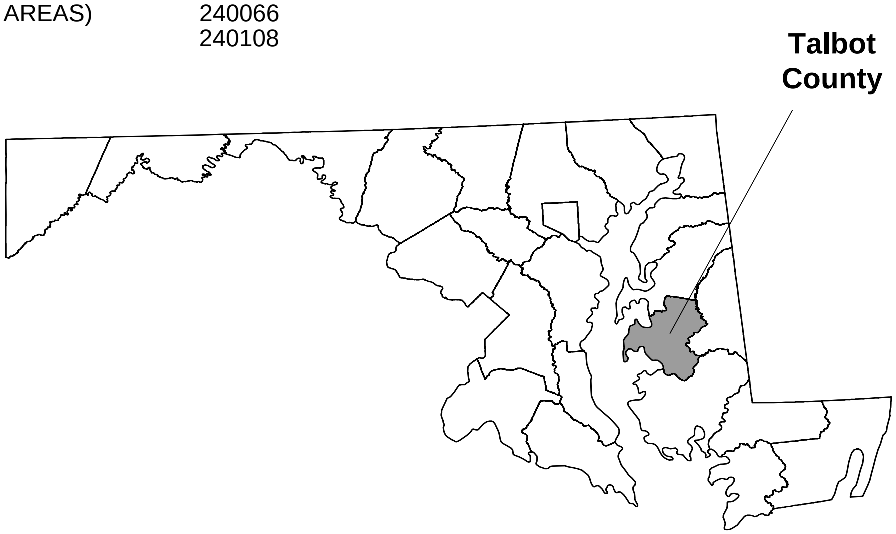
FLOOD INSURANCE STUDY

TALBOT COUNTY, MARYLAND AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
EASTON, TOWN OF	240067
OXFORD, TOWN OF	240068
ST. MICHAELS, TOWN OF	240069
TALBOT COUNTY (UNINCORPORATED AREAS)	240066
TRAPPE, TOWN OF	240108



REVISED: JULY 20, 2016

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER 24041CV000B

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) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Countywide FIS Effective Date: August 5, 2013

Revised Countywide FIS Effective Date: July 20, 2016

TABLE OF CONTENTS

TABLE OF CONTENTS - continued

Page

FIGURES

TABLES

EXHIBITS

FLOOD INSURANCE STUDY
TALBOT COUNTY, MARYLAND AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide FIS revises and updates previous FISs / Flood Insurance Rate Maps (FIRMs) in the geographic area of Talbot County, Maryland, including the Towns of Easton, Oxford, St. Michaels and Trappe, and the unincorporated areas of Talbot County (referred to collectively herein as Talbot County) and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This FIS has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates. This information will also be used by the communities in Talbot County to update existing floodplain regulations as part of the Regular Phase of the NFIP, and will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that the Town of Queen Anne is geographically located in Queen Anne's and Talbot Counties. Flood hazard information for the entire Town of Queen Anne is included in the Queen Anne's County FIS, and therefore not included in this countywide study.

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) shall be able to explain them.

1.2 Authority and Acknowledgments

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

The August 5, 2013, initial countywide FIS was prepared to include the unincorporated areas of, and incorporated communities within, Talbot County in a countywide format FIS. Information on the authority and acknowledgments for each jurisdiction included in the August 5, 2013 countywide FIS, as compiled from their previously printed FIS reports, is shown below.

The hydrologic and hydraulic analyses for the pre-countywide FISs for the unincorporated areas of Talbot County and the Towns of Easton, Oxford, and St. Michaels, were performed by the State of Maryland, Water

Resources Administration (WRA) for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-C-0274. These analyses were completed in February 1983.

There is no pre-countywide FIS for the Town of Trappe; therefore the previous authority and acknowledgement information for this community is not included in this FIS.

For the August 5, 2013, initial countywide FIS, new hydrologic and hydraulic analyses were performed for portions of Tanyard Branch, Windmill Branch, and Tributary No. 3 to Windmill Branch. New approximate floodplains were also mapped for Talbot County and its incorporated areas. The criteria for these floodplains can be found in Section 2.0 of this FIS.

The FIRM production for the August 5, 2013, initial countywide FIS was performed by AMEC, Earth & Environmental, Inc. for FEMA, under Contract No. HSFE03-07-D-0030, Task Order HSFE03-08-J-0014.

For this July 20, 2016, countywide revision, the coastal analysis and mapping for Talbot County were conducted for FEMA by the U.S. Army Corps of Engineers (USACE) and its project partners under Project Nos. HSFE03-06-X-0023 and HSFE03-09-X-1108. The coastal analysis involved transect layout, field reconnaissance, erosion analysis, and overland wave modeling including wave setup, wave height analysis and wave runup.

For this July 20, 2016, countywide revision, the coastal boundaries were mapped using a Digital Elevation Model (DEM) derived from Light Detection and Ranging (LiDAR) data collected in 2003. This 2003 LiDAR data was further supplemented by 2006 2-foot topographic contour and spot elevation data provided by Talbot County. The coastal mapping was completed in October 2014. The coastal flood boundaries were delineated using the elevations determined at each transect; between transects, the boundaries were interpolated using engineering judgment, land cover data, and topographic data.

Base map information for this July 20, 2016, countywide revision was provided in digital format. Streamline files, road centerline and political boundary files were provided by the Talbot County Department of Public Works. Digital aerial photography tiles, published in 2006, were also provided by Talbot County. Adjustments were made to specific base map features to align them to 1 inch = 200 feet and 1 inch = 400 feet scale orthophotos.

The projected coordinate system used for the production of this FIRM is Universal Transverse Mercator (UTM), Zone 18, North American Datum of 1983 (NAD 83), GRS 80 spheroid. Corner coordinates shown on the FIRM are in latitude and longitude referenced to the UTM projection, NAD 83. Differences in the datum and spheroid used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on the FIRM.

1.3 Coordination

The purpose of the initial Consultation Coordination Officer (CCO) meeting is to discuss the scope of the study. A final CCO meeting is held to review the results of the study.

On May 31, 1979, time and cost allocations were discussed at an initial CCO meeting attended by representatives of FEMA, Talbot County, the Towns of Easton, Oxford, and St. Michaels, and the study contractor. Further coordination occurred between the USACE, the U.S. Geological Survey (USGS), the U.S. Department of Agriculture, Soil Conservation Service (SCS, now the National Resources Conservation Service, NRCS), Talbot County officials and the officials of the Towns of Easton, Oxford and St. Michaels.

On November 22, 1983, the results of the work by the study contractor were reviewed and accepted at a final coordination meeting attended by representatives of the study contractor, FEMA, and the communities.

The dates of the initial and final CCO meetings held for the incorporated communities within the boundaries of Talbot County are shown in Table 1, "Initial and Final CCO Meetings".

TABLE 1 – INITIAL AND FINAL CCO MEETINGS

Community Name	Initial CCO Date	Final CCO Date
Easton, Town of	May 31, 1979	November 22, 1983
Oxford, Town of	May 31, 1979	November 22, 1983
St. Michaels, Town of	May 31, 1979	November 22, 1983
Talbot County (Unincorporated Areas)	May 31, 1979	November 22, 1983

For the August 5, 2013, initial countywide FIS, Talbot County and the Towns of Easton, Oxford, St. Michaels and Trappe were notified by phone in August 2008 that the FIS would be updated and converted to countywide format. A final CCO meeting was held on August 22, 2011, and was attended by representatives from FEMA, the Maryland State NFIP Office, the officials of Talbot County and the Towns of Easton, Oxford, St. Michaels, and Trappe, and the study contractors. At this meeting the findings of the study and the potential impact of the study results on the community were discussed.

For this July 20, 2016, countywide revision, the FEMA Region III office initiated a coastal storm surge study in 2008 for the Atlantic Ocean, Chesapeake Bay including its tributaries, and the Delaware Bay. No initial CCO meeting for the coastal storm surge study was held.

For this July 20, 2016, countywide revision, a final CCO meeting was held on September 24, 2013, with representatives from FEMA, the Maryland Department of the Environment (MDE), the USACE, the study contractor, and officials from the communities of Talbot County.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Talbot County, Maryland, including the unincorporated areas, and the Towns of Easton, Oxford, St. Michaels, and Trappe.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development.

August 5, 2013 Initial Countywide Analyses

All or portions of the flooding sources listed in Table 2 "Riverine Flooding Sources Studied by Detailed Methods" were studied by detailed methods. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

TABLE 2 – RIVERINE FLOODING SOURCES
STUDIED BY DETAILED METHODS

Tanyard Branch
Tributary No. 3 to Windmill Branch
Windmill Branch

Numerous streams were studied by approximate methods. Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by FEMA and Talbot County. Table 3, "Riverine Flooding Sources Studied by Approximate Methods", lists the streams studied by approximate methods.

TABLE 3 – RIVERINE FLOODING SOURCES
STUDIED BY APPROXIMATE METHODS

Barker Creek	Tributary 2A to Beaverdam Branch
Beaverdam Branch	Tributary 2A to Choptank River
Deep Branch	Tributary 2A to Goldsborough Creek
Galloway Run	Tributary 2A to Peachblossom Creek
Goldsborough Creek	Tributary 2A to Potts Mill Creek
Kings Creek	Tributary 2A to Skipton Creek
Miles Creek	Tributary 2A to Turkey Creek
Miles River	Tributary 2A to Wye East River
Miles Ton Creek	Tributary 2B to Peachblossom Creek
Mill Creek	Tributary 2B to Skipton Creek
Norwich Creek	Tributary 3 to Beaverdam Branch
Peachblossom Creek	Tributary 3 to Choptank River
Potts Mill Creek	Tributary 3 to Kings Creek
Skipton Creek	Tributary 3 to Miles Creek
Tanyard Branch	Tributary 3 to Mill Creek
Tributary 1 to Barker Creek	Tributary 3 to Peachblossom Creek
Tributary 1 to Beaverdam Branch	Tributary 3 to Potts Mill Creek
Tributary 1 to Choptank River	Tributary 3 to Skipton Creek
Tributary 1 to Deep Branch	Tributary 3 to Trippe Creek
Tributary 1 to Goldsborough Creek	Tributary 3 to Tuckahoe Creek
Tributary 1 to Kings Creek	Tributary 3 to Windmill Branch
Tributary 1 to Miles Creek	Tributary 3A to Choptank River
Tributary 1 to Miles River	Tributary 3A to Mill Creek
Tributary 1 to Miles Ton Creek	Tributary 3A to Kings Creek
Tributary 1 to Mill Creek	Tributary 4 to Beaverdam Branch
Tributary 1 to Norwich Creek	Tributary 4 to Choptank River
Tributary 1 to Peach Blossom	Tributary 4 to Kings Creek
Tributary 1 to Potts Mill Creek	Tributary 4 to Miles Creek
Tributary 1 to Skipton Creek	Tributary 4 to Mill Creek
Tributary 1 to Trippe Creek	Tributary 4 to Potts Mill Creek
Tributary 1 to Tuckahoe Creek	Tributary 4 to Skipton Creek
Tributary 1 to Turkey Creek	Tributary 4 to Tuckahoe Creek
Tributary 1 to Windmill Branch	Tributary 4 to Windmill Branch
Tributary 1 to Wootenaux Creek	Tributary 4A to Potts Mill Creek
Tributary 1 to Wye East River	Tributary 4A to Tuckahoe Creek
Tributary 1A to Beaverdam Branch	Tributary 5 to Choptank River
Tributary 1A to Kings Creek	Tributary 5 to Kings Creek
Tributary 1A to Mill Creek	Tributary 5 to Miles Creek
Tributary 1A to Trippe Creek	Tributary 5 to Mill Creek

TABLE 3 – RIVERINE FLOODING SOURCES
STUDIED BY APPROXIMATE METHODS – CONTINUED

Tributary 1A to Tuckahoe Creek	Tributary 5 to Tuckahoe Creek
Tributary 1A to Wootenaux Creek	Tributary 5A to Tributary to Miles Creek
Tributary 1B to Kings Creek	Tributary 6 to Choptank River
Tributary 1B to Tuckahoe Creek	Tributary 6 to Kings Creek
Tributary 2 to Beaverdam Branch	Tributary 6 to Mill Creek
Tributary 2 to Choptank River	Tributary 7 to Choptank River
Tributary 2 to Deep Branch	Tributary 7 to Kings Creek
Tributary 2 to Goldsborough Creek	Tributary 7A to Choptank River
Tributary 2 to Kings Creek	Tributary 7A to Kings Creek
Tributary 2 to Miles Creek	Tributary 7B to Choptank River
Tributary 2 to Millcreek	Tributary 7B to Kings Creek
Tributary 2 to Norwich Creek	Tributary 8 to Choptank River
Tributary 2 to Peachblossom Creek	Tributary 8A to Choptank River
Tributary 2 to Potts Mill Creek	Tributary 9 to Choptank River
Tributary 2 to Skipton Creek	Tributary 9A to Choptank River
Tributary 2 to Trippe Creek	Tributary 10 to Choptank River
Tributary 2 to Tuckahoe Creek	Trippe Creek
Tributary 2 to Turkey Creek	Tuckahoe Creek
Tributary 2 to Windmill Branch	Turkey Creek
Tributary 2 to Wootenaux Creek	Williams Creek
Tributary 2 to Wye East River	Windmill Branch
	Wootenaux Creek

Portions of the approximate study areas were found to be inundated by tidal flooding from the Chesapeake Bay. For these areas, the detailed tidal surge elevation is shown on the FIRM.

