FLOOD INSURANCE STUDY

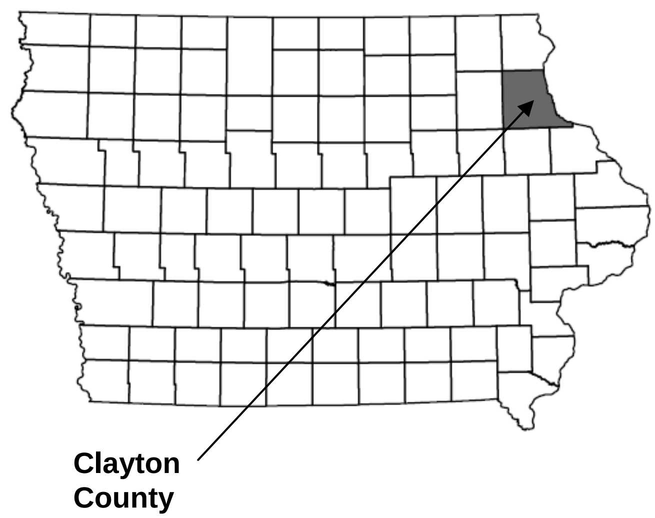
CLAYTON COUNTY, IOWA

AND INCORPORATED AREAS

Community Name	Community Number
Clayton, City of	190072
Clayton County (Unicorporated Areas)	190858
* Edgewood, City of (Clayton and Delaware Counties)	190573
Elkader, City of	190073
Elkport, City of	190074
Farmersburg, City of	190075
Garber, City of	190076
Garnavillo, City of	190580
Guttenberg, City of	190077
Luana, City of	190767
Marquette, City of	195182
McGregor, City of	195183
Millville, City of	190081
Monona, City of	190620
North Buena Vista, City of	190082
Osterdock, City of	190083
** Postville, City of	190641
Saint Olaf, City of	190084
Strawberry Point, City of	190662
Volga, City of	190085

* NO SPECIAL FLOOD HAZARD AREAS IDENTIFIED

** COMMUNITY NOT INCLUDED IN CLAYTON COUNTY STUDY



June 2, 2011

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
19043CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

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

Part or all of this Flood Insurance Study may be revised and republished at any time. In addition, part of this Flood Insurance Study may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the Flood Insurance Study. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current Flood Insurance Study 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 Zones	New Zone
A1 through A30	AE
B	X
C	X

Countywide FIS Effective Date: June 2, 2011

Revised FIS Report Dates:

TABLE OF CONTENTS

TABLE OF CONTENTS *(continued)*

Page

FIGURES

TABLES

EXHIBITS

FLOOD INSURANCE STUDY

CLAYTON COUNTY, IOWA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) revises and supersedes the FIS reports, Flood Insurance Rate Maps (FIRMs) and/or Flood Boundary and Floodway Maps (FBFMs) in the geographic area of Clayton County, including the Cities of Clayton, Edgewood, Elkader, Elkport, Farmersburg, Garber, Garnavillo, Guttenberg, Littleport, Luana, Marquette, McGregor, Millville, Monona, North Buena Vista, Osterdock, Saint Olaf, Strawberry Point, and Volga; and the unincorporated areas of Clayton County (hereinafter referred to collectively as Clayton County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Please note that the City of Edgewood is located in both Clayton and Delaware Counties and is included in its entirety in this FIS. No Special Flood Hazard Areas (SFHAs) were identified for the City of Edgewood. Also note that the City of Postville is located in both Allamakee and Clayton Counties and will be included in its entirety in the FIRM for Allamakee County, which is currently in progress. The City of Littleport is a former city in Clayton County. The City was officially disincorporated in 2005. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR. 60.3.

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

The Digital Flood Insurance Rate Map (DFIRM) and FIS Report for this countywide study have been produced in digital format. Flood hazard information was converted to meet the Federal Emergency Management Agency (FEMA) DFIRM database specifications and Geographic Information System (GIS) format requirements. The flood hazard information was created and is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community.

1.2 Authority and Acknowledgments

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

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

City of Clayton	The hydrologic and hydraulic analyses for the March 1989 study were performed by the U.S. Army Corps of Engineers (USACE), St. Paul District, for FEMA, under Inter-Agency Agreement No. EMW-87-E-2509, Project Order No. 12. This work was completed in September 1987 (Reference 1).
City of Elkader	The hydrologic and hydraulic analyses for the July 1996 study were performed by Stanley Consultants, Inc. (SCI), for FEMA, under Contract No. H-4005. This work was completed in March 1977 (Reference 2).
City of Guttenberg	The hydrologic and hydraulic analyses for the September 1979 study were performed by SCI for the Federal Insurance Administration, under Contract No. H-4005. This work was completed in April 1978 (Reference 3).

Additional areas of the Mississippi River were studied by detailed methods and have been incorporated in this countywide FIS. The hydrologic and hydraulic analyses for this study were performed by the USACE as part of the Upper Mississippi River System Flow Frequency Study (UMRSFFS) (Reference 4). This study was a collaboration of effort between the Rock Island, St. Louis, Kansas City, Omaha, and St. Paul districts and was completed in 2003. The 1-percent-annual-chance flood water-surface profile and floodway computations for the Mississippi River were performed for FEMA under Interagency Agreement No. EMW-2002-IA-0114 by the St. Paul, Rock Island, and St. Louis districts and were completed in 2004. The floodplain mapping for the Mississippi River was performed by Watershed Concepts for FEMA under Interagency Agreement No. HSFE07-07-C-0022.

Additional approximate hydrologic and hydraulic analyses for this countywide FIS were performed by Stantec Consulting Services, Inc. (Stantec), for FEMA under Contract No. EMK-2001-CO-2018, Task Order No. 30. This work, which was completed in July 2007, covered unprotected flooding sources affecting Clayton County.

In addition to incorporating the existing three FISs for communities within Clayton County, this countywide FIS includes new and restudied approximate studies, new detailed study areas, redelineation of all other effective profiles, and incorporation of approved Letter of Map Changes (LOMCs). The vertical datum was shifted to North American Vertical Datum of 1988 (NAVD88). The digital floodplain data was merged into a single, updated DFIRM. The DFIRM includes 2006 digital orthophotography (Reference 5), a digital terrain model (DTM) covering the Mississippi River floodplain with a vertical accuracy to support the creation of 4 foot contours (Reference 16); 20-foot contours developed from a United States Geological Survey (USGS) digital elevation model (DEM) covering the areas outside of the Mississippi River floodplain (Reference 6); topographic break lines and spot elevations, political boundaries, road centerlines with street names, railroads, airports, rivers, lakes, streams, bridges and other hydraulic structures, and elevation reference marks.

The coordinate system used for the production of the digital FIRMs is State Plane Iowa North Zone 1401 referenced to the North American Datum of 1983 and the Geodetic Reference System 1980 ellipsoid.

1.3 Coordination

The purpose of an initial Consultation Coordination Officer's (CCO's) meeting is to discuss the scope of the FIS. A final CCO meeting is held to review the results of the study. The dates of the initial and final CCO meeting held for the previous FISs for the incorporated communities within Clayton County's boundaries are shown in TABLE 1 (References 1-3).

TABLE 1 – Clayton County CCO Meetings

Community Name	Initial CCO Date	Final CCO Date
City of Clayton	December 11, 1986	May 4, 1988
City of Elkader	April 1976	August 18, 1976
City of Guttenberg	April 1976	March 16, 1979
Clayton County	January 4, 2009	October 20, 2009

Results of the technical aspects of this study were reviewed and accepted by representatives of Stantec, FEMA, and the community.

On January 4, 2007, an initial CCO meeting was held concerning this countywide FIS. This meeting was attended by representatives of Clayton County, FEMA, and Stantec. The results of the study were reviewed at the final CCO meeting held on October 20, 2009, and attended by Clayton County, FEMA, and Stantec. All problems raised at the final CCO meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This countywide FIS covers the geographic area of Clayton County, Iowa, as well as the portion of the City of Edgewood located in Delaware County and excluding the City of Postville.

The flooding sources studied previously by detailed methods are shown in TABLE 2.

TABLE 2 – Limits of Previous Detailed Studies

Flooding Source	Limits of Detailed Study
Mississippi River	Within the Cities of Clayton and Guttenberg
Turkey River	From a point approximately 1.03 miles downstream of State Highway 13 to a point approximately 1.14 miles upstream of Bridge Street

A new detailed study was performed on the flooding source shown in TABLE 3 as part of this study. The previous detailed studies along the Mississippi River within the Cities of Clayton and Guttenberg were replaced by this study.

