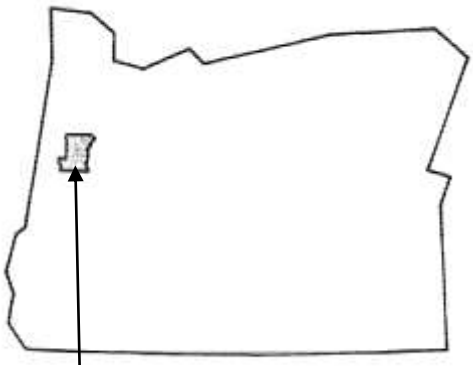
FLOOD INSURANCE STUDY



BENTON COUNTY, OREGON AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
*ADAIR VILLAGE, CITY OF	410089
BENTON COUNTY UNINCORPORATED AREAS	410008
CORVALLIS, CITY OF	410009
MONROE, CITY OF	410010
PHILOMATH, CITY OF	410011

*No Special Flood Hazard Areas identified



Benton County

Revised: December 8, 2016

Federal Emergency Management Agency

Flood Insurance Study Number
41003CV000B

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.

This FIS report was revised on June 2, 2011 and December 8, 2016. User should refer to Section 10.0, Revision Descriptions, for further information. Section 10.0 is intended to present the most up-to-date information for specific portions of this FIS report. Therefore, users of this FIS report should be aware that the information presented in Section 10.0 supersedes information in Sections 1.0 through 9.0 of this FIS report.

Initial Countywide FIS Effective Date: June 2, 2011

Revised Countywide Date: December 8, 2016

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PUBLISHED SEPARATELY

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
BENTON COUNTY AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and updates information on the existence and severity of flood hazards in the geographic area of Benton County, including the Cities of Adair Village, Corvallis, Monroe, Philomath and the unincorporated areas of Benton County (referred to collectively herein as Benton County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that the City of Albany is geographically located in Benton and Linn Counties. The City of Albany is included in its entirety in the Linn County FIS. The Flood Hazard information for the City of Albany is contained in the Benton County FIS and FIRMs and is for information purposes only.

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

1.2 Authority and Acknowledgments

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

The hydrologic and hydraulic analyses were performed by the U.S. Army Corps of Engineers (USACE), Portland District, for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. IAA-H-18-78, Project Order No. 21. This study, which was completed in December 1980, covered all significant flooding sources in the incorporated and un-incorporated areas of Benton County.

The countywide update was performed in July 2008 by WEST Consultants, Inc. for FEMA under Contract No. EMS-2001-CO-0068.

This update combined the Flood Insurance Rate Maps and Flood Insurance Study reports for Benton County and incorporated communities into the countywide format. Under the countywide format, FIRM panels were produced using a single layout format for the entire area within the county, instead of separate layout formats for each community. The single-layout format facilitates the matching of adjacent panels and depicts the flood-hazard area within the entire panel border, even in areas beyond a community's corporate boundary line. In addition, under the countywide format a single FIS report provides all associated information and data for the entire county area.

As part of the countywide update, the format of the map panels was changed. Previously, flood-hazard information was shown on both FIRMs and Flood Boundary and Floodway Maps (FBFMs). In the new format, all base flood elevations, cross sections, zone designations, and floodplain and floodway boundary delineations are shown on the FIRM; the FBFM has been eliminated. Some of the flood insurance zone designations were changed to reflect the new format. Areas previously shown as numbered Zone A were changed to Zone AE. Areas previously shown as Zone B were changed to Zone X (shaded). Areas previously shown as Zone C were changed to Zone X (unshaded). In addition, all Flood Insurance Zone Data Tables were removed from the FIS report and all zone designations and reach determinations were removed from the profile panels.

All flood elevations shown in this FIS report and on the FIRM panels were converted from National Geodetic Vertical Datum of 1929 (NGVD 29) to North American Vertical Datum of 1988 (NAVD 88).

1.3 Coordination

The dates of the initial, intermediate, and final CCO meetings held for the previous FIS reports for Benton County and the incorporated communities within its boundaries are shown in Table 1, "Initial, Intermediate, and Final CCO Meetings". They were attended by representatives of FEMA, the communities, and the study contractor.

Table 1: Initial, Intermediate, and Final CCO Meetings

Community	Initial CCO Date	Interim CCO Dates	Final CCO Date
Adair Village, City of	--[1]	--[1]	--[1]
Benton County, Unincorporated Areas	February 17, 1978	May 21, 1981	July 22, 1985
Corvallis, City of	February 15, 1978	September 17, 1980	July 21, 1981
Monroe, City of	--[1]	--[1]	--[1]
Philomath, City of	February 15, 1978	September 17, 1980	July 15, 1981

[1] Information not available

The initial coordination meetings were held in February, 1978, and attended by representatives of the Federal Emergency Management Agency, Benton County, the Cities of Corvallis and Philomath, and the study contractor to identify stream reaches to be studied, explain the study concepts, identify data sources, and establish communication and coordination procedures.

Intermediate coordination meetings were held between FEMA, local officials and the study contractor to review plan and profile drawings showing water-surface profiles, floodway delineations, and flooded-area outlines. The dates of the Intermediate coordination dates are listed in Table 1.

Final community coordination meetings were held and attended by representatives of FEMA, local officials, the study contractor, and the community. All problems and concerns raised at the final meetings have been addressed in this study. The dates of the Final coordination dates are listed in Table 1.

Countywide Update

An initial community coordination meeting for Benton County was held on March 20, 2006. This meeting was attended by representatives of the City of Corvallis, Benton County, State of Oregon, FEMA and WEST Consultants. The results of the study were reviewed at the final Consultation Coordination Officer [CCO] meeting held on January

15, 2009, and attended by representatives of County Staff, Local City Staff, FEMA Region X, and Department of Land Conservation and Development. All problems raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the geographic area of Benton County, Oregon, including the incorporated communities listed in Section 1.1.

The flooding sources studied by detailed methods in Benton County were selected with priority given to all known flood hazards and areas of projected development or proposed construction through 1985 for the Cities of Corvallis and Philomath, and through 1990 for the remainder of Benton County.

The limits of detailed studies in Benton County were determined by FEMA with community and study contractor consultation at the meeting in February 1978. Table 2 lists the flooding sources studied in detail and the included segments.

Table 2. Flooding Sources Studied by Detailed Methods

Flooding Source	Limits of Detailed Study
1. North Fork Alsea River	From the western boundary of Section 1 of T. 14 S., R. 8 W., upstream 1.5 miles through the community of Alsea
2. Dixon Creek	From the mouth to its confluence with North and South Forks Dixon Creek
3. South Fork Dixon Creek	From the mouth to a point approximately 2,000 feet upstream
4. Dunawi Creek	From the mouth to its confluence with North and South Forks Dunawi Creek
5. Frazier Creek	From sump area east of U.S. Highway 99 West upstream to Crescent Valley Drive
6. Jackson Creek	From the confluence with Frazier Creek upstream to Crescent Valley Drive
7. Marys River	From the confluence with the Willamette River to U.S. Highway 20 west of the City of Philomath
8. Millrace	From the confluence with the Marys River to its divergence from the Marys River
9. Newton Creek	From the confluence with the Marys River to West Hills Road
10. Oak Creek	From the confluence with the Marys River to the Southern Pacific Railroad crossing
11. Stewart Slough	From its mouth upstream to 0.08 mile upstream from the City of Corvallis northern corporate limits

12. Soap Creek	From the State game refuge upstream 1.5 miles
13. Willamette River	Entire length affecting Benton County

Approximate analyses were used to study flooding sources in areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by representatives from FEMA, Benton County, and the Cities of Corvallis and Philomath. Table 3 lists the flooding sources, grouped by watershed, which were studied by approximate methods.

Table 3. Flooding Sources Studied by Approximate Methods

1.	Alsea River, North Fork Alsea River, South Fork Alsea River, Bummer Creek, Crooked Creek
2.	Greasy Creek, Rock Creek
3.	Lobster Creek, Little Lobster Creek
4.	Long Tom River, Lake Slough, Shafer Creek
5.	Luckimute River, Maxfield Creek, Price Creek, Woods Creek, Plunkett Creek, Vincent Creek, Burgett Creek
6.	Marys River, East Fork Marys River, West Fork Marys River, Devitt Creek, Horton Creek, Tumtum River, Lasky Creek, Mulkey Creek, Blakesley Creek, Evergreen Creek, North Fork Dunawi Creek, South Fork Dunawi Creek, Oak Creek, East Fork Newton Creek
7.	Muddy Creek, Bull Run Creek, Beaver Creek, Starr Creek, Gray Creek, Reese Creek, Oliver Creek, Larsen Creek, Belknap Creek, Nichols Creek, Hammer Creek, Hawley Creek
8.	Stewart Slough, Frazier Creek, North Fork Dixon Creek, South Fork Dixon Creek, unnamed tributary to Dixon Creek, Dry Creek, Mountain View Creek, Bowers Slough, Calloway Creek

2.2 Community Description

Benton County is located in west-central Oregon. It is bordered to the north by Polk County, to the south by Lane County, to the west by Lincoln County, and to the east by Linn County and the Willamette River. Benton County has experienced moderate growth during the 1970s. The population increased from 18,629 in 1940 to 68,800 in 1978 (Reference 1). The population was estimated to be 85,579 in 2010 (Reference 2). Most of this increase has occurred in incorporated cities within the county.

All streams studied, except for the Alsea River, are a part of the Willamette River basin. The Willamette River forms at the confluence of its Coast and Middle Forks approximately 5 miles upstream of Eugene, Oregon. The Coast Fork originates in the Calapooia Mountains, whereas the Middle Fork originates in the Cascade Mountains. At Eugene, the Willamette River emerges from the foothills and flows northerly through the Willamette Valley. Upstream of Albany, the Willamette River drains approximately 4,840 square miles of mostly mountainous timberland. At the City of Corvallis, the Willamette River drains approximately 4,400 square miles.

The Marys River originates in the Coast Range and flows about 45 miles easterly and then northeasterly to meet the Willamette River east of Philomath at Corvallis. The 299-square-mile drainage basin is roughly triangular in shape.

The Alsea River originates in the Coast Range and flows westerly into the Pacific Ocean at Waldport. Within Benton County, the Alsea River drains mostly timberlands in the Coast Range.

The other streams studied are tributaries to either the Willamette River or Marys River. The drainage areas of these tributaries are less than 13 square miles. Many of these tributaries are located in the flat, wide Willamette River Valley.

Benton County's economy is keyed closely to Oregon State University, a major employer in the area. Other industries in the area are forest products, electronics, and rye seed production.

Benton County's climate consists of warm, dry summers and mild, wet winters. Temperatures range from an average January minimum of 34°F in the Willamette River Valley to an average July maximum of 81°F (Reference 3). Precipitation varies over the county, depending of elevation and location. In the Willamette River Valley, where the majority of the county residents live, the average annual precipitation is 37 inches, with approximately 75 percent occurring between November and March. Average annual snowfall is 7 inches, with most occurring in January (Reference 4).

Vegetation in the county varies from timber in the higher elevations to agricultural species in the lower valley areas. Soils in the mountainous areas range from light soils to sands and gravels. In the valley areas Willamette soil types predominate. Soils in these areas vary from moderate to poor permeability, and in wet winter months may have a water table that in some areas comes within 10 inches or less of the ground surface.

Residential development within the flood plain areas of unincorporated Benton County is minimal. However, moderately dense residential development in areas such as North Albany and South Corvallis is subject to flooding.

City of Adair Village

Adair Village is located in northeast Benton County. It is located approximately 10 miles north of Corvallis, Oregon, and 40 miles south of Salem, the state capital. The population was estimated to be 536 in 2000 (Reference 2).

City of Corvallis

Corvallis is situated along the easterly boundary of Benton County formed by the Willamette River, in western Oregon. It is located approximately 40 miles north of Eugene and approximately 35 miles south of Salem. Corvallis is bordered completely by unincorporated areas of Benton County. The population of Corvallis increased from 20,699 in 1960 to an estimated 40,500 in 1978 (Reference 1). The population of Corvallis was approximately 50,126 in 2000 (Reference 2). Included in the population are approximately 16,000 Oregon State University Students (Reference 5).

The Corvallis economy is keyed closely to Oregon State University, the major source of employment in the area. Other industries in the area are related to forest products, electronics, and agriculture. Because Corvallis is the county seat, local and State governments also contribute to employment. Corvallis has only limited industrial development; most of the area is devoted to single-family residences, community

services, and the university campus. The central business district is located along the Willamette River between Western and Harrison Boulevards.

The Willamette River flows northerly through a mix of residential and commercial areas of Corvallis. Upstream of Corvallis, the Willamette River has a drainage area of approximately 4,400 square miles

The Millrace is an overflow channel from the Marys River. It leaves the Marys River, passes under the Southern Pacific Railroad trestle, and flows through a mixed residential and commercial area for approximately 1 mile before re-entering the Marys River near its mouth.

Dixon Creek flows southeasterly from the foothills of the Coast Range through residential and commercial areas of Corvallis before entering the Willamette River. The creek has a drainage area of approximately 5 square miles. North and South Forks Dixon Creek have their confluence just south of Walnut Boulevard.

Oak Creek leaves the foothills west of Corvallis, then crosses rolling farmlands before flowing through southern Corvallis. It is a tributary of the Marys River and has a drainage area of 13.4 square miles.

Dunawi Creek flows through the rolling farmlands south of Oak Creek and then passes through southern Corvallis on its way to the Marys River. It has a drainage area of 3.7 square miles. North and South Forks Dunawi Creek have their confluence west of 35th Street.

Stewart Slough, a small drainage way in northeastern Corvallis, is one of two outlets from a ponding area outside of the corporate limits of Corvallis. The slough, subject to Willamette River backwater, passes through a rapidly developing suburban area on its way to the Willamette River.

Residential development exists in portions of the flood plains of all of the detailed-study streams. In addition, there is also some commercial and industrial development in the Millrace flood plain.

Vegetation in the area is that associated with a small established university community. The city has abundant tree cover and large amounts of lawn-grass areas. Soils within the study area vary from moderate to poor draining and, therefore, have a reasonable water table that in some areas comes within 10 inches or less of the ground surface (Reference 5).

City of Monroe

Monroe is located in southeastern Benton County. It is surrounded by unincorporated areas of Benton County and is located approximately 20 miles south of Corvallis, and approximately 25 miles northwest of Eugene. The population was estimated to be 607 in 2000 (Reference 2).

City of Philomath

Philomath is located 5 miles west of the eastern boundary of Benton County. It is surrounded by unincorporated areas of Benton County and is located approximately 40 miles north of Eugene, 4 miles west of Corvallis, and approximately 35 miles south of Salem. The population of Philomath increased rapidly, from 1,359 in 1960 to an estimated 2,400 in 1978 (Reference 1). The population was 3,838 in 2000 (Reference 2).

Newton Creek flows southeasterly from the foothills of the Coast Range through central Philomath before entering the Marys River at River Mile 10. The creek has a drainage area of approximately 5 square miles.

The East Fork of Newton Creek leaves the foothills northeast of Philomath, then crosses under U.S. Highway 20 before passing through the east side of Philomath. It is a tributary of Newton Creek and has a drainage area of 0.6 square miles.

The Philomath economy is keyed closely to forest products and agriculture, and their related industries. Philomath has only limited industrial development. Most development in the area is devoted to single-family residences. The central business district is located along U.S. Highway 20 between 12th Street and 20th Street. Development in Philomath has generally taken place outside of the flood plain. However, residential and commercial development south of Main Street between the western corporate limits and 15th Street is subject to flooding from the Marys River. Also, a small area of residential development along Newton Creek between U.S. Highway 20 and Applegate Street is subject to flooding.

Vegetation in the Philomath urban growth boundary is residential trees and grass cover. Soils are relatively dense clays to silty clays on steep to moderate slopes and vary from moderately to poorly drained.

2.3 Principal Flood Problems

Flooding in Benton County is caused by intense rainfall from large winter storms moving inland from the Pacific Ocean. This condition often results in simultaneous flooding on all streams in the study area. The greatest known flood on the Willamette River occurred in December 1861, before there was a stream-gaging network for recording flood heights. Discharges and crest elevations for large Willamette River floods at the U.S. Geological Survey (USGS) Albany gage (No. 14174000) from 1941 to 2007 are listed in Table 4.

Table 4. Historical Floods of the Willamette River

	Willamette River at Albany Gage	
Flood Date	Discharge (cfs)	Recurrence Interval (years)
1890	291,100[1]	50[1]
1901	231,000[1]	14[1]
1909	226,000[1]	14[1]
1923	206,000[1]	10[1]
1927	191,000[1]	8[1]
1964	186,000[1]	80[2]
1972	102,000[2]	8[2]
1974	118,000[2]	15[2]
1996	125,000[2]	20[2]
1997	101,000[2]	6[2]

[1]Based on Unregulated Flow
[2]Based on Regulated Flow

The 1964 flood was a result of unusually intense precipitation on frozen topsoil,

augmented by snowmelt in the mountains and valley. Without upstream regulation, the 1964 flood would have been the largest flood of the 20th century, with a peak discharge of 320,000 cubic feet per second (cfs) at the Albany gage. However, upstream regulation reduced the peak discharge to 186,000 cfs (Reference 6). Flood damage caused by the 1964 flood in the unincorporated areas was limited primarily to agricultural lands. However, residential developments near Stewart Lake and North Albany suffered extensive damage. The 1964 flood had a recurrence interval of 80 years (Reference 7). The most recent Willamette River flood occurred in 1997 and had a recurrence interval of about 6 years (Reference 8).

Three of the largest Marys River floods occurred in December 1964, January 1974, and December 2005. Those floods had peak flows of 13,600, 11,100, and 13,000 cfs, respectively, and recurrence intervals of about 35-,15-, and 35-years, respectively, at the USGS stream gage near Philomath, Oregon (Reference 9 and 10). The 1964 flood resulted from unusually intense precipitation on frozen topsoil, augmented by snowmelt and was especially severe because Willamette River flooding backed water up the Marys River. The 1974 flood was caused by intense rainfall on frozen terrain at higher elevations. The Corvallis Water Bureau gage, in the upper portion of the Marys River basin, recorded 4.42 inches of rainfall on January 15, 1974 (Reference 11). Flood damage along Marys River and the Millrace was severe during the December 1964 and January 1974 floods. For those floods, the area east of the Southern Pacific Railroad embankment to between 100 and 500 feet east of the millrace, and the area from Tunison Avenue to the Willamette River were flooded, except for some areas of high ground. The flooded areas included mobile homes, residences, and industrial buildings. Those floods caused only minor damage in Philomath.

Little historical flood data are available for the remaining streams within the study area. However in December 1964, flooding occurred in the lower portions of Dixon, Dunawi, and Oak Creeks, in addition to Millrace and Stewart Slough. In general, the flooding was caused by backwater from either the Willamette River or Marys River. Few historical flood data are available for Newton Creek and East Fork Newton Creek.

A major Alsea River flood occurred in 1964. On the North Fork of the Alsea River at Alsea, Oregon, the peak flood flow for that event was 14,000 cfs. This event had a recurrence interval of about 90 years (Reference 12).

2.4 Flood Protection Measures

The USACE operates eight flood-control storage projects upstream of the study area on major tributaries of the Willamette River. These projects, constructed from 1942 to 1968, control runoff from approximately 75 percent of the drainage area upstream of Benton County. In addition, many bank-protection projects have been constructed along the Willamette River in the study area. Most of the protection projects are riprapped-bank projects that do not reduce flood levels. There are no flood-control structures on the Marys River, the Alsea River, or any of the small streams within the study area.

The Cities of Corvallis, Monroe, and Philomath, and Benton County participate in the National Flood Insurance Program and each have a floodplain ordinance approved by FEMA for controlling development in flood hazard areas.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood-hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) 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. Stream gage records for the Willamette River were statistically analyzed utilizing the standard long-Pearson Type III distribution as outlined by the U.S. Water Resources Council (Reference 13). Natural discharge-frequency curves (References 7 and 14) were developed for the USGS gages on the Willamette River at Albany (gage No. 14174000) and Harrisburg (gage No. 14166000) using data from 1893 to 1976. Regulated discharge-frequency curves were then prepared for each gage using flood-routing computations to take upstream storage projects into account. Between the gaging stations, Willamette River-regulated discharge values were derived based upon a ratio of change in drainage area. Regulated discharge values were derived for the Corvallis segment of the Willamette River based on a ratio of drainage areas between the Albany and Harrisburg gages.

Marys River stream gage records were statistically analyzed utilizing the standard log-Pearson Type III distribution (Reference 13). A discharge-frequency curve (Reference 9) was developed for the USGS gage on the Marys River (gage No. 14171000) near Philomath, using data from 1941 to 1975. Discharge values on the Marys River at the mouth were obtained using drainage area ratios in combination with storm-hydrograph routings. For each frequency considered, the amount of flow diverted from the Marys River to the Millrace was estimated using a hydraulic computer analysis. Flows along the Millrace are diverted upstream of Crystal Lake Drive.

Alsea River discharge was determined at the Alsea gage (gage No. 14306100) utilizing log-Pearson Type III distribution (Reference 13). Stream records from 1940 through 1968 were used in the analysis (Reference 12). For the remaining streams studied in detail, frequency-discharge values were based upon drainage area ratios and a correlation of streamflow records for Rock Creek and the Marys River USGS gage near Philomath.

There are no stream gages on Dixon, Squaw, Newton, or Oak Creeks. Discharge-frequency values from those creeks were based on drainage area ratios and a correlation of streamflow records from 1941 to 1975 for the U.S. Geological Survey gage on Marys

River near Philomath (No. 14171000) and records from 1945 to 1960 and from 1974 to 1975 for the U.S. Geological Survey gage on Rock Creek near Philomath (No. 14170500).

Stewart Slough is one of two outlets from a ponding area which has a fluctuating water-surface elevation, depending on inflow and outflow rates. Therefore, discharges were based on high-water marks from the December 1964 flood.

Peak discharge-drainage area relationships for each stream studied in detail are shown in Table 5, “Summary of Discharges”.

Table 5. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
Alsea River, North Fork					
At West Boundary Section 1, T. 14 S., R. 8 W.	128	15,650	23,200	26,700	35,500
At USGS Gage 14306100	63	9,030	13,400	15,400	20,500
Dixon Creek					
At Mouth	5.1	610	840	945	1,190
At Circle Boulevard	3.2	380	520	590	740
At 29th Street	2.5	300	410	465	585
Dunawi Creek					
At Mouth	3.7	440	610	690	867
At Confluence of North and South Forks	3.4	405	560	615	797
Frazier Creek					
At Mouth	6.7	800	1,115	1,250	1,585
Upstream of Confluence with Jackson Creek	4.2	500	695	780	985
At Crescent Valley Drive	1.7	200	275	310	395
Jackson Creek					
At Mouth	2.5	300	420	470	600
Crescent Valley Drive	1.8	215	300	335	420
Marys River					
Upstream of Millrace	299	13,200	18,300	20,500	26,000
At USGS Gage 141710000	159	10,700	15,400	17,700	23,400
Upstream of Confluence with Greasy Creek	120	8,200	11,700	13,200	17,200

Table 5. Summary of Discharges (continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
Millrace					
At Crystal Lake Drive	--[1]	370	1,350	1,810	3,200
Newton Creek					
At Mouth	4.6	550	760	860	1,080
At U.S. Highway 20	3.6	430	600	680	860
Oak Creek					
At Mouth	13.4	1,595	2,210	2,495	3,140
Stewart Slough	--[2]	300[3]	--[4]	500[3]	--[4]
Soap Creek					
At North Boundary Section 34, T. 10 S., R. 5 W.	10.3	1,300	--[5]	1,890	--[5]
Willamette River					
At USGS Albany Gage No. 14174000	4,840	117,000	172,000	200,000	272,000
At State Highway 34 Bridge	4,400	107,000	153,000	177,000	246,000
At USGS Harrisburg Gage No. 14166000	3,420	81,000	107,000	123,000	182,000

[1]Overflow from Marys River
[2] Drainage area indeterminate
[3]Discharge based on high-water marks
[4]Discharge not required under study agreement
[5]Data not available

3.2 Hydraulic Analyses

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

Water-surface profiles for the portion of the Willamette River within Benton County, except for the reach through North Albany, were determined from hydraulic rating curves. Those curves were based on crest gages established in 1964 and high-water marks recorded at the crest gages. High-water marks for the January 1943 flood were used to complete the profile determination. The remaining reach of the Willamette River through north Albany was analyzed using the USACE HEC-2 step-backwater computer program (Reference 15).