This July 20, 2016, countywide revision incorporates new detailed coastal flood hazard analyses for Broad Creek, the Chesapeake Bay, Choptank River, Eastern Bay, Harris Creek, Miles River, Tred Avon River, and Wye East River. Study efforts were initiated in 2008 and concluded in 2012.

No LOMRs were incorporated into this countywide revision.

2.2 Community Description

Talbot County is located on the Eastern Shore of Maryland and is bordered by Queen Anne's County on the north, Caroline County on the east (Tuckahoe Creek and the Choptank River), Dorchester County on the south (the Choptank River and the Chesapeake Bay), and Chesapeake

Bay, Eastern Bay and Wye East River on the west. The population for Talbot County as determined by the 2000 Census was 33,812, and the 2010 Census population was 37,782, an increase of 7.2% (Reference 1). Easton is the county seat of Talbot County and has many commercial and retail establishments including seafood canning, manufacturing, and printing and publishing industries. Local rural industries include farming, fishing, and service trades.

The continental type of climate of Talbot County is moderated by effects from the Chesapeake Bay and Atlantic Ocean. The highest temperature recorded in the Town of Easton was 104 degrees Fahrenheit (°F) on July 21, 1930 and again on July 10, 1936. The lowest temperature of -15°F occurred on February 11, 1899. The average summer temperature is 76.6°F; the average winter temperature is 38.5 °F. The average annual precipitation is 45.9 inches and the average annual snowfall is 14.2 inches. On November 2, 1956, a total of 8.90 inches of rainfall was recorded, the most from a single storm. The prevailing winds are southwesterly, switching to northwesterly during the winter months (References 2 and 3). The maximum elevation of Talbot County, located approximately 3 miles east of Easton, is 72 feet above mean sea level (MSL) (Reference 4).

The underlying unconsolidated sediments slope gently toward the southeast at approximately 10 to 95 feet per mile. These unconsolidated deposits were the result of the deposition of sediment from meltwater of the continental glaciers and the terracing effect of several sea level oscillations. Beneath the coastal plain sediments lie older Paleozoic crystalline rocks at an average depth of 3,000 feet. Abundant ground water is available throughout Talbot County with the depth of the water table generally less than 25 feet.

There are 3 major drainage areas in Talbot County. The eastern and southern portions of the county drain into the Choptank River. The northwestern portion of the county drains west into the Wye East River. The central portion from Easton westward drains into the Miles River (Reference 4). Talbot County's irregular shoreline is a result of drowned river valleys formed by the gradually sinking land mass. This has led to a change in the overall drainage pattern due to widening rivers and creeks. Extensive estuaries and tidal basins have resulted, producing a myriad of waterways.

Floodplain development in Talbot County primarily consists of single family residential homes with some commercial and industrial development interspersed.

<u>Town of Easton</u>

The Town of Easton is located on the Eastern Shore of Maryland with a maximum elevation of 69 feet MSL (Reference 4) and is bordered by the unincorporated areas of Talbot County. The population for the Town of

Easton as determined by the 2010 Census was 15,945 (Reference 1). The Town of Easton is the county seat of Talbot County and has many commercial and retail establishments, including manufacturing, printing and publishing industries.

Floodplain development in the Town of Easton primarily consists of single family residential homes with some commercial and industrial development interspersed.

Town of Oxford

The Town of Oxford is located on the Eastern Shore of Maryland with a maximum elevation of 11 feet MSL (Reference 4) and is bordered on the west and north by the Tred Avon River, on the east by Town Creek, and on the east and south by the unincorporated areas of Talbot County. The population for the Town of Oxford as determined by the 2010 Census was 651 (Reference 1).

Founded in 1683, the Town of Oxford remains an important boating center for the Chesapeake Bay. Commercial marinas, boat builders, and yacht clubs form an important segment of the Oxford economy. Several restaurants attract visiting boating enthusiasts.

Town of St. Michaels

The Town of St. Michaels is bordered on the east by the Miles River and on the north, west and south by the unincorporated areas of Talbot County, with a maximum elevation of approximately 12 feet MSL (located along a ridge west of Talbot Street) (Reference 4). The population for the Town of St. Michaels as determined by the 2010 Census was 1,029 (Reference 1). Primary industries in St. Michaels include fishing, seafood processing and marketing, boating marinas, and commercial and retail sales establishments.

Town of Trappe

The Trappe District consists of roughly one-third of the county, although the actual incorporated town is a small portion of that area. Trappe began as a small crossroads hamlet, likely in the period between 1750 and 1760. The town became an incorporated municipality in 1827 but did not actually function as such until 1856. The population for the Town of Trappe as determined by the 2010 Census was 1,077 (Reference 1).

2.3 Principal Flood Problems

The low lying, relatively undisturbed topography, high seasonal water tables, poor drainage and high runoff characteristics of the soils combine to provide a high flooding potential. When heavy rainfall and a high river discharge combine with storm tides, low lying areas adjacent to rivers and estuaries become inundated with saltwater. Major floods in the Talbot County area have occurred in 1876, 1933, 1935, 1954, 1955, 1960, 1962, 1967, 1972, and 1975. Major hurricanes and tropical storms to affect Talbot County have recently occurred in 1972, 1999, 2003, 2011, and 2012. Few detailed records of historical flood damage are available.

The great storm of August 1933 caused extensive damage throughout the county. The storm dropped 7.16 inches of rain and washed away Devils Island (Reference 5).

On Tilghman Island, the waters of the Chesapeake Bay and the Choptank River met in 5 separate places. Workboats were piled high on the shore by heavy winds and high waves. In all, 35 boats were damaged, most beyond repair. The bridge connecting the mainland with the island was washed away. The Tilghman Packing Company, Faulkner Company, and Roe Company buildings, all located in Avalon, suffered extensive structural damage. Sinclair's Store and the Post Office had several inches of water inside. A conservative estimate of damage for Tilghman Island was placed at $50,000 (Reference 5).

Throughout the county, many roads were flooded. The bridge over Papermill Pond Road was covered by water waist deep. Water reportedly was just a few inches below the Old Dover Bridge girders on the Choptank River. Approximately 30 percent of the sweet corn and 40 percent of the tomato crop was damaged, which was only a portion of the $200,000 total county crop damage expected (Reference 5).

It was described then as the "worst storm in ten years" where one "could not describe the damage done" to Oxford (Reference 5). A later newspaper article stated that the tide was over the causeway, houses were flooded, and considerable damage occurred near Town Point. The Chesapeake and Potomac Telephone Company's building had 2 feet of water above the first floor. Approximately $3,000 worth of damage resulted to the roads and wharfs (Reference 5).

In St. Michaels, the homes of the Dodson and Dryden families on Navy Point were flooded. The local newspaper reported that the “water was high in front of the fire house” prompting the firemen to park the fire engines on higher ground (Reference 5).

In October 1954, Hurricane Hazel struck the Eastern Shore with winds up to 100 miles per hour. Tidal surges were reported at 5.5 to 6.0 feet by *The Banner*, a Cambridge newspaper (Reference 6). The resulting damage was the worst in history, prompting President Eisenhower to declare Talbot County a critical disaster area. Damage estimates exceeded 1 million dollars (Reference 5).

The high winds fell numerous old trees, blew roofs off buildings, and washed many small boats up onto land, into pilings and against bridges.

Three county telephone offices (St. Michaels, Oxford, and Tilghman Island) were sandbagged to stop the high water. The Oxford telephone office was inundated with waist deep water. The Sherwood public wharf was swept away leaving only the pilings intact. The Faulkner Packing House on Tilghman Island was partially destroyed by winds and high tides (Reference 5).

Hurricane Connie dropped 8.88 inches of rain in August 1955. Winds of 60 miles per hour leveled corn. Tides ran 3 feet above normal. The Tred Avon Yacht Club clubhouse missed flooding by 6 inches. The lower end of Cherry Street in St. Michaels was completely flooded. Hurricane Diane followed several days later (Reference 5).

On August 17, 1955, Hurricane Diane brought tides of 1.5 to 2.5 feet above normal (Reference 6). The Tred Avon Yacht Club building again missed flooding by 6 inches (Reference 7). The full force of the hurricane missed the Delmarva Peninsula and Talbot County.

Hurricane Donna struck on September 16, 1960, causing approximately $100,000 of road damage. The bridge at Three Bridge Branch near the Village of Longwoods was completely washed out and Rabbit Hill Road, near the Village of Longwoods, was reportedly under water. Between 15 and 30 percent of the corn crop was damaged. The storm produced 6.17 inches of rain (Reference 5).

Damage from the March 6-7, 1962, northeaster in Talbot County accompanied a high overnight tide. The tide was 4 feet above normal, putting the Easton Point dock under 3 feet of water. Approximately 40 percent of Tilghman Island was flooded. Cooperstown Road (the eastern extension) on Tilghman Island was hip deep under water. St. Michaels reported tides 2 feet above normal with no flooding (Reference 7). However, in Oxford the firemen were called out in the middle of the night to help move furniture out of several houses in the low lying areas. Approximately 30-40 percent of the town was under water at one time. The causeway was between 1 and 4 feet under water (Reference 7).

Tropical Storm Agnes brought winds up to 55 miles per hour during late June 1972 (Reference 4). Some local flooding occurred but damage was primarily restricted to crops. In the Town of Oxford, 11 yachts were grounded by high winds. Many crab pots were carried away by tremendous amounts of debris (Reference 7).

The remnants of Hurricane Fran moved through West Virginia on September 6, 1996, reaching northwest Pennsylvania the morning of the 7th. The strong south to southeast winds accompanying it caused tidal flooding along the Chesapeake Bay. In Talbot County, flooding was reported in St. Michaels. Flooding in Oxford was reported as the worst since Hurricane Hazel in 1954. Town Creek spilled over as did the Tred Avon River. Waterfront restaurants and homes in low lying areas were flooded. Many persons were encouraged to evacuate to the second floor of their establishments. Bank Street was closed. A few people were evacuated. In Easton, the Easton Point Marina parking lot was flooded with two feet of water (Reference 8).

An intense northeaster pounded the Eastern Shore of Maryland with heavy rain, strong winds and some minor tidal flooding on January 28, 1998. Heavy rain moved into the southern part of the Eastern Shore of Maryland shortly after midnight on the 28th and continued through the early afternoon. In Talbot County, several roads had considerable flooding and a culvert was washed out from under a roadway. Storm rainfall totals reached around 3.5 inches in southern parts of Talbot County. The heavy rain and the strong onshore flow in the lower part of the Chesapeake Bay helped combine to produce some minor tidal flooding at the times of high tide on the 28th. Bay flooding in some yards was reported in Oxford. Also in Oxford, one lane of State Route 333 was totally submerged near the causeway. Field flooding was reported in Saint Michaels and on Tilghman Island. Strong winds increased during the day on the 28th and became their strongest between 10 a.m. and 2 p.m. EST. Peak gusts reached between 45 and 55 mph. The strong winds and heavy rain were able to push over some weak trees and power lines across the Eastern Shore. There were downed trees and morning power outages in Talbot County (Reference 8).

On February 4, 1998, the strongest northeaster of the winter brought heavy rain, damaging winds and minor tidal flooding to the southern half of the Eastern Shore of Maryland. In Talbot County, flooding was reported along low lying areas of Neavitt, Oxford, Saint Michaels and Unionville during the afternoon of the 4th. Roadway flooding was also reported in Trappe. A few roads were closed and minor outages were reported because of the downed trees (Reference 8).

Hurricane Floyd battered the Eastern Shore of Maryland on September 16, 1999 and brought with it torrential rains and damaging winds. The torrential downpours associated with Hurricane Floyd exceeded the 1-percent annual chance flood return period for most of the Eastern Shore. Hundreds of roads and bridges were closed. Flooding forced the closure of numerous roads in Easton, St. Michaels and Oxford. At 10:40 a.m. EST, a man hanging from a branch was rescued in Easton. About 75 people went to shelters as citizens in low-lying areas were urged to evacuate. Severe damage occurred to 10 homes, three businesses and 30 vehicles on Cannery Road. The water was up to 10 feet high on the 16th and there was still up to six feet of water in the streets the next day. Downed trees caused about 3,000 homes and businesses to lose power in Easton, St. Michaels and Trappe. Storm rainfall totals included 9.16 inches in Royal Oak, and 9.15 inches in Easton. Another effect of Floyd was a boom in the mosquito population throughout the Middle Atlantic States (Reference 8).

