	1110.2	1110.2	1110.2	0.0
O	9,450	100	672	5.9	1110.4	1110.4	1110.4	0.0
P	10,030	90	518	7.7	1111.1	1111.1	1111.1	0.0
Q	10,650	93	710	5.6	1113.1	1113.1	1113.2	0.1
R	11,430	78	844	4.7	1113.8	1113.8	1114.0	0.2
S	12,445	150	1308	3.1	1114.5	1114.5	1114.9	0.4
T	13,400	160	1076	3.7	1115.0	1115.0	1115.4	0.4
U	16,170	103	508	7.9	1118.5	1118.5	1118.8	0.3
V	17,400	90	615	6.5	1122.4	1122.4	1123.4	1.0
W	18,250	540	3059	1.3	1123.9	1123.9	1124.6	0.7
X	19,740	535	3026	1.3	1125.1	1125.1	1125.8	0.7

[1] FEET ABOVE CONFLUENCE WITH WINNEBAGO RIVER

[2] ELEVATIONS COMPUTED WITHOUT CONSIDERATION OF BACKWATER EFFECTS FROM WINNEBAGO RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE 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
WILLOW CREEK								
Y	22,275	584	2975	1.3	1125.4	1125.4	1126.2	0.8
Z	25,210	367	2077	1.9	1128.3	1128.3	1128.9	0.6
AA	26,385	179	1277	3.1	1128.7	1128.7	1129.4	0.7
AB	28,880	240	1194	3.3	1130.5	1130.5	1131.4	0.9
AC	30,535	210	962	4.1	1132.8	1132.8	1133.6	0.8
AD	32,740	130	879	4.5	1136.0	1136.0	1136.8	0.8
AE	33,800	210	2207	1.8	1139.1	1139.1	1139.4	0.3
AF	34,800	118	621	6.4	1139.1	1139.1	1139.3	0.2
AG	37,800	140	885	4.5	1146.6	1146.6	1147.4	0.8
AH	39,870	150	707	5.6	1150.3	1150.3	1151.3	1.0
AI	41,445	140	888	4.5	1153.8	1153.8	1154.6	0.8
AJ	42,530	170	982	4.1	1155.3	1155.3	1156.1	0.8
AK	42,730	49	511	7.8	1157.7	1157.7	1157.7	0.0
AL	44,054	600	4406	0.6	1157.8	1157.8	1158.8	1.0
AM	45,887	550	2753	1.0	1157.9	1157.9	1158.9	1.0
AN	47,653	190	772	2.8	1158.6	1158.6	1159.3	0.7
AO	47,924	120	894	2.4	1159.7	1159.7	1160.3	0.6
AP	50,644	200	1027	2.1	1162.4	1162.4	1163.2	0.8
AQ	52,229	150	698	3.1	1163.4	1163.4	1164.3	0.9
AR	52,785	290	1184	1.8	1164.4	1164.4	1165.0	0.6
AS	53,562	115	610	3.5	1164.9	1164.9	1165.5	0.6
AT	55,451	150	732	2.9	1167.3	1167.3	1168.1	0.8
AU	56,710	335	1389	1.6	1168.2	1168.2	1168.8	0.6
AV	60,508	255	1064	2.0	1171.2	1171.2	1172.1	0.9

[1] FEET ABOVE CONFLUENCE WITH WINNEBAGO RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE 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
WILLOW CREEK								
AW	64,068	155	645	3.3	1173.4	1173.4	1174.1	0.7
AX	64,805	170	808	3.2	1174.2	1174.2	1175.1	0.9
AY	64,891	282	1081	2.0	1174.4	1174.4	1175.3	0.9
AZ	67,970	275	1029	2.1	1176.1	1176.1	1177.0	0.9
BA	69,797	160	581	3.7	1177.4	1177.4	1178.3	0.9
BB	70,059	130	879	2.5	1179.8	1179.8	1180.5	0.7
BC	70,496	135	962	2.3	1180.0	1180.0	1180.7	0.7
BD	70,655	275	1893	1.5	1181.0	1181.0	1181.7	0.7
BE	71,612	680	3924	0.8	1181.2	1181.2	1181.8	0.6
BF	71,727	625	3579	0.7	1181.2	1181.2	1182.0	0.8
BG	72,895	465	2425	0.5	1181.2	1181.2	1182.0	0.8
BH	76,432	270	931	1.3	1181.3	1181.3	1182.2	0.9
BI	77,565	240	655	1.9	1181.5	1181.5	1182.4	0.9
BJ	79,795	120	444	2.8	1184.3	1184.3	1185.1	0.8
BK	80,850	135	606	2.1	1185.7	1185.7	1186.6	0.9
BL	82,477	210	692	1.8	1186.7	1186.7	1187.7	1.0
BM	84,400	54	346	3.6	1189.4	1189.4	1189.8	0.4
BN	84,565	64	339	3.7	1190.0	1190.0	1190.3	0.3
BO	85,128	70	470	2.7	1190.5	1190.5	1191.0	0.5
BP	85,903	45	377	3.3	1191.3	1191.3	1191.7	0.4
BQ	86,431	64	560	3.2	1195.2	1195.2	1195.8	0.6
BR	86,616	100	688	2.6	1195.3	1195.3	1195.9	0.6
BS	86,916	98	621	2.9	1195.3	1195.3	1195.9	0.6
BT	87,076	72	525	3.5	1195.4	1195.4	1196.1	0.7

[1] FEET ABOVE CONFLUENCE WITH WINNEBAGO RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE 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
WILLOW CREEK								
BU	87,356	87	584	3.1	1196.4	1196.4	1196.9	0.5
BV	87,616	88	599	3.0	1196.6	1196.6	1197.1	0.5
BW	87,816	89	609	3.0	1196.7	1196.7	1197.2	0.5
BX	88,866	74	597	3.0	1197.3	1197.3	1197.7	0.4

[1] FEET ABOVE CONFLUENCE WITH WINNEBAGO RIVER

Table 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS

FLOODWAY DATA

WILLOW CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE 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
WINNEBAGO RIVER								
A	3,163	500	3179	4.2	1062.5	1062.5	1063.4	0.9
B	9,153	467	3490	3.8	1068.4	1068.4	1069.3	0.9
C	13,011	169	2091	6.3	1071.9	1071.9	1072.8	0.9
D	13,326	240	2891	4.6	1072.8	1072.8	1073.6	0.8
E	14,982	180	2255	5.9	1074.2	1074.2	1075.0	0.8
F	17,046	305	3419	3.9	1076.4	1076.4	1077.3	0.9
G	18,592	395	2671	5.0	1077.5	1077.5	1078.4	0.9
H	19,923	382	2834	4.7	1078.8	1078.8	1079.8	1.0
I	20,199	194	2524	5.2	1079.8	1079.8	1080.4	0.6
J	20,653	241	2443	5.4	1080.4	1080.4	1081.0	0.6
K	21,591	355	3344	4.0	1081.3	1081.3	1082.1	0.8
L	22,831	149	1792	7.5	1082.3	1082.3	1083.1	0.8
M	23,127	156	2231	6.0	1084.9	1084.9	1085.5	0.6
N	25,464	255	2725	4.9	1086.3	1086.3	1087.0	0.7
O	25,754	360	3339	4.5	1086.5	1086.5	1087.3	0.8
P	26,076	320	3460	3.9	1088.2	1088.2	1088.9	0.7
Q	28,747	171	2977	4.5	1089.7	1089.7	1090.4	0.7
R	29,695	178	2696	5.0	1090.1	1090.1	1090.9	0.8
S	31,476	293	4050	3.3	1091.0	1091.0	1091.9	0.9
T	33,549	223	3403	4.0	1091.8	1091.8	1092.7	0.9

[1] FEET ABOVE CHICAGO MILWAUKEE ST PAUL AND PACIFIC RAILROAD

5.0 INSURANCE APPLICATIONS

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

Zone A

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

Zone AE

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

Zone X (Shaded)

Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depth of less than 1 foot or with drainage areas less than a square mile; and areas protected by levees from 1% annual chance flood.

Zone X

Zone X is the flood insurance risk zone that corresponds to areas determined to be outside of the 0.2% annual chance floodplain.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

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

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

The current FIRM presents flooding information for the entire geographic area of Cerro Gordo County. Previously, separate FIRMs were prepared for each identified flood prone incorporated community and for the unincorporated areas of the county.

7.0 OTHER STUDIES

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

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Federal Office building, 911 Walnut Street, Room 200, Kansas City, Missouri, 64106-2085.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Cerro Gordo County (Unincorporated Areas)	June 7, 1977	None	December 1, 2001	None
Clear Lake, City of	May 24, 1974	August 15, 1975	August 4, 1987	None
Dougherty, City of	May 16, 2012	None	May 16, 2012	None
Mason City, City of	March 1, 1974	None	December 2, 1980	March 16, 1995
*Meservey, City of	N/A	None	N/A	None
Nora Springs, City of	September 26, 1975	None	September 1, 1987	None
Plymouth, City of	November 8, 1974	May 21, 1976	January 1, 1992	None
Rock Falls, City of	January 14, 1977	None	July 1, 1997	None
Rockwell, City of	March 26, 1976	None	July 1, 1991	None
Swaledale, City of	May 16 ,2012	None	May 16, 2012	None
Thornton, City of	December 20, 1974	None	May 1, 1987	None
Ventura, City of	November 5, 1976	None	May 16, 2012	None

* No special flood hazard areas identified

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

9.0 BIBLIOGRAPHY AND REFERENCES

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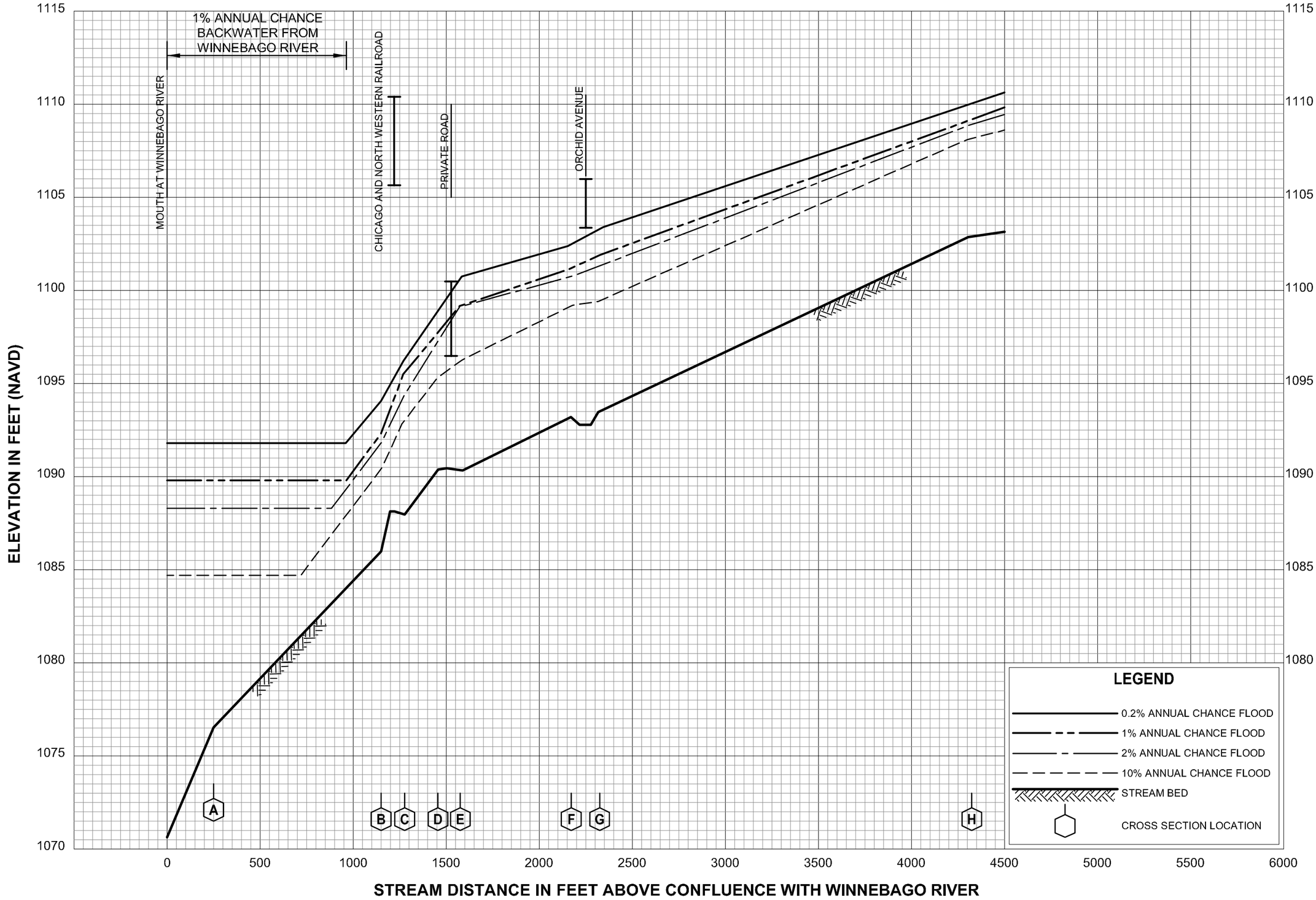
7.) Black & Vetch. Hydrologic and Hydraulic Analyses Performed Using Nebraska Department of Natural Resources N-FACT, September 2007.

8.) U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles Generalized Computer Program, Davis, California, January 1981.



FLOOD PROFILES

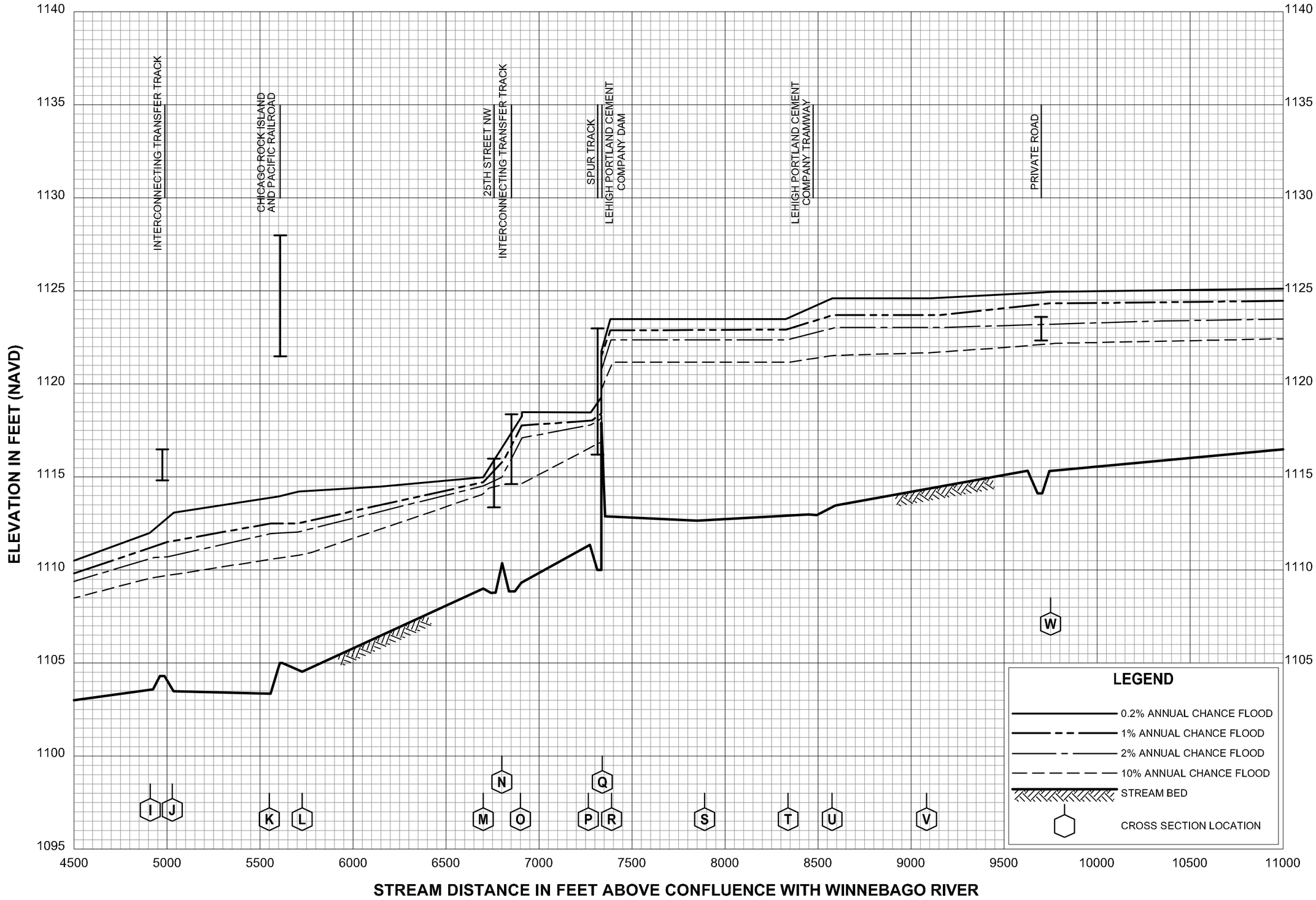
CALMUS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS

01P



FLOOD PROFILES

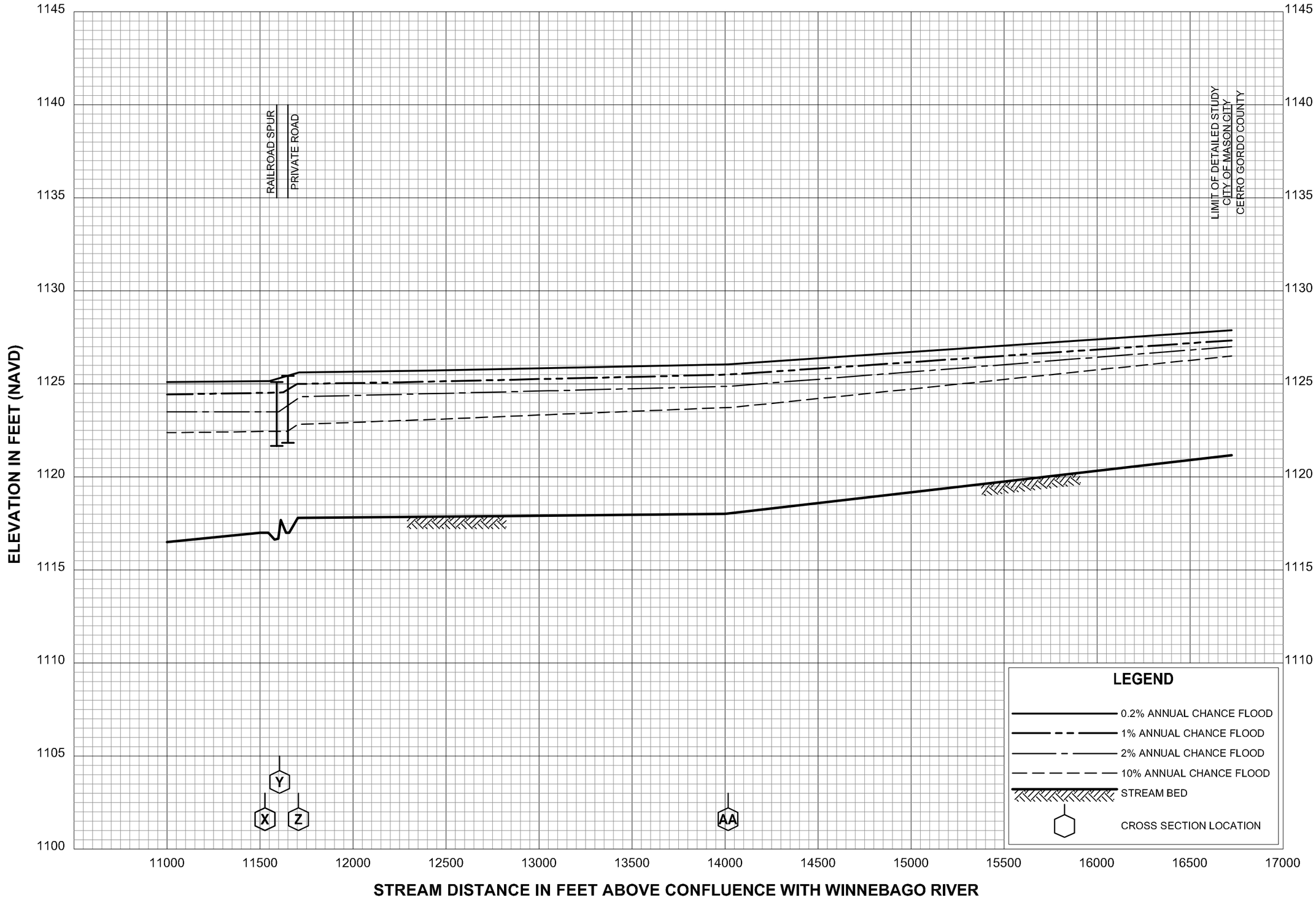
CALMUS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS

02P



FLOOD PROFILES

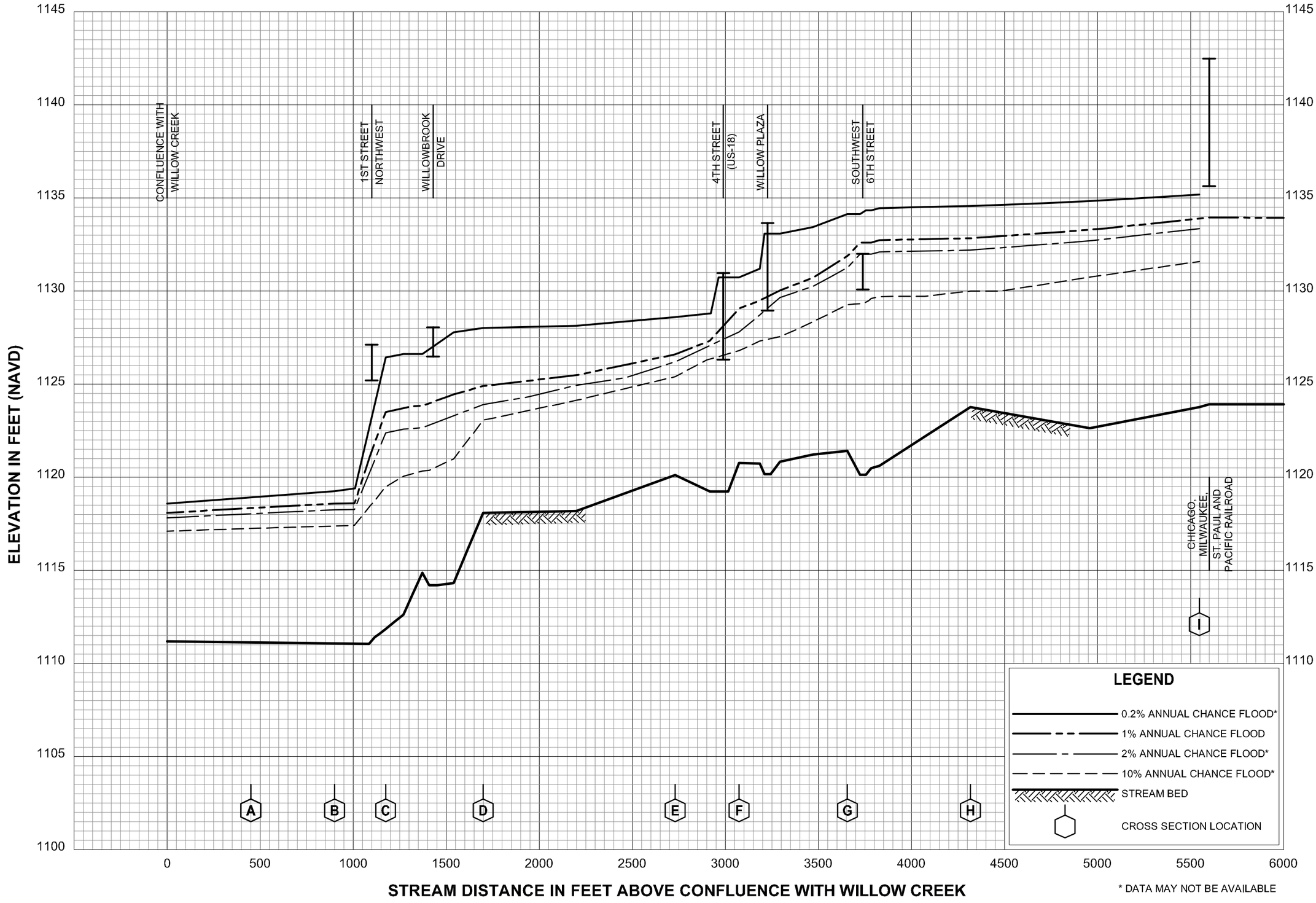
CALMUS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS

03P



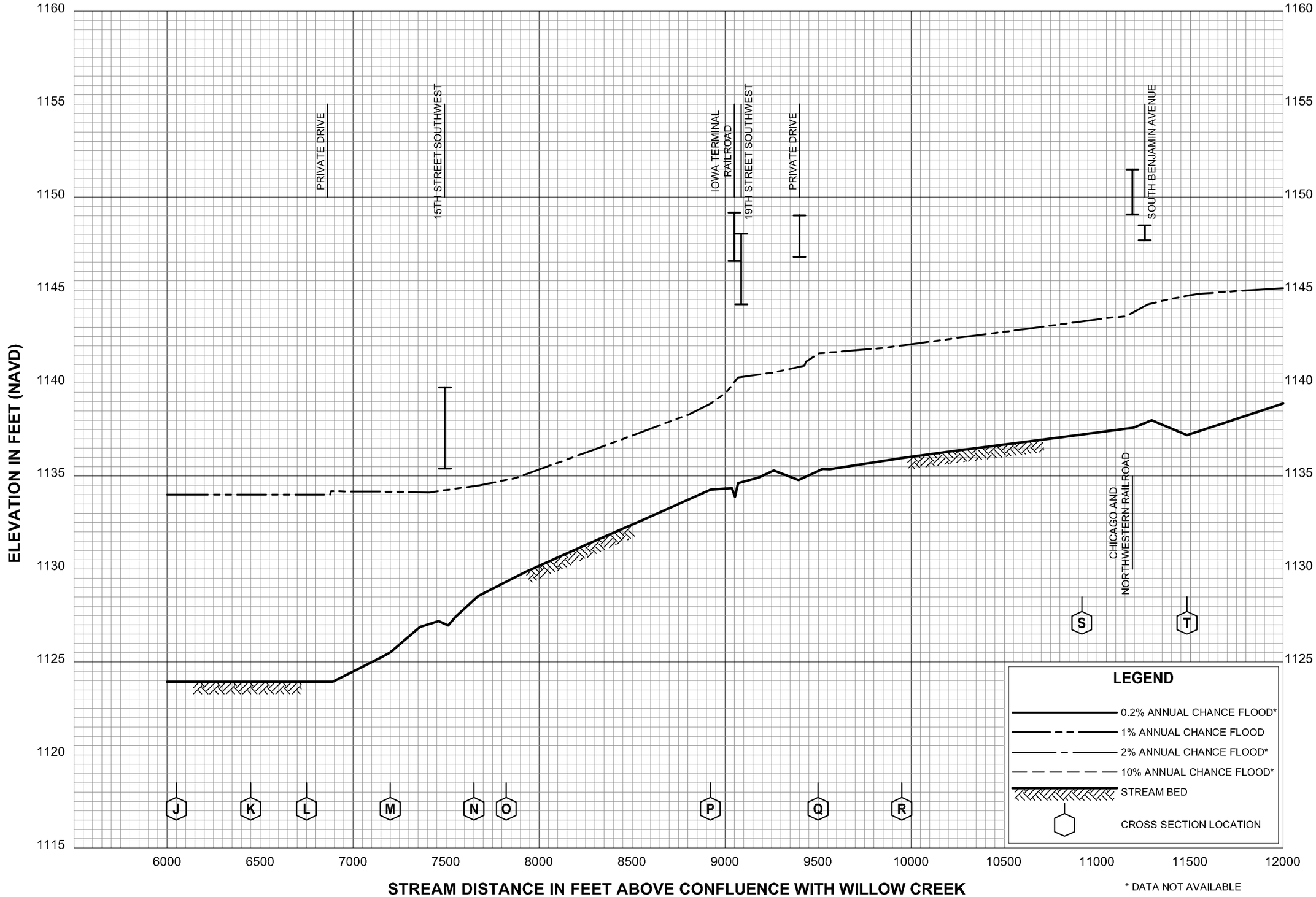
FLOOD PROFILES

CHESLEA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS



* DATA NOT AVAILABLE

FLOOD PROFILES

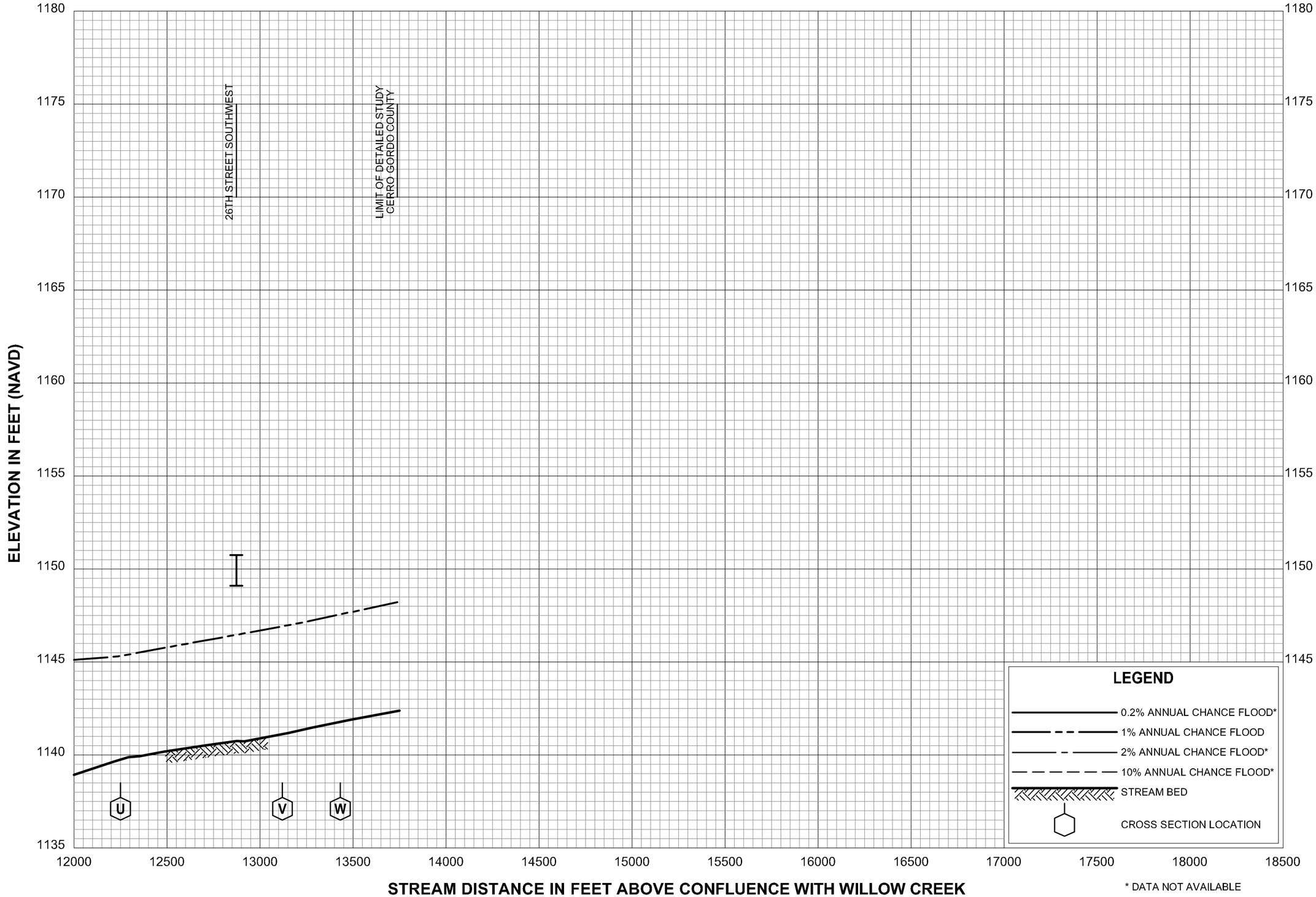
CHESLEA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS

05P



FLOOD PROFILES

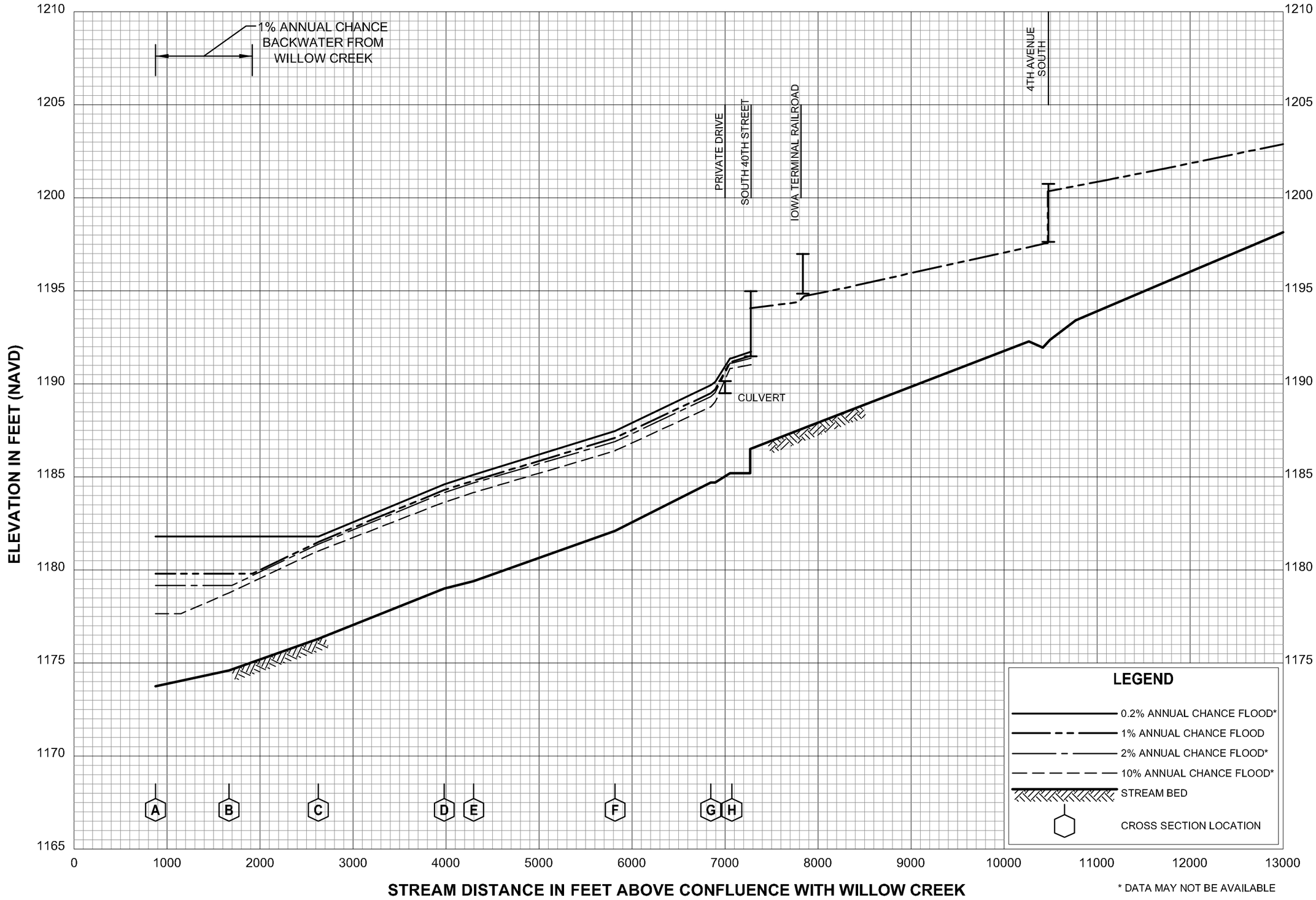
CHESLEA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS

06P



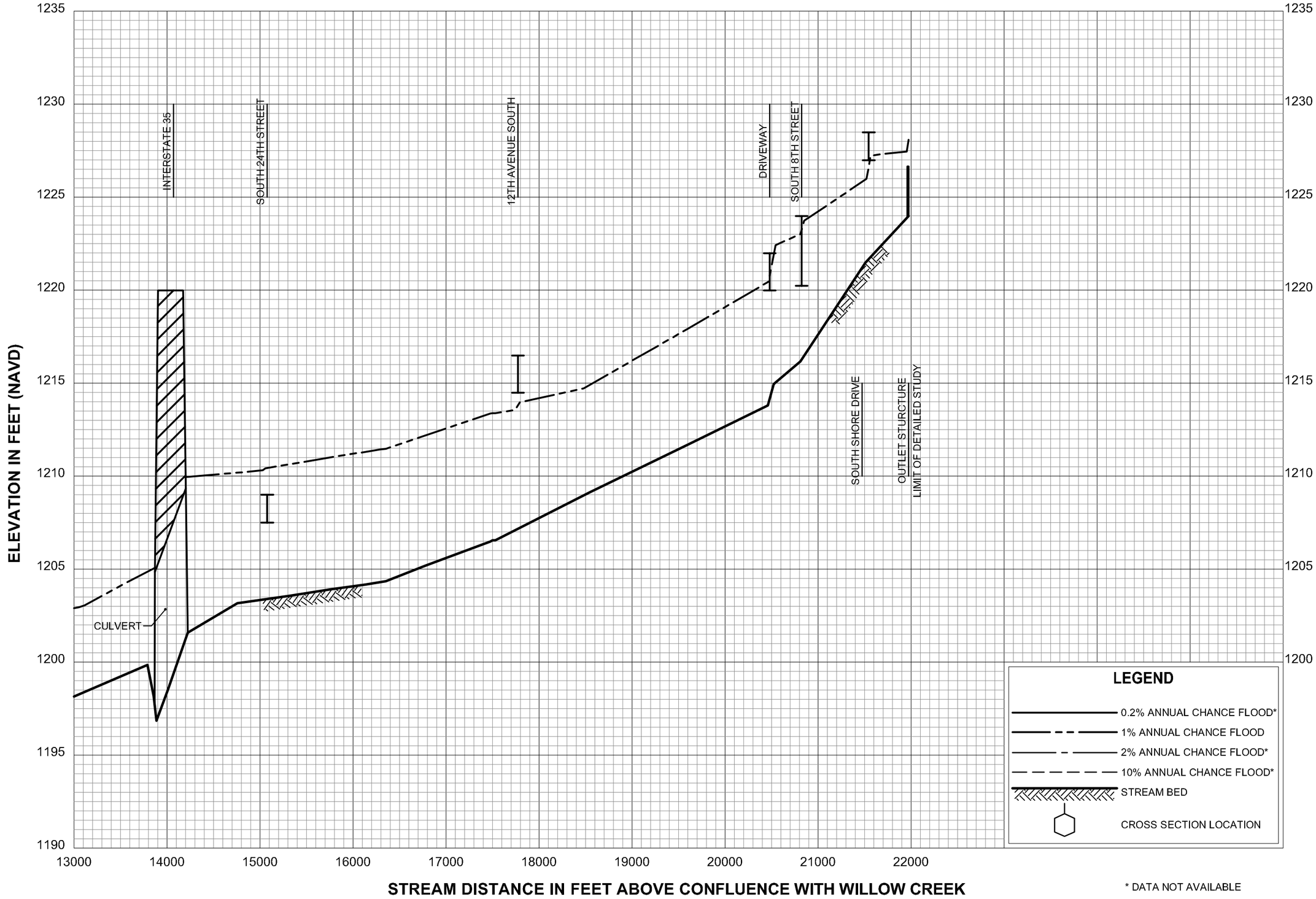
FLOOD PROFILES

CLEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS



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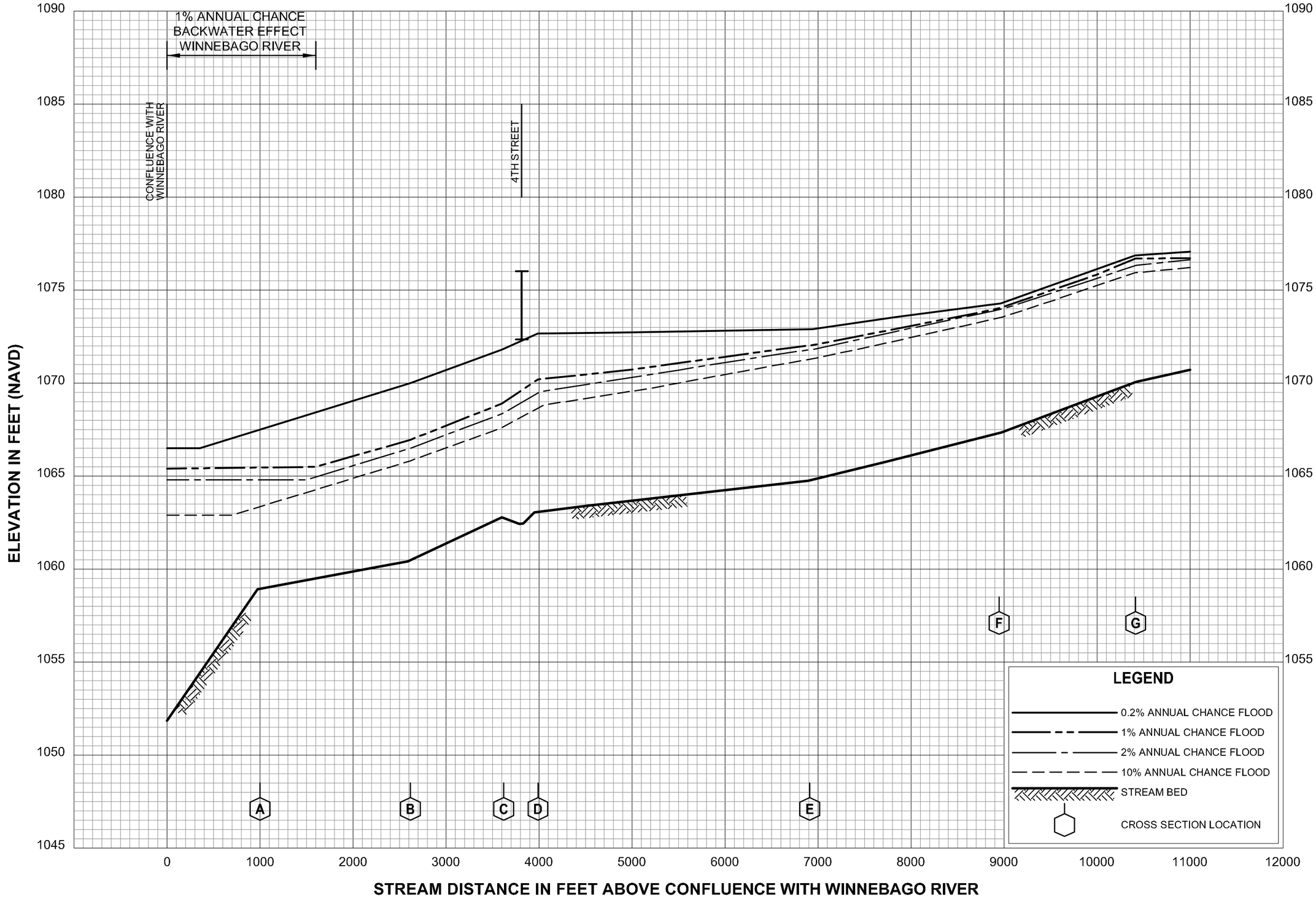
FLOOD PROFILES

CLEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS



FLOOD PROFILES

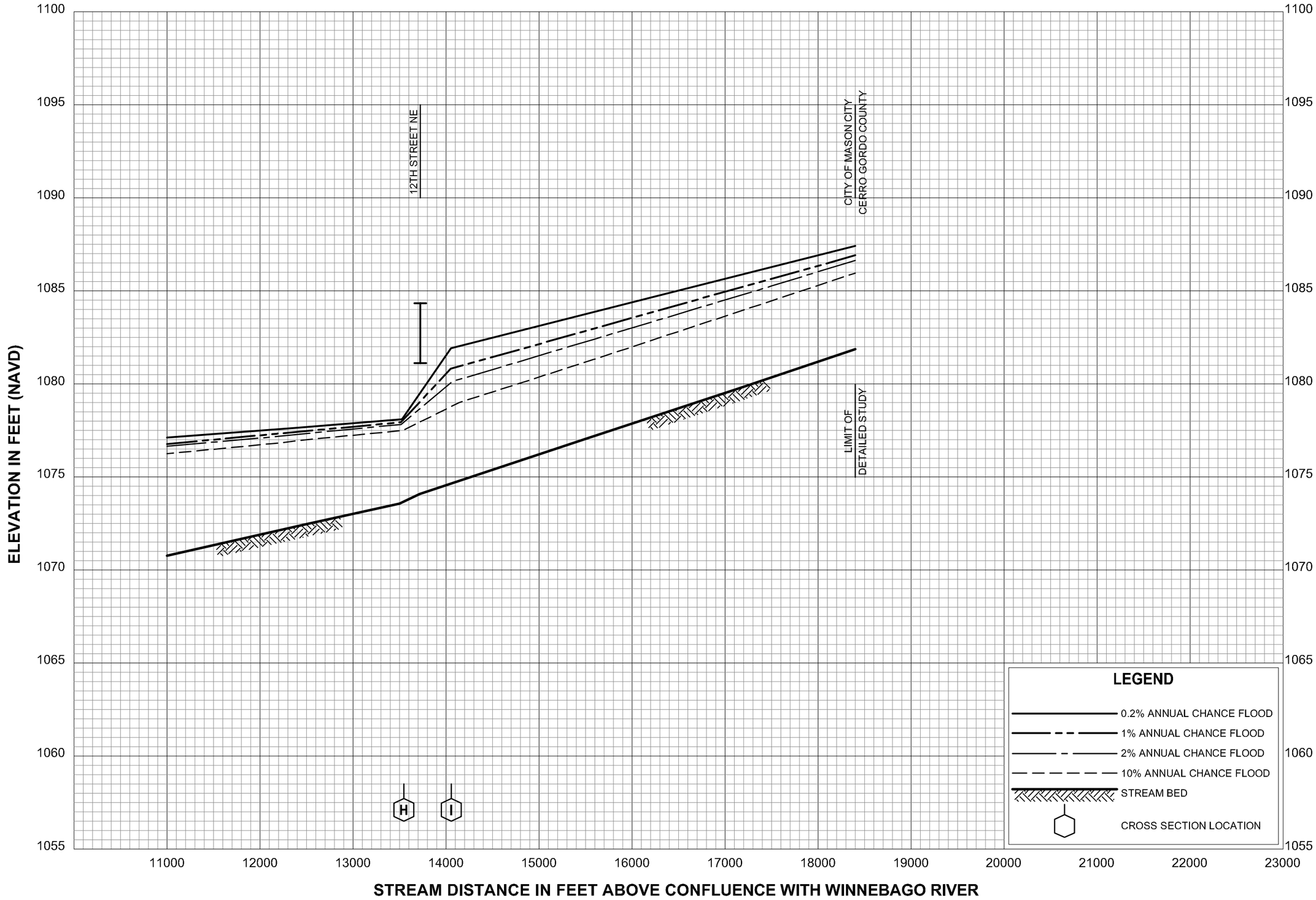
IDEAL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS

09P



FLOOD PROFILES

IDEAL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS

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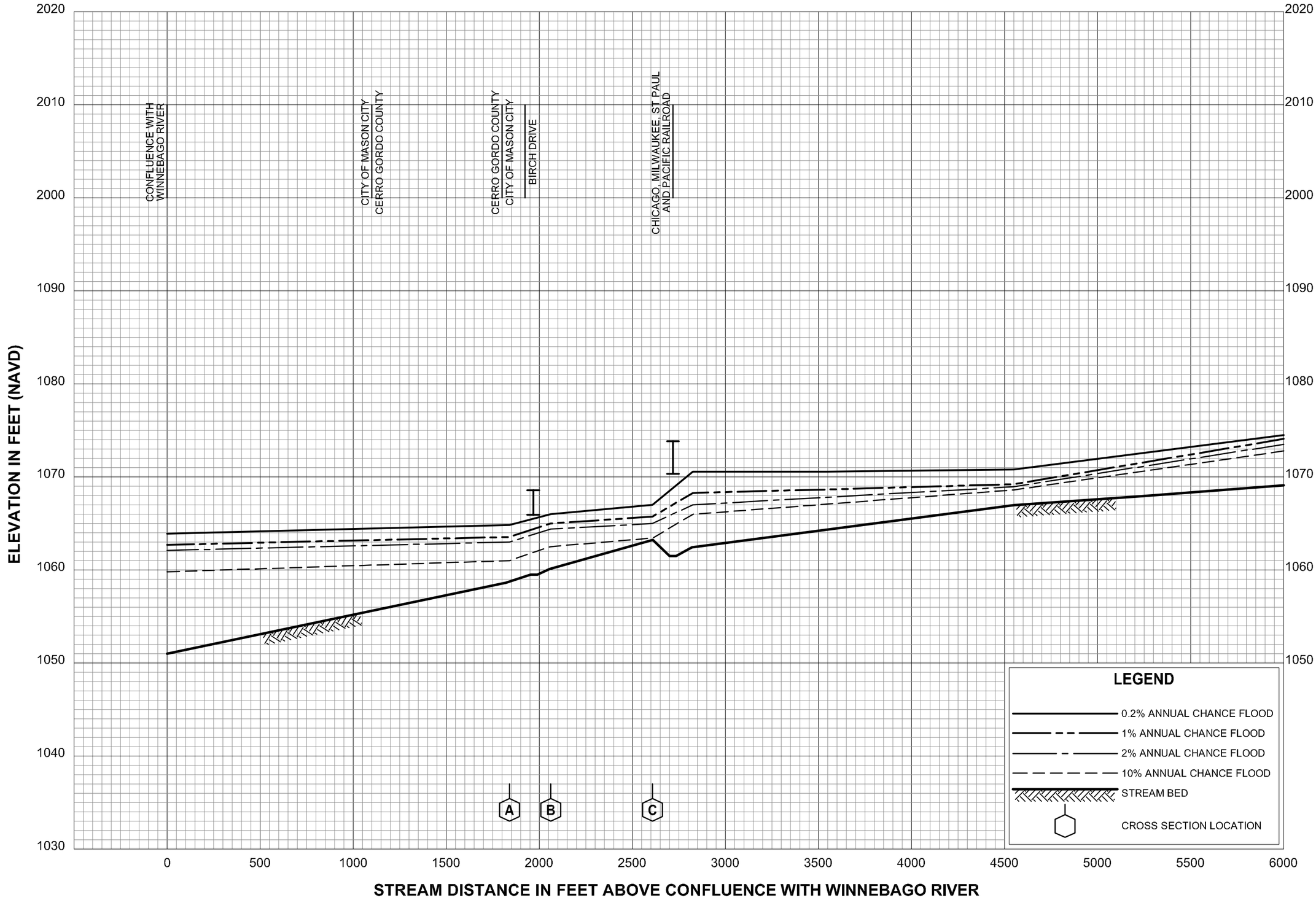


