

2018 Flood Mitigation Plan Update

Howard County, Maryland



October 1st, 2018



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Flood Mitigation Plan

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Acknowledgements

This Flood Mitigation Plan was prepared under the guidance of the County's Department of Public Works—Storm Water Management Division, the Howard County Office of Emergency Management, and the Joint Steering Committee. The members of the Steering Committee are listed in Chapter 1.

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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION.....	13
1.1 Background	13
1.2 Study Area.....	14
1.3 Plan Objectives	16
1.4 Planning Approach.....	16
1.5 Flood Mitigation Plan Participants.....	16
1.5.1 Flood/Hazard Mitigation Steering Committee.....	17
1.6 Planning Process	17
1.6.1 Step 1 – Organize work group and process	17
1.6.2 Step 2 – Assess hazards, risks, vulnerability, and mitigation capability.....	19
1.6.3 Step 3 – Develop a mitigation plan	20
1.6.4 Step 4 – Implement the Plan	20
1.7 Organization of this Report.....	21
CHAPTER 2: PROBLEM DESCRIPTION.....	23
2.1 Introduction.....	23
2.2 Sources of Flooding.....	23
2.2.1 Riverine Flooding	24
2.2.2 Dam Failure.....	26
2.2.3 Stormwater Flooding	27
2.3 Flood Measurement	28
2.3.1 Flood Levels	28
2.4 Hazards from Floods	28
2.4.1 During the Flood	28
2.4.2 After the Flood.....	29
2.4.3 Impact to Buildings	29
2.5 Vulnerability Assessment.....	29
2.5.1 Methodology	29
2.5.2 Flood Loss and Vulnerability	30
2.5.3 Critical Facilities	33
2.5.4 Spatial Distribution of Flooding	33
2.5.5 Potential and Average Losses	38

2.6	Repetitive Loss Properties	40
2.7	Economic Impact	40
2.7.1	Businesses.....	40
2.7.2	Impact on taxes.....	40
2.7.3	Transportation	41
2.7.4	Other impacts	41
2.8	Future Trends and Development.....	41
2.9	Conclusions	41
CHAPTER 3: PREVENTATIVE MEASURES		43
3.1	Introduction	43
3.2	Howard County Plan/Ordinance Review	44
3.3	County Government, Departments, and Staffing Capabilities.....	52
CHAPTER 4: PROPERTY PROTECTION		56
4.1	Introduction	56
4.2	Building Relocation	56
4.3	Acquisition	57
4.4	Building Elevation	57
4.4.1	Advantages	57
4.4.2	Disadvantages.....	58
4.5	Barriers	58
4.6	Dry and Wet Flood-proofing.....	58
4.6.1	Advantages	59
4.6.2	Disadvantages.....	59
4.7	Sewer Backup Protection.....	60
4.8	Flood Insurance	60
4.8.1	National Flood Insurance Program	61
4.9	Mandates.....	62
CHAPTER 5: PUBLIC EDUCATION AND AWARENESS.....		64
5.1	Introduction	64
5.2	Map Information.....	64
5.3	Library and Web Sites	65
5.4	Outreach Projects	66
5.5	Technical Assistance	67
5.6	Real Estate Hazard Disclosure.....	67

5.7	Environmental Educational Programs	68
CHAPTER 6: NATURAL RESOURCE PROTECTION		70
6.1	Introduction	70
6.2	Wetland Protection and Forest Conservation	70
6.3	Erosion and Sedimentation Control.....	71
6.4	Best Management Practices	73
6.5	Illicit Discharge Regulations	73
CHAPTER 7: EMERGENCY SERVICES.....		75
7.1	Introduction	75
7.2	Threat Recognition	75
7.3	Warning	76
7.4	Response.....	77
7.5	Critical Facilities Protection	79
7.6	Post-Disaster Recovery and Mitigation.....	80
CHAPTER 8: STRUCTURAL PROJECTS		81
8.1	Introduction	81
8.1.1	Advantages	81
8.1.2	Disadvantages	81
8.2	Reservoirs and Dams	82
8.3	Levees/Floodwalls.....	84
8.4	Bridge Modifications.....	84
8.5	Channel Improvements	85
8.6	Dredging	85
8.7	Diversion	85
CHAPTER 9: MITIGATION STRATEGY.....		88
9.1	Introduction	88
9.2	Goals and Objectives	88
9.2.1	Preventative Measures	89
9.2.2	Property Protection	89
9.2.3	Emergency Services	89
9.2.4	Structural Projects	89
9.2.5	Natural Resource Protection.....	90
9.2.6	Public Education and Awareness	90
9.3	Mitigation Actions.....	90

9.4	Prioritization	90
9.5	Past Actions	97
9.6	Funding Sources.....	103
CHAPTER 10: PLAN MAINTENANCE		105
10.1	Introduction	105
10.2	High Priority Actions	105
10.3	Monitoring, Evaluating, and Updating the Plan.....	106
10.3.1	Annual Review	106
10.3.2	Ad Hoc Review	107
10.4	Plan Adoption	107
	Hazard Mitigation Plan	112
	Sample Annual Report Form.....	112
Appendix A: Meetings		114
Appendix B: Press Releases, Notices, and Public Participation		127
Appendix C: Acronyms.....		135
Appendix D: Community Survey Results.....		138

List of Figures

Figure 1.1 – State Context Map

Figure 1.2 – Regional Context Map

Figure 2.1 – Major Rivers and Creeks in Howard County

Figure 2.2 – Howard County 100-year Floodplain

Figure 2.3 – Schematic of a Floodplain

Figure 2.4 – Frequently Flooded Areas of Howard County

Figure 2.5 – Identification of Census Blocks Utilized by Hazus

Figure 2.6 – Howard County Critical Facilities

Figure 2.7 – Estimated Total Losses from a 100-year Flood Event

Figure 2.8 – Historic Ellicott City Drainage Patterns

Figure 2.9 – Patapsco River USGS Water Gauge Near Elkridge, MD from May 20-27, 2018

Figure 2.10 – Increase in Frequency and Intensity of Localized Precipitation Events

Figure 7.1 – Emergency Operations Center Activation Levels

Figure 8.1 – FEMA Dam Classification System

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List of Tables

Table 1.1 – Joint Steering Committee Members
Table 2.1 – High and Significant Hazard Dams in Howard County, Maryland
Table 2.2 – Gauging Stations in Howard County
Table 2.3 – Comparison of Hazus Default Data Versus County Supplied Data
Table 2.4 – 100-year Estimated Building Exposure and Damage Count
Table 2.5 – 500-year Estimated Building Exposure and Damage Count
Table 2.6 – 100-year Estimated Losses
Table 2.7 – 500-year Estimated Losses
Table 2.8 – Critical Facilities in the Modeled Flood Zone
Table 2.9 – Potential Losses Following a 100-year Event
Table 2.10 – Potential Losses Following a 500-year Event
Table 2.11 – Average Annual Losses for Howard County
Table 3.1 – PlanHoward 2030 Review
Table 3.2 – Howard County Code of Ordinances Review
Table 3.3 – Howard County Emergency Strategic Plan Review
Table 4.1 – Howard County Loss Statistics
Table 4.2 – Howard County NFIP Policy Statistics
Table 7.1 – Agency Responsibilities for Flood Emergency Responses
Table 9.1 – Evaluation Criteria for Project Prioritization
Table 9.2 – Mitigation Action Prioritization and Implementation
Table 9.3 – Action Status Definitions
Table 9.4 – Status Updates from 2012 Plan Actions
Table 10.1 – Highest Ranked Actions and Corresponding Scores

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CHAPTER 1: INTRODUCTION



1.1 Background

Floods are the most common weather-related natural disaster to occur in the United States, and causes more deaths than hurricanes, lightning, and tornados combined¹. Floods can 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 not only high waters, but also high velocity waters that carry large amounts of debris with nearly no warning and are highly unpredictable.

Over the years, communities have taken proactive measures to reduce the impact of flooding and the damage caused by it to residents and structures. In June 2010, the County hired Howard County Planning firm, Vision Planning and Consulting (VPC) to assist with the preparation of Howard County's Flood Mitigation Plan (FMP). In 2017, the County rehired VPC to update the 2010 FMP and Natural Hazard Mitigation Plan (NHMP). By selecting VPC for this update, Howard County retains that tacit knowledge from previous planning cycles.

The overarching goal of this project is *"To update and continually improve the County's Flood Mitigation Plan to reduce the impact of floods to County residents, properties, structures, and resources."*

¹ <http://www.nssl.noaa.gov/education/svrwx101/floods/>

1.2 Study Area

Howard County is located in central Maryland approximately halfway between Washington, D.C. and Baltimore, Maryland. Howard County is the only County in the State that is only surrounded by other Maryland counties, namely Frederick County, Carroll County, Baltimore County, Anne Arundel County, Prince George's County, and Montgomery County. There are no incorporated towns in the County; however, there are a number of identified communities and neighborhoods including Columbia, ElkrIDGE, Ellicott City, Lisbon, Savage, and West Friendship. In 2017, the population of Howard County was approximately 321,113, with an estimated 109,872 households²².

Figure 1.1 – State Context Map

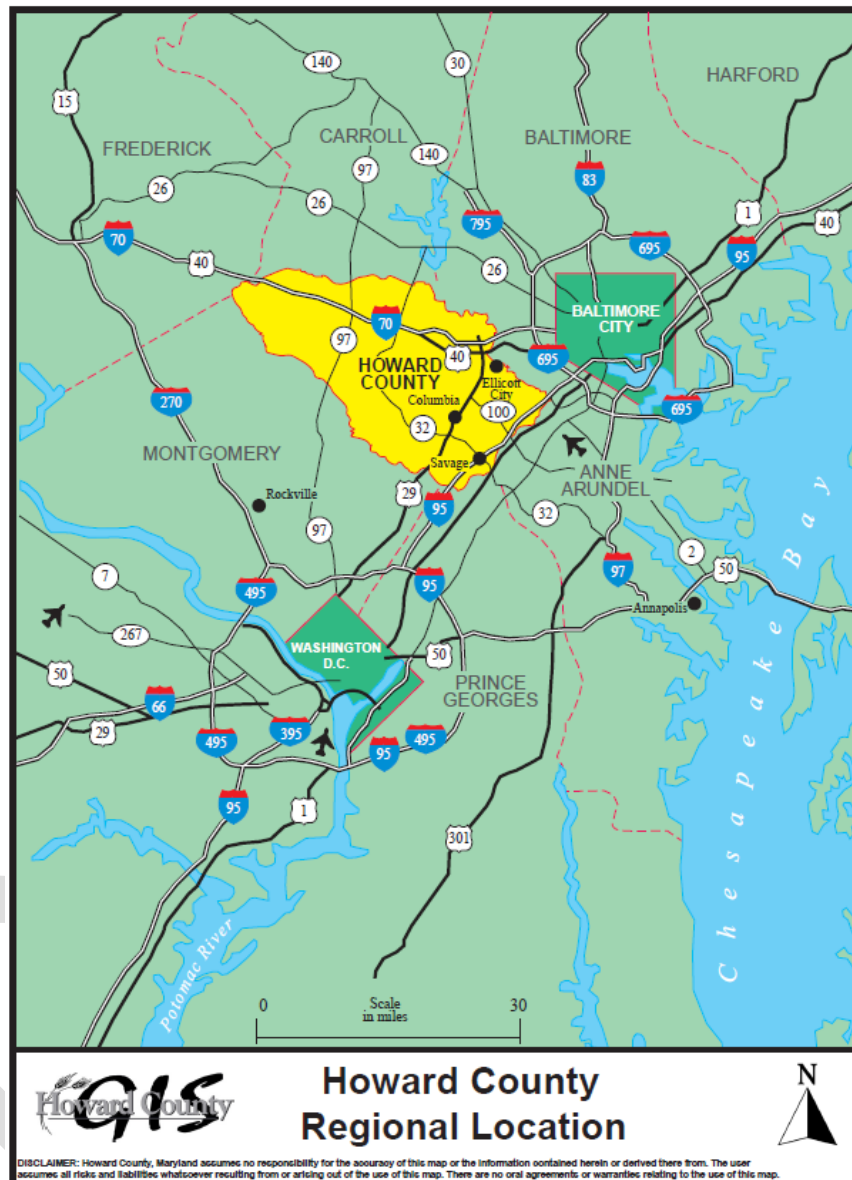


Howard County has a generally mild climate with four distinct seasons, and generally mild temperatures. The average annual precipitation is 43.4 inches and the average annual snowfall is 24 inches. The topography of the Maryland Piedmont region, where Howard County is located, is made up of consistently rolling hills. The entire County falls into either the Patapsco Watershed (to the north) or the Patuxent

²² <https://www.census.gov/quickfacts/fact/table/howardcountymaryland,US/PST045217>

Watershed (to the south). The elevation ranges between 20 and 873 feet above sea level throughout the County³.

Figure 1.2 – Regional Context Map



Source: Howard County Department of Technology and Communication Services, GIS Division

Source: Howard County GIS Office

In Howard County, the flood origins consist of riverine flooding from the tributaries of the Patuxent River bordering Prince George's and Montgomery Counties to the southwest and the Patapsco River bordering Carroll and Baltimore County to the north and northeast, as well as many streams and rivers in between. These include the Little Patuxent River, the Middle Patuxent River, Cattail Creek, Deep Run, Dorsey Run,

³ HCEDA

Bonnie Branch, Plumtree Branch, Guilford Branch, Hammond Branch, Clyde's Branch, Tiber-Hudson Branch, and many others (Figure 1.2).

1.3 Plan Objectives

This FMP 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 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 Howard County;
- 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 the Maryland Emergency Management Agency (MEMA) and the Federal Emergency Management Agency (FEMA) for approval, opening the way for future Federal funding of flood mitigation projects.

1.4 Planning Approach

The FMP for Howard 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 the National Flood Insurance Program (NFIP);
- Describes procedures for ensuring implementation, reviewing progress, and making revisions; and,
- Provides documentation of Plan by legal authority.

1.5 Flood Mitigation Plan Participants

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

- Joint Steering Committee (JSC), FMP and HMP, members (Howard County staff and residents, and business representatives) – Attendance at meetings and review of plan materials;

- Consultants – VPC– Assessment of flood risk, development of mitigation actions, plan preparation and meeting facilitation;
- Public – Meeting attendance, Plan input, response to questionnaire;
- VPC – plan review and approval; and
- FEMA – project funding, plan review, and approval.

1.5.1 Flood/Hazard Mitigation Steering Committee

The JSC was formed to serve as the committee for this 2018 planning process. Members of the original (2010) Steering Committee were invited to serve again and new members from various organizations, the public, and key stakeholders were solicited. The JSC members participated in Steering Committee meetings and provided input to the Consultants. Table 1.1 lists the members of the Hazard Mitigation JSC and the agencies represented.

Table 1.1 Joint Steering Committee Members

Name	Affiliation
Michael Hinson	Office of Emergency Management
Amanda Faul	Office of Emergency Management
Chris Meyer	Office of Emergency Management
Mark Richmond	Department of Public Works – Storm Water Management
Brian Cleary	Department of Public Works – Storm Water Management
Steve Hardesty	Department of Fire and Rescue Services
Rocco Sovero	Howard County Police Department
David Keane	Howard County Recreation and Parks
Peter Conrad	Department of Planning and Zoning
Bill Sieger	County Resident
Don Mock	Department of Inspections, Licenses and Permits
Lindsay DeMarzo	Office of Community Sustainability
Krishnakanth (Kris) Jagarapu	Department of Public Works - Highways
Philip Nichols	Howard County Administration
Sean Harbaugh	Columbia Association

1.6 Planning Process

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

1.6.1 Step 1 – Organize work group and process

The JSC was formed by a joint effort between the County's Office of Emergency Management (OEM) and the Department of Public Works (DPW), Bureau of Environmental Service (BES), Stormwater Management Division (SWMD). The Committee included staff representatives from various County agencies, residents, and stakeholders from around the County. The consultants worked closely with the JSC and met with them four times during the planning process.

The first JSC meeting was held on December 7th, 2017, at the County Emergency Operations Center (EOC) in Ellicott City, Maryland (Photo 1.1). At this meeting, the planning process, key elements of the Plan, schedule, and deliverables were discussed. An exercise to examine previous plans existing goals, and to develop new or updated County-wide goals and objectives was conducted to guide mitigation action development. Additionally, formats for public meetings and level of public involvement were discussed.



Photo 1.1 Discussion of plan update process at Steering Committee Meeting 1 in December 2017

The second JSC meeting was held on February 6th, 2018 at the County EOC in Ellicott City. At this meeting, the data on the flood hazard identification, hazard vulnerability, and risk assessment was presented (Photo 1.2) and input on the flood risk was solicited. The meeting concluded with a review of the mitigation actions from the 2010 FMP. Additionally, mitigation actions from the previous plan were reviewed to determine their current status (i.e., in progress, completed, deferred), relevance, and feasibility.



Photo 1.2 Presentation of hazards and threats at Steering Committee Meeting 2 in February 2018.

At the third JSC meeting, held on April 3rd, 2018 at the County EOC, a range of mitigation actions were examined that addressed the Plan's updated goals and objectives. Additionally, the results of the hazard mitigation questionnaire were reviewed. A brainstorming session was held with the JSC to determine additional new mitigation actions, based on results of the public, new mitigation actions were developed and appropriate content and verbiage finalized.

The fourth and final Steering Committee meeting was held on May 16th, 2018 at the County EOC. An exercise to finalize and prioritize the list of mitigation actions for the FMP was held. An implementation plan was developed to determine Lead Agency, Timeline, Estimated Cost and Funding Sources for each action item. Mitigation actions were also prioritized based on the prioritization rubric which utilizes criteria including Life/Safety, Technical/Administrative Staffing, and Cost. A plan maintenance schedule was also developed at this meeting.

Public Involvement

Public involvement during the planning process included JSC Meetings, Public Meetings/Open Houses, and Surveys.

Steering Committee Meetings

Select residents were invited to serve on the JSC, and encouraged to provide input and concerns from their community as representatives on the JSC.

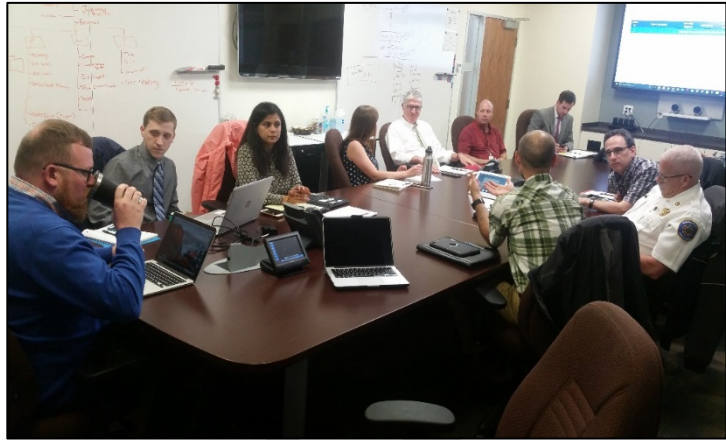


Photo 1.3 Discussion on priority of actions at Steering Committee Meeting 4 in May 2018.

Public Meetings/Open Houses

Public input was solicited at two public meetings during the planning process.

The first public meeting was held on February 15th, 2018 at the North Laurel Community Center. At this meeting, the planning process and the results of the hazard identification were presented to the public to solicit comment. VPC explained how the implementation plan would lead to prioritizing actions based on social, administrative, economic, and cost factors.

The second public meeting was held on May 17th, 2018 at the Howard County Library in ElkrIDGE. At this meeting, updated mitigation goals and objectives along with actions were presented for review and discussion. VPC discussed the integration of other County plans, as well as the Howard County 2017 Hazard Identification and Risk Assessment (HIRA), which was used to determine the hazard risk ranking for the County.

Both meetings were published through the Howard County Office of Public Information (PIO). All news releases went out to local media outlets (TV, radio and paper), as well as Howard County State Delegation. Additionally, the meeting notices were sent to fellow PIO's in the Howard County Public School System (HCPSS), Howard Community College (HCC), Howard County General Hospital (HCGH), etc. The meeting was also posted on the County's main social media pages.

Residents Survey

An online survey was developed to gather information from County residents on the frequency of various natural hazard events, as well as the kind of damages typically found by home and property owners. Approximately 160 responses were received from the online survey. The results of the flood components of the survey are provided in Appendix D.

Floodplain Coordinator Questionnaire

A Mitigation Capability questionnaire was sent to DPW-SWMD for completion. The purpose of the questionnaire was to solicit input on critical facilities, existing plans and ordinances, flood-related policies, and mitigation projects that have been implemented in the past as well as the County's technical and staffing capability.

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

In this step, information on past flood events in the County was gathered and areas with flooding issues, 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 Geographic Information System (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. Additionally, a review and analysis of the County's plans, ordinances, programs, and policies regarding flood mitigation and floodplain management, and their capability to adequately address the flood threats, was conducted and is included in Chapter 3. The flood risk assessment is documented in detail in Chapter 2 of this report.

1.6.3 Step 3 – Develop a mitigation plan

Mitigation goals and objectives were developed based on compiled flood hazard data, the vulnerability and capability assessments, and input from the JSC. 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:

- Preventative measures – e.g., zoning, floodplain management, storm water, and other ordinances;
- Property protection measures– e.g., relocation, flood-proofing, flood insurance;
- Public Education and Awareness – e.g., outreach projects, technical assistance;
- Natural resource protection – e.g., wetlands protection, best management practices;
- Emergency Services – e.g., warning, event response, evacuation; and,
- Structural projects – e.g., levees, reservoirs, channel improvements.

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

1.6.4 Step 4 – Implement the Plan

An Implementation Plan has been developed to describe how each mitigation action is prioritized, implemented, funded, and administered. Cost estimates for the recommended projects, and funding sources to implement recommended projects were identified, where available.

A description of the method and schedule of monitoring, evaluating, and updating the FMP within a five-year cycle and ways to incorporate community participation into the plan maintenance process is included in the final section of this Plan.

1.7 Organization of this Report

The Howard County FMP is organized by Community Rating System (CRS) categories and comprises 10 chapters.

- Chapter 2: Identifies the sources of flooding and assesses the County's vulnerability to flooding;
- Chapter 3: Elaborates on preventative measures;
- Chapter 4: Focuses on property protection techniques;
- Chapter 5: Identifies options for public education and awareness;
- Chapter 6: Examines natural resources protection techniques;
- Chapter 7: Discusses emergency services;
- Chapter 8: Identifies structural projects;
- Chapter 9: Defines the goals and objectives for the Plan and includes actions to mitigate the flood hazard and includes the criteria for, and a ranking of flood mitigation projects, and,
- Chapter 10: Identifies top-priority projects and outlines a process for Plan update and maintenance.

It should be noted that while this is a standalone document, it is a related Plan to the 2018 NHMP. As flooding is the most common, highest priority, and costliest hazard, this document focuses on flooding and gives this high priority hazard the importance it deserves as a stand-alone Plan of the Howard County NHMP.

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CHAPTER 2: PROBLEM DESCRIPTION



Photo 2.1 – Patapsco River along the Howard County and Baltimore County Line at Ellicott City

2.1 Introduction

“Floods are the most common and widespread of all weather-related natural disasters.”⁴ Flooding occurs when rivers, creeks, streams, ditches, or other bodies of water receive more water than they can handle. This can be a result of heavy precipitation, snowmelt, or even dam failure. The excess water flows over adjacent banks into the adjacent floodplain. Up to 90 percent of the natural hazard disasters across the United States include some degree of flooding.⁵ In the United States alone, floods are responsible for more deaths each year than hurricanes, lightning, or even tornadoes.⁶

This Chapter outlines the scope of Howard County’s flooding problems including the sources of flooding, the 100-year flood levels in each of Howard County’s waterways, the hazards that could be expected from a flood, and the type and degree of damage a flood could cause. Additionally, 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, are included. For a comprehensive review of past flood events in Howard County, refer to the 2018 NHMP.

2.2 Sources of Flooding

In Howard County, the sources of flooding consist primarily of riverine flooding. This comes from the tributaries of the Patuxent River, bordering Prince George’s and Montgomery Counties to the southwest,

⁴ <https://www.nssl.noaa.gov/education/svrwx101/floods/>

⁵ <https://www.fbiic.gov/public/2010/mar/FloodingHistoryandCausesFS.PDF>

⁶ <https://www.nssl.noaa.gov/education/svrwx101/floods/>

and the Patapsco River, bordering Carroll and Baltimore County to the north and northeast, as well as the streams, creeks, and rivers in between. These streams include: the Little Patuxent River, the Middle Patuxent River, Cattail Creek, Deep Run, Dorsey Run, Bonnie Branch, Plumtree Branch, Guilford Branch, Hammond Branch, Clyde's Branch, and Tiber-Hudson Branch, among others. (Figure 2.1).

Figure 2.1 Major Rivers and Creeks in Howard County

Source: Howard County Department of Technology and Communication Services, GIS Division



Source: Howard County Department of Technology and Communication Services, GIS Division

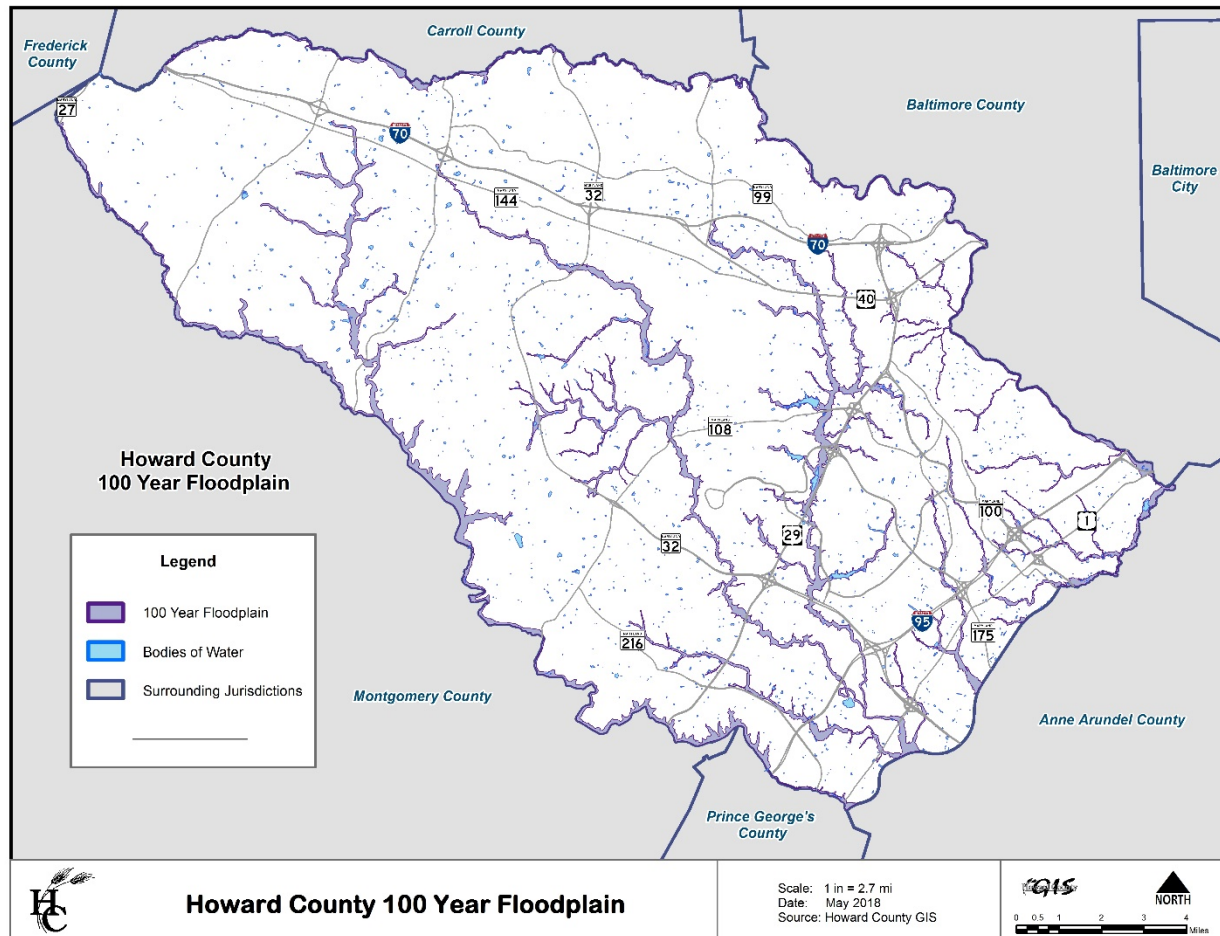
2.2.1 Riverine Flooding

Howard County can experience riverine flooding as a result of excessive rainfall in a matter of hours, such as from a severe thunderstorm or a series of training thunderstorms. Additionally, soils can become saturated over a longer time period, such as from a hurricane/tropical storm system, and reduce their absorption potential. Riverine flooding can affect any of the rivers, streams, and associated tributaries in the County.

