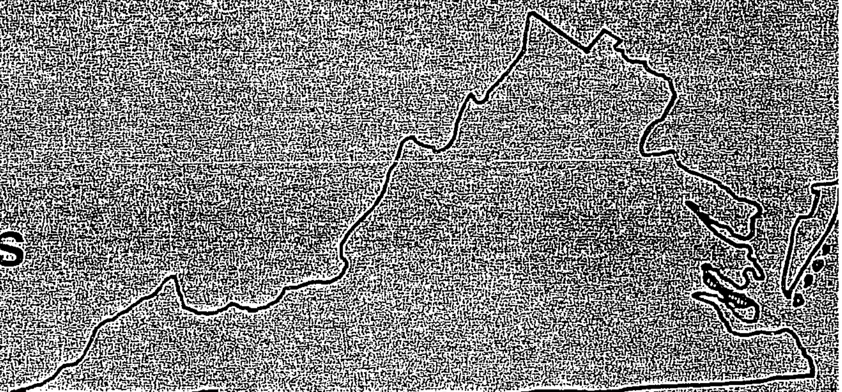
FLOOD INSURANCE STUDY

YORK COUNTY, VIRGINIA
UNINCORPORATED AREAS



DECEMBER 16, 1988

Federal Emergency Management Agency

COMMUNITY NUMBER - 510182

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 study 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.

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FLOOD INSURANCE STUDY
UNINCORPORATED AREAS OF YORK COUNTY, VIRGINIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the unincorporated areas of York County, Virginia, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

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

1.2 Authority and Acknowledgments

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

The hydrologic and hydraulic analyses for this study were prepared by the Norfolk District of the U. S. Army Corps of Engineers (COE) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement EMW-84-E-1506, Project Order No. 1, Amendment No. 20. This work was completed in October 1986.

1.3 Coordination

On June 12, 1979, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA, the 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 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 Norfolk District of the COE (the study contractor).

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.

On January 28, 1988, the results of the study were reviewed at a final CCO meeting attended by representatives of FEMA, the county, the Virginia State Water Control Board, and the study contractor.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated area of York County, Virginia. The area of study is shown on the Vicinity Map (Figure 1).

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. These flooding sources were extended up the stream to where the drainage area is less than one square mile. 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 through October 1991.

The following flooding sources were studied by approximate methods: Skimino Creek, Waller Mill Reservoir, Carter Creek, Barlows Pond, King Creek, Beaverdam Creek, Baptist Run, Great Run, the Poquoson River, City of Newport News Reservoir, Harwoods Mill Reservoir, and Big Bethel Reservoir. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of 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 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 1). The 1980 population of the county was 35,463 (Reference 2).

York County, first called Charles River County, was one of Virginia's original shires formed in 1634 (Reference 3). 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 1950. These installations now

include the U. S. Coast Guards Officers School, the Naval Weapons Station, the Cheatham Annex of the Norfolk Naval Supply Center, two naval fuel facilities, and Camp Peary (Reference 3).

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 and to a lesser extent by those of the Richmond and Norfolk areas. The largest employers in the area are the Federal government and the Newport News Shipbuilding and Drydock Company. Tourism is very important to York County with the attractions at Jamestown, Williamsburg, and Yorktown.

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, pronounced 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 100 feet.

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 and the York River and their estuaries. York County has become increasingly attractive as a residential location for persons employed in Newport News, Hampton, or Williamsburg. Residential development has concentrated on many of these peninsulas because of the desirability of waterfront locations. With the county's many miles of shoreline, there will be pressure for future development in the floodplains.

York County enjoys a temperate climate with moderate seasonal changes characterized by warm summers and cool winters. Temperatures average approximately 78 degrees Fahrenheit (^{o}F) during July, the warmest month, and 41^{o}F in January, the coolest month. Annual precipitation over the area averages approximately 43 inches (Reference 3). There is some variation in the monthly averages; however, this rainfall is distributed uniformly throughout the year. Snowfall is infrequent, generally occurring in light amounts and usually melting in a short period of time.