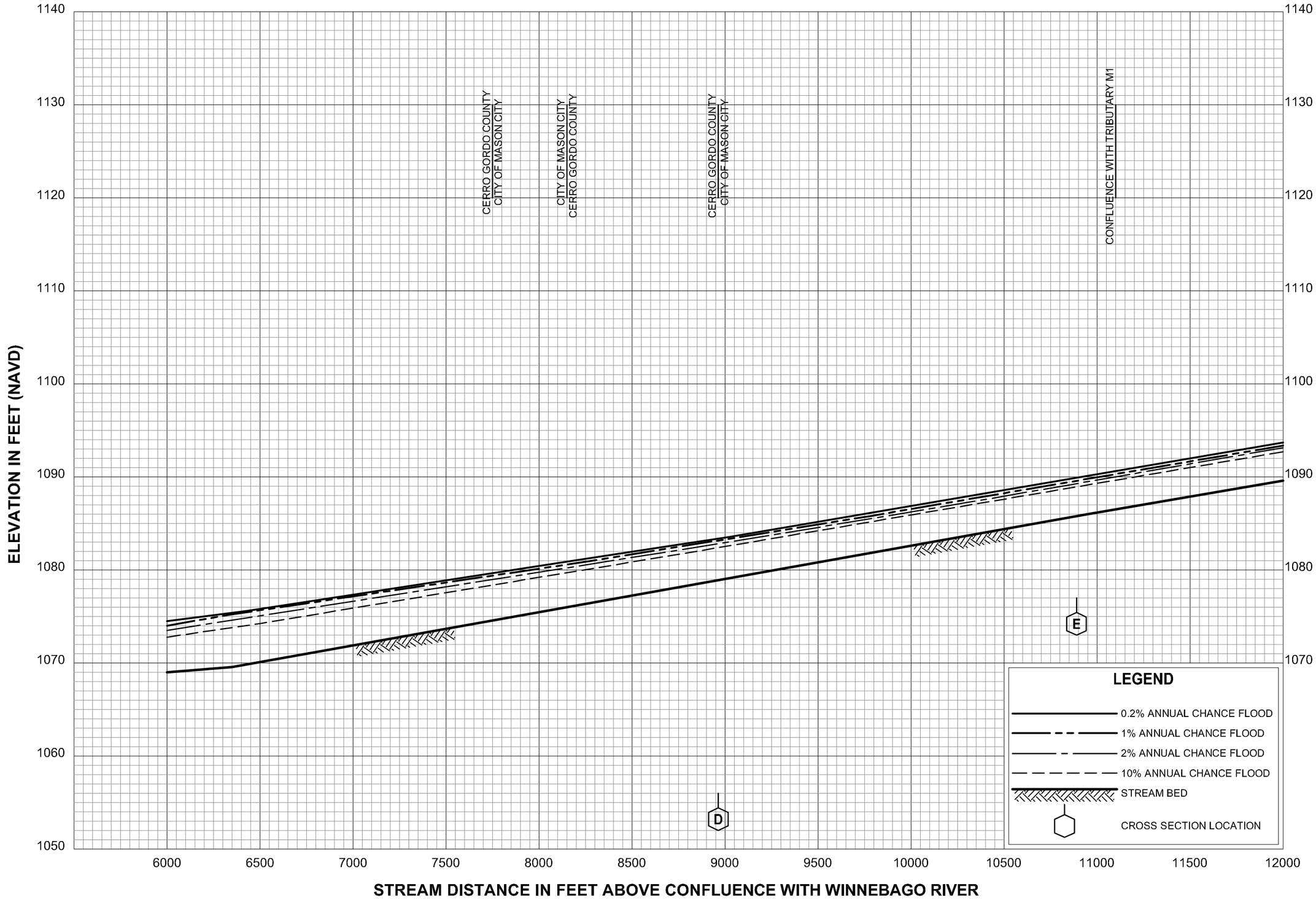
FLOOD PROFILES

MASON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS



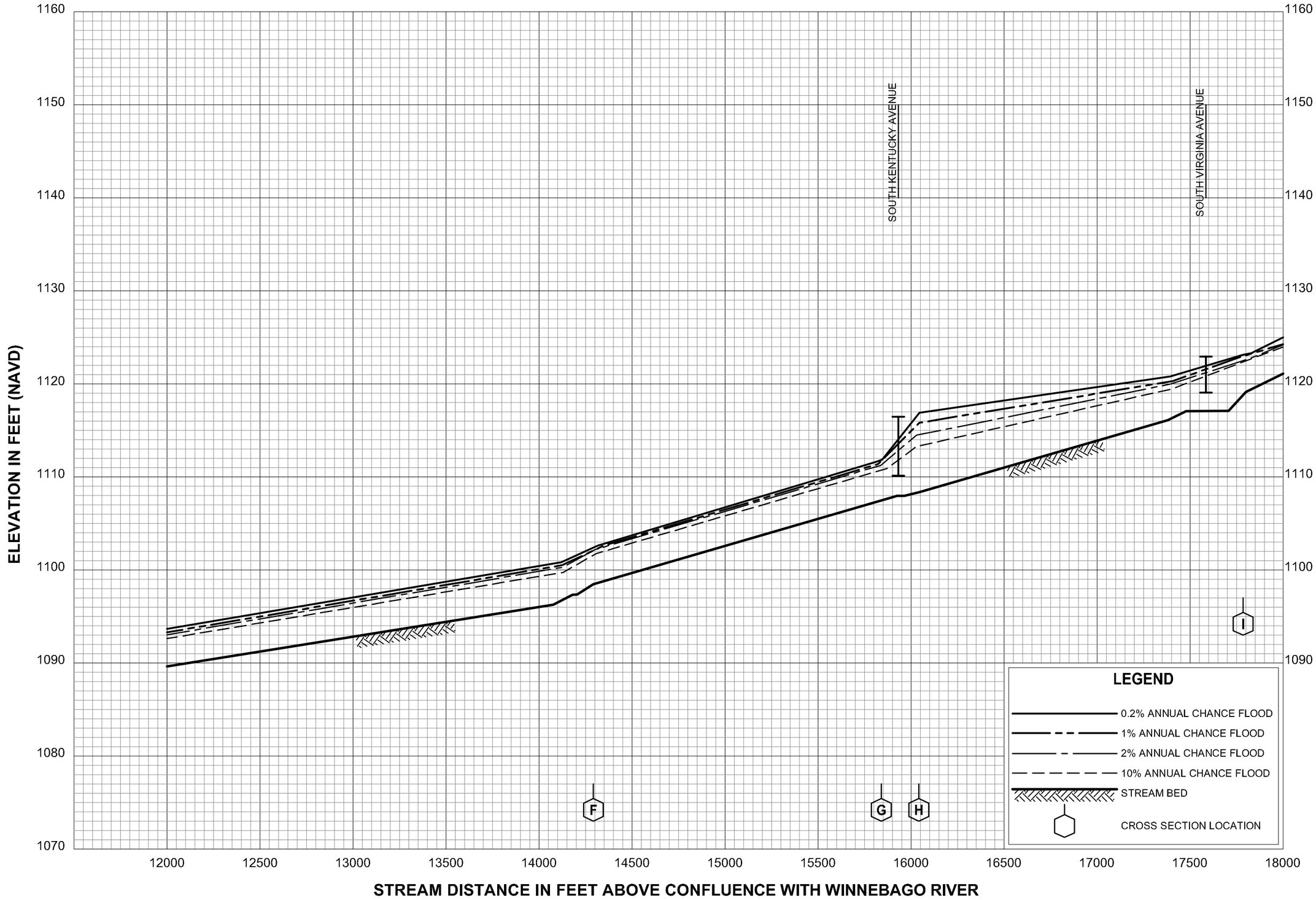
FLOOD PROFILES

MASON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS



FLOOD PROFILES

MASON CREEK

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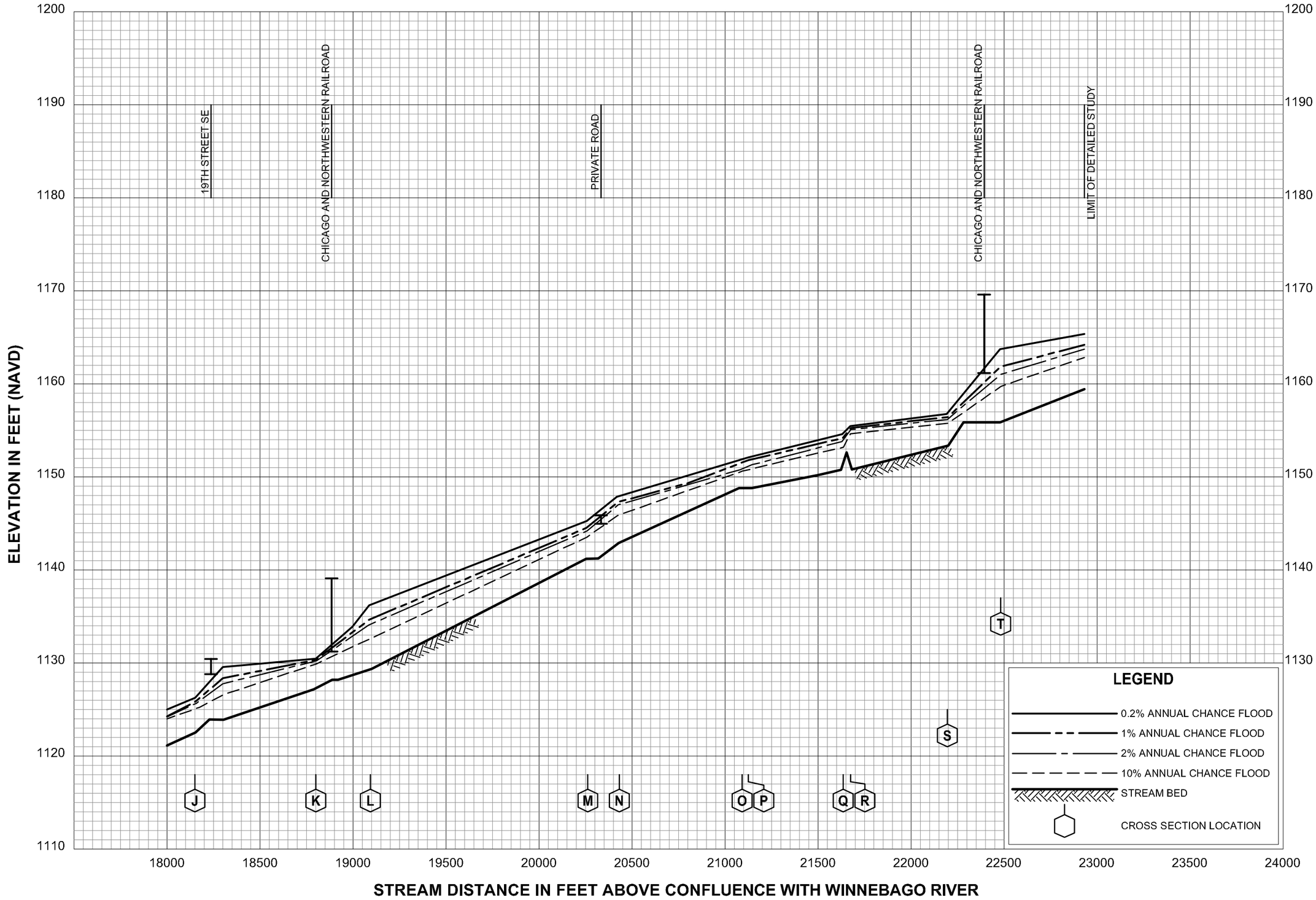
CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS



FLOOD PROFILES

MASON CREEK

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CERRO GORDO COUNTY, IA

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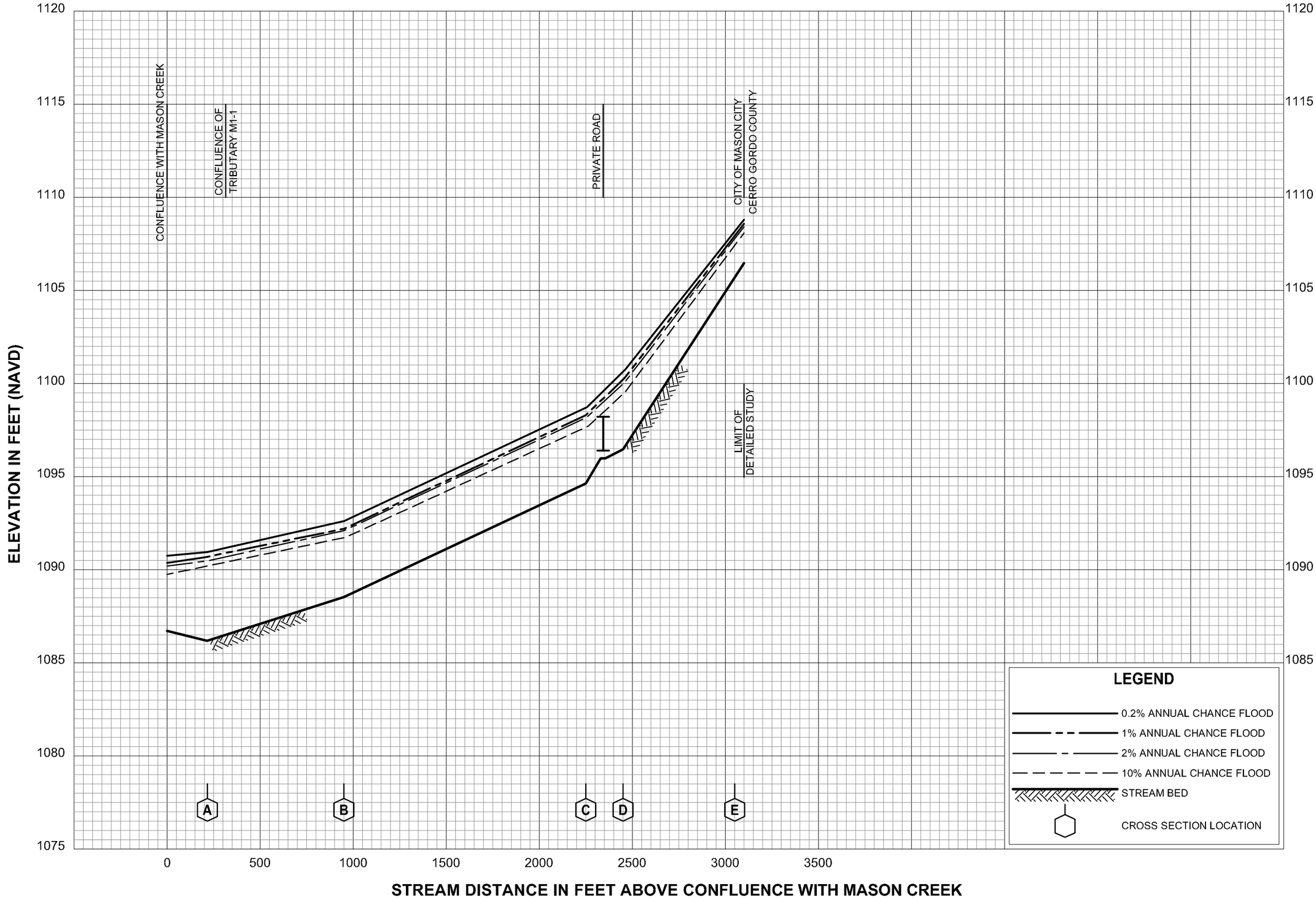