Hydraulic analyses for the remaining streams studied in detail were performed using the USACE HEC-2 step-backwater computer program (Reference 15). Cross sections are composites of data from City of Corvallis, City of Philomath, USGS, and USACE topographic information (References 16, 17, 18, and 19) and USACE field surveys. All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry.

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

Starting water-surface elevations for all streams except the Willamette River and Millrace were calculated using the slope-area method. Separate step-backwater computations were prepared for Marys River and the Millrace from their mouths to the point on Marys River where the Millrace exits (River Mile 2.44). Various combinations of flows on the Millrace and on the portion of Marys River downstream of the Millrace exit were entered in the computer until the same flood elevation was calculated at the exit point. Starting water-surface elevations for Millrace were determined from elevations computed on Marys River at the confluence with the Millrace.

Channel roughness values (Manning's "n") used in the hydraulic computations were first estimated from field observations. The "n" values were then adjusted to match high-water marks where available. The range of roughness values for all floods is shown in Table 6. The acceptability of all assumed hydraulic factors, cross sections, non-effective flow areas, and hydraulic structure data was checked by hydraulic computations that were calibrated against historic floodwater profiles.

Table 6. Range of Manning's Roughness Values

Flooding Source	Main Channel	Overbank
Alsea River, North Fork	0.025-0.045	0.041-0.250
Dixon Creek	0.040-0.100	0.070-0.130
Dixon Creek, South Fork	0.040-0.100	0.070-0.130
Dunawi Creek	0.040-0.100	0.070-0.130
Frazier Creek	0.070-0.120	0.100-0.185
Jackson Creek	0.090	0.100-0.224
Marys River	0.035-0.084	0.060-0.100
Millrace	0.040-0.100	0.070-0.130
Newton Creek	0.045-0.060	0.080-0.120
Oak Creek	0.040-0.110	0.070-0.130
Stewart Slough	0.040-0.110	0.070-0.130
Soap Creek	0.040-0.070	0.160
Willamette River	0.025-0.045	0.041-0.250

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail. The hydraulic analysis for Marys River and the Millrace assumed the Southern Pacific Railroad between State Highway 99W and Marys River did not fail downstream of the Millrace crossing, where it is overtopped by Marys River 100-year flood flows. If flooding conditions cause the embankment to fail, a flood wave would result in the vicinity of the Millrace.

Only the 10- and 100-year recurrence intervals have been computed for Soap Creek. The 50- and 500-year recurrence intervals were not within the scope of study.

Generally, the distances on the flood profiles correspond to distances measured along the centerline of the designated watercourses. On the maps, this flow line, used to establish the respective distances, is delineated and labeled as a Profile Base Line.

Because of limitations of map scale and the use of established river miles. Stream distances as depicted on the flood profiles may not always match those depicted on the maps.

In the City of Corvallis, shallow flooding was determined along the Millrace left overbank. This flooding, with a calculated average depth of 1.0 foot, is bounded by Twin Oaks Circle, 3rd Street, Avery Avenue, and Southern Pacific Railroad This source originates from flooding along the Millrace and is not affected by backwater from the Willamette River.

Approximate study reaches were analyzed using existing topographic maps (References 18 and 20) and approximate hydraulic calculations.

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 used for newly created or revised FIS reports and FIRMs was the NGVD 29. With the completion of the NAVD 88, many FIS reports and FIRMs are now prepared using NAVD 88 as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRMs are referenced to NAVD 88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the NGVD and the NAVD, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242
(301) 713-4172 (fax)

The conversion factor from NGVD to NAVD for all flooding sources in this report is +3.42 feet.

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

To obtain current elevation, description and/or location information for benchmarks shown on the FIRMs, please contact information services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides 1-percent annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1-percent-annual-chance and 0.2-percent-annual-chance floodplains; and 1-percent-annual-chance floodway. 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 Elevation tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied by

detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section.

Floodplain boundaries for a portion of the Willamette River in the vicinity of Albany were mapped using interpolated data from the City of Albany topographic maps at a scale of 1:2,400, with a contour interval of 2 feet (Reference 21). Floodplain boundaries for Oak Creek, Frazier Creek, Jackson Creek, Millrace, and segments of the Willamette and Marys Rivers in the vicinity of Corvallis were mapped using interpolated data from the City of Corvallis topographic maps at a scale of 1:2,400, with a contour interval of 2 feet (Reference 16). This information was then transferred to USGS 7.5-minute series topographic maps (Reference 18 and 22), enlarged to a scale of 1:4,800. This area was revised in 1999 to incorporate more detailed topographic information along the Willamette River, from approximately 5.5 miles downstream of the confluence of the Calapooia River to approximately 1.5 miles upstream of the confluence with the Calapooia River. Topographic maps at a scale of 1:1,200 (Reference 23) were used to produce the revised 100- and 500-year floodplain boundary delineations.

Willamette River floodplain boundaries outside the Albany and Corvallis topographic mapping were interpolated using USGS 7.5-minute series topographic maps enlarged to a scale of 1:4,800 (Reference 18) using rating curve elevations.

Floodplain boundaries for Newton Creek were mapped using interpolated data from the City of Philomath topographic maps at a scale of 1:2,400, with a contour interval of 2 feet (Reference 17). This information was also transferred to USGS 7.5-minute series topographic maps enlarged to a scale of 1:4,800 (Reference 18). Floodplain boundaries for Soap Creek were mapped using interpolated cross sections from surveyed cross section data. This information was then transferred to an aerial photograph at a scale of 1:4,800. Floodplain boundaries for the North Fork Alsea River were mapped using USACE topographic information at a scale of 1:4,800, with a contour interval of 5 feet (Reference 19). Floodplain boundaries for Marys Rivers outside the Corvallis area were mapped using USGS 7.5-minute series topographic maps enlarged to a scale of 1:4,800 (Reference 18).

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 (Zone[s] [A, AE, AO, and AH]), 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 Flood Insurance Rate Map . Floodplain boundaries for streams studied by approximate method were delineated using topographic maps (References 16, 17, 18, and 19), and elevations were established through approximate hydraulic calculations. For the Cities of Corvallis and Philomath, flood boundaries for approximate-study areas were delineated using the previously estimated elevations on topographic maps at a scale of 1:2,400 with a contour interval of 2 feet (Reference 20 and Reference 24). Approximate boundaries in some portions of Benton County were taken directly from the Flood Hazard Boundary Map (Reference 25).

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The detailed study area floodplain boundaries of Dixon Creek, South Fork Dixon Creek, Dunawi Creek, Frazier Creek, Jackson Creek, Oak Creek, and approximately 7 miles of the Marys River, from the mouth to the confluence with Muddy Creek, were revised using topographic mapping with a contour interval of 2 feet (Reference 26). Detailed study area floodplain boundaries for the North Fork Alsea River, Newton Creek, Soap Creek, and 8 miles of the Marys River, from the confluence with Muddy Creek to the upstream limit of the detailed study area, were revised using topographic mapping with a contour interval of 5 feet (Reference 27).

Approximately 14 miles of Willamette River floodplain boundaries were revised using topographic mapping with a contour interval of 2 feet (Reference 26 and 28). The portion of the Willamette River floodplain redelineation using 2 foot contours were divided into two separate reaches. The first reach is located in the vicinity of Albany, starts from 2,000 feet north of the northern corporate limit of Albany and continues 7.5 miles upstream, to approximately 2000 feet west of the southwest corporate limit of Albany. The second reach begins approximately 1.8 miles downstream of the mouth of Dixon Creek and continues upstream 6.5 miles to approximately 3,000 feet upstream of the confluence with the Boonville channel. The remainder of the Willamette River floodplain boundaries within Benton County were revised using topographic mapping with a contour interval of 5 feet (Reference 27).

Approximately 19.6 miles of Marys River and Rock Creek approximate A Zone areas were refined using topographic mapping with a contour interval of 5 feet (Reference 27). Where applicable, the contour data was used to adjust the flood hazard areas to more accurately match the topography.

Letter of Map Revision (LOMR) case number 04-10-0422P was incorporated "as-is" into the floodplain mapping. This LOMR revised Millrace floodway, profile baseline, and flood boundaries within the City of Corvallis. LOMR 91-10-17P, which affects Benton County Unincorporated Areas, has been superseded by the redelineation of the Willamette River floodplain boundaries using topographic mapping with a contour intervals of 2 feet and 5 feet (Reference 26 and 27). LOMR 06-10-B494P, which affects Benton County Unincorporated Areas, has been superseded by the redelineation of the Willamette River floodplain boundaries using topographic mapping with a contour interval of 2 feet (Reference 28).

Base map aerial imagery shown on the Benton County FIRMs is from the National Agriculture Imagery Program (Reference 29). Non-revised floodplains were compared to this new base map data and adjusted where appropriate.

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 results of the floodway computations at selected stream cross sections are shown Table 7 "Floodway Data".

The floodways presented in this study 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 are tabulated for selected cross sections. In cases where the floodway and 1-percent-annual chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

A floodway was determined for the Willamette River from River Mile 159.7 to River Mile 160.4. Discharges were determined by normal depth calculations for the main channel and the east overbank for two cross sections. Encroachment stations were determined by assuming that all discharge elimination from the east overbank would flow in the main channel and not in the west overbank. The floodway is shown on the Flood Boundary and Floodway Map (Exhibit 2). No floodway was developed for the remainder of the Willamette River within Benton County because of minimal future development potential.

For the original Flood Insurance Study for the City of Corvallis, both 1-foot-increase and 0.2-foot-increase floodways were computed for all streams containing a floodway, except for the Willamette River. However, only the 1 foot-increase floodways were used for the original study. The 0.2 foot-increase floodways are shown on maps prepared by the study contractor. At the request of the City of Corvallis, 0.2 foot-increase floodways for the Marys River, Dunawi Creek, and Oak Creek were delineated using existing work maps and included on the FIRM panels during the 2011 countywide update. The floodway data tables were updated using effective model output for the 0.2 foot-increase floodway case.

No floodways were computed for: Dixon Creek and South Fork Dixon Creek, because their flood plains are essentially developed; for Newton Creek because the floodway would be contained in the channel; for Stewart Slough because of its complex relationship with several other local drainages; and Soap Creek because it was not within the scope of the study.

A Letter of Map Revision 04-10-0422P (LOMR) was incorporated "as-is" into the floodplain mapping. This LOMR revised the Millrace floodway, profile baseline, and flood boundaries within the City of Corvallis. As part of the LOMR, a 1 foot-increase floodway developed. Updated floodplain mapping and the Floodway Data Tables supersede the 0.2 foot-increase floodway computed during the original study.

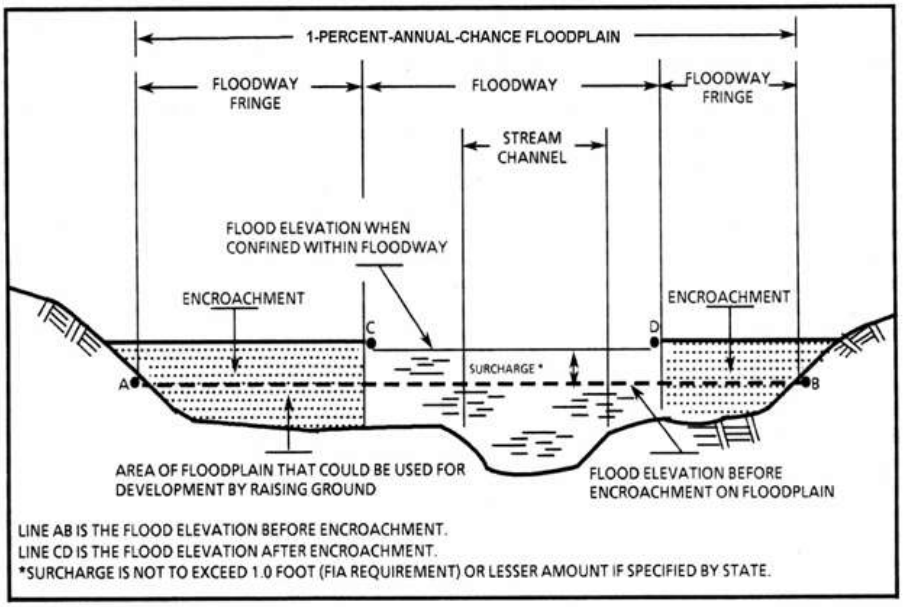


Figure 1. Floodway Schematic

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
Dunawi Creek								
A	95[1]	38	166	4.2	225.2	211.0[3]	211.1[3]	0.1
B	380[1]	31	84	8.2	225.6	213.2[3]	213.2[3]	0.0
C	1,570[1]	29	188	3.7	226.8	223.9[4]	224.1[4]	0.2
D	2,390[1]	52	154	4.5	228.7	228.7	228.9	0.2
E	2,774[1]	68	272	2.5	231.1	231.1	231.3	0.2
F	3,825[1]	60	257	2.7	235.3	235.3	235.4	0.1
G	4,200[1]	185	653	1.1	235.6	235.6	235.8	0.2
H	4,500[1]	292	776	0.9	235.7	235.7	235.9	0.2
Frazier Creek								
A	0.001[2]	500	1,081	1.2	220.8	220.8	221.8	1.0
B	0.247[2]	290	794	1.6	225.6	225.6	226.5	0.9
C	0.389[2]	240	750	1.7	228.7	228.7	229.6	0.9
D	0.480[2]	90	569	2.2	230.5	230.5	231.2	0.7
E	0.623[2]	300	1,220	1.0	233.6	233.6	234.5	0.9
F	0.718[2]	450	1,177	1.1	234.2	234.2	235.2	1.0
G	0.765[2]	140	372	2.1	235.3	235.3	235.7	0.4
H	0.945[2]	110	149	5.2	241.6	241.6	241.7	0.1
I	1.078[2]	120	410	1.9	245.2	245.2	246.1	0.9
J	1.286[2]	50	178	2.7	252.8	252.8	253.3	0.5
K	1.608[2]	60	138	3.5	269.7	269.7	270.4	0.7
L	1.665[2]	30	129	3.7	271.4	271.4	272.1	0.7

[1] Feet above mouth [2] Miles Above Sump Area East of U.S. Highway 99 [3] Elevation Computed Without Consideration of Influence from Marys River

[4] Elevation Computed Without Consideration of Backwater from Willamette River

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OREGON AND INCORPORATED AREAS

FLOODWAY DATA

DUNAWI CREEK, FRAZIER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
Frazier Creek (continued)								
M	1.729[1]	22	89	5.4	274.2	274.2	274.2	0.0
N	1.881[1]	20	100	4.7	282.0	282.0	282.7	0.7
O	2.146[1]	14	47	6.6	298.9	298.9	298.9	0.0
P	2.448[1]	30	185	1.7	324.5	324.5	325.0	0.5
Jackson Creek								
A	0.129[2]	150	268	1.8	238.5	238.5	239.3	0.8
B	0.328[2]	60	161	2.9	246.0	246.0	246.7	0.7
C	0.508[2]	36	153	3.1	252.6	252.6	253.1	0.5
D	0.764[2]	29	75	6.3	270.2	270.2	270.2	0.0
E	0.856[2]	22	87	3.9	277.7	277.7	277.7	0.0
F	1.049[2]	24	74	4.5	289.4	289.4	289.4	0.0
G	1.134[2]	39	71	4.7	299.2	299.2	299.2	0.0
H	1.367[2]	40	95	3.5	325.9	325.9	326.5	0.6
I	1.623[2]	25	81	4.1	346.6	346.6	347.0	0.4

[1]Miles Above Sump Area East of U.S. Highway 99 [2]Miles above mouth

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OREGON AND INCORPORATED AREAS

FLOODWAY DATA

FRAZIER CREEK, JACKSON CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
Marys River								
A	1,056	247	4,799	3.8	224.7	219.9[2]	220.0[2]	0.1
B	1,473	190	3,291	5.6	224.7	220.2[2]	220.3[2]	0.1
C	1,901	244	3,914	4.7	224.7	221.1[2]	221.3[2]	0.2
D	2,497	190	4,165	4.4	224.7	221.7[2]	221.9[2]	0.2
E	3,538	320	3,868	4.7	224.7	222.6[2]	222.8[2]	0.2
F	4,097	200	3,826	4.8	224.7	223.3[2]	223.5[2]	0.2
G	4,910	525	5,934	3.2	224.7	224.2[2]	224.4[2]	0.2
H	5,966	780	7,471	2.5	224.9	224.9	225.1	0.2
I	7,181	740	5,309	3.5	226.0	226.0	226.2	0.2
J	8,521	1,470	11,335	1.6	226.9	226.9	227.1	0.2
K	10,351	1,930	18,552	1.0	227.2	227.2	227.4	0.2
L	11,771	1,520	17,133	1.1	227.3	227.3	227.5	0.2
M	12,391	1,580	18,021	1.0	227.4	227.4	227.6	0.2
N	13,611	2,150	8,292	2.5	227.7	227.7	227.9	0.2
O	15,411	2,400	10,769	1.9	228.6	228.6	228.8	0.2
P	17,371	2,340	12,540	1.6	229.3	229.3	229.5	0.2
Q	21,621	1,593	12,016	1.7	230.4	230.4	231.4	1.0
R-AC[3]								
AD	59,938	1,322	5,902	3.0	261.4	261.4	261.7	0.3
AE	64,540	1,262	4,116	4.3	265.8	265.8	266.7	0.9
AF	65,310	1,440	7,991	2.2	266.6	266.6	267.6	1.0
AG	68,790	961	5,359	3.3	269.4	269.4	270.3	0.9
AH	70,310	603	4,109	4.3	271.9	271.9	272.8	0.9
AI	73,915	223	2,212	6.0	278.6	278.6	279.1	0.5
AJ-AK[3]								

[1] Feet above mouth [2]Elevation computed without consideration of backwater from Willamette River [3]Floodway not developed for these cross sections

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OREGON AND INCORPORATED AREAS

FLOODWAY DATA

MARYS RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
Millrace								
A	0.036	250	1,679	1.4	224.7	219.6[2]	220.5[2]	0.9
B	0.116	105	657	3.5	224.7	219.6[2]	220.5[2]	0.9
C	0.219	140	1,113	2.1	224.7	223.6[2]	224.5[2]	0.9
D	0.269	213	976	2.4	224.7	223.6[2]	224.6[2]	1.0
E	0.295	100	664	3.5	224.7	224.0[2]	224.9[2]	0.9
F	0.340	133	624	3.7	224.7	224.5[2]	225.5[2]	1.0
G	0.433	280	1,610	1.4	224.9	224.9	225.8	0.9
H	0.484	253	831	2.8	224.9	224.9	225.8	0.9
I	0.550	260	1,452	1.6	225.2	225.2	226.1	0.9
J	0.623	190	927	2.5	225.3	225.3	226.2	0.9
K	0.696	104	672	3.4	225.6	225.6	226.5	0.9
L	0.867	280	2,394	1.0	226.8	226.8	227.7	0.9
M	0.892	370	2,057	1.1	227.0	227.0	227.8	0.8
N	1.021	190	862	2.7	227.3	227.3	228.2	0.9

[1] Miles above mouth [2]Elevation computed without consideration of backwater from Willamette River

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OREGON AND INCORPORATED AREAS

FLOODWAY DATA

MILLRACE

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
North Fork Alsea River								
A	0[1]	434	4,197	6.4	281.6	281.6	282.6	1.0
B	1,975[1]	689	6,393	4.2	284.9	284.9	285.9	1.0
C	4,740[1]	209	2,141	7.2	289.0	289.0	289.5	0.5
D	5,220[1]	249	2,765	5.6	290.3	290.3	290.6	0.3
E	7,060[1]	216	2,249	6.8	292.9	292.9	293.5	0.6
Oak Creek								
A	0.127[2]	36	344	7.2	224.7	217.4[3]	217.5[3]	0.1
B	0.162[2]	60	465	5.4	224.7	218.3[3]	218.3[3]	0.0
C	0.240[2]	90	646	3.9	224.7	219.6[3]	219.7[3]	0.1
D	0.307[2]	40	268	9.3	224.8	224.8	224.9	0.1
E	0.379[2]	145	599	4.2	227.4	227.4	227.4	0.0
F	0.442[2]	230	1,190	2.1	228.4	228.4	228.5	0.1
G	0.518[2]	250	791	3.2	228.9	228.9	229.0	0.1
H	0.614[2]	200	444	5.6	231.7	231.7	231.8	0.1
I	0.686[2]	740	2,834	0.9	232.8	232.8	233.0	0.2
J	0.892[2]	1000	803	3.1	234.7	234.7	234.8	0.1
K	0.994[2]	100	654	3.8	236.6	236.6	236.8	0.2
L	1.028[2]	67	351	7.1	237.3	237.3	237.5	0.2

[1] Feet above downstream limit of detailed study [2] Miles above mouth [3] Elevation Computed Without Consideration of Backwater from Willamette River

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OREGON AND INCORPORATED AREAS

FLOODWAY DATA

NORTH FORK ALSEA RIVER, OAK 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)
THORNTON LAKES OVERFLOW								
A	5,593	494	5,518	1.0	200.1	200.1	200.9	0.8
B	7,094	430	3,289	1.7	200.2	200.2	201.1	0.9

[1]Feet above convergence with Willamette River

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR
AND INCORPORATED AREAS

FLOODWAY DATA

THORNTON LAKES OVERFLOW

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
Willamette River								
A[2]								
B	114.36	3,435/1,435[3]	43,320	4.6	197.0	197.0	197.6	0.6
C	115.11	4,020/3,750[3]	43,798	4.6	197.9	197.9	198.6	0.7
D	116.01	4,900/2,500[3]	51,244	3.9	199.3	199.3	199.8	0.5
E	116.99	3,369/2,790[3]	70,851	2.8	200.8	200.8	201.8	1.0
F	117.58	4,308/3,950[3]	80,883	2.5	202.2	202.2	203.2	1.0
G	118.27	3,639/3,260[3]	70,821	2.8	203.4	203.4	204.4	1.0
H	118.92	2,481/2,120[3]	44,263	4.5	204.4	204.4	205.4	1.0
I	120.99	5,460/1,790[3]	66,485	2.7	207.9	207.9	208.8	0.9
J-S[2]								

[1]Miles above mouth [2]Floodway not developedfor these cross sections [3]Width/Width within county limits

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OREGON AND INCORPORATED AREAS

FLOODWAY DATA

WILLAMETTE RIVER

5.0 INSURANCE APPLICATION

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

Zone A

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

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

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

Zone AO

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

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

Zone X

Zone X is the flood insurance rate 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 depths are shown within this zone.

Table 8 lists the flood insurance zones that each community is responsible for regulating.

Table 8. Flood Insurance Zones Within Each Community

Community	Flood Zone(s)
Adair Village, City of	D
Benton County, Unincorporated Areas	A, AE, AH, X,
Corvallis, City of	A, AE, AO, X
Philomath, City of	A, AE, X
Monroe, City of	A, AE, X

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate 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 Flood Insurance Rate Map presents flooding information for the entire geographic area of Benton County. Previously, Flood Insurance Rate Maps were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide Flood Insurance Rate Map 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 9, "Community Map History."

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Adair Village, City of [1,2]	N/A	N/A	N/A	-----
Benton County Unincorporated Areas	December 27, 1974	April 8, 1977 March 6, 1979	August 5, 1986	-----
Corvallis, City of	June 14, 1974	December 26, 1975 December 27,1977 November 7,1978 April 7, 1981	January 3, 1985	-----
Monroe, City of	November 8,1974	September 26, 1975	January 3, 1986	-----
Philomath, City of	February 22, 1974	February 7, 1975	June 15, 1982	-----

[1]This community did not have a FIRM prior to the first countywide FIRM for Benton County

[2]No Special Flood Hazard Areas identified

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OREGON
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

In 1971, the USACE prepared a Flood Plain Information (FPI) report for the Cities of Corvallis and Philomath (Reference 30). The reports contain 1 percent-annual-chance flood profiles for the Willamette and Marys Rivers. The water-surface profiles in this study are higher than those shown in the FPI reports. The Willamette River profile is from 1 to 4 feet higher along the reach through Benton County. This difference is caused by an increase in the estimated discharge, a result of including additional years of streamflow records in the frequency analysis and correlating the amount of flood-control regulation in the study reach with other locations along the Willamette River. The Marys River 1 percent-annual-chance flood profile in this report when compared with the FPI report profile is about the same height near the Highway 34 Bridge, approximately 2 feet higher at the downstream Philomath corporate limits, 2 feet higher near Bellfountain Road, about 1 foot lower at the west edge of Corvallis and approximately 4 feet higher immediately upstream of Avery Park Bridge. The differences in elevations are a result of additional years of streamflow records and more accurate hydraulic modeling.