The map below (Figure 2.2) depicts the 100-year floodplains within Howard County, as identified by FEMA on the Flood Insurance Rate Maps (FIRMs). The 100-year flood is a flood which has a one percent chance of being equaled or exceeded in any given year per the Maryland Department of the Environment (MDE), Maryland Floodplain Manager's Handbook).

Figure 2.2 Howard County 100-year Floodplain

Source: Howard County Department of Technology and Communication Services, GIS Division



It is evident that the floodplains impact many parts of Howard County. In fact, 5.5 percent of the County's land area is in the 100-year floodplain. The floodplain is defined as the area adjoining a river or stream that has been or may be covered by floodwater (Figure 2.3). 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. There are no FEMA regulated floodways in Howard County.

In addition, the review of past flood events showed that many of the streams in Howard County carry a flash flood threat. A flash flood is defined as a rapid flooding event that generally starts, peaks, and passes

in less than six hours, and commonly in as little as three hours.⁷ The small basins and incised nature of the streams in the County suggest a notable degree of “flashiness” to this flood threat.

2.2.2 Dam Failure

Dams are water storage, control, or diversion barriers that impound water upstream in reservoirs. Dam failure is a collapse or breach of this 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.

MDE lists a total of 27 dams in its dam inventory for Howard County, a few are in the process of being reclassified by MDE. Most of the dams in Howard County are relatively small earthen impoundments that were created for either flood control or recreation. 13 of these dams are owned/maintained by Howard County. Two dams owned/maintained by Howard County, the Columbia Gateway Dam and the Centennial Park Dam, are rated as being a high hazard. Table 2.1 lists the high and significant hazard dams and their respective owners.

Figure 2.3 – Schematic of a floodplain
Source: Ohio Department of Natural Resources

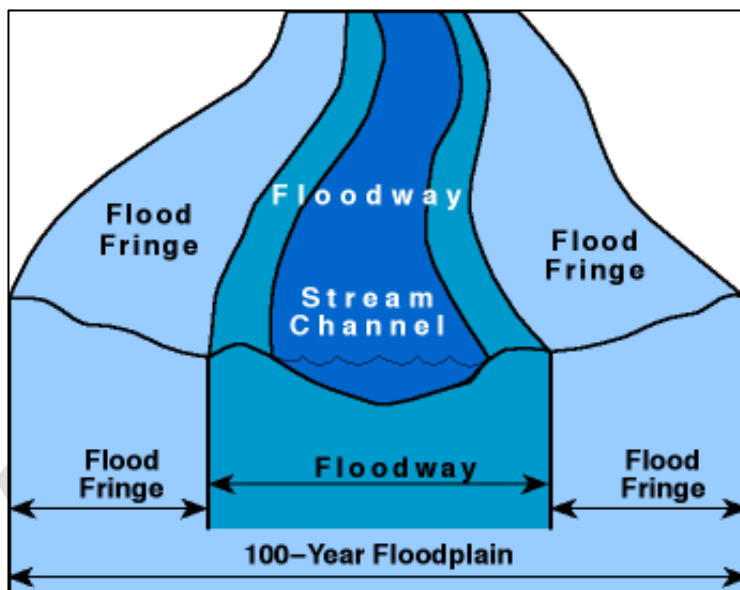


Table 2.1 High and Significant Hazard Dams in Howard County, Maryland (National Inventory of Dams, 2021)
Source: National Inventory of Dams, 2021

Dam Name	Waterway	Owner
High Hazard		
Centennial Park Dam	Tributary of Little Patuxent River	Howard County Parks Department
Columbia Gateway Dam	Tributary of Dorsey Run	General Growth Properties
Diversified Lane Dam	Tributary of Patapsco River	Howard County
Holly House Meadows	Tributary of Little Patuxent River	The Home Farm LLC
Lake Elkhorn (L-4)	Tributary of Little Patuxent River	Columbia Association
Significant Hazard		
Gateway Village Community Dam	Tributary of Little Patuxent River	Home Properties of NY
Gerwig Lane	Tributary of Little Patuxent River	Howard County
Glenmar Pond #2	Tributary of Deep Run	Howard County
Guilford Road Dam	Tributary of Little Patuxent River	Howard County
Hobbits Glen Dam	Tributary of Middle Patuxent River	Columbia Association
Jessup Park	Tributary of Little Patuxent River	William T. Wheeler, Trustee
Laurel Lumber	Tributary of Little Patuxent River	Annapolis Junction Holding, LP
Linden Chapel Dam	Tributary of Middle River	Howard County
Lutheran Village at Millers Grant Dam	Tributary of Little Patuxent River	Carroll Lutheran Village
Mary Lee Dam	Tributary of Little Patuxent River	Howard County
Montgomery Run Pond #1	Tributary of Patapsco River	Howard County

⁷ <https://www.weather.gov/phi/FlashFloodingDefinition>

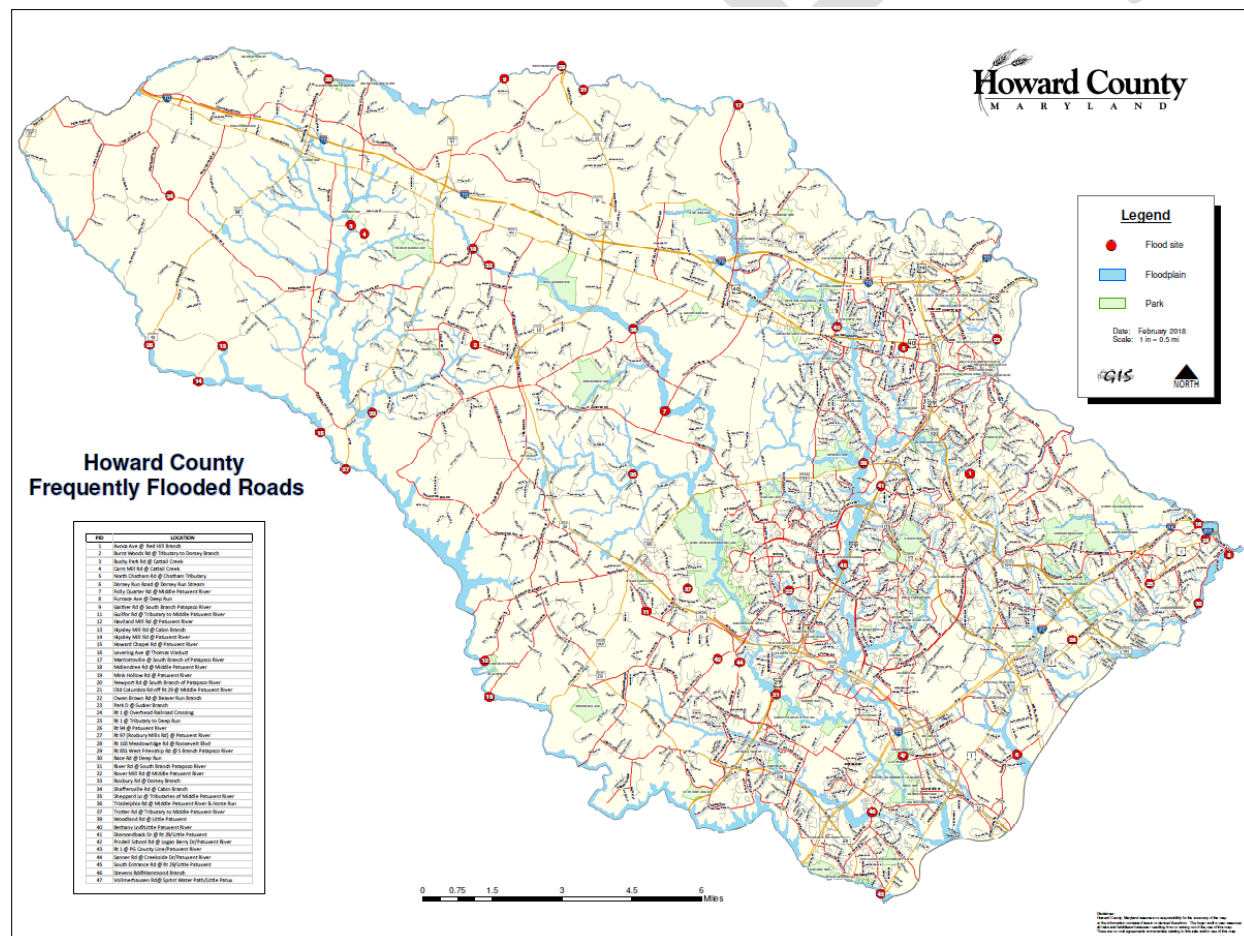
North Laurel Park SWM Pond	Tributary of Patuxent River	Howard County
Strawberry Fields	Tributary of Patapsco River	Howard County
Waiting Springs	Tributary of Little Patuxent River	Columbia Association
Whiskey Bottom West	Tributary of Patuxent River	Harris Mamie
Wilde Lake Dam	Tributary of Little Patuxent River	Columbia Association
Woodmark Community	Tributary of Little Patuxent River	Woodmark Homeowners Association
Wyndemere SWM Pond	Tributary of Patuxent River	Howard County

2.2.3 Stormwater Flooding

Another source of flooding in Howard County is storm water 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. The County maintains a map Figure 2.4, identifying frequently flooded roads. These locations are well known and closed as needed during events by maintaining situational awareness. There are no projects currently planned at these locations.

Figure 2.4 – Frequently flooded areas of Howard County

Source: Howard County Department of Technology and Communication Services, GIS Division



2.3 Flood Measurement

The measurements of stream discharge, river stage, and expected flood height are critical to the prediction of flood events. There are only seven active US Geological Survey gauging stations and no National Weather Service (NWS) hydrographs within the County, or important for the County. (Table 2.2).

Table 2.2 - Gauging stations in Howard County

	ID Number	Station Name	Real-Time or Daily
USGS	01589035	Patapsco River near Elkridge	Real-time
USGS	01591400	Cattail Creek near Glenwood	Real-time
USGS	01593450	Little Patuxent Tributary above lake Elkhorn NR Guilford	Real-time
USGS	01593370	Little Patuxent Tributary above Wilde Lake at Columbia	Real-time
USGS	01589000	Patapsco River at Hollofield	Real-time
USGS	01589025	Patapsco River near Catonsville	Real-time
USGS	01592500	Patuxent River near Laurel	Real-time

2.3.1 Flood Levels

The 2013 Flood Insurance Study (FIS) of Howard County provides the drainage areas and discharge amounts for key flooding sources. Information available in the study include: flooding source and location; drainage area (in square miles); and peak discharges in the 10, two, and one percent annual chance event. For more information on flood levels and peak discharges, the FIS is available at <https://www.howardcountymd.gov/public-works/fema-flood-insurance-rate-maps>.

2.4 Hazards from Floods

Flooding causes \$7.96 billion⁸ in average annual losses in the United States annually and accounts for an average of 82 fatalities annually.⁹ While most peoples' vision of the threat from flooding may include being swept away or buildings being structurally impacted, there are other hazards associated with flooding that occur both during and after an event.

2.4.1 During the Flood

While a flood event is underway, citizens will be faced with several types of threats. The hydraulic power of water is significant and walking through as little as six 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. That fact, combined with an inability for drivers to judge the depth of flood water, the potential for flood waters to rise quickly without warning, and the potential for washouts or sinkholes makes driving through flood water a very unwise action.

In addition to being swept away, flood water itself should be avoided. Because of leaking industrial containers, septic and sewer systems, 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. Fire outbreaks are also possible during a flood. Electric sparks often cause fire to erupt and because of the inability of

⁸ <http://www.nws.noaa.gov/hic/>

⁹ Ibid.

firefighting personnel to respond, a fire can quickly burn out of control. Additionally, underground utilities (natural gas, fuel, uncovered manholes) face potential damage during a flood event.

2.4.2 After the Flood

Cleaning up after a flood could 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, additionally, there may be mobility problems that keep fire-fighting equipment from being able to reach an outbreak. Finally, there is the mental toll of being hit by a disaster. Prolonged hours of work, losses from damaged homes, and the possibility of temporary job layoffs, could create a highly stressful situation and take an emotional and physical toll on residents. People exposed to these stressful conditions have an increased risk of injury and emotional crisis, and are more vulnerable to stress-induced illnesses and diseases.

2.4.3 Impact to Buildings

Although, the number of people killed or injured nationally during floods each year is relatively small, Howard County suffered three flood-related deaths in the course of less than two years. It is the built environment within the floodplain however, which is most 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 hydraulic pressure variation between the inside of the building and the 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 could 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 objects have become wet but the sediment, contaminants, and chemicals from the floodwaters could make it impossible to recover all but the most precious/heirloom items.

2.5 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.

2.5.1 Methodology

The Vulnerability Assessment was conducted using Hazus 4.2, FEMA's loss estimation software, to assess the County's built environment and critical facilities. Hazus is a GIS-based software that applies

engineering and scientific risk calculations that have been developed by hazard and information technology experts to provide credible damage and loss estimations. These methods are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards, including flood, hurricane wind and surge, earthquake and tsunami.

The analysis conducted for this study is referred to as a Basic, or Level 1, analysis, where the hazard data (floodplains and depth grids) are generated by Hazus, rather than being generated outside of Hazus and loaded into the software for analysis. To conduct this assessment, 10-meter resolution Digital Elevation Models (DEMs) were utilized by Hazus to develop the hydrology and hydraulic data for a full suite of return periods including 10-year, 25-year, 50-year, 100-year, and 500-year. While higher resolution (2 meter) DEM data is available for Howard County, a bug in the current version of Hazus prevents high resolution DEM data from loading correctly. The use of high and low-resolution DEM data has been assessed previously, finding that in riverine areas the value of high resolution DEMs is not as significant as in coastal areas. As such, the analysis conducted using the 10-meter DEM is an appropriate approach for updating Hazard Mitigation Plans. A Hazus-generated synthetic stream network using five square mile drainage basin threshold was developed from the 10-meter DEM. Using five square mile results in a more precise stream network than a 10 square mile drainage basin, which are commonly used in Hazard Mitigation Plan updates. It is possible to generate a higher resolution stream network using two square mile basins, however in a highly urbanized area such as Howard County, these can result in more problem reaches being encountered during the Hazus hydrology analysis, resulting in incomplete flood models generated by the software.

Selected critical facilities (essential facilities in Hazus) were updated with corrected locations for police stations, fire stations, and schools. Replacement values were updated for police stations and public schools from data provided by the County. The critical facility update inventory represents an Advanced, or Level 2, analysis, whereas the general building stock analysis described in the paragraph above represents a Level 1 analysis.

The table below displays the difference between the default Hazus critical facility inventory and the County-supplied critical facility data and emphasizes the importance of utilizing County provided data for a more accurate analysis.

Table 2.3 Comparison of Hazus Default Data versus County Supplied Data

Critical Facility Type	Hazus Default Data	County-Supplied Data
Fire Stations	16	12
Police Stations	0	3
Schools	112	114
Hospitals	3	3

2.5.2 Flood Loss and Vulnerability

Before proceeding with the result documentation, it is important to note that the results provided in this FMP update vary from the results in the current (2010) FMP due to three factors:

- 1) Hazus flood loss calculations were found to have a problem in the coding that did not correctly account for foundation height or first floor elevations. This was resolved in Hazus 4.0.

- 2) The 2010 flood analysis was based on address points that were likely placed in the center of parcels or building polygons. While this approach is considered to be the most accurate, it also results in many structures not being accounted for if the center of that property parcel or building does not intersect the floodplain and some portion of the polygon does fall within the floodplain.
- 3) The General Building Stock (GBS) approach used for this analysis assumes that all buildings are distributed equally across census blocks. This method does lead to overestimation of losses and damages, however, is an approved cost-effective approach to generating flood risk information. To improve GBS analysis, Hazus now uses a dasymetric dataset for the census blocks. The dasymetric data was developed from the homogenous US Census Blocks, where portions of the census blocks were removed to better reflect the locations of the built environment. Land use types of water, ice, wetlands, scrubland, barren, and forest were overlaid on the Census blocks to remove overlapping areas. The result is that the built environment is now assumed to be equally distributed on a smaller area of the block, which often better represents the location of the built environment. To better reflect where buildings exist on the ground, building footprints generated in 2014 by Howard County were used to clip portions of the census blocks, ensuring that only areas of the blocks where buildings actually exist are factored into the loss estimation.

Figure 2.5 Identification of Census Blocks Utilized by Hazus

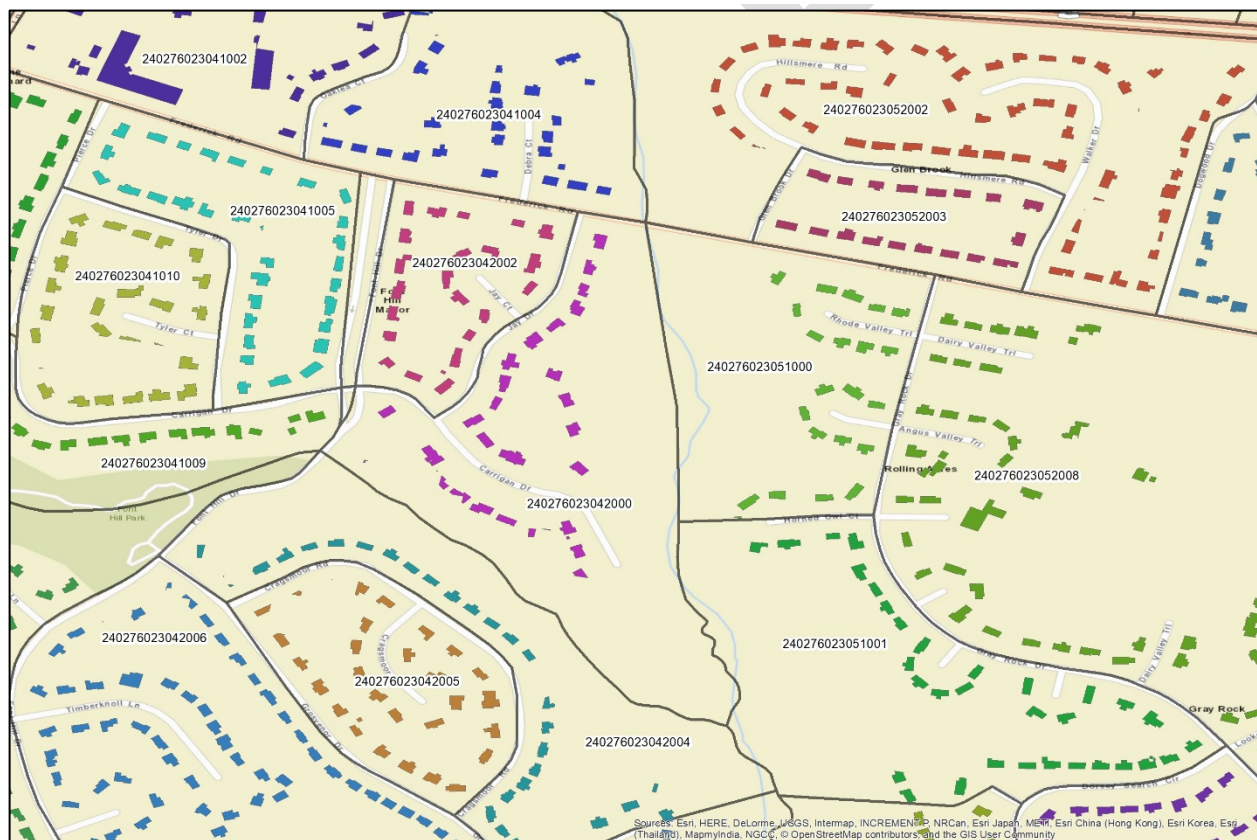


Figure 2.5 shows the results of the census block clipping using the building footprints. Each similar color group of footprints represents the census block that was used for the Hazus Flood analysis. This approach is not as precise as using the site-specific analysis approach that was conducted in the 2010 FMP, however, this is far more accurate than using the default dasymetric data distributed with Hazus.

Due to the nature of the aggregated GBS data, results will be provided in round numbers, since it is not considered to be appropriate to report precise results with Basic Hazus analysis. Additionally, GBS results should be reviewed at local and regional levels, as opposed to specific blocks.

Table 2.4 through 2.7 provide statistics regarding estimated building exposure, damage counts, and estimated losses for a 100-year and 500-year flood hazard.

Table 2.4 100-year Estimated Building Exposure and Damage Count

Study Area	Exposed Structures	Damaged Buildings	Damaged Residential Buildings	Damaged Commercial Buildings
Columbia	38	0	0	0
Elkridge	33	1	0	1
Ellicott City	49	27	9	0
County Total	234	29	9	1

Table 2.5 500-year Estimated Building Exposure and Damage Count

Study Area	Exposed Structures	Damaged Buildings	Damaged Residential Buildings	Damaged Commercial Buildings
Columbia	82	0	0	0
Elkridge	60	0	0	0
Ellicott City	89	48	16	0
County Total	412	65	21	1

Table 2.6 100-year Estimated Losses

Study Area	Residential Building Loss	Residential Building and Content Loss	Commercial Building Loss	Total Building Loss	Total Building and Content Loss	Estimated Total Loss
Columbia	\$1,234,000	\$1,941,000	\$57,000	\$1,301,000	\$2,184,000	\$2,845,000
Elkridge	\$620,000	\$934,000	\$19,000	\$817,000	\$1,843,000	\$2,342,000
Ellicott City	\$7,026,000	\$10,589,000	\$2,614,000	\$9,526,000	\$20,449,000	\$37,207,000
County Total	\$15,358,000	\$23,319,000	\$3,594,000	\$19,830,000	\$39,620,000	\$66,889,000

Table 2.7 500-year Estimated Losses

Study Area	Residential Building Loss	Residential Building and Content Loss	Commercial Building Loss	Total Building Loss	Total Building and Content Loss	Estimated Total Loss
Columbia	\$3,388,000	\$15,294,000	\$247,000	\$3,660,000	\$6,142,000	\$8,375,000
Elkridge	\$743,000	\$1,383,000	\$1,147,000	\$3,641,000	\$9,511,000	\$15,510,000
Ellicott City	\$9,951,000	\$14,961,000	\$3,650,000	\$14,415,000	\$30,217,000	\$56,014,000
County Total	\$26,168,000	\$39,862,000	\$6,608,000	\$35,541,000	\$71,722,000	\$120,579,000

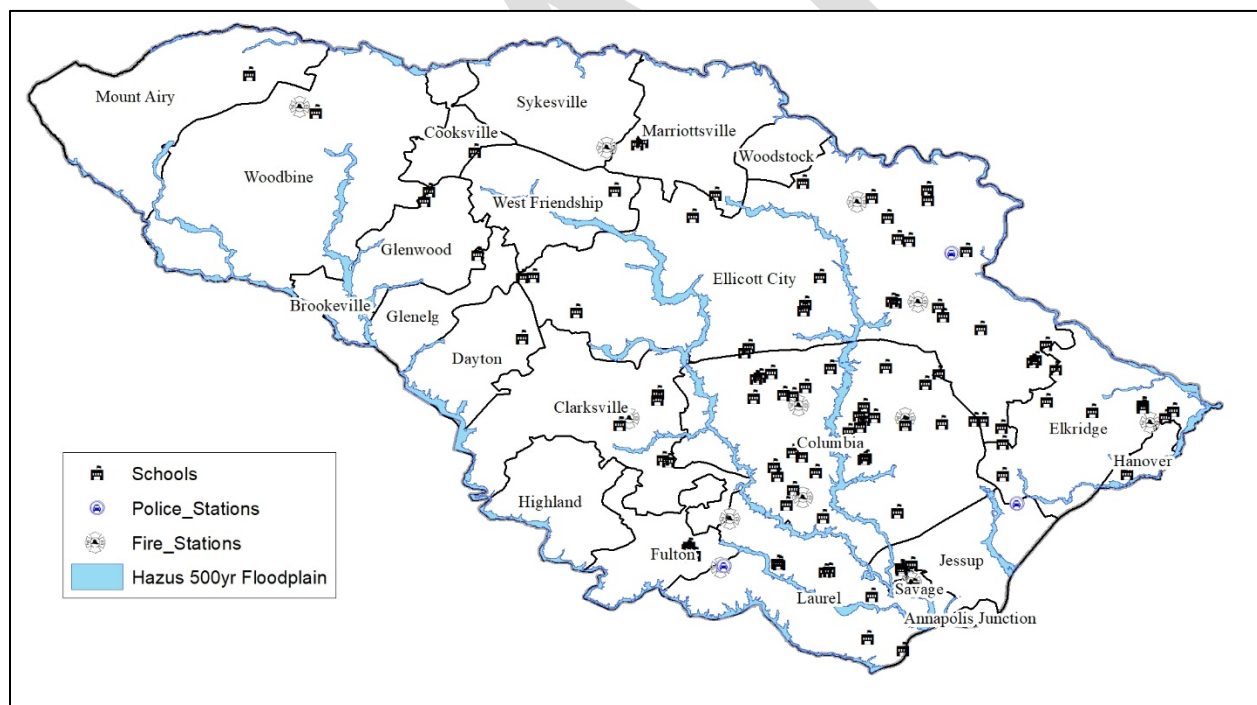
2.5.3 Critical Facilities

In addition to the GBS, critical facilities were also examined as part of the vulnerability assessment. Specifically, the locations of fire stations, police stations, schools, government buildings, wastewater treatment facilities, senior centers, assisted housing, hospitals, and nursing homes were reviewed relative to the floodplain and then compared to the potential depth grid. There were only three critical facilities determined to be in the modeled flooded area (Table 2.8). The government “building” is actually a pavilion in Centennial Park and was deemed to be “not critical.” Figure 2.6 shows the locations of the County’s critical facilities in relation to the floodplain.

Table 2.8 Critical facilities in the Modeled Flood Zone

Facility Type	Name
Waste Water Treatment Plant (WWTP)	Little Patuxent Water Reclamation Plant
School	High Road Academy
Government Building	Pavilion H in Centennial Park

Figure 2.6: Howard County Critical Facilities



2.5.4 Spatial Distribution of Flooding

The geography of the flood vulnerability can best be described as “dispersed” and “infrequent.” With the exception of Historic Ellicott City and ElkrIDGE, the County has very few legacy structures that are vulnerable to flooding. Most of the other more recently constructed vulnerable structures are located in

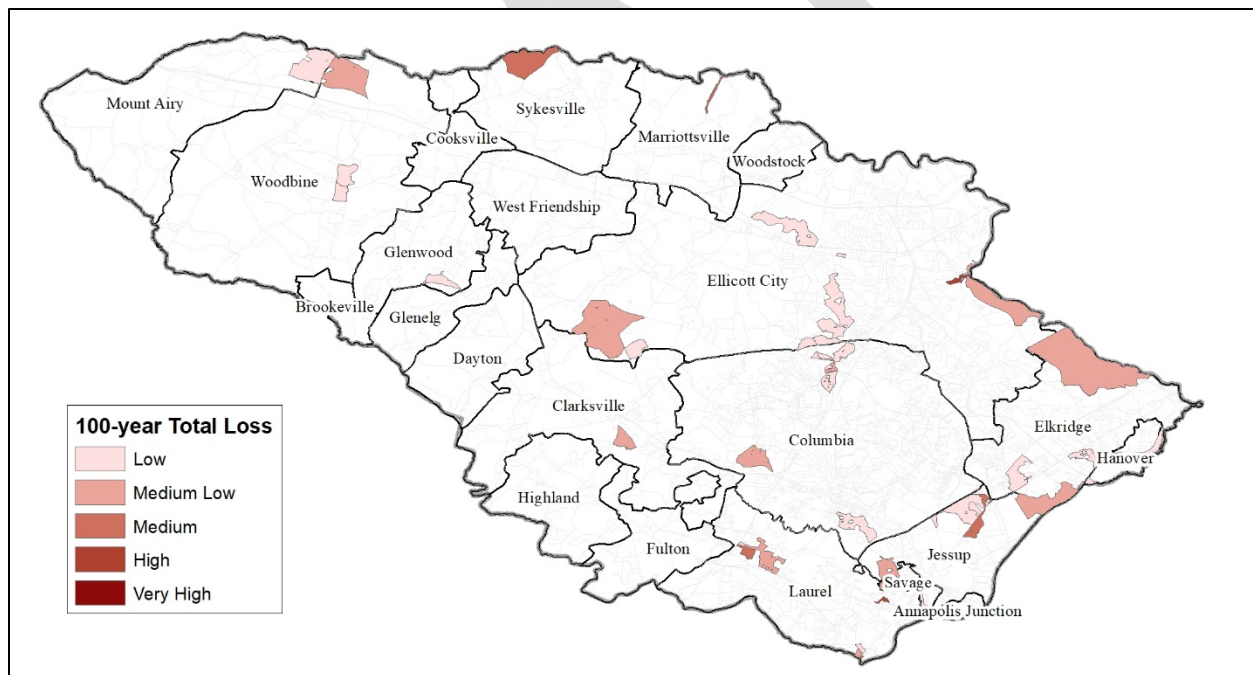
clusters of just a few along one of the County's many streams, creeks, and rivers. Although these buildings are not located in the floodplain, they just happen to be part of a planned development that was located close to a water source. The overall pattern suggests that the County's restrictions on floodplain development have achieved the desired effect, in most cases. This is highlighted in Chapter 3, Plan Integration, where in the County's comprehensive plan, zoning ordinance, and emergency strategic plan were carefully reviewed flood hazard-related content.