Tropical Storm Isabel caused a record breaking tide and storm surge up the Chesapeake Bay, heavy rain and strong power outage-producing winds on September 18-19, 2003. Winds gusted up to 58 mph in the bay and caused numerous trees, tree limbs and power lines to be knocked down. This was one of the worst power outage events in history for Conectiv Energy. Storm rainfall totals included 2.97 inches in Saint Michaels (Reference 8).

On September 6, 2008, Tropical Storm Hanna brought heavy rain, strong winds and some tidal flooding to the Eastern Shore. Rain moved into the region during the morning, fell heavy at times from the late morning into the afternoon and ended during the evening. Storm rainfall totals ranged from around 1 to around 4 inches. The strongest winds occurred during the morning and afternoon with peak gusts as high as 56 mph. Siding was ripped from a restaurant in Tilghman. Tidal flooding occurred during the early evening as the surge averaged two to three feet and affected mainly Talbot and Caroline Counties. In Talbot County, in Oxford, Pier Street was flooded. The water was over the docks and bulkheads at Knapps Narrow. In St. Michaels, the tide reached into the parking lot of a restaurant off of Mill Street. Patrons were ferried in and out of the restaurant by pick-up truck. Southeast of St. Michaels, the tide covered the deck of a restaurant off of Mulberry Street and totally closed North Harbour Road. In Easton, the Easton Point Marina became an island off of Port Street. Peak wind gusts included 56 mph in Tilghman. Precipitation totals included 1.20 inches in Easton (Reference 8).

On August 28, 2011, Hurricane Irene produced heavy flooding, rain, tropical storm force wind gusts and caused one wind related death across the Eastern Shore. Preliminary damage estimates were around three million dollars and approximately 85,000 homes and businesses lost power. Power was not fully restored until September 1st. The combination of heavy rain and wind closed numerous roadways across the Eastern Shore and downed thousands of trees. Event precipitation totals averaged 6 to 12 inches and caused widespread field and roadway flooding. In Talbot County, debris closed State Route 662C. Flooding rains forced the closure of sections of State Routes 565A, 329, 328 and 33. The combination of flooding and tropical storm winds damaged 100 properties and 50 roadways and bridges. Roadway damage alone was estimated at $750,000. Event rainfall totals included 11.50 inches in Beechwood, 10.68 inches in North Easton, 9.75 inches in Easton, 9.48 inches in Papermill Pond, 9.40 inches in Bellevue and 9.12 inches in Trappe (Reference 8).

In October 2012, Hurricane Sandy made landfall north of the State of Maryland, but caused substantial damage in Maryland. President Barack Obama declared the entire State of Maryland as a disaster area, which allowed residents affected by the hurricane to apply for federal aid.

2.4 Flood Protection Measures

The State of Maryland Department of Natural Resources (DNR) has established rules and regulations governing construction on nontidal waters and floodplains. It restricts development in, obstructions to, and encroachment on the 1-percent annual chance floodplain.

Talbot County has no flood protection measures and none are currently proposed.

Minimum construction setback requirements from shorelines are enforced; however, this regulation does not reference flood waters.

When the unincorporated areas of Talbot County and the Towns of Easton, Oxford, and St. Michaels entered the Emergency Phase of the NFIP, the communities adopted 7.5 feet as the minimum first floor elevation for a new structure (Reference 9).

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on 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-, 2-, 1-, and 0.2-percent annual chance 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 which equals or exceeds the 1-percent annual chance flood in any 50-year period is approximately 40 percent (4 in 10), and, 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 the peak discharge-frequency relationships for each flooding source studied in detail affecting the county.

Information on the methods used to determine peak discharge-frequency relationships for the streams studied by detailed methods is shown below.

Pre-countywide Analyses

The pre-countywide FIS for Talbot County, Maryland included hydrologic analyses for the areas studied in detail. The TR-20 computer program (Reference 10) was used to determine the 10-, 2-, 1- and 0.2-percent annual change peak discharges for Windmill Branch.

The stillwater surge elevations were determined for various frequency relationships by the Virginia Institute of Marine Science (VIMS). The relationships were computed by using a finite element, hydrodynamic computer model of the Chesapeake Bay and the Virginia offshore area of the Atlantic Ocean (Reference 11). The model utilized meteorologic, topographic, and bathymetric input to generate and modify storm surges. This general input included the astronomical tide, the inverted barometer effect, wind stress acting on water surface, coastal configurations, bottom topography, bottom friction, internal stress, and discharge and surface elevations of rivers. The compilation and analysis of this data were accomplished using a high speed digital computer which forecasted peak elevations.

August 5, 2013 Initial Countywide Analyses

All streams studied by detailed methods received updated hydrologic and hydraulic data as part as this revision except for the tidal portions of the Chesapeake Bay, Eastern Bay, Choptank River, Tred Avon River, Wye East River, Miles River, Harris Creek and Broad Creek. The new hydrologic analysis calculated revised 10-, 2-, 1- and 0.2-percent annual chance flows. For this FIS update, flows were also established for streams studied using approximate methods.

The MDE contracted Dr. Glenn E. Moglen of the Department of Civil and Environmental Engineering at the University of Maryland to perform the updated hydrologic calculations for this FIS (Reference 12).

The current regional regression equations being used by the Maryland State Highway Administration (SHA) were developed by Jonathan Dillow, a hydrologist for the USGS. Dillow defined regression equations for five hydrologic fixed regions: Appalachian Plateaus and Allegheny Ridges, Blue Ridge and Great Valley, Piedmont, Western Coastal Plain and Eastern Coastal Plain (Reference 13).

Dr. Moglen developed a new set of regression equations, called the fixed region regression equations, for the State of Maryland. The fixed region method used in his study is based on the predefined regions defined by Dillow since these regions are based on physiographic regions. Talbot County is located within the Eastern Coastal Plain.

The fixed region regression equations for the Eastern Coastal Plain Region are based on 15 stations in Maryland and 9 stations in Delaware with drainage area (DA) ranging from 2.27 to 112.20 square miles, basin relief (BR) ranging from 5.1 to 43.5 feet, and percent A soils (S_A) ranging from 0.0 to 49.4 percent.

Basin relief is not statistically significant for discharges less than the 20-percent annual chance event but is included in the equations for consistency. The standard errors range from 33.7 percent (0.142 log units) for $Q_{1.50}$ to 50.8 percent (0.208 log units) for Q_{500}. Equations applicable to this report, along with their standard error of estimate in percent, and equivalent years of record are listed in Table 4, "Eastern Coastal Plain Fixed Region Regression Equations" (Reference 14).

TABLE 4 – EASTERN COASTAL PLAIN
FIXED REGION REGRESSION EQUATIONS

Eastern Coastal Plain

Fixed Regression Equation	Standard Error (percent)	Equivalent Years of Record
$Q_{10} = 31.17\ DA^{0.777}\ BR^{0.439}\ (S_A + 1)^{-0.215}$	38.2	9.5
$Q_{50} = 50.00\ DA^{0.732}\ BR^{0.549}\ (S_A + 1)^{-0.261}$	41.7	16
$Q_{100} = 63.44\ DA^{0.711}\ BR^{0.576}\ (S_A + 1)^{-0.279}$	44.0	18
$Q_{500} = 108.7\ DA^{0.660}\ BR^{0.628}\ (S_A + 1)^{-0.316}$	50.8	21

The work on the fixed region regression equations was aided by the GISHydro2000 software. GISHydro is a computer program used to assemble and evaluate hydrologic models for watershed analysis. Originally developed in the mid-1980s, the program combines a database of terrain, land use, and soils data with specialized geographic information system (GIS) tools for assembling data and extracting model parameters. The primary purpose of the GISHydro program is to assist engineers in performing watershed analyses in Maryland. In the fall of 1997, a new collaborative project between the Department of Civil and Environmental Engineering at the University of Maryland and the Maryland SHA updated and enhanced GISHydro into GISHydro2000. GISHydro2000 runs on ArcView 3, software no longer supported by its developer ESRI. The move of GISHydro to the ArcGIS platform is ongoing and will result in the GISHydroNXT application.

It should also be emphasized that these regression equations, although not developed by the USGS, provide better standard error performance than the current USGS regression equations for Maryland. These equations were endorsed for use in Maryland by the Maryland Hydrology Panel as documented in its report which can be obtained from the Maryland SHA or from the following URL (Reference 14):

http://www.gishydro.umd.edu/HydroPanel/panel_report_103106.pdf

Peak discharge-drainage area relationships for the selected recurrence intervals are shown in Table 5, "Summary of Discharges".

TABLE 5 - SUMMARY OF DISCHARGES

		PEAK DISCHARGES (cubic feet per second)			
FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Windmill Branch					
Approximately 50 feet downstream of Washington Street	3.28	235	477	626	1,130
Approximately 130 feet downstream of confluence from Tributary1 to Windmill Branch	3.06	226	460	606	1,100
Approximately 450 feet upstream of confluence from Tributary1 to Windmill Branch	2.84	218	449	593	1,080
Approximately 163 feet downstream of confluence from Tributary 2 to Windmill Branch	2.76	215	445	589	1,080
Approximately 280 feet downstream of confluence from Tributary 2 to Windmill Branch	2.56	205	427	566	1,040
Approximately 570 feet downstream of confluence from Tributary 3 to Windmill Branch	2.3	193	405	539	1,000
Approximately 121 feet upstream of confluence from Tributary 3 to Windmill Branch	1.61	148	316	424	802
Approximately 280 feet downstream of confluence from Tributary 4 to Windmill Branch	1.56	141	301	403	761
Approximately 225 feet upstream of confluence from Tributary 4 to Windmill Branch	1.35	119	251	336	635

TABLE 5 - SUMMARY OF DISCHARGES – (CONTINUED)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second)			
		10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Windmill Branch (continued)					
Approximately 600 feet upstream of confluence from Tributary 4 to Windmill Branch	1.31	96	194	256	474
Approximately 250 feet downstream of farm access road crossing	0.82	63	129	171	323
Tanyard Branch					
Approximately 185 feet upstream of Easton Parkway	0.98	93	200	270	518
Approximately 775 feet upstream of access road	0.79	74	157	212	408
Approximately 40 feet upstream from Aurora Street	0.57	60	132	180	354
Approximately 400 feet upstream of railroad trail	0.43	33	67	90	171
Tributary No. 3 to Windmill Branch					
Approximately 120 feet upstream of confluence with Windmill Branch	0.69	73	161	220	432

July 20, 2016 Countywide Revision

No new detailed hydrologic analyses were carried out for this July 20, 2016, countywide revision.

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 for the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data table in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

The hydraulic analyses for this countywide FIS were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if the hydraulic structures remain unobstructed, operate properly, and do not fail.

Pre-countywide Analyses

Analyses of the hydraulic characteristics of the streams in the county were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Water-surface elevations for Windmill Branch were computed through the use of the USACE HEC-2 step-backwater computer program (Reference 15). Input data for the backwater analyses were developed from field surveys. Cross sections were located at various intervals throughout the stream length to present an accurate representation of cross-sectional geometry. Cross sections were surveyed directly above and below bridges, dams, and culverts to compute backwater effects from these structures. Additional information and supplemental cross sections were determined from detailed topographic maps at a scale of 1:7,200 with a contour interval of 2 feet for Windmill Branch (Reference 16).

The starting water-surface elevations for Windmill Branch and Tanyard Branch were developed from tidal elevations interpolated from VIMS data (Reference 11) at Peach Blossom Road and Easton Parkway, respectively.

Roughness coefficients (Manning's “n”) were assigned from information collected in the field regarding vegetation, type of channel lining, surface soils, and channel and bank irregularities. The range of “n” values is shown in Table 6, “Mannings ‘n’ Values”.

TABLE 6 - MANNING’S ‘n’ VALUES

Stream	Channel “n”	Overbank “n”
Tanyard Branch	0.012-0.050	0.040-0.080
Tributary No. 3 to Windmill Branch	0.012-0.040	0.080
Windmill Branch	0.012-0.040	0.080

Hydraulic analyses of the shoreline characteristics of the flooding sources studied in detail were carried out to provide estimates of wave heights and corresponding wave crest elevations of floods of the selected recurrence intervals along each of the shorelines.

August 5, 2013 Initial Countywide Analyses

This FIS is a restudy of all flood hazards identified on the effective FIRM. Streams studied by detailed methods on the effective FIRM were restudied in detail while approximate effective streams were improved through enhanced approximate studies. The restudied detailed study streams for Talbot County do not include new detailed field surveyed cross section data. Channel cross section information was extracted from the effective detailed models and incorporated into the new hydraulic models, where appropriate. The revised detailed models do include field measured stream crossing data that was collected and provided by the MDE. The enhanced approximate floodplain models also incorporate new hydraulic structure information.

Detailed hydraulic models include water-surface profile development for the 10-percent (10-year), 2-percent (50-year), 1-percent (100-year) and 0.2-percent (500-year) annual chance floods and floodway. Enhanced approximate models include only the 1-percent annual chance flood and do not include flood profile or floodway development.

