BK 0003 PG 127 **ORDINANCE NO.** 2-11 28-11

Pertaining to the Adoption of the Calvert County Flood Mitigation Plan

WHEREAS, pursuant to the authority contained in Article 66B of the Annotated Code of Maryland, the Board of County Commissioners of Calvert County, Maryland, has general powers to promulgate and adopt County plans; and

WHEREAS, after study and evaluation, the Department of Planning and Zoning recommended to the Planning Commission and the Board of County Commissioners of Calvert County, Maryland, a draft Calvert County Flood Mitigation Plan; and

WHEREAS, after due notice was published, the Planning Commission conducted a public hearing on July 20, 2011, at which time the proposed plan was discussed, staff's recommendations were considered, and public comment was solicited; and

WHEREAS, at the conclusion of said public hearing, the Planning Commission voted to recommend to the Board of County Commissioners of Calvert County, Maryland, adoption of the plan as proposed; and

WHEREAS, after due notice was published, the Board of County Commissioners of Calvert County, Maryland, conducted a public hearing on July 26, 2011, at which time the proposed plan was discussed, staff's recommendations were considered, and public comment was solicited; and

WHEREAS, at the conclusion of said public hearing the Board of County Commissioners of Calvert County, Maryland, voted to adopt the Flood Mitigation Plan with minor amendments as indicated in Exhibits A, attached hereto and made a part hereof; and

WHEREAS, after considering the evidence that was presented at the public hearings regarding the proposed plan and the recommendation of the Planning Commission, the Board of County Commissioners of Calvert County, Maryland, adopted the Calvert County Flood Mitigation Plan as amended.

NOW, THEREFORE, BE IT RESOLVED AND ORDAINED, by the Board of County Commissioners of Calvert County, Maryland, that the Calvert County Flood Mitigation Plan **BE,** and hereby **IS,** adopted as shown in attached Exhibit A, and effective on the date set forth below.

DONE, this 24 day of Aug., 2011, by the Board of County Commissioners for Calvert County, Maryland, sitting in regular session.

ATTEST:

Corinne J. Cook

Corinne J. Cook, Clerk

Approved for legal sufficiency on 8/17/11 by

Pamela R. Lucas

Pamela R. Lucas,
Associate County Attorney

Received for Record 8/25/ 20 11
at 11:25 o'clock A M. Same day
recorded in Liber KPS No. 37
Folio 127 COUNTY COMMISSIONERS
ORDINANCES AND RESOLUTION.

Kathy P. Smith

BOARD OF COUNTY COMMISSIONERS
CALVERT COUNTY, MARYLAND

Susan Shaw

Susan Shaw, President

Pat Nutter

Pat Nutter, Vice President

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Evan K. Slaughenhoupt Jr.

Evan K. Slaughenhoupt Jr.

Steven R. Weems

28-11

Flood Mitigation Plan
Calvert County, Maryland

August 2, 2011

Prepared for:

Calvert County Department of Planning and Zoning
County Services Plaza, 150 Main Street
Prince Frederick, MD 20678

Acknowledgments

This Flood Hazard Mitigation Plan was prepared under the guidance of the County's Department of Planning and Zoning and the Hazard Mitigation Steering Committee. The members of the Steering Committee are listed in Chapter 1.

This Plan was funded by a Flood Mitigation Assistance (FMA) grant from FEMA and administered through the Maryland Emergency Management Agency (MEMA).

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CHAPTER 1: INTRODUCTION

Background

Floods are a common occurrence throughout the United States and result from large-scale weather systems that generate rainfall or on-shore winds for prolonged periods. Other causes of flooding include local thunderstorms, snowmelt, ice jams, and dam failures. Flash-floods are characterized by high velocity waters that carry large amounts of debris.

Over the years, communities throughout the country have taken proactive measures to reduce the impact of flooding and the damage caused by it to residents and structures. In May 2007, Calvert County received funding from (FEMA) through the Flood Mitigation Assistance (FMA) grant for the development of a Flood Mitigation Plan for the County. The purpose of the Plan was to address flood hazards that threatened the health and welfare of the County and develop actions to mitigate the effects of flooding.

In September 2008, the County hired consultants Deepa Srinivasan, President of Vision Planning & Consulting, and Dr. Michael Scott, Director of the Eastern Shore Regional GIS Cooperative at Salisbury University to assist the County with the preparation of their Flood Mitigation Plan.

The overarching goal of this project was to *"To develop a flood mitigation plan to improve Calvert County and its municipalities' resistance to floods by identifying actions to reduce the impact of floods to county residents and structures.*

Study Area

Calvert County is located in southern Maryland approximately 30 miles southeast of Washington DC. The County is a peninsula and is bordered by the Chesapeake Bay in the south and east while the western shore is bounded by the Patuxent River. There are two incorporated towns in the County and both are located along the Chesapeake Bay: Chesapeake Beach, incorporated in 1886, and North Beach, incorporated in 1910. There are seven designated "town centers" within the county, including Prince Frederick, the county seat. Others include Dunkirk, Huntingtown, Lusby, Owings, St. Leonard, and Solomon's Island. In 2010, the population of Calvert County was 88,737[1], and the total number of households was 31,299.

Calvert County has a generally mild climate with four distinct seasons and mild temperatures. On average, 43.1 inches of precipitation fall annually. Snowfall averages 19.4 inches annually. [2]

The topography in Calvert County is varied. An upland plain runs the length of the County from the northwest to the southwest. The land is more rugged on the east side of the plain, ending in sharp cliffs, while the west side is marked by down sloping land toward the Patuxent River that is good for farming. This plain also divides the

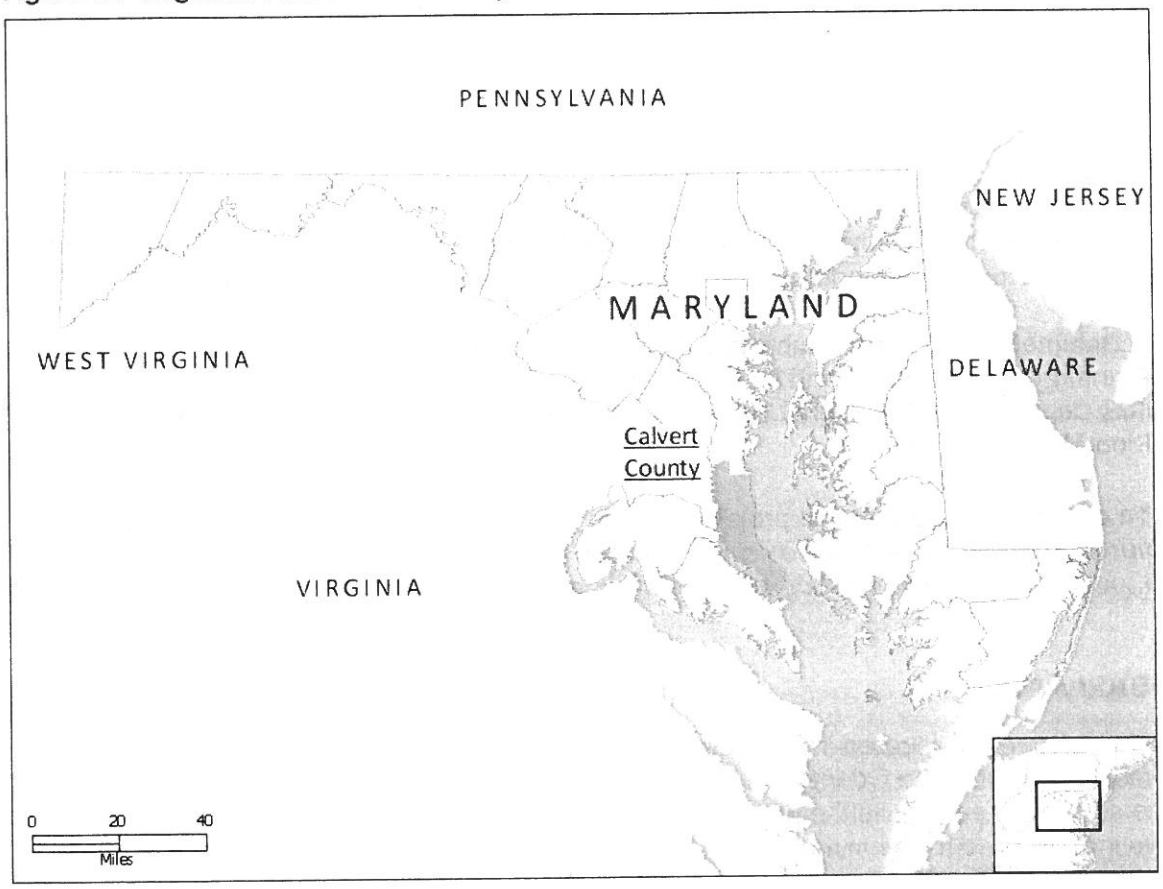
[1] US 2010 Census of Population and Housing

[2] Maryland State Office of Climatology

watersheds into the Lower Western Shore and the Patuxent River watersheds. The elevation ranges between sea level and 168 feet throughout the County.

The flood threats include riverine flooding from the tributaries of the Patuxent River and coastal flooding from the Chesapeake Bay. Riverine flooding sources include the Patuxent River itself, Hall Creek, Hunting Creek, Battle Creek, St. Leonard Creek, Back Creek, and Mill Creek (Figure 1.2)

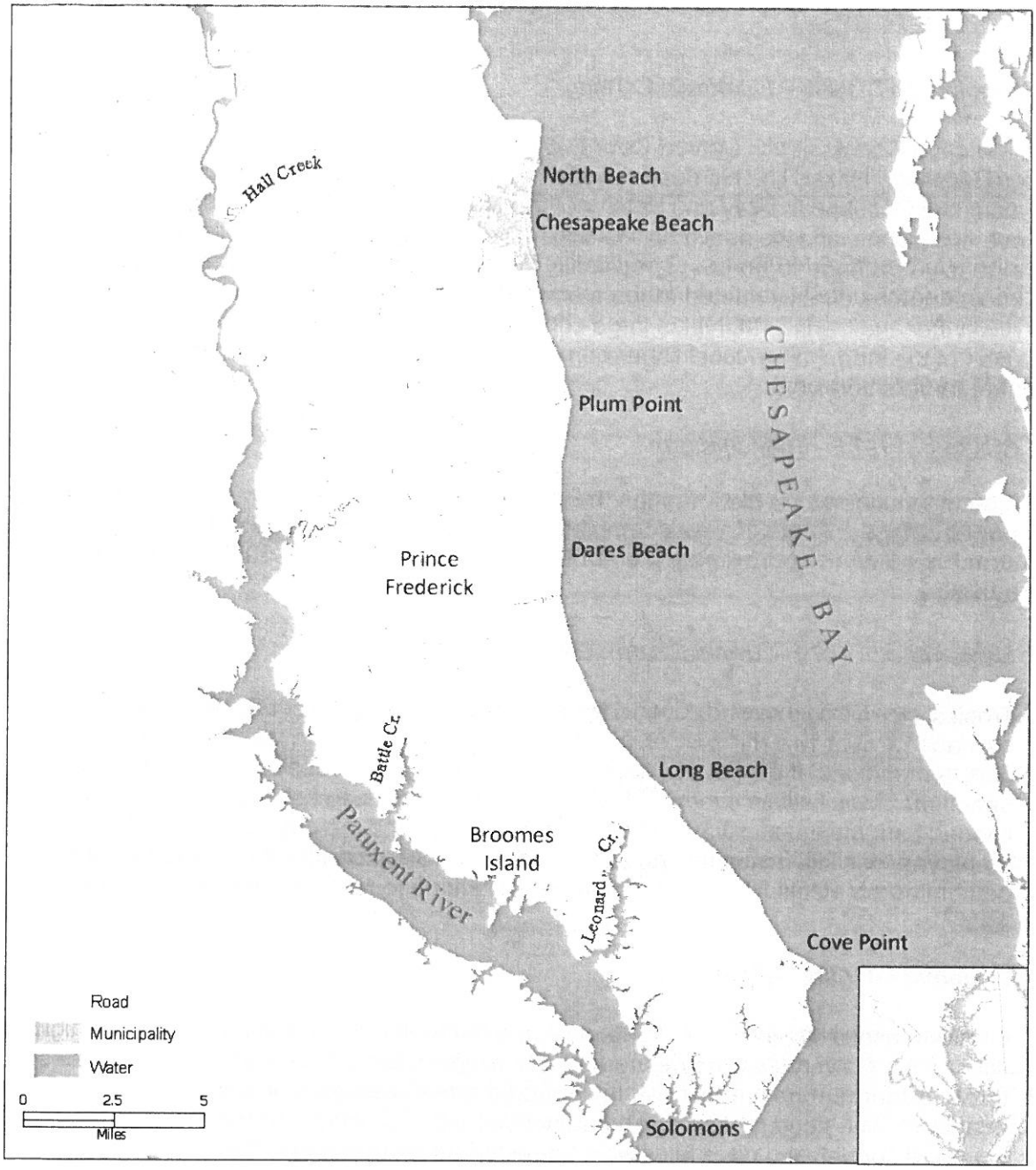
Figure 1.1 Regional context of the study area



Flooding History

Calvert County has had numerous incidents of flooding, including a couple major events such as Hurricane Hazel in 1954, Hurricane Floyd in 1999, and Hurricane Isabel in 2003. Most incidents are the result of storm surges from tropical systems, tidal flooding from either nor'easters, or a combination of landward winds and astronomical high tides, and flash flooding from sudden, short-lived rainstorms. Many references were found for Calvert County when researching the history of floods in the region, and it is reasonable to assume that this is just a selection of flood events. The sources for these flood history narratives include the Flood Insurance Study for Calvert County and the National Climatic Data Center who maintains a national database of storm events, including flooding, from 1950 to 2008. A search of that database yielded 16 flood events in Calvert County, beginning in 1993.

Figure 1.2 Flooding sources and study area context



October 1954 – Hurricane Hazel

On October 21st, 1954, Hurricane Hazel hit Calvert County. The Solomons and North Beach areas of the county were affected the most by the damaging tides, which were six to eight feet above the normal tidal range. The hurricane caused thousands of dollars worth of damage to barns, tobacco plants, businesses, and residential homes. Despite sustained winds over 100 miles per hour and extreme tides, there were only three injuries and zero casualties. The injures were kept to a minimum for good reason, the citizens stood ready to help wherever they could, "It is indeed gratifying to know that during such an emergency our citizens unconcerned for their own safety worked in the truly American way-'One for All, and All for one'" (Calvert Independent, October 21, 1954).

August 13-17, 1955 – Hurricane Connie

Hurricane Connie struck Calvert County on August 18, 1955, reminding many of her predecessor, Hazel. The Hurricane caused widespread damage with flooding occurring along the Chesapeake Bay and Potomac; this was caused but the storms heavy rainfall, over 9.5 inches, and the above normal tides. The flooding filled many wells and caused extensive damage to homes, specifically filling basements. There were at least 12 known deaths directly related to the storm's damage on land and 14 people lost their lives when the Levin J. Marvel, a large schooner was wrecked by the storm. During the peak of the storm, a few local fishermen braved the storm in a 14' boat and saved six of the Marvel's survivors.

October 3, 1971 – Thunderstorm

A strong thunderstorm blew through the Calvert area causing flooding, road closings and power outages. Route 261 was completely flooded due to the effects of the storm. The storm resulted in approximately $50,000 of crop damage and $10,000 of property damage.

September 5, 1979 – Tropical Storm David

Tropical storm David moved through the Calvert area on September 5, 1979, resulting in damage of over two million dollars. The major flood damage was confined to the northern portions of the county, especially the low-lying twin beach area. The Kenwood beach area was hit with over six inches of rain, which caused collapsed retaining walls, flooded basements, and washed out roads in and around the development. A SMECO employee was killed instantly when he and a co-worker came into contact with a live power line on Mackall Road; the men were working to restore power to the Wallville area.

November 4, 1985 – Thunderstorm

On Wednesday, November 4, 1985, a severe thunderstorm brought rain, wind, and high tides to the Calvert area. There were four foot waves battering the shoreline and tides of three to four feet above normal; this caused many residents of low lying areas to evacuate. The flooding damaged businesses, homes, roads, and piers, many places were still flooded two days later which delayed damage reports. The major damage occurred around North beach, along Atlantic Avenue where decks and porches were ripped from their foundations. The Chesapeake beach area sustained less damage than the North Beach area, but was flooded for days after the storm. Most of the damage was confined to North Beach, Chesapeake Beach, Broomes Island, Neeld Estates, Willows Colony, Kenwood Beach, Long Beach, and Cove Point, with damages in excess of 1.5 million dollars dollars. Approximately 150 homes affected by the storm, 2,500 feet of seawall was destroyed, and the estimated road damage was over $30,000.

September 6, 1996 – Hurricane Fran

On September 6, 1996, Tropical Storm Fran passed through Maryland just west of Calvert County. The hardest hit areas of the county were North Beach, Breezy Point,

Hallowing Point and Broomes Island. High winds and surging tides brought flood damage to many homes in these areas. There were at least 60 residences which sustained flood damage, the worst hit were three homes on Annapolis Avenue in North Beach and four apartments in Hallowing Point. In addition to residential damage, many roads in Solomon's Island were flooded. The damage for the Calvert area was estimated at $750,000.00.

January 28, 1998 – Nor'easter

A fairly intense and slow-moving nor'easter produced a large area of moderate to heavy rains across the central and lower portion of southern Maryland beginning on 27 January and continuing through late afternoon on the 28th. Rain totals ranged from 3 and 4 inches. Widespread minor to moderate flooding of small streams, creeks, and low-lying areas occurred over much of lower southern Maryland. Though no coastal flooding was observed, there was some minor overwash at Chesapeake Beach and two homes sustained minor damage from fallen trees.

February 4 - 5, 1998 – Nor'easter

A powerful nor'easter, carrying copious moisture from the Gulf of Mexico and Caribbean region, dumped between 3 to 5 inches in lower southern Maryland, causing widespread flooding of low lying areas and small streams and creeks. The nor'easter, coming on the heels of one just a week earlier, caused tides of 3 to 4 feet above normal from Solomons Point to North Beach. Local officials in North Beach noted that up to one-half of the beach was pushed southward by the pounding waves; an outfall was trapped open by the action of the shifting sand, causing water from the bay to inundate local roads and some establishments. The degree of erosion was greater than that associated with the remnants of hurricane Fran in 1996.

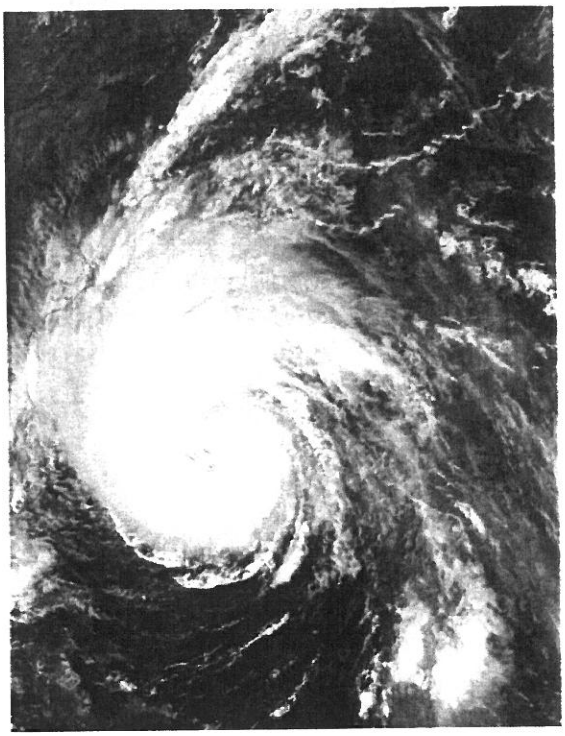
September 16, 1999 – Hurricane Floyd

The eye of Hurricane Floyd passed east of the Chesapeake Bay on 16 September 1999. Gusty winds of 30 to 50 MPH blew across the area resulting in 5-12 inches of rain across Calvert County. The degree of damage Calvert County received from the storm enabled the county to qualify for FEMA disaster assistance. Tidal flooding was reported along the Chesapeake Bay. Strong southerly winds ahead of the hurricane pushed tides 2 to 3 feet above normal, flooding several low lying areas. Numerous shoreline homes between 2 and 4 feet above sea level were flooded. In Calvert County, hundreds of large trees were downed onto roads, homes, and power lines. Over 11,000 electrical outages were reported. Winds gusted to 69 MPH at Mid Bay buoy offshore of Calvert Cliffs.

September 2, 2000 – Thunderstorm

Several roads in the northern portion of the county were flooded. Slow moving thunderstorms produced heavy rainfall and damaging lightning across portions of central Maryland on September 2nd. Law enforcement officials reported cars floating off Mt. Harmony Road after water rapidly rose. Route 4 and 260 and roads in Dunkirk, Owings, and North Beach were also inundated by water. A total of 1.25 inches of rain was reported in Dunkirk where lightning strikes damaged two homes and a fire station.

Figure 1.3 Hurricane Isabel; September, 2003 (Source: NOAA)



September 19 – 21, 2003 – Tropical Storm Isabel

Tropical Storm Isabel raged through Maryland, hitting Calvert County on September 18th, 2003. The storm surge that came with Isabel was five to nine feet above normal. In North Beach, a house was moved off of its foundation, the pier at Solomon's Island was completely demolished, and much shoreline was lost. Approximately 22,400 customers were left without power in the county and the hospitals were seeing an additional 130 patients per day. Over 100 homes sustained major damage and a few were completely destroyed. Residents who had lived in the area for 80 years felt that Isabel caused more damage than the 1933 Hurricane, which created the Ocean City Inlet.

June 26, 2006 – Thunderstorm

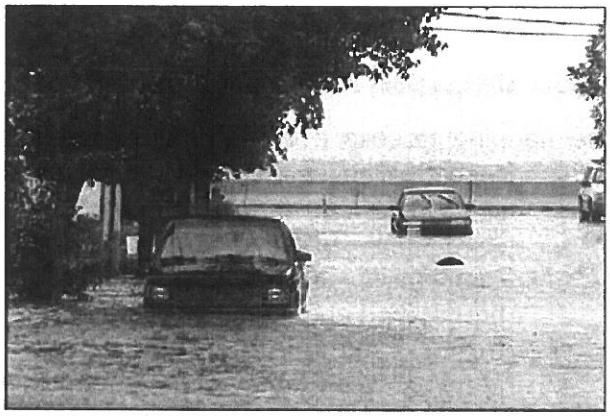
Scattered areas of flash flooding began on June 23 and continued into June 24. Then, flooding began to take on a more serious nature on June 26 since the ground had become saturated in so many spots. A mudslide occurred on B Street near the boardwalk in Chesapeake Beach. As a result, double digit rainfall totals affected parts of the region during the previous five days.

September 1, 2006 – Tropical Depression Ernesto

Tropical Depression Ernesto brought high winds and heavy rain to the Calvert area on September 1st, 2006. Ernesto also had a hand in affecting the purity of the Chesapeake Bay; during the storm the Chesapeake wastewater plant released approximately 1.5 million gallons of wastewater into the Chesapeake Bay. Many trees were uprooted during the storm's rage including an historic red oak in Dunkirk.

May 11-12, 2008 – Thunderstorm, High tide

Figure 1.4 Flooding on Ninth Street in North Beach, May 12, 2008. (Source: Washington Post)



Calvert County was hit hard with heavy rain and flooding during May 11th and 12th, 2008; rainfall totaled over 4 inches. This coupled with high tides caused flood damage to many residential buildings. The North Beach area was hit the hardest by flooding, where cars that were parked on Bay Avenue were partially submerged, and Route 261 in North Beach was impassable due to the flood waters (Figure 1.4). In the Long Beach area, a few houses were battered by surging waves late Sunday night into Monday morning. The Hallowing Point Trailer Park had to be evacuated due to the Patuxent River's rising waters.

Plan Objectives

This Flood Mitigation Plan for the County fulfills the following objectives:

- It is consistent with the requirements of the 44 Code of Federal Regulations part 78.5 - Flood Mitigation Plan Development in accordance with the National Flood Insurance Act of 1968 (42 U.S.C. 4104c et seq.);
- It conforms to all pertinent criteria and regulations, including those found in applicable state and local ordinances and NFIP requirements;
- It identifies risks from flood and mitigation strategies for Calvert County and its two municipalities;
- It helps reduce the risk of loss of life, personal injury and property damage to the County's residences and businesses; and
- It will be submitted to MEMA and FEMA for approval, opening the way for future federal funding of flood mitigation projects.

Planning Approach

The Flood Mitigation Plan for Calvert County has been developed in compliance by the 44 Code of Federal Regulations (CFR) 78.5 Flood Mitigation Plan Requirements. This Plan:

- Describes the planning process;
- Describes public involvement;
- Includes existing flood risk;
- Includes the number of estimated structures in floodplain;
- Identifies repetitive loss structures;
- Identifies the extent of flood depth and damage potential;
- Discusses floodplain management goals;
- Identifies and evaluates feasible mitigation actions;
- Presents a strategy for reducing flood risks;
- Provides a strategy for continued compliance with NFIP;

Describes procedures for ensuring implementation, reviewing progress, and making revisions; and
Provides documentation of Plan by legal authority.

Flood Mitigation Plan Participants

The planning process involved a number of entities at the local, state, and Federal level:

- Hazard Mitigation Steering Committee members (Calvert County and municipal staff) – attendance at meetings and review of plan materials;
- Consultants – Vision Planning and Consulting, and Eastern Shore Regional GIS Cooperative – assessment of flood risk, development of mitigation actions, plan preparation and meeting facilitation;
- Public – plan input
- Maryland Emergency Management Agency (MEMA) – plan review and approval
- Federal Emergency Management Agency (FEMA) – project funding and plan review and approval.

Hazard Mitigation Steering Committee

A Hazard Mitigation Steering Committee (HMSC) was formed to serve as the committee for this planning process. The HMSC members participated in all committee meetings, and provided input on the issues to the consultants. Table 1.1 lists the members of the Hazard Mitigation Steering Committee and the agencies they represent.

Table 1.1 Hazard Mitigation Steering Committee members

Name	Title	Agency
Carl Brown	Emergency Planner	Emergency Management
Dave Brownlee	Principal Environmental Planner	Planning & Zoning
Ron Clark	Engineering Bureau Chief	Public Works
Mary Beth Cook	Deputy Directory / Department of Planning and Zoning	Planning & Zoning
Bobby Fenwick	Division Chief	Emergency Management
Joe Hawxhurst	Division Chief	Inspections & Permits
John Hofmann	Town Engineer	Town of North Beach
John Knopp	Project Engineer / Plan Review	Public Works
Steve Kullen	Environmental Planner: Watershed / Grants	Planning & Zoning
Barbara Mason	Resident: Cove Point Beach	Citizen-at-Large
Dawn Mister	Permit Coordinator	Inspections & Permits
Mieke Rockhill	Resident: Long Beach	Citizen-at-Large
Mike Scott	Consultant	Consulting Team / ESRGC
Deepa Srinivasan	Consultant	Consulting Team / Vision
John Swartz	Environmental Planner: Critical Area / Permit Review	Planning & Zoning
Marjorie Tuttle	Resident: Cove Point Beach	Citizen-at-Large
Bill Watson	Engineer	Town of Chesapeake Beach

Planning Process

The planning process comprised of four main steps: 1) organizing work group and process; 2) assessing the flood hazard, vulnerability, and mitigation capability; 3) developing a mitigation plan; and 4) implementing the plan. These steps are elaborated in the sections below.

Step 1 – Organize work group and process

A Hazard Mitigation Steering Committee was formed by the County's Department of Planning and Zoning that included staff representatives from various County and City agencies, and stakeholders from the flood-prone areas. The Consultants worked closely with the Hazard Mitigation Steering Committee and met with them four times during the planning process.

Figure 1.5 Calvert County Hazard Mitigation Steering Committee

The first Steering Committee meeting was held on November 13, 2008 at the Calvert County Government Building in Prince Frederick. At this meeting, the planning process, key elements of the Plan, schedule, and deliverables were discussed. A mitigation capability assessment questionnaire was also distributed to the Steering Committee for input on plans and ordinances and the County's capabilities with respect to flood mitigation.

The second Steering Committee meeting was held on March 31, 2009 at the Calvert County Government Building. At this meeting, the data on the flood hazard identification was presented; input on the flood risk was solicited; and the data from the hazard vulnerability and risk assessment was discussed.

At the third Steering Committee meeting held on April 23, 2009 at the Calvert County Government Building, the highlights of the mitigation capability assessment were presented and an exercise to develop goals and objectives was conducted. At this meeting, a range of mitigation actions were examined that addresses the Plan's goals.

The fourth and final Steering Committee meeting was held on June 4, 2009 at the Calvert County Government Building. At this meeting, mitigation alternatives were discussed and prioritized, along with an implementation strategy for each action. A plan maintenance schedule was also developed at this meeting.

Public Involvement

In this planning process, public involvement assumed various forms. First, county and municipality residents were encouraged to provide input through representatives on the Mitigation Steering Committee. Residents in flood-prone areas were also invited to attend meetings and provide their comments and concerns.

Second, public input was solicited at two public meetings during the planning process. The first public meeting was held at Court House Square in Prince Frederick on April 30, 2009. At this meeting, the planning process and the results of the hazard identification were

presented to the public. The group discussed the community's risk to flooding in specific areas and offered suggestions for mitigation actions. A public notice was published in the local newspaper, the Calvert Recorder. Approximately 15 people attended the public meeting.

The second Public Meeting was held at the Calvert Pines Senior Center on West Dares Beach Road in Prince Frederick on June 16, 2009. At this meeting, mitigation goals and objectives along with actions were presented for review and discussion. A public notice of this meeting was published in the local newspaper, the Calvert Recorder (included in the Appendix). Copies of the draft plan were available for review during this meeting. A public forum was held on June 16, 2011 also at the Calvert Pines Senior Center. At this meeting, the Draft Flood Mitigation Plan was presented and comments received. Public Hearings are scheduled for July 20, 2011 before the Calvert County Planning Commission and July 26, 2011 before the Board of County Commissioners of Calvert County.

Third, a mitigation capability questionnaire was developed and distributed to the Steering Committee members. The purpose of the questionnaire was to solicit input on critical facilities, existing plans and ordinances and flood-related policies, and mitigation projects that have been implemented in the past.