Flood Insurance Studies have been prepared for the Cities of Corvallis, Philomath, Albany, and Millersburg (References 31, 32, 33, and 34) and Lincoln and Polk Counties (References 35 and 36). These studies are or will be in agreement with the data presented in this study. The City of Millersburg Flood Insurance Study does not include the more accurate hydraulic modeling for the Willamette River that has been employed for the other areas affected by the Willamette River. As a result, the Willamette River 1 percent-annual-chance elevations are approximately 1 foot higher in this study than in the City of Millersburg Flood Insurance Study. The City of Millersburg Flood Insurance Study will be revised when it is incorporated into the countywide Flood Insurance Study for Linn County.

A Flood Hazard Boundary map was prepared for the City of Monroe (Reference 37). The information presented on that map is in agreement with this study.

Flood Insurance Studies have also been prepared for Lane and Linn Counties, Oregon (References 38 and 39). Data presented in those studies match the information shown in this study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the 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, Mitigation Division, Federal Regional Center, 130 228th Street, SW, Bothell, Washington 98021-9796.

9.0 BIBLIOGRAPHY AND REFERENCES

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2. U.S. Department of Commerce, Bureau of the Census website, http://www.census.gov/, 2010
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5. City of Corvallis Planning Division, Personal Communication with Fred Towne, Planning Division Manager, September 2008

6. U.S. Department of the Army, Corps of Engineers, Portland District, Flood Plain Information, Albany, Oregon, 1971

7. U.S. Department of the Army, Corps of Engineers, Portland District, Cumulative Frequency Curve, Willamette River, Albany, Oregon, December 1978

8. U.S. Department of the Interior, Geological Survey, National Water Information System website, Peak Streamflow for Oregon, USGS Gage 14174000, Willamette River at Albany Oregon http://nwis.waterdata.usgs.gov/or/nwis/peak/?site_no=14174000&amp

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19. U.S. Department of the Army, Corps of Engineers, Portland District, Alsea River Topography, Scale 1:400, Contour Interval 5 feet, October 1978

20. City of Philomath, City Engineer, Topographic Maps, Scale 1:2400, Contour Interval 2 feet: Philomath, Oregon (April 11, 1975)

21. City of Albany Public Works Department, Topographic Maps, Scale 1:2,400, Contour Interval 2 Feet: Albany, Oregon (1976)

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23. Geographic Information Systems, Albany, Oregon, City of Albany, North Albany & Vicinity, Topographic Maps, Scale 1:1,200, Contour Interval 2 feet, Photo Date April and May 1994

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27. Benton County, Topographic Data, Contour Interval 5 feet, Benton County, Oregon, March 2000

28. City of Albany, Topographic Data, Contour Interval 2 feet, Albany, Oregon, June 2003

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33. Federal Emergency Management Agency, Flood Insurance Study, City of Albany, Oregon, 1984

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10.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data located at Benton County Department of Planning and Development, 360 SW Avery Avenue, Corvallis, Oregon 97333.

LOMR Revisions

LOMR 91-10-17P revises floodplain boundary delineations and base flood elevations of the Willamette River, between River Miles 125 and 130. The revised flood hazard area of this LOMR is within Benton County Unincorporated areas. The effective date is August 23, 1991.

LOMR 04-10-0422P revises Millrace and Millrace Overflow flood hazard areas in the City of Corvallis. The LOMR revises Millrace from its confluence with the Marys River to immediately upstream of Bridgeway Avenue and Millrace Overflow, from approximately 630 feet downstream to approximately 630 feet upstream of Crystal Lake Drive. Since the original Flood Insurance Study, significant modifications have occurred along Millrace and Millrace overflow; including installation of a 200 foot long culvert, placement of fill in Millrace channel, channelization and realignment of Millrace, and the partial filling and construction of an embankment across Millrace Overflow. Using new topographic data, a updated hydraulic analysis was performed. As a result, Millrace floodway and floodplain boundaries were updated and Millrace Overflow was eliminated. The effective date is February 16, 2005.

LOMR 06-10-B494P revises Willamette River flood hazard areas in Benton County Unincorporated areas. The LOMR revises the Base Flood Elevation (BFE) of the flooding effects from the Willamette River, located approximately 2,000 feet downstream of Lyon Street. The effective date is September 18, 2006.

Table 10 summarizes the flooding sources updated since the original study was completed.

Table 10. Revised Study Descriptions

Flooding Source(s)	Community	Limits of Study	Date of Revision
Willamette River	Benton County Unincorporated Areas	From river mile 125 to river mile 130	August 23, 1991
		Approximately 2,000 feet downstream of Lyon Street	September 8, 2006

Flooding Source(s)	Community	Limits of Study	Date of Revision
Millrace, Millrace Overflow	City of Corvallis	Millrace: from its confluence with the Marys River to immediately upstream of Bridgeway Avenue and Millrace Overflow: from 630 feet downstream to 630 feet upstream of Crystal Lake Drive.	February 16, 2005
Willamette River	Benton County Unincorporated Areas	From the convergence with Thornton Lakes Overflow to approximately 2.2 miles upstream of the Southern Pacific Railroad	December 8, 2016
Quarry Road East Overflow	Benton County Unincorporated Areas	From the convergence with Thornton Lakes Overflow to approximately 480 feet upstream of the convergence with Thornton Lakes Overflow	December 8, 2016
Quarry Road West Overflow	Benton County Unincorporated Areas	From the convergence with Thornton Lakes Overflow to approximately 1,420 feet upstream of the convergence with Thornton Lakes Overflow	December 8, 2016
Thornton Lakes Overflow	Benton County Unincorporated Areas	From the convergence with Willamette River to just downstream of Northwest Quarry Road	December 8, 2016

10.1 First Revision (December 8, 2016)

a. Authority and Acknowledgments

The redelineation of the Willamette River and the hydraulic and hydrologic analyses for Quarry Road East Overflow, Quarry Road West Overflow, and Thornton Lakes Overflow, were performed by AMEC Environment and Infrastructure, Inc., for FEMA.

The partial countywide map revision was performed by the Strategic Alliance for Risk Reduction (STARR) for FEMA under Contract No. HSFEHQ-09-D-0370.

b. Coordination

A final meeting was held January 24, 2014, with representatives from FEMA, Oregon Department of Land Conservation and Development, and the communities to review the results of the study.

c. Scope of Study

The purpose of this revision was to incorporate updated analyses of the Thornton Lakes Overflow system and the Willamette River. FLO2D (Reference 1) was used to refine the floodplain mapping and BFE delineations on the west bank of the Willamette River from the confluence with Thornton Lakes Overflow to approximately 2.2 miles upstream of the Southern Pacific Railroad. When the water surface elevation of the Williamette River near Mile 120.75 exceeds 193.45 feet (NAVD88), water reverses flow and enters several interconnected overflow paths that compose the Thornton Lakes Overflow system. This system is comprised of the following streams, which were studied by detailed methods for this revision:

- Quarry Road East Overflow
- Quarry Road West Overflow
- Thornton Lakes Overflow

This revision primarily covers the geographic area of the City of Albany, within Benton County, Oregon. The new analyses incorporate high ground that exists within the Willamette River floodplain in the vicinity of the City of Albany in Benton County, Oregon.

d. Hydrologic Analyses

Discharges through the Thornton Lakes System were estimated by balancing the hydraulics at each junction and matching water surface elevations with the Willamette River. Peak discharge-drainage area relationships for each stream studied in detail for the revision are shown in Table 11:

Table 11. Summary of Discharges for Revised Study

		Peak Discharges (cfs)			
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
QUARRY ROAD EAST OVERFLOW					
Approximately 880 feet upstream of the convergence with Thornton Lakes Overflow	*	**	**	230	*
QUARRY ROAD WEST OVERFLOW					

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
Approximately 1,180 feet upstream of the convergence with Thornton Lakes Overflow	*	**	**	80	*
THORNTON LAKES OVERFLOW					
Approximately 3,985 feet upstream of the convergence with Willamette River	*	560	1,810	9,560	*
Approximately 6,330 feet upstream of the convergence with Willamette River	*	560	1,230	5,660	*
Approximately 7,275 feet upstream of the convergence with Willamette River	*	560	1,230	5,350	*

* Data not available

e. Hydraulic Analyses

Ground points were surveyed across each cross section. Sections were surveyed across most of the floodplain including wetted areas and steep, densely vegetated areas where Light Detection And Ranging (LiDAR) was expected to be unsatisfactory. Many of these sections crossed overflow paths where there was no defined channel. These points were supplemented with 1-foot LiDAR contours, and the two data sources were merged at each cross section by an experienced hydraulic engineer. Additional survey measurements were made at bridges and culverts. Hydraulic engineers also interpolated a selected group of cross-sections by combining LiDAR ground contours at the new cross-sections with interpolated or copied survey section points from nearby cross sections that were judged to be representative (Reference 2).

Boundary conditions for the Thornton Lakes System were estimated by balancing the hydraulics at each junction and matching water surface elevations with the Willamette River.

Flood profiles for the selected recurrence intervals were computed using the U.S. Army Corps of Engineer, Hydrologic Engineering Center (HEC) computer program, HEC-RAS, version 4.1.0 (Reference 3).

Channel roughness values (Manning's "n") used in the hydraulic computations were mapped by engineers based on professional judgment using field reconnaissance and aerial photographs. The values were varied horizontally across each cross section. The values are summarized in the following table:

HEC-RAS n-Value	Description of Land Cover
0.020	Paved
0.025	Gravel
0.028	Open Water
0.030	Lawn
0.040	Field/Pasture
0.045	Orchard
0.070	Brush
0.100	Trees/Closed Canopy
0.120	Suburb

f. Floodplain Boundaries

For Quarry Road East Overflow, Quarry Road West Overflow, Thornton Lakes Overflow, and the west bank of the Willamette River, floodplain boundaries were interpolated between cross sections using LiDAR topographic data, with a contour interval of one foot (Reference 2).

g. Floodways

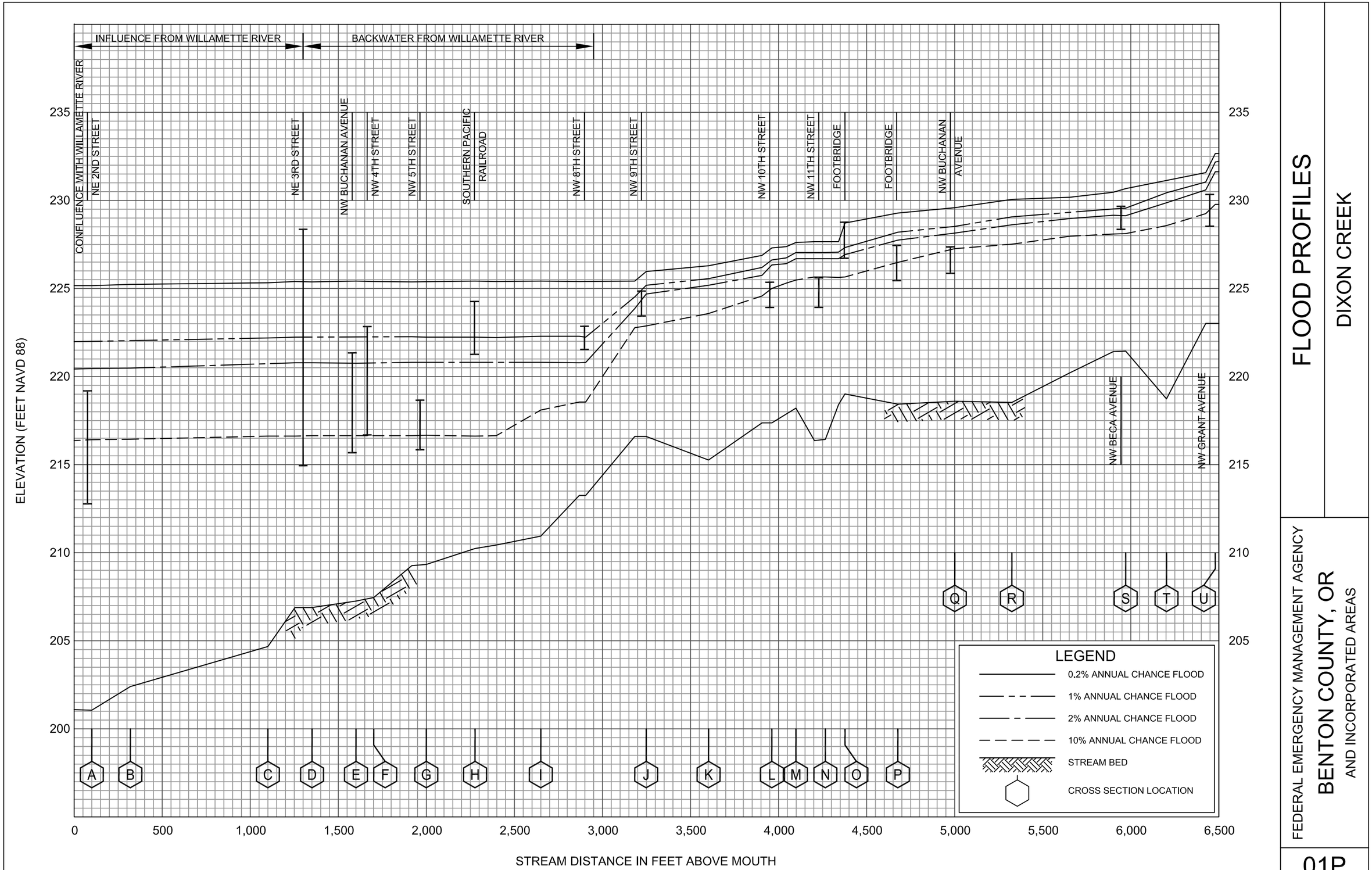
No floodway was computed for Quarry Road West Overflow. A floodway was computed for Quarry Road East Overflow that includes a short reach in Benton County, but no cross section data was published within Benton County. Please see the Flood Insurance Study Table for Linn County, Oregon for information regarding that overflow.

h. Bibliography and References

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FLOOD PROFILES

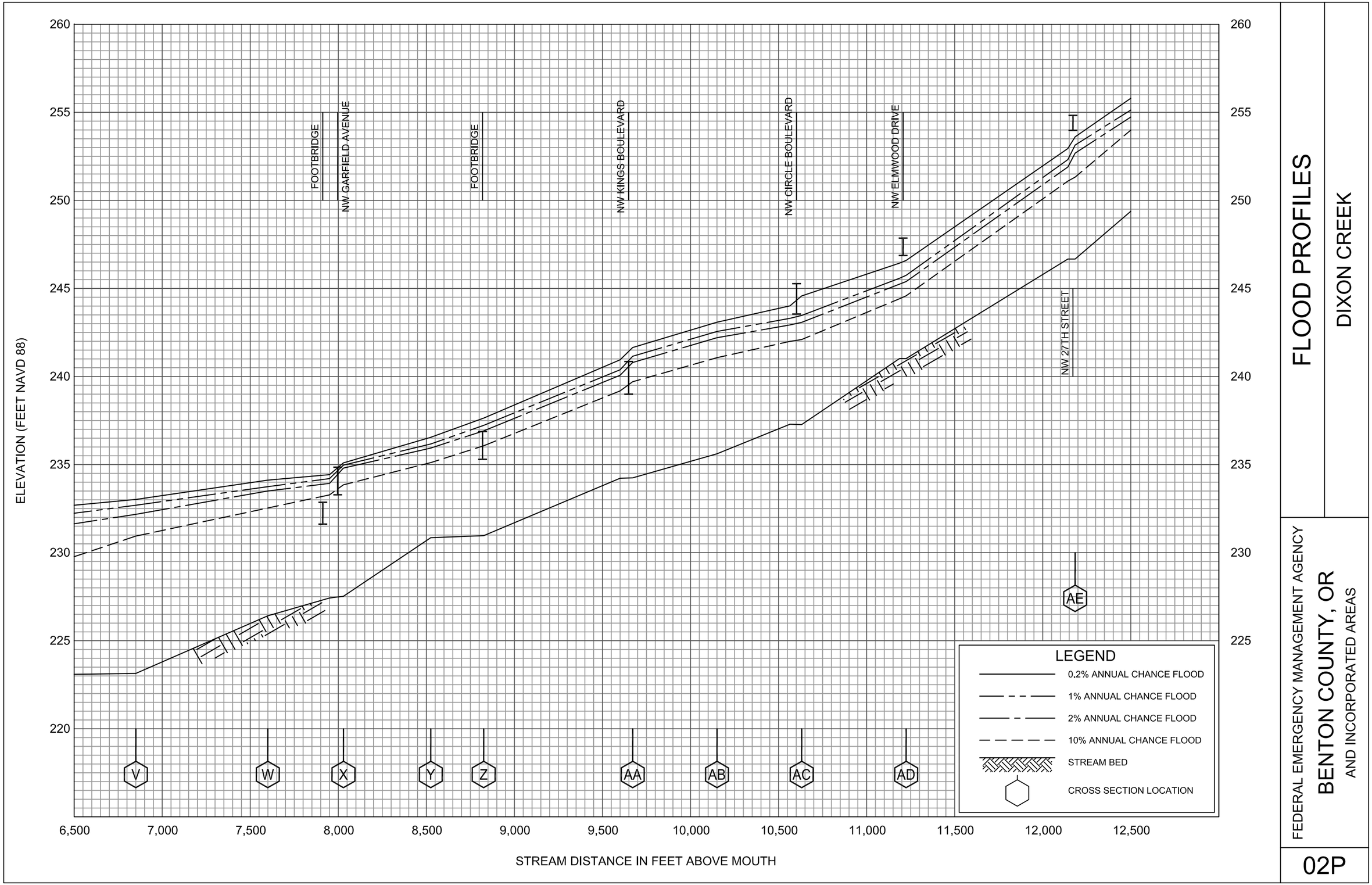
DIXON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

01P



FLOOD PROFILES

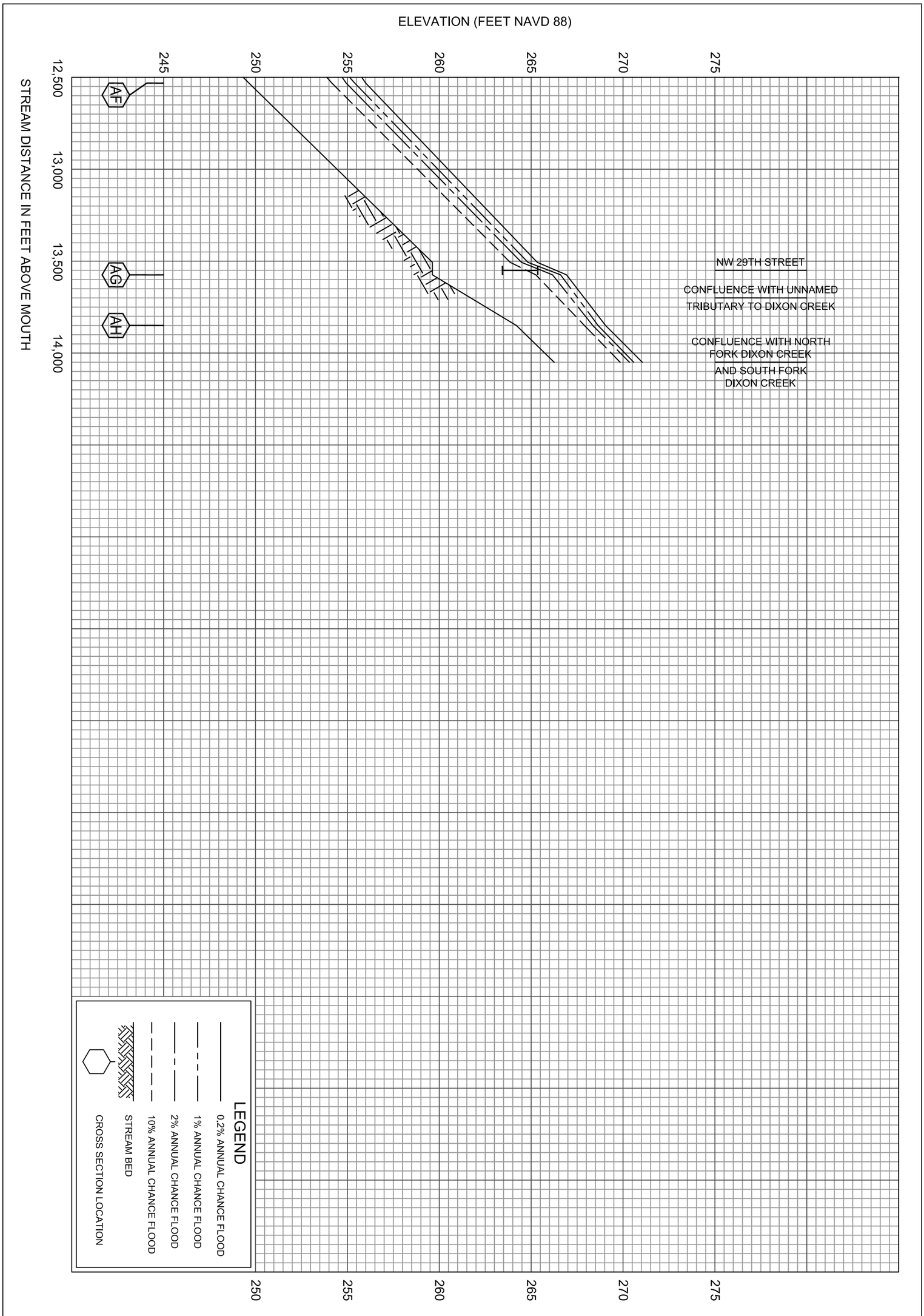
DIXON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