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

- Columbia (40 structures)
- Elkridge (35 structures)
- Ellicott City (50 structures)

Using the Hazus generated floodplains with the Howard County building footprints, nearly 50 buildings in Ellicott City are exposed to the 100-year flood event. When comparing against the 500-year flood event, that number increases to nearly 90 buildings. Figure 4.7 shows the estimated total losses from a 100-year flood event in Howard County

Figure 2.7: Estimated Total Losses from a 100-year Flood Event



2.5.4.1 Columbia

A significant (40) number of buildings are vulnerable to the 100-year riverine flood from the Little Patuxent River in the Columbia area near Clarksville Pike and Columbia Road. Specifically, it is a number of residential apartments and houses in the area of Vantage Point Road, Brook Way, Ten Mills Road, Whetstone Road, Carlinda Avenue, Allview Drive, Vollmerhausen Drive, and Woodland Road that are

vulnerable to loss from flooding. The combination of physical proximity to the water and the lack of elevation of structures equal a significant degree of vulnerability.

2.5.4.2 *Elkridge*

The Elkridge area was significantly impacted in the Flood of 1972 created by the remnants of Hurricane Agnes. A number of businesses were impacted during that 1972 flood including restaurants, gas stations, tire stores, and car dealerships. In the Hazus 100-year flood scenario, 35 structures are predicted to be damaged from flooding. The Hazus model is predicting 15 feet of flood water from a 100-year event and over 20 feet of flood water from a 500-year event along the Patapsco River near Elkridge.

2.5.4.3 *Ellicott City*

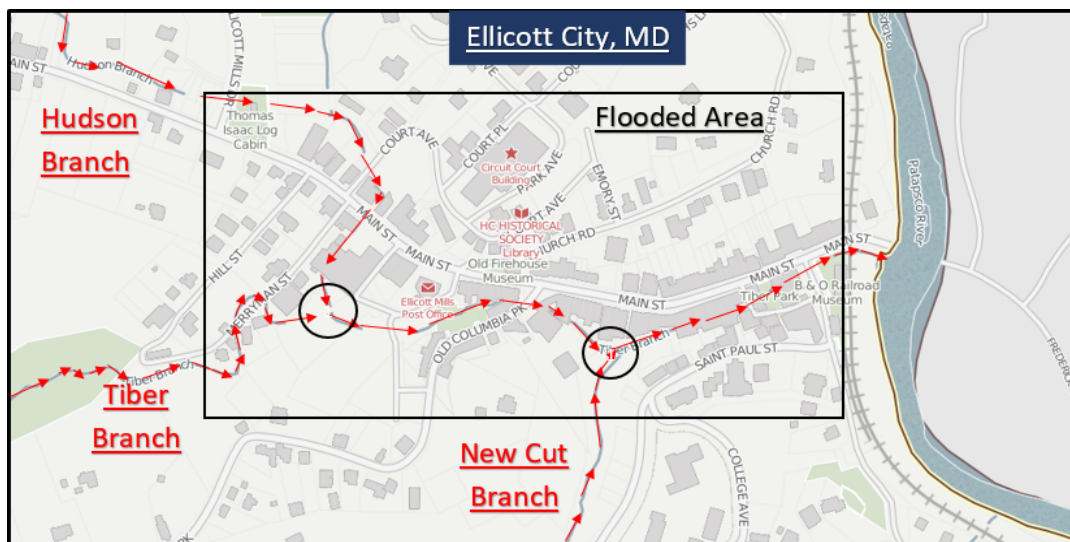
Historic Ellicott City will potentially be one of the most impacted during a 100-year flood event on the Patapsco River and its nearby tributaries. This area was devastated in 1972 during a flood event associated with torrential rainfall delivered by the remnants of Hurricane Agnes. During that historical event, the Patapsco River crested at 14.5 feet with a flood volume of 80,600 cubic feet per second. In addition to flooding from the Patapsco River, the Historic Ellicott City area is also impacted by the Tiber Branch, Hudson Branch, Autumn Hill Branch, and New Cut Branch. Flooding from these tributaries can result in flash flooding through Ellicott City, which was the case in the July 2016 flash flood, as well as the May 2018 flash flood, which rivaled that of 2016. The 2016 flash flood in Ellicott City caused \$22.4M worth of damage, including extensive damage to 90 businesses and 107 homes, and two people lost their lives.¹⁰

On Sunday, May 27th, 2018, an unexpected and second flash flood occurred in a 22-month timeframe making its way through Historic Ellicott City, and leaving in its path, destroyed businesses, residences, infrastructure, vehicles, and debris, and cost one life.

Historic Ellicott City is the convergence of the Tiber Branch, Hudson Branch, and New Cut Branch tributaries that drain into the Patapsco River located at the bottom of Main Street. The Hudson Branch weaves its way down Main Street before cutting across at Court Avenue, where it then converges with the Tiber Branch coming into the City from the southwest. The Tiber flows downhill behind buildings on Main Street, then turns and flows underneath several buildings, before re-emerging once more where it then converges with the New Cut Branch entering the City from the south. The Tiber then continues downhill, turns again and flows underneath a strip of Main Street buildings, before emerging again at the bottom of Ellicott City, where it drains into the Patapsco River (Figure 2.8). As afternoon turned into evening that Sunday, the region was battered with eight-to-10 inches of rainfall in roughly five hours, resulting in these tributaries overflowing their banks and turning lower Historic Main Street and the upper residential sections of Main Street Ellicott City into a flowing river.

¹⁰ Howard County HIRA, 2017.

Figure 2.8 Historic Ellicott City Natural Drainage Patterns



This torrent of water, specifically from the Hudson Branch in this section of the City, caused severe damage to residences and infrastructure further uphill, which made the flooding situation further downhill more severe and dangerous. For example, the flood waters from the Hudson Branch washed out significant portions of roadway and underlying stormwater infrastructure at the intersection of Main Street and Ellicott Mills Drive. The water and debris from the road washout (including earthen material and debris from the flood-destroyed original Ellicott City courthouse) made the flooding situation worse, as waters carried debris and floating vehicles downstream, blocking the next culvert, and causing further flooding down Main Street.

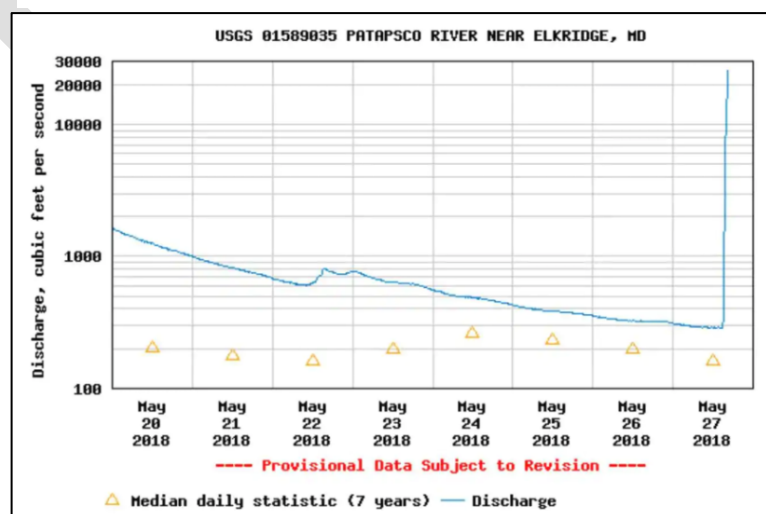
Ellicott City has experienced approximately 15 destructive floods over the course of its history.¹¹ Although it has experienced flooding over the years, the conditions leading to the two recent flash floods have occurred from top to bottom (approximately 250-foot drop), and the type and cost of damage that has been left behind from them has drawn attention to various inter-related and contributing factors. The overwhelmed streams could not drain the water fast enough, resulting in a backup into Main Street, which is in the 100-year floodplain.

What Caused the Flood?

There are several interrelated factors that contribute to the dangerous flooding in Ellicott City:

Figure 2.9 Patapsco River USGS Water Gauge Near Elkrige, MD from May 20-27, 2018

Source: NOAA

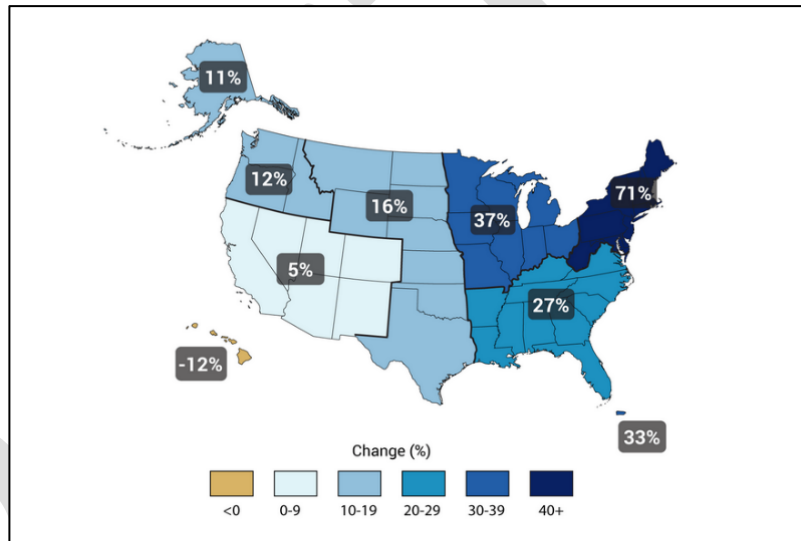


¹¹ Andersen, K. 2018. 'History of Flooding: Ellicott City 'was built where it is for a reason''. Fox 45 News Baltimore. 29 May, Accessed 12 June 2018, <http://fox45baltimore.com/news/local/history-of-flooding-ellcott-city-was-built-where-it-is-for-a-reason>

Ellicott City sits at the bottom of a topographical funnel, at the confluence of several streams feeding into the Patapsco River, which during the 2018 flood, rose more than 18-feet to record-level heights (Figure 2.9).

The frequency and intensity of small-scale (localized) precipitation events are increasing in the northeast United States.¹² These types of extreme floods have become more common, and will most likely continue to become more common over the long term¹³. To put it in perspective, in the 2018 flood, more than eight inches fell on Ellicott City over a multiple hour timeframe in an atmospheric process known as storm training, where a train of rain-bearing storm cells formed nearby and moved eastward one after another over Ellicott City.

Source: National Climate Assessment, 2014



During the 2016 flood, over six inches fell in nearly 90 minutes. This increased level of precipitation has been evident over the last few years. The National Climate Assessment Study completed in 2014 showed a 71 percent increase in observed heavy precipitation events in the north-east United States (Figure 2.10).

Weeks of previous rainfall in the Baltimore-Washington D.C. region was an additional contributing factor to the May 27th flash flood. Due to an already saturated ground, water was hindered from infiltrating the ground. This resulted in increased runoff flowing downhill toward Ellicott City.

The scale of the damage and the range of different types of damage resulting from the flash flood included, but was not limited to: landslides, road washout, culvert damage, debris in streams, sewer and stormwater infrastructure damage, sidewalk washout, and significant structural damage.

¹² Halverson, J. 2018, 'The second 1,000-year rainstorm in two years engulfed Ellicott City. Here's how it happened', The Washington Post, 28 May 2018, Accessed 13 June 2018 https://www.washingtonpost.com/news/capital-weather-gang/wp/2018/05/28/the-second-1000-year-rainstorm-in-two-years-engulfed-ellcott-city-heres-how-it-happened/?utm_term=.4f03cf583d69

¹³ <https://health2016.globalchange.gov/extreme-events>

Structural and Stormwater Infrastructure Damage



Road Washouts and Landslides



Adapting the Flood Terminology to Flash Floods

It is time to consider adapting the terminology regarding the scale and type of flood events. While major floods are typically categorized as “100-year, 500-year, or 1,000-year events” different metrics should be used to describe flash flood events.

Flash floods are inherently multi-factor disasters: Rain falls from the sky, and the land surface must absorb and/or distribute that water. If the surface is already saturated from previous rainfall, and the area is heavily urbanized, that water cannot infiltrate, and will simply run off. The meteorology is just one factor, while land surface and the topography are also factors. A distinction should be made between standard riverine flooding, and flash flooding that is influenced by multiple factors.

Many natural hazards are ranked based on more than one factor. For example, tornados are categorized based on wind speeds and corresponding damages. Earthquakes are categorized by the distance a fault was moved during the quake, and the energy release needed to move it¹⁴. Similarly, flash floods should be categorized on their own metric, such as rainfall total, topography, etc., particularly where multiple factors contribute to their onset and velocity. By adapting the terminology for flash flooding, a probabilistic definition can be redirected towards a definition based on strength/magnitude, thereby stressing the urgency for appropriate mitigation actions.

2.5.5 Potential and Average Losses

Tables 2.9 and 2.10 below highlight losses and potential damage for the primary town centers as well as other areas in the County with the greatest flood losses. Due to the nature of the Hazus GBS analysis, result counts are rounded to the nearest five. Dollar losses are rounded at the nearest \$10,000 if less than

¹⁴ <https://www.usgs.gov/faqs/moment-magnitude-richter-scale-what-are-different-magnitude-scales-and-why-are-there-so-many>

\$100,000, and the nearest \$50,000 if greater than \$100,000. Average annual flood losses, which are the estimated losses that could occur any given year are rounded to nearest \$5,000. Note that the tables below reflect the Hazus modeled losses, and do not reflect actual losses from the 2016 and 2018 Ellicott City flash floods.

Table 2.9 – Potential Losses following a 100-year event

100-Year Results	Columbia	Elkridge	Ellicott City	County Total
Estimated Number of Structures Exposed to 100yr Flooding	40	35	50	235
Building Substantial Building Damage Count 100yr	0	0	30	30
Residential Substantial Building Damage Count 100yr	0	0	10	10
Commercial Substantial Building Damage Count 100yr	0	0	0	5
Estimated 100yr Residential Building Losses	\$1,250,000	\$600,000	\$7,050,000	\$15,350,000
Estimated 100yr Residential Building & Content Losses	\$1,950,000	\$950,000	\$10,600,000	\$23,300,000
Estimated 100yr Commercial Building Losses	\$50,000	\$20,000	\$2,600,000	\$3,600,000
Estimated 100yr Total Building Loss	\$1,300,000	\$800,000	\$9,550,000	\$19,850,000
Estimated 100yr Total Building & Content Loss	\$2,220,000	\$1,850,000	\$20,450,000	\$39,600,000
Estimated Total Loss	\$2,850,000	\$2,350,000	\$37,200,000	\$66,900,000
Debris Results 100yr (Total Tons)	20	30	515	695
Displaced Population 100yr	80	25	90	365
Shelter Needs 100yr	5	0	5	10

Table 2.10 – Potential Losses following a 500-year event

500-Year Results	Columbia	Elkridge	Ellicott City	County Total
Estimated Number of Structures Exposed to 500yr Flooding	80	60	90	415
Building Substantial Damage Count 500yr	0	0	50	65
Residential Building Damage Count 500yr	0	0	16	20
Commercial Building Damage Count 500yr	0	0	0	5
Estimated 500yr Residential Building Losses	\$3,400,000	\$750,000	\$9,950,000	\$26,150,000
Estimated 500yr Residential Building & Content Losses	\$5,300,000	\$1,400,000	\$14,950,000	\$39,850,000
Estimated 500yr Commercial Building Losses	\$2,507,000	\$1,150,000	\$3,650,000	\$6,600,000
Estimated 500yr Total Building Loss	\$3,650,000	\$3,650,000	\$14,400,000	\$35,550,000
Estimated 500yr Total Building & Content Loss	\$6,150,000	\$9,500,000	\$30,200,000	\$71,700,000
Estimated Total Loss	\$8,400,000	\$15,500,000	\$56,000,000	\$120,600,000
Debris Results 500yr (Total Tons)	95	185	720	1,305
Displaced Population 500yr	185	40	140	690
Shelter Needs 500yr	5	0	5	15

Table 2.11 Average Annual Losses for Howard County

Average Annual Loss (AAL)	Columbia	Elkridge	Ellicott City	County Total
Estimated Residential Building Annual Loss	\$65,000	\$30,000	\$485,000	\$985,000
Estimated RES 1 Building Annual Loss	\$35,000	\$30,000	\$485,000	\$945,000
Estimated Total Building AAL	\$70,000	\$50,000	\$690,000	\$1,280,000

Estimated Total Annual Loss	\$140,000	\$185,000	\$2,625,000	\$4,330,000
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2.6 Repetitive Loss Properties

A Repetitive Loss (RL) property is defined as any insurable building for which two or more claims of more than \$1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A RL property may or may not be currently insured by the NFIP. Structures that flood frequently strain the National Flood Insurance Fund. RL properties not only increase the NFIP's annual losses and the need for borrowing, but they drain funds needed to prepare for catastrophic events.

A Severe Repetitive Loss (SRL) property is defined as a residential property that is covered under a NFIP flood insurance policy and:

- 1) Has at least four NFIP claim payments (including building and contents) over \$5,000 each; or,
- 2) 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.

Community leaders and residents are also concerned with the RL problem because residents' lives are disrupted and may be threatened by the continual flooding.

As of March 27th, 2018, MDE reports that there are 14 non-mitigated RL properties in Howard County, one of which, is a SRL property. There are two mitigated RL properties, which were acquired by the County using FEMA funds. Both houses were removed, and the lots are now open space. As RL information is available from MDE at any time, and the information is covered by Privacy Act, the County does not include a table in this Plan update.

2.7 Economic Impact

2.7.1 Businesses

Floods cause additional problems that are not as easily identifiable or conspicuous as property damage to buildings and critical facilities. Businesses that are disrupted by floods often must close their doors, and can remain closed for extensive periods of time. Inventories can be lost, business locations cannot be accessed by customers, and employees can be busy protecting or cleaning up their flooded homes or properties and cannot report to work.

Business interruption can be estimated using Hazus, and includes factors such as Income Loss, Relocation Costs, Rental Income Loss and Wage Loss. For the 100-year event, Hazus estimates that nearly \$27 million of the total \$66.9 million in losses are related to Business Interruption, roughly 40 percent. For the 500-year event, Hazus estimates nearly \$49 million of the \$120.6 million in losses are related to Business Interruption, which is also 40 percent.

2.7.2 Impact on taxes

Public expenditures on flood fighting, sandbags, fire department calls, clean up, and repairs to damaged public property affect the residents of Howard County. While a State or Federal disaster declaration may

help reimburse the County for portions of some events, this aid cannot be counted on for every event, both now and in the future. Furthermore, a recent law now requires that public agencies obtain and maintain insurance. The amount of insurance that should be carried will be deducted from any potential disaster assistance payments. Despite Federal and state disaster assistance, public agencies can still incur many expenses that will be borne by local taxpayers.

2.7.3 Transportation

A critical component of response and recovery, the loss of road access could affect all County residents and businesses, not just those that live or own property in the floodplain. This can have an impact on not only the direct costs to fix the roads and/or 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. The estimated losses to bridge infrastructure calculated by Hazus do not exceed \$20,000 for either the 100-year or 500-year events.

2.7.4 Other impacts

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

2.8 Future Trends and Development

To date, Howard County is one of the fastest growing counties in Maryland. From 1970 to 2015, the population of the County has increased by nearly 400 percent (from 61,911 to 309,050).¹⁵ The pace of that growth will slow considerably over the next 30 years. The Maryland Department of Planning (MDP) estimates that Howard County will grow its population at an average rate of about one percent per year with an expected population in 2040 of 366,350¹⁶. This slow 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 Howard County's residents and businesses and to suggest and implement changes to policies as the years progress.

On the other hand, the southern/eastern portion of the County can be considered nearly fully developed. While there is some development capacity in the northern/western part of the County, there will be increasing pressure to develop land that was previously considered marginal, vulnerable, or otherwise not previously suitable. However, the fact that the County Code prohibits development within the floodplain will help maintain that relatively low vulnerability profile.

2.9 Conclusions

Several conclusions can be made regarding the question of flooding vulnerability in Howard County. First, given that Howard County has a number of streams and rivers with significant floodplains, and that the County contains more than 80,000 structures, the fact that only 234 (0.3%) structures are vulnerable to

¹⁵ <http://planning.maryland.gov/MSDC/County/howa.pdf>

¹⁶ Ibid.

flooding, according to the Hazus-generated 100-year flood event, is probably a result of strong land use regulations and the leadership and foresight to implement them (as well as a fortuitous geomorphology). Using the current FEMA National Flood Hazard Layer (the data from which NFIP insurance requirements are based on), 463 buildings intersect the mapped 100-year floodplain which is still only around 0.6 percent. Second, given the potential for increased development, plus the “flashy” nature of many of the County’s streams and geography, the County should continue to make efforts to protect its citizens, resources, and infrastructure from future flooding. Third, even though the County is largely flood-resistant, there are certain areas that remain very vulnerable, such as Ellicott City and Elkridge, 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 residents of Howard County to reduce their personal vulnerability to flooding.

CHAPTER 3: PREVENTATIVE MEASURES



3.1 Introduction

Preventative measures are taken to ensure that future development does not increase the damage caused by a flood or other hazard thereby reducing its vulnerability. Preventative measures are put in place to keep the community's problem from occurring or being exacerbated. These measures include inserting language in planning, zoning, building codes, floodplain development regulations, stormwater management techniques, and open space preservation to minimize flood risk. These plans and ordinances are usually administered by the planning, public works, and/or code enforcement departments.

Zoning ordinances address the issues of keeping 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 in flood hazard areas, thereby preventing aggravating flood problems. Building codes are also very important in addressing the issue of mitigating the impact of non-flood hazards on new buildings. Stormwater management addresses the runoff of stormwater from new developments onto other properties.

3.2 Howard County Plan/Ordinance Review

A Document Review comprises an inventory of the County's existing planning and regulatory tools and a review and incorporation of existing plans and other technical information as appropriate. The purpose of a plan/ordinance review is tri-fold:

- To identify existing county standards and mandates;
- To provide an inventory and review of sample plans and ordinances and identify sections in these documents that address hazard mitigation-related issues; and,
- To provide a platform to integrate plans and other documents so recommendations and strategies are not in contradiction with one another (e.g., between the NHMP and comprehensive plan).

The sections below include a review of Howard County's comprehensive plan, floodplain regulations, and emergency strategic plan, and identifies areas in these documents where flood mitigation principles are addressed.

Howard County Comprehensive Plan – PlanHoward2030 (2017)

The following policies and implementing actions in the County comprehensive plan, developed by the Howard County Department of Planning and Zoning (DPZ), relate directly to mitigation and are echoed in this document.

Table 3.1 – PlanHoward 2030 Review

Source: Howard County Department of Planning and Zoning, 2017

Plan Topic	Page Number	Item Type	Current Clause
Environmental Protection	19	Policy 3.1	Ensure the adequacy of wastewater treatment capacity.
	19	Policy 3.2	Reduce pollution loads to surface and groundwater.
	19	Implementing Action	Stormwater Utility. Institute a dedicated fund to ensure increased and sustained funding for stormwater and watershed management programs.
	20	Policy 3.3	Use watershed management plans to guide the protection and restoration of water resources.
	20	Implementing Action	Watershed Management Plans. Prepare comprehensive watershed management plans for all watersheds, to set priorities and guide efforts to protect, restore, and improve the County's water resources. Complete and update all watershed management plans on a regular cycle.
	20	Implementing Action	Forest Cover and Riparian Forest Buffers. Establish and achieve measurable goals for forest cover and riparian forest buffers in all County watersheds.
	20	Implementing Action	Wetlands. Develop a wetlands program to inventory, map, protect, and enhance wetland resources.
	20	Policy 3.4	Coordinate regional protection of water resources.

Plan Topic	Page Number	Item Type	Current Clause
	20	Implementing Action	Patuxent and Patapsco Rivers. Coordinate and cooperate with other local, regional, and State agencies and organizations on joint watershed planning and management for the Patuxent and the Patapsco Rivers.
	22	Implementing Action	Best Management Practices. Expand current outreach and education efforts to promote and assist private property owners with the implementation of best management practices.
	24	Implementing Action	Streams, Wetlands, and Floodplains. Evaluate the effectiveness of current regulations in protecting streams, wetlands, and floodplains.
	25	Policy 3.8	Improve stormwater management practices throughout the County to help restore and protect water resources.
	25	Implementing Action	Redevelopment. Ensure redevelopment is designed and implemented to reduce stormwater runoff rate, volume, and pollution to the maximum extent practicable.
	Recommendation: There are no additional recommendations at this time.		
Resource Conservation	Recommendation: Include an additional implementing action to protect historic resources from the impacts of natural hazards through preservation-based hazard mitigation solutions.		
Economic Development	Recommendation: Develop a new policy and implementing actions that encourages economic resilience and encourages business owners to have a business continuity plan for flood and other hazard events.		
Public Facilities and Services	105	Policy 8.4	Ensure the adequacy of water and sewer services.
	105	Implementing Action	Wastewater Treatment Plant Capacity. Monitor flows to the Little Patuxent Water Reclamation Plant to ensure sufficient capacity for projected growth in the Planned Service Area.
	108	Policy 8.7	Identify and fund the most cost-effective strategies for Watershed Implementation Plan execution.
	108	Implementing Action	Best Management Practices. Monitor and evaluate the cost-effectiveness of diverse best management practices to maximize nutrient reduction from the funds expended.
	119	Policy 8.16	Minimize loss of life, loss of property, and injury due to fire or medical emergencies.
	119	Implementing Action	Fire Stations. Construct and staff the new and replacement fire stations in the current Capital Improvement Program (Waterloo, Elkridge, and Banneker). Renovate and rehabilitate existing fire stations as appropriate to ensure the continued provision of efficient service.
	120	Implementing Action	Underground Cisterns. Continue to construct underground cisterns to support fire suppression in the Rural West.

Plan Topic	Page Number	Item Type	Current Clause
	120	Implementing Action	Fire and Rescue Vehicles. Provide funding to replace fire and rescue vehicles when needed.
	120	Implementing Action	Adequate Resources. Ensure the Police Department has adequate staff and equipment based on levels of crime and demand for services.
	Recommendation: There are no additional recommendations at this time.		
Community Design	138	Implementing Action	Infrastructure Gaps. Expand existing infrastructure for older communities that were constructed under prior regulations, so these communities could benefit from additional improvements such as storm drains and sidewalks.
	138	Implementing Action	Environmental Enhancement. Expand environmental remediation to address storm water management, stream bank erosion, and buffer conservation.
	Recommendation: There are no additional recommendations at the time.		

Howard County Code of Ordinances – Subdivision and Land Development, Flooding, & Stormwater Management (2015)

The following sections of the Howard County Subdivision and Land Development, Floodplain, and Stormwater Management Ordinances relate to mitigation and are acceptable standards and echoed in this document.