Step 2 – Assess hazards, risks, vulnerability, and mitigation capability

In this step, information on past flood events in the County was gathered and areas where flooding is an issue, were identified. This step also involved a literature review of publications addressing historical flood events, an internet search for data related to historic events, and an inventory and review of the existing GIS layers and other documentation pertinent to the County. The vulnerability analysis included estimates of potential losses, types and numbers of existing and future at-risk buildings, infrastructure, and critical facilities located in the identified hazard areas. This is addressed in detail in Chapter 2. The Mitigation Capability Assessment included a review and analysis of the County's plans, ordinances, programs, and policies in light of flood mitigation and floodplain management. This section also included an analysis of the County's programs and policies, and their capability to adequately address the flood threats.

Step 3 – Develop a mitigation plan

Based on flood hazard data and the vulnerability and capability assessments, mitigation goals and objectives were developed. These goals were aimed at protecting the community from long-term vulnerability to the identified flood hazards. A comprehensive range of specific mitigation actions and projects to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure, were developed in this step.

The Plan explored various categories for mitigation actions. Examples of the types of projects in each of these categories are included below:

- Preventive measures – e.g., zoning, floodplain management, stormwater, and other ordinances;
- Structural projects – e.g., levees, reservoirs, channel improvements;

- Property protection measures – e.g., relocation, flood-proofing, flood insurance;
- Emergency services – e.g., warning, sandbagging, evacuation;
- Natural resource protection – e.g., wetlands protection, best management practices; and
- Public information – e.g., outreach projects, technical assistance

Each of these categories is discussed in detail in Chapters 3 through 8 in the report.

Step 4 – Implement the Plan

An Action Plan was developed that described how the mitigation strategies and activities identified would be prioritized, implemented, funded, and administered. Cost estimates for the recommended projects, where available, and funding sources to implement recommended projects were identified. A description of the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle and also ways to incorporate community participation into the plan maintenance process was included in the final section of the Plan.

Organization of the Report

The Calvert County Flood Mitigation Plan is comprised of 9 chapters. Chapter 2 identifies the sources of flooding and assesses the County's vulnerability to flooding; Chapter 3 elaborates on preventive measures; Chapter 4 focuses on property protection techniques; Chapter 5 discusses emergency services; Chapter 6 identifies structural projects; Chapter 7 examines natural resources protection techniques; Chapter 8 identifies options for public outreach. Chapter 9 identifies goals and objectives for the plan and includes actions to mitigate the flood hazard. The final chapter includes the criteria for ranking flood mitigation projects; identifies top-priority projects; and outlines a process for plan update and maintenance.

CHAPTER 2: PROBLEM DESCRIPTION

Flooding occurs when rivers, creeks, streams, ditches, or other water bodies receive more water that they can handle from rain or snowmelt. The excess water flows over adjacent banks into the adjacent floodplain. As many as 85 percent of the natural hazard disasters across the United States have been attributed to flooding.

This Chapter outlines the scope of Calvert County's flooding problems including the sources of flooding, the 100-year flood levels in each of Calvert County's waterways, the hazards that could be expected from a flood, and the type and degree of damage a flood could cause. However, the primary focus of this Chapter is to present the results of the flood vulnerability assessment including potential damage amounts, probable locations of flooding in a 100-year event, and an accounting of the critical facilities exposed to the flood hazard.

Sources of Flooding

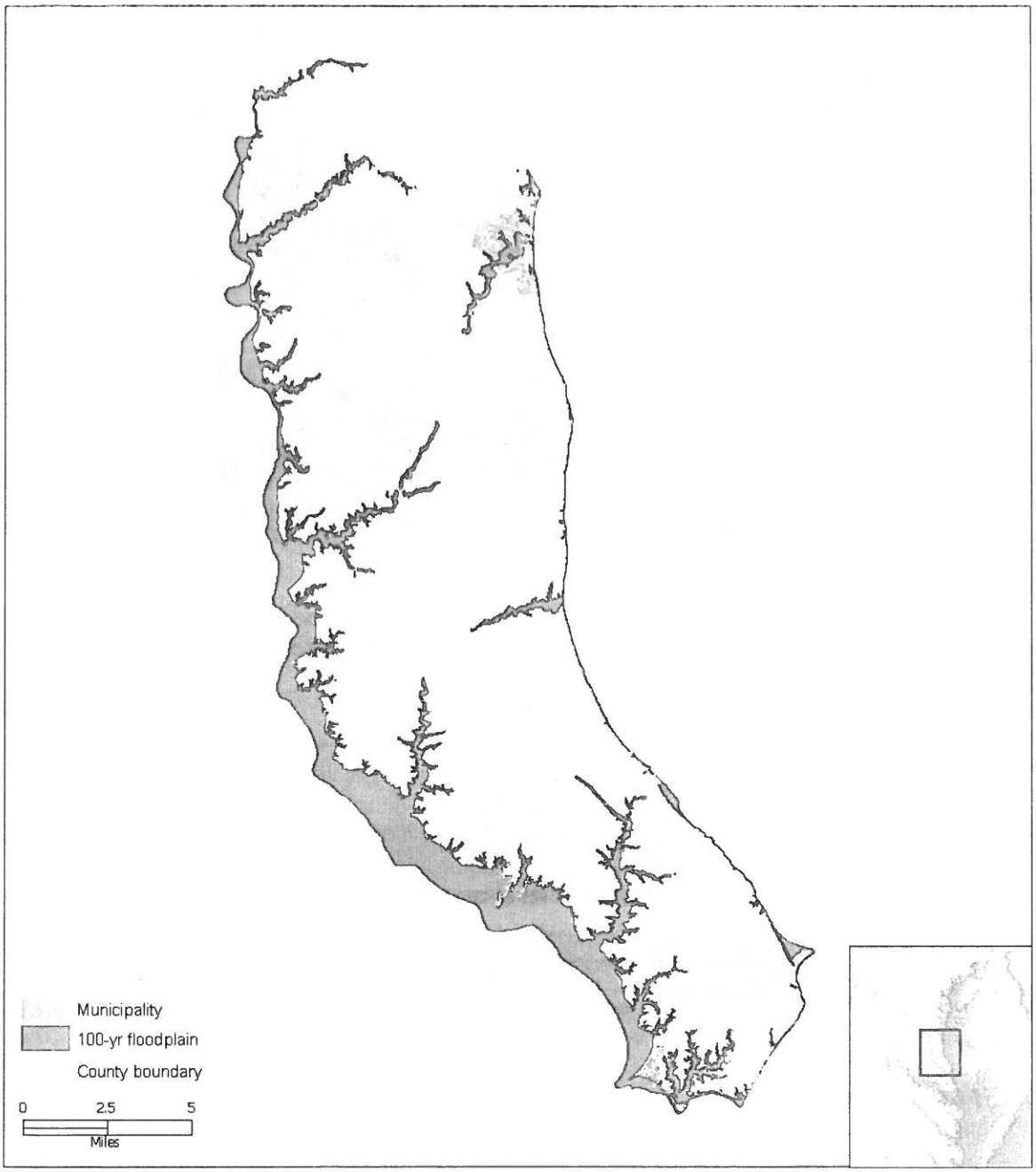
In Calvert County, flood origins include riverine flooding from the tributaries of the Patuxent River and coastal flooding from the Chesapeake Bay. Riverine flooding sources include the Patuxent River itself, Hall Creek, Hunting Creek, Battle Creek, St. Leonard Creek, Back Creek, and Mill Creek.

Riverine and Tidal Flooding

The following map (Figure 2.1) depicts the 100-year floodplains within Calvert County, as designated by FEMA on the Flood Insurance Rate Maps or FIRMs. The 100-year flood is a flood which has a 1 percent chance of being equaled or exceeded in any given year (MDE, *Maryland Floodplain Manager's Handbook*). Calvert County can experience riverine flooding as a result of excessive rainfall in a matter of hours, such as from a severe thunderstorm. Additionally, some soils can become saturated over a longer period of time and reduce their absorption potential. Riverine flooding can affect any of the rivers and streams in the County but primarily affects the non-tidal or brackish portions of the streams that feed the Patuxent River. Tidal flooding in Calvert County usually occurs as a result of tropical storms (including hurricanes) as well as the combination of high astronomical tides with a northeast wind.

It is evident (Figure 2.1) that the floodplains impact many parts of Calvert County. In fact, 7.6 percent of the County's land area is in the 100-year floodplain. Given the exposure of the County to the water, one would expect this percentage to be higher. Fortunately, much of the central to southern coastline of Calvert County is in the form of a significant scarp, keeping it safe from flooding. The floodplain is defined as the area adjoining a river or stream that has been or may be covered by floodwater (Figure 2.2). This is different than the floodway, defined as the channel of a river or stream and the parts of the floodplain adjoining the channel that are reasonably required to efficiently carry and discharge the floodwater or flood flow of a river or stream. Encroachments in the floodway cause increased flood elevation, both upstream and downstream. Unfortunately, the FIRMs do not depict the floodway as a separate area.

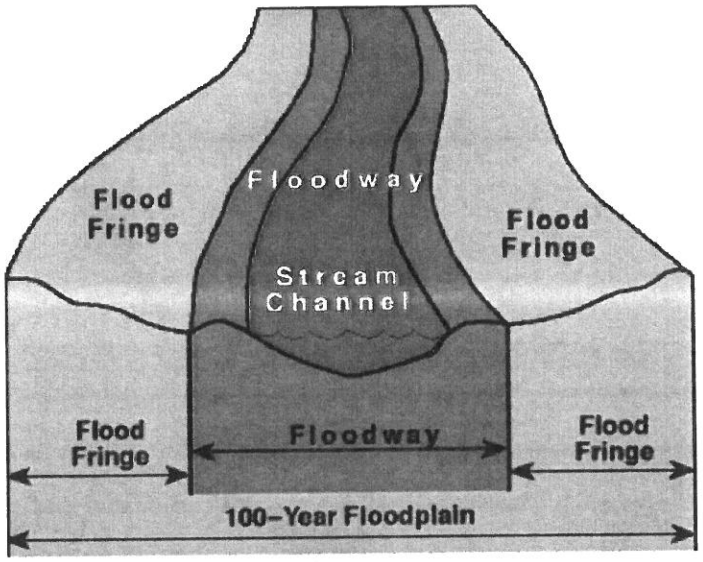
Figure 2.1 Calvert County 100-yr floodplain from FIRMs



Dam Failure

Dams are water storage, control, or diversion barriers that impound water upstream in reservoirs. Dam failure is a collapse or breach of the structure. While most dams have storage volumes small enough that failures have little or no repercussions, dams with large storage volumes can cause significant flooding.

Figure 2.2 Schematic of a floodplain (Source: Ohio Dept of Natural Resources)



Storm water Flooding

Another source of flooding in Calvert County is stormwater system overflow, resulting from a large amount of precipitation in a short period of time. This type of flooding occurs much more often than riverine flooding, but the impacts are often localized and minimal. Most of these more-frequently flooded locations are within the built-up areas and known to the county and municipal staff.

Flood Measurement

There are no active US Geological Survey gauging stations within the County. Only one National Weather Service Advanced Hydrologic Prediction Service hydrographs exists in the County (Table 2.1). The measurements of stream discharge, river stage, and tide height are critical to the prediction of flood events. While recording the water level, the SLIM2 hydrograph does not list flood levels or level prediction

Table 2.1 Hydrographs in Calvert County

Agency	ID Number	Station Name	Real-Time or Daily
NWS	SLIM2	Chesapeake Bay at Solomons Island	Real-time

Flood Levels

Using the Flood Insurance Studies (FIS) of Calvert County, Chesapeake Beach, & North Beach, the following tables (Tables 2.2 and 2.3) report the flood elevations and discharge amounts for the key flooding sources. Normally, these numbers would be used without question in the modeling of the potential flood depth. However, when the coastal flood elevations were compared to the actual storm surge measurements from Hurricane Isabel (a 75- or 80-year storm), it was found that the flood elevations were significantly underestimated. In order to create a more realistic estimate of flood depths, the flood elevations from the 2006 US Army Corps of Engineers' Sea, Lake, and Overland Surge from Hurricanes (SLOSH) model results of the Chesapeake Bay. Using these flood elevations add a modicum of uncertainty to the results because they are modeled estimates, the results are much more realistic than if the obviously incorrect FIS elevations were used.

Table 2.2 Peak discharges and flood elevations for 100-year riverine event (Units are NAVD 1988 feet)

Flooding Source	Drainage Area	100-year Peak Discharge (CFS)	100-year Flood Elevation
Hall Creek @ Patuxent River	13.85	4,701	7.2

Table 2.3 Flood elevations for 100-year coastal event (Units are NAVD 1988 feet)

Flooding Source	100-year Flood Elevation from FIS	100-year Flood Elevation from SLOSH
Chesapeake Bay @ north county boundary	5.3	8.2
Chesapeake Bay @ Randle Cliff Beach	5.3	8.1
Chesapeake Bay @ Plum Point	5.2	8.0
Chesapeake Bay @ Dares Beach	5.0	8.0
Chesapeake Bay @ Calvert Beach	4.8	7.5
Chesapeake Bay @ Cove Point	4.4	7.3
Chesapeake Bay @ Drum Point	4.7	7.6
Patuxent River @ Chesapeake Bay	4.7	7.7
Patuxent River @ St. Leonard Creek	5.2	8.1
Patuxent River @ Battle Creek	5.8	8.9
Patuxent River @ US 231	6.2	9.3
Patuxent River @ Holland Drive	6.8	11.0
Patuxent River @ Hall Creek	7.2	12.3
Patuxent River @ Lyons Creek	7.5	12.3

Hazards from Floods

Flooding causes $6 billion in average annual losses in the United States annually and account for an average of 140 casualties annually (USGS, "Flood Hazards – A National Threat," 2006). While most people's vision of the threat from flooding may include being swept away or buildings being structurally impacted, there are actually a number of hazards associated with flooding that occur both during and after an event.

During the Flood

While a flood event is underway, citizens will be faced with a number of threats. The hydraulic power of water is significant and walking through as little as 6 inches of moving water is dangerous because of the possibility of losing stable footing. Driving through flood water is the cause of many flood deaths each year. As little as one foot of water can float many cars and two feet of rushing water can carry away most vehicles including SUVs. That fact, combined with an inability for drivers to judge the depth of flood water, as well as the potential for flood waters to rise quickly without warning, making driving through flood water a very unwise action.

In addition to being swept away, flood water itself is to be avoided. Because of leaking industrial containers, household chemicals, and gas stations, it is not healthy to even touch the flood water without protective equipment and clothing. Downed power lines, flooded electric breaker panels, and other sources of electricity are a significant threat during a flood. One should also be prepared for the outbreak of fire. Electric sparks

often cause fire to erupt and because of the inability of fire fighting personnel to respond, a fire can quickly burn out of control.

After the Flood

Cleaning up after a flood can also expose citizens to a number of threats. For example, electrical circuits or electrical equipment could pose a danger, particularly if the ground is wet. Buildings that have been exposed to floodwater may exhibit structural instability of walkways, stairs, floors, and possibly roofs. Flood waters often dislodge and carry hazardous material containers such as tanks, pipes, and drums. They may be leaking or simply very heavy and unstable. The combination of chemical contamination and the likely release of untreated sewage (necessary when the sewage treatment plant is overwhelmed with flood-swelled effluent) mean that drinking water supplies can be unusable. Fire continues to be a very real threat after a flood. First-responders could be occupied with more pressing emergencies and traditional fire suppression equipment may be inoperable, but there may be mobility problems that keep fire-fighting equipment to reach an outbreak. Finally, there is the mental toll of being involved in a disaster. Continued long hours of work, combined with emotional and physical exhaustion and losses from damaged homes and temporary job layoffs, can create a highly stressful situation for citizens. People exposed to these stressful conditions have an increased risk of injury and emotional crisis, and are more vulnerable to stress-induced illnesses and disease.

Impact to Buildings

Fortunately, the number of people killed or injured during floods each year is relatively small. The built environment within the floodplain, however, is likely to bear the brunt of a flood's impact. Whether the water is moving or standing, the exposure of buildings to flood water could cause a great deal of damage. If the water is moving, the differing hydraulic pressure inside the building vs. outside can cause the walls and foundation to buckle and fail. If the water is standing for any length of time, even materials above the flood height will become saturated with flood water as the flood water is absorbed (known as wicking). Certainly, most of the contents of flooded buildings that were located at or below the flood height will need to be discarded. This includes carpet, furniture, electronic equipment, and other household or commercial items. In most cases it is not simply the fact that the objects have become wet but since the flood water brings with it sediment and chemicals, it makes it nearly impossible to recover all but the most precious/heirloom items.

Vulnerability Assessment

The goal of mitigation is to increase the flood resistance of a community, so that the residents and businesses will become less susceptible to future exposures to flooding, thereby resulting in fewer losses. A key component to reducing future losses is to first have a clear understanding of the current threats, the current probability that those threats would occur, and the potential for loss from those threats. The Vulnerability Assessment is a crucial first step in the process as it is an organized and coordinated process of assessing potential hazards, their risk of occurring, and the possible impact of an event.

Methodology

The Vulnerability Assessment was conducted using HAZUS-MH MR3, FEMA's loss estimation software, to assess the County's built environment and critical facilities'

vulnerability to flooding. HAZUS-MH is a Geographic Information System (GIS)-based software tool that applies engineering and scientific risk calculations that have been developed by hazard and information technology experts to provide credible damage and loss estimates. These methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards, including floods, hurricane winds and earthquakes. The methodology supports the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

The primary input to any vulnerability assessment is a "depth of flood" grid. This flood depth grid was created using an elevation grid derived from LiDAR measurements with a 2 m spatial resolution. By incorporating the polygons of the 100-year floodplain from the FIRMs, the flood elevations from the Flood Insurance Studies for Calvert County, Chesapeake Beach, and North Beach, as well as the current elevation grid, HAZUS-MH was able to create a flood depth grid with a reasonable precision.

Once this flood depth grid was created, Calvert County's tax parcel centroids were digitally overlaid and those centroids that intersect the floodplain were selected. The height to the first finished floor of each building in the floodplain was determined by field inspection. The height to the first finished floor was then compared with the predicted flood depth to estimate the potential depth of water for each building. For each level of water depth, there is a corresponding "percent damaged" metric. The 2007 assessed value of the building was then adjusted based on a formula to account for the value of the contents of the building. The total value was multiplied by the percent damaged metric to calculate an estimate of damage from the 100-year flood event.

It is important to note when viewing the following results that the numbers generated carry with them a degree of uncertainty. The flood heights used to generate the flood depths are from an interpolated source (SLOSH output), as discussed above. Therefore, we recommend that these damage statistics be viewed as merely an indicator of the potential degree of damage and not as a final and absolute number.

Results

The results of the analysis indicate that there are 577 buildings within the 100-year floodplain in Calvert County (Table 2.4). When the flood depth grid (Figure 2.3) is intersected with the height of the foundations of each of these buildings, 10 of them show minimal damage. The maximum amount of damage predicted is 75% percent; 23 buildings in Calvert County could possibly sustain a severe degree of damage (50% or more). The total value of both the structures and their contents is over $178 million. The total potential damage from flooding is over $30 million. This number represents 17.1 percent of the total assessed value. When standardized per building, it is important to note that the most valuable buildings (average of $549,670) are those predicted to be damaged minimally (less than 10%). Unfortunately, those buildings expected to sustain moderate to significant damage (30% - 40%) are the least valuable buildings. The majority of the potential damage to flooding (63.3%) is likely to be to those 365 buildings damaged between 10 and 30 percent.

Table 2.4 Potential damage to structures/contents from a 100-year flood event by degree of damage catego

Degree of Damage	Building Count	% of Total Count	Value of Structure and Contents	Value per Building	Total Potential Damage	Damage per Building	% of Total Damage
Less than 1%	10	1.7%	$ 3,027,300	$302,730	$ 14,819	$1,482	0.1%
1 - 10%	97	16.8%	$ 53,318,060	$549,670	$ 3,847,957	$39,670	12.6%
10 - 20%	230	39.9%	$67,872,785	$295,099	$9,815,451	$42,676	32.1%
20 - 30%	135	23.4%	$33,171,125	$245,712	$8,700,876	$64,451	28.5%
30 - 40%	75	13.0%	$13,849,555	$184,660	$4,567,704	$60,903	14.9%
40 – 50%	7	1.2%	$2,241,360	$320,194	$1,004,415	$143,488	3.3%
50% or more	23	4.0%	$4,715,100	$205,004	$2,615,835	$113,732	8.6%
Total	577	100%	$178,195,285	$308,830	$30,567,059	$52,976	100%

Note: All dollar values are from 2007 tax assessments.

When the potential damage was also examined with respect to land use, it was found that the vast majority all of buildings in the 100-year floodplain in Calvert County were residential (Table 2.5). The second largest category was commercial buildings. While commercial buildings only account for 5.2% of the buildings impacted, its potential damage is nearly 3 times larger (14.3%). This suggests that mitigating commercial structures may offer an opportunity for mitigation, thereby reducing flood losses.

Table 2.5 Potential damage to structures/contents from a 100-year flood event by general occupancy type

General Occupancy Type	Building Count	% of Total	Value of Structure and Contents	Total Damage	% of Total
Residential	534	92.5	132,071,445	22,827,564	74.7
Commercial	30	5.2	17,127,780	4,382,715	14.3
Educational	1	0.2	713,500	261,431	0.9
Government	2	0.3	689,160	222,493	0.7
Industry	9	1.6	26,624,800	2,703,850	8.8
Religious	1	0.2	968,600	169,005	0.6
Total	577	100%	$178,195,285	$30,567,059	100%

Note: All dollar values are from 2007 tax assessments.

When the specific occupancies of each of the buildings in the 100-year floodplain were examined, a similar pattern emerged (Table 2.6). The majority of the structures damaged were single family residential (492 or 85.2% of the total). The occupancy types that were likely to suffer the greatest damage, besides single family dwellings, were entertainment & recreation businesses, food/drug/chemical industrial sites, multi-family dwellings, and temporary lodgings (i.e. hotels/motels).

Table 2.6 Potential damage to structures/contents from a 100-year flood event by specific occupancy type

Specific Occupancy Type	Building Count	Value of Structure and Contents	Value per Building	Total Damage	Damage per Building
Retail Trade	10	$1,676,340	$167,634	$279,545	$27,954
Personal/Repair Service	7	$1,365,400	$195,057	$547,638	$78,234
Medical Office/Clinic	1	$757,000	$757,000	$352,553	$352,553
Entertainment & Recreation	12	$13,329,040	$1,110,753	$3,202,977	$266,914
Schools	1	$713,500	$713,500	$261,431	$261,431
General Government Services	2	$689,160	$344,580	$222,493	$111,246
Food/Drug/Chemical Industry	9	$26,624,800	$2,958,311	$2,703,850	$300,427
Church	1	$968,600	$968,600	$169,005	$169,005
Single Family Dwelling	492	$110,667,795	$224,934	$17,669,944	$35,914
Manufactured Home	10	$2,407,665	$240,766	$1,094,998	$109,499
Multi-Family Dwelling	30	$6,215,835	$207,194	$2,041,701	$68,056
Temporary Lodging	2	$2,780,150	$6,390,075	$2,020,919	$1,010,459

Note: All dollar values are from 2007 tax assessments.

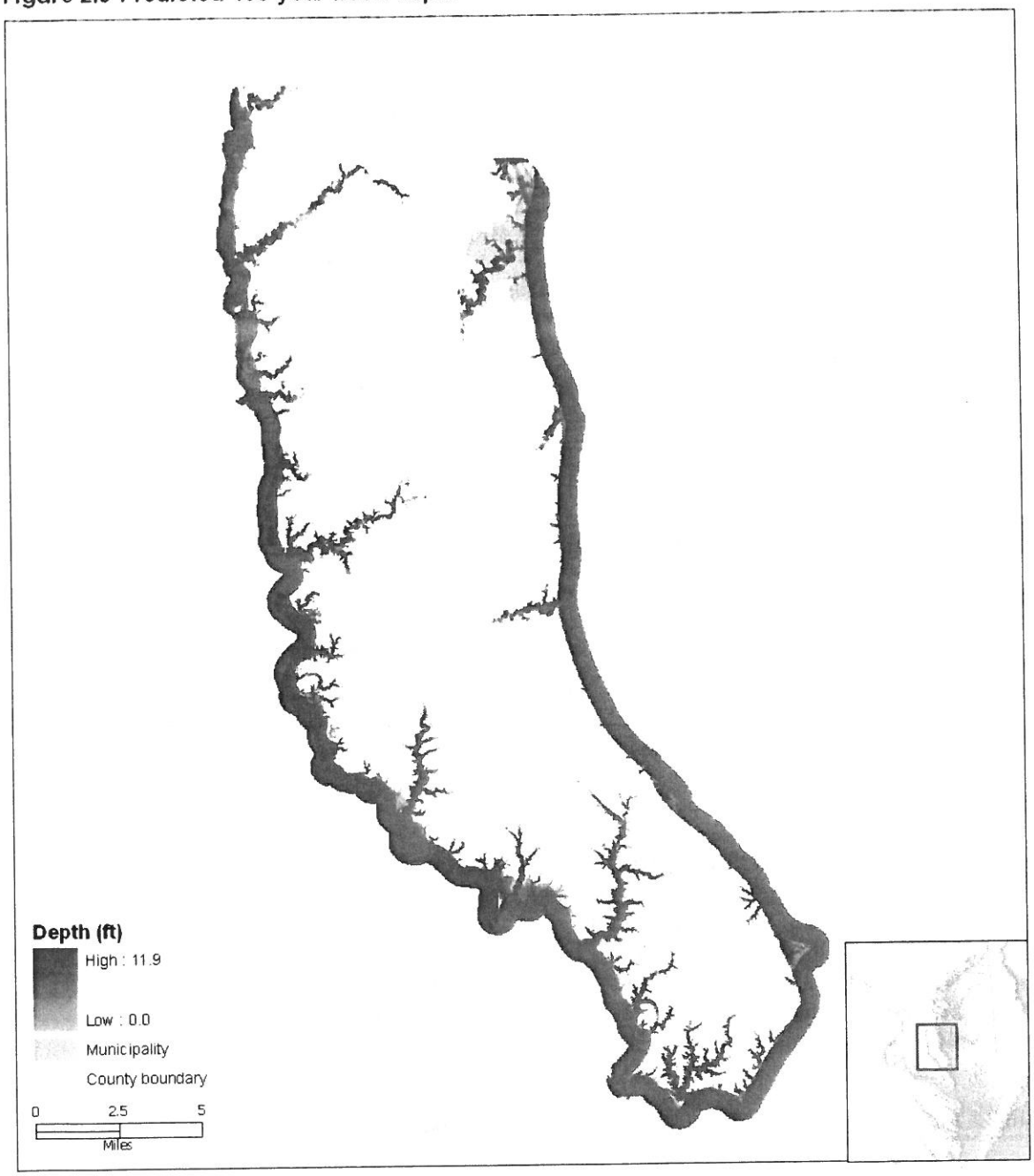
Critical Facilities

In addition to the general building stock, critical facilities were also examined as part of the vulnerability assessment. Specifically, the location of wastewater treatment facilities, fire stations, police stations, and schools was compared to the flood depth grid. There were no critical facilities in the modeled flooded area. However, there were a few facilities very near (less than 100 meters) the flood zone. Given the uncertainty of model results and the potential for sea-level rise in Calvert County, the following facilities bear observance (Table 2.7).

Table 2.7 Critical facilities within 100 meters of the modeled flood zone

Type	Name
WWTP	Industrial Park WWTP (Skipjack Road)
WWTP	Chesapeake Beach WWTP
Fire Station	North Beach Volunteer Fire Company
School	Our Lady Star of the Sea School
Police Station	Hallowing Point Station (MDDNR)
Police Station	Solomons Police Substation

Figure 2.3 Predicted 100-year flood depth



Spatial Distribution of Flooding

The geography of the flood vulnerability can best be described as "dispersed." While there are certainly a few communities that find themselves entirely within the 100-year floodplain, most of the other vulnerable areas are either pockets of development along the Chesapeake Bay coastline or in the two municipalities in the north that were built specifically to take advantage of their proximate location on the water.

Areas of significant or moderate flood vulnerability in the county comprise the following areas, each of which is elaborated below.

- Cove Point (166 structures)
- Broomes Island (71 structures)
- Chesapeake Beach (70 structures)
- North Beach (61 structures)
- Plum Point (45 structures)
- Long Beach (32 structures)
- Breezy Point (23 structures)

Figure 2.4 Flooding on Poplar Drive in Cove Point from the remnants of Tropical Storm Ida, November 2009

Cove Point (Figures 2.4 & 2.5)

The Cove Point neighborhood will potentially be one of the most impacted during a coastal 100-year flood event. Nearly all (166) structures in the area may suffer flooding damage to their buildings and contents. Many are likely to be impacted significantly or severely. The Cove Point community was built on a sand split created by the longshore transport of sediment from north to south along the Calvert County shoreline. Behind the spit, a shallow bay has formed. The residents that are located along this back bay have reported flooding from rainfall runoff as well as astronomical tides. Combined with the precarious position of the community with regard to the Chesapeake Bay, many of the structures have low or no appreciable foundations, adding to their vulnerability. Finally, it is well known that periodic flooding events often cover the road leading to the community, cutting the residents off from access to emergency vehicles and medical care.

Broomes Island (Figure 2.6)

Broomes Island, a small waterfront community on the Patuxent River is the second-most vulnerable area in Calvert County to the 100-year flood. 71 structures are predicted to sustain some damage, some severe, from a 100-year event, which will most likely come in the form of the storm surge of a tropical storm. Areas that are particularly at risk in Broomes Island include Patuxent Avenue, Shady Lane, Songbird Lane, and Broomes Island Road near Oyster House Road. Again, the combination of physical proximity to the water and the lack of elevation of structures equal a significant degree of vulnerability.

Figure 2.6 Potential flooding and building damage in Cove Point

Figure 2.7 Potential flooding and building damage in the Broomes Island

Town of Chesapeake Beach (Figures 2.7, 2.8 & 2.9)

The Town of Chesapeake Beach is one of two incorporated municipalities in Calvert County. It was established as a beach resort around the turn of the last century. Given its proximity to the Chesapeake Bay and its relatively low topography (compared with the scarp landscape to the south), the area's flood vulnerability is well-known. Access to the tidal streams in the northern portion of the town is restricted by a seawall and a sluice gate (Figure 2.8). Approximately 70 structures are predicted to be impacted by the 100-year flood in the Town. However, many of these will be impacted minimally. The Town was affected by Hurricane Isabel greatly, with many vulnerable structures damaged and elevated when rebuilt. In fact, much of the more significant damage is predicted to be a result from storm surge flooding in Fishing Creek rather than the Chesapeake Bay frontage.

