

# CB56-2018: Tiber Branch Watershed and Plumtree Branch Watershed Safety Act



## ADDENDUM

*Revised May 29, 2019*

*This addendum provides information supplementary to the presentation dated May 21, 2019. Please review the presentation prior to reviewing this addendum.*

# Task 1



## ANALYSIS OF THE 5/27/2018 FLOOD BASED ON 7/30/2016 MODELS AND REPORTS

# Task 1

- The following resources supplement the information presented in Task 1:
  - 2017 Valley Mede Drainage Study: Plumtree Branch and Little Plumtree Branch Presentation. November 15, 2017  
<https://www.howardcountymd.gov/LinkClick.aspx?fileticket=Dln-fxMRz-0%3d&portalid=0>
  - Ellicott City Hydrology & Hydraulic (H&H) Study Presentation. May 31, 2017  
<https://www.howardcountymd.gov/LinkClick.aspx?fileticket=4lgjn7v8P-Y%3d&portalid=0>
  - Ellicott City Hydrology/Hydraulic Study and Concept Mitigation Analysis. June 16, 2017  
<https://www.howardcountymd.gov/LinkClick.aspx?fileticket=t3mtiyi2qIg%3d&portalid=0>

## Task 2



**DESIGNS/PLANS FOR STORMWATER  
STORAGE FACILITIES COMBINED WITH  
STORMWATER CONVEYANCE  
INFRASTRUCTURE IMPROVEMENTS,  
AND DRAINAGE INFRASTRUCTURE AND  
FLOOD MITIGATION**

# Task 2

- No addendum material to supplement the presentation slides

# Task 3



## **ANALYSIS OF THE FLOODING IMPACT OF EXISTING OR PROPOSED DEVELOPMENT OR REDEVELOPMENT**

# Task 3

- The following slides supplement those presented on May 21, 2019
- Resources that supplement the May 21 presentation include:
  - Ellicott City Hydrology & Hydraulic (H&H) Study Presentation. May 31, 2017  
<https://www.howardcountymd.gov/LinkClick.aspx?fileticket=4lgjn7v8P-Y%3d&portalid=0>
  - Ellicott City Watershed Master Plan: Public Meeting Presentation. March 22, 2018. Mahan Rykiel et. al.  
[https://www.howardcountymd.gov/LinkClick.aspx?fileticket=-Zgvr7\\_nqHQ%3d&portalid=0](https://www.howardcountymd.gov/LinkClick.aspx?fileticket=-Zgvr7_nqHQ%3d&portalid=0)

# Stormwater Management: 1984 & Earlier

<b>Stormwater Management Era</b>	<b>Plumtree Watershed</b>	<b>Tiber-Hudson Watershed</b>
1984 and earlier  No stormwater requirements; <b>curb and gutter</b> built to move water	No stormwater management requirements – <b>curb and gutter</b>	No stormwater management requirements – <b>curb and gutter</b>

# Stormwater Management: 1985-2002

Stormwater Management Era	Plumtree Watershed	Tiber-Hudson Watershed
1985-2002  “2&10-year” stormwater management: manage the post-development discharge rate to be no more than the pre-development discharge rate for both the 2- and 10-year storms. Safely pass the 100-year post development flow from the site.	“2&10-year” stormwater management through facilities like <b>dry retention ponds</b>	“2&10-year” stormwater management through facilities like <b>dry retention ponds</b> until the 1990s  In 1990, 100-year stormwater management was introduced as a requirement – developments began managing the 100-year storm in the 1990s with facilities like <b>larger retention ponds</b>

# Stormwater Management: 2002-2010

Stormwater Management Era	Plumtree Watershed	Tiber-Hudson Watershed
<p data-bbox="86 418 341 461">2002-2010</p> <p data-bbox="86 525 861 918">State regulations changed to incentivize stormwater management for water quality with optional credits. <b>Large bioretention facilities</b> began being used, designed to manage the 1-year storm.</p> <p data-bbox="86 982 861 1146"><b>Redevelopment projects:</b> treat 20% of impervious area for water quality.</p>	<p data-bbox="886 411 1635 518"><b>Large bioretention facilities</b> for water quality</p>	<p data-bbox="1661 411 2456 518"><b>Large bioretention facilities</b> for water quality</p> <p data-bbox="1661 582 2456 746">And 10- and 100-year stormwater management facilities (such as <b>retention ponds</b>)</p>

# Stormwater Management: 2010 & Later

<b>Stormwater Management Era</b>	<b>Plumtree Watershed</b>	<b>Tiber-Hudson Watershed</b>
<p data-bbox="78 411 410 458">2010 and later</p> <p data-bbox="78 525 843 915">In response to state Stormwater Management Act of 2007, <b>environmental site design (ESD) on-lot micro practices</b> were required wherever possible to address water quality, designed to manage 1-year storm.</p> <p data-bbox="78 982 843 1152"><b>Redevelopment projects:</b> treat 50% of impervious area for water quality.</p>	<p data-bbox="843 411 1352 458"><b>ESD</b> for water quality</p>	<p data-bbox="1658 411 2142 458"><b>ESD</b> for water quality</p> <p data-bbox="1658 525 2463 686">And 10- and 100-year stormwater management facilities (such as <b>retention ponds</b>)</p>

# Existing Development by SWM Era

## Acres of Watershed by SWM Era – Developed Lands Only

<u>SWM Era</u>	<u>Plumtree</u>		<u>Tiber/Hudson</u>	
	<u>Developed Acreage</u>	<u>% of Total Developed Acreage</u>	<u>Developed Acreage</u>	<u>% of Total Developed Acreage</u>
1984 and Earlier (No SWM)	1,143	81%	726	54%
1985 to 2002 (2- and 10-year)	223	16%	391	29%
2002 to 2010 (Large bioretention)	28	2%	148	11%
2010 and Later (ESD)	21	1%	82	6%
<b>Total Developed Watershed Acres*</b>	<b>1,415</b>		<b>1,347</b>	

## Tiber-Hudson Special Requirement – Developed Lands Only

	<u>Developed Acreage</u>	<u>% of Total Developed Acreage</u>
1990 to Present (10- and 100-year)	465	35%
<b>Total Developed Watershed Acres*</b>	<b>1,347</b>	

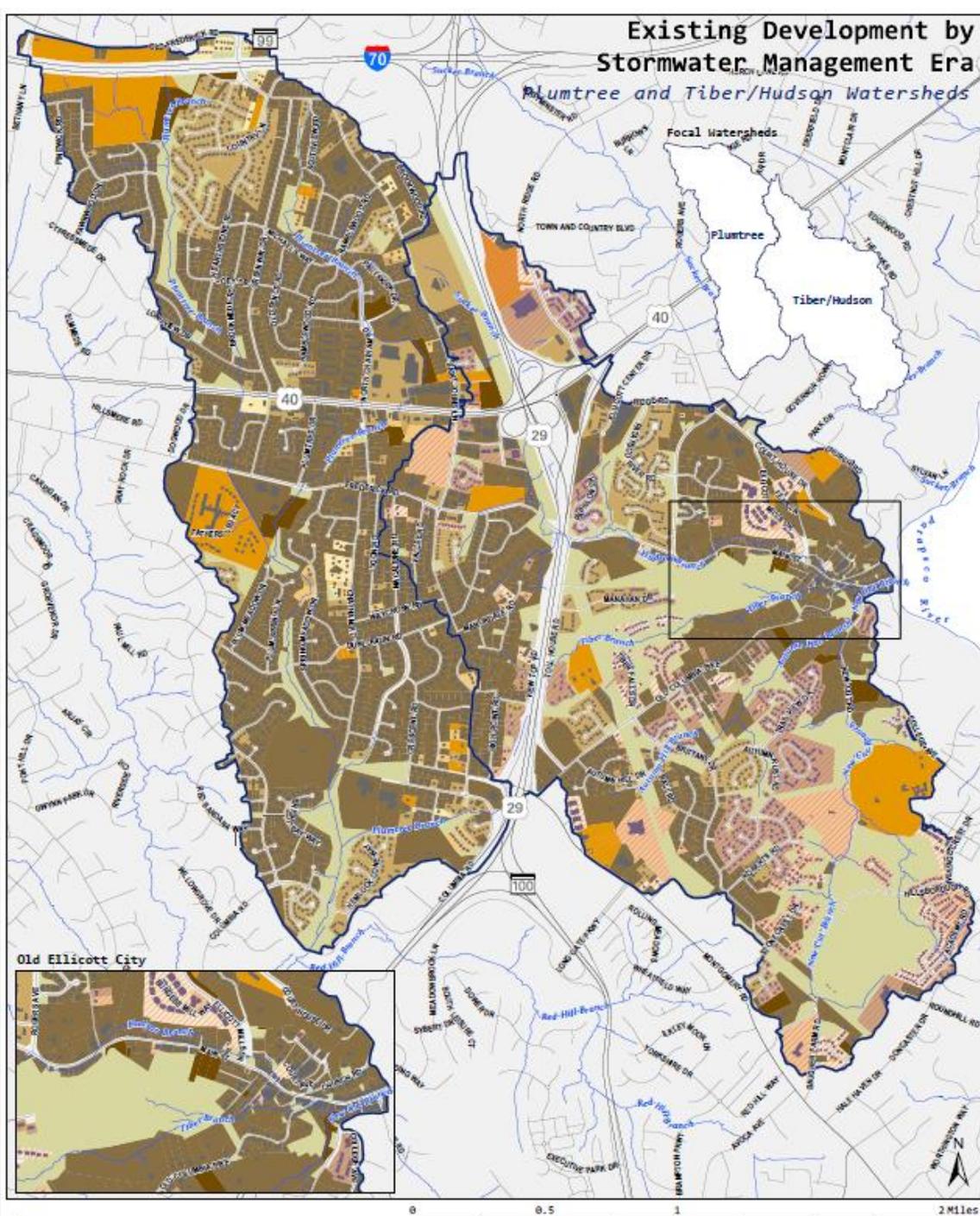
# Existing Watershed Acreage by Category

## Watershed Acreage by Category

<u>Category</u>	<u>Plumtree</u>		<u>Tiber/Hudson</u>	
	<u>Acreage</u>	<u>% of Total</u>	<u>Acreage</u>	<u>% of Total</u>
Developed lands	1,415	71%	1,347	57%
Undeveloped lands (no existing improvements)	38	2%	29	1%
In-Progress lands	128	6%	119	5%
Open Space, Parks and Easements	145	7%	505	21%
Right of Ways	276	14%	370	16%
<b>Total Watershed Acres</b>	<b>2,002</b>		<b>2,370</b>	
<i>Tiber/Hudson 1990 to Present (100-year)</i>			465	20%

# Existing Development by SWM Era

-  1) 1984 and earlier  
No stormwater management
-  2) 1985 to 2002  
2 and 10-year requirements\*
-  3) 2002 to 2010  
Large bioretention facilities
-  4) 2010 and later  
Environmental site design
-  In-Progress
-  Tiber/Hudson 1990 and later  
100-year stormwater management
-  Undeveloped
-  Open Space, Parks, and Easements



# Development In-Progress + Future Potential

- Development in-progress includes projects in varying stages:
  - Under plan review
  - Awaiting permits
  - Partially built
- Future Potential\* includes lands that are classified as:
  - Undeveloped
  - Resubdividable (such as a flag lot)
  - Redevelopable (technical definition for stormwater management purposes)

*\*Potential does not imply owner intent*

# Development In-Progress + Future Potential

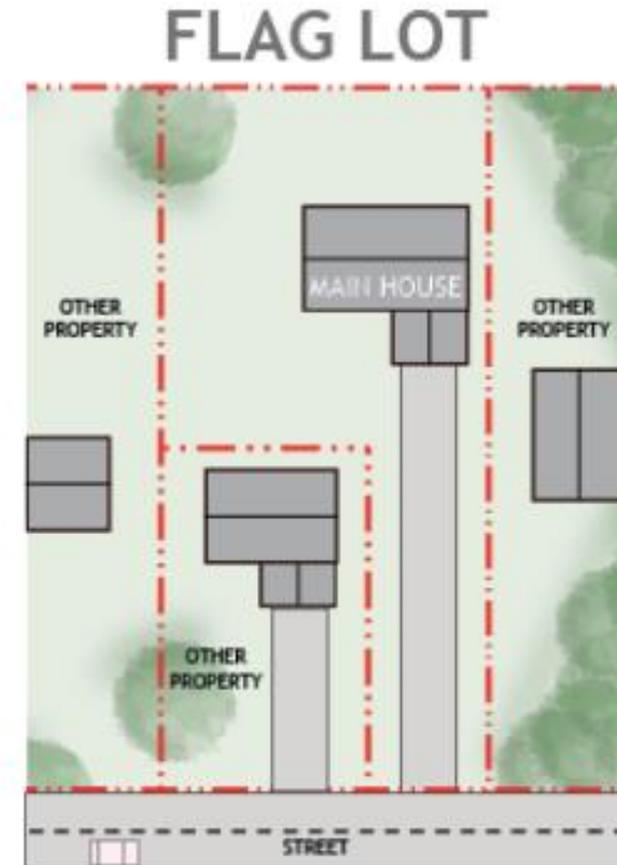
## Undeveloped Land

- Includes completely undeveloped as well as partially undeveloped
- Parcels not vetted for buildability
- Unbuildable area like steep slopes, stream buffers, not netted out
- Does not imply intent to develop by owners

# Development In-Progress + Future Potential

## Resubdivision Potential

- Part of an existing subdivision with an existing residence
- Parcel has potential for future resubdivision into additional lots, for example, flag lot
- Criteria for inclusion in analysis:
  - Parcel square footage large enough to accommodate one or more additional units relative to zoning code
  - Contiguous square footage excluding steep slopes, stream buffers and developed area
- Does not imply intent by owners to resubdivide



# Development In-Progress + Future Potential Redevelopment Potential (SWM)

- Potential to qualify as a future redevelopment site for SWM purposes
- Criteria for inclusion in analysis:
  - Parcel must meet the technical definition of redevelopment for stormwater management purposes:
    - 40% or greater existing impervious cover
    - Existing land use = commercial, industrial, institutional, or multifamily residential
- Does not imply intent to redevelop by owners
- Economic viability of redevelopment not tested

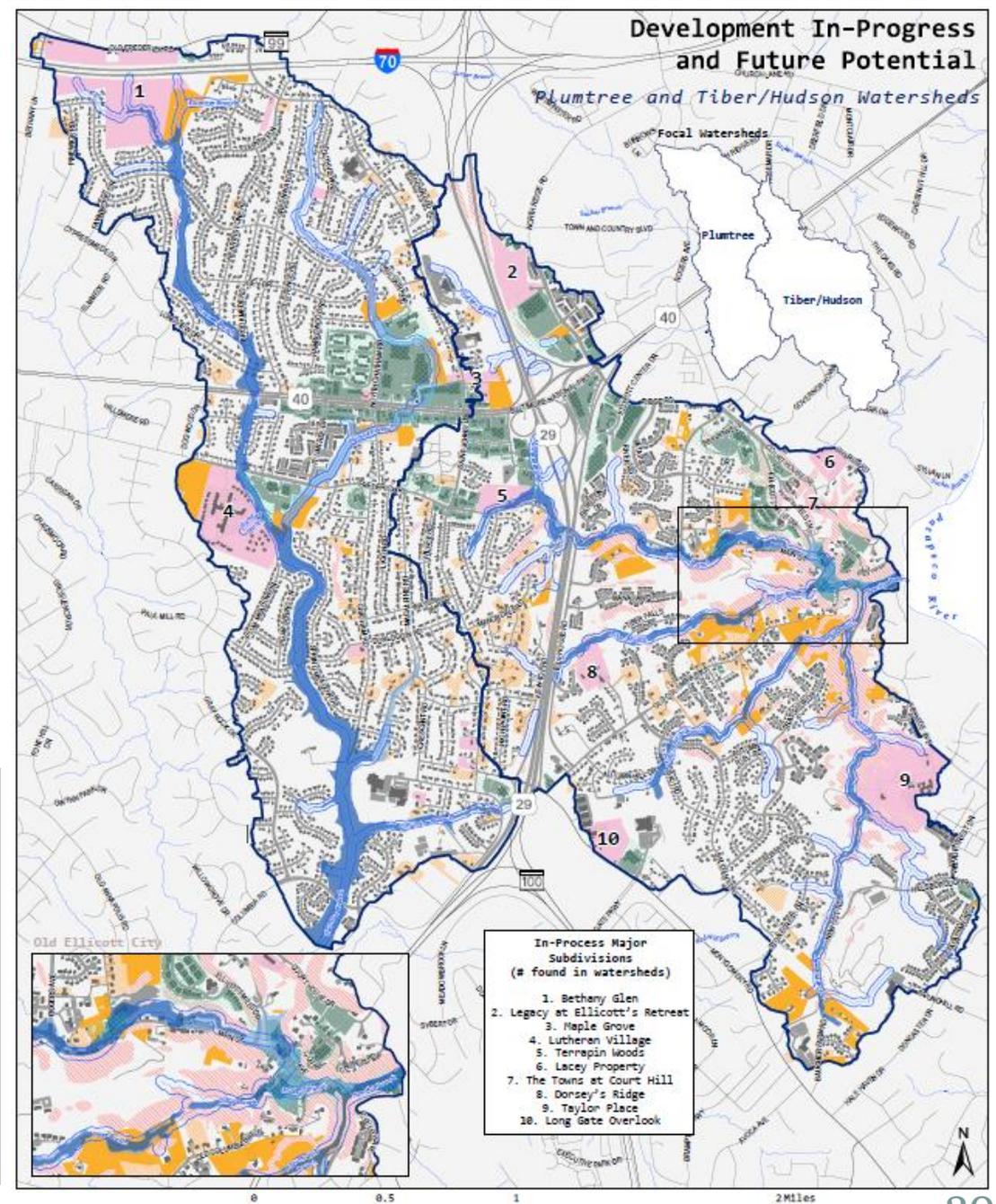
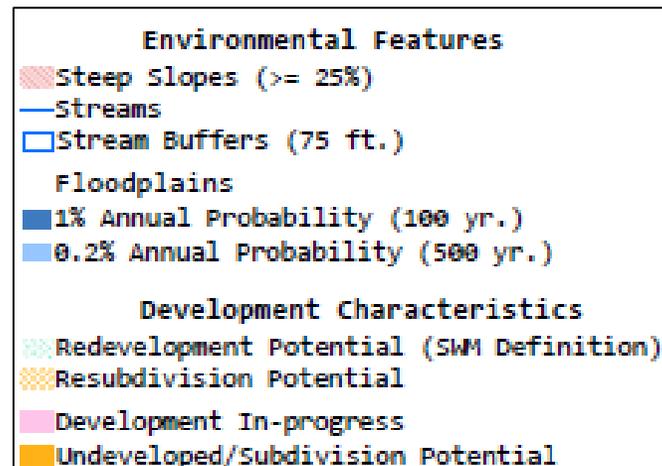
# Development In-Progress + Future Potential

## Acres of Watershed by Development Characteristics

<u>Development Characteristics</u>	<u>Plumtree</u>		<u>Tiber/Hudson</u>	
In-Progress	128	6%	119	5%
Undeveloped/Subdivision Potential	62	3%	123	5%
Resubdivision Potential	65	3%	94	4%
Redevelopment Potential (SWM)	140	7%	183	8%
<b>Total Watershed Acres</b>	<b>2,002</b>		<b>2,370</b>	

# Development In-Progress + Future Potential

- 10 major subdivisions in-progress in addition to minor subdivisions (4 lots or fewer)



# Small-Scale Impervious Improvements

- Includes small projects under 5,000 square feet, including:
  - Residential and commercial additions
  - Detached and attached garages
  - Pools and spas
  - Sheds and similar out-buildings
- No stormwater management requirements for these types of projects

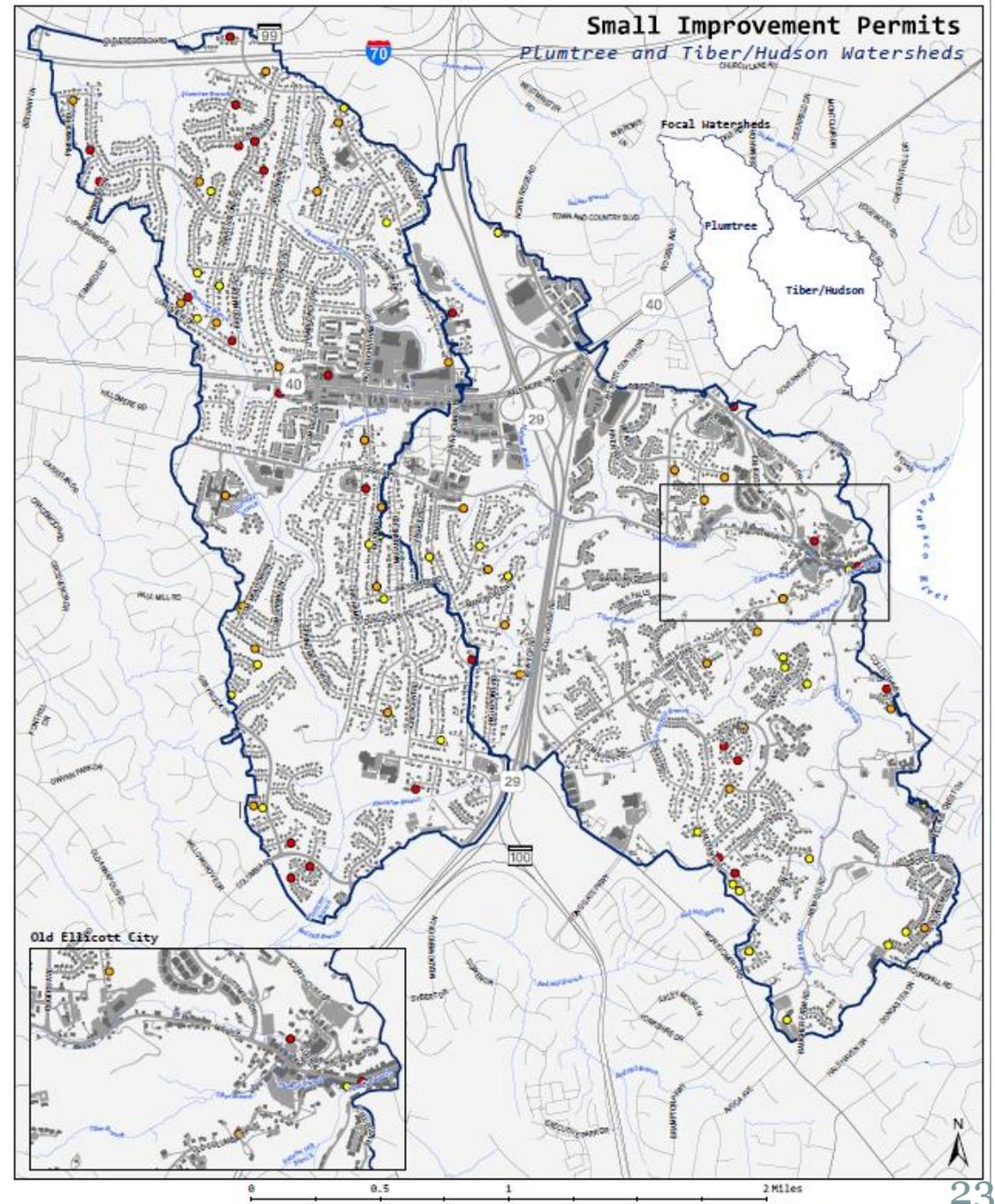
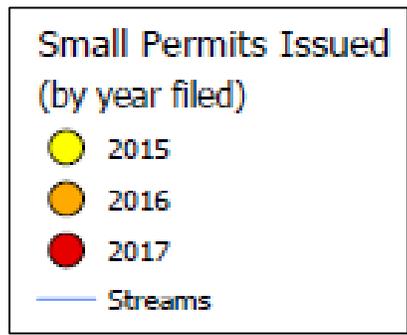
# Small-Scale Impervious Improvements

## Number of Permits Issued, 2015-2017

<u>Year Filed</u>	<u>Plumtree</u>	<u>Tiber/Hudson</u>
2015	14	18
2016	17	14
2017	18	9
<b>Total Number of Permits</b>	<b>49</b>	<b>41</b>

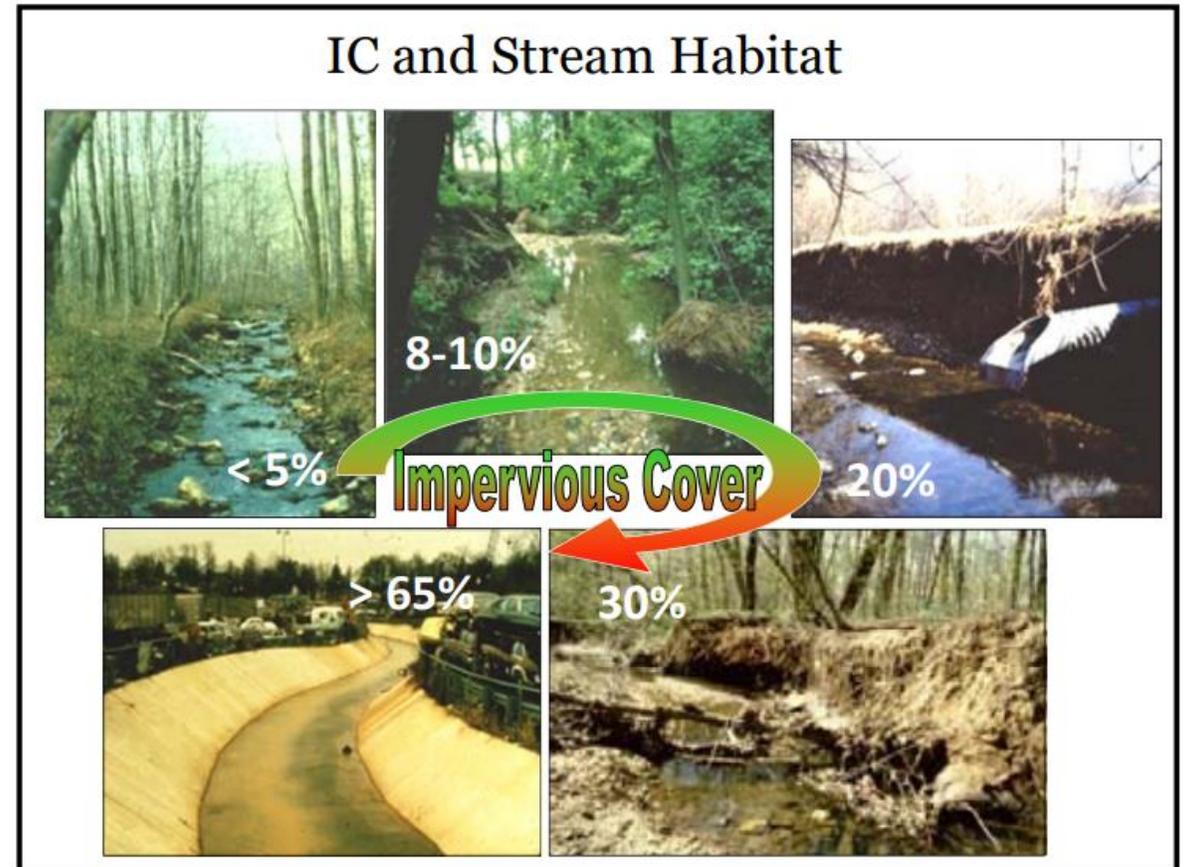
# Small-Scale Impervious Improvements

- Less than 20 small permits per year in 2015, 2016, and 2017 in each watershed, respectively



# Impervious Surface

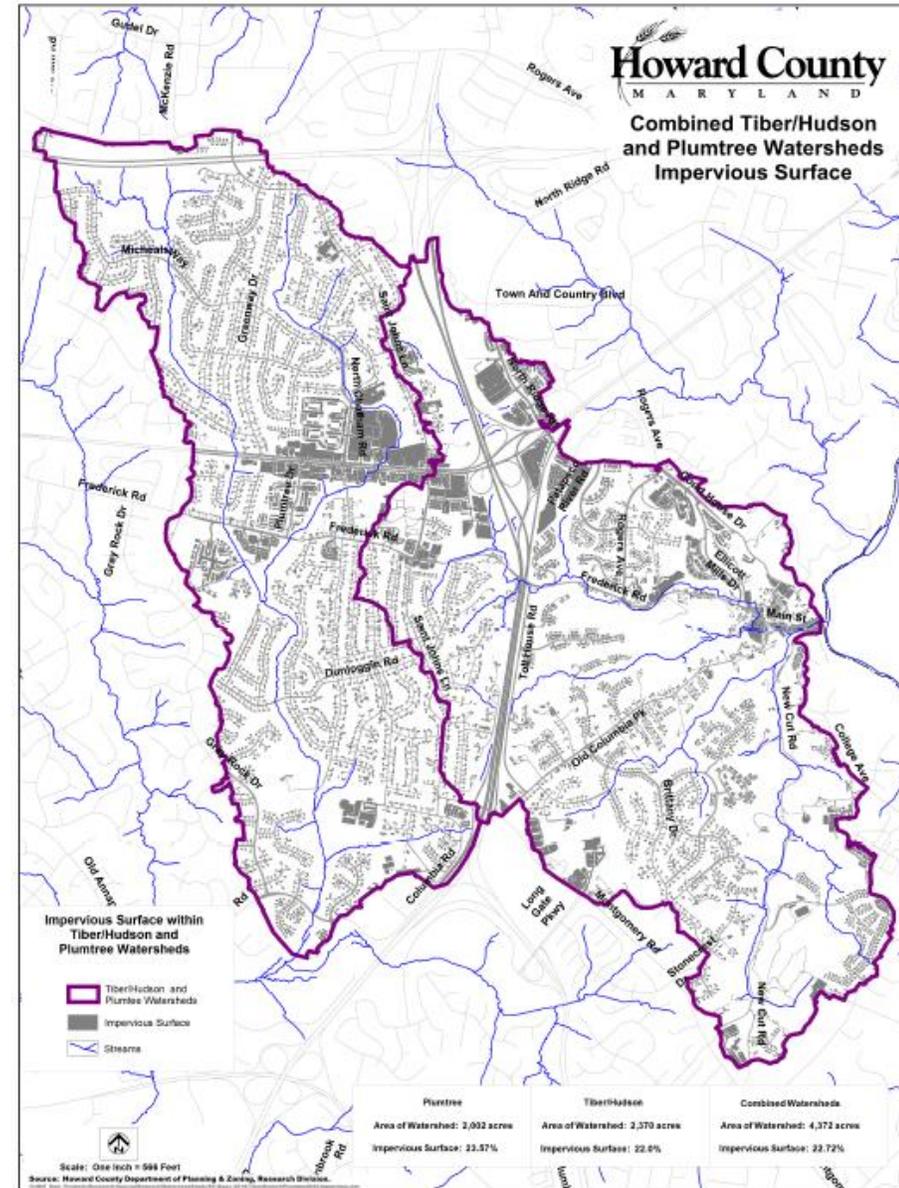
- Imperviousness: metric representing the sum of impermeable surfaces (roads, rooftops, sidewalks, parking lots, etc.) that prevent water from infiltrating into the soil, increasing stormwater runoff
- The reformulated Impervious Cover Model (ICM) classifies urban watersheds based upon the percent impervious cover in the watershed from sensitive, to impacted, to non-supporting urban drainage
- Source: <https://www.cwp.org/wp-content/uploads/2018/04/ICM-Revisited.pdf> (please copy and paste into a web browser to view)



- Schueler, 2018

# Impervious Surface

- Plumtree:
  - 23.57% impervious cover
  - Concentrated in commercial areas, including Chatham area of Route 40
- Tiber-Hudson:
  - 22.0% impervious cover
  - Concentrated in commercial areas, including Route 40/29 interchange and Old Ellicott City



# Task 4



## **RECOMMENDED CHANGES TO STORMWATER MANAGEMENT REGULATIONS**

# Task 4

- Resources that supplement the May 21 presentation include:
- Current Howard County Design Manual - Volume I Storm Drainage  
The [Howard County Design Manual - Volume I](#) was last revised in 2017
- National Weather Service Flood [Return Period Calculator](#)

Though this calculator is worded for the flood event return period it would work for any extreme weather event

# Task 5



## ANALYSIS OF PUBLIC AND PRIVATE OPTIONS FOR RETROFITTING EXISTING PUBLIC AND PRIVATE PROPERTY

# Task 5

- Resources that supplement the May 21 presentation include:
- Additional information on the Plumtree Branch Watershed and Tiber Branch Watershed Stormwater Retrofit Studies can be found on the [DPW stormwater management webpage](#)

# Task 6



## ANALYSIS OF POTENTIAL CHANGES TO GENERAL PLAN, DENSITY, AND OPEN SPACE ZONING

# Task 6

- The following slides supplement those presented on May 21, 2019
- Resources that supplement the May 21 presentation include:

# Howard County PlanHoward 2030

- [PlanHoward 2030](#) was adopted in 2012
- The plan guides decisions related to development, land preservation, changing demographic and employment trends, neighborhood sustainability, capital projects, County services and other key issues
- The plan is organized by a dozen related themes including Chapter 3: Environmental Protection and Chapter 6: Growth
- Each chapter contains policies and implementing actions
- In Chapter 3, there are several reference to flooding, Riparian Forest buffers, stormwater and watersheds

# Howard County PlanHoward 2030

- In chapter 3, several policies should be considered in terms of Task 3
  - Policy 3.2 – Reduce pollution loads to surface and groundwater
  - Policy 3.3 – Use watershed management plans to guide the protection and restoration of water resources
  - Policy 3.7 – Secure better protection of environmental resources within new developments
  - Policy 3.8 – Improve stormwater management practices throughout the County to help restore and protect water resources

# Open Space and Water Resources

- According to the [Environmental Protection Agency](#), preservation of open space can help to ensure adequate water resource protection (quality) when the open space is:
  - Large and continuous
  - Absorbent
  - Undisturbed/natural (i.e. soil not compacted)
  - Of high ecological value (wetlands, floodplains, riparian/river corridors)

# Open Space and Water Resources

- Benefits of continuous, absorbent, undisturbed open space:
  - This type of open space reduces and slows runoff (in small storm events), absorbs sediments, helps maintain aquatic communities
  - Provides habitat for plants and animals, places of natural beauty and community recreation areas

# Trees and Water Resources

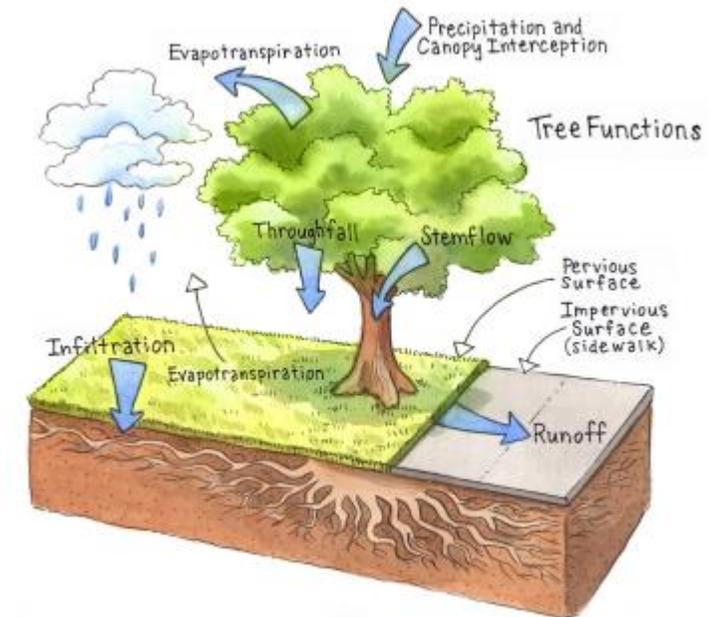
## i-Tree [Software and Analysis](#)

- i-Tree is a set of free tools built on science that quantifies the benefits and values of trees around the world
- i-Tree [Study](#) examines the estimated runoff avoided solely by the effect of trees
- While there is variance in the models, there is an established value for tree canopy interception of rainfall, which decreases with storm intensity



# Trees and Water Resources

- According to a [recent study in Charleston, South Carolina](#):
  - All other factors influencing runoff being equal (see next slide for factors), mature tree canopy can reduce the proportion of precipitation that becomes stream and surface flow
  - This reduction is more pronounced in low-intensity storms
  - Study modeled tree canopy capture rates under 24-hour storm scenarios (not flash flood scenarios)



Trees and the Water Cycle

# Factors Influencing Runoff

- In terms of flash flooding, keep in mind that:
  - All land has a saturation point for absorbing water – a variety of factors influence this point
  - In a high-intensity storm, runoff and flash flooding will occur when rainfall exceeds land's saturation point

## Major Factors Influencing Runoff

Hydrologic soil group – defined by surface infiltration rates and transmission rates of water through the soil profile, when thoroughly wetted

Land cover types

Soil compaction

Hydrologic condition – density of vegetative cover, surface texture, seasonal variations

Treatment – design or management practices that affect runoff

# Density and Water Resources

- According to the [Environmental Protection Agency](#), the pattern of development (with an emphasis on open space preservation) is more impactful to water resource protection than density
  - If denser developments consume/disturb less land than lower-density developments, then higher-density development can be used as a strategy for water resource protection (quality)
  - Development that uses land efficiently and protects undisturbed natural lands allows growth while still protecting water resources
    - This development pattern is often referred to as “cluster development” or “conservation development”

# Zoning and Water Resources

- According to [Naturally Resilient Communities](#) (a partnership of the American Planning Association and others) and [Subdivision Design And Flood Hazard Areas](#), zoning and subdivision regulations can reduce flood impacts by:
  - Keeping certain land uses out of vulnerable areas where they may be subject to or contribute to increased flood risk
  - Establish requirements for setbacks and buffers that promote overall health and effectiveness of natural flood protection
  - Establish retention requirements for keeping stormwater onsite
  - Avoid new development in the floodplain whenever feasible
  - Consider future conditions of the floodplain, including development impacts and climate change

# Reducing Flood Losses through Regulation

- According to a [FEMA study](#) in Colorado, higher regulatory standards can reduce flood losses. Best practices cited to have most impact on reducing flood losses included:
  - Requiring increased freeboard as part of design standards for properties in floodplains
  - Restricting floodplain development
  - Restricting construction of basements in new or expanded special flood hazard areas

# Howard County Zoning and Subdivision Information

- Howard County Zoning Regulations can be found [here](#)
- The Howard County Zoning map can be accessed through the [County's Interactive Map](#)
- The R-ED (Residential: Environmental Development) District can be found in [this section](#)
- Howard County Subdivision And Land Development Regulations are located [here](#)
- Several guides to the Howard County development process are found [here](#)

# Task 7



## **ANALYSIS OF CREATING A SPECIAL ASSESSMENT DISTRICT OR OTHER FUNDING MECHANISM**

# Task 7

- The following slides supplement those presented on May 21, 2019

# Howard County Watershed Protection Fee

- The [Watershed Protection Fee](#) funds projects that treat stormwater runoff and improve the stormwater infrastructure in Howard County to address water quality
- The Watershed Protection Fee is included on county real property tax bills
- In the Plumtree, this fee currently generates @ \$214,000 from residential properties and @ \$84,000 from non-residential properties
- In the Tiber/Hudson, this fee currently generates @ \$145,000 from residential properties and @ \$111,000 from non-residential properties

## Task 8



Any other matter that may assist the County in identifying and clarifying the various complex factors contributing to and in establishing a comprehensive plan for managing and controlling such factors to the maximum extent practicable to protect public safety, health, and welfare in the Watersheds

# Task 8

- No addendum material to supplement the presentation slides

# Resources



# Resources

- 2017 Valley Mede Drainage Study: Plumtree Branch and Little Plumtree Branch Presentation. November 15, 2017. <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=Dln-fxMRz-o%3d&portalid=0>
- Ellicott City Hydrology & Hydraulic (H&H) Study Presentation. May 31, 2017. <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=4lgjn7v8P-Y%3d&portalid=0>
- Ellicott City Hydrology/Hydraulic Study and Concept Mitigation Analysis. June 16, 2017. <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=t3mtiyi2qIg%3d&portalid=0>
- Howard County Stormwater Management Division. <https://www.howardcountymd.gov/Departments/Public-Works/Bureau-Of-Environmental-Services/Stormwater-Management>
- Schueler, Tom. *The Impervious Cover Model, Revisited (Again)*. Chesapeake Stormwater Network, Ellicott City, MD. April 12, 2018. <https://www.cwp.org/wp-content/uploads/2018/04/ICM-Revisited.pdf>
- US Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service. *NOAA Atlas 14. Precipitation-Frequency Atlas of the United State*. Silver Spring, MD. 2004, revised 2006. [https://www.nws.noaa.gov/oh/hdsc/PF\\_documents/Atlas14\\_Volume2.pdf](https://www.nws.noaa.gov/oh/hdsc/PF_documents/Atlas14_Volume2.pdf)
- Ellicott City Watershed Master Plan: Public Meeting Presentation. March 22, 2018. Mahan Rykiel et. al. [https://www.howardcountymd.gov/LinkClick.aspx?fileticket=-Zgvr7\\_nqHQ%3d&portalid=0](https://www.howardcountymd.gov/LinkClick.aspx?fileticket=-Zgvr7_nqHQ%3d&portalid=0)

# Resources

- United States Environmental Protection Agency, Office of Sustainable Communities Smart Growth Program, “Protecting Water Resources with Higher-Density Development:”  
<https://www.epa.gov/smartgrowth/protecting-water-resources-higher-density-development>
- Naturally Resilient Communities, a partnership of the American Planning Association, American Society of Civil Engineers, et. al., “Regulatory and Policy Approaches to Address Hazards:”  
<http://nrcsolutions.org/mapping-planning-regulation-regulatory-and-policy-approaches-to-address-hazards/>
- City of Charleston, Green Infrastructure Center, United States Forest Service, South Carolina Forestry Commission, “Trees to Offset Stormwater – Case Study 04: Charleston, South Carolina:”  
<https://www.charleston-sc.gov/DocumentCenter/View/19091>
- Federal Emergency Management Agency, “Final Report: Reducing Losses through Higher Regulatory Standards:” [https://www.fema.gov/media-library-data/1429759809776-2dobe16f764doe704aff1f7664334bao/FEMA\\_CO\\_BestPractices\\_Strategies.pdf](https://www.fema.gov/media-library-data/1429759809776-2dobe16f764doe704aff1f7664334bao/FEMA_CO_BestPractices_Strategies.pdf)
- Hirabayashi, Satoshi, “i-Tree Streets/Design/Eco Rainfall Interception Model Comparisons:”  
[https://www.itreetools.org/eco/resources/iTree Streets Design Eco Rainfall Interception Model Comparisons.pdf](https://www.itreetools.org/eco/resources/iTree%20Streets%20Design%20Eco%20Rainfall%20Interception%20Model%20Comparisons.pdf)
- National Weather Service Flood Return Period Calculator:  
[https://www.weather.gov/epz/wxcalc\\_floodperiod](https://www.weather.gov/epz/wxcalc_floodperiod)

# Resources

- Current Howard County Design Manual - Volume I Storm Drainage: <https://www.howardcountymd.gov/LinkClick.aspx?fileticket=oESSne3SxMA%3d&portalid=o&timestamp=1502312370559>
- Howard County General Plan, “PlanHoward 2030:” <https://www.howardcountymd.gov/Departments/Planning-and-Zoning/Community-Planning/General-Plan>
- American Planning Association, “Subdivision Design and Flood Hazard Areas:” <https://planning-org-uploaded-media.s3.amazonaws.com/publication/online/PAS-Report-584.pdf>
- Howard County Zoning Regulations: [https://library.municode.com/md/howard\\_county/codes/zoning](https://library.municode.com/md/howard_county/codes/zoning)
- Howard County Zoning map can be accessed through the County’s Interactive Map (to view, select ‘Planning and Zoning,’ and then select ‘Zoning’): <https://data.howardcountymd.gov/InteractiveMap.html>
- Howard County Zoning Regulations for the R-ED (Residential: Environmental Development) District: [https://library.municode.com/md/howard\\_county/codes/zoning?nodeId=HOWARD\\_CO\\_ZONING\\_REGULATIONS\\_S107.0REENDEDI](https://library.municode.com/md/howard_county/codes/zoning?nodeId=HOWARD_CO_ZONING_REGULATIONS_S107.0REENDEDI)
- Howard County Subdivision And Land Development Regulations: [https://library.municode.com/md/howard\\_county/codes/code\\_of\\_ordinances?nodeId=HOCOCO\\_TIT16PLZOSULADERE\\_SUBTITLE\\_1SULADERE](https://library.municode.com/md/howard_county/codes/code_of_ordinances?nodeId=HOCOCO_TIT16PLZOSULADERE_SUBTITLE_1SULADERE)
- Guides to the Howard County development process: <https://www.howardcountymd.gov/Departments/Planning-and-Zoning/Land-Development/Development-Process-and-Procedures>

# Resources

- Howard County Watershed Protection Fee: <https://www.cleanwaterhoward.com/watershed-protection-fee>
- NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: MD  
[https://hdsc.nws.noaa.gov/hdsc/pfds/pfds\\_map\\_cont.html?bkmrk=md](https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=md)
- The National Climate Assessment: Heavy Downpours Increasing.  
<https://nca2014.globalchange.gov/report/our-changing-climate/heavy-downpours-increasing#tab2-images>
- United States Environmental Protection Agency - Climate Change Impacts.  
[https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-northeast\\_.html#Precipitation%20and%20sea%20level](https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-northeast_.html#Precipitation%20and%20sea%20level)