TABLE 3 – Limits of New Detailed Studies

Flooding Source	Limits of Detailed Study
Mississippi River	From the Dubuque / Clayton County boundary to Clayton / Allamakee County boundary

Approximate analyses are usually used to study areas having a low development potential or minimal flood hazards. In 2007, additional approximate analyses were performed to protect areas where flood hazards were not previously identified. This analysis included Bear Creek and tributaries, Bente Branch, Bloody Run and tributaries, Bluebell Creek and tributaries, Bruce Creek, Buck Creek and tributaries, Carlan Creek and tributary, Coon Creek and tributary, Cow Branch, Cox Creek and tributaries, Deep Creek and tributary, Deer Creek and tributaries, Doe Creek and tributary, Dousman Creek and tributaries, Dry Mill Creek and tributaries, Elk Creek and tributaries, Fenchel Creek and tributaries, French Hollow Creek, Hewett Creek and tributaries, Hickory Creek and tributaries, Honey Creek and tributaries, Howard Creek and tributaries, Joles Creek and tributaries, Kleinlein Creek and tributary, Lindsey Creek and tributaries, Little Turkey River and tributaries, Maquoketa River and tributaries, McGregor Drainage Ditch, Mill Creek, Miners Creek and tributaries, Mink Creek and tributaries, Moody Run, North Cedar Creek, Nagle Creek, Panther Creek and tributary, Panther Hollow and tributary, Peck Creek, Pine Creek and tributaries, Plum Creek and tributary, Price Branch, Rabbit Creek, Roberts Creek and tributaries, Sand Creek, Silver Creek and tributaries, Sny Magill Creek and tributaries, South Cedar Creek and tributaries, Spring Branch, Steeles Branch, Suttle Creek, Turkey River and tributaries, Volga River and tributaries, Wayman Creek and tributary, West Branch Roberts Creek and tributary, West Branch South Cedar Creek and tributary, Willow Creek, Wolf Creek and tributary, and several unnamed tributaries.

This countywide FIS also incorporates the determination of letters issued by FEMA resulting in map amendments (Letters of Map Amendment (LOMAs)). There are no Letters of Map Revision (LOMRs) for Clayton County, Iowa. LOMAs that are revalidated, superseded, or redetermined for this study are summarized in the Summary of Map Amendment (SOMA) included in the Technical Support Data Notebook (TSDN) associated with this FIS update. Copies of the TSDN may be obtained from the Community Map Repository.

2.2 Community Description

Clayton County, Iowa encompasses approximately 793 square miles and is located in the northeastern portion of the state. It is bounded on the north by Allamakee County; on the west by Fayette County; on the south by Delaware and Dubuque Counties; and on the east by the Mississippi River. The major transportation arteries of Clayton County are U.S. 18, U.S. 52, and State Highways 3, 13, 56, 76, and 128. According to U.S. Census Bureau figures, the April 1, 2000 census population was 18,678. The estimated July 1, 2007 population was 17,685 (Reference 7). The county seat is the City of Elkader.

Clayton County's climate is characterized as continental, with very cold winters and rather hot summers. The Mississippi River has a moderating effect on the weather, resulting in warmer temperatures and longer growing seasons in areas adjacent to the river. On average, the warmest month is July, with an average maximum temperature of 84°F, as recorded at National Climatic Data Center (NCDC) station #132603 located in the City of Elkader. The lowest average daily minimum temperature occurs in January and averages 6°F. The average total annual precipitation is 34 inches, which includes 37 inches of snowfall. Most precipitation occurs from April through September (Reference 8).

The Mississippi River flows in a steep-sided "trench" that forms the eastern border of Clayton County. Steep bluffs rise abruptly from the sandy floodplain on either side of the Mississippi River and can reach heights of 300 to 400 feet above the river bed.

The Mississippi River has played a major role in the development of the Midwest. Channel modifications made in the interest of navigation date back to 1830, when the federal government became aware of the river's importance to the settlement of the valley. By 1878, a 4.5-foot channel was authorized by congress, followed by authorization of a 6-foot channel in 1907, and a 9-foot channel in 1930. Twenty-nine locks and dams, as well as channel dredging, create the nine-foot channel. Lock and Dam No. 10 is located at the City of Guttenberg.

The City of Clayton was developed on a relatively flat, narrow terrace on the west bank of the Mississippi River, with a prevailing elevation of approximately 630 feet (NAVD88). The soils consist of sand, clay, and silt deposited during periodic flooding.

The City of Elkader is located in the lower portion of the Turkey River. The narrow plain on the west bank of the Turkey River, approximately 10 feet above normal river level, is highly developed with commercial and residential structures. The east bank has no floodplain in the central part of town. Little development has occurred on the floodplain in the southeast portion of the City. New development is primarily taking place on the hills above potential floodwaters.

The Mississippi River floodplain in the City of Guttenberg is fully developed. This development is primarily commercial and residential. However, since the late 1960s, a substantial levee system has been in place to protect the city from flooding. The majority of new construction takes place on the bluffs above potential floodwaters.

2.3 Principal Flood Problems

Low-lying areas along the Mississippi River are subject to flooding. Floods along the Mississippi River are caused primarily by spring snowmelt or early winter rainfall on frozen ground, but they can also occur from intense, long-duration summer rain. TABLE 4 lists record floods recorded at the City of Guttenberg between 1880 and 1970 in order of magnitude.

The 1965 flood is the largest flood of record and was caused by the combination of snowmelt and heavy rain. Having a flood elevation 3.5 feet higher than any other recorded flood in the Guttenberg area, the 1965 flood had an annual chance of 0.45-percent (a return interval of 220 years). Although flood protection measures were successfully implemented, flood damages to residents within the City of Guttenberg were still extensive. Damages were estimated around $818,700; however, it was estimated that $2,640,700 in additional damages were prevented by the flood protection measures (Reference 9). Upon the forecast of the flood, thousands of tons of sand were stockpiled for emergency use and volunteers worked nonstop for several weeks to raise the dike road, which consists of Koszciusko Street, River Park Drive, and Dekalb Street, three feet. This dike road had provided adequate protection during the 1952 flood (Reference 10).

TABLE 4 – Mississippi River Floods at Guttenberg

Date	Maximum Discharge cubic feet per second (cfs)	Maximum Elevation feet NAVD88
April 24, 1965	308,000	623.64
April 1969	241,250	619.90[1]
June 23, 1880	226,000	619.50
April 24,1952	226,000	619.60
April 21, 1951	217,500	619.55
May 1888	202,500[2]	618.20[3]
April 7, 1920	195,000[2]	617.75[3]
April 21, 1922	195,000[2]	617.75[3]
September 19, 1938	191,000[2]	617.50
May 11, 1954	185,000	617.20
1881	181,000[2]	616.90[3]
May 3, 1916	173,500[2]	616.45[3]

[1]This flood was retained by a permanent levee constructed in the late 1960's.
[2]Discharge estimated using Lock and Dam No. 10 headwater rating curve and the maximum observed elevation.
[3]Elevation estimated using the Dubuque to Lock and Dam No. 10 pool relationship curve from the observed maximum elevation observed at Dubuque, Iowa. The flood occurred before the dam was built, so the actual elevation was probably a few tenths lower than the elevation shown.

Water between the Chicago, Milwaukee, St. Paul and Pacific Railroad tracks and U.S. 52 was caused by seepage and interior drainage. Between the tracks and River Park Drive and between Koszciusko and Koerner Streets, the City of Guttenberg was an island. Although the Mississippi River crested at 623.64 feet (NAVD88), seepage water reached approximately only 619 feet (NAVD88). From topographic maps and aerial photography, buildings on over 75 properties were affected by seepage water. It is estimated that 338 residences would have been affected if no emergency protection measures had been implemented or were unsuccessful (Reference 9).

Within the City of Elkader, the largest flood on record occurred June 1991, when rainfall in excess of 10 inches fell in the Turkey River Watershed with already-moist ground conditions. On June 15, the Turkey River peaked at 623.5 feet (NAVD88) (stage of 28.67 feet) on the downstream side of State Route 13 bridge. The discharge was documented to be 38,300 cfs at the USGS gage No. 05412020, which is greater than the 1-percent-annual-chance discharge. Several bridges in Clayton County were damaged during this event and three were destroyed. Approximately $2 million dollars in damage to roads and bridges was attributed to flooding of the Turkey River and its tributaries. Thirty-five homes and 38 businesses were flooded.

2.4 Flood Protection Measures

Within the City of Clayton, a small levee system was constructed during the spring of 1965. This system may provide protection to some degree against the more frequent flood events, but cannot be depended upon to provide protection against larger flood events, such as the 1-percent-annual-chance flood event. The levee system is not certified, does not provide adequate freeboard, nor does it have adequate provision for closure structures or interior drainage.