Topographic data (2008), provided by Talbot County, was used to generate triangulated irregular networks (TINs) that served as the terrain basis for detailed and approximate study model data extractions. HEC-RAS (Version 4.0) models were created using AMEC-developed automated tools. For each stream a geodatabase containing the stream centerline, bank stations, flow path locations and cross sections is created, and the data is imported into a HEC–RAS model. There is a single model for each defined reach.

The stream centerlines provided by the county were ortho-rectified and aligned with the contours where orthophotos were inconclusive. Cross-sections were placed within ArcGIS at hydraulically significant locations. Stream stationing for each designated reach begins at the reach's outlet.

The TINs were used to import the cross section data into the HEC-RAS model. For streams studied in detail the channel data was extracted from effective HEC-2 hydraulic models and incorporated into the updated hydraulic models, where appropriate. All hydraulic structures were computed using MDE inventory information, aerials and topography to obtain elevation data and structural geometry. For this study, the computed water-surface elevations were converted from the National Geodetic Vertical Datum of 1929 (NGVD 29) to the North American Vertical Datum of 1988 (NAVD 88).

Water-surface elevations for floods of the selected recurrence intervals were computed through use of the USACE's HEC-RAS (Version 4.0) step-backwater computer program (Reference 17).

Starting conditions for both Windmill Branch and Tanyard Branch are unchanged from the previously effective models. According to the FIS for the Town of Easton, dated March 27, 1984, the starting water-surface elevations for Windmill Branch and Tanyard Branch were developed from tidal elevation data interpolated from VIMS data at Peach Blossom Road and Easton Parkway, respectively. The only adjustment made was to account for the change in vertical datum. Normal depth was specified as the boundary condition for Tributary No. 3 to Windmill Branch.

Stream crossings inventoried by MDE were incorporated in HEC-RAS models. Since the provided bridge data were not vertically referenced, structures were coded relative to road surface extracted from the TINs. Inaccessible structures were modeled using data from effective HEC-2 models; otherwise, assumptions were made for structure geometry based on the available data and engineering judgment. The internal manning's 'n' values for stream crossings were adjusted based on the MDE inventory data photos.

Manning's 'n' values were assigned to each cross section using HEC-RAS Reference Manual Table 3-1 (Reference 17). The aerial photographs and pictures taken by MDE during structure inventory were used to estimate the roughness coefficients.

Floodways were developed for streams studied by detailed methods. Initially, Encroachment Method 4 was used to obtain equal conveyance reduction on each overbank, if possible. The results were imported into Method 1 and adjusted accordingly to maintain allowable surcharges throughout the study reach.

The hydraulic analyses for the riverine portions of this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of the selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the FIRM (Exhibit 2).

July 20, 2016 Countywide Revision

No new detailed hydraulic analyses were carried out for this July 20, 2016, countywide revision.

All qualifying benchmarks within a given jurisdiction that are catalogued by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Benchmarks catalogued by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation (e.g., mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation (e.g., concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)
- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

In addition to NSRS benchmarks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

To obtain current elevation, description, and/or location information for benchmarks shown on the FIRM for this jurisdiction, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their Web site at www.ngs.noaa.gov.

It is important to note that temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this study. Interested individuals may contact FEMA to access these data.

3.3 Coastal Analyses

Coastal analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding sources studied, were carried out to provide estimates of the elevations of floods for the selected recurrence intervals along the shoreline. Users of the FIRM should be aware that coastal flood elevations are provided in Table 7, 'Summary of Coastal Stillwater Elevations' in this report. If the elevation on the FIRM is higher than the elevation shown in this table, a wave height, wave runup, and/or wave setup component likely exists, in which case, the higher elevation should be used for construction and/or floodplain management purposes.

Residential development encompasses much of the shoreline within Talbot County with the exception of a few commercial and agricultural areas. Shorelines vary from low marshes, to low bluffs between 2 to 15 feet in height (NAVD 88). Behind the shoreline, the ground slopes gently upward into open woodlands or agricultural areas.

An analysis was performed to establish the frequency peak elevation relationships for coastal flooding in Talbot County. The FEMA Region III office initiated a study in 2008 to update the coastal storm surge elevations within the states of Virginia, Maryland, and Delaware, and the District of Columbia including the Atlantic Ocean, Chesapeake Bay including its tributaries, and the Delaware Bay. The study replaces outdated coastal storm surge stillwater elevations for all FISs in the study area, including Talbot County, and serves as the basis for updated FIRMs. Study efforts were initiated in 2008 and concluded in 2012.

The storm surge study was conducted for FEMA by the USACE and its project partners under Project HSFE03-06-X-0023, “NFIP Coastal Storm Surge Model for Region III” and Project HSFE03-09-X-1108, “Phase II Coastal Storm Surge Model for FEMA Region III”. The work was performed by the Coastal Processes Branch (HF-C) of the Flood and Storm Protection Division (HF), U.S. Army Engineer Research and Development Center – Coastal & Hydraulics Laboratory (ERDC-CHL) (Reference 18).

A coastal flooding analysis was performed to establish the frequency peak elevation relationships in Talbot County. The end-to-end storm surge modeling system includes the Advanced Circulation Model for Oceanic, Coastal and Estuarine Waters (ADCIRC) for simulation of 2-dimensional hydrodynamics (Reference 19). ADCIRC was dynamically coupled to the unstructured numerical wave model Simulating WAves Nearshore (unSWAN) to calculate the contribution of waves to total storm surge (Reference 18). The resulting model system is typically referred to as SWAN+ADCIRC (Reference 18). A seamless modeling grid was developed to support the storm surge modeling efforts. The modeling system validation consisted of a comprehensive tidal calibration followed by a validation using carefully reconstructed wind and pressure fields from three major flood events for the Region III domain: Hurricane Isabel, Hurricane Ernesto, and Extratropical Storm Ida. Model skill was accessed by quantitative comparison of model output to wind, wave, water level, and high water mark observations.

The tidal surge for those estuarine areas affected by the Chesapeake Bay affect the entire shoreline within Talbot County. The entire open coastline, from Eastern Bay to the Choptank River, is more prone to damaging wave action during high wind events due to the significant fetch over which winds can operate. Inland from the mouths of these water bodies, as well as Tred Avon River, Wye East River, Miles River, Harris Creek and Broad Creek, river widths narrow considerably as they converge with non-tidal tributaries. In this area, the fetch over which winds can operate for wave generation is significantly less.

The storm surge elevations for the 10-, 2-, 1-, and 0.2-percent annual chance floods determined for the Chesapeake Bay are shown in Table 7, "Summary of Coastal Stillwater Elevations." The analyses reported herein reflect the stillwater elevations due to tidal and wind setup effects.

TABLE 7 - SUMMARY OF COASTAL STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD 88)			
	10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
CHESAPEAKE BAY				
At Tilghman Island	3.4	4.0	4.1	4.8
At Clairborne	3.5	4.1	4.2	5.1
EASTERN BAY	3.6	4.1	4.2	5.3
CHOPTANK RIVER				
At Bow Knee Point	3.9	4.8	5.0	5.9
At Cambridge	3.5	4.1	4.3	5.0
TRED AVON RIVER				
At Oxford	3.5	4.1	4.3	5.1
At Southern End of Baileys Neck	3.6	4.2	4.4	5.5
WYE EAST RIVER				
At Bruffs Island	3.7	4.2	4.4	5.5
MILES RIVER				
At St. Michaels	3.5	4.1	4.3	5.2
HARRIS CREEK				
At Indian Point	3.6	4.2	4.9	5.8
BROAD CREEK				
At Mulberry Point	3.6	4.1	4.5	5.7

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in a report prepared by the National Academy of Sciences (NAS) (Reference 20). This method is based on three major concepts. First, depth-limited waves in shallow water reach maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions, such as sand dunes, dikes and seawalls, buildings and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures prescribed in the NAS report. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

The coastal analysis and mapping for Talbot County was conducted for FEMA by RAMPP under contract No. HSFEHQ-09-D-0369, Task Order HSFE03-09-0002. The coastal analysis involved transect layout, field reconnaissance, erosion analysis, and overland wave modeling including wave setup, wave height analysis and wave runup.

Wave heights were computed across transects that were located along coastal areas of Talbot County, as illustrated on the FIRM. Transects were located with consideration given to existing transect locations and to the physical and cultural characteristics of the land so that they would closely represent conditions in the locality.

Each transect was taken perpendicular to the shoreline and extended inland to a point where coastal flooding ceased. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for a 1% annual chance event were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The location of the 3-foot breaking wave for determining the terminus of the Zone VE (area with velocity wave action) was computed at each transect. Along the open coast, the Zone VE designation applies to all areas seaward of the landward toe of the primary frontal dune system. The primary frontal due is defined as the point where the ground profile changes from relatively steep to relatively mild.

Due to the low marshy nature, dune erosion was not taken into account along the Chesapeake Bay coastline. A review of the geology and shoreline type in Talbot County was made to determine the applicability of standard erosion methods, and FEMA's standard erosion methodology for coastal areas having primary frontal dunes, referred to as the "540 rule," was used (Reference 21). This methodology first evaluates the dune's cross-sectional profile to determine whether the dune has a reservoir of material that is greater or less than 540 square feet. If the reservoir is greater than 540 square feet, the "retreat" erosion method is employed and approximately 540 square feet of the dune is eroded using a standardized eroded profile, as specified in FEMA guidelines. If the reservoir is less than 540 square feet, the "remove" erosion method is employed where the dune is removed for subsequent analysis, again using a standard eroded profile. The storm surge study provided the return period stillwater elevations required for erosion analyses. Each cross-shore transect was analyzed for erosion, when applicable.

Wave height calculations used in this study follow the methodologies described in the FEMA guidance for coastal mapping (Reference 21). Wave setup results in an increased water level at the shoreline due to the breaking of waves and transfer of momentum to the water column during hurricanes and severe storms. For the Talbot County study, wave setup was determined directly from the coupled wave and storm surge model The total stillwater elevation (SWEL) with wave setup was then used for simulations of inland wave propagation conducted using FEMA's Wave Height Analysis for Flood Insurance Studies (WHAFIS) model Version 4.0 (Reference 22). WHAFIS is a one-dimensional model that was applied to each transect in the study area. The model uses the specified SWEL, the computed wave setup, and the starting wave conditions as input. Simulations of wave transformations were then conducted with WHAFIS taking into account the storm-induced erosion and overland features of each transect. Output from the model includes the combined SWEL and wave height along each cross-shore transect allowing for the establishment of base flood elevations (BFEs) and flood zones from the shoreline to points inland within the study area.

Wave runup is defined as the maximum vertical extent of wave uprush on a beach or structure. FEMA's 2007 Guidelines and Specifications require the 2% wave runup level be computed for the coastal feature being evaluated (cliff, coastal bluff, dune, or structure) (Reference 21). The 2% runup level is the highest 2 percent of wave runup affecting the shoreline during the 1-percent annual chance flood event. Each transect defined within the Region III study area was evaluated for the applicability of wave runup, and if necessary, the appropriate runup methodology was selected and applied to each transect. Runup elevations were then compared to WHAFIS results to determine the dominant process affecting BFEs and associated flood hazard levels. Based on wave runup rates, wave overtopping was computed following the FEMA 2007 Guidelines and Specifications.

Computed controlling wave heights at the shoreline range from 2.0 feet at embayments where the fetch is short to 3.4 feet at the southern end where the fetch is longer. The corresponding wave elevation at the shoreline varies from 5.7 feet NAVD 88 at the northern end to 7.5 feet NAVD 88 at the southern end.

Between transects, elevations were interpolated using topographic maps, land-use and land cover data, and engineering judgment to determine the aerial extent of flooding. The results of the calculations are accurate until local topography, vegetation, or cultural development within the community undergoes major changes. The transect data table, Table 8, "Transect Descriptions" below, provides the 10%, 2%, 1% and 0.2% annual chance stillwater elevations and the starting wave conditions for each transect. Figure 1, "Transect Location Map", provides an illustration of the transect locations for the county.