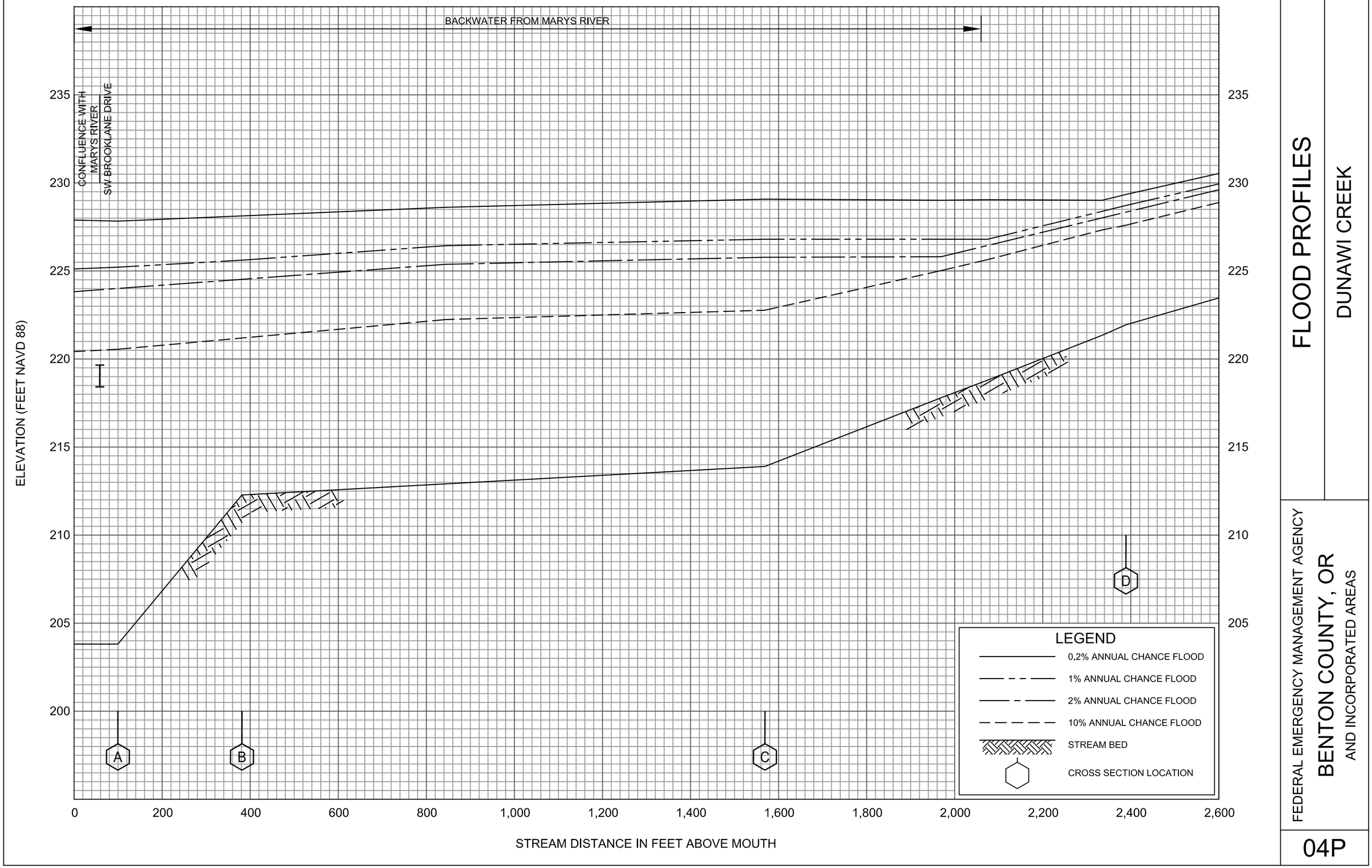
BENTON COUNTY, OR

AND INCORPORATED AREAS

02P



03P	FEDERAL EMERGENCY MANAGEMENT AGENCY BENTON COUNTY, OR AND INCORPORATED AREAS	FLOOD PROFILES DIXON CREEK



FLOOD PROFILES

DUNAWI CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

04P

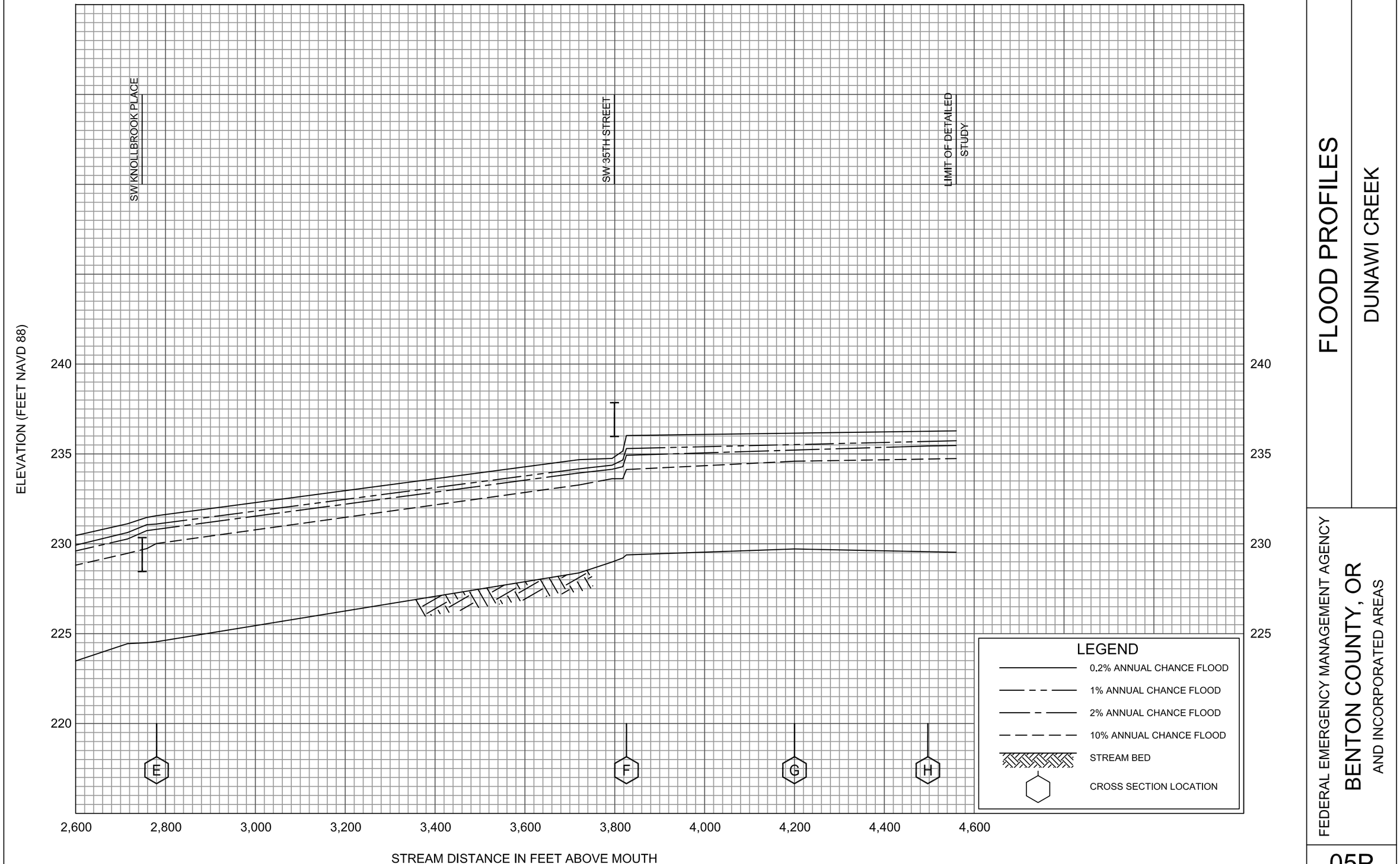
FLOOD PROFILES

DUNAWI CREEK

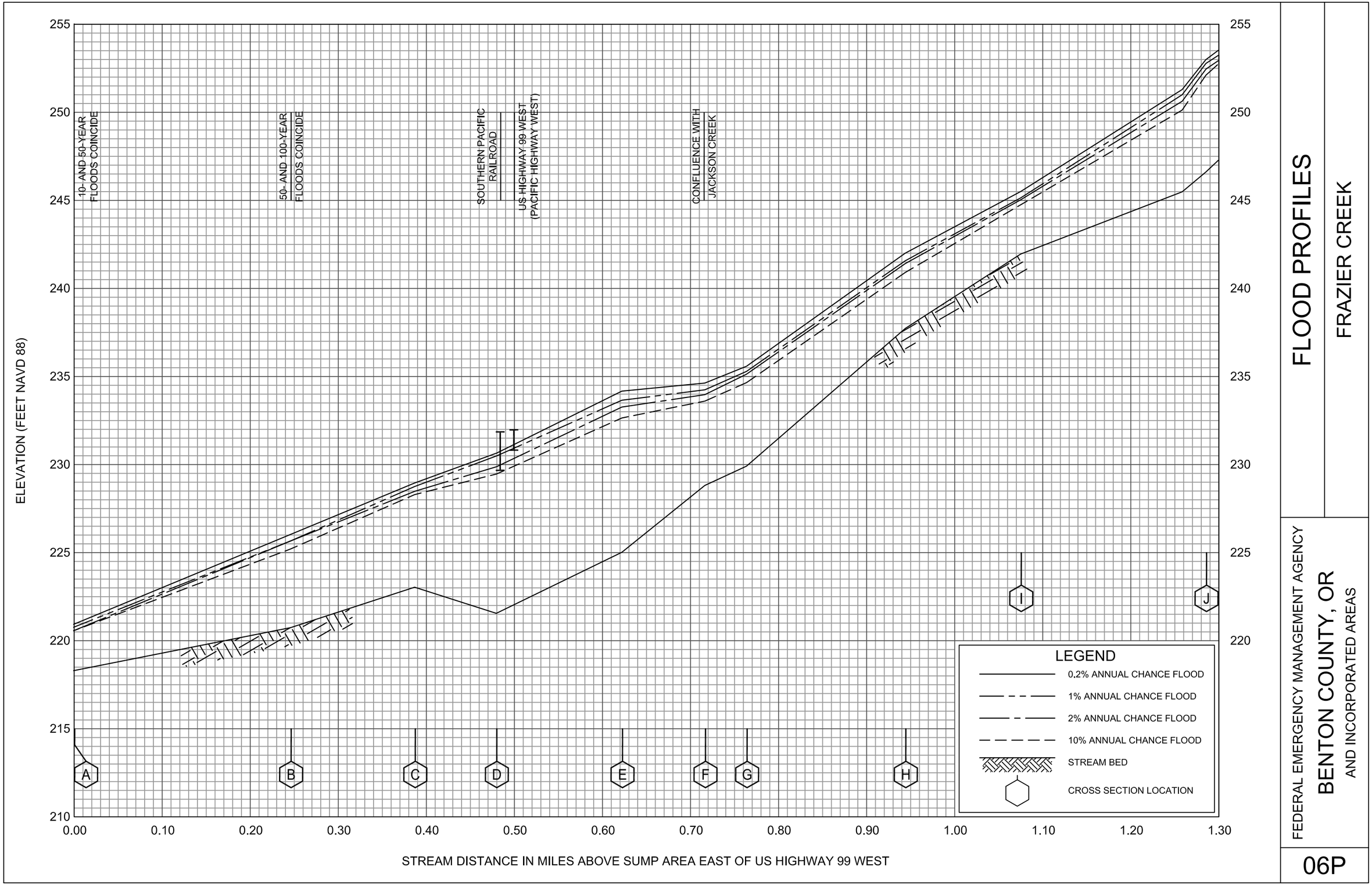
FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS



05P



FLOOD PROFILES

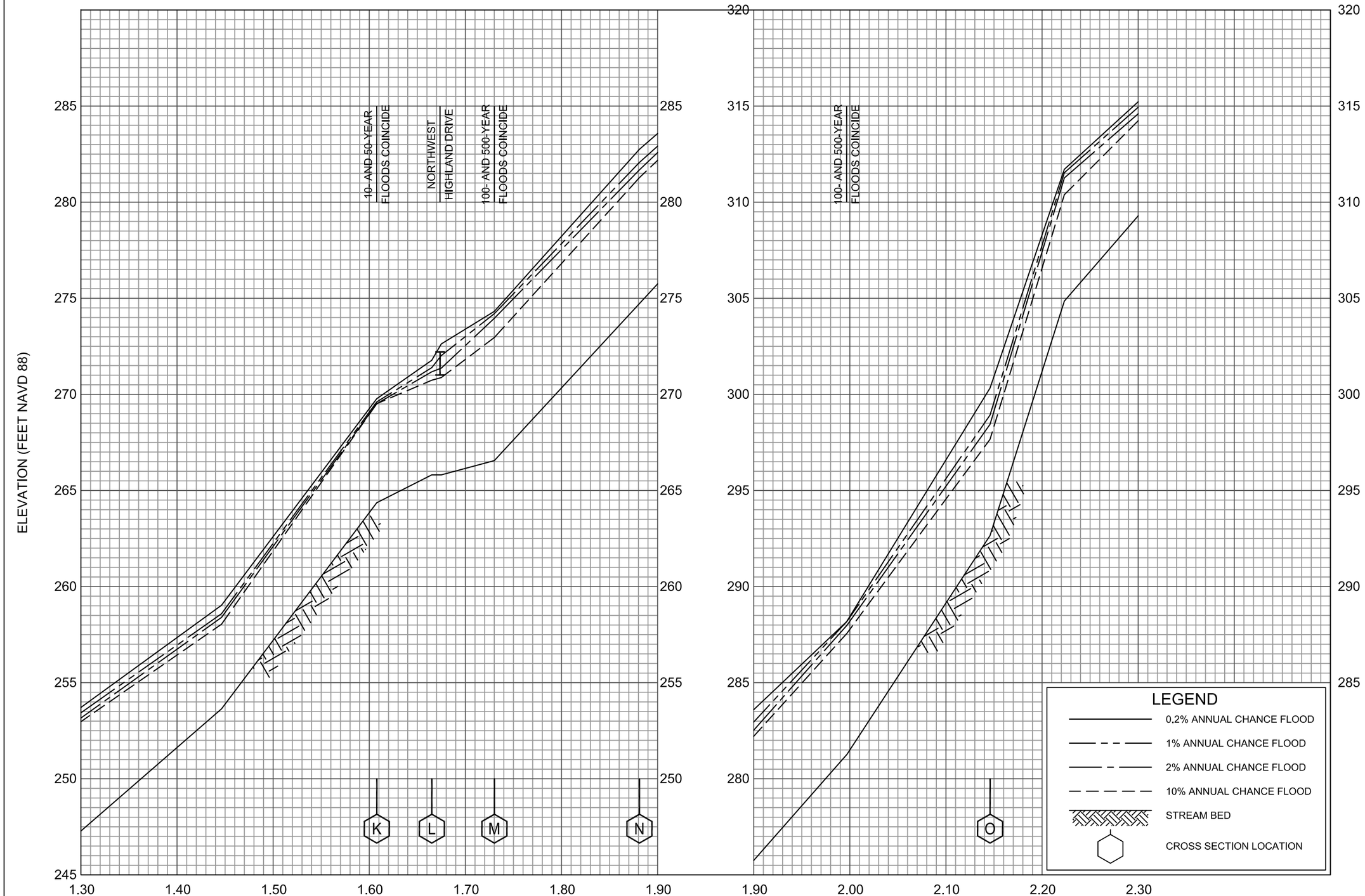
FRAZIER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

06P



FLOOD PROFILES

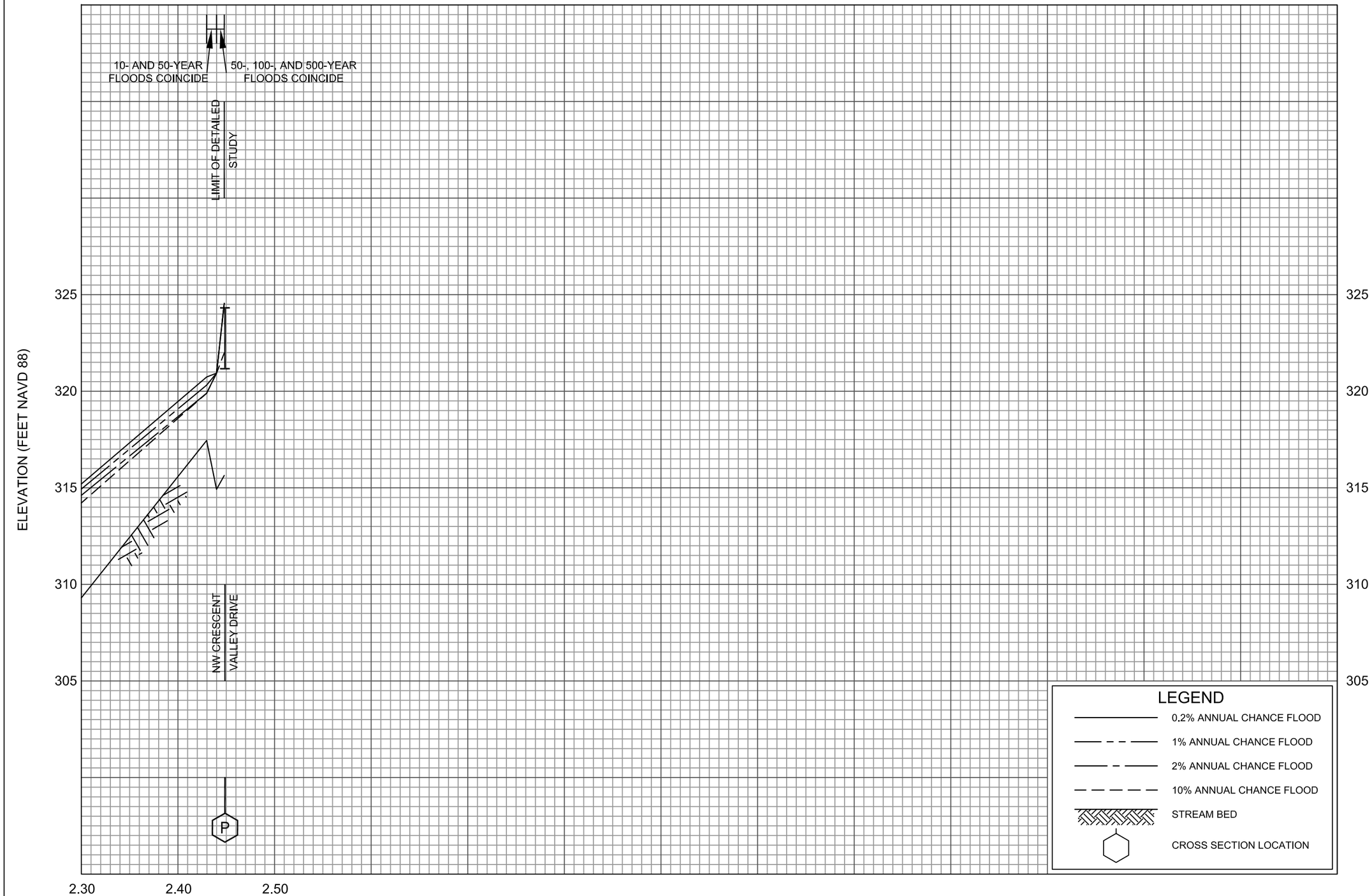
FRAZIER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

07P



FLOOD PROFILES

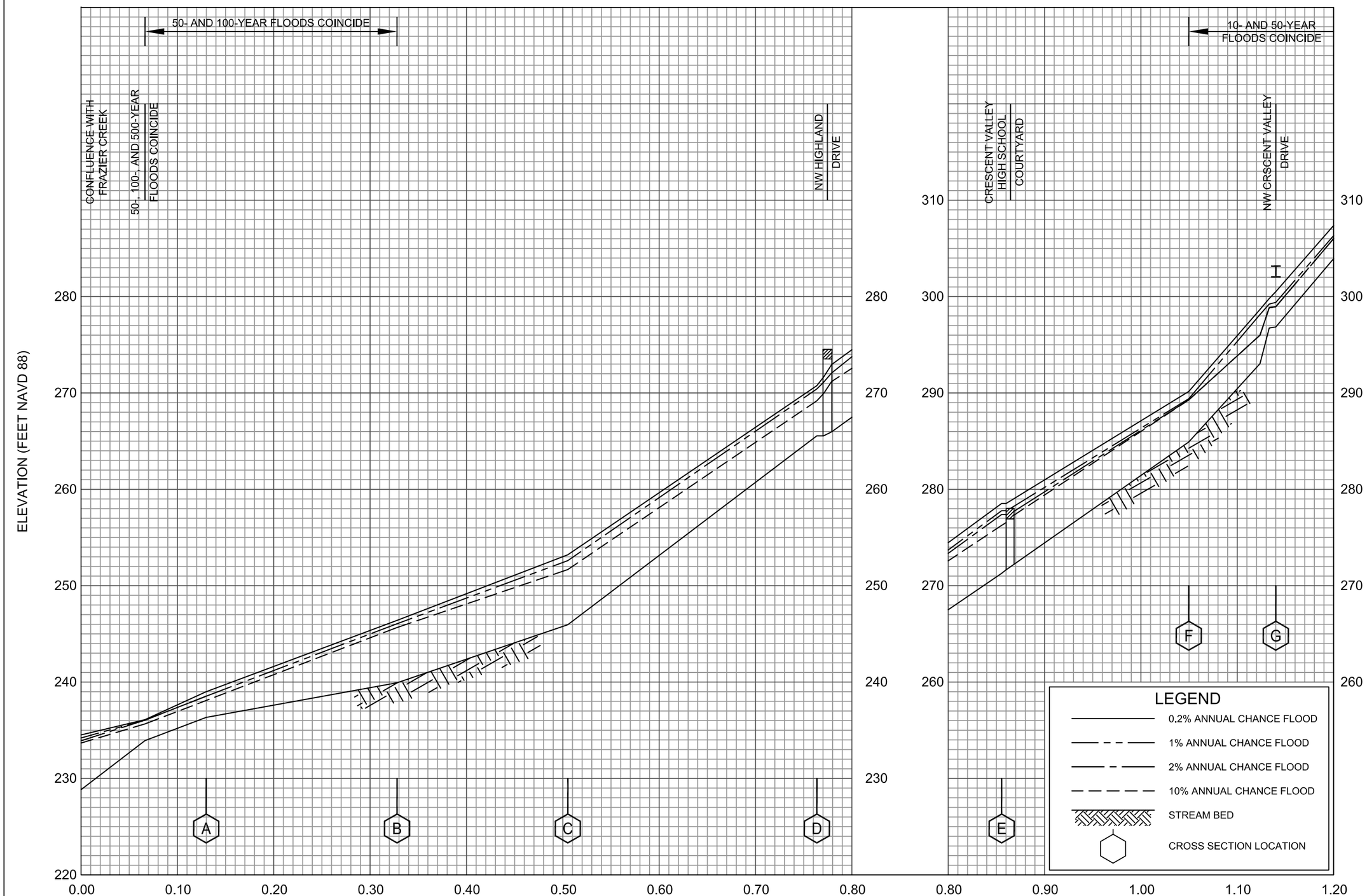
FRAZIER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

08P



FLOOD PROFILES

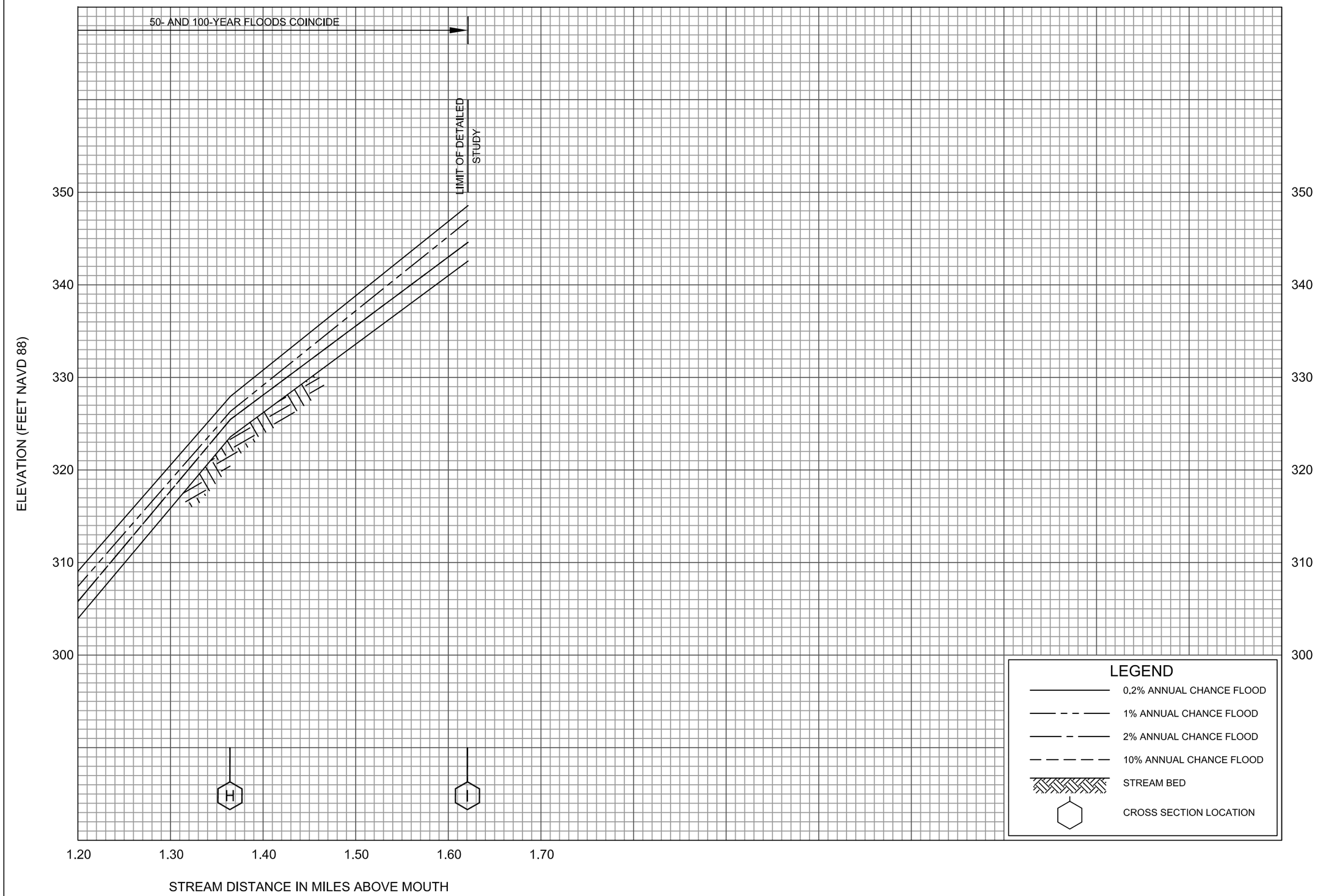
JACKSON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