Figure 2.7 Residential development along Fishing Creek Harbor in Chesapeake Beach

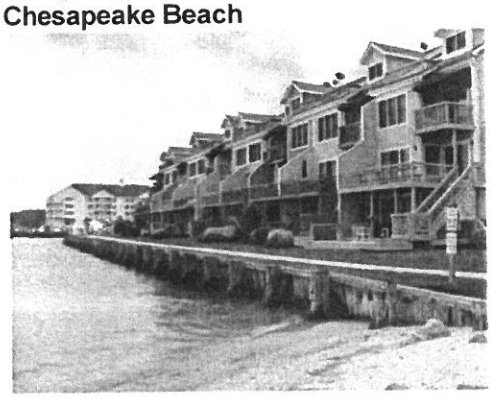
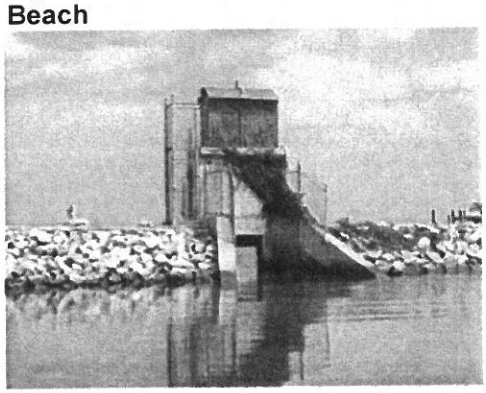


Figure 2.8 Sluice gate in Chesapeake Beach



Town of North Beach (Figures 2.10)

The Town of North Beach is the other municipality in Calvert County. Owing its history to legalized gambling in Maryland, today it is a Chesapeake Bay resort town with both full-time and part-time residents, including commuters. The vulnerability of North Beach, caused by the low-lying topography and its proximity to the Bay, is mitigated somewhat by a seawall. Based on the computations by HAZUS-MH, it is predicted that 61 structures would be potentially impacted by the 100-year flood; a few would be severely damaged.

Figure 2.11 Potential flooding and building damage in the Town of Chesapeake Beach

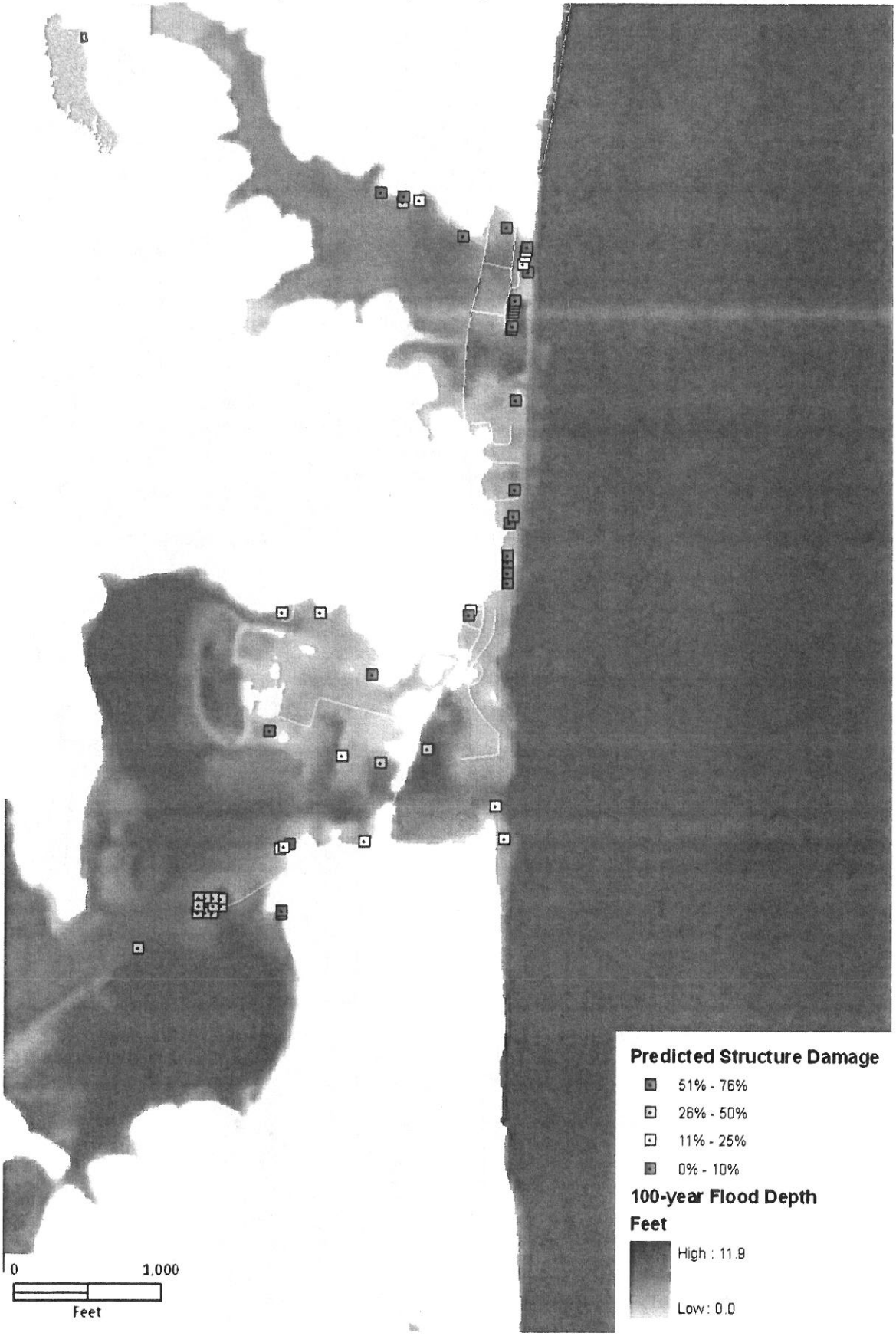
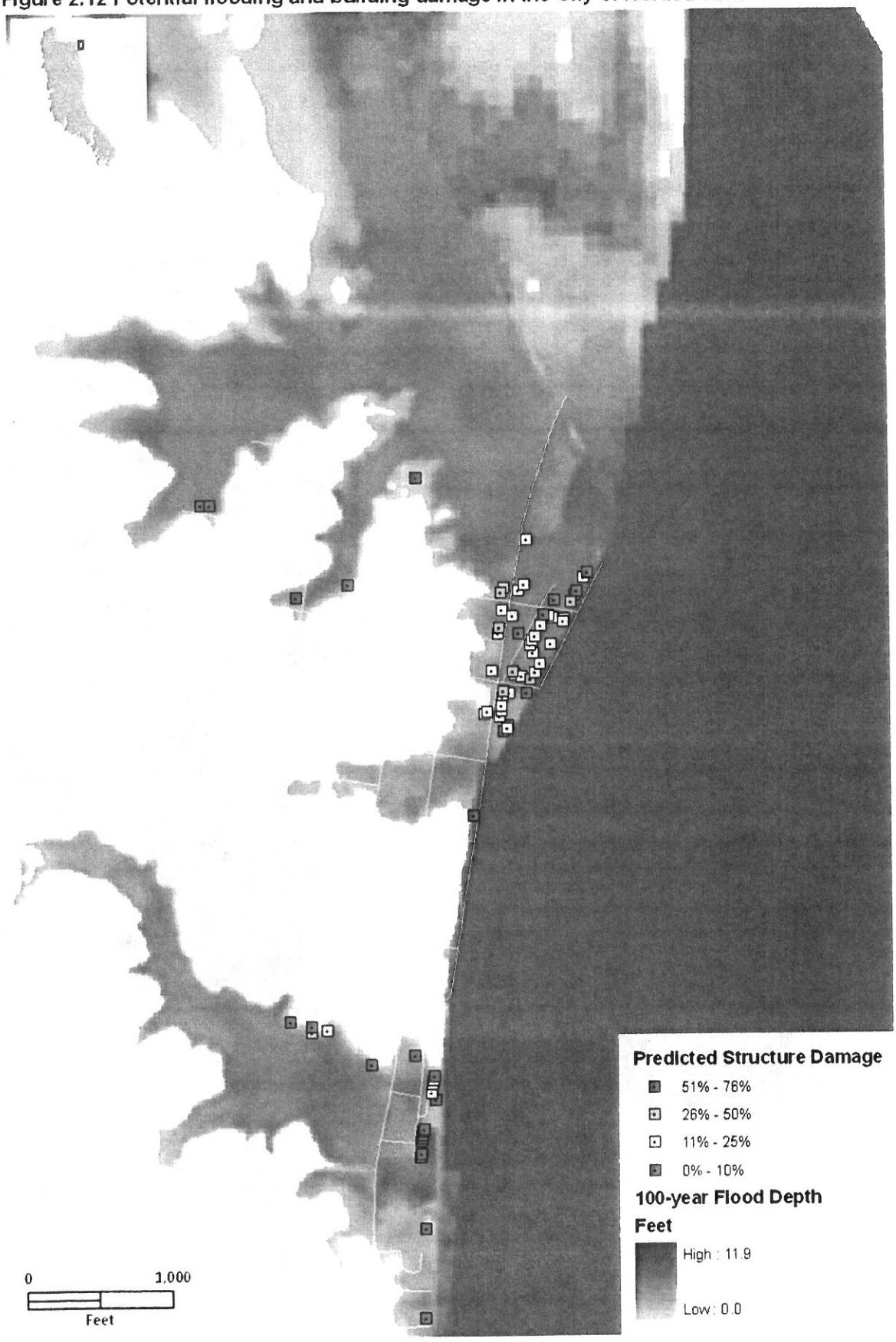
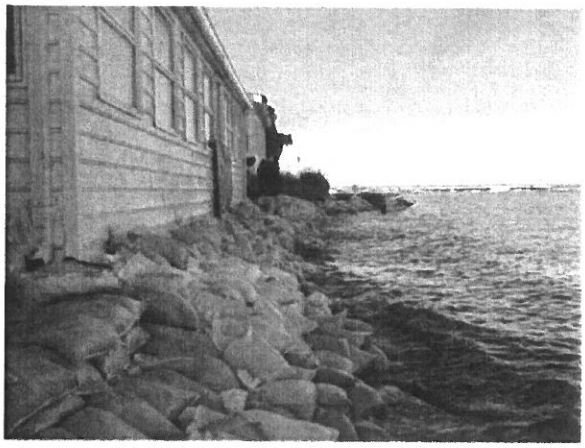


Figure 2.12 Potential flooding and building damage in the City of North Beach



Neeld Estate / Breezy Point (Figures 2.11 & 2.12)
Another area of the county that is consistently prone to flooding is the Plum Point/Breezy Point area. Located south of Chesapeake Beach on the Chesapeake Bay, the communities of Neeld Estate and Breezy Point sit on opposite sides of Plum Point Creek. The northern community of Breezy Point would likely have 23 structures damaged in a 100-year coastal flood event; Neeld Estate would likely have 45 damaged structures. In Breezy Point, the structures are concentrated along Breezy Point Road and Ridge Road and in Neeld Estate community, it is Beach Drive and Bay Boulevard that will likely be inundated the most.

Figure 2.11 Sandbags protect a house in Neeld Estate from flooding caused by the remnants of Tropical Storm Ida in November 2009



Long Beach (Figures 2.13)
The southern end of Long Beach (along Long Beach Drive, Bayberry Road, Beech Road, Walnut Road, Cedar Road, Cypress Road, and Oak Road) is vulnerable to flooding where up to 32 structures could be potentially damaged. This area that fronts the Chesapeake Bay is low-lying and many of the structures have either a crawlspace or no foundation at all.

Other areas with damaged buildings include Solomons (19 structures), Lloyd Bowen Road (17), Johnstown/Dowell (14), Dares Beach (8), Olivet (7), and Buzzard Island Creek (6). Finally, it bears mentioning that only 4 structures in the area of Owings were found that would be impacted by riverine flooding only. While riverine flooding does and will continue to occur, the HAZUS-MH model results suggest that the primary flood threat to Calvert County involves a coastal source.

Repetitive Loss Properties

A repetitive loss property is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Structures that flood frequently strain the National Flood Insurance Fund. Repetitive loss properties not only increase the NFIP's annual losses and the need for borrowing; but they drain funds needed to prepare for catastrophic events. Community leaders and residents are also concerned with the repetitive loss problem because residents' lives are disrupted and may be threatened by the continual flooding.

Figure 2.13 Potential flooding and building damage in the Plum Point/Breezy Point area

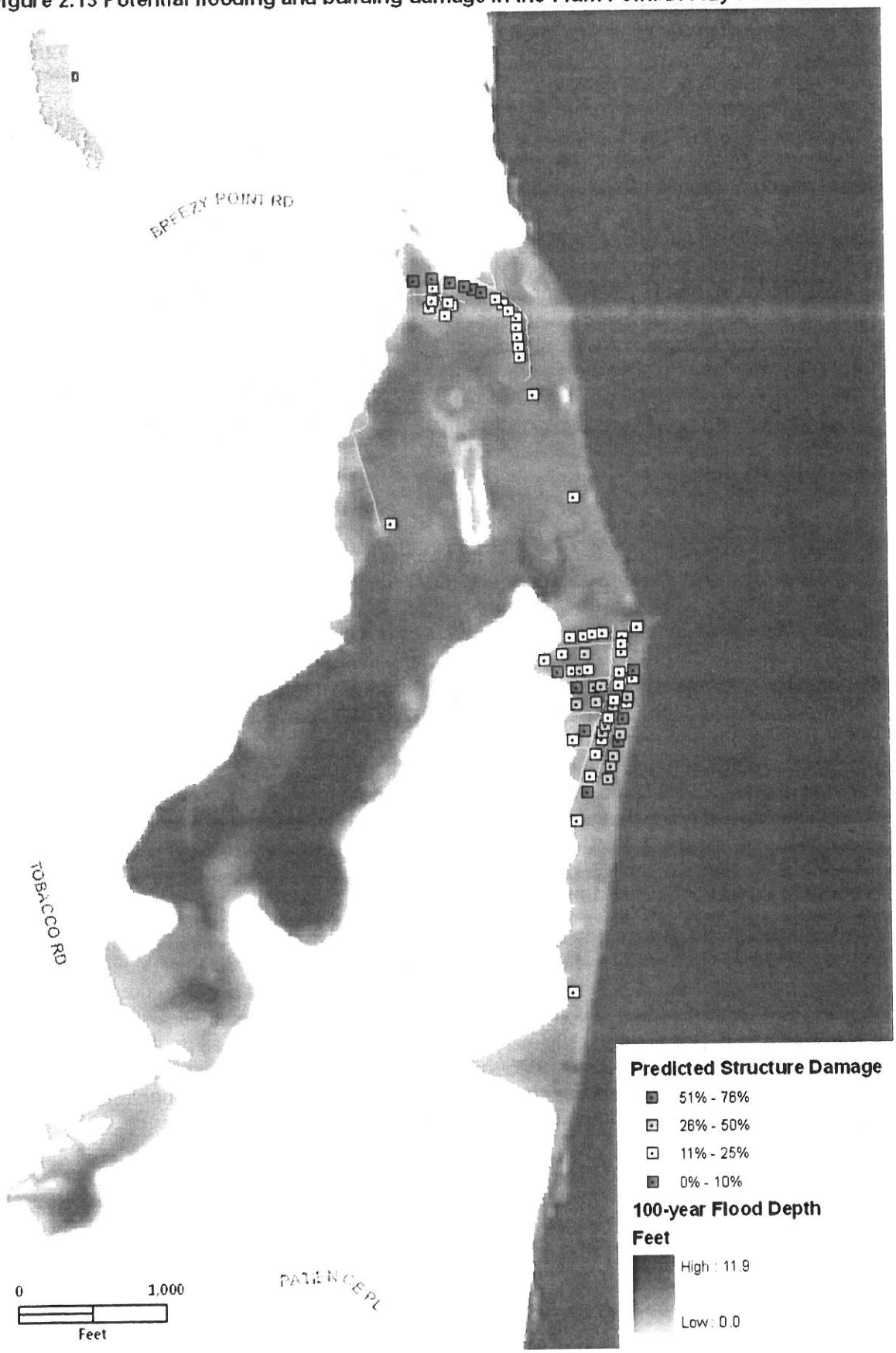


Figure 2.15 Potential flooding and building damage in the Long Beach area

According to the Maryland Department of the Environment as of March 2009, Calvert County has 39 unmitigated repetitive loss properties. According to their property address, the following areas contain these repetitive loss properties:

- Lusby (Cove Point)– 15 properties
- Saint Leonard (Long Beach) – 6 properties
- Huntingtown (Plum Point) – 5 properties
- Town of North Beach – 5 properties
- Town of Chesapeake Beach – 3 properties
- Broomes Island – 2 properties
- Owings – 2 property
- Solomons – 1 property

Economic Impact

Businesses

Floods cause other problems that are not as easy to identify as damage to buildings and critical facilities. Businesses that are disrupted by floods often have to be closed, often for long stretches of time. Inventories are lost, businesses cannot be accessed by customers, and employees are often busy protecting or cleaning up their flooded homes.

Impact on taxes

Public expenditures on flood fighting, sandbags, fire department calls, clean up and repairs to damaged public property affect all residents of Calvert County. While a state or federal disaster declaration may help reimburse the County, these handouts cannot be counted on in the future. Further, a recent law now requires that public agencies purchase insurance. The amount of insurance that should be carried will be deducted from disaster assistance payments. Despite Federal and state disaster assistance, public agencies incur many expenses that must be paid by local taxpayers.

Transportation

Loss of road access is a major flood impact that could affect the residents and businesses, not just those that own property in the floodplain. This can have an impact on not only the direct costs to fix the roads/bridges but also the value of lost time and productivity for the County's residents. As with taxes, these costs are borne by everyone, not just floodplain residents.

Other impacts

Finally, areas that are consistently prone to flooding will have a negative impact on property values, thereby encouraging neighborhood destabilization factors such as blight and crime to take over.

Future Trends

Between 1970 and 2000, Calvert County's growth rate was 8.7%/yr (from 20,682 to 74,563 persons). Based on County growth management policies and economic trends, the average annual growth rate slowed to 1.9% between 2000 and 2010 (from 74,563 to

88,737 persons) and only increased 0.7% between 2009 and 2010. This slower growth trend creates an opportunity with regard to flood vulnerability in the county. With a slower pace, it will be easier to continually monitor the collective vulnerability of Calvert County's residents and businesses and suggest changes to policies as the years progress.

On the other hand, while a slowing rate of growth will have a moderating effect on the flood vulnerability of the County, aggravating this vulnerable situation is the potential for sea-level rise combined with subsidence. The flood depth model created in this vulnerability mapping effort suggests that because of the topographic characteristics, sea-level rise is not likely to impact a large amount of land area in the county not already vulnerable to flooding, except in the most severe scenarios. What even a small amount of sea-level rise is likely to increase, however, is the frequency of flood stage levels of water, the degree of damage from relatively frequent flood levels, and the damage of fresh water supplies as salt water intrudes into surface streams and groundwater supplies. Citizens and leaders should be informed about these facts so they may take appropriate actions for coastal and riverine flooding.

Conclusions

Several conclusions can be made regarding the question of flooding vulnerability in Calvert County. First, given that Calvert County is surrounded on three sides by water and given that it contains more than 31,000 improved properties, the fact that only 577 (1.8%) are vulnerable to flooding is probably a result of strong land use regulations and the leadership and foresight to implement them (as well as a fortuitous geomorphology). Second, given the potential for sea level rise and subsidence in the coming decades, the time to increase the County's efforts to protect its citizens from flooding is now. Third, even though making the County largely flood-resistant, there are certain areas that remain very vulnerable, such as Cove Point and Broomes Island, for which there is no easy answer. In the chapters that follow, a number of potential actions will be recommended. In the end, it will be incumbent upon the people of Calvert County to reduce their personal vulnerability to flooding.

CHAPTER 3: PREVENTIVE MEASURES

Introduction

Preventive measures include codes and regulations found in plans and ordinances (comprehensive plans, zoning ordinances, building codes, floodplain development regulations, stormwater management regulations, and open space preservation) that are put in place to keep issues such as flooding problems from occurring or exacerbating. They are usually administered by the jurisdiction's planning, public works, and/or code enforcement departments. Preventive measures are also introduced to ensure that future development does not increase the potential damage caused by a flood or other hazard and that new construction does not contribute to the flood risk, thereby reducing the community's vulnerability.

Comprehensive plans, master plans, and zoning ordinances typically contain language to keep damage-prone development out of the hazardous or sensitive areas, while building codes and floodplain development regulations impose construction standards on what is allowed to be built in the floodplain. They protect buildings, roads, and other projects from flood damage and prevent development from aggravating the flood problem. Stormwater management regulations address the runoff of stormwater from new developments onto other properties.

The sections below include a review of Calvert County and its municipalities' codes, plans, and ordinances and identify areas in these documents where hazard mitigation principles are addressed. Recommendations for future actions are intended to provide Calvert County with ideas to better integrate hazard mitigation into other plans and activities.

County/Municipality Plans and Ordinances

Calvert County Hazard Mitigation Plan –2004

Of the 14 hazards that were assessed, flooding and hurricanes/tropical storms were among the top five high-risk hazards. The Plan identifies the following goals and objectives that pertain to flooding and that will be revisited during the preparation of this Flood Mitigation Plan:

- Goal: Prevent flood-related repetitive losses from natural disaster through regulation and education
    - Develop and support public and private projects and programs to retrofit, relocate, or acquire structures susceptible to repetitive flooding.
    - Require systematic maintenance programs for stormwater management systems.
    - Direct population concentrations away from known or predicted high hazard areas through appropriate regulations.
- Goal: Emphasize pre- and post-disaster planning to decrease vulnerability of existing and new construction to loss.

- Identify vulnerable existing public and private critical facilities and encourage pre-disaster retrofit.
- Promote accuracy of FIRMS by requesting FEMA restudy of the floodplain.

The Plan identified the following actions that should, again, be taken into consideration during the preparation of the flood mitigation plan.

High Priority Mitigation Actions

- Encourage uninsured property owners in known flood hazard areas to purchase flood insurance through the NFIP.
- Ensure municipal compliance with local Stormwater Management Plans.
- Store the community's FIRMs and FIS in an easily accessible location and make them available for public inspection. Conduct routine inspections, regular maintenance and annual tests on all emergency communications equipment, public awareness systems, and hazard alert sirens to ensure unhindered operation during an emergency event.

Medium Priority Mitigations

- Coordinate with the local municipalities or the DOT on the potential feasibility of replacing, removing, or enlarging bridge and culvert stream crossings that are unable to pass the 10-year frequency flood flow.
- Ensure continued contractor compliance with approved Erosion and Sediment Control Plans and continue to work with local farmers to implement best management practices.
- Preserve the highest priority for undeveloped floodplain areas via fee simple acquisition and/or permanent easement and retain as public open space for passive recreational uses. Less critical floodplain areas may be preserved/protected via local ordinances.
- Elevate known flood-prone structures in accordance with the general guidelines.
- Relocate and/or acquire known flood-prone structures with the general guidelines.

Calvert County Comprehensive Plan - 2010

The following objectives in the Natural Resources and Sensitive Areas section in the Plan have a direct impact on flood mitigation principles:

- Establish a comprehensive approach to environmental planning with special emphasis on watershed planning.
- Protect environmentally sensitive areas such as floodplains, wetland and water way buffers from development impacts.
- Preserve stream valleys to maintain the natural functions and to provide greenways throughout the County.

The Plan identifies the following specific actions to address sensitive areas, streams and buffers, wetlands, and floodplains that should continue to be implemented:

- Establish greenways systems along stream valleys to preserve the low lands.
- Require and maintain sufficient buffers from all perennial and intermittent streams to provide environmental protections.
- Reforest stream buffers wherever possible.

- Consider altering the 50 foot buffer requirements.
- Continue to direct development out of the floodplain.
- For development in the floodplain, ensure that construction practices minimize damage to property and the environment during flooding.
- Require vegetation in floodplain to remain except when it is required to be removed for stormwater management.

The Plan recommends improving the environmental education programs through the Board of Education and developing environmental education programs for adults.

As summarized in the 2004 Hazard Mitigation Plan, the County has instituted a number of techniques to protect wetlands, floodplains, and steep slopes. Since 1988, a 100-foot Critical Area buffer has been established for the county's waterways and the allowable density in the 1,000-foot (from Tidal waterways) Critical Area was reduced to 20 acres per dwelling unit.

The Plan also identifies incentives given to use low-impact techniques such as rain gardens and bioretention that greatly reduce run off by keeping water onsite.

Calvert County Zoning Ordinance – Revised October 2010

The zoning ordinance addresses wetlands, buffers, and natural resources protection.

Article 7 of the Zoning Ordinance comprises the Subdivision Regulations.

- Land may be found unsuitable for subdivision or development due to features which will reasonably be harmful to the safety, health and general welfare of the subdivision such as Natural Resources Protection Areas.
- Development of designated Floodplain Districts are restricted to specific uses and require to be in accordance with erosion and sediment control plans approved by the Calvert Soil Conservation District. A minimum 10-foot setback is required to be established adjacent to 100-year floodplain areas.
- Minimum sufficient contiguous suitable land area, exclusive of steep slopes (greater than 25 percent), buffers, forest retention areas, septic recovery areas, and required setbacks, are required to have at least 5,000 square feet for lots having individual septic systems and 3,000 square feet for lots served by a public or community septic system.

Article 8 of the Zoning Ordinance addresses Environmental Regulations

- The Critical Area buffer (100 feet) minimizes the adverse effects of human activities on wetlands, shorelines, stream banks, tidal waters, and aquatic resources. The Buffer can be expanded beyond 100 feet to include contiguous, sensitive areas, such as steep slopes, hydric soils, or highly erodible soils, whose development or disturbance may impact streams, wetlands, or other aquatic environments.
- New subdivisions are required to be designed to locate all house sites out of the 100-year floodplain area.

- A wetland buffer zone of 50 feet is required to be maintained adjacent to non-tidal wetlands and 100 feet adjacent to tidal wetlands is required to be maintained. A 10-foot setback is required to be maintained from the edge of the wetland buffer.

Article 8-3 of the Zoning Ordinance addresses Forest Conservation Requirements

- A Forest Stand Delineation and a Forest Conservation Plan is required for any subdivision development in addition to a grading permit and sediment and erosion control permit.
- Retention, afforestation and reforestation areas on the lots are required to be identified on the final subdivision plat as forested areas that will be left undisturbed in perpetuity and to serve water quality benefits.
- Standard Forest Stand Delineations are required to show the location of the 100-year floodplains and not-tidal wetlands and their buffers.
- The establishment or enhancement of forest buffers adjacent to intermittent and perennial streams to widths of at least 50 feet and the establishment or enhancement of non-forested areas on 100-year floodplain are considered a priority for afforestation and reforestation.

Building Codes

Building codes set construction standards for the minimum acceptable level of safety for buildings in a community and are also important in mitigating the impact of non-flood hazards on new buildings. Hazard protection standards for all new and improved or repaired buildings can be incorporated into the local building code. Typically, these standards should include criteria to ensure that the foundation will withstand flood forces and that all portions of the building subject to damage are above or otherwise protected from flooding.

The International Building Code (IBC) serves as the County's basic building code. The IBC regulates construction materials and methods for all structures (except for one and two family dwellings). The one and two-family dwellings are regulated by the International Residential Code (IRC). The IBC and IRC establish criteria that resist damage to natural hazards including wind speed (for hurricane, tornados, thunderstorms, winter storms) seismic activity, snow load, and flooding. This code prohibits building in any 100-year floodplain or stream or drainage course and prohibits development in any area that is subject to flooding, erosion, unstabilized slope or fills within the danger reach of a high-hazard dam. However, these codes are not retroactive codes, and do not include older buildings. Only pre-existing structures are subject to the codes that exist at the time of construction and when there are major additions to structures, they need to be brought up to the new code's standards. Older buildings are more vulnerable to damage from natural hazards unless they are brought up to the current code's standards.

<u>Building Code Effectiveness Grading Schedule</u>

The Building Code Effectiveness Grading Schedule (BCEGS) is a program that measures local building code natural hazard protection standards and code administration. The Building Code Effectiveness Grading Schedule is used by the insurance industry to determine how well new construction is protected from wind, earthquake, and other non-flood hazards. The BCEGS program assigns each municipality a BCEGS grade from 1 (exemplary commitment to building-code

enforcement) to 10. The County has not been evaluated for a BCEGS score nor does it anticipate going through this process in the near future.

Calvert County Floodplain Development Ordinance – Revised March 1992

- Any development within the floodplain zone is required to obtain a permit from the local permitting agency.
- The freeboard requirement is one foot above the base flood elevation.
- Wetland disturbance is required to be avoided. State and federal permits are required for any development that encroaches into wetlands.
- Basements are not permitted. All new or substantially improved residential and non-residential structures are required to have the lowest floor elevated to or above the flood protection elevation.
- Consideration should be given to clustering development lots out of the floodplain and preserving the open space.
- All new or substantially improved structures are required to be elevated on adequately anchored pilings or columns to resist movement due to the effect of the 100-year water loads and wind loads acting at the same time on all the building components.
- Utilities – distribution panel boxes are required to be at least two feet above the flood protection elevation and all outlets and electrical installations (heat pumps, air conditioners, generators, etc.) are required to be installed at or above the flood protection elevation.

The Ordinance also includes a requirement for new structures in the floodplain to submit first floor elevations.

Town of North Beach Floodplain Management Ordinance – Revised March 1991

- 100-year elevations are required to be determined and certified by a Registered Professional Engineer for all development proposals involving five acres or more or the creation of five lots or more.
- The freeboard requirement is one foot above the base flood elevation.
- Electric and mechanical systems are required to be elevated to one foot above the base flood elevation.
- Electrical distribution panels are required to be elevated three feet above the base flood elevation.
- Fill is permitted so long as it does not adversely affect neighboring properties.
- Manufactured homes (new, replaced, or substantially improved) are required to be elevated so that their lowest floor will be at or above one foot above the base flood elevation.
- Manufactured homes are required to be securely anchored to their foundations.
- In the Coastal High Hazard Area, all development proposals are required to meet the minimum standards established by FEMA's Coastal Construction Manual.