Table 8 – Transect Descriptions								
		Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (feet NAVD 88)			
Flooding Source	Transect Number	Coordinates	Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Choptank River	1	N 38.676278 W -75.963319	2.1	2.6	3.9	4.8	5.0	5.9
Choptank River	2	N 38.645272 W -75.966950	2.4	3.4	3.8	4.6	4.8	5.6
Choptank River	3	N 38.633128 W -75.989056	2.3	2.9	3.8	4.5	4.7	5.5
Choptank River	4	N 38.607466 W -75.993122	2.0	2.9	3.7	4.4	4.6	5.3
Choptank River	5	N 38.579069 W -76.028076	2.2	2.8	3.6	4.1	4.3	5.0
Choptank River	6	N 38.596036 W -76.052110	2.8	3.2	3.5	4.1	4.3	5.0
Choptank River	7	N 38.613004 W -76.073022	3.3	3.6	3.5	4.1	4.3	5.0
Choptank River - Dickinson Bay	8	N 38.625786 W -76.089044	3.2	3.4	3.5	4.1	4.3	5.0
Choptank River	9	N 38.635007 W -76.127536	3.1	3.6	3.4	4.0	4.2	4.8
Choptank River	10	N 38.648101 W -76.152898	3.6	3.9	3.4	4.0	4.2	4.8
Choptank River - Island Creek	11	N 38.665044 W -76.135384	1.3	2.3	3.5	4.1	4.3	5.1
Choptank River	12	N 38.670670 W -76.173250	3.8	4.0	3.5	4.0	4.2	4.9
Tred Avon River	13	N 38.690560 W -76.175682	2.4	3.9	3.5	4.1	4.3	5.1
Tred Avon River	14	N 38.701234 W -76.142356	1.8	2.4	3.6	4.2	4.4	5.4

Table 8 – Transect Descriptions								
Flooding Source	Transect Number	Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (feet NAVD 88)			
		Coordinates	Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Tred Avon River	15	N 38.711609 W -76.141546	2.0	2.8	3.6	4.2	4.4	5.5
Tred Avon River	16	N 38.711439 W -76.167225	2.6	3.3	3.6	4.2	4.4	5.4
Tred Avon River	17	N 38.685212 W -76.192851	3.7	4.1	3.5	4.1	4.3	5.1
Choptank River	18	N 38.681762 W -76.212757	4.3	4.1	3.5	4.0	4.2	5.0
Choptank River	19	N 38.787168 W -76.234951	4.4	4.1	3.5	4.1	4.3	5.2
Broad Creek - Edge Creek	20	N 38.733369 W -76.193749	1.5	2.4	3.6	4.3	4.5	5.7
Broad Creek - Edge Creek	21	N 38.751116 W -76.224831	2.5	2.9	3.7	4.3	4.5	5.8
Broad Creek	22	N 38.749253 W -76.248433	3.3	3.6	3.6	4.1	4.5	5.7
Choptank River	23	N 38.721432 W -76.283933	5.4	4.9	3.6	4.2	4.3	5.4
Harris Creek	24	N 38.748011 W -76.298295	3.1	3.1	3.6	4.2	4.4	5.8
Harris Creek	25	N 38.771513 W -76.306321	2.3	2.9	3.7	4.3	4.5	6.1
Choptank River	26	N 38.722298 W -76.322707	5.3	5.0	3.5	4.1	4.4	5.5
Choptank River - Dogwood Harbor	27	N 38.707734 W -76.333179	5.1	5.1	3.4	4.1	4.3	5.2
Choptank River	28	N 38.679085 W -76.926923	5.3	4.7	3.4	4.0	4.3	4.9

Table 8 – Transect Descriptions								
		Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (feet NAVD 88)			
Flooding Source	Transect Number	Coordinates	Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Choptank River - Blackwalnut Cove	29	N 38.683156 W -76.337755	5.1	4.8	3.4	4.1	4.3	5.3
Chesapeake Bay	30	N 38.700270 W -76.343616	3.9	4.5	3.4	4.0	4.1	4.8
Chesapeake Bay	31	N 38.717923 W -76.340153	4.2	4.7	3.4	3.9	4.1	4.8
Chesapeake Bay	32	N 38.756606 W -76.339480	2.8	3.2	3.4	3.9	4.1	4.7
Chesapeake Bay	33	N 38.777173 W -76.323763	3.5	3.2	3.4	4.0	4.2	4.8
Chesapeake Bay	34	N 38.803177 W -76.309797	2.7	2.9	3.5	4.0	4.2	5.0
Eastern Bay	35	N 38.830062 W -76.283458	2.5	2.7	3.5	4.1	4.2	5.1
Eastern Bay	36	N 38.831221 W -76.250010	2.7	3.3	3.6	4.1	4.3	5.2
Eastern Bay	37	N 38.821023 W -76.233280	2.3	2.7	3.6	4.1	4.3	5.3
Miles River	38	N 38.788151 W -76.219252	2.2	3.0	4.4	4.9	5.1	5.2
Miles River	39	N 38.778085 W -76.205594	2.3	2.9	4.3	4.8	5.1	5.2
Miles River	40	N 38.756935 W -76.167560	1.6	2.4	4.4	4.9	5.1	5.2
Miles River	41	N 38.793119 W -76.133186	1.5	2.4	3.6	4.2	4.4	5.5
Miles River	42	N 38.784342 W -76.181376	2.2	2.7	3.6	4.1	4.3	5.2

Table 8 – Transect Descriptions								
		Starting Wave Conditions for the 1% Annual Chance			Starting Stillwater Elevations (feet NAVD 88)			
Flooding Source	Transect Number	Coordinates	Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Miles River	43	N 38.794292 W -76.192024	2.2	3.0	3.6	4.1	4.3	5.3
Eastern Bay	44	N 38.820043 W -76.194594	2.5	3.1	3.6	4.1	4.3	5.3
Eastern Bay	45	N 38.842048 W -76.197938	3.2	3.5	3.6	4.2	4.3	5.4
Wye East River	46	N 38.854309 W -76.177856	1.9	2.4	3.7	4.3	4.4	5.5
Wye East River	47	N 38.867157 W -76.163582	2.0	2.6	3.7	4.3	4.5	5.6

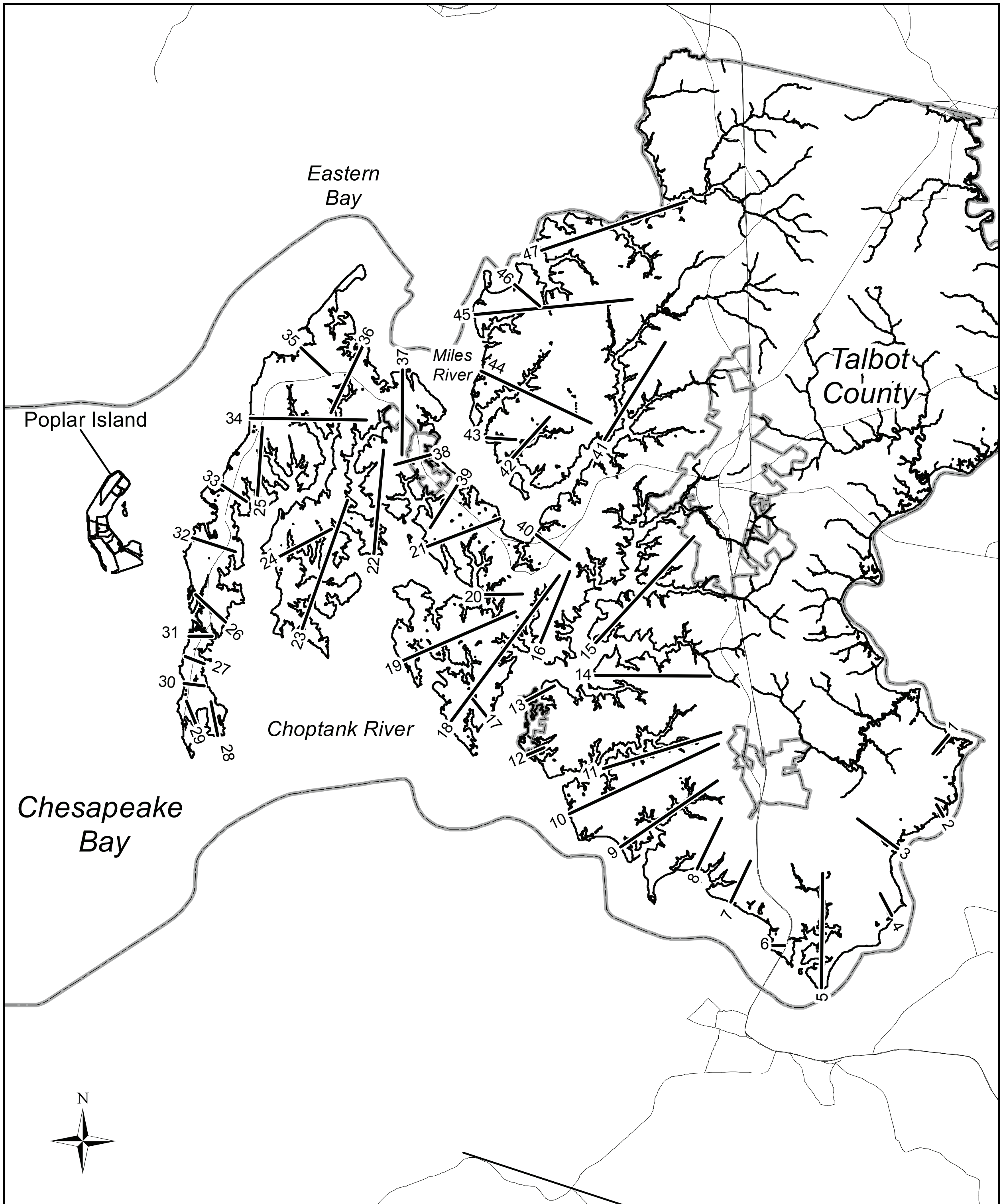


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TALBOT COUNTY, MARYLAND
AND INCORPORATED AREAS

0 1 2 4 6 8 Miles

TRANSECT LOCATION MAP

3.4 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 NGVD 29. With the completion of NAVD 88, many FIS reports and FIRMs are now prepared using NAVD 88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are now referenced to NAVD 88. Structure and ground elevations in the community must, therefore, be referenced to NAVD 88. It is important to note that adjacent communities may be referenced to NGVD 29. This may result in differences in base flood elevations across the corporate limits between the communities. The vertical datum conversion factor from NGVD 29 to NAVD 88 for Talbot County is -0.77 feet.

NGVD 29 - 0.77 = NAVD 88

For more information on NAVD 88, see Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication FIA-20/June 1992, 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
http://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 and 0.2-percent annual chance floodplains; and a 1-percent annual chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, and Floodway Data 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 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 county. For the streams studied in detail, the 1-percent annual chance and 0.2-percent annual chance boundaries have been determined at each cross section. The delineations are based on the best available topographic information.

Pre-countywide Analyses

For the streams studied in detail, the 1-percent and 0.2-percent annual chance floodplains have been delineated using the flood elevations determined at each cross section.

Talbot County (Unincorporated Areas)

The boundaries between cross sections were interpolated using topographic maps at a scale of 1:7,200 with a contour interval of 2 feet (Reference 16). For wave height analysis, the 1-percent annual chance and 0.2-percent annual chance boundaries were delineated using the same scale topographic maps of the study area.

For the areas studied by approximate methods, the boundary of the 1-percent annual chance flood was delineated using SCS soil survey maps and the existing Flood Hazard Boundary Map (FHBM) for the Unincorporated Areas of Talbot County (References 23 and 24).

The Zones A and V were divided into whole-foot elevation zones based on the average wave crest elevation in that zone. Where the map scale did not permit delineating zones at 1-foot intervals, larger increments were used.

Town of Easton

The boundaries between cross sections the boundaries were interpolated using topographic maps at a scale of 1:7,200 with a contour interval of 2 feet (Reference 16).

For streams studied by approximate methods, the boundary of the 1-percent annual chance flood was developed from normal depth calculations and the topographic maps referenced above.

Town of Oxford

For each flooding source studied in detail, the boundaries of the 1-percent and 0.2-percent annual chance floods have been delineated using topographic maps at a scale of 1:7,200 with a contour interval of 2 feet (Reference 16). For the wave height analysis, the 1-percent and 0.2-percent annual chance boundaries were delineated using the same scale topographic maps of the study area.

Zones A and V were divided into whole-foot elevation zones based on the average wave crest elevation in that zone. Where the map scale did not permit delineating zones at one foot intervals, larger increments were used.

Town of St. Michaels

For each flooding source studied in detail, the boundaries of the 1-percent and 0.2-percent annual chance floods have been delineated using topographic maps at a scale of 1:7,200 with a contour interval of 2 feet (Reference 18).

August 5, 2013 Initial Countywide Analyses

Floodplains were spatially adjusted to fit the best available stream centerline data. Also, floodplain boundaries from the pre-countywide FIRMs were combined in this countywide revision.

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

For the streams studied by approximate methods, only the 1-percent annual chance floodplain boundary is shown on the FIRM (Exhibit 2).

July 20, 2016 Countywide Revision

Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The USACE has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones (Reference 25). The 3-foot wave has been determined the minimum size wave capable of causing major damage to conventional wood frame or brick veneer structures. The one exception to the 3-foot wave criteria is where a primary frontal dune exists. The limit of the coastal high hazard area then becomes the landward toe of the primary frontal dune or where a 3-foot or greater breaking wave exists, whichever is most landward. The coastal high hazard zone is depicted on the FIRMs as Zone VE, where the delineated flood hazard includes wave heights equal to or greater than three feet. Zone AE is depicted on the FIRMs where the delineated flood hazard includes wave heights less than three feet. A depiction of how the Zones VE and AE are mapped is shown in Figure 2, "Typical Transect Schematic".

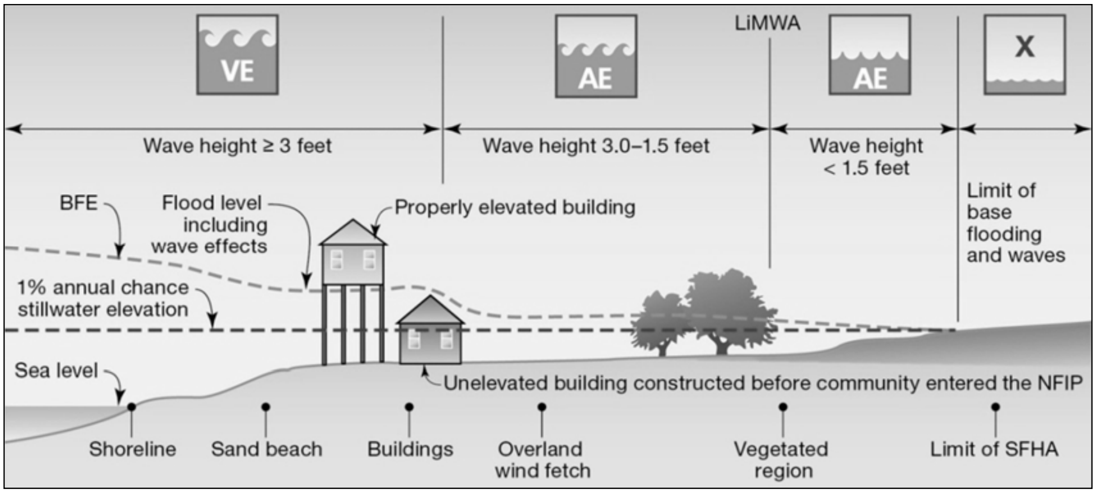


Figure 2 – Typical Transect Schematic

Post-storm field visits and laboratory tests have confirmed that wave heights as small as 1.5 feet can cause significant damage to structures when constructed without consideration to the coastal hazards. Additional flood hazards associated with coastal waves include floating debris, high velocity flow, erosion, and scour which can cause damage to Zone AE-type construction in these coastal areas. To help community officials and property owners recognize this increased potential for damage due to wave action in the AE zone, FEMA issued guidance in December 2008 on identifying and mapping the 1.5-foot wave height line, referred to as the Limit of Moderate Wave Action (LiMWA). While FEMA does not impose floodplain management requirements based on the LiMWA, the LiMWA is provided to help communicate the higher risk that exists in that area. Consequently, it is important to be aware of the area between this inland limit and the Zone VE boundary as it still poses a high risk, though not as high of a risk as Zone VE (see Figure 2, "Typical Transect Schematic").

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 FIS 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 floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the floodplains. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 9).

As shown on the FIRM (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the flood-way and the 1-percent annual chance flood are either close together or collinear, only the floodway boundary has been shown.

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The area between the floodway and 1-percent annual chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent annual chance flood by 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 3, "Floodway Schematic".

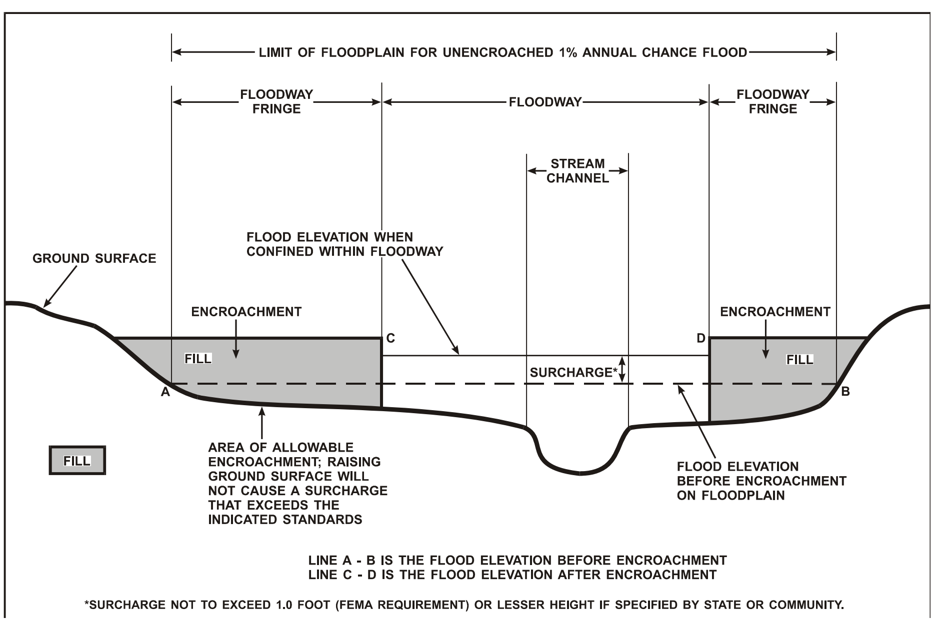


FIGURE 3 - FLOODWAY SCHEMATIC

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Tanyard Branch								
A	296.6	72	420.3	0.6	5.5	5.2[2]	5.2	0.0
B	907.8	65	229.1	1.2	5.5	5.5	5.5	0.0
C	1,441.4	140	544.9	0.5	5.7	5.7	6.1	0.4
D	1,626.8	140	470.4	0.6	5.7	5.7	6.1	0.4
E	2,111.8	92	426.5	0.6	6.9	6.9	7.1	0.2
F	2,362.4	72	247.4	1.1	6.9	6.9	7.1	0.2
G	2,799.4	33	102.3	2.6	7.2	7.2	7.6	0.4
H	3,043.7	38	94.0	2.3	7.3	7.3	8.0	0.7
I	3,234.9	10	28.1	6.4	7.8	7.8	8.3	0.5
J	4,877.2	23	63.2	2.9	19.8	19.8	19.8	0.0
K	5,499.8	31	44.5	4.0	21.6	21.6	21.6	0.0
L	5,681.2	32	63.4	2.8	22.6	22.6	22.7	0.1
M	6,259.7	17	38.1	2.4	26.9	26.9	27.8	0.9

[1] Feet above confluence with North Branch Tred Avon River
[2] Elevation computed without consideration of tidal flooding from the Chesapeake Bay

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

TALBOT COUNTY, MD
AND INCORPORATED AREAS

FLOODWAY DATA

TANYARD BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Tributary 3 to Windmill Branch								
A	589.9	30	67.1	3.3	21.1	20.8[2]	20.9	0.1
B	1,100.5	13	44.7	4.9	22.8	22.8	23.0	0.2
C	1,618	11	32.6	6.8	24.2	24.2	24.3	0.1

[1] Stream distance in feet above confluence with Windmill Branch
[2] Elevation computed without consideration of backwater effects from Windmill Branch

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

TALBOT COUNTY, MD
AND INCORPORATED AREAS

FLOODWAY DATA

TRIBUTARY 3 TO WINDMILL BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Windmill Branch								
A	181.0	71	1,567.7	1.5	6.5	6.5	7.1	0.6
B	528.6	260	679.6	1.6	6.6	6.6	7.2	0.6
C	741.4	250	2,407.5	0.3	8.2	8.2	8.9	0.7
D	1,440.3	140	869.9	0.7	8.3	8.3	9.0	0.7
E	2,518.2	125	515.8	1.2	8.5	8.5	9.1	0.6
F	3,307.3	145	700.6	0.9	9.0	9.0	9.6	0.6
G	4,204.5	52	101.5	5.8	9.7	9.7	10.1	0.4
H	4,485.0	204	1,227.5	0.5	14.8	14.8	14.8	0.0
I	5,434.1	111	346.5	1.6	14.8	14.8	14.9	0.1
J	6,400.7	52	111.3	5.1	16.2	16.2	16.3	0.1
K	6,643.9	198	1,224.4	0.5	21.0	21.0	21.7	0.7
L	7,595.8	100	744.6	0.7	21.1	21.1	21.7	0.6
M	7,987.9	90	693.1	0.6	21.1	21.1	21.8	0.7
N	9,209.6	105	202.0	1.7	21.8	21.8	22.3	0.5
O	9,791.8	110	253.3	1.0	23.3	23.3	23.5	0.2
P	10,012.4	55	170.8	1.0	24.0	24.0	24.6	0.6
Q	10,190.8	30	177.1	1.0	24.4	24.4	25.0	0.6

[1] Stream distance in feet above Easton Parkway

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

TALBOT COUNTY, MD
AND INCORPORATED AREAS

FLOODWAY DATA

WINDMILL BRANCH

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. The 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 FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations 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 FIS by detailed methods. In most instances, whole-foot base flood elevations 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 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 risk 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 base flood depths derived from the detailed hydraulic analyses are shown within this zone.

Zone AR

Zone AR is the flood insurance risk zone that corresponds to an area of special flood hazard formerly protected from the 1-percent annual chance flood event by a flood-control system that was subsequently decertified. Zone AR indicates that the former flood-control system is being restored to provide protection from the 1-percent annual chance or greater flood event.

Zone A99

Zone A99 is the flood insurance risk zone that corresponds to areas of the 1-percent annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No BFEs or depths are shown within this zone.

Zone V

Zone V is the flood insurance risk zone that corresponds to the 1-percent annual chance coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no BFEs are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 1-percent annual chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

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, and to 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 base flood elevations or 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 rate zones as described in Section 5.0. In the 1-percent annual chance floodplains that were studied by detailed methods, show selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations 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-percent and 0.2-percent annual chance floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

The current FIRM presents flooding information for the entire geographic area of Talbot County. Historical map dates for each community are presented in Table 10, "Community Map History."

COMMUNITY NAME	INITIAL NFIP MAP DATE	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	INITIAL FIRM DATE	FIRM REVISIONS DATE
Easton, Town of	August 9, 1974	January 16, 1976	September 28, 1984	
Oxford, Town of	August 9, 1974	None	September 28, 1984	
St. Michaels, Town of	August 30, 1974	June 25, 1976	November 1, 1984	
Talbot County (Unincorporated Areas)	April 25, 1975	None	May 15, 1985	June 16, 1992
Trappe, Town of [1]	N/A	N/A	N/A	

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

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

TALBOT COUNTY, MD
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

A countywide FIS revision for Dorchester County has been published. The results of that study are in agreement with the results of this study (Reference 26).

Countywide FISs for Caroline and Queen Anne's Counties have been published. The results of those studies are in agreement with the results of this study (References 27 and 28).

This study is authoritative for purposes of the NFIP and the data presented here either supersede or are compatible with previous determinations.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting Federal Insurance and Mitigation Division, Federal Emergency Management Agency, One Independence Mall, Sixth Floor, 615 Chestnut Street, Philadelphia, Pennsylvania 19106-4404.

9.0 BIBLIOGRAPHY & REFERENCES

1. U.S. Department of Commerce, Census Bureau, State & County QuickFacts, http://quickfacts.census.gov/.

2. Maryland Department of Economic and Community Development, Talbot County Community Economic Inventory, Annapolis, Maryland, June 1976, June 1982.

3. Maryland Department of Business & Economic Development, Talbot County, Maryland, Brief Economic Facts, Baltimore, Maryland. http://www.choosemaryland.org/Resources/pdffiles/briefeconomicfacts/TalbotBEF.pdf.

4. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 20 feet: Tilghman, MD, 1974; Oxford, MD, 1942; St. Michaels, MD, 1974; Claiborne, MD, 1974; Cambridge, MD, 1974; Easton, MD, 1974; Trappe, MD, 1974; Wye Mills, MD, 1973; East New Market, MD, 1974; Ridgely, MD, 1973; Fowling Creek, MD, 1974; and Preston, MD, 1974.

5. The Star-Democrat, Easton, Maryland, August 25, 1933; September 1, 1933; September 8, 1933; August 19, 1955; September 16, 1960.

6. The Banner, Cambridge, Maryland, October 16-19, 1954; August 17-18, 1955; June 23, 26, and 27, 1972.

7. The Star-Democrat, Easton, Maryland, September 16, 1960; March 7, 1962; June 28, 1972.

8. National Climatic Data Center, National Environmental Satellite, Data, and Information Services (NESDIS), NOAA Satellite and Information Service, U.S. Department of Commerce, Storm Events for Maryland, Asheville, North Carolina. http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms.

9. Robert Rauch, Talbot County Engineer, conversation, September 9, 1982.

10. U.S. Department of Agriculture, Soil Conservation Service, Engineering Division, Technical Release No. 20, Computer Program for Project Formulation, Hydrology, May 1965.

11. Virginia Institute of Marine Science, A Storm Surge Model Study, Volumes I and II, Gloucester Point, Virginia, June 1978.

12. University of Maryland, Department of Civil and Environmental Engineering, Procedure Used to Calculate Peak Flow Hydrology in Maryland, Glenn E. Moglen, November 27, 2006.

13. Dillow, J.J.A., 1996. Technique for estimating magnitude and frequency of peak flows in Maryland: U.S. Geological Survey Water-Resources Investigations Report, 95-4154, 55p.

14. Maryland State Highway Administration and Maryland Department of the Environment, Application of Hydrologic Methods in Maryland, Third Edition, Baltimore, MD, Revised August 2006. http://www.gishydro.umd.edu/HydroPanel/panel_report_103106.pdf.

15. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, August 1977.