09P



FLOOD PROFILES

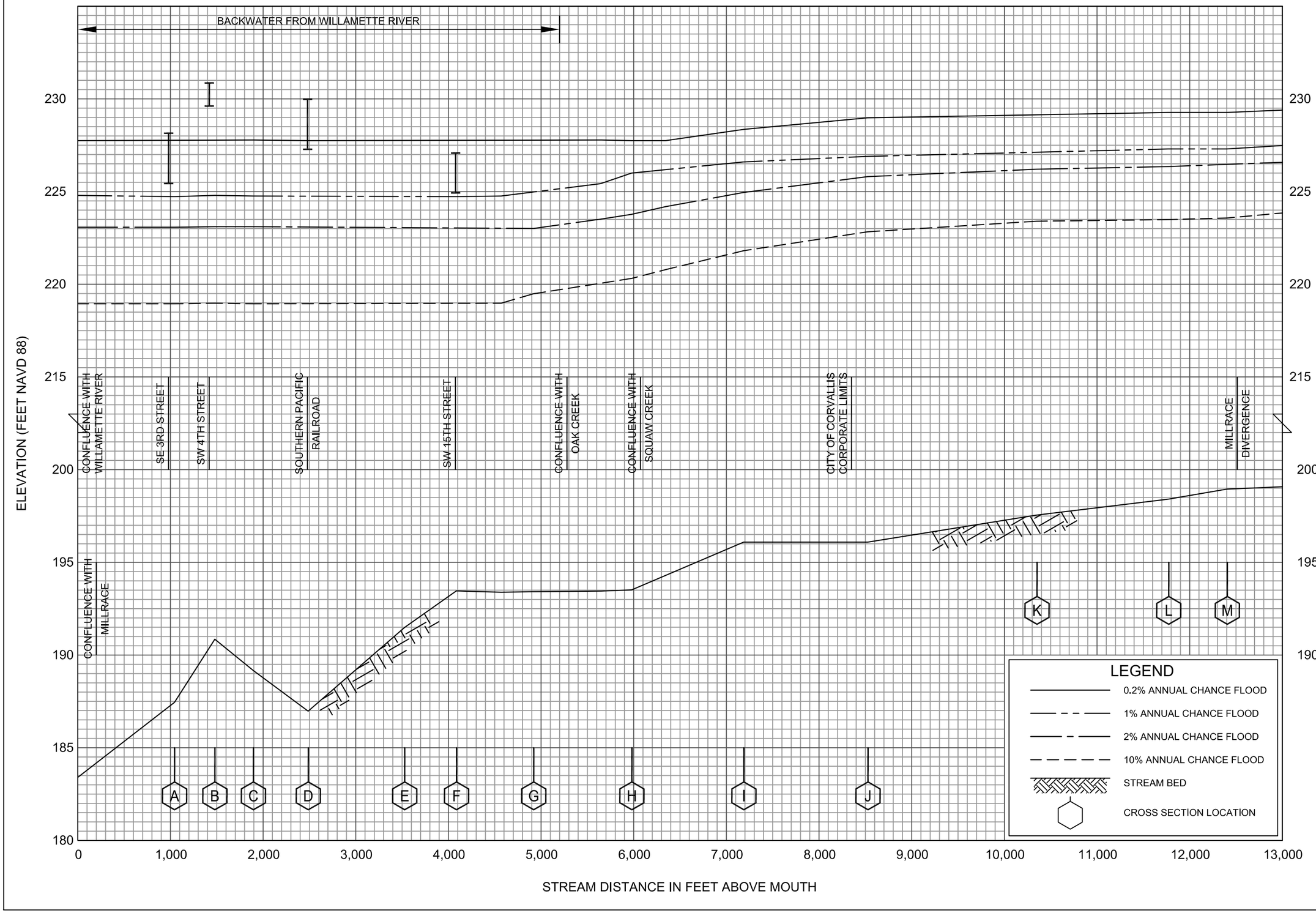
JACKSON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

10P



FLOOD PROFILES

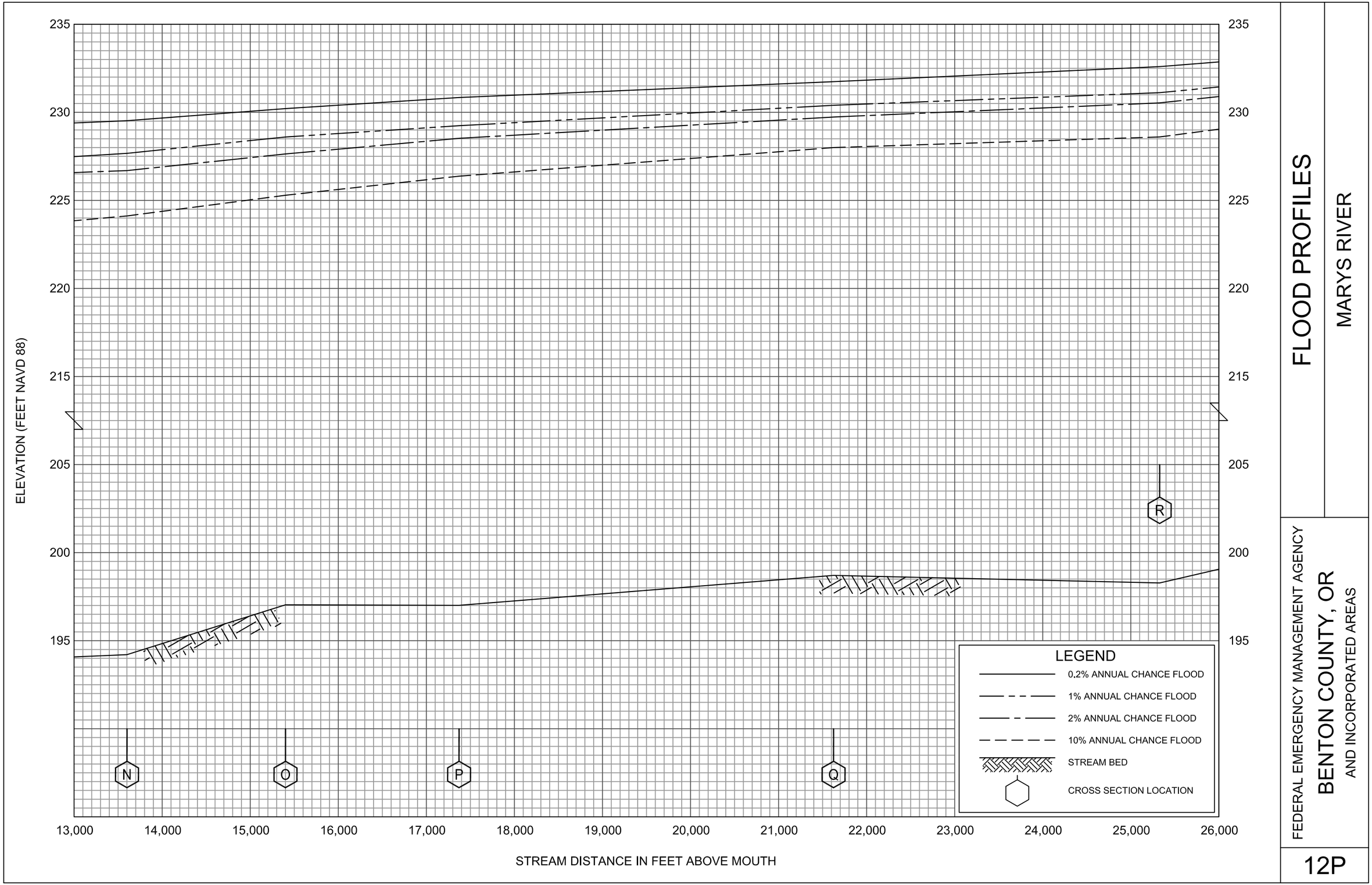
MARYS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

11P



FLOOD PROFILES

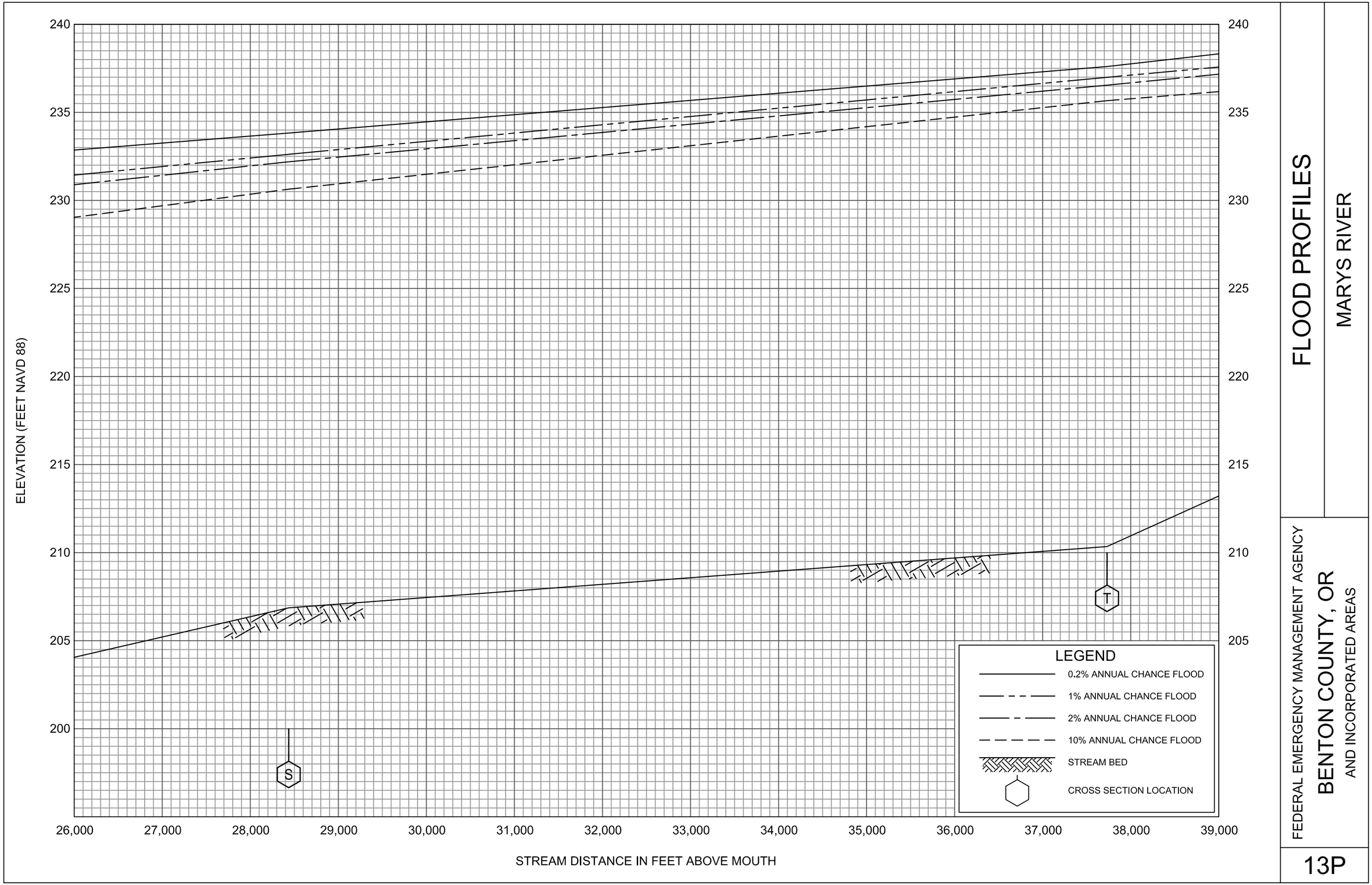
MARYS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

12P



FLOOD PROFILES

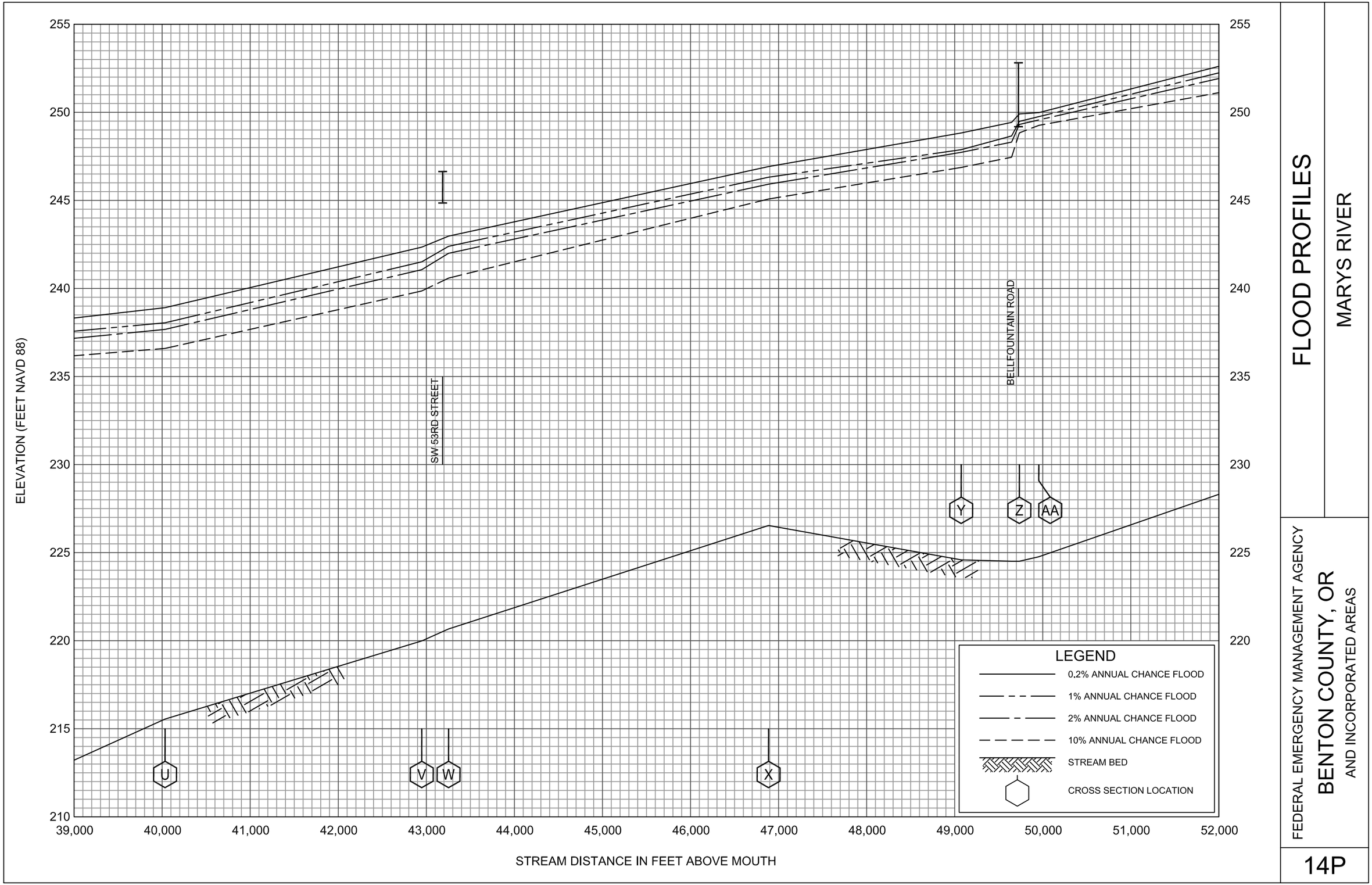
MARYS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

13P



FLOOD PROFILES

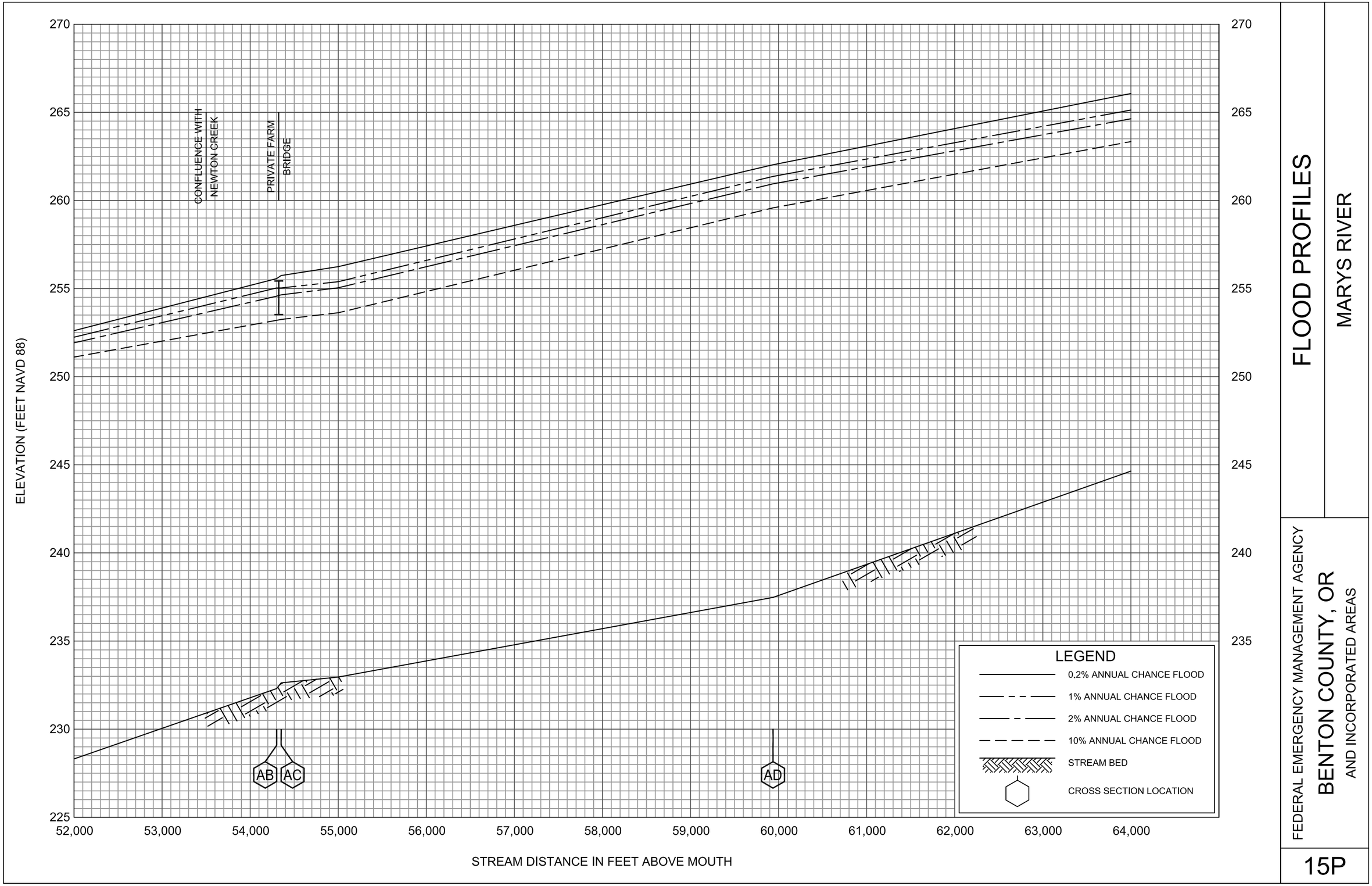
MARYS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

14P



FLOOD PROFILES

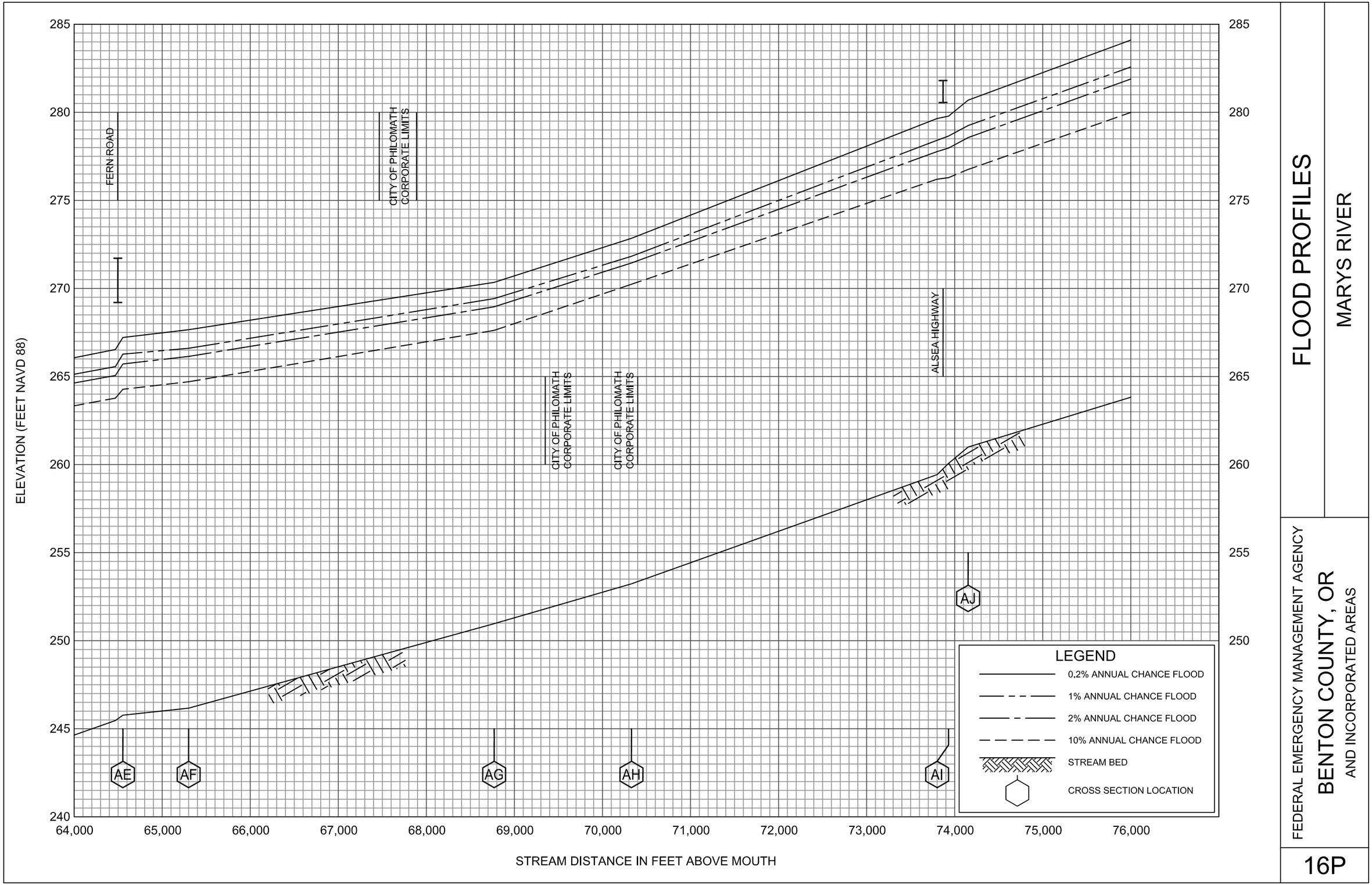
MARYS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