Near the edge of downtown Elkader, a small dam was constructed on the Turkey River in 1914 for producing hydroelectric power. The dam does not retain a large pool of water, nor does it store a significant quantity of water during high-flow periods. The dam does not provide flood-protection capabilities. The City of Elkader has constructed a levee on the west bank of the Turkey River in the southern portion of the city. Much of the levee was constructed in the late 1960s and 1970s. After the 1991 flood, the levee embankment was raised in certain areas. Silt and sediment deposited on the adjacent streets from the flood was added to the levee. However, it still does not provide flood protection from events with large flows similar to that in 1991. The City of Elkader has no other flood protection measures.

Within the City of Guttenberg, major flood protection measures are in place. An extensive levee system and an interior drainage system were developed by the USACE in the late 1960s. The levee system consists of a north and south levee. The north levee extends eastward from the Chicago, Milwaukee, St. Paul and Pacific Railroad tracks along Steuben Street and then southward along Second Street to high ground at Lock and Dam No. 10. The south levee extends southward from high ground near Herman Street along River Park Drive and then southwestward to the Chicago, Milwaukee, St. Paul and Pacific Railroad tracks, about 500 feet south of Dekalb Street. The interior drainage system consists of two pumping stations and a series of ponds. The ponds are located west of the Chicago, Milwaukee, St. Paul and Pacific Railroad tracks to Bluff Street on the south side of the community, and west of the railroad tracks to U.S. Highway 52 on the north side of the community. One pumping station is near the north end of the north levee, and the other is on the south levee near Dekalb Street. The levees, pumping stations, and ponds are designed to provide protection against the 0.2-percent-annual-chance flood defined in this report (Reference 9). The City of Guttenberg accepted the operation and maintenance responsibilities of the levee in 1974. No extensive flood damage has occurred with the city since the construction of the levee system.

3.0 ENGINEERING METHODS

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

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community. This countywide FIS report includes information from previously-published FIS reports as well as new information.

Major Upper Mississippi River Basin flooding during the 1990s resulted in significant losses and raised questions regarding the frequency of the associated flood events. Reevaluation of the Upper Mississippi River System became necessary to address the questions resulting from the Great Flood of 1993, and was facilitated based on the availability of new topographic data, new computational techniques, and about 20 more years of recorded hydrologic data since the previous study of the Mississippi River had been performed in 1979.

The UMRSFFS was undertaken starting in 1998 with the purpose to update the discharge-frequency relationships and associated water-surface profiles for the Mississippi River from St. Paul, Minnesota downstream to the confluence of the Ohio River; for the Illinois River from Lockport, Illinois downstream to its mouth at the Mississippi River; and for the Missouri River from Gavins Point Dam, located near Yankton, South Dakota, to its mouth at the Mississippi River. Five USACE districts participated in the study: Rock Island, St. Louis, St. Paul, Kansas City, and Omaha. The study was completed in 2003.

The hydrologic analysis for the UMRSFFS utilized a combination of the following methods and approaches to determine discharge-frequency relationships: 100 years of record from 1898 to 1998; the log-Pearson Type III distribution for unregulated flows at gages; main stem flows between gages determined by interpolation of the mean and standard deviation for the annual flow distribution based on drainage area in conjunction with a regional skew; flood control reservoir impacts defined by developing regulated versus non-regulated relationships for discharges; extreme events determined by factoring up major historic events; HEC-HMS and/or HEC-1 models for the main tributaries; and the UNET unsteady flow program to address hydraulic impacts. In situations where historic records were not adequate or appropriate to develop discharge-frequency relationships or to verify the results, hydrologic modeling was used to create synthetic flows based on rainfall. Gage records for all streams were carefully evaluated.

The result of the hydrologic aspects of the study was a discharge and related frequency of occurrence for stations or given cross sections located along each of the principle main stem rivers. For more detailed information on each of the hydrologic methodologies used to determine discharges, the reader is encouraged to consult the report cited as Reference 4 in Section 9.0 of this FIS.

Initially, for the Turkey River within the City of Elkader, discharge-frequency relationships were developed using a log-Pearson Type III analysis of the discontinued USGS gage No. 05412000 at Elkader. This gage was discontinued in 1942, with only ten years of consecutive record. Because of the limited continuous streamflow record at Elkader and the recurring flooding there, flooding characteristics on the Turkey River were reviewed using active USGS gaging stations located at Spillville (No. 05411600) and Garber (No. 05412500). The results obtained from the log-Pearson Type III analysis at these two gage stations were used to compare values obtained from the Iowa Regional

Regression Equations to determine the most appropriate discharge-frequency curve for the Turkey River at Elkader (Reference 2).

The Iowa Regional Regression Equations, published in USGS Water-Resources Investigation Report (WRIR) 87-4132 (Reference 11), were used to develop discharge-frequency curves for Spillville, Elkader, and Garber. The USGS report divides the State of Iowa into five hydrologic regions using physiographic regions of Iowa as a guide. The majority of the Turkey River Watershed lies in Region 2, with a small portion of the upper portion of the watershed lying in Region 3. The regression equations from Region 3 correlated very well with the log-Pearson Type III analysis of the streamflow data at the two previously-mentioned gaging stations. The differences between the two methods were less than 10 percent for all frequencies at both locations. The Region 3 regression equations were then used to create a discharge-frequency curve at Elkader. This curve was plotted along with standard percent errors associated with each frequency as published in Reference 11. The existing regulatory discharge-frequency curve fit well within the limits of the regional regression equation analysis and therefore the regulatory discharges from the 1978 FIS for the City of Elkader (Reference 12) are currently being used (Reference 2).

Peak discharges for the 10-, 2-, 1-, and 0.2-percent–annual-chance floods of each flooding source studied in detail in the community are shown in TABLE 5.

TABLE 5 – Peak Discharge Values

		Peak Discharges (cfs)			
Flooding Source & Location	Drainage Area (square miles)	10%-Annual-Chance	2%-Annual-Chance	1%-Annual-Chance	0.2%-Annual-Chance
Mississippi River					
At McGregor, IA (USGS gage No. 05389500	67,500	168,000	227,000	251,000	309,000
Turkey River					
At State Highway 13	902	23,600	32,500	36,000	43,700

Approximate studies were performed on those streams outlined in Section 1.2. Hydrologic calculations were performed using the regression equations presented in WRIR 00-4233, Techniques for Estimating Flood Frequency Discharges for Streams in Iowa (Reference 13). In this report, regional regression analysis was performed using generalized least-squares regressions and data from 241 gaging stations in Iowa and neighboring states to develop equations for three hydrologic regions. One-variable equations were developed for each of these regions to allow users to estimate peak discharge using drainage area as the independent variable. Using the watershed boundaries delineated for the study streams, it was determined that the contributing drainage areas for the study streams in Clayton County are located entirely within Region 2. Therefore, the one-variable regression equation for Region 2 was used to estimate peak discharges for the 1-percent-annual-chance discharge event along the approximate study reaches.

Discharge estimates at ungaged sites located on gaged streams can be determined by weighting the regression-estimated discharges with the discharges from a nearby gaged site. Six USGS gaging stations with 10 or more years of annual peak discharge data were located on the study streams. Bulletin 17B estimates were determined using the log-Pearson Type III distribution to fit the annual peak discharges Bulletin No. 17B, Guidelines for Determining Flood Flow Frequency (Reference 14). These analyses were performed using PeakFQ software (Reference 15) for the gages at Bloody Run Creek near Marquette (USGS Gage No. 05389400); Sny Magil Creek near Clayton (USGS Gage No. 05411400); Turkey River at Elkader (USGS Gage No. 05412000); and Turkey River at Garber (USGS Gage No. 05412500). WRIR 00-4233 provided the Bulletin 17B estimates for the gages at Silver Creek near Luana (USGS Gage No. 05412060) and Roberts Creek above Saint Olaf (USGS Gage No. 05412100). The Bulletin 17B estimates were compared to the Standard Error of Prediction (SEP) for the regression equations. Five of the six gaging stations were utilized to calculate weighted discharge estimates and adjustment factors for ungaged sites on gaged streams. The gaging station at Sny Magil Creek near Clayton (USGS Gage No. 05411400) was not used because the difference between the regression equation estimate and the Bulletin 17B estimate for discharge was large. This is likely a result of the historical record of annual peak discharge data being short.

For ungaged locations on gaged streams where the drainage area ratio (defined below) between the ungaged location and the gaged site was less than 0.5, the gage-weighted discharge was utilized to adjust the 1-percent-annual-chance regression discharge estimates. Otherwise, the regression-estimated discharges were used. Likewise for ungaged sites on ungaged streams, the regression-estimated discharges were used.

$$DAR = \frac{\left| DA_g - DA_u \right|}{DA_g}$$

Where DAR = drainage area ratio; DA_g = drainage area of the gaged site; and DA_u = drainage area of the ungaged site.