Town of North Beach Zoning Ordinance – Revised January 2005

- The ordinance contains a floodplain overlay district that comprises all the tidal flood plain and coastal high hazard areas as delineated by the FIRMs. All provisions of the Town's floodplain ordinance apply in this district. All uses permitted in the underlying district are permitted in the Overlay District.
- A Critical Area overlay district includes those areas within 1,000 feet of all tidal waters and tidal wetlands in the Critical Area of the Town. The district provides special regulatory protection for the natural resources located within the Town

Critical Area by requiring more sensitive development activity in these areas. Land within the Critical Area overlay district is divided into three land use designations: Intensely Developed Areas (IDAs); Limited Development Areas (LDAs); and Resource Conservation Areas (RCAs), each of which, have specific development standards.

- A Growth Allocation District (is not mapped) but is designated for use within the Critical Area Overlay District on lands classified as Limited Development Areas. Only specific development projects that have been approved by the Mayor and Council are approved for the Growth Allocation District classification and thereby receive Critical Area Growth Allocation.

Erosion and Sediment Control Ordinance – 1993

- Any land development in the floodplain is required to have a sediment control and stormwater management control permit.
- A grading permit and implementation of soil erosion and sediment controls is required for any development that results in disturbance greater than 5,000 square feet of land area and more than 100 cubic yards of earth, cut or fill.
- Erosion and sediment control is required during construction projects in order to reduce siltation and loss of channel carrying capacity.
- Dumping or placing debris in stream channels is prohibited.

Calvert County Storm water Management Ordinance – July 2001

- Any development that disturbs over 5,000 square feet of land area, including new and redevelopment is required to provide stormwater management.
- All redevelopment projects are required to reduce existing site impervious areas by at least 20 percent.
- The County and its municipalities are required to design Best Management Practices to control the 10-year frequency storm where historical flooding problems exist.

Watershed Management Plans

- Currently, draft watershed management plans exist for Parkers Creek and Hunting Creek. There are plans to develop watershed management plans for all of the county's major 12-digit tributaries.

Flood Insurance Rate Maps (FIRMs) and Flood Insurance Study (FIS)

The Flood Insurance Study and Flood Insurance Rate Maps for North Beach and Chesapeake Beach were completed in 1984 and Calvert County's FIRM was completed in 1998. DFIRMS are in the preliminary stages. There has been no restudy done for the County; only a model rerun. The DFIRMS will be a digital conversion of the old paper map into a digital layer. Floodplain information is administered and disseminated by the County's Planning and Zoning Department.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a Federal program that enables property owners in participating communities to purchase flood insurance as protection against flood losses, while requiring state and local governments to enforce floodplain management regulations that reduce future flood damages. The NFIP plays a critical role in encouraging communities to adopt and enforce floodplain management regulations and to implement broader floodplain management programs. The county and

the municipalities of North Beach and Chesapeake Beach participate in the NFIP but are not members of the Community Rating System (CRS). The County was enrolled in the CRS program from 1989 to 1998. Due to staff changes, their participation in the program was discontinued.

Continued Compliance with NFIP

The Maryland Department of the Environment (MDE) works closely with FEMA to provide assistance to communities participating in the NFIP. The County participates in the NFIP and has its own floodplain ordinance that requires all new or substantially improved residential and non-residential structures to have the lowest floor elevated to or above the flood protection elevation.

Maryland State Model Floodplain Ordinance

A Maryland State Model Floodplain Management Ordinance that contains recommendations for improved management of floodplains has been adopted by communities participating in the NFIP including those in Calvert County. The Building Officials Code Administrators National Building Code includes flood provisions that, in part, satisfy the minimum requirements of the National Flood Insurance Program. A comparison of the code provisions and the City's Floodplain Ordinance could identify inconsistencies between the documents and ensure they are not in conflict with each other.

Some highlights from the Maryland State Model Floodplain Ordinance are included below:

- All new and substantially improved structures are required to be built one-foot above the base flood elevation.
- Ordinances do not allow buildings or fill in the floodway. Any development that impedes floodwaters or causes an increase in water surface elevations during the 100-year flood is not allowed.
- Existing buildings can only be replaced or substantially improved so long as they don't increase in footprint and any minor additions are required to be elevated.

Capital Improvements Program

The Capital Improvements Program is administered by the County's Public Works Department and identifies funding for projects in a variety of categories. Between FY2011 and FY2015, expenditures have been budgeted for: Dares Beach waterline/tank painting, east Prince Frederick water tower and well, Lakewood water system upgrade, Chesapeake Heights/Dares Beach water treatment, and water meter replacement project.

State Plans

Planning studies include a wide variety of projects such as comprehensive plans, master plans, land use plans, revitalization plans, mitigation plans, and transportation plans. In general, land use plans and comprehensive plans discuss the direction of growth of the community and can pave the way to integrate principles of hazard mitigation.

Maryland Hazard Analysis - 2005
The State Hazard Analysis provided Calvert County a medium-high risk ranking for tidal/coastal flooding, a medium-low ranking for flash flooding, and a low risk ranking for riverine flooding. The most vulnerable areas identified in the Analysis include the areas near Battle, Hunting, and Hall Creeks. The Analysis identifies most areas bordering the Chesapeake Bay are protected from flooding by the bluffs that characterize this portion of the Bay's western shore with the exception of low-lying areas near Cove Point, Long Beach, Parker's Creek, and upper North Beach.

State of Maryland Hazard Mitigation Plan – September 2004
The State Hazard Mitigation Plan identifies a number of objectives and policies to assist local communities such as Calvert County and its municipalities with their hazard mitigation strategies. The following specific mitigation actions discuss the State's support to local governments with local mitigation projects:

- Since many important mitigation decisions are and will continue to be made at the local government level MEMA will continue to support the development and implementation of local hazard mitigation plans.
- MEMA will integrate local mitigation plan mitigation goals, objectives and strategies into the 2007 State of Maryland Hazard Mitigation Plan and future updates.
- MEMA will continue to support local governments in the updating and development of local hazard mitigation plans by providing extensive technical assistance. This assistance will include continued training on regulatory requirements and the use of Hazard Analysis and Risk Assessment Data.
- MEMA will partner with responsible State agencies to identify mitigation strategies for State-owned facilities that have been identified in the Risk Assessment as located in hazard areas for flash and riverine flooding.
-

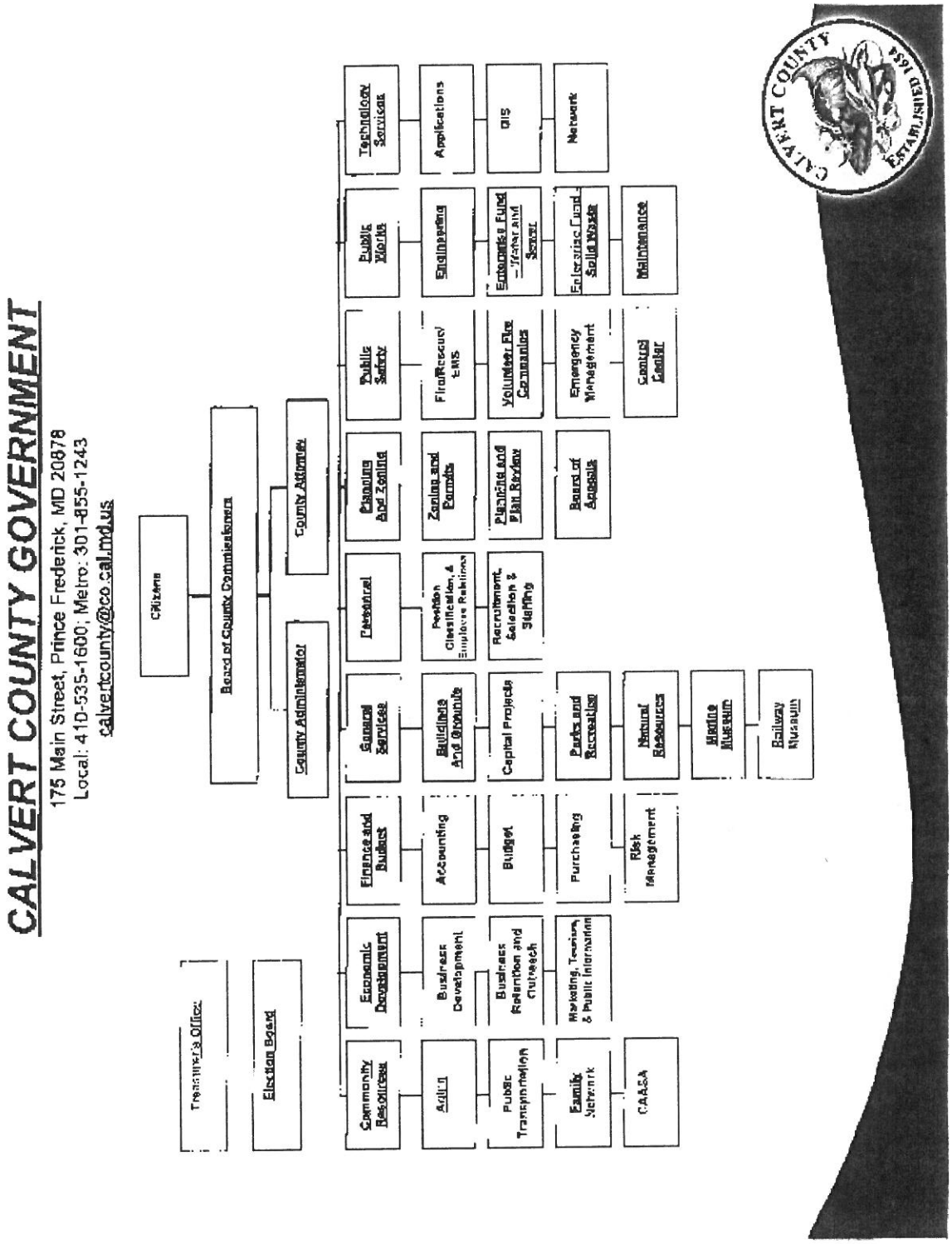
County Government, Departments, and Staffing Capabilities

Calvert County was established 1654 and renamed Patuxent County by the Puritans and then renamed Calvert County. It is governed by a Board of County Commissioners. Calvert County government comprises the following departments: Community Resources, Economic Development, Finance and Budget, General Services, Personnel, Planning and Zoning, Public Safety, Public Works and Technology Services (see Organizational Chart, Figure 3.1).

Staffing for flood plain management and flood mitigation related projects:

- Department of Economic Development: Calvert County's Department of Economic Development focuses on encouraging existing businesses, attracting new employers, and promoting tourism. The Department also handles public outreach through a Public Information Specialist.

Figure 3.1 County Organizational Chart



- Department of Public Safety: The Department of Public Safety manages daily emergency response calls; works to mitigate manmade, technological and/or natural disasters; and serves as a point of contact and coordination for Homeland Security issues at the County, State, and Federal levels. Public Safety functions as a reference or resource center for all emergency related issues.
- Emergency Management Division (EMD): The Emergency Management Division, Department of Public Safety, strives to minimize the effects of future disasters through mitigation, planning, training and response efforts. The Division maintains and updates the Emergency Operations Plan and promotes public awareness of disaster prevention or preparedness to insure the County is ready for any emergency. The Division staff includes the Division Chief, Emergency Planner, Emergency Management Specialist and office assistant.
- Fire, Rescue & Emergency Medical Services Division: This division within the Department of Public Safety is responsible for providing fire protection, rescue and emergency medical services to the citizens of Calvert County. The Division staff includes the Coordinator, Assistant Coordinator, Recruitment and Retention Specialist and the volunteer fire and rescue companies.
- Department of Planning & Zoning (P&Z): P&Z is responsible for county-wide zoning, plan and map updates. This Department in conjunction with EMD administers the NFIP for Calvert County. P&Z also administers and supervises the Critical Area and Forest Conservation Programs, permit review, Site Plan and Subdivision review, Board of Appeals, Planning Commission, and zoning violations (including floodplain violations). Relative to floodplain management, P&Z has one code enforcement officer and two code enforcement inspectors, a reviewer who is a Certified Floodplain Manager for all floodplain permits, the Floodplain Administrator (Zoning Officer), a GIS/mapping specialist, a site plan/subdivision reviewer who also insures compliance with the floodplain regulations, a Principal Environmental Planner that processes amendments to the Floodplain Ordinance and supervises environmental review staff and a Board of Appeals Planner.
- Department of Public Works (PW): The primary functions of PW include: engineering and stormwater management project review, developing the County transportation system (roads), sediment and erosion control inspection, developing and managing the public water and sewer and solid waste facilities and fleet and highway maintenance (including bridge construction and maintenance.
- Department of Technical Services (TS): There are two GIS Specialists in this department.

CHAPTER 4: PROPERTY PROTECTION

Introduction

Property protection measures comprise those techniques used to modify existing buildings that are subject to flood damage. Most of these measures are implemented by or cost-shared with property owners and are thus relatively inexpensive to the community compared with other structural flood protection measures. The benefit of many of these protection measures is that they do not usually affect the appearance or use of a building. Examples of property protection measures include: relocation, acquisition, building elevation, flood-proofing, sewer backup protection, flood insurance, and mandates.

Building Relocation

Relocation involves moving a building to another location on higher ground. While this is often the best way to protect it from flooding, it can prove expensive for heavier (exterior brick and stone wall structures and for large and irregularly shaped buildings). Relocation is also preferred for large lots that include buildable areas outside the floodplain or where the owner has a new flood-free lot (or portion of their existing lot) available. All building relocation projects are administered by the County's Emergency Management Division.

Acquisition

Acquisition is similar to relocation, where buildings in the flood-prone area are removed to avoid future damage to them. However, in this case, the buildings are acquired by the local or state government and the land is converted to public use such as a park. No cost is borne by the homeowner. Acquiring buildings and removing them from the floodplain is not only the most effective flood protection measure available, it is also a method to convert a problem area into a community asset and obtain environmental benefits. However, a "checkerboard" pattern in which nonadjacent properties are acquired could occur when some owners are reluctant to leave.

Acquisitions can be funded by the Federal Emergency Management Agency (FEMA) using post-disaster mitigation funds that are administered through the Maryland Emergency Management Agency (MEMA). The buyout would involve eligible willing sellers only and be funded with 75 percent federal dollars and 25 percent local match. Three properties have been acquired in the County. The acquired properties are located at Cove Point, Kenwood Beach, and Hallowing Point Trailer Park at the Route 231 Bridge.

Building Elevation

This technique involves raising a building above the flood level so that water can flow under the building, causing little or no damage to the structure or its contents. Elevating a building will change its appearance. If only a small elevation is required, such as a

couple feet, the front door would be three steps higher than before. If the building is raised eight or more feet, the lower area can be wet flood-proofed and used for parking and for storage of items that will not be damaged by flood waters.

Raising a building above the flood level is cheaper than moving it and can be less disruptive to a neighborhood. Elevation has proven to be an acceptable and reasonable means of complying with NFIP regulations that require new, substantially improved, and substantially damaged buildings to be elevated above the base flood elevation.

Cove Point and Long Beach are the two areas that are typically in danger of flooding in the County. Three properties are currently being elevated in the Cove Point subdivision. Two properties in Long Beach were identified for elevation but did not meet the benefit cost analysis. After Hurricane Isabel in 2003, a total of five properties had been identified for elevation and a total of 19 property owners applied for grants. Of this, only one property met the benefit cost analysis but the project was not pursued.

Barriers

A barrier can be built of dirt or soil ("berm") or concrete or steel ("floodwall") and are used to prevent floodwaters from reaching a building. The standard design for earthen berms is three horizontal feet for each vertical foot (3:1 slope) requiring a minimum area six feet wide for each foot in height. Floodwalls need less room, but are more expensive. Barriers must be placed so as not to create flooding or drainage problems on neighboring properties, nor can they be constructed in the floodway. Depending on how porous the ground is, if floodwaters stay up for more than an hour or two, a barrier needs to handle leaks, seepage of water underneath, and rainwater that falls inside the perimeter. This is usually done with a sump and/or drain to collect the internal groundwater and surface water and a pump and pipe to pump the internal drainage over the barrier.

The Town of North Beach has floodwalls along both sides of Highway 261. The road is elevated for about 100 yards and separates the marsh from the bay.

Dry and Wet Flood-proofing

The dry flood-proofing technique involves using measures to seal up a building so floodwaters are prevented from entering it. All areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or plastic sheeting and openings such as doors, windows, and vents are closed, either permanently, with removable shields, or with sandbags. Examples of dry flood-proofing modifications include the following:

- installing watertight shields over doors and windows;
- reinforcing walls to withstand floodwater pressures and impact forces generated by floating debris;
- using membranes and other sealants to reduce seepage of floodwater through walls and wall penetrations;
- installing drainage collection systems and sump pumps to control interior water levels, collect seepage, and reduce hydrostatic water pressures on the floor slab and walls;

- installing backflow valves to prevent the entrance of floodwater or sewage flows through utilities; and
- anchoring the building to resist flotation, collapse, and lateral movement.

Advantages

- The appearance of the building is not altered.
- It is appropriate for buildings on concrete slab floors (without basements) and for those without cracks.
- It is recommended where floodwaters are less than three feet and slow moving or for buildings that are too expensive to elevate (e.g., a slab building).

Disadvantages

- The waterproofing compounds can deteriorate over a period of time.
- It is dependent on human action for the installation of closures on windows and doorways.
- It cannot be used if the structure has a basement.

Wet flood-proofing, unlike dry flood-proofing, allows floodwaters to enter a structure. Wet flood-proofing is appropriate for structures with uninhabited areas below the flood elevation, such as unfinished basements, garages, and crawlspaces. Because wet flood-proofing allows floodwaters to enter a structure, modifications must be made to minimize damage to the portion of the structure below the flood elevation and its contents. Typically, the structure is designed so that walls and floors below the flood elevation are resistant to damage from floodwaters, and utilities and other valuable equipment are located above the flood elevation.

Wet flood-proofing is not feasible for one-story houses because the flooded areas are the living areas. However, basements, crawlspaces, garages, and accessory buildings can be wet proofed simply by relocating furnaces, heavy furniture and electrical outlets. Fuse and electric breaker boxes should be located high and near a door in order to safely turn the power off to the circuits serving flood prone areas.

No matter how little it is done, flood damage is reduced by wet proofing. For example, thousands of dollars in damage can be prevented by simply moving furniture and electrical appliances out of a basement.

Sewer Backup Protection

In areas where sanitary and storm sewers are combined, basement flooding can be caused by storm-water overloading the system and backing up into the basement through the sanitary sewer line. In areas where sanitary flows and storm-water are carried in separate pipes, the same problem can be caused by cross connections between the sanitary and storm sewers or by infiltration or inflow into the lines.

Buildings that have downspouts, footing drain tile, and/or a sump pump connected to the sanitary sewer service may be flooded inside when heavy rains overload the system. If local code does not require these systems to be directly connected to the sewer system, they should be disconnected. Rain water and surface water should be directed out onto the ground where it will flow away from the building.

Other approaches may be used to protect a structure against sewer backup: floor drain plugs, floor drain stand-pipes, overhead sewers, and backflow protection valves. The first two devices keep water from flowing out of the lowest opening in the building, the floor drain. They cost less than $25. However, if water becomes deep enough in the sewer system, it can flow out of the next lowest opening, such as a toilet or tub, or it can overwhelm a drain plug by hydrostatic pressure and flow into the building through the floor drain. The other two measures are more secure, but more expensive ($3,000-$4,000). An overhead sewer keeps water in the sewer line during a backup. A backflow protection valve prevents backups from flowing into the building.

The County's Division of Water and Sewerage has never had a sewer backup protection program, and is not looking to implement one at this time. The sewer backup protection program is routinely implemented on the basis of individual users/customers.

The county-wide SCADA system (Mission Communications) performs a function of remotely monitoring all sewer pump stations that contacts county staff via cellular phone when any operational issues arise (high level in the wet wells, power failures, pump failure) that allow them to intervene if we have a failure at any pump station before the level gets high enough to either overflow the pump station and/or backup in the collection lines such that a backup would occur. This system only prevents backups that are a result of a pump station failure. Typically, any blockage that occurs upstream of the pump station wet wells cannot be detected or identified until such time that the water/sewage level in the sewer collection lines or service laterals rises to a point where it is observed at ground level (outside or inside of structures).

Sewer backup protection devices can be subject to failure due to clogging, especially if not regularly maintained, potentially causing more backups than would have occurred without the devices. Those that are installed inside in the basement would not be accessible to the County. Also, no other plumbing fixtures can be used in the house when the valve is in the closed position so, for example, during a hurricane, if the owner is not aware that the device is activated, they will have their own sewage back up into the house.

Flood Insurance

With the purchase of flood insurance, as long as the policy is in force, the property is protected. Although most homeowner's insurance policies do not cover a property for flood damage, an owner can insure a building for damage by surface flooding through the National Flood Insurance Program.

Flood insurance coverage is provided for insurable buildings and their contents damaged by a "general condition of surface flooding" in the area. Building coverage is for the structure. This includes all things that typically stay with the building when it changes ownership, including: utility equipment (furnace or water heater); wall-to-wall carpeting; built-in appliances; and wallpaper and paneling.

Ten percent of a residence's building coverage may apply to a detached garage or carport. Other appurtenant structures are required to be insured under a separate policy. Contents coverage is for the removable items inside an insurable building. A renter can take out a policy with contents coverage, even if there is no structural coverage. Items not insurable include:

- items outside a building, such as fences, car ports, landscaping and driveways;
- jewelry, artwork, furs and similar items valued at more than $250;
- finished structural parts of a basement, such as paneling and wall to wall carpeting;
- animals and livestock;
- licensed vehicles;
- money or valuable papers; and
- contents in a basement.

In most cases, a 30-day waiting period follows the purchase of a flood insurance policy before it goes into effect. The objective of this waiting period is to encourage people to keep a policy at all times. People cannot wait for the river to rise before they buy their coverage.

Through the Basement Backup Insurance, the National Flood Insurance Program covers seepage and sewer backup for an additional deductible provided there is a general condition of flooding in the area which was the proximate cause of the basement becoming wet. Several insurance companies offer coverage for damage incurred should a sump pump fail or a sewer line backup. Most exclude damage from surface flooding that would be covered by the NFIP. Each company has different amounts of coverage, exclusions, deductibles, and arrangements. There is a need to encourage property owners in the 100-year floodplain to purchase flood insurance.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a Federal program that enables property owners in participating communities to purchase flood insurance as protection against flood losses, while requiring State and local governments to enforce floodplain management regulations that reduce future flood damages. The NFIP plays a critical role in encouraging communities to adopt and enforce floodplain management regulations and to implement broader floodplain management programs. Calvert County and its two municipalities participate in the Flood Insurance Program and allow property owners to purchase flood insurance through this program. The NFIP policies and premiums are administered by the County's Planning and Zoning Department. The County was initially involved in the Community Rating System from 1991 through 1996 as a Class 9 community. Based on information from the Maryland Department of the

Environment, several communities throughout the country retrograded to Class 10 when the Repetitive Loss Planning requirement was added in the 1990's. This included Calvert County.

Table 4.1 Effective FIRM dates for local communities

Community Name	Current Effective Map Date
Calvert County (unincorporated areas)	July 20, 1998
Town of Chesapeake Beach	November 1, 1984
Town of North Beach	September 28, 1984

Source: FEMA Community Status Book Report, July 28, 2008

The loss and policy statistics for Calvert County have been included along with those for the individual municipalities for the period from January 1978 to September 2008. Calvert County incurs 1.9 percent of the total losses for the State of Maryland and 0.7 percent of the total policies.[3]

Table 4.2 Calvert County loss statistics

Area	Losses	Total Payments
Maryland	14,185	$235,442,637.31
Calvert County	269	$4,329,129.73
Town of Chesapeake Beach	64	$1,548,029.55
Town of North Beach	94	$2,615,266.18

Table 4.3 Calvert County NFIP policy statistics

Area	Policies in Force	Insurance in Force	Whole Written Premiums in Force
Maryland	68,241	$13,505,442,300	$32,812,163
Calvert County	508	$130,483,600	$349,955
Town of Chesapeake Beach	187	$52,956,100	$123,043
Town of North Beach	111	$21,497,100	$61,089

Mandates

Mandates are compulsions that are used when incentives are inadequate to convince a property owner to take protective actions. An example of a mandate could include the improvements or repairs made to a building in the mapped floodplain. If the project is worth more than 50% of the value of the original building it is considered a "substantial improvement." The building must then be elevated or otherwise brought up to current flood protection codes.

The Floodplain Management Ordinance requires a one-foot freeboard above the base flood elevation. Utilities are required to be protected from higher flood levels. Electric and mechanical systems are required to be elevated to one foot above the base flood elevation and distribution panels are required to be elevated three feet above the base flood elevation.

[3] FEMA's Policy and Claim Statistics for Flood Insurance http://www.fema.gov/business/nfip/statistics/pcstat.shtm

CHAPTER 5: EMERGENCY SERVICES

Introduction

Emergency services involve measures to protect people during and after a disaster. In this Chapter, the following five types of emergency services measures are discussed: 1) Threat recognition; 2) Warning; 3) Response; 4) Critical facilities protection; and 5) Post-disaster recovery and mitigation.

Threat Recognition

A flood threat recognition system provides early warning to emergency managers. The National Oceanic and Atmospheric Administration (NOAA) Weather Radio is considered the official source for weather information. Flood threat predictions are disseminated on the NOAA Weather Wire or NOAA Weather Radio.

NOAA typically uses two levels of notification in flood warning programs: 1) flood watch: conditions are right for flooding; and 2) flood warning: a flood has started or is expected to occur. Under certain conditions, the National Weather Service may issue a "flash flood watch." This means the amount of rain expected may cause rapid increases in local stream flows and/or localized ponding. However, these events are so localized and so rapid that a "flash flood warning" is seldom issued.

In the State of Maryland, all County Emergency Management Agencies are alerted by the Maryland Emergency Management Agency (MEMA). Warnings from the National Weather Service are relayed to municipalities by County Emergency Management Agencies (EMAs), who monitor weather radio and broadcast networks.

Calvert County's weather is forecasted by the National Weather Service located in Wakefield, Virginia. They provide daily updates on weather advisories; watches; and warnings. In the event of severe weather, up-to-date information is broadcast on local television channels and the following radio channels: WSMD 98.3 FM, WKIK 102.9 FM & 1560 AM, WPRS 104.1 FM, WYRX 97.7 FM, and WPTX 1690 and updated on the County's Emergency Management website. There are two USGS flood gauges in the County used to monitor flood levels. They are located on the Route 4 and Route 263 (Plum Point Road) stream and on the Route 4 and Parran Road stream.

Warning

After a flood threat is recognized, the first priority is to alert others through the flood warning system. The second priority is to respond with actions that can prevent or reduce damage and injuries. The following responses to flood emergencies are undertaken by various agencies in the City and County:

Calvert County operates a CodeRED telephone emergency notification system that allows County staff to contact residents in the event of an emergency. CodeRED employs mapping capability for geographic targeting of calls coupled with a high-speed telephone system capable of delivering pre-recorded messages directly to homes and

businesses. In the event of extended power outages, staff use CodeRED to provide updates and broadcast emergency information such as warning center locations and mass care shelter activations.

The Emergency Management Department advocates the use of NOAA radios throughout the County. While the school system is equipped with NOAA radios, residents are also strongly encouraged to purchase these radios.

The County's website includes a link on what to do and where to go if residents are asked to evacuate: http://www.co.cal.md.us/residents/safety/emergency/evacuation/

Response

An Emergency Operations or Response Plan identifies emergency planning, organization, and response policies and procedures and lays out details to address the integration and coordination with other governmental levels, during an emergency or when required. The Plan addresses how the jurisdictions will respond to extraordinary events or disasters from preparation through recovery. Emergency response plans should be updated annually to keep contact names and telephone numbers current and to ensure that supplies and equipment that will be needed are still available and revised after disasters based on the changing conditions. A well written Emergency Operations Plan (EOP) will contain information to enable emergency management staff to identify the number of properties flooded, roads that will be under water, critical facilities that will be affected. This information will enable staff to prepare a plan that shows problem sites and determines what resources will be needed to respond to the predicted flood level.

The Calvert County Emergency Management Agency is the entity responsible for planning and coordinating plans, procedures and resources in preparation for a natural or man-made disaster. Emergency management services at the State level are coordinated by the Maryland Emergency Management Agency. The County EMA is located at 175 Main Street in Prince Frederick which also contains the County's Emergency Communications Center. The EOC is located in the lower level of the north wing of the Courthouse, along with the Calvert Control (911 Center). The Emergency Operations Center is staffed during normal working hours and the County 911 Center is staffed 24/7. Upon activation of the EOC, 24-hour staffing is available through personnel assigned to EOC communications. An alternate EOC is located at the Prince Frederick Fire Department located on Route 2 and 4, at the intersection with Monitor Way, should the primary EOC become inoperable or unusable.

The ultimate responsibility for Emergency Management of any disaster rests with the Calvert County Board of Commissioners. The Board is responsible for all policy-level decisions which are implemented through the County Administrator. A Public Information Officer is responsible for preparing news releases and coordinating the release of information to the media and the public.

Annex A of the County's Emergency Operations Plan lays out the procedures to be used by the County's Emergency Management staff in the operation of the Emergency Operations Center during major emergency or disaster situations.

The Communications Annex (Annex B) provides information on communication capabilities during emergency situations when the Emergency Operations Center has been activated. The Annex identifies the organization and responsibilities of a number of agencies including the Emergency Management Agency; county departments with communication capabilities; Calvert Control; Fire, Rescue, and Police services; and Radio Amateur Civil Emergency Services.

Evacuation issues are addressed in Annex C of the County's EOP. The purpose of this Annex is to provide for an orderly and coordinated evacuation in the event of evacuations such as a riverine flood, hurricane, hazardous materials incident, fixed nuclear facility incident, major fire or transportation accident or terrorist attack. The measures considered for control and coordinating when planning for an evacuation include the geographic area; traffic control points; assembly points; and shelters.

Currently, there is no flood-specific response plan for Calvert County. However, since the County is subject to periodic hurricanes and since these hurricanes can produce events as high winds, heavy rainfall, storm surge, tornadoes, flooding or a combination of these, Annex O of the County's EOP – Hurricane Plan - establishes policies and procedures for direction and control during a hurricane emergency.

The Emergency Public Information Officer prepares public information releases to advise residents of areas affected and actions to be taken, i.e. assembly points for persons without private transportation, evacuation routes to be used, etc. and insures that current and accurate information is available for dissemination.

The County's Emergency Management website also provides a link to emergency management information: www.co.cal.md.us/residents/safety/emergency/ and to resources including state and federal agencies and the American Red Cross.