Table 3.2 – Howard County Code of Ordinances Review – Subdivision and Land Development, Floodplain, and Stormwater Management Ordinances

Source: Howard County Code of Ordinances, 2015

Title 16 – Subtitle 1 – Subdivision And Land Development		
Sec. 16.104 - Waivers	16.104, (d), (2-4)	<p>No Waivers of Floodplain, Wetland, Stream, or Steep Slope Regulations in the Tiber Branch Watershed. The Department may not grant waivers of any requirement of section 16.115 or section 16.116 of this title for any property located in the Tiber Branch Watershed unless the waiver:</p> <ol style="list-style-type: none"> 2. Is necessary for the reconstruction of existing structures or infrastructure damaged by flood, fire, or other disaster; 3. Is necessary for the construction of a stormwater management or flood control facility as part of a redevelopment project; 4. Is necessary for the retrofit of existing facilities or installation of new facilities intended solely to improve stormwater management or flood control for existing development;
Sec. 16.115 – Floodplain Preservation	16.115, (a), (1-3)	<p>Development Restricted in 100-Year Floodplain (Base Flood Elevation). Development within the boundaries of the 100-year floodplain (base flood elevation) shall be pursuant to title 16, subtitle 7 of this Code. Most land within base flood elevation is considered a protection area (i.e., a stream valley or valuable ecological area or scenic resource) which is shown:</p> <ol style="list-style-type: none"> (1) In the General Plan of Howard County for conservation status; or (2) In the master plan of parks for acquisition as a conservation area; or (3) In the capital improvement program for acquisition as a conservation area

	16.115, (b), (1-2)	<p>Floodplain Protection. In subdivisions and site development plans containing a 100-year floodplain (base flood elevation), the floodplain land shall be protected in accordance with one of the following alternatives.</p> <ol style="list-style-type: none"> (1) Deed the floodplain land to the County. Developers are encouraged to dedicate and deed the land in the 100-year floodplain (base flood elevation) to Howard County as permanent open space. (2) Grant a floodplain easement to Howard County. If the floodplain is not dedicated to the County, the developer shall grant the County right of entry through a perpetual easement
	16.115, (c), (1-2)	<p>Prohibitions on Use of Floodplain Land:</p> <ol style="list-style-type: none"> (1) A person shall not store materials of any kind in a floodplain either temporarily or permanently. Accordingly, building materials and other debris shall not be stored or discarded in floodplains. (2) No clearing, excavating, filling, altering drainage, or impervious paving, may occur on land located in a floodplain unless required or authorized by the Department of Planning and Zoning...
Sec. 16.116 – Protection of Wetlands, Streams, and Steep Slopes	16.116, (a), (1-3); (b), (1-2)	<p>Streams and Wetlands:</p> <ol style="list-style-type: none"> (1) Grading, removal of vegetative cover and trees, paving, and new structures shall not be permitted within 25 feet of a wetland in any zoning district. (2) Grading, removal of vegetative cover and trees, paving, and new structures shall not be permitted within: <ol style="list-style-type: none"> (i) Fifty feet of an intermittent stream bank; (ii) Seventy-five feet of a perennial stream bank for Use I streams as classified by the Maryland Department of the Environment in residential zoning districts and residential and open space land uses in the NT, PGCC, and MXD districts; (iii) One hundred feet of a perennial stream bank for Use III and IV streams; and (iv) Fifty feet of a perennial stream bank in nonresidential zoning districts. (3) In residential subdivisions, wetlands, streams, and their buffers shall be located in required open space or a non-buildable preservation parcel <p>(b) Steep Slopes.</p> <ol style="list-style-type: none"> (1) Grading, removal of vegetative cover and trees, new structures, and paving shall not be permitted on land with existing steep slopes, except when: (2) There is sufficient area, a minimum ten feet, outside of stream and wetland buffers for required sediment and erosion control measures.
Sec. 16.119 – Highways, Streets, and Roads	16.119, (a), (9-12); (c)	<p>General Guidelines. In designing a highway, street, or road system, the following guidelines shall apply.</p> <ol style="list-style-type: none"> (9) The street system layout shall be designed insofar as practicable to preserve natural features such as streams, wetlands, forest, topography, scenic views, and other natural features. (11) Street system layout shall provide for the acceptable disposal of stormwater to comply with provisions elsewhere in this subtitle and the Design Manual. (12) Where topography or other conditions make the inclusion of utilities or drainage facilities within street rights-of-way impractical, perpetual unobstructed easements at least 20 feet in width for such utilities shall be provided across property outside the street right-of-way as determined by the Department of Public Works. <p>(c) Grades. Grades of streets shall not exceed the standards of the Design Manual, except that the Department of Planning and Zoning after consultation with the Department of Public Works</p>

		may permit steeper grades where warranted by unusual topographic conditions or for the purpose of preserving trees or other natural conditions.
Sec. 16.123 – Grading, Soils, and Sediment Control	16.123, (c), (1, 3)	<p>Sediment Control:</p> <ol style="list-style-type: none"> (1) The developer shall plan for practical and effective sediment control on the site to prevent off-site damages due to erosion and sedimentation processes which are accelerated by changing vegetation and grades. (3) Plans for erosion and sediment control measures shall be prepared in accordance with the requirements of the Howard Soil Conservation District and shall be approved by the Department of Planning and Zoning.
Sec. 16.131 – Sewage Disposal and Water Supply	16.131, (b)	<p>Sewage Disposal and Water Supply Required Pursuant to Regulations. Subdivision and site development plans shall provide for sewage disposal and for an appropriate supply of potable water in accord with the provisions of the Howard County master plan for water and sewerage, the regulations of the Maryland Department of Environment and the regulations of the Howard County Health Department.</p>
Sec. 16.133 – Storm Drainage		<p>Requirement to Construct Storm Drainage.</p> <ol style="list-style-type: none"> (1) The developer shall construct storm drains to handle on-site runoff; and (2) The developer shall provide on-site drainage easements; and (3) The developer shall provide off-site drainage easements; and (4) The developer shall provide for the handling of off-site runoff to an acceptable outlet in the same watershed pursuant to subsection (c) below. <p>Options for Handling Off-site Runoff: Developers shall do one of the following for all subdivisions:</p> <ol style="list-style-type: none"> (1) Provide for the construction of all necessary drainage structures through and between the developer's subdivision and an acceptable outlet in the same watershed; or (2) If all or part of the necessary drainage structures between the developer's subdivision and an acceptable outlet in the same watershed has been provided by another developer, the developer of the proposed subdivision shall pay the County an off-site drainage fee prior to recordation of the plat; or (3) Pay the County an off-site drainage fee prior to recordation of the plat.
Title 16 – Subtitle 7 - Floodplain		
<u>Plan Topic</u>	<u>Item #</u>	<u>Current Clause</u>
Sec. 16.705 – Requirements and Restrictions Applicable to the floodway	16.705, (c), (1-6)	<p>Buildings and Structures. In addition to the requirements set forth in the Howard County Building Code, new buildings and structures and substantial improvement of existing structures located in any special flood hazard area shall:</p> <ol style="list-style-type: none"> 1. Be designed (or modified) and constructed to safely support flood loads. Structures shall be designed, connected and anchored to resist flotation, collapse or permanent lateral movement due to structural loads and stresses, including hydrodynamic and hydrostatic loads and the effects of buoyancy. 2. Be constructed by methods and practices that minimize flood damage. 3. Use flood damage-resistant materials below the elevation of the lowest floor. 4. Have electrical systems, equipment and components, and mechanical, heating, ventilating, air conditioning, and plumbing appliances, plumbing fixtures, duct systems, and other service equipment located at or above the elevation of the lowest floor required in section 3112 of the Howard County Building Code.
	16.705, (e), (1-3)	<p>Protection of Water Supply and Sanitary Sewage Systems.</p> <ol style="list-style-type: none"> 1. New and replacement water supply systems shall be designed to minimize or eliminate infiltration of floodwaters into the systems.

		<ol style="list-style-type: none"> 2. New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into systems and discharges from systems into floodwaters. 3. In addition to the requirements of section 3.808 of this Code, on-site waste disposal systems shall be located to avoid impairment to or contamination from them during conditions of flooding.
Sec. 16.706 – Permits	16.706, (e), (1-2)	<p><i>Additional Application Requirements – Certain Development.</i> A permit application for development proposals and subdivision proposals having the lesser of five lots or at least five acres in special flood hazard areas where base flood elevations are not shown on the FIRM shall include:</p> <ol style="list-style-type: none"> 1. A determination of the base flood elevations; and 2. If hydrologic and hydraulic engineering analyses are submitted, such analyses shall be performed in accordance with the requirements and specifications of MDE and FEMA.
Sec. 16.710 – Subdivision Proposals and Development Proposals	16.710, (a-c)	<p>In accordance with section 16.115 of this Code, in all flood zones, subdivision proposals and development proposals shall:</p> <ol style="list-style-type: none"> (a) Be consistent with the need to minimize flood damage and are subject to all applicable standards in this subtitle and the Howard County Building Code. (b) Have utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize flood damage. (c) Have adequate drainage paths provided to reduce exposure to flood hazards and to guide floodwaters around and away from proposed structures.
Sec. 16.711 – Variances	16.711, (c), (1-2)	<p><i>Variance Prohibited.</i></p> <ol style="list-style-type: none"> 1. A variance shall not be issued within any designated regulatory floodway if any increase in flood levels during the base flood discharge would result. 2. A variance may not be issued for any property located in the Tiber Branch Watershed unless the variance: <ol style="list-style-type: none"> (ii) Is necessary for the reconstruction of existing structures or infrastructure damaged by flood, fire, or other disaster; (iii) Is necessary for the construction of a stormwater management or flood control facility as part of a redevelopment project; (iv) Is necessary for the retrofit of existing facilities or installation of new facilities intended solely to improve stormwater management or flood control for existing development; (v) There will be improvement to flood control in the Tiber Branch Watershed at least ten percent more than what would otherwise be required by law;

Title 18 – Subtitle 9 – Stormwater Management

Plan Topic	Item #	Current Clause
Sec. 18.903 – Design Criteria, Minimum Control Requirements; Alternatives	18.903, (a), (2-4); (b)	<ol style="list-style-type: none"> (a) The minimum control requirements established in this section and the design manual are as follows: <ol style="list-style-type: none"> (2) Control of the two-year and ten-year frequency storm event is required according to the design manual and all subsequent revisions if the County determines that additional stormwater management is necessary because historical flooding problems exist and downstream floodplain development and conveyance system design cannot be controlled. (3) One-hundred-year peak management control is required according to the design manual. For purposes of calculating the 100-year 24-hour storm event, 8.51 inches of rainfall depth shall be the minimum depth used. (4) The County may require more than the minimum control requirements if: <ol style="list-style-type: none"> (i) Hydrologic or topographic conditions warrant; or

		<p>(ii) Flooding, stream channel erosion, or water quality problems exist downstream from a proposed project.</p> <p>(b) Stormwater management where applicable, shall be consistent with adopted and approved watershed management plans or flood management plans as approved by the Maryland Department of the Environment in accordance with the Flood Hazard Management Act of 1976.</p>
Sec. 18.904 – Stormwater Management Measures	18.904, (a,g,h)	<p>Alternatives. Alternative ESD planning techniques and treatment practices and structural stormwater measures may be used for new development runoff control if they meet the performance criteria established in the design manual and all subsequent revisions. Practices used for redevelopment projects shall be approved by the County.</p> <p>Modifications. For the purposes of modifying the minimum control requirements or design criteria, the owner or developer shall submit to the County an analysis of the impacts of stormwater flows downstream in the watershed.</p>
Sec. 18.905 – Stormwater Management Design Process	18.905, (6)	(6) If a stormwater management plan involves direction of some or all runoff off of the site, the developer shall obtain from adjacent property owners any easements or other necessary property interests concerning flowage of water.
Sec. 18.908 – Waivers; Watershed Management Plans	18.908, (a), (4), (ii-v)	<p>(a) Waiver Requests. A request for a waiver under this section shall:</p> <p>(4) Be prohibited for any property located in the Tiber Branch Watershed unless the waiver:</p> <p>(ii) Is necessary for the reconstruction of existing structures or infrastructure damaged by flood, fire, or other disaster;</p> <p>(iii) Is necessary for the construction of a stormwater management or flood control facility as part of a redevelopment project;</p> <p>(iv) Is necessary for the retrofit of existing facilities or installation of new facilities intended solely to improve stormwater management or flood control for existing development;</p> <p>(v) Upon completion of construction of the development, there will be improvement to flood control in the Tiber Branch Watershed at least ten percent more than what would otherwise be required by law; or</p>
Sec. 18.910 - Redevelopment	18.910, (b), (c)	<p>(a) All redevelopment projects shall reduce existing impervious area within the limit of disturbance by at least 50 percent.</p> <p>(b) Alternative stormwater management measures may be used to meet the requirements in subsection.</p>

Howard County Emergency Strategic Plan (2016)

The following goals and objectives of the Howard County Emergency Strategic Plan, developed by OEM, relate directly to mitigation and are echoed in this document.

Table 3.3 – Howard County Emergency Strategic Plan Review

Source: Howard County Emergency Strategic Plan, Office of Emergency Management, 2016

Plan Topic	Item Type	Current Clause
Strategic Goal 1	Goal	Strengthen Howard County's capabilities to restore and stabilize government operations, economy and community life.

Plan Topic	Item Type	Current Clause
	Objectives	Develop plans for a post-disaster business and nonprofit economic recovery advisory taskforce to ensure that County recovery planning addresses economic recovery.
		Develop a recovery plan complete with short-term and long-term recovery strategies.
		Develop plans to establish a County Disaster Recovery Center to provide operational disaster assistance to the community following a disaster.
Strategic Goal 3	Goal	Prevent, protect, and mitigate against manmade and natural hazards.
	Objectives	Maintain, improve, and update the mitigation plan.
		Synchronize the timelines of all mitigation planning activities
		Seek additional mitigation grant funding and ensure match availability as applicable.
		Expand mitigation plan to include manmade hazards.
		Initiate the mitigation steering committee to implement mitigation planning objectives and strategies.
		Integrate mitigation plans with Department of Planning and Zoning plans.
Strategic Goal 4	Objectives	Create an accountability plan for mitigation action items.
		Tailor emergency management funding, projects, and planning initiatives according to the HIRA, THIRA, and any relevant risk and vulnerability assessments.
		Use risk and vulnerability assessments to determine funding priorities, and to direct county investments towards increasing preparedness, reducing risk, and increasing the capacity to respond and recover.
		Base mitigation priorities on the findings from risk and vulnerability assessments.
		Update and review risk and vulnerability assessments on a regular cycle.
Strategic Goal 5	Objectives	Use risk and vulnerability assessments to identify gaps in planning and resources.
		Develop and implement a community outreach program and identify opportunities to foster relationships among individuals and community groups.
		Provide easy to understand information on hazard risks to residents of high-risk areas to encourage them to take action to reduce risks and build resilience.
		Ensure that pre-disaster preparedness, mitigation information, and post-disaster assistance programs and services are available to all people in the community.
		Develop a plan to provide leadership and support, through guidance documents and dissemination of best practices, to encourage businesses and nonprofits to prepare mitigation and recovery plans.
	Objectives	Identify and target community preparedness education efforts for communities without adequate resources

Plan Topic	Item Type	Current Clause
Strategic Goal 7	Goal	Adopt a strategic planning process that holistically integrates planning, training, exercises, and evaluation, and that ensures plans are vertically and horizontally synchronized with appropriate departments, stakeholder agencies, and jurisdictions.
	Objectives	Ensure that the County's emergency management program (including mitigation, preparedness, response, recovery, and training) integrates planning efforts for the whole community.
		Continue to standardize emergency procedures, protocols, and policies throughout the County in order to promote a unified response when necessary.
Strategic Goal 8	Goal	Maintain a formal training and exercise program that is driven by hazard vulnerabilities, corrective actions from after action reports and gaps in capabilities and plans.
	Objectives	Ensure training and exercises are implemented as appropriate to evaluate and improve capabilities, preparedness, plans, strategies, and operational readiness in a fault-free environment.
		Incorporate and organize training opportunities for officials and emergency management and response personnel, as well as the public in an effort to improve inter and intra departmental collaboration.
Strategic Goal 9	Goal	Continually improve Emergency Operations Center (EOC) and Departmental Operation Centers (DOCs) functions and capabilities.
	Objectives	Ensure the EOC and County DOCs are properly equipped to meet planning, training, exercise, and activation needs.
		Maintain a Joint Information System with current information on hazards and activities to prevent injuries and property loss in Howard County.
Strategic Goal 10	Goal	Enhance and expand partnerships and collaboration with Non-Governmental Organizations (NGOs), faith-based organizations, the private sector, and public sector agencies.
	Objectives	Link businesses together with government resources to create a resource network for emergency events to enable the marshalling of resources to confront novel or complex disasters.
		Ensure community preparedness for and rapid recovery from disaster threats in Howard County and the region by providing businesses with encouragement and with the tools to assess their risks and to develop appropriate plans.
		Increase private-sector involvement, information, tools, and education in countywide preparedness and recovery.

3.3 County Government, Departments, and Staffing Capabilities

County government consists of 17 Departments, several of which are responsible for planning and responding to natural hazard events that occur within the County. The primary Departments that plan for, and respond to natural hazard events include:

- **OEM:** OEM is the local emergency organization for emergency management in Howard County¹⁷ and is responsible for “implementing programs and establishing positions recommended by MEMA to meet Federal and State standards.”¹⁸ OEM also develops and implements local and State emergency management plans for the County. OEM has the responsibility for coordinating all components of the County’s emergency response capabilities. Those components include, but are not limited to: the civil defense efforts, fire and police, public health and emergency medical services, public works, volunteer, and any other groups or agencies contributing to the management of emergency situations. OEM also facilitates public, multi-government agency planning efforts that enhance domestic preparedness for all hazards.
- **DPZ:** DPZ is responsible for “comprehensively planning for the growth and development of the County”¹⁹ by creating innovative plans and strategies to address environmental concerns, economic development, housing, transportation and land use within the jurisdiction. DPZ reviews variances as well as zoning and subdivision regulations to enhance and protect the health, safety and welfare of its citizens.
- **Department of Inspections, Licenses, and Permits (DILP):** DILP is responsible for the protection of public health, safety and welfare through the issuance of licenses and permits. The Department also conducts inspections as required by law and enforces codes, laws, rules, and regulations relating to facilities and utilities.²⁰
- **Department of Fire and Rescue Services (DFRS):** DFRS is responsible for the administration of fire suppression and prevention, fire training, arson investigation, rescue services, and emergency medical emergencies, within the County.²¹ The Department is devoted to protecting the citizens of Howard County and their property from fire and other hazardous conditions through public education, fire prevention, code enforcement and professional emergency response. DFRS is considered a “combination” Department, made up of both career and volunteer firefighters.
- **Howard County Police Department (HCPD):** The HCPD is responsible for the operation and enforcement of the laws, rules, and regulations concerning the following: the preservation of the public peace, the prevention of crime, the apprehension of criminals, and the protection of the rights of person and property.²² HCPD is dedicated to protecting life and property, enforcing the law, and assisting victims.
- **DPW:** DPW is responsible for the County’s capital projects and also designs, constructs, oversees, and maintains the County’s public facilities and utilities (roads, bridges, water systems, sewerage systems, and draining operations).²³ The protection of these facilities and infrastructure against natural hazards is of utmost importance to the advancement of quality of life for County citizens.

¹⁷ Howard County Code tit. 17 § 109 (a)(2) (2009).

¹⁸ *Id.* at 17 § 109 (a)(1).

¹⁹ Howard County Code tit. 16 § 801 (c) (2009).

²⁰ *See* Howard County Code 6 tit. § 301(c)(1) – (4) (2009).

²¹ Howard County Code 17 tit. § 100 (d)(1)(i-vi), (d)(3) (2009).

²² Howard County Code 17 tit. § 200a (d)(1) (2009).

²³ *See* Howard County Code 18 tit. § 1001 (c) (2009).

The following statistics for law enforcement, fire departments, medical services, and schools are current as of publication of this updated 2018 HMP. However, they are subject to change and will be updated appropriately.

- **Law Enforcement** – Howard County is served by the HCPD. HCPD has two stations, Northern District (Headquarters) and Southern District. Also, the Maryland State Police (MSP) – Waterloo Barrack is located in Howard County.
- **Fire Departments** – Howard County is served by DFRS. The County maintains twelve fire stations throughout the County.
- **Medical Services** – Howard County is an acute-care medical center and a member of Johns Hopkins Medicine. Sheppard Pratt Hospital in Ellicott City is a psychiatric facility serving a range of patients. Medstar Health is part of the largest healthcare provider in Maryland and it has several locations in the county. Altogether, Howard County has:
 - One inpatient hospital (HCGH)
 - One hospice and palliative care facility
 - One home health facility
 - Six nursing homes
 - 11 large assisted living facilities (17+ residents)
 - 72 small assisted living facilities (1-16 residents)
- **Recreation and Parks** – The Howard County Department of Recreation and Parks (DRP) offers more than 50 parks, and are responsible for the maintenance, operation, and stewardship of 9,378 acres of land.²⁴ In addition, DRP manages and oversees recreation facilities, the Robinson Nature Center, historic sites, as well as natural resource areas and the thousands of acres of open space throughout the County. DRP owns and operates 25 historic sites, all of which are either stand-alone sites or structures located within County-owned parks.²⁵ Of the total park and open space, 25 percent are considered natural resource areas, while DRP oversees over 1,035 parcels of open space.²⁶ The Maryland Department of Natural Resources manages two State parks and a wildlife management area in the County, totaling over 9,700 acres.²⁷
- **Critical Facilities** – The list of County critical facilities and infrastructures were re-evaluated and updated. HCPD and OEM identified the facilities and infrastructures that are considered the most critical to County Government. Planners and engineers evaluated a subset of these facilities as part of the vulnerability assessment process used in the updated NHMP. These critical facilities included: Emergency Services (Fire/Police), Criminal Justice (District and Circuit Court), Key Government, Transportation (Air and Rail), Water/Waste Water Treatment, Research, Major Retail, and Entertainment.

²⁴ LPPRP, pg. 32

²⁵ LPPRP, pg. 34

²⁶ LPPRP, pg. 33

²⁷ LPPRP, pg. 36

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CHAPTER 4: PROPERTY PROTECTION



4.1 Introduction

Property protection measures involve 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. Most protection measures do not 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. These measures are elaborated below.

4.2 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 a new flood-free lot (or portion of their existing lot) is available. DPW-SWMD administers building relocations. There have been no relocations in Howard County since 2009.

4.3 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. 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. Typically, no cost is borne by the homeowner in an acquisition project.

Acquisitions can be funded by FEMA using post-disaster mitigation funds that are administered through MEMA. Buyouts involve eligible and willing sellers only and are funded with 75 percent federal dollars and 25 percent local match.

DPW SWMD administers building demolitions and acquisitions. Federal dollars for building acquisition are provided by FEMA and administered by MEMA. There have only been two properties with houses on them that were acquired by the County using FEMA funds since the last FMP update. Both houses were removed, and the lots are now County open space. The addresses for the two properties are 6456 Harthorn Avenue and 6414 Glenmore Avenue. These properties were handed over to DRP to be maintained as open space in perpetuity. The County has considered applying for grants to acquire other homes in the past, but the properties have not had a suitable benefit/cost ratio (BCR). A new analysis will need to be conducted to determine if the 2016 and 2018 floods have had any effect on property acquisitions.

Currently, the County does not maintain a database of acquired properties since there have been only a couple in the past several years. In addition to FEMA funding, County funds have been used to acquire buildings in Historic Ellicott City.

4.4 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. For example, 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/or storage.

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 (BFE).

Elevation of properties is typically done on by individual homeowners. The County maintains a record of elevation certificates for some properties within the floodplain.

4.4.1 Advantages

- Elevating a house reduces the flood risk to the house and contents, and eliminates the need to move vulnerable and valuable contents to areas above the water level during flooding.

- Elevating a building above the BFE is cheaper than relocating it, and can be less disruptive to a neighborhood, especially a neighborhood of historic significance.
- Elevation is an acceptable and reasonable means of complying with NFIP regulations, as well as the community's floodplain management ordinance or law, that require new, substantially improved, and substantially damaged buildings to be elevated above the BFE.
- Elevating your house often reduces flood insurance premiums.

4.4.2 Disadvantages

- The cost of elevating your house may be prohibitive.
- The appearance of the house, and access to the house, may be adversely affected.
- Additional costs are likely if the house must be brought into compliance with current code requirements for plumbing, electrical, and energy systems.
- Special measures must be taken in areas of high velocity flows, waves, fast-moving ice, debris flows, or erosion.

4.5 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 will 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. There is no evidence of any barrier walls in the County that protect against surface flooding.

4.6 Dry and Wet Flood-proofing

The dry flood-proofing technique involves using measures to seal a building to prevent floodwaters 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:

- 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.
- Anchoring the building to resist flotation, collapse, and lateral movement.

4.6.1 Advantages

- The appearance of the building is not altered with floodproofing.
- Floodproofing is appropriate for buildings on concrete slab floors (without basements) and for those without cracks.
- Floodproofing 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).

4.6.2 Disadvantages

- The waterproofing compounds can deteriorate over a period of time.
- Floodproofing requires the installation of closures on windows and doorways.
- Floodproofing measures 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/utility outlets. Fuse and electric breaker boxes should be located high and near a door 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. The County does not maintain any documentation of properties that have been flood-proofed. While there are not technical experts to advise residents on how to floodproof their properties, DPW sends out flood-related publications annually to advise residents on these matters.

The Army Corps of Engineers recently completed a study *Nonstructural Flood Proofing Study for Ellicott City, Maryland* in February 2018 which addressed floodproofing to the Ellicott City Main Street corridor. These techniques may be applied Countywide. This study is available on the County's webpage (<https://www.howardcountymd.gov/LinkClick.aspx?fileticket=dHPynIDuG5l%3d&portalid=0>).

While the County's DPW - (BES) has administered a Floodplain Management Program since 1982 and required flood elevation certificates since then, the County has not maintained any records of properties that have been flood-proofed. This is typically done by the individual property owners who bear the time and cost of flood-proofing their properties. However, these properties would be on record with the County if a building permit was required.

4.7 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. However, if water is 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 Little Patuxent Reclamation Plant is located in Savage and currently has a capacity of 25 million gallons per day. It is a biological nutrient removal (BNR) process facility that removes nitrogen and phosphorus. The DPW-Bureau of Utilities (BOU) has a Pretreatment program that prohibits discharge of obstructive waste (items included: fats, oils and grease) into the sanitary sewer system. The Howard County Code Section 18.122a – Regulation of sewer discharges into collection system regulates the discharges of obstructive waste into the sanitary sewer system. Industries are required to put in pre-treatment devices (grease abatement devices, solids interceptors oil and water separators, and catch screens) to catch waste and by-products of the daily activities. BOU conducts inspections on a regular basis and requires industries to send in maintenance reports. Restaurants are provided wastewater discharge permits that dictate the requirements for the removal of food and oil from wastewater before discharge from sewer main. Industries are required to put in pre-treatment devices to remove obstructive waste so that it will be removed from wastewater before it is discharged into Howard County Sanitary Sewer System.

BOU has monitoring stations that determine if pipelines have the capacity to be able to accommodate discharge from a certain community. Sewage backups are handled by BOU. For sewage blockage issues, the County can dispatch a sewer truck to send a high-pressure water hose down through the cleanout, near the property line, and out to the sewer main. This typically resolves the problem if the blockage is on the County's side and will ensure that the County's portion of the sewer service is open and not causing the problem.

4.8 Flood Insurance

Most homeowner's insurance policies do not cover a property for flood damage; however, an owner can insure a building for damage by surface flooding through the NFIP.

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.

10 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 and not wait for the river 'to rise' before they buy their coverage.

Through the Basement Backup Insurance, the NFIP 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 back-up. Most exclude damage from surface flooding that would be covered by the NFIP. Each company has different amounts of coverage, exclusions, deductibles, and arrangements.

4.8.1 National Flood Insurance Program

FEMA produces loss and claim statistics for all NFIP communities throughout the Country. Tables 4.1 and 4.2 provide data on the loss and policy statistics respectively, for Howard County as of June 30th, 2018. Howard County incurred three-and-a-quarter percent of the total losses for the State of Maryland and one-and-a-half percent of the total policies in force.

Table 4.1 Howard County Loss Statistics²⁸

Area	Losses	Total Payments
Maryland	18,588	\$ 297,130,556.27
Howard County	370	\$9,634,967.94

Table 4.2 Howard County NFIP Policy Statistics²⁹

²⁸ Source: <https://bsa.nfipstat.fema.gov/reports/1040.htm#24> as of 6/30/2018

²⁹ Source: <https://bsa.nfipstat.fema.gov/reports/1011.htm#MDT> as of 6/30/2018

Area	Policies in Force	Insurance in Force	Whole Written Premiums in Force
Maryland	66,608	\$ 15,988,551,300	\$ 37,903,814
Howard County	1,050	\$ 295,650,800	\$ 764,727

4.9 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: If the project is worth more than 50 percent 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.

Currently, there is a two-foot freeboard mandate for structures in the 100-year floodplain. Also, the County requires an elevation certificate for all residential and nonresidential structures built in special flood hazard areas at or above the BFE. The certificate is required to indicate that the lowest floor of the structure has been built at or above the BFE. The elevation certificate is required to be completed before the structure is used or a certificate of occupancy is issued.

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CHAPTER 5: PUBLIC EDUCATION AND AWARENESS



5.1 Introduction

The Public Information aspect of flood mitigation involves the dissemination of pertinent information to property owners, renters, businesses, and local officials about hazards such as flooding and ways to protect people and property from these hazards. 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.