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 Tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

Cross section data used in the riverine hydraulic models are described in TABLE 6. The methods used to obtain cross section data for each hydraulic study is listed.

TABLE 6 – Cross Section Data

Flooding Source and Location	Year	Description
Mississippi River		
Clayton County	1995-1998	Hydrographic surveys were assembled from navigation channel maintenance surveys, dam periodic inspection surveys, and environment management project surveys. These surveys date from 1997 or later. For areas where no digital hydrographic surveys were available, such as in some side channels and chutes, depths were estimated from the most current printed surveys available. Bluff-to-bluff digital terrain data collected in 1995 and 1998 supplemented the channel survey data (Reference 16).
Turkey River		
City of Elkader	1996	Obtained by field survey. Bridges and other structures on the stream were also surveyed 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 for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the FIRM.

Channel roughness factors (Manning's "n") used in the hydraulic computations for all detail-studied streams were chosen by engineering judgment and are based on field observations. TABLE 7 shows the channel and overbank "n" values for the flooding sources studied by detailed methods.

TABLE 7 – Manning's "n" Values

Flooding Source and Location	Channel "n" Values	Overbank "n" Values
Mississippi River		
Clayton County	0.020 - 0.028	0.030 - 0.120
Turkey River		
City of Elkader	0.025 - 0.035	0.060 - 0.120

The methods for determining starting water-surface elevations used in each hydraulic model are described in TABLE 8.

TABLE 8 – Starting Water-Surface Elevations

Flooding Source and Location	Method for Determining Starting WSE
Mississippi River	
Clayton County	not published
Turkey River	
City of Elkader	Slope-area method.

The main hydraulic tool used to determine flood elevations along the Mississippi River was the UNET unsteady flow computer modeling program (Reference 17). Included in the UNET model were the main stem of the Mississippi River, several of its main tributaries, navigation dams, and the levees and levee systems. Model development consisted of constructing HEC-RAS models from the original cross-sections, adding in ineffective flow areas or obstructions as necessary, and then converting the models to UNET.

The UNET model was calibrated to reproduce recorded flood hydrographs for a selected period of record. The UNET model was calibrated to both stage and discharge at gaging locations primarily by adjusting roughness coefficients and estimated lateral inflows. Annual peak flows and peak stages from the period of record run of the calibrated UNET model were used to develop rating curves for each cross section location. Using these station rating curves and the station frequency flows developed during the hydrology phase, frequency elevation points were obtained for each cross section location. Connecting the corresponding points resulted in flood frequency profiles. These profiles were coordinated among the computational teams and appropriate adjustments were made to assure consistency.

Some special considerations and techniques were required to address especially complex flow reaches. The confluences of the Missouri and Illinois Rivers with the Mississippi relied primarily on development of graphical stage-probability relationships for backwater-impacted cross sections. These were created using a graphical Weibull approach. The graphical period-of-record stage-probability curves were combined to blend a consistent and reasonable profile for each probability flood. Confluences of many other smaller streams with the main stem also exhibited backwater effects resulting in discontinuities in the profiles. A computer routine was developed to smooth the profile in these reaches so as to form a consistent, reasonable transition through the zone of backwater.

The 1-percent-annual-chance water surface elevation profile was calculated using the HEC-RAS 3.1.3 computer program (Reference 18). The 10-, 2-, and 0.2-percent-annual-chance elevations shown on the flood profiles were plotted using the original UNET elevations.

The cross section stationing used in the Mississippi River model was based on existing USACE River Mile markers of 1960 (Reference 19). The reach length between cross sections is based on a model centerline developed for the HEC-RAS converted model of the UMRSFFS. The distances between cross sections shown in the floodway data table and flood profile were created using the cross section stations based on the 1960 River Miles. While the calculated distance between cross sections using the 1960 River Miles are similar to the measured distance along the model centerline, some differences may occur. This difference in distance does not affect the calculated water surface elevation at each cross section shown on the floodway data table and flood profile, nor does it affect the placement of the BFEs on the map.

For more detailed information on each of the hydraulic methodologies used to calculate flood elevation profiles, the reader is encouraged to consult the report cited as Reference 4 in Section 9.0 of this FIS.

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

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

Flood profiles were drawn showing the computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals.

Streams studied by approximate methods are listed in Section 1.2. Channel cross sections for these streams were based on elevation data obtained from USGS (Reference 6). In locations where no channel was defined by this elevation data, one was approximated using aerial photography (Reference 5) and approximate 50-percent-annual-chance (2-year) flows for sizing. Manning's "n" values were based on visual observation of aerial photography and standard, accepted values published in Open-Channel Hydraulics by Chow (Reference 20). Separate overbank and channel roughness values were selected for each stream reach. Starting water-surface elevations were determined using one of two methods: the normal depth routine in the HEC-RAS computer program or a known water-surface elevation. The USACE HEC-RAS computer program, Version 3.1.3 (Reference 18), was used to generate water-surface elevations using the step-backwater method.

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

3.3 Vertical Datum

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

The studied reach of the Mississippi River spans multiple counties in multiple states, and the river forms the actual border between adjacent counties. The UMRSFFS was originally performed using NGVD29. Applying an average countywide datum shift to convert to NAVD88 would have resulted in a mismatch of elevations between counties. Therefore, in order to perform the most accurate vertical datum conversion possible and, to maintain consistency in approach across county lines, the datum conversion for the

Mississippi River was performed on a cross-section by cross-section basis rather than by applying an average countywide or stream-wide value.

Effective information for the Turkey River within the City of Elkader was previously published with elevation data referenced to NAVD88 and therefore no datum conversion was necessary.

For streams studied by approximate methods, elevation information obtained from USGS (Reference 6) was referenced to NGVD29. Therefore an average conversion was used to shift the flood elevation data obtained for the approximate studies. Approximate information for this FIS report was converted from NGVD29 to NAVD88 based on data presented in TABLE 9. The average conversion of NGVD29 - 0.129 = NAVD88 was applied.

Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities in other counties not presented in this countywide FIS may be referenced to NGVD29. This may result in differences in BFEs across the corporate limits between communities.

TABLE 9 – Datum Conversion Calculation

Quadrangle	Corner	Latitude	Longitude	Conversion (ft) from NGVD29 to NAVD88
Arlington	SE	42.625	-91.625	-0.102
Cassville	SE	42.625	-90.875	-0.141
Castalia	SE	43.000	-91.625	-0.125
Clayton	SE	42.875	-91.125	-0.154
Colesburg	SE	42.625	-91.125	-0.121
Edgewood	SE	42.625	-91.375	-0.098
Elgin	SE	42.875	-91.625	-0.112
Elkader	SE	42.750	-91.375	-0.161
Farmersburg	SE	42.875	-91.250	-0.115
Garber	SE	42.625	-91.250	-0.108
Garnavillo	SE	42.750	-91.125	-0.154
Giard	SE	43.000	-91.250	-0.135
Giard	SW	43.000	-91.375	-0.131
Gunder	SE	42.875	-91.500	-0.125
Guttenberg	SE	42.750	-91.000	-0.131
Littleport	SE	42.750	-91.250	-0.167
Postville	SE	43.000	-91.500	-0.128
Prairie Du Chien	SE	43.000	-91.125	-0.157
Saint Olaf	SE	42.875	-91.375	-0.141
Strawberry Point	SE	42.625	-91.500	-0.112
Turkey River	SE	42.625	-91.000	-0.121
Volga	SE	42.750	-91.500	-0.125
Wadena	SE	42.750	-91.625	-0.092
			Average Conversion	-0.129
			Range	-0.167 through -0.092
			Max Offset	0.038

For more information on NAVD88, see the FEMA publication entitled Converting the National Flood Insurance Program to the North American Vertical Datum of 1988 (Reference 21), visit the National Geodetic Survey website at http://www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

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

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

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

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

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using digital base map information. This data includes 2006 digital orthophotography and contours at twenty-foot intervals (References 5 and 6). Between cross sections along the Mississippi River, the boundaries were interpolated using a DTM created from photogrammetric-derived mass points and break lines, with a post spacing of 15 feet and vertically accurate enough to support the creation of 4 foot contours (Reference 16).

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

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

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the l-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the l-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

Upon completion of the UMRSFFS, FEMA funded the USACE to compute a floodway for the studied reach of the Mississippi River. This floodway determination consisted of converting the hydraulic data from UNET to HEC-RAS, calibrating the HEC-RAS steady-state models to the UMRSFFS results, and performing the floodway computations.