15P



FLOOD PROFILES

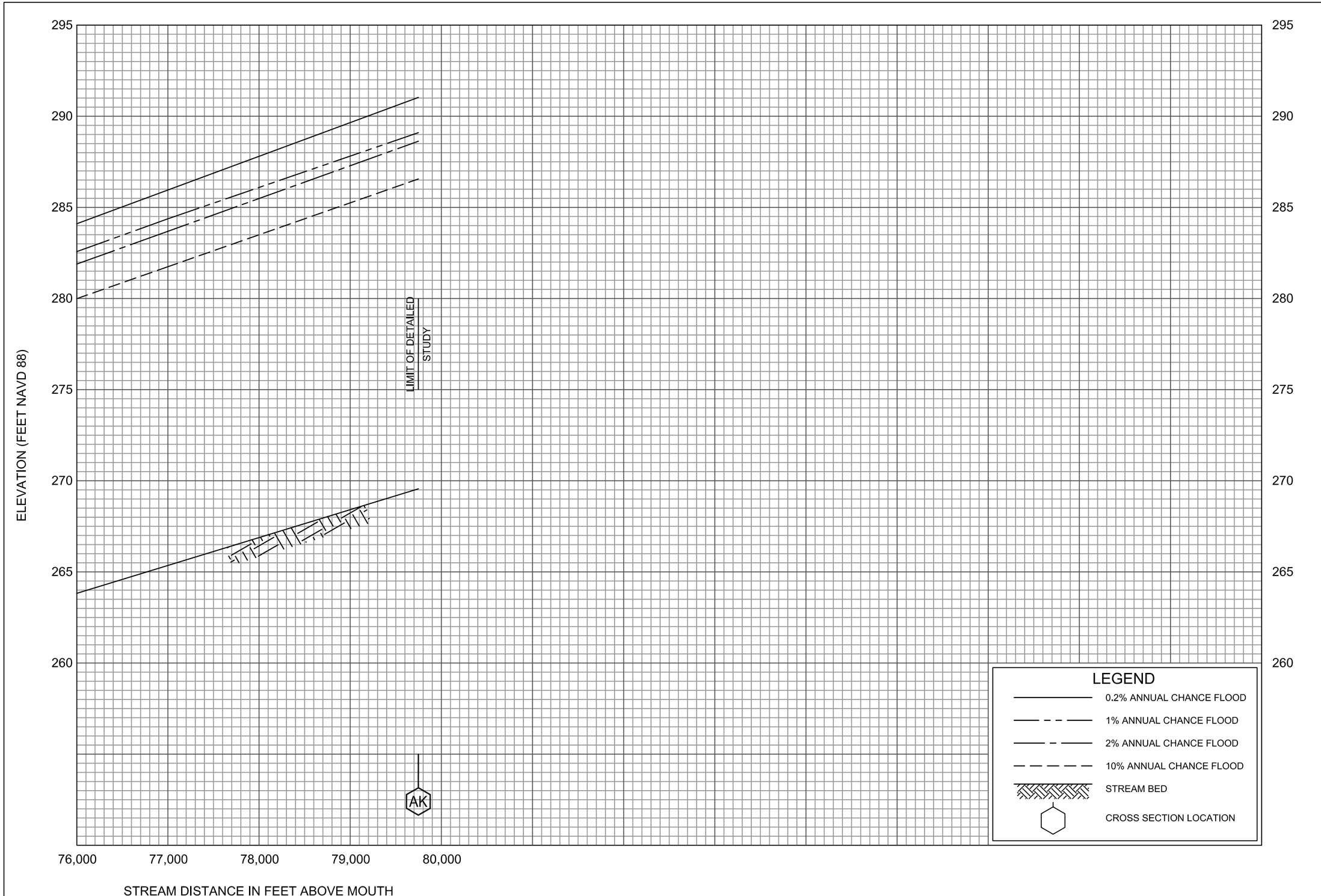
MARYS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

16P



FLOOD PROFILES

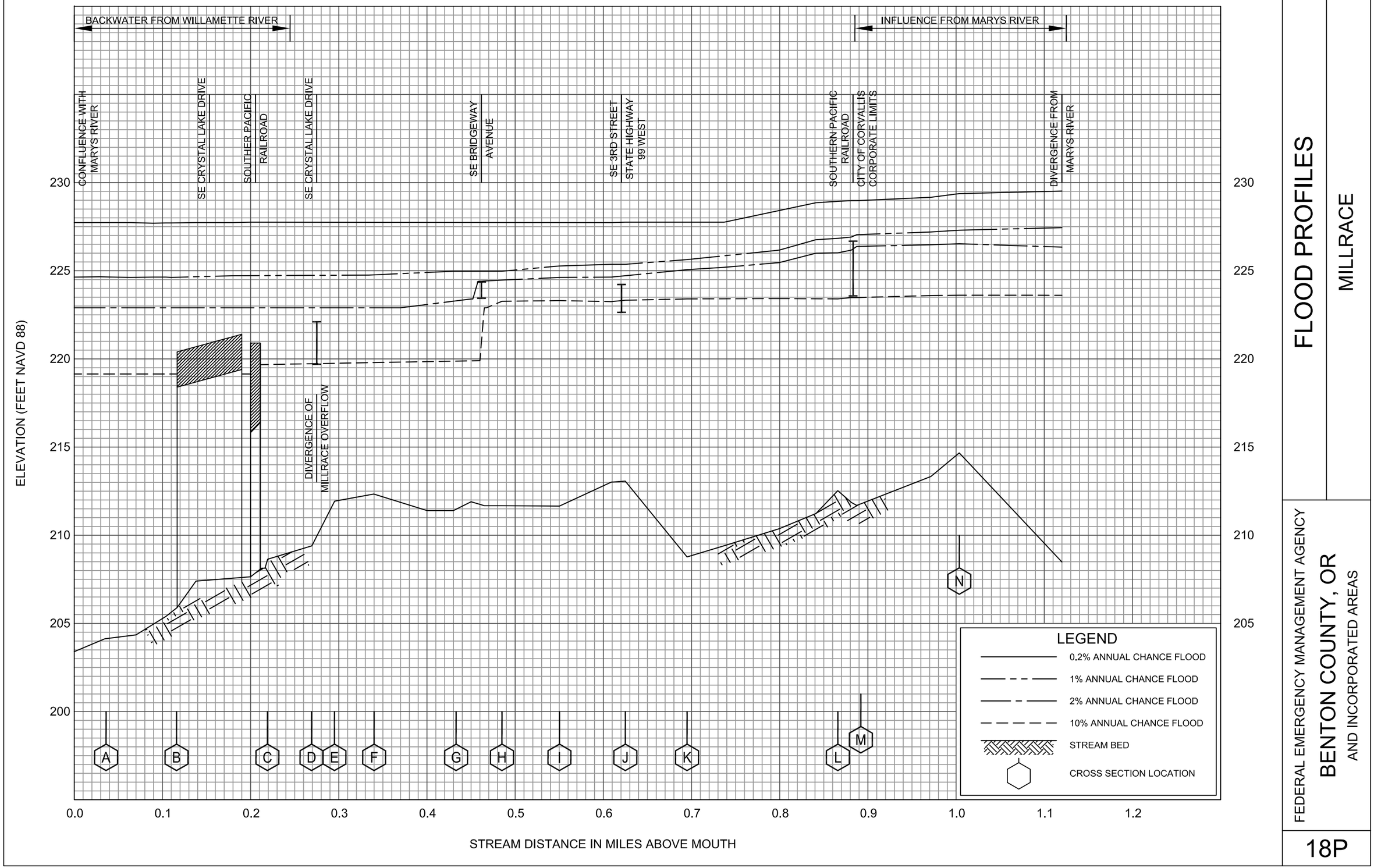
MARYS RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

17P



FLOOD PROFILES

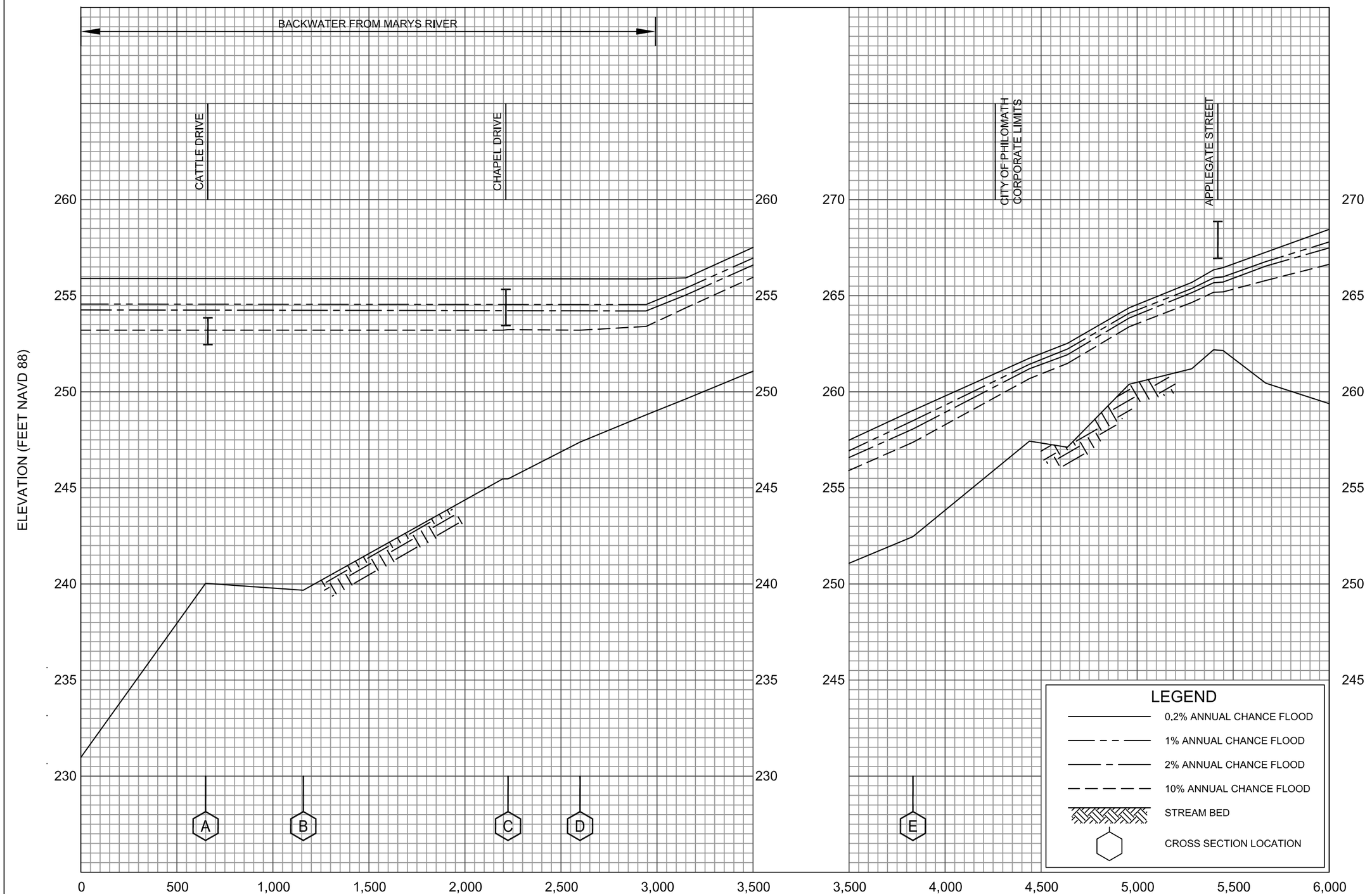
MILLRACE

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

18P



FLOOD PROFILES

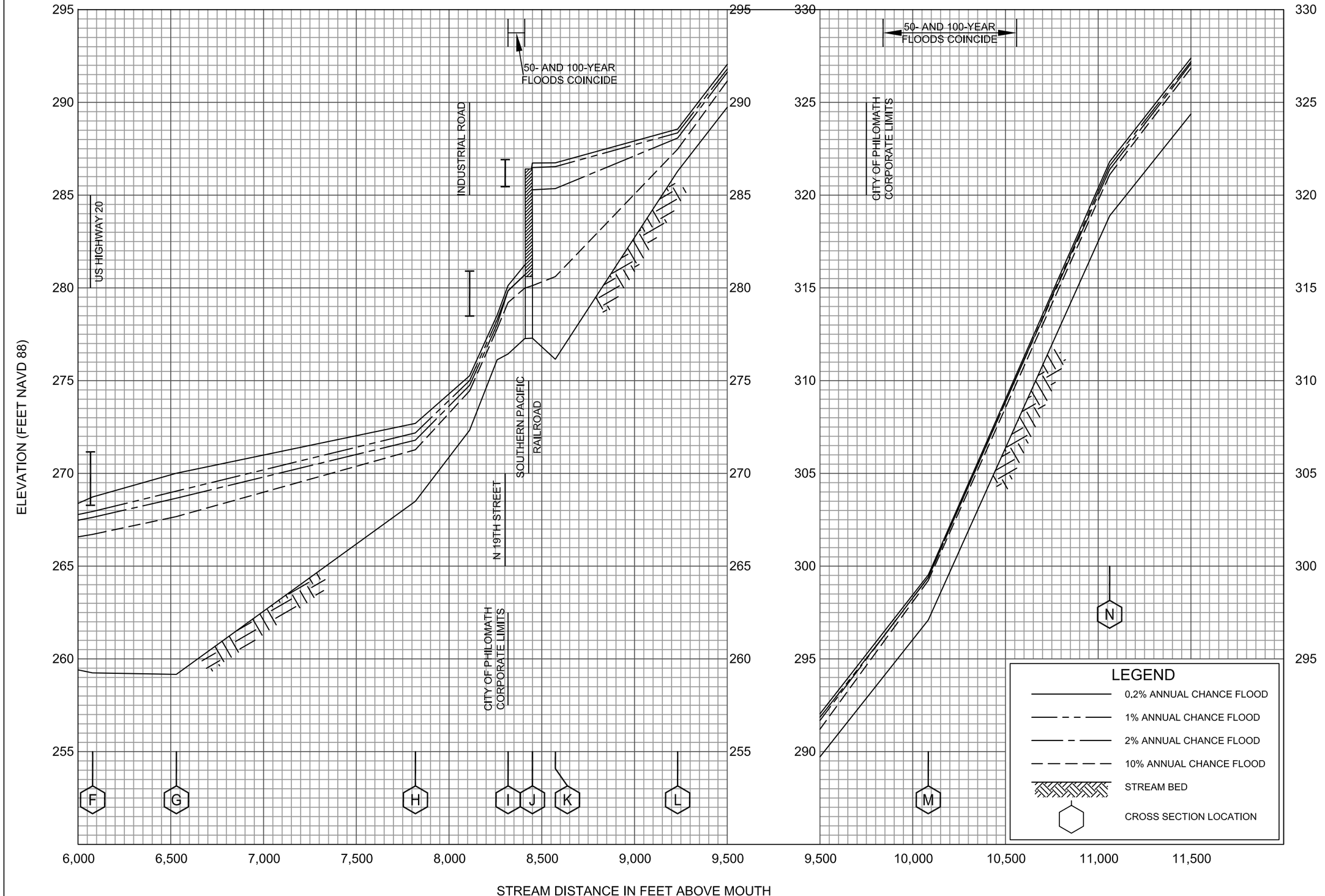
NEWTON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

19P



FLOOD PROFILES

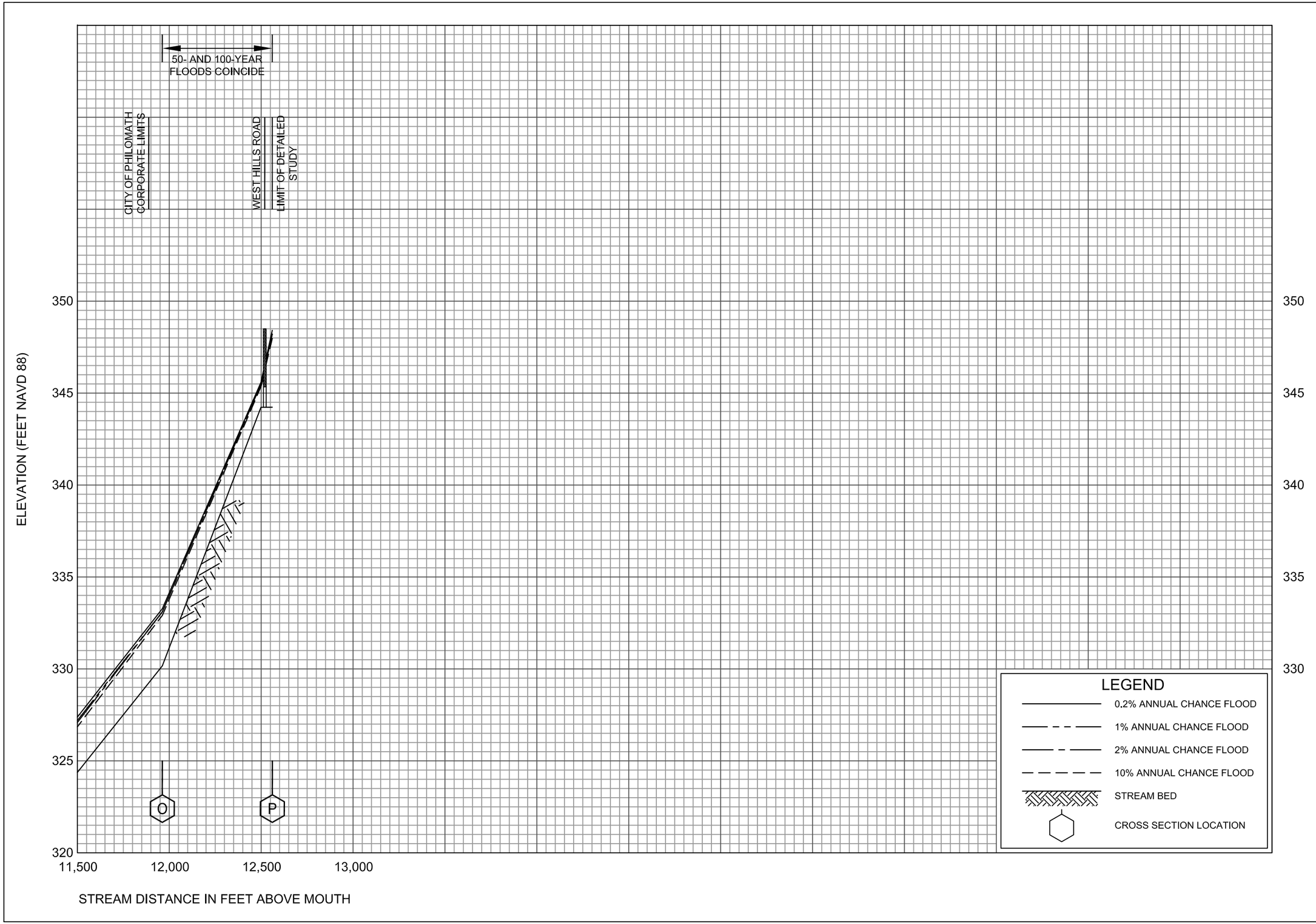
NEWTON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