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 that push large volumes of water against the shore.

With their high winds and heavy rainfall, hurricanes are the most severe storms that can hit the study area. The term hurricane is applied to an intense cyclonic storm originating in tropical or subtropical latitudes in the Atlantic Ocean north of the equator.

A study of tracks of all tropical storms for which there is a record indicates that once a year on an average, a tropical storm of hurricane force passes within 250 miles of the area, and poses a threat to York County. 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. The most severe hurricane to strike the county occurred in August 1933.

Another type of storm that 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 can 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 to ever hit the study area.

The amount and extent of damage caused by any tidal flood will depend on the topography of the area flooded, the rate of rise of floodwaters, the depth and duration of flooding, the exposure to wave action, and the extent to which damageable property have been placed in the floodplain. The depth of flooding during these storms depends on 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 on the duration of 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 can 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 for the Chesapeake Bay normally fluctuate twice daily from elevation 1.2 feet to minus 1.2 feet (Reference 4). The range of fluctuation may vary slightly in some of the connecting bays and inlets.

All development in the floodplain is subject to water damage. Some areas, depending upon exposure, are subject to high velocity wave action, which can cause structural damage and severe erosion along the shoreline. Waves are generated by the action of wind on the surface of the water. Portions of the eastern and northern shorelines of York County are vulnerable to wave damage because of 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 floods that have occurred in recent history.

The August 23, 1933, hurricane was 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, passed slightly west of Norfolk, and continued in a northern direction accompanied by extreme wind and tide. At Norfolk, gusts of wind reached measured velocities of 88 miles per hour (m.p.h.) although the maximum sustained velocity was only 56 m.p.h. The storm surge in the Chesapeake Bay and tidal estuaries was the highest of record. At Gloucester Point, the elevation of flooding reached 8.8 feet. 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 to be expected during a hurricane (Reference 5).

On September 18, 1936, a hurricane passed approximately 20 miles east of Cape Henry on the morning of the 18th. 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. Damage was severe, and by occurring during the depression period, became a double hardship on the populace (Reference 5).

On October 15, 1954, Hurricane Hazel, entered the mainland south of Wilmington, North Carolina. The storm moved rapidly northward, passing through Virginia in the early afternoon. Hurricane force winds with gusts of 70 to 100 m.p.h. 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 of the normal high tide (Reference 5).

The northeast storm of March 6-8, 1962, brought disastrous flooding and high waves all along the Atlantic Seaboard from New York to Florida. This storm was unucual even for a northeaster since it was caused by a low pressure cell that moved from south to north and then reversed its course moving again to the south and bringing with it high 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 2 days, and disrupted all normal activities for several days in the area (Reference 6). At Gloucester Point, the elevation of flooding reached 5.8 feet.

In November 1985, high winds and tides combined to play havoc with the Rappahannock 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 m.p.h. pushed tides above normal and battered piers, bulkheads, 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 7).

2.4 Flood Protection Measures

There are no existing flood control structures that would provide protection during major floods in the county. 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" that went into effect in September 1973 states, "where a structure is located in a 100-Year flood plain, the lowest floor of all future construction or substantial improvement to an existing structure..., must be built at or above that level, except for nonresidential structures which may be floodproofed to that level" (Reference 8). These requirements will be beneficial in reducing future flood damage in the county.

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 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 <u>average</u> 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 100-year flood (1 percent chance of annual exceedence) 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 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 established in 1950.

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 9). 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 floods could be high outliers. However, assuming that the true distribution is defined by the computed (non-adjusted) statistics, the value for the 1933 flood has an exceedence probability of 0.010. It was determined that, with 51 years of record, the probability of a flood 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 in 1667 and 1785 and approximately 7.9 feet in 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 historical floods. To avoid overestimating the impact of the rise in sea level, the historical floods were increased by only 0.50 feet (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 COE 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 (Reference 9). It included all elevations above 4.26 feet.

f. Tidal elevations were correlated at the Gloucester Point gage for Norfolk Harbor to determine estimated tidal heights for York County.

