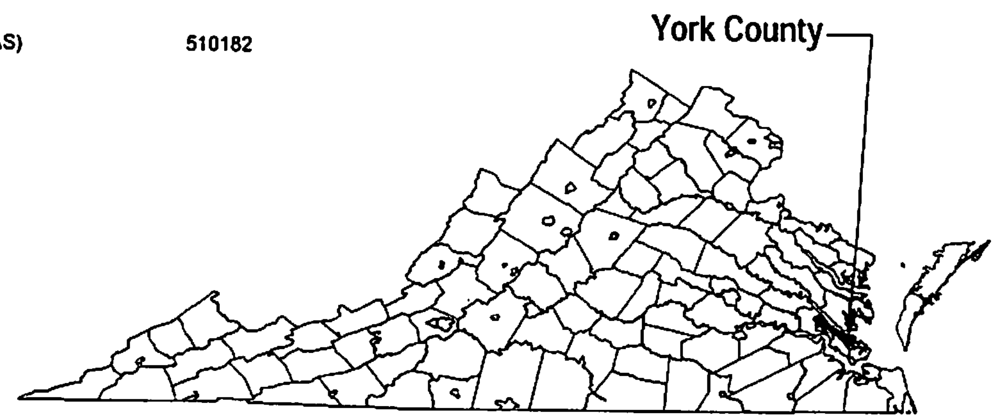
FLOOD INSURANCE STUDY

YORK COUNTY, VIRGINIA
AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
YORK COUNTY (UNINCORPORATED AREAS)	510182



June 16, 2009

Federal Emergency Management Agency
FLOOD INSURANCE STUDY NUMBER
51199CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

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

Part or all of this FIS report may be revised and republished at any time. In addition, part of this FIS report may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. 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 report components.

Initial Countywide FIS Effective Date: June 16, 2009

FLOOD INSURANCE STUDY
YORK COUNTY, VIRGINIA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of the unincorporated areas of York County, Virginia (referred to collectively herein as York County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Act of 1973. There are no incorporated communities within York County. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain development. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

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

1.2 Authority and Acknowledgements

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

For the original December 16, 1988 FIS, the hydrologic and hydraulic analyses were prepared by the Norfolk District of the U.S. Army Corps of Engineers (USACE) for the Federal Emergency Management Agency (FEMA), under Interagency Agreement No. EMW-84-E-1506, Project Order No. 1, Amendment No. 20. That work was completed in October 1986.

For this revision and update, the FIS was prepared by the USACE for FEMA, under Interagency Agreement No. HSFE03-05-X-0005, Project Order No. P403558Y/ P403560Y. This work was completed in January 2007. This FIS was revised to show updated community description information, historical flood information, FEMA contact information, and bibliography and references. The hydrologic and hydraulic analyses have not been revised or updated. The revised FIS also includes information regarding survey bench marks and vertical datums. The previous FIRMs were converted to a digital format, utilizing geographic information system (GIS) vector data as the base map. The floodplain boundaries were also revised to reflect updated topographic data (Reference 1).

Base map vector data was provided in digital format by the York County Computer Support Services office. This information was compiled from various sources dating from 1990 to 2005 (Reference 2). The projection used in the preparation of the FIRMs is Universal Transverse Mercator Zone 18. The horizontal datum is the North American Datum of 1983, Geodetic Reference System 80 Spheroid.

1.3 Coordination

The purpose of an initial Consultation and Coordination Officer's (CCO) meeting is to discuss the scope of the FIS. A final CCO meeting is held to review the results of the study. Contacts with various state and federal agencies were made during the study in order to minimize possible hydrologic and hydraulic conflicts. A search for basic data was made at all levels of government.

For the original FIS, an initial CCO meeting was held on June 12, 1979 with representatives of FEMA, York County, the Virginia State Water Control Board, and an architect/engineering firm. At this meeting, the nature and purpose of the study and the scope and limits of the work were explained, and flood information currently available concerning the county was obtained. On February 2, 1984, an intermediate CCO meeting was held to review the scope of work with the USACE. A final CCO meeting was held on January 28, 1988, attended by representatives of FEMA, York County, the Virginia State Water Control Board, and the USACE.

For this revision, an initial CCO meeting was held on March 15, 2005, with representatives of FEMA, York County, the Virginia Department of Conservation and Recreation, and the USACE (the study contractor). A final CCO meeting was held on April 3, 2008 and attended by representatives of FEMA, York County, the Virginia Department of Conservation and Recreation, and the USACE.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of York County, Virginia.