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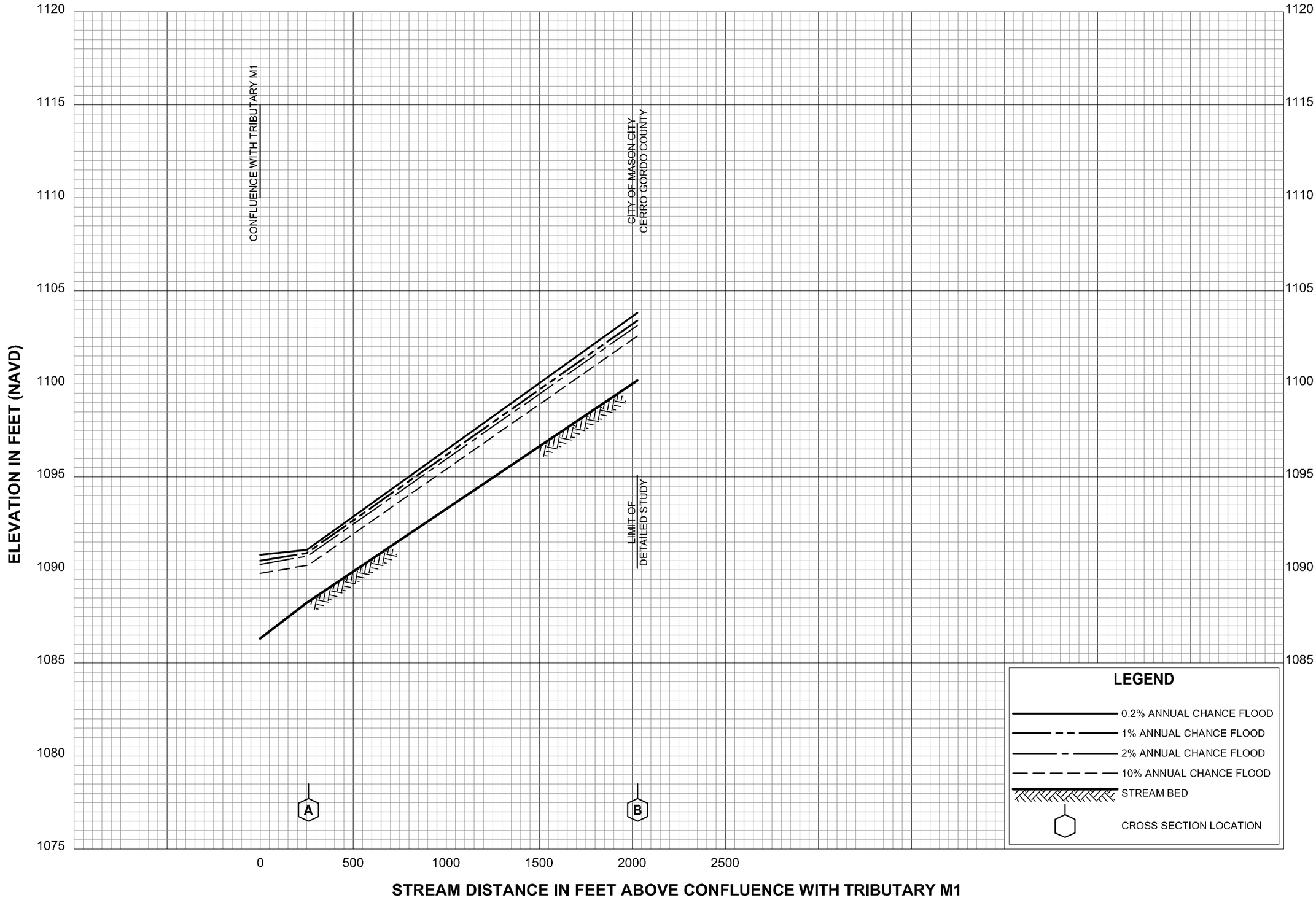
CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS



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CERRO GORDO COUNTY, IA

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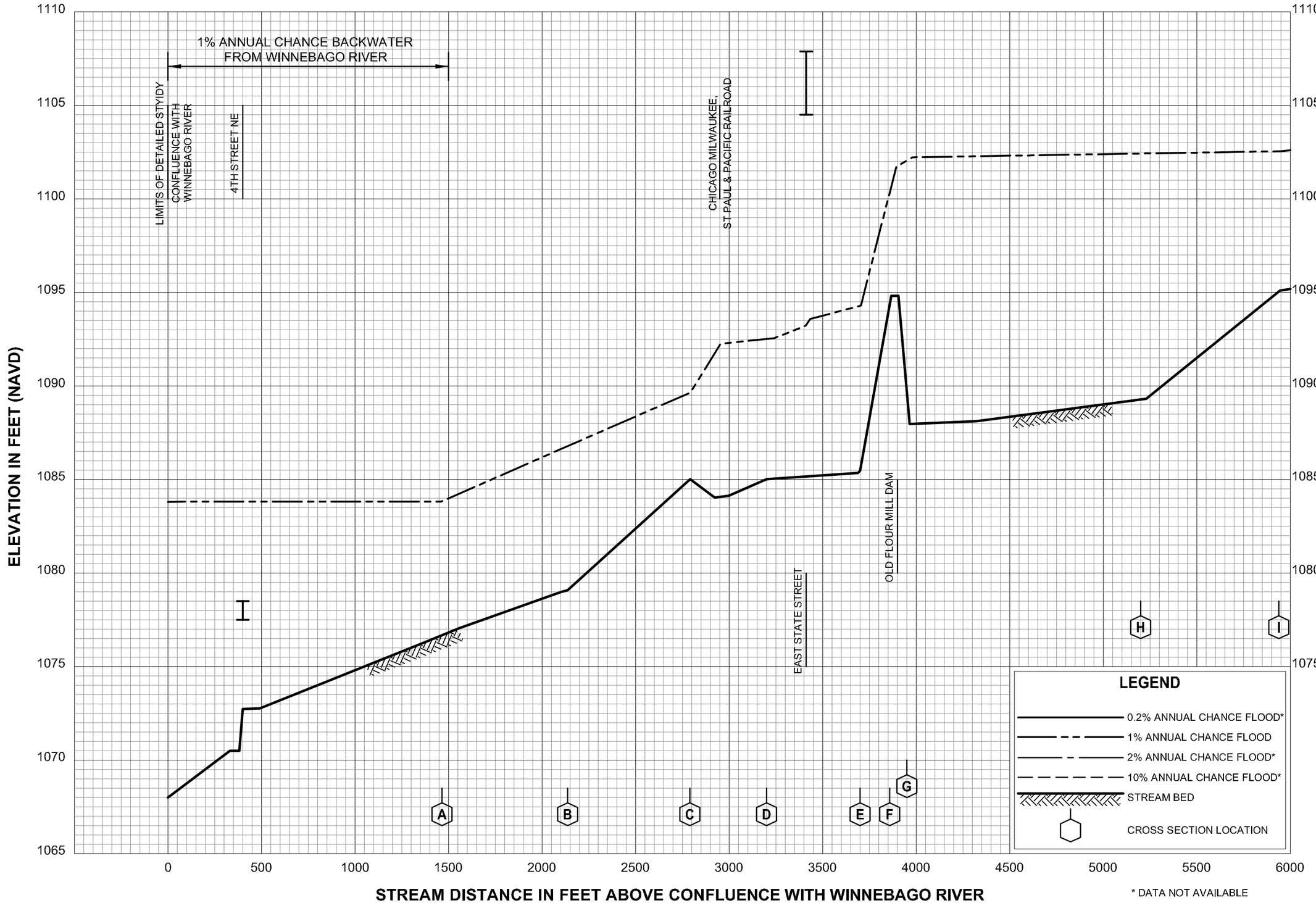


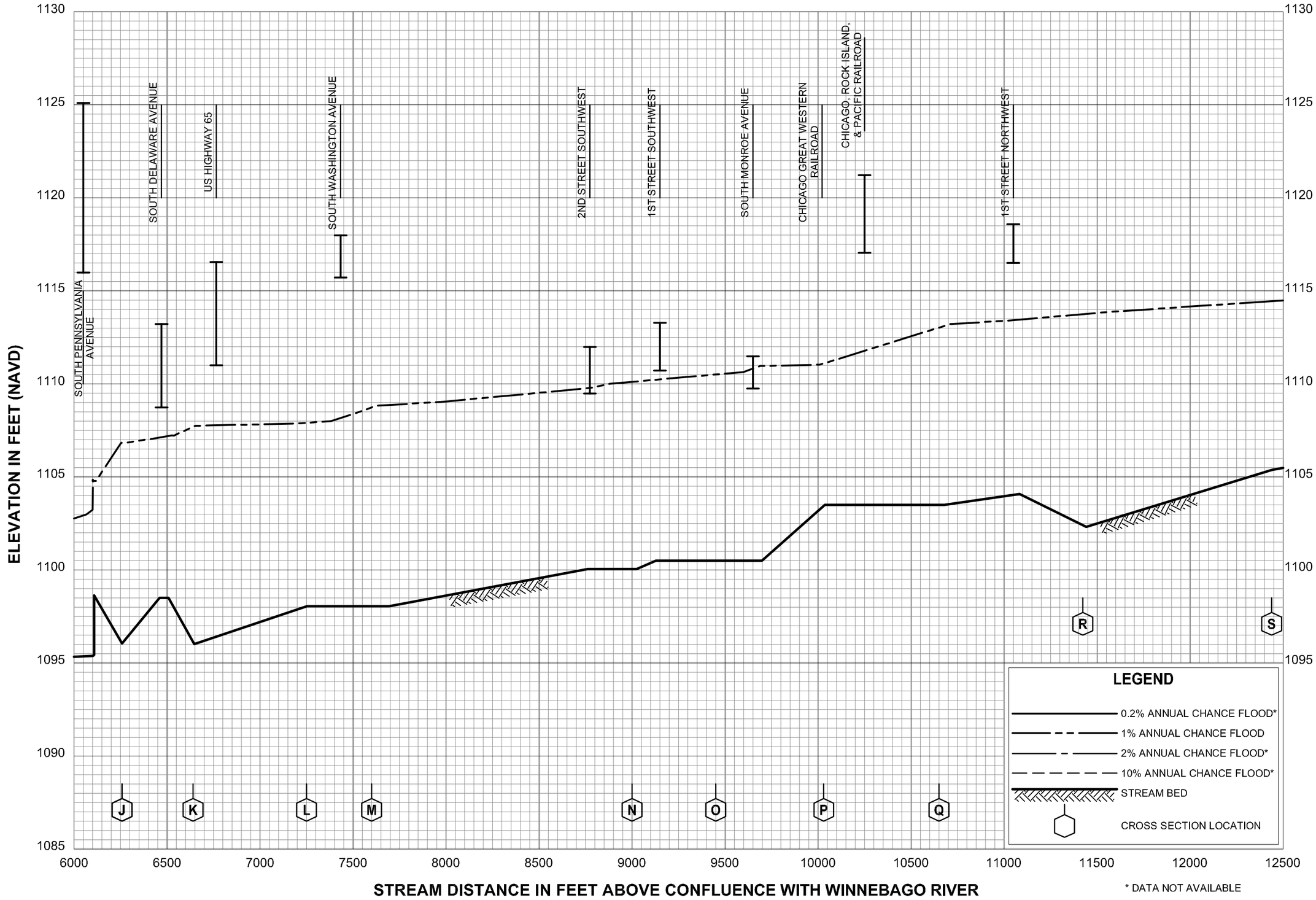
FLOOD PROFILES

WILLOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS



FLOOD PROFILES

WILLOW CREEK

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CERRO GORDO COUNTY, IA

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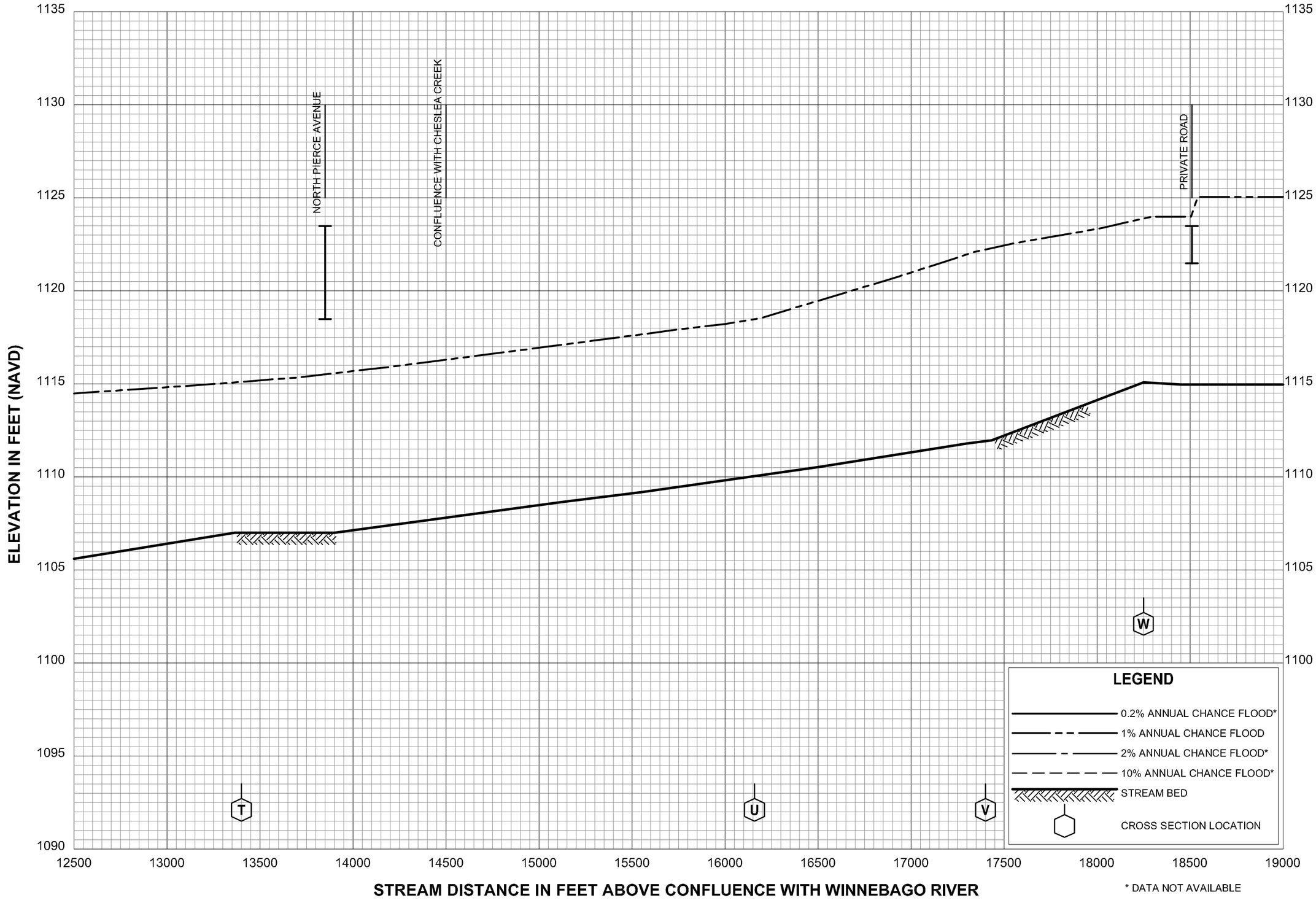

FLOOD PROFILES

WILLOW CREEK

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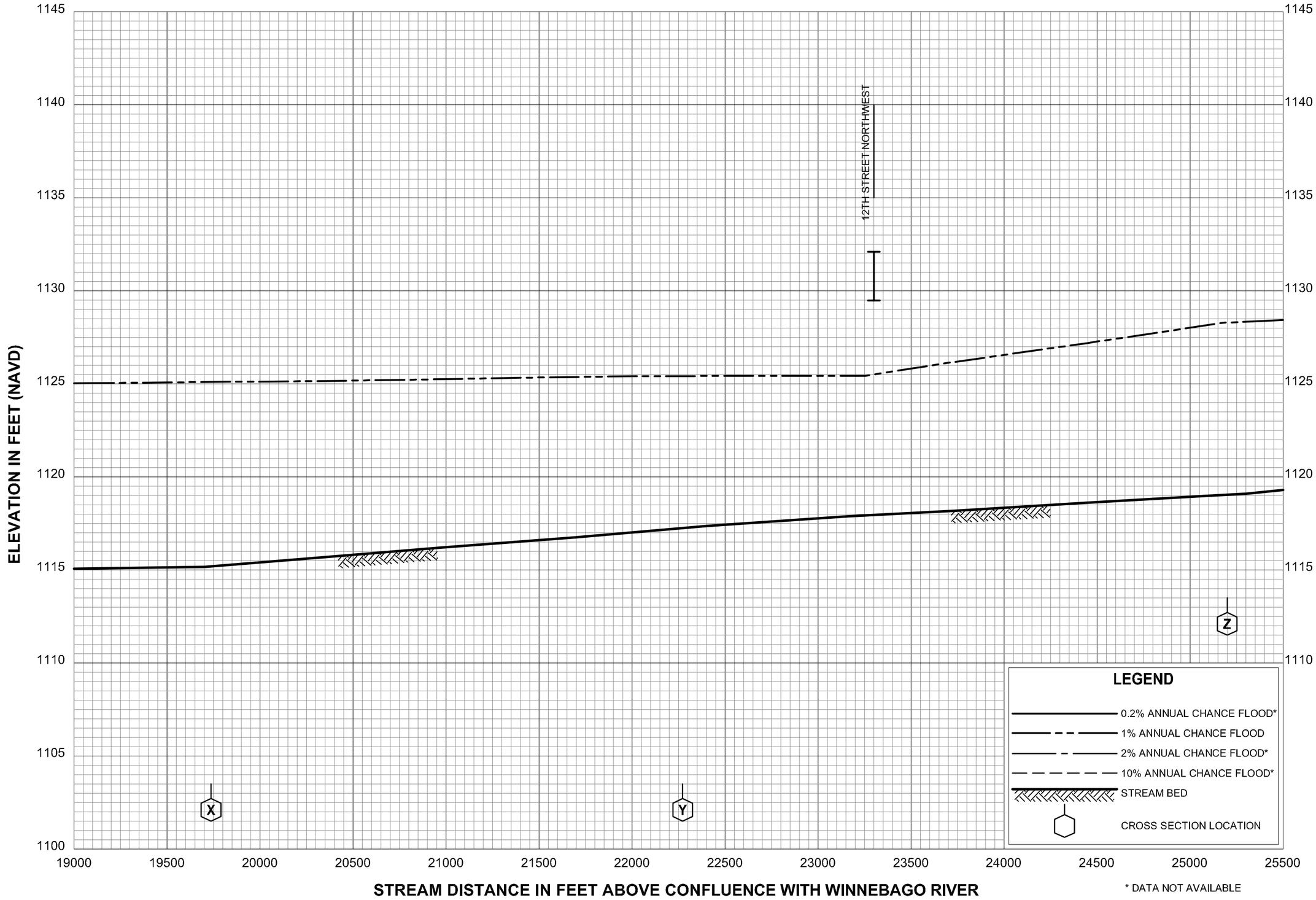