The floodway presented in this countywide 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. In cases where the floodway and l-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

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

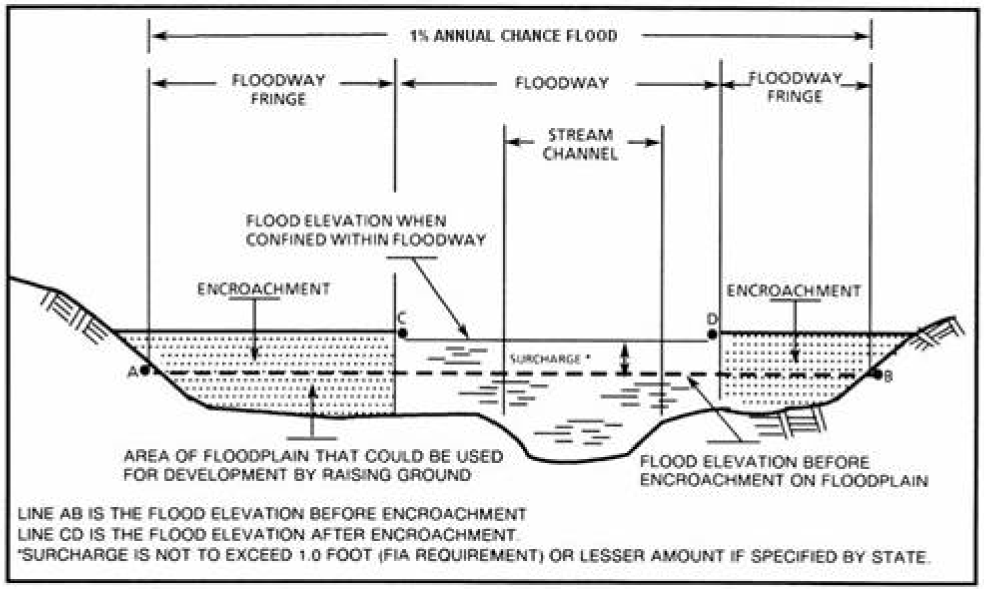


FIGURE 1 – Floodway Schematic

In the redelineation efforts, the floodways were not recalculated. As a result, there were areas where the previous floodway did not fit within the boundaries of the redelineated 1-percent-annual-chance floodplain. In these areas, the floodway was reduced. Water-surface elevations with and without a floodway, the mean velocity in the floodway, and the location and area at each surveyed cross section as determined by hydraulic methods can be seen in TABLE 10, Floodway Data. The width of the floodway depicted by the FIRM panels and the amount of reduction to fit the floodway inside the 1-percent-annual-chance floodplain, if necessary, is also listed.

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1,2]	WIDTH[3] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
MISSISSIPPI RIVER									
A	600.800	1,478 / 6,288	93,246	3.0		615.7	615.7	616.5	0.8
B	601.500	2,813 / 6,366	92,661	3.0		615.9	615.9	616.8	0.9
C	602.000	3,721 / 6,658	100,700	2.8		616.2	616.2	617.0	0.8
D	602.300	3,623 / 6,966	95,432	2.9		616.4	616.4	617.2	0.8
E	602.700	1,781 / 5,879	87,903	3.2		616.6	616.6	617.3	0.7
F	603.100	690 / 4,262	74,435	3.7		616.7	616.7	617.5	0.8
G	603.500	839 / 4,514	77,321	3.6		616.9	616.9	617.6	0.7
H	604.000	1,020 / 4,500	84,069	3.3		617.0	617.0	617.8	0.8
I	604.400	2,191 / 5,800	87,369	3.2		617.3	617.3	618.1	0.8
J	604.900	2,856 / 6,240	90,661	3.1		617.5	617.5	618.3	0.8
K	605.500	3,592 / 6,580	94,110	2.9		617.8	617.8	618.5	0.7
L	606.100	5,410 / 5,900	94,286	2.9		618.0	618.0	618.7	0.7
M	607.000	6,437 / 6,977	102,975	2.7		618.3	618.3	619.0	0.7
N	607.500	6,450 / 7,000	95,227	2.9		618.6	618.6	619.2	0.6
O	608.000	5,356 / 7,558	109,005	2.5		619.0	619.0	619.6	0.6
P	608.600	4,887 / 6,998	102,970	2.7		619.3	619.3	619.9	0.6
Q	609.000	4,995 / 6,800	116,768	2.4		619.6	619.6	620.2	0.6
R	609.500	6,973 / 7,229	128,641	2.2		619.8	619.8	620.4	0.6
S	610.000	6,773 / 7,760	145,208	1.9		620.0	620.0	620.6	0.6
T	610.600	4,687 / 7,928	133,179	2.1		620.1	620.1	620.7	0.6
U	611.200	6,276 / 7,936	140,412	2.0		620.3	620.3	620.9	0.6
V	612.000	5,493 / 8,517	122,892	2.3		620.4	620.4	621.0	0.6
W	612.500	7,098 / 9,602	150,442	1.9		620.7	620.7	621.2	0.5
X	613.000	9,007 / 9,795	148,753	1.9		620.8	620.8	621.4	0.6
Y	613.600	7,787 / 8,787	140,692	2.0		621.0	621.0	621.5	0.5

[1]Miles above confluence with the Ohio River

[2]Distance based on the 1960 River Mile stationing, which may not match the measured distance along the profile baseline shown on the maps.

[3]Width within Clayton County / Total width

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLAYTON COUNTY, IA
AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1,2]	WIDTH[3] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
MISSISSIPPI RIVER									
Z	614.000	7,100 / 7,822	147,557	1.9		621.1	621.1	621.6	0.5
AA	614.500	6,387 / 7,157	124,118	2.7		621.1	621.1	621.7	0.6
AB	614.700	6,264 / 6,885	115,738	3.6		621.1	621.1	621.7	0.6
AC	614.900	6,091 / 6,651	114,387	4.0		621.2	621.2	621.8	0.6
AD	615.270	6,236 / 6,539	149,831	3.2		622.3	622.3	623.3	1.0
AE	615.522	6,752 / 7,166	153,353	2.0		622.5	622.5	623.5	1.0
AF	615.769	6,781 / 7,184	145,371	2.0		622.5	622.5	623.5	1.0
AG	616.043	6,711 / 7,153	142,160	2.0		622.5	622.5	623.5	1.0
AH	616.373	7,537 / 7,995	156,178	1.9		622.6	622.6	623.6	1.0
AI	616.648	7,991 / 8,345	145,812	2.0		622.6	622.6	623.6	1.0
AJ	616.921	7,973 / 8,348	124,176	2.3		622.7	622.7	623.6	0.9
AK	617.281	7,711 / 8,305	126,627	2.3		622.8	622.8	623.8	1.0
AL	617.409	7,406 / 8,145	123,694	2.3		622.8	622.8	623.8	1.0
AM	617.760	7,868 / 8,463	138,598	2.1		623.0	623.0	623.9	0.9
AN	618.208	8,156 / 8,358	132,078	2.2		623.1	623.1	624.0	0.9
AO	618.687	8,007 / 8,554	132,132	2.2		623.2	623.2	624.1	0.9
AP	618.925	7,461 / 8,233	145,964	2.0		623.3	623.3	624.2	0.9
AQ	619.492	7,148 / 8,802	154,777	1.9		623.4	623.4	624.3	0.9
AR	620.000	6,843 / 8,322	143,818	2.0		623.6	623.6	624.5	0.9
AS	620.515	5,599 / 7,464	137,173	2.1		623.8	623.8	624.7	0.9
AT	621.032	5,985 / 6,734	125,599	2.3		623.9	623.9	624.8	0.9
AU	621.529	4,703 / 6,144	116,384	2.5		624.1	624.1	625.0	0.9
AV	622.000	2,831 / 5,092	100,553	2.9		624.5	624.5	625.3	0.8
AW	622.586	2,209 / 4,482	93,519	3.1		624.8	624.8	625.7	0.9
AX	623.145	1,838 / 5,433	106,019	2.8		625.2	625.2	626.0	0.8

[1]Miles above confluence with the Ohio River

[2]Distance based on the 1960 River Mile stationing, which may not match the measured distance along the profile baseline shown on the maps.