Table 5.1 indicates specific agencies within the County that are responsible for various aspects during a flood emergency situation.

Table 5.1 Agency responsibilities for flood emergency responses

Action	Responsible Agency
Ordering an evacuation	Emergency Management in conjunction with the Board of County Commissioners
Activating the emergency operations center	Emergency Management
Opening and operating evacuation shelters	EOC activates the shelters if the Board of Education and Department of Social Services agree. Only schools with shower facilities (high schools) are used as shelters
Sandbagging certain areas	Property owners are primarily responsible for sandbagging with some assistance from Public Works.
Closing levee and floodwall systems	City of Chesapeake Beach
Closing streets or bridges	Public Works, Transportation, and Law Enforcement
Monitoring water levels at the high hazard dams which fall outside the city limits	Public Works, all bridges are privately owned
Shutting off power to threatened areas	Southern Maryland Electric Cooperative, BG&E
Releasing children from school	Board of Education

Critical Facilities Protection

Critical facilities are defined as those buildings or infrastructure that is vital to the functioning of a community and to the flood response effort. If a critical facility is flooded, workers and resources may be unnecessarily drawn away from protecting the rest of the community. If such a facility is adequately prepared, it will be better able to support the community's flood response efforts.

Critical facilities include emergency operations centers, police and fire stations, hospitals, and roads and bridges. Critical facilities also include those buildings or locations that, if flooded, would create secondary disasters such as hazardous materials facilities, water and wastewater treatment plants, pump stations, schools, and nursing homes.

The State Hazard Mitigation Plan identifies 22 state-owned facilities in Calvert County that are at risk from at least one hazard. The State Plan also identifies four critical and state-owned facilities that are at risk of at least four hazards: erosion, flood, surge, and radiological activity. These facilities include: the University of Maryland Center for Environmental Science, University of Maryland Chesapeake Biological Lab, University of Maryland Center for Environmental and Estuarine Studies, and University System of Maryland Warehouse. Calvert County has the second highest number of critical and state-owned facilities at risk in Maryland.

Based on data in the State Hazard Mitigation Plan, the counties surrounding the Chesapeake Bay have an increased risk of Category 1 Storm damage. Calvert County is home to 17 critical facilities at risk making up nine percent of all critical facilities at risk in Maryland. The total value at these 17 facilities is over $5.2 million.

Table 5.2 Number and value of critical and state-owned facilities at extreme risk of tidal and coastal flooding from a Category 1 storm

Jurisdiction	Facilities	Value of Facilities	Value of Contents in Facilities	Total Value of Facilities
Calvert	17	$2,171,252	$3,036,947	$5,208,199
Maryland Total	186	$93,633,509	$116,002,283	$209,635,792
% of Total	9.1	2.3	2.6	2.5

Calvert County is also among the jurisdictions with the greatest number of State-owned and critical facilities at-risk from a Category II Coastal Storm (other counties include Worcester, Dorchester and Somerset Counties). Calvert County accounts for seven percent of all the critical facilities at-risk from a Category II Costal Storm (total value of over $7 million).

Table 5.3 Number and value of critical and state-owned facilities at extreme risk of tidal and coastal flooding from a Category 2 storm

Jurisdiction	Number of Facilities	Value of Facilities	Value of Contents in Facilities	Total Value of Facilities
Calvert	18	$2,961,994	$4,131,158	$7,093,152
Maryland Total	256	$155,508,205	$165,253,845	$350,762,050
% of Total	0.7	1.9	2.5	2.0

Post-Disaster Recovery and Mitigation

Post disaster recovery refers to steps taken by communities to prepare people and property after a disaster and for the next disaster. These activities are implemented during recovery to keep people from immediately going "back to normal" (i.e., the way they were before the disaster). While recovery operations follow a disaster, mitigation actions are undertaken when communities are in 'quiet' mode, prior to a disaster or several months after a disaster occurs in order to reduce the impact of a disaster.

Some examples of recovery actions include the following:

- Clearing streets;
- Cleaning up debris and garbage;
- Patrolling evacuated areas to prevent looting;
- Providing safe drinking water;
- Monitoring for diseases and vaccinating residents for diseases such as tetanus; and
- Regulating reconstruction to ensure that it meets all code requirements.

Some examples of mitigation actions include the following:

- Conducting a public information campaign to advise residents about various mitigation alternatives that could be considered;
- Assessing damage to public facilities and developing measures to mitigate hazards in the future;
- Acquiring substantially or repeatedly damaged properties from willing sellers; and
- Applying for post-disaster mitigation funds.

The Calvert County Emergency Management Agency ensures that the Federal, State and County activities are implemented with respect to emergency management procedures. The County's Emergency Operations Plan lists tasks and responsibilities of various entities in the County and its municipalities, during an emergency situation. If County resources prove to be inadequate during an emergency; assistance for equipment, supplies, and personnel may be obtained through the negotiated mutual-aid agreements with surrounding counties (Charles and St. Mary's Counties). The County has also developed working relationships with volunteer organizations in the incorporated communities and rural areas.

The Calvert County Emergency Operations Plan identifies actions to be taken by the government of Calvert County, Board of County Commissioners and by cooperating private organizations, to prevent disasters and to reduce the vulnerability of county residents to any disasters that may strike, to establish capabilities for protecting citizens from the effects of disasters, and to provide for recovery in the aftermath of any emergency involving extensive damage or debilitating influence on the normal pattern of life within the community. The Basic Plan and all 16 Annexes are working documents and are reviewed and revised on an ongoing basis.

The Basic Plan identifies the organizations and assigned responsibilities of a number of key personnel including the President of the Board of County Commissioners, Director of Emergency Management, Board of County Commissioners, Public Information Officer, Calvert Control, Fire Rescue EMS Coordinator, Fire Service, EMS Service, Police Department, Maryland State Police, Health Services, Social Services, School Board, Red Cross, and various County departments.

The 2004 Calvert County Hazard Mitigation Plan discussed in Chapter 3 was funded by FEMA and the Maryland Emergency Management Agency. The Plan provides recommendations for the mitigation of a number of different hazards including flood that pose a risk to the County's structures and residents

After a disaster, various types of assistance may be available to the County by local, state and federal governments. In the event of a Presidential disaster declaration, the County becomes eligible for Individual Assistance (IA) and Public Assistance (PA). Individual Assistance is typically funded by the US Small Business Administration and other federal, state, and local agencies that support the program and are designed to provide help to individuals and businesses, homeowners and renters, as they recover from disasters.

The Public Assistance program is largely funded by FEMA with local and state matches. The PA program provides cost reimbursement aid to local governments (state, county, local, municipal authorities, and school districts) and certain non-profit agencies that were involved in disaster response and recovery programs or that suffered loss or damage to facilities or property used to deliver governmental-like services.

Annex D – Damage Assessment Part II of the County's Emergency Operations Plan prescribes the procedures, responsibilities and actions to be taken by the Calvert County Emergency Management Agency and other County agencies in order to determine the extent and impact of damage caused by a manmade or natural disaster. These agencies include: Planning and Zoning, Public Works, Emergency Management, County Roads Department, Superintendent of Schools, Public Information Office, and American Red Cross, among others. Most post-disaster damage assessment efforts within the County are carried out cooperatively between the Emergency Management Agency and the Public Works Department. These entities, along with the Floodplain Administrator (Planning and Zoning) should be responsible for coordinating activities with the Flood Mitigation Steering Committee after a flood event, to ensure that the applicable mitigation actions are brought to the County Commission for potential implementation. This coordination should be reflected in the update of the County's Emergency Operations Plan.

CHAPTER 6: STRUCTURAL PROJECTS

Introduction

Structural projects such as reservoirs, levees and floodwalls, channel improvements, crossings and roadways, drainage and storm sewer improvements, and drainage system maintenance are designed to control floodwaters. Based on their sheer magnitude, structural flood control is generally the most expensive type of mitigation measure in terms of installation costs, maintenance requirements and environmental impacts. It, therefore, requires considerable thought and analysis before a structural project is selected. Since these projects often have regional or watershed-wide implications, they could be planned, funded and implemented by regional agencies such as watershed authorities. While flood control projects can be beneficial, they also have disadvantages.

Advantages

- Flood control projects can provide the greatest amount of protection for land area used.
- Due to land limitations, they may be the only practical solution in some circumstances.
- They can also be beneficial to the community for water supply and recreational uses.
- Regional detention may be more cost-efficient and more effective than requiring numerous small detention basins.

Disadvantages

- They disturb the land and disrupt natural water flows, often destroying wildlife habitat.
- They require regular maintenance in order to function properly.
- They are built to a certain flood protection level that can be exceeded by larger floods, causing extensive damage.
- They can create a false sense of security as people protected by a project often believe that no flood can ever reach them.
- They end up promoting more intensive land use and development in the floodplain.

Reservoirs and Dams

Reservoirs control flooding by holding high flows behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate that the river can accommodate downstream. The lake created may provide recreational benefits or water supply (which could help mitigate a drought). Reservoirs are suitable for protecting existing development downstream from the project site. Unlike levees and channel modifications, they do not have to be built close to or disrupt the area to be protected. Reservoirs are most efficient in deeper valleys where there is more room to store water, or on smaller rivers where there is less water to store. Building a reservoir in flat areas and on large rivers may not be cost-effective, because large areas of land have to be

purchased. In urban areas, some reservoirs are simply manmade holes with the capacity to store floodwaters.

On the other hand, reservoirs and detention basins can have the following disadvantages:

- There is the threat of flooding to the protected area if the reservoir's dam fails;
- There is a constant expense incurred for management and maintenance of the facility;
- They may fail to prevent floods that exceed their design levels;
- Sediment deposition may occur and reduce the storage capacity over time;
- They can impact water quality as they are known to affect temperature, dissolved Oxygen, Nitrogen, and nutrients; and
- If not designed correctly, they may cause backwater flooding problems upstream.

There are no reservoirs in Calvert County. Storm water management ponds are evident throughout the county. The Victoria Station and Chesapeake Ranch Estate subdivisions contain large stormwater facilities.

The 2005 Maryland Hazard Assessment lists six dams in Calvert County[4]. All of the county's dams are of earthen construction. Five of the dams are rated as being in good condition. Bowen Farm Pond at the Battle Creek Cypress Swamp (low hazard) is rated in poor condition by MDE.

Levees/Floodwalls

Earth barriers are termed as levees and concrete or steel barriers between the watercourse and the property to be protected are termed floodwalls. Levees occupy more space than floodwalls; therefore, when adequate space for a levee is not available, floodwalls are used, even though they are usually more expensive than levees. Levees and floodwalls may not be constructed in the floodway. Designs for both levees and floodwalls must provide for access through (e.g., watertight closures) or over (e.g., ramps or stairs) the barrier. In addition, the designs for both levee and floodwall projects must compensate for any loss of flood storage that will result from construction. There are no floodwalls in the unincorporated areas of the county. The Towns of North Beach and Chesapeake Beach each have a floodwall. Chesapeake Beach has a flood gate and sea wall. Both communities reported having revetment projects.

Bridge Modifications

Modifications to bridges involve the replacement, enlargement, or removal of existing bridge decks at roadway and railway crossings. Often bridges are not large enough to pass flood flows, resulting in floodwater backing up upstream of the structure.

Highways and bridges are maintained by the County's Public Works Department. Table 6.1 identifies a total of 14 bridges. These bridges are inspected by professionals trained by the Maryland State Highway Administration every two years in accordance with State's Safety regulations.

[4] Data from MDE's Dam Inventory

Table 6.1 Calvert County bridges

Bridge Number	Road	Water Crossing
C-0001	Ward Road	Tributary of Hall Creek
C-0003	Chaneyville Road	Graham Creek
C-0004	Huntingtown Road	Cocktown Creek
C-0005	Dalrymple Road	Fishing Creek
C-0006	Hardesty Road	Fishing Creek
C-0007	Cox Road	Sewell Branch
C-001 0	Parran Road	St. Leonard Creek
C-0012P	Ball Road	St. Leonard Creek
C-0013	Stinnett Road	Plum Point Creek
C-0014B	Stoakley Road	Mill Creek
C-0015B	Olivett Road	Old House Cove
C-0016	Lower Marlboro Road (Wharf)	Patuxent River
C-0018B	German Chapel Road	Battle Creek
C-001 9	Mill Branch Road	Tributary of Chew Creek

Source: Calvert County Bridge/Structure Inventory and Postings – County Public Works Department

Two main bridges over the Patuxent River connect Calvert County to St. Mary's and Charles Counties: the Thomas Johnson Memorial Bridge at Solomons and the Route 231 Bridge at Hallowing Point. The Maryland State Highway Administration (SHA) is in the process of a planning study on MD Route 4 from MD Route 2 to MD Route 235. The project includes improvements to the MD 4 crossing of the Thomas Johnson Bridge. The purpose of the study is to address congestion and high traffic volume on the bridge particularly during peak periods.

Channel Improvements

Channels can be improved by making them wider, deeper, or straighter. Improving channel conveyance causes more water to flow through it at a faster rate. However, channel ized streams could create or worsen flooding problems downstream as larger volumes of water are transported at a faster rate.

While channel improvements are one-time projects, they have to be maintained to clean out blockages caused by overgrowth or debris. Some communities also pass ordinances prohibiting dumping and making riverfront owners responsible for maintaining their areas. A proper maintenance program includes picking up debris as well as riparian restoration, i.e., removing non-native growth. By planting native grasses and plants, there are fewer sources of logs and woody debris, soils are better stabilized, bank erosion is reduced and habitat is improved.

The County's Department of Public Works conducts channel improvements and addresses all drainage issues. The Department is also in charge of clearing debris and carrying out routine maintenance throughout the year

Dredging

Dredging is a form of conveyance improvement. Dredging may not be effective in most cases given the large volume of water that comes downstream during a flood, and so removing a foot or two from the bottom of the channel will have little effect on the height of the flood. Dredging is not a permanent improvement. Unless in-stream and/or tributary erosion are corrected upstream, the dredged areas usually fill back in within a few years, and the process and expense have to be repeated. In order to protect the natural values of the stream, Federal law requires a Corps of Engineers permit before dredging can proceed. This can be a lengthy process that requires much advance planning and many safeguards to protect habitat.

Diversion

A diversion is a new channel that sends floodwaters to a different location, thereby reducing flooding along an existing watercourse. During normal flows, the water stays in the old channel. During flood flows, the floodwaters spill over to the diversion channel or tunnel, which carries the excess water to a receiving lake or river. Unless the receiving water body is relatively close to the flood-prone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive. Where topography and land use are not favorable, a more expensive tunnel is needed. Sometimes diversions could cause new flood problems when diversion channels may be blocked by residents who do not understand, or disagree with, their purpose.

CHAPTER 7: NATURAL RESOURCE PROTECTION

Introduction

While open space is an amenity and serves the community in the form of parks, greenways, recreational opportunities, and golf courses, it also serves a beneficial function; it reduces the vulnerability to flooding when the floodplain is preserved as open space. Preserving floodplains, wetlands, and natural water storage areas enables the existing stormwater storage capacities of an area to be maintained. Open space can exist in the form of preserved open lands, purchased, or dedicated by developers in the form of easements.

Natural resource protection activities focus on preserving floodplains and watersheds, thereby improving their naturally beneficial functions. These functions include: storage of floodwaters, absorption of flood energy, groundwater recharge, removal/filtering of excess nutrients, pollutants, and sediments from floodwaters, habitat for flora and fauna, and recreational and aesthetic opportunities, among others. These measures are implemented by a variety of public and private parties ranging from local park districts, forest preserves and regulatory agencies to land developers and farmers. The following five natural resource protection activities are discussed below in light of reducing Calvert County's susceptibility to flood damage and also in improving the quality of life in the community: 1) wetland protection and forest conservation; 2) erosion and sedimentation control; 3) river restoration; 4) best management practices; and 5) dumping regulations.

Wetland Protection and Forest Conservation

Wetlands are often found in floodplains and depression areas of a watershed and also serve as a natural filter to help improve water quality and provide healthy habitat for fish, plants, and wildlife. Wetlands receive and store floodwaters, thus slowing and reducing downstream flows and protect shorelines from erosion. Wetlands are regulated by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency under Section 404 of the Clean Water Act. Both these agencies are required to authorize individual permits. There are also nationwide permits that allow small projects that meet certain criteria to proceed without individual permits. The purpose of the permit is to protect wetlands by preventing development that would adversely affect them, and if that is indeed the case, wetlands are required to be mitigated. Wetland mitigation can include creation, restoration, enhancement or preservation of wetlands. The appropriate type of mitigation is addressed in each permit. Development regulations and educating property owners and local officials on the benefits are some ways to protect wetlands.

The County's wetlands are protected and regulated through the Maryland Department of the Environment. However, the County's wetland protection regulations are more stringent than that of the State's regulations. The County requires a 50-foot buffer around all non-tidal wetlands while the State only requires a 25-foot buffer. Filling of wetlands is prohibited for single-family dwellings except for unavoidable driveway or road crossings. All subdivision plats are required to show buffers.

Based on the County's floodplain ordinance, encroachment by developments in not allowed without State of federal permits. The applicant is required to demonstrate that no alternatives exist and that the encroachment is at the minimum amount necessary.

The Maryland Forest Service defines a buffer of at least 50 feet to be forested on each side of a stream with an increase of four feet for every one percent increase in slope. Article 8.3 of the County's Zoning Ordinance addresses forest conservation requirements. Any residential construction activity that does not result in the cumulative cutting, clearing, or grading of more than 30,000 square feet of forest on lots greater or equal to 40,000 square feet in size and 10,000 square feet of forest on lots less than 40,000 square feet in size of a forest the area is not subject to the requirements of a previous Forest Conservation Plan.

Erosion and Sedimentation Control

Erosion occurs along stream banks and shorelines when the volume and velocity of flow or wave action destabilize and wash away the soil. Surface water runoff can erode soil from construction sites, sending sediment into downstream waterways. This sediment tends to settle down when the water flow slows down and can clog storm sewers, drain tiles, culverts and ditches and reduce the water transport and storage capacity of river and stream channels, lakes and wetlands. When channels are constricted and flooding cannot deposit sediment in the bottomlands, it results in clogged streams or increased dredging costs. These issues are addressed through sedimentation and erosion measures which include: phased construction, minimal land clearing, and stabilizing bare ground as soon as possible with vegetation and other soil stabilizing practices. Erosion and sedimentation control regulations mandate that these types of practices be incorporated into construction plans. They are usually oriented toward construction sites rather than farms. The most common approach is to require applicants to submit an erosion and sediment control plan for the construction project.

Erosion and sediment control practices are required to be in conformance with the 1994 Maryland Standards and Specifications for Soil Erosion and Sediment Control published jointly by Water Resources Administration, Soil Conservation Service and State Soil Conservation Committee. Sediment and erosion control approval must be obtained from MDE if more than 5,000 square feet of surface area or more than 100 cubic yards is disturbed.

The County's Erosion and Sediment Control Ordinance requires all development in the floodplain to have a sediment control and stormwater management control permit. A grading permit and implementation of soil erosion and sediment controls is required for any development that results in disturbance greater than 5,000 square feet of land area and more than 100 cubic yards of earth, cut or fill.

Best Management Practices

The term Best Management Practices (BMPs) refers to design, construction and maintenance practices and criteria that minimize the impact of stormwater runoff rates and volumes, prevent erosion, protect natural resources and capture nonpoint source pollutants (including sediment). In addition to preventing increases in downstream flooding and minimizing water quality degradation, BMPs preserve beneficial natural

features onsite, maintain natural base flows, minimize habitat loss, and provide multiple uses of drainage and storage facilities.

Point source pollutants come from pipes such as the outfall of a municipal wastewater treatment plant. They are regulated by MDE. Non-point source pollutants come from non-specific locations and are harder to regulate. Examples of non-point source pollutants are lawn fertilizers, pesticides, and other farm chemicals, animal wastes, oils from street surfaces and industrial areas and sediment from agriculture, construction, mining and forestry operations.

The County's Storm water Management Ordinance directly references the State's Stormwater and Design Manual which informs developers how to implement BMPS into their designs.

The County's Zoning Ordinance lists criteria for development in the Intensely Developed areas: In the case of new development, technologies are required to be used to minimize adverse impacts to water quality caused by stormwater. If these technologies do not reduce pollutant loadings by at least 10 percent below the level of pollution on the site prior to development, then offsets should be used to reduce pollutant loadings by at least 10 percent of the predevelopment levels by: 1) Installing a new BMP in an existing urbanized area not already served by a stormwater BMP; 2) Installing or financing an agricultural BMP in the Resource Conservation Area; and 3) Modifying an existing stormwater BMP to improve its pollutant removal capability.

Dumping Regulations

While BMPs address pollutants that are liquids or suspended in water that are washed into a lake or stream, dumping regulations address solid matter, such as shopping carts, appliances and landscape waste that can be accidentally or intentionally thrown into channels or wetlands. Although these materials may not pollute the water, they can obstruct flows and reduce the channels' and wetlands' ability to convey or clean stormwater. Many cities have nuisance ordinances that prohibit dumping garbage or other "objectionable waste" on public or private property. People may not realize the consequences of their actions and for example, may fill in the ditch in their front yard without realizing that it is needed to drain street runoff. Therefore, a dumping enforcement program could prevent this and help in educating people on the same.

CHAPTER 8: PUBLIC INFORMATION

Introduction

The public outreach and awareness aspect of flood mitigation involves the dissemination of pertinent information to residents, businesses, and local officials about hazards such as flooding. These actions are intended to educate the community and encourage them to be better prepared to face a hazard. Public information can be disseminated in many ways. The following six methods are discussed in this chapter: 1) Map information; 2) Library and websites; 3) Outreach projects; 4) Technical assistance; 5) Real estate disclosure; and 6) Educational programs.

Map Information

FEMA's Flood Insurance Rate Maps provide valuable information about past and potential flood hazards and can help residents and businesses who are aware of the potential hazards to take steps to avoid problems and/or reduce their exposure to flooding. Flood maps are also to be used by real estate agents and potential home owners to determine if a property is flood-prone and whether flood insurance may be required.

Staff from Calvert County's Planning and Zoning Department (floodplain administrator) offer a walk-in service and assist residents by providing them with information on hazards, flooding outside of mapped areas, and zoning. They also explain flood insurance, property protection measures and mitigation options available to property owners. The Staff also assists in submitting requests for map amendments and revisions when needed, to show that a building is outside the mapped floodplain. FIRMs are available to the public at the County's Planning and Zoning Department.

Library and Web Sites

The community library and local web sites are common places for residents to seek information on hazards, hazard protection, and protecting natural resources. Interested property owners can read or check out handbooks or other publications that cover their situation. Libraries also have their own public information campaigns with displays, lectures, and other projects, which can augment the activities of the local government. However, more recently, web sites have become popular as research tools as they provide quick access to a wealth of public and private sites and sources of information.

The Central Library is located on Costly Way in Prince Frederick. Branch libraries are located in Owings (Fairview Branch), Lusby (Southern Branch) Chesapeake Beach (Twin Beaches Branch). The County also has an Outreach Van that visits local agencies and institutions. The libraries stock flood-related books and publications. The libraries' website offers a search feature where flood related books, publications and DVDs may be viewed by typing the keywords on their website:
http://64.26.86.236/uhtbin/cgisirsi/OkCmVhCuMv/COMMINFO/198170056/60/1180/X

The Calvert County Emergency Management website offers a link to flood preparedness information on its homepage: http://www.co.cal.md.us/residents/safety/emergency/flood/

Information on how to prepare before, during, and after a flood is detailed on the site. Separate web pages are included for tornado, hurricane, and winter storm preparedness. The webpage also contains information on evacuation procedures.

Outreach Projects

Outreach projects are designed to provide property owners information on property protection. Outreach materials may include funding sources, newspaper articles, flood protection techniques, etc. Other ways to disseminate information to the public include: displays in public buildings or shopping malls;

- articles and special sections in newspapers;
- radio and TV news releases and interview shows;
- flood protection video for cable TV programs or to loan to organizations;
- presentations at meetings of neighborhood groups, realtors, bankers, or other special interest groups;
- open houses that discuss flood-proofing techniques;
- web site notices with hyperlinks to other sources of information; and
- school curriculums on flood preparedness and flood safety.

Calvert County has offered outreach in the following forums: A workshop on floodplain management for surveyors and the public was conducted in July 2008 to fulfill a requirement for the forest conservation regulations; the annual Patuxent River Appreciation day is held by the County Environmental Commission where educational outreach activities are conducted; the County Environmental Commission writes articles on various topics for local newspapers; and the County's Emergency Management Department participates in some passive educational outreach through postings on their website and brochures. They also participate in community events and encourage residents to purchase NOAA radios.

The County Commissioners launched a monthly electronic email newsletter in July 2009. This is distributed via the internet to anyone subscribing via the initiation link on the county website (http://www.co.cal.md.us/). The principal use of the newsletter is for economic development but they will include other items of interest.

Technical Assistance

Technical assistance is typically provided by experts such as the local floodplain manager or building department staff who offer free advice and guide residents. Some building department or public works staff visit properties and offer suggestions. Most can recommend or identify qualified or licensed companies, to assist homeowners who are unsure of the project or the contractor. Technical assistance can be provided in one-on-one sessions with property owners or can be provided through seminars or open houses on specific topics such as: retrofitting techniques, selecting qualified contractors, and carrying out preparedness activities.

Another effective technique is called a *flood audit*. This involves a flood expert to visit a flood prone site, locates past and potential (e.g., the 100-year) flood depths on the property, and discusses alternative protection measures with the owner. The owner is given a written report with recommendations and a photograph of the property showing flood depths.

The County's Floodplain Administrator provides technical assistance and advice on development projects that are proposed in the floodplain. The Planning and Zoning Department offers information to homeowners who are interested in retrofitting their homes.

Real Estate Disclosure

In many instances, people feel, in hindsight, that they would have taken steps to protect themselves from a disaster such as a flood if they had known their property was in a flood-prone area. Based on Federal law, federally regulated lending institutions must advise applicants for a mortgage or other loan that is to be secured by an insurable building that the property is in a floodplain as shown on the Flood Insurance Rate Map. Flood insurance is required for buildings located within the base floodplain if the mortgage or loan is federally insured. However, because this requirement has to be met only 10 days before closing, often the applicant is already committed to purchasing the property when they first learn of the flood hazard.

Maryland Real Property Disclosure Act: *Effective October 1, 2005, a new Maryland law took effect that substantially affects residential real estate sales within the State. Under the new law, a seller of residential real property - unless otherwise exempt - would still be required to complete and deliver to the purchaser a disclosure or disclaimer statement. In addition to this, a seller - whether the seller elects to give the disclosure or disclaimer - is required to disclose to the purchaser, any latent defects of which the seller has actual knowledge. Under the new law, a latent defect is defined as material defects in real property or an improvement to real property that a purchaser would not reasonably be expected to ascertain or observe by a careful visual inspection of the real property and which would pose a direct threat to the health or safety of the purchaser or an occupant of the real property, including a tenant or invitee of the purchaser.*

In Calvert County, there is no real estate disclosure requirement at this time.

Educational Programs

Environmental education programs can teach children about natural hazards, their cause and effect, and ways to be better prepared to face hazards, which can, in turn, be imparted to their parents. Assignments on developing an emergency kit for specific hazards can get parents interested and become involved in the exercises. Educational programs are typically undertaken by schools, park and recreation departments, conservation associations, and youth organizations, such as the Boy Scouts, Campfire Girls and summer camps.

The Board of Education and Chespax support environmental clubs in high schools county-wide. The County also has a recycling program.

CHAPTER 9: GOALS AND OBJECTIVES

Introduction

The Mitigation Strategy serves as the long-term roadmap for reducing potential losses identified in the earlier sections of the report. This Chapter identifies goals and objectives to help the County to be better prepared to face flooding and specific actions that should be implemented to reduce the community's vulnerability to flooding.

Goals and Objectives

The goals and objectives form a basis upon which, specific mitigation actions will be developed. During the Steering Committee meetings held in March and April 2009 and the Public Meeting held in April 2009, citizens and local government representatives discussed the findings of the vulnerability assessment, its implications for flooding, and actions that needed to be taken to mitigate the flood risk to the unincorporated areas of the County as well as the municipalities. With this in mind, mitigation goals and objectives have been developed. For the purpose of this report, goals and objectives have been defined as the following:

- *Goals are general guidelines that explain what is to be achieved. They are usually broad policy-type statements, long term and represent global visions.*
- *Objectives define strategies or implementation steps to attain the identified goals. Unlike goals, they are more specific and measurable.*

The following goals and objectives developed in this Plan have been divided into the same six categories, as chapters 3 through 8 in the report: prevention; property protection; structural projects; natural resource protection; emergency services; and public information.

Prevention

Goal 1: Direct population concentrations away from known or predicted high flood hazard areas through appropriate regulations

- Address hazard mitigation goals through existing plans and ordinances.
- Examine ordinance, and include language to ensure that any new development does not increase the vulnerability to flooding and make changes if required.
- Continue to ensure that the current building codes, floodplain ordinances, wetland protection, and erosion and sediment control standards are properly enforced.
- Consider a multi-objective management approach that promotes public involvement & coordination of floodplain management with other community concerns such as economic development, housing, water quality, and recreation.
- Ensure continued coordination and notification procedures between departments within the County and municipalities that are responsible for implementing flood mitigation activities.

Property Protection

Goal 2: Ensure new construction and reconstruction is resistant to flood damage.

- Encourage owners of high-risk, pre-FIRM residential structures to use retrofitting techniques to avoid repeated flooding.
- Support projects and programs to retrofit, relocate/acquire structures that are susceptible to repetitive flooding.
- Emphasize the importance of flood insurance to residents.

Natural Resource Protection

Goal 3: Existing natural resources and open-space within the floodplain and watersheds should be protected.

- Ensure all acquired properties are cleared and remain in public ownership in perpetuity.

Emergency Services

Goal 3: Ensure continued coordination during emergencies.

- Evaluate coordination and notification procedures.

Goal 4: Ensure critical facilities are less vulnerable to flooding.

- Identify appropriate mitigation techniques for critical facilities in the floodplain.

Structural Projects

Goal 5: Reduce potential disruption of the County's infrastructure during hazard events.

- Ensure regular maintenance of the County's critical facilities and infrastructure within the 100-year floodplain.

Natural Resource Protection

Goal 6: Protect existing natural resources and open-space within the floodplain and watersheds.