20P



FLOOD PROFILES

NEWTON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

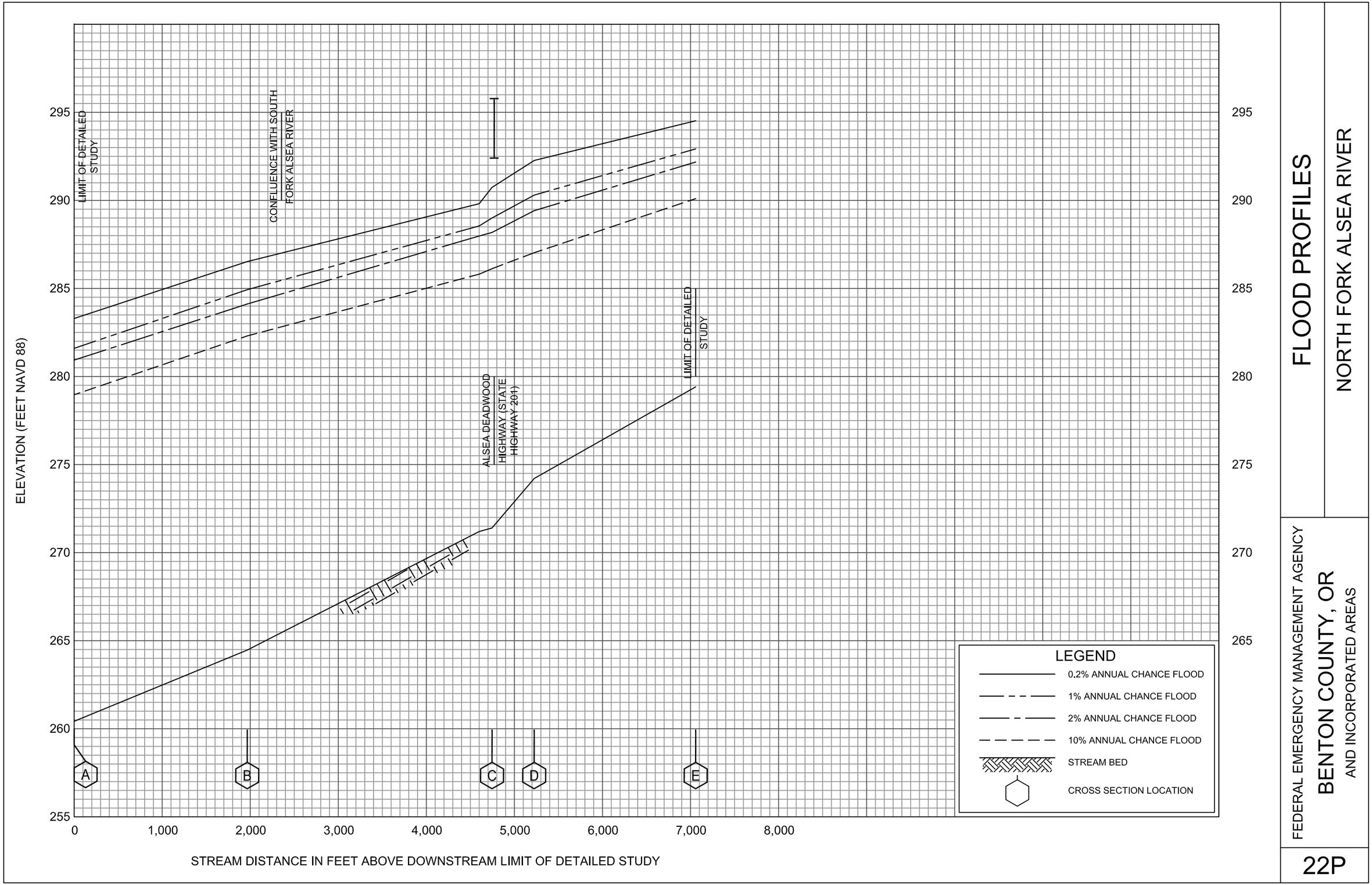
BENTON COUNTY, OR

AND INCORPORATED AREAS

21P

FLOOD PROFILES

NORTH FORK ALSEA RIVER



FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

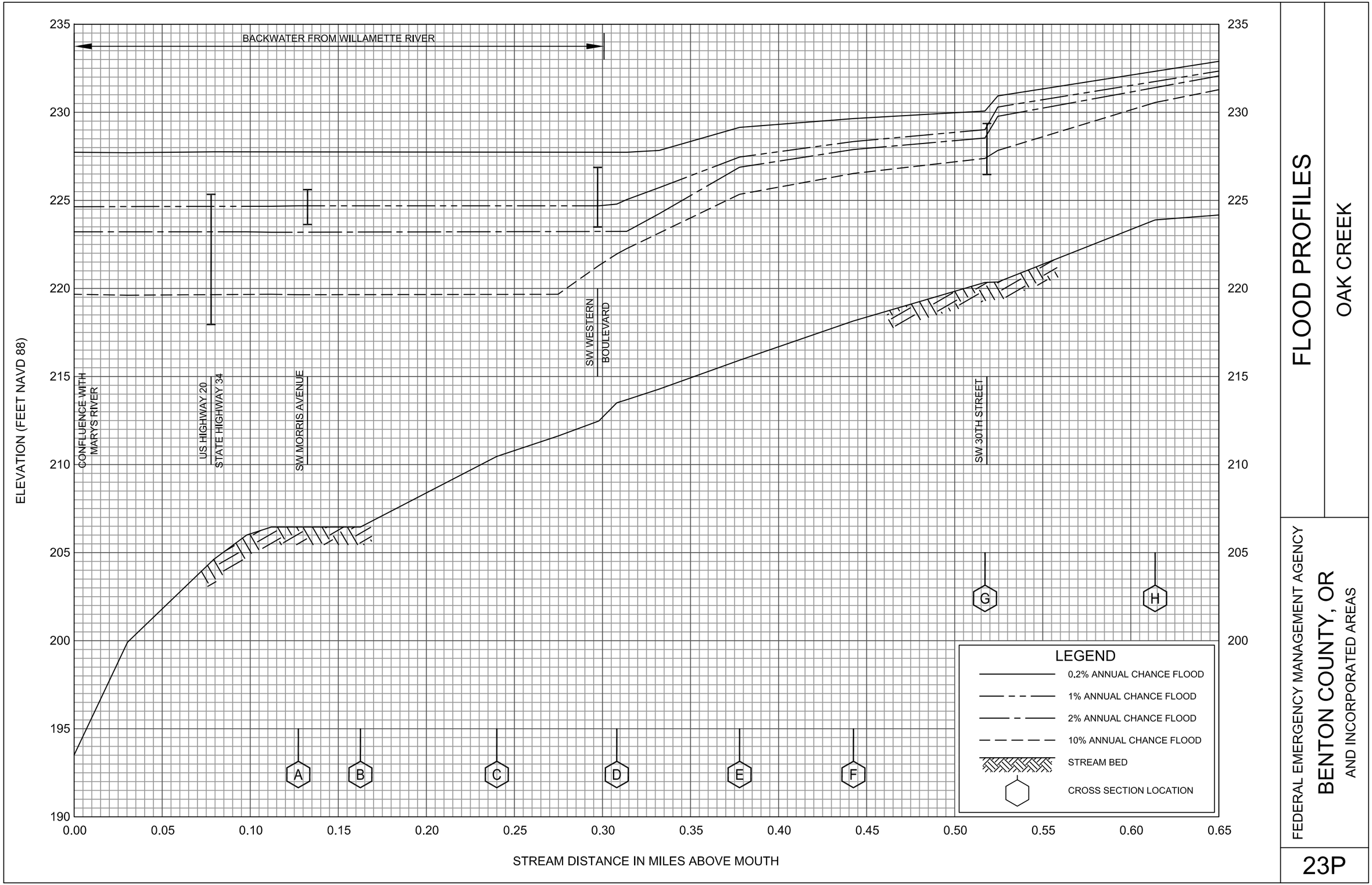
FLOOD PROFILES

OAK CREEK

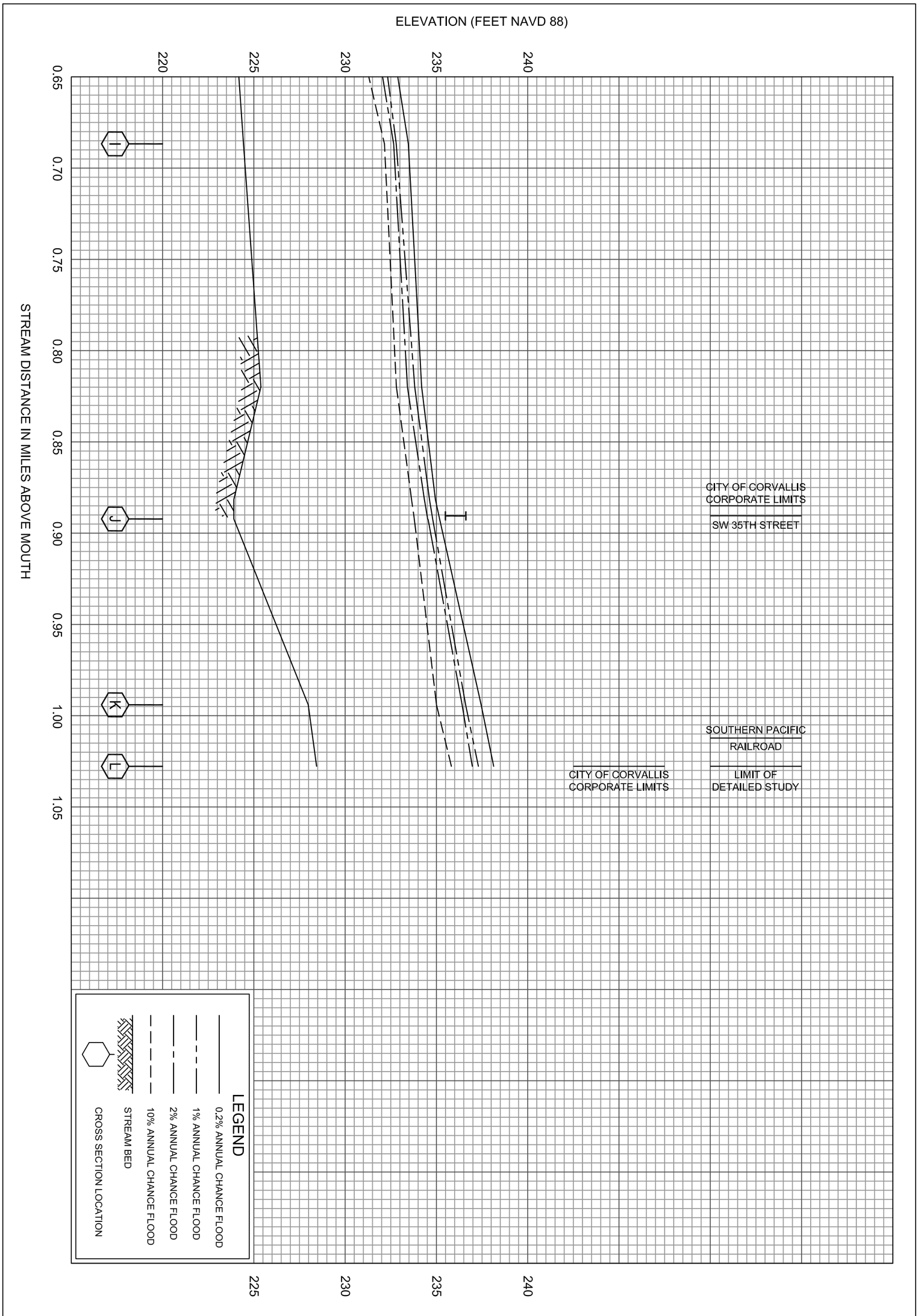
FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS



23P



24P

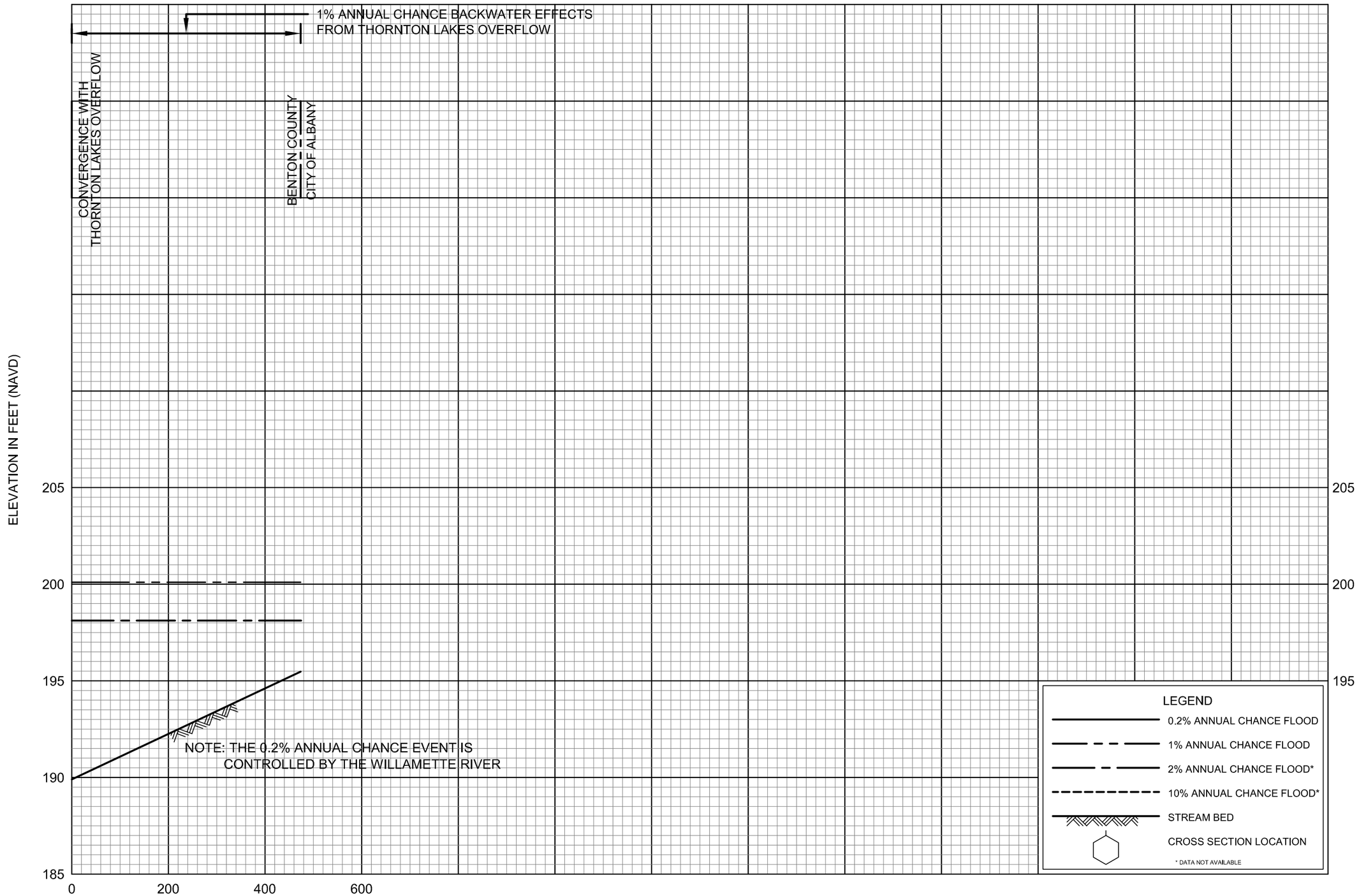
FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

OAK CREEK



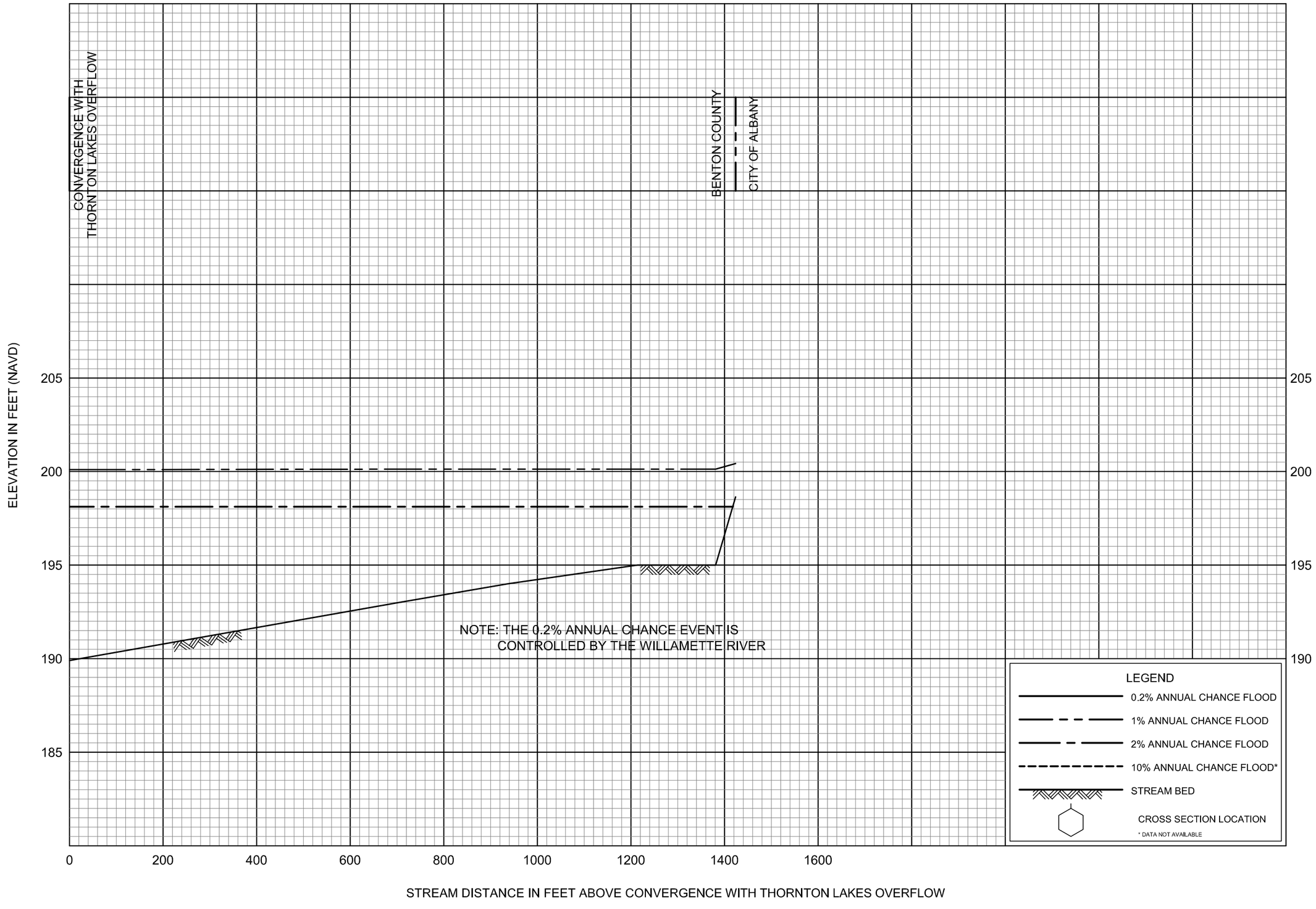
FLOOD PROFILES

QUARRY ROAD EAST OVERFLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS



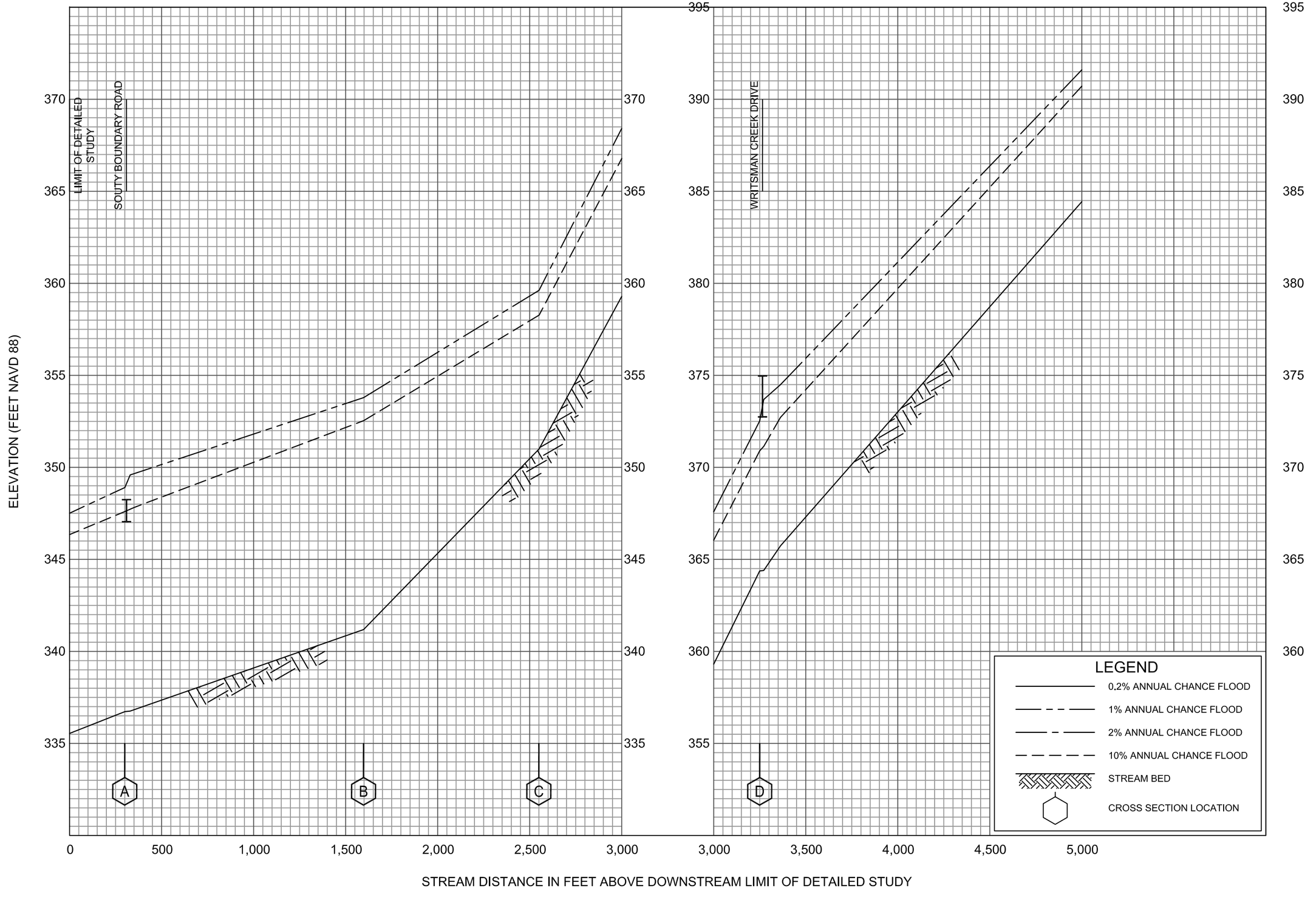
FLOOD PROFILES

QUARRY ROAD WEST OVERFLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS



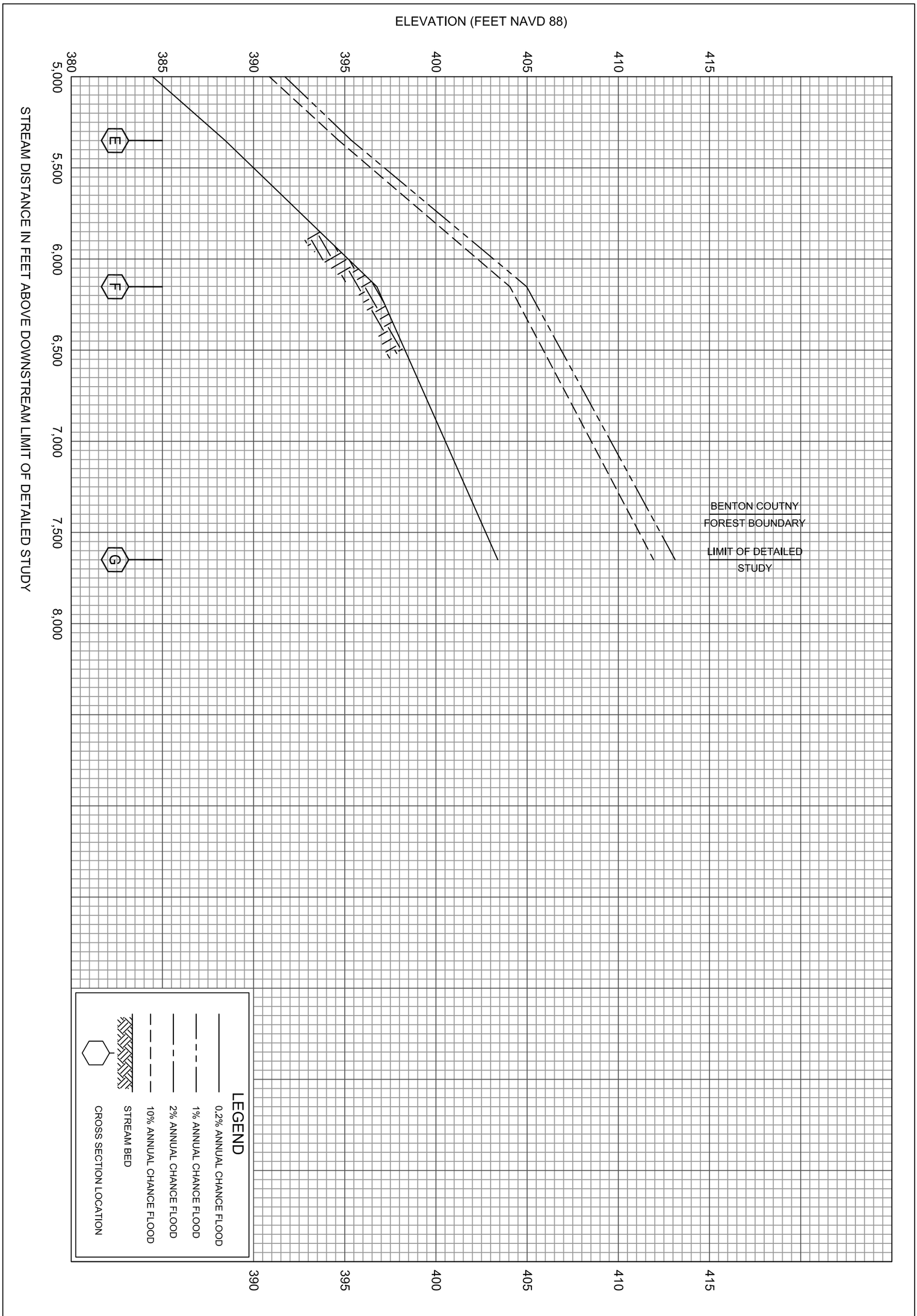
FLOOD PROFILES

SOAP CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS



28P

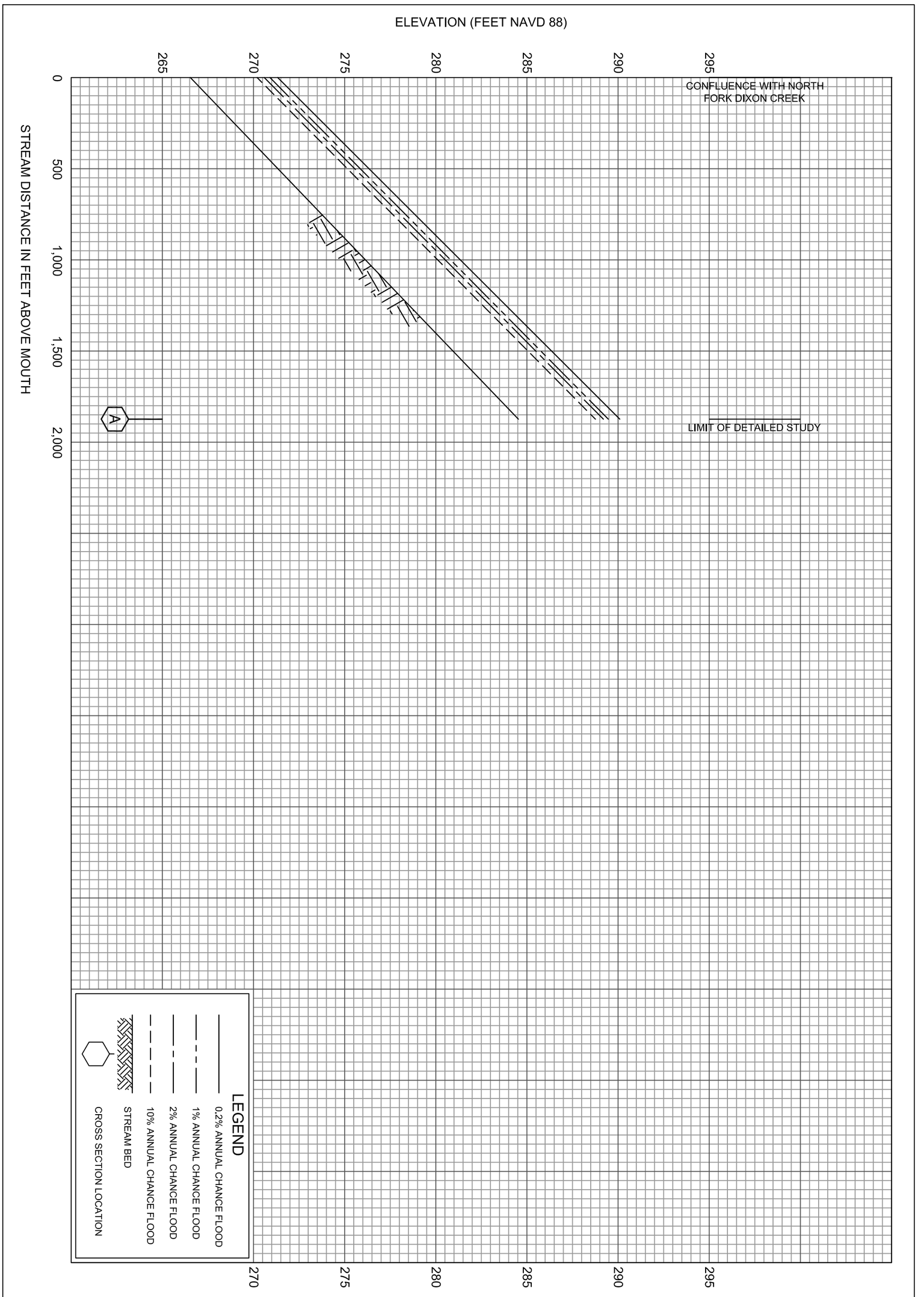
FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