FLOOD PROFILES

WILLOW CREEK

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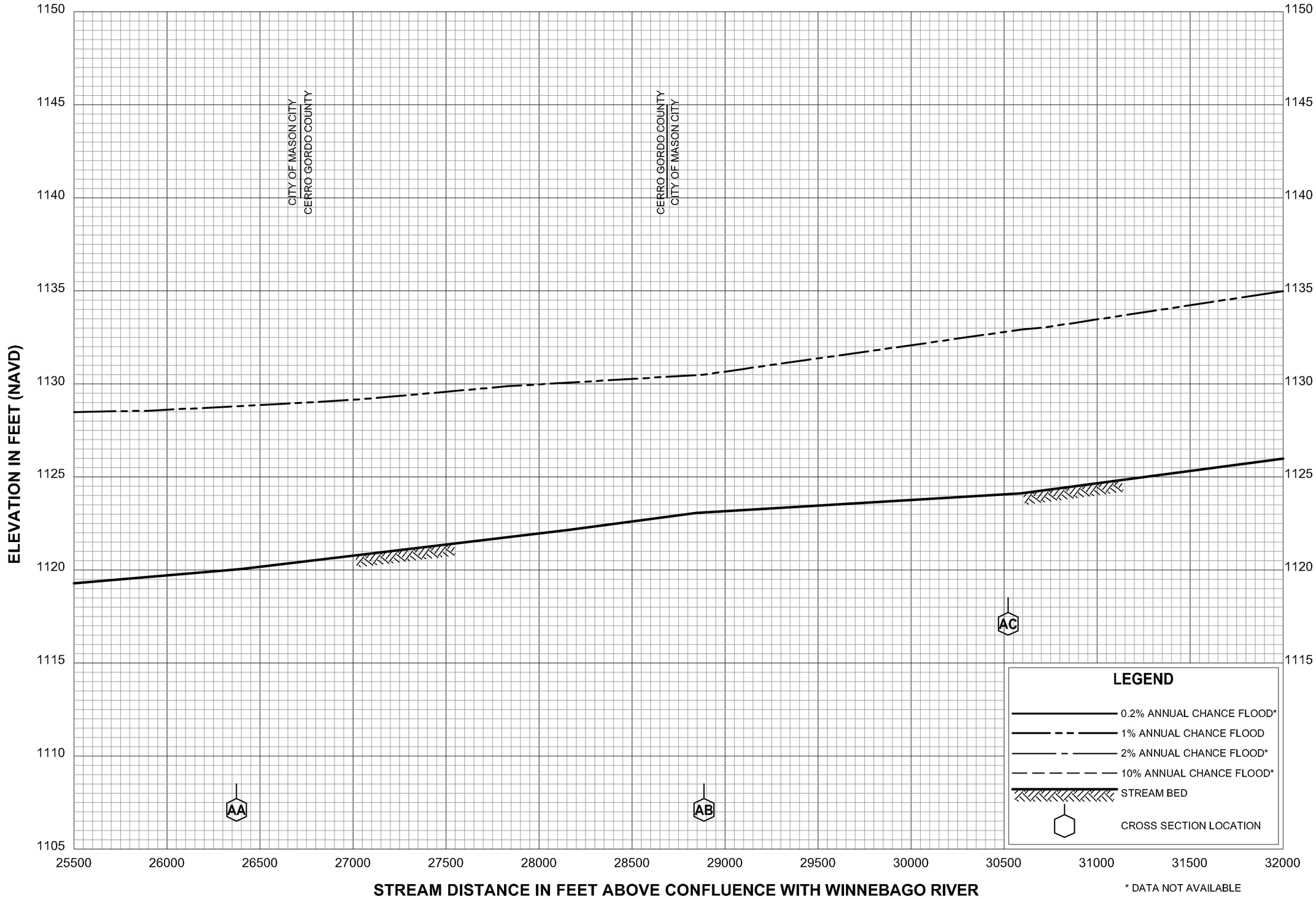

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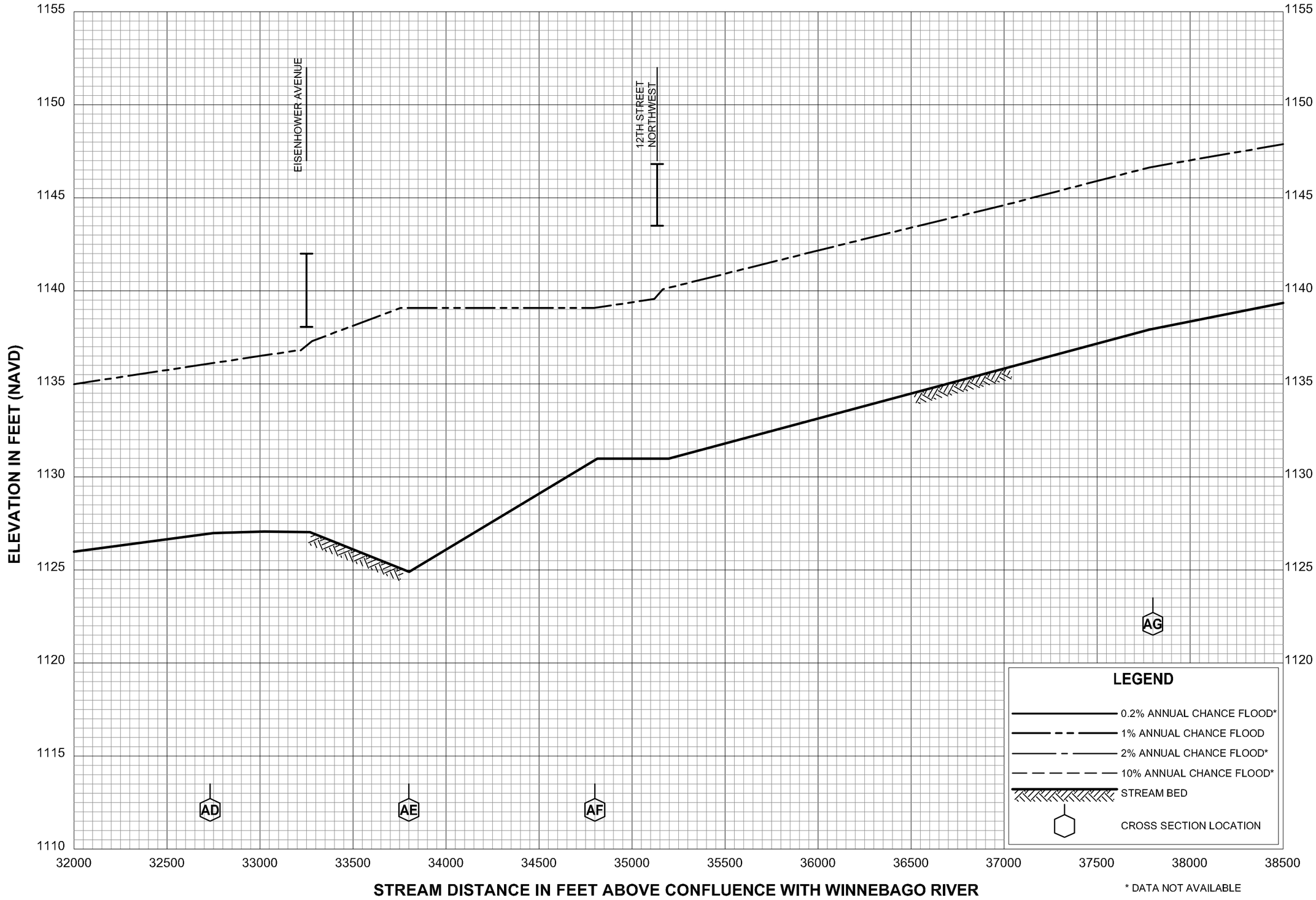

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FLOOD PROFILES

WILLOW CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

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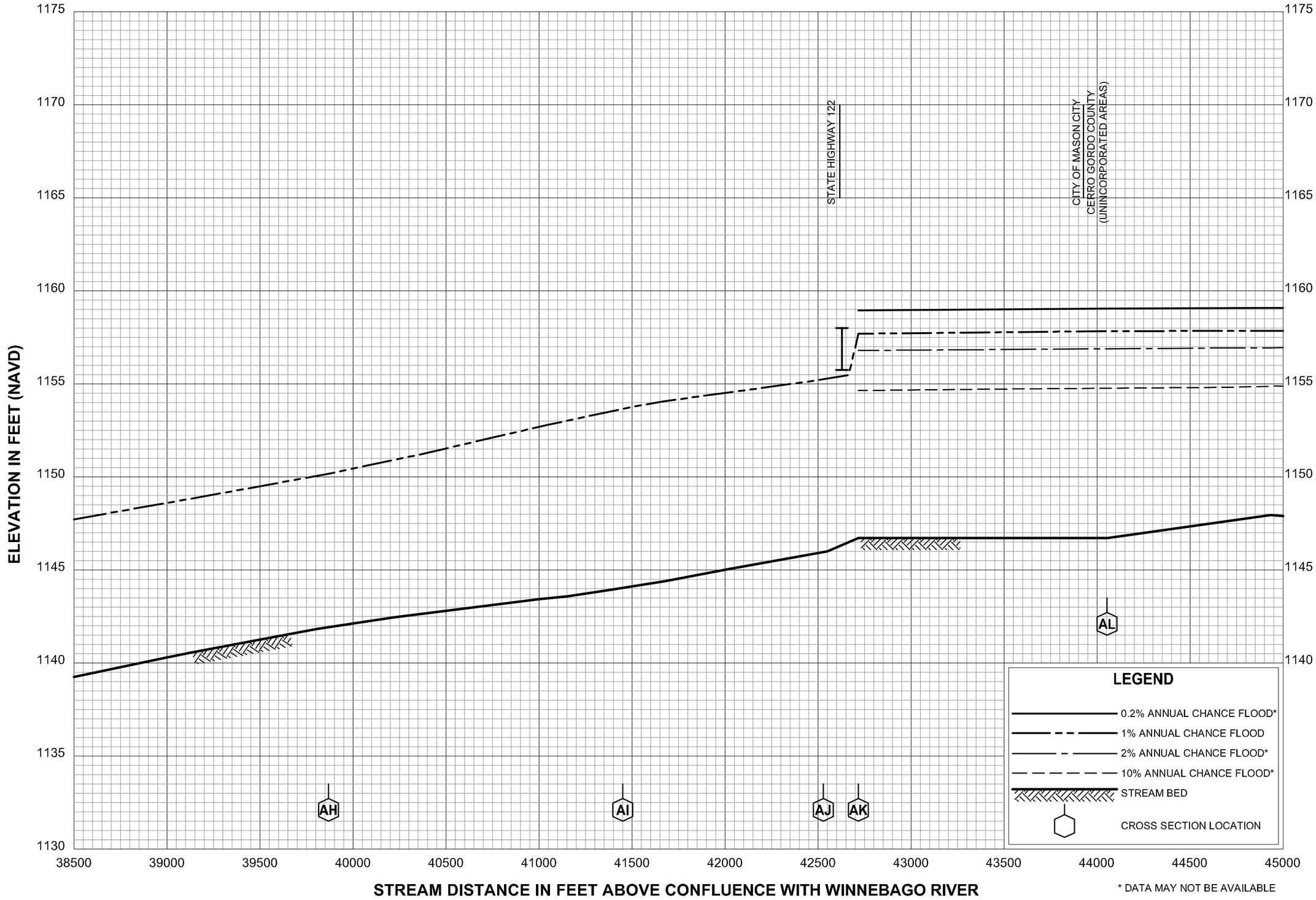

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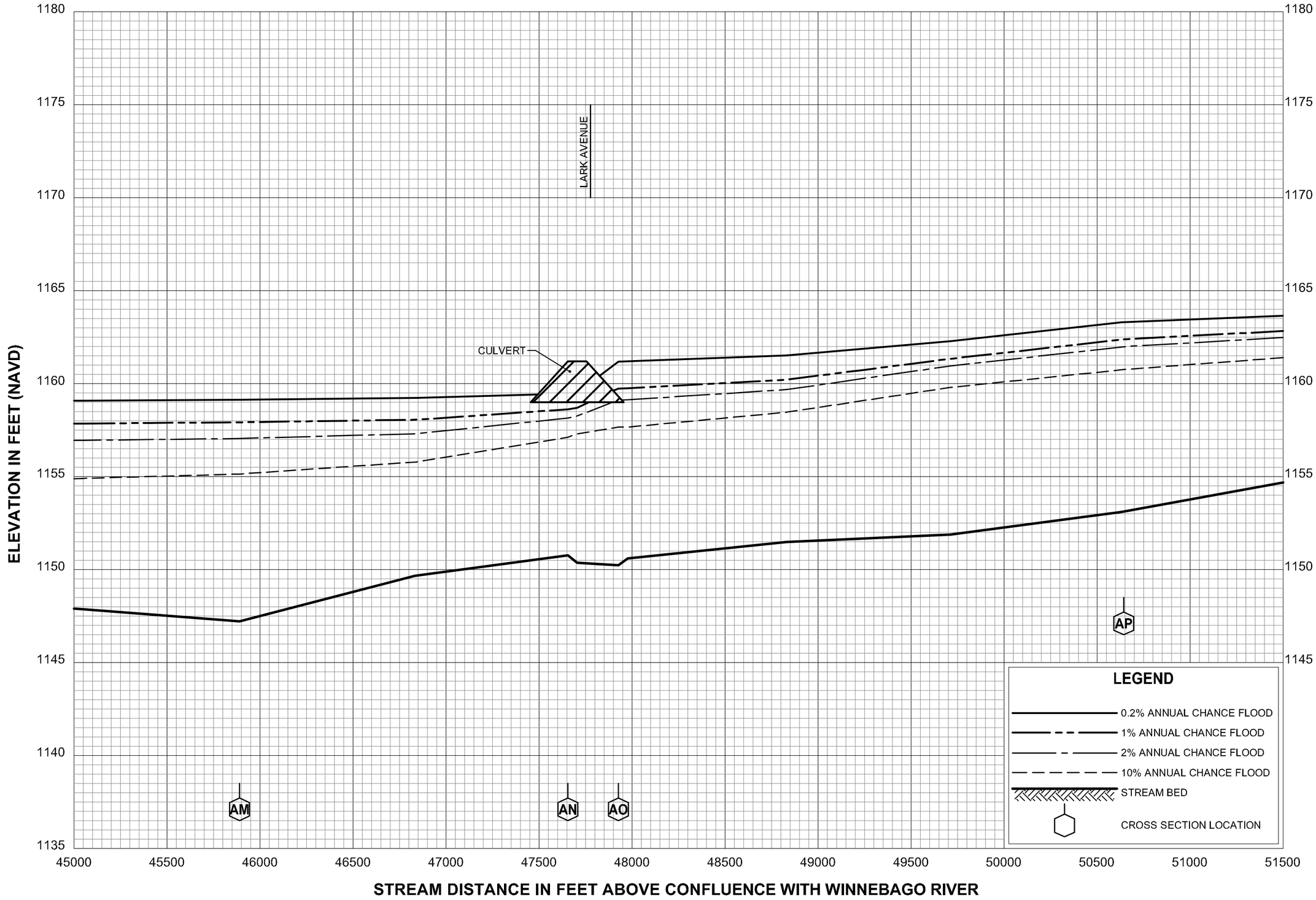