16. State of Maryland Department of Natural Resources, Flood Management Division, Topographic Maps, developed from aerial photographs, Scale 1:7200, Contour Interval 2 feet: Annapolis, Maryland, 1981.

17. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-RAS River Analysis System, Version 4.0.0, Davis, California, March 2008.

18. U.S. Army Corps of Engineers, ERDC/CHL TR11-X, FEMA Region 3 Storm Surge Study Coastal Storm Surge Analysis: Modeling System Validation Submission No. 2, 2012.

19. Luettich, R.A. and Westerink, J.J. A (Parallel) Advanced Circulation Model for Oceanic, Coastal and Estuarine Waters (ADCIRC), Version 45.12, University of North Carolina at Chapel Hill, Institute of Marine Sciences, Morehead City, North Carolina, February 6, 2008 .

20. National Academy of Sciences, Methodology for Calculating Wave Action Effects Associated with Storm Surges, Washington, District of Columbia, 1977.

21. Federal Emergency Management Agency, Atlantic Ocean and Gulf of Mexico Update Coastal Guidelines Update, Washington, District of Columbia, 2007.

22. Federal Emergency Management Agency, Wave Height Analysis for Flood Insurance Studies (WHAFIS), Version 4.0, Washington, District of Columbia, August 2007.

23. U.S. Department of Agriculture, Soil Conservation Service, Soil Survey, Talbot County, Maryland, 1970.

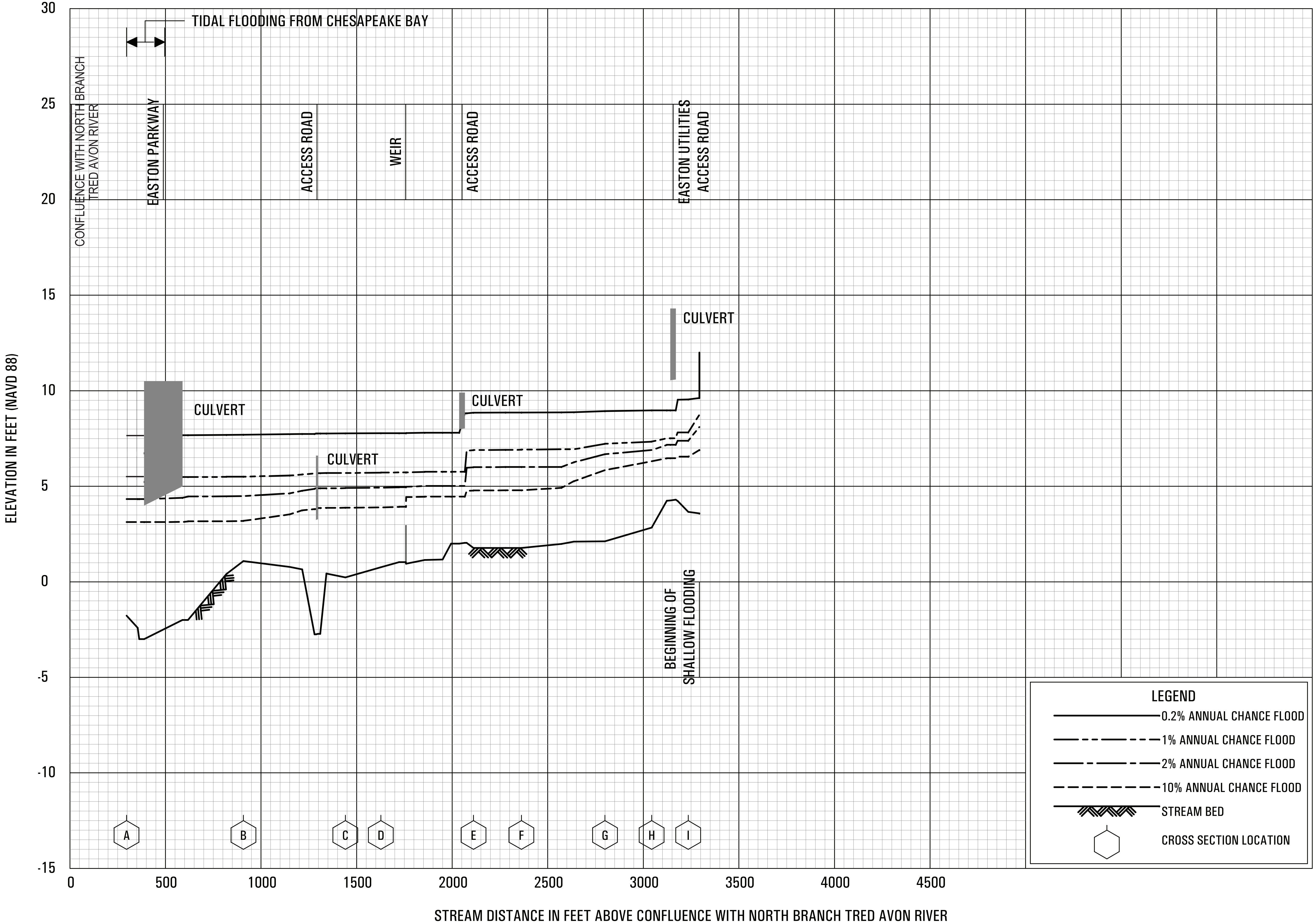
24. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Talbot County, Unincorporated Areas, Maryland, September 1975.

25. U.S. Army Corps of Engineers, Galveston District, Guidelines for Identifying Coastal High Hazard Zones, Galveston, Texas, June 1975.

26. Federal Emergency Management Agency, Flood Insurance Study, Dorchester County, Maryland and Incorporated Areas, Washington, District of Columbia, March 16, 2015.

27. Federal Emergency Management Agency, Flood Insurance Study, Caroline County, Maryland and Incorporated Areas, Washington, District of Columbia, January 16, 2015.

28. Federal Emergency Management Agency, Flood Insurance Study, Queen Anne's County, Maryland and Incorporated Areas, Washington, District of Columbia, November 5, 2014.



FLOOD PROFILES

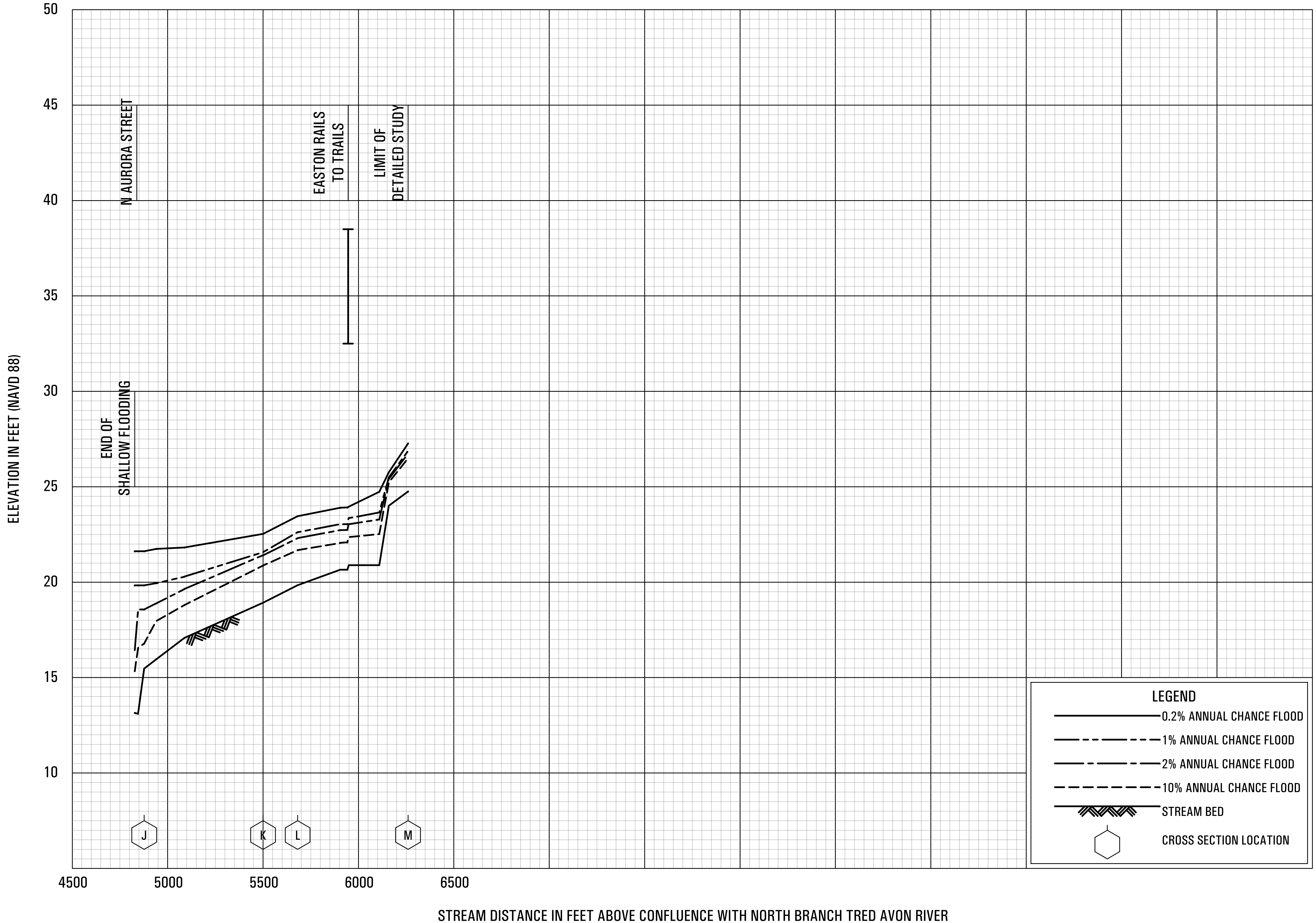
TANYARD BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TALBOT COUNTY, MD

AND INCORPORATED AREAS

01P



FLOOD PROFILES

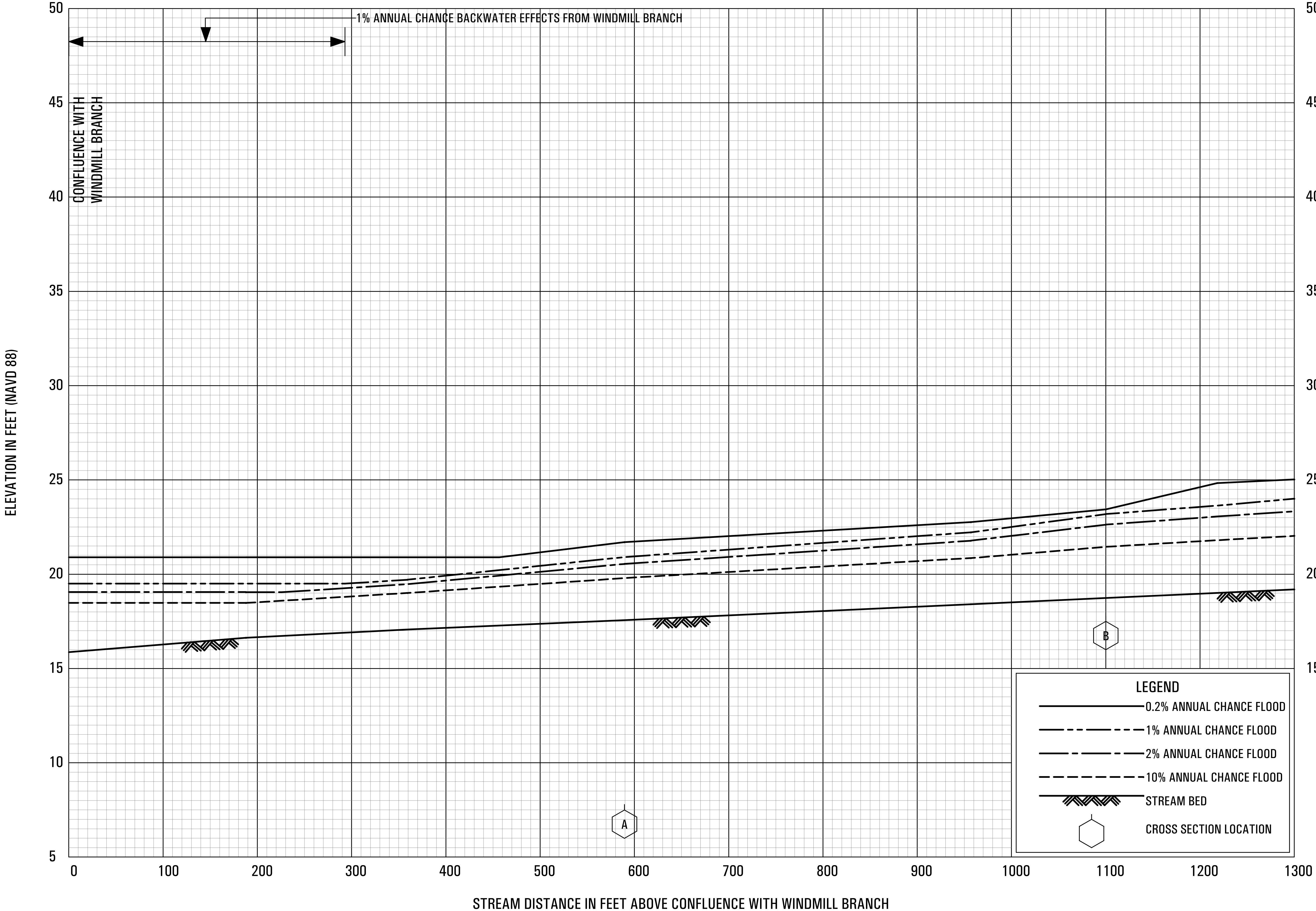
TANYARD BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TALBOT COUNTY, MD