- On FEMA acquired properties (buy-outs), ensure all structures are removed and the property remains in public ownership in perpetuity.
- Consider best management practices for development in the 100-year floodplain.
- Encourage the maintenance and/or establishment of native vegetation in the floodplain.

Public Information

Goal 7: Increase flood-awareness among county residents.

- Involve community residents in the implementation of this Flood Mitigation Plan and in protecting their lives and property.
- Develop a coordinated outreach strategy to make citizens aware of and informed on flooding.

Mitigation Actions

This section includes specific mitigation projects that have been derived from the goals and objectives in Chapter 9 that should be implemented over a period of time. The mitigation actions developed have once again been classified in the same six categories as are the goals and objectives. For each action item, the relevant issue and the goal(s) the action supports are identified. The agency or agencies responsible for implementation as well as applicable funding sources, an approximate cost, and general timeline for the implementation of each mitigation action are included. A detailed list of funding sources is provided at the end of this chapter. The abbreviations used below in the mitigation actions refer to the funding resources listed at the end of this chapter.

Prevention

Action 1a: Based on sea level rise and wave action, adopt a 2-foot minimum freeboard (currently 1 foot) above the Base Flood Elevation (BFE) for the county and municipalities.

Goal: 1
Responsible Agencies: Planning and Zoning
Possible Funding Sources: None required
Approximate Cost: Staff time
Timeline: 1-2 years

Action 2a: Review zoning density and restrict zoning to low density in 100-year floodplain (conservation, agricultural or large lot residential use) outside the town centers.
Action 2b: Consolidate the floodplain ordinance into the County's Zoning Ordinance.

Goal: 1
Responsible Agencies: Planning and Zoning
Possible Funding Sources: None Required
Approximate Cost: Staff time
Timeline: 1-2 years

Action 3: Emphasize the criticality in rejoining the CRS program. Hire a consultant to complete the CRS application and develop a template for future use.

Goal: 1
Responsible Agencies: Planning and Zoning
Funding Source: PDM
Approximate Cost: Consultant Fees
Timeline: 3-5 years

Action 4a: Riverine dFIRMs have been completed and coastal dFIRMs are underway. Incorporate coastal information once available and dFIRM information into future flood mitigation planning efforts.

Action 4b: Continue to require that recorded subdivision plats show the 100-year floodplain.

Goal: 1
Responsible Agencies: Planning and Zoning
Funding Source: None required
Approximate Cost: Not applicable
Timeline: 1-2 years

Property Protection

Action 5a: Consider elevation or acquisition of the identified repetitive loss properties in specific areas –all of Cove Point; and Mears Drive and Bayside Road in Chesapeake Beach.
Action 5b: Develop a comprehensive plan that identifies specific properties for acquisition, demolition, or flood-proofing of structures in Cove Point Beach, Lusby.

Goal: 2
Responsible Agencies: Public Works, Emergency Management Division, Housing Authority
Possible Funding Sources: FMA, PDM-C, SRL
Approximate Cost: To be determined
Timeline: 5+ years

Action 6: Consider lowering the threshold for cumulative substantial improvements from 50 percent to 40 percent so that more building projects meet the flood protection standards.

Goal: 2
Responsible Agencies: Planning and Zoning - Division of Inspections and Permits
Funding Source: None required
Approximate Cost: Staff time
Timeline: 1-2 years

Action 7: Identify uninsured property owners in known flood hazard areas and encourage them to purchase flood insurance.

Goal: 2
Responsible Agencies: Town Staff, Planning and Zoning
Funding Source: $10,000
Approximate Cost: Staff time
Timeline: 1-2 years

Emergency Services

Action 8a: Identify more state-of-the-art capabilities to provide emergency notifications to the public.
Action 8b: Ensure more complete notifications to the public throughout the county, particularly in the northern end of the county where sirens are ineffective.
Goal: 3
Responsible Agencies: Emergency Services
Possible Funding Sources: FMA, PDM-C, County Funds
Approximate Cost: $25,000-50,000
Timeline: 1-2 years

Action 9: Prepare a power-backup plan for county's critical facilities. Incorporate SMECO's Reliability Project to improve power service to the county.
Goal: 4
Responsible Agencies: Public Works
Possible Funding Sources: FMA, PDM-C, County Funds
Approximate Cost: $25,000-50,000
Timeline: 1-2 years

Structural Projects

Action 10: Continue to develop routine procedures that require examination of the potential for flood damage to a road, bridge, culvert, water line or sewer line as well as regular maintenance.
Goal: 5
Responsible Agencies: Public Works, Division of Inspections and Permits
Possible Funding Sources: PDM, FMA
Approximate Cost: Staff time
Timeline: 1-2 years

Action 11: Conduct a flood audit to identify ways to protect critical facilities in or near the 100-year floodplain: Industrial Park Wastewater Treatment Plant on Skipjack Road; Chesapeake Beach Wastewater Treatment Plant; North Beach Water Treatment Plant; North Beach Volunteer Fire Company; Our Lady Star of the Sea School; and Hallowing Point Station and Solomon's Police Station. The flood audit should include a review of the flood hazard at the site, low entry points, warning times, etc. as well as specific mitigation options to prevent future damage.
Goal: 5
Responsible Agencies: Public Works, Division Inspections and Permits, Planning and Zoning, Emergency Management
Possible Funding Sources: FMA, PDM
Approximate Cost: $100,000
Timeline: 5+ years

Action 12a: Elevate the entrance into the Cove Point neighborhood to allow easier access during emergency situations.
Action 12b: Investigate the possibility and feasibility of constructing a culvert with riser from the southwest corner of the Cove Point freshwater marsh to the Chesapeake Bay along Park Drive to mitigate flooding of Cove Point from freshwater sources.

Goal: 5
Responsible Agencies: Public Works, Division Inspections and Permits, Planning and Zoning, Emergency Management, Cove Point community
Possible Funding Sources: FMA, PDM for 12a and 12b; 12c and 12d would be privately funded by Dominion Cove Point LNG facility
Approximate Cost: >$150,000 Timeline: 5+ years

Natural Resource Protection

Action 13: Continue to implement BMPs during construction or as part of a project's design to permanently address nonpoint source pollutants. In addition to improving water quality, BMPs can have flood related benefits. By managing runoff, they can attenuate flows and reduce the peaks after a storm.

Goal: 6
Responsible Agencies: Planning and Zoning, Division of Inspections and Permits, Environmental Commission
Funding Sources: County funds
Approximate Cost: Staff time
Timeline: 1-2 years

Public Information

Action 14a: Prepare a presentation to demonstrate what happens when future adverse impacts caused by development are not accounted for, and the benefits of planning, improved mapping and regulatory standards.
Action 14b: Include information on hazards in the County's and municipalities' newsletters (Calvert Currents) as well as the County's website.
Action 14c: Conduct environmental and safety education programs to teach children about flooding, forces of nature, significance of protecting watersheds and floodplains and educate the floodplain property owners and elected officials.

Goal: 7
Responsible Agency: Public Information Office (Economic Development), Planning and Zoning, Emergency Management Division, Public Libraries
Possible Funding Sources: FMA, PDM
Approximate Cost: $40,000-$50,000
Timeline: 1-2 years

Action 15: Continue to promote the use of NOAA radios as a source of immediate information by disseminating information at public meetings, community and senior centers, and citizen associations.

Goal: 7
Responsible Agency: Public Information Office (Economic Development), Planning and Zoning, Emergency Management Division, Public Libraries
Possible Funding Sources: FMA, PDM
Approximate Cost: $40,000-$50,000
Timeline: 1-2 years

Action 16: Conduct training sessions on the use of dFIRMs to stakeholder groups including planners, engineers, realtors, and community leaders.

Goal: 7
Responsible Agencies: Planning and Zoning, Public Works
Funding Source: No funding required
Approximate Cost: Staff time
Timeline: 1-2 years

Action 17a: Make dFIRMs available for download on the County website.
Action 17b: Develop a map website that allows users to determine their FIRM zone and other property information. Also consider adding links to gages to provide real-time water levels and national weather service flood crest predictions. Include additional data with aerial photographs and information on additional hazards, flooding outside mapped areas, and zoning and development regulations.

Goal: 7
Responsible Agencies: Planning and Zoning, Technology Services Department
Possible Funding Sources: PDM, County Funds
Approximate Cost: $1 0,000-$1 5,000
Timeline: 1-2 years

Action 18: Introduce public awareness and outreach activities related to floodplain management as part of the Patuxent River Appreciation Day activities.

Goal: 7
Responsible Agencies: Environmental Commission, Parks and Recreation Division, Planning and Zoning
Possible Funding Sources: PDM
Approximate Cost: $10,000
Timeline: 1-2 years

Municipality Recommendations

Action 19a: For a property in North Beach, consider the following actions: a) install water equalizing vents to allow flooding without damage; and b) elevate all utilities above the Base Flood Elevation.
Action 19b: For properties on Mears Drive in Chesapeake Beach, consider the following actions: a) install water equalizing vents to allow flooding without damage; and b) elevate all utilities to upper floor level.
Action 19c: Consider acquisition and demolition of properties on Bayside Road in Chesapeake Beach. As a short-term option, install flood shields at all door openings and elevate all utilities above the Base Flood Elevation.
Goal: 5
Responsible Agencies: Public Works, Planning and Zoning, Emergency Management
Funding Source: HMGP, SRL, FMA, PDM
Approximate Cost: To be determined (will vary with the number of properties)
Timeline: 5+years

Action 20: Investigate the feasibility of constructing a flood wall or other flood protection measures in the Towns of Chesapeake Beach and North Beach that would protect the residential and commercial properties in the two towns.
Goal: 5
Responsible Agencies: Public Works, Division Inspections and Permits, Planning and Zoning, Emergency Management
Possible Funding Sources: FMA, PDM
Approximate Cost: >$1 50,000
Timeline: 5+ years

Plan Implementation

Action 21a: Work with the Flood Hazard Mitigation Steering Committee and members of the public who are interested in flood-related issues to implement this plan and review its progress.
Action 21b: Meet every six months to review projects that have been completed, altered, or are no longer applicable.
Action 21c: Update the Flood Mitigation Plan every five years and after a flood event.
Action 21d: Integrate this Plan into the All-Hazard Mitigation Plan as an annex.
Goal: All goals
Responsible Agencies: Planning and Zoning, Public Works
Funding Source: No funding required
Approximate Cost: Staff time
Timeline: 1-2 years

Response to Public Comment

Action 22. Investigate flooding of Western Shores Blvd. with the Western Shores Citizen Association

Goal: 3,5 and 7
Responsible Agencies: Planning and Zoning, Public Works, Public Safety
Funding Source: TBD
Approximate Cost: TBD
Timeline: 1-2 years

Funding Sources

The following funding sources provide grants for flood mitigation planning and project related activities:

- Hazard Mitigation Grant Program (HMGP) – HMGP is administered by FEMA and provides grants to states, tribes and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable mitigation activities to be implemented as a community recovers from a disaster. Eligible projects include: elevating flood-prone homes or businesses; acquisition of flood-prone homes from willing owners and returning the property to open space; retrofitting buildings; and construction of floodwall systems to protect critical facilities.

- Pre-Disaster Mitigation (PDM) Program – The PDM program provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. The program provides technical and financial assistance to States and local governments to assist in the implementation of pre-disaster mitigation actions, which must be cost-effective and designed to reduce injuries, loss of life and damage and destruction of property.

- Flood Mitigation Assistance (FMA) Program – FMA provides funding to assist communities and states in implementing actions that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, or other National Flood Insurance Program (NFIP) insurable structures with a focus on repetitive loss properties. The NFIP enables property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Three types of FMA grants are available to States and communities: 1) planning grants to prepare Flood Mitigation Plans; 2) project grants to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures; and 3) technical assistance grants for the State to help administer the FMA program and activities.

- Repetitive Flood Claims – The program provides funding to States and communities to reduce or eliminate the long-term risk of flood damage to structures insured under the NFIP that have had one or more claims for flood damages, and that cannot meet the requirements of the Flood Mitigation Assistance (FMA) program for either cost share or capacity to manage the activities. Eligible activities include: 1)acquisition of properties and either demolition or relocation of flood-prone structures, where the property is deed restricted for open space uses in perpetuity; 2) elevations; 3) dry flood-proofing of non-residential structures; and 4) minor localized flood control projects.

- Severe Repetitive Loss (SRL) - A SRL property is defined as a residential property that is covered under a NFIP flood insurance policy and: 1) that has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or 2) for which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building. Eligible flood mitigation project activities under the SRL program include: 1) acquisition and demolition or relocation of at risk structures and conversion of the property to open space; 2) elevation of existing structures to at least the base flood elevation; 3) minor physical localized flood reduction projects; and 4) dry flood-proofing for historic properties.

- Emergency Management Performance Grants (EMPG) – The EMPG program provides resources to state and local governments to develop an all-hazards planning approach to emergency management and to sustain and enhance all-hazards emergency management capabilities.

Most State and Federal grant programs require local communities to provide at least part of the necessary project funding in real dollars or through "in-kind" services. While the percentage of local contribution varies from program to program, Local communities need to assess their financial capability and resources to implement their hazard mitigation action plans.

CHAPTER 10 - PRIORITIZATION

Once the mitigation actions were finalized by the Hazard Mitigation Steering Committee, mitigation actions were ranked based on the following evaluation criteria. The following questions were taken into consideration while evaluating each factor:

Social Considerations – Life/Safety Impact

- Will the project have minimal/direct/or significant impact on the safety of businesses, residents, and properties?
- Will the proposed action adversely affect one segment of the population?
- Will the project be a proactive measure to reducing flood risk?

Administrative Considerations – Administrative/Technical Assistance

- Is there sufficient staff currently to implement the project?
- Is training required for the staff to implement this project?

Legal Considerations – Statutory Requirements

- Does the action satisfy a statutory requirement?
- Does the action improve data collection and storage?

Economic Considerations – Project Cost

- What is the approximate cost of the project?

These considerations were then grouped into low, medium, and high categories and assigned points: low - 3 points; medium - 5 points; and high - 10 points. Timelines for these projects were also established as to when the projects would be initiated: Short range projects – implemented within first 2 years; medium range projects - 3 to 5 years; and long range projects – over 5 years.

Table 10.1 Evaluation criteria for project ranking

Evaluation Criteria	Evaluation Value		
	Low (L) 3 points	Medium (M) 5 points	High (H) 10 points
Life/Safety Impact	Minimal/negligible number of businesses, residents, properties affected by action.	Moderate number of businesses, residents, properties affected by action.	Significant number of businesses, residents, properties affected by action.
Administrative/Technical Assistance (staffing, funding, maintenance)	No staff and/or training required to implement project.	Some staff staff/training required to implement project.	Significant staff/training needed to implement project.
Statutory (codes, plans, ordinances)	Does not satisfy a statutory requirement or requires a change to the code.	May require a change to the code but action improves data collection and storage.	Satisfies a statutory requirement or does not require a change to the code. Action may improve data collection and storage.
Project Cost	>$250,000	$50,000 to $250,000	<$50,000

Table 10.2 Ranking of flood mitigation actions

Action No.	Project Description	Life/ Safety Impact	Admin/ Tech Support	Statutory Implications	Cost	Total Score	Timeline
1a/1b	Based on sea level rise and wave action, adopt a 2-foot minimum freeboard (currently 1 foot) above the BFE for the county and municipalities. Adopt a 3-foot minimum above the base flood elevation for all distribution panel boxes, outlets and electrical installations.	10	10	3	10	33	S
2a/2b	Review zoning density and restrict zoning to low density in the 100-year floodplain (conservation, agricultural or large lot residential use) outside the town centers. Consolidate the floodplain ordinance into the County's Zoning Ordinance.	10	10	3	10	33	S
3	Emphasize the criticality in rejoining the CRS program. Hire a consultant to complete the CRS application and develop a template for future use.	5	3	10	10	28	M
4a/4b	Riverine dFIRMs have been completed and coastal dFIRMs are underway. Incorporate coastal information once available and dFIRM information into future flood mitigation planning efforts. Continue to require that recorded subdivision plats show the 100-year floodplain.	5	5	10	10	30	S
5a/5b	Consider elevation or acquisition of the identified repetitive loss properties in specific areas – all of Cove Point; and beach Street in Cove Point Beach, Lusby; and Mears Drive and Bayside Road in Chesapeake Beach. Develop a comprehensive plan that identifies specific properties for acquisition, demolition, or flood-proofing of structures in Cove Point Beach, Lusby.	10	5	10	3	28	L

	Project Description	Life/ Safety Impact	Admin/ Tech Support	Statutory Implications	Cost	Total Score	Timeline
6	Consider lowering the threshold for cumulative substantial improvements from 50 percent to 40 percent so that more building projects meet the flood protection standards.	3	10	3	10	26	S
7	Identify uninsured property owners in known flood hazard areas and encourage them to purchase flood insurance.	5	5	10	10	30	S
8a/8b	Identify more state-of-the-art capabilities to provide emergency notifications to the public. Ensure more complete notifications to the public throughout the county, particularly in the northern end of the county where sirens are ineffective.	10	5	10	10	35	S
9	Prepare a power-backup plan for county's critical facilities. Incorporate SMECO's Reliability Project to improve power service to the county.	3	5	10	10	28	S
10	Continue to develop routine procedures that require examination of the potential for flood damage to a road, bridge, culvert, water line or sewer line as well as regular maintenance.	3	3	10	10	26	S
11	Conduct a flood audit to identify ways to protect critical facilities in or near the 100-year floodplain: Industrial Park Wastewater Treatment Plant on Skipjack Road; Chesapeake Beach Wastewater Treatment Plant; North Beach Water Treatment Plant; North Beach Volunteer Fire Company; Our Lady Star of the Sea School; and Hallowing Point Station and Solomon's Police Station. The flood audit should include a review of the flood hazard at the site, low entry points, warning times, etc. as well as specific mitigation options to prevent future damage.	3	3	10	3	19	L
12a/12b/	Elevate the entrance into the Cove Point neighborhood to allow easier access during emergency situations. Investigate the possibility and feasibility of constructing a culvert with riser from the southwest corner of the Cove Point freshwater marsh to the Chesapeake Bay along Park Drive to mitigate flooding of Cove Point from freshwater sources.	5	5	3	3	16	L

Action No.	Project Description	Life/ Safety Impact	Admin/ Tech Support	Statutory Implications	Cost	Total Score	Timeline
13	Continue to implement BMPs during construction or as part of a project's design to permanently address nonpoint source pollutants. In addition to improving water quality, BMPs can have flood related benefits. By managing runoff, they can attenuate flows and reduce the peaks after a storm.	3	5	3	10	21	S
1 4a/14b/ 14c	Prepare a presentation to demonstrate what happens when future adverse impacts caused by development are not accounted for, and the benefits of planning, improved mapping and regulatory standards. Include information on hazards in the County's and municipalities' newsletters (Calvert Currents) as well as the County's website. Conduct environmental and safety education programs to teach children about flooding, forces of nature, significance of protecting watersheds and floodplains and educate the floodplain property owners and elected officials.	10	5	10	10	35	S
15	Continue to promote the use of NOAA radios as a source of immediate information by disseminating information at public meetings, community and senior centers, and citizen associations.	10	5	10	10	35	S
16	Conduct training sessions on the use of dFIRMs to stakeholder groups including planners, engineers, realtors, and community leaders.	3	5	10	10	28	S
17a/17b	Make dFIRMs available for download on the County website. Develop a map website that allows users to determine their FIRM zone and other property information. Also consider adding links to gages to provide real-time water levels and national weather service flood crest predictions. Include additional data with aerial photographs and information on additional hazards, flooding outside mapped areas, and zoning and development regulations.	3	5	3	10	21	S
18	Introduce public awareness and outreach activities related to floodplain management as part of the Patuxent River Appreciation Day activities.	10	5	10	10	35	S

Action No.	Project Description	Life/ Safety Impact	Admin/ Tech Support	Statutory Implications	Cost	Total Score	Timeline
19a/19b/ 19c	For a property in North Beach, consider the following actions: a) install water equalizing vents to allow flooding without damage; and c) elevate all utilities above the Base Flood Elevation. For properties on Mears Drive in Chesapeake Beach, consider the following actions: a) b) install water equalizing vents to allow flooding without damage; and c) elevate all utilities to upper floor level. Consider acquisition and demolition of properties on Bayside Road in Chesapeake Beach. As a short-term option, install flood shields at all door openings and elevate all utilities above the Base Flood Elevation.	5	5	10	3	23	L
20	Investigate the feasibility of constructing a flood wall in the Towns of Chesapeake Beach and North Beach that would protect the residential and commercial properties in the two towns.	3	5	10	3	21	L
21a/21b/ 21c/21d	Work with the Flood Hazard Mitigation Steering Committee and members of the public who are interested in flood-related issues to implement this plan and review its progress. Meet every six months to review projects that have been completed, altered, or are no longer applicable. Update the Flood Mitigation Plan every five years and after a flood event. Integrate this Plan into the All-Hazard Mitigation Plan as an annex.	3	5	10	10	28	S
22	Investigate flooding of Western Shores Blvd. with Western Shores Citizen Association	10	3	3	5	21	S

High-Priority Actions

The actions listed below received the highest scores based on the ranking.

- Review zoning density and restrict zoning to low density in the 100-year floodplain (conservation, agricultural or large lot residential use) outside the town centers. Consolidate the floodplain ordinance into the County's Zoning Ordinance.
- Identify more state-of-the-art capabilities to provide emergency notifications to the public.
- Ensure more complete notifications to the public throughout the county, particularly in the northern end of the county where sirens are ineffective.
- Prepare a presentation to demonstrate what happens when future adverse impacts caused by development are not accounted for, and the benefits of planning, improved mapping and regulatory standards. Include information on hazards in the County's and municipalities' newsletters as well as the County's website. Conduct environmental and safety education programs to teach children about flooding, forces of nature, significance of protecting watersheds and floodplains and educate floodplain property owners and elected officials.

- Continue to promote the use of NOAA radios as a source of immediate information by disseminating information at public meetings, community and senior centers, and citizen associations.
- Introduce public awareness and outreach activities related to floodplain management as part of the Patuxent River Appreciation Day activities.

Plan Maintenance

Once this Plan has been reviewed by the Maryland Emergency Management Agency (MEMA) and the Federal Emergency Management Agency (FEMA), the Plan will be adopted by the Calvert County Board of County Commissioners. Since the Plan is envisioned to be a 'living document', plan adoption is not considered the final step in the planning process but rather as a first step to implementation. The plan monitoring and maintenance schedule is a cycle of events that involves periodic review, adjustments, and improvement. This section establishes a method to monitor how the Plan will be evaluated and maintained in the future.

In order to ensure that the Plan continues to provide a framework for reducing the flood risk to the County, the Planning and Zoning Department will take responsibility to convene an annual meeting of the Hazard Mitigation Steering Committee. At this meeting, the Steering Committee will determine the status of each mitigation action. Each action proposed in the Mitigation Plan will be categorized as one of the following: completed, in progress, not started/delayed, modified, or cancelled. The Steering Committee will assist the Planning and Zoning Department in preparing a status report of the mitigation actions.

In addition to conducting an annual review of the Plan, the Steering Committee will review the Plan within 30 days after a flood event. Each goal and objective will be examined for its relevance and its validity to the changing situation in the County, and the mitigation actions will be reviewed to ensure that they address any recent issues that may have stemmed from the disaster.

APPENDIX 1

Steering Committee Materials

Calvert County
FLOOD MITIGATION PLAN

Mitigation Core Team Meeting #1
13 November 2008
1 0am-Noon
AGENDA

Introductions – Steve Kullen

- County Staff
- Mitigation Core Team Members
- Consultants
  - Deepa Srinivasan, Vision Planning and Consulting
  - Dr. Mike Scott, ESRGC

PowerPoint Presentation – Deepa Srinivasan and Dr. Mike Scott

- FMA Plan Requirements
- Overview of the Hazard Mitigation Planning Process
- Schedule
- Requested Information

Discussion - Group

- Hazard Identification and Risk Assessment
- Mitigation Capability Analysis and Distribution of Questionnaires

Wrap-up – Deepa Srinivasan

- Next steps
- Schedule Mitigation Core Team Meeting #2
- Questions

Adjournment

SC Meeting 1 Slides 1 of 5

Flood Mitigation Plan
Calvert County, MD

VISION

ESGC

Project Purpose

To develop a flood mitigation plan to improve Calvert County's resistance to floods by identifying actions to reduce the impact of floods to county residents and structures

Key Players

- Calvert County Staff
- Flood Mitigation Plan Steering Committee
- Municipal Representatives
  - North Beach, Chesapeake Beach
- Consultants
  - Deepa Srinivasan, President, Vision Planning & Consulting
  - Dr. Mike Scott, Director, Eastern Shore Regional GIS Cooperative @ Salisbury University
- Public
- Maryland Emergency Management Agency (MEMA)
- Federal Emergency Management Agency (FEMA)

Project Goals

- The Flood Mitigation Plan for Calvert County will:
  - Be consistent with the requirements of the 44 Code of Federal Regulations part 78.5 Flood Mitigation Plan Development;
  - Help reduce the risk of loss of life, personal injury and property damage to the County's residences and businesses by identifying the flood risk,
  - Include mitigation strategies to address the flood risk within the County, and
  - Gain approval from the MEMA and FEMA, paving the way for future federal funding of flood mitigation projects.

[illegible] Federal Regulations [illegible] Flood Mitigation Plan Requirements

- Describe the planning process
- Describe public involvement
- Include existing flood risk
- Include number of estimated structures in the floodplain
- Identify repetitive loss structures
- Identify extent of flood depth and damage potential
- Discuss floodplain management goals
- Identify and evaluate feasible mitigation actions
- Present a strategy for reducing flood risks
- Provide a strategy for continued compliance with NFIP
- Describe procedures for ensuring implementation, reviewing progress, and making revisions
- Provide documentation of Plan by legal authority

Steps in the Planning Process

1. Organize steering committee and process (meetings)
2. Assess hazards, risks, vulnerability
3. Assess local capabilities
   - Existing Plans, Programs, Policies
   - Personnel and Equipment Resources
   - Local Codes and Zoning Ordinances
   - Current and Proposed Construction Projects

SC Meeting 1 Slides 2 of 5

Steps in the Planning Process (cont'd)

5. Develop goals and objectives and mitigation actions
   - Prevention
   - Property Protection
   - Public education and Awareness
   - Natural Resource Protection
   - Emergency Services
   - Structural Projects
6. Write mitigation plan and prioritize projects (Evaluation Criteria STAPLEE)
   - Social
   - Technical
   - Administrative
   - Political
   - Legal
   - Economic
   - Environmental

Steps in the Planning Process (cont'd)

6. Develop implementation plan
   - Priorities for Mitigation Actions
     - Short-, Medium-, or Long-Range
     - Potential Funding Sources
     - Responsible Entities
     - Target Completion Dates
   - Five-Year Plan Maintenance Cycle

Meetings

1. 4 Steering Committee Meetings
   - Meeting 1: Planning process, schedule, deliverables, capability assessment
   - Meeting 2: Hazard identification, risk assessment
   - Meeting 3: Goals and objectives, Mitigation actions
   - Meeting 4: Mitigation actions prioritization and implementation

2 Public Meetings
- Meeting 1
  - Planning process
  - Hazard identification, risk assessment, capability assessment
- Meeting 2
  - Goals and objectives
  - Mitigation actions and implementation

Hazard Identification and Vulnerability Assessment

1. Definitions
   - Hazard – the threat to things we value
   - Risk – the probability the hazard might occur
   - Vulnerability – the potential for loss
   - Mitigation Capability – the degree of ability to either remove the threat or to resist and/or recover from a hazard event

Hazard Identification and Vulnerability Assessment

1. Seek to determine for the 100-year coastal/riverine event:
   - Where will it flood?
   - How deep will the floodwater likely be?
   - Which structures are likely to be impacted?
   - What is the value of those structures and their contents?
   - What is the likely damage to occur from a 100-year event?
2. 100-year flood – has a 1% chance of happening every year
3. Also, seek to inventory known or suspected stormwater flooding issues/locations

Hazard Identification and Vulnerability Assessment

1. Determined using:
   - Flood insurance rate maps (FIRMs) - both old and new
   - Most recent flood modeling software (HAZUS-MH) developed by FEMA
   - The best data available
     - USACE, MDNR, MDP, MDAT, MDE, County/City Planning
     - All the data has been compiled
     - A GIS-based spatial analysis
     - Digital mapping and analysis system
   - Input from local experts

SC Meeting 1 Slides 3 of 5

Hazard Identification and Vulnerability Assessment

- Method and Approach
  - Collect all necessary data
    - Air photos, LiDAR, building locations, FIS, FIRMs, etc
  - Field check all structures in the floodplain for construction types and foundation height
  - Realign FIRMs and create new interpolated cross sections, if necessary
  - Use the FIS to inform flood heights
  - Input all data to HAZUS-MH model
  - Display results

Capability Assessment

- Calvert County Plans
  - 2004 Comprehensive Plan Calvert County, 2004
  - 2004 County Hazard Mitigation Plan, 2004
  - Water Resources Update (update to Comp. Plan) October 2009
  - County Land Preservation, Parks and Recreation Plan, 2006
  - County Water and Sewage Plan, 2008

Capability Assessment

- Calvert County Ordinances
  - County Floodplain Management Ordinance, 1992
  - Calvert County Zoning Ordinance, 2006 (rev June 2008)
    - Residential Development Requirements – Article 5
    - Subdivision Regulations – Article 7
    - Environmental Requirements – Article 8
    - Shore Erosion Protection Works – Article 9-8

Summary of Hazards and Risk

- Flood Related Hazards and their Level of Risk
  - (Maryland Hazard Analysis 2004)
  - (Calvert County Hazard Mitigation Plan 2004)

Flood Related Hazards	Maryland Hazard Analysis 2004	Calvert County Hazard Mitigation Plan 2004
Tidal/coastal flooding	Medium-high	High
Flash floods	Medium-low	High
Riverine flooding	Low	High
Hurricane/tropical storms	Medium	High
Storm surge	Medium-low	
Heavy rain	Medium-low	

Capability Assessment

- Flooding Highlights
  - Most of 100-year floodplains in County located in the western side of the county, along Patuxent River and tributaries
  - Most vulnerable areas are near Battle, Hunting, & Hall Creeks
  - Most areas bordering the Chesapeake Bay protected from flooding by the bluffs that characterize this portion of Bay's western shore. Exceptions include low-lying areas near Cove Point, Long Beach, Parker's Creek, and upper North Beach.
  - Approximately 22 sq.m (5%) of County's total land area (225 sq m) lie within 100-year floodplains

Source: 2004 Maryland State Hazard Analysis, Chap 33

Capability Assessment

- **Storm Surge Inundation Highlights**
  - Bluffs along the Chesapeake Bay offer protection to most shorelines on the eastern side of the county, though parts of Chesapeake Beach and North Beach are exposed to storm surge.
  - Low-lying areas adjacent to creeks and portions northwestern Calvert County along the Patuxent River also vulnerable.