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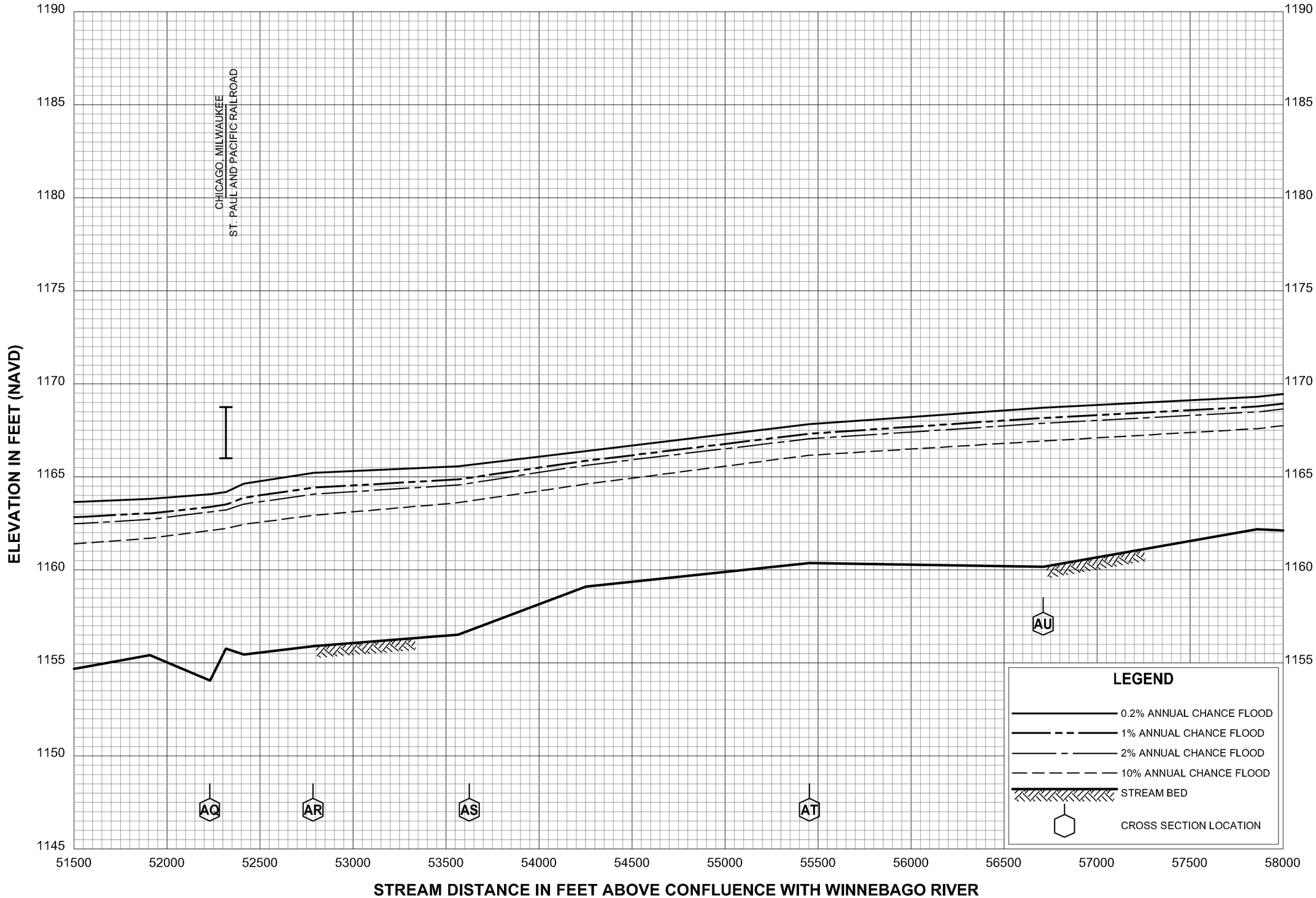

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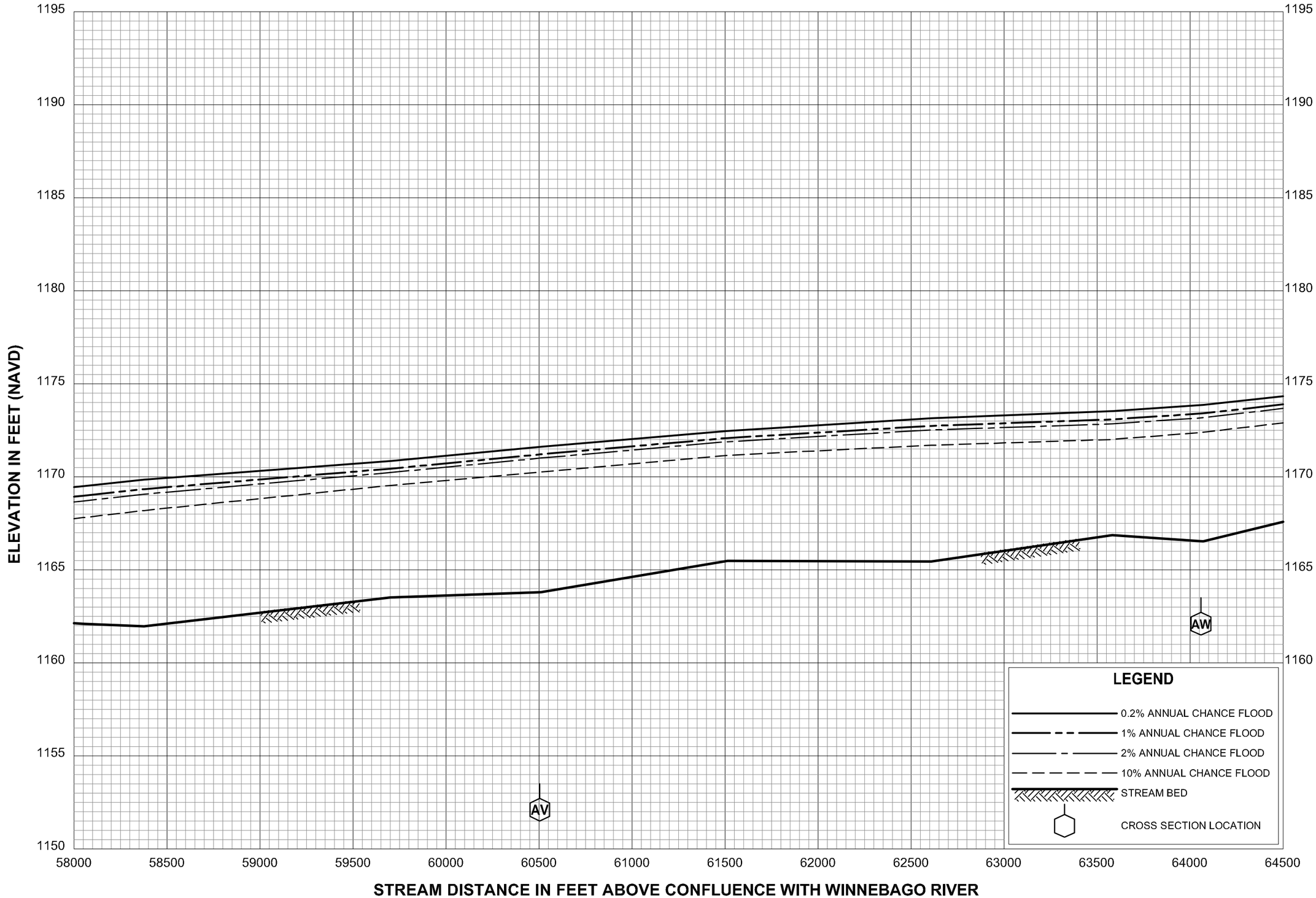

FLOOD PROFILES

WILLOW CREEK

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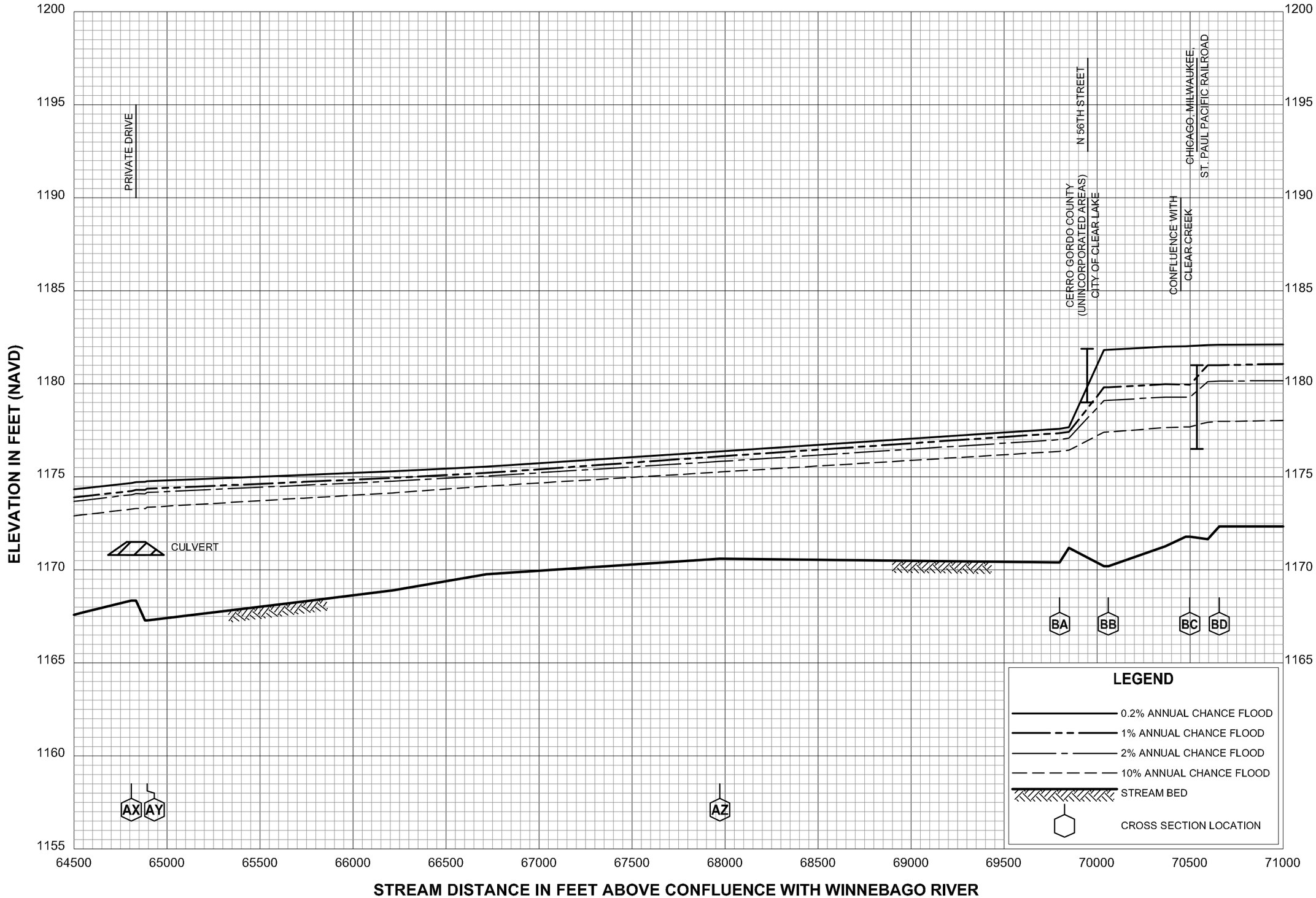

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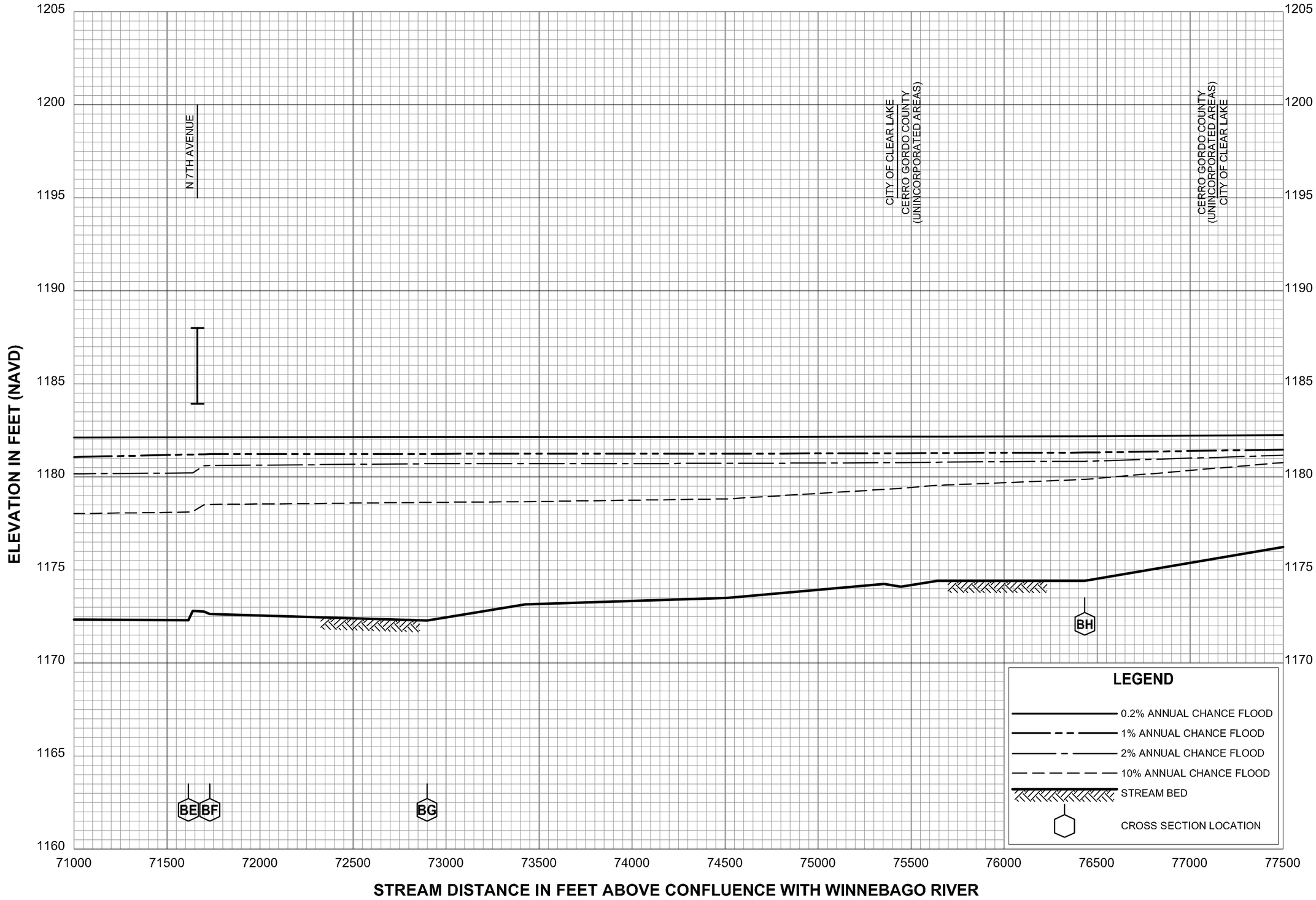

FLOOD PROFILES

WILLOW CREEK

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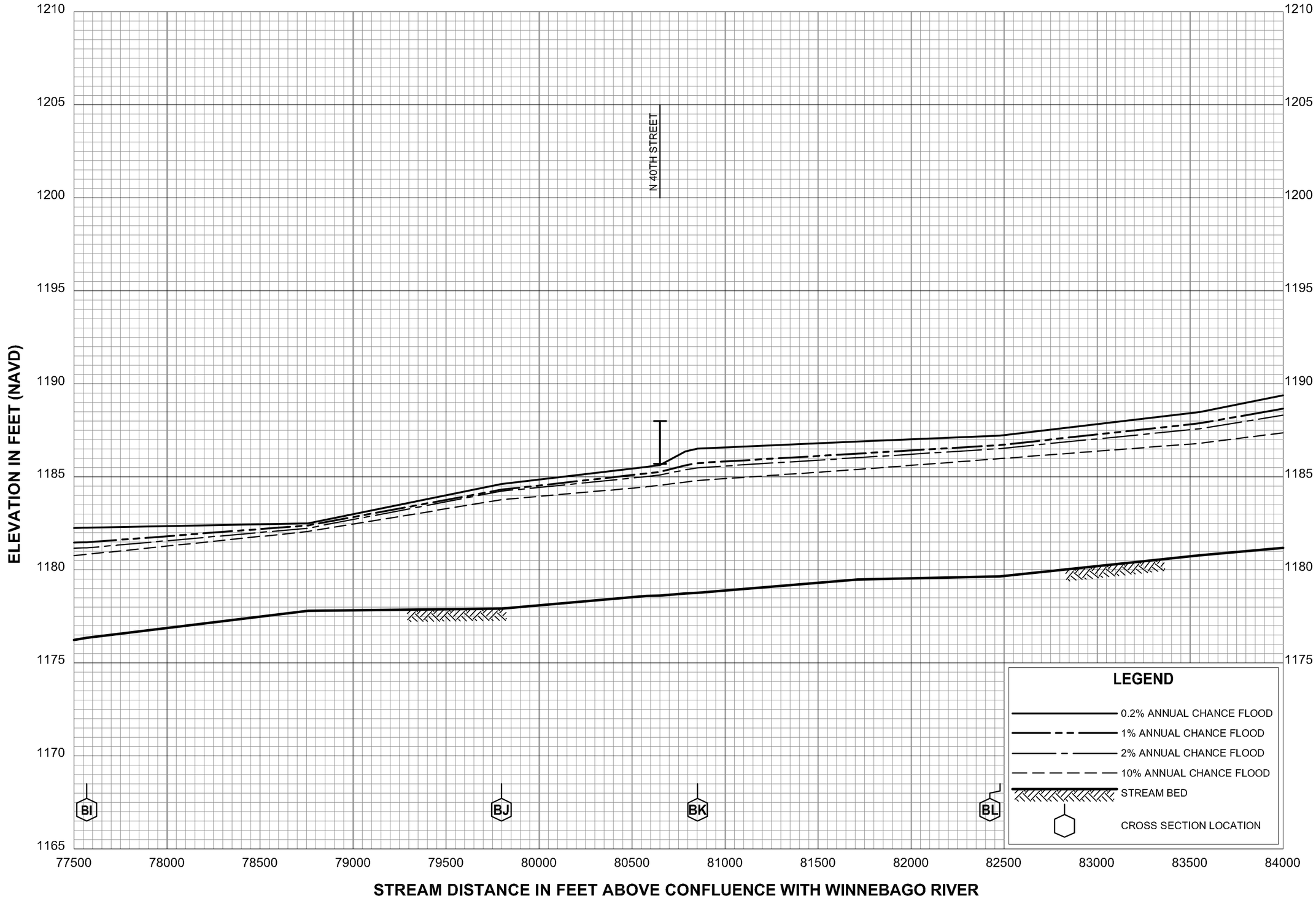