5.2 Map Information

Flood maps provide valuable information about past and potential flood hazards and can help residents and businesses, who are aware of the potential hazards, take steps to avoid problems and/or reduce their

exposure to flooding. They are also useful to real estate agents and house hunters as they can determine if a property is flood prone and whether flood insurance may be required.

The County's DPW staff enforces the Floodplain Management Ordinance and coordinates the review of new development projects in the floodplain with developers and their consultants. The County is not typically involved in the filing of a Letter of Map Amendment (LOMA). In the past, the County has filed for the owner and conducted the survey as well, but this has been discontinued due to the liability issue. The current process is that anyone proposing a LOMA or Letter of Map Revision (LOMR) must contact the SWMD to review the proposal and request SWMD's support of the LOMA. Typically, it is the property owner's engineer who proposes the change and makes the actual submittal to FEMA. The County is copied on all comments and correspondence between FEMA and the engineer and the County receives and archives FEMA's notification of the final disposition of the request.

5.3 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 main library is located on Little Patuxent Parkway and its five branches are located in East Columbia, Elkridge, Glenwood, Ellicott City, and Savage. The libraries stock flood related books and publications. The libraries' website offers a search feature where flood related books, publications and FIRMS may be viewed (<https://hclibrary.org/community-education/disaster-preparedness-recovery/>).

The County provides residents with flood risk information on FEMA FIRMs. These maps show the locations of properties relative to the floodplain. The County's GIS website (https://data.howardcountymd.gov/gdfirm/main_Web.aspx) enables resident to access the County mapping system and map their location to determine if they are in a flood area. Additionally, the county GIS website provides general online mapping services for residents at <https://data.howardcountymd.gov/InteractiveMap.html>.

SWMD's website (<https://www.howardcountymd.gov/SWM>) houses flood related information such as: flood safety and what county residents should do during heavy rains and how to prepare during a flood; floodplain functions; flood insurance resources; and a flood protection library.

OEM also hosts a website which provides information on Emergency Preparedness information: How to prepare for emergencies before they happen, emergency preparedness kits, and links to MEMA's website and resources (<https://www.howardcountymd.gov/fire-and-rescue-services/emergency-management>).

The following is a list of FEMA information booklets, manuals, and brochures that are available for review at the County Office building in Ellicott City, and online at the County website. In addition to these, there are other manuals and guides available for County officials.

1. Guide to Flood Maps
2. Preparing for Disaster
3. Preparacion y seguridad en inundaciones (Spanish)
4. National Flood Insurance Program Top Ten Facts for Consumers
5. An Insurance Preparedness Guide for Natural Disasters
6. Hurricane Floods- Safety Tips for Coastal Inland Flooding
7. Flood Preparation and Safety
8. After a Flood- The First Steps
9. After the Storm – A Citizen’s Guide to Understanding Stormwater
10. Repairing Your Flooded Home
11. Preparing Makes Sense-Get Ready Now, by Homeland Security
12. Three sets of Flood Insurance Rate Maps
13. Above the Flood: Elevating Your Floodprone House, FEMA-347 (2000)
14. Answers to Questions About the National Flood Insurance Program, F-084 (2011)
15. Elevated Residential Structures, FEMA-54 (1984)
16. Protecting Manufactured Homes from Floods and Other Hazards, FEMA P-85 (2009)
17. Protecting Building Utilities From Flood Damage, FEMA-P-348 (1999)
18. Protecting Floodplain Resources, FEMA-268 (1996)
19. Reducing Damage from Localized Flooding, FEMA 511 (2005)

5.4 Outreach Projects

Outreach projects are the first step in providing property owners information on property protection and assisting them in the design and implementation of projects. Outreach can be general, such as releasing informational articles in a local newspaper, or targeted, such as sending annual letters to homeowners living in the floodplain. These messages can include notices to flood prone property owners to introduce the idea of property protection or identifying sources of assistance or articles in the newspaper. Examples of other approaches to improve awareness include the following:

- Displays in public buildings or shopping malls;
- Articles and special sections in newspapers;
- Radio and TV news releases and interview shows;
- Flood protection videos for cable TV programs or to loan to organizations;
- Open houses that discuss flood-proofing techniques;
- Website notices with hyperlinks to other sources of information;
- School presentations on flood preparedness and flood safety; and,
- Presentations at meetings of neighborhood groups, realtors, bankers, or other special interest groups.

DPW-BES includes information regarding location of flood maps, flood insurance, and important websites as part of inserts sent out with tax bills to all property owners, not just those near a flood-prone area. The letter contains information on the location of flood maps, permits, clearing of storm drains, obtaining flood insurance and important websites.

5.5 Technical Assistance

Technical assistance is typically provided by experts such as the local building department staff who offer free advice in terms of various available options and guide residents. Some building department or DPW staff visit properties and offer suggestions. Most can recommend or identify qualified or licensed companies, an activity that is especially appreciated by owners who are unsure of the project or the contractor. This is very helpful to educate owners who do not feel ready to retrofit their buildings without appropriate guidance. 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 visiting a flood prone site, locating past and potential (e.g., the 100-year) flood depths on the property, and discussing alternative protection measures with the owner. The owner is given a written report with recommendations and a photograph of the property showing flood depths.

All development plans are reviewed by DPZ. If work is proposed in or near a floodplain, the DPZ reviewer will make sure that any work is in accordance with the County floodplain regulations. If a building permit is required, DILP will verify whether the work is allowed, and if it is, they will make sure it is done per County floodplain regulations.

5.6 Real Estate Hazard 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.

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 FIRM. 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 1st, 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 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.

Additionally, question #17 on the Maryland Residential Property Disclosure and Disclaimer Statement³⁰ (accessed April 26th, 2018), “Is the property located in a flood zone, conservation area, wetland area, Chesapeake Bay critical area or Designated Historic District?”

Currently, there is no County requirement for real-estate disclosure if a property is located in the floodplain, and realtors do not require a disclosure from the seller. The buyer is usually informed at settlement, however at that time it may be too late to retract the offer.

5.7 Environmental 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. Presentations and handouts on developing an emergency kit for specific hazards can get parents interested and become involved in the exercises. Educational programs can be undertaken by schools, park and recreation departments, conservation associations, and youth organizations, such as the Boy Scouts, Campfire Girls and summer camps.

DRP regularly offers classes in environmental education. Programs are tailored to the needs of adult or children’s groups.

OEM regularly provides emergency preparedness presentations to the community, tailored to specific audiences (i.e. children, older adults, persons with access and functional needs, houses of worship, businesses, etc.). In addition to these presentations, OEM attends community wide events, promotes preparedness on social media, and provides preparedness materials (customizable emergency plan templates, information on building a kit) through their Ready HoCo Outreach Program (get informed, make a plan, build a kit, and be involved).

The County hosts GreenFest at HCC. GreenFest includes a variety of County agencies, vendors, and experts relative to environmental issues. There are usually 70 – 80 hosted tables with information for the public. The event is held annually on a Saturday in April, close to Earth Day. The event focuses on purchasing green products, ecological home cleaning and lawn care, alternative energy, water conservation and reuse, organic and local food, and tips for greening everyday activities.

Although the County no longer conducts formal, scheduled educational programs at the Font Hill Wetland Park, educational opportunities are now more user driven. Group tours are led by DRP staff for small groups such as Boy Scout or Girl Scout troops and are scheduled upon request.

Additional outreach and education projects include:

- DILP hosting the annual workshops for local builders to discuss how to build homes that are more resistant to flooding hazards;
- DPW - Bureau of Highways (BOH) continues to design, site and install Road Weather Information Systems to allow quicker response to changing road conditions and facilitate in keeping the transportation network open; and,
- Office of Risk Management continues to educate all building safety coordinators about safety, evacuations, appropriate assembly areas, and shelter-in-place guidelines.

³⁰ <https://www.dlir.state.md.us/license/mrec/mrecaff.shtml>

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CHAPTER 6: NATURAL RESOURCE PROTECTION



6.1 Introduction

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 entities ranging from local park districts and regulatory agencies to land developers and farmers. The following four natural resource protection activities are discussed below in light of reducing the 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) Best management practices; and,
- 4) Illicit discharge (dumping) regulations.

6.2 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 habitats for fish, plants, and wildlife. They 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 (EPA) under Section 404 of the Clean Water Act. Both these agencies are required to sign off on 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 in this case, wetlands are required to be mitigated. Wetland mitigation can include creation, restoration, and 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.

Section 16.116. of the Subdivision and Land Development Ordinance discusses the protection of wetlands and streams. Grading, removal of vegetative cover and trees, paving, and new structures is not permitted within 25 feet of a wetland in any zoning district. Grading, removal of vegetative cover and trees, paving and new structures is not permitted within:

- (i) 50 feet of an intermittent streambank;
- (ii) 75 feet of a perennial streambank for Use I streams as classified by MDE in residential zoning districts and residential and open space land uses;
- (iii) 100 feet of a perennial streambank for Use III and IV streams; and
- (iv) 50 feet of a perennial streambank in nonresidential zoning districts.

In residential subdivisions, wetlands, streams, and their buffers are required to be located in required open space or a non-buildable preservation parcel rather than on residential lots.

The Howard County Forest Conservation Manual is the technical manual used to establish standards of performance required in preparing forest stand delineations and forest conservation plans. The Forest Conservation Manual is prepared by DPZ. The Manual includes standards and guidelines for forest conservation plans, forest stand delineations, reforestation and afforestation, forest mitigation banking, and other forestry related activities.

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. Section 16 of the County Code discusses Forest Conservation requirements. A Forest Conservation Plan is required for a subdivision plan site. Unless exempted, any person or unit of local government developing land 40,000 square feet or greater in an area is required to file a forest conservation plan with DPZ in accordance with Section 16.1202(a) of Howard County Subdivision and Land Development Regulations.

6.3 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 out 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, this can result in clogged streams or increased dredging costs. These issues are addressed through sedimentation and erosion control 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, since agricultural properties typically address erosion issues directly through the Howard Soil Conservation District. The most common approach is to require applicants for permits to submit an erosion and sediment control plan for the construction project.

Erosion and Sediment Control regulations are provided in Section 3.403, Section 16.123, and Section 18.3 of the County's Code of Ordinances. DPW coordinates with the Howard Soil Conservation District in administering soil erosion and sediment control regulations in the County. The Howard Soil Conservation District has the ultimate review and approval authority. Field inspection for erosion and sediment control facilities and practices are conducted by DILP. The MDE publication, Maryland Standards and Specifications for Soil Erosion and Sediment Control, serve as the basis for soil erosion and sediment control in Howard County.

Section 16.123 of the Land Development and Subdivision Ordinance addresses Sediment Control issues:

- The developer is required to plan for practical and effective sediment control on the site to prevent off-site damages due to erosion and sedimentation processes which are accelerated by changing vegetation and grades.
- Plans for erosion and sediment control measures are required to be prepared in accordance with the requirements of the Howard Soil Conservation District and be approved by DPZ in consultation with the Soil Conservation District, DILP, and DPW.

The County is also responsible for the coordination of the erosion and sediment control with other components of the storm drainage system, the provision of standard details, application of erosion control to storm drains and supplemental requirements related to both health and safety.

Filtration Best Management Practices (BMP) such as bioretention, surface sand filters, underground sand filters, perimeter sand filters, organic filters and pocket sand filters and non-structural BMP's such as dry wells, dry swales, wet swales, etc. cannot serve as a sediment control device during construction. The erosion and sediment control plans are required to indicate how sediment will be prevented from entering these filtration areas during construction.

Based on erosion and sediment control regulations from MDE, an approved plan is required for any earth disturbance of 5,000 square feet or more and 100 cubic yards or more; plan approval exemptions for agricultural uses; plan review and approval by the Howard Soil Conservation District; and project inspection by DILP. Clearing or grading activities that disturb less than 5,000 square feet of land area and less than 100 cubic yards of earth are not required to submit a plan.

DPW-BOH coordinates various water quality programs and inspects storm drains within the County. The County's SWMD inspects all BMPs, both public and private, within the County on a triennial basis. BOH is responsible for maintenance of all County owned facilities.

6.4 Best Management Practices

The term BMP 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 the U.S. and 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.

DPW-BES is entrusted with the responsibility of enforcing BMP. Structural BMP facilities that are outlined in the Stormwater Design Manual are required to be located on open space lots within the appropriate easements. BMP's on individual lots such as dry wells, rain gardens and overland flow used to obtain stormwater management disconnection credits are not required to have easements.

6.5 Illicit Discharge Regulations

Dumping and placing debris in channels are considered illicit discharges and are addressed in Section 18.502 of the Howard County Code. People are prohibited from discharging any pollutant or non-stormwater discharge into a storm drainage facility or waterway which contaminates or alters the physical, chemical, or biological properties of any water conveyed to a storm drainage facility including, without limitation, a change in the temperature, taste, color, turbidity, or odor.

Exceptions to this rule include:

- Waterline flushing or discharges from other potable water sources;
- Landscape irrigation or lawn watering;
- Diverted stream flows;
- Rising groundwater;
- Uncontaminated groundwater infiltration;
- Uncontaminated pumped groundwater;
- Foundation or footing drains;
- Air conditioning condensate;
- Irrigation waters;
- Springs;
- Individual residential vehicle washing;
- Flows from riparian habitats and wetlands;
- Dechlorinated swimming pool discharges;
- Firefighting activities; and,

- Discharges permitted under the EPA's National Pollutant Discharge Elimination System (NPDES) stormwater discharge permit or a non-stormwater discharge permitted under a NPDES discharge permit.

Dumping into streams and rivers is considered a violation of the Howard County Code. This includes grass clippings, leaves, and branches that can accumulate and plug channels. Residents are also encouraged to check that local storm drains are clear of debris when a heavy rain or snow event is expected, to prevent water from backing up and flooding local areas.

CHAPTER 7: EMERGENCY SERVICES



7.1 Introduction

Emergency services involve measures to protect people before, 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.

7.2 Threat Recognition

A flood threat recognition system provides early warning to emergency managers. NWS is considered the official source for weather information.

The following are the possible notifications in the NWS flood alerting programs:

- Flash Flood Warning: A Flash Flood Warning is issued when a flash flood is imminent or occurring.
- Flash Flood Watch: A Flash Flood Watch is issued when conditions are favorable for flash flooding. It does not mean that flash flooding will occur, but it is possible.

- Flood Warning: A Flood Warning is issued when the hazardous weather event is imminent or already happening.
- Flood Watch: A Flood Watch is issued when conditions are favorable for flooding. It does not mean flooding will occur, but it is possible.
- Flood Advisory: A Flood Advisory is issued when flooding is not expected to be bad enough to issue a warning. However, it may cause significant inconvenience, and if caution is not exercised, it could lead to situations that may threaten life and/or property.

Howard County's weather is forecasted, and weather alerts are relayed to the County, by the NWS Office located in Sterling, Virginia. This location provides 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: WBAL-AM 1090, WMAL-AM 630, WTOP-FM 107.7, WIYY-FM 97.9 and pushed out on the County's social media feeds. Howard County also has direct access to NWS personnel before and during weather events.

The County's flood warning system is comprised of 15 gauges sites. At those 15 sites there are 10 stage gauges and eight precipitation gauges monitoring various streams and basins within the County. During events these gauges are monitored by SWMD staff and OEM's On-Call Emergency Manager is alerted when concerns arise. Additionally, there are specific trigger alarms that send out messages to on call SWMD personnel. Those messages identify the alarm description. Notification is not made directly between the gauges and the 9-1-1 communications center, the on-call person monitoring those gauges will contact the 9-1-1 communications center and OEM as needed during an event.

7.3 Warning

Once 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. Alert and warning systems in the County comprise of the following:

- Emergency Management Network (EMnet) that is administered statewide by MEMA and provides a means for the County to deliver emergency public information and advisories directly to the news media;
- Emergency Alert System (EAS) which is a network of public broadcast stations and interconnecting facilities to operate in a controlled manner during a national emergency and for warnings that need immediate action such as tornadoes and flashfloods;
- National Warning System (NAWAS) used for warning of national emergencies. This is a civil defense system used to disseminate warnings from the National Warning Center to each state by landline;

The County maintains a local flood warning system comprising several rain and stream level gauges located throughout the County. These gauges are monitored during storms to determine when significant flooding can be expected. More information on Howard County river gauges is available at: https://waterdata.usgs.gov/md/nwis/current/?type=dailystagedischarge&group=key=county_cd.

7.4 Response

Howard County Code Section 17.109 requires the preparation of “an emergency operations plan in accordance with applicable state and federal laws and regulations.” The Comprehensive Emergency Response and Recovery Plan (CERRP) updates and replaces the 2015 Emergency Operations Plan (EOP) and incorporates lessons learned from the 2016 and 2018 Ellicott City Floods. The CERRP encompasses emergency preparedness, response, and recovery tasks, and guides a more seamless transition from response to recovery. The CERRP defines the actions and roles necessary to provide a coordinated response and recovery within Howard County in the event of an emergency or disaster event. The CERRP provides guidance to agencies within Howard County, with a general concept of potential emergency assignments before, during, and after emergency situations. It also provides for the systematic integration of emergency resources when activated, but does not replace subsequent County or local EOPs or procedures.



Photo 7.1: Inside the Emergency Management Mobile Command Vehicle (Photo Courtesy of Howard County OEM)

Typically, emergency response plans should be continuously updated to keep contact names and telephone numbers current and to ensure that supplies and equipment that will be needed are still available. They should also be reviewed and revised after a disaster and incorporate the changing conditions. A well-written CERRP will contain a process that enables emergency management staff to identify the number of properties flooded or that would be flooded, roads that would be under water, and critical facilities that would be affected during a flood event. This information will enable staff to determine the resources that will be needed to respond to the predicted flood event.

Howard County's CERRP is administered by the County's OEM staff. The CERRP identifies actions to be taken by the County government as well as cooperating private organizations. This helps to reduce the County's vulnerability to any disasters that may strike, to establish capabilities for protecting citizens from the effects of disasters, and to provide recovery in the aftermath of any emergency involving extensive damage or debilitating influence on the normal pattern of life within the community. The CERRP and all applicable annexes are reviewed and revised annually. The annexes are based on County Coordinating Functions (CCFs). Activities taken under the CERRP are coordinated using the Incident Command System (ICS) and the National Incident Management System.

The CERRP is divided into five parts:

- 1) Introduction and Planning Overview;
- 2) Response Base Plan;
- 3) Recovery Base Plan;
- 4) CCF Annexes; and,
- 5) Support Annexes.

The CERRP provides an overview of Howard County's unique characteristics and outlines the authority of the County's leadership. Additionally, the Base Plans (Introduction and Planning Overview, Response, and Recovery) 1) describe the processes and procedures for maintaining, distributing, and implementing the

CERRP, and 2) outline the overall strategy for how the County will organize and operate for response and recovery in the event of a planned event, incident, emergency, or disaster. The CCF Annexes provide the structure for coordinating function-specific County response and recovery operations. The Support Annexes supplement the CERRY by detailing specific processes and operating procedures.

While all disasters start locally, it is important that Howard County's plans be aligned with the emergency management plans developed by the region, the State, and by the Federal government. Coordination is obtained at the regional level, state level, and with private entities. Howard County is part of the Baltimore Urban Area Security Initiative (UASI), which is comprised of the cities to Baltimore and Annapolis and the additional counties of Anne Arundel, Baltimore, Carroll, and Harford. The Baltimore UASI was established in 2008 to promote coordinated response and recovery operations across jurisdictional boundaries. In terms of state coordination, in accordance with the Maryland Public Safety Code Title 14 Subtitle 7, Howard County agencies may have mutual aid agreements that authorize Howard County government to ask other governments for assistance in the event of a disaster. Additionally, Howard County participates in the Maryland Emergency Management Assistance Compact (MEMAC), which is an intra-state mutual aid agreement between the 25 local jurisdictions within Maryland.

Table 7.1 Agency responsibilities for flood emergency responses

Action	Responsible Agency
Ordering an evacuation	County Executive (Title 6 of the County Code)
Conducting an evacuation	HCPD
Operating and maintaining the flood warning system	DPW-BES, SWMD
Activating the emergency operations center	DFRS, OEM (Title 17 of the County Code)
Opening and operating evacuation shelters	Department of Community Resources and Services (DCRS)
Sandbagging certain areas	DPW
Closing streets or bridges	DPW, Bureau of Highways (BOH) or HCPD
Shutting off power to threatened areas	Responsibility of the property owners or DFRS (Title 17 of the County Code.) Power company would be responsible for the actual shut-offs.
Identifying landfill and debris staging and storage areas for use during emergencies	DPW-BES, Solid Waste Operations Division
Releasing children from school	Superintendent of HCPSS

Emergency management services at the State level are coordinated by MEMA. At the county level, OEM is the entity responsible for planning and coordinating plans, procedures, and resources in preparation for natural as well as manmade disasters.

The 2019 CERRP identifies the EOC as the location for centralized policy direction and control of emergencies and a location for coordination of the County's emergency response and recovery, including interagency and intergovernmental response activities, information collection and analysis, communication, and resource allocation and tracking. An Alternate EOC (AEOC) is the designated operating facility used in the event that the Primary EOC is inoperable. It provides the same required functions as the main EOC.

The County's hazard response for EOC activation and evacuations can be found under Title 6 County Code. The purpose of an evacuation plan is to provide an orderly and coordinated evacuation in the event of

small scale localized evacuations such as a riverine flood, hazardous materials incident, fixed nuclear facility incident, major fire or transportation accident, or a large-scale evacuation (enemy attack or a hurricane). The County has a separate evacuation plan that describes the process for planning and initializing an evacuation in the County. There is also a Regional Evacuation Coordination Plan for the Baltimore UASI. There may be future need to develop a specific evacuation plan for vulnerable areas.

ACTIVATION LEVEL	CRITERIA	STAFFING
Full Activation	An emergency that will require interagency coordination as well as possible state and federal assistance.	<ul style="list-style-type: none"> All EOC positions filled. CCFs activated and staffed accordingly. State and/or federal representatives may be present.
Partial Activation	An emergency that will require some or limited interagency coordination.	<ul style="list-style-type: none"> OEM personnel. EOC positions filled as required. CCFs activated and staffed as required.
Monitoring	An emergency or event that has the potential for interagency coordination.	<ul style="list-style-type: none"> OEM personnel.
Normal Operations	Normal day-to-day operations for OEM.	<ul style="list-style-type: none"> On-Call Emergency Manager available.

The County's OEM website also provides a link to emergency management information (<https://www.howardcountymd.gov/fire-and-rescue-services/emergency-management>) and links to the OEM, hazards, educational programs, and frequently asked questions pages. A link to brochures and other information to assist families in developing a disaster preparedness plan to be better equipped to handle a disaster is available through the OEM website (<https://www.howardcountymd.gov/emergency-management/readyhoco>).

The 911 Communications Center serves as the County's Public Safety Answering Point (PSAP) and provides communications support to the field with all available communication media. It is staffed 24 hours a day, seven days a week.

7.5 Critical Facilities Protection

Critical facilities are defined as those buildings or infrastructure vital to the functioning of a community, government, and to the flood response effort. If these facilities are adequately prepared, they will be better able to support the community's flood response efforts.

Critical facilities include EOCs, police and fire stations, hospitals, shelters, 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 WWTPs, pump stations, schools, medical clinics and nursing homes.

The Little Patuxent Water Reclamation Plant located at 8900 Greenwood Place, the North Laurel SPS building at 10150 Washington Boulevard, are within the floodplain.

The 2016 State of Maryland HMP identifies 112 facilities in Howard County that are deemed “critical.” The analysis conducted for the State HMP identified 35 facilities that are in FEMA designated Flood Zone X. Loss estimates for critical facilities in Howard County were developed for the State Plan. The estimate for all 112 facilities was \$1,220,125,900 for building and contents combined. The State Plan also identifies 425 state-owned assets within the County.³¹ All 156 facilities fell within the FEMA “X” Zone, which is identified as “Minimal Risk”.

7.6 Post-Disaster Recovery and Mitigation

Post disaster recovery refers to steps taken by a community to prepare people and property after a disaster, and mitigate for potential future disasters. 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 future 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; and,
- Regulating reconstruction to ensure that it meets all code requirements.

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

The PA 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.

Post-disaster damage assessment efforts within the County are carried out by DILP. DILP is responsible for conducting preliminary damage assessment, and is entrusted with ensuring that significant personnel are trained to conduct rapid damage assessments immediately following the emergency. A working group will be responsible for coordinating activities after a flood event, to ensure that applicable mitigation actions are brought to the County Executive and County Council for potential adoption/implementation.

³¹ <http://mema.maryland.gov/community/Documents/2016%20Maryland%20Hazard%20Mitigation%20Plan%20final%202.pdf#page=134>

CHAPTER 8: STRUCTURAL PROJECTS



8.1 Introduction

Structural projects are designed to control floodwaters and include: reservoirs, levees and floodwalls, channel improvements, crossings and roadways, drainage and storm sewer improvements, and drainage system maintenance. 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, and often have regional or watershed-wide implications. Therefore, considerable and thorough analysis is required before a structural project is selected.

8.1.1 Advantages

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

8.1.2 Disadvantages

- They disturb the land and disrupt natural water flows, sometimes 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; and,
- They can promote more intensive land use and development in the floodplain.

8.2 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 very 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. While reservoirs and detention basins are an effective means to control flooding by storing water, they have the following disadvantages:

- Threat of flooding to the protected area if the reservoir's dam fails;
- Facility maintenance expenses;
- Failure to prevent floods if their design capacity is exceeded;
- Sediment deposition may occur and reduce the storage capacity over time;
- Their impact on 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.

The MDE lists a total of 27 dams in its dam inventory for Howard County, which are considered to be Significant or High Hazard structures. Overall, the County ranks as medium-low risk for dam failure. Two dams, the Columbia Gateway Dam and the Centennial Park Dam, are rated as being a high hazard. The Brighton Dam and Rocky Gorge Dam are potential threats to businesses in Laurel, but they are owned and operated by the Washington Suburban Sanitary Commission (WSSC). Howard County is also located below Liberty Reservoir, which is owned by Baltimore City. A failure of Liberty Reservoir would impact portions of Howard County that are along the Patapsco River.

Several dams in the County were originally built for power generation and recreation but are not being maintained and therefore are not performing the functions for which they were intended. The following is the status of these dams:

- Simpkins Dam – Removed in 2011
- Daniels Dam – No Plans for Removal
- Bloede Dam – Removed in 2019
- Union Dam – Removed in 2010

All dams in the State of Maryland are subject to inspections by the State of Maryland's Dam Safety Division and the Corps of Engineers. A potential failure at any of the dams in the County would be reported to OEM and relayed to citizens via local media outlets.

An Emergency Action Plan (EAP) exists for the following 27 dams:

- Centennial Park Dam (high hazard)
- Columbia Gateway Dam on Samuel Morse Drive (high hazard)
- Diversified Lane Dam (high hazard)
- Holly House Meadows Dam (high hazard)
- Lake Elkhorn Dam (high hazard)
- Gateway Village Community Dam (high hazard)
- Gerwig Lane (significant hazard)
- Glenmar Pond #2 (significant hazard)
- Guilford Road Dam (significant hazard)
- Hobbits Glen Dam (significant hazard)
- Jessup Park (significant hazard)
- Laurel Lumber (significant hazard)
- Linden Chapel Dam (significant hazard)
- Lutheran Village at Millers Grant Dam (significant hazard)
- Mary Lee Lane Dam (significant hazard)
- Montgomery Road Pond #1
- North Laurel Park SWM Pond (significant hazard)
- Strawberry Fields Dam (significant hazard)
- Waiting Springs (significant hazard)
- Whiskey Bottom West (significant hazard)
- Wilde Lake Dam (significant hazard)
- Woodmark Community
- Wyndemere Dam on Old Scaggsville Road (significant hazard)

A description of dam hazard definitions is included Figure 8.1 below.

Figure 8.1 – FEMA Dam Classification System
Source: FEMA³²

Hazard Potential	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

Local EAPs exist for County-owned dams and were last revised in May 2021 and are updated annually.

8.3 Levees/Floodwalls

Barriers that are constructed out of earth are termed as levees and those that are constructed of concrete or steel between the watercourse and the property to be protected are called 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. Levees and floodwalls are usually not constructed in the floodway. Designs for both levees and floodwalls are required to 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 are required to compensate for any loss of flood storage that will result from construction. There are no levees or floodwalls within the County.

8.4 Bridge Modifications

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

In Howard County, the BOH, which is a part of the County's DPW, is entrusted with the maintenance and improvement of roadways and bridges. DPW operates 1,034 miles of local roads and 147 bridges. The largest bridges in the County are located where I-70 crosses the Patapsco River and in the eastern part of the County where I-95 spans the Patuxent River and U.S. 29 crosses Rocky Gorge Reservoir, and are the responsibility of the State Highway Administration (SHA).

³² <https://www.fema.gov/media-library-data/20130726-1516-20490-7951/fema-333.pdf>

8.5 Channel Improvements

Channel capacity can be increased by making them wider, deeper, or straighter. Improving channel conveyance causes more water to flow through it at a faster rate. However, channelized 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 regularly to clean out blockages caused by overgrowth or debris. Some communities pass ordinances prohibiting dumping and making riverfront owners responsible for maintaining these areas. A proper maintenance program includes picking up debris as well as riparian restoration, i.e., removing non-native growth. Channel/stream projects can also be performed, which stabilize the stream banks, create habitat, and improve the riparian corridor. These projects are done in a manner that does not increase the potential for flooding adjacent to and/or downstream from the project.

Channel Improvements - The DPW-BOH maintains roadside drainage ditches on an as-needed basis and maintains rip-rap at their storm drain outfalls and road culverts. The BOU may place rip-rap over a water or sewer line to protect the pipes, as needed, where they cross under a stream.

8.6 Dredging

Dredging is a form of channel improvement. However, it is often cost prohibitive because the need to dispose of the dredged material. 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 over time, and the process and expense have to be repeated. In order to protect the natural values of the stream, Federal law requires an Army 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.

Occasionally, some stormwater management ponds in the County are dredged. The County has a dredging project for Centennial Lake being planned, subject to the availability of funding. The Columbia Association utilizes dredging in all three of their lakes. Wilde Lake dredging has been completed and Lake Elkhorn/Forebay Pond dredging was completed in 2019.

8.7 Diversion

A diversion is a new channel that sends floodwaters to a different location, thereby reducing flooding along an existing watercourse. Care must be taken during design not to increase the potential for flooding where the diverted water is being sent. 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.

Howard County's SWMD performs numerous stream stabilization and restoration projects each year. The projects vary in length and complexity, but the primary goal is to address eroding stream channels and improve habitat. A variety of approaches and techniques are available for the County to choose from based on the specific opportunities and constraints of an individual project site. The majority of the work is stabilizing the channel in its current location but sometimes a minor adjustment to the stream location is warranted, e.g. to smooth out a sharp meander bend or to shift a stream away from County infrastructure. The designs are done such that there are no increases to the 100-year floodplain outside of County property and only minor increases are allowed within the County property.

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CHAPTER 9: MITIGATION STRATEGY



9.1 Introduction

The Mitigation Strategy, comprised of goals, objectives, and recommendations, 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 mitigation actions that should be implemented to reduce the community's vulnerability to flooding.

9.2 Goals and Objectives

The goals and objectives form a basis upon which, specific mitigation actions are developed. During the Joint Steering Committee (JSC) meetings and Public Meetings from December 2017 to May 2018, 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. Mitigation goals and objectives have been developed for the County and its population center on this premise. 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 goals and objectives developed by the JSC for this Plan Update have been divided into the same categories as chapters 3 through 8 of the report: prevention; property protection; structural projects; emergency services; natural resource protection; and public information.

9.2.1 Preventative Measures

Goal 1: Regularly review and improve language in existing plans and ordinances that address protecting people, properties, and natural resources from flooding within the County.

- Identify techniques to ensure that development or redevelopment in the County does not increase the vulnerability to flooding.
- Continue to ensure proper enforcement of standards and ordinances to make them more effective.

9.2.2 Property Protection

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

- Develop incentives to encourage high-risk, pre-FIRM residential structures to use retrofitting techniques to avoid repeated flooding.
- Support projects and programs to retrofit, acquire, relocate, or demolish structures that are susceptible to flooding.

9.2.3 Emergency Services

Goal 3: Ensure Critical facilities are less vulnerable to, or impacted by, flooding.

- Identify vulnerable existing critical facilities and encourage pre-disaster retrofit.
- Implement appropriate mitigation techniques to ensure seamless operation of critical facilities located in the 100-year floodplain.

Goal 4: Exercise and strengthen coordination and linkages between local and neighboring jurisdictions pre-disaster, to support response and recovery efforts post-disaster.

- Continuously evaluate and reinforce coordination between County departments responsible for implementing flood response activities.
- Include local, regional, and statewide jurisdictions in trainings, drills, and exercises to strengthen interagency cooperation.

9.2.4 Structural Projects

Goal 5: Ensure that bridges, dams, and other infrastructure within the County maintain structural integrity.

- Ensure regular inspection and maintenance of the County's critical infrastructure within the 100-year floodplain.
- Coordinate with any managing entities for privately-owned stormwater or flood control devices, including dams, berms, and retention ponds, to encourage regular inspections on all structures, and improvements when and where warranted.

9.2.5 Natural Resource Protection

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

- Continue to identify and implement Best Management Practices for stormwater management and erosion and sediment control.
- Ensure all acquired properties are cleared of all structures, returned to their natural state, and remain in public ownership in perpetuity.

9.2.6 Public Education and Awareness

Goal 7: Improve flood awareness and education among county residents and develop notification systems and procedures.

- Research and determine the feasibility of a flood warning system for areas prone to repetitive or flash flooding.
- Continue to emphasize the importance of flood insurance to residents through CRS and other outreach efforts.
- Educate citizens, property owners, and business owners on flood risks and mitigation practices to reduce the vulnerability to flooding on private property within the County.
- Develop and support flood preparedness education and awareness programs that target residents, visitors, businesses, and elected officials.

9.3 Mitigation Actions

Specific mitigation actions have been derived from the goals and objectives developed by the JSC. Additionally, this section includes mitigation actions determined to be “in progress” or “ongoing” from the previous FMP. The new mitigation actions developed have been classified in the same six categories as the goals and objectives. For each action item, the relevant category is identified. The agencies responsible for implementation, applicable funding sources, an approximate cost, and general timeline for the implementation of each mitigation action are also included. A detailed list of funding sources is provided at the end of this chapter. The abbreviations used below in the mitigation actions table refer to the funding resources listed.

It is important to note that each of the responsible agencies listed below have ever-expanding responsibilities with limited staff resources. In order to accomplish many of these actions, strategies will have to be employed to either secure additional help or rearrange short-term priorities.

9.4 Prioritization

The following questions were used by the JSC to determine the level (high, medium, and low) for the social, administrative, and economic considerations for each action. These priorities were translated into points and facilitated the ranking and identification of high priority projects as shown in Table 9.1.

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?

Economic Considerations – Project Cost

- What is the approximate cost of the project?

Table 9.1 Evaluation Criteria for Project Prioritization

Criteria	Points	High	Points	Medium	Points	Low
Life/ Safety Impact	10	Significant impact on public safety for businesses, residents, properties	6	Direct impact on businesses, residents, properties	2	Minimal/negligible impact on businesses, residents, properties
Administrative/ Tech Assistance	5	No additional staff or technical support needed to implement action	3	Some administrative and technical support needed to implement action	1	Significant administrative and technical support needed to implement action
Project Cost	5	Low cost (<\$25,000)	3	Moderate cost (\$25,000-\$100,000)	1	High cost to implement (>\$100,000)

These considerations were then grouped into low, medium, and high categories and assigned points as identified in Table 9.2. Timelines for these projects were also established:

- Short-range projects – implemented within first 2 years;
- Medium-range projects - 3 to 5 years; and
- Long-range projects – over 5 years.

It should be noted that this Plan does not include a prioritization of projects within a category; i.e., there is no ranking of projects listed within the Natural Resources category. **Note:** The mitigation actions table is reviewed and updated annually within the five-year-planning cycle (2019 – 2024).

Table 9.2 - Mitigation Action Prioritization and Implementation

Mitigation			Prioritization					Implementation			
Action ID	Project Description	Hazard(s) Mitigated	Lead Agency	Life/Safety Impact	Admin/Tech Support	Cost Ranking	Total	Funding Source	Est. Cost	Timeline	Action Category
Ongoing/In Progress Actions (From Previous Plan)											
1	Continue to enforce Subdivision and Land Development Regulations, namely Section 16.115 which prohibits clearing, grading, paving and construction activity in the 100-year flood plain, and Section 16.116 which protects streams, wetlands, and steep slopes from future development.	Flooding	DPZ	2	5	5	12	County Funds	Staff Time	Ongoing	Preventative Measures
2	Continue to enforce the incorporation of State and local storm water management regulations and progressive techniques into all development plans.	Flooding	DPZ	6	5	5	16	County Funds	Staff Time	Ongoing	Preventative Measures
3	Continue to administer the Forest Mitigation Program to establish new forests in parkland and along streams and rivers, to protect against erosion and uprooting trees.	Flooding	DRP	2	5	5	12	Forest Conservation Fee in Lieu	Staff Time	Ongoing	Natural Resources
4	Continue to work with property owners to increase vegetation in riparian buffers through the Plant-It-Green program, which consists of supplying free trees to plant adjacent to the streams to reduce velocity of storm water and to stabilize soil.	Flooding	DRP	2	5	3	10	County Funds; Watershed Protection and Restoration Fund; CoastSmart Grant	\$50,000-100,000	Ongoing	Public Education and Outreach
5	Evaluate infrastructure on frequently flooded roadways to determine whether the roads/bridges/culverts need to be upgraded to lessen the frequency of flooding. Prioritize projects and seek funding.	Flooding	DPW - Bureau of Engineering, Transportation and Special Projects Division	6	5	5	16	County Funds	Staff Time for County roads; – County conveying information to SHA for State roads	Ongoing /As needed	Structural Projects
6	When beaver dams are identified and located, continue to monitor the dams. Dismantle dams if they pose a flooding threat.	Flooding	DRP	2	5	5	12	County Funds	Staff Time	Ongoing /As needed	Natural Resources
7	Review and reevaluate the existing codes for County retaining walls.	Flooding	DILP	2	5	5	12	County Funds	Staff Time	Ongoing	Structural Projects
8	Assess all county-owned retaining walls to see if they need to be reinforced and prioritize that work.	Flooding	DPW - Bureau of Engineering, Transportation and Special Projects Division, DPW-SWMD	2	5	5	12	County Funds	Staff Time	Ongoing	Structural Projects

Mitigation				Prioritization			Implementation				
Action ID	Project Description	Hazard(s) Mitigated	Lead Agency	Life/Safety Impact	Admin/Tech Support	Cost Ranking	Total	Funding Source	Est. Cost	Timeline	Action Category
9	Evaluate the new FEMA floodplain, including non-structure hazards within 100 feet of the flood zone on an as needed basis.	Flooding	DPW SWMD, Department of Technology and Comm. Services	2	5	5	12	County Funds	Staff Time	Ongoing	Preventative Measures
10	Inventory existing culverts that are maintained by the Department of Public Works, Bureau of Highways and create an addressable GIS layer.	Flooding	DPW, Bureaus of Highways; Engineering, Department of Technology and Comm. Services, GIS Unit	2	5	5	12	County Funds	Staff Time	Ongoing	Structural Projects
11	Continue to work on a number of issues related to floodplain identification and mapping risk; responsible floodplain management; and flood insurance. Continue to ensure compliance with the National Flood Insurance Program.	Flooding	DPZ, DPW, DILP	2	5	5	12	County Funds	Staff Time	Ongoing	Preventative Measures
12	Identify and pursue incentives to mitigate private and public properties from flood hazards through the following techniques: elevation, acquisition/demolition and dry/wet floodproofing	Flooding	OEM; SWMD; DPZ	6	5	5	16	County Funds; Grant and non-grant options	Staff Time	Ongoing	Property Protection
New Actions											
13	Ensure reconstruction activities are compliant with NFIP substantial damage/improvement requirements and existing codes.	Flooding	DILP	2	5	5	12	County Funds	Staff Time	Ongoing	Preventative Measures
14	Conduct sampling and analysis of public drinking water supply sources, in flooded areas, immediately after a major (100yr) flood event and issue boil water advisories as needed. Health Department is limited to well water testing in areas exposed to flooding.	Flooding	DPW - Utilities; Health Dept	10	5	5	20	County Funds	Staff Time; Water sampling costs, Laboratory Costs	As needed	Public Education and Outreach
15	Notify the public when the County conducts sampling and analysis of public drinking water supply sources to raise awareness for private property owners who may wish to analyze their drinking water. Health Department is limited to well water testing in areas exposed to flooding.	Flooding	DPW - Utilities, Health Dept; PIO	10	5	5	20	County Funds	Staff Time; Water sampling costs	As Needed	Public Education and Outreach

Mitigation				Prioritization				Implementation			
Action ID	Project Description	Hazard(s) Mitigated	Lead Agency	Life/Safety Impact	Admin/Tech Support	Cost Ranking	Total	Funding Source	Est. Cost	Timeline	Action Category
16	Assess County-owned flood/channel walls after a major flood inundation event to determine if the structural integrity of any wall may be compromised and recommend repairs as needed to reduce the chances of wall failure.	Flooding	DPW - Transportation and Special Projects	6	5	5	16	County Funds	Staff Time	As Needed	Structural Projects
17	Assess, implement, and maintain stream restoration and bank stabilization techniques on County-controlled property to reduce bank erosion, as needed.	Flooding	DPW SWMD	2	5	5	12	County Funds	Staff Time	Ongoing	Natural Resources
18	Assess the use of environmental site design projects to increase stormwater capacity and public education.	Flooding	DPW/OEM; DPZ; DRP; Office of Community Sustainability	2	5	5	12	CoastSmart Grant; Watershed Protection and Restoration Fund; County Funds	Staff Time	Ongoing	Public Education and Outreach
19	Establish a debris monitoring plan to monitor and remove significant debris blockages to minimize debris accumulation within the County-owned stream channels. A part of Safe and Sound Program.	Flooding, Tornado/Wind Storm, Winter Storm/Nor'easter	DPW	2	5	5	12	County Funds	Staff Time	Ongoing	Preventative Measures
20	Integrate relevant flood mitigation considerations from other studies into the overall county flood mitigation strategy as applicable.	Flooding	DPW, OEM	2	5	5	12	County Funds	Staff Time	Ongoing	Preventative Measures
21	Identify all designated historic properties that are located in the County's 100-year floodplains.	Flooding	OEM, DPZ - Hist Pres.; DPW	2	3	3	8	MHT; FEMA HMA; County Funds	Staff Time	1-2 years	Preventative Measures
22	Collect structural elevation-related data for historic buildings/structures in the floodplain, including but not limited to, elevation of the first floor, lowest opening, and lowest adjacent grade, and incorporate that data into the appropriate existing County GIS layer(s).	Flooding	DPZ - Hist Pres.	2	3	3	8	County Funds	Staff Time	Ongoing	Preventative Measures

Mitigation				Prioritization			Implementation				
Action ID	Project Description	Hazard(s) Mitigated	Lead Agency	Life/Safety Impact	Admin/Tech Support	Cost Ranking	Total	Funding Source	Est. Cost	Timeline	Action Category
23	Assess the vulnerability historic and cultural resources located in the 100-year floodplain, and determine appropriate mitigation techniques that account for historic integrity, significance, and designation.	Flooding	OEM; DPZ - Hist Pres.	2	3	3	8	County Funds	Staff Time	Ongoing	Preventative Measures

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9.5 Past Actions

Action items from the original 2012 FMP that have been completed, deemed infeasible, or merged/combined with another action item have been removed from the above table. Those actions are itemized, described, and justified in the Table below.

Table 9.3 – Action Status Definitions

Status	Definition
In Progress	Work has been initiated on these actions. These projects have a definite end-date.
On-Going	Actions that are performed on a regular and continuous basis by the County.
Completed	The department has completed the action since the development of the 2012 plan.
Not Applicable	Actions that were deemed by the JSC to not apply to the HMP.
Cancelled	SWM or OEM has decided to terminate the project.
Infeasible	After further study this project was deemed to be infeasible based on benefit/cost analysis, engineering study, or other criterion.

Table 9.4 - Status Updates from 2012 Plan Actions

Action Item	Status	Lead Agency	Notes
Action 1a: Incorporate the results of any new flood studies into the new Digital Flood Insurance Rate Maps (DFIRMs).	Completed	DPW-Bureau of Environmental Services: SWMD	Updated DFIRMS have been adopted.
Action 1b: Reconcile the new DFIRM data with the flood data in this Flood Mitigation Plan.	Completed		This action item was completed as part of the DFIRM adoption process
Action 1c: Prepare new hydrology and hydraulic studies for the Patuxent and Patapsco areas.	On Hold		New studies for the main stem Patuxent and Patapsco Rivers were not included in the DFIRM update performed by FEMA and will be considered at a future date.

Action Item	Status	Lead Agency	Notes
Action 2a: Consider integration of the comprehensive plan with flood and other all-hazard mitigation plans. During the next update of the comprehensive plan, encourage emergency planners and comprehensive planning staff from DPZ to work together to cross reference goals and objectives and actions between the Comprehensive Plan and the Flood Mitigation Plan to ensure that flood issues are addressed in the Comprehensive Plan.	Completed	DPZ, DPW-Bureau of Environmental Services SWMD	The recently adopted comprehensive plan, PlanHoward2030 (Plan), was developed with input from the community and other county agencies. The Plan includes policies and implementing actions that support the goals and objectives of other agency plans. The Department of Planning and Zoning continues to work directly with the Office of Emergency Management on emergency planning and response issues, including the mitigation of hazards.
Action 3a: Continue to encourage various land planning techniques (cluster development and transfer of development rights) to provide flexibility in design and conserve common open space.	Completed	DPZ	The recently adopted comprehensive plan, PlanHoward2030 (Plan) includes a policy to secure better protection of environmental resources within new developments. This policy includes associated implementing actions to: evaluate the effectiveness of current regulations to protect streams, wetlands and floodplains; encourage more environmentally sensitive design in residential zoning districts other than the Residential-Environmental Development District; promote the use of the neighborhood preservation parcel option, as well as the use of smaller, tightly clustered lots to limit site disturbance and maximize open space for natural resource protection; and institute development requirements and/or incentives for better resource protection in higher density residential developments and commercial, office and manufacturing areas. Additionally, the Plan calls for the County to develop a wetlands program to inventory, map, protect, and enhance wetland resources.
Action 4a: Work with DPZ to examine 'inbuilding' within any area upstream that would contribute to additional flooding in a floodprone neighborhood and clear cutting of trees on these properties in areas such as Columbia Hills at the Intersection of Routes 29 and 108 and the intersection of Sybert and Meadowbrook.	Completed	DPZ; DRP	The recently adopted comprehensive plan (Plan) established growth tiers in accordance with the Sustainable Growth and Agricultural Preservation Act of 2012. Areas designated as Tier IV in the Rural West will no longer be allowed to subdivide more than four lots. Policies and regulations affecting infill development within the Priority Funding Area (PFA) in the east will be examined to ensure new development is compatible with the existing community. Additionally, the Stormwater Management Act of 2007, which took effect in 2010, includes strict stormwater management requirements for new development and redevelopment projects.

Action Item	Status	Lead Agency	Notes
Action 5a: Consider developing an Impervious Surface Ordinance for the County that encourages the reduction of newly installed impervious surfaces or offsets the impacts of these surfaces in the County.	On Hold	DPZ	The new stormwater management regulations, which became effective in 2010, require environmental site design to the maximum extent practicable, which encourages minimizing site disturbance and the creation of impervious surfaces. The new regulations require offsetting the stormwater quality and quantity impacts from new development and redevelopment through techniques such as bioretention facilities, vegetated swales, and rain gardens. In 2013, the County created a new Watershed Protection and Restoration Fund, which will be used in part to install new stormwater management practices to treat runoff from impervious surfaces that do not currently have management. The County will give these new measures time to be effective before evaluating the need for an impervious surface ordinance.
Action 7a: Identify the “at-risk” properties that are prone to damage during flooding and conduct a survey of these properties. Collect the following data for each “at-risk” property using the National Flood Mitigation Data Collection Tool, FEMA 497 (also referred to as the National Tool or NT): structure type and condition, foundation type, number of stories, building size, depth of flooding, occurrence of flash flooding, flood velocity, location of the structure in the floodway, and method of notification during a flood event.	Completed	DPW-Bureau of Environmental Services: SWMD	The County has identified structures in the 100-year floodplain through the County GIS system. Property owners are notified during large storm events, as applicable
Action 7b: Develop a database of properties that have been relocated, acquired, elevated, or flood-proofed. Ensure that the database has up-to-date information on address, ownership, mitigation technique, date, and status.	Completed		A file is being maintained in the Stormwater Management Division that contains information on the mitigated and non-mitigated repetitive loss properties that includes information on the owner addresses, ownership, date, and status of the property.
Action 8a: Develop appropriate mitigation solutions for High Road Academy School	Cancelled	DPW-Bureau of Environmental Services SWMD; OEM	The Storm Water Management Division and the Office of Emergency Management have determined that High Road Academy School is not a critical facility.
Action 8b: Consider relocating the fire station in Woodbine to higher ground.	On Hold		The Lisbon volunteer fire station is located within the floodplain. The current building was built in the year 1950. Plans were started to obtain the 3 to 4 million dollars to relocate the station and 8 acres

Action Item	Status	Lead Agency	Notes
			<p>were purchased near route 144 and MD 94. MEMA was willing to provide \$300,000 - \$400,000 toward the new fire station, but the process was halted since the funding was insufficient to construct the new fire station.</p> <p>The fire department is opening a different site within a few months as of August 2021; however the new building will be located outside the floodplain on the new site.</p>
Action 9a: Consider structural hardening of the facilities - senior centers – Bain, Ellicott City, and Glenwood and the Department of Corrections Work Release Unit so they can serve as shelters during flood and wind events.	Cancelled	OEM	The Office of Emergency Management has evaluated this action item and determined that hardening of these facilities is not needed as part of the County's overall sheltering needs. The County does not experience tidal water issues or wind issues and only uses these structures when a threat exists. If the facility is standing, then it is used as a shelter. If one of these facilities is not standing, then the facility is not used for shelter purposes. The Corrections facility is already a hardened facility.
Action 11a: Create a rating system for areas that flood quickly, to rate the degree of flashflood threat and enhance the current warning system based on the flashflood threat.	Completed	DPW-Bureau of Environmental Services SWMD; OEM	Any low-lying area is subject to flash flooding based on the specific rain event and antecedent conditions. It is not practical to assign a degree of flash flood threat. The County has posted signs on roads that frequently flood so as to inform residents of the flooding risk in the area in the case of flash flooding. This action item has been attained and requires no further action.
Action 11b: Develop signage on roads that frequently flood to warn residents and commuters of the potential flood hazard.	Completed		The County has posted signage on frequently flooded roads. The sign reads "Flood Area" and the sign can be flipped during a flooding event to read "Road Closed". This action item was completed in late fall 2014.
Action 12a: Conduct an engineering study to identify mitigation alternatives such as elevation, barrier wall, elevating equipment, etc., for the wastewater treatment plant and pumping stations	Completed	DPW- Bureau of Environmental Services: Utility Design Division	In 2012, two projects were finished. One was called the 7th edition which was a project to enhance the nutrient removal of the treatment plant. All new structures related to that project were elevated above the flood plain. Solar panels were also installed and the columns that support the solar panels were elevated above the flood plain. In 2015, emergency generators were installed and completed and the supporting structure was elevated above the flood plain. In 2015, the Bureau of Utilities started a biosolids project and the biosolids drying building and other structures will be elevated out of the floodplain. The

Action Item	Status	Lead Agency	Notes
			Bureau of Utilities is aware of the plant's location within the floodplain and works with contractors to elevate structures whenever possible.
<p>The area on Route 1 at the junction between Howard and Prince George's County on the Main Patuxent River floods periodically.</p> <p>Action 16a: Coordinate with the Public Works Department in Prince George's County to develop a mitigation solution.</p>		DPW-Bureau of Engineering, SHA	<p>This goal has been corrected to say "Main Patuxent River" instead of the "Middle Patuxent River" as was previously written. Howard County met with State Highway Administration (SHA) officials on September 24, 2013. SHA is not aware of any plans to fix the bridges and does not think that the bridges and the adjacent approaching roads would be raised up out of the floodplain, due to expense.</p> <p>The City of Laurel has recently installed three stream stage gages between Rocky Gorge Reservoir and the City of Laurel. Howard County can access this stage data real-time through its existing County-wide flood warning system. The City of Laurel emergency management staff has access to the County's rain and stage gage data as well.</p>
Action 17b: Develop incentives to promote green infrastructure concepts for stormwater retention on private properties and promote the use of landscaping, rain gardens, rain barrels, etc. to retain water longer on properties.	Completed		The County has a residential rain barrel program that offers free, predrilled rain barrels to resident who are interested in reducing runoff. Rain garden and conservation landscaping workshops are also offered free to residents through the County's Master Gardeners program
Action 22b: Include flood-related articles and success stories in the County newsletter.	Ongoing	PIO, DPW-Bureau of Environmental Services: SWMD, OEM, Public Libraries	Combined with another mitigation action.
Action 23b: See http://www.fema.gov/plan/prevent/floodplain/publications.shtml for a detailed listing of flood-related publications and include this link on the County's webpage.	Completed		The County has links to FEMA's FloodSmart and www.fema.gov websites.

Action Item	Status	Lead Agency	Notes
Action 23c: Once they are completed, make DFIRMS available on the County's website that allows users to determine their flood zone and other property information as well as aerial photographs.	Completed		The DFIRMS have been completed and a link to the DFIRMS is on the County website. In addition, the County has posted a webpage with an interactive map "Do I Flood" where property owners can look up their address to see if their property is in the FEMA floodplain.
Action 25a: Continue to implement mitigation actions from the Flood Mitigation Plan and strive to move up to a Class 6 community where residents can obtain a 20 percent reduction in flood insurance premiums.	Completed	DPW-Bureau of Environmental Services: SWMD	In 2013, the County acquired enough points under the CRS program to earn a Class 7 rating. In 2017 the County re-applied to the CRS program and has achieved an upgrade to Class 6.
Action 26a: When DFIRMs become available, provide training of the use of DFIRMs to stakeholder groups including planners, engineers, realtors, and community leaders.	Completed	DPW-Bureau of Environmental Services: SWM	The DFIRMS were approved and information on how to use them was posted on the Howard County website that enables residents to research their property to determine if they are in the floodplain. Howard County storm water engineers are cognizant of how to use the DFIRM maps and look for opportunities to explain, train and communicate the meaning and purpose of the DFIRMS and their impact on properties through the County's Map Information Service. The Map Information Service is advertised throughout the County via the annual tax bill.
Action 27d: Integrate this Plan into the All-Hazard Mitigation Plan as an annex.	Completed		The 2004 All Hazards Mitigation Plan (HMP) has been finalized and approved and references the Flood Mitigation Plan. This action item has been achieved.

9.6 Funding Sources

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

- **Building Resilient Infrastructure and Communities (BRIC)** - BRIC is administered by FEMA and provides grants to states, tribes, and local governments. The BRIC Program provides funds for hazard mitigation projects that reduce risks faced from disasters and natural hazards. BRIC is a new hazard mitigation program that replaces the Pre-Disaster Mitigation (PDM) program. The guiding principles are:
 - Supporting communities through capability-capacity building
 - Encouraging and enabling innovation
 - Promoting partnerships
 - Enabling large projects
 - Maintaining flexibility
 - Provide consistency
 - **Note:** The BRIC grant was implemented in Federal Fiscal Year 2020 and replaces the Pre-Disaster Mitigation (PDM) Grant Program
- **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.
- **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.
- **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. Every State is eligible for a percentage of the available funds and is intended to sustain the core capabilities of the five (Prevention, Protection, Mitigation, Response, and Recovery) mission areas.

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: PLAN MAINTENANCE



10.1 Introduction

Upon completion, the NHMP, and by extension, this FMP, will be formally adopted by the County Council in January 2019. Once the HMP is adopted by the County Council, it will be sent for review and approval by both MEMA and FEMA in January 2019. This 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.

10.2 High Priority Actions

Following the finalization of the mitigation actions by the JSC, the mitigation actions were prioritized based on specific evaluation criteria which took into consideration such factors as: impact on life and community safety, staffing and technical assistance requirements, and potential cost of implementation. These actions were then sorted into three categories based on score: high (16-20), medium (10-14), and low priority (4-8), based on their total scores. Table 10.1 identifies the highest ranked actions and their corresponding scores.

Table 10.1 - Highest Ranked Actions and Corresponding Scores

Action ID	Project Description	Score
14	Conduct sampling and analysis of public drinking water supply sources, in flooded areas, immediately after a major (100yr) flood event and issue boil water advisories as needed.	20
15	Notify the public when the County conducts sampling and analysis of public drinking water supply sources to raise awareness for private property owners who may wish to analyze their drinking water.	20
2	Continue to enforce the incorporation of State and local storm water management regulations and progressive techniques into all development plans.	16
5	Evaluate infrastructure on frequently flooded roadways to determine whether the roads/bridges/culverts need to be upgraded to lessen the frequency of flooding. Prioritize projects and seek funding.	16
12	Identify and pursue incentives to mitigate private and public properties from flood hazards through the following techniques: elevation, acquisition/demolition and dry/wet floodproofing	16
16	Assess County-owned flood/channel walls after a major flood inundation event to determine if the structural integrity of any wall may be compromised and recommend repairs as needed to reduce the chances of wall failure.	16

10.3 Monitoring, Evaluating, and Updating the Plan

In order to ensure that the Plan continues to provide a framework of reducing risk in the County, the SWMD and the OEM will review the Plan on two occasions, Annual Reviews and Ad Hoc or after disaster events. The review will be completed in tandem with the JSC and will consist of those members who were involved in the preparation of the Plan Update, as well as any select departmental and/or community representatives. The review process will be communicated to the public and any updates or amendments will be released to the public for a comment period.

10.3.1 Annual Review

In order to ensure that the Plan continues to provide a framework for reducing the flood risk to the County, DPW-SWMD will take responsibility to convene an annual meeting of the JSC. At this meeting, the Committee will review the status of each mitigation action based on reporting forms. The Committee will assist the DPW SWMD in preparing an annual status report of the mitigation actions.

An annual report form is included at the end of this Chapter for each high priority County project, and for each department to provide an update to the County on the status of their mitigation projects. This form will be distributed to all lead agencies/departments, requesting them to document the status of each of their respective hazard mitigation actions. Each action proposed in the FMP will be categorized as one of the following: completed, in progress, not started, modified, or cancelled.

The JSC may also assist the County Mitigation Project Manager to prepare an annual status report of the mitigation actions based on the annual report forms from the agencies/departments as well as the County. An annual status report form is included at the end of this Chapter.

10.3.2 Ad Hoc Review

In addition to conducting an annual review of the Plan, the JSC will review the Plan within 30 days after a disaster. Each goal and objective will be examined for its relevance and validity to the changing situation in affected communities, and the mitigation actions will be reviewed to ensure that they address any recent issues that may have stemmed from disaster events. During quiet times, the Plan will be updated every five years to reflect the current risk, vulnerabilities, development trends, and as mitigation actions are implemented. While an annual report will be completed each year, any State and Federal mandates from MEMA and FEMA respectively, will be addressed in the five-year update.

10.4 Plan Adoption

Adoption by the Local Governing Body

Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., County Commission).



County Council Of Howard County, Maryland

2019 Legislative Session

Legislative Day No. 1Resolution No. 6-2019

Introduced by: The Chairperson at the request of the County Executive

A RESOLUTION adopting the Howard County Natural Hazards Mitigation Plan.

Introduced and read first time January 7, 2019.By order: 
Jessica Feldmark, AdministratorRead for a second time at a public hearing on January 22, 2019.By order: 
Jessica Feldmark, AdministratorThis Resolution was read the third time and was Adopted ☒, Adopted with amendments ☐, Failed ☐, Withdrawn ☐, by the County Council
on January 22, 2019.Certified By: 
Jessica Feldmark, AdministratorNOTE: [[text in brackets]] indicates deletions from existing law; TEXT IN SMALL CAPITALS indicates additions to existing law; Strike-out indicates material deleted by amendment; Underlining indicates material added by amendment

1 **WHEREAS**, the County Council of Howard County, Maryland, recognizes that natural
2 hazards are common occurrences throughout the region and cause significant property damage and
3 loss of life; and
4

5 **WHEREAS**, by passage of County Council Resolution No. 112-2004, the County took
6 proactive measures to reduce the impact of these hazards by adopting the first Natural Hazards
7 Mitigation Plan (NHMP); and
8

9 **WHEREAS**, by passage of County Council Resolution No. 22-2013, the County adopted
10 the second Natural Hazards Mitigation Plan (NHMP); and
11

12 **WHEREAS**, the County remains committed to the mitigation of natural hazards through
13 the concerted efforts of Howard County departments, government partners, and community
14 members; and
15

16 **WHEREAS**, OEM and the Natural Hazard Mitigation Update Steering Committee have
17 updated the NHMP consistent with a federally mandated planning process; and
18

19 **WHEREAS**, the NHMP articulates a comprehensive strategy for implementing
20 technically feasible mitigation activities for the area affected by natural hazards; and
21

22 **WHEREAS**, adoption of the NHMP will make the County eligible for future Federal and
23 State grants to implement the NHMP's recommendations, if and when funds become available;
24 and
25

26 **WHEREAS**, the County Executive recommends that the NHMP be adopted by the
27 County Council.
28

29 **NOW, THEREFORE, BE IT RESOLVED** by the County Council of Howard County,
30 Maryland this ____ day of _____ 2019 that the effort to become more disaster
31 resistant is deemed worthy of support, and that the Howard County Natural Hazards Mitigation

- 1 Plan prepared by the Howard County Office of Emergency Management, attached and
- 2 incorporated by reference, is adopted.

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Hazard Mitigation Plan Sample Annual Report Form

Progress Report Period _____ to _____

Next Plan Update _____

Project Title _____

Project ID # _____

Project Type: (select one)

County Project _____ Municipal Project _____

Responsible County Agency(ies) or Municipality _____

Address: _____

Contact: _____

Title: _____

Phone: _____

Email: _____

Project Description:

Project Status (select one)

Completed ____ In Progress ____ Not started/delayed ____ Modified ____ Cancelled ____

How many people were protected by this action? _____

Were there any structures mitigated? If so, how many? _____

Explain:

Obstacles/challenges/delays incurred:

Method to resolve obstacle/challenge/delay:

Next steps to be accomplished over the next reporting period:

Other comments:

APPENDIX A: MEETINGS



Howard County 2017 Hazard Mitigation & Flood Mitigation Plan Update

Steering Committee Meeting #1

Agenda

Date: December 7, 2017

Time: 2:00-4:00pm

Introductions

- Howard County Bureau of Environmental Services
- Howard County Office of Emergency Management
- Consultants – VPC

Project Overview Presentation

- A.1. Purpose and background
- A.2. Key players
- A.3. Planning process
- A.4. Hazards and definitions
- A.5. Risk Assessment and GIS Data
- A.6. Plan integration
- A.7. Existing County Plans and Reports
- A.8. Mitigation Actions
- A.9. Implementation Plan
- A.10. Project schedule
- 1.0 Meetings – Steering Committee/Stakeholders and Public
 - Progress to date

Goals and Objectives Exercise

- (1) Review 2010 Flood Mitigation Plan Goals and Objectives
- (2) Review 2012 Hazard Mitigation Plan Goals and Objectives
- (3) Discuss additional Goals and Objectives

Open Discussion

- (4) Hot Topics



SIGN-IN SHEET
Howard County Hazard Mitigation & Flood Mitigation Plan Update

1st Steering Committee Meeting
December 7th, 2017 2:00-4:00pm

Name	Phone	Email	Agency
Amanda Faul		aful@howardcountymd.gov	OEM
Mike Hinson	x5911	mhinson@ho	OEM
Rocco Sovero	x3680	Rsovero@howard...	Police
Stephen Hardesty	6509	shardesty@howard...	DFRS
Brian Cleary	6455	bcleary@howard...	DPW- BES- SWM
Bill Seiger	410-537-3921	William Seiger @maryland.gov	Citizen / MRF
Andrew Estrain	301-537-7947	aestrain@vision-rc.net	VPC
Chris Meyer		Cmeyer@howardcountymd.gov	OEM
Dave Keane	x1676	dkeane@howardcountymd.gov	/R+P/NR
Mark Richmond	x6413	mrichmond@howardcountymd.gov	/DPLO-BES-SW
Ally Samonishy	410 463 4277	asamonishy@vision-rc.net	VPC

**2018 Howard County Hazard Mitigation/Flood Mitigation Plan Update
Steering Committee Meeting #1
December 7, 2017 – 2:00pm-4:00pm
Ligon Building, 3450 Courthouse Drive, Ellicott City, MD**

Meeting Summary by Andrew Estrain, Vision Planning and Consulting



Attendees were given a brief introduction to the Consulting firm Howard County has contracted for the Flood and Hazard Mitigation Plan Update process, Vision Planning and Consulting (VPC). VPC representatives working on the project, Ashley and Andrew, introduced themselves and introductions for the members of the steering committee in attendance were given. VPC presented and discussed the project purpose and background, key players, steps in the planning process, county hazards, a risk assessment preview, plan integration efforts, future mitigation action development, project schedule, future meetings, and existing County HMP and FMP goals and objectives,

VPC worked with Committee members to examine and refine each of the goals and objectives laid out in the previous plans for both the Flood Mitigation Plan and the Natural Hazard Mitigation Plan. Each goal and objective was evaluated for clarity, cohesiveness, and relevance. Terminology was discussed, and suggestions made to help the plan, goals, and objectives become more actionable and be more comprehensible to the responsible implementing agencies and to the general public. These goals and objectives will be sent to the steering committee members to give those who could not attend a chance for additional review and comment.

The format of the two public meetings is still undetermined, but is important. OEM's desire is that those in attendance at the public meetings should be from throughout the entire County, as this is a countywide planning process. VPC will work with OEM and DPW/Stormwater Management to identify the best format and location for the public meetings.

Next steps include drafting the updated goals and objectives based on today's meeting, and an update upon receiving comments from the steering committee; performing GIS analysis and the risk assessment; beginning to develop mitigation actions; finalizing plan integration; the second steering committee meeting; and determining the format and location of the first public meeting.



Howard County Hazard Mitigation/ Flood Mitigation Plan Update

Steering Committee Meeting #2 Draft Agenda

Date: February 2018 TBD
Time: TBD

Review Hazard Identification and Risk Assessment

- (1) Hazus analysis
- (2) Flood
- (3) Other hazards
- (4) HIRA summary
- (5) Hazard prioritization

Goals/ Actions Review

- 1.0 Discussion and finalization of 2018 Goals and Objectives
- 2.0 Examine 2012 HMP and FMP mitigation actions and review current status (in progress, completed, ongoing, etc.)

Open Discussion

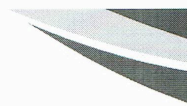
- Solicit input on risks from flood and other hazards

Questions

Next Steps

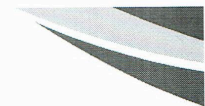
- Public Meeting (TBD)
- Past mitigation action finalization
- Develop new mitigation actions

Adjournment



Howard County Hazard Mitigation & Flood Mitigation Plan Update

[illegible]



Howard County Hazard Mitigation & Flood Mitigation Plan Update

[illegible]

**2018 Howard County Hazard Mitigation/Flood Mitigation Plan Update
Steering Committee Meeting #2
February 6, 2018 – 2:00pm-4:00pm
Ligon Building, 3450 Courthouse Drive, Ellicott City, MD**

Meeting Summary by Andrew Estrain, Vision Planning and Consulting



The Steering Committee was presented with the initial findings of the Vulnerability and Risk Assessment by Zach Baccala, a member of the VPC Team. This presentation provided information on HAZUS and information on the various hazards Howard County could potentially face. Mr. Baccala discussed the process for generating the 1% and .02% chance flood area, and maps to illustrate the county's flood hazard areas.

Using HAZUS 4.2, the total number of exposed structures and damaged buildings was estimated for a 100-year and 500-year flood, for the county, and for three specific communities. Dollar amounts were also assigned for the potential losses associated with a serious flooding event, where total losses were estimated around \$67 million for a 100-year event, and over \$120 million for a 500-year event. Similar maps and exposure estimates were also generated for earthquakes and hurricanes.

VPC discussed the integration of the Howard County 2017 HIRA, which was used to determine the hazard risk ranking for county, determined based on likelihood, impact, warning time, and duration of a hazard event. Flooding is the highest ranked hazard in the county.

A final review of goals and objectives was then held to gather input or recommendations on the content and verbiage. Additionally, mitigation actions from the previous plans were reviewed to determine current status (in progress, completed, deferred), relevance, and feasibility.

Next steps include finalizing the updated goals and objectives, developing new mitigation actions for review at the next Steering Committee meeting, and hosting the first public meeting, as well as the third Steering Committee meeting.



Howard County Hazard Mitigation/ Flood Mitigation Plan Update

Steering Committee Meeting #3 Draft Agenda

Date: March 21, 2018
Time: 1:00-3:00pm

2018 Actions Review

1.0 Examine New Mitigation Actions that Address Goals and Objectives

Discuss Preliminary Questionnaire Results

Develop Additional Mitigation Actions

Open Discussion

Questions

Next meeting

- Mitigation Action Finalization
- Prioritize Mitigation Actions
- Implementation Strategy

Next Steps

Adjournment



SIGN-IN SHEET

Howard County Hazard Mitigation & Flood Mitigation Plan Update

3rd Steering Committee Meeting
April 3rd, 2018 2:00-4:00pm

Name	Phone	Email	Agency
Mike Hinson	5911	mhinson@hcc...	OEM
Peter Conrad	4352	pconrad@...	DPZ
Stephen Hardesty	6000	shardesty@howardcountymd.gov	DFRS
David Keane	1676	dkeane@howardcountymd.gov	DRP
BRIAN F. CLEARY	6455	bcleary@howardcountymd.gov	DPW
Mark S. Richmond	6413	msrichmond@howardcountymd.gov	DPW
Dana Smarsh		dsmarsh@vision-pc.net	VPC
Don Mock	3948	dmock@howardcountymd.gov	DILP
Rocco Sovero	3680	rsovero@howardcountymd.gov	HCPD
Chris Meyer	x5913	cmeyer@howardcountymd.gov	OEM
Ashley Samonishky		asamonishky@vision-pc.net	VPC

**2018 Howard County Hazard Mitigation/Flood Mitigation Plan Update
Steering Committee Meeting #3
April 3, 2018 – 2:00pm-4:00pm
Ligon Building, 3450 Courthouse Drive, Ellicott City, MD**

Meeting Summary by Andrew Estrain, Vision Planning and Consulting



Attendees were first provided with the project's progress to date. The Steering Committee was presented with the results of the public poll/questionnaire developed and disseminated by VPC. This poll included questions that were designed to gather information and viewpoints of county residents regarding their property's vulnerability to natural hazards. It is specifically intended to identify common damages and potential mitigations that may have been overlooked.

Examples of poll questions include:

- 1.0 How at risk is your property to flooding/winter storms/hurricanes/wind events?
- 2.0 Has your property experienced flooding/winter storms/hurricanes/wind events more than three times in the past five years?
- 3.0 What type of property damage do you typically find after a hazard event?
- 4.0 Have you taken any actions to avoid future damages and loss from natural hazards?

VPC then had a brainstorming session with the Steering Committee to determine additional new mitigation actions based on results of the public poll. Several new mitigation actions were developed, and appropriate content and verbiage finalized. The Steering Committee also provided input on lead agency and potential funding sources related to the newly developed mitigation actions.

Next steps include finalizing and prioritizing hazard mitigation actions, developing an implementation plan, and hosting the fourth Steering Committee meeting and second public meeting.



Howard County Flood Mitigation Plan

Steering Committee Meeting #4 Draft Agenda

Date: May 16, 2018
Time: 2:00pm – 4:00pm

Mitigation Actions

1.0 Mitigation Action Finalization

2.0 Prioritize Mitigation Actions

Open Discussion

Questions

Next Steps

- Public Meeting – 5/17/2018
- Finalization of Draft Report(s)

Adjournment



SIGN-IN SHEET
Howard County Hazard Mitigation & Flood Mitigation Plan Update
4th Steering Committee Meeting
May 16th, 2018 2:00pm-4:00pm

Name	Phone	Email	Agency
Andrew Estrain	888-VPC-9626	aestrai@visionpc.net	VPC
Mark S. Richmond	410-313-6413	msrichmond@howardcountymd.gov	How Co. DPW-SWM
David Keane	410.313.1676	dkeane@howardcountymd.gov	How. Co. Rec + Parks
Bill Seiger	410-537-3921	William.Seiger@montland.gov	MDA / Ho Co resident
Deepa Srinivasan	240-893-8719	dsrinivasan@vision-pc.net	VPC
Ashley Samonishky	888-VPC-9626	asamonishky@vision-pc.net	VPC
Stephen Hurd	410-812-5962	shurd@howardcountymd.gov	HCDARS
Chris Meyer	410-313-5913	Cmeyer@howardcountymd.gov	OEM
Sean Harbaugh	410-381-3470	Sean.Harbaugh@Columbiaassociation.org	CA
Phil Nichols	410-313-2051	Phil.Nichols@howardcountymd.gov	Ho Co Admin
Peter Conrad	410-313-4352	pconrad@howardcountymd.gov	DPZ
Lindsay Demarzo	410 313 4374	LDemarzo@howardcountymd.gov	Community Sust.
Mike Hinson	x5911	m.hinson@ho...	OEM
Don mock	410-313-3949	dmock@howardcountymd.gov	DILP

**2018 Howard County Hazard Mitigation/Flood Mitigation Plan Update
Steering Committee Meeting #4
May 16, 2018 – 2:00pm-4:00pm
Ligon Building, 3450 Courthouse Drive, Ellicott City, MD**

Meeting Summary by Ashley Samonisky, Vision Planning and Consulting



Vision Planning and Consulting (VPC) representative Ashley Samonisky, led an exercise to finalize and prioritize the list of mitigation actions for the Flood and Hazard Mitigation Plans, which had been emailed out prior to the meeting to ensure the Committee had sufficient time for review.

Each action item was discussed to determine phrasing, efficacy, and implementation methods. Some action items were combined for clarification and efficiency. HMP actions relating to flooding were removed as they were elaborated on in the Flood Mitigation Plan. Recently completed actions were also removed.

An implementation plan was developed to determine Lead Agency, Timeline, Estimated cost and potential Funding Sources for each action item. Additionally, VPC then discussed the prioritization rubric which was based on Life/Safety, Technical/Administrative Difficulty, and Cost. As Life/Safety is the main goal of mitigation actions, it received a weight double that of the other considerations.

VPC worked with Committee members to examine and prioritize mitigation actions for both the Flood Mitigation Plan and the Natural Hazard Mitigation Plan. Newly developed actions, as well as those carried forward from the previous plans, were evaluated and given a score based on their projected cost, the difficulty in performing or implementing the action, and the scale of area the action would protect (one street, one neighborhood, countywide, etc.). Actions were then ranked based on the prioritization score.

Next steps include assembling the draft report for county and public review, and hosting the second and final public meeting.

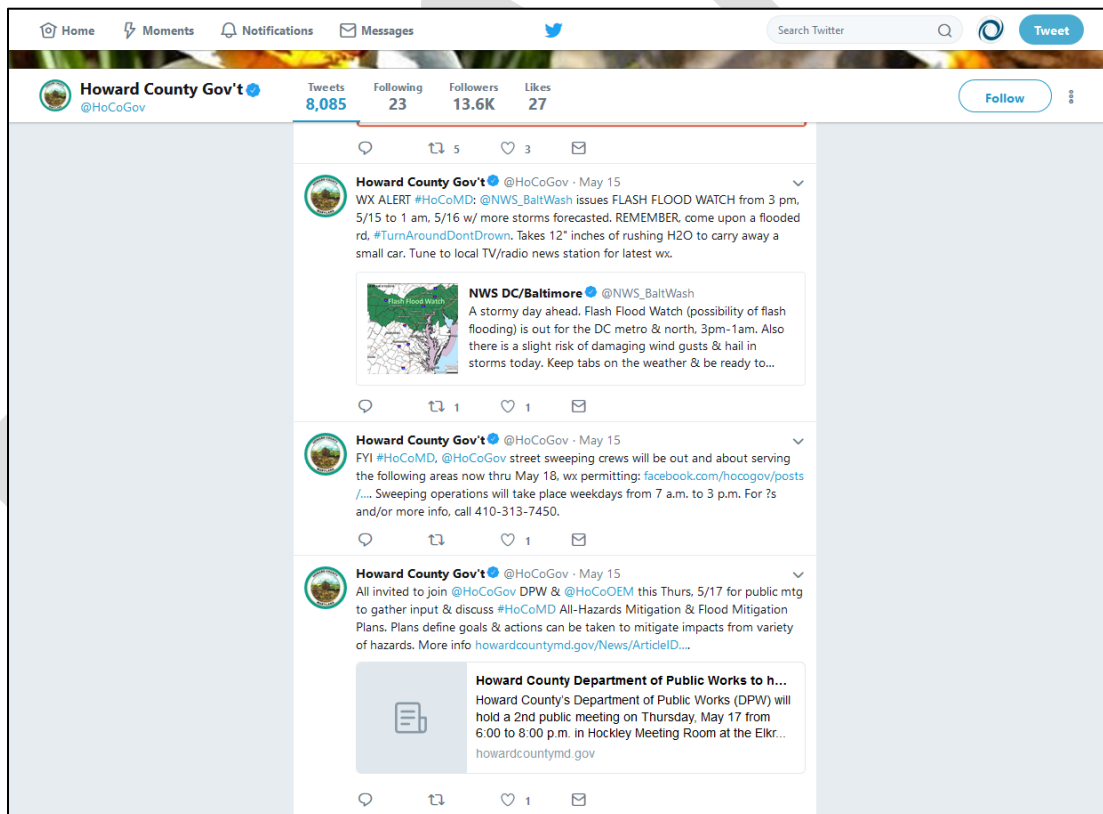
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APPENDIX B: PRESS RELEASES, NOTICES, AND PUBLIC PARTICIPATION

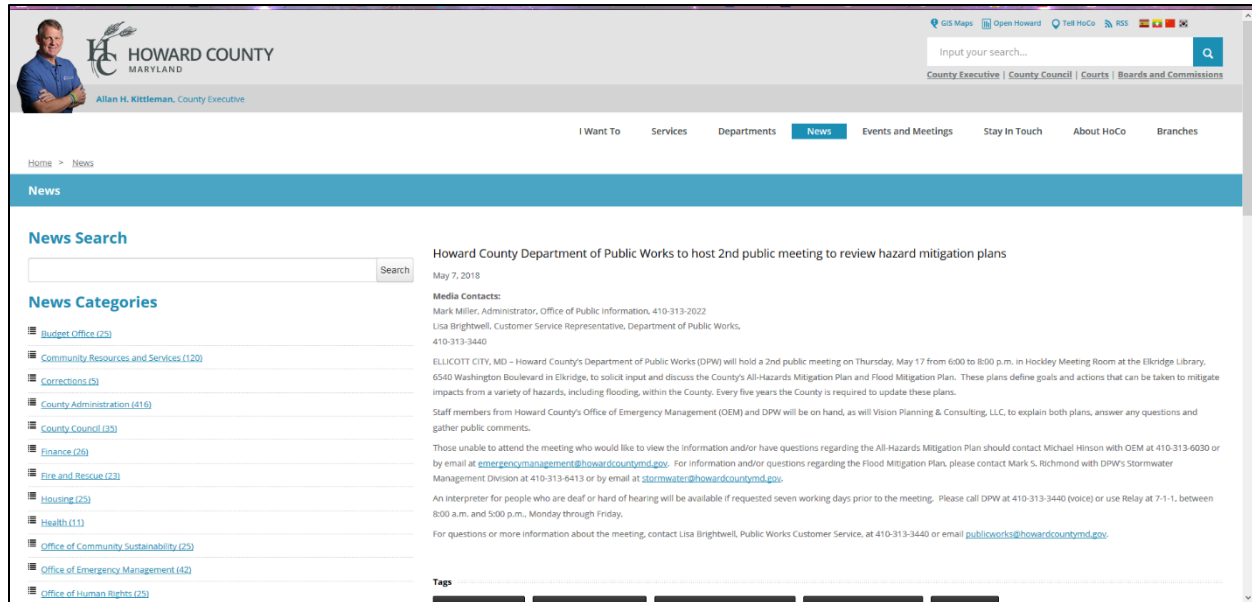
A requirement of the planning process is to not only solicit input from the public and stakeholders in developing the plans, but to keep them informed on the entire process as well.

Requirement §201.6(c)(1): *The Plan must document the planning process, including how it was prepared and who was involved in the process for each jurisdiction.*

Notices regarding meetings were distributed through the County Website, Social Media, and Press outlets. Howard County Government, and OEM both maintain a Twitter Page as well as a Facebook. Notices regarding the Planning process and meetings were distributed through the County PIO Office which has distribution channels including newspaper, television, and partnering agencies. Samples of these informational releases and invitations are included below.



Howard County Twitter Page



Howard County
MARYLAND

Allan H. Kittleman, County Executive

Home > News

News Search

News Categories

- Budget Office (73)
- Community Resources and Services (120)
- Corrections (5)
- County Administration (816)
- County Council (33)
- Finance (26)
- Fire and Rescue (73)
- Housing (23)
- Health (11)
- Office of Community Sustainability (25)
- Office of Emergency Management (42)
- Office of Human Rights (25)

Howard County Department of Public Works to host 2nd public meeting to review hazard mitigation plans

May 7, 2018

Media Contacts:
Mark Miller, Administrator, Office of Public Information, 410-313-2022
Lisa Brightwell, Customer Service Representative, Department of Public Works, 410-313-3440

ELLCOTT CITY, MD - Howard County's Department of Public Works (DPW) will hold a 2nd public meeting on Thursday, May 17 from 6:00 to 8:00 p.m. in Hockley Meeting Room at the Ellicott Library, 6540 Washington Boulevard in Ellicott, to solicit input and discuss the County's All-Hazards Mitigation Plan and Flood Mitigation Plan. These plans define goals and actions that can be taken to mitigate impacts from a variety of hazards, including flooding, within the County. Every five years the County is required to update these plans.

Staff members from Howard County's Office of Emergency Management (OEM) and DPW will be on hand, as will Vision Planning & Consulting, LLC, to explain both plans, answer any questions and gather public comments.

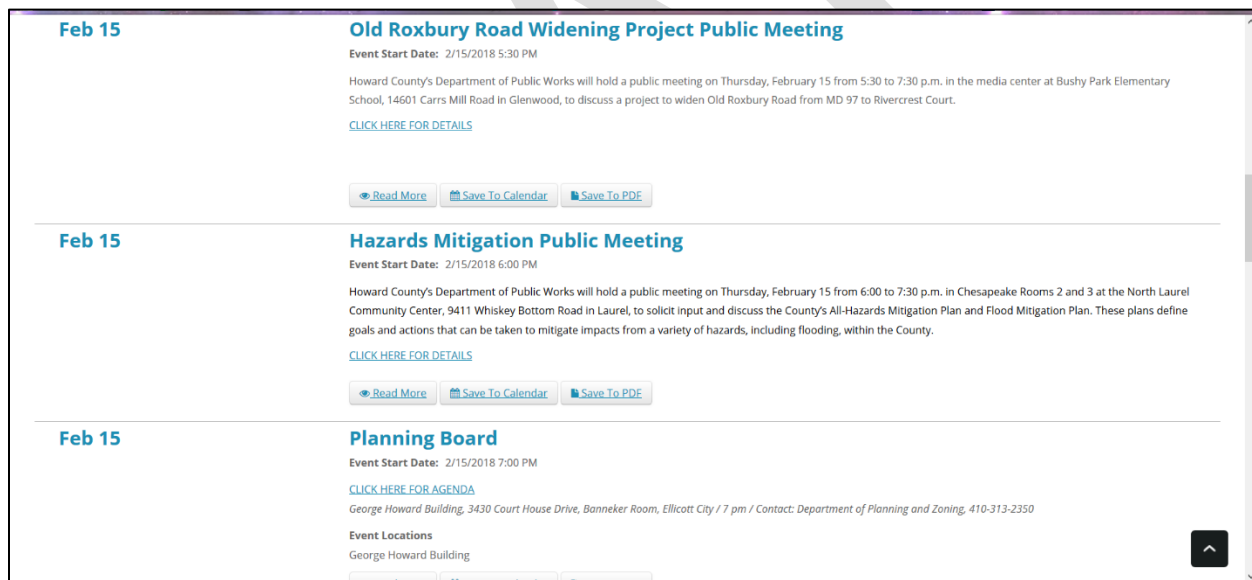
Those unable to attend the meeting who would like to view the information and/or have questions regarding the All-Hazards Mitigation Plan should contact Michael Hinson with OEM at 410-313-6030 or by email at emergencymanagement@howardcountymd.gov. For information and/or questions regarding the Flood Mitigation Plan, please contact Mark S. Richmond with DPW's Stormwater Management Division at 410-313-6413 or by email at stormwater@howardcountymd.gov.