[3]Width within Clayton County / Total width

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLAYTON COUNTY, IA
AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1,2]	WIDTH[3] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
MISSISSIPPI RIVER									
AY	623.610	925 / 5,959	116,797	2.5		625.3	625.3	626.2	0.9
AZ	624.109	577 / 6,204	113,116	2.6		625.4	625.4	626.2	0.8
BA	624.800	935 / 6,742	119,618	2.5		625.6	625.6	626.5	0.9
BB	625.056	1,736 / 7,893	152,333	1.9		625.9	625.9	626.8	0.9
BC	625.523	3,452 / 7,888	137,677	2.1		626.0	626.0	626.8	0.8
BD	626.030	5,215 / 7,090	129,390	2.3		626.3	626.3	627.1	0.8
BE	626.743	6,208 / 7,816	129,673	2.3		626.5	626.5	627.3	0.8
BF	627.275	5,927 / 7,186	134,574	2.2		626.8	626.8	627.6	0.8
BG	627.762	5,919 / 7,068	140,304	2.1		627.0	627.0	627.8	0.8
BH	628.269	5,842 / 7,226	134,037	2.2		627.1	627.1	627.9	0.8
BI	628.912	4,814 / 6,798	126,786	2.3		627.3	627.3	628.1	0.8
BJ	629.421	3,726 / 6,564	121,820	2.4		627.5	627.5	628.3	0.8
BK	629.860	1,886 / 6,530	127,145	2.3		627.7	627.7	628.5	0.8
BL	630.319	572 / 5,847	118,470	2.5		627.8	627.8	628.6	0.8
BM	630.609	397 / 5,770	115,495	2.6		627.9	627.9	628.7	0.8
BN	630.825	454 / 6,136	118,123	2.5		628.0	628.0	628.8	0.8
BO	631.000	455 / 5,953	120,072	2.1		628.1	628.1	628.9	0.8
BP	631.258	446 / 6,537	134,796	1.9		628.2	628.2	628.9	0.7
BQ	631.440	444 / 6,532	130,810	1.9		628.2	628.2	629.0	0.8
BR	631.990	518 / 7,430	148,602	1.7		628.3	628.3	629.1	0.8
BS	632.442	554 / 6,517	141,159	1.8		628.4	628.4	629.2	0.8
BT	632.917	525 / 7,091	142,343	1.8		628.5	628.5	629.2	0.7
BU	633.181	584 / 7,152	141,780	1.8		628.5	628.5	629.3	0.8
BV	633.379	583 / 7,455	156,850	1.6		628.6	628.6	629.4	0.8
BW	633.600	484 / 7,732	163,087	1.5		628.6	628.6	629.4	0.8

[1]Miles above confluence with the Ohio River

[2]Distance based on the 1960 River Mile stationing, which may not match the measured distance along the profile baseline shown on the maps.

[3]Width within Clayton County / Total width

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLAYTON COUNTY, IA
AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI RIVER

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1,2]	WIDTH[3] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
MISSISSIPPI RIVER									
BX	633.916	525 / 6,660	145,906	1.7		628.7	628.7	629.5	0.8
BY	634.210	487 / 6,540	146,037	1.7		628.7	628.7	629.5	0.8
BZ	634.468	549 / 6,431	137,627	2.1		628.7	628.7	629.5	0.8
CA	634.690	437 / 5,550	122,594	2.7		628.8	628.8	629.5	0.7
CB	634.723	434 / 5,519	1,197,112	2.9		628.7	628.7	629.5	0.8
CC	635.027	396 / 4,933	103,560	2.4		628.8	628.8	629.6	0.8
CD	635.352	450 / 4,704	108,608	2.3		628.9	628.9	629.7	0.8
CE	635.626	485 / 7,504	132,679	1.9		629.0	629.0	629.8	0.8
CF	635.913	419 / 7,269	127,462	2.0		629.0	629.0	629.8	0.8
CG	636.266	614 / 6,983	177,169	1.4		629.1	629.1	629.9	0.8
CH	636.768	785 / 5,861	123,385	2.0		629.1	629.1	629.9	0.8
CI	637.231	762 / 6,255	135,110	1.9		629.2	629.2	630.0	0.8

[1]Miles above confluence with the Ohio River
[2]Distance based on the 1960 River Mile stationing, which may not match the measured distance along the profile baseline shown on the maps.
[3]Width within Clayton County / Total width

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLAYTON COUNTY, IA
AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI 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)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
TURKEY RIVER									
A	36.42	1,100	12,888	2.8		722.4	722.4	723.2	0.8
B	36.71	860	8,966	4.0		722.5	722.5	723.3	0.8
C	36.91	222	3,902	9.2		722.5	722.5	723.5	1.0
D	37.00	266	4,138	8.7		723.1	723.1	724.1	1.0
E	37.20	264	3,611	10.0		734.9	734.9	734.9	0.0
F	37.27	419	4,517	8.0		735.2	735.2	735.2	0.0
G	37.61	300	4,588	7.8		737.2	737.2	737.2	0.0
H	37.79	830	9,314	3.9		738.3	738.3	738.3	0.0
I	38.02	562	4,938	7.3		738.3	738.3	738.3	0.0

[1]Miles above confluence with the Mississippi River

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLAYTON COUNTY, IA
AND INCORPORATED AREAS

FLOODWAY DATA

TURKEY RIVER

5.0 INSURANCE APPLICATIONS

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

Zone A

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

Zone AH is the flood insurance risk zone that corresponds to the 1-percent-annual-chance shallow flooding where depths are between one (1) and three (3) feet. In most instances, whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

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

6.0 FLOOD INSURANCE RATE MAP

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

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

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

The current FIRM presents flooding information for the entire geographic area of Clayton County. Previously, separate FIRMs were prepared for each identified floodprone incorporated community and the unincorporated areas of the county. Historical data relating to the maps prepared for each community are presented in TABLE 11.

7.0 OTHER STUDIES

This countywide FIS incorporates all previously published FISs and FIRMs for the incorporated areas within Clayton County.

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

The countywide FIRMs for Allamakee County will become effective on September 25, 2009. A countywide FIS and FIRMs are in progress for Fayette County.

8.0 LOCATION OF DATA

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

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Clayton, City of	August 23, 1974	April 23, 1976	March 16, 1989	none
Clayton County (Unincorporated Areas)	January 31, 1978	none	May 1, 1990	July 16, 1996
* Edgewood, City of	N/A	none	N/A	none
Elkader, City of	February 8, 1974	none	September 29, 1978	July 16, 1996
Elkport, City of	August 22, 1975	none	August 1, 1986	none
Farmersburg, City of	November 1, 1974	none	August 19, 1986	none
Garber, City of	August 30, 1974	April 30, 1976	August 1, 1986	none
Garnavillo, City of	June 2, 2011	none	June 2, 2011	none
Guttenberg, City of	February 8, 1974	January 2, 1976	March 4, 1980	September 15, 1981 September 5, 1984
** Littleport, City of	August 23, 1974	February 6, 1976	August 4, 1987	none
Luana, City of	June 2, 2011	none	June 2, 2011	none
Marquette, City of	January 19, 1972	none	January 19, 1972	July 25, 1975 October 3, 1975
McGregor, City of	January 19, 1972	none	January 19, 1972	July 1, 1974 October 17, 1975
Millville, City of	July 2, 1987	none	July 2, 1987	none
Monona, City of	June 2, 2011	none	June 2, 2011	none
North Buena Vista, City of	October 18, 1974	March 19, 1976	June 2, 2011	none
Osterdock, City of	July 18, 1978	none	August 1, 1986	none
Saint Olaf, City of	August 30, 1974	none	August 1, 1986	none
Strawberry Point, City of	June 2, 2011	none	June 2, 2011	none
Volga, City of	August 30, 1974	January 9, 1976	August 1, 1986	none

* No Special Flood Hazard Areas identified

** Disincorporated

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLAYTON COUNTY, IA
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

9.0 BIBLIOGRAPHY AND REFERENCES

1. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, City of Clayton, Clayton County, Iowa, Washington, D.C., March 16, 1989 (Flood Insurance Study); December 16, 1989 (Flood Insurance Rate Map).

2. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, City of Elkader, Clayton County, Iowa, Washington, D.C., Revised July 16, 1996 (Flood Insurance Study and Flood Insurance Rate Map).

3. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, City of Guttenberg, Clayton County, Iowa, Washington, D.C., September 1979 (Flood Insurance Study); Revised September 15, 1984 (Flood Insurance Rate Map).

4. U.S. Department of the Army, Corps of Engineers, Rock Island District, Upper Mississippi River System Flow Frequency Study Main Report, January 2004, http://www.mvr.usace.army.mil/pdw/pdf/FlowFrequency/Documents/FinalReport/default.asp

5. National Air Imagery Program, Digital Orthophotography for Clayton County, Iowa, Iowa City, Iowa, November 21, 2006.

6. U.S. Geological Survey, Clayton County, Iowa Digital Elevation Model, Contour Interval 20 Feet: February 1, 1999.

7. U.S. Department of Commerce, Bureau of the Census, April 1, 2000 Census Population; July 1, 2007 Population Estimate, Retrieved August 8, 2008, from www.census.gov/.

8. Midwestern Regional Climate Center, Retrieved August 8, 2008, from http://mcc.sws.uiuc.edu/climate_midwest/maps/ia_mapselector.htm.

9. U.S. Army Corps of Engineers, St. Paul District, Flood Control, Mississippi River at Guttenberg, Iowa, General Design Memorandum, St. Paul, Minnesota, October 1967.