Tidal flooding, including its wave action from the Chesapeake Bay, Chisman Creek, Back Creek, Brick Kiln Creek, and the York River and their adjoining estuaries were studied by detailed methods. All areas within the county which are affected by tidal flooding were included in the detailed study. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

All streams in the county not affected by tidal flooding were studied by approximate methods. Generally, these studies were extended up the streams to where the drainage area is less than one square mile. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The following flooding sources were studies by approximate methods: Skimino Creek, Waller Mill Reservoir, Carter Creek, Barlows Pond, King Creek, Beaverdam Creek, Baptist Run, Great Run, Poquoson River, City of Newport News Reservoir, Harwoods Mill Reservoir, and Big Bethel Reservoir. The scope and methods of the study were proposed to, and agreed upon by, FEMA and York County.

2.2 Community Description

York County is located on Virginia's Coastal Plain, on a peninsula bordered by the York and James Rivers and the Chesapeake Bay. It is bordered by the Cities of

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Flood Insurance Rate Maps (Published Separately)

Poquoson, Hampton, and Newport News to the east and south; by the City of Williamsburg and the unincorporated areas of James City County to the west; and the unincorporated areas of Gloucester County to the north. The county has approximately 108 square miles of land area, is rectangular in shape, approximately 27 miles in length, and 6 miles in width (Reference 3). The population of York County was 35,463 in 1980, 42,422 in 1990, 56,297 in 2000, and estimated at 61,758 in 2005 (Reference 4).

York County, first called Charles River County, was one of Virginia's original shires formed in 1634. York County has played a major role in the development of this nation. It was at Yorktown on October 19, 1781, that Lord Cornwallis surrendered his British Army to the Allied French and American forces bringing a close to the Revolutionary War. Yorktown and York County also played roles in the War of 1812 and the Civil War. In 1917-18, during World War I, the York River was the base for the Atlantic Fleet of the U.S. Navy. During World War II, several important military installations were enlarged or added, and further expansion has taken place since. These installations now include the U.S. Coast Guard Training Center, the Naval Weapons Station, Cheatham Annex, and Camp Perry (Reference 3).

York County is located in the Coastal Plain province and is underlain primarily by sand, gravel, clay, and marl strata. The county is characterized by a series of distinct level flats, called scarps, and rolling plains progressing from the low-lying areas along the Chesapeake Bay to the uplands in the northwestern portion of the county, reaching elevations of approximately 100 feet above sea level.

The area enjoys a temperate climate with moderate seasonal changes. The climate is characterized by moderately warm summers with temperatures averaging approximately 78 degrees Fahrenheit (°F) during July, the warmest month. The winters are cool with temperatures averaging approximately 40°F in January, the coolest month. The annual precipitation over the area averages approximately 44 inches. There is some variation in the monthly averages; however, this rainfall is distributed evenly throughout the year. Snowfall averages six inches each year, generally occurring in light falls which normally melt within 24 hours (Reference 5).

Being strategically located within the Hampton/Newport News metropolitan area, approximately midway between Richmond and Norfolk, the economy of York County is significantly influenced by the economies and development of all peninsula jurisdictions. Today, the economy of the county is primarily oriented toward the retail, service, and tourism industries. Tourism is very important to York County with the attractions at Jamestown, Williamsburg, and Yorktown.

The floodplains of York County are concentrated in the eastern portion of the county among the numerous peninsula-like landforms created by the tidal waters of the Chesapeake Bay, the York River, and their estuaries. Residential development has concentrated on many of these peninsulas because of the desirability of waterfront locations. York County has become increasingly attractive as a residential location for persons employed in Newport News, Hampton, or Williamsburg. With the county's many miles of shoreline, there will be pressure for future development in the floodplain.

2.3 Principal Flood Problems

The coastal areas of York County are vulnerable to tidal flooding from major storms such as hurricanes and northeasters. Both types of storms produce winds which push large volumes of water against the shore.

The type of storm which affects the area most severely is the hurricane with its high winds and heavy rainfall, which produces large waves and tidal flooding. The term hurricane is applied to an intense cyclonic storm originating in tropical or subtropical latitudes in the Atlantic Ocean just north of the equator. While hurricanes may affect the area from May through November, nearly 80 percent occur in the months of August, September, and October with approximately 40 percent occurring in September. From analysis of records from 1944 to 1999 for hurricanes passing within approximately 100 miles, there is approximately a 40 percent chance that York County will be affected by a hurricane (Reference 6). The most severe hurricanes on record to strike the study area occurred in August 1933 and Hurricane Isabel in September 2003. Another notable hurricane which caused significant flooding in York County occurred in September 1936.

Another type of storm which could cause severe damage to the county is the northeaster. This is also a cyclonic type of storm and originates with little or no warning along the middle and northern Atlantic coast. These storms occur most frequently in the winter months but may occur at any time. Accompanying winds are not of hurricane force but are persistent, causing above-normal tides for long periods of time. The March 1962 northeaster was the worst ever recorded in the county.

The amount and extent of damage caused by any tidal flood will depend upon the topography of the area flooded, rate of rise of floodwaters, the depth and duration of flooding, the exposure to wave action, and the extent to which structures have been placed in the floodplain. The depth of flooding during these storms depends upon the velocity, direction, and duration of the wind; the size and depth of the body of water over which the wind is acting; and the astronomical tide. The duration of flooding depends upon the duration of the tide-producing forces. Floods caused by hurricanes are usually of much shorter duration than those caused by northeasters. Flooding from hurricanes rarely lasts more than one tidal cycle, while flooding from northeasters may last several days, during which the most severe flooding takes place at the time of the peak astronomical tide.

The timing or coincidence of the maximum storm surge with the normal high tide is an important factor in the consideration of flooding from tidal sources. Tidal waters in the county from the Chesapeake Bay normally fluctuate twice daily with a mean tide range of approximately 2.4 feet (Reference 7). The range of fluctuation may vary slightly in most of the connecting bays and inlets.

All development in the floodplain is subject to water damage. Some areas, depending on exposure, are subject to high velocity wave action which can cause structural damage and severe erosion along beaches. Waves are generated by the action of wind on the surface of the water. Wave heights at any location are dependent upon the velocity, direction, and duration of the wind, and the length, width, and depth of water over which the wind is acting. Portions of the eastern and northern shorelines of York

County are vulnerable to wave damage due to the vast exposure afforded by the Chesapeake Bay.

York County has experienced major storms since the early settlement of the area. Historical accounts of severe storms in the area date back several hundred years. The following paragraphs discuss some of the larger known storms which have occurred in recent history. This information is based on newspaper accounts, historical records, field investigations, and routine data collection programs normally conducted by the USACE.

The August 23, 1933, hurricane was one of the most destructive for this area as well as for the remainder of the Chesapeake Bay region. The hurricane entered the mainland near Cape Hatteras, North Carolina on August 22, passed slightly west of Norfolk, and continued in a northern direction accompanied by extreme winds and tides. At Norfolk, gusts of wind reached measured velocities of 88 miles per hour (mph), although the maximum sustained velocity was only 56 mph. The storm surge in the Chesapeake Bay and tidal estuaries was the highest on record. At Gloucester Point, the elevation of flooding reached 8.8 feet, referenced to the National Geodetic Vertical Datum of 1929 (NGVD). In addition to damage from tidal flooding, much damage was caused to roofs, communication lines, and other structures by the high wind. Damage of this nature is characteristic of that caused by hurricanes (Reference 8).

The eye of the September 18, 1936, hurricane passed approximately 20 miles east of Cape Henry. High tides and gale force winds caused much damage throughout the lower Chesapeake Bay area as the storm moved off to the northeast. At Gloucester Point, the elevation of flooding reached 6.4 feet, NGVD. Damage was severe, and by occurring during the Depression period, became a double hardship on the populace (Reference 8).

On October 15, 1954, Hurricane Hazel entered the mainland south of Wilmington, North Carolina. The storm moved rapidly northward, passing approximately 60 miles inland through Virginia in the early afternoon, causing high winds and moderately high tides. Hurricane force winds with gusts of 80 to 100 mph were experienced near the path of the storm center and eastward to the coast. The hurricane surge was not as high as the August 1933 storm although the tidal surge was superimposed on the normal high tide (Reference 8).

On March 6-8, 1962, a northeaster caused disastrous flooding and high waves all along the Atlantic Seaboard from New York to Florida. This storm was unusual even for a northeaster since it was caused by a low pressure cell which moved from south to north and then reversed its course, moving again to the south and bringing with it huge volumes of water and high waves. This storm caused severe tidal flooding in York County. Great destruction was caused by high waves and breakers superimposed on high tides. The waves and breakers undermined and collapsed buildings, eroded beaches and roads, interrupted communications, and damaged power lines. Damaging high water occurred on five successive high tides over a period of two days, and disrupted all normal activities for several days in the area (Reference 9). At Gloucester Point, the elevation of flooding reached 5.8 feet, NGVD.

In November 1985, high winds and tides combined to play havoc with the Chesapeake Bay and York River shoreline in the worst storm in decades. The storm was a product of a low pressure system that swept up the Atlantic Seaboard. Northeast winds in excess of 65 mph pushed tides above normal and battered piers, bulkheads, boats, boathouses, and other waterfront structures along the exposed areas. In Yorktown, along Water Street, most of the sidewalk was destroyed and sections of the road undermined. Yorktown Beach lost at least 500 tons of sand reducing the width and length of the beach. County officials said damage to the beach was some of the worst in 25 years (Reference 10).

The most recent tidal stage of major proportions occurred during Hurricane Isabel, making landfall on September 18, 2003 along the Outer Banks of North Carolina and tracking northward through Virginia and up to Pennsylvania. At landfall, maximum sustained winds were estimated at 104 mph. Isabel weakened to a tropical storm by the time it moved into Virginia and lost tropical characteristics as it moved into Pennsylvania. The storm caused high winds, storm surge flooding, and extensive property damage throughout the Chesapeake Bay region. Within Virginia, ninety-nine communities were directly affected by Isabel. There were thirty-three deaths, over a billion dollars in property damage, and over a million electrical customers without power for many days (Reference 11). Historical maximum water level records were exceeded at several locations within the Chesapeake Bay. In general, maximum water levels in the lower Chesapeake Bay resembled those of the August 1933 hurricane, with storm surge occurring around the time of the predicted high tide. Some communities along the Chesapeake Bay and its tributaries also experienced severe damage from wave action (Reference 12).

2.4 Flood Protection Measures

There are no existing flood control structures that would provide protection during major floods in the study area. There are a number of measures that have afforded some protection against flooding, including bulkheads and seawalls, jetties, sand dunes, and non-structural measures for floodplain management such as zoning codes. The "Uniform Statewide Building Code" which went into effect in September 1973 states, "where a structure is located in a 100-year floodplain, the lowest floor of all future construction or substantial improvement to an existing structure . . ., must be built at or above that level, except for non residential structures which may be floodproofed to that level" (Reference 13). These requirements will no doubt be beneficial in reducing future flood damages in the county.

3.0 ENGINEERING METHODS

For the flooding sources studied by detail methods 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 that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (four in ten); for any

90-year period, the risk increases to approximately 60 percent (six in ten). The analyses reported herein reflect flooding potentials based on conditions existing in the county 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 elevation-frequency relationships for each flooding source studied in detail affecting the county.

Tide records for York County are inadequate to establish a tide frequency relationship. The adopted tide frequency was obtained by a correlation of the tide frequency curve developed for the Norfolk Harbor gage (located approximately 10 miles inside the Chesapeake Bay) with available tide records and high-water marks at Gloucester Point. There are historical accounts of tidal flooding for nearly 300 years, but a reasonably accurate indication of the heights reached in Norfolk Harbor is available only since 1908 and a complete record since 1928. The Gloucester Point gage was in operation from 1950 through 1968.

The procedure used to develop the frequencies for York County is as follows:

a. A Norfolk Harbor statistical analysis was performed in accordance with the procedures outlined in Bulletin 17B (Reference 14). The Pearson Type III methodology without the logs was incorporated for the selected period of record from 1928 through 1978. The Pearson Type III distribution without the logs was selected as a result of the following:
   (1) A number of different distributions were fitted to tidal elevation data. The Pearson Type III distribution without the logs provided the best fit of the data points.
   (2) It was felt that a statistical analysis would produce a more reliable and reproducible result when compared to a graphical approach.

b. Consideration was given to separating hurricane and non-hurricane events. Although objective statistical approaches are available for incomplete samples (a hurricane related tide exists for less than 50 percent of the years on record), they do not always provide reasonable results. Therefore, all tropical and extratropical events were included together in the analysis of the annual maximum tides.

c. The analysis of the 51 years of systematic record indicated that the 1933 and 1936 events could be high outliers. However, assuming that the true distribution is defined by the computed (non-adjusted) statistics, the value for the 1933 event has an exceedence probability of 0.010. It has been determined that, with 51 years of record, the probability of an event this rare being exceeded is 40 percent. Since this risk is so high and it is known that several floods as large and possibly larger than the 1933 flood have historically occurred, the 1933 flood (and any smaller floods) was not considered to be a high outlier.

d. Historical accounts indicate that tides have occurred in Norfolk Harbor at approximately 8 feet, NGVD in 1667, 1785 and 1846. There has been a gradual rise in sea level over the investigated period of record at Norfolk Harbor. There was some question as to the amount of adjustment that should be made to the historic events. To avoid overestimating the impact of sea level rise, the historic events were increased by only 0.50 foot (approximately the same adjustment for the 1924 to 1942 period). The analysis, based on a historical period of 312 years, resulted in a slight move to the left of the upper portion of the frequency curve when compared to the systematic record. Since the adjustment was not very large and there is some question as to the reliability of the historical data, the USACE adopted the computed statistics based on the 51 years of systematic record.

e. The lower portion of the statistical curve was adjusted with a partial duration analysis using plotting positions in accordance with Weibull. It included all elevations above 4.26 feet, NGVD.

f. Tidal elevations were correlated between the Gloucester Point gage, with 19 years of continuous record, and Norfolk Harbor to determine estimated tidal heights for York County.

The stillwater elevations for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods have been determined for those portions of the Chesapeake Bay, the York River, and their adjoining estuaries pertinent to York County and are shown in Table 1. The tidal frequency relationship represents the combined effect of both hurricanes and northeasters on tidal flooding and reflects the random probability of surges occurring coincident with the normal astronomical tide. All elevations are referenced to NGVD.

TABLE 1 - SUMMARY OF STILLWATER ELEVATIONS

	Elevation (Feet)			
Flood Source and Location	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Chesapeake Bay and Estuaries				
Shoreline from York River to Poquoson River – includes Back Creek, Chisman Creek, and Poquoson River	5.5	7.1	7.7	9.3
Northwest Branch Back River – Shoreline along Brick Kiln Creek	5.8	7.8	8.5	9.8
York River				
Shoreline from Mouth to Amoco Tank Farm Docking Facilities	5.5	7.1	7.7	9.3
Shoreline from Amoco Tank Farm Docking Facilities to Coleman Memorial Bridge (U.S. Route 17)	5.3	6.8	7.5	9.3
Shoreline above Coleman Memorial Bridge (U.S. Route 17)	5.0	6.5	7.3	9.3

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on Tables 1, 2, and 3 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.

Hydraulic 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 of the selected recurrence intervals along each of the shorelines.

Special consideration was given to the vulnerability of York County to wave attack. The inclusion of wave heights, which is the distance from the trough to the crest of the wave, increases the water-surface elevation. The height of a wave is dependent upon wind speed and its duration, depth of water, and length of fetch. The wave crest elevation is the sum of the stillwater elevation and the portion of the wave height above the stillwater elevation. During severe storms such as the August 1933 hurricane, the March 1962 northeaster, and Hurricane Isabel in 2003, wave attack produced breaching and failure of bulkheads and dunes. The intruding waters caused damage to buildings and cropland.

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 15). The factors considered for such a determination include: choice of a suitable fetch, its length and width, sustained wind velocities, coastal water depths, and physical propagation. All of these factors are analyzed to determine if a wave with a height of 3 feet can be generated. The 3-foot wave has been determined as the minimum size wave capable of causing major damage to conventional wood frame or brick veneer structures. This criterion has been adopted by FEMA for the determination of V Zones.

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in the National Academy of Sciences (NAS) report (Reference 16). This method is based on three major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth, and the wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that the wave height may be diminished by the dissipation of energy due to the presence of obstructions such as sand dunes, dikes, seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures described in Reference 16. 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. The added energy is related to fetch length and water depth.

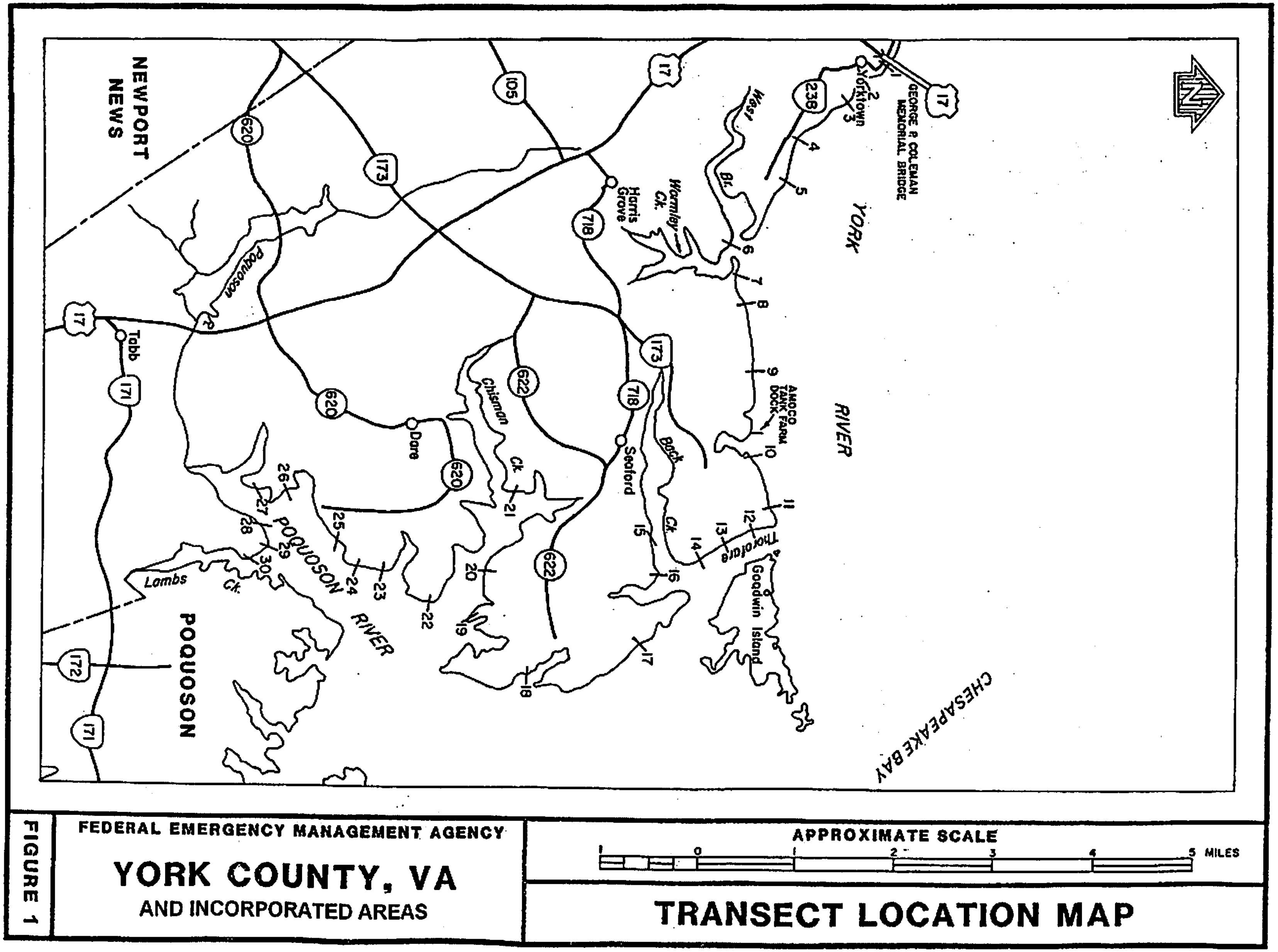
These concepts and equations were used to compute wave heights and wave crest elevations associated with the 1-percent-annual-chance storm surge. Accurate topographic, land-use, and land-cover data are required for the wave height analysis. Maps of the shoreline areas at a scale of 1:4,800 with a contour interval of 5 feet were used for the topographic data (Reference 17). The land-use and land-cover data were obtained from notes and photographs taken during field inspections, engineering judgment, and aerial photographs (Reference 18).

Wave heights were computed along transects (cross-section lines) that were located along the coastal areas, as illustrated in Figure 1, in accordance with the User's Manual for Wave Height Analysis (Reference 19). The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their proximity. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects. Table 2, "Transect Descriptions", provides a listing of the transect locations, stillwater elevations, and maximum wave crest elevations. All elevations are referenced to NGVD.

TABLE 2 - TRANSECT DESCRIPTIONS

		1-Percent-Annual-Chance Flood Elevation (Feet)	
Transect	Location	Stillwater	Maximum Wave
1 - 6	Shoreline along York River from Coleman Memorial Bridge (U.S. Route 17) to Wormley Creek	7.5	12
7 - 9	Shoreline along York River from Wormley Creek to Amoco Tank Farm Docking Facilities	7.5	12
10 - 11	Shoreline along York River from Amoco Tank Farm Docking Facilities to the Thorofare - Chesapeake Bay	7.7	12
12 - 14	Area along the east shoreline of the Thorofare From York River to Back Creek	7.7	12
15 - 16	Shoreline along Back Creek	7.7	12
17 - 18	Shoreline along Chesapeake Bay from Back Creek to Chisman Creek	7.7	12
19 - 21	Shoreline along Chisman Creek	7.7	12
22 - 29	Shoreline along Poquoson River from Chisman Creek to Lambs Creek	7.7	12
30	Shoreline along Lambs Creek	7.7	12

FIGURE 1 – TRANSECT LOCATION MAP



Each transect was taken perpendicular to the shoreline and extended inland to a point where wave action ceased. Along each transect, wave heights and wave crest elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The 1-percent-annual-chance stillwater elevations were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave crest elevations were determined at whole-foot increments along the transect. The calculations were carried inland along the transect until the wave crest elevation was permanently less than 0.5 foot above the stillwater surge elevation. The location of the 3-foot breaking wave for determining the terminus of the V Zone (area with velocity wave action) was also computed at each transect. It was assumed that the beach area would erode during a major storm, thus reducing its effectiveness in decreasing wave heights.

Figure 2 is a profile for a typical transect illustrating the effects of energy dissipation and regeneration on a wave as it moves inland. This figure shows the wave crest elevations being decreased by obstructions, such as buildings, vegetation, and rising ground elevations, and being increased by open, unobstructed wind fetches. Actual conditions in York County may not include all the situations illustrated in Figure 2.

After analyzing wave heights along each transect, wave crest elevations were interpolated between transects. Various source data were used in the interpolation, including the topographic work maps, notes and photographs taken during field inspections, and engineering judgment (References 17 and 18). Controlling features affecting the wave crest elevations were identified and considered in relation to their positions at a particular transect and their variation between transects. The results of the calculations are accurate until local topography, vegetation, or cultural development within the county undergo any major changes. The results of this analysis are summarized in Table 3. All elevations are reference to NGVD.

For streams studied by approximate methods, the 1-percent-annual-chance flood boundaries were determined using the slope/area method.

FIGURE 2 - TYPICAL TRANSECT SCHEMATIC

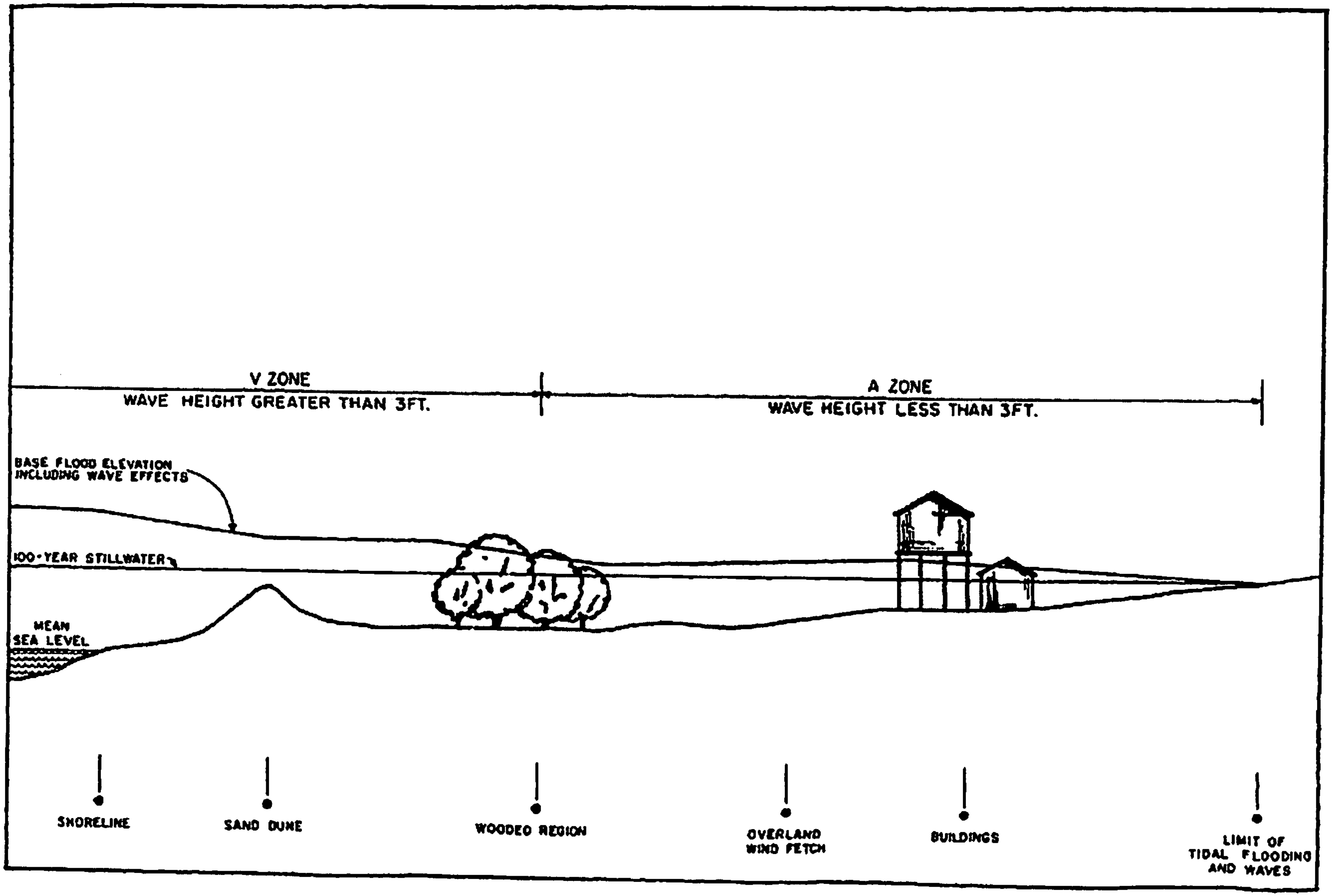


TABLE 3 - TRANSECT DATA

Flooding Source	Stillwater Flood Elevation (Feet) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance	Base Flood Elevation (Feet)[1]
York River					
Upstream of Coleman Memorial Bridge (U.S. Route 17)	5.0	6.5	7.3	9.3	7 - 12
Transects 1 - 9	5.3	6.8	7.5	9.3	8 - 12
Transects 10 - 11	5.5	7.1	7.7	9.3	8 - 12
Chesapeake Bay					
Transects 12 - 30	5.5	7.1	7.7	9.3	8 - 12
Backwater on Brick Kiln Creek	5.8	7.8	7.3	9.8	9

[1]Due to map scale limitations, Base Flood Elevations (BFEs) shown on the FIRM represent average elevations for the depicted Zones.

Qualifying bench marks (elevation reference marks) within a given jurisdiction that are cataloged 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.

Bench marks cataloged 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 well (e.g., mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation well (e.g., concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movement (e.g., concrete monument below frost line)
- Stability D: Mark of questionable or unknown stability (e.g., concrete monument above frost line, or steel witness post)

In addition to NSRS bench marks, 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 bench marks shown on the FIRM for this jurisdiction, please contact the Information Services Branch of the NGS at (301) 713-3242, (Internet address 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 this FIS and FIRMs. Interested individuals may contact FEMA to access this data.

3.3 Vertical Datum

All FISs and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created and revised FISs and FIRMs was NGVD. With the finalization of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are being prepared using NAVD as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRMs are referenced to NGVD. Structure and ground elevations in the community must, therefore, be referenced to NGVD. It is important to note that adjacent communities may be referenced to NAVD. This may result in differences in BFEs across the corporate limits between the communities.

For more information on NAVD, see Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication FIA-20/June 1992, or contact the Spatial Reference System Division, National Geodetic Survey, National Oceanic and Atmospheric Administration, Silver Spring Metro Center, 1315 East-West Highway, Silver Spring, Maryland 20910 at (301) 713-3191 (Internet address www.ngs.noaa.gov).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides 1-percent-annual-chance floodplain data, which may include a combination of the following: 10-percent-annual-chance, 2-percent-annual chance, 1-percent-annual-chance, and 0.2-percent-annual-chance flood elevations; delineations of the 1-percent-annual-chance and 0.2-percent-annual-chance floodplains; and 1-percent-annual-chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of the FIS report, including Summary of Stillwater Elevations Table, Transect Descriptions Table, and Transect Data Table. Users should reference the data presented in the FIS report as well as additional information that may be available at the local map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the county. For the flooding sources studied in detail, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using GIS technology and digital elevation data supporting a topographic contour interval of 2 feet (Reference 1).

For the tidal areas with wave action, the 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 maps (Reference 17 and 18). The 1-percent-annual-chance floodplain was divided into whole-foot elevation zones based on the average wave crest envelope in that zone. Where the map scale did not permit these zones to be delineated at 1-foot intervals, larger increments were used.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones AE 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- 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.

5.0 INSURANCE APPLICATION

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

Zone A

Zone A is the flood insurance 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 BFEs or base flood 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 BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone V

Zone V is the flood insurance rate 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 BFEs 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, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by levees. No BFEs or depths are shown within this zone.

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

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

The current FIRMs present flooding information for the entire geographic area of York County. Historical data relating to the previous maps prepared for the community is presented in Table 4.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
York County (Unincorporated Areas)	November 29, 1974	July 2, 1982	December 16, 1988	

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
YORK COUNTY, VA
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

A search was made for existing literature on the flood hazards in York County. In 1978, the Virginia Institute of Marine Science (VIMS), under contract to FEMA, prepared a storm surge model for predicting storm surges along the Chesapeake Bay, both eastern and western shores (References 20 and 21). Consideration was given to these frequency studies, but they were not adopted in this report. An evaluation of the data led to conclusions that the elevations should be higher than presented. At Gloucester Point, for instance, the VIMS 1.0 exceedence frequency was determined to be at elevation 5.9 feet, NGVD. In the last 50 years alone, records indicate that this value was either approached or exceeded several times. Specifically, those dates and elevations are: August 23, 1933 – 8.8 feet; September 18, 1936 – 6.4 feet; March 7, 1962 – 5.8 feet; and September 16, 1933 – 5.1 feet; all referenced to NGVD. Several other storms would probably have reached these elevations had they coincided with the peak astronomical tide.

FIS reports have been prepared for the unincorporated areas of Gloucester *and James City* Counties and for the Cities of Poquoson, Hampton, Newport News, and Williamsburg (References 22, 23, 24, 25, 26, and 27). Some of the tidal elevations in those studies are not in numerical agreement with this study. However, the tidal elevations are in agreement from a hydrologic standpoint. The numerical discrepancies are a result of the varying flood tidal elevations that are produced because of the different exposures encountered in the bay, river, and estuary configurations.

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

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this FIS can be obtained by contacting FEMA, Federal Insurance and Mitigation Division, Sixth Floor, 615 Chestnut Street, Philadelphia, Pennsylvania 19106-4404.

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