FLOOD PROFILES

WILLOW CREEK

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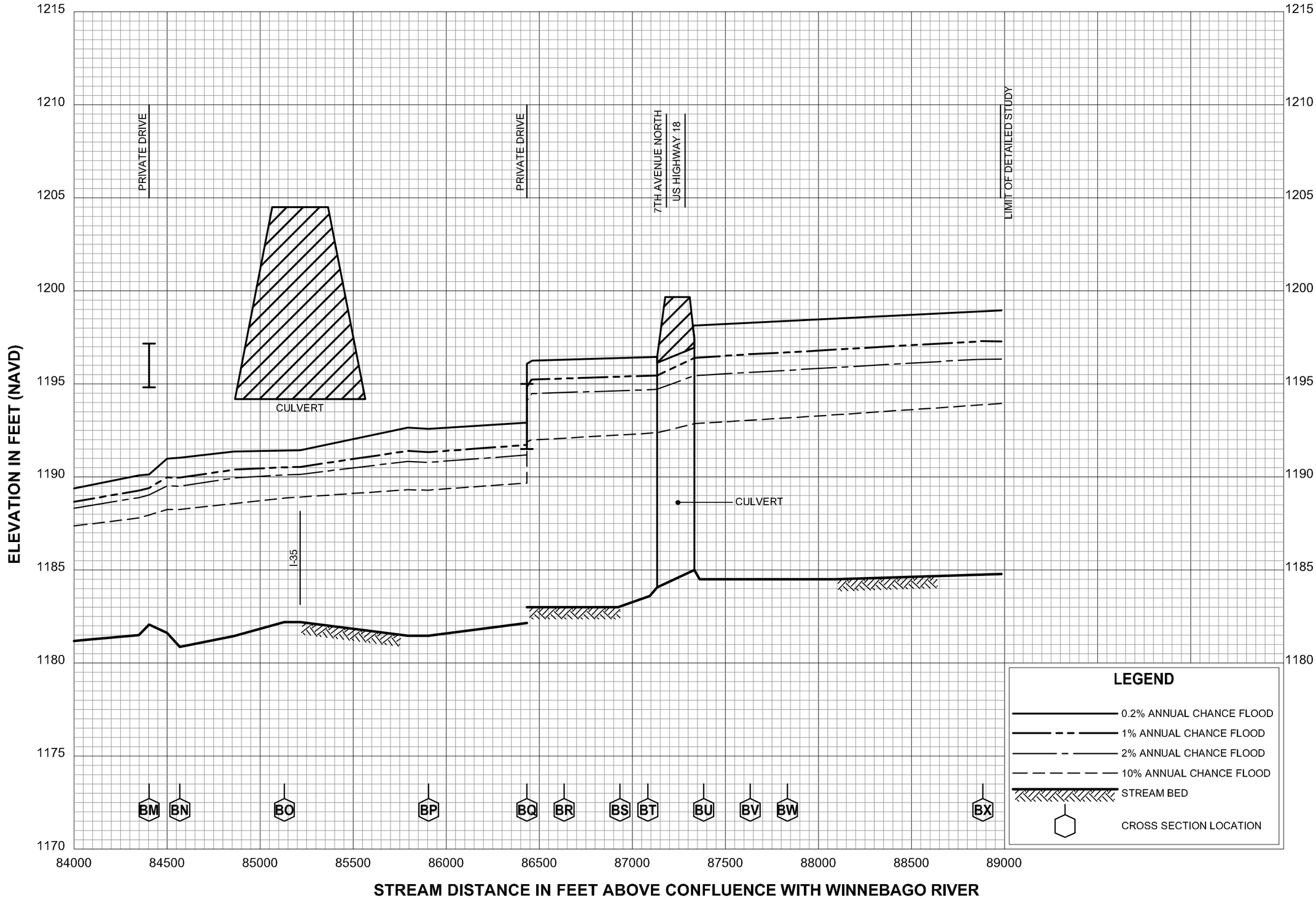

FLOOD PROFILES

WILLOW CREEK

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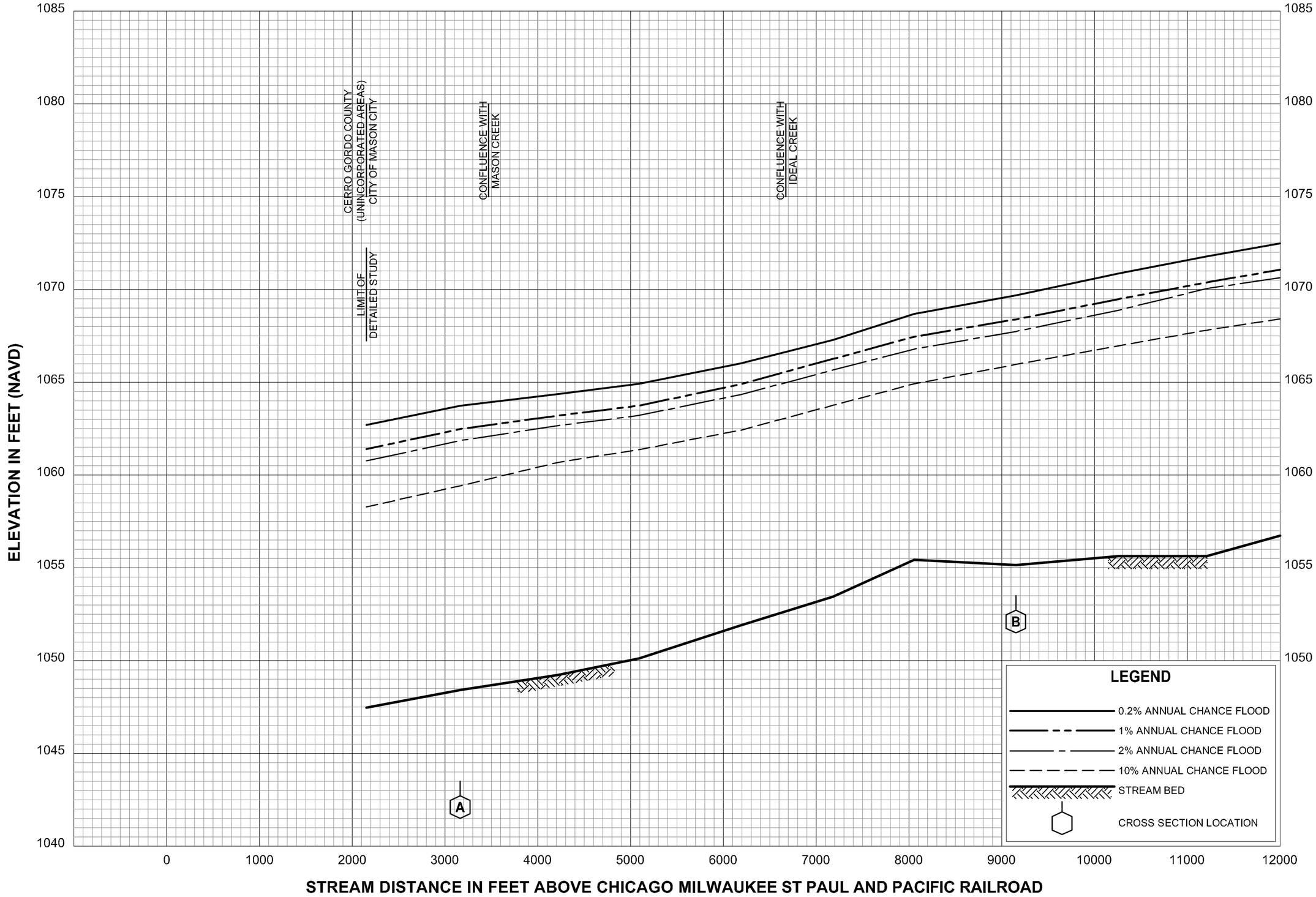


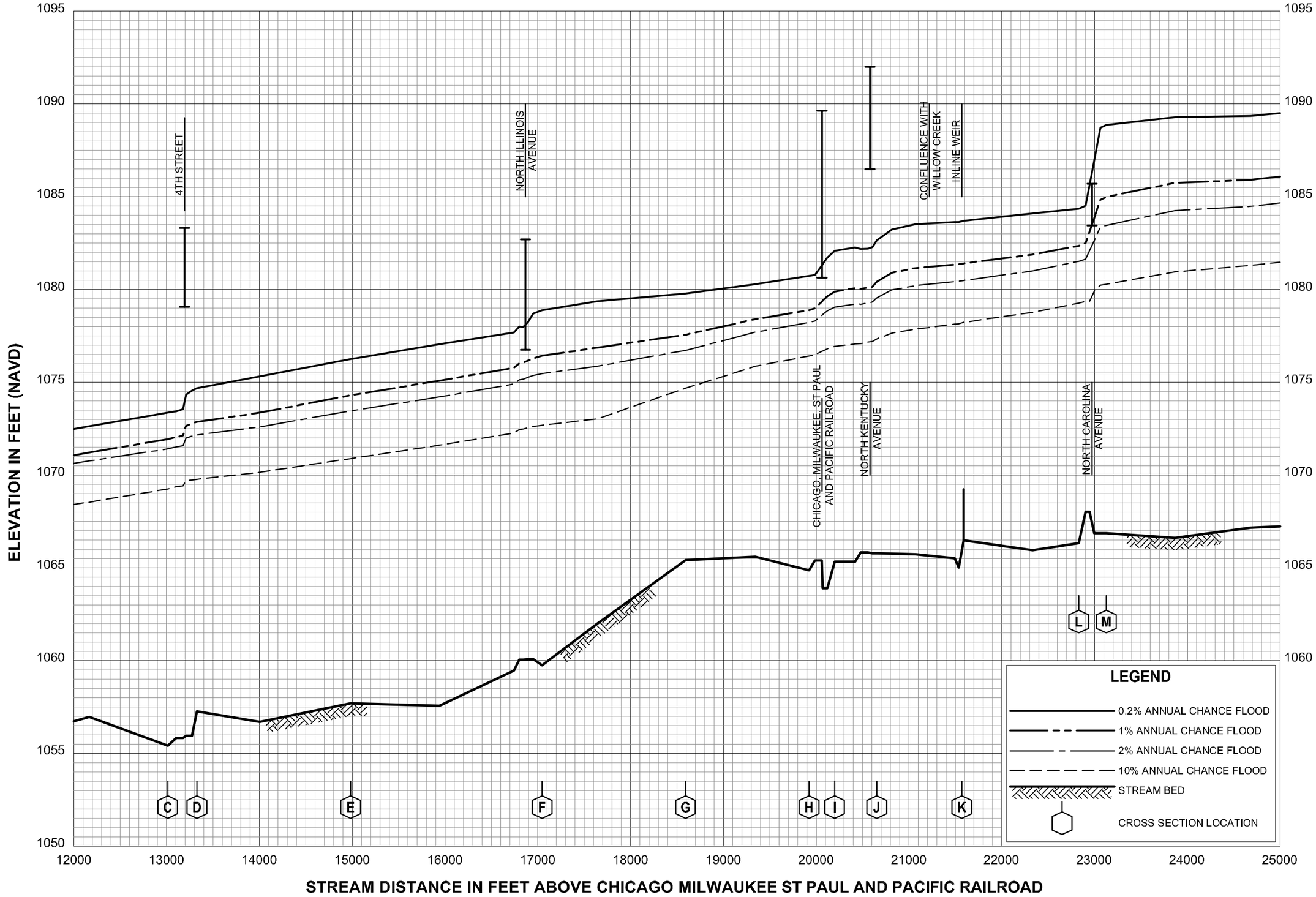
FLOOD PROFILES

WINNEBAGO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS



FLOOD PROFILES

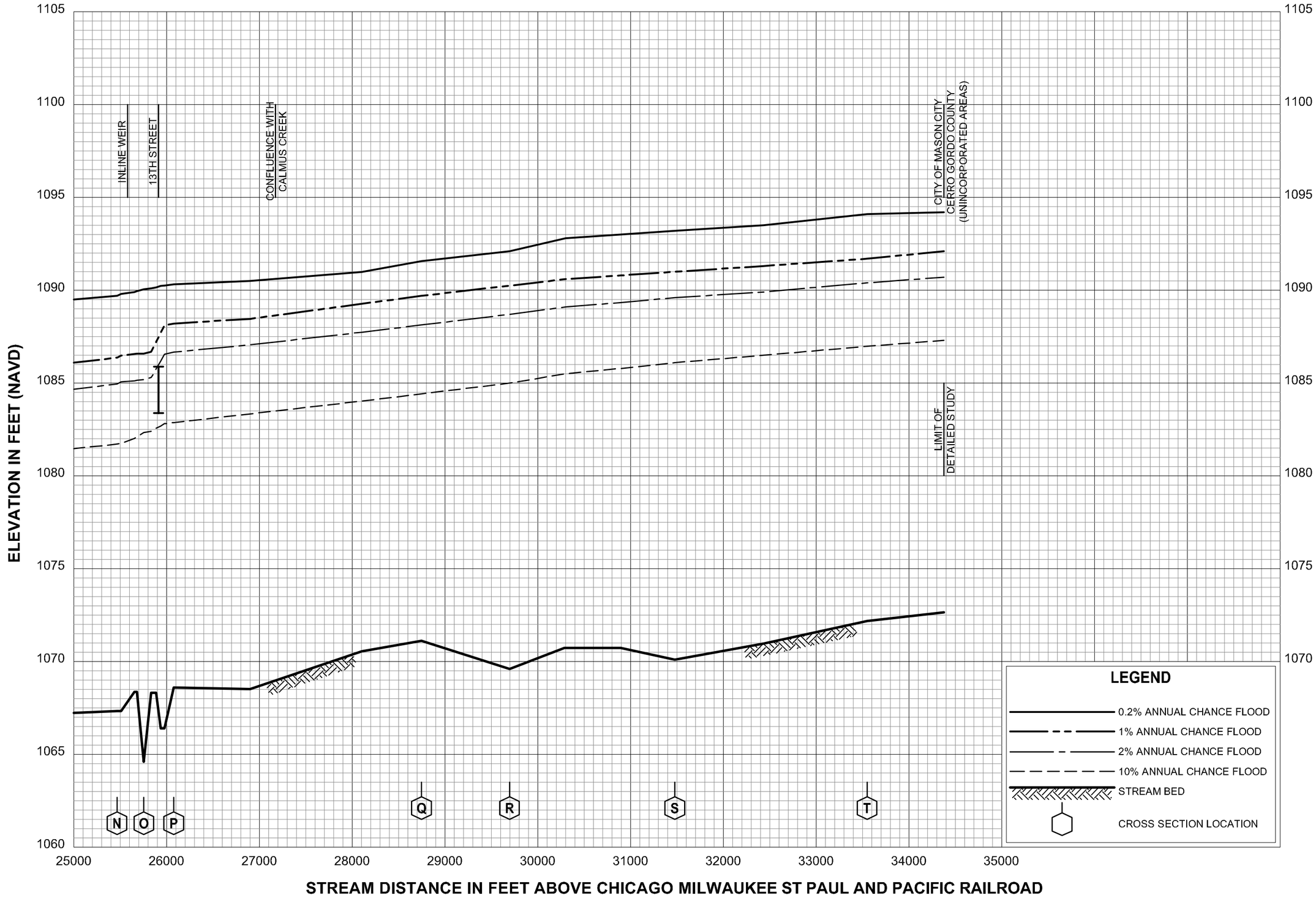
WINNEBAGO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

AND INCORPORATED AREAS

32P



FLOOD PROFILES

WINNEBAGO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CERRO GORDO COUNTY, IA

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