The stillwater elevations for the 10-, 50-, 100-, and 500-year floods have been determined for the Chesapeake Bay, and 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.

TABLE 1 - SUMMARY OF STILLWATER ELEVATIONS

	ELEVATION (feet)			
FLOODING SOURCE AND LOCATION	10-YEAR	50-YEAR	100-YEAR	500-YEAR
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
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

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 that of the August 1933 hurricane, wave attack produced breaching and failure of bulkheads. The intruding waters caused damage to residences and commercial buildings.

Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The COE has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones (Reference 10). 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 and brick veneer structures. This criterion has been adopted by FEMA for the determination of V-zones.

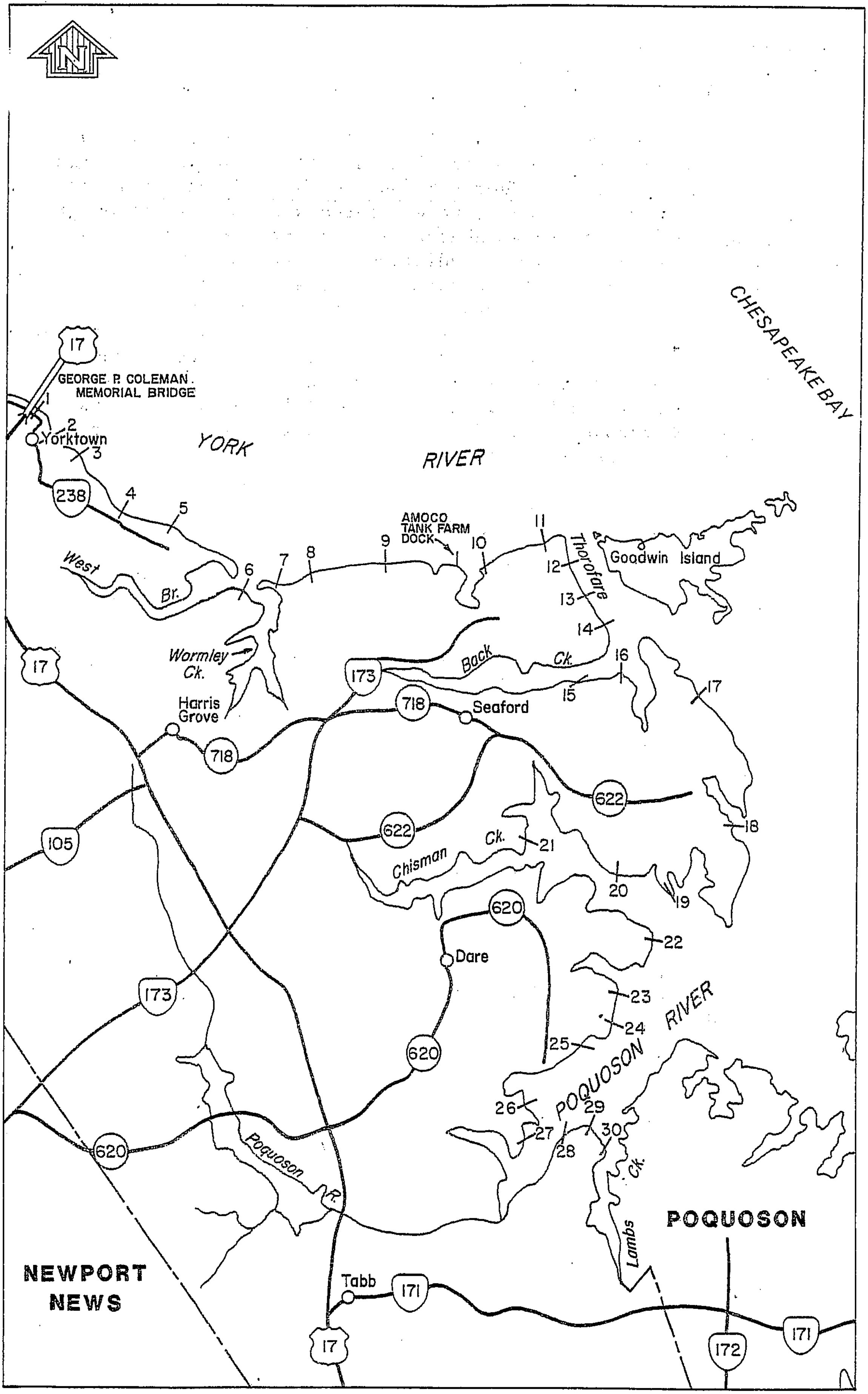
The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in the National Academy of Sciences (NAS) report (Reference 11). This method is based on three major concepts. First, depth-limited waves in shallow water reach a maximum breaking height 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 11. 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.

These concepts and equations were used to compute wave heights and wave crest elevations associated with the 100-year storm surge. Accurate topographic, land-use, and land-cover data are required for the wave height analysis. Maps of the shoreline areas subject to wave action at a scale of 1:4,800 with a contour interval of 5 feet were used for the topographic data (Reference 12). The land-use and land-cover data were obtained from notes and photographs taken during field inspections and aerial photographs (Reference 13).

Wave heights were computed along transects (cross-section lines) that were located along the coastal areas, as illustrated in Figure 2, in accordance with the User's Manual for Wave Height Analysis (Reference 14). 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 locality. 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 and stillwater elevations, as well as initial wave crest elevations.

TABLE 2 - TRANSECT DESCRIPTIONS

Transect	Location	Elevation (feet) Stillwater 100-year	Elevation (feet) Maximum Wave Crest 100-year
Nos. 1 to 6	Shoreline along York River from Coleman Memorial Bridge (U. S. Route 17) to Wormley Creek	7.5	12
Nos. 7 to 9	Shoreline along York River from Wormley Creek to Amoco Tank Farm Docking facilities	7.5	12
Nos. 10 to 11	Shoreline along York River from Amoco Tank Farm Docking Facilities to Thorofare-Chesapeake Bay	7.7	12
Nos. 12 to 14	Area along the east shoreline of the Thorofare from York River to Back Creek	7.7	12
Nos. 15 to 16	Shoreline along Back Creek	7.7	12
Nos. 17 to 18	Shoreline along Chesapeake Bay from Back Creek to Chisman Creek	7.7	12



APPROXIMATE SCALE

0 1 2 3 4 5 MILES

TRANSECT LOCATION MAP

FEDERAL EMERGENCY MANAGEMENT AGENCY

YORK COUNTY, VA.

(Unincorporated Areas)

FIGURE 2

TABLE 2 - TRANSECT DESCRIPTIONS - continued

Transect	Location	Elevation (feet) Stillwater 100-year	Elevation (feet) Maximum Wave Crest 100-year
Nos. 19 to 21	Shoreline along Chisman Creek	7.7	12
Nos. 22 to 29	Shoreline along Poquoson River from Chisman Creek to Lambs Creek	7.7	12
No. 30	Shoreline along Lambs Creek	7.7	12

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 100-year 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.

Figure 3 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 3.

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, aerial photographs, notes and photographs taken during field inspection, and engineering judgment (References 12 and 13). 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 community undergo any major changes. The results of this analysis are summarized in Table 3.

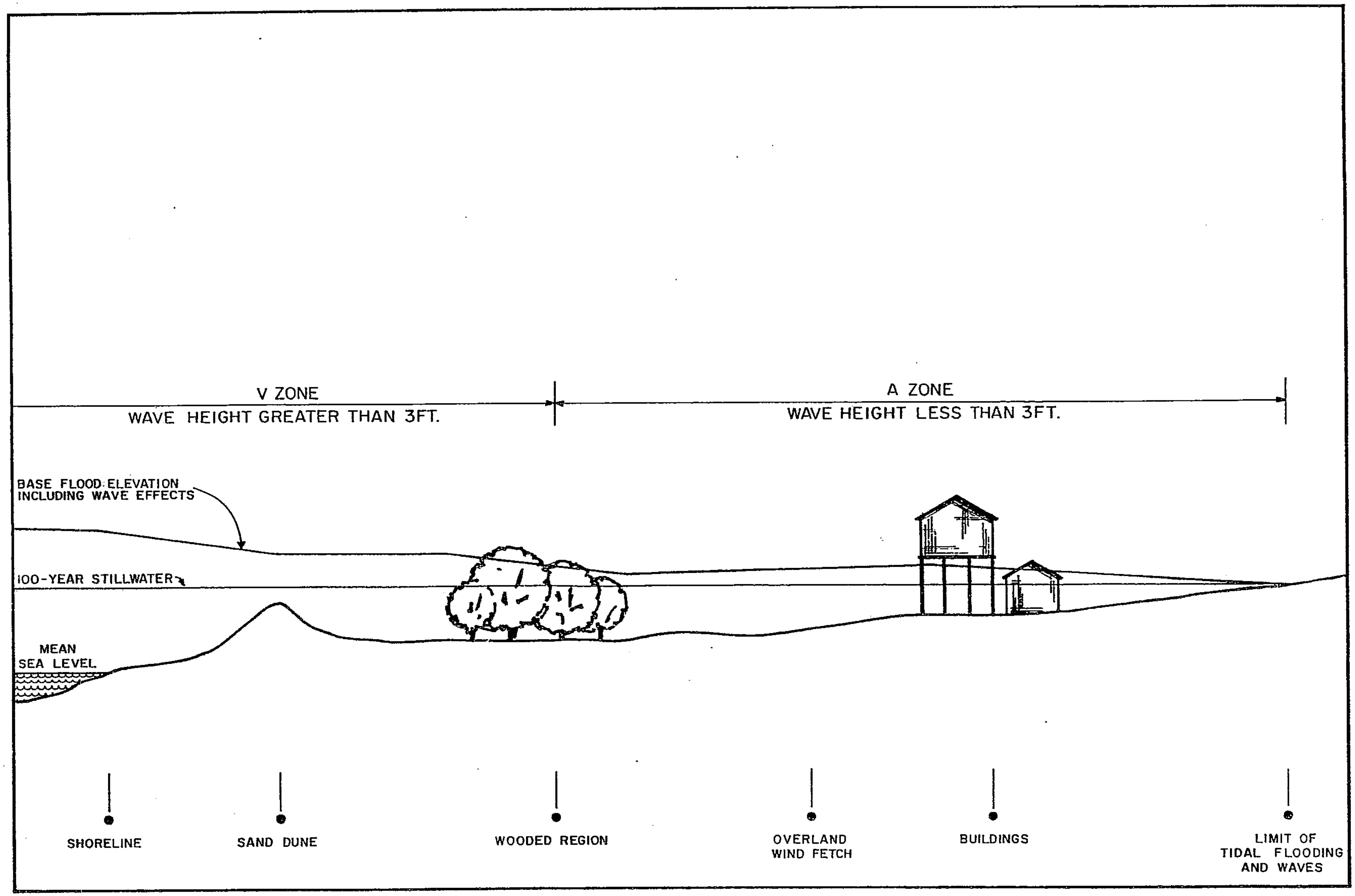


FIGURE 3
TYPICAL TRANSECT SCHEMATIC

TABLE 3 - TRANSECT DATA

Flooding Source	Stillwater Elevation 10-Year	50-Year	100-Year	500-Year	Zone	Base Flood Elevation * (Feet NGVD)
York River						
Upstream of Coleman Memorial Bridge (U. S. Route 17)	5.0	6.5	7.3	9.3	VE	9-12
					AE	7-9
Transects 1-9	5.3	6.8	7.5	9.3	VE	10-12
					AE	8-10
Transects 10-11	5.5	7.1	7.7	9.3	VE	10-12
					AE	8-10
CHESAPEAKE BAY						
Transects 12-30	5.5	7.1	7.7	9.3	VE	10-12
					AE	8-10
Backwater on Brick Kiln Creek	5.8	7.8	8.5	9.8	AE	9

*Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.

For the streams studied by approximate methods, the 100-year flood boundaries were determined using the slope/area method.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 2).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For tidal areas without wave action, the 100-year and 500-year boundaries were delineated using topographic maps at a scale of 1:4,800 with a contour interval of 5 feet (Reference 12). 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 at a scale of 1:4,800 with a contour interval of 5 feet (Reference 12). The 100-year floodplain was divided into whole-foot elevation zones based on the average wave crest elevation in that zone. Where the map scale did not permit these zones to be delineated at one foot intervals, larger increments were used.

For the flooding sources studied by approximate methods, the boundary of the 100-year flood was delineated using topographic maps and the Flood Hazard Boundary Map for the unincorporated areas of York County (References 12 and 15).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 1). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, and VE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year 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 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 1).

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 100-year floodplains that are determined in the Flood Insurance Study 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 100-year floodplains that are determined in the Flood Insurance Study 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 rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year 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 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

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

6.0 FLOOD INSURANCE RATE MAP

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

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows 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 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

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 16 and 17). 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 percent 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 NGVD; September 18, 1936, 6.4 feet NGVD; March 7, 1962, 5.8 feet NGVD; and September 16, 1933, 5.1 feet NGVD. Several other storms would probably have reached these elevations had they coincided with the peak astronomical tide.

A Flood Insurance Study for the unincorporated areas of Gloucester County is currently being prepared (Reference 18); and Flood Insurance Studies for the Cities of Poquoson, Hampton, Newport News, and Williamsburg have been published (References 19, 20, 21, and 22). 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.

Due to its more detailed nature, this study supersedes the Flood Hazard Boundary Map for the unincorporated areas of York County (Reference 15).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

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20. Federal Emergency Management Agency, Flood Insurance Study, City of Hampton, Independent City, Virginia, Washington, D. C., July 16, 1984.

21. Federal Emergency Management Agency, _Flood Insurance Study, City of Newport News, Independent City, Virginia_, Washington, D. C., January 17, 1986.

22. Federal Emergency Management Agency, Federal Insurance Administration, _Flood Insurance Study, City of Williamsburg, Independent City, Virginia_, Washington, D. C., November 20, 1981.

EXHIBIT 2 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1	16	4.57	Railroad spike in Vepco pole No. WD-31/12A, located on south side of State Route 173, approximately 0.4 mile north-northwest of intersection of State Route 173 and northeast end of Middle Road.
RM 2	17	3.16	Railroad spike in Vepco pole No. 613-42, located on northwest side of State Route 712, approximately 0.55 mile north of intersection of State Route 622.
RM 3	14	6.532	Coast and Geodetic Survey (C&GS) disk stamped F 298 1949 set in concrete foundation for Post Office in Yorktown, located 1.3 feet north of west corner of building, 230 feet northeast of centerline of State Route 238, 59.5 feet southwest of wooden bulkhead along southwest bank of the York River, and 9 feet southeast of centerline of driveway.
RM 4	14	53.50	C&GS disk stamped PRIM TRAV STA. NO. 0 set vertically in northeast side of Old Customhouse, near east corner of building, located on west corner of intersection of Main Street and Read Street in Yorktown.
RM 5	18	9.59	Railroad spike in base of sawed off telephone pole used as guard post on north side of State Route 631. Post is first on west side of canal at east end of Vepco plant.
RM 6	18	15.88	Railroad spike in Vepco pole No. VB03, located on east side of State Route 631 at intersection of Oak Point Drive.
RM 7	18	6.05	Large nail in Vepco pole No. 8GS, located on south side of State Route 622 at intersection of State Route 718.
RM 8	18	11.46	Railroad spike in Vepco pole No. IJ69, located on south side of State Route 718, approximately 0.6 mile east of intersection of State Route 173.

EXHIBIT 2 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 9	19	10.47	Railroad spike in Vepco pole No. 57313, located on northwest side of intersection of State Route 620 and Railway Road.
RM 10	25	81.998	C&GS disk stamped PEARY NO 1 1958 set in top of concrete post level with ground, located 26 feet from southwest side of State Route 168 and Interstate Route 64, approximately 0.4 mile southeast along State Route 168 from junction of State Route 604 leading northeast.
RM 11	35	69.104	C&GS disk stamped S 313 VADH RESET 1975 set in top of concrete post projecting 1 inch above level of ground, located at junction of State Routes 238 and 638; 58.5 feet south of centerline of State Route 238 and 73.5 feet southwest of centerline of State Route 638.
RM 12	35	82.470	C&GS disk stamped R 313 1952 set in top of concrete post projecting 1 inch above level of ground, located on State Route 238, approximately 0.6 mile southwest along State Route 238 from south entrance to U. S. Naval Weapons Station. Disk is 32 feet southeast of centerline of highway, 47.7 feet west of west corner of small frame house, 10.5 feet southwest of centerline of dirt driveway, and 3 feet east of Vepco pole No. 70-35 supporting transformer.
RM 13	32	71.13	Railroad spike in base of 30-inch Pine tree, located on north side of State Route 637, approximately 0.5 mile southwest of junction of State Routes 637 and 638.
RM 14	32	35.29	Chiseled square on southwest corner of concrete headwall on southwest side of U. S. Route 17, approximately 15 feet below highway and located approximately 0.6 mile northwest along U. S. Route 17 from junction of State Route 636.

EXHIBIT 2 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 15	36	52.62	Chiseled square on concrete island with STOP sign, located on southwest side of U. S. Route 17 at intersection of State Route 622 leading southwest.
RM 16	37	10.72	Railroad spike in Vepco pole No. UL-77/20, located at southwest corner of intersection of State Routes 620 and 621.
RM 17	37	14.65	Railroad spike in Vepco pole No. JJ79, located on southeast side of State Route 620, approximately 900 feet northeast of intersection of Patricks Creek Road.
RM 18	37	18.68	Railroad spike in Vepco pole No. EP11, located on east side of T junction of State Routes 621 and 1550 (Brandywine Drive).
RM 19	37	32.11	Railroad spike in Vepco pole No. HM12 located on east side of State Route 614 opposite the T junction of Ella Taylor Road.
RM 20	38	30.55	Chiseled square on northeast corner of concrete step to brick shed at entrance to Newport News Park Harwood's Mill on south side of State Route 620.
RM 21	39	17.431	C&GS disk stamped L 266 1942 set in east face of brick building at Harwood's Mill Filtration Plant located on west side of U. S. Route 17, located 1.8 feet north of southeast corner of building, 46 feet west of centerline of U. S. Route 17, and 4.8 feet above ground.
RM 22	39	32.65	Railroad spike in Vepco pole No. 100 amp A-174, located in front of Tabb TV Service on west side of U. S. Route 17, approximately 0.2 mile south of junction of Rich Road.
RM 23	43	16.41	Railroad spike in Vepco pole No. XN09, located on northeast side of State Route 134 opposite T junction of 1st Avenue; at north end of Dairy Queen lot.