SOAP CREEK



29P

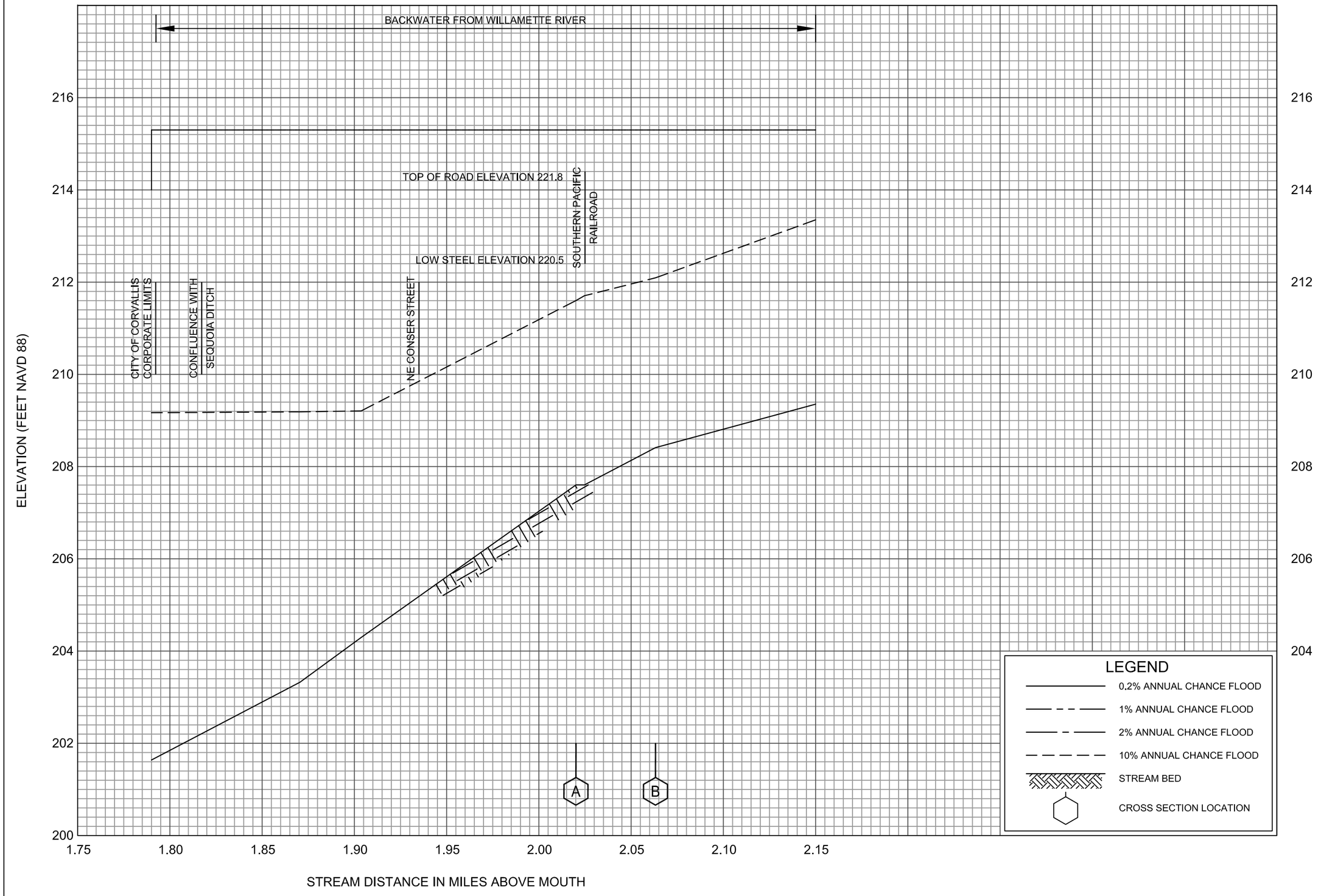
FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

SOUTH FORK DIXON CREEK



FLOOD PROFILES

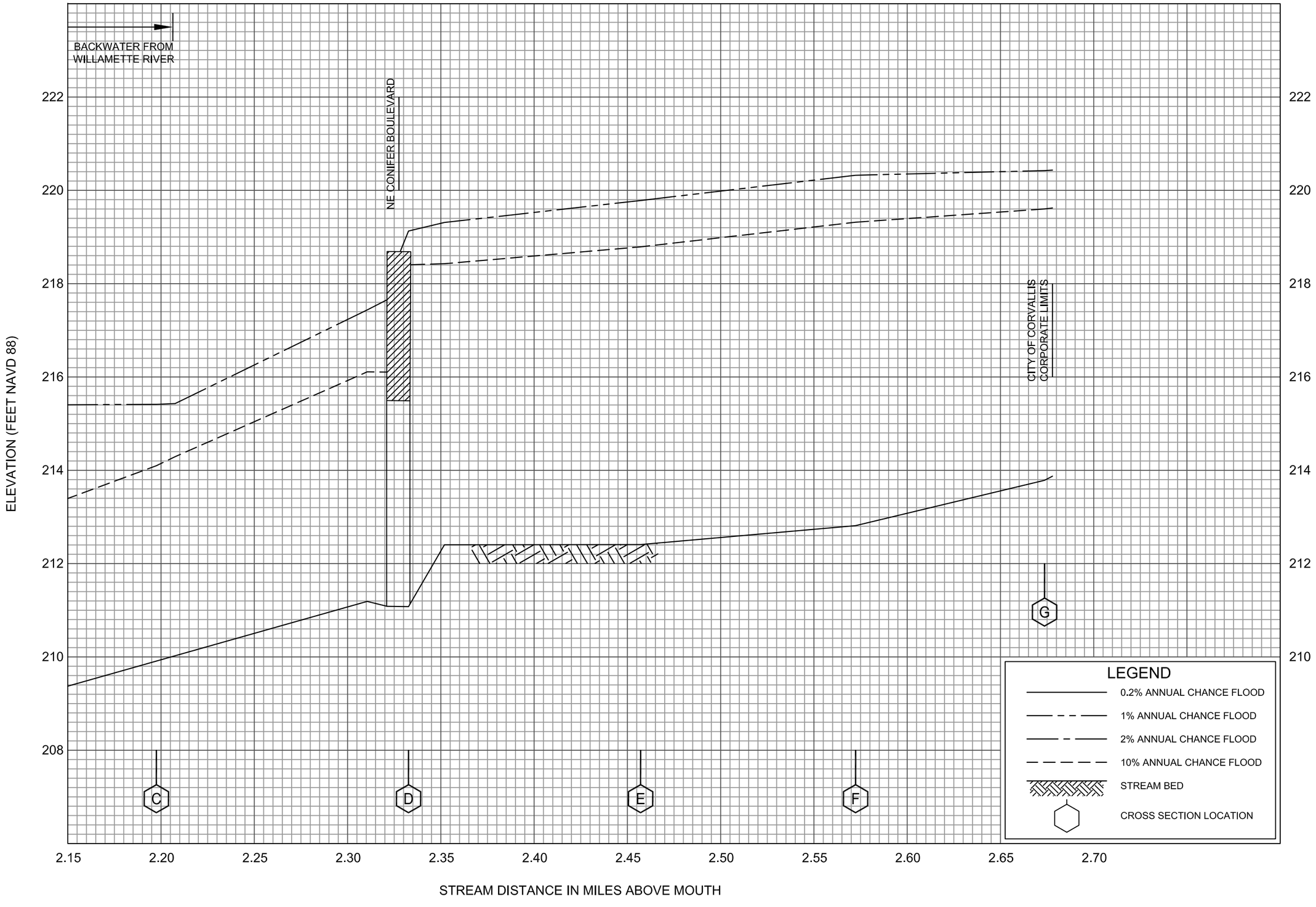
STEWART SLOUGH

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

30P



FLOOD PROFILES

STEWART SLOUGH

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

NOTE: THE 0.2% ANNUAL CHANCE EVENT IS CONTROLLED BY THE WILLAMETTE RIVER

CONVERGENCE WITH WILLAMETTE RIVER

ELEVATION IN FEET (NAVD)

205
200
195
190
185
180
175
170
165

0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500

STREAM DISTANCE IN FEET ABOVE CONVERGENCE WITH WILLAMETTE RIVER

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

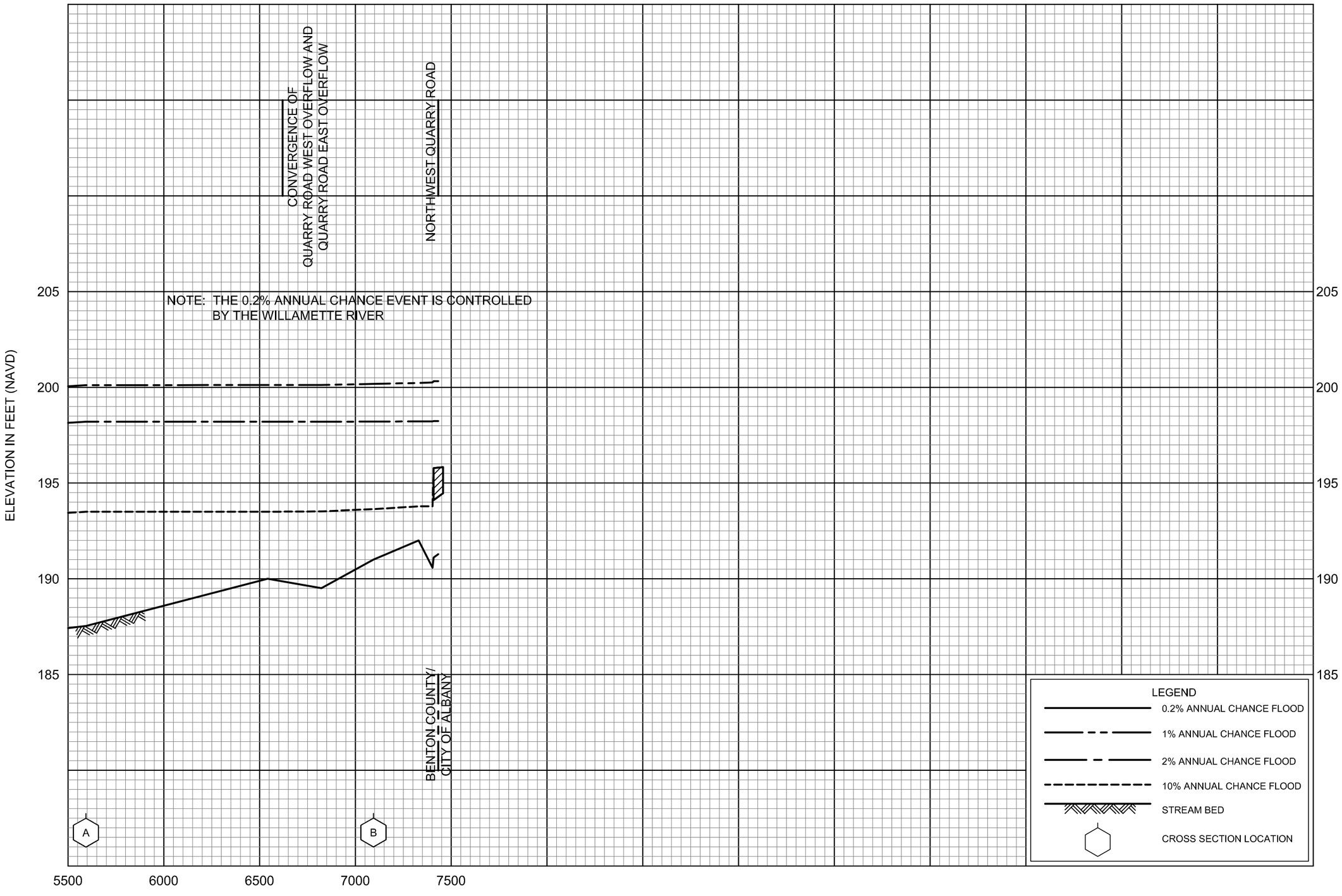
THORNTON LAKES OVERFLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

32P



FLOOD PROFILES

THORNTON LAKES OVERFLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

33P

FLOOD PROFILES

WILLAMETTE RIVER

ELEVATION (FEET NAVD 88)

STREAM DISTANCE IN MILES ABOVE MOUTH

LIMIT OF FLOODING AFFECTING BENTON COUNTY

LOW WATER PROFILE, AUGUST 1965

FOURTH LAKE OUTLET

CONFLUENCE WITH COX CREEK

CONFLUENCE WITH PERIWINKLE CREEK

SOUTHERN PACIFIC RAILROAD

US HIGHWAY 20 BRIDGE

CONFLUENCE WITH CALAPOOIA RIVER

DIVERGENCE TO EAST THORNTON LAKE OVERFLOW

DIVERGENCE TO THORNTON LAKE OVERFLOW

CONFLUENCE WITH LITTLE WILLAMETTE RIVER

STREAM GAGE

CONFLUENCE WITH BOWERS SLOUGH

CONFLUENCE WITH KIGER CUTOFF

BENTON COUNTY / CITY OF ALBANY

BENTON COUNTY / LINN COUNTY

DIVERGENCE TO WEST THORNTON LAKE OVERFLOW

CONFLUENCE WITH THORNTON LAKES OVERFLOW

BENTON COUNTY / CITY OF ALBANY CORPORATE LIMITS / BENTON COUNTY

A B C D E F G H I J

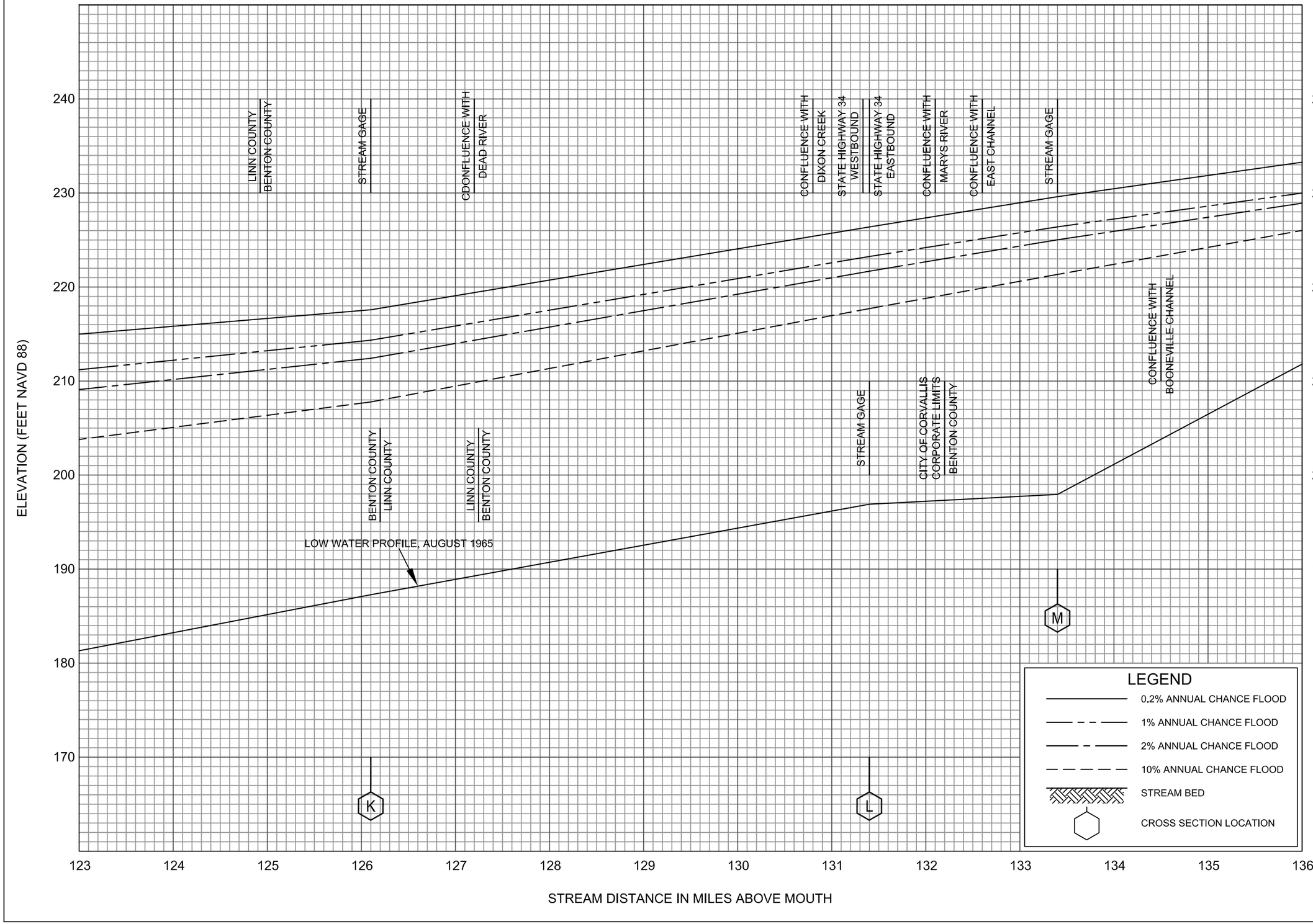
LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS



FLOOD PROFILES

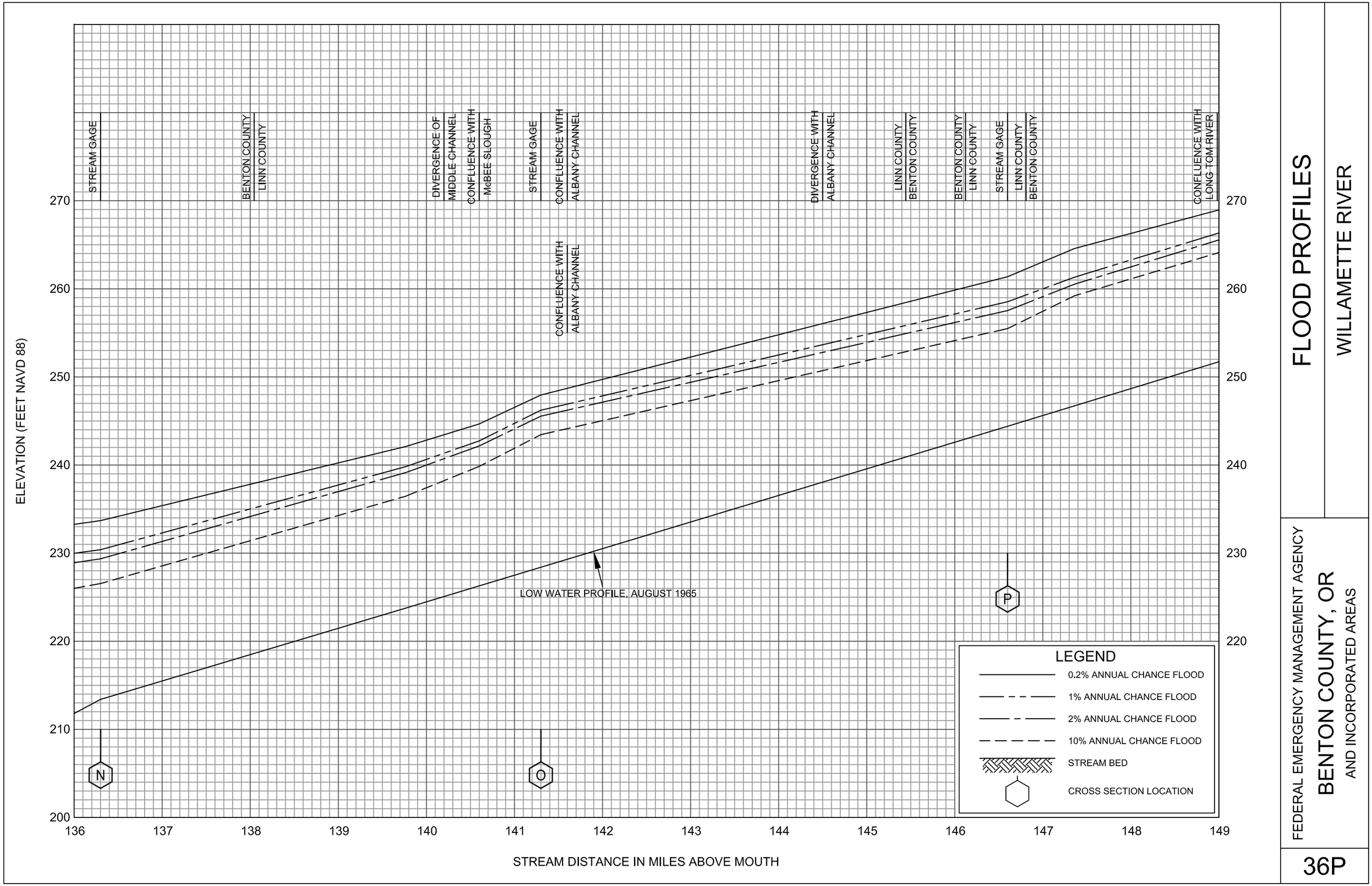
WILLAMETTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

35P



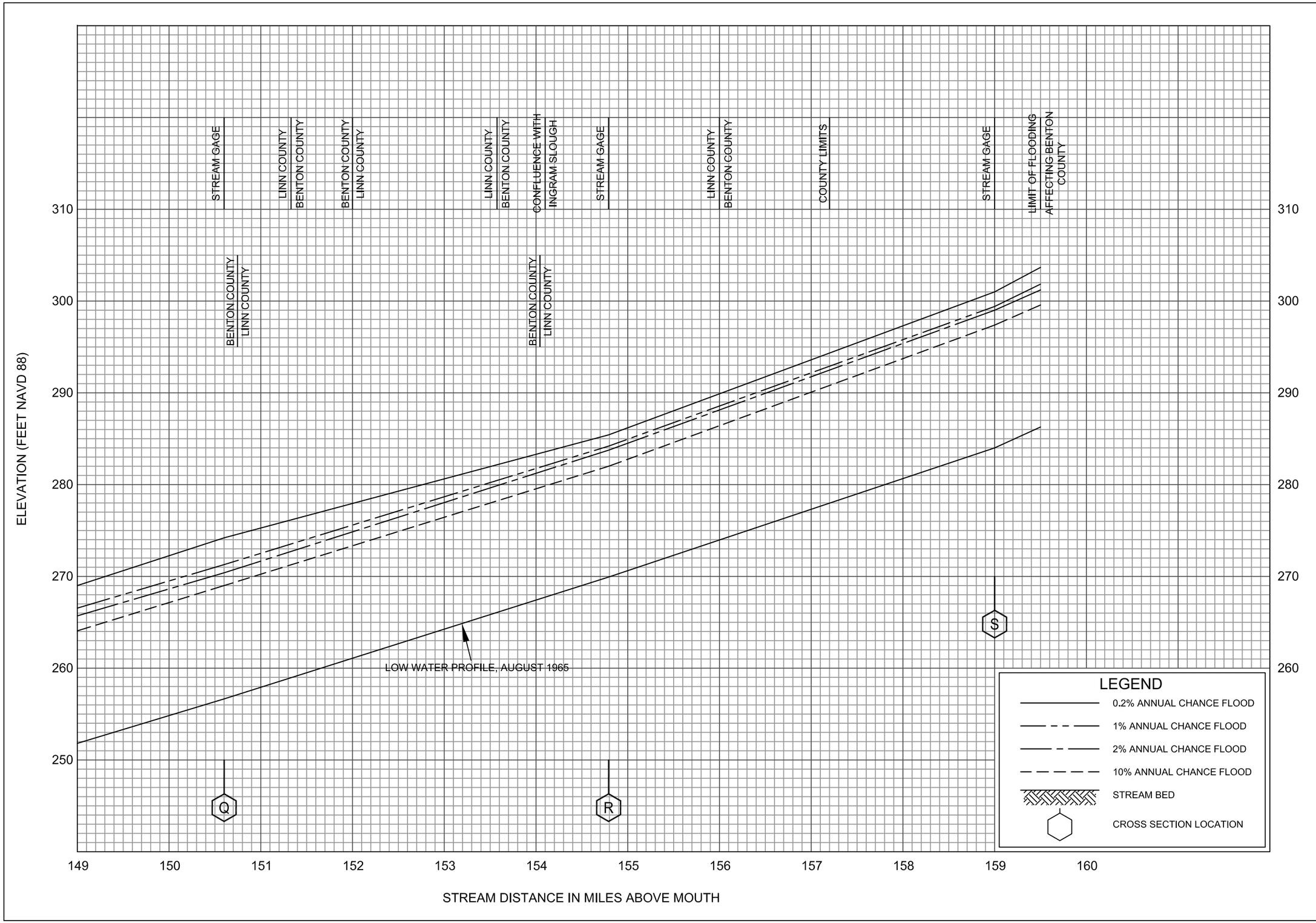
FLOOD PROFILES

WILLAMETTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS



FLOOD PROFILES

WILLAMETTE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BENTON COUNTY, OR

AND INCORPORATED AREAS

37P