Source: 2004 Maryland State Hazard Analysis, Chap 33

SC Meeting 1 Slides 4 of 5

Capability Assessment

- Floodplain ordinance requires elevation certificates to show elevated structures to or above BFE.
- Public facilities cannot be located within the Farm Community District or Resource Preservation District.
- Watershed plans complete for Parkers creek and Huntingdon and will be completed for all major tributaries in the county.
- Stormwater studies have been conducted for Town Centers

Capability Assessment

- County works with MDE on joint inspections of sites involving site grading and stormwater management construction.
- County plans to restore or create wetlands in disturbed areas

Capability Assessment

- County mitigates future flood losses through its Subdivision Regulations, Floodplain Management Ordinance, and Building Code.
  - Floodplain ordinance for Calvert County has a freeboard requirement of 2 feet above base floor elevation in the 100-year floodplain
  - County participates in the NFIP and allows property owners to purchase flood insurance through this program.
  - Building Code has wind loading requirements for new structures and tie-down requirements for mobile homes

Capability Assessment

1992 Floodplain Management Ordinance

- In all floodplain zones, all development that proposes to alter a watercourse must get a variance.
- If a development activity is proposed in a non-tidal floodplain for drainage areas of more than 400 acres, a waterway construction permit is required from the State.
- Any land disturbance permitted in the floodplain must have a stormwater management and S&E control plan.
- All new or substantially improved structures should have the lowest floor elevated at or above the FPE
- Manufact homes not permitted in coastal high hazard area

Capability Assessment

- Recommended Flood Related Mitigation Projects - Calvert County Hazard Mitigation Plan (2004)
  - Encourage uninsured property owners in known flood hazard areas to purchase flood insurance
  - Update FIRMs to include previously unmapped areas and additional BFEs
  - Ensure regular maintenance of county owned bridges
  - Establish a partnership with NWS to enhance existing flood forecast & warning system via the Advanced Hydrologic Prediction Services Program
  - Make FIRMs and FIS available for public inspection
  - Prepare a power-back up plan for county's critical facilities
  - Increase number of NOAA radios in public places across the county
  - Provide adequate shelters with backup power, in various parts of the county to serve as refuge areas during floods and other hazards

Capability Assessment

National Flood Insurance Program Participants

Community Name	Curr. Eff. Map Date
[illegible]	7/20/1998
[illegible]	1/5/1984
[illegible]	6/16/1984

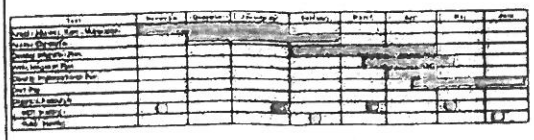
Source: FEMA Community Status Book Report, 03/18/08

SC Meeting 1 Slides 5 of 5

Capability Assessment

- Calvert County Departments
  - Planning and Zoning Department
  - Economic Development Department
  - Emergency Management Division
  - Fire, Rescue, and Emergency Medical Services Division
  - Housing Authority
  - Parks and Recreation Division
  - Environmental Commission
  - Public Safety Department
  - Public Works Department
  - Transportation Department
  - Division of Inspections and Permits

Schedule



Next Steps

- Data Collection
- Hazard Identification and Risk Assessment
- Review of Plans and Ordinances
- Mitigation Capability Assessment
- Steering Committee Meeting #2 (Mid January 2009)

Thank You!

Calvert County
FLOOD MITIGATION PLAN

Mitigation Core Team Meeting #2
31 March 2009
1:30-3:30pm
AGENDA

Introductions
- County Staff
- Steering Committee Members
- Consultants
  - Dr. Mike Scott, ESRGC

PowerPoint Presentation – Dr. Mike Scott
- Hazard Identification
- Modeling Results
- Vulnerability Assessment

Discussion - Group
- Hazard Identification and Risk Assessment
- Mitigation Capability Analysis and Discussion of Questionnaire

Wrap-up – Dr. Mike Scott
- Next steps
- Questions

Adjournment

SC Meeting 2 Slides 1 of 3

2nd MCT Meeting: Hazard and Vulnerability Assessment Progress

Michael S. Scott, PhD, GISP
ESRGC/Salisbury University
March 31, 2009

Meeting Agenda

- Discuss method steps
- Examine maps
- Examine GIS, if necessary
- Discuss particular areas that need extra attention as well as particular mitigation strategies
- Discuss public meeting agenda

Method Steps

- Gather historical flood information
  - Completed
- Review available GIS data
- Conduct vulnerability assessment
- Conduct mitigation capability assessment
  - On-going, will be the subject of the next MCT meeting

Review Available GIS Data

- Flood Elevations and Periodicity
  - FIRMs and Flood Insurance Studies
    - Calvert County, Unincorporated Areas (1986)
    - City of North Beach (1984)
    - Town of Chesapeake Beach (1984)
  - USACE SLOSH Model (draft) maps

Review Available GIS Data

- Calvert Parcels/Building footprints
  - Used to refine property centroids
- Maryland PropertyView centroids
  - Building assessment information
- Critical infrastructure
  - Road network
  - Locations of schools, nursing homes, etc
- Orthophotography
- Topography
  - 10 ft DEM from LiDAR

Conduct Hazard Assessment

- Rectify the most recent FIRMs
- Digitize the flood boundary
- Break the flood boundary polygons into their respective stream reaches
  - Hall Creek only
- Digitize the location of cross-sections and capture the 100-year flood height and discharge amounts
- Record adjusted coastal flood heights and assign to flood boundary polygons
- Denote the center of the floodway

SC Meeting 2 Slides 2 of 3

Conduct Hazard Assessment (cont.)

- Buffer the center to enclose the floodplain
- Clip the LiDAR data to the extent of each reach
- Run HAZUS Flood Information Tool (FIT)
  - Riverine
    - Provide the cross sections, the floodplain extent, and the LiDAR data
    - Calculates initial flood depths then asks for the definition of non-conveyance areas
  - Coastal
    - Provide coastline characterization, floodplain extent, LiDAR data, and stillwater elevations/wave setup
- Merge all of FIT results
- Result is the flood depth grid for the County

Conduct Vulnerability Assessment

- Find the intersection with the flood boundary
  - Maryland PropertyView points selected in or near existing 100-year floodplain
  - Points moved to building locations
  - Critical infrastructure
- For each building centroid, we collected
  - Building use
    - SFR, MFR, Retail, Government, Industrial, etc
  - Foundation construction materials
  - Date of construction
  - Height of foundation (generalized)
  - Assessed value of the improvements

FIS or SLOSH?

Flood Insurance Study
- Completed in either 1984 or 1988
- No way to examine the models used
- Consistently underestimates the height of the water during coastal flood events
  - Seen during Hurricane Isabel, a 65- to 70-year storm

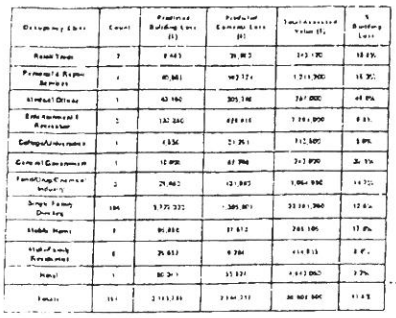
Sea, Lake and Overland Surges from Hurricanes
- Developed by the National Hurricane Center
- Calvert study conducted in 2006 by USACE
- Seems to yield a more reasonable flood height

Preliminary Results - FIS

- Preliminary work completed, comparing building locations within new 100-yr flood zone
  - 194 buildings impacted (86% are SFD)
  - $6,009,986 in potential damage
  - Further broken down by occupancy class

Cluster Locations
- Cove Point
- Solomon's Island
- Broome's Island
- North Beach
- Chesapeake Beach (south side)

Preliminary Results - FIS



Critical Facilities – FIS

- No critical facility points are within the 100-year floodplain, but a few are within 100 meters
- WW Treatment Plants
  - Industrial Park WWTP on Skipjack Rd
  - Chesapeake Beach WWTP
- Fire Stations
  - North Beach Volunteer Fire Company
- Emergency shelters - None

SC Meeting 2 Slides 3 of 3

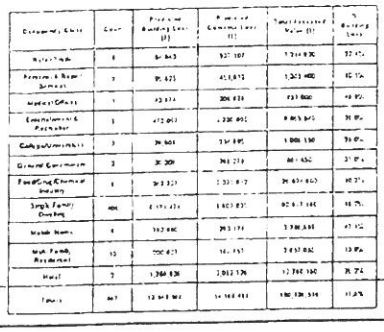
Critical Facilities – FIS (cont.)

- Schools
  - Our Lady Star of the Sea School
- Police
  - Hallowing Point Station – NRP
  - Solomons Police Substation
- Nursing homes - None
- Government buildings - None

Preliminary Results - SLOSH

- Preliminary work completed, comparing building locations within new 100-yr flood zone
  - 467 buildings impacted (87% are SFD)
  - $26,729,055 in potential building damage
  - Further broken down by occupancy class
- Cluster Locations
  - Cove Point
  - Solomon's Island
  - Broome's Island
  - North Beach
  - Chesapeake Beach

Preliminary Results - SLOSH



Critical Facilities - SLOSH

- No change from FIS to SLOSH
- WW Treatment Plants
  - Industrial Park WWTP on Skipjack Rd
  - Chesapeake Beach WWTP
- Fire Stations
  - North Beach Volunteer Fire Company
- Emergency shelters – None
- Schools
  - Our Lady Star of the Sea School
- Police
  - Hallowing Point Station – NRP
  - Solomons Police Substation

Next Steps

- Which numbers to use?
- A return to the field ..
- Areas of critical concern
  - Cove Point, Broome's Island, ...
  - What others should specifically be mentioned?
- Are there areas where mitigation measures
  - Have been implemented in the past?
  - Are planned for the future?
- What sort of mitigation strategies are most achievable, given the fiscal, environmental, and political realities of Calvert County?

Calvert County
FLOOD MITIGATION PLAN

Mitigation Core Team Meeting #3
23 April 2009
1:30-3:30pm
AGENDA

PowerPoint Presentation – Working meeting

- Findings
- Goals and Objectives
- Preliminary Mitigation Actions

Discussion of 1st Public Meeting (30 April 2009)

Wrap-up and Next Steps

- Draft Plan
- Discuss Mitigation Core Team Meeting #4 (4 June 2009)
- Discuss Public Meeting #2 (18 June 2009)

Questions

Adjournment

SC Meeting 3 Slides 1 of 4

[illegible]

23 Apr 2009
3rd Steering Committee Meeting

Presented by:
Deepa Srinivasan, AICP, CFM
Vision Planning and Consulting, LLC

VISION

Goals and Actions Categories

- Preventive Measures (codes, ordinances, regulations, procedures)
- Property Protection (relocation/acquisition, elevation, insurance)
- Emergency Services (hazard warnings/response, critical facilities protection, post-disaster recovery, and mitigation)
- Structural Projects (bridges/culverts, channel modifications, dams)
- Natural Resource Protection (wetland protection, BMPs, open space)
- Public Information (map info, outreach, environmental educ.)

Risk Assessment Findings

No critical facilities within 100-year floodplain, but a few within 100m

- Wastewater Treatment Plant
  - Industrial Park wastewater treatment plant on Skipjack Rd
  - Chesapeake Beach wastewater treatment plant
- Fire Stations
  - North Beach Volunteer Fire Company
- Schools
  - Our Lady Star of the Sea School
- Police Stations
  - Hallowing Point Station – NRF
  - Solomon's Police Substation

Goals and Objectives

Prevention

Goal 1: Direct population concentrations away from known or predicted high flood hazard areas through appropriate regulations

- Promote hazard mitigation goals through implementation into other existing plans and ordinances
- Examine language in ordinances to ensure that any new development in the County does not increase the vulnerability to flooding and make changes if required
- Continue to ensure that the current building codes, floodplain ordinances, wetland protection, and erosion and sediment control standards are properly enforced
- Consider rejoining CRS to continue to implement flood mitigation activities
- Consider a multi-objective management approach that promotes public involvement & coordination of floodplain management with other community concerns such as economic development, housing, water quality and recreation

Risk Assessment Findings

Cluster Locations

- Cove Point
- Solomon's Island
- Broome's Island
- North Beach
- Chesapeake Beach
- Need to add other areas that were mentioned at the meeting

Goals and Objectives

Property Protection

Goal 2: Ensure new construction and reconstruction is resistant to flood damage

- Encourage high-risk, pre-FIRM residential structures to use retrofitting techniques to avoid repeated flooding
- Support projects and programs to retrofit, relocate/acquire structures that are susceptible to repetitive flooding
- Emphasize the importance of flood insurance to residents

SC Meeting 3 Slides 2 of 4

Goals and Objectives

Emergency Services

Goal 3. Improve coordination during emergencies

- Improve coordination and notification procedures between departments within the County and municipalities that are responsible for implementing flood mitigation activities

Goal 4. Ensure critical facilities are less vulnerable to flooding

- Identify appropriate mitigation techniques for critical facilities in the floodplain
- Identify vulnerable public and private critical facilities and encourage pre-disaster retrofit

Goals and Objectives

Structural Projects

- *Goal 5. [illegible] to add goal*

Goals and Objectives

Natural Resource Protection

Goal 6. Protect existing natural resources and open-space within the floodplain and watersheds

- Ensure all acquired properties are cleared and remain in public owner-ship in perpetuity.
- Consider best management practices for development in the 100-year floodplain

Goals and Objectives

Public Information

Goal 7. Increase flood-awareness among county residents

- Involve community residents in the implementation of this Flood Mitigation Plan and in protecting their lives and property
- Promote the accuracy of the DFIRMS/FIRMS by requesting a restudy

Preliminary Mitigation Actions

Prevention

- Based on sea level rise and wave action, adopt a 2-foot freeboard (currently 1 foot) above the BFE for the county and municipalities.
- Review zoning density and restrict zoning to low density in 100-year floodplain (conservation, agricultural, or large lot residential use).
- Consolidate the floodplain ordinance into the County's Zoning Ordinance
- Consider rejoining the CRS program. Hire a consultant to complete the CRS application and develop a template for future use
- Require that recorded plats show hazardous areas.
- Improve accuracy of FIRMs/DFIRMs by requesting FEMA restudy. Incorporate DFIRM information into future flood mitigation planning efforts.
- The storm surge flood level model for Chesapeake Bay surge information for Calvert County was incorrect and off by 2 feet. What is the action?

Preliminary Mitigation Actions

Property Protection

- Consider elevation or acquisition of repetitive loss properties in specific areas – Atlantic Avenue, North Beach, Poplar and Chesapeake Drive, Lusby, Mears Drive and Bayside Road, Chesapeake Beach
- Consider a lower threshold for substantial improvements such as 40% so that more building projects meet the flood protection standards.
- Identify uninsured property owners in known flood hazard areas and encourage them to purchase flood insurance

SC Meeting 3 Slides 3 of 4

Preliminary Mitigation Actions

Emergency Services (from 2004 County All-hazard Mitigation Plan)

- Establish a partnership with NWS to enhance existing flood forecast & warning system via Advanced Hydrologic Prediction Service Program
- Prepare a power back up plan for county's critical facilities
- Increase number of NOAA access points across county
- Provide adequate shelters with back up power in all populated parts of county to serve as refuge areas during floods and other hazards

Preliminary Mitigation Actions

Structural Projects

- Develop permit procedures that require examination of the potential for flood damage to a road, bridge, culvert, water line or sewer line as well as regular maintenance
- Conduct a flood audit to identify ways to protect critical facilities

Preliminary Mitigation Actions

Natural Resource Protection

- Consider transfer of development rights (allow developer to purchase development from property owners in special areas such as the high risk floodplain to let their remain open space forever, in return allow the developer to use the units that would have been allowed to increase units on non-floodplain land)
- Implement BMPs during construction or as part of a project's design to permanently address nonpoint source pollutants. In addition to improving water quality, BMPs can have flood related benefits. By managing runoff, they can attenuate flows and reduce the peaks after a storm

Preliminary Mitigation Actions

Public Information

- Prepare a presentation to demonstrate what happens when future adverse impacts caused by development are not accounted for, and the benefits of planning, higher mapping and regulatory standards.
- Conduct environmental and safety education programs to teach children about flooding, forces of nature, significance of protecting watersheds and floodplains and educate the floodplain property owners and elected officials
- Develop a county newsletter to include information on hazards
- Make FIRMs and FIS available for public review

Preliminary Mitigation Actions

Public Information (continued)

- Include floodplain management outreach activities on the Patuxent River Appreciation Day
- Develop a map website that allows users to determine their firm zone and other property information. Also consider adding links to gages to provide real-time water levels and national weather service flood crest predictions. Include additional data with aerial photographs and information on additional hazards, flooding outside mapped areas, and zoning and development regulations

Repetitive Loss Properties - MDE

- Atlantic Avenue , North Beach - Abandon use of lowest floor. Install water equalizing vents to allow flooding without damage. Elevate all utilities above the Base Flood Elevation (medium priority).
- Poplar Drive, Lusby – Consider a comprehensive plan of the area for acquisition and demolition of structures. Sewer drainage fields do not function during periods of high water table. Elevate all utilities, including exterior HVAC unit, above the Base Flood Elevation (medium priority).
- Chesapeake Drive, Lusby – Consider a comprehensive plan of the area for acquisition and demolition of structures. Sewer drainage fields do not function during periods of high water table. Elevate all utilities, including exterior HVAC units, above the Base Flood Elevation. As another option, a floodwall/planter could be constructed around the perimeter of the structure (medium priority)

SC Meeting 3 Slides 4 of 4

Repetitive Loss Properties - MDE

- Mears Drive, Chesapeake Beach - Abandon use of lowest floor. Install water equalizing vents to allow flooding without damage. Elevate all utilities to upper floor level (high priority)
- Fayette Road, Chesapeake Beach - Acquire and demolish structure. If this option is not feasible, install flood shields at all door openings and elevate all utilities above the Base Flood Elevation. Use appliances with electrical components at top (high priority).

Next Steps

- 4th Core Team Meeting – 4 June2009
  - Finalize Goals
  - Finalize Mitigation Actions
  - Prioritize Mitigation Actions
- Final Public Meeting – 18 June 2009
- Preparation of Draft Plan for review
- Submission of Draft Plan to MEMA

Calvert County
FLOOD MITIGATION PLAN

Steering Committee Meeting #4
3 June 2009
1 pm-3pm
AGENDA

Mitigation Actions
- Discussion and review of mitigation actions
- Comments by Steering Committee
- Identification of Responsible Agencies and Implementation Schedule

Prioritization of Actions
- Review of prioritization criteria

Wrap-up
- Next steps
- Discuss Public Meeting #2 (16 June 2009)
- Questions

Adjournment

APPENDIX 2

Public Meeting Materials

Public Meeting 1 Notice

The public is invited to a Public Forum on the development of an updated

Calvert County Flood Mitigation Plan

Date: Thursday, April 30, 2009

Time: 7 p.m.

Location: **Courthouse Square**, 205 Main Street, Prince Frederick, MD 20678 (Located at the corner of Duke St & Main St – Enter from the parking lot – lower level of building)

IS FLOODING IN YOUR COMMUNITY A MAJOR CONCERN TO YOU?

The Calvert County Department of Planning & Zoning will host the first Public Forum on Thursday, April 30, 2009 to present the assessment of the flood risk in the County and solicit public input. All residents owning property in flood or other hazard-prone areas, or those who would be affected by potential regulatory changes are encouraged to attend.

The meeting will be held at the **Courthouse Square.** A second Public Forum will be held in June 2009. At the second meeting, the Draft Flood Mitigation Plan with mitigation actions will be presented.

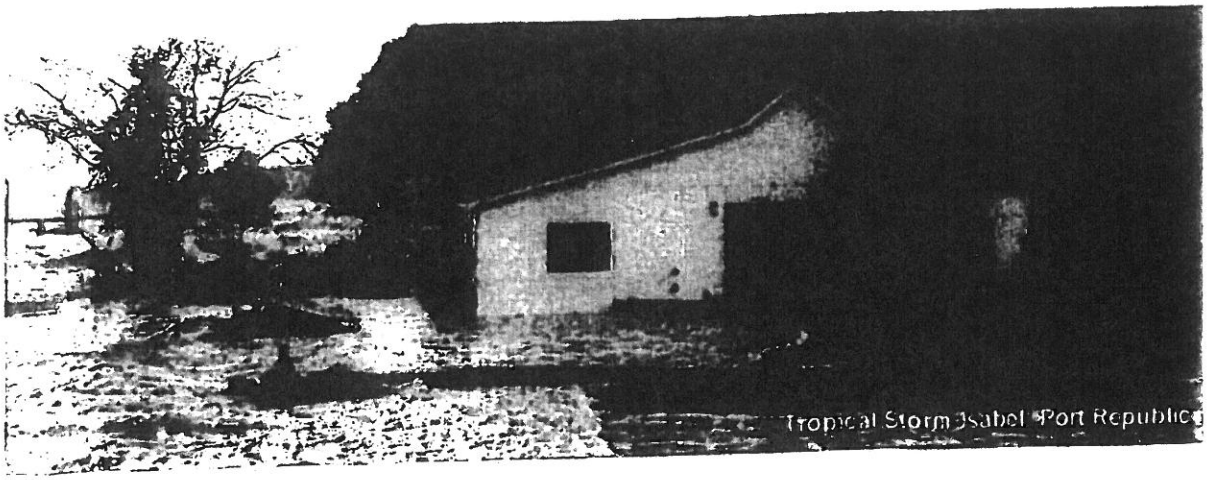
As a result of a grant from the Maryland Emergency Management Agency, Calvert County formed a Mitigation Task Force comprising of county staff, municipal representatives, and residents to assist with the countywide Flood Mitigation Planning Process. The Task Force held its first meeting in November Since that time the advisory group has worked together to develop the Plan which aims to identify the flood hazard; assess the County's vulnerability to the hazards, and develop mitigation measures to help reduce the County's vulnerability and prevent loss of life, injury, and property damage.

Lead organization for the Flood Mitigation Plan:

Calvert County Department of Planning and Zoning

Point of Contact:

Steve Kullen, Watershed Planner – Phone: 410-535-1600 Extension 2336



Public Meeting 1 Sign-in Sheet

April 30, 2009 Public Forum – Sign-In Sheet
Calvert County Flood Mitigation Plan

Name	Address	e-Mail
David A Pastrnata	1510 Elm Reed St. Leonard	dpastrnata@comcast.net
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[illegible] eBurns	4803 Davenport St. NW Washington DC 20016	JFBscout@aol.com
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Jeffrey Barnes	COVE POINT BEACH 10956 Chesapeake Dr Lusby	jabarnes@[illegible].edu
cl * Maxine Tuttle	10972 Beach Dr - cove pt beach Lusby MD	artandsoul[illegible]@verizon.net
Bill Gallagher	3214 Calvert Blvd Lusby	bilgal@comcast.net
cl * Barbara Mason	COVE POINT BEACH 3204 Calvert BLVD, Lusby	barbarajmason@yahoo.com
Larry & Bonnie Ohler	PO Box 271, St. Leonard	lohlertravel@yahoo.com
Manya B. Stoetzel	1622 Bayberry Rd, St Leonard	manyastoetzel@yahoo.co
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[illegible]	11064 Elm Dr Cove Pt Beach, Lusby	[illegible]@comcast.net
Robert W. Williams	6525 Long Beach Dr St. Leonard	BWillie06@yahoo.com
Steve Kullen	150 Main St P.F	kullensr@co.cal.md.us
Tom Kearney	COVE POINT BEACH 3137 CALVERT BLVD LUSBY	TKKEARNEY@CUPPERI.NET
Frank Leland	COVE POINT BEACH 11014 BEACH DR, LUSBY	covepoint2@comcast.net
Mason 3BR		
410. 326 4570		
21 people - total		

Tuttle

Public Meeting 1 Slides 1 of 4

Calvert County's Flood Mitigation Plan (Proposed): Planning Process and Hazard Assessment

Michael S. Scott, PhD, GISP
ESRGC/Salisbury University
April 30, 2009

Meeting Agenda

- Why are we creating this plan?
- What are the goals of this plan?
- What is the process to create the plan?
- What areas of Calvert County are susceptible to flooding?
- Mitigation capability assessment

Consulting Team

- Ms. Deepa Srinivasan, President
  - Vision Planning & Consulting, LLC
- Dr. Michael S. Scott, Director
  - Eastern Shore Regional GIS Cooperative at Salisbury University

Why are we creating this plan?

- In Calvert County, flooding is frequent occurrence, has become part of the culture. And yet, Hurricane Isabel in 2003 and the riverine/tidal flooding in May 2006 shows that the County's residents continue to be vulnerable to floods.
- Calvert County is bounded on the west by the Patuxent River, contains many rivers and streams (such as Hall Creek, Leonard Creek, and Mill Creek). It also has a large exposure to the Chesapeake Bay.
- Calvert County is growing and developing (estimated 41% population increase from 2000 to 2030) likely increasing the exposure to the flood threat.
- Plan Goal: To reduce the vulnerability of Calvert County's residents and business owners to flooding.
  - Riverine & Coastal
    - Floodplain
    - Storm surge
    - Tidal flooding

What are the objectives of this plan?

- Be consistent with 44 CFR 78.5 – Flood Mitigation Plan Development in accordance with the National Flood Insurance Act
- Conform to all pertinent criteria, particular those found in state and local ordinances, as well as the NFIP
- Identify risks from flood
- Develop coherent mitigation strategies
- Help reduce the loss of life, personal injury and property damage to the County's residents and businesses
- Be approved by MEMA and FEMA, paving the way for future federal funding of mitigation projects

What is the process to create the plan?

- Step 1 – Organize work group and process
- Step 2 – Assess hazards, risk, vulnerability, and mitigation capability
- Step 3 – Develop the mitigation plan
- Step 4 – Implement the plan

Public Meeting 1 Slides 2 of 4

Step 1 – Organize the work group and process

- Core Team has been established
  - Emergency Management Staff
  - Planning Staff
    - Environmental
    - Land Use
    - Code enforcement
  - Representatives from Towns
  - Impacted citizens
- 1st Core Team meeting was November 13th, 2008
  - Discussed were
    - Planning process
    - Key elements of the plan
    - Schedule
    - Deliverables
  - Mitigation capability assessment questionnaire was distributed

Step 2 – Assess hazards, risk, vulnerability, and mitigation capability

- 2nd Core Team meeting was held March 31st, 2009
  - Preliminary hazard assessment was presented and comments incorporated
- 1st Public Meeting (tonight) will review the findings
- Definitions
  - Hazard – the threat to things we value
  - Risk – the probability the hazard might occur
  - Vulnerability – the potential for loss
  - Mitigation Capability – the degree of ability to either remove the threat or to resist and/or recover from a hazard event

Step 3 – Develop the Mitigation Plan

- 3rd Core Team Meeting – April 23rd, 2009
  - Present the mitigation capability assessment
  - Development of specific plan goals and objectives
- Final Core Team Meeting – June 4th, 2009
  - Discussion of mitigation alternatives, prioritization of alternatives, and the implementation plan
- 2nd Public Meeting – June 18th, 2009
  - Present miligation options and projects, the prioritization matrix, and the plan implementation schedule
  - Draft plans will be available

Hazard and Vulnerability Assessment

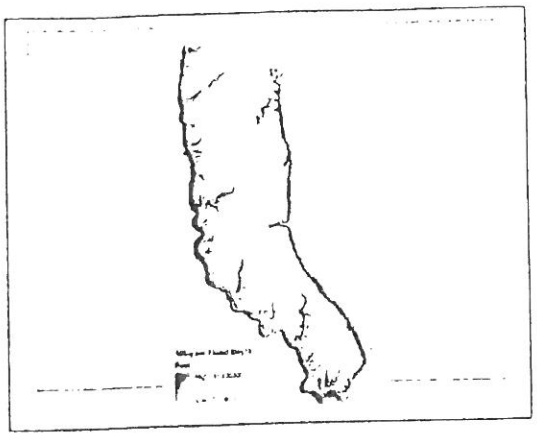
- Sought to determine for the 100-year event:
  - Where will it flood?
  - How deep will the floodwater likely be?
  - Which structures are likely to be impacted?
  - What is the value of those structures and their contents?
  - What is the likely damage to occur from a 100-year event?
- 100-year flood – has a 1% chance of happening every year

Hazard and Vulnerability Assessment

- Determined using:
  - Flood insurance studies (range from 1984 – 1988)
  - Flood insurance rate maps (FIRMs)
  - USACE SLOSH Model (draft) maps
  - Most recent flood modeling software (HAZUS-MH) developed by FEMA
  - The best data available
    - USACE, MDNR, MDP, MDAT, MDE, County Planning & Technology Services
  - A GIS-based spatial analysis
    - Digital mapping and analysis system

Hazard and Vulnerability Assessment: Caveats

- Flood heights are out-of-date and (likely) incorrect
  - The Calvert County FIS states a 100-year storm surge as 5.8 ft above sea level at Dares Beach, for example.
  - Hurricane Isabel (a 60- to 70-year storm) generated a surge 6.4 feet in Dares Beach
  - USGS and USACE sources were used to create a more realistic flood height
    - Dares Beach height – 8.0 feet
- Reliable engineering studies of the County's flood threat have been sporadic and incomplete
  - Some are nearly 25 years old
  - HAZUS-MH cannot replace high-quality engineering studies



What is the vulnerability of the County's built environment to a 100-year event?

- Total predicted properties damaged: 577
  - Total improved properties: 31,747 (1.82% damaged)
- Total predicted damage: $30,567,056
  - Structural building damage: $15,393,227
  - Building contents damage: $15,173,833
  - The total assessed value of structures & contents: $178,195,335
    - This damage is 17.2% of a t value

What is the vulnerability of the County's critical facilities to a 100-year event?