10. The Gutenberg Press, The Mississippi Flood, 1965, Guttenberg, Iowa, (not dated).

11. U.S. Department of the Interior, Geological Survey, Water-Resources Investiagtion Report 87-4132, Method for Estimating the Magnitude and Frequency of Floods at Ungaged Sites on Unregulated Rural Streams in Iowa, 1987.

12. Federal Emergency Management Agency, Flood Insurance Study, City of Elkader, Iowa, March 1978.

13. U.S. Department of the Interior, Geological Survey, Water-Resources Investigation Report 00-4233, Techniques for Estimating Flood Frequency Discharges for Streams in Iowa, 2001.

14. U.S. Department of the Interior, Geological Survey, Interagency Advisory Committee on Water Data, Office of Water Data Coordination, Hydrology Subcommittee, Bulletin No. 17B, Guidelines for Determining Flood Flow Frequency, September 1981, revised March 1982.

15. U.S. Geological Survey, PeakFQWin Computer Program, Version 5.0, July 30, 2005.

16. Earthdata International of Maryland, LLC., "Mississippi River DEM/DTM Project," Gaithersburg, Maryland, Data collection in 1995 & 1998.

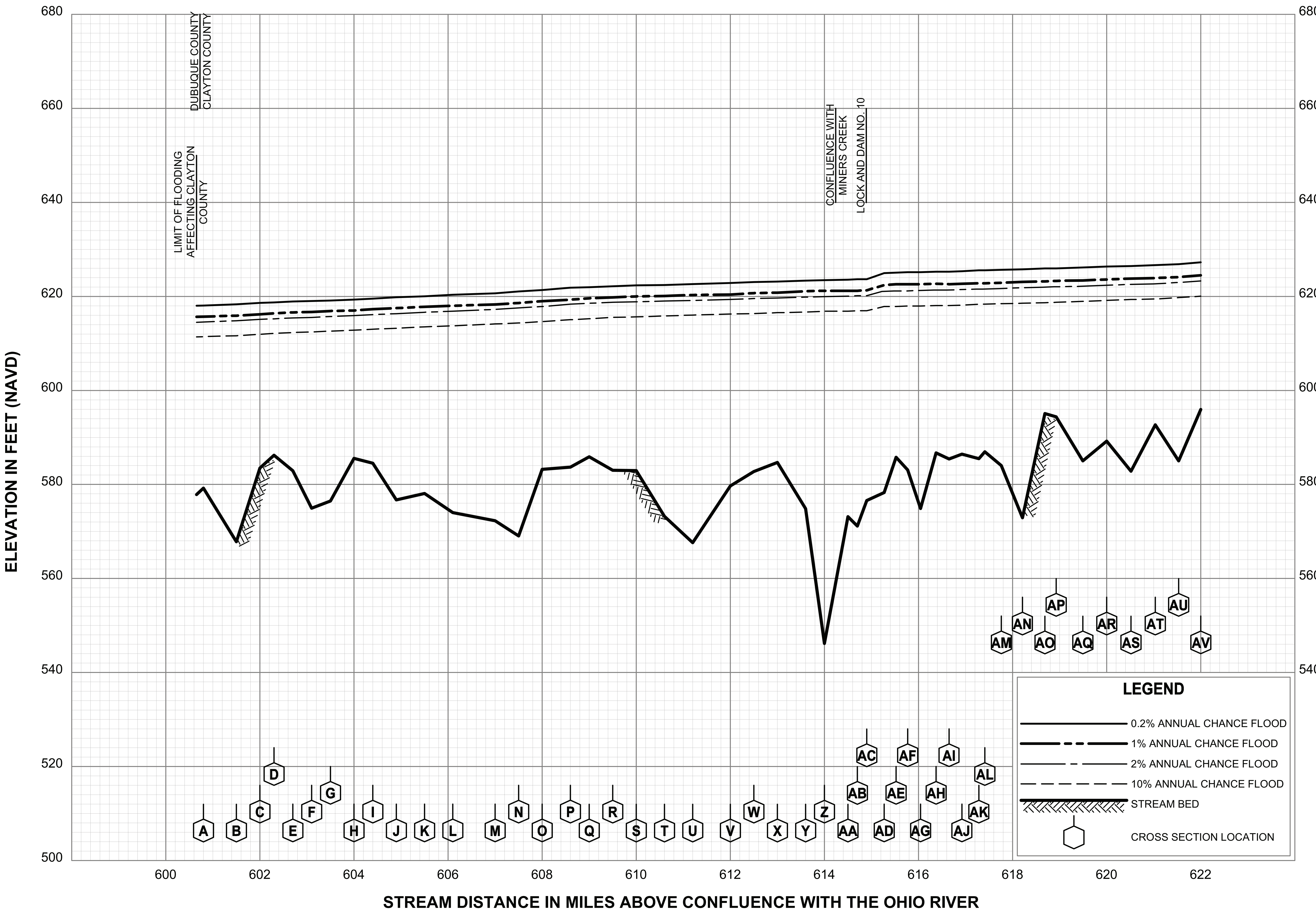
17. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, UNET, One-Dimensional Unsteady Flow through a Full Network of Open Channels, User's Manual, Davis, California, 1997.

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

19. Scientific Assessment and Strategy Team, Upper Mississippi/Missouri River Basin River Miles, Sioux Falls, SD, May 1, 1995.

20. Chow, Ven Te, Ph.D., Open-Channel Hydraulics, McGraw-Hill Book Company, New York, 1959, pp. 106-114.

21. Federal Emergency Management Agency, Federal Insurance Administration, Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, June 1992.



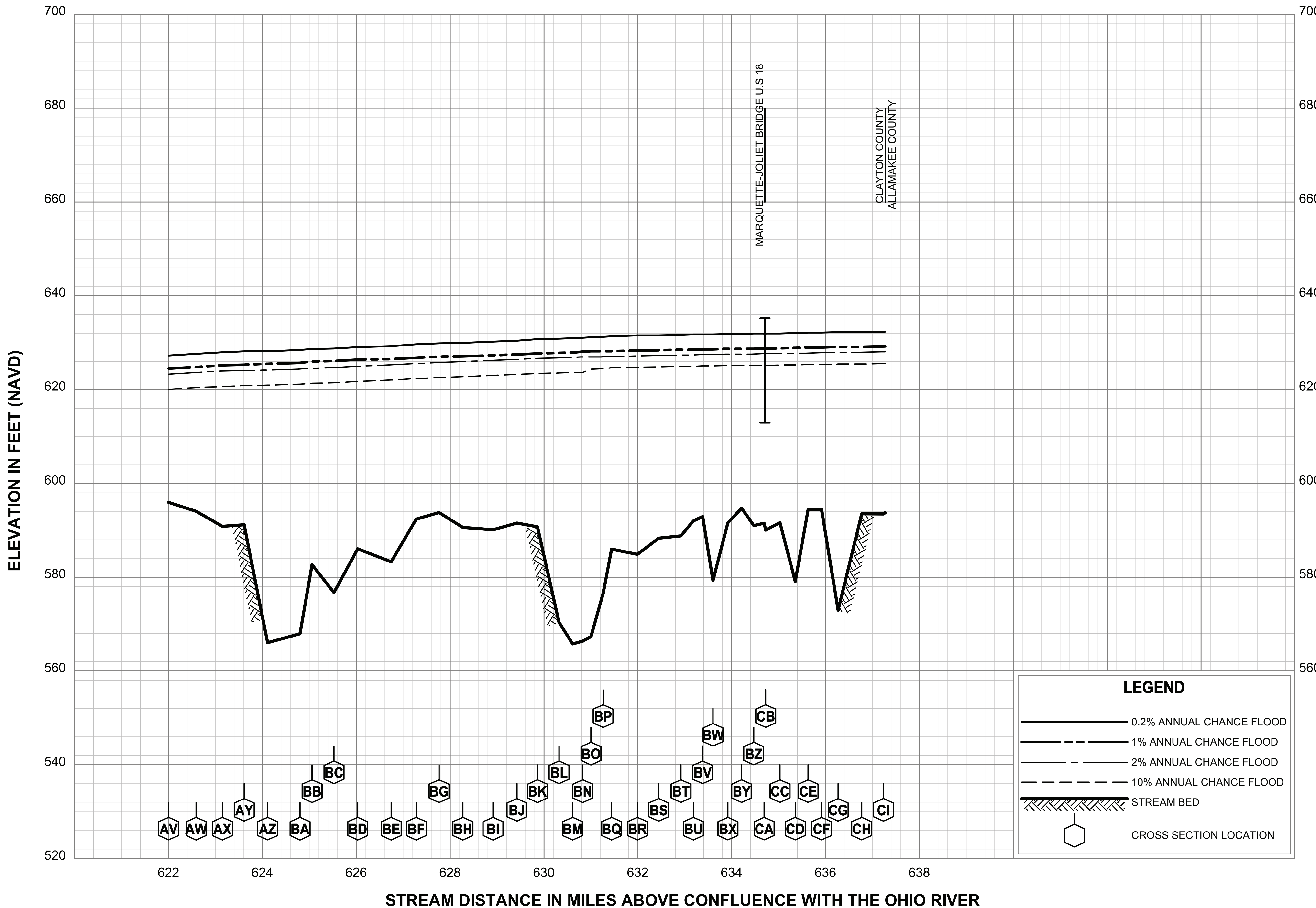
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLAYTON COUNTY, IA

AND INCORPORATED AREAS



FLOOD PROFILES

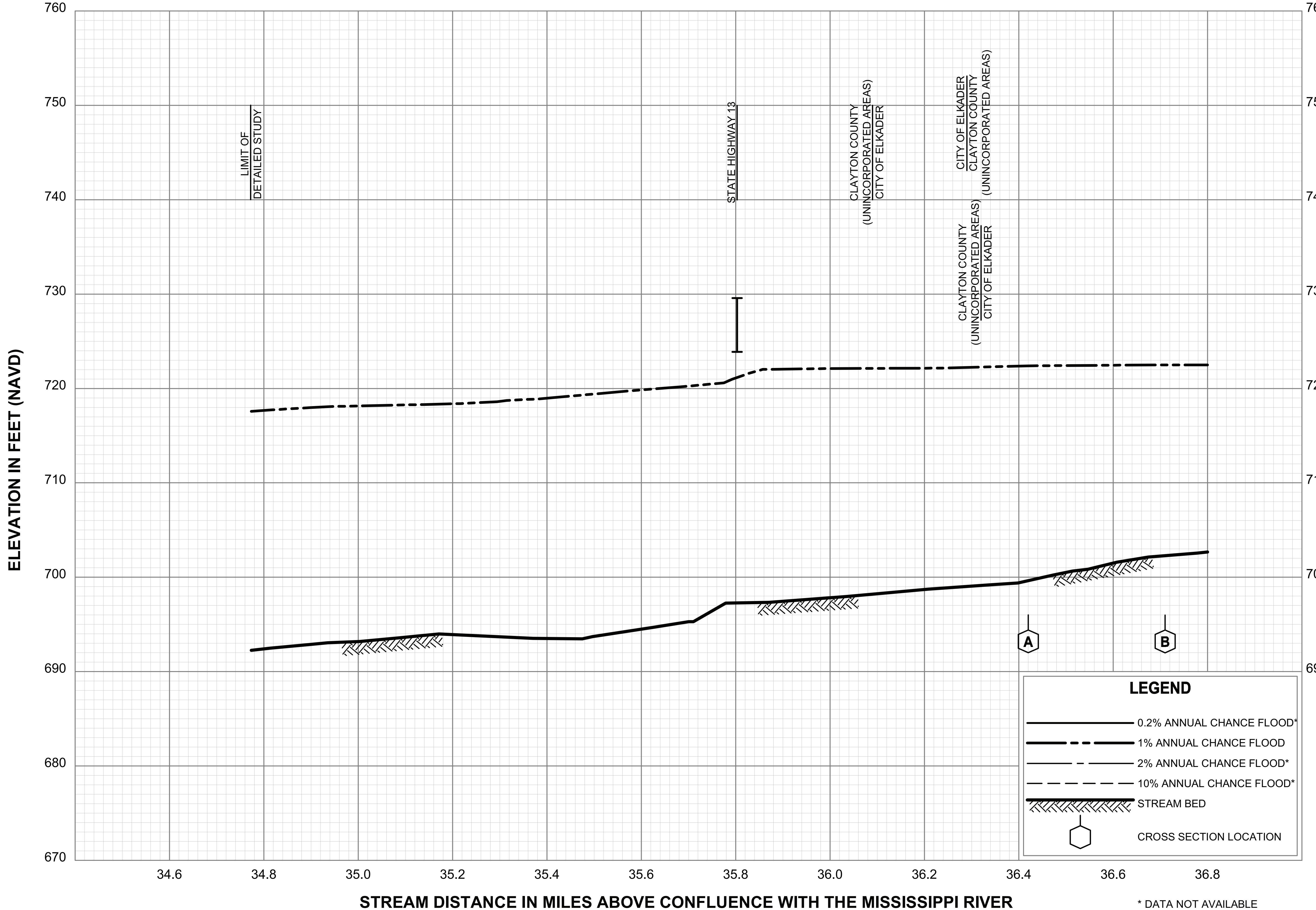
MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLAYTON COUNTY, IA

AND INCORPORATED AREAS

02P



FLOOD PROFILES

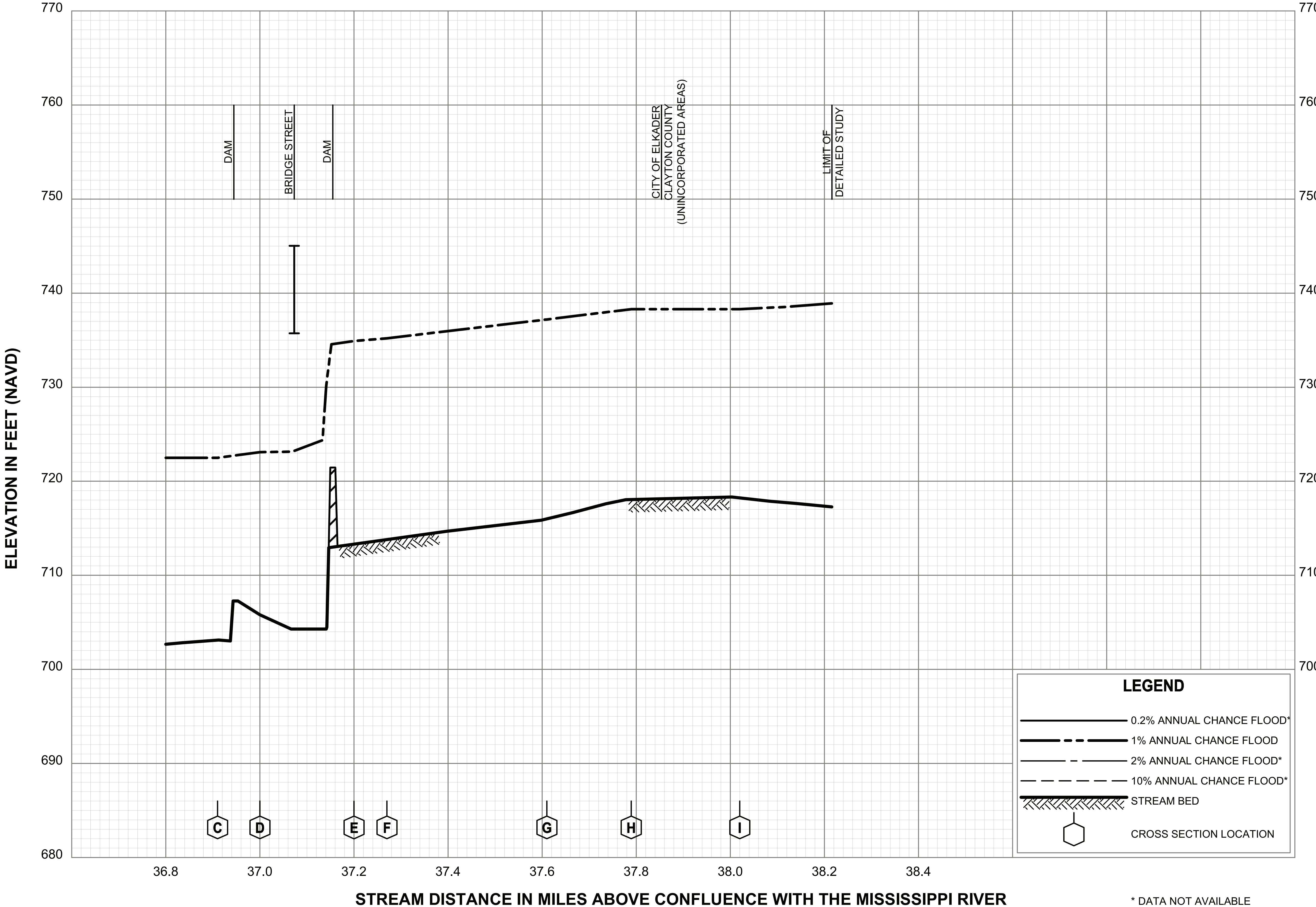
TURKEY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLAYTON COUNTY, IA

AND INCORPORATED AREAS

03P



* DATA NOT AVAILABLE

FLOOD PROFILES

TURKEY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLAYTON COUNTY, IA

AND INCORPORATED AREAS