An interpreter for people who are deaf or hard of hearing will be available if requested seven working days prior to the meeting. Please call DPW at 410-313-3440 (voice) or use Relay at 7-1-1, between 8:00 a.m. and 5:00 p.m., Monday through Friday.

For questions or more information about the meeting, contact Lisa Brightwell, Public Works Customer Service, at 410-313-3440 or email publicworks@howardcountymd.gov.

Tags

Howard County Website



Feb 15

Old Roxbury Road Widening Project Public Meeting

Event Start Date: 2/15/2018 5:30 PM

Howard County's Department of Public Works will hold a public meeting on Thursday, February 15 from 5:30 to 7:30 p.m. in the media center at Bushy Park Elementary School, 14601 Carrs Mill Road in Glenwood, to discuss a project to widen Old Roxbury Road from MD 97 to Rivercrest Court.

[CLICK HERE FOR DETAILS](#)

[Read More](#) [Save To Calendar](#) [Save To PDF](#)

Feb 15

Hazards Mitigation Public Meeting

Event Start Date: 2/15/2018 6:00 PM

Howard County's Department of Public Works will hold a public meeting on Thursday, February 15 from 6:00 to 7:30 p.m. in Chesapeake Rooms 2 and 3 at the North Laurel Community Center, 9411 Whiskey Bottom Road in Laurel, to solicit input and discuss the County's All-Hazards Mitigation Plan and Flood Mitigation Plan. These plans define goals and actions that can be taken to mitigate impacts from a variety of hazards, including flooding, within the County.

[CLICK HERE FOR DETAILS](#)

[Read More](#) [Save To Calendar](#) [Save To PDF](#)

Feb 15

Planning Board

Event Start Date: 2/15/2018 7:00 PM


[CLICK HERE FOR AGENDA](#)

George Howard Building, 3430 Court House Drive, Banneker Room, Ellicott City / 7 pm / Contact: Department of Planning and Zoning, 410-313-2350

Event Locations
George Howard Building


[Read More](#) [Save To Calendar](#) [Save To PDF](#)

Howard County Calendar of Events

 Howard County Government News Release	<i>Office of Public Information 3430 Courthouse Drive Ellicott City, Maryland, 21043</i>
410-313-2022 / FAX 410-313-3390 / www.howardcountymd.gov	<i>Mark Miller, Administrator msmiller@howardcountymd.gov</i>
May 7, 2018	
Media Contacts: Mark Miller, Administrator, Office of Public Information, 410-313-2022 Lisa Brightwell, Customer Service Representative, Department of Public Works, 410-313-3440	
Howard County Department of Public Works to host 2nd public meeting to review hazard mitigation plans	
ELLCOTT CITY, MD – Howard County’s Department of Public Works (DPW) will hold a 2 nd public meeting on Thursday, May 17 from 6:00 to 8:00 p.m. in Hockley Meeting Room at the ElkrIDGE Library, 6540 Washington Boulevard in ElkrIDGE, to solicit input and discuss the County’s All-Hazards Mitigation Plan and Flood Mitigation Plan. These plans define goals and actions that can be taken to mitigate impacts from a variety of hazards, including flooding, within the County. Every five years the County is required to update these plans.	
Staff members from Howard County’s Office of Emergency Management (OEM) and DPW will be on hand, as will Vision Planning & Consulting, LLC, to explain both plans, answer any questions and gather public comments.	
Those unable to attend the meeting who would like to view the information and/or have questions regarding the All-Hazards Mitigation Plan should contact Michael Hinson with OEM at 410-313-6030 or by email at emergencymanagement@howardcountymd.gov . For information and/or questions regarding the Flood Mitigation Plan, please contact Mark S. Richmond with DPW’s Stormwater Management Division at 410-313-6413 or by email at stormwater@howardcountymd.gov .	
An interpreter for people who are deaf or hard of hearing will be available if requested seven working days prior to the meeting. Please call DPW at 410-313-3440 (voice) or use Relay at 7-1-1, between 8:00 a.m. and 5:00 p.m., Monday through Friday.	
For questions or more information about the meeting, contact Lisa Brightwell, Public Works Customer Service, at 410-313-3440 or email publicworks@howardcountymd.gov .	
###	

Howard County Press Release

Participation with the public was solicited through two avenues: a property owner/resident survey and public meetings. Agendas and Summaries for each of the two public meetings are included below. A copy of the public survey and flood related results are included in Appendix D.



Howard County 2018 Hazard Mitigation & Flood Mitigation Plan Update

Public Meeting #1

Date: February 15, 2018
Time: 6:00-7:30pm

Introductions

- Howard County Bureau of Environmental Services
- Howard County Office of Emergency Management
- Consultants – VPC

Project Overview Presentation

- (1) Purpose and background
- (2) Key players
- (3) Planning process
- (4) Hazards and definitions
- (5) Risk Assessment and GIS Data
- (6) Plan integration

1.0 Meetings – Steering Committee/Stakeholders and Public

HIRA

- Hazus analysis
- Flood
- Other hazards
- HIRA summary
- Review Hazard Prioritization Results

Open Discussion

- Hot Topics
- Flood-Related Issues

Questions

Next Steps

Adjournment

**2018 Howard County Hazard Mitigation/Flood Mitigation Plan Update
Public Meeting #1
February 15, 2018 – 6:00pm-8:00pm
North Laurel Community Center, 9411 Whiskey Bottom Road, Laurel, MD
Meeting Summary by Andrew Estrain, Vision Planning and Consulting**



VPC presented to county residents in attendance the purpose, background, and key players of the project. VPC team member, Ashley Samonisky, then discussed the initial findings of the Vulnerability and Risk Assessment including definitions used throughout the project and information on the various hazards Howard County could potentially face. This involved discussing the process used for generating the 1% and .02% chance flood area, and providing maps to illustrate the county's flood hazard areas.

Ms. Samonisky then discussed estimates regarding flood losses and vulnerability, including the estimated total number of exposed structures and damaged buildings during a 100-year and 500-year flood, for the county, and for three specific communities. Dollar amounts were also assigned for the potential losses associated with a serious flooding event, where total losses were estimated around \$67 million for a 100-year event, and over \$120 million for a 500-year event. Similar maps and exposure estimates were also generated for earthquakes and hurricanes.

VPC discussed the integration of the Howard County 2017 HIRA, which was used to determine the hazard risk ranking for county, determined based on likelihood, impact, warning time, and duration of a hazard event. Flooding is the highest ranked hazard in the county.

Draft goals and objectives were then provided, along with the mitigation action categories that newly developed mitigation actions will be based around. Finally, VPC explained an implementation plan will lead to prioritizing actions based on social, administrative, economic, and other factors. A Q&A session for the public was then held.

The public was then asked to observe a map of frequently flooded roads in the county, and identify roads and areas that do flood that may not already be represented on the map.



**Howard County
Hazard Mitigation/ Flood Mitigation Plan Update
Public Open House #2
Draft Agenda
Date: 5/ 17/ 2018
Time: 6:00-8:00pm**

Goals and Objectives

- Review 2018 Goals and Objectives

Mitigation Actions Review

- 1.0 Discussion of 2018 Actions
- 2.0 Explanation of Prioritization Process

Open Discussion

- Additional recommended actions

Questions

Next Steps

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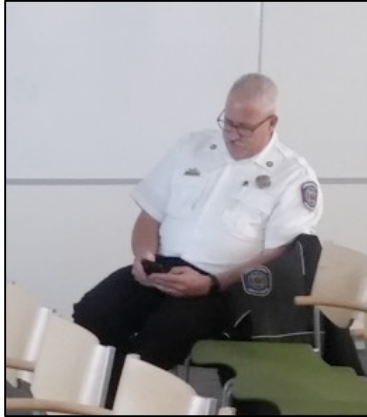
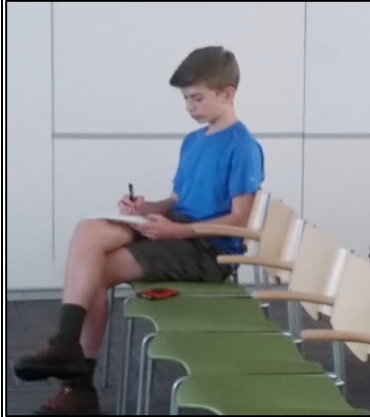
Adjournment

**2018 Howard County Hazard Mitigation/Flood Mitigation Plan Update
Public Meeting #2**

May 17, 2018 – 6:00pm-8:00pm

Howard County Library System, Laurel Branch, 6540 Washington Blvd., Elkridge, MD

Meeting Summary by Andrew Estrain, Vision Planning and Consulting



The public was presented basic findings of the Vulnerability and Risk Assessment, including information on the flood hazards that different areas of Howard County could potentially face. This involved identifying and discussing major flood hazard areas in the county, the most damaging tributaries in areas with the highest estimated total losses, and critical facilities in the county vulnerable to flooding. the process used for generating the 1% and .02% chance flood area, and providing maps to illustrate the county's flood hazard areas.

VPC discussed the integration of other county plans, as well as the Howard County 2017 HIRA, which was used to determine the hazard risk ranking for county. Hazard risk rankings were determined based on likelihood, impact, warning time, and duration of that hazard event. Flooding is the highest ranked hazard in the county.

The Flood Mitigation and Hazard Mitigation Plans goals and objectives were then presented, along with the mitigation action categories that hazard mitigation actions are created around. VPC then explained an implementation plan will lead to prioritizing and ranking the mitigation actions based on social, administrative, economic, and other factors.

Attendees were then provided a sample of hazard mitigation actions, specifically, the highest ranked actions from both the Flood Mitigation and Hazard Mitigation Plan. A Q&A session for the public was then held.

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APPENDIX C: ACRONYMS

AEOC – Alternate EOC

BCR – Benefit Cost Ratio

BES – Howard County Department of Public Works Bureau of Environmental Services

BFE – Base Flood Elevation

BMP – Best Management Practices

BNR – Biological Nutrient Removal

BOH – Howard County Department of Public Works Bureau of Highways

BOU – Howard County Department of Public Works Bureau of Utilities

BRIC – Building Resilient Infrastructure and Communities

CCF – County Coordinating Functions

CERRP – Comprehensive Emergency Response and Recovery Plan

CFR – Code of Federal Regulations

CRS – Community Ratings System

DCRS – Howard County Department of Community Resources and Services

DEM – Digital Elevation Model

DFRS – Howard County Department of Fire and Rescue Services

DILP – Howard County Department of Inspections, Licenses, and Permits

DPW – Department of Public Works

DPZ – Howard County Department of Planning and Zoning

DRP – Department of Recreation and Parks

EAP - Emergency Action Plan

EAS - Emergency Alert System

EMnet - Emergency Management Network

EMPG - Emergency Management Performance Grants

EOC – Emergency Operations Center

EOP - Emergency Operations Plan

EPA - Environmental Protection Agency

FEMA – Federal Emergency Management Agency

FIRM - Flood Insurance Rate Map

FIS – Flood Insurance Study

FMA - Flood Mitigation Assistance Program

FMP – Flood Mitigation Plan

GBS - General Building Stock

GIS – Geographic Information System

HCC – Howard Community College

HCGH – Howard County General Hospital

HCPD - Howard County Police Department

HCPSS – Howard County Public School System

HIRA – Hazard Identification and Risk Assessment

HMGP - Hazard Mitigation Grant Program

IA - Individual Assistance

ICS - Incident Command System

JSC – Joint Steering Committee

LOMA - Letter of Map Amendment

LOMR - Letter of Map Revision

MDE – Maryland Department of the Environment

MDP – Maryland Department of Planning

MEMA – Maryland Emergency Management Agency

MEMAC - Maryland Emergency Management Assistance Compact

MSP – Maryland State Police

NAWAS - National Warning System

NFIP – National Flood Insurance Program

NHMP – Natural Hazard Mitigation Plan

NIMS - National Incident Management System

NPDES - National Pollutant Discharge Elimination System

NWS - National Weather Service

OEM – Howard County Office of Emergency Management

PA - Public Assistance

PDM - Pre-Disaster Mitigation Program

PIO – Office of Public Information

PSAP - Public Safety Answering Point

RL - Repetitive Loss

SHA – State Highway Administration

SRL - Severe Repetitive Loss

SWMD – Howard County Department of Public Works, Bureau of Environmental Services, Storm Water Management Division

THIRA – Threat Hazard Identification and Risk Assessment

UASI - Urban Area Security Initiative

VPC – Vision Planning and Consulting

WSSC - Washington Suburban Sanitary Commission

WWTP - Waste Water Treatment Plant

APPENDIX D: COMMUNITY SURVEY RESULTS

The Community Survey was released through multiple County channels and was left open for a period of two weeks. A total of 160 responses were received, with 75% of all responses being received in the first 5 days of release.

Posting	Date	Time
Survey placed on HoCo OEM website	3/1/18	1:25 PM
Survey posted on OEM Facebook	3/2/18	10:00 AM
Survey posted on OEM Nextdoor Account	3/2/18	10:36 AM
Survey posted on OEM Twitter	3/2/18	10:36 AM
Survey posted on Howard County Gov Facebook Account	3/13/18	3:53 PM
Survey posted on Howard County Gov Twitter Account	3/13/18	3:53 PM

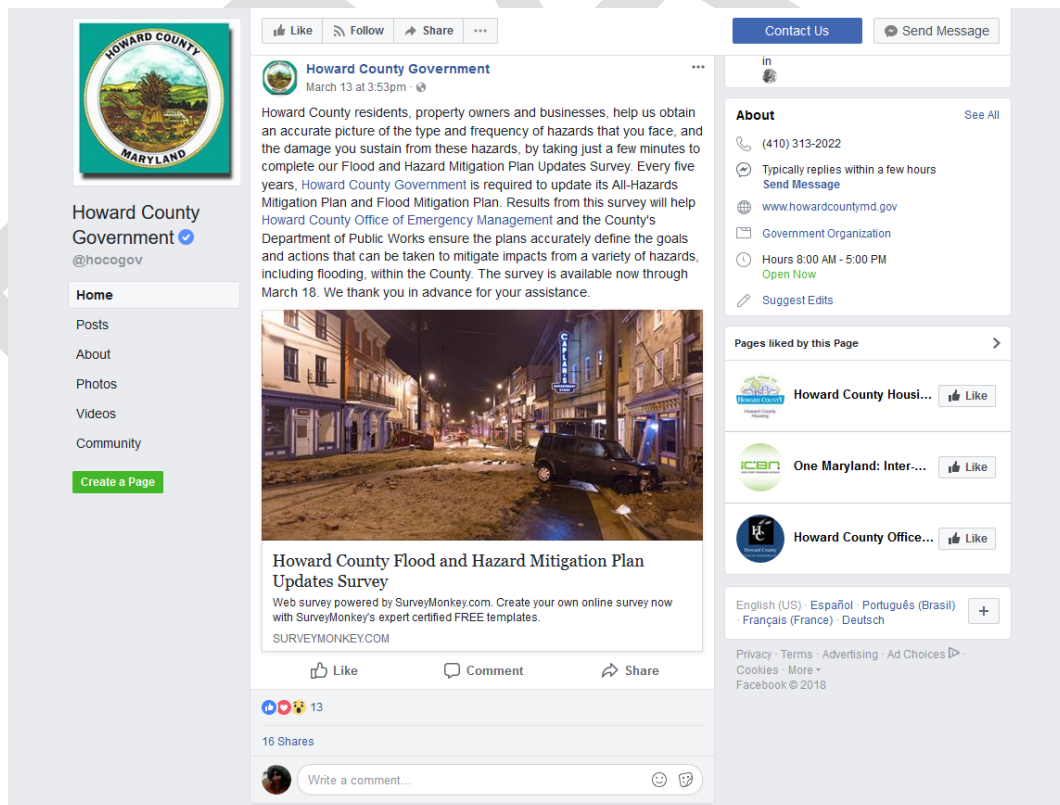
Samples of the survey release announcement are included below.



Howard County OEM Twitter



Howard County Twitter



Howard County Facebook

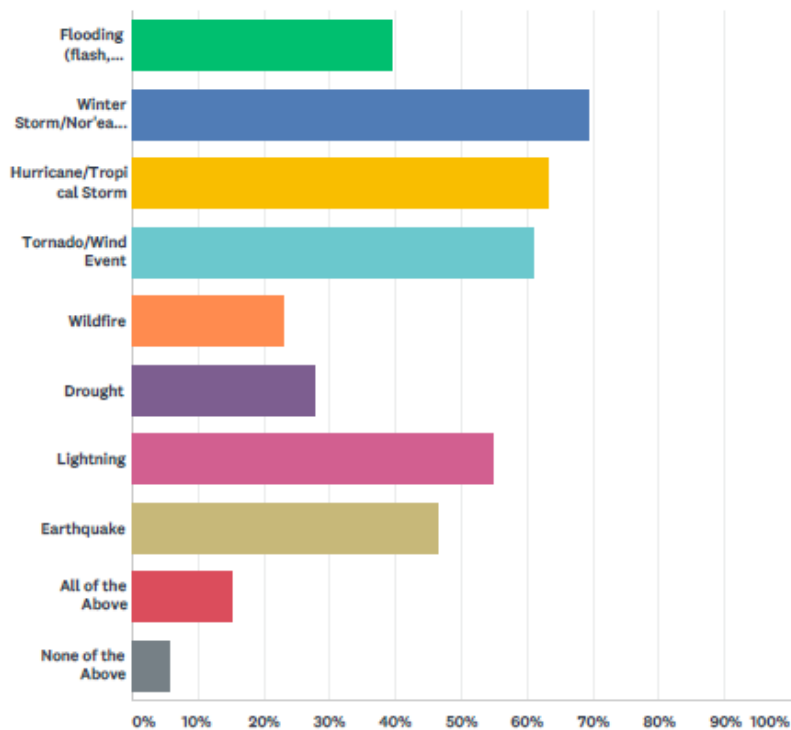
Although the survey was intended to gather responses for a variety of hazards, only those regarding flooding are included in this Appendix.

Howard County Flood and Hazard Mitigation Plan Updates

SurveyMonkey

Q2 Is your property vulnerable to the following hazards? (Check all that apply)

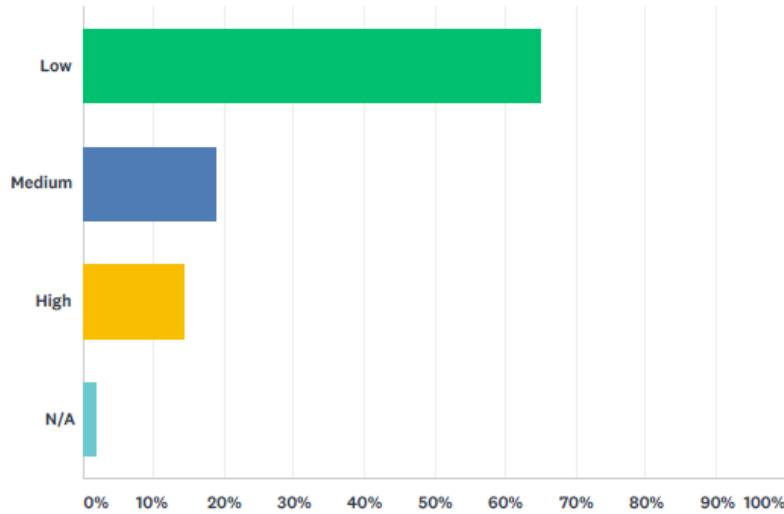
Answered: 144 Skipped: 2



ANSWER CHOICES	RESPONSES	
Flooding (flash, stormwater)	39.58%	57
Winter Storm/Nor'easter	69.44%	100
Hurricane/Tropical Storm	63.19%	91
Tornado/Wind Event	61.11%	88
Wildfire	22.92%	33
Drought	27.78%	40
Lightning	54.86%	79
Earthquake	46.53%	67
All of the Above	15.28%	22
None of the Above	5.56%	8

Q3 How at-risk is your property to Flooding?

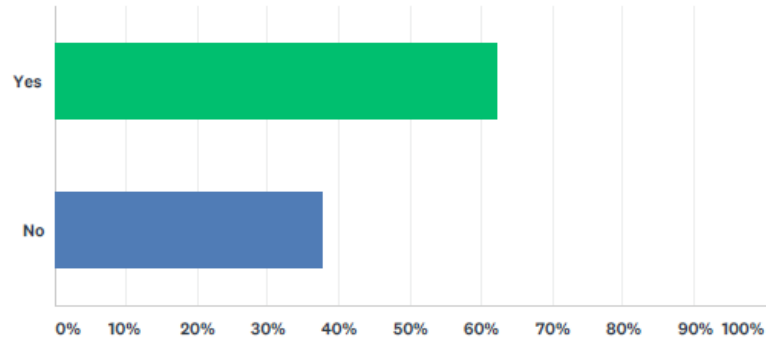
Answered: 160 Skipped: 0



ANSWER CHOICES	RESPONSES	
Low	65.00%	104
Medium	18.75%	30
High	14.37%	23
N/A	1.88%	3
TOTAL		160

Q20 Have you taken any actions to avoid future damages and loss from natural hazards?

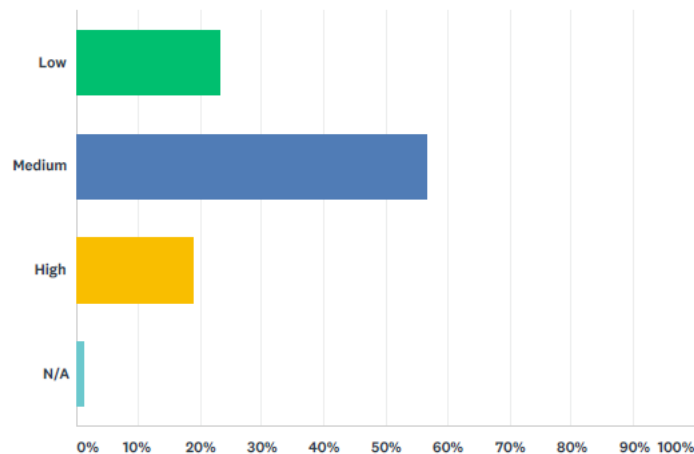
Answered: 117 Skipped: 43



ANSWER CHOICES	RESPONSES	
Yes	62.39%	73
No	37.61%	44
TOTAL		117

Q4 How at-risk is your property to a Winter Storm/Nor'easter?

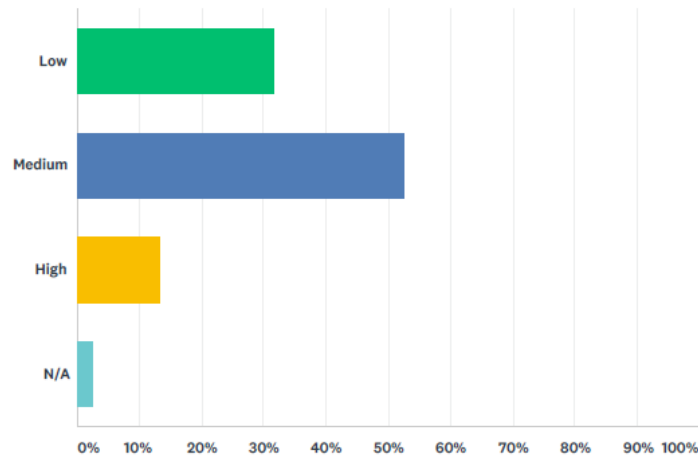
Answered: 159 Skipped: 1



ANSWER CHOICES	RESPONSES	
Low	23.27%	37
Medium	56.60%	90
High	18.87%	30
N/A	1.26%	2
TOTAL		159

Q5 How at-risk is your property to a Hurricane/Tropical Storm ?

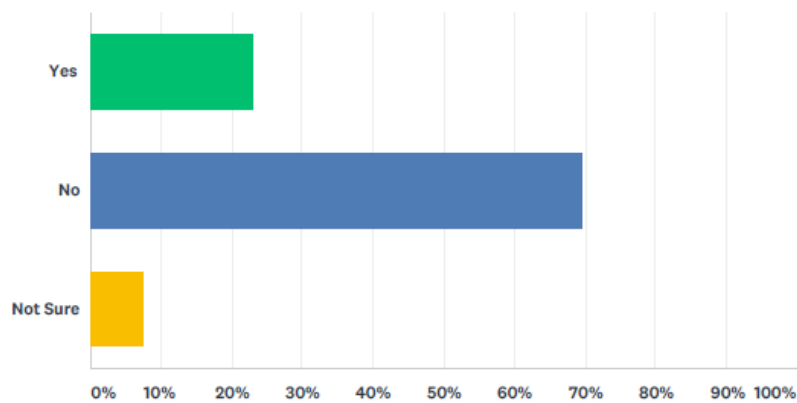
Answered: 158 Skipped: 2



ANSWER CHOICES	RESPONSES	
Low	31.65%	50
Medium	52.53%	83
High	13.29%	21
N/A	2.53%	4
TOTAL		158

Q11 Has your property experienced the Flooding hazards more than three times in the past 5 years?

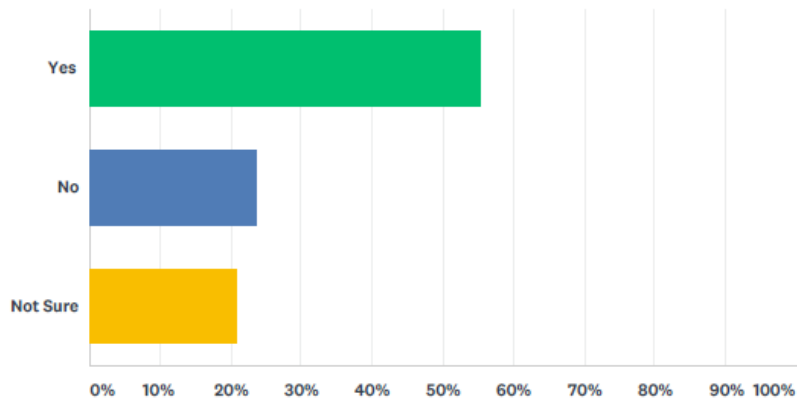
Answered: 148 Skipped: 12



ANSWER CHOICES	RESPONSES	
Yes	22.97%	34
No	69.59%	103
Not Sure	7.43%	11
TOTAL		148

Q12 Has your property experienced a Winter Storm/Nor'easter more than three times in the past 5 years?

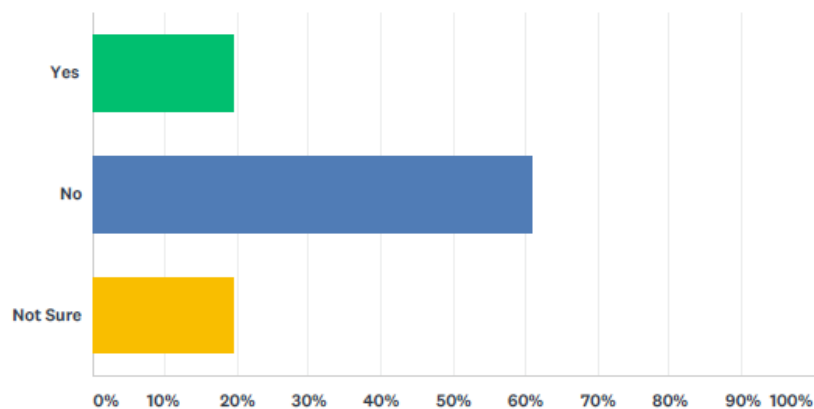
Answered: 148 Skipped: 12



ANSWER CHOICES	RESPONSES	
Yes	55.41%	82
No	23.65%	35
Not Sure	20.95%	31
TOTAL		148

Q13 Has your property experienced a Hurricane/Tropical Storm more than three times in the past 5 years?

Answered: 148 Skipped: 12



ANSWER CHOICES	RESPONSES	
Yes	19.59%	29
No	60.81%	90
Not Sure	19.59%	29
TOTAL		148

Note: The damage assessment question reflects all hazards, not just flooding.

ANSWER CHOICES	RESPONSES	
Architectural feature damage (spires, lintels, cornices, railings)	14.85%	15
Damage to secondary buildings (shed, garage, boat house)	26.73%	27
Damaged Masonry (fireplace, stairs)	24.75%	25
Damaged/rotting wood features (exterior)	30.69%	31
Damaged/rotting wood features (interior)	15.84%	16
Finished (or first) floor flooding	19.80%	20
Loss of vegetation (trees, shrubs, gardens)	70.30%	71
Plumbing, sewer, or septic damages, issues or challenges	26.73%	27
Roof/shingle damage	62.38%	63
Siding/exterior damage	60.40%	61
Soil washout or erosion	65.35%	66
Standing water on property (around buildings)	57.43%	58
Structural or Foundation Damage	32.67%	33
Utility damage (hvac, electrical, natural gas)	36.63%	37
Window/Door damage	29.70%	30

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