AND INCORPORATED AREAS

02P



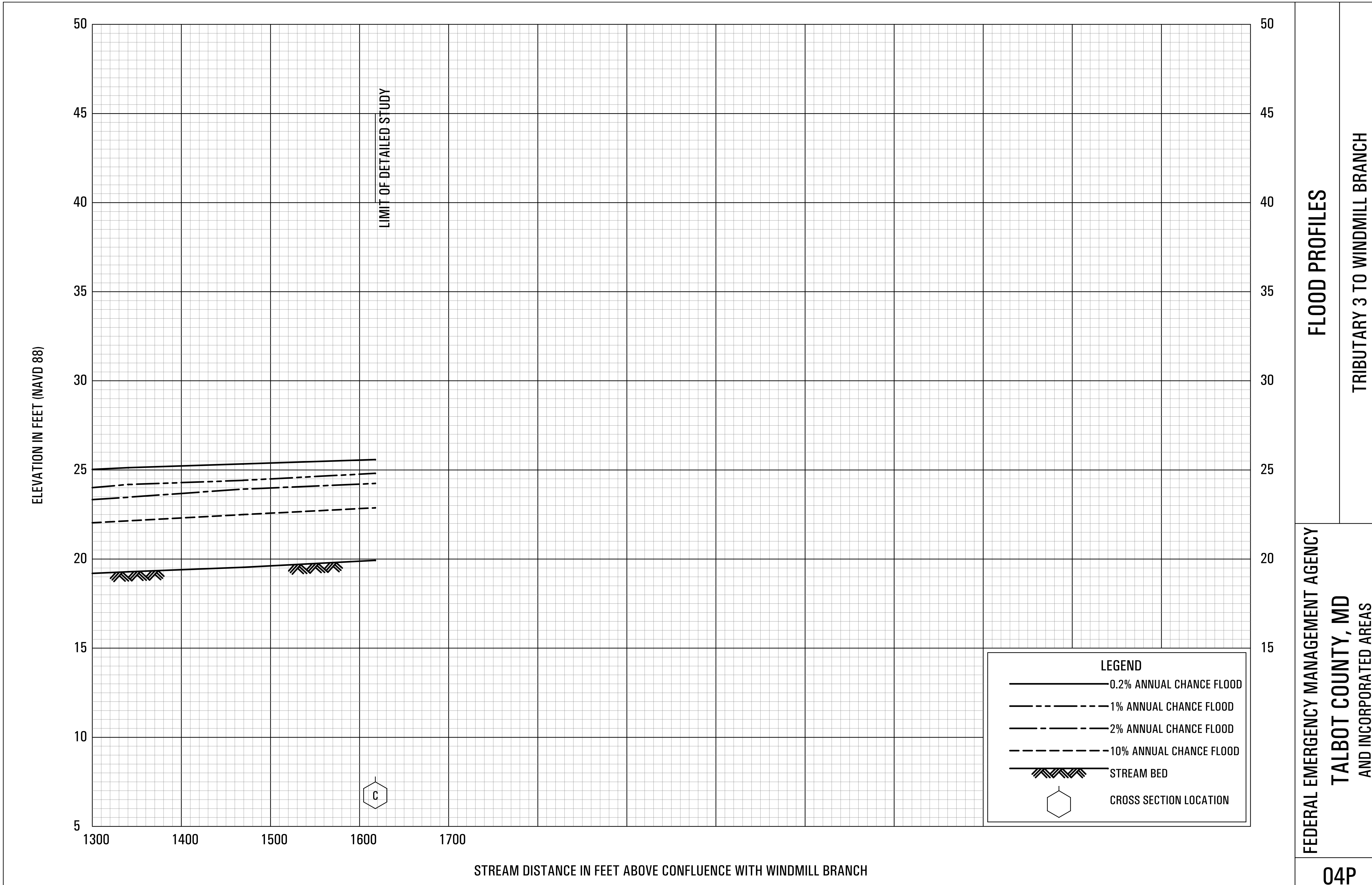
FLOOD PROFILES

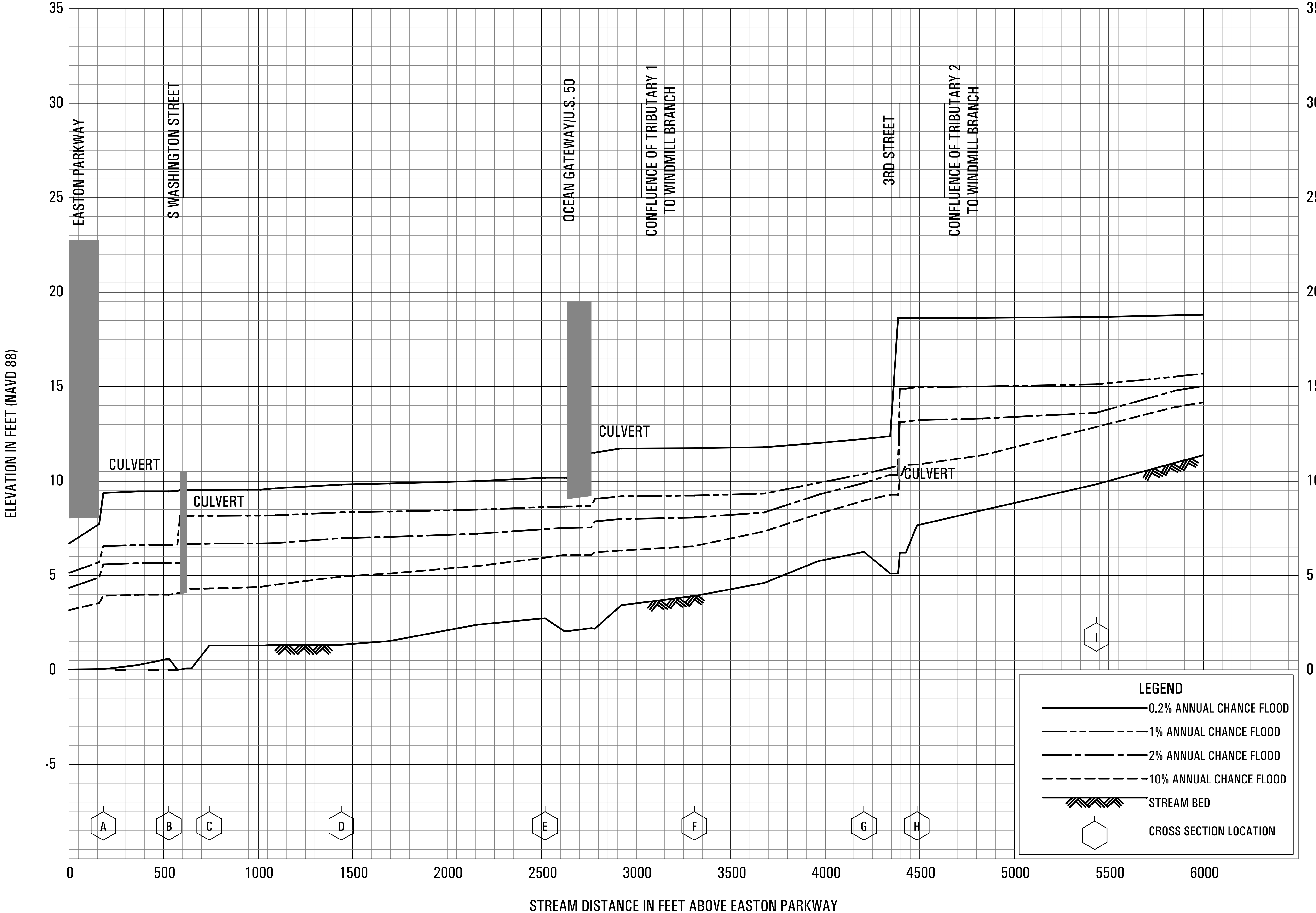
TRIBUTARY 3 TO WINDMILL BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TALBOT COUNTY, MD
AND INCORPORATED AREAS

03P


LIMIT OF DETAILED STUDY
ELEVATION IN FEET (NAVD 88)
50
45
40
35
30
25
20
15
10
5
1300
1400
1500
1600
1700
STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH WINDMILL BRANCH
C
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
TRIBUTARY 3 TO WINDMILL BRANCH
FEDERAL EMERGENCY MANAGEMENT AGENCY
TALBOT COUNTY, MD
AND INCORPORATED AREAS
04P



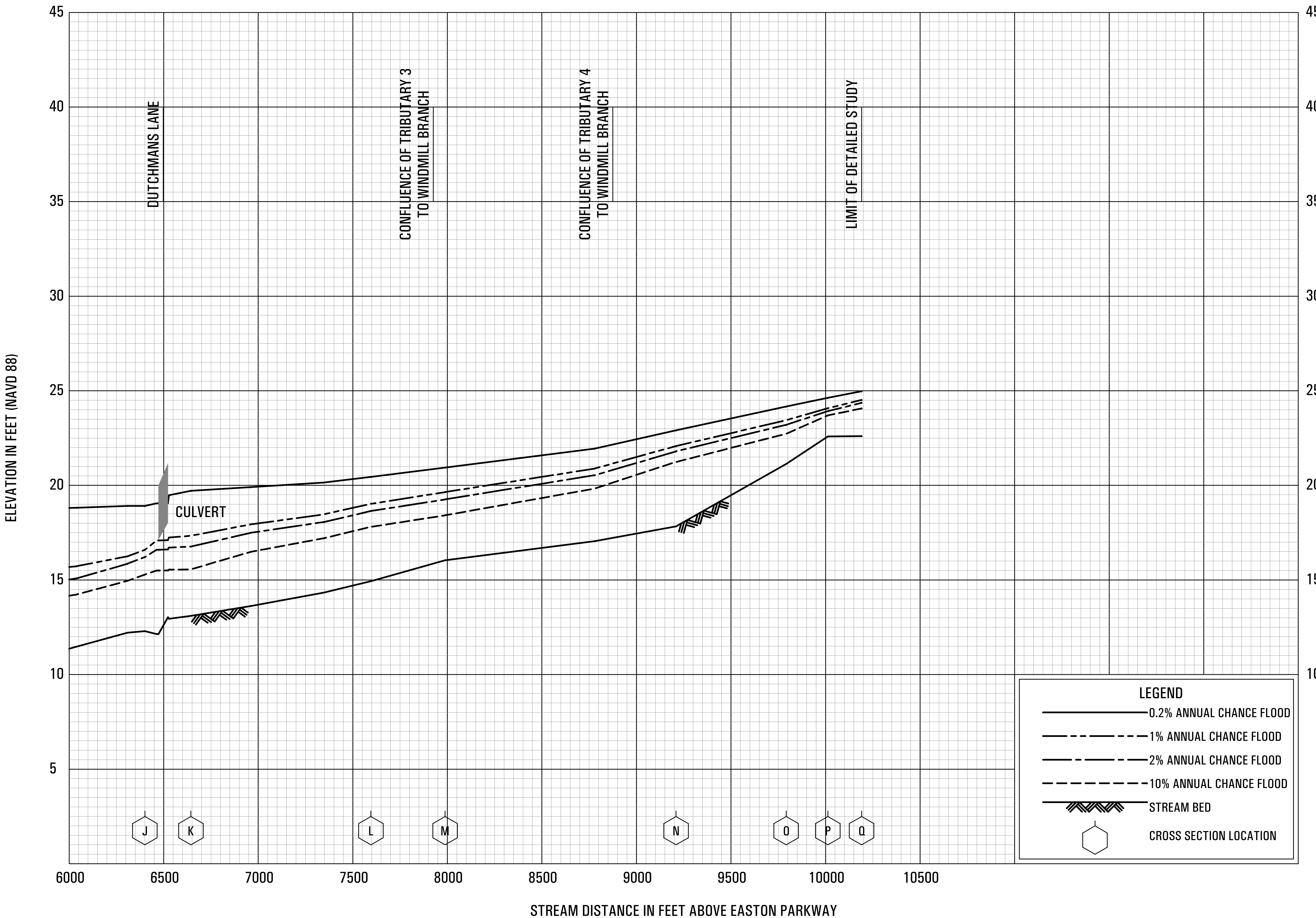
FLOOD PROFILES

WINDMILL BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TALBOT COUNTY, MD

AND INCORPORATED AREAS



FLOOD PROFILES

WINDMILL BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TALBOT COUNTY, MD

AND INCORPORATED AREAS

06P