- No critical facility points are within the 100-year floodplain, but a few are within 100 meters
- WW Treatment Plants
  - Industrial Park WWTP on Skipjack Rd
  - Chesapeake Beach WWTP
- Fire Stations
  - North Beach Volunteer Fire Company
- Schools
  - Our Lady Star of the Sea School
- Police
  - Hallowing Point Station – NRP
  - Solomons Police Substation

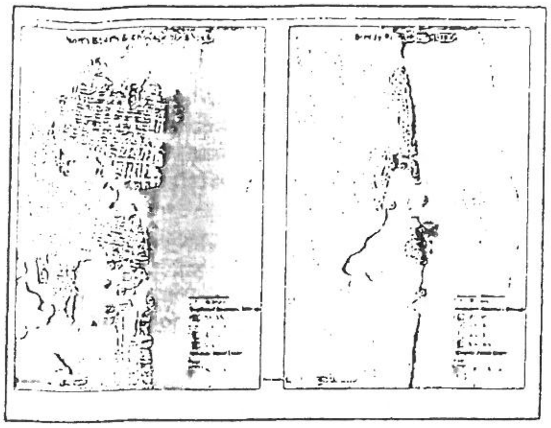
What is the vulnerability of the County's built environment to a 100-year event?

- Other potential damage is not included
  - Public infrastructure (roads, bridges, culverts, dams).
  - Buildings other than primary building (garages, barns).
  - Losses due to evacuation, displacement, sheltering, crops, catch, etc

What areas are susceptible to flooding in a 100-year event?

Area	Vulnerable Structures
Cove Point	166
Broomes Island	71
Chesapeake Beach	70
North Beach	61
Plum Point	45
Long Beach	32
Breezy Point	25
Solomons	16
Lloyd Bowen Road	12
Johnstown/Dowell	11
Dares Beach	8
Other	7
Buzzard Island Creek	6
Owings	4

Public Meeting 1 Slides 4 of 4



What is the degree of potential damage from a 100-year event?

Degree of Damage	Property Count	% of Total	Value of Structure and Contents ($)	Total Potential Damage ($)	% of Total
Less than 5%	36	6.2%	10,277,210	209,711	0.6%
5 - 10%	71	12.3%	48,068,200	3,652,002	12.0%
10 - 15%	132	22.9%	30,586,250	3,548,644	11.6%
15 - 20%	98	17.0%	27,788,535	6,266,811	20.5%
20 - 25%	68	11.8%	12,885,085	2,808,794	6.5%
25 - 30%	67	11.6%	20,276,040	5,812,077	16.0%
30 - 40%	75	13.0%	13,849,555	4,587,702	14.9%
40 - 50%	7	1.2%	2,241,260	1,004,414	3.3%
More than 50%	23	4.0%	4,715,100	2,615,836	8.6%
Total	577		$178,195,335	$30,567,058	

How is the potential damage divided between property uses?

Occupancy Class	Count	Predicted Building Loss ($)	Predicted Contents Loss ($)	Total Assessed Value ($)	% Loss
Commercial	30	767,087	3,615,678	17,127,780	25.6%
Schools/Library	1	28,535	234,898	719,500	36.6%
General Government	2	30,309	192,183	689,180	32.3%
Industry	6	382,237	2,221,614	26,824,850	10.2%
Church	1	23,184	145,821	968,600	17.4%
Single Family Dwelling	494	11,052,818	7,462,517	123,447,645	15.0%
Mobile Home	10	797,268	297,729	2,407,865	45.5%
Multi-Family Dwelling	30	1,136,258	903,442	6,215,835	32.8%
Total	577	15,393,227	15,173,832	178,195,335	17.2%

What are County's current capabilities to mitigate losses from flooding?

- Complete set of ordinances, plans, and policies are currently being reviewed
- Information is currently being reviewed on:
  - Preventive Measures
  - Property Protection
  - Structural Projects
  - Natural Resource Protection
  - Public Information
  - Emergency Services
- Results will be presented to the public in June

What to do now?

- Please review the maps
- Point out areas that you think flood often so that we can investigate them
- Ask lots of questions
- Stay involved
  - Public meeting with draft plan - an announcement will go out well ahead of time
  - Contact me with any thoughts or concerns (msscott@salisbury.edu)

Musicians get big opportunity

Three young musicians from Huntingtown High School have gone on to perform with All-Eastern Honors Choir and All-Eastern Honors Orchestra, highly selective groups that draw students from across the Northeast.

Trumpet player Ian Dahlstrom was selected to join the orchestra, while tenor Joshua Olexa and alto Molly Wilkerson joined the All-Eastern Honors Mixed Choir.

Dan Boyer, Huntingtown's choir teacher, said it was an honor for students to be nominated for either group.

"Its more of an honor to get nominated," he said. "Each state nominates students who are capable of being selected and participate in the ensembles, and after that it's a statistical issue. They go through and it's a long, drawn-out process. In order to be selected you really had to be in the top echelon in terms of getting the selection. ... We were all very proud here at Huntingtown of their accomplishments.

Join Marine Museum's lighthouse cruises

The Calvert Marine Museum is once again offering lighthouse lovers a chance to join the Lighthouse Adventure Cruises during the 2009 season.

All cruises are aboard a private charter vessel, and require advanced ticket purchase to secure a spot, according to a release.

The cruises are scheduled for Saturday, June 6, and Sept. 26. Both cruises will head south with departures from the Drum Point Lighthouse. Participants will visit Point No Point, Point Lookout and Smith Point Lighthouses before stopping for lunch at The Bayside Inn on Smith Island. After taking in the local sites, the cruise will continue on to circle Solomons Lump and Hoopers Island Lighthouses.

On the journey, cruisers will learn the history of the lighthouses they visit from the museum's lighthouse expert, along with fascinating stories that make each light unique, from fires to ice floes to ravaging storms. Participants should bring sunscreen

WRITER'S NOTEBOOK

Erica Mitrano

a camera, hat and rain jacket.

The cost is $150 for the day-long trip; lunch is on your own. Register by May 15 and get the early bird special rate of $130. Museum members pay $125. Participants will meet at the Calvert Marine Museum under the Drum Point Lighthouse at 7:45 a.m.; expected return time to the museum is 4 p.m. Preregistration is required. For information or to register, call 410-326-2042, Ext. 41. Space is limited and sold on a first-come, first-serve basis.

County hosting meeting on flood control

The Calvert County Department of Planning and Zoning will host the first public forum on Thursday, April 30, to present the assessment of the flood risk in the county and solicit public input, according to a release. All residents owning property in flood or other hazard-prone areas, or those who would be affected by potential regulatory changes, are encouraged to attend. The meeting will be held at the Courthouse Square.

The meeting will be held Thursday, April 30, at 7 p.m. at 205 Main Street in Prince Frederick. Enter the building from the parking lot at the lower level of the building.

A second public forum will be held in June. At the second meeting, the Draft Flood Mitigation Plan with mitigation actions will be presented.

Calvert and St. Mary's counties' League of Women Voters chapters.

The forum is titled "Nuclear Waste: Safety, Health and Environmental Issues," and will include a diverse panel of guests, according to a release. The forum panel will address issues and concerns including nuclear technologies, health, safety, environment and waste. The forum format includes a question and answer session from the audience.

Issues involving nuclear reactors are complex and difficult topics worthy of exploration to help raise the level of public understanding, according to a release. The league was encouraged to conduct such a forum by public demand in reference to the proposed third nuclear reactor at the Lusby plant, already the site of two other reactors in Lusby.

The forum will be held Wednesday, May 20, from 6:30 to 9 p.m. at Calvert Pines Senior Center, 450 W. Dares Beach Road in Prince Frederick.

April 22 activities planned to recognize volunteers

April 22 is the day set aside for special recognition of Girl Scout leaders. The day is known in Girl Scouting as Leader Appreciation Day. Girls in the Washington, D.C.-area plan a variety of special activities and tributes to acknowledge the contributions of dedicated volunteers, without whom troops would not exist.

"Please, if you see a Girl Scout volunteer on April 22 or any other day, take the time to say 'thank you' [because] they are helping to build a better tomorrow for each of us by working with our girls today. Girl Scout Volunteers help to build girls of courage, confidence and character, who make the world a better place," according to the release.

Complete information on the Girl Scout Council of the Nation's Capital is available at www.gscnc.org, or by calling 800-523-7898 or 800-834-1702, Ext. 4020. To learn more about volunteering, e-mail ldavis@gscnc.org.

emitrano@somdnews.com

Public Meeting 2 Notice

You are invited to a Public Forum on the development of an updated

Calvert County Flood Mitigation Plan

Date: Tuesday, June 16, 2009

Time: 7 p.m.

Location: Calvert Pines Senior Center - Auditorium, 450 West Dares Beach Road, Prince Frederick, MD 20678 Enter the main front entrance to the Auditorium.

IS FLOODING IN YOUR COMMUNITY A MAJOR CONCERN TO YOU?

The Calvert County Department of Planning & Zoning will host the second Public Forum on Tuesday, June 16, 2009 to present the Draft Flood Mitigation Plan with mitigation actions. All residents owning property in flood or other hazard-prone areas, or those who would be affected by potential regulatory changes are encouraged to attend. The meeting will be held in the Calvert Pines Senior Center Auditorium at 7 p.m.

As a result of a grant from the Maryland Emergency Management Agency, Calvert County formed a Mitigation Task Force comprising of county staff, municipal representatives, and residents to assist with the countywide Flood Mitigation Planning Process. The Task Force held its first meeting in November. Since that time the advisory group has worked together to develop the Plan which aims to: identify the flood hazard; assess the County's vulnerability to the hazards; and develop mitigation measures to help reduce the County's vulnerability and prevent loss of life, injury, and property damage.

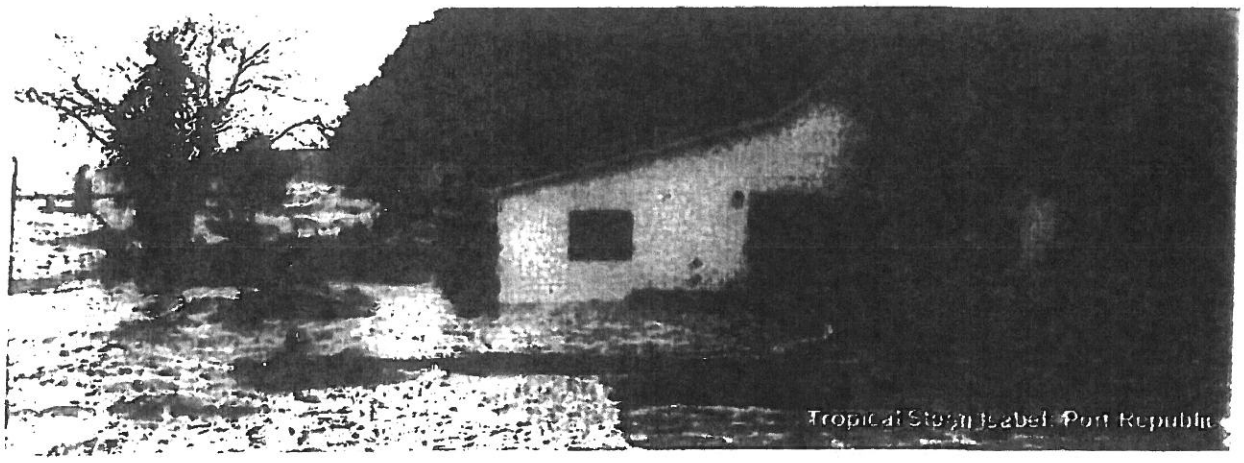
FEMA

Lead organization for the Flood Mitigation Plan:

Calvert County Department of Planning and Zoning

Point of Contact:

Steve Kullen, Watershed Planner – Phone: 410-535-1600 Extension 2336



Public Meeting 2 Sign-in Sheet

FEMA Flood Mitigation Public Forum

Tuesday – June 16, 2009 7 p.m.
Calvert Pines Senior Center Auditorium

Sign In Sheet

NAME	ADDRESS	EMAIL INFO	PHONE
SANDRA BELL	2991 GOVERNORS RUN RD PORT REPUBLIC MD 20676	SANDRAJEANBELL @ COMCAST.NET	443-295-7267
CAROL BOOKER	3149 CALVERT BLVD LUSBY MD 20657	CAROLBOOKER@YAHOO.COM	
KATHY DUNCAN	3143 LIGHTHOUSE BLVD LUSBY	KJDUNCAN58@YAHOO.COM	
TOM KEARNEY	3137 CALVERT BLVD LUSBY	TKKEARNEY@CHESPEAKE.NET	410 326-2470
Frank Leland	11014 Beach Drive, Lusby MD	covepoint2@comcast.net	410 326 9131
RITA ILG	3245 WOODRIDGE AVE. PORT REP.	rita.ilg@LNF.COM	301-785-2550
WILLIAM GALLAGHER	3214 CALVERT BLVD, LUSBY MD 20657	bilgal@comcast.net	443-404-5886
JOHN KNOPP	CALVERT CO GOV.	knoppjf@co.cal.md.us	410-535-1600
VALERIE STEWART	3116 LIGHTHOUSE BLVD. LUSBY 20657	valctewart@hotmail.com	240 882 9402
Barbara Mason	3204 Calvert BLVD LUSBY 20657		410-326-6570
Marjorie Tuttle	10972 Beach Dr Lusby Md 20657	artandsould@verizon.net	202-413-7996
Brigid Quinn	10985 Webster Dr. Lusby 20657	brigidq@yahoo.com	410/326-2416
Rex Cox	3164 Lighthouse Blvd 20657	rex@cablespeed.com	443-904-4130

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FEMA Flood Mitigation Public Forum

Tuesday – June 16, 2009 7 p.m.
Calvert Pines Senior Center Auditorium

Sign In Sheet

NAME	ADDRESS	EMAIL INFO	PHONE
Fay Fretz	Cove Pt. Bch. 11026 Elm Ct. Lusby, Md.	lorraine@ [illegible]	410-326-3457
LEA CALLAHAN	3187 CALVERT BLVD LUSBY MD	EVCALLAHAN@aol.com	410-326-8482
Gwen Myers	10951 Poplar Dr. Lusby, Md.	gwenmyers@ [illegible] .com	301-372-6211
Michele Rockhill	6500 Long Beach Dr St Leonard, MD	rockhill@chesapeake.net	410 586 0658
GEORGE + SANDY KAHL	10971 BEACH DR LUSBY MD	George.kahl@comcast.net	4103266479

Public Meeting 2 Slides 1 of 3

Flood Mitigation Plan
Calvert County, MD

VISION

Project Purpose

To develop a flood mitigation plan to improve Calvert County's resistance to floods by identifying actions to reduce the impact of floods to county residents and structures

Key Players

1. Calvert County Staff
1. Flood Mitigation Plan Steering Committee
1. Municipal Representatives
   - North Beach, Chesapeake Beach
1. Consultants
   - Deepa Srinivasan, President, Vision Planning & Consulting
   - Dr. Mike Scott, Director, Eastern Shore Regional GIS Cooperative @ Salisbury University

Public

Maryland Emergency Management Agency (MEMA)

Federal Emergency Management Agency (FEMA)

Project Goals

1. The Flood Mitigation Plan for Calvert County:
   - Is consistent with the requirements of the 44 Code of Federal Regulations part 78.5 Flood Mitigation Plan Development;
   - Helps reduce the risk of loss of life, personal injury and property damage to the County's residences and businesses by identifying the flood risk;
   - Includes mitigation strategies to address the flood risk within the County; and
   - Will gain approval from the MEMA and FEMA, paving the way for future federal funding of flood mitigation projects.

Steps in the Planning Process

1. Organize steering committee and process (meetings)
2. Assess hazards, risks, vulnerability
3. Assess local capabilities
   - Existing Plans, Programs, Policies
   - Personnel and Equipment Resources
   - Local Codes and Zoning Ordinances
   - Current and Proposed Construction Projects

Steps in the Planning Process (cont'd)

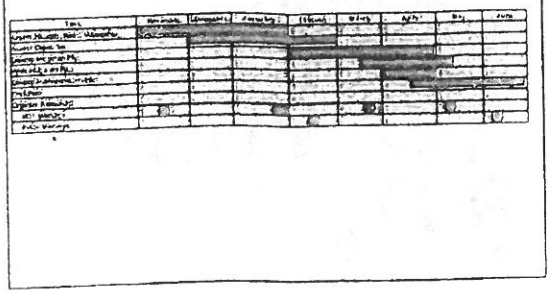
4. Develop goals and objectives and mitigation actions
   - Prevention
   - Property Protection
   - Public education and Awareness
   - Natural Resource Protection
   - Emergency Services
   - Structural Projects
5. Write mitigation plan and prioritize projects

Public Meeting 2 Slides 2 of 3

Steps in the Planning Process (cont'd)

- Develop implementation plan
  - Priorities for Mitigation Actions
    - Short-, Medium-, or Long-Range
    - Potential Funding Sources
    - Responsible Entities
    - Target Completion Dates
  - Five-Year Plan Maintenance Cycle

Schedule



Meetings

- 4 Steering Committee Meetings
  - Meeting 1 Planning process, schedule, deliverables, capability assessment
  - Meeting 2 Hazard identification, risk assessment
  - Meeting 3 Goals and objectives, Mitigation actions
  - Meeting 4 Mitigation actions prioritization and implementation
- 2 Public Meetings
  - Meeting 1
    - Planning process
    - Hazard identification, risk assessment, capability assessment
  - Meeting 2
    - Goals and objectives
    - Mitigation actions and implementation

Capability Assessment

- Calvert County Plans
  - 2004 Comprehensive Plan Calvert County, 2004
  - 2004 County Hazard Mitigation Plan, 2004
  - Water Resources Update (update to Comp. Plan) October 2009
  - County Land Preservation, Parks and Recreation Plan, 2006
  - County Water and Sewage Plan, 2008

Capability Assessment

- Calvert County Ordinances
  - County Floodplain Management Ordinance, 1992
  - Calvert County Zoning Ordinance, 2006 (rev June 2008)
    - Residential Development Requirements – Article 5
    - Subdivision Regulations - Article 7
    - Environmental Requirements – Article 8
    - Shore Erosion Protection Works – Article 9-8

Sources of Flooding

- Riverine flooding sources:
  - Tributaries of the Patuxent River
  - Hall Creek
  - Hunting Creek
  - Battle Creek
  - Leonard Creek
  - Back River
  - Mill Creek
- Coastal flooding from the Chesapeake Bay

Storm Surge Inundation

- Bluffs along the Chesapeake Bay offer protection to most shorelines on the eastern side of the county, though parts of Chesapeake Beach and North Beach are exposed to storm surge
- Low-lying areas adjacent to creeks and portions northwestern Calvert County along the Patuxent River also vulnerable

Source: 2004 Maryland State Hazard Analysis, Chap 3:

Critical Facilities in close proximity to Floodprone Areas

Critical facilities within 100 meters of the modeled floodzone

Type	Name
WWTP	Industrial Park WWTP (Skipjack Road)
WWTP	Chesapeake Beach WWTP
Fire Station	North Beach Volunteer Fire Company
School	Our Lady Star of the Sea School
Police Station	Hallowing Point Station (MDDNR)
Police Station	Solomons Police Substation

Structures within 100-year Floodplain

- Cove Point (166 structures)
- Broomes Island (71 structures)
- Chesapeake Beach (70 structures)
- North Beach (61 structures)
- Plum Point (45 structures)
- Long Beach (32 structures)
- Breezy Point (23 structures)

Repetitive Loss Properties

- Lusby (Cove Point)– 15 properties
- Saint Leonard (Long Beach) – 6 properties
- Huntingtown (Plum Point) – 5 properties
- City of North Beach – 5 properties
- Town of Chesapeake Beach – 3 properties
- Broomes Island – 2 properties
- Owings – 2 property
- Solomons – 1 property

Structural Damage by Building Type

1 Potential damage to structures/contents from a 100-year flood event by general occupancy type

General Occupancy Type	Building Count	% of Total	Value of Structure and Contents	Total Damage	% of Total
Residential	534	92.5	132,071,445	22,877,564	74.7
Commercial	30	5.2	17,127,780	4,362,715	14.3
Educational	1	0.2	712,500	261,431	0.9
Government	2	0.3	689,160	222,493	0.7
Industry	9	1.6	26,624,800	2,703,850	8.8
Religious	1	0.2	968,600	188,005	0.6
Total	577	100%	$178,195,285	$30,567,059	100%

Note: All dollar values are from 2007 tax assessments

APPENDIX 3

Mitigation Capability Questionnaire

1 Critical Facilities Information

a. Have any critical facilities such as police and fire stations, hospitals, schools, etc. been damaged from past hazards? If so, please indicate the hazard event and describe the damage.

Critical Facility	Address	Hazard Event	Damage Description

b Do any critical facilities fall within flood hazard areas? If so, please indicate the type of facility and location.

Critical Facility	Location

2. Existing Plans and Ordinances

a. Does the City/County have the following plans? If so, indicate the document, year adopted, and the agency/department that administers it.

Type of Plan	Name of Document	Year Adopted	Administered by
Comprehensive Plan			
Land Use Plan			
Zoning Ordinance			
Subdivision Ordinance			
Hazard Mitigation Plan			
Beachfront Management Plan			
Floodplain Development Ordinance			
Stormwater Management Plan			
Local Emergency Operations Plan			
Risk Assessment			
Capital Improvements Program			

b. Do your plans and ordinances contain the following policies? If yes, please indicate the name of the plan or ordinance.

Policy	Yes/No	Plan/Ordinance
Is there a freeboard requirement? If yes, how many feet?		
Is there a policy preventing new development or substantial improvements to structures in floodplains?		
Is there a regulation prohibiting fill in the floodplain?		
Is there a regulation prohibiting enclosure of structural elements below BFE?		
Is there a regulation requiring fill and building foundations be designed to protect them from scour, erosion?		
Is there a requirement that critical facilities be protected from higher flood levels?		
Is there a policy encouraging cluster development near floodplains, wetlands?		
Is there a policy for prohibition against dumping or placing debris in stream channels?		
Is there a regulation requiring erosion and sedimentation control during construction projects to reduce siltation and loss of channel carrying capacity?		
Is there a requirement for new structures in the floodplain to submit 1st floor elevations?		

Please fax your questionnaire to Deepa Srinivasan at 480 393 5396 by 4 December 2008
Thank you for your cooperation!

3. **Flood Mitigation Projects**

a. Has the City/County completed any flood mitigation projects in the past? If so, please indicate the type of project, location, and year of completion.

Flood Mitigation Projects	Yes/No	Location	Year Completed
Property Protection			
Buy outs			
Elevation of structures			
Floodproofing			
Berms/floodwalls			
Structural Projects			
Levees			
Drainage facilities			
Retention/detention basins			
Emergency Services			
Hazard warning (sirens, reverse 911)			
Hazard response (EOC activation, evacuation orders)			
Post disaster recovery (clearing streets, debris removal)			
Critical Facilities Protection (power stations, water/sewer facilities, police, fire, EMS, hospitals)			
Natural Resource Projects			
Wetlands protection			
Erosion and sedimentation control			
Public Outreach			
Map information			
Library resources			
Outreach projects (newsletters, brochures)			
Environmental education programs			
Real estate disclosure			

4. **Staff Capabilities and Building Data**

a Please provide information on the City's/County's staff capabilities and buildings in the floodplain with respect to the following:

Staff	Yes/No	Department
Floodplain Administrator		
Building Official/Inspector		
Site Plan Reviewer		
Surveyor		
GIS Specialist		
Total buildings in floodplain		
Total flood insurance policies		
Total repetitive loss structures		

5. **Training**

a. Has your staff had any training in the following?

Training	Yes/No	Staff Position
GIS		
Floodplain management/NFIP regulations		
Community Rating System		
Building inspection		
Building code administration		
Building retrofits		

Please include your information: *Name*_____ *Title* _____
Phone number *Email address*

Please fax your questionnaire to Deepa Srinivasan at 480 393 5396 by 4 December 2008
Thank you for your cooperation!

APPENDIX 4

Glossary

Glossary	
Base Flood	The flood having a one-percent chance of being equaled or exceeded in any given year; the base flood also is referred to as the 1-percent annual chance (100-year) flood.
Base Flood Elevation (BFE)	The water surface elevation of the base flood in relation to the datum specified on the community's Flood Insurance Rate Map. In areas of shallow flooding, the base flood elevation is the highest adjacent natural grade elevation plus the depth number specified in feet on the Flood Insurance Rate Map, or at least four (4) feet if the depth number is not specified.
Community, Relative to Floodplain Management	A political subdivision of the State of Maryland (county, city or town) that has authority to adopt and enforce floodplain management regulations within its jurisdictional boundaries.
Critical and Essential Facilities	Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes. [Note: See Maryland Building Performance Standards, Sec. 1602 and Table 1604.5.] Critical and essential facilities typically include hospitals, fire stations, police stations, storage of critical records, facilities that handle or store hazardous materials, and similar facilities.
Federal Emergency Management Agency (FEMA)	The Federal agency with the overall responsibility for administering the National Flood Insurance Program.
Flood or Flooding	A general and temporary condition of partial or complete inundation of normally dry land areas from: (1) The overflow of inland or tidal waters, and/or (2) The unusual and rapid accumulation or runoff of surface waters from any source.
Flood Damage-Resistant Materials	Any construction material that is capable of withstanding direct and prolonged contact with floodwaters without sustaining any damage that requires more than cosmetic repair. [Note: See NFIP Technical Bulletin #2, "Flood Damage-Resistant Materials Requirements."]
Flood Insurance Rate Map (FIRM)	An official map on which the Federal Emergency Management Agency has delineated special flood hazard areas to indicate the magnitude and nature of flood hazards, to designate applicable flood zones, and to delineate floodways, if applicable. FIRMs that have been prepared in digital format or converted to digital format are referred to as Digital FIRMs (DFIRM).

Flood Insurance Study (FIS)	The official report in which the Federal Emergency Management Agency has provided flood profiles, floodway information, and the water surface elevations.
Flood Protection Elevation:	The base flood elevation plus two (2) feet of freeboard, except for Solomons Town Center where the Flood Protection Elevation is 10' NAVD 88. Freeboard is a factor of safety that compensates for uncertainty in factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, obstructed bridge openings, debris and ice jams, climate change, and the hydrologic effect of urbanization in a watershed.
Flood Zone	A designation for areas that are shown on Flood Insurance Rate Maps: (1) Zone A: Special flood hazard areas subject to inundation by the 1-percent annual chance (100-year) flood; base flood elevations are not determined. (2) Zone AE and Zone A1-30: Special flood hazard areas subject to inundation by the 1-percent annual chance (100-year) flood; base flood elevations are determined; floodways may or may not be determined. In areas subject to tidal flooding, the Limit of Moderate Wave Action may or may not be delineated. (3) Zone AH and Zone AO: Areas of shallow flooding, with flood depths of 1 to 3 feet (usually areas of ponding or sheet flow on sloping terrain), with or without BFEs or designated flood depths. (4) Zone B and Zone X (shaded): Areas subject to inundation by the 0.2-percent annual chance (500-year) flood; areas subject to the 1-percent annual chance (100-year) flood with average depths of less than 1 foot or with contributing drainage area less than 1 square mile; and areas protected from the base flood by levees. (5) Zone C and Zone X (unshaded): Areas outside of Zones designated A, AE, A1-30, AO, VE, V1-30, B, and X (shaded). (6) Zone VE and Zone V1-30: Special flood hazard areas subject to inundation by the 1-percent annual chance (100-year) flood and subject to high velocity wave action (also see coastal high hazard area).
Floodplain	Any land area susceptible to being inundated by water from any source (see definition of "Flood" or "Flooding").

Floodproofing or Floodproofed	Any combination of structural and nonstructural additions, changes, or adjustments to buildings or structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents, such that the buildings or structures are watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. [Note: State regulations at COMAR 26.17.11(B)(7) do not allow new nonresidential buildings in nontidal waters of the State to be floodproofed.]
Floodway	The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to pass the base flood discharge such that the cumulative increase in the water surface elevation of the base flood discharge is no more than a designated height. When shown on a FIRM, the floodway is referred to as the "designated floodway."
Lowest Floor	The lowest floor of the lowest enclosed area (including basement) of a building or structure; the floor of an enclosure below the lowest floor is not the lowest floor provided the enclosure is constructed in accordance with these regulations. The lowest floor of a manufactured home is the bottom of the lowest horizontal supporting member (longitudinal chassis frame beam).
Market Value	The price at which a property will change hands between a willing buyer and a willing seller, neither party being under compulsion to buy or sell and both having reasonable knowledge of relevant facts. For the purposes of these regulations, the market value of a building is determined by a licensed real estate appraiser or the most recent, full phased-in assessment value of the building (improvement) determined by the Maryland Department of Assessments and Taxation.
Maryland Department of the Environment (MDE)	A principal department of the State of Maryland that is charged with, among other responsibilities, the coordination of the National Flood Insurance Program in Maryland (NFIP State Coordinator) and the administration of regulatory programs for development and construction that occur within the waters of the State, including nontidal wetlands, nontidal waters and floodplains, and State and private tidal wetlands (Tidal Wetlands). Unless otherwise specified, "MDE" refers to the Department's Wetlands and Waterways Program.
Maryland Emergency Management Agency (MEMA)	MEMA and MDE are the responsible agency for administering the flood management programs in Maryland.
National Flood Insurance Program (NFIP)	The program authorized by the U.S. Congress in 42 U.S.C. §§4001 - 4128. The NFIP makes flood insurance coverage available in communities that agree to adopt and enforce minimum regulatory requirements for development in areas prone to flooding (see definition of "Special Flood Hazard Area").

Special Flood Hazard Area (SFHA)	The land in the floodplain subject to a one-percent or greater chance of flooding in any given year. Special flood hazard areas are designated by the Federal Emergency Management Agency in Flood Insurance Studies and on Flood Insurance Rate Maps as Zones A, AE, AH, AO, A1-30, and A99, and Zones VE and V1-30. The term includes areas shown on other flood maps that are specifically listed or otherwise described in Section 1.5.
Substantial Damage	Damage of any origin sustained by a building or structure whereby the cost of restoring the building or structure to its before damaged condition would equal or exceed 50 percent of the market value of the building or structure before the damage occurred. Also used as "substantially damaged" structures.
Substantial Improvement	Any reconstruction, rehabilitation, addition, or other improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the building or structure before the start of construction of the improvement. The term includes structures which have incurred substantial damage, regardless of the actual repair work performed. The term does not, however, include either: (1) Any project for improvement of a building or structure to correct existing violations of State or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official prior to submission of an application for a permit and which are the minimum necessary to assure safe living conditions; or (2) Any alteration of a historic structure, provided that the alteration will not preclude the structure's continued designation as a historic structure.

APPENDIX 5

Resolution of Adoption