West Point Critical Facilities and Public Utilities

Located at the confluence of the Mattaponi and Pamunkey Rivers where they become the headwaters of the York River, there is public infrastructure, private residences and downtown businesses that are at risk of flooding during severe storms.

The town provides both public water and sewer service to its residents. The water system is owned and operated by the town and sustains little damage during flooding events.

The ownership and operation of the town's sewerage system has been turned over to the Hampton Roads Sanitation District (HRSD). The wastewater treatment plant is located at the east end of 23rd Street. The facility did not flood during Hurricane Isabel in 2003 and the vital electrical and mechanical controls are on a slightly elevated portion of the site and therefore, the facility's location does not pose a risk of flooding.

A sewer pump station located on 2nd Street near the point does have a flooding problem. During Hurricane Isabel, the pump motors in the well house flooded and needed to be dried out. However, the electrical controls are mounted high enough in the pump house so that they did not sustain flood damage. There is a sewer pump station located on 13th street that did not flood during Hurricane Isabel, but the floodwaters did reach within 1-foot of the facility.

Public Boat Landings

There is one public boat landing located along the Mattaponi River on the north side of the Lord Delaware Bridge on Glass Island Road. This facility does receive minor damage to the roadway and parking areas during severe storms.

Water Body	Access Area	Barrier Free	Type	Ramps	Latitude	Longitude
Mattaponi River	West Point	Yes	Concrete Ramp	2	37° 47' 8" N 37.5406099	76° 47' 23"W -76.7896487
Directions: Town of West Point on Rt 33						
						VDGIF, 2015

Public Park Facility

On the south side of the Lord Delaware Bridge, there is a small town park with walking trails and benches adjacent to the water's edge. This is a new facility that was built in conjunction with the new bridge construction that was completed in 2006. Due to the minimal amount of infrastructure at this shoreline facility, it is an anticipated that there will be no more than minor damages from rising waters in this wetlands area adjacent to the Mattaponi River.

Repetitive and Severe Repetitive Loss Residential Structures in West Point

According to FEMA's records, the Town of West Point has 8 Single Family and 1 Non-Residential Repetitive Loss properties and zero Severe Repetitive Losses as of 5/31/15.

The properties in the 100-year floodplain and 500-year floodplain are shown in the previous set of maps that also include King William County structures in the floodplain.

Numerous homes and downtown businesses at the southern end of West Point flood during severe storms particularly as flood waters reached 8 feet 6 inches above mean low water which is 6 inches above the 8 ft 100-year flood plan elevation. Additionally winds were sustained at excess of 80 miles per hour. Of the homes that underwent repairs, 2 of them were elevated by the homeowners at their own expense.

The West Point School Complex, which serves as the town's shelter, is located on the northern side of the town and the buildings are not subjected to floodwaters. However, Chelsea Road is located along the Mattaponi River and it is 1 of 2 routes that are used to access the school complex. This roadway does flood during severe storms.

4.5.4. Gloucester Critical Facilities and Public Utilities

The county has a relatively extensive network of public water and sewer facilities in and around the Gloucester Courthouse area. The Beaverdam Reservoir, located just north of the courthouse area, serves as the drinking water source for the county's public water supply system. As discussed earlier in the Dam Impoundment Section of the plan, the dam is structurally well-built and remains fully certified by the DCR (Figure 3). Below the dam there are approximately 200 homes that would flood if the Reservoir structure failed. However, in 1999 the impoundment overflowed during Hurricane Floyd yet no flood damage to the home since the excess water flowed downstream using the emergency spillway.

Table 31 provides a list of dams within the locality that may be impacted by natural hazards as well.

Table 31: The following is a list of dams in Gloucester County that are on the Virginia Department of Conservation and Recreation's Certification List.

Dam Name	Class	Height	Capacity in Acre Feet	Water Body
Woodberry Farm	3	8	158	Jones Creek
Weaver Dam	3	6	81	Jones Creek
Haynes	3	15	366	Carter Creek
Robins Creek	3	16	219	Wilson
Cow Creek	2	16	931	Cow
Burke Stream	3	20	481	Burke Mill
Cypress Shores River	3	15	143	Piankatank
Haines Pond	3	9	50	Carter Creek
Beaverdam Reservoir	1	39	20,523	Beaverdam Creek
Wood Duck Pond	4	Unknown	Unknown	Unknown
Leigh Lake	4	12	unknown	Jones Creek

The water distribution system does not suffer damage during severe storm events since it is a closed underground system. The sewerage collection lines and pumps stations are owned and operated by Gloucester County. There are 2 pump stations in the Gloucester Courthouse area (Pump # 11 and Pump #13) that sustained damage during Hurricane Floyd in 1999. The damage was caused by floodwaters resulting from the overtopping of the Beaverdam Reservoir as previously mentioned. After the wastewater is collected, it is transported in a large force main that runs down Route 17, crosses under the York River and then flows into the York River Wastewater Treatment Plant in York County. The large force main and treatment plant are owned and operated by the Hampton Roads Sanitation District. The force main is a closed underground system that does not sustain damage during severe flooding events.

The Achilles Elementary School site, located in the southeastern section of the county, is adversely affected by flood waters from storms surges associated with a Category 1 hurricane.

According to VDOT officials, flood prone roads in Gloucester County include the following:

Table 32: Gloucester County Flood Prone Roads		
Route	**Road Name**	**Location of Floodwaters**
684	Starvation Road	From Big Oak Lane to ESM
662	Allmondsville Road	From Rte. 606 to Rte. 618
618	Chappahosic Road	From Rte. 662 to Rte. 639
636	Brays Point Road	From Eagle Lane to ESM
1303	Carmines Islands Road	From Gardner Lane to ESM
646	Jenkins Neck Road	Various spots from Owens Road to ESM
648	Maundys Creek Road	From Rte. 649 to ESM
649	Maryus Road	From Haywood Seafood Lane to ESM
652	Rowes Point Road	From 653 to ESM
649	Severn Wharf Road	Various spots from 653 to ESM

Public Boat Ramps

There are **4** public boat landings in Gloucester County that are owned and operated by the VDGIF:

Water Body	Access Area	Barrier Free	Type	Ramps	Latitude	Longitude
Piankatank River	Deep Point	Yes	Concrete Ramp	1	37° 32' 10" N 37.5361228	76° 29' 43"W -76.4953889
Directions: From Glenns, Rt 198 East (7.5 miles); Left on Rt 606 (1.5 miles)						
Porpoptank River	Tanyard	No	Concrete Ramp	1	37° 27' 17" N 37.4548078	76° 40' 5"W -76.6679753
Directions: From Gloucester, Rt 14 North (4.3 miles); Left on Rt 613 (3.3 miles); Right on Rt 610 (.6 miles); left on Rt 617 (.5 miles)						
Ware River	Warehouse	Yes	Concrete Ramp	1	37° 24' 11" N 37.4031611	76° 29' 23"W -76.4896286
Directions: East of Gloucester on Rt 621						
York River	Gloucester Point	Yes	Concrete Ramp	2	37° 14' 45" N 37.2457058	76° 30' 17"W -76.5048003
Directions: Town of Gloucester Point, Rt 1208 – TEMPORARILY CLOSED						
VDGIF, 2015						

In addition to VDGIF there is a list of other public boat ramps throughout the County, including:

- *Cappahosic Landing Location*: End of Cappahosic Road. York River Access. Bank fishing, beach, Picnicking, limited parking, and restrooms - May thru October. Park area maintained by Gloucester County while the Landing is maintained by VDOT.
- *Cedar Bush, Oliver's Landing Location*: End of Cedar Bush Road. York River Access. Gravel ramp and finger pier. Maintained by Gloucester County and VDOT.
- *Field's Landing*: End of Field's Landing Road. York River Access. Car top boats only, no trailer access. Maintained by VDOT.
- *Glass Point Landing*: End of Glass Road. Severn River Access. Car top boats only, no trailer access Maintained by Gloucester County and VDOT.
- *Gloucester Point Beach Park Location*: End of Greate Road, next to Coleman Bridge. York River Access. Sandy beach, swimming, picnicking, outdoor showers – seasonal, restrooms, playground, fishing pier, parking and two landings. One landing is maintained by Gloucester County and one by DGIF (see above for details).
- *John's Point Landing* - End of John's Point Road . Small boats only, gravel ramp and sand ramp for car top boats : Fishing Parking Maintained by Gloucester County and VDOT

- *Miller's Landing* - car top boats only, no trailer access Location: End of Miller's Landing Road Poropotank River Access Fishing Parking Maintained by VDOT
- *Payne's Landing*: End of Paynes Landing Road. Ware River Access. Car top boats only, no trailer access. Maintained by Gloucester County.

Repetitive and Severe Repetitive Loss Residential Structures in Gloucester County
According to FEMA's records, Gloucester County has 146 (ie.141 Single Family, 1 Non-Residential, 3 Assmd Condo, and 1 2-4 Family properties) Repetitive Loss properties and 13 (i.e. 11 Single Family and 2 non-residential properties) Severe Repetitive Losses as of 5/31/15.

Properties In 100-year Floodplain by Census Block Group
The following series of maps show the location of structures in Gloucester County that are in Flood Zone A, Flood Zone AE or Flood Zone VE. This 2004 information is the latest structure data available. The legend is color coded to indicate the specific flood zone in which each structure lies.

Figure 65:

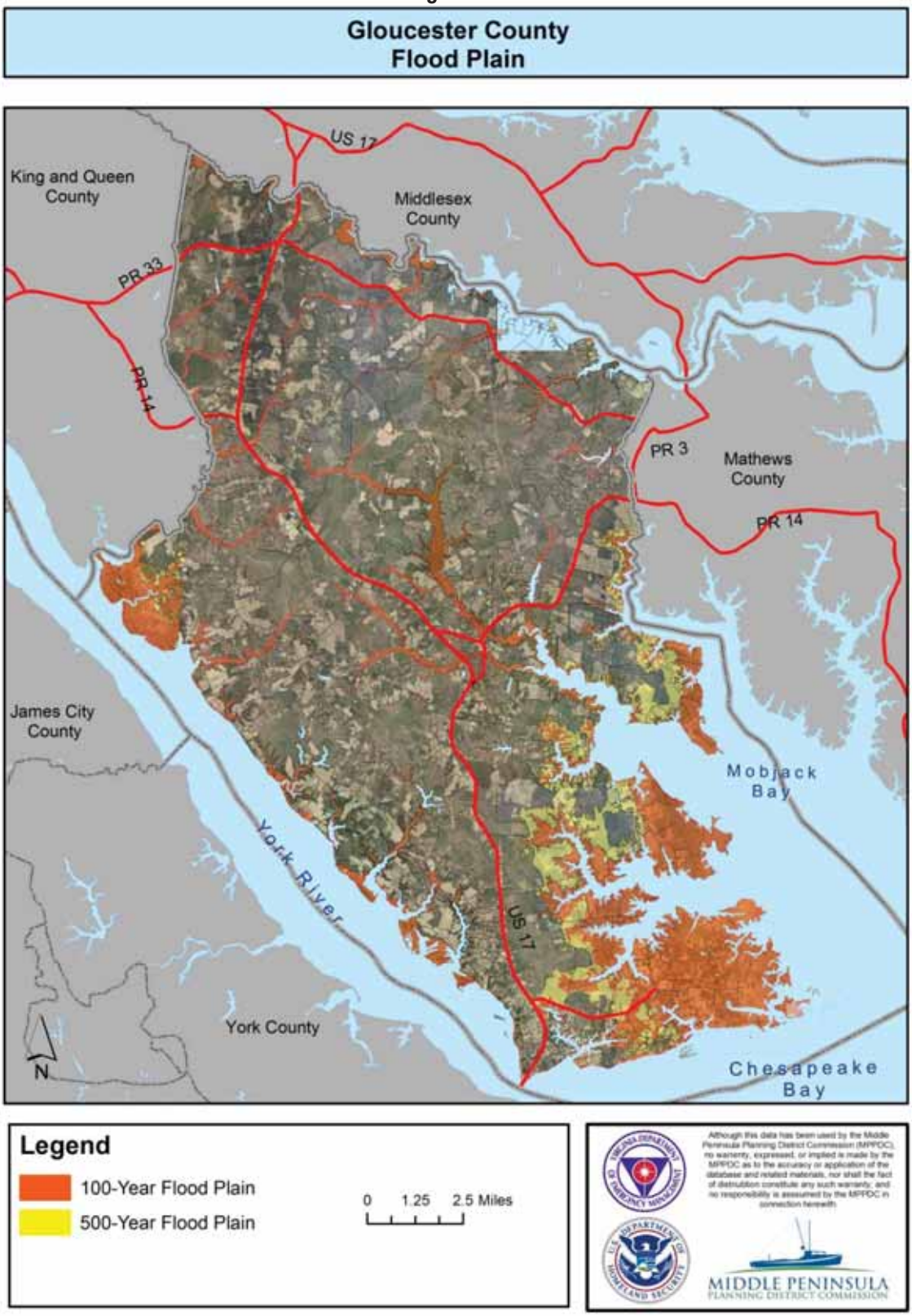

Gloucester County
Flood Plain
US 17
King and Queen County
Middlesex County
PR 33
PR 14
PR 3
Mathews County
PR 14
James City County
Mobjack Bay
York River
US 17
York County
N
Chesapeake Bay
Legend
100-Year Flood Plain
500-Year Flood Plain
0 1.25 2.5 Miles
MIDDLE PENINSULA
PLANNING DISTRICT COMMISSION

Figure 66:

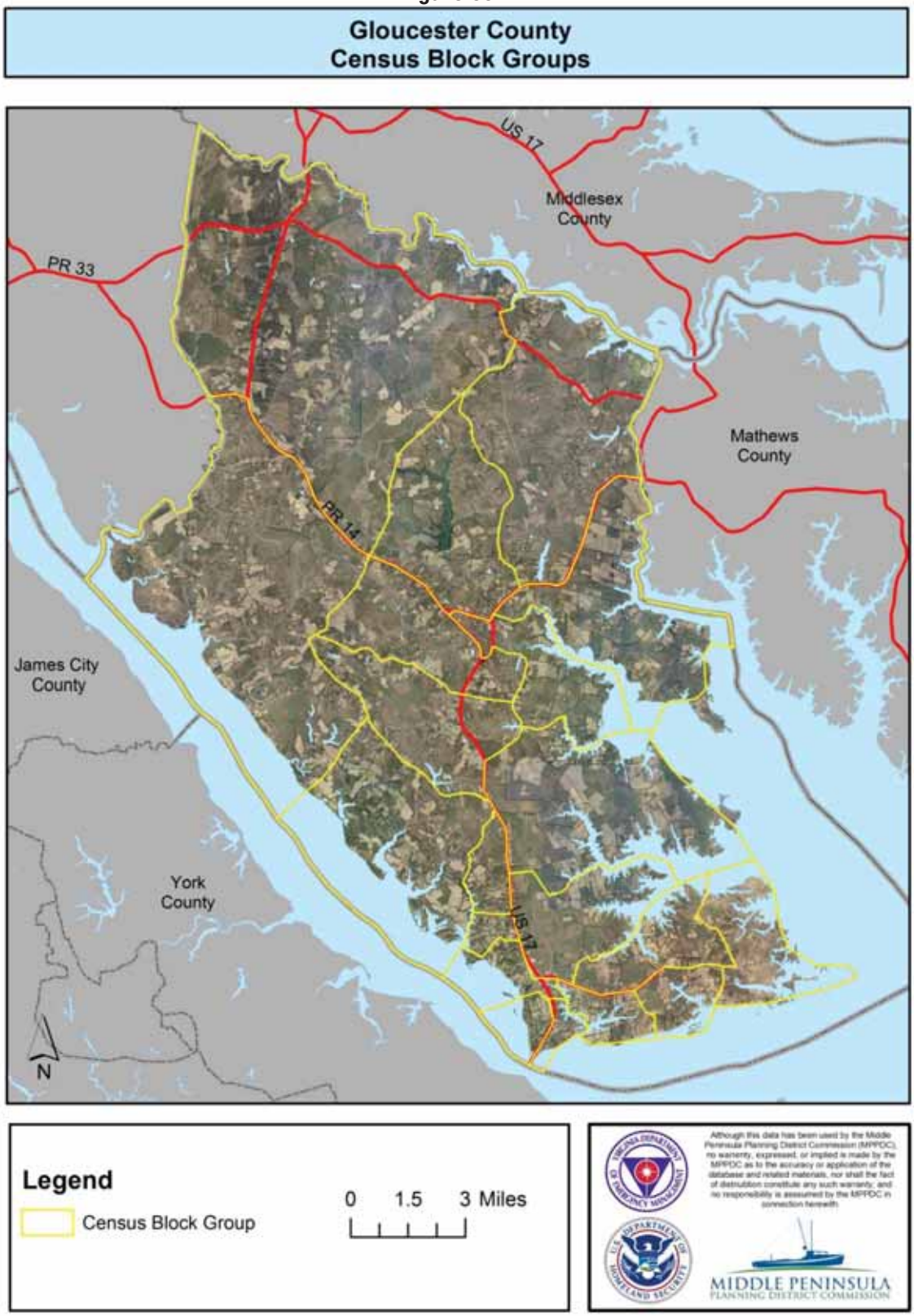

Gloucester County
Census Block Groups
US 17
Middlesex County
PR 33
Mathews County
PR 14
James City County
York County
US 17
N
Legend
Census Block Group
0 1.5 3 Miles
MIDDLE PENINSULA
PLANNING DISTRICT COMMISSION

Figure 67:


Gloucester County
Census Block Group10011
US 17
Middlesex County
James City County
PR 14
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Afftected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.5 1 Miles
MIDDLE PENINSULA
PLANNING DISTRICT COMMISSION

Figure 68:

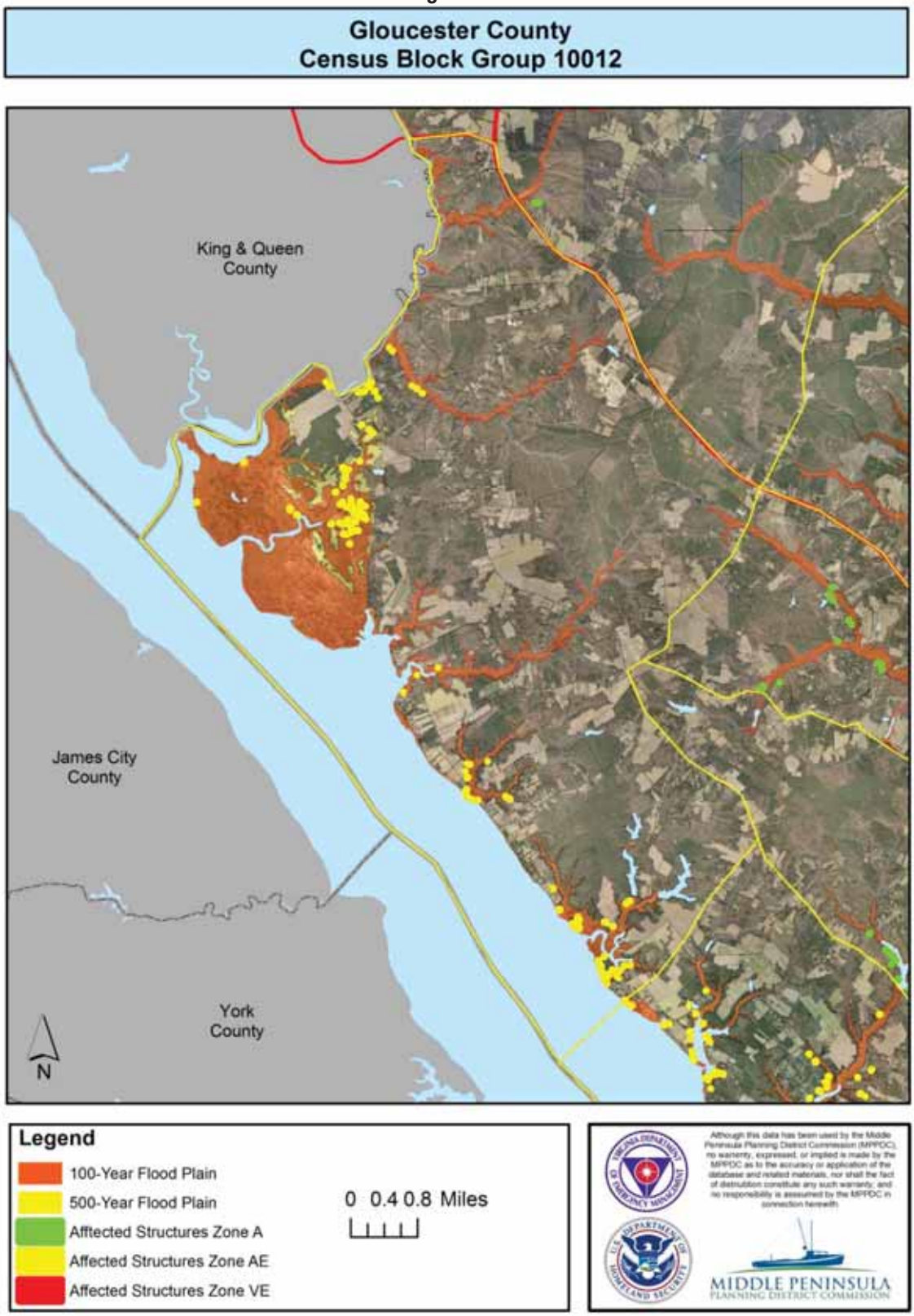

Gloucester County
Census Block Group 10012
King & Queen County
James City County
York County
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Afftected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.4 0.8 Miles
MIDDLE PENINSULA
PLANNING DISTRICT COMMISSION

Figure 69:

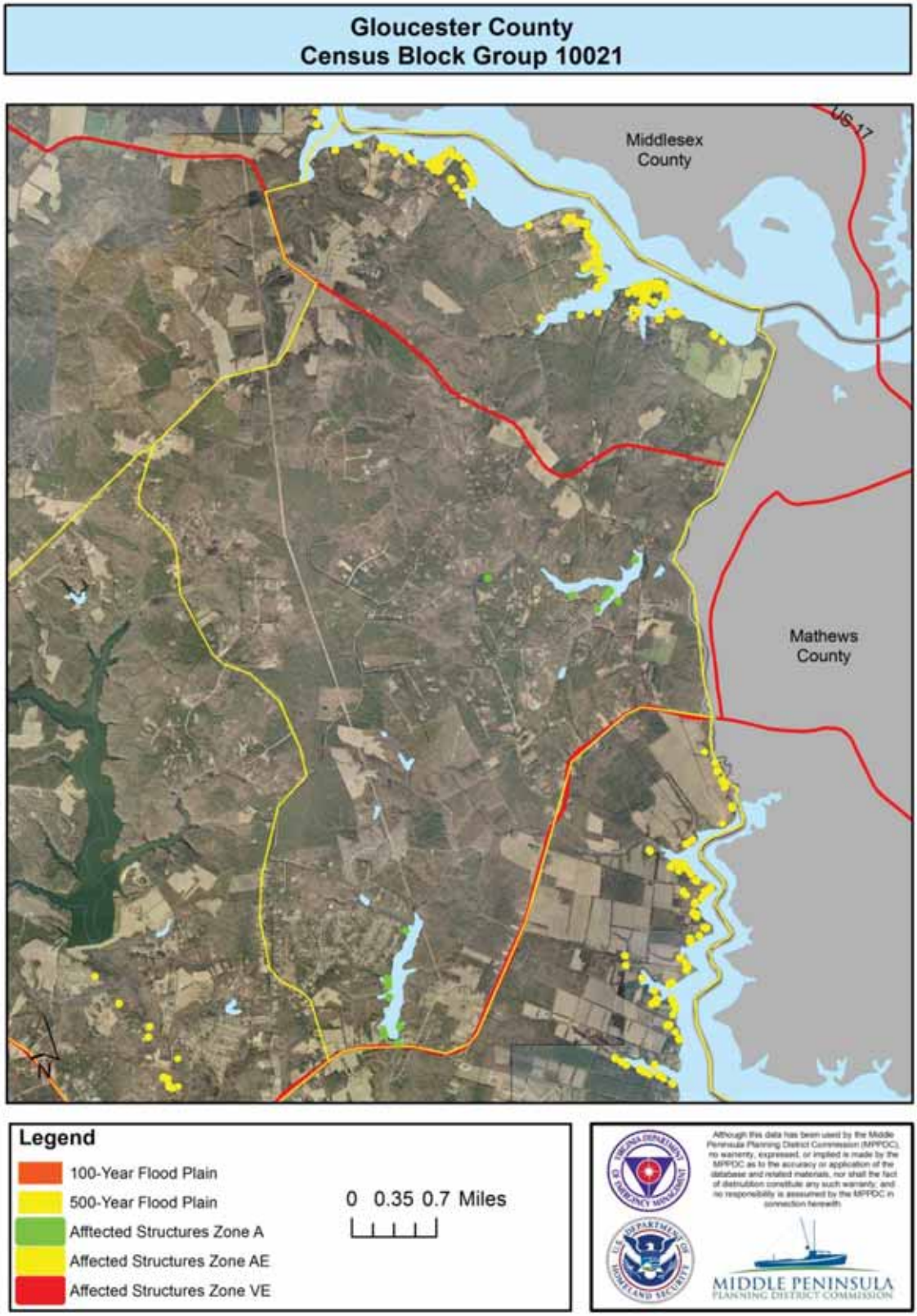

Gloucester County
Census Block Group 10021
Middlesex County
US-17
Mathews County
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Afftected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.35 0.7 Miles
MIDDLE PENINSULA
PLANNING DISTRICT COMMISSION

Figure 70:

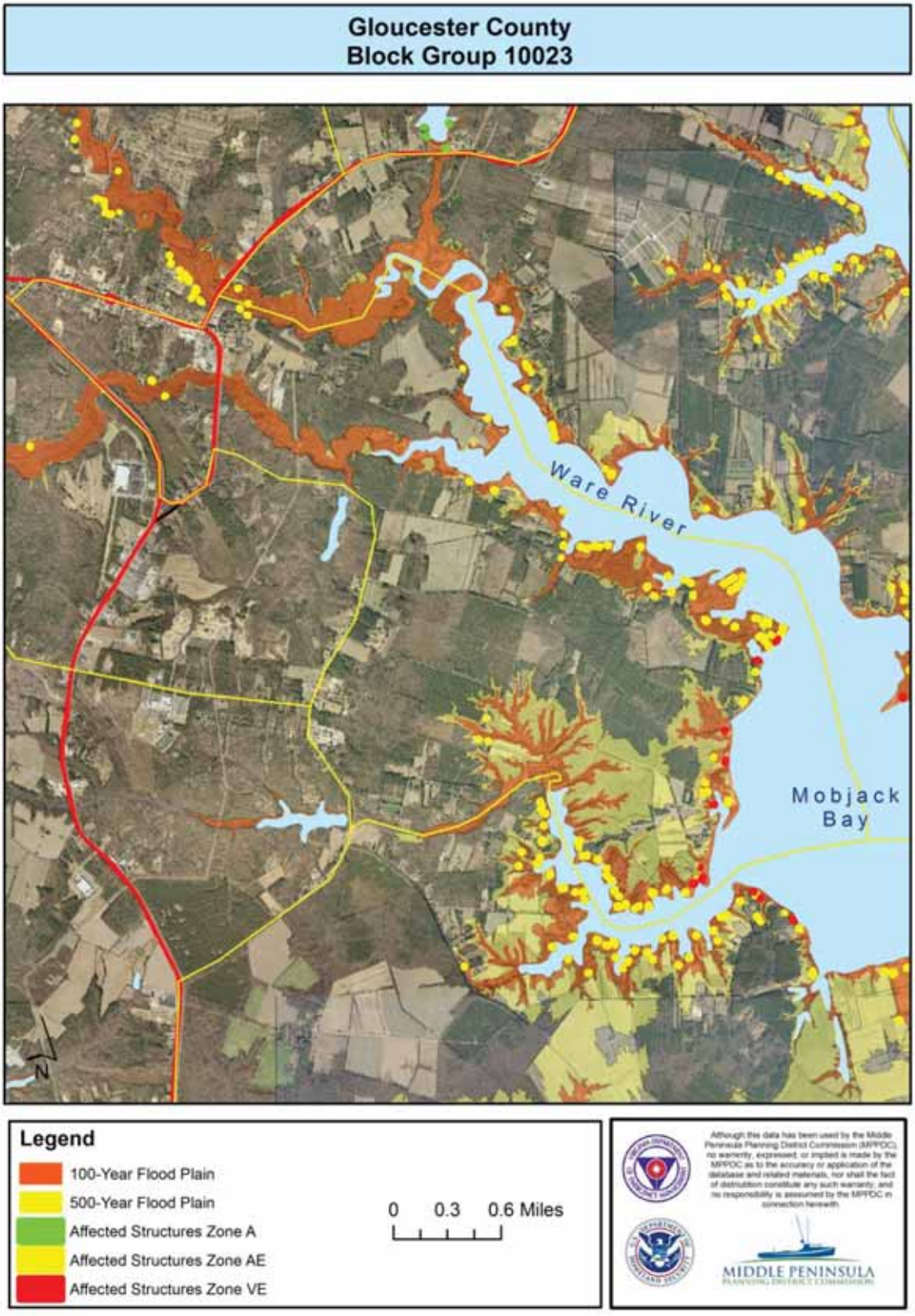

Gloucester County
Block Group 10023
Ware River
Mobjack Bay
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.3 0.6 Miles
MIDDLE PENINSULA

Figure 71:


Gloucester County
Block Group 10024
York River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.35 0.7 Miles
MIDDLE PENINSULA

Figure 72:

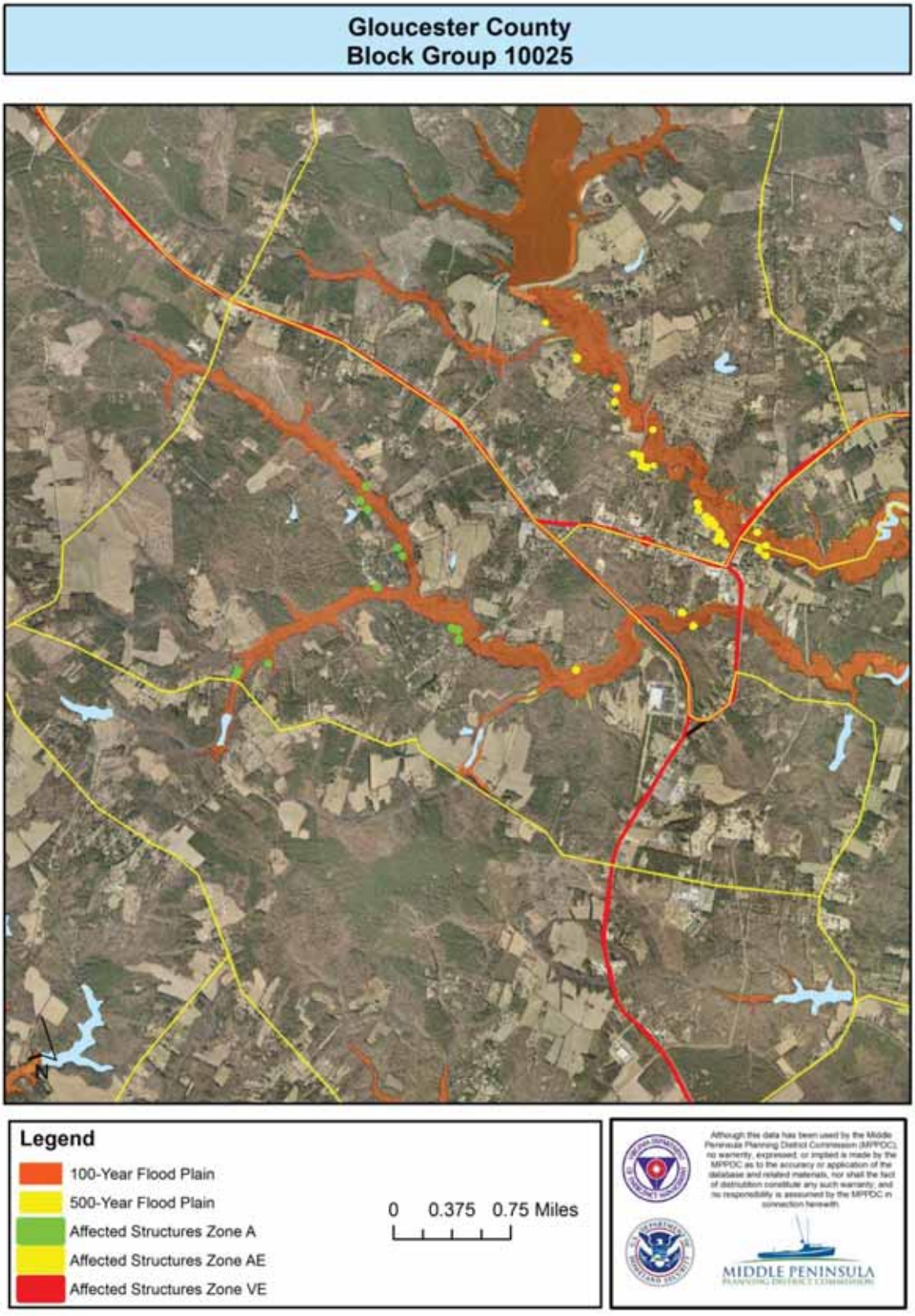

Gloucester County
Block Group 10025
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.375 0.75 Miles
MIDDLE PENINSULA

Figure 73:

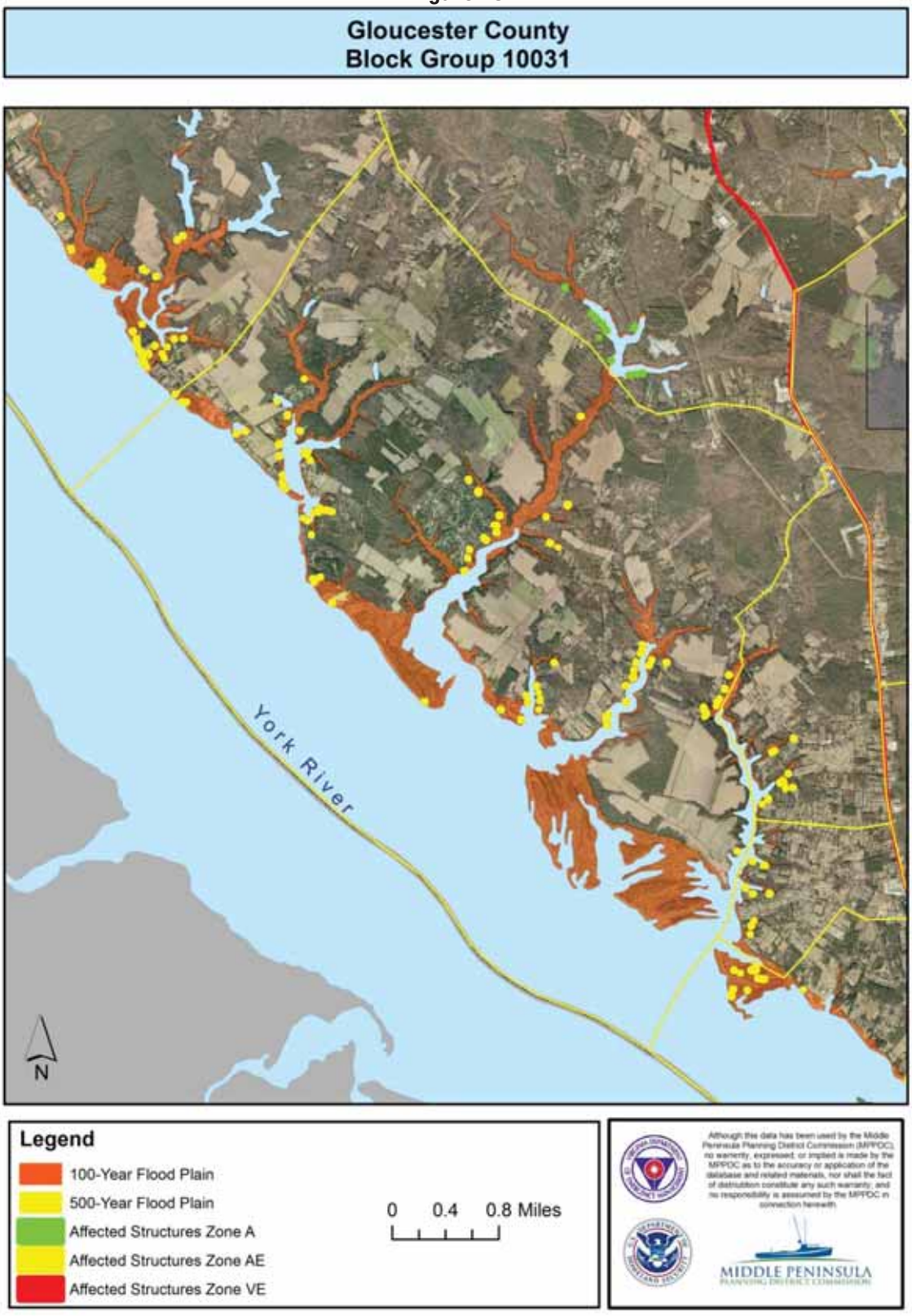

Gloucester County
Block Group 10031
York River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.4 0.8 Miles
MIDDLE PENINSULA

Figure 74:

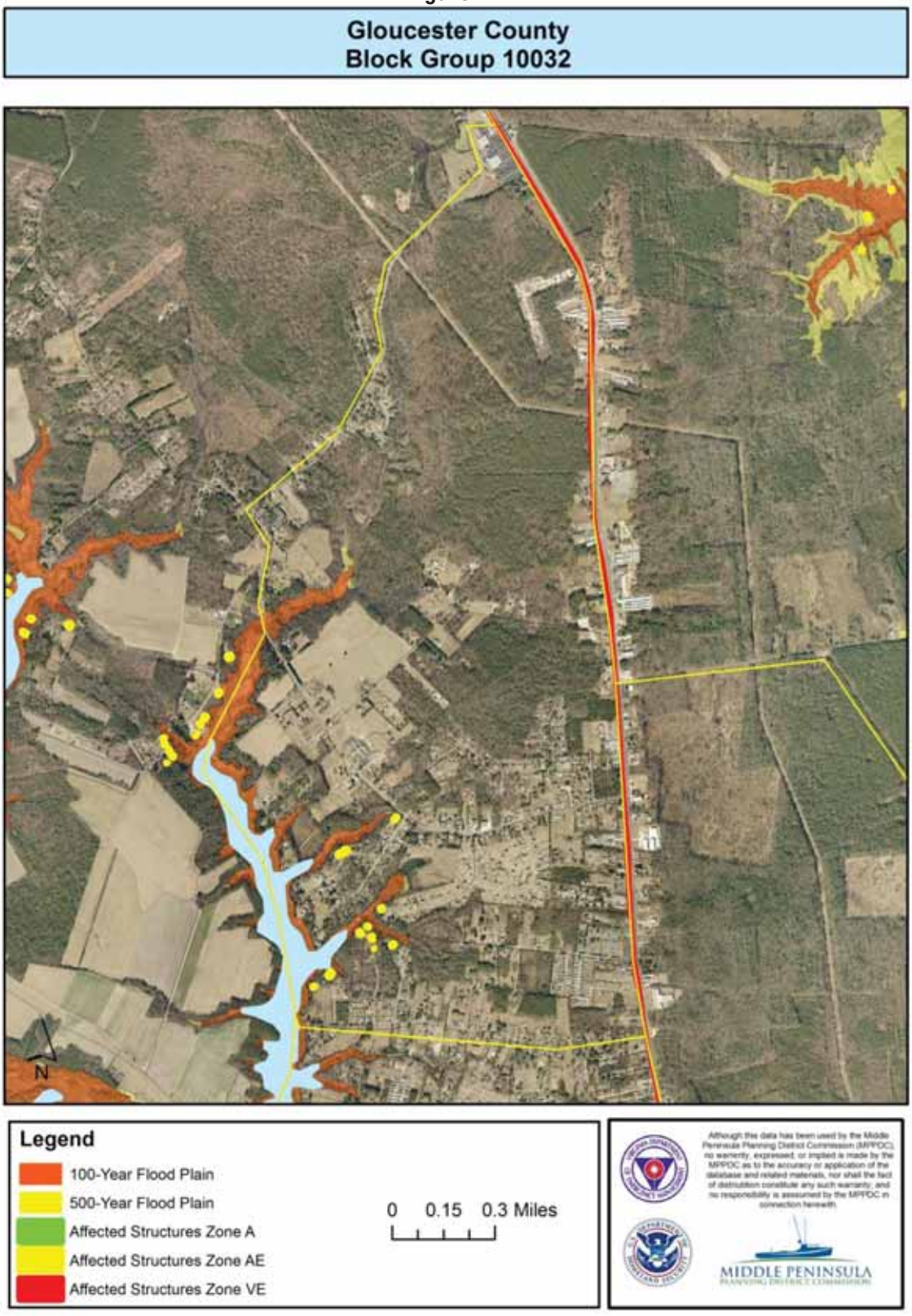

Gloucester County
Block Group 10032
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.15 0.3 Miles
MIDDLE PENINSULA

Figure 75:

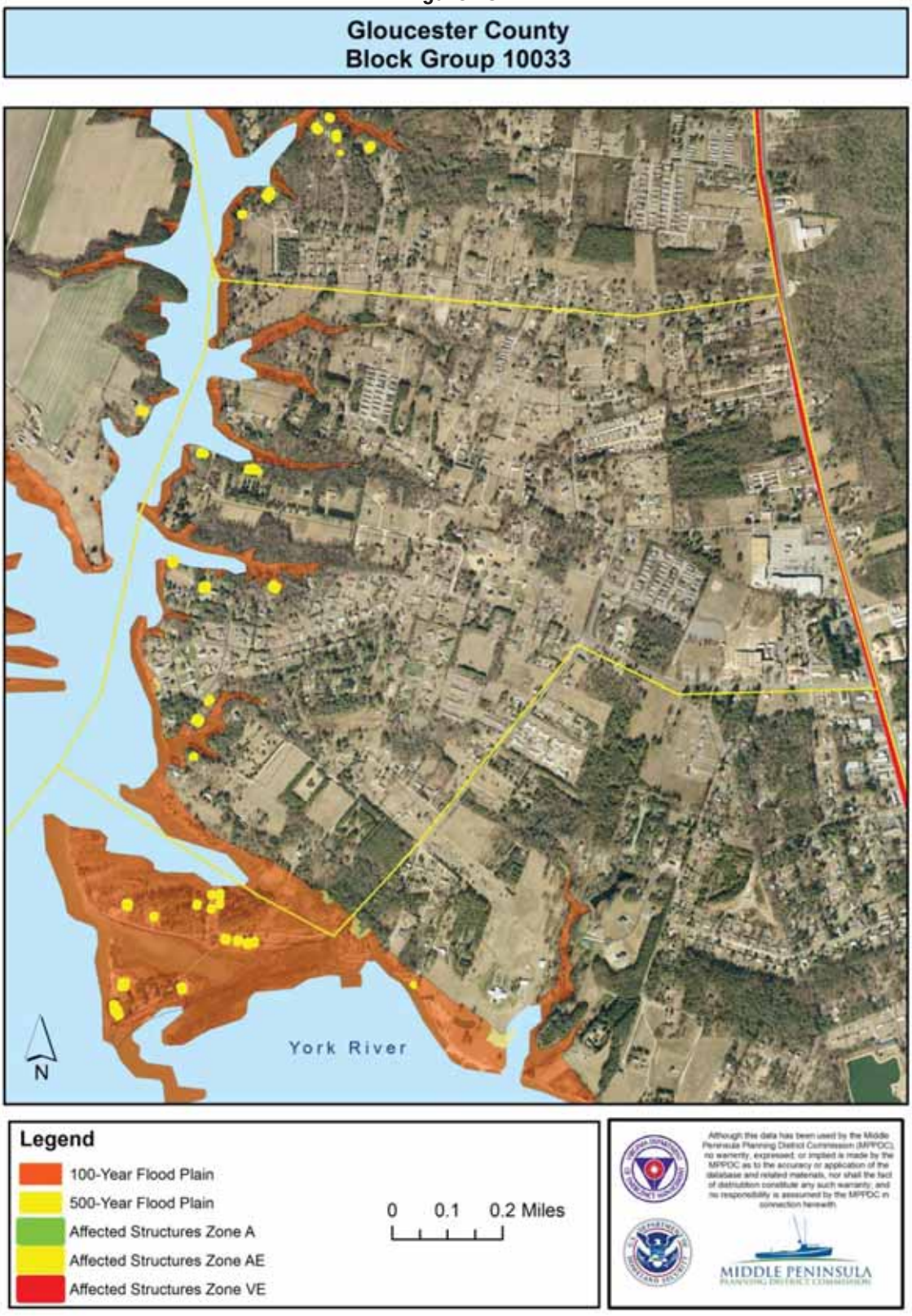

Gloucester County
Block Group 10033
York River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.1 0.2 Miles
MIDDLE PENINSULA

Figure 76:

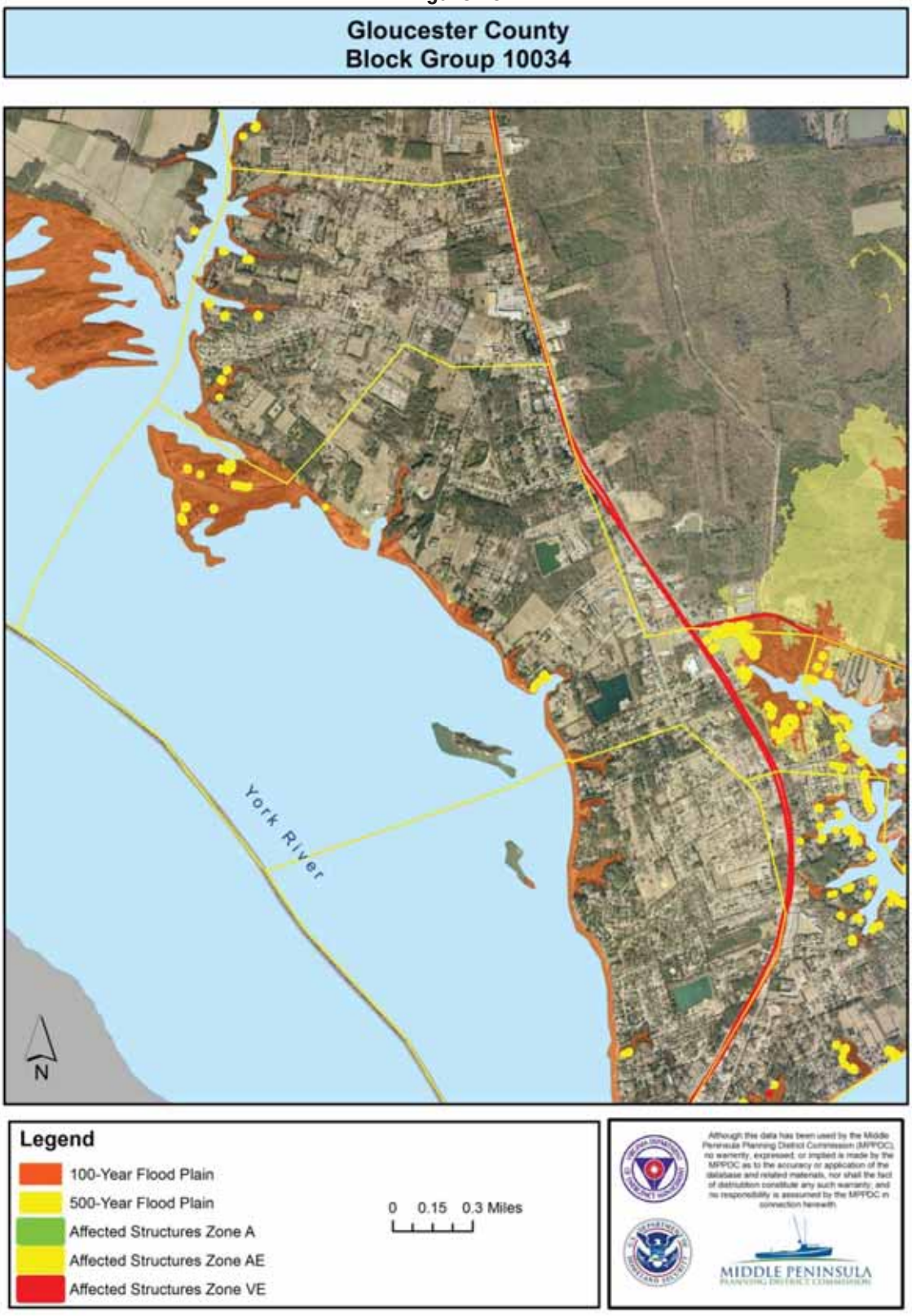

Gloucester County
Block Group 10034
York River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.15 0.3 Miles
MIDDLE PENINSULA

Figure 77:

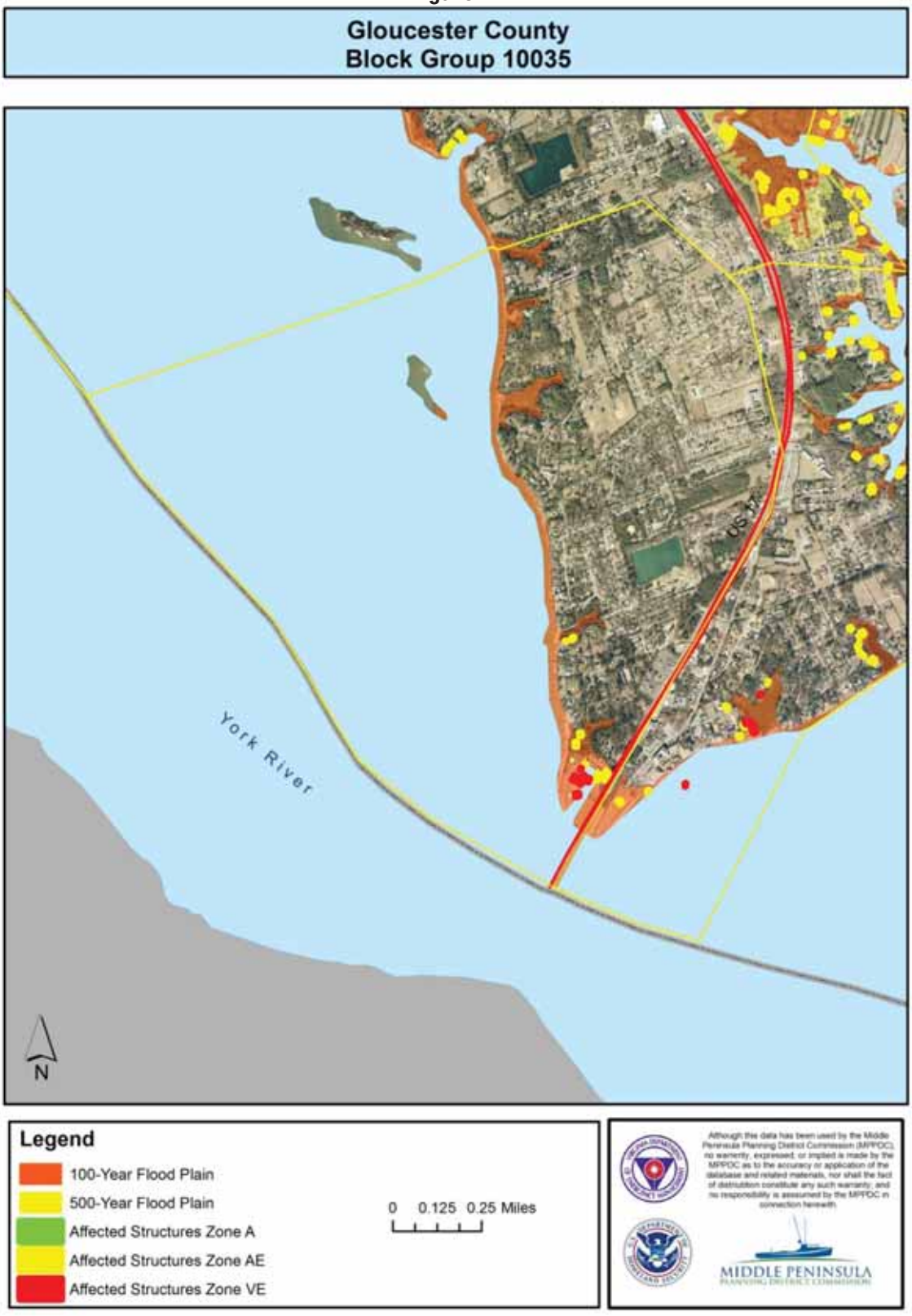

Gloucester County
Block Group 10035
York River
US 17
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.125 0.25 Miles
MIDDLE PENINSULA

Figure 78:

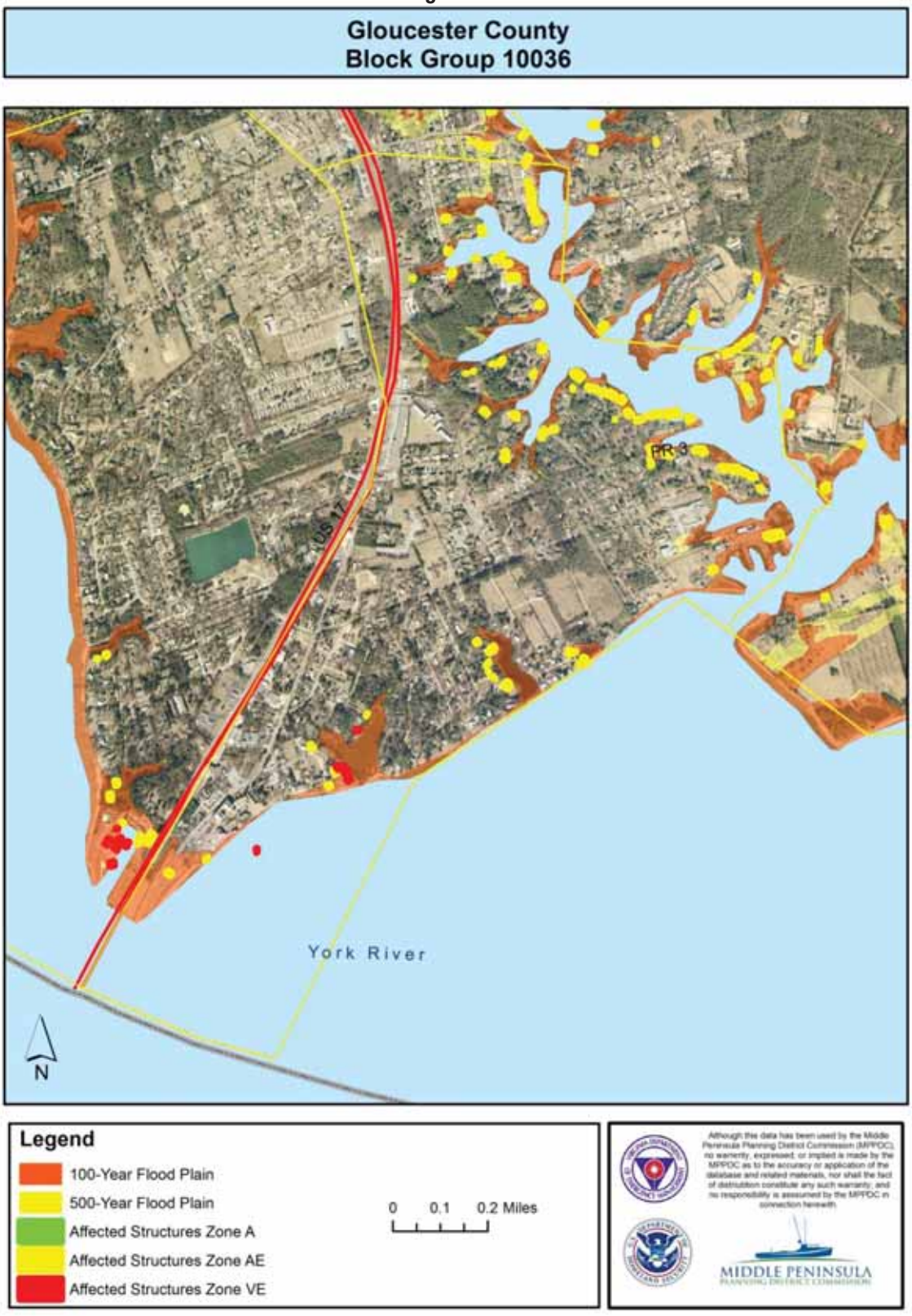

Gloucester County
Block Group 10036
US 17
PR 3
York River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.1 0.2 Miles
MIDDLE PENINSULA

Figure 79:

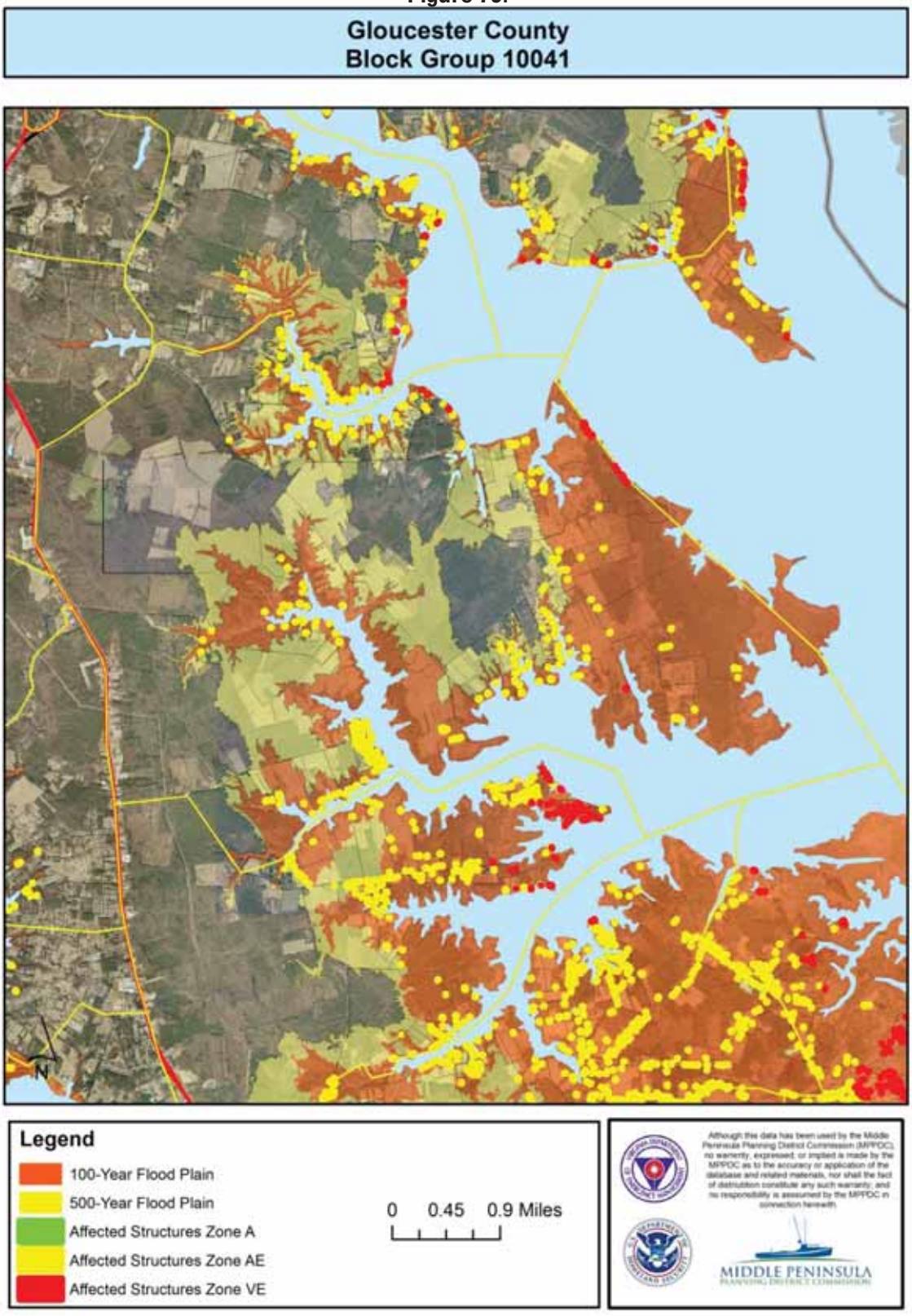

Gloucester County
Block Group 10041
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.45 0.9 Miles
MIDDLE PENINSULA

Figure 80:

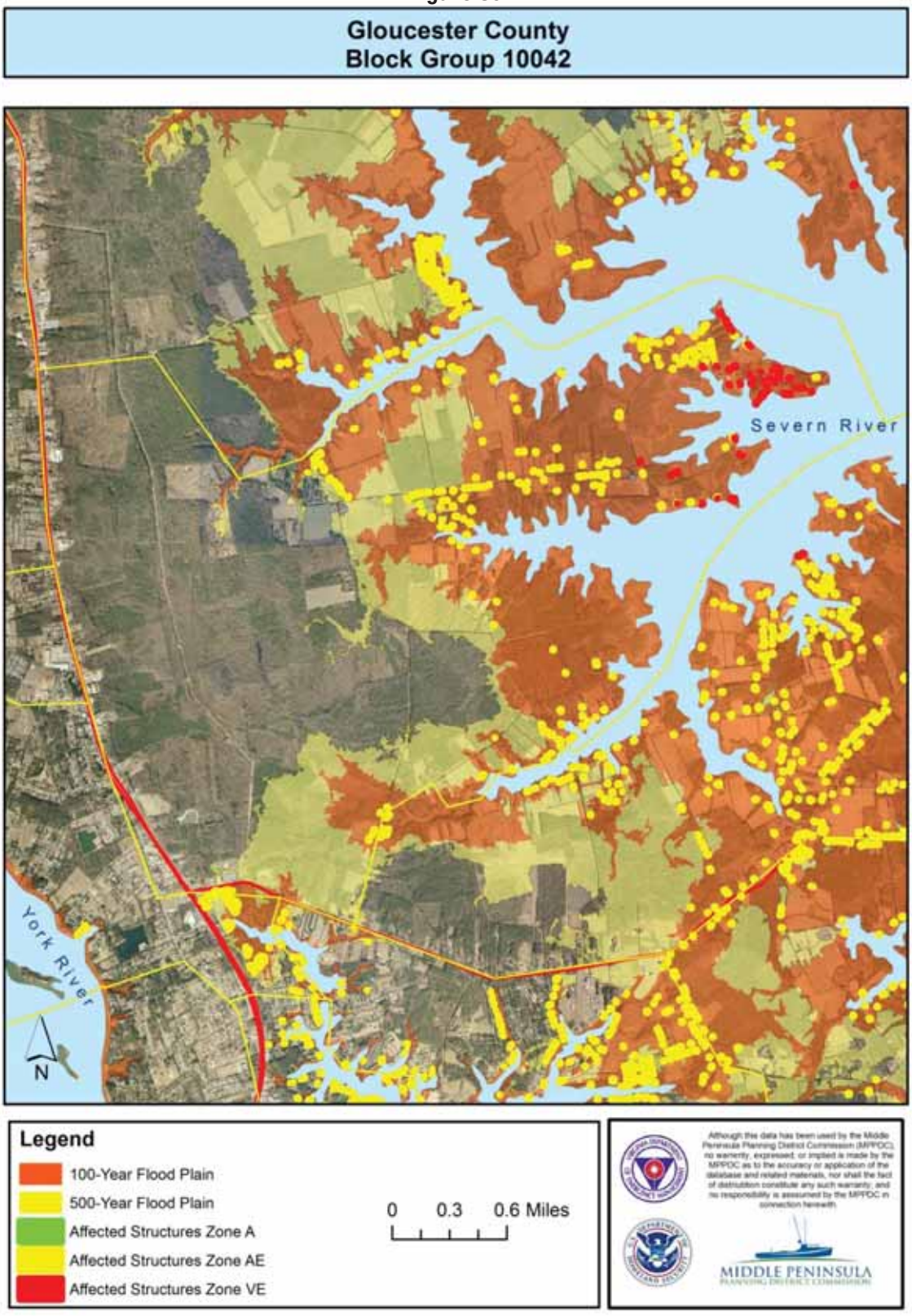

Gloucester County
Block Group 10042
Severn River
York River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.3 0.6 Miles
MIDDLE PENINSULA

Figure 81:

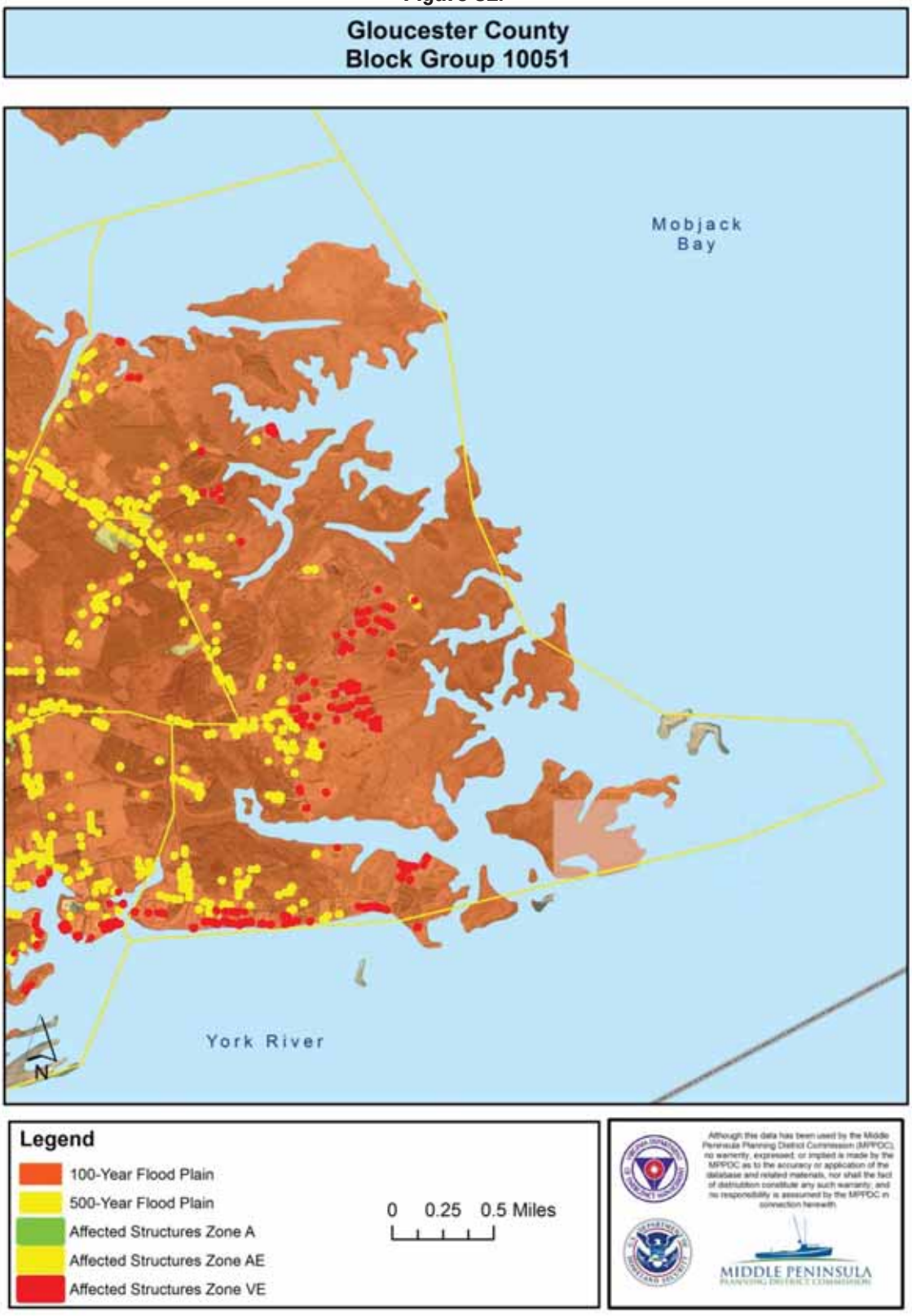

Gloucester County
Block Group 10051
Mobjack Bay
York River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.25 0.5 Miles
MIDDLE PENINSULA

Figure 82:

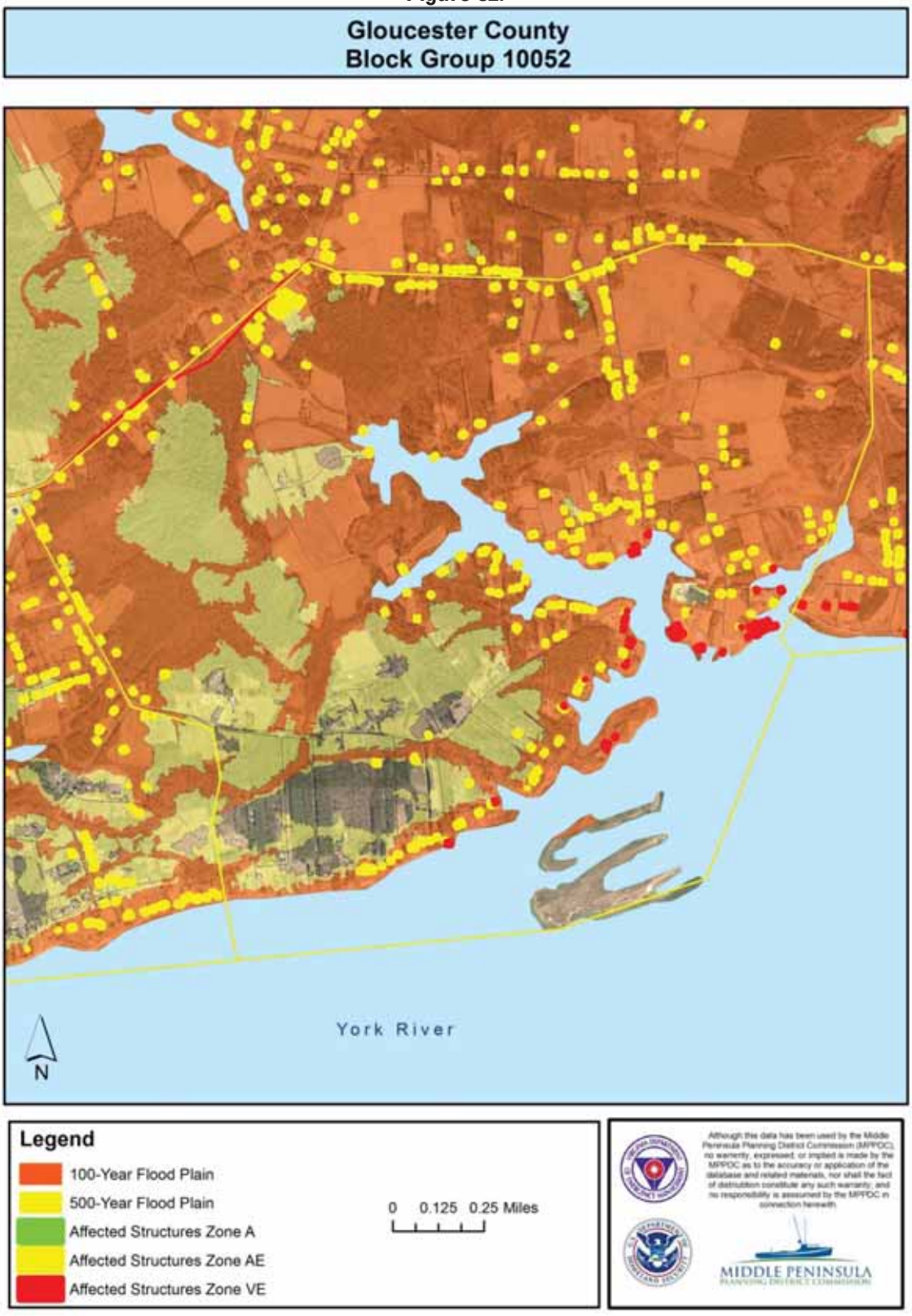

Gloucester County
Block Group 10052
York River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.125 0.25 Miles
MIDDLE PENINSULA

Figure 83:

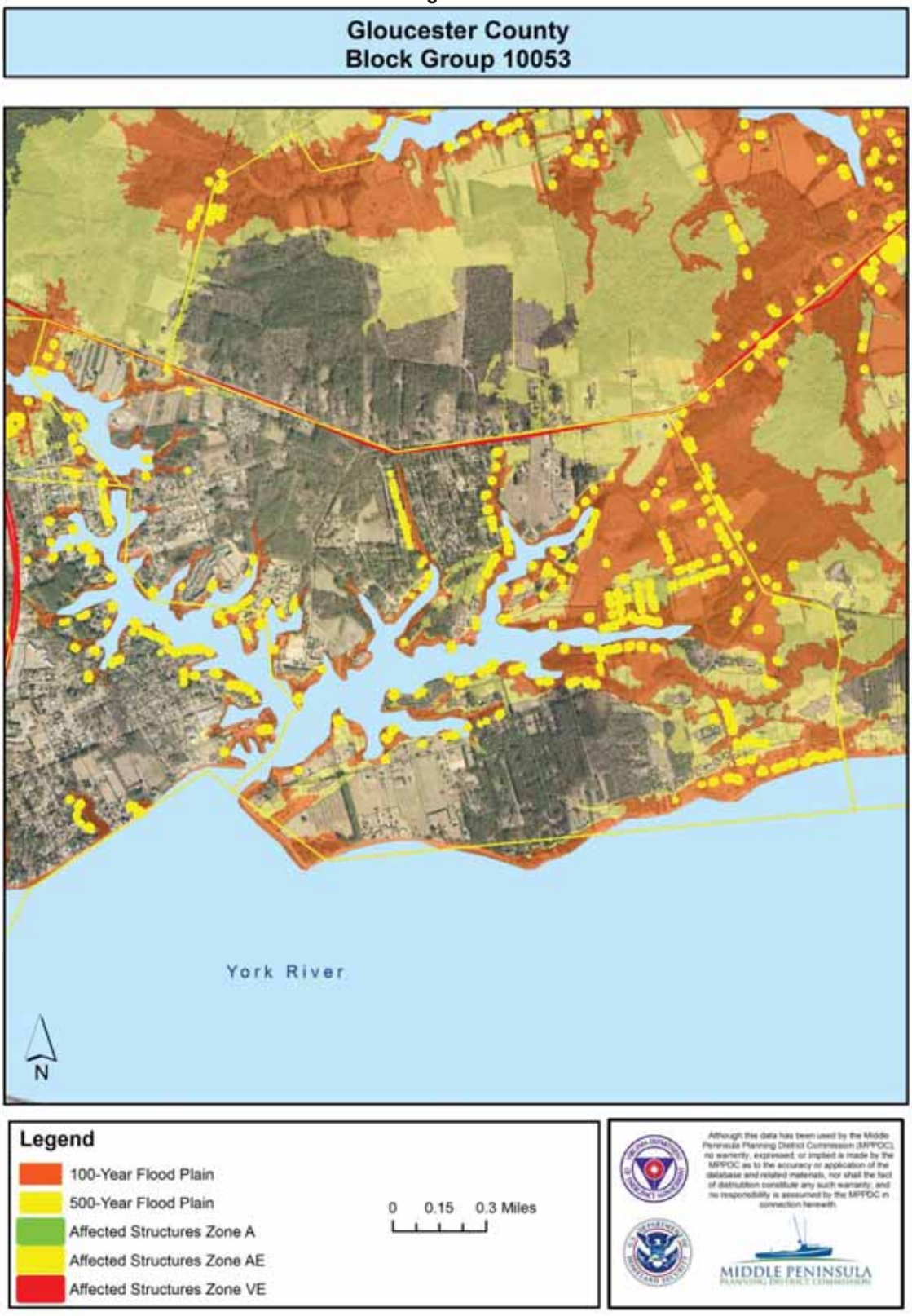
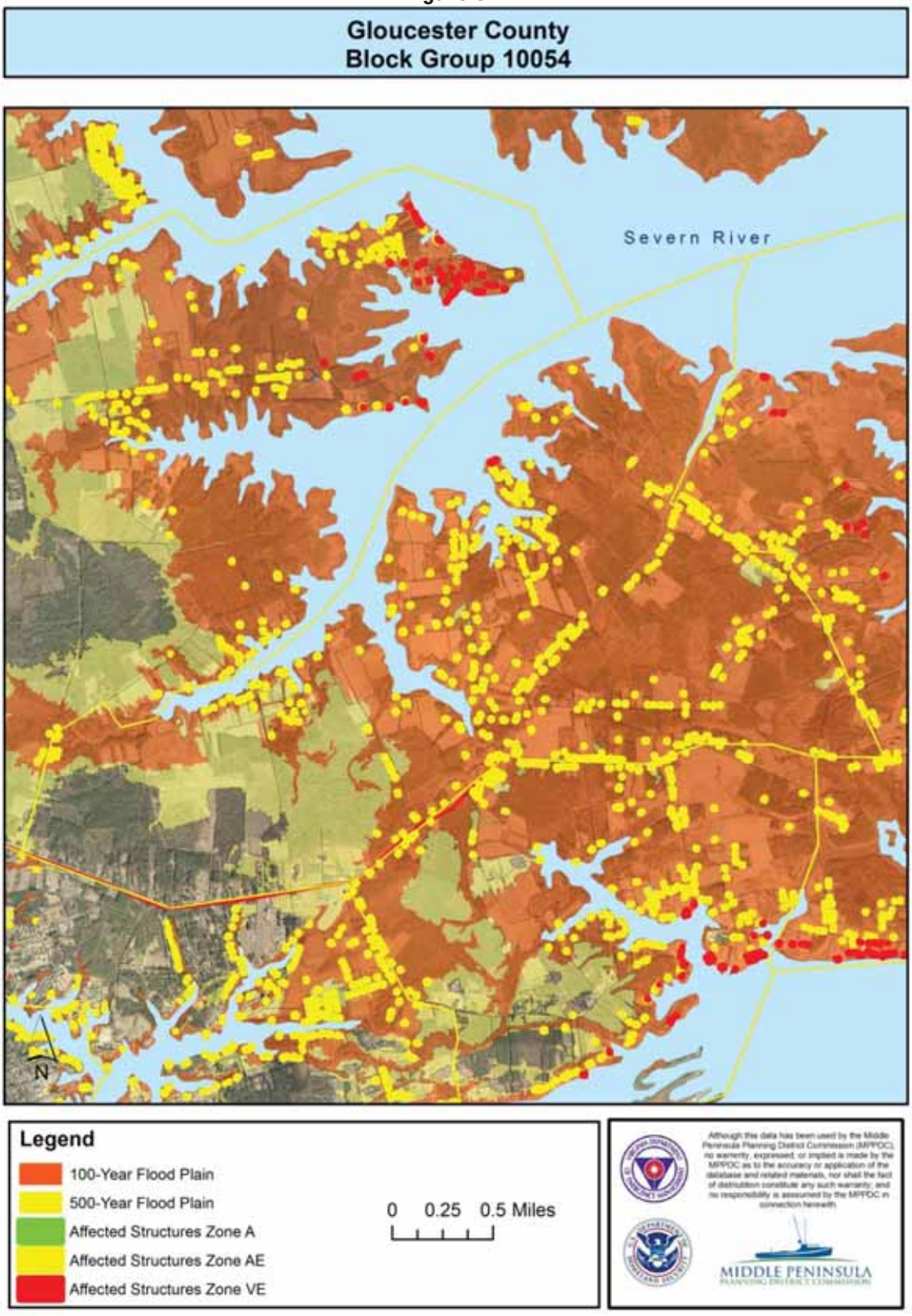

Gloucester County
Block Group 10053
York River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.15 0.3 Miles
MIDDLE PENINSULA

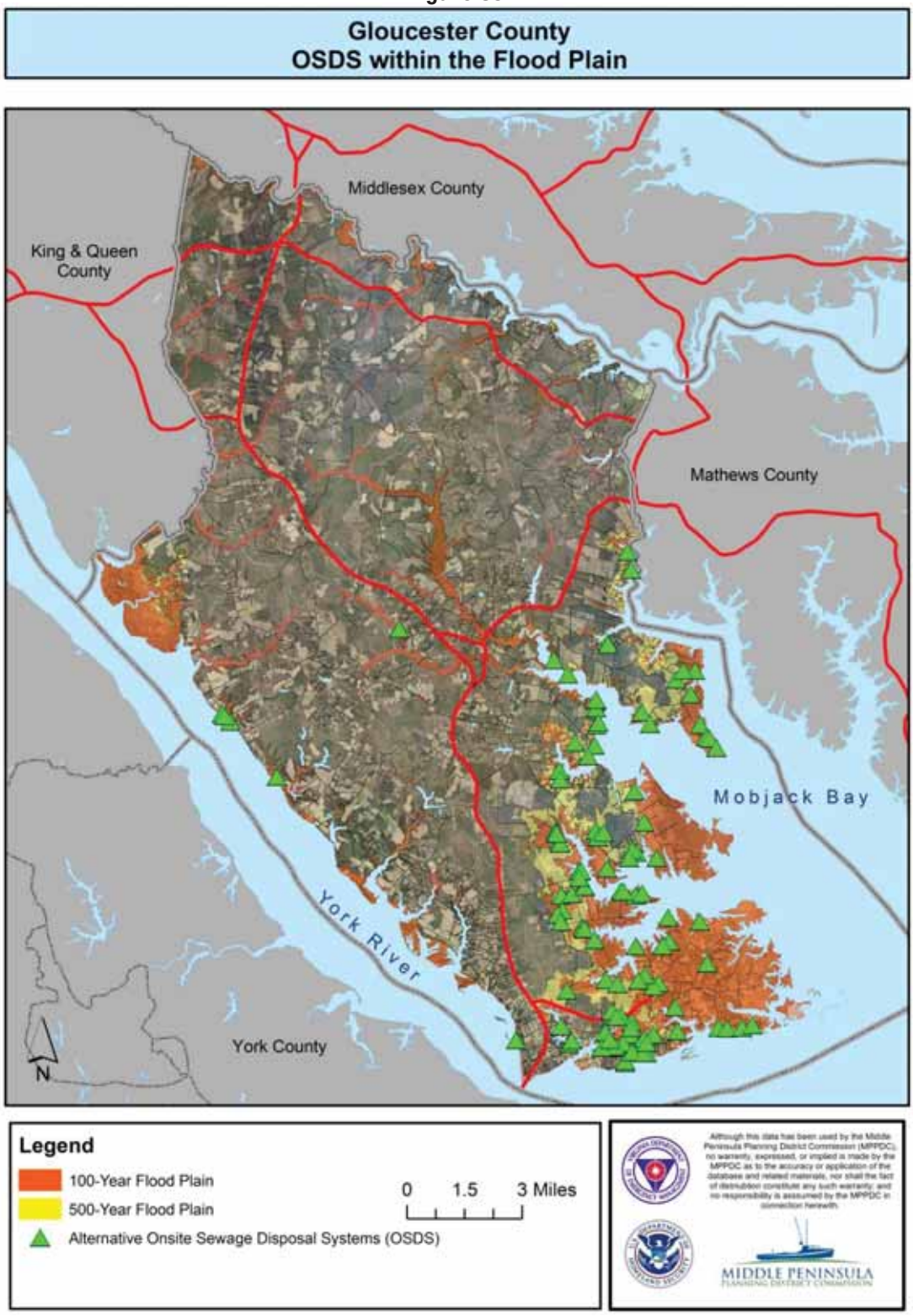
Figure 84:


Gloucester County
Block Group 10054
Severn River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures Zone A
Affected Structures Zone AE
Affected Structures Zone VE
0 0.25 0.5 Miles
MIDDLE PENINSULA

Alternative On-site Sewage Disposal Systems (OSDS)

The following maps (Figure 85) show the locations of the installed OSDS facilities constructed in the 100-year and 500-year floodplain in Gloucester County.

Figure 85:



4.5.5. Mathews Critical Facilities and Public Utilities

New Point Comfort Lighthouse, located at the southern tip of Mathews County, has undergone significant flood damage resulting from the lighthouse being separated from the mainland due to severe erosion. Mathews County owns the lighthouse facility and the locality has plans to undertake stabilization work to "weather-harden" the base/foundation of the structure.

According to VDOT officials, flood prone roads in Mathews County include the following:

Table 33: Mathews County Flood Prone Roads

Route	Road Name	Location
610	Marsh Hawk Road	From Rte. 614 to Rte. 611
600	Circle Drive	From Rte.14 to Rte. 14
600	Light House or Point Road	From Rte. 14 to ESM
611	Tabernacle Road	From Rte. 613 to Rte. 609
611	Tabernacle Road	From Rte. 610 to Rte. 609
609	Bethel Beach Road	From Rte. 610 to ESM
609	Bethel Beach Road	From Rte. 614 to Rte. 611
643	Haven Beach Road	From Rte. 704 to ESM
633	Old Ferry Road	From Rte. 704 to 636
608	Potato Neck Road	From Rte. 649 to ESM
644	Bandy Ridge Road	From Rte. 611 to Rte. 614

Public Boat Ramps

There is one public boat landing in Mathews County that is owned and operated by the VDGIF:

Water Body	Access Area	Barrier Free	Type	Ramps	Latitude	Longitude
East River	Town Point	Yes	Concrete Ramp	1	37° 24' 55" N 37.4143723	76° 20' 15"W -76.3375842
Directions: From Mathews, Rt 14 South (3.8 miles); Right onto Rt 615 (.6 miles)						
VDGIF, 2015						

Repetitive and Severe Repetitive Loss Residential Structures in Mathews County

According to FEMA's records, Mathews County has 169 (i.e. 164 Single family, 3 Non-resident, 1 Other resident, and 1 Assmd Condo) Repetitive Loss residential properties and 11Single Family Severe Repetitive Losses as of 5/31/15.

Public School Properties

During a Category 2 hurricane, the Thomas Hunter Middle School and the Lee Jackson Elementary School properties become flooded.

Properties In 100-year Floodplain by Census Block Groups

The following series of maps show the location of structures in Mathews County that are in Flood Zone AE or Flood Zone VE in the 100-year and 500-year floodplains. The legend is color coded to indicate the specific flood zone in which each structure lies.

Figure 86:

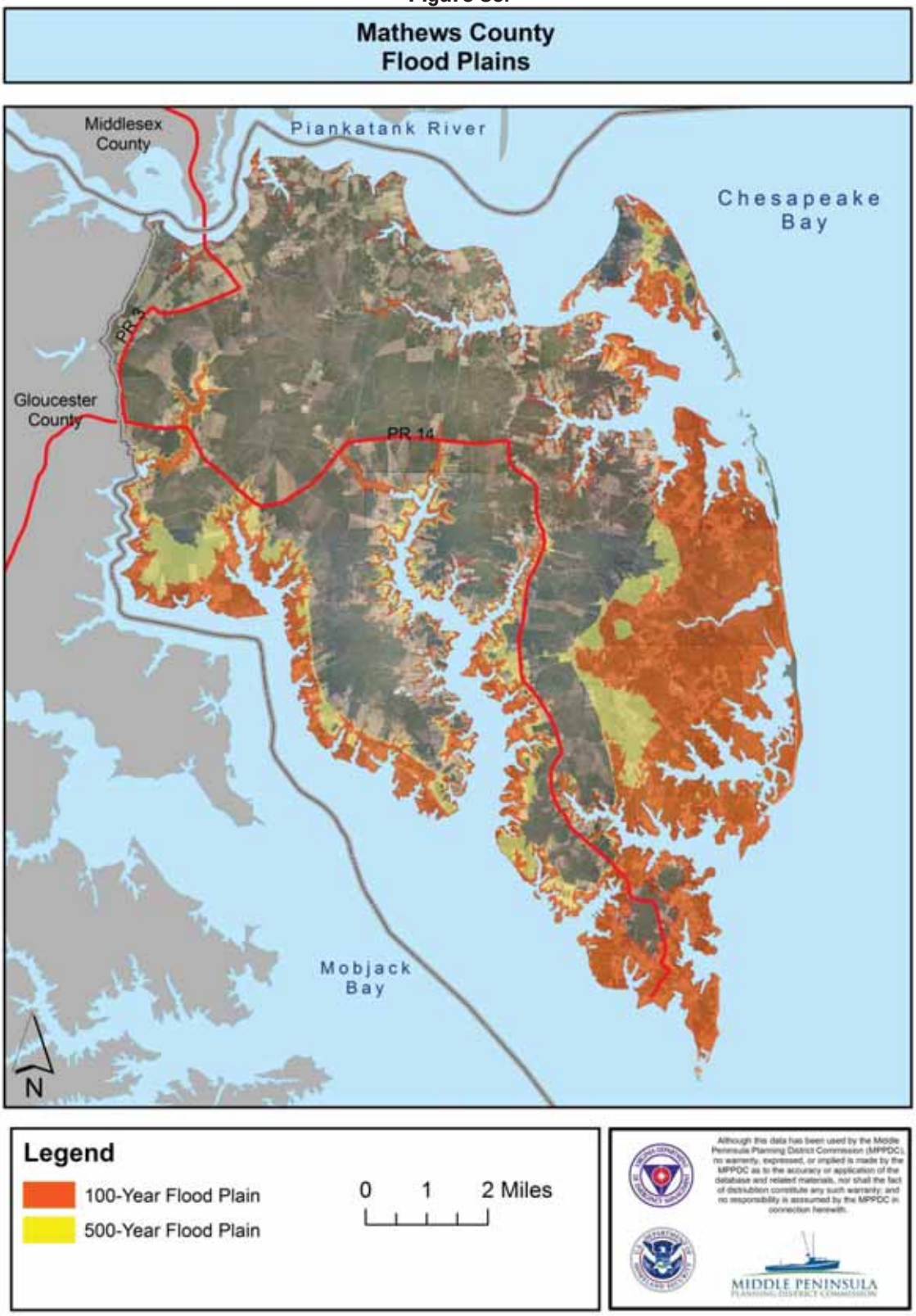

Mathews County
Flood Plains
Middlesex County
Piankatank River
Chesapeake Bay
PR 3
Gloucester County
PR 14
Mobjack Bay
N
Legend
100-Year Flood Plain
500-Year Flood Plain
0 1 2 Miles
MIDDLE PENINSULA

Figure 87:


Mathews County
Census Block Groups
Middlesex County
Piankatank River
Chesapeake Bay
PR 3
Gloucester County
PR 14
Mobjack Bay
N
Legend
Census Block Groups
0 1 2 Miles
MIDDLE PENINSULA

Figure 88:

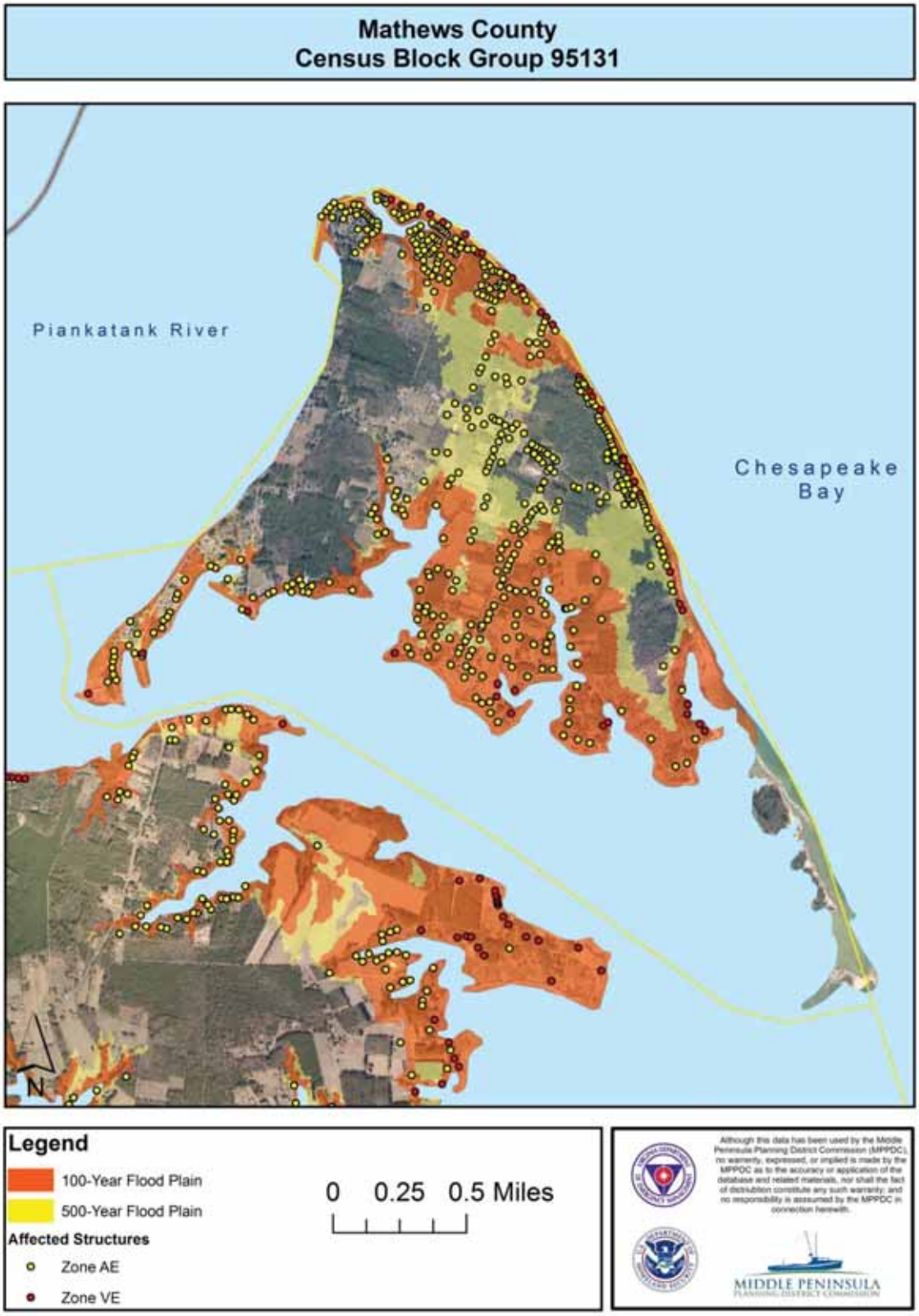

Mathews County
Census Block Group 95131
Piankatank River
Chesapeake Bay
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone AE
Zone VE
0 0.25 0.5 Miles
MIDDLE PENINSULA

Figure 89:

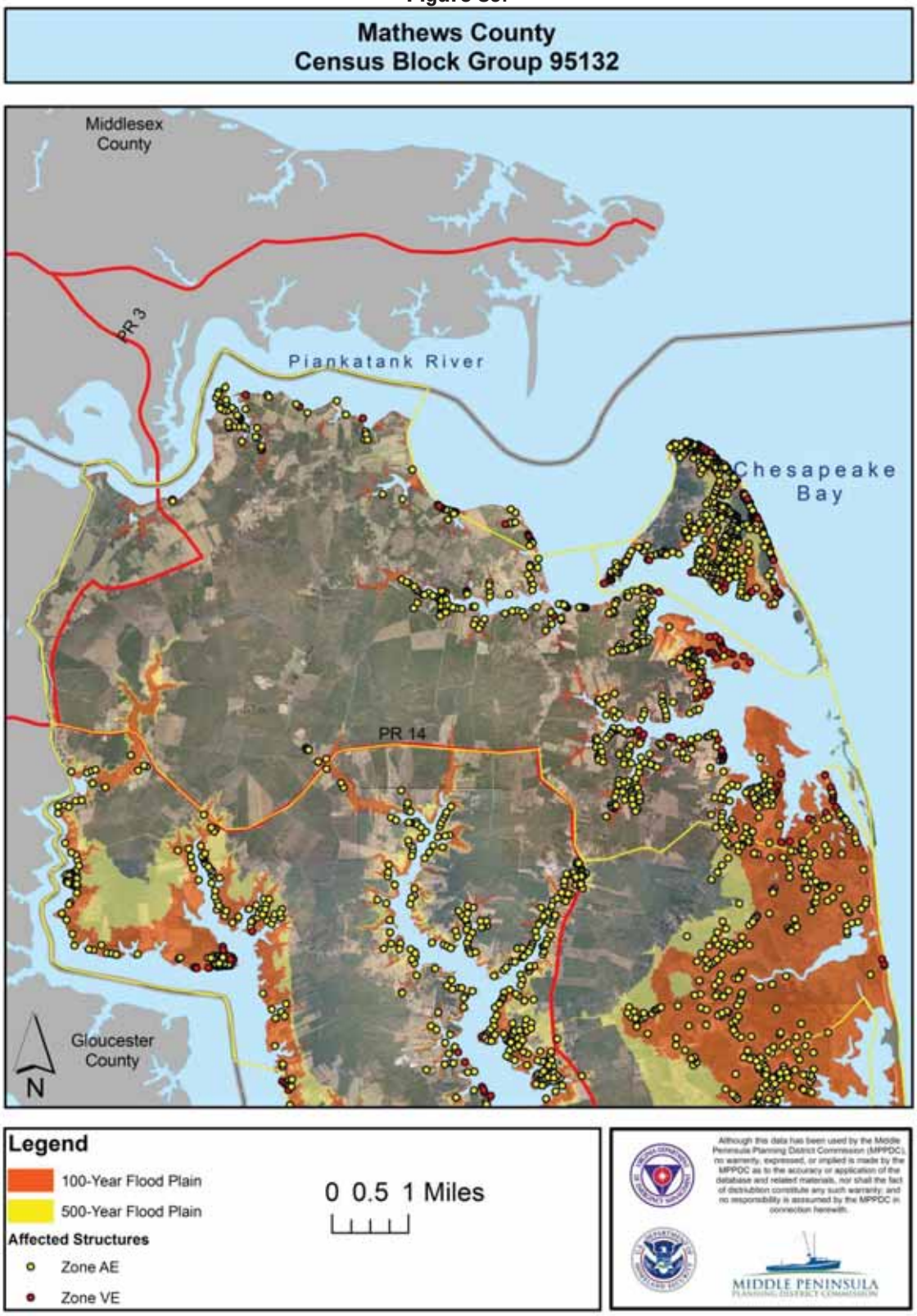

Mathews County
Census Block Group 95132
Middlesex County
Piankatank River
Chesapeake Bay
PR 3
PR 14
Gloucester County
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone AE
Zone VE
0 0.5 1 Miles
MIDDLE PENINSULA

Figure 90:

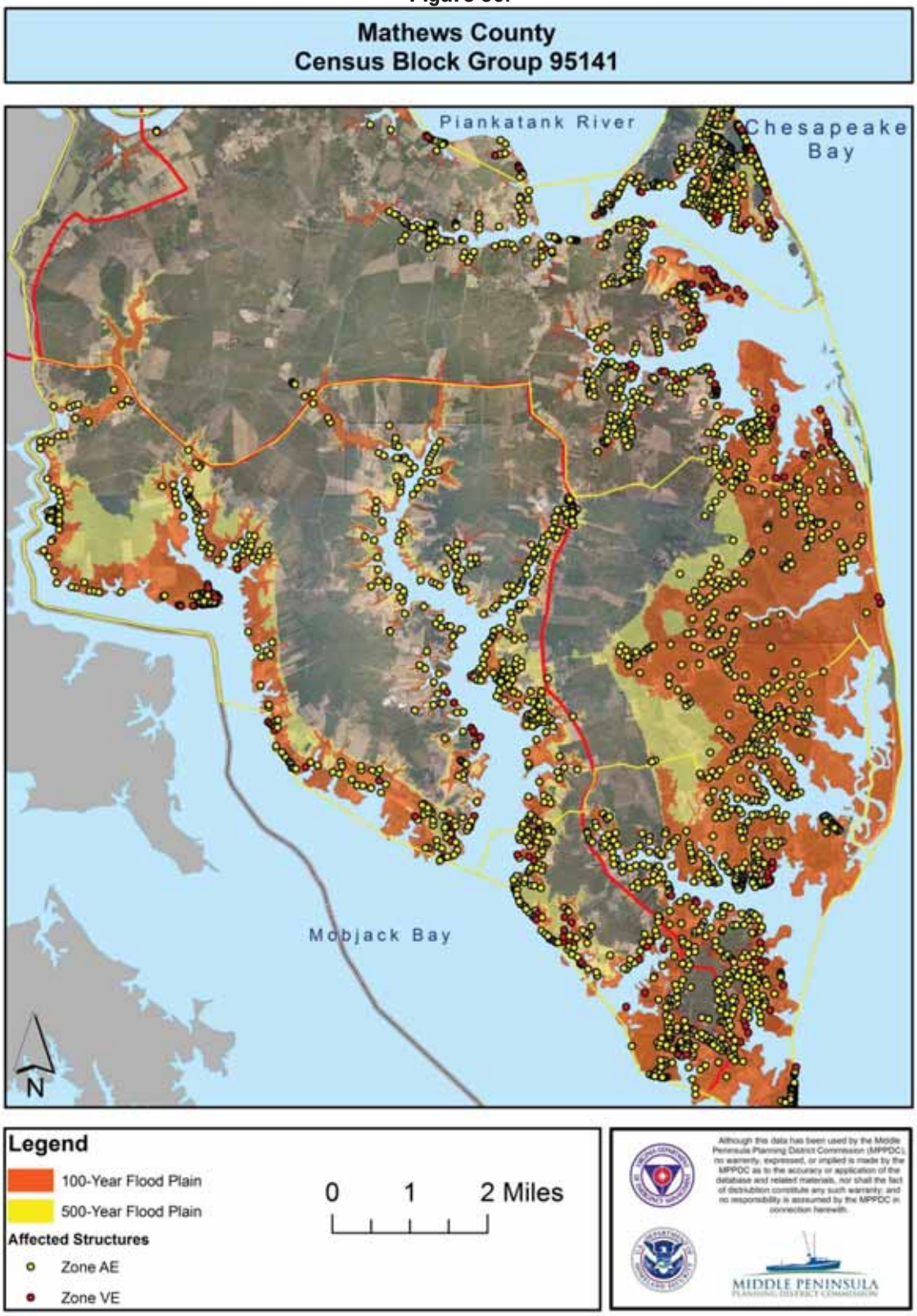
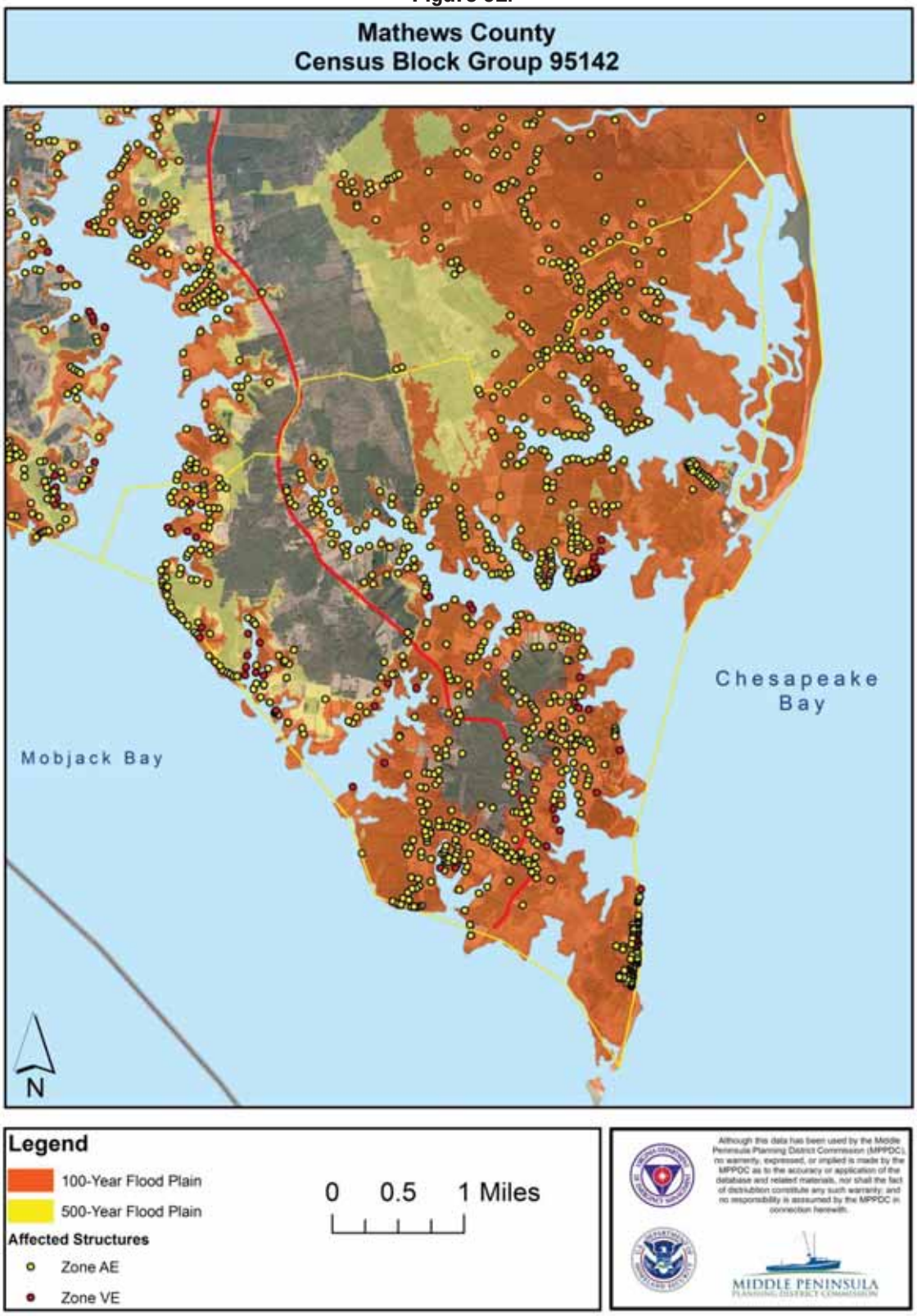

Mathews County
Census Block Group 95141
Piankatank River
Chesapeake Bay
Mobjack Bay
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone AE
Zone VE
0 1 2 Miles
MIDDLE PENINSULA

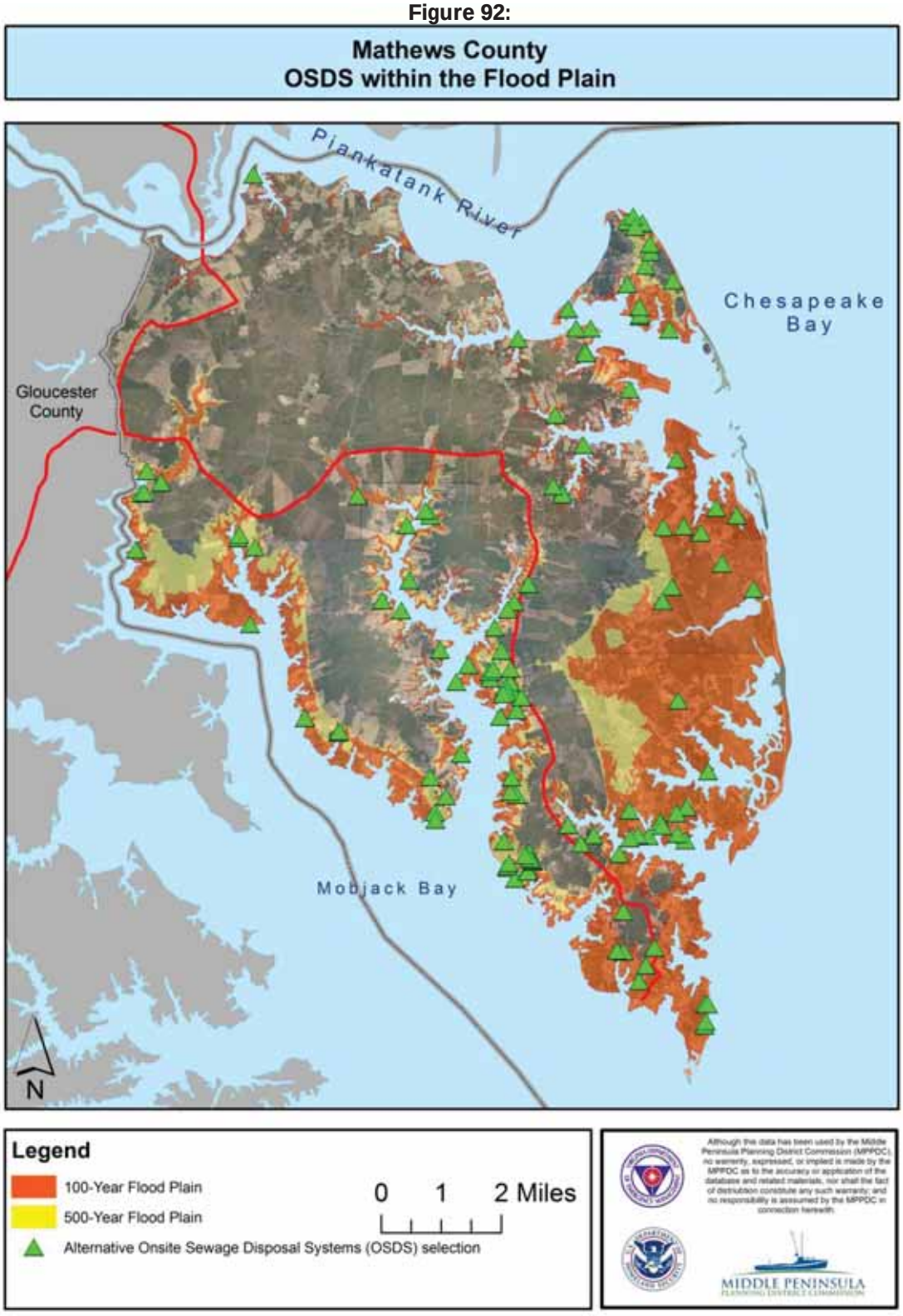
Figure 91:


Mathews County
Census Block Group 95142
Chesapeake Bay
Mobjack Bay
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone AE
Zone VE
0 0.5 1 Miles
MIDDLE PENINSULA

Alternative On-site Sewage Disposal Systems (OSDS)

The following map (Figure 92) show the location of the OSDS facilities constructed in the 100-year and 500-year floodplains in Mathews County.

Figure 92:



4.5.6. Middlesex County Critical Facilities and Public Utilities

The county does not currently operate any public water systems. However, there are community water systems operated by private companies serving the Village of Saluda and some of the larger residential subdivisions in the lower portion of the county in the Hartfield and Deltaville areas. These water systems do not sustain flood damages from severe hurricanes and nor'easters.

The County does have a public sewerage system in the planning stages that will serve the Village of Saluda and properties east along the Route 33 corridor towards the Cook's Corner area. The wastewater treatment plant and outfall for this proposed system will be built along a tributary of Urbanna Creek, located between Saluda and Cook's Corner.

Since this project is in the permitting/design stage, it is assumed that the facility will be designed and constructed in a manner to avoid any future adverse impacts from floodwaters.

According to VDOT officials, flood prone roads in Middlesex County/Urbanna include the following:

Table 34: Middlesex County/Urbanna Flood Prone Roads

Route	Road Name	Location
648	Montague Island Road	From Rte.604 to ESM
651	Smokey Point	From Rte. 640 to Rte. 685
1103	Irma's Lane	From Rte. 33 to Rte. 1102
628	Mill Creek Road	From Rte. 702 to ESM
636	Timber Neck Road	From Rte. 643 to Rte. 659

Public Boat Ramps

There are 3 public boat landings in Middlesex County that are owned and operated by the VDGIF:

Water Body	Access Area	Barrier Free	Type	Ramps	Latitude	Longitude
Parrotts Creek	Mill Stone	Yes	Concrete Ramp	1	37° 43' 36" N 37.7266569	76° 37' 19"W -76.6219992
Directions: Church View, Rt 17 North (1.1 miles); Right on Rt 640 (4.4miles; Left on Rt 608 (0.8 miles)						
Rappahannock River	Mill Creek	Yes	Concrete Ramp	1	37° 35' 3" N 37.5842494	76° 25' 28"W -76.4244480
Directions: From Hartfield, Rt 3 North (0.5 miles); Right on Rt 626 (3.1 miles)						
Rappahannock River	Saluda	Yes	Concrete Ramp	1	37° 37' 21" N 37.6225893	76° 34' 54"W -76.5816117
Directions: Rt 618 North (1.4 miles) of Saluda						
VDGIF, 2015						

Repetitive and Severe Repetitive Loss Residential Structures in Middlesex County

According to FEMA's records, Middlesex County has 35 Single Family Repetitive Loss properties and 2 Single Family Severe Repetitive Loss properties as of 5/31/15.

Properties in 100-year Floodplain by Census Block Group

The following series of maps show the location of structures in Middlesex County that are in Flood Zone A, Flood Zone AE or Flood Zone VE in the 100-year and 500-year floodplains. The legend is color coded to indicate the specific flood zone in which each structure lies.

Figure 93:

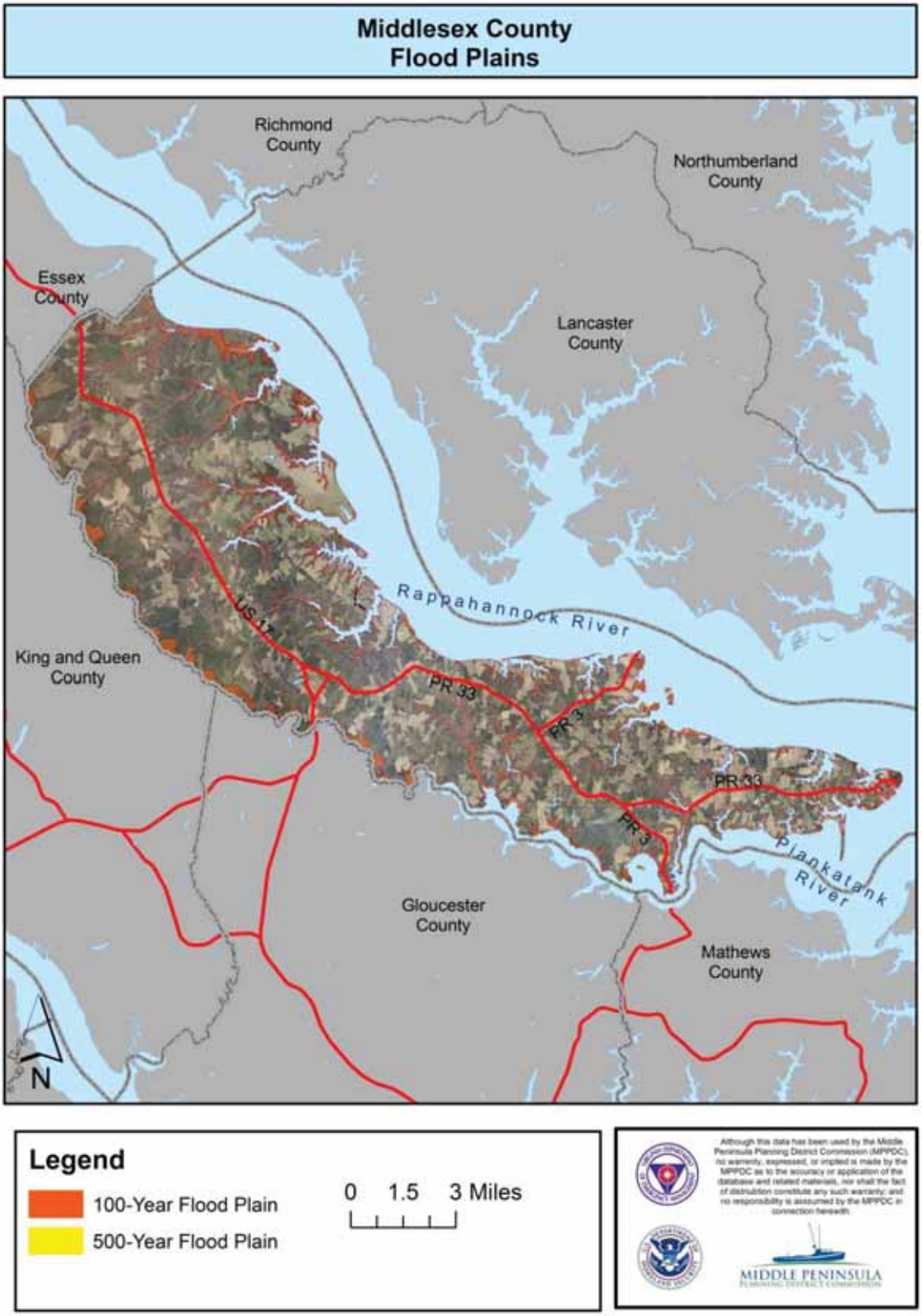

Middlesex County
Flood Plains
Richmond County
Northumberland County
Essex County
Lancaster County
Rappahannock River
US 17
King and Queen County
PR 33
PR 3
PR 33
PR 3
Piankatank River
Gloucester County
Mathews County
N
Legend
100-Year Flood Plain
500-Year Flood Plain
0 1.5 3 Miles
MIDDLE PENINSULA

Figure 94:

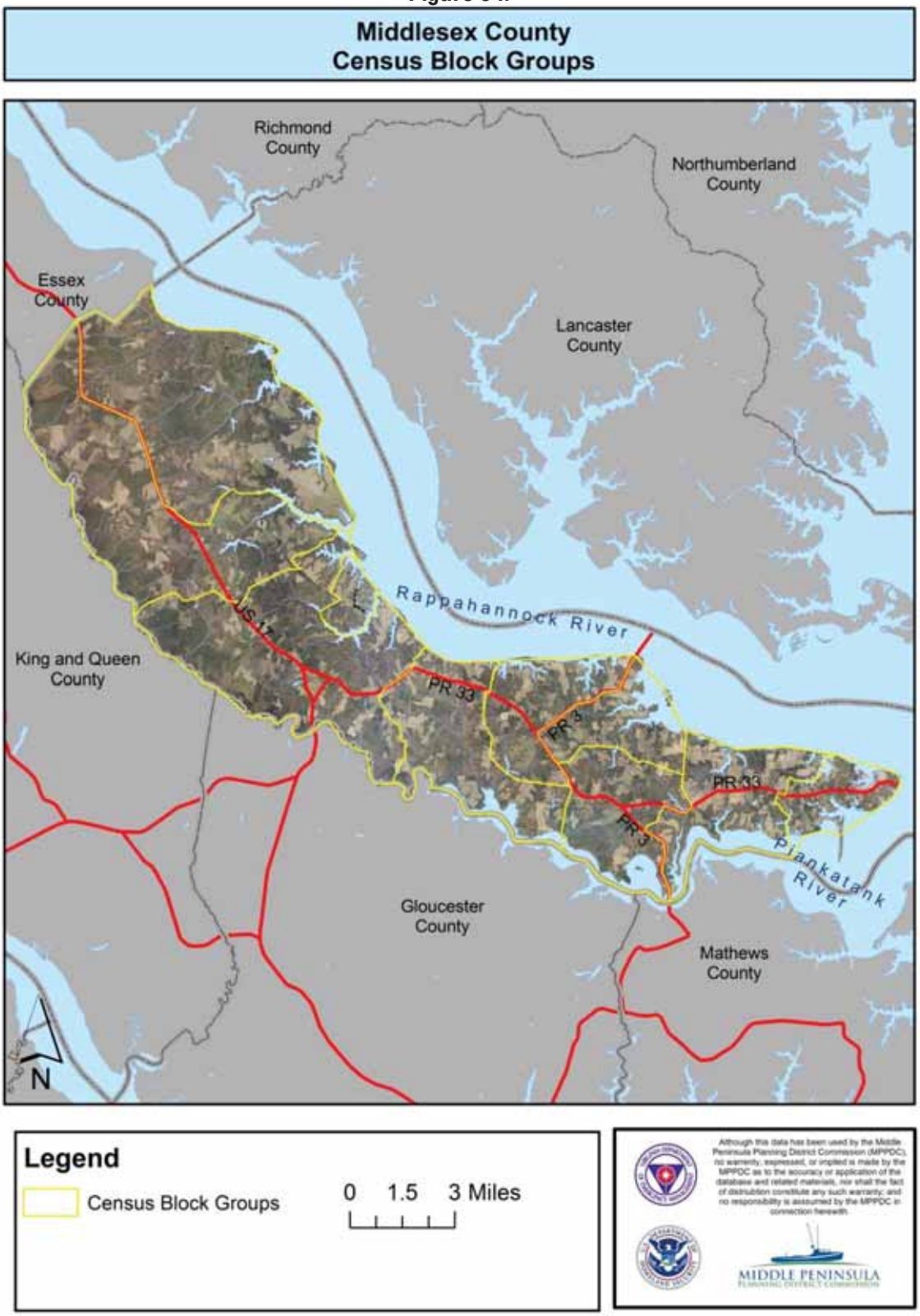

Middlesex County
Census Block Groups
Richmond County
Northumberland County
Essex County
Lancaster County
Rappahannock River
King and Queen County
US 17
PR 33
PR 3
Piankatank River
Gloucester County
Mathews County
N
Legend
Census Block Groups
0 1.5 3 Miles
MIDDLE PENINSULA

Figure 95:

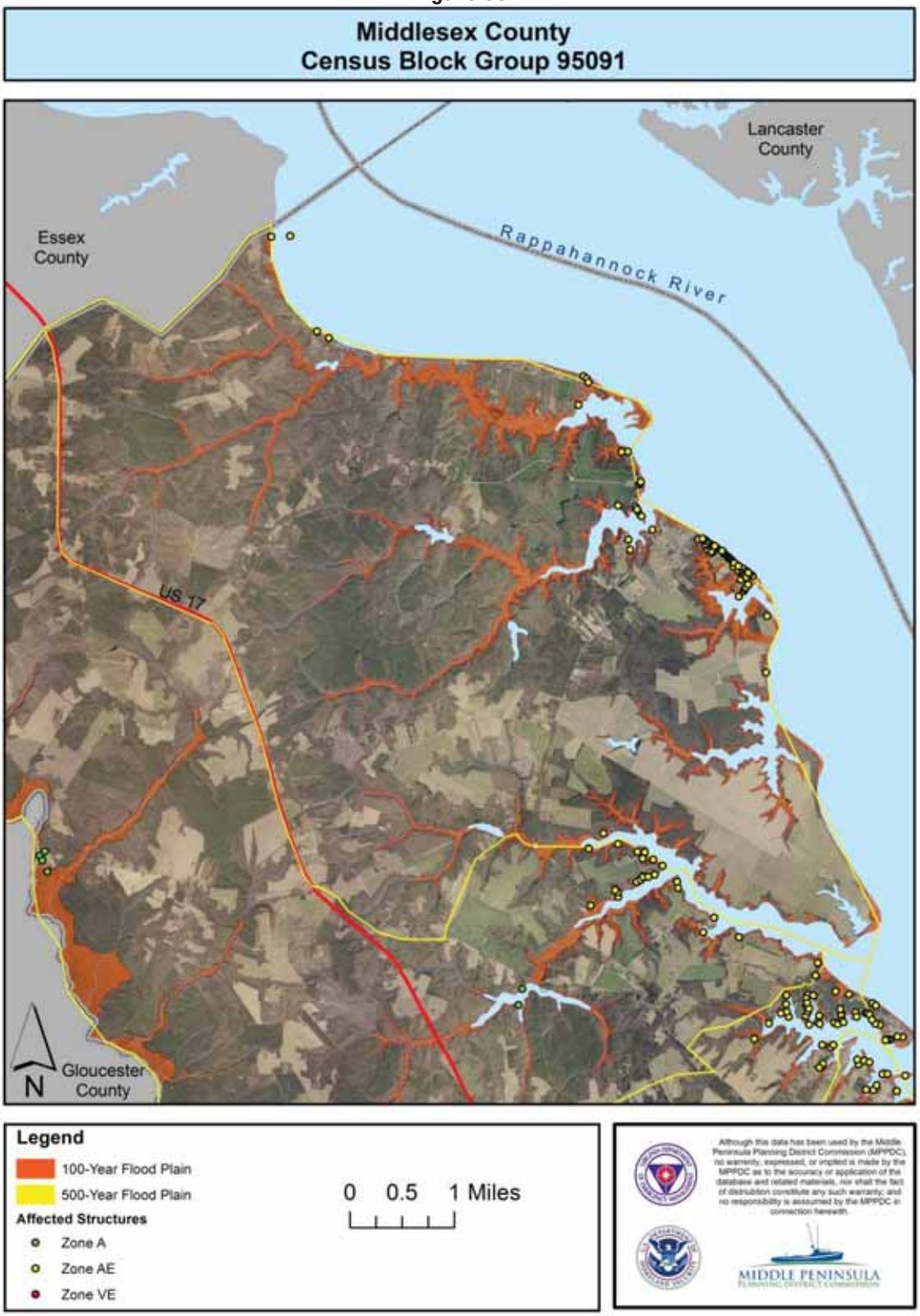

Middlesex County
Census Block Group 95091
Lancaster County
Essex County
Rappahannock River
US 17
Gloucester County
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone A
Zone AE
Zone VE
0 0.5 1 Miles
MIDDLE PENINSULA

Figure 96:

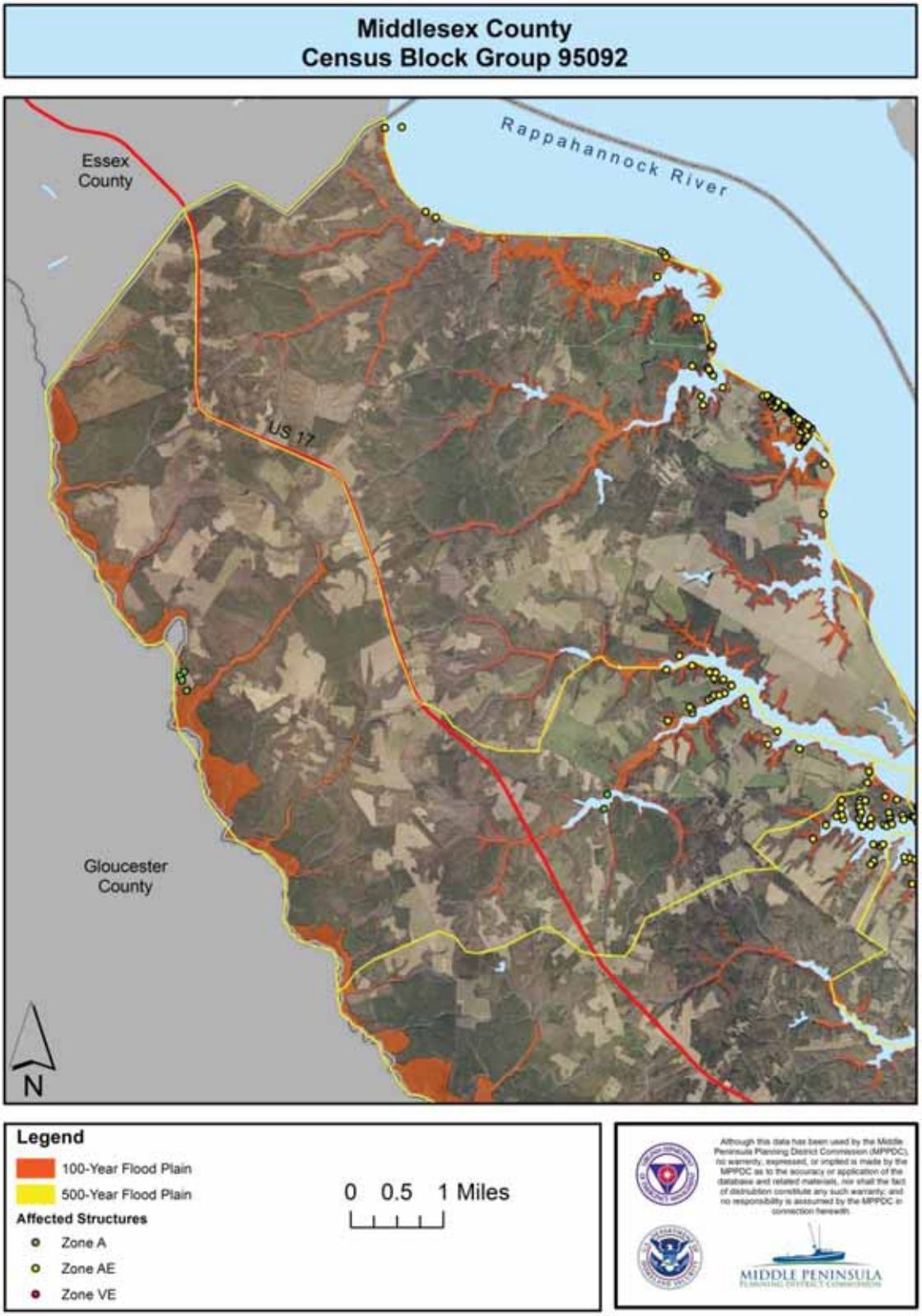

Middlesex County
Census Block Group 95092
Essex County
Rappahannock River
US 17
Gloucester County
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone A
Zone AE
Zone VE
0 0.5 1 Miles
MIDDLE PENINSULA

Figure 97:

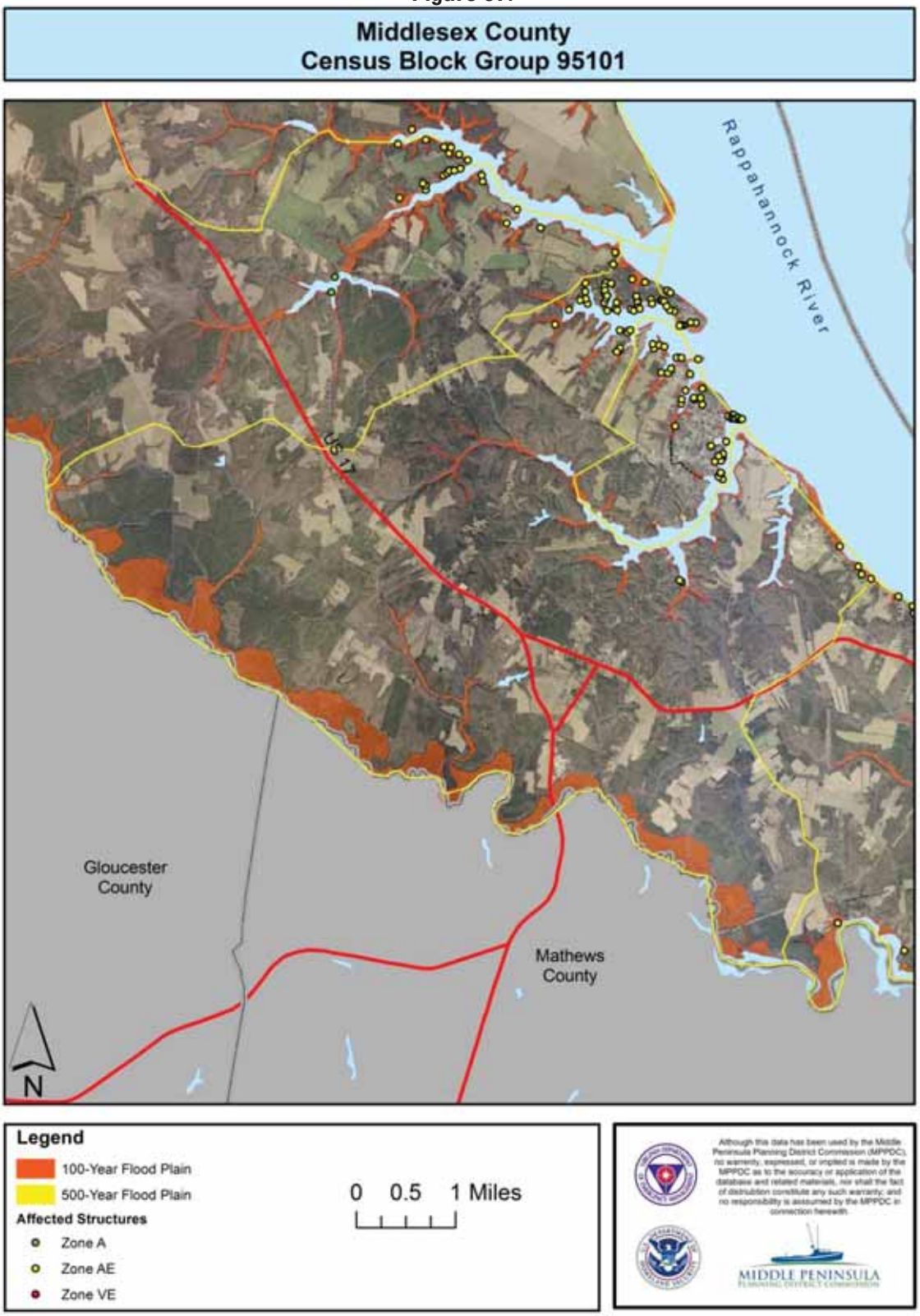

Middlesex County
Census Block Group 95101
Rappahannock River
US 17
Gloucester County
Mathews County
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone A
Zone AE
Zone VE
0 0.5 1 Miles
MIDDLE PENINSULA

Figure 98:

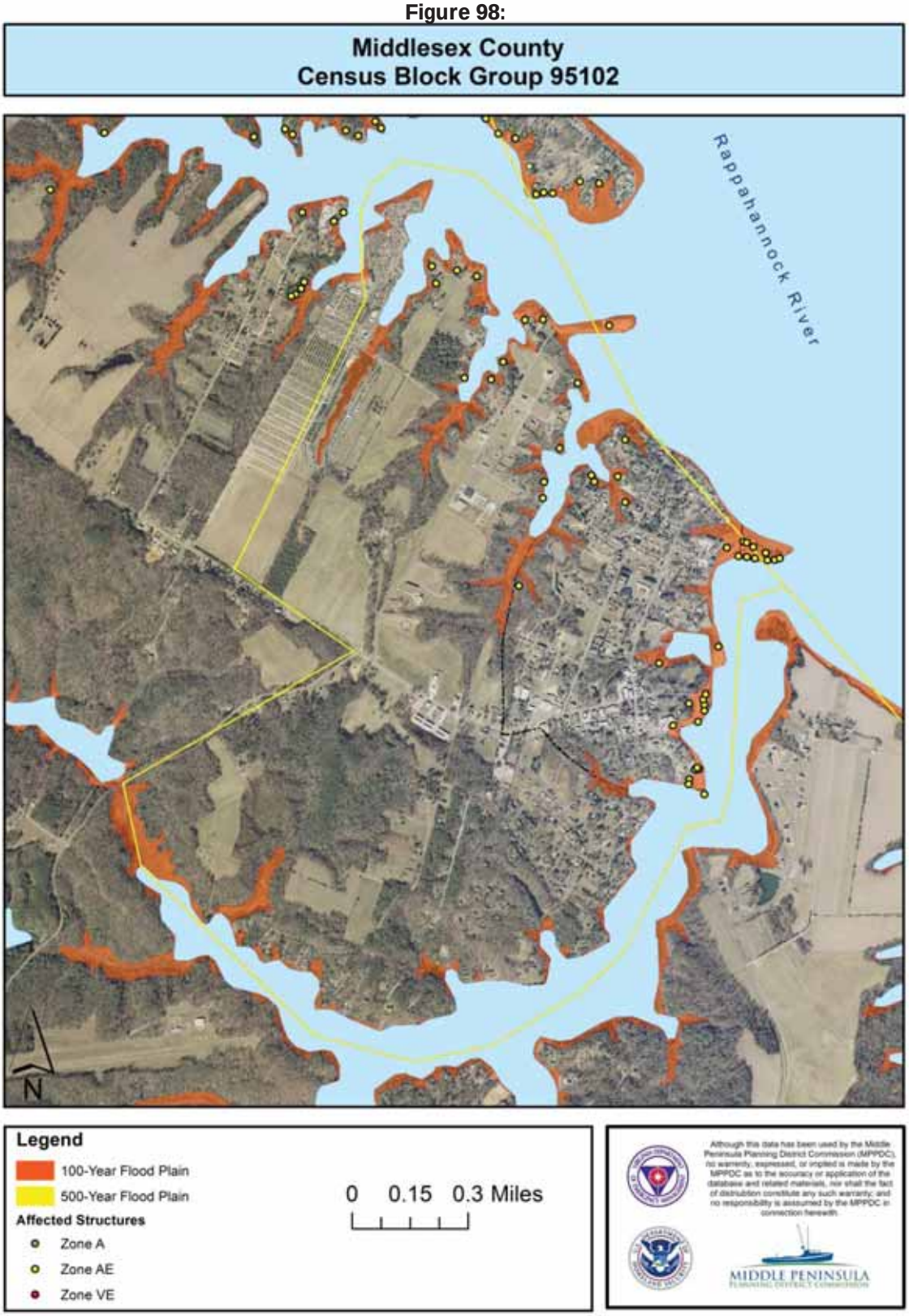

Middlesex County
Census Block Group 95102
Rappahannock River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone A
Zone AE
Zone VE
0 0.15 0.3 Miles
MIDDLE PENINSULA

Figure 99:

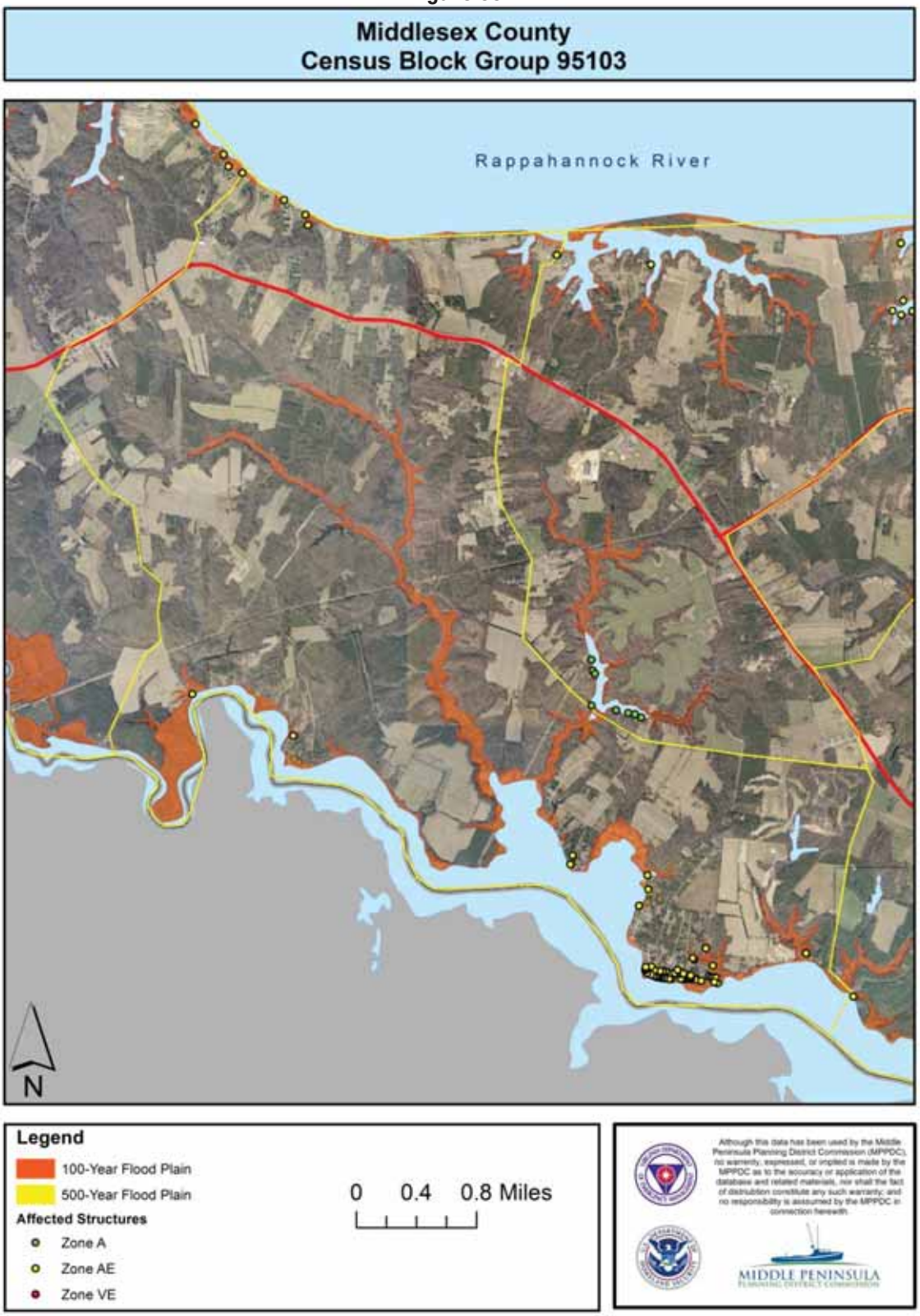

Middlesex County
Census Block Group 95103
Rappahannock River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone A
Zone AE
Zone VE
0 0.4 0.8 Miles
MIDDLE PENINSULA

Figure 100:


Middlesex County
Census Block Group 95111
Rappahannock River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone A
Zone AE
Zone VE
0 0.3 0.6 Miles
MIDDLE PENINSULA

Figure 101:

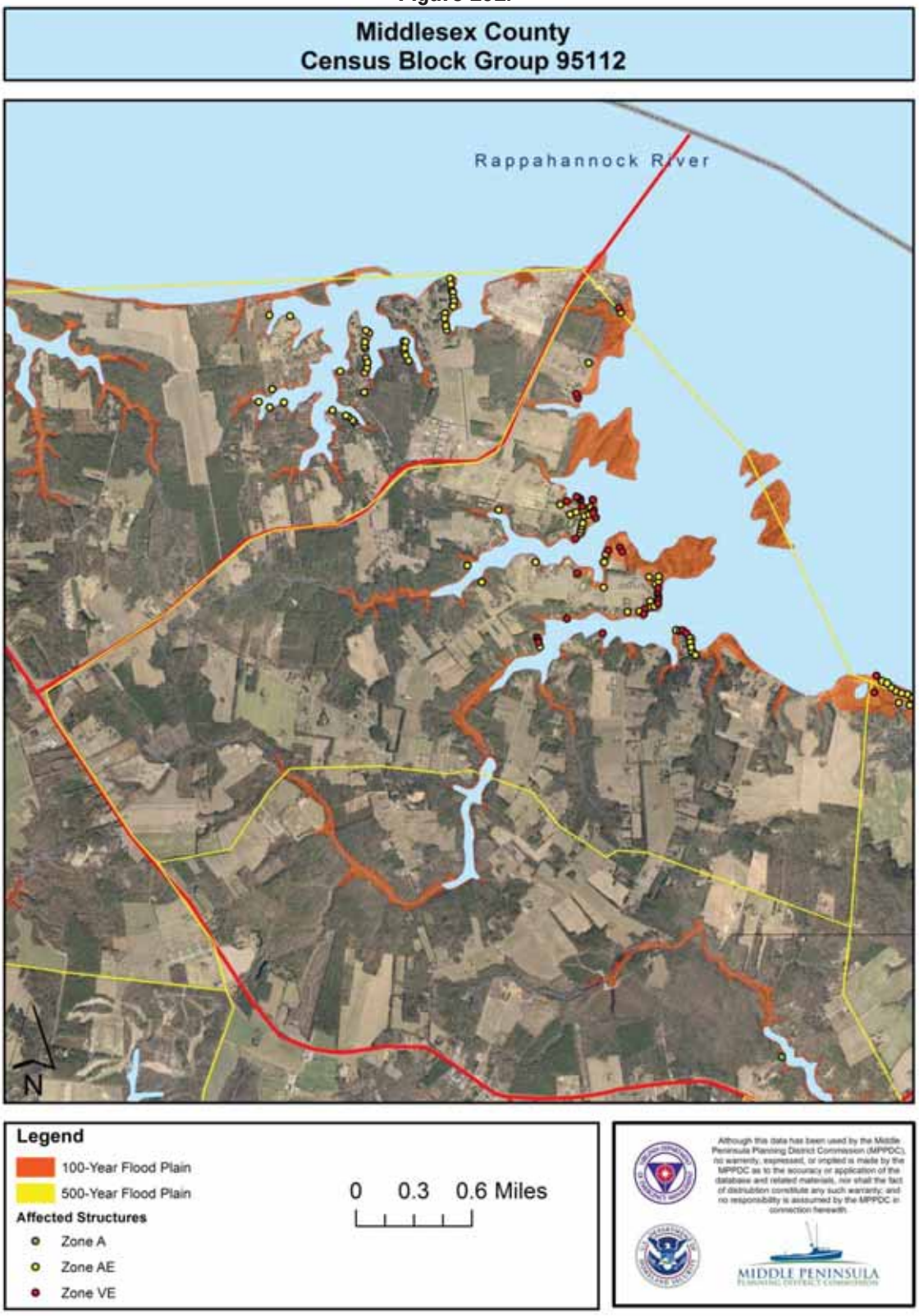

Middlesex County
Census Block Group 95112
Rappahannock River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone A
Zone AE
Zone VE
0 0.3 0.6 Miles
MIDDLE PENINSULA

Figure 102:

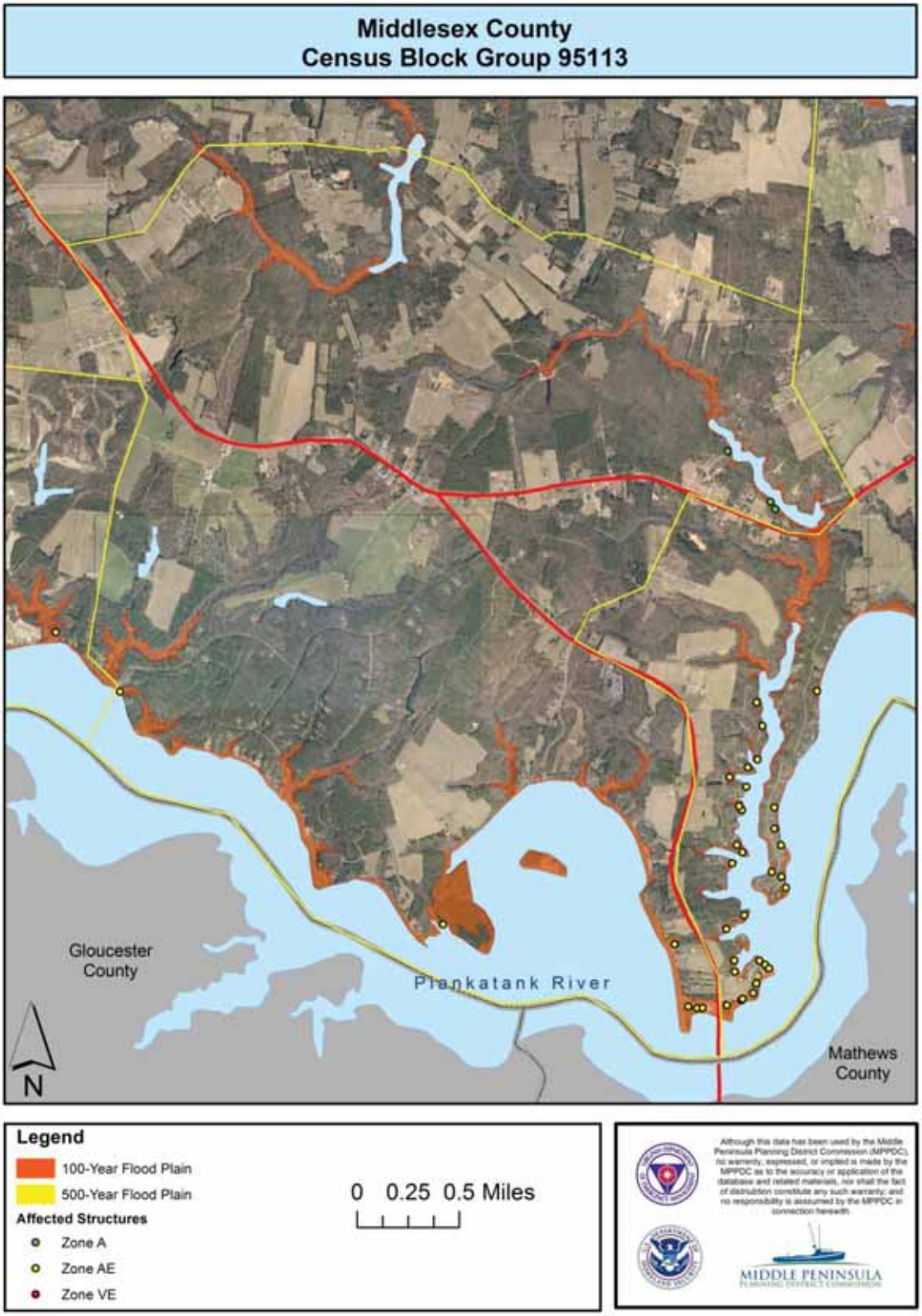

Middlesex County
Census Block Group 95113
Gloucester County
Plankatank River
Mathews County
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone A
Zone AE
Zone VE
0 0.25 0.5 Miles
MIDDLE PENINSULA

Figure 103:


Middlesex County
Census Block Group 95121
Rappahannock River
Piankatank River
Mathews County
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone A
Zone AE
Zone VE
0 0.375 0.75 Miles
MIDDLE PENINSULA

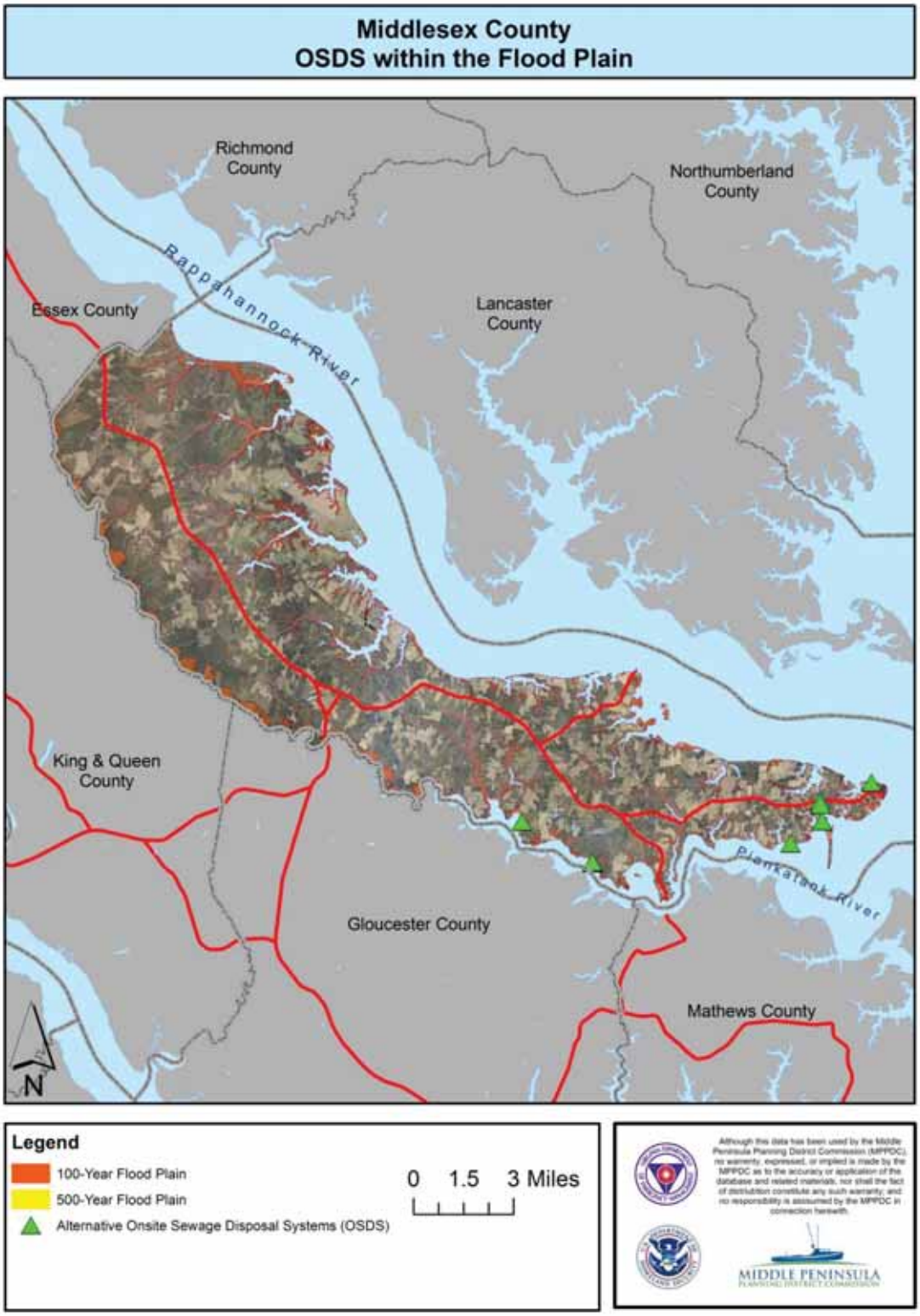
Figure 104:


Middlesex County
Census Block Group 95122
Rappahannock River
Piankatank River
N
Legend
100-Year Flood Plain
500-Year Flood Plain
Affected Structures
Zone A
Zone AE
Zone VE
0 0.25 0.5 Miles
MIDDLE PENINSULA

Alternate On-site Sewage Disposal Systems (OSDS)

The map (Figure 105) below show the location of the OSDS facilities constructed in the 100-year and 500-yer floodplain in Middlesex County.

Figure 105:



Urbanna Critical Facilities and Public Utilities

The Town of Urbanna provides public water and sewer service to its residents. The town operates the public water system which serves town residents as well as some nearby customers in surrounding Middlesex County.

The sewerage collection and treatment system is operated by the Hampton Roads Sanitation District (HRSD). When flood waters are anticipated, the staff at HRSD turn off the pumps at the sewerage pump stations in order to prevent pumping floodwaters into the wastewater treatment plant.

The wastewater treatment plant is located on high land next to the town's water tower, which is an area that does not flood.

The town operates the Urbanna Town Marina that includes a boat/fishing dock, a small beach area, a small park and a small operations building - all located at Upton's Point along the Rappahannock River. This facility suffered significant damage in 2003 from Hurricane Isabel and has been completely rebuilt since then at an approximate cost of $850,000.

Repetitive and Severe Repetitive Loss Residential Structures in the Town of Urbanna

According to FEMA's records, the Town of Urbanna has 2 (ie. 1 Single Family and 1 Other resident property) Repetitive Loss residential properties and zero Severe Repetitive Loss properties as of 5/31/15.

In 2003, Hurricane Isabel damaged/destroyed 5 houses along low-lying Island Drive. When these houses were re-built by the property owners, they were elevated in order to prevent future damage from flood waters along this section of the Rappahannock River.

Section 5: Risk Assessment Analysis –
Flooding, Hurricane, and Sea Level Rise

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide methodology and software application to develop multi-hazard losses at a regional scale. The loss estimates are used primarily by local, state and regional officials to plan and stimulate efforts to reduce risk from multi-hazards and prepare for emergency response and recovery[1]. For specifics regarding methodology please see Appendix J.

Potential loss estimates analyzed in Hazus-MH include:

- Physical damage to residential and commercial buildings, schools, essential facilities, and infrastructure
- Economic loss including lost jobs, business interruptions, repair and reconstruction costs.

The Hazus Flood Model analyzes both riverine and coastal flood hazards. Flood hazard is defined by a relationship between depth of flooding and the annual chance of inundation to that depth. Statistical flood frequencies were modeled in this revision to be able to determine annualized loss for each of the counties in Middle Peninsula PDC. Statistical flood frequencies are modeled by looking at the damage that is likely to occur over a given period of time, known as a return period or recurrence interval.

Depth, duration and velocity of water in the floodplain are the primary factors contributing to flood losses. Other hazards associated with flooding that contribute to flood losses include channel erosion and migration, sediment deposition, bridge scour and the impact of flood-born debris. The Hazus Flood Model allows users to estimate flood losses primarily due to flood depth to the general building stock (GBS). While velocity is also considered, it is not a separate input parameter and is accounted within depth-damage functions (i.e., expected percent damage given an expected depth) for census blocks that are defined as either coastal or riverine influenced. The agricultural component will allow the user to estimate a range of losses to account for flood duration. The flood model does not estimate the losses due to high velocity flash floods at this time[1].

Flood Analysis

The flood analysis for the HIRA was completed using the FEMA Hazus – MH V2.2 software for both riverine and coastal flood hazards. Varying flood analyses have been performed to both identify and characterize the flood hazard and the subsequent loss-potential or risk. The standard methodology of defining loss potential for any given hazard, includes annualizing the potential over a series of statistical return periods. Annualization is the mathematical method of converting individual losses to a weighted-average that may be experienced in any given year. The standard scope pertaining to flood risk corresponds to annualizing the 0.2%, 1%, 2%, 4%, and 10% flooding return periods. In layman's-terms these same annual-chance return periods are often described as the 500-year, 100-year, 50-year, 25-year and 10-year events as shown in Table 35 below:

[1] HAZUS-MH Flood User Manual

Table 35: Annual probability base on flood recurrence intervals.	
Flood Recurrence Interval	**Annual Chance of Occurrence**
10 year	10.0%
25 year	4.0%
50 year	2.0%
100 year	1.0%
500 year	0.2%

Practically, these statistical events represent the chance of being equaled or exceeded in any given year; i.e., the likelihood that a particular event with a given intensity occurs on average at least once every x-years. Once each of these statistical return periods are calculated, an annualized value is computed thus offering a perspective for any given year.

The various flood modeling performed as part of the current Plan update, along with the respective risk results, represent the primary goal of producing estimated flood losses for the aforementioned statistical return periods and then the annualized flood losses. However, it is important to note that the idiom of 'comparing apples with oranges' very-much applies to the various elements of flood modeling as well as modeling risk from flooding potential. Therefore, where appropriate differing modeling methodologies and their respective results have been separated for comparative purposes as described and highlighted in the bulleted List below. The same list also presents the order in which Hazus modeling information is presented:

The various modeling performed includes the following:

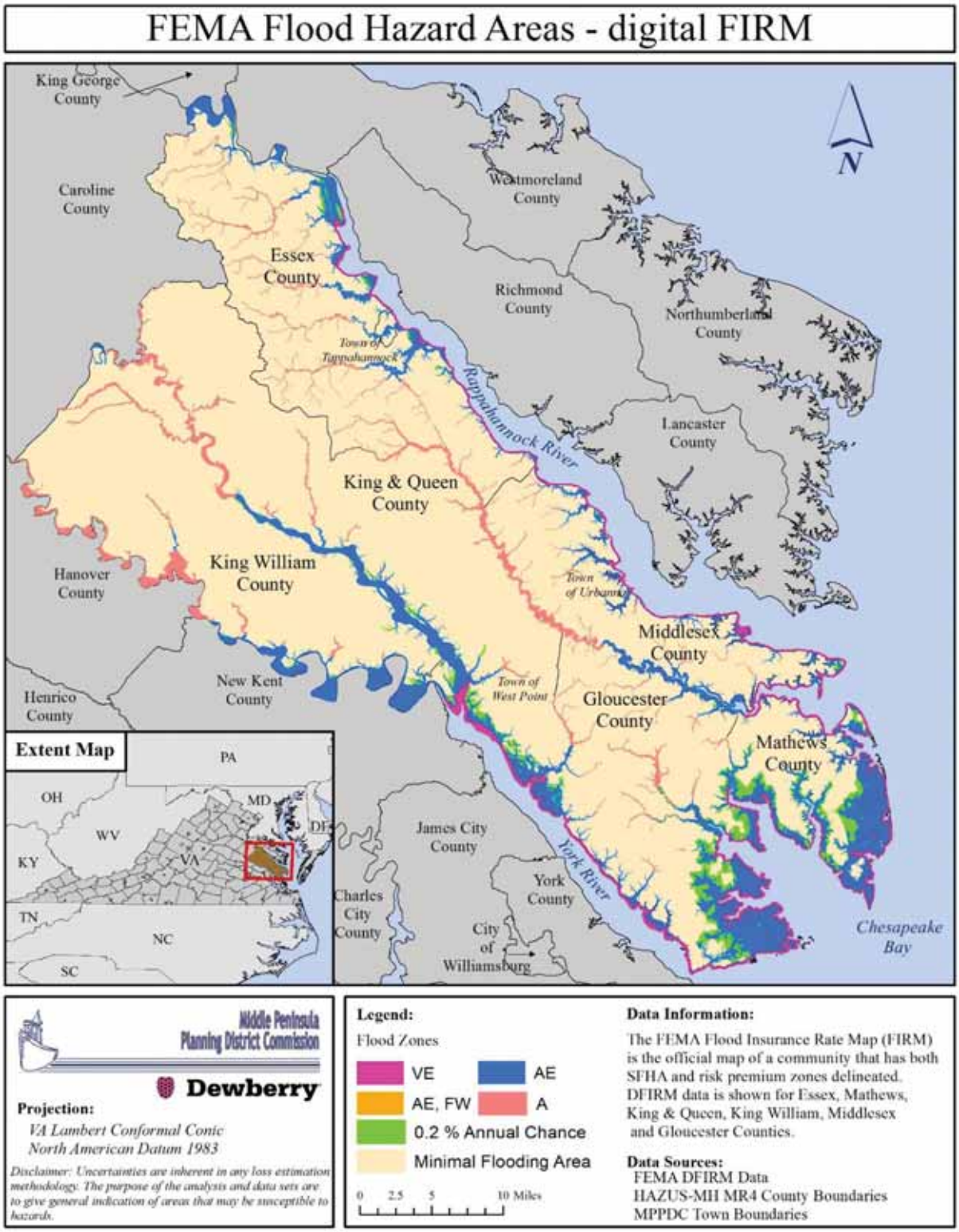
- **FEMA Floodplains and Depth Grid Information**
- **Hazus Building Stock (Inventory of Buildings)**:
  - All modeling utilized stock Hazus inventory values (Version 2.2 – Census 2010)
  - All modeling utilized Hazus Dasymetric Census Geographies
  - All modeling utilized stock Hazus facilities
- **Hazus Level 1 Multi-frequency Flood Modeling** – Hazus Level 1 methodology employed
  - Core Inputs or Parameters:
    - Digital Elevation Model (DEM) – National Elevation Dataset (NED) One-Arc Second (~30 meter resolution)
    - Frequencies (Both Riverine & Coastal) - 0.2%, 1%, 2%, 4%, and 10%
    - Riverine:
      - One-Square Mile (1 mi^2)Drainage Threshold
    - Coastal:
      - Stillwater elevations from Table 2 – Transect Data from each respective FEMA Flood Insurance Study (FIS):
        - ESSEX COUNTY – Revised May 4, 2015
        - GLOUCESTER COUNTY – Revised November 19, 2014
        - KING AND QUEEN COUNTY – Preliminary October 3, 2013
        - KING WILLIAM COUNTY – Preliminary October 3, 2013
        - MIDDLESEX COUNTY – Revised May 18, 2015
        - MATHEWS COUNTY – Revised December 9, 2014
      - NOTE: Hazus stock shoreline data was modified to extend up the York River so that Level 1 coastal modeling could be completed for King William County, King and Queen County and portions of Gloucester County upstream of the George Washington Memorial Highway Bridge (US 17).

- **Hazus Level 1 Annualized Loss** - Hazus Level 1 methodology employed (from Multi-frequency above)
- **Comparative Flood Modeling**:
    - FEMA RiskMAP 1% Coastal - Hazus Level 2 methodology employed
        - Hazus Level 2 – Only use of the updated or refined flood hazard produced and provided by Army Corps of Engineers (USACE) for FEMA Risk MAP studies
    - Hazus Level 1 – Only 1% Coastal (from Multi-frequency above)
        - Use only the Level 1 Coastal 1% frequency to compare to the FEMA RiskMAP Coastal 1% frequency

FEMA Floodplains and Depth Grid Information

FEMA initiates Flood Insurance Studies (FIS) on a national prioritization schedule. The most recent FIS's have been incorporated into this Plan as outlined by date in the list above; dates ranging from October 2013 to May 2015. These various new studies have produced updated coastal flood hazards for all of the jurisdictions in the MPPDC planning area; and riverine flood hazards remain from previous flood insurance studies. Figure 106 illustrates the extent of flood hazards as defined by the most recent FEMA flood insurance studies.

Figure 106:

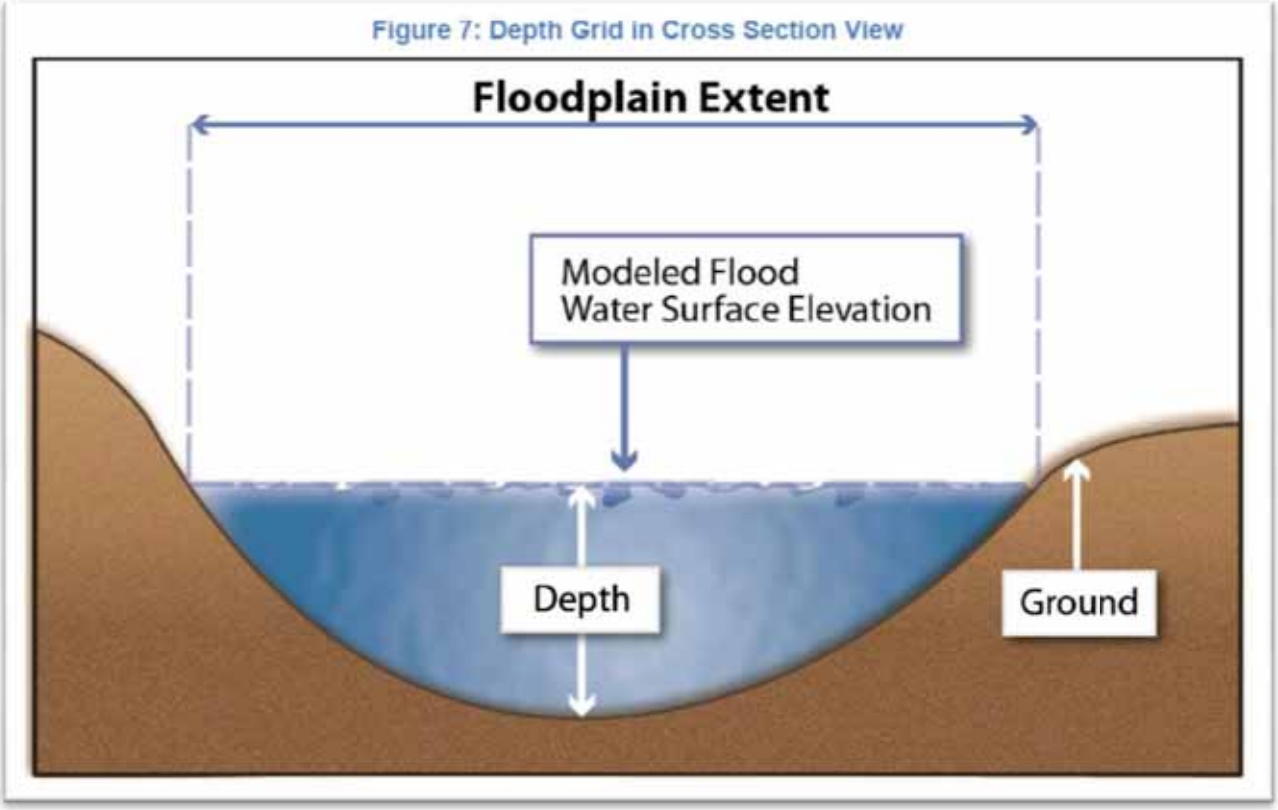


The new coastal flood hazards associated with the most recent FEMA studies have been produced under the RiskMAP Program. In short, the RiskMAP Program seeks to include risk assessments as part

of a flood insurance study to better communicate the risk of flooding. Consequently, a RiskMAP study includes all of the regulatory Flood Insurance Study products; namely engineering, floodplain mapping, digital FIRM data and report text. However, in addition to the traditional regulatory products, RiskMAP also includes new non-regulatory products aimed at communicating risk. One of the core non-regulatory datasets includes the creation of depth grids from the digital FIRM data. These new depth grids are the key to performing risk assessments in the Hazus software as they are able to be directly imported.

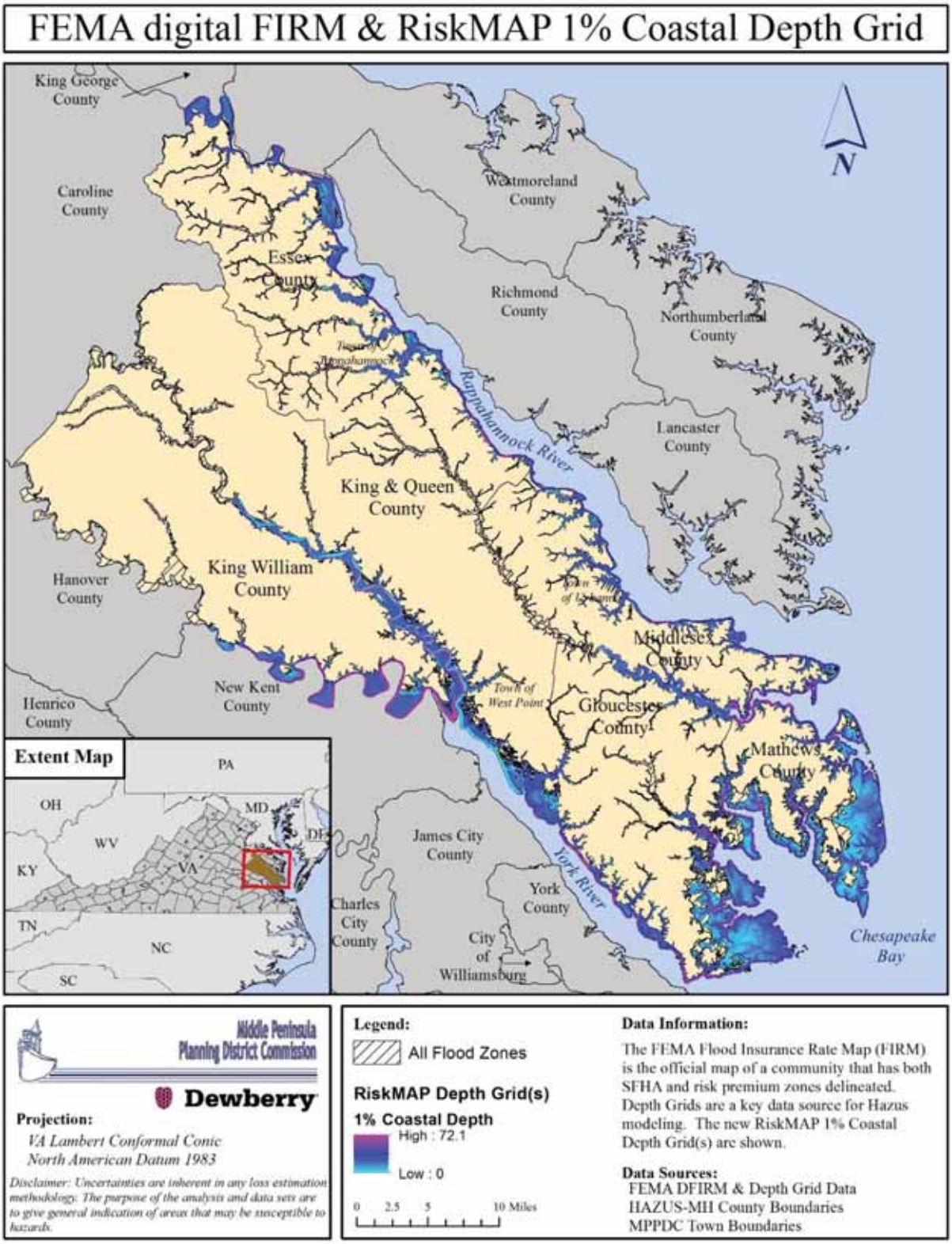
The flood hazard within Hazus is ultimately defined by a depth grid which is a representation of the difference between the estimated water surface and ground elevations for each respective flood frequency or annual chance. The following image is a simplified representation as shown in FEMA's Guidance for Flood Risk Analysis and Mapping, Flood Depth and Analysis Grids (May 2014):

Figure 7: Depth Grid in Cross Section View



The new RiskMAP projects for each of the counties in the MPPDC planning area include new coastal 1% Annual Chance depth grids. Figure 107 below shows these new coastal 1% Annual Chance depth grids and the new FEMA digital FIRM floodplains:

Figure 107:


FEMA digital FIRM & RiskMAP 1% Coastal Depth Grid
King George County
Caroline County
Westmoreland County
Essex County
Richmond County
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Middlesex County
New Kent County
Henrico County
Gloucester County
Mathews County
James City County
York River
York County
Charles City County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
All Flood Zones
RiskMAP Depth Grid(s)
1% Coastal Depth
High : 72.1
Low : 0
0 2.5 5 10 Miles
Data Information:
The FEMA Flood Insurance Rate Map (FIRM) is the official map of a community that has both SFHA and risk premium zones delineated. Depth Grids are a key data source for Hazus modeling. The new RiskMAP 1% Coastal Depth Grid(s) are shown.
Data Sources:
FEMA DFIRM & Depth Grid Data
HAZUS-MH County Boundaries
MPPDC Town Boundaries

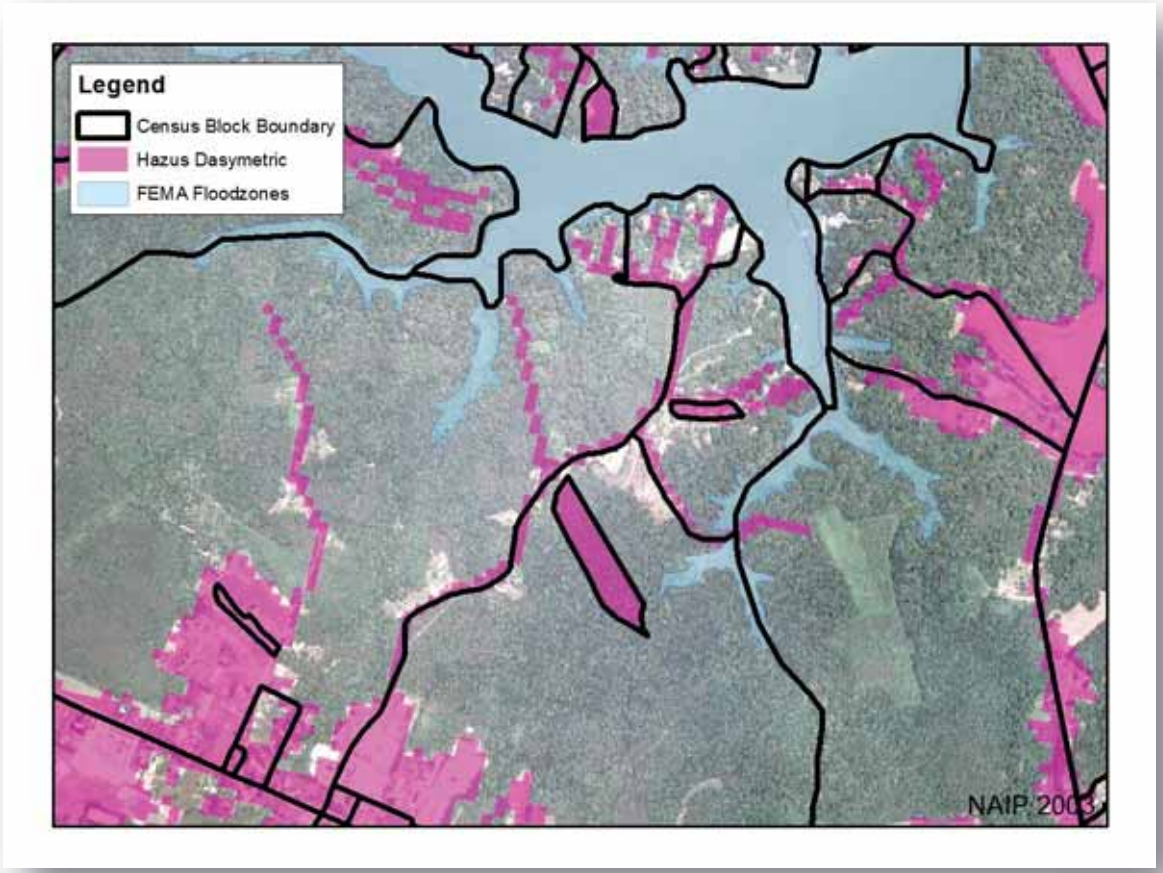
RiskMAP depth grids are considered to be superior to depth grids created from typical out-of-the-box Hazus analyses for a variety of reasons. However, users should understand that RiskMAP coastal projects are only scoped to produce 1% Annual Chance depth grids; i.e., multi-frequency depth grids are not prescribed for coastal projects. Armed with this information, it therefore becomes necessary to model multiple-frequencies in Hazus to arrive at annualized loss results. Fortunately, Hazus is a tool that offers flexibility and enables the user to provide more detailed inputs or specify input parameters that can introduce an increased level of reliability of depth values produced. Notwithstanding, RiskMAP depth grids are considered superior because of the guidelines under which they were created and the precision and accuracy of the inputs to their creation. Ultimately, where RiskMAP projects produce new multi-frequency depth grids, these grids can all be run through Hazus and a new annualized values can be produced. And where multi-frequency depth grids do not exist, it best to refrain from 'mixing apples and oranges' and rather, compare results for relative differences or similarities.

Ultimately, the Hazus flood modeling and risk assessments for this Plan update have been produced with the intent to improve upon previous Plan Hazus modeling and to incorporate any new RiskMAP-based depth grids. Riverine flood hazards were not updated in the most recent FIS's and there are no new RiskMAP depth grids. Therefore, this Plan update includes Hazus Level 1 multi-frequency modeling for both riverine and coastal. Improvements to the riverine modeling from the previous Plan are related to the drainage area threshold defined. In most cases, the FEMA flood maps have been developed for streams with contributing drainage area of 1 square mile. The previous Plan Hazus flood modeling only utilized a one-square mile drainage threshold for Mathews County and the remainder were completed at ten-square mile. However, this Plan revision has utilized one-square mile drainage threshold for all counties in the MPPDC region. As for the Level 1 multi-frequency modeling for coastal influences, the new Stillwater elevations from Table 2 – Transect Data from each respective FEMA Flood Insurance Study (FIS) was entered into the Hazus software.

Results from the various Hazus flood modeling are covered in sections below with primary focus on the annualized results. However, first the inventory of building stock is discussed.

Building Stock

Hazus building stock is the inventory of buildings (i.e., square-footage) of each respective type or sub-type of buildings in the following categories; residential, commercial, industrial, agricultural, religious, government, and education. Hazus assumes that all square-footage (i.e., buildings) are evenly distributed throughout a given census block and therefore damage is estimated as a percent and is weighted by the area of inundation at a given depth for a given census block. The methodology therefore, is known as an area-weighted methodology. FEMA has initiated recent improvements to the area-weighted methodology by further refining the distribution of building square-footage to land areas characterized by development and removing land areas typical of non-developed land classes (e.g., forests, wetlands, etc…). This refinement is called dasymetric mapping and the current Plan modeling utilizes the FEMA dasymetric building stock. The following shows a small example area in which the developed areas are pink:



Use of the new dasymetric data will typically reduce the total area subject to area-weighted loss estimations - particularly for those census blocks that have flood risk yet actual development does not exist within the floodplains. An area analysis of the dasymetric versus full stock census blocks is exemplified in the chart below:

Digital FIRM Acreage Type	Census Block Type	
	Dasymetric	Full Stock
Acres of 0.2% Annual Chance Floodplains (500-year)	5,909 Ac (1% of Total Acres)	14,806 Ac (2% of Total Acres)
Acres of 1% Annual Chance Floodplains (100-year)	23,216 Ac (3% of Total Acres)	85,736 Ac (11% of Total Acres)
Total Acres of Census Blocks MPPDC Region		**794,644 Ac**

A comparison of FEMA digital FIRM data intersecting the two types of Hazus census blocks reveals that an estimated four-percent (4%) of the dasymetric data is within the extents of the 0.2% Annual Chance Floodplains versus thirteen-percent (13%) when using full census blocks. And, considering the 1% Annual Chance Floodplains, there is approximately three-percent (3%) intersecting the dasymetric data versus eleven-percent (11%) when using full census blocks. Consequently, this refinement can be considered a benefit to the risk analyses in that the expectation of over-estimations are mitigated by limiting potential losses ONLY to developed areas.

As noted earlier, loss estimations are first based on inundation area for specified sub-types of building square-footage. The second type of data includes information on the local economy that is used in estimating losses. Table 36 displays the economic loss categories used to calculate annualized losses by Hazus. Data for this analysis has been provided at the census block level.

Table 36: Hazus direct economic loss categories and descriptions.

Category Name	Description of Data Input into Model	Hazus Output
Building	Cost per sq ft to repair damage by structural type and occupancy for each level of damage	Cost of building repair or replacement of damaged and destroyed buildings
Contents	Replacement value by occupancy	Cost of damage to building contents
Inventory	Annual gross sales in $ per sq ft	Loss of building inventory as contents related to business activities
Relocation	Multiple factors; primarily a function of Rental Costs ($/ft^2/month) for non-entertainment buildings where damage ≥10%	Relocation expenses (for businesses and institutions); disruption costs to building owners for temporary space.
Income	Income in $ per sq ft per month by occupancy	Capital-related incomes losses as a measure of the loss of productivity, services, or sales
Rental	Rental costs per month per sq ft by occupancy	Loss of rental income to building owners
Wage	Wages in $ per sq ft per month by occupancy	Employee wage loss as described in income loss

Middle Peninsula currently has approximately 43,501 structures with an estimated exposure value of approximately $17.7 billion. Average estimated replacement value of buildings in the study area range from approximately $94,000 to $297,000, with the mean approximation value of $134,000 [2]. Eighty-one percent of the planning district's general occupancy is categorized as residential, followed by commercial (12%). Table 37 below provides inventory information for each of the six counties that were included in the analysis. Gloucester County occupies a large percentage (40%) of the building stock exposure for the region.

Table 37: Building stock exposure for general occupancies by county.

County	Residential	Commercial	Industrial	Agriculture	Religion	Govt.	Education	Total
Gloucester	$5,698,054	$831,318	$147,429	$32,557	$84,190	$32,437	$190,065	$7,016,050
King William	$2,463,239	$274,254	$110,725	$32,549	$41,687	$24,273	$24,786	$2,971,513
Middlesex	$2,151,683	$354,607	$65,244	$14,045	$26,670	$11,736	$40,679	$2,664,664
Essex	$1,578,275	$402,650	$146,178	$25,395	$28,679	$18,661	$31,423	$2,231,261
Mathews	$1,566,770	$149,340	$45,066	$9,877	$19,875	$6,830	$12,042	$1,809,800
King & Queen	$886,914	$52,850	$29,064	$6,710	$19,927	$2,968	$7,284	$1,005,717
Total	$14,344,935	$2,065,019	$543,706	$121,133	$221,028	$96,905	$306,279	$17,699,005
All values are in thousands of dollars								

[2] Previous Plan values adjusted per BLS CPI Inflation Calculator (2000 to 2010) to match Hazus/Census years.

Building stock exposure is also classified by building type. General Building Types (GBTs) have been developed as a means to classify the different buildings types. This provides an ability to differentiate between buildings with substantially different damage and loss characteristics. Model building types represent the characteristics of core construction of buildings in a class. The damage and loss prediction models are developed for model building types and the estimated performance is based upon the "average characteristics" of the total population of buildings within each class. Five general classifications have been established, including wood, masonry, concrete, steel and manufactured homes (MH). A brief description of the building types is available in Table 38. The Hazus inventory serves as the default when a user does not have better data available.

Table 38: Hazus General Building Type classes.

General Building Type	Description
Wood	Wood frame construction
Masonry	Reinforced or unreinforced masonry construction
Steel	Steel frame construction
Concrete	Cast-in-place or pre-cast reinforced concrete construction
MH	Factory-built residential construction

Wood construction represents the majority (61%) of building types in the planning district. Masonry construction accounts for a quarter of the building type exposure. Table 39 below provides building stock exposure for the five main building types.

Table 39: Building stock exposure for general building type by county.

County	Wood	Masonry	Concrete	Steel	Manufactured Home	Total
Gloucester	$4,338,118	$1,782,044	$177,833	$591,235	$126,913	$7,016,143
King William	$1,895,656	$751,978	$61,374	$227,445	$35,155	$2,971,608
Middlesex	$1,631,388	$678,395	$67,789	$225,948	$61,315	$2,664,835
Mathews	$1,166,398	$450,836	$32,534	$113,035	$47,165	$1,809,968
Essex	$1,202,922	$558,827	$102,763	$319,225	$47,615	$2,231,352
King & Queen	$661,413	$247,318	$11,118	$49,521	$36,527	$1,005,897
Total	$10,895,895	$4,469,398	$453,411	$1,526,409	$354,690	$17,699,803
All values are in thousands of dollars						

Multi-frequency Flood Modeling – Hazus Level 1 methodology

As explained earlier, annualized loss is the preferred manner with which to express potential risk for hazard mitigation planning as it is useful for creating a common denominator by which different types of hazards can be compared. The tables below (Table 40 – Table 46) show the multi-frequency results for the MPPDC Region and each County. The following section will present details of the annualized losses; see General Building Stock Loss Estimation (Annualized Flood Loss).

Table 40: Hazus Level 1 Multi-frequency GBS Losses for the MPPDC Region.

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
MPPDC Region	Level 1 - 10YR	$107,113	$57,802	$48,644	$1,126
MPPDC Region	Level 1 - 25YR	$137,228	$74,580	$61,788	$1,375
MPPDC Region	Level 1 - 50YR	$194,731	$105,823	$87,602	$1,941
MPPDC Region	Level 1 - 100YR	$245,562	$133,342	$110,570	$2,427
MPPDC Region	Level 1 - 500YR	$842,030	$460,912	$375,607	$7,497
MPPDC Region	Level 1 - Annualized	$18,102	$9,921	$8,111	$116
		Data in Thousands of Dollars			

Table 41: Hazus Level 1 Multi-frequency GBS Losses for Essex County.

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
Essex County	Level 1 - 10YR	$7,226	$3,729	$3,432	$80
Essex County	Level 1 - 25YR	$8,994	$4,676	$4,243	$89
Essex County	Level 1 - 50YR	$12,846	$6,599	$6,126	$140
Essex County	Level 1 - 100YR	$16,813	$8,843	$7,846	$144
Essex County	Level 1 - 500YR	$31,230	$16,306	$14,666	$287
Essex County	Level 1 - Annualized	$1,047	$548	$493	$6
Data in Thousands of Dollars					

Table 42. Hazus Level 1 Multi-frequency GBS Losses for Gloucester County.

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
Gloucester County	Level 1 - 10YR	$53,037	$27,925	$24,750	$25,491
Gloucester County	Level 1 - 25YR	$68,606	$36,345	$31,788	$32,684
Gloucester County	Level 1 - 50YR	$98,481	$52,381	$45,397	$46,610
Gloucester County	Level 1 - 100YR	$121,998	$64,526	$56,568	$58,085
Gloucester County	Level 1 - 500YR	$565,571	$310,999	$251,301	$255,854
Gloucester County	Level 1 - Annualized	$9,984	$5,394	$4,552	$79
Data in Thousands of Dollars					

Table 43. Hazus Level 1 Multi-frequency GBS Losses for King & Queen County.

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
King & Queen County	Level 1 - 10YR	$3,850	$2,295	$1,512	$43
King & Queen County	Level 1 - 25YR	$5,152	$3,088	$2,011	$53
King & Queen County	Level 1 - 50YR	$7,086	$4,294	$2,735	$57
King & Queen County	Level 1 - 100YR	$7,535	$4,612	$2,878	$45
King & Queen County	Level 1 - 500YR	$19,376	$11,714	$7,506	$156
King & Queen County	Level 1 - Annualized	$585	$355	$224	$6
Data in Thousands of Dollars					

Table 44: Hazus Level 1 Multi-frequency GBS Losses for King William County.

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
King William County	Level 1 - 10YR	$12,037	$5,882	$6,084	$107
King William County	Level 1 - 25YR	$14,339	$7,084	$7,169	$124
King William County	Level 1 - 50YR	$17,689	$8,729	$8,851	$147
King William County	Level 1 - 100YR	$20,858	$10,332	$10,395	$191
King William County	Level 1 - 500YR	$65,545	$29,037	$35,462	$1,584
King William County	Level 1 - Annualized	$1,656	$797	$852	$11
Data in Thousands of Dollars					

Table 45: Hazus Level 1 Multi-frequency GBS Losses for Mathews County.

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
Mathews County	Level 1 - 10YR	$21,094	$12,426	$8,575	$104
Mathews County	Level 1 - 25YR	$29,509	$17,341	$12,025	$167
Mathews County	Level 1 - 50YR	$45,778	$26,496	$19,003	$325
Mathews County	Level 1 - 100YR	$60,800	$35,055	$25,356	$451
Mathews County	Level 1 - 500YR	$134,862	$78,353	$55,815	$798
Mathews County	Level 1 - Annualized	$3,682	$2,170	$1,500	$13
Data in Thousands of Dollars					

Table 46: Hazus Level 1 Multi-frequency GBS Losses for Middlesex County

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
Middlesex County	Level 1 - 10YR	$9,869	$5,545	$4,291	$51
Middlesex County	Level 1 - 25YR	$10,628	$6,046	$4,552	$46
Middlesex County	Level 1 - 50YR	$12,851	$7,324	$5,490	$59
Middlesex County	Level 1 - 100YR	$17,558	$9,974	$7,527	$79
Middlesex County	Level 1 - 500YR	$25,446	$14,503	$10,857	$119
Middlesex County	Level 1 - Annualized	$1,148	$657	$490	$1
Data in Thousands of Dollars					

General Building Stock Loss Estimation (Annualized Flood Loss)

Annualized loss is the preferred manner with which to express potential risk for hazard mitigation planning as it is useful for creating a common denominator by which different types of hazards can be compared. While annualized loss values in and of themselves do not necessarily determine if the values are too high or too low, when compared across a region the relative difference in values can indicate problem areas for prioritization or justification for further and more detailed analyses. Next, we consider the annualized losses of the Hazus Level 1 analyses.

Hazus Level 1 flood model annualized losses for the Middle Peninsula PDC are $18,102,000 US Dollars. Property or "capital stock" losses are $18,093,000 US Dollars and make up about 99.95% of the

damages which includes the values for building, content, and inventory. Business interruption accounts for $9,000 US Dollars (0.05%) of the annualized losses and includes relocation, income, rental and wage costs.

The flood model incorporates National Flood Insurance Program (NFIP) entry dates to distinguish Pre-FIRM and Post-FIRM census blocks. The results provided in this report show the combined total losses for both pre- and post-FIRM values combined.

Table 47 illustrates the expected annualized losses broken down by county and Table 48 includes the annualized losses along with Population and Per-Capita losses.

Table 47: County based Hazus annualized loss for both Pre- and Post-FIRM by building type.

County	Building	Content	Inventory	Relocation	Income	Rental	Wage	Annualized Loss
Gloucester	$5,394	$4,552	$31	$0	$1	$0	$6	$9,984
Mathews	$2,170	$1,500	$12	$0	$0	$0	$0	$3,682
King William	$797	$852	$5	$0	$0	$0	$2	$1,656
Middlesex	$657	$490	$1	$0	$0	$0	$0	$1,148
King & Queen	$355	$224	$6	$0	$0	$0	$0	$585
Essex	$548	$493	$6	$0	$0	$0	$0	$1,047
Total	$9,921	$8,111	$61	$0	$1	$0	$8	$18,102
All values in Thousands of Dollars								

Table 48: County based Census 2010 population, Hazus Annualized Loss & Per-Capita Loss.

County	Population[1]	Annualized Loss (US Dollar)	Per-Capita Loss (US Dollar)
Mathews	8,978	$3,682,000	$410.11
Gloucester	36,858	$9,984,000	$270.88
Middlesex	10,959	$1,148,000	$104.75
King William	15,935	$1,656,000	$103.92
Essex	11,151	$1,047,000	$93.89
King & Queen	6,945	$585,000	$84.23
MPPDC Region	**90,826**	**$18,102,000**	**$199.30**
[1] *2010 Census-based population counts - as exists within Hazus stock data.*			

Gloucester County has the highest annualized loss, $9,984,000 US Dollars, accounting for 55.2% of the total losses for Middle Peninsula and 40% of the county's building stock, and ranks second (2nd) in terms of per-capita losses at $270.88. The majority of the expected damages can be attributed to building and content value.

Mathews County has the second highest loss, $3,682,000 US Dollars, accounting for 20.34% of the total annualized losses for Middle Peninsula and 17% of the county's building stock, however has the greatest annualized per-capita loss at $410.11.

Building value loss accounts for approximately 55% of the expected annualized damages and 45% is attributed to content value loss. Table 43 summarizes the property losses and business interruption losses shown for pre- and post-FIRM structures.

Residential building damage represents the majority of the damages, followed closely by the residential content damages. Wood buildings account for $11,529,000 US Dollars, or 62.1% of the annualized damages of which the majority (54.06%) are in Gloucester County. Occupancy results indicate that agricultural, non-profit and industrial have the largest percent of exposure at risk; i.e. these are the predominant occupancy types that intersect the flood hazard. Manufactured homes only account for 5.05% of the total annualized damages but have the highest percentage of building stock at risk to yearly damages. Tables 49 and 50 summarize the property losses and business interruption losses shown by occupancy and building type. The slight differences in the annualized losses for building type and occupancy can be attributed to the Hazus classification methodology (Table 51 and 52).

Table 49: Annualized loss by building type.

Building Type	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Annualized Loss
Wood	$6,886	$4,641	$2	$0	$0	$0	$0	$11,529
Masonry	$2,459	$2,122	$6	$0	$0	$0	$2	$4,589
Steel	$329	$1,088	$42	$0	$0	$0	$2	$1,461
Manufactured Housing	$444	$147	$0	$0	$0	$0	$0	$591
Concrete	$80	$289	$5	$0	$0	$0	$1	$375
Annualized Loss	$10,198	$8,287	$55	$0	$0	$0	$5	$18,545
% of Ann. Loss	54.99%	44.69%	0.30%	0%	0%	0%	0.03%	*Hazus-MH (V2.2) results*
Values In Thousands of Dollars								

Table 50: Annualized loss by general occupancy type.

Occupancy Type	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Annualized Loss
Residential	$9,244	$5,732	$0	$0	$0	$0	$0	$14,976
Commercial	$426	$1,408	$19	$0	$0	$0	$2	$1,855
Industrial	$161	$352	$41	$0	$0	$0	$0	$554
Non-Profit	$36	$207	$0	$0	$0	$0	$0	$243
Agricultural	$8	$71	$1	$0	$0	$0	$0	$80
Education	$44	$321	$0	$0	$1	$0	$4	$370
Government	$2	$20	$0	$0	$0	$0	$2	$24
Annualized Loss	$9,921	$8,111	$61	$0	$1	$0	$8	$18,102
% of Ann. Loss	54.81%	44.81%	0.34%	0%	0.01%	0%	0.04%	*Hazus-MH (V2.2) results*
Values in Thousands of Dollars								

Table 51: County based Hazus annualized loss by general building type.

County	Total Exposure	Concrete	Masonry	Manufactured Homes	Steel	Wood	Annualized Loss
Gloucester	$7,016,050	$182	$2,549	$320	$904	$6,233	$10,188
Mathews	$1,809,800	$33	$907	$192	$154	$2,543	$3,829
King William	$2,971,513	$103	$440	$3	$212	$903	$1,661
Middlesex	$2,664,664	$13	$292	$23	$57	$813	$1,198
King & Queen	$1,005,717	$6	$136	$31	$25	$404	$602
Essex	$2,231,261	$38	$265	$22	$109	$633	$1,067
Annualized Loss		$375	$4,589	$591	$1,461	$11,529	$18,545
% of Annualized Loss		2.02%	24.75%	3.19%	7.88%	62.17%	*Hazus-MH (V2.2) results*
% of Total Exposure		2.56%	25.25%	2.00%	8.62%	61.56%	
All values in Thousands of Dollars							

Table 52: County based Hazus annualized loss by general occupancy type.

County	Total Exposure	Residen-tial	Comm-ercial	Indust-rial	Non-Profit	Educa-tion	Govern-ment	Agricul-ture	Annualized Loss
Gloucester	$7,016,050	$7,948	$1,227	$249	$153	$354	$8	$45	$9,984
Mathews	$2,231,261	$3,350	$139	$123	$36	$5	$3	$26	$3,682
King William	$2,971,513	$1,285	$243	$65	$39	$6	$12	$6	$1,656
Middlesex	$2,664,664	$1,017	$98	$18	$14	$1	$0	$0	$1,148
King & Queen	$1,005,717	$543	$0	$42	$0	$0	$0	$0	$585
Essex	$1,809,800	$833	$148	$57	$1	$4	$1	$3	$1,047
Annualized Loss		$14,976	$1,855	$554	$243	$370	$24	$80	$18,102
% of Annualized Loss		82.73%	10.25%	3.06%	1.34%	2.04%	0.13%	0.44%	*Hazus-MH (V2.2) results*
% of Exposure		81.05%	11.67%	3.07%	1.25%	1.73%	0.55%	0.68%	

Figures 108 through 114 on the following pages show the total annualized loss for the planning district and individual counties culminating in Figure 115 which categorizes the Total Annualized Losses by Top Ten ranking and a Hotspot overlay representing those areas throughout the MPPDC Region that may require mitigation measures.

Figure 108:

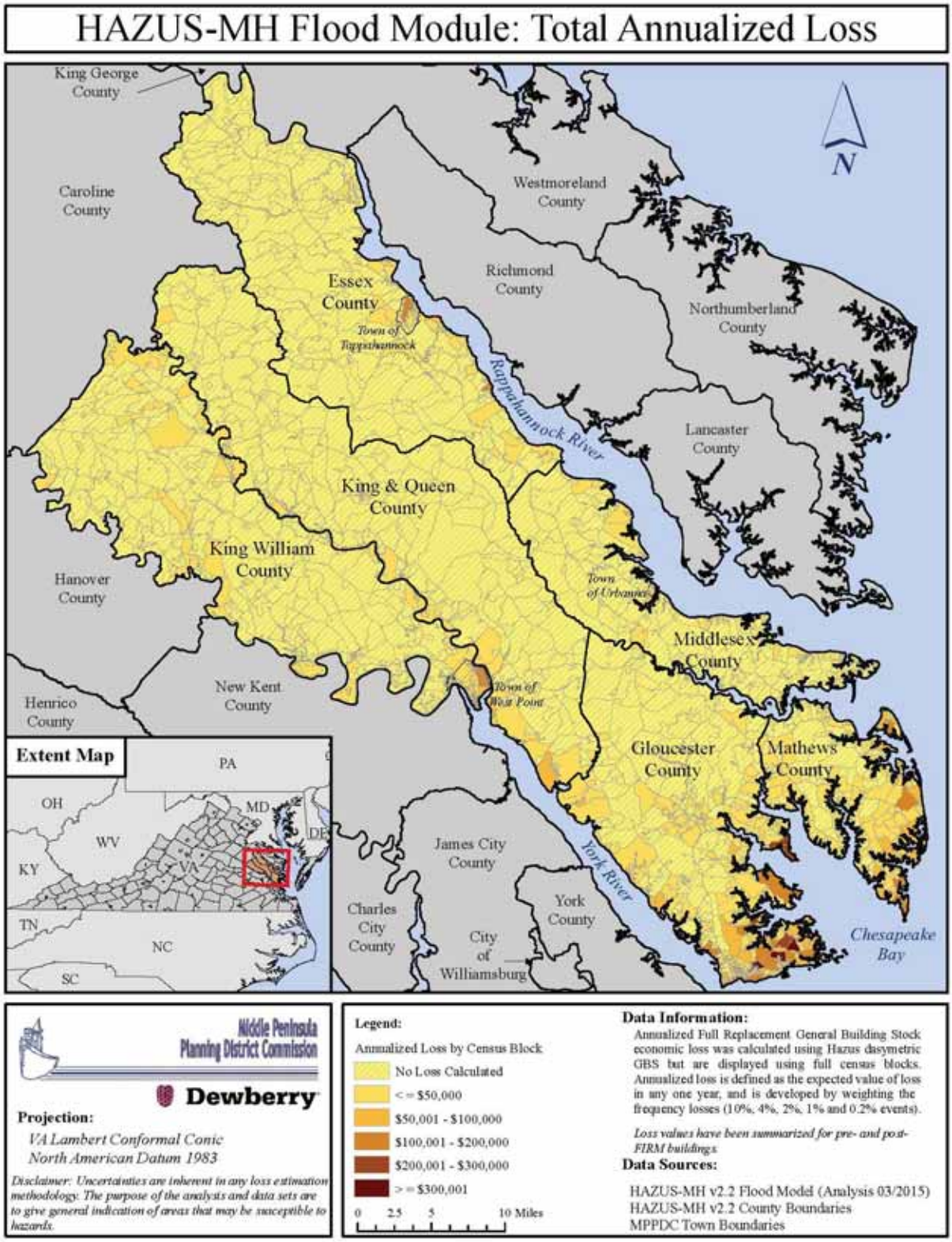

HAZUS-MH Flood Module: Total Annualized Loss
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Town of Tappahannock
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Town of Urbanna
Middlesex County
New Kent County
Henrico County
Town of West Point
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
No Loss Calculated
< = $50,000
$50,001 - $100,000
$100,001 - $200,000
$200,001 - $300,000
> = $300,001
0 2.5 5 10 Miles
Data Information:
Annualized Full Replacement General Building Stock economic loss was calculated using Hazus dasymetric GBS but are displayed using full census blocks. Annualized loss is defined as the expected value of loss in any one year, and is developed by weighting the frequency losses (10%, 4%, 2%, 1% and 0.2% events).
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (Analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 109:

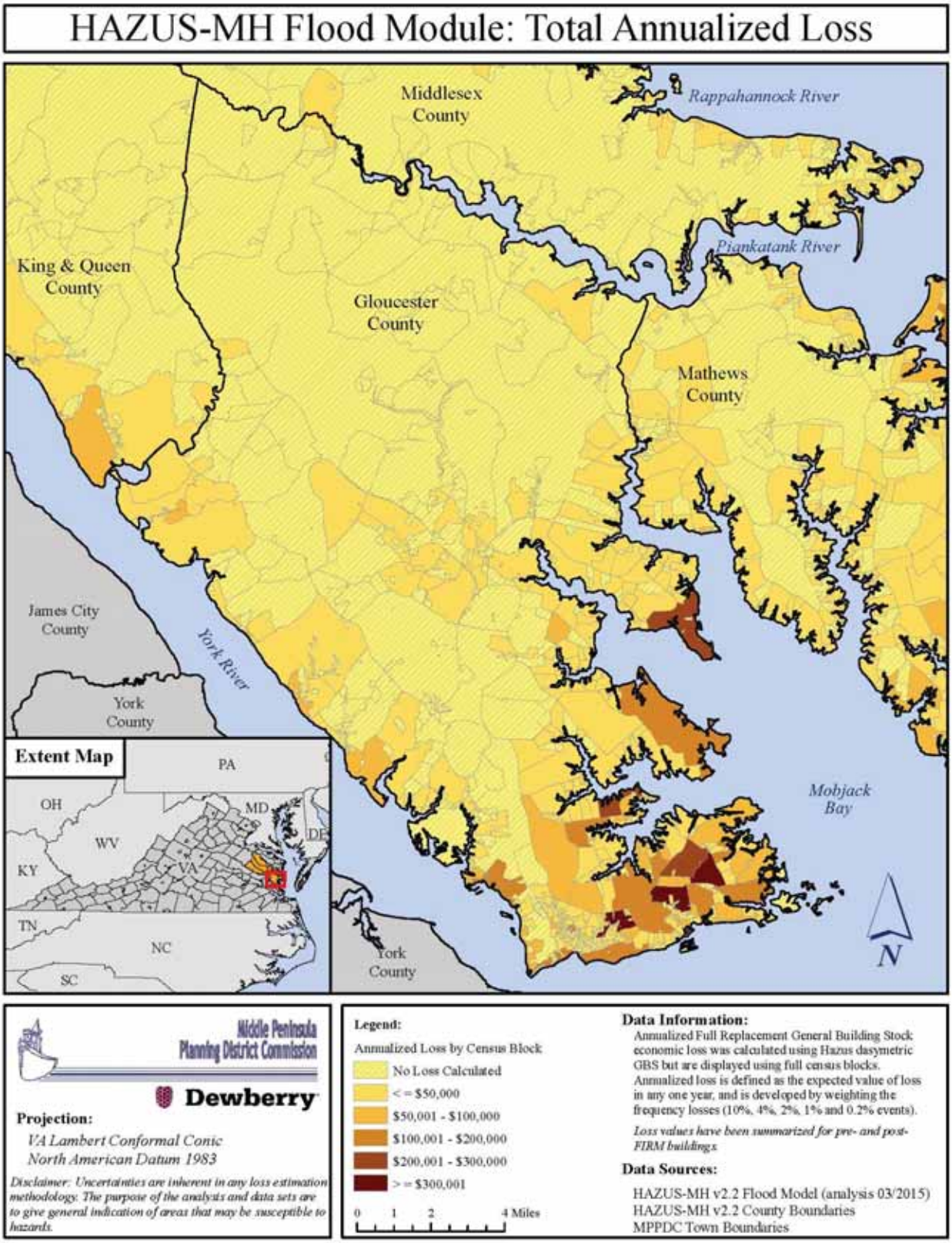

HAZUS-MH Flood Module: Total Annualized Loss
Middlesex County
Rappahannock River
King & Queen County
Piankatank River
Gloucester County
Mathews County
James City County
York River
York County
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Mobjack Bay
York County
N
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
No Loss Calculated
< = $50,000
$50,001 - $100,000
$100,001 - $200,000
$200,001 - $300,000
> = $300,001
0 1 2 4 Miles
Data Information:
Annualized Full Replacement General Building Stock economic loss was calculated using Hazus dasymetric GBS but are displayed using full census blocks. Annualized loss is defined as the expected value of loss in any one year, and is developed by weighting the frequency losses (10%, 4%, 2%, 1% and 0.2% events).
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 110:

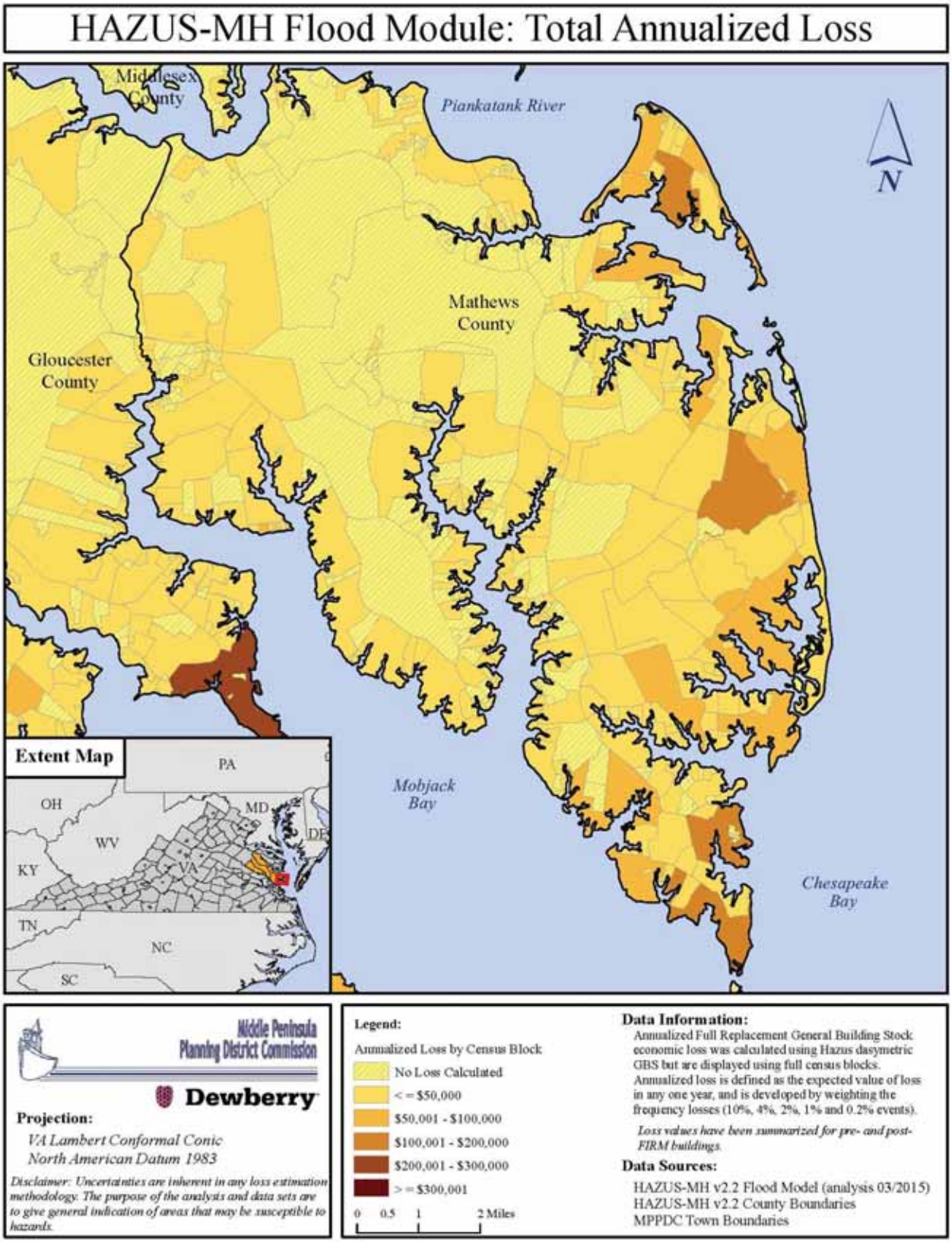

HAZUS-MH Flood Module: Total Annualized Loss
Middlesex County
Piankatank River
N
Mathews County
Gloucester County
Mobjack Bay
Chesapeake Bay
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
No Loss Calculated
< = $50,000
$50,001 - $100,000
$100,001 - $200,000
$200,001 - $300,000
> = $300,001
0 0.5 1 2 Miles
Data Information:
Annualized Full Replacement General Building Stock economic loss was calculated using Hazus dasymetric GBS but are displayed using full census blocks. Annualized loss is defined as the expected value of loss in any one year, and is developed by weighting the frequency losses (10%, 4%, 2%, 1% and 0.2% events).
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 111:

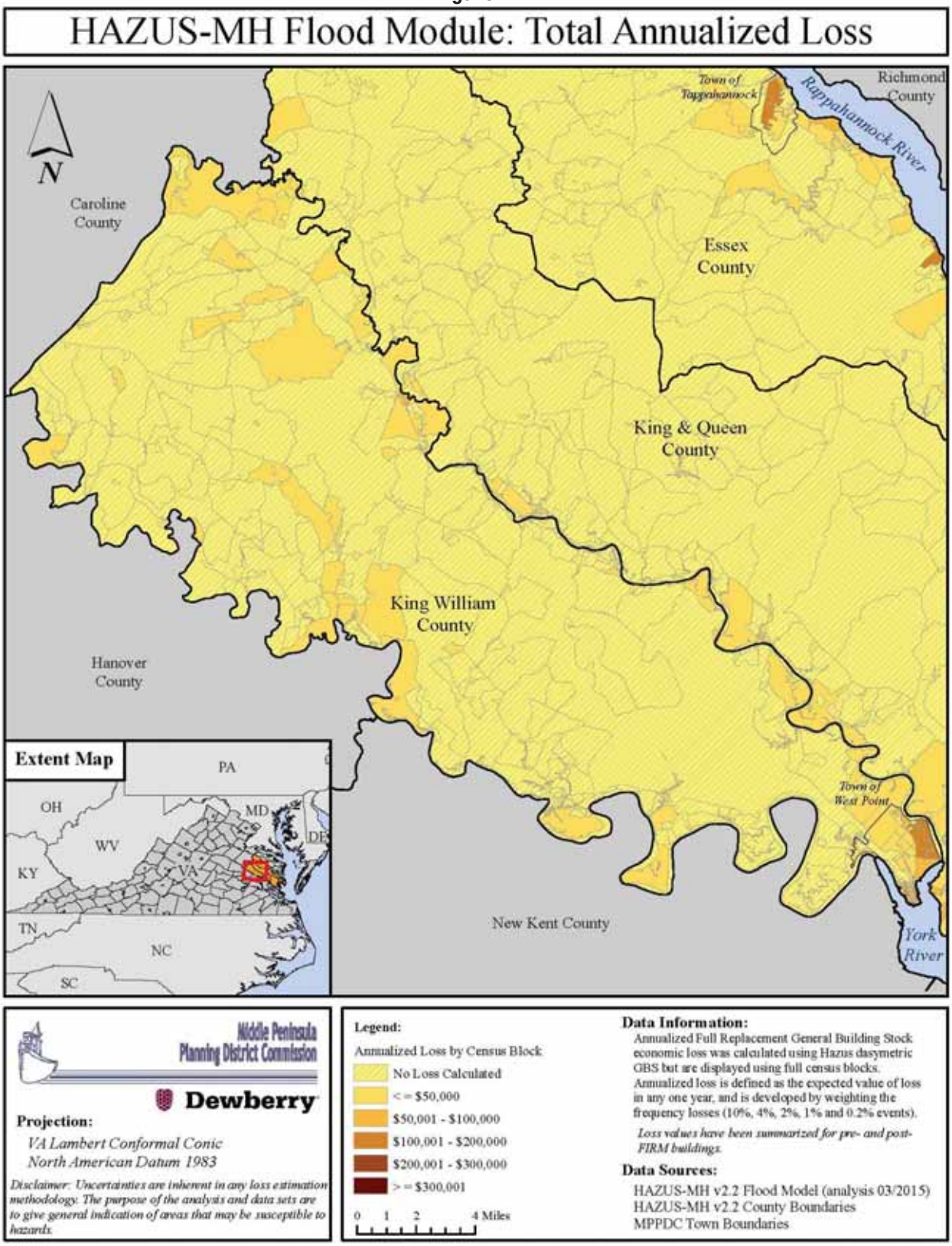

HAZUS-MH Flood Module: Total Annualized Loss
N
Caroline County
Hanover County
King William County
King & Queen County
Essex County
Richmond County
Town of Tappahannock
Rappahannock River
Town of West Point
New Kent County
York River
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
No Loss Calculated
<= $50,000
$50,001 - $100,000
$100,001 - $200,000
$200,001 - $300,000
>= $300,001
0 1 2 4 Miles
Data Information:
Annualized Full Replacement General Building Stock economic loss was calculated using Hazus dasymetric GBS but are displayed using full census blocks. Annualized loss is defined as the expected value of loss in any one year, and is developed by weighting the frequency losses (10%, 4%, 2%, 1% and 0.2% events).
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 112:

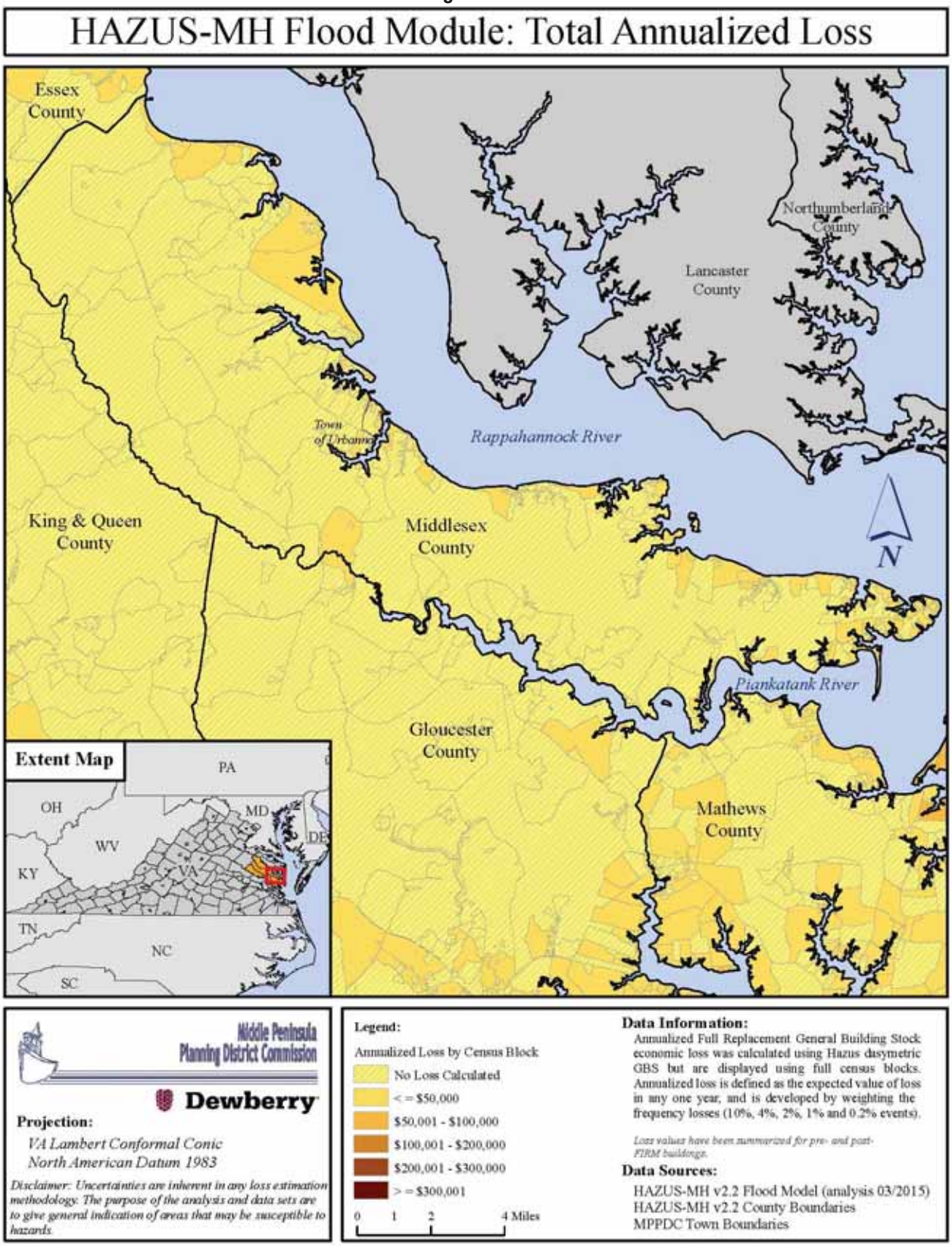

HAZUS-MH Flood Module: Total Annualized Loss
Essex County
Northumberland County
Lancaster County
Town of Urbanna
Rappahannock River
King & Queen County
Middlesex County
N
Piankatank River
Gloucester County
Mathews County
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
No Loss Calculated
< = $50,000
$50,001 - $100,000
$100,001 - $200,000
$200,001 - $300,000
> = $300,001
0 1 2 4 Miles
Data Information:
Annualized Full Replacement General Building Stock economic loss was calculated using Hazus dasymetric GBS but are displayed using full census blocks. Annualized loss is defined as the expected value of loss in any one year, and is developed by weighting the frequency losses (10%, 4%, 2%, 1% and 0.2% events).
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 113:

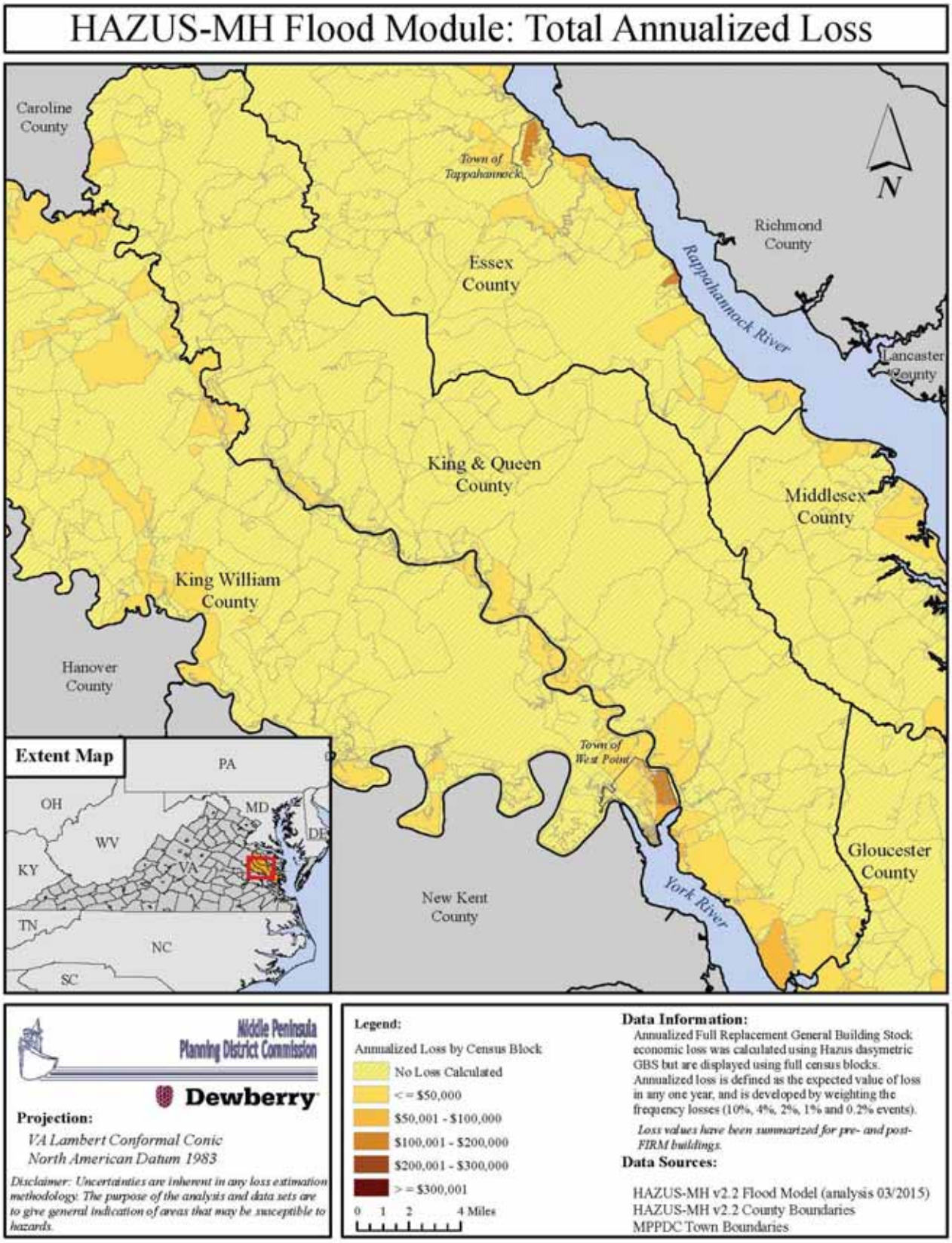

HAZUS-MH Flood Module: Total Annualized Loss
Caroline County
Town of Tappahannock
Essex County
Richmond County
Rappahannock River
Lancaster County
King & Queen County
Middlesex County
King William County
Hanover County
Town of West Point
Gloucester County
New Kent County
York River
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
No Loss Calculated
< = $50,000
$50,001 - $100,000
$100,001 - $200,000
$200,001 - $300,000
> = $300,001
0 1 2 4 Miles
Data Information:
Annualized Full Replacement General Building Stock economic loss was calculated using Hazus dasymetric GBS but are displayed using full census blocks. Annualized loss is defined as the expected value of loss in any one year, and is developed by weighting the frequency losses (10%, 4%, 2%, 1% and 0.2% events).
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 114:

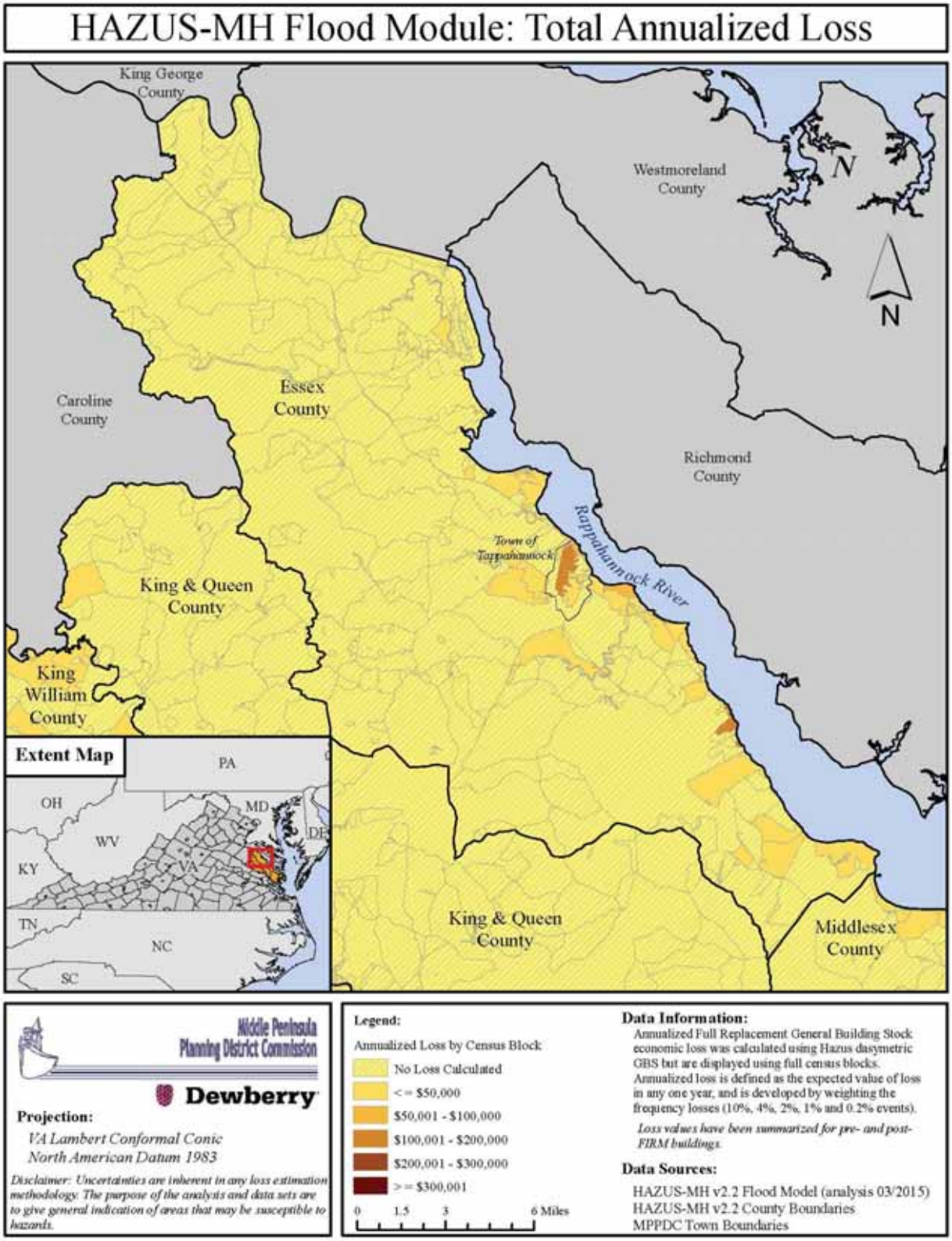
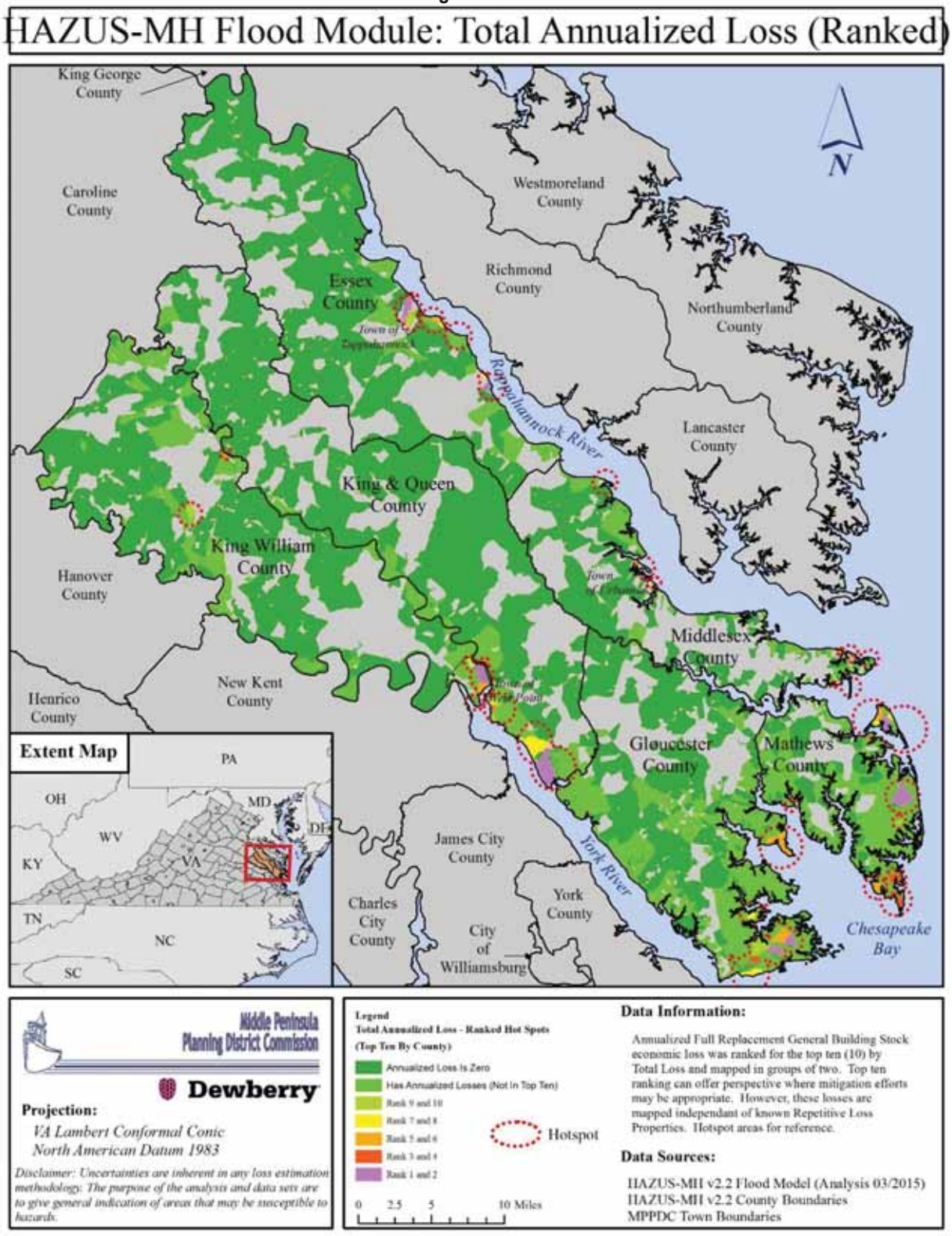

HAZUS-MH Flood Module: Total Annualized Loss
King George County
Westmoreland County
N
N
Caroline County
Essex County
Richmond County
Rappahannock River
Town of Tappahannock
King & Queen County
King William County
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
King & Queen County
Middlesex County
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
No Loss Calculated
<= $50,000
$50,001 - $100,000
$100,001 - $200,000
$200,001 - $300,000
>= $300,001
0 1.5 3 6 Miles
Data Information:
Annualized Full Replacement General Building Stock economic loss was calculated using Hazus dasymetric GBS but are displayed using full census blocks. Annualized loss is defined as the expected value of loss in any one year, and is developed by weighting the frequency losses (10%, 4%, 2%, 1% and 0.2% events).
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 115:


HAZUS-MH Flood Module: Total Annualized Loss (Ranked)
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Middlesex County
New Kent County
Henrico County
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend
Total Annualized Loss - Ranked Hot Spots
(Top Ten By County)
Annualized Loss is Zero
Has Annualized Losses (Not in Top Ten)
Rank 9 and 10
Rank 7 and 8
Rank 5 and 6
Rank 3 and 4
Rank 1 and 2
Hotspot
0 2.5 5 10 Miles
Data Information:
Annualized Full Replacement General Building Stock economic loss was ranked for the top ten (10) by Total Loss and mapped in groups of two. Top ten ranking can offer perspective where mitigation efforts may be appropriate. However, these losses are mapped independant of known Repetitive Loss Properties. Hotspot areas for reference.
Data Sources:
HAZUS-MH v2.2 Flood Model (Analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Gloucester County accounts for almost 55.15% of the planning district's annualized losses. The census blocks bordering the York River and Mobjack Bay have higher loss values as compared to the larger census blocks in the northwest portions of the county. Collective damages between both the York River and Mobjack Bay are nearly equivalent. The southeast portion of the County contains the greatest concentration of loss. The vicinity of Guinea Road and Kings Creek Road; beginning in the locale of Hayes and heading east to Kings Creek being bordered on the north by the Severn River and on the south by the York River exhibits the greatest concentration of loss. Additionally, the land area of Saddlers Neck to Stump Point being bounded on the north by the Northwest Branch Severn River and Willetts Creek to the south exhibits a second concentration of risk. Finally, the peninsula and vicinity of Ware Neck Point -where the Ware River and North River converge – is another location exhibiting a concentration of losses.

Losses in Mathews County are spread throughout the county with a high frequency of census block having damages greater than $50,000 US Dollars along the Chesapeake Bay to include the various harbor/haven inlets and also at the confluences of the Piankatank River in the north as well as Mobjack Bay in the south. Another location that exhibits relatively higher loss estimates includes Roys Point in the area around Daniel Avenue. Ultimately, Mathews County ranks second of the six counties and accounts for 20.4% of the total annualized losses in the MPPDC planning district.

The census blocks bordering the Pamunkey and Mattaponi rivers contain almost all of the annualized damages for King William County with the greatest concentration of losses in the Town of West Point. Wood framed structures across the county account for more than 50% of the losses. The total annualized damages for the Town of West Point is approximately $1.3 million US Dollars. Total annualized losses of the Pamunkey Indian Reservation is approximately $40,000 US Dollars and the Mattaponi Indian Reservation is $14,000 US Dollars. Two (2) locations in the northwestern portion of the County exhibit relatively higher annualized loss values; the two areas are in the vicinity of both Manquin and Aylett with Aylett experiencing the greater losses near $145,000 US Dollars and Manquin having estimated losses of $40,000 US Dollars.

Middlesex County's annualized losses account for 6.3% of the total risk with wood framed structures accounting for nearly 68% of the losses. The census blocks along the Rappahannock River collectively account for the greatest amount of losses within the County. Losses in the vicinity of Mud Creek, Balls Point, The Town of Urbanna, and the confluence with the Chesapeake Bay constitute the areas having the highest loss values. The Town of Urbana has an estimated $300,000 US Dollars in annualized damages and includes the census block having the highest estimated loss ($226,000 US Dollars) within the County. The second highest census block loss ($70,000) is located at the confluence between the Rappahannock River and the Chesapeake Bay in the southeastern portion of the County.

King and Queen County has the lowest annualized loss values for the region, accounting for 3.2% of the total damages. Residential occupancy makes up the majority of the losses in the county. A relatively small group of census blocks along the York River account for most of the damages near $400,000 US Dollars. In comparison, along the Mattaponi River damages are in the range of near $100,000 or roughly one-quarter of the expected damages along the York River. Notwithstanding, a small pocket of development at the end of Limehouse Road along the Mattaponi River downstream of Muddy Point and opposite the Town of West Point is an area with annualized losses near $20,000 US Dollars. The majority of damage within Essex County is along the Rappahannock River with the greatest concentration of annualized losses from the Town of Tappahannock in the north, extending downstream to the vicinity of Wares Warf. Total annualized damages along the length of the Rappahannock are approximately $1.34 million. The concentrated damages from Tappahannock to Wares Point is approximately $0.67 million or nearly one-half of the expected damages along the Rappahannock River.

The Town of Tappahannock accounts for approximately $0.34 million or nearly one-half of the expected damages in the area of concentrated damages along the Rappahannock. The county and town combined, account for approximately 5.8% of annualized damages for the MPPDC region.

Comparative Flood Modeling:

Noting the existence of new RiskMAP-based depth grids from recent FEMA studies, presented below are results of running the new coastal-only 1% Annual Chance Flood Hazard (Tables 53-59). As discussed earlier, the new RiskMAP-based depth grid was not utilized to replace the Hazus Level 1 depth grids. However, the study data (i.e., the same study data that would have been used to create the RiskMAP-based depth grid) was utilized in the Level 1 analysis. Again, this included use of the Stillwater Elevations reported for coastal transects in Table 2 – Transect Data for each FEMA Flood Insurance Study. Consequently, the loss values presented below for general comparison, effectually exhibit that losses are relatively close. Consequently, knowing that losses are relatively close is confirmation that the Hazus Level 1 methodology is quite reasonable for the regional estimations and analyses presented. However, in the event that further analyses at smaller mapping scales (e.g., Parcel-level) are warranted in other projects, it would be advisable to use the RiskMAP-based data.

Table 53: MPPDC Loss Comparison – 1% Coastal (RiskMAP vs. Level 1 Methodology).

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
MPPDC Region	100YR_RiskMapCstlOnly [A]	$233,744	$128,057	$104,166	$2,220
MPPDC Region	100YR_LVL1CstlOnly [B]	$236,591	$128,430	$106,547	$2,389
Data in Thousands of Dollars					
Notes:					
[A] **Scenario uses depth grids produced for FEMA RiskMAP Studies by USACE circa March 2015.**					
[B] **Scenario uses depth grids produced from Hazus Level 1 methodology; NED 1-Arc DEMs, 1 mi² Drainage Threshold, most recent coastal water surfaces from FEMA FIS text (Table 2 – Transect Data) for each respective county.**					

Table 54: Essex County Loss Comparison – 1% Coastal (RiskMAP vs. Level 1 Methodology).

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
Essex County	100YR_RiskMapCstlOnly [A]	$14,695	$7,541	$7,014	$162
Essex County	100YR_LVL1CstlOnly [B]	$16,421	$8,637	$7,663	$141
Data in Thousands of Dollars					
Notes:					
[A] **Scenario uses depth grids produced for FEMA RiskMAP Studies by USACE circa March 2015.**					
[B] **Scenario uses depth grids produced from Hazus Level 1 methodology; NED 1-Arc DEMs, 1 mi² Drainage Threshold, most recent coastal water surfaces from FEMA FIS text (Table 2 – Transect Data) for each respective county.**					

Table 55: Gloucester County Loss Comparison – 1% Coastal (RiskMAP vs. Level 1 Methodology).

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
Gloucester County	100YR_RiskMapCstlOnly [A]	$108,158	$58,259	$49,148	$50,416
Gloucester County	100YR_LVL1CstlOnly [B]	$118,631	$62,714	$55,018	$56,528
Data in Thousands of Dollars					
Notes:					
[A] **Scenario uses depth grids produced for FEMA RiskMAP Studies by USACE circa March 2015.**					
[B] **Scenario uses depth grids produced from Hazus Level 1 methodology; NED 1-Arc DEMs, 1 mi² Drainage Threshold, most recent coastal water surfaces from FEMA FIS text (Table 2 – Transect Data) for each respective county.**					

Table 56: King & Queen County Loss Comparison – 1% Coastal (RiskMAP vs. Level 1 Methodology).

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
King Queen County	100YR_RiskMapCstlOnly [A]	$5,152	$3,094	$2,004	$54
King Queen County	100YR_LVL1CstlOnly [B]	$7,140	$4,375	$2,720	$45
Data in Thousands of Dollars					
Notes:					
[A] **Scenario uses depth grids produced for FEMA RiskMAP Studies by USACE circa March 2015.**					
[B] **Scenario uses depth grids produced from Hazus Level 1 methodology; NED 1-Arc DEMs, 1 mi² Drainage Threshold, most recent coastal water surfaces from FEMA FIS text (Table 2 – Transect Data) for each respective county.**					

Table 57: King William County Loss Comparison – 1% Coastal (RiskMAP vs. Level 1 Methodology).

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
King William County	100YR_LVL1CstlOnly [B]	$16,553	$7,961	$8,489	$163
King William County	100YR_RiskMapCstlOnly [A]	$18,428	$8,564	$9,737	$194
Data in Thousands of Dollars					
Notes:					
[A] **Scenario uses depth grids produced for FEMA RiskMAP Studies by USACE circa March 2015.**					
[B] **Scenario uses depth grids produced from Hazus Level 1 methodology; NED 1-Arc DEMs, 1 mi² Drainage Threshold, most recent coastal water surfaces from FEMA FIS text (Table 2 – Transect Data) for each respective county.**					

Table 58: Mathews County Loss Comparison – 1% Coastal (RiskMAP vs. Level 1 Methodology).

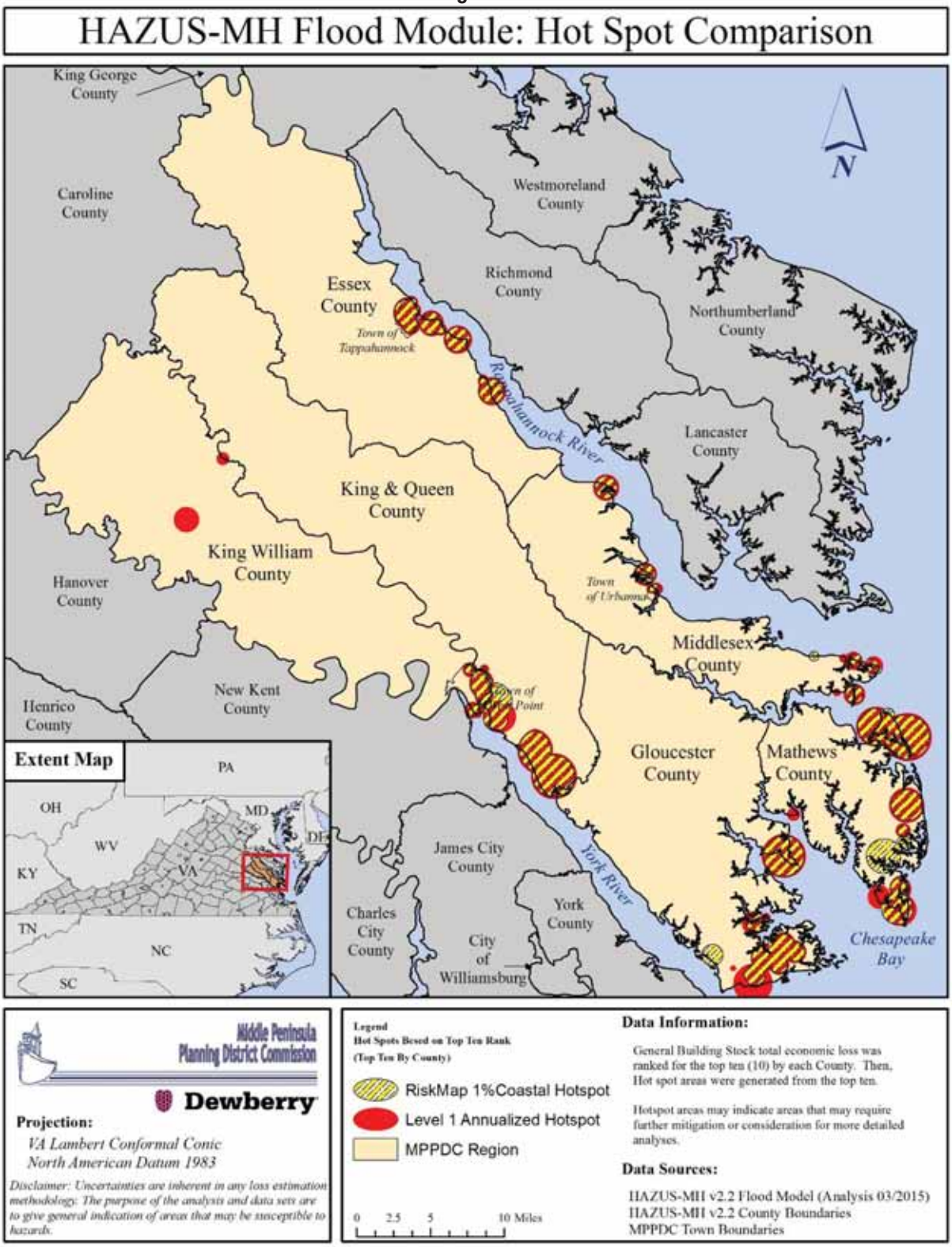
Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
Mathews County	100YR_LVL1CstlOnly [B]	$60,614	$34,946	$25,279	$451
Mathews County	100YR_RiskMapCstlOnly [A]	$65,453	$37,867	$27,188	$466
Data in Thousands of Dollars					
Notes:					
[A] **Scenario uses depth grids produced for FEMA RiskMAP Studies by USACE circa March 2015.**					
[B] **Scenario uses depth grids produced from Hazus Level 1 methodology; NED 1-Arc DEMs, 1 mi² Drainage Threshold, most recent coastal water surfaces from FEMA FIS text (Table 2 – Transect Data) for each respective county.**					

Table 59: Middlesex County Loss Comparison – 1% Coastal (RiskMAP vs. Level 1 Methodology).

Area	Scenario	Total Loss	Building Loss	Contents Loss	Business Disruption
Middlesex County	100YR_LVL1CstlOnly [B]	$17,232	$9,797	$7,378	$79
Middlesex County	100YR_RiskMapCstlOnly [A]	$21,858	$12,732	$9,075	$76
Data in Thousands of Dollars					
Notes:					
[A] **Scenario uses depth grids produced for FEMA RiskMAP Studies by USACE circa March 2015.**					
[B] **Scenario uses depth grids produced from Hazus Level 1 methodology; NED 1-Arc DEMs, 1 mi² Drainage Threshold, most recent coastal water surfaces from FEMA FIS text (Table 2 – Transect Data) for each respective county.**					

A comparison of the "hot spots" that exist form the Level I Annualized and the new RiskMAP-based 1% Annual Chance loss estimates reveals very similar results. Figure 116 below, shows the hot spots generated from the two different types of modeling. It can be seen that the new RiskMAP-based analysis shows a number of similarities in the potential flood losses. Any location where the two hot spot types overlap, are locations where the relative risk is considered to be comparative or relatively similar. However, it is important to note that the two (2) Level 1 Annualized Hotspots in northwestern King William County (vicinity of Manquin and Aylett) are areas attributed to Riverine flooding influence. Therefore, the RiskMAP 1% Coastal Hotspots will not reveal these same areas as potential hot spots. Consequently, the RiskMAP 1% Coastal Hotspots will reveal the addition of other new areas given the extents of the costal flood hazard (see Figure 117 – FEMA digital FIRM & RiskMAP 1% Coastal Depth Grid).

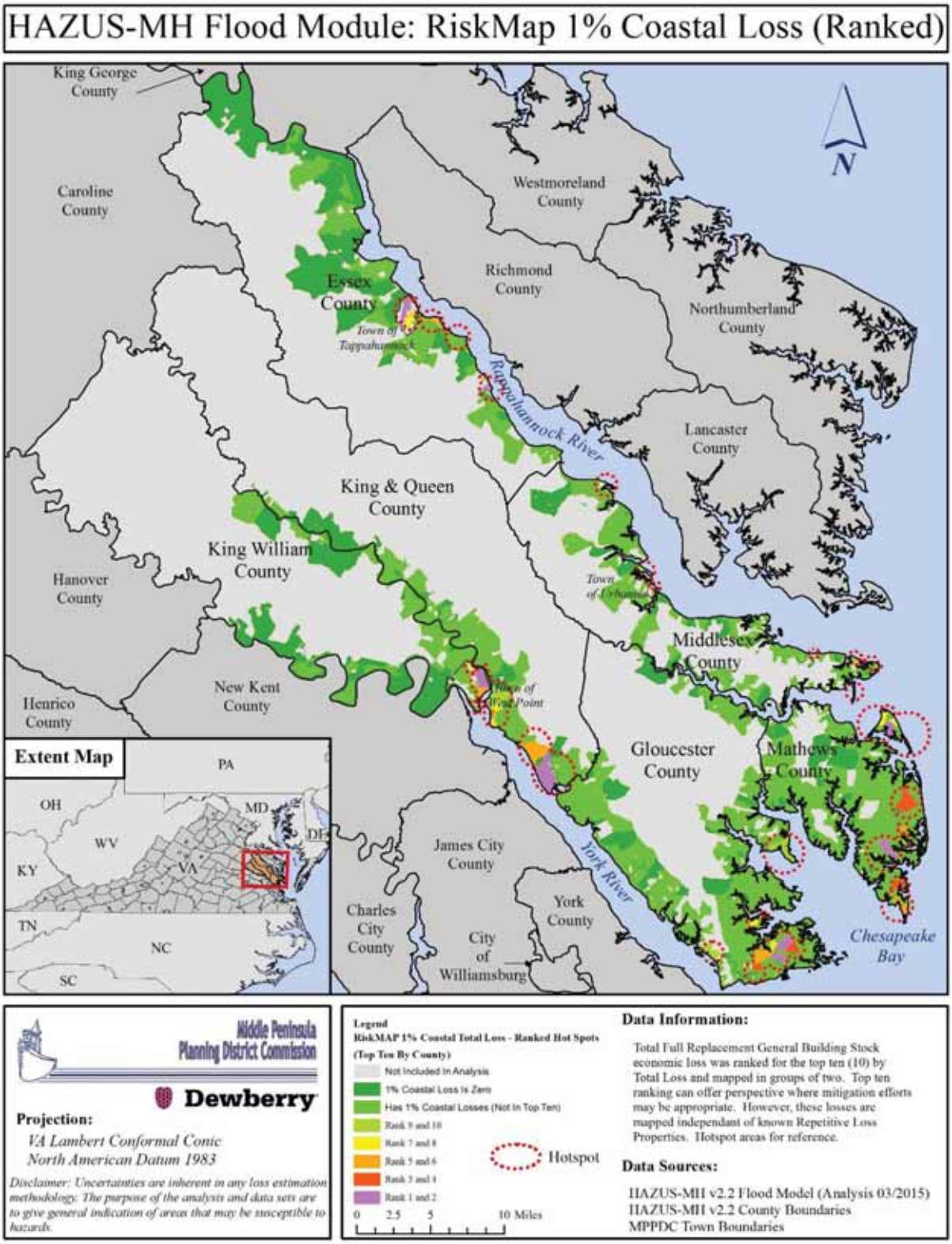
Figure 116:


HAZUS-MH Flood Module: Hot Spot Comparison
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Northumberland County
Lancaster County
King & Queen County
King William County
Hanover County
New Kent County
Henrico County
Middlesex County
Gloucester County
Mathews County
James City County
York County
Charles City County
City of Williamsburg
Rappahannock River
York River
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend
Hot Spots Based on Top Ten Rank
(Top Ten By County)
RiskMap 1%Coastal Hotspot
Level 1 Annualized Hotspot
MPPDC Region
0 2.5 5 10 Miles
Data Information:
General Building Stock total economic loss was ranked for the top ten (10) by each County. Then, Hot spot areas were generated from the top ten.
Hotspot areas may indicate areas that may require further mitigation or consideration for more detailed analyses.
Data Sources:
HAZUS-MH v2.2 Flood Model (Analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Given the coastal focus of the RiskMAP study, it can be seen that a few new areas of consideration include the following:

- Middlesex County – an area along the Rappahannock River where the River confluences with Woods Creek.
- Gloucester County – an area along the York River, east of the Carmines Islands and situated between Carmines Island Road (in the west) and Pigeon Hill Road (in the east).
- Mathews County – portions of land on the northern banks of Horn Harbor and also along Winter Harbor.
- King and Queen County – a greater area (as compared to the Level 1 Annualized Hot Spot) in the vicinity of Mattaponi; i.e., confluence of Mattaponi and York Rivers near State Highway 33 (Lewis B. Puller Memorial Highway).

Figure 117:


HAZUS-MH Flood Module: RiskMap 1% Coastal Loss (Ranked)
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Middlesex County
New Kent County
Henrico County
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend
RiskMAP 1% Coastal Total Loss - Ranked Hot Spots
(Top Ten By County)
Not Included in Analysis
1% Coastal Loss is Zero
Has 1% Coastal Losses (Not In Top Ten)
Rank 9 and 10
Rank 7 and 8
Rank 5 and 6
Rank 3 and 4
Rank 1 and 2
Hotspot
0 2.5 5 10 Miles
Data Information:
Total Full Replacement General Building Stock economic loss was ranked for the top ten (10) by Total Loss and mapped in groups of two. Top ten ranking can offer perspective where mitigation efforts may be appropriate. However, these losses are mapped independant of known Repetitive Loss Properties. Hotspot areas for reference.
Data Sources:
HAZUS-MH v2.2 Flood Model (Analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Essential Facilities

Level 1 analysis of essential facilities typically involves using the data provided with Hazus (i.e., Out-of-the-Box). This means the Hazus data of Essential Facilities is used as-is and no local data inputs are utilized. Essential facilities were modeled in this manner which includes the following feature types:

- Medical Care Facilities
- Emergency Operation Centers
- Fire Stations
- Police Stations
- Schools

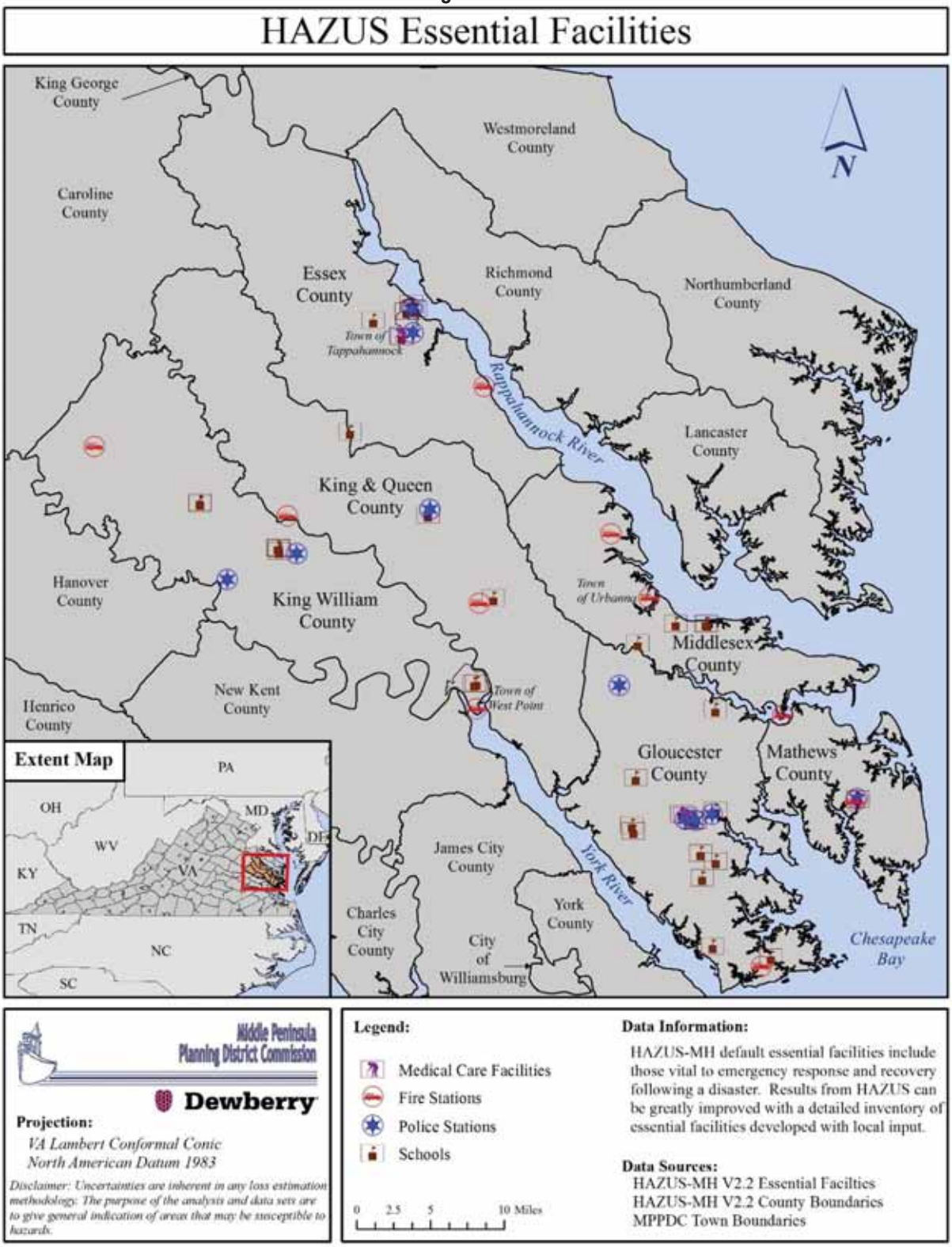
Essential facilities are typically those facility types that are vital to emergency response and recovery following a disaster. School buildings are included in this category because of the key role they often play in sheltering people displaced from damaged homes. Generally there are very few of each type of essential facilities in a census tract, making it easier to obtain site-specific information for each facility. Thus, damage and loss-of-function are evaluated on a building-by-building basis for this class of structures, even though the uncertainty in each such estimate is large[3].

Figure 118 displays the spatial location of the mapped essential facilities as provided with the Hazus software. Thereafter, Figure 114 highlights those facilities that are damaged by the Hazus Level 1 multi-frequency flood hazard(s) – thus experiencing estimated damage and loss.

Future versions of this plan can be enhanced, as illustrated in the mitigation actions, with further Level 2 refinements and Level 3 analyses.

[3] Multi-hazard Loss Estimation Methodology HAZUS-MH V2.2, Chapter 1: Introduction, 1-6

Figure 118:

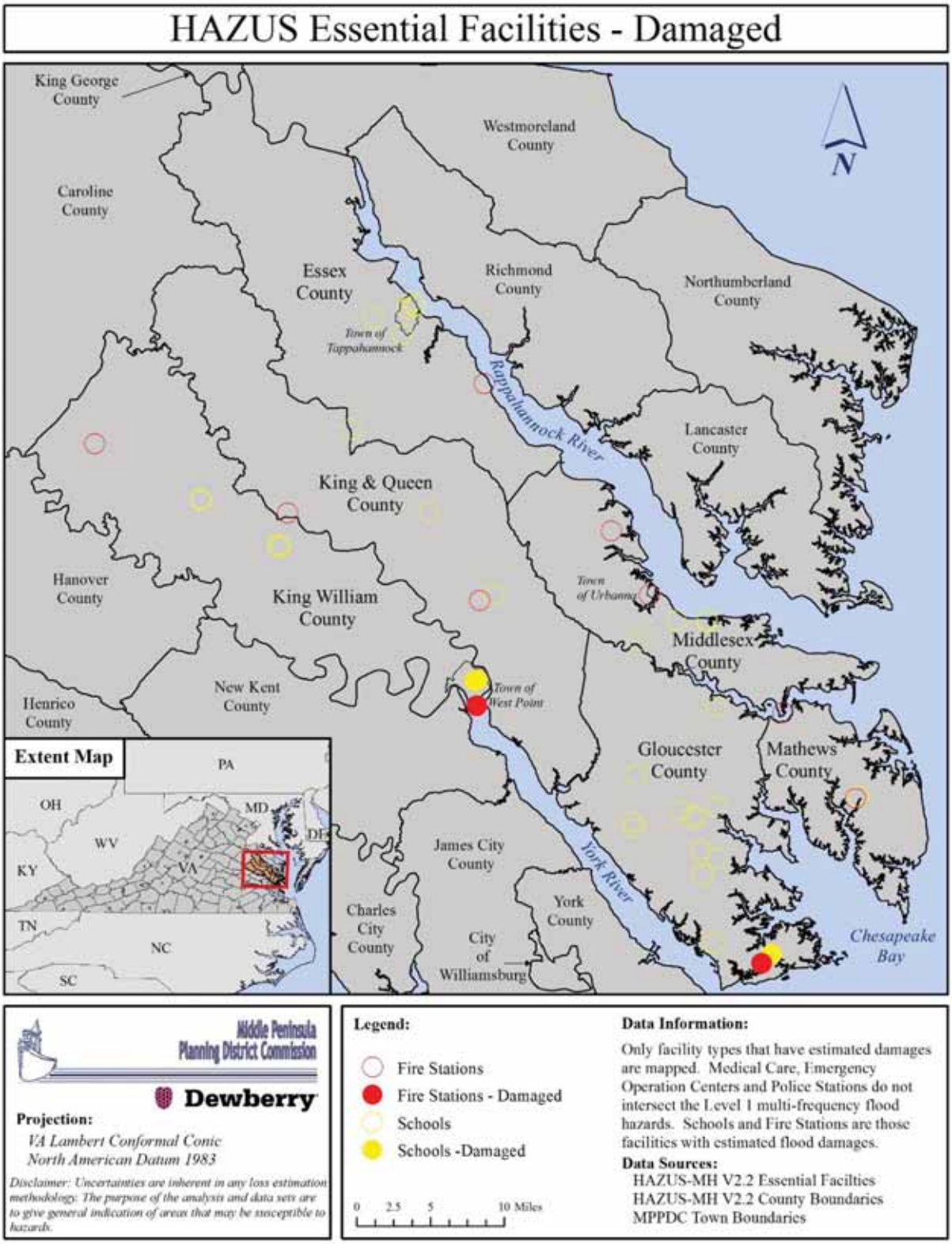

HAZUS Essential Facilities
King George County
Westmoreland County
Caroline County
Essex County
Richmond County
Northumberland County
Town of Tappahannock
Rappahannock River
Lancaster County
King & Queen County
Hanover County
King William County
Town of Urbanna
Middlesex County
New Kent County
Town of West Point
Henrico County
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Medical Care Facilities
Fire Stations
Police Stations
Schools
0 2.5 5 10 Miles
Data Information:
HAZUS-MH default essential facilities include those vital to emergency response and recovery following a disaster. Results from HAZUS can be greatly improved with a detailed inventory of essential facilities developed with local input.
Data Sources:
HAZUS-MH V2.2 Essential Facilties
HAZUS-MH V2.2 County Boundaries
MPPDC Town Boundaries

Name	City	Return Period	Control Hazard	Bldg DmgPct	Bldg Loss (US Dollar)	Contents DmgPct	Cont Loss (US Dollar)	MaxTime toFull Restoration
ACHILLES ELEM.	Hayes	50-YR	Coastal	4.9	$190,476	26.2	$1,028,573	480 days
ACHILLES ELEM.	Hayes	100-YR	Coastal	6.7	$261,818	36.2	$1,420,380	480 days
ACHILLES ELEM.	Hayes	500-YR	Coastal	18.8	$737,641	81.4	$3,194,153	720 days
WEST POINT MIDDLE	West Point	500-YR	Coastal	5.5	$133,548	29.8	$722,392	480 days
WEST POINT ELEM.	West Point	500-YR	Coastal	3.1	$124,359	16.5	$671,537	481 days
WEST POINT HIGH	West Point	500-YR	Coastal	0.5	$15,976	2.4	$86,268	482 days
West Point Volunteer Fire Department & R	West Point	500-YR	Coastal	1.8	$ -	2.0	$ -	483 days
Abingdon Volunteer Fire and Rescue Inc.	Hayes	25-YR	Coastal	9.9	$ -	19.4	$ -	484 days
Abingdon Volunteer Fire and Rescue Inc.	Hayes	50-YR	Coastal	10.9	$ -	35.8	$ -	485 days
Abingdon Volunteer Fire and Rescue Inc.	Hayes	100-YR	Coastal	11.2	$ -	42.0	$ -	486 days
Abingdon Volunteer Fire and Rescue Inc.	Hayes	500-YR	Coastal	27.7	$ -	100.0	$ -	720 days

NOTES:

Fire Station facilities in the stock Hazus Data do not have estimated replacement values associated with the facilities; therefore estimated dollar losses are NULL or void of any valid values.

Figure 119:


HAZUS Essential Facilities - Damaged
King George County
Westmoreland County
Caroline County
Essex County
Richmond County
Northumberland County
Town of Tappahannock
Rappahannock River
Lancaster County
King & Queen County
Hanover County
King William County
Town of Urbanna
Middlesex County
New Kent County
Town of West Point
Henrico County
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Fire Stations
Fire Stations - Damaged
Schools
Schools -Damaged
0 2.5 5 10 Miles
Data Information:
Only facility types that have estimated damages are mapped. Medical Care, Emergency Operation Centers and Police Stations do not intersect the Level 1 multi-frequency flood hazards. Schools and Fire Stations are those facilities with estimated flood damages.
Data Sources:
HAZUS-MH V2.2 Essential Facilties
HAZUS-MH V2.2 County Boundaries
MPPDC Town Boundaries

Potential Mitigation Actions:
The potential mitigation actions noted are those that are Hazus-specific and would benefit refinement of Hazus analyses. The previous Plan update included the following items (below). Those items that have been accomplished in the current Plan update are symbolized with a check-mark (☑) and those that still remain for future efforts (☐). New potential Hazus Mitigation actions are denoted with the following (➢).

- ☑ Complete Hazus flood runs for the 1 sq mi threshold. In most cases, this will need to be done on priority stream reaches as the program does not run efficiently at this level.
- ☑ Re-run Hazus for plan update to reflect 2010 census data.
- ☐ Refine and update data sets for GBS and essential facilities.
  - o Improvements in the future should aim to further refine the building stock. Notably, one improvement should include adding any new development that may not have been in the land use/land cover data; e.g., new housing developments, new construction, etc…
  - o Perform localized building-level assessments in known areas of loss and or areas subject to likely losses.

Hurricane Wind Analysis

The hurricane wind analysis for the HIRA was completed using the FEMA Hazus – MH V2.2 software. The model uses state of the art wind field models, calibrated and validated hurricane data. Wind speed has been calculated as a function of central pressure, translation speed, and surface roughness. This assessment has been completed for Probabilistic Level 1 analysis. The standard methodology of defining loss potential for any given hazard, includes annualizing the potential over a series of statistical return periods. Annualization is the mathematical method of converting individual losses to a weighted-average that may be experienced in any given year. The standard probabilistic scope pertaining to Hazus Level 1 hurricane wind risk corresponds to annualizing the 0.1%, 0.2%, 0.5%, 1%, 2%, 5%, and 10% wind return periods. In layman's-terms these same annual-chance return periods are often described as the 1,000-year, 500-year, 200-year, 100-year, 50-year, 20-year and 10-year events as shown in Table 60 below:

Table 60: Annual probability based on wind recurrence intervals.

Wind Recurrence Interval	Annual Chance of Occurrence
10 year	10.0%
20 year	5.0%
50 year	2.0%
100 year	1.0%
200 year	0.5%
500 year	0.2%
1000 year	0.1%

Practically, these statistical events represent the chance of being equaled or exceeded in any given year; i.e., the likelihood that a particular event with a given intensity occurs on average at least once every x-years. Once each of these statistical return periods are calculated, an annualized value is computed thus offering a perspective for any given year.

In addition to the Level 1 probabilistic methodology employed, Level 1 analysis is performed on stock data provided with the Hazus software; i.e., no local data inputs. This is an acceptable level of information for mitigation planning; future versions of this plan can be enhanced, as illustrated in the mitigation actions, with additional Level 1 scenarios and/or Level 2 and 3 analyses. Dollar values shown

in this report should only be used to represent cost of large aggregations of building types. Highly detailed, building specific, loss estimations have not been completed for this analysis as they require additional local data inputs. Note that combined wind, storm surge and wave-type scenarios have not been implemented in this Plan update however, the Flood modeling includes various scenarios that include the effects of storm surge and wave-action. Storm surge risk and coastal flooding is discussed in Section 4.

Loss estimation for this Hazus module is based on specific input data. The first type of data includes square footage of buildings for specified types or population. The second type of data includes information on the local economy that is used in estimating losses. Table 61 displays the economic loss categories used to calculate annualized losses by Hazus.

Table 61: Hazus direct economic loss categories and descriptions.

Category Name	Description of Data Input into Model	Hazus Output
Building	Cost per sq ft to repair damage by structural type and occupancy for each level of damage	Cost of building repair or replacement of damaged and destroyed buildings
Contents	Replacement value by occupancy	Cost of damage to building contents
Inventory	Annual gross sales in $ per sq ft	Loss of building inventory as contents related to business activities
Relocation	Multiple factors; primarily a function of Rental Costs ($/ft^2/month) for non-entertainment buildings where damage ≥10%	Relocation expenses (for businesses and institutions); disruption costs to building owners for temporary space.
Income	Income in $ per sq ft per month by occupancy	Capital-related incomes losses as a measure of the loss of productivity, services, or sales
Rental	Rental costs per month per sq ft by occupancy	Loss of rental income to building owners
Wage	Wages in $ per sq ft per month by occupancy	Employee wage loss as described in income loss

A probabilistic scenario Hazus analysis was completed using the planning district as the study area. The individual county results have been derived from this data set.

Middle Peninsula currently has approximately 43,501 structures with an estimated exposure value of approximately $17.7 billion. Average estimated replacement value of buildings in the study area range from $94,000 to $297,000, with the mean approximation value of $134,000 [4]. Eighty-one percent of the planning district's general occupancy is categorized as residential, followed by commercial (12%). Table 62 below provides inventory information for each of the six counties that were included in the analysis. Gloucester County occupies a large percentage (40%) of the building stock exposure for the region.

[4] Previous Plan values adjusted per BLS CPI Inflation Calculator (2000 to 2010) to match Hazus/Census years.

Table 62: Building stock exposure for general occupancies by county.

County	Residential	Commercial	Industrial	Agriculture	Religion	Govt.	Education	Total
Gloucester	$5,698,054	$831,318	$147,429	$32,557	$84,190	$32,437	$190,065	$7,016,050
King William	$2,463,239	$274,254	$110,725	$32,549	$41,687	$24,273	$24,786	$2,971,513
Middlesex	$2,151,683	$354,607	$65,244	$14,045	$26,670	$11,736	$40,679	$2,664,664
Essex	$1,578,275	$402,650	$146,178	$25,395	$28,679	$18,661	$31,423	$2,231,261
Mathews	$1,566,770	$149,340	$45,066	$9,877	$19,875	$6,830	$12,042	$1,809,800
King & Queen	$886,914	$52,850	$29,064	$6,710	$19,927	$2,968	$7,284	$1,005,717
Total	$14,344,935	$2,065,019	$543,706	$121,133	$221,028	$96,905	$306,279	$17,699,005
All values are in thousands of dollars								

Building stock exposure is also classified by building type. General Building Types (GBTs) have been developed as a means to classify the different buildings types. This provides an ability to differentiate between buildings with substantially different damage and loss characteristics. Model building types represent the average characteristics of buildings in a class. The damage and loss prediction models are developed for model building types and the estimated performance is based upon the "average characteristics" of the total population of buildings within each class. Five general classifications have been established, including wood, masonry, concrete, steel and manufactured homes (MH). A brief description of the building types is available in Table 63.

Table 63: Hazus General Building Type classes.

General Building Type	Description
Wood	Wood frame construction
Masonry	Reinforced or unreinforced masonry construction
Steel	Steel frame construction
Concrete	Cast-in-place or pre-cast reinforced concrete construction
MH	Factory-built residential construction

Wood construction represents the majority (61%) of building types in the planning district. Masonry construction accounts for a quarter of the building type exposure. Table 64 below provides building stock exposure for the five main building types.

Table 64: Building stock exposure for general building type by county.

County	Wood	Masonry	Concrete	Steel	Manufactured Home	Total
Gloucester	$4,338,118	$1,782,044	$177,833	$591,235	$126,913	$7,016,143
King William	$1,895,656	$751,978	$61,374	$227,445	$35,155	$2,971,608
Middlesex	$1,631,388	$678,395	$67,789	$225,948	$61,315	$2,664,835
Essex	$1,202,922	$558,827	$102,763	$319,225	$47,615	$2,231,352
Mathews	$1,166,398	$450,836	$32,534	$113,035	$47,165	$1,809,968
King & Queen	$661,413	$247,318	$11,118	$49,521	$36,527	$1,005,897
Total	$10,895,895	$4,469,398	$453,411	$1,526,409	$354,690	$17,699,803
All values are in thousands of dollars						

Multi-frequency Hurricane Modeling – Probabilistic Level 1 methodology

Annualized loss is defined as the expected value of loss in any one year, and is developed by aggregating the losses and exceedance probabilities for the 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year return periods. The following figures illustrate the 3-second peak gust wind speeds for the 100-, 500-, and 1000-year return periods. Wind speeds are based on estimated 3-second gusts in open terrain at 10 meters above the ground at the centroid of each census track. Buildings that must be designed for a 100-year mean recurrence interval wind event include[5]:

- Buildings where more than 300 people congregate in one area
- Buildings that will be used for hurricane or other emergency shelter
- Buildings housing a day care center with capacity greater than 150 occupants
- Buildings designed for emergency preparedness, communication, or emergency operation center or response
- Buildings housing critical national defense functions
- Buildings containing sufficient quantities of hazardous materials

[5] Whole Building Design Guide (WBDG) Wind Safety of the Building Envelop by Tom Smith 5/26/2008

Figure 120:

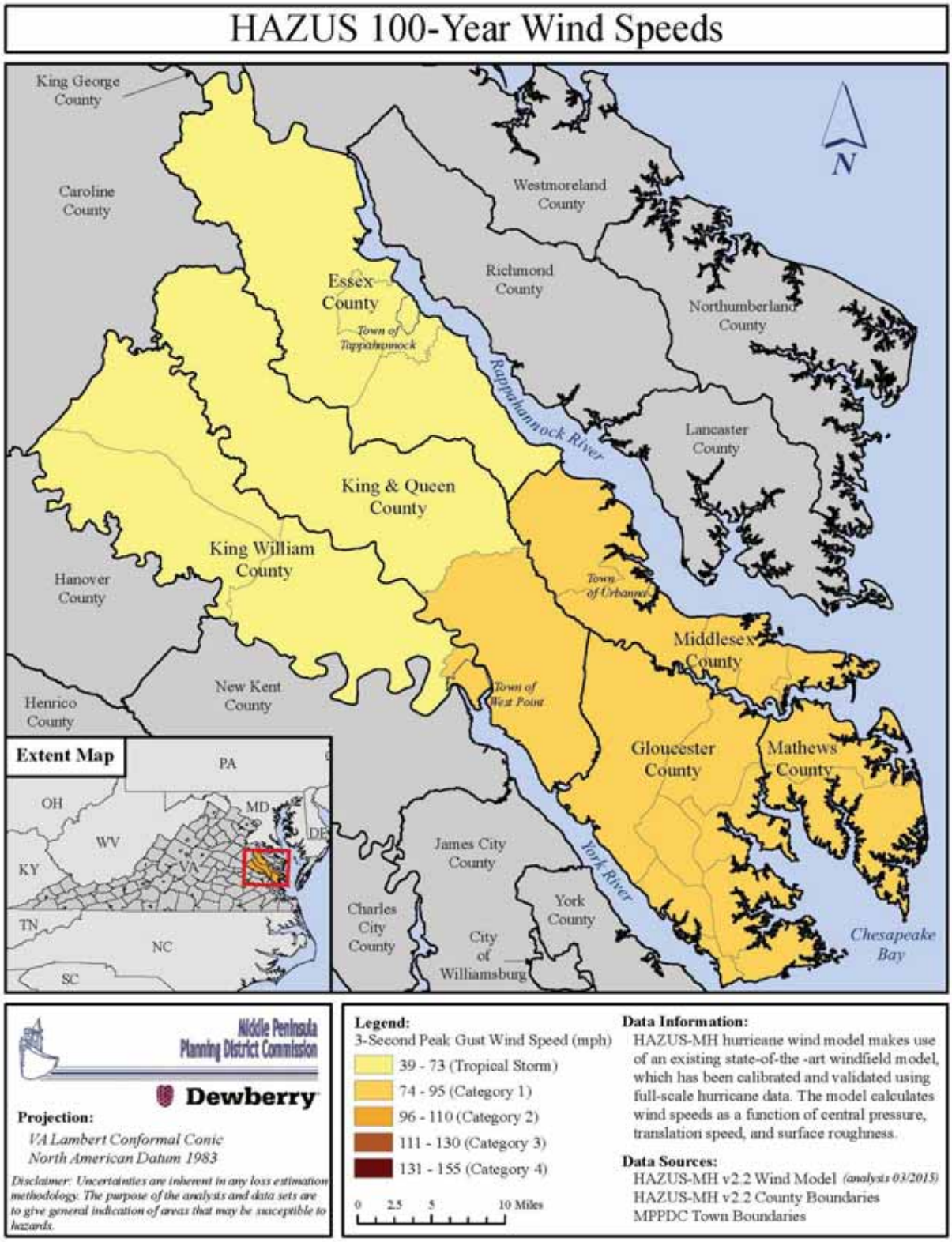

HAZUS 100-Year Wind Speeds
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Town of Tappahannock
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Town of Urbanna
Middlesex County
New Kent County
Town of West Point
Henrico County
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
3-Second Peak Gust Wind Speed (mph)
39 - 73 (Tropical Storm)
74 - 95 (Category 1)
96 - 110 (Category 2)
111 - 130 (Category 3)
131 - 155 (Category 4)
0 2.5 5 10 Miles
Data Information:
HAZUS-MH hurricane wind model makes use of an existing state-of-the -art windfield model, which has been calibrated and validated using full-scale hurricane data. The model calculates wind speeds as a function of central pressure, translation speed, and surface roughness.
Data Sources:
HAZUS-MH v2.2 Wind Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 121:

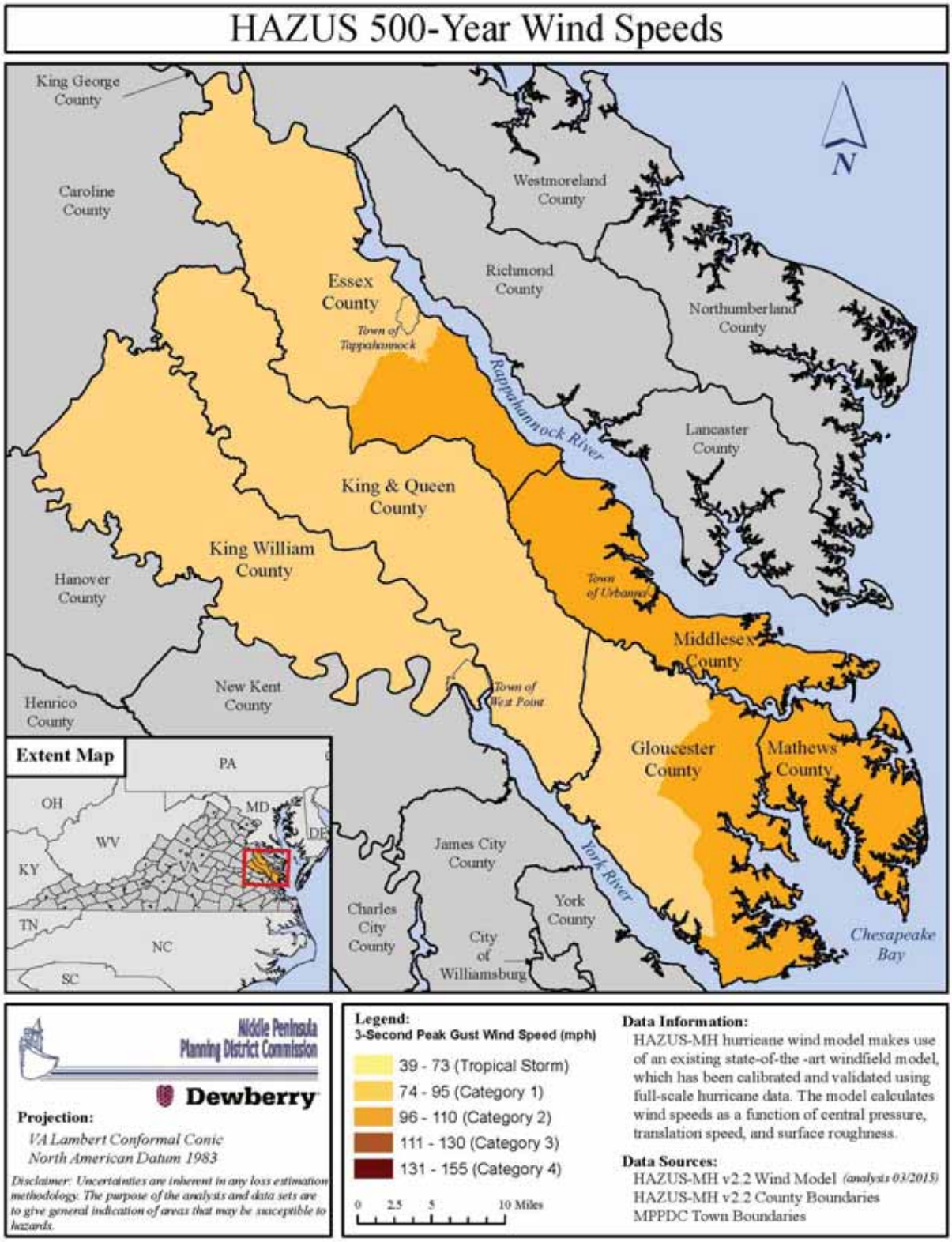
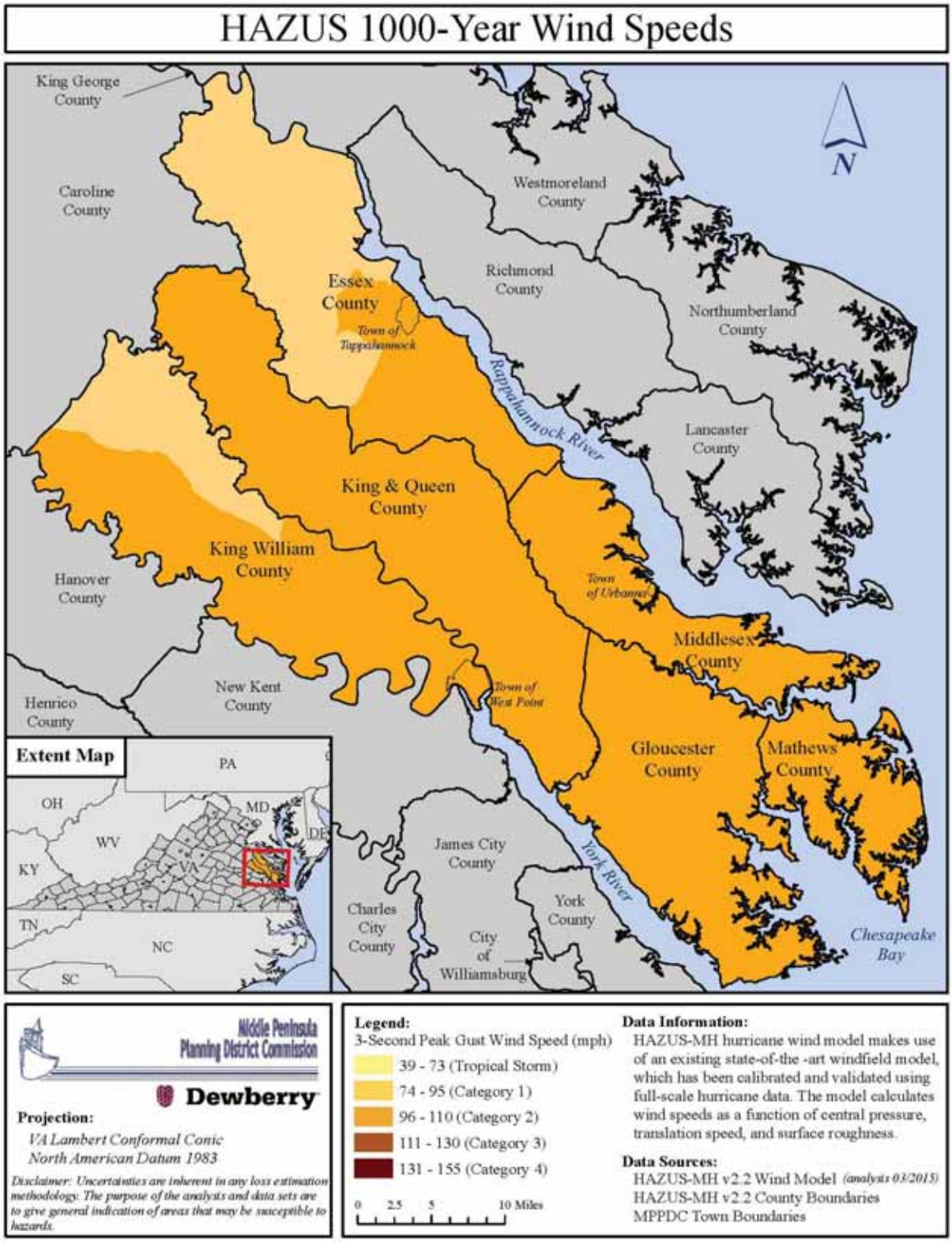

HAZUS 500-Year Wind Speeds
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Town of Tappahannock
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Town of Urbanna
Middlesex County
New Kent County
Town of West Point
Henrico County
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
3-Second Peak Gust Wind Speed (mph)
39 - 73 (Tropical Storm)
74 - 95 (Category 1)
96 - 110 (Category 2)
111 - 130 (Category 3)
131 - 155 (Category 4)
0 2.5 5 10 Miles
Data Information:
HAZUS-MH hurricane wind model makes use of an existing state-of-the -art windfield model, which has been calibrated and validated using full-scale hurricane data. The model calculates wind speeds as a function of central pressure, translation speed, and surface roughness.
Data Sources:
HAZUS-MH v2.2 Wind Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 122:


HAZUS 1000-Year Wind Speeds
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Town of Tappahannock
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Town of Urbanna
Middlesex County
New Kent County
Town of West Point
Henrico County
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
3-Second Peak Gust Wind Speed (mph)
39 - 73 (Tropical Storm)
74 - 95 (Category 1)
96 - 110 (Category 2)
111 - 130 (Category 3)
131 - 155 (Category 4)
0 2.5 5 10 Miles
Data Information:
HAZUS-MH hurricane wind model makes use of an existing state-of-the -art windfield model, which has been calibrated and validated using full-scale hurricane data. The model calculates wind speeds as a function of central pressure, translation speed, and surface roughness.
Data Sources:
HAZUS-MH v2.2 Wind Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

General Building Stock Loss Estimation

The probabilistic Hazus-MH hurricane analysis predicts that the Middle Peninsula can annually expect close to $2,516,200 US Dollars in damages due to hurricane wind events. Property or "capital stock" losses of $2,359,300 US Dollars make up about 94% of the damages. This includes the values for buildings, contents, and inventory. Business interruption accounts for approximately $156,900 US Dollars of the annualized losses, or 6%, and includes relocation, income, rental, and wage costs.

Table 65 illustrates the expected annualized losses broken down by county. Gloucester County has the highest annualized loss, $1,242,600 US Dollars, accounting for 49% of the total losses for Middle Peninsula. The majority of the expected damages can be attributed to building and content value.

Mathews County has the second highest loss, $464,930 US Dollars, accounting for 18% of the total annualized losses for Middle Peninsula.

Building value accounts for approximately 66% of the expected annualized damages; residential occupancy makes up the vast majority of these losses. More than 70% of the buildings are categorized as wood frame and 22% masonry construction. Tables 66 and 67 summarize the property losses and business interruption losses shown by occupancy and building type. The slight differences in the annualized losses for building type and occupancy can be attributed to the Hazus classification methodology.

Table 65: County based Hazus annualized loss by all building and occupancy types.

County	Building	Content	Inventory	Relocation	Income	Rental	Wage	Annualized Loss
Gloucester	$801.30	$371.43	$0.67	$45.98	$2.89	$15.13	$5.22	$1,242.61
Mathews	$291.59	$145.16	$0.22	$19.93	$0.76	$6.31	$0.96	$464.93
King William	$121.47	$37.33	$0.22	$6.17	$0.27	$2.04	$0.76	$168.26
Middlesex	$263.93	$69.84	$0.25	$24.91	$1.11	$8.21	$1.60	$369.86
King & Queen	$66.90	$27.37	$0.09	$3.70	$0.08	$1.07	$0.13	$99.35
Essex	$111.93	$49.34	$0.27	$6.40	$0.38	$2.19	$0.69	$171.21
Annualized Loss	**$1,657.12**	**$700.47**	**$1.73**	**$107.10**	**$5.49**	**$34.96**	**$9.35**	**$2,516.23**
All values are in thousands of dollars								

Table 66: Annualized loss by general building type in the Middle Peninsula Region.

Building Type	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Annualized Loss
Wood	$1,207.35	$550.42	$0.18	$71.02	$1.19	$22.84	$1.76	**$1,853.00**
Masonry	$368.21	$126.01	$0.35	$26.27	$1.62	$8.91	$2.85	**$531.38**
MH	$49.06	$10.01	$0	$4.41	$0	$0.67	$0	**$64.14**
Steel	$26.61	$11.64	$0.99	$4.28	$2.20	$1.85	$3.72	**$47.57**
Concrete	$5.89	$2.39	$0.21	$1.12	$0.48	$0.69	$1.03	**$10.79**
Annualized Loss	**$1,657.12**	**$700.47**	**$1.73**	**$107.10**	**$5.49**	**$34.96**	**$9.35**	**$2,506.88**
% of Ann. Loss	**66.10%**	**27.94%**	**0.07%**	**4.27%**	**0.22%**	**1.39%**	**0.37%**	*Hazus-MH (V2.2) results*
All values (except percentages) are in thousands of dollars								

Table 67: Annualized loss by general occupancy type in the Middle Peninsula Region.

Occupancy Type	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Annualized Loss
Residential	$1,585.15	$671.08	$0	$97.18	$0.05	$31.23	$0.11	**$2,384.69**
Commercial	$39.99	$14.15	$0.37	$6.25	$4.30	$3.36	$4.88	**$68.42**
Industrial	$10.77	$7.10	$1.24	$0.71	$0.14	$0.11	$0.23	**$20.08**
Non-Profit	$5.47	$0.90	$0	$0.91	$0.54	$0.08	$1.27	**$7.90**
Education	$5.42	$3.09	$0	$1.08	$0.35	$0.08	$0.83	**$10.04**
Government	$1.42	$0.62	$0	$0.28	$0.02	$0.06	$1.83	**$2.40**
Agricultural	$2.09	$1.64	$0.12	$0.40	$0.01	$0.02	$0.01	**$4.28**
Annualized Loss	**$1,650.32**	**$698.58**	**$1.73**	**$106.81**	**$5.41**	**$34.95**	**$9.17**	**$2,497.81**
% of Ann. Loss	**65.83%**	**27.97%**	**0.07%**	**4.28%**	**0.22%**	**1.40%**	**0.37%**	*Hazus-MH (V2.2) results*
All values (except percentages) are in thousands of dollars								

Residential occupancy accounts for the majority of the damages. Tables 68 and 69 summarize the annualized loss values by county. These values are broken down by building type and general occupancy for comparison. Total exposure has been included as a reference point for damages. Wood structures account for the greatest percentage (62%) of the total annualized damages, with masonry structures next representing near 25% of the total annualized damages.

Table 68: County based Hazus annualized loss by general building type.

County	Total Exposure	Concrete	Masonry	Manufactured Homes	Steel	Wood	Annualized Loss
Gloucester	$7,016,050	$6.27	$257.37	$27.17	$26.51	$925.30	$1,242.61
Mathews	$1,809,800	$1.26	$93.60	$14.09	$6.15	$349.84	$464.93
Middlesex	$2,664,664	$1.99	$87.52	$12.50	$9.04	$258.82	$369.86
Essex	$2,231,261	$1.20	$37.51	$4.48	$5.01	$123.01	$171.21
King William	$2,971,513	$0.90	$38.42	$2.38	$3.56	$123.01	$168.26
King & Queen	$1,005,717	$0.19	$19.81	$3.53	$1.03	$74.79	$99.35
Annualized Loss		$11.82	$534.23	$64.14	$51.29	$1,854.75	$2,516.23
% of Annualized Loss		0.5%	21.2%	2.5%	2.0%	73.7%	*Hazus-MH (V2.2) results*
% of Total Exposure		< 1%	< 1%	< 1%	< 1%	< 1%	
All values (except percentages) are in thousands of dollars							

Table 69: County based Hazus annualized loss by general occupancy type.

County	Total Exposure	Residential	Commercial	Industrial	Non-Profit	Education	Gov.	Agriculture	Annualized Loss
Gloucester	$7,016,050	$1,174.83	$37.91	$7.07	$4.62	$11.14	$2.20	$1.67	$1,239.45
Essex	$2,231,261	$449.32	$8.26	$3.26	$1.41	$0.38	$0.31	$0.70	$463.63
Middlesex	$2,664,664	$345.81	$15.04	$3.02	$1.40	$1.29	$0.60	$0.63	$367.80
Mathews	$1,809,800	$159.34	$6.92	$3.25	$0.50	$0.45	$0.36	$0.55	$171.37
King William	$2,971,513	$158.87	$4.08	$2.63	$0.80	$0.35	$0.72	$0.59	$168.03
King and Queen	$1,005,717	$96.63	$1.09	$1.08	$0.44	$0.05	$0.05	$0.14	$99.49
Annualized Loss		$2,384.80	$73.30	$20.32	$9.17	$13.66	$4.23	$4.29	$2,509.77
% of Annualized Loss		95.02%	2.92%	0.81%	0.37%	0.54%	0.17%	0.17%	*Hazus-MH (V2.2) results*
% of Exposure		< 1%	< 1%	< 1%	< 1%	< 1%	< 1%	< 1%	
All values (except percentages) are in thousands of dollars									

Figures 123 through 130 on the following pages show the total annualized losses mapped for the planning district and individual counties.

Figure 123:

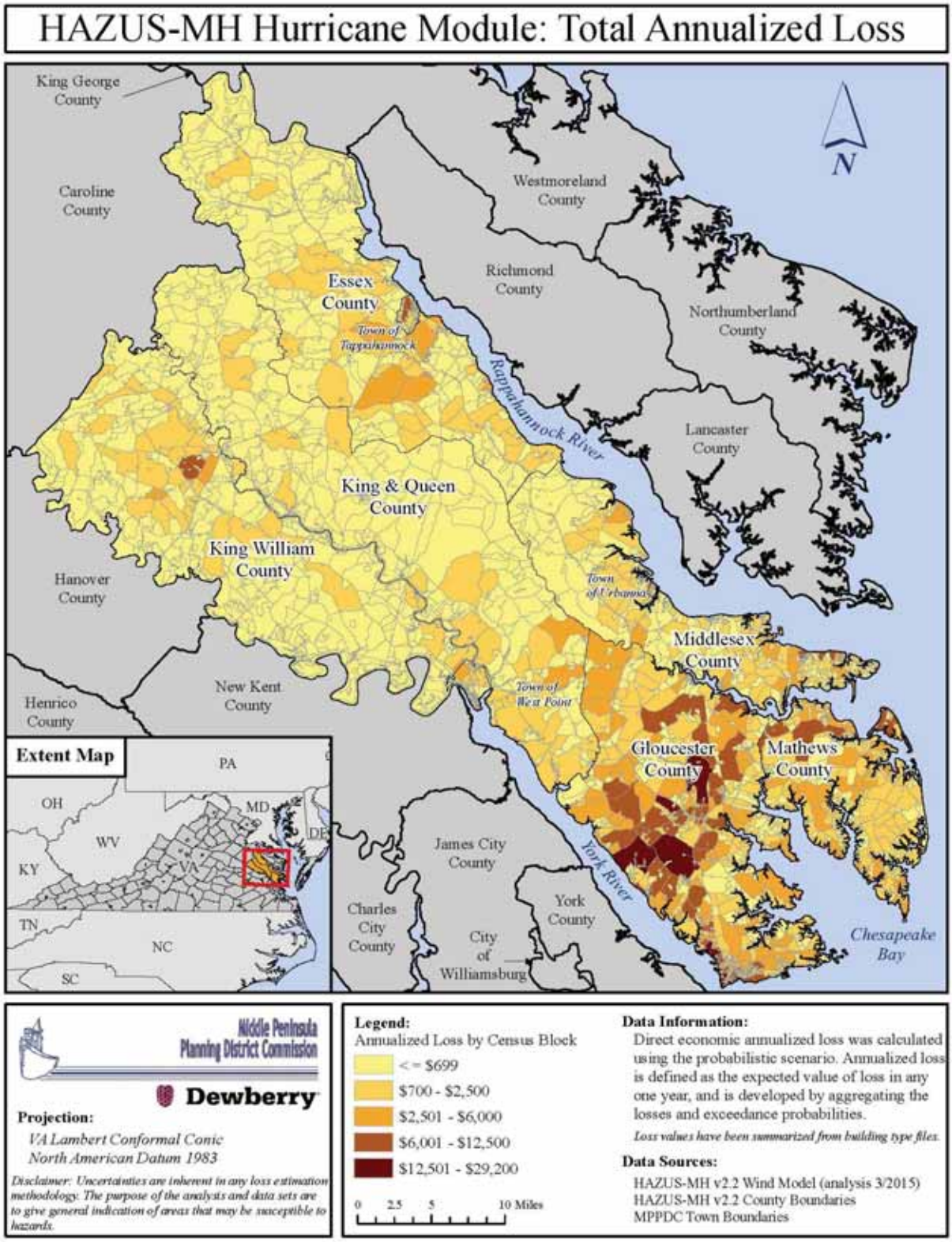

HAZUS-MH Hurricane Module: Total Annualized Loss
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Town of Tappahannock
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Town of Urbanna
Middlesex County
New Kent County
Town of West Point
Henrico County
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
<= $699
$700 - $2,500
$2,501 - $6,000
$6,001 - $12,500
$12,501 - $29,200
0 2.5 5 10 Miles
Data Information:
Direct economic annualized loss was calculated using the probabilistic scenario. Annualized loss is defined as the expected value of loss in any one year, and is developed by aggregating the losses and exceedance probabilities.
Loss values have been summarized from building type files.
Data Sources:
HAZUS-MH v2.2 Wind Model (analysis 3/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 124:

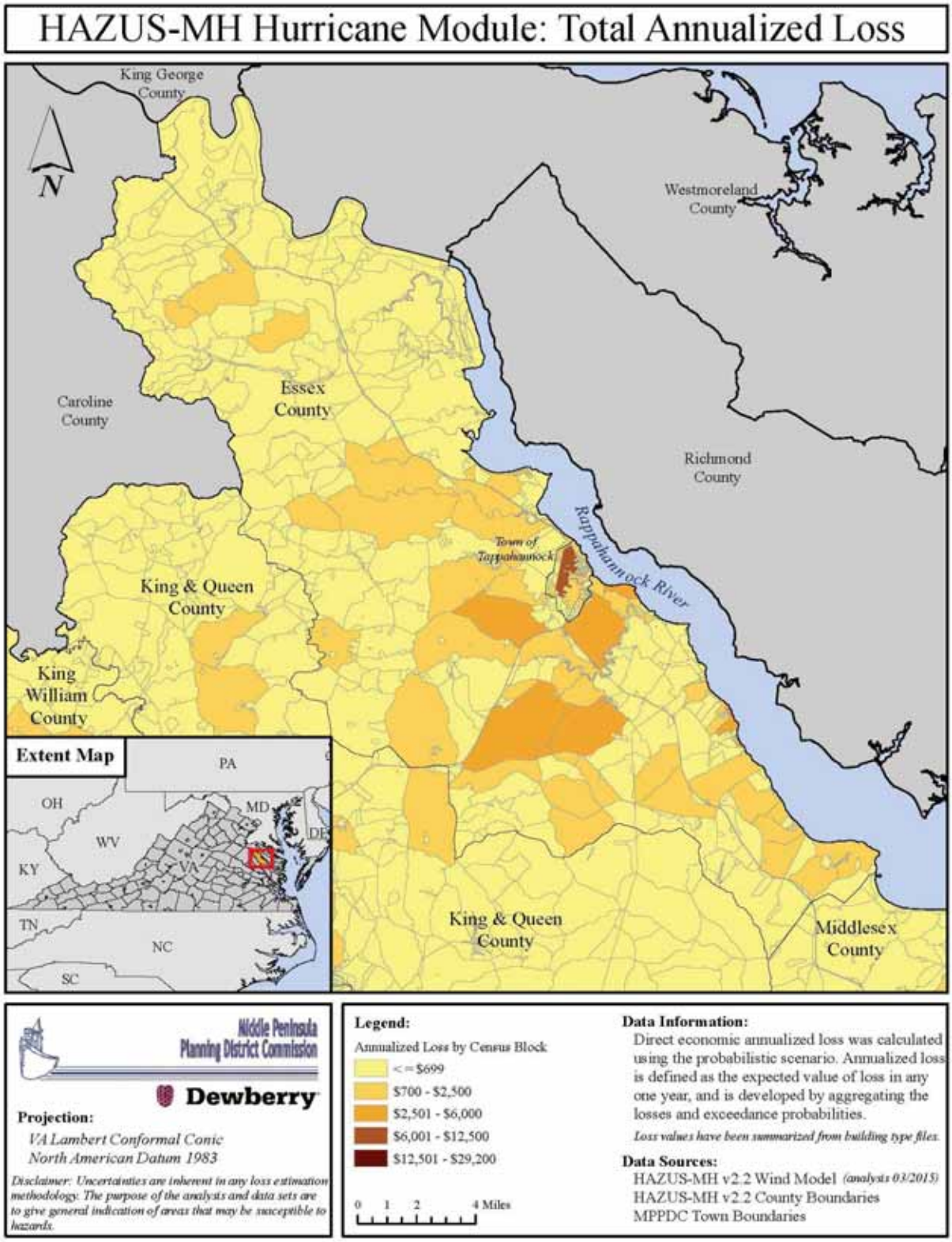

HAZUS-MH Hurricane Module: Total Annualized Loss
King George County
N
Westmoreland County
Caroline County
Essex County
Richmond County
Rappahannock River
Town of Tappahannock
King & Queen County
King William County
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
King & Queen County
Middlesex County
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
<= $699
$700 - $2,500
$2,501 - $6,000
$6,001 - $12,500
$12,501 - $29,200
0 1 2 4 Miles
Data Information:
Direct economic annualized loss was calculated using the probabilistic scenario. Annualized loss is defined as the expected value of loss in any one year, and is developed by aggregating the losses and exceedance probabilities.
Loss values have been summarized from building type files.
Data Sources:
HAZUS-MH v2.2 Wind Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 125:

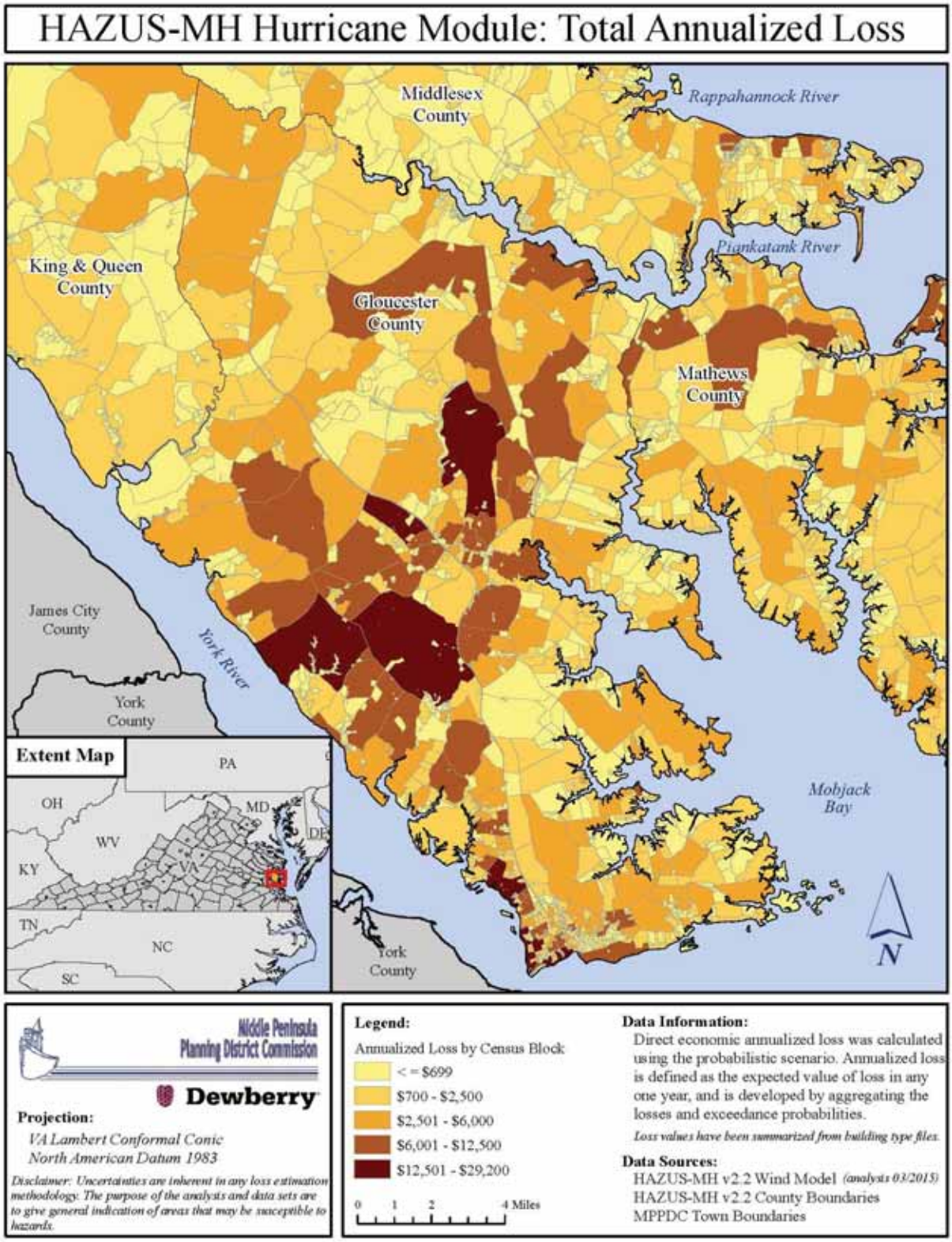

HAZUS-MH Hurricane Module: Total Annualized Loss
Middlesex County
Rappahannock River
King & Queen County
Piankatank River
Gloucester County
Mathews County
James City County
York River
York County
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Mobjack Bay
York County
N
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
< = $699
$700 - $2,500
$2,501 - $6,000
$6,001 - $12,500
$12,501 - $29,200
0 1 2 4 Miles
Data Information:
Direct economic annualized loss was calculated using the probabilistic scenario. Annualized loss is defined as the expected value of loss in any one year, and is developed by aggregating the losses and exceedance probabilities.
Loss values have been summarized from building type files.
Data Sources:
HAZUS-MH v2.2 Wind Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 126:

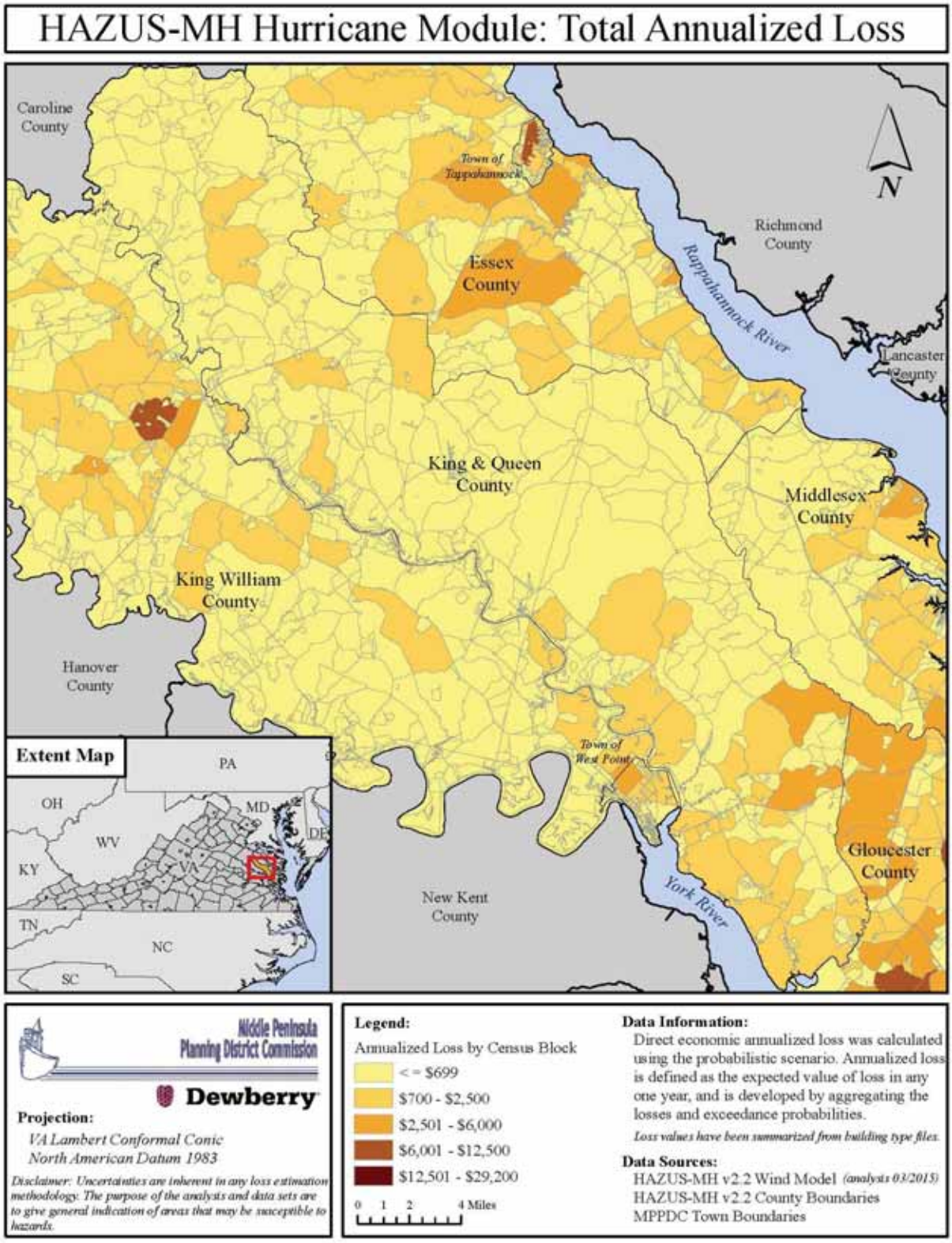

HAZUS-MH Hurricane Module: Total Annualized Loss
Caroline County
Town of Tappahannock
Essex County
Richmond County
Rappahannock River
Lancaster County
King & Queen County
Middlesex County
King William County
Hanover County
Town of West Point
Gloucester County
New Kent County
York River
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
<= $699
$700 - $2,500
$2,501 - $6,000
$6,001 - $12,500
$12,501 - $29,200
0 1 2 4 Miles
Data Information:
Direct economic annualized loss was calculated using the probabilistic scenario. Annualized loss is defined as the expected value of loss in any one year, and is developed by aggregating the losses and exceedance probabilities.
Loss values have been summarized from building type files.
Data Sources:
HAZUS-MH v2.2 Wind Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 127:

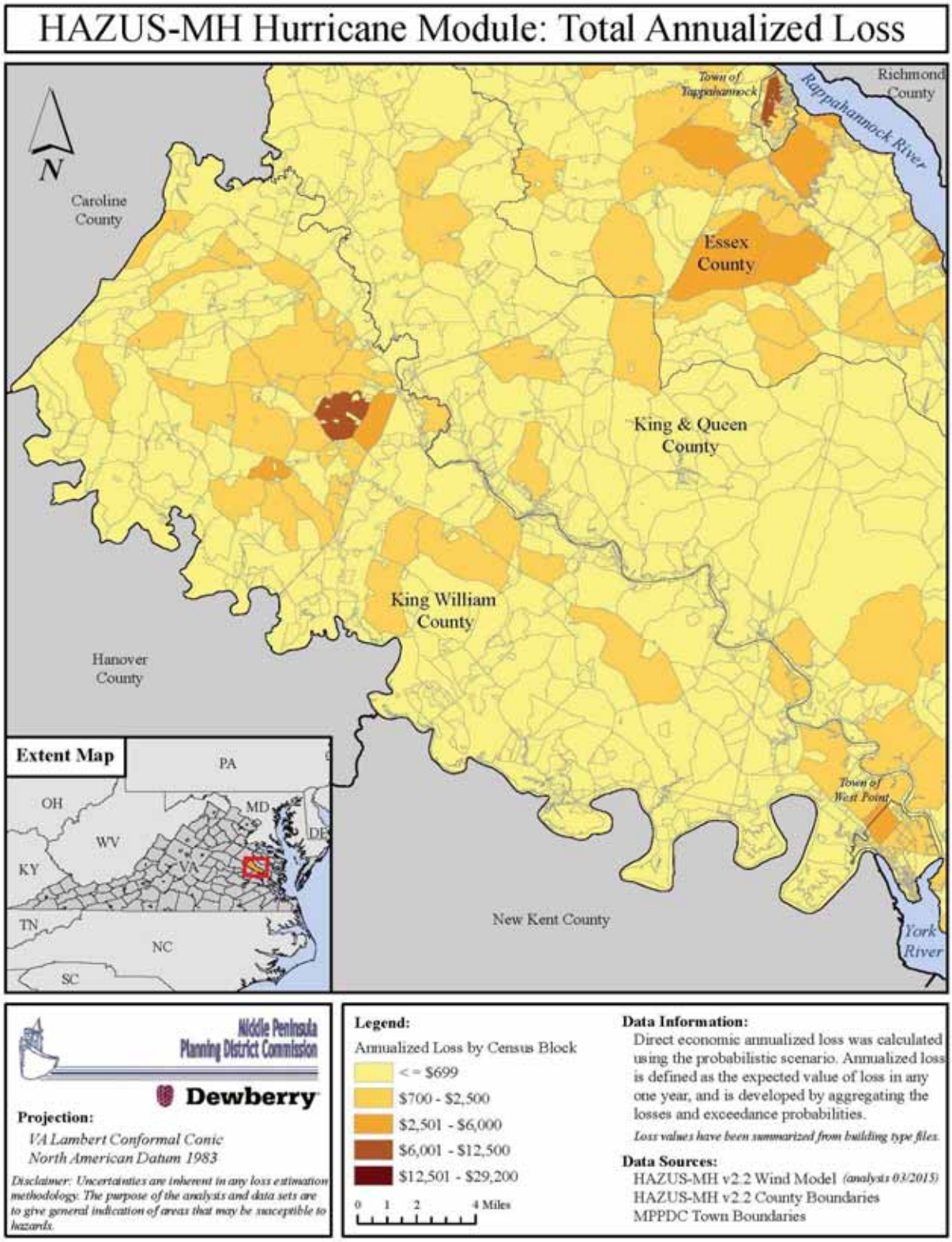

HAZUS-MH Hurricane Module: Total Annualized Loss
N
Caroline County
Hanover County
King William County
King & Queen County
Essex County
New Kent County
Richmond County
Rappahannock River
Town of Tappahannock
Town of West Point
York River
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
<= $699
$700 - $2,500
$2,501 - $6,000
$6,001 - $12,500
$12,501 - $29,200
0 1 2 4 Miles
Data Information:
Direct economic annualized loss was calculated using the probabilistic scenario. Annualized loss is defined as the expected value of loss in any one year, and is developed by aggregating the losses and exceedance probabilities.
Loss values have been summarized from building type files.
Data Sources:
HAZUS-MH v2.2 Wind Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 128:

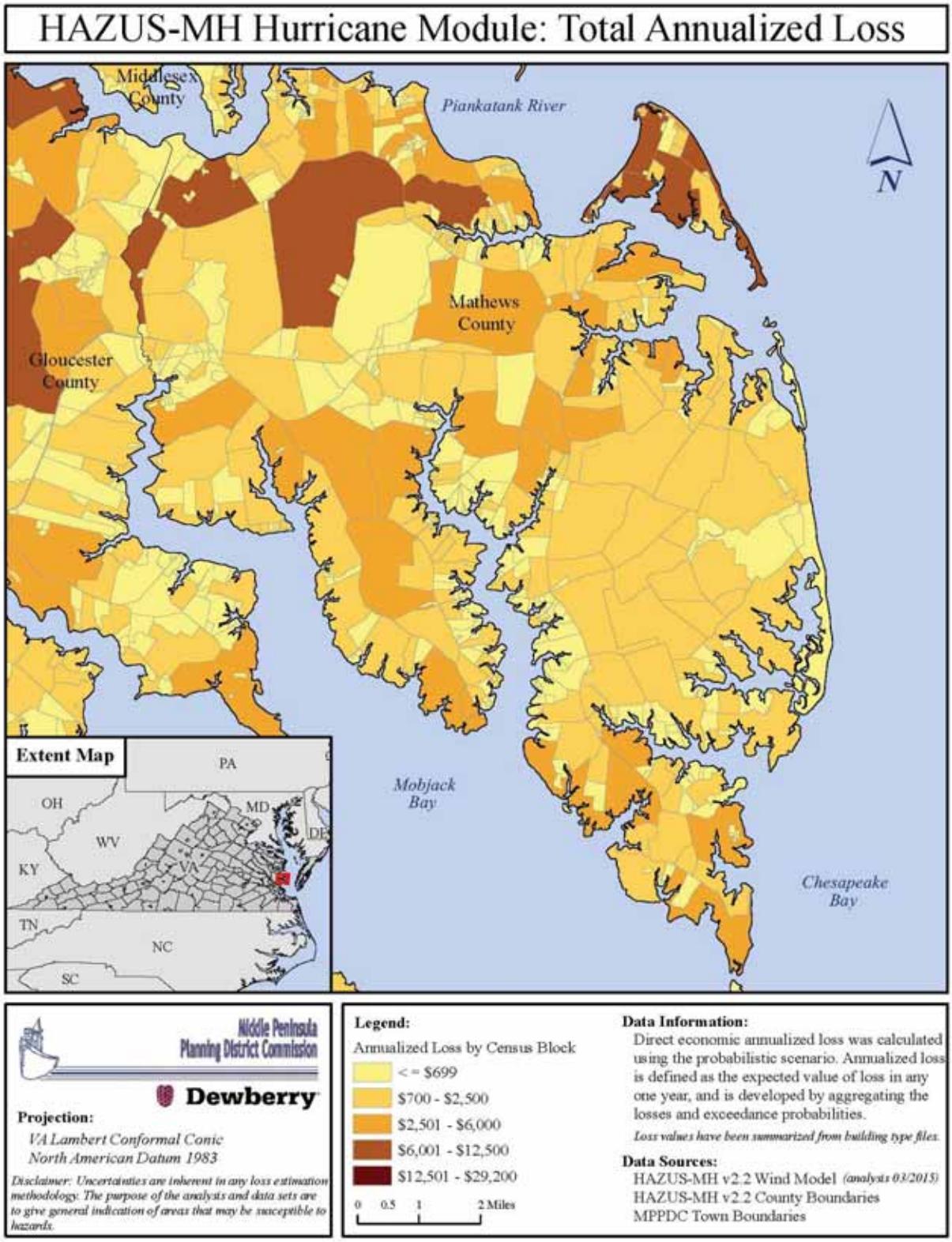

HAZUS-MH Hurricane Module: Total Annualized Loss
Middlesex County
Piankatank River
N
Mathews County
Gloucester County
Mobjack Bay
Chesapeake Bay
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
<= $699
$700 - $2,500
$2,501 - $6,000
$6,001 - $12,500
$12,501 - $29,200
0 0.5 1 2 Miles
Data Information:
Direct economic annualized loss was calculated using the probabilistic scenario. Annualized loss is defined as the expected value of loss in any one year, and is developed by aggregating the losses and exceedance probabilities.
Loss values have been summarized from building type files.
Data Sources:
HAZUS-MH v2.2 Wind Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 129:

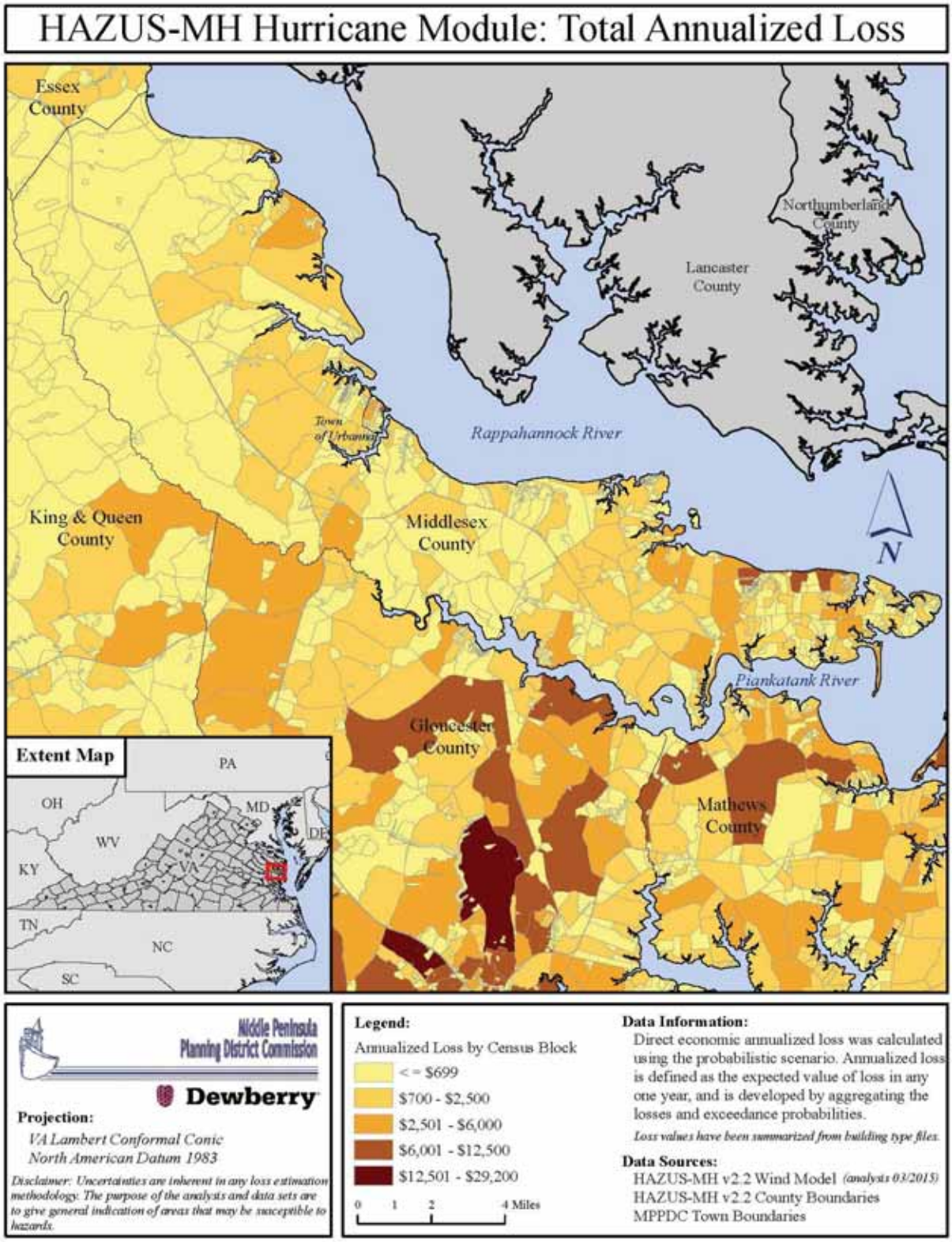
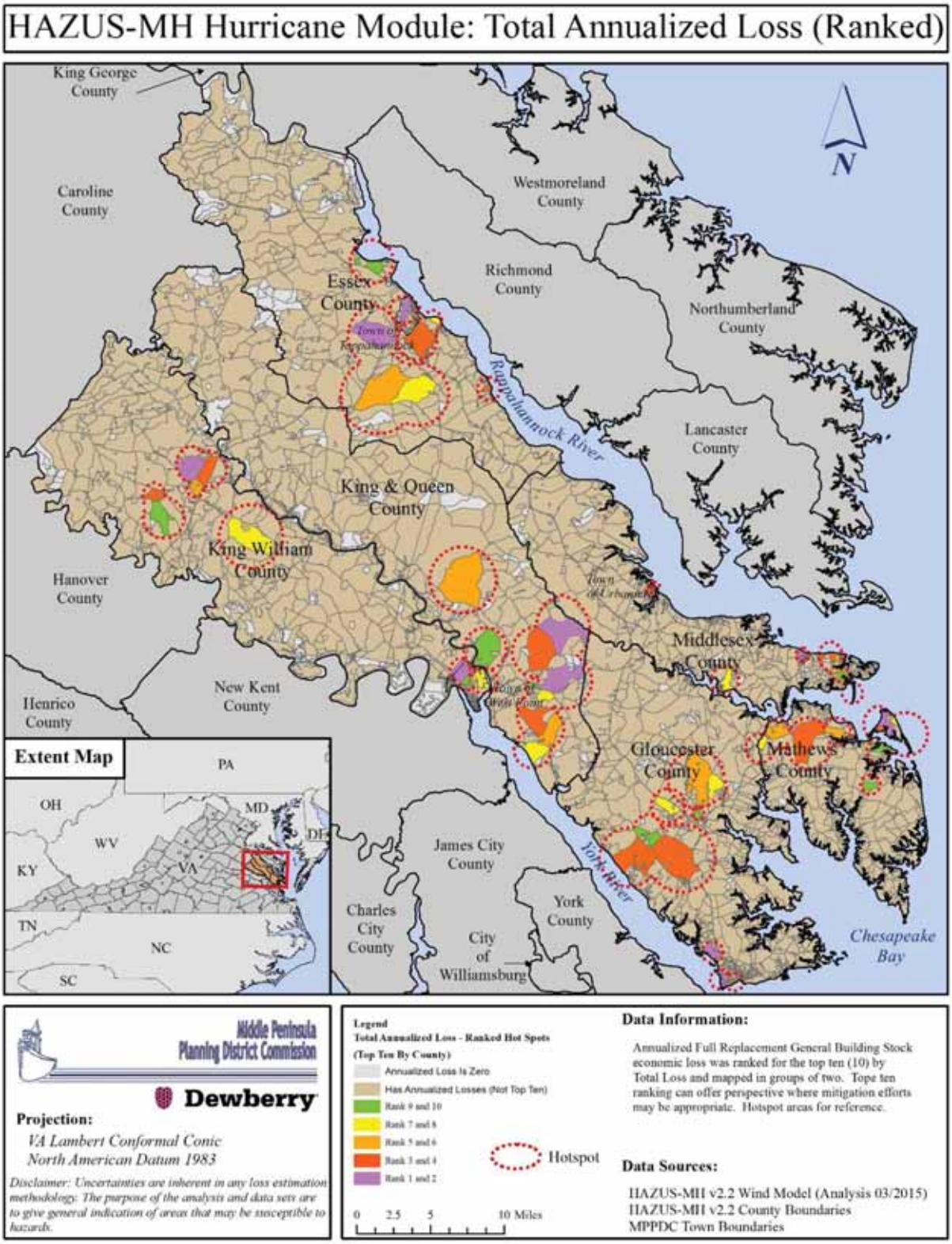

HAZUS-MH Hurricane Module: Total Annualized Loss
Essex County
Northumberland County
Lancaster County
Rappahannock River
Town of Urbanna
King & Queen County
Middlesex County
N
Piankatank River
Gloucester County
Mathews County
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Annualized Loss by Census Block
<= $699
$700 - $2,500
$2,501 - $6,000
$6,001 - $12,500
$12,501 - $29,200
0 1 2 4 Miles
Data Information:
Direct economic annualized loss was calculated using the probabilistic scenario. Annualized loss is defined as the expected value of loss in any one year, and is developed by aggregating the losses and exceedance probabilities.
Loss values have been summarized from building type files.
Data Sources:
HAZUS-MH v2.2 Wind Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 130:


HAZUS-MH Hurricane Module: Total Annualized Loss (Ranked)
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Middlesex County
New Kent County
Henrico County
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend
Total Annualized Loss - Ranked Hot Spots
(Top Ten By County)
Annualized Loss is Zero
Has Annualized Losses (Not Top Ten)
Rank 9 and 10
Rank 7 and 8
Rank 5 and 6
Rank 3 and 4
Rank 1 and 2
Hotspot
0 2.5 5 10 Miles
Data Information:
Annualized Full Replacement General Building Stock economic loss was ranked for the top ten (10) by Total Loss and mapped in groups of two. Tope ten ranking can offer perspective where mitigation efforts may be appropriate. Hotspot areas for reference.
Data Sources:
HAZUS-MH v2.2 Wind Model (Analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Gloucester County accounts for almost 50% of the planning district's annualized losses. While losses are distributed throughout the County a few patterns of concentration can be identified. Many of the census blocks exhibiting annualized losses of $10,000 or greater appear to be on either side of State Route 17, clustered and radiating around Gloucester Courthouse. More specifically, from Gloucester Courthouse to the York River being bounded on the North by County 606 or Ark Road and bounded on the south by Nursery Lane, Haynes Pond, and Carter Creek – this area accounts for approximately $226,000 (or approximately 18%) of expected annualized damages. On the northern side of Gloucester Courthouse the area generally bounded in the west by Beech Swamp and Cow Creek in the east, and being traversed by Indian Road through the middle and extending north-east to the Piankatank River in the vicinity of Ferry Creek at Hell Neck – this area accounts for approximately $131,000 (or approximately 11%) of expected annualized damages. Finally, those census blocks having the greatest expected annualized losses are in the vicinity of Hayes and Gloucester Point along the York River where as much as $285,000-plus (or approximately 23% - and greater) of annualized damages are estimated. Losses in Mathews County are also spread throughout the county with pockets of higher loss in the northern one-third of the county. Approximately $210,000 US Dollars (or 45%) of estimated annualized damages can be attributed to the northern one-third of the County; versus approximately $145,000 US Dollars (or 31%) in the center and $109,000 US Dollars (or 24%) in the southern one-third. Compared to Gloucester County, Mathews only has two (2) census blocks having expected annualized losses of $10,000 or greater, versus eighteen (18) such blocks in Gloucester. Mathews County accounts for approximately $464,000 or 18% of the total annualized losses in the planning district.

Middlesex County accounts for 15% of the total losses. The greatest concentration of estimated annualized loss is in the lower-eastern portion of the County; Gray's Point Road and south-eastward. This south-eastern portion of the County includes approximately $240,000 US Dollars (or 65%) of the estimated damages for the County. Other concentrations of estimated damages are distributed between Saluda, Urbanna and Water View. Urbanna accounts for approximately 6% of the annualized losses at approximately $24,000 US Dollars. Urbanna also includes two (2) census blocks within the top ten ranked blocks within the County accounting for $11,400 US Dollars or 48% of the losses in Urbanna.

Seven-percent of the total annualized damages ($168,260) for the region are attributed to King William County. King William exhibits four (4) primary areas where losses are concentrated. The first being the Town of West Point which can be attributed with thirty-one percent (31%) of the damages within the County having approximately $51,800 US Dollars of annualized loss. Next, there are two (2) areas near both Aylett and Manquin on the northern side of US 360 (Richmond-Tappahannock Highway). These two areas combined account for approximately $25,100 of annualized losses or fifteen-percent (15%). Last, the central portion of the County includes an area on either side of King William Road from West River Road in the north to Horse Landing Road in the south and accounting for roughly $7,500 US Dollars or four-percent (4%) of losses. The remainder of losses are distributed throughout the county with the greatest concentration of loss in the northwest quarter of the County. The Pamunkey Indian Reservation is estimated to have annualized loss values of approximately $1,100 US Dollars and the Mattaponi Reservation close to $830 US Dollars; combined the Indian Reservation losses account for approximately 1.2% of the losses throughout the County.

Essex County accounts for 7% of the total annualized losses. The greatest concentration of potential annualized wind damage exists in the central portion of the County – to include the Town of Tappahannock. This central area is traversed by three (3) of the primary roads being, US 360 (Richmond Highway), US 17 (Tidewater Trail) and Tappahannock Boulevard – running through the Town of Tappahannock. The combined annualized losses for this general area is approximately $71,000 US Dollars or forty-one percent (41%) of the losses within the County. The Town of Tappahannock

accounts for twenty-percent (20%) of the damages in the County and an estimated $34,700 in annualized damages. Two pockets of development along the Rappahannock River (one south of Tappahannock and the other on the north side) represent clusters of potential damages. The area to the south of Tappahannock exists in the vicinity of River Landing Road in the north and Mill Swamp Road in the south having potential damages of $8,500 annually. The area north of Tappahannock is the vicinity near Woodside Country Club having potential damages of $7,300 annually.

King and Queen County has the lowest annualized loss values for the region, accounting for 4% of the total damages. Residential occupancy makes up the majority of the losses in the county. The southern one-third of the county, from roughly Dragon Run State Forest southward, has the greatest concentration of losses across the entire County accounting for nearly $59,500 or 60% of the losses. The remaining 40% of potential losses are distributed through the remainder of the county to the north and west with approximately $14,000 or 14% existing north of the Richmond-Tappahannock Highway and twenty-six percent (26%) distributed between the Richmond-Tappahannock Highway in the north to roughly Dragon Run State Forest in the south; note that this area includes locales such as Bruington, King and Queen Courthouse as well as Walkerton.

Building Damage

Hazus calculates expected damage percentages for each probabilistic return period. This represents the percentage of building square footage in each damage state. Five damage states have been specified in Hazus and are outlined in Table 70.

Table 70: Hazus-MH damage state thresholds.

Damage State	Qualitative Damage Description
None (Livable)	Little or no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof over, with no or very limited water penetration.
Minor (Livable)	Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on wall requiring painting or patching for repair.
Moderate (Typically still livable)	Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.
Severe (Typically non-livable but repairable)	Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.
Destruction (Non-livable)	Complete roof failure and/or, failure of wall frame. Loss of more than 50% of roof sheathing.
Hazus-MH V2.2 Technical Manual	

Building Damage by Annual Chance Frequency (i.e., Multi-frequency Building Damages)

- **10 Year** - Hazus estimates that about 1 building will have minor damage. No buildings (0) are expected to be at least moderately damaged and no buildings (0) are expected to be completely destroyed during the 10-year event, or 10% annual chance.
- **20 Year** - Hazus estimates that about 7 buildings will have minor damage. No buildings (0) are expected to be at least moderately damaged and no buildings (0) are expected to be completely destroyed during the 20-year event, or 5% annual chance.

- **50 Year** - Hazus estimates that about 5 buildings will be at least moderately damaged and no buildings (0) are expected to be completely destroyed during the 50-year event, or 2% annual chance.
- **100 Year** - Hazus estimates that about 42 buildings will be at least moderately damaged and a single building (1) is expected to have severe damage – potentially another single (1) building may be expected to be completely destroyed during the 100-year event, or 1% annual chance.
- **200 Year** - Hazus estimates that about 131 buildings will be at least moderately damaged, approximately two (2) buildings are expected to be severely damaged, and four (4) buildings are expected to be completely destroyed during the 200-year event, or 0.5% annual chance.
- **500 Year** - Hazus estimates that about 740 buildings will be at least moderately damaged, approximately forty-one (41) buildings are expected to be severely damaged, and forty-seven (47) buildings are expected to be completely destroyed during the 500-year event, or 0.2% annual chance.
- **1000 Year** - Hazus estimates that about 1,523 buildings will be at least moderately damaged, approximately 127 buildings are expected to be severely damaged, and 133 buildings are expected to be completely destroyed during the 1,000-year event, or 0.1% annual chance.

Table 71 and Appendix J provide detailed information on the damage state percentages and number of buildings damaged for each of the probabilistic return periods.

The default data and parameters that Hazus utilizes are capable of producing crude estimates of losses. Building damages, for each building stock category, are calculated based on the probabilities of the four different damage states for each wind building type as a function of peak gust wind speed. It should be noted that the results in Table 71 are based solely on the modeled direct economic loss for the study region with the simulated hurricane activity for each of the independent return periods. It is possible, and not uncommon, to see reversals in damage state percentages, and there is no guarantee that the non-economic results will increase monotonically with return period.

Table 71: Building Damage by County.

Essex County	Average Damage State (%)				
Return Period	None	Minor	Moderate	Severe	Destruction
10-year Event	**100.00%**	**-**	**-**	**-**	**-**
20-year Event	**99.98%**	**0.02%**	**-**	**-**	**-**
50-year Event	**98.49%**	**1.46%**	**0.05%**	**-**	**-**
100-year Event	**99.97%**	**0.03%**	**-**	**-**	**-**
200-year Event	**98.82%**	**1.14%**	**0.04%**	**-**	**-**
500-year Event	**99.77%**	**0.23%**	**-**	**-**	**-**
1000-year Event	**94.26%**	**5.36%**	**0.35%**	**0.01%**	**0.01%**

King William County	Average Damage State (%)				
Return Period	None	Minor	Moderate	Severe	Destruction
10-year Event	**99.99%**	**0.01%**	**-**	**-**	**-**
20-year Event	**99.99%**	**0.01%**	**-**	**-**	**-**
50-year Event	**98.94%**	**1.04%**	**0.02%**	**-**	**-**
100-year Event	**99.93%**	**0.06%**	**-**	**-**	**-**
200-year Event	**98.67%**	**1.28%**	**0.05%**	**-**	**-**
500-year Event	**98.78%**	**1.15%**	**0.07%**	**-**	**-**
1000-year Event	**97.01%**	**2.79%**	**0.18%**	**-**	**0.01%**

Gloucester County	Average Damage State (%)				
Return Period	None	Minor	Moderate	Severe	Destruction
10-year Event	**100.00%**	**-**	**-**	**-**	**-**
20-year Event	**99.97%**	**0.03%**	**-**	**-**	**-**
50-year Event	**99.95%**	**0.05%**	**-**	**-**	**-**
100-year Event	**96.96%**	**2.86%**	**0.17%**	**-**	**-**
200-year Event	**92.95%**	**6.50%**	**0.53%**	**0.02%**	**0.01%**
500-year Event	**81.28%**	**15.90%**	**2.48%**	**0.18%**	**0.15%**
1000-year Event	**78.04%**	**18.14%**	**3.28%**	**0.30%**	**0.25%**

Mathews County	Average Damage State (%)				
Return Period	None	Minor	Moderate	Severe	Destruction
10-year Event	**100.00%**	**-**	**-**	**-**	**-**
20-year Event	**99.99%**	**0.01%**	**-**	**-**	**-**
50-year Event	**99.99%**	**0.01%**	**-**	**-**	**-**
100-year Event	**96.53%**	**3.31%**	**0.15%**	**-**	**-**
200-year Event	**95.89%**	**3.90%**	**0.20%**	**-**	**-**
500-year Event	**85.73%**	**12.67%**	**1.45%**	**0.075%**	**0.08%**
1000-year Event	**66.06%**	**26.15%**	**6.23%**	**0.81%**	**0.76%**

King & Queen County	Average Damage State (%)				
Return Period	None	Minor	Moderate	Severe	Destruction
10-year Event	**100.00%**	**-**	**-**	**-**	**-**
20-year Event	**100.00%**	**-**	**-**	**-**	**-**
50-year Event	**98.90%**	**1.08%**	**0.02%**	**-**	**-**
100-year Event	**99.88%**	**0.12%**	**-**	**-**	**-**
200-year Event	**97.79%**	**2.14%**	**0.07%**	**-**	**-**
500-year Event	**97.12%**	**2.73%**	**0.14%**	**-**	**-**
1000-year Event	**93.54%**	**6.03%**	**0.40%**	**0.01%**	**0.01%**

Middlesex County	Average Damage State (%)				
Return Period	None	Minor	Moderate	Severe	Destruction
10-year Event	**100.00%**	**-**	**-**	**-**	**-**
20-year Event	**99.99%**	**0.01%**	**-**	**-**	**-**
50-year Event	**99.90%**	**0.10%**	**-**	**-**	**-**
100-year Event	**98.70%**	**1.26%**	**0.04%**	**-**	**-**
200-year Event	**94.75%**	**4.95%**	**0.29%**	**-**	**0.01%**
500-year Event	**83.23%**	**14.25%**	**2.15%**	**0.17%**	**0.20%**
1000-year Event	**73.66%**	**20.86%**	**4.39%**	**0.53%**	**0.56%**

Debris Generation

Hazus estimates the amount of debris that will be generated by a hurricane. The model breaks the debris into three general categories: Brick/Wood, Reinforced Concrete/Steel, and Trees. Tree debris makes up the majority of tonnage generated in the hurricane analysis. Brick and wood debris makes up the remainder and a very small percentage (0.01%) associated with Concrete and Steel; i.e., not shown in Table. Table 72 summarizes, by return period, the total generated debris by Type.

Table 72: Hurricane debris generation.

Return Period	Total Debris (tons)	Tree Debris (tons)	% Tree Debris	Brick & Wood (tons)	% Brick and Wood
10-year Event	84	84	100%	0	0.00%
20-year Event	31,872	31,867	99.98%	5	0.02%
50-year Event	155,202	154,721	99.69%	481	0.31%
100-year Event	136,004	134,162	98.65%	1,842	1.35%
200-year Event	322,936	318,532	98.64%	4,400	1.36%
500-year Event	376,818	363,772	96.54%	12,930	3.43%
1000-year Event	705,647	682,410	96.71%	22,801	3.23%

Essential Facilities

Essential facilities, including medical care facilities, emergency response facilities and schools, are those vital to emergency response and recovery following a disaster. School buildings are included in this category because of the key role they often play in sheltering people displaced from damaged homes. Generally there are very few of each type of essential facilities in a census tract, making it easier to obtain site-specific information for each facility. Thus, damage and loss-of-function are evaluated on a building-by-building basis for this class of structures; even through the uncertainty in each such estimate is large[6].

The Hazus essential facilities database includes default data for Medical Care Facilities, Emergency Response Facilities (fire stations, polices stations, EOCs) and schools. Table 73 shows the functionality, by return period for each essential facility type. The region's essential facilities are able to remain functional for the 10-, 20-, 50-, and 100-yr recurrence interval. Functionality begins to decline at the 100-year event. All of the facilities have zero functionality during a 1000-year event.

[6] Multi-hazard Loss Estimation Methodology Hurricane Model User Manual, HAZUS-MH V2.2, