

Town of Charlestown

Stormwater Vulnerability & Floodplain Management Assessment



	<u>Page</u>
1 Introduction	
<i>Acknowledgements</i>	
<i>Charlestown Green Team</i>	
<i>Funding</i>	
<i>Project Scope</i>	
<i>Outreach</i>	
2 Flooding Hazard and Vulnerability	
<i>Flood Hazards and Storm Surge</i>	
<i>Local Flooding - Areas of Concern</i>	
<i>Sea Level Rise and Increased Coastal Flood</i>	
3 Stormwater Vulnerability and Existing Conditions	
<i>Existing Town Data</i>	
<i>Inventory and Inspection Approach</i>	
<i>Inventory and Inspection Results</i>	
<i>Identified Areas of Improvement</i>	
4 Floodplain Management Regulations	
<i>Background</i>	
<i>Current Regulations</i>	
<i>Regulation Comparisons</i>	
<i>Suggested Revisions</i>	
5 Conclusions	
6 Maps	

1 - Introduction

Acknowledgements

This Town wide assessment was created over a 16-month period and involved the dedication of many people. Everyone listed served in some capacity, over time, to help create the document during the input, drafting, or final deliverable stage of the Report.

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Charlestown Green Team

The Town's Green Team leads the outreach efforts with the Environment related initiatives in the Community. This twenty-nine member team often partners with several local organizations and has volunteered over 1,257 hours of time in Charlestown. They provide a great service to the Town and Community by protecting the environment a little more with each initiative. Listed below are some of the initiatives completed within the past few years:



- ✓ Twice a year, Horticultural & Historic walking Tours of Charlestown are conducted and led by a local horticulturist and historian from the Colonial Charlestown Group.
- ✓ A STEAM/Green Fair is held annually at the Charlestown Elementary School. This initiative started in 2017 and has grown each year with many attendees and outreach partners.
- ✓ The Annual Cecil County Wade In Event was hosted by Charlestown hosted in 2017 and 2019.
- ✓ In 2017, a Rain Garden was installed at the Charlestown Elementary School and updated in 2019.
- ✓ Assisted with the Charlestown Elementary School installation of a Memorial Garden dedicated to Debbie, a beloved school secretary.
- ✓ Participates in the Lower Susquehanna River Sweep clean up in 2018 and 2019.
- ✓ Assisted with 4 weekly Community Invasive Species Classes offered by a local horticulturist that was held at the Perryville Library and co-sponsored by the Town of Perryville's Green Team.
- ✓ Assisted with a Native Plant Demonstration Garden design and installation in 2019 at Avalon Park as a result of a local Capstone Project with three Cecil County Watershed Stewards. Educational signage and community outreach events were also included in the project.
- ✓ Provided continued maintenance in 2016 for the Native Plant Shore Revetment Project.
- ✓ Provided "Green initiative" budgeted funding to control invasive species at the Long Point Native Plant Shore Revetment Project.
- ✓ Facilitated an educational Community Rain Barrel workshop on June 8, 2019.
- ✓ Placed "No Dumping, Drains to the Bay" educational awareness decals on storm drains in 2019.
- ✓ Facilitated a Nature Hike and Tree & Plant Identification Workshop for the Community.
- ✓ Partner with the local Girl Scout Troop to help with service projects throughout the town.
- ✓ Ongoing partnership with the Elk & North East River Association for community projects.
- ✓ Organized the installation of pet waste stations and the creation of the applicable Ordinance.

The Team has been successful in obtaining multiple grants and funding resources to initiate several projects. Continual funding with increased amounts will be required to initiate some of the implementation items within this document. With little to no available allocated funding, the Town of Charlestown continually works on environmental improvement initiatives dependent on the financial resources. Some of these are listed below:

- Currently updating multiple regulations, such as: zoning, subdivision, floodplain and critical areas.
- Maintaining the Street improvement plan as determined based on the annual budget allocations.
- Installed private driveway pipes to divert the drainage of water to the street infrastructure system.

Funding

As stated above, the Town of Charlestown continually searches for available funding resources to implement many projects. This is a continual effort and reviewed each year during the budget process when identifying the priority projects for the upcoming fiscal year. In regards to stormwater and drainage issues, the Town's approach has been a reactive and an as needed basis, this is due on lack of funding and resource availability as well as higher priority projects. The need to provide an existing condition analysis was imminent and is the first step to eventually preparing a priority project approach and capital plan.

The funding source for this project was provided by the State of Maryland's Department of Natural Resources-Chesapeake and Coastal Service. Maryland's Chesapeake & Coastal Service is a partnership among local, regional and state agencies. CCS collaborates with many private



organizations, such as local land trusts and economic development groups. Through this networked approach, no one agency or department is responsible for Maryland's entire coast. Rather, all partners help to ensure its proper management. Internally, six divisions and two Senior Policy Advisors contribute to CCS's functional goal to ensure that the expertise, tools and financial resources are used to their utmost capacity to address Chesapeake, coastal and ocean management priorities. CCS is comprised of six divisions: Conservation Education and Stewardship, Restoration Finance and Policy, Habitat Restoration and Conservation, Coastal and Marine Assessment, Geospatial Information and Analysis, and Management Services.

With the assistance from KCI Technologies Inc. (KCI), the Town of Charlestown submitted a *Letter of Interest* on January 26, 2018 to the State of Maryland, Department of Natural Resources-Chesapeake and Coastal Service for a Chesapeake Bay Implementation Grant. The Town's request solicited a better understanding of how to best protect its numerous coastal and riparian assets from current and future hazards (e.g., sea level rise, shoreline erosion, flooding) by compiling existing resources and data (e.g., Master Drainage Plan, floodplain hazard, sea level rise projections, increasing storm frequencies and intensities) to identify what is needed to protect the Town's assets. Information would be assessed and used to identify areas of vulnerability as well as prioritizing implementation items. The Town is also proposing the identification and exploration of BMPs in a number of areas to guide future planning and implementation efforts.



The Town received notification for the approval to move forward with their official grant application and submitted March 2, 2018 for \$40,000 in funding assistance to prepare a Town wide assessment for stormwater vulnerability and floodplain management regulations. KCI executed the followings tasks in preparation for the grant application: created the project scope and budget; coordinated and obtained community partner support letters; created the objectives, deliverables and schedule; completed watershed research; and reviewed previous town initiatives to meet the grant requirements.

On June 19, 2008 the Maryland Department of Natural Resources announced \$700,000 in Climate Resilience Grants to help communities prepare for and recover from climate-related impacts. The competitive grants were designed to help strengthen a community' ability to assess risk through planning and construct solutions to boost their capacity to withstand flooding and other weather-related events. The Town of Charlestown was awarded grant funding to develop a system wide inventory of the town's stormwater drainage system with a prioritized list of improvements. Evaluate the town's floodplain management regulations.

Project Scope

The Town has a number of project goals that have been identified related to an overall vulnerability assessment with the overarching goal of better understanding potential stormwater and floodplain hazards affecting Charlestown. These include the following:

1. Describing vulnerabilities within the existing stormwater system and areas where flooding has the potential to cause issues to the town;
2. Identifying the impacts that flooding have on the town and potential ways these impacts can be alleviated;
3. Providing tools and guides to better inform decision-makers on the current status of the town's systems as well as for implementation of their regulations; and
4. Educating both elected officials and the general public on the data gathered by the assessment as well as any resulting recommendations.

The funding from this contract supports the town in achieving these goals by completing a town-wide assessment (covering the entire town, or approximately 1.5 square miles) of flooding hazards, the stormwater drainage system, and floodplain regulations. The assessment will be utilized to update town mapping and regulations, and to inform future studies and implementation strategies. The project tasks are also complementary to a number of others outlined in the town's Comprehensive Plan and Sustainable Community Action Plan. The assessment report will have three main focus areas and provide specific outputs, as described below:

1. *Flooding hazards and vulnerability assessment*
 - Current flooding hazards (stormwater and riparian) identified and described
 - Potential future flooding hazards identified
 - Local Flooding - Areas of Concern
2. *Stormwater Vulnerability and Existing Conditions assessment*
 - Drainage structure inventory, database, and map
 - List of required and recommended maintenance items and replacement projects
 - One Green Team workshop
 - One outreach event to share project results
3. *Floodplain Management Regulations assessment*
 - Recommended revisions to the Floodplain District Zoning Regulations and/or Floodplain Management Regulations submitted for consideration to the Town
 - One workshop with a designated committee
 - One workshop with government officials and the general public
 - One community outreach event

Outreach

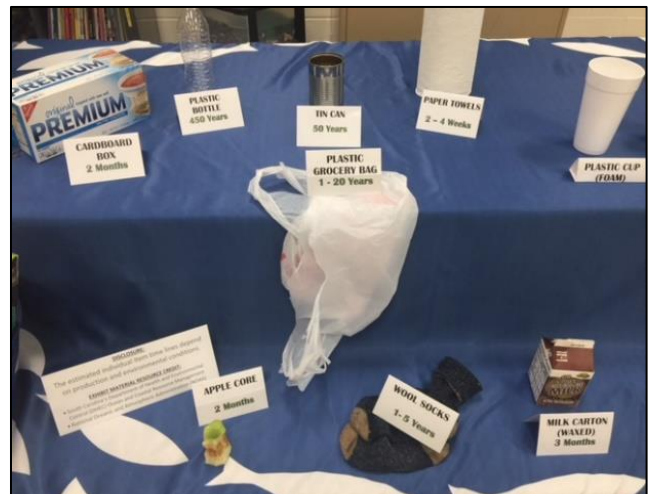
As with any successful project, community educational outreach is key to promoting an initiative, providing factual information and obtaining local input to meet the goals of the particular initiative. The result of the outreach can include receiving additional local data and recommendations that may lead into initiative decisions. Often community members may even change at least one of their patterns of behavior to assist in protecting the environment after attending educational outreach events and workshops.



This particular project scope included participation in two community outreach events to promote the town wide assessment project and increase education for littering awareness throughout the waterways. The town selected the two events listed below and KCI created and educational exhibit and facilitated the outreach events. The exhibit showcased a stormwater pipe with trash and debris along with items commonly found in the waterways with their average length of time to disintegrate.

STEAM Green Fest Friday, April 12

The 2nd Annual STEAM/Green Fest was held at the Charlestown Elementary School this year on Friday, April 12th with approximately 100 attendees and many program partners. This was the first year the event added Arts to the program, with the new title “STEAM” representing Science, Technology, Engineering, the Arts and Mathematics. Several exhibitors participated in the event and children of all ages enjoyed interactive learning and creating projects throughout the evening.



Cecil County Wade-In Event

The 10th Annual Cecil County Wade-In event was held in the Town of Charlestown this year on Saturday, June 15th with around 333 guests and several local and county officials. This annual event is organized by the Stormwater Management Division of the Cecil County Department of Public Works with a focus on local water quality and natural resources. Several exhibitors participated in the event and participants of all ages enjoyed interactive learning, live music, demonstrations, live animal exhibits and community fellowship throughout the day. The 1st Annual Wade in was held in Elk Neck State Park and retired Senator Bernie Fowler lead the group into the water for the first measurement. This year's water quality measurement was taken at Foot Log Beach.

Fun For All Ages!
Rain or Shine!
FREE!

10th Annual
CECIL COUNTY
Wade-In
Clear Water, Healthy Life!

Saturday, June 15, 2019
10:00 a.m. - 2:00 p.m.

Join us, as Charlestown welcomes us for our 10th Annual Wade-In! Come on out to this free event at the Foot Log Park Beach in Charlestown, and put up your pants legs and wade into the Upper Chesapeake Bay to measure water quality the way retired Maryland State Senator Bernie Fowler did 31 years ago with his "senator meter".

Parking is located at Charlestown Elementary with a free shuttle provided by Cecil Transit from the school to the event location.

Learn about:
Local watercraft
View native plants & natural paintings
Seine Netting & Fish ID
Live animals: Scuba & Tails
Prumpton Park & Zoo
Food Truck: Maryland In a Can
Drone Demonstration by the Cecil County Sheriff's Office

Call Steve McCaskey or Wendy Hughes at (410) 996-2222 for more information. No reservations needed!



2 - Flooding Hazards and Vulnerability

Flood Hazards & Storm Surge

The Federal Emergency Management Agency's (FEMA's) Flood Insurance Study (FIS) for Cecil County (2015) is part of a nationwide program to evaluate flood risk. Each FIS produces a map, called a Flood Insurance Rate Map (FIRM), depicting the geographic extent of flooding, referred to as a floodplain and the elevation of flood waters, referred to as the Base Flood Elevation (BFE) associated with a 1% Annual Chance Event. As described above, the 1% Annual Chance Event has a 1 in 100 chance of occurring in any given year. From a probability standpoint, there is a 63% chance of more than one 1% Annual Chance Event occurring in any 100-year timeframe and a 26% chance of occurring over the course of a 30-year mortgage.

In tidally influenced areas, like the Town of Charlestown, the FEMA FIRMs are based on the combined effects of storm surge and wave hazards. Storm surge is the rise of water above normal tide levels generated by a storm. Waves develop atop the storm surge due to wind, increasing the base flood elevation. The FIRMs describe the magnitude of waves throughout the floodplain using a zone designation of either VE or AE. Areas designated as Zone VE are expected to experience a wave height of 3 feet or greater during a 1% Annual Chance Event. In the Town, VE Zones are limited to areas immediately adjacent to the Northeast River. Areas designated as Zone AE are expected to experience a wave height between 0 and 3 feet. AE Zone areas can be further subdivided by a FIRM feature called the Limit of Moderate Wave Action (LiMWA), which delineates the location of the 1.5-foot wave height contour. Zone AE areas inland of the LiMWA have a wave height of 0 to 1.5 feet and Zone AE areas seaward of the LiMWA have a wave height between 1.5 and 3 feet.

Zone X are also shown on the FIRM, and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood. The areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood, are labeled Zone C or Zone X. A Special Flood Hazard Area (SFHA) is an area identified by the United States Federal Emergency Management Agency (FEMA) as an area with a special flood or mudflow, and/or flood related erosion hazard, as shown on a flood hazard boundary map or flood insurance rate map.

The FEMA FIS and resulting FIRM are based on modeling informed by historical storm behavior; therefore, the magnitude of the 1% Annual Chance Event in the Town is influenced by the size and frequency of storms that have already affected the area. The FEMA FIS also relies upon the existing conditions in the study area, including the following:

- Current sea level;
- State of the shoreline, which is subject to change due to storms and other natural processes or man-made alterations;
- Extent and health of marshlands, which can deteriorate with increasing sea levels;
- Density and extent of development, which are subject to change as a community develops over time; and
- Upland topography, which can subside gradually over time or change due to man-made alterations.

Note that these maps do not include changes that may result from sea level rise, weather patterns, or development. Changes to these conditions can influence how a storm affects an area and potentially change the 1% Annual Chance Event; consequently, FEMA recommends accounting for potential increases through regulations requiring freeboard and other flood mitigation actions.

Table 1. Flood Zone Information

Flood Zone	Town wide		Town Owned		
	Acres	No.		No.	
		Properties	Structures	Properties	Structures
AE	34.5	108	49	6	2
VE	6.8	39	5	2	0
X, 0.2%	6.8	66	21	5	1
TOTAL	48.1	213	75	13	3

Source: FEMA FIRM, KCI Analysis

Looking at the maps located in the rear of this document in the Appendix, **Map 1** provides a look of the floodplain at a town wide scale. **Map 2** provides a look at the floodplain focused on the coastal area and its floodplain limits.

In addition to just using this floodplain information, one can also use Sea, Lake, and Overland Surges from Hurricanes (SLOSH) modeling to evaluate potential flooding impacts. For Charlestown, the US Army Corps of Engineers generated SLOSH modeling that describes the flood extent and elevation associated with hurricanes ranging from category 1 through 4, as defined by the Saffir-Simpson scale. **Map 3** provides a look at this storm surge vulnerability at a town wide scale, while **Map 4** provides a focused look on the coastal area and anticipated storm surge limits.

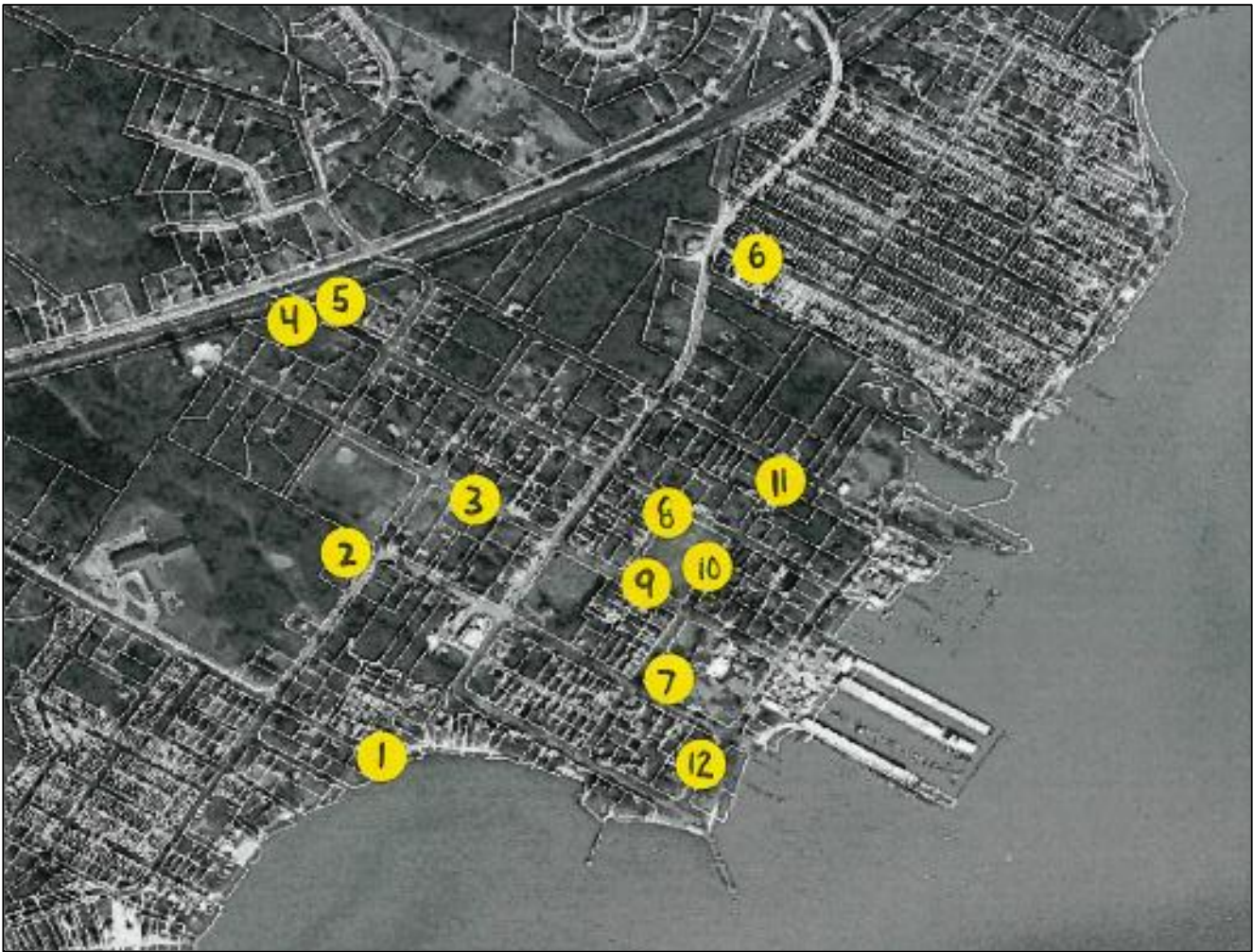


Local Flooding - Areas of Concern

During the outreach portion of the project, several local residents voiced their opinion regarding flooding within the Town limits. They were directed to provide these areas to the Town to ensure they are included in the assessment. During brief conversations with the residents and Town staff, it was further determined that some property owners and the Town have installed improvements to very specific properties. The feedback included that some of these drainage improvements may have impacted the neighboring properties and downstream drainage.

The Town staff collected flooding areas of concerns over the summer months and prepared the list and map shown below based on the feedback received by the residents:

1. Baltimore Street right-of-way, from 308 Baltimore Street to the North East River.
2. 493 Cecil Street, northwest of Structure 200 & Conveyance 202.
3. 333 Frederick Street to 340 Market Street, ending just north east of Conveyance 128.
4. 707 Caroline Street to 466 Frederick Street, starting around Structure 943 & ending northwest of Conveyance 1030.
5. 701 N Ogle Street, along Caroline Street, from railroad right-of-way & Structure 943, south east towards N Ogle Street.
6. 108 Edgewater Avenue.
7. 132 Market Street to Water Street, from Structure 160 to Structure 27 & Conveyance 37.
8. Caroline St & Cooper Ave intersection to Frederick St & Riverview Ave intersection, starting just north of Structure 875 & Conveyance 876.
9. Frederick St & Riverview Ave intersection to Water Street, to Conveyance 19.
10. Calvert St, half way between Caroline & Frederick Streets, to 520 Calvert Street, and then south to Water Street, ending at Structure 27 & Conveyance 37.
11. 726 Calvert St, from Calvert St to Water Street.
12. Water Street, from 429 Water St, to 407 Water St.



These areas may require additional investigation, interviews and research regarding any previous improvements. The information needed would include a list of projects, private and public improvements, any construction documents and neighbor input regarding potential impacts. Some of these identified problem areas may improve with cleaning out the structures and pipes that have visible evidence of excessive sedimentation or other clogging materials.

Sea Level Rise and Increased Coastal Flood

Worldwide sea level is rising and it has been documented that the rate of sea level rise has accelerated in recent decades. Responding to sea level rise requires careful consideration regarding whether and how particular areas will be protected with structures, elevated above the tides, relocated landward, or left alone and potentially given up to the rising waters.

This rise in ocean levels will affect the natural environment as well as the built environment. Sea level rise is expected to increase floodwater inundation, storm surge, coastal erosion, and other coastal hazards, thus threatening vital infrastructure, settlements, and facilities.

Nationally, most current coastal regulations and building codes do not accommodate sea level rise. Floodplain maps, which are used to guide development and building practices in hazardous areas, are generally based upon recent observations of topographic elevation and local mean sea level; however, these maps do not take into account sea level rise or possible increases in storm intensity. As a result, most shore protection structures are designed for current sea level and development policies that rely on setting development back from the coast are designed for current rates of coastal erosion and flood heights, not taking into account sea level rise. The prospect

of accelerated sea level rise underscores the need to rigorously assess vulnerability and examine the costs and benefits of taking adaptive actions.

Relative sea level rise is an important consideration in coastal floodplain management in both vertical and horizontal dimensions. Flood and wave crest elevations along a particular coast will rise commensurate with the rate of relative sea level rise. Floodwater inundation will also reach farther inland as sea level rises. Buildings constructed to be safe from flood levels today will not be safe in the future as sea levels continue to rise; thus, it is important to factor sea level rise into building elevation and site locations for the anticipated life of the building into local coastal floodplain regulations.

The 4th National Climate Assessment reported that global average sea level has risen by about 7-8 inches since 1900, with almost half this rise occurring since 1993 as oceans have warmed and land-based ice has melted. The reported rates of sea level rise are generally worldwide averages; however, sea level is highly variable from area to area. In addition, the worldwide averages consider solely the rise in sea level. Landmasses are also oftentimes rising or subsiding. Together, worldwide sea level rise coupled with the landmass movement constitute ‘relative sea level rise’.

In 2018, the University of Maryland Center for Environmental Science along with several project partners created the “Sea Level Projections for Maryland 2018” document. This document covers previous projections, rapidly development science, 2018 projections as well as practical use for adaptive planning. This document is a great resource to better understand Sea Level Rise specific to Maryland. This document can be found on the UMCES website, located here: <https://www.umces.edu/sea-level-rise-projections>:

Another local resource and partner is the Maryland Sea Grant, which is part of the University System of Maryland. They play an important role in the network of organizations working to preserve and restore the Chesapeake Bay and Maryland’s coastal waters. They provide educational information and detailed studies addressing coastal flooding and climate change. One example is the Chesapeake Quarterly magazine that explores scientific, environmental, and cultural issues relevant to the Chesapeake Bay and its watershed. The magazine is produced and funded by the Maryland Sea Grant College. In 2014, the Chesapeake Quarterly Volume 13, Number 2 & 3 specifically provides information on Sea level Rise and a special report titled “Come High Water: Sea Level Rise and Chesapeake Bay”. This document and additional resources can be found at this website link: <https://www.mdsg.umd.edu/topics/coastal-flooding/coastal-flooding-and-climate-change>



Specific to the Town of Charlestown and the surrounding area, the project included providing two vulnerability maps. Once again, looking at the **Map 5** located in the rear of this document in the Appendix, it provides a look at possible town wide sea level rise vulnerability, which ranges from 0 to 10 foot inundation. **Map 6** provides a focused look on the potential impacted area, mostly along the coastline, but with reaches along Conestoga Street and Edgewater Avenue. All maps can be located at the back of the document in a clear and legible format.

One of the largest concern is the large amount of vulnerable Historic properties in the Sea Level Rise and Floodplain areas. Preservation and protection of these valuable assets located in the Town limits requires research and identifying areas of improvements and funding to complete such initiatives. The Town provided a list of Historic Buildings within Flood Vulnerability and they can be found below. An exhibit map was also provided by the Town and can be found in the Appendix.

Name 1	Name 2	Address	Tax ID	Improvements Value	MHT Inventory #	Date of Construction	Type
Tory House	Supreme Development Company House	Market St	5061598	\$97,600	CE 386	18th century	Tavern
Barnes House	Paca House	Market St	5006120	\$115,900	CE 111	1740-1760	Dwelling
Eagle Point Gun Club		125 Conestoga St	5008514		CE 389	1810	Dwelling
Charlestown Wharf		Conestoga & Water Sts	N/A		CE 1297	18th century	Public Park
Still House	Thomas Haldes House	424 Water St	5007488	\$265,100	CE 393	1900/19th century	Dwelling
Wellwood Club		523 Water St	5010292	\$418,400	CE 394	19th century	Resort Hotel
Seamark Marina, Inc.		8 Louisa Ln	5123461	\$118,200	CE 395	19th century	Dwelling

3 - Stormwater Vulnerability and Existing Conditions

Existing Town Data

In May of 2005, the Town of Charlestown received a complete master drainage plan prepared by URS Corporation. This report included recommendations that fell into two categories: maintenance aspects and capital needs. The immediate recommendation included cleaning out the structures and pipes that have visible evidence of excessive sedimentation or other clogging such that their original carrying capacity is restored. Thirteen structures with locations were noted to be cleaned before they could be inspected. The regular on-going maintenance program of every structure was the second recommendation noted in the report. The report further provided specific long term maintenance items as well as multiple capital needs.

Inventory and Inspection Approach

Upon receiving the 2005 report and mapping shapefiles from the town, KCI reviewed the information prior to starting the field work. KCI provided inventory, inspection, and mapping for the municipal separate storm sewer (MS4) infrastructure located within the Town of Charlestown. The inspections were completed by field crews between January and April of 2019. Listed below is the equipment used, what was inspected and what data was collected:

The following equipment was used to inventory and inspect:

- Field data collection application called Collector for ArcGIS.
- Laptop computer.
- Global Positioning System (GPS) equipment that locates structures to within sub-meter accuracy.
- Pole-mounted camera technology that allows field crews to optically zoom 200 feet into pipes sized six inches to six feet in diameter, without having to perform confined space entry.



The infrastructure that was inventoried and inspected included the following:

- Stormwater point features, or structures (inlets, manholes, junction boxes, and outfalls).
- Conveyances (pipes, culverts, and swales).
- Best Management Practices (wet ponds and infiltration practices). Note: This data was copied from Cecil County's GIS database.

The following data was collected:

- Type, size, material, and photos.
- A rating for each structure and conveyance on a scale of Good, Fair, or Poor. Poor ratings were further identified and placed on the areas of improvement priority list.
- Previously collected storm drain inventory data (2005) was leveraged as a reference while in the field.

Existing conditions measurement scales were predetermined based on the following ratings:

- Good – Structure/Conveyance is in good condition and does not need require repair.
- Fair – Structure/Conveyance is in fair condition and may require repair in the near future.
- Poor – Structure/Conveyance is in poor condition and requires repair to be scheduled.
- Not Inspected – Structure/Conveyance was not inspected for a specific reason.

The project deliverables associated with the existing conditions assessment included the following:

1. An Excel database inventory spreadsheet of all BMP's, structures and conveyances (modified)
2. Inventory map book
3. Complete geodatabase and KMZ file
4. Identified areas of improvement (map, table and itemized list)

Item # 1 and #3 were provided electronically to the Town due to file size and content.

Inventory and Inspection Results

The infrastructure inventory and inspection included 317 structures as shown in Table 2 below. The total number of structures collected was an increase from the 239 structures previously collected in the 2005 assessment.

Table 2. Total Structures Inventoried/Inspected

Structure Type	Number of Structures Inspected	Number of Structures Not Inspected	Number of Points
Inlet	194	32	226
Manhole	87	6	93
Outfall	36	9	45
TOTAL STRUCTURES	317	47	364

During the inspections, several structures were not accessible and further identified on the master inventory spreadsheet. The justifications are provided in Table 3 below.

Table 3. Justification for Uninspected Structures

Justification	Number of Structures
Fence blocks access to structure	1
Filled with sediment/buried	3
Filled with sediment/debris	1
Filled with water/submerged	13
Grate/cover bolted shut	24
Grate/cover seized to frame	6
Pipe submerged/filled with water	1
Unable to locate/access structure	11
Not required	199
TOTAL	259

The infrastructure inventory and inspection included 41,353 linear feet of conveyances as shown in Table 4 below.

Table 4. Total Conveyances Inventoried/Inspected

Conveyance Type	Linear Feet (LF)	Number of Conveyances Inspected	Number of Conveyances Not Inspected
Pipe	25,347	337	48
Culvert	2,884	22	68
Swale	13,122	207	2
TOTAL	41,353	566	118

Again, several conveyances were not accessible and further identified on the master inventory spreadsheet. The justifications are provided in Table 5 below.

Table 5. Justification for Uninspected Conveyances

Justification	Number of Conveyances
Cannot inspect due to position of pipe in basin	1
Connecting structures not inspected	23
Filled with water/submerged	12
Not required	82
TOTAL	118

Table 6 below provided the overall ratings for those structure and conveyance inspections. Only thirty two were identified as rating Poor.

Table 6. Structure/Conveyance Ratings

Structure/Conveyance Type	Poor	Fair	Good
Inlet	9	4	182
Manhole	0	2	85
Outfall	3	0	34
Swale Point	1	0	149
Dummy Point	3	0	0
Pipe	13	36	288
Culvert	3	2	17
Swale	0	1	206
TOTAL STRUCTURES	32	45	961

Identified Areas of Improvement

During the inspection process, thirty two (32) structures and conveyances were found to be in Poor condition. As mentioned above, these are further identified as priority areas of improvement and include additional information. Each priority area is identified with the following information:

- Date.
- Address.
- Identification number.
- Priority (low or high).
- Structure or conveyance properties (size and material).
- Defect description.
- Defect photos.
- Location aerial map.

Furthermore, structures and conveyances rated in poor condition were prioritized in the following manner:

- Low – Requires attention but can be scheduled as time and resources permit.
- High – Requires immediate attention.

Recommended actions for the identified areas of improvement are categorized and listed below:

- *Structure/Conveyance full of debris* – Recommend flushing and vacuuming out until clean. Monitor for proper drainage after cleaning has occurred.
- *Separated Pipe Joints / Pipe damaged* – Recommend pipe replacement or repaired by lining problem areas. Recommended actions should be evaluated by a stormwater engineer.
- *Sinkholes* – Recommend further investigation be evaluated by a stormwater engineer to determine cause (s).
- *Grate/Frame Defects* – Recommend further investigation be evaluated by a stormwater engineer.

The identified areas of improvement are provided in three formats:

- Map
- Summary Table
- Detailed Descriptions

Town of Charlestown Identified Areas of Improvement



TOWN OF CHARLESTOWN
IDENTIFIED AREAS OF IMPROVEMENT – SUMMARY TABLE
(Organized By Priority High to Low)

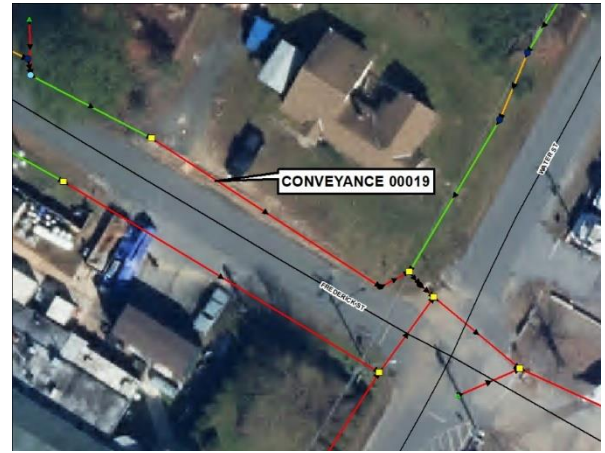
Date	Structure/ Conveyance ID No.	Address	Priority	Pipe Properties	Defect Description
01-08-19	Structure 00075	205 Conestoga Street	High	N/A	Bottom of pipe is missing; tire filled with concrete was placed on end of outfall blocking water from leaving system.
01-09-19	Structure 00103	424 Calvert Street	High	N/A	Cast iron grate placed on inlet does not support weight; no frame.
01-09-19	Structure 00160	132 Market Street	High	N/A	Grate bent in; side of grate broken off; no frame.
01-09-19	Structure 00166	Beach Road	High	N/A	Filled with leaves and water; no grate or frame (just sheet metal).
01-25-19	Structure 00184	333 Frederick Street	High	N/A	Backyard swale is flooded; outfall is submerged; sinkhole created around outfall and fencing is placed over top.
01-25-19	Structure 00336	Frederick Street (side of 601 N Ogle Street)	High	N/A	Grate does not sit properly in frame.
01-25-19	Structure 00338	708 North Ogle Street	High	N/A	Filled 90% with debris.
01-28-19	Structure 00408	Behind 137 Steamboat Court	High	N/A	Missing grate in construction zone.
03-26-19	Structure 00875	216 Caroline Street (across from)	High	N/A	End of pipe is buried and submerged.
03-27-19	Structure 00943	707 Caroline Street	High	N/A	Drainage leaves ROW and floods downstream backyards.
03-27-19	Structure 01056	Beach Road	High	N/A	Two foot sinkhole adjacent to a trailer, filled with water.
03-27-19	Structure 01057	Beach Road	High	N/A	Sinkhole formed adjacent to a trailer. 12" RCP in sinkhole, possibly abandoned. Second sinkhole a few feet down, on top of water.
03-27-19	Structure 01058	Beach Road	High	N/A	Sinkhole underneath trailer. Start of runoff heading towards trailer park downstream.
01-07-19	Conveyance 00014	523 Water Street	High	15" RCP	Pipe is 80% full of debris.
01-07-19	Conveyance 00019	613 Water Street	High	15" HDPE	Hole in top of exposed pipe.
01-07-19	Conveyance 00032	524 Water Street	High	21" RCP	Exposed pipe with joint separation.
01-07-19	Conveyance 00037	524 Water Street	High	15" CMP	CMP with hole in bottom.
01-07-19	Conveyance 00043	724 Water Street	High	15" CMP	CMP with hole in bottom.
01-16-19	Conveyance 00202	Cecil Street (front of 344 Market Street)	High	18" CMP	Pipe is 70% full of debris.

TOWN OF CHARLESTOWN
IDENTIFIED AREAS OF IMPROVEMENT – SUMMARY TABLE
(Organized By Priority High to Low)

Date	Structure/ Conveyance ID No.	Address	Priority	Pipe Properties	Defect Description
01-22-19 and 01-23-19	Conveyance 00277	231 Louisa Lane	High	8" CMP	Bottom of pipe is corroded and downstream end is misshapen. Joint separation in upstream end of pipe.
01-25-19	Conveyance 00340	708 North Ogle Street	High	12" CMP	Exposed pipe with joint separation that is also 70% filled with debris.
02-04-19	Conveyance 00596	Clemency Drive	High	36" CMP	Bottom of pipe is corroded.
03-26-19	Conveyance 00876	216 Caroline Street (across from)	High	12" CMP	Hole in top of pipe and a pipe segment is detached.
03-27-19	Conveyance 01030	Frederick Street	High	15" CMP	Bottom of a driveway culvert is corroded and missing.
03-27-19	Conveyance 01068	607 Cecil Street (side of)	High	18" CMP	Pipe is 70% full of debris.
01-07-19	Structure 00027	523 Water Street	Low	N/A	Missing material in side of wall.
01-16-19	Structure 00200	Cecil Street (front of 344 Market Street)	Low	N/A	Grate of structure is broken.
01-30-19	Structure 00512	Grace Road (side of 136 Cool Springs Drive)	Low	N/A	Closed drainage sinkhole forming directly behind structure.
01-09-19	Conveyance 00073	424 Calvert Street	Low	8" PVC	Joint separation in upstream end of conveyance near seal.
01-08-19	Conveyance 00074	205 Conestoga Street	Low	10" PVC	Joint separation.
01-09-19	Conveyance 00128	241 Market Street	Low	18" HDPE	Joint separation where pipe material changes.
01-23-19	Conveyance 00297	Chesapeake Road	Low	17x13 Arch CMP	Joint separation in bottom of pipe.

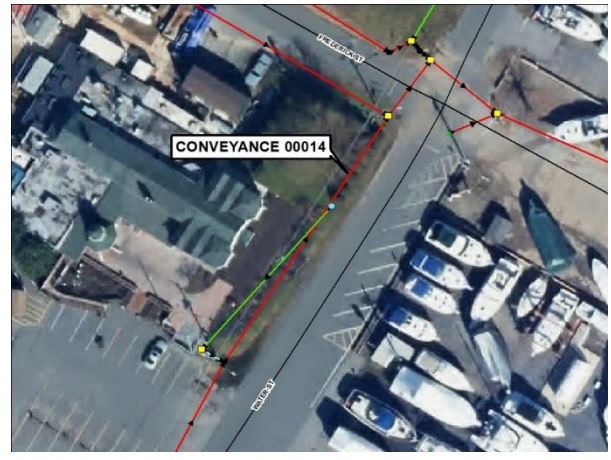
DATE: 01-07-19
CONVEYANCE ID: 00019
DEFECT DESCRIPTION: Hole in the top of an exposed pipe.
PRIORITY: High

ADDRESS: 613 Water Street
PROPERTIES: 15" HDPE
LOCATION:



DATE: 01-07-19
CONVEYANCE ID: 00014
DEFECT DESCRIPTION: Pipe is 80% full of debris.
PRIORITY: High

ADDRESS: 523 Water Street
PROPERTIES: 15" RCP
LOCATION:



DATE: 01-07-19
CONVEYANCE ID: 00032
DEFECT DESCRIPTION: Exposed pipe with joint separation.
PRIORITY: High

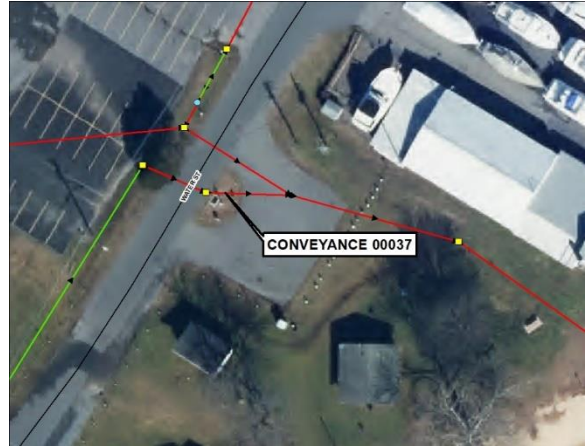
ADDRESS: 524 Water Street
PROPERTIES: 21" RCP
LOCATION:



DATE: 01-07-19
CONVEYANCE ID: 00037
DEFECT DESCRIPTION: CMP with hole in the bottom.
PRIORITY: High

ADDRESS: 524 Water Street
PROPERTIES: 15" CMP

LOCATION:



DATE: 01-07-19
CONVEYANCE ID: 00043
DEFECT DESCRIPTION: CMP with hole in the bottom.
PRIORITY: High

ADDRESS: 724 Water Street
PROPERTIES: 15" CMP

LOCATION:



DATE: 01-07-19
STRUCTURE ID: 00027
DEFECT DESCRIPTION: Missing material in the side of the wall.
PRIORITY: Low

ADDRESS: 523 Water Street
PROPERTIES: N/A

LOCATION:



DATE: 01-08-19
CONVEYANCE ID: 00074
DEFECT DESCRIPTION: Joint separation.
PRIORITY: Low

ADDRESS: 205 Conestoga Street
PROPERTIES: 10" PVC

LOCATION:



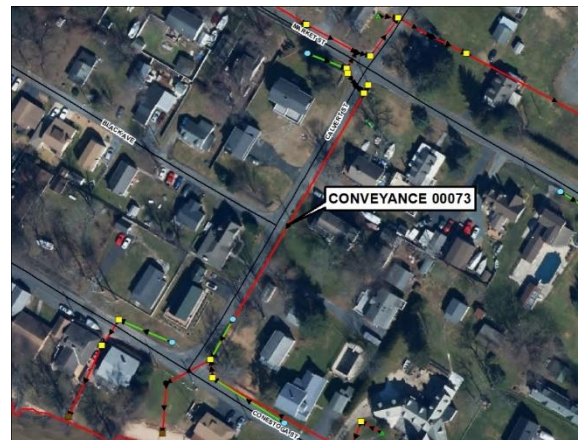
DATE: 01-08-19
STRUCTURE: 00075
PRIORITY: High
DEFECT DESCRIPTION: Bottom of the pipe is missing.
DEFECT DESCRIPTION: A tire filled with concrete was placed on the end of the outfall blocking water from leaving the system.

ADDRESS: 205 Conestoga Street
PROPERTIES: N/A
LOCATION:



DATE: 01-09-19
CONVEYANCE ID: 00073
DEFECT DESCRIPTION: Joint separation in the upstream end of the conveyance near the seal.
PRIORITY: Low

ADDRESS: 424 Calvert Street
PROPERTIES: 8" PVC
LOCATION:



DATE: 01-09-19
CONVEYANCE ID: 00128
DEFECT DESCRIPTION: Joint separation where the pipe material changes.
PRIORITY: Low

ADDRESS: 241 Market Street
PROPERTIES: 18" HDPE
LOCATION:



DATE: 01-09-19
STRUCTURE ID: 00103
DEFECT DESCRIPTION: Cast iron grate placed on inlet does not support weight, no frame.
PRIORITY: High

ADDRESS: 424 Calvert Street
PROPERTIES: N/A
LOCATION:



DATE: 01-09-19
STRUCTURE ID: 00160
DEFECT DESCRIPTION: Grate bent in, side of grate broken off, and no frame.
PRIORITY: High

ADDRESS: 132 Market Street
PROPERTIES: N/A
LOCATION:



DATE: 01-09-19 **ADDRESS:** Beach Road
STRUCTURE ID: 00166 **PROPERTIES:** N/A
DEFECT DESCRIPTION: Filled with leaves/water, no grate or frame (just sheet metal resting on top).
PRIORITY: High **LOCATION:**



DATE: 01-16-19 **ADDRESS:** Cecil Street (front of 344 Market Street)
CONVEYANCE ID: 00202 **PROPERTIES:** 18" CMP
DEFECT DESCRIPTION: Pipe is 70% full of debris.
PRIORITY: High **LOCATION:**



DATE: 01-16-19 **ADDRESS:** Cecil Street (front of 344 Market Street)
STRUCTURE ID: 00200 **PROPERTIES:** N/A
DEFECT DESCRIPTION: Grate of the structure is broken.
PRIORITY: Low **LOCATION:**



DATE: 01-22-19 & 01-23-19
CONVEYANCE ID: 00277
PRIORITY: High

ADDRESS: 231 Louisa Lane
PROPERTIES: 8" CMP
LOCATION:

DEFECT DESCRIPTION:
Bottom of the pipe is corroded and downstream end is misshapen.

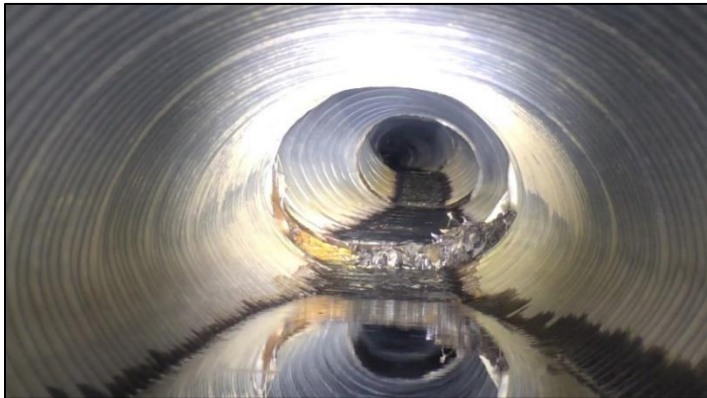


DEFECT DESCRIPTION:
Joint separation in the upstream end of the pipe.



DATE: 01-23-19
CONVEYANCE ID: 00297
DEFECT DESCRIPTION: Joint separation in the bottom of the pipe.
PRIORITY: Low

ADDRESS: Chesapeake Road
PROPERTIES: 17"x13" Arch CMP
LOCATION:



DATE: 01-25-19
CONVEYANCE ID: 00340
DEFECT DESCRIPTION: Exposed pipe with joint separation that is also 70% filled with debris.
PRIORITY: High

ADDRESS: 708 North Ogle Street
PROPERTIES: 12" CMP
LOCATION:



DATE: 01-25-19

ADDRESS: 333 Frederick Street

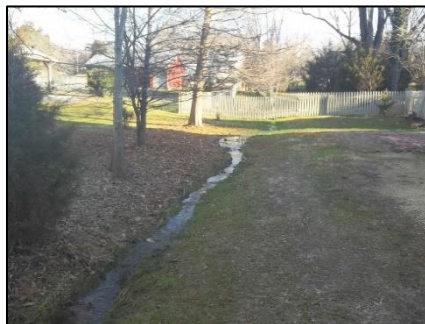
STRUCTURE ID: 00184

PROPERTIES: N/A

DEFECT DESCRIPTION: Outfall is submerged, sinkhole created around the outfall and fencing is placed over top. Backyard swale is flooded and water discharges onto the roadway.

PRIORITY: High

LOCATION:



DATE: 01-25-19 **ADDRESS:** Frederick Street (side of 601 N Ogle Street)
STRUCTURE ID: 00336 **PROPERTIES:** N/A
DEFECT DESCRIPTION: Grate does not sit properly in the frame.
PRIORITY: High **LOCATION:**



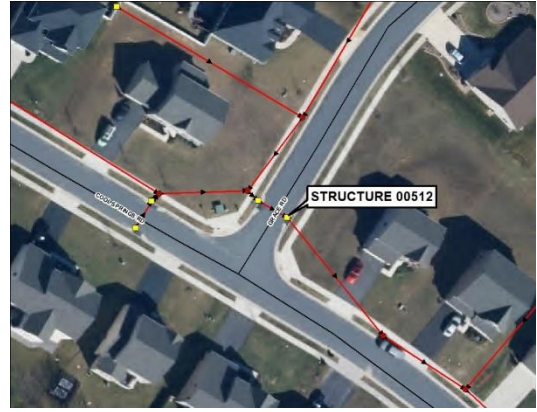
DATE: 01-25-19 **ADDRESS:** 708 North Ogle Street
STRUCTURE ID: 00338 **PROPERTIES:** N/A
DEFECT DESCRIPTION: Filled 90% with debris
PRIORITY: High **LOCATION:**



DATE: 01-28-19 **ADDRESS:** Behind 137 Steamboat Court
STRUCTURE ID: 00408 **PROPERTIES:** N/A
DEFECT DESCRIPTION: Missing grate in construction zone.
PRIORITY: High **LOCATION:**



DATE: 01-30-19 **ADDRESS:** Grace Road (side of 136 Cool Springs Drive)
STRUCTURE ID: 00512 **PROPERTIES:** N/A
DEFECT DESCRIPTION: Closed drainage sinkhole forming directly behind structure.
PRIORITY: Low **LOCATION:**



DATE: 02-04-19 **ADDRESS:** Clemency Drive
CONVEYANCE ID: 00596 **PROPERTIES:** 36" CMP
DEFECT DESCRIPTION: The bottom of the pipe is corroded.
PRIORITY: High **LOCATION:**



DATE: 03-26-19 **ADDRESS:** 216 Caroline Street (across from)
CONVEYANCE ID: 00876 **PROPERTIES:** 12" CMP
PRIORITY: High **LOCATION:**

DEFECT DESCRIPTION:
 Hole in the top of the pipe.



DEFECT DESCRIPTION:
 A pipe segment is detached.



DATE: 03-26-19
STRUCTURE ID: 00875
DEFECT DESCRIPTION: End of pipe is both buried and submerged.
PRIORITY: High

ADDRESS: 216 Caroline Street (across from)
PROPERTIES: N/A
LOCATION:



DATE: 03-27-19
CONVEYANCE ID: 01030
DEFECT DESCRIPTION: Bottom of a driveway culvert is corroded and is now missing.
PRIORITY: High

ADDRESS: Frederick Street
PROPERTIES: 15" CMP
LOCATION:



DATE: 03-27-19
CONVEYANCE ID: 01068
DEFECT DESCRIPTION: Pipe is 70% full of debris.
PRIORITY: High

ADDRESS: 607 Cecil Street (side of)
PROPERTIES: 18" CMP
LOCATION:



DATE: 03-27-19

STRUCTURE ID: 00943

DEFECT DESCRIPTION: Drainage leaves right-of-way and floods downstream backyards.

PRIORITY: High

ADDRESS: 707 Caroline Street

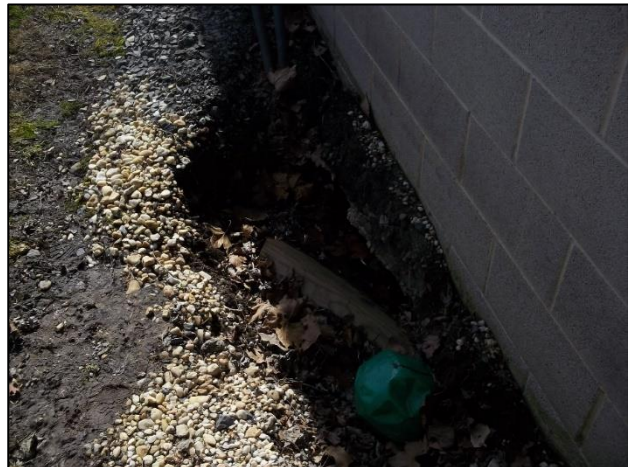
PROPERTIES: N/A

LOCATION:



DATE: 03-27-19
STRUCTURE ID: 01056
DEFECT DESCRIPTION: 2 foot sinkhole adjacent to a trailer, filled with water.
PRIORITY: High

ADDRESS: Beach Road
PROPERTIES: N/A
LOCATION:



DATE: 03-27-19
STRUCTURE ID: 01057
PRIORITY: High

ADDRESS: Beach Road
PROPERTIES: N/A
LOCATION:

DEFECT DESCRIPTION:

- 1) Sinkhole formed adjacent to a trailer. 12" RCP in the sinkhole, possibly abandoned.



DEFECT DESCRIPTION:

- 2) Second sinkhole a few feet down, on top of the water.



DATE: 03-27-19
STRUCTURE ID: 01058
DEFECT DESCRIPTION: Sinkhole underneath trailer. Start of runoff heading towards trailer park downstream.
PRIORITY: High

ADDRESS: Beach Road
PROPERTIES: N/A

LOCATION:



4 - Floodplain Management Regulations

Background

By the year 2000, flood damages in the U.S. approached \$6 billion annually and the trend of increased disaster costs was continuing into the first decade of the 21st century. In 2005, Hurricane Katrina alone caused 1,300 deaths and more than \$120 billion in flood damage¹. The National Flood Insurance Program (NFIP) minimum requirements alone will not reverse this trend because they do not take into account future conditions, do not address all coastal hazards, and do not protect against large flood or storm surge events¹. The NFIP has paid over \$36 billion in claims since 1978 and has over 6 million policies in force in more than 20,600 participating communities². Even with wide-spread public predictions of a more-than-likely significant rise in the rate of relative sea level and potentially more intense and perhaps increased frequency of major coastal storms, coastal floodplains continue to attract extensive development. FEMA's Deputy Associate Administrator for Insurance and Administration stated, in part, "Communities must proactively take steps to reduce risks based on their own knowledge of local risks. It is the local implementation of risk reduction programs that make the difference."³ Through the implementation of local floodplain ordinances alone, it is estimated that \$1.1 billion in flood damages are prevented annually."

The National Flood Insurance Program (NFIP) was created in 1968 as a way to offer an alternative to disaster assistance for properties subject to flood damage. In return for federally supported flood insurance, local governments had to agree to regulate development in their floodplains in accordance with the Program's criteria. Since 1979, the Program has been administered by the Federal Emergency Management Agency (FEMA).

As an insurance-driven program, the NFIP is funded by insurance premiums, not tax dollars. The program is focused on protecting all new and substantially improved buildings. It sets minimum floodplain management standards that protect these buildings. As a result, buildings in the floodplain that meet the NFIP standards suffer 80% less flood damage than buildings constructed before the requirements went into effect⁴.

While the minimum requirements of the NFIP protect the public health, safety, and welfare of the community by protecting buildings from the 1% annual chance flood (also known as the base or 100-year flood), the program was not intended to address other floodplain management concerns. Regulations that just meet the minimum NFIP requirements do not protect property from the greater than 1% annual chance floods and floods that occur outside the mapped Special Flood Hazard Area. While buildings can be built to minimize 1% annual chance flood damage, people may still be exposed to flood hazards, especially residents of flood prone homes who cannot get out in time.

The emphasis in coastal floodplain management has historically relied on structural measures, such as dikes, levees, and seawalls as well as post-disaster recovery. In more recent times, however, focus has shifted toward developing disaster-resistant building alternatives and pre-disaster mitigation planning. With the massive migration of the nation's population toward coastal communities continuing and anticipated to accelerate, the Association of State Floodplain Managers (ASFPM) is championing 'no adverse impact' floodplain management as a major national initiative. The only way to achieve a true meaning of 'no adverse impact' is to prohibit all development in the floodplain. Flooding is a natural event whose adverse impacts are exacerbated by human

¹ Association of State Floodplain Managers, May 2007, Coastal No Adverse Impact Handbook

² FEMA, September 2008, National Flood Insurance Disaster News

³ Maurstad, 2007, Natural Hazards Observer

⁴ FEMA Region 10

development. Any construction in the floodplain will alter the land surface and interfere to varying degrees with floodwater flow, often causing unanticipated adverse impacts to the developed and natural environment.

In light of this, the ASFPM called for a renewed direction and approach to floodplain management that called for preventing new development from encroaching on flood prone and environmentally sensitive areas and removing existing development from flood prone and environmentally sensitive areas wherever possible. The right to appropriately and safely develop property in the floodplain and along the coast is however, clearly recognized; thus, prohibiting development in specific, limited areas and permitting appropriately sited and constructed development while preserving the natural and beneficial functions of coastal floodplains is a balance to achieve. Accordingly, it is a good practice (and FEMA recommends) that communities consider the NFIP as a starting point and adopt higher regulatory standards that better meet local needs.

Current Regulations

The Town’s current Floodplain Management Ordinance was adopted on April 14, 2015 and went into effect on May 4, 2015. It follows the Maryland Model Floodplain Management Ordinance, which was prepared by the Maryland Department of the Environment in response to the requirement that local jurisdictions adopt regulations that fully comply with the requirements of the National Flood Insurance Program (NFIP). The requirement to update these regulations was triggered by the May 4, 2015 revisions to the Cecil County Flood Insurance Study (FIS) and associated Flood Insurance Rate Maps (FIRMs).

Regulation Comparisons

As part of this assessment, the Charlestown Floodplain Management Ordinance was reviewed against a number of model regulations produced by the Maryland Department of the Environment, FEMA, and the NFIP requirements, as well as the floodplain regulations of the Town of Elkton and Cecil County. The following tables provide a synopsis of the components of the various documents.

Table 2. Floodplain Management Regulations Comparison

Topic	Charlestown	Elkton	Cecil County	MDE Model	FEMA Model	NFIP Reqs.
Findings	X	X	X	X	X	
Statutory Authority	X	X	X	X	X	X
Purpose	X	X	X	X	X	X
Applicability	X	X	X	X	X	X
Basis for Establishment	X	X	X	X	X	
Abrogation & Greater Restrictions	X	X	X	X	X	X
Interpretation	X	X	X	X	X	
Warning/Liability Disclaimer	X	X	X	X	X	X
Severability	X	X	X	X	X	X
Definitions	X	X	X	X	X	X
Designation of Floodplain Administrator	X	X	X	X	X	X
Duties & Responsibilities of Floodplain Administrator	X	X	X	X	X	X
Use & Interpretation of FIRMs	X	X	X	X	X	
Permits Required & Expiration	X	X	X	X	X	X
Application Contents	X	X	X	X		
New Technical Data	X	X	X	X	X	X
Review of Application	X	X	X	X		
Inspections	X	X	X	X		
Submissions Required Prior to Final Inspection	X	X	X	X	X	
Application of Requirements	X	X	X	X		X

Subdivision & Development Proposals	X	X	X	X	X	X
Protection of Water Supply & Sanitary Sewage Systems	X	X	X	X		X
Buildings & Structures	X	X	X	X	X	
Placement of Fill	X	X	X	X		
Historic Structures	X	X	X	X		
Manufactured Homes	X	X	X	X	X	X
Recreational Vehicles	X	X	X	X		X
Critical & Essential Facilities	X	X	X	X	X	
Temporary Structures & Temporary Storage	X	X	X	X		
Hazardous Materials					X	
Gas or Liquid Storage Tanks	X	X	X	X		
Functionally Dependent Uses	X	X	X	X		
Requirements in A Zones that are not V Zones or Coastal A Zones						
<i>General Requirements</i>	X	X	X	X		X
<i>Flood Protection Setbacks</i>	X	X	X	X		
<i>Development that Affects Flood-Carrying Capacity of Nontidal Waters of the State</i>	X	X	X	X		
<i>Residential Structures & Residential Portions of Mixed Use Structures</i>	X	X	X	X		
<i>Nonresidential Structures & Nonresidential Portions of Mixed Use Structures</i>	X	X	X	X		
<i>Accessory Structures</i>	X	X	X	X		
Requirements in V Zones and Coastal A Zones						
<i>General Requirements</i>	X		X	X		
<i>Location & Site Preparation</i>	X		X	X		
<i>Residential & Nonresidential Structures</i>	X		X	X		X
<i>Horizontal Additions to Structures</i>	X		X	X		
<i>Accessory Structures</i>	X		X	X		
<i>Other Structures & Development</i>	X		X	X		
Variances						
<i>General</i>	X	X	X	X	X	
<i>Application</i>	X	X	X	X	X	
<i>Considerations</i>	X	X	X	X	X	X
<i>Limitations for Granting</i>	X	X	X	X	X	
<i>Fees</i>			X			
Enforcement						
<i>Compliance Required</i>	X	X	X	X	X	X
<i>Notice of Violation & Stop Work Order</i>	X	X	X	X		
<i>Violations & Penalties</i>	X	X	X	X	X	X
<i>Subsequent Amendments & Effective Date</i>	X	X	X	X		

Table 3. Floodplain Management Definitions Comparison

Definition	Charlestown	Elkton	Cecil County	MDE Model	FEMA Model	NFIP Reqs.
Accessory Structure	X	X	X	X	X	

Agreement to Submit an Elevation Certificate	X	X	X	X		
Alteration of a Watercourse	X	X	X	X		X
Area of Shallow Flooding	X	X	X	X		
ASCE 24						X
Base Building	X	X	X	X	X	X
Base Flood	X	X	X	X	X	
Base Flood Elevation	X	X	X	X	X	
Basement	X	X	X	X	X	
Breakaway Wall			X			
Building Code(s)	X	X	X	X		X
Coastal A Zone	X		X	X		
Coastal High Hazard Area	X		X	X		
Community	X	X	X	X		
Critical and Essential Facilities	X	X	X	X	X	
Declaration of Land Restriction (Nonconversion Agreement)	X	X	X	X		
Development	X	X	X	X	X	X
Dry Floodproofing					X	
Elevation Certificate	X	X	X	X	X	
Enclosure Below the Lowest Floor	X	X	X	X		
Encroachment						X
Federal Emergency Management Agency (FEMA)	X	X	X	X	X	
Flood or Flooding	X	X	X	X		
Flood Damage-Resistant Materials	X	X	X	X		
Flood Insurance Rate Map (FIRM)	X	X	X	X	X	
Flood Insurance Study (FIS)	X	X	X	X	X	
Flood Opening	X	X	X	X		
Flood Protection Elevation (FPE)	X	X	X	X	X	
Flood Protection Setback	X	X	X	X		
Flood Zone	X	X	X	X		
Zone A	X	X	X	X	X	
Zone AE and Zone A1-30	X	X	X	X	X	
Zone AH and Zone AO	X	X	X	X	X	
Zone B and Zone X (shaded)	X	X	X	X	X	
Zone C and Zone X (unshaded)	X	X	X	X	X	
Zone VE and Zone V1-30	X	X	X	X	X	
Floodplain	X	X	X	X		
Flood proofing or Flood proofed	X	X	X	X		
Flood proofing Certificate	X	X	X	X		
Floodway	X	X	X	X	X	
Floodway Fringe			X			
Freeboard	X		X			
Free-of-Obstruction	X		X	X		
Functionally Dependent Use	X	X	X	X	X	X
Highest Adjacent Grade	X	X	X	X		
Historic Structure	X	X	X	X	X	
Hydrologic and Hydraulic Engineering Analyses	X	X	X	X		
Impervious Surface					X	

Letter of Map Change (LOMC)	X	X	X	X		
Letter of Map Amendment (LOMA)	X	X	X	X		
Letter of Map Revision (LOMR)	X	X	X	X		
Conditional LOMR (CLOMR)	X	X	X	X		
Licensed	X	X	X	X		
Limit of Moderate Wave Action (LiMWA)	X	X		X		
Lowest Floor	X	X	X	X	X	
Manufactured Home	X	X	X	X	X	X
Manufactured Home Park or Subdivision						X
Market Value	X	X	X	X		
Maryland Department of the Environment (MDE)	X	X	X	X		
Mixed-use Structure	X			X		
National Flood Insurance Program (NFIP)	X	X	X	X		
NAVD			X			
New Construction	X	X	X	X	X	
NFIP State Coordinator	X	X	X	X		
Nontidal Waters of the State	X	X	X	X		
Person	X	X	X	X		
Recreational Vehicle	X	X	X	X	X	X
Special Flood Hazard Area (SFHA)	X	X	X	X	X	
Start of Construction	X	X	X	X	X	
Structure	X	X	X	X	X	
Substantial Damage	X	X	X	X	X	
Substantial Improvement	X	X	X	X	X	
Temporary Structure	X	X	X	X		
Variance	X	X	X	X	X	X
Violation	X	X	X	X		X
Watercourse	X	X	X	X		X
Waters of the State	X	X	X	X		
Wetland			X			
Zone					X	

Suggested Revisions

Based on reviewing Charlestown’s current Floodplain Management Regulations and the comparisons noted previously, several suggestions are provided below in terms of revisions that could be made. It should be noted that any changes to the Town’s Floodplain Management Regulations must be reviewed by MDE prior to adoption to ensure that they are in compliance with FEMA and NFIP requirements. In addition, MDE created supplements to the Maryland Model Floodplain Management Ordinance. The Model Resource version that identifies where specific NFIP or Maryland regulations for pertinent provisions can be found along with comparable requirements in the building code or ASCE 24. It also identifies what provisions might qualify for additional points through FEMA’s Community Rating System (CRS). The Model Resource version is also cross referenced to explanatory Model Notes that identify if a provision exceeds NFIP minimum requirements, as well as providing explanations for some provisions.

Short Term

- Remove Sec. 3.2 (F) – the Town is not subject to Coastal Barrier Resource System provisions
- Suggest seeking more recent MDE/FEMA/legal guidance regarding keeping the underlined language in Sec. 7.1, “The CHARLESTOWN BOARD OF APPEALS shall notify, in writing, any applicant to whom a variance is granted to construct or substantially improve a building or structure with its lowest floor below the elevation required by these regulations that the variance is to the floodplain management requirements of these regulations only, and that the cost of Federal flood insurance will be commensurate with the increased risk, with rates up to \$25 per \$100 of insurance coverage.”
- Consider adding the definitions found below under “Suggested Definitions to Add”

Medium Term

- In Sec. 4.11 regarding gas or liquid storage tanks, consider changing the minimum requirements for above-ground tanks to be *above* the base flood elevation, rather than *at or above*
- Consider increasing the elevation required for Critical and Essential Facilities in Sec. 4.9 (B)

Long Term

- Consider strengthening the requirements of Sec. 6.0 in regard to those properties that fall seaward of the LiMWA
- Consider increasing the Flood Protection Elevation to take into account effects of storm surge and future effects of sea level rise

Suggested Definitions to Add:

- Actual Cash Value (ACV) – The cost to replace an insured item of property at the time of loss, less the value of physical depreciation.
- Anchored – Adequately secured to prevent flotation, collapse, or lateral movement.
- Breakaway Wall – A wall that is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces, without causing damage to the elevated portion of the building or supporting foundation system.
- Crawlspace – An under-floor space that has its interior floor area (finished or not) no more than 5 feet below the top of the next-higher floor. Crawlspaces generally have solid foundation walls. See Diagram 8 in the Elevation Certificate Instructions.
- Dry Flood proofing – Any combination of structural and non-structural measures that prevent floodwaters from entering a structure.
- Elevated Building – A building that has no basement and that has its lowest elevated floor raised above ground level by foundation walls, shear walls, posts, piers, pilings, or columns. Solid (perimeter) foundation walls are not an acceptable means of elevating buildings in V and VE zones.
- Encroachment – An addition to or change to the physical condition of a specified type of flood hazard area that results in the blockage, diversion, or displacement of floodwaters.
- Erosion – The collapse, undermining, or subsidence of land along the shore of a lake or other body of water.
- Floodplain Management – The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to, emergency preparedness plans, flood-control works, and floodplain management regulations.
- Freeboard – An additional amount of height above the Base Flood Elevation used as a factor of safety (e.g., 2 feet above the Base Flood) in determining the level at which a structure’s lowest floor must be elevated or flood proofed to be in accordance with floodplain management regulations.

- Grade Elevation – The lowest or highest finished ground level that is immediately adjacent to the walls of the building.
- Impervious Surface – Surfaces that resist penetration by water.
- Improvements and Betterments – Fixtures, alterations, installations, or additions made or acquired solely at an owners or tenant’s expense and comprising part of an insured building.
- Map Revision – A change in the Flood Insurance Rate Map (FIRM) for a community, which reflects revised zone, base flood, or other information.
- NAVD – North American Vertical Datum of 1988 Plane; Elevation datum currently used by FEMA for the determination of flood elevations.
- Sheet Flow Hazard – A type of flood hazard with flooding depths of 1 to 3 feet that occurs in areas of sloping land. The sheet flow hazard is represented by the zone designation AO on the FIRM.
- Unfinished Area – An enclosed area that is used for the parking of vehicles, building access, or storage purposes and that does not meet the definition of a finished (habitable) area. Drywall used for fire protection is permitted in unfinished areas.
- Zone – A geographical area shown on a Flood Insurance Rate Map (FIRM) that reflects the severity or type of flooding in the area.

Intergovernmental Coordination

Cecil County completed its first Cecil County Green Infrastructure Plan and received approval in August 2019. The Plan included partners such as: The Conservation Fund, MD Department of Natural Resources, Susquehannock Wildlife Society and Jean K. Akers, AICP, PLA. This Plan incorporated information from several County Plans:

- Comprehensive Plan
- Hazard Mitigation Plan
- LPPR Plan
- Land Preservation, Parks and Recreation Plan

The Town should continue to work closely with the Cecil County and consider partnerships for funding future initiatives, when eligible and monitoring their implementation activity to benefit the Town on a local level.

5 - Conclusions

Some items may not be accomplished immediately and will take years to achieve, but all items are strategic and should be pursued as soon as possible. The recommendations are not in any specific order and will be considered for implementation based on available funding and resources as well as priority initiatives established by the local Municipal leaders.

The majority of these items will require funding assistance to initiate; however, the Town could partner with organizations and other government agencies to meet grant requirements for these improvements in relation to water quality issues.

Flooding Hazards and Vulnerability Assessment Recommendations

1. Community and Town Leader outreach and education opportunities are recommended as one of the highest priorities. Three specific workshop topics could be considered in the near future for a better public understanding- Floodplain 101, Hurricane Storm Surge & Proper Preparations, Sea Level Rise-In and Around Charlestown. Several partner organizations may assist in facilitating these educational workshops.
2. Identified flooding areas of concern may require additional investigation, interviews and research regarding any previous improvements. The information needed would include a list of projects, private and public improvements, any construction documents and neighbor input regarding potential impacts. Some of these identified problem areas may improve with cleaning out the structures and pipes that have visible evidence of excessive sedimentation or other clogging materials.

Stormwater Vulnerability and Existing Conditions Assessment Recommendations

1. Two hundred fifty nine (259) structures referenced in Table #3 were not accessible and further identified on the master inventory spreadsheet. The immediate recommendation is to clean out the structures and pipes that have visible evidence of excessive sedimentation or other clogging such that their original carrying capacity is restored. This action item was also a recommendation in the 2005 URS Report.
2. Thirty two (32) structures and conveyances were found to be in Poor condition. These are further identified as areas of improvement and include additional information. The structures and conveyances rated in poor condition were prioritized in the following manner:
 - Low – Requires attention but can be scheduled as time and resources permit.
 - High – Requires immediate attention.

The recommended actions for the identified areas of improvement are categorized and listed below:

- *Structure/Conveyance full of debris* – Recommend flushing and vacuuming out until clean. Monitor for proper drainage after cleaning has occurred.
 - *Separated Pipe Joints / Pipe damaged* – Recommend pipe replacement or repaired by lining problem areas. Recommended actions should be evaluated by a stormwater engineer.
 - *Sinkholes* – Recommend further investigation be evaluated by a stormwater engineer to determine cause (s).
 - *Grate/Frame Defects* – Recommend further investigation be evaluated by a stormwater engineer.
3. Research resources and coordinated educational workshops on MS4 regulations and stormwater utilities for potential future impacts on the Community.

Floodplain Management Regulations Assessment

1. Specific items for consideration are mentioned in Chapter 4; however, the Town could continue to follow the changes applied by Cecil County and Municipalities outside of Cecil County that are taking an active approach to updating their floodplain regulations.
2. Prepare easy to understand outreach brochures and/or a floodplain packet with additional resources to help the Community better understand the justification and regulations. Utilizing the Town's website for this information serves as a great portal for information.
3. Research mitigation strategies that could protect the historic structures with neighboring Municipalities and work with the Town's Historic Commission on this initiative.

6 - Maps

1. Current Floodplain – Townwide
2. Current Floodplain – Impacted Area
3. Storm Surge Vulnerability – Townwide
4. Storm Surge Vulnerability – Impacted Area
5. Sea Level Rise Vulnerability – Townwide
6. Sea Level Rise Vulnerability – Impacted Area
7. Historic Map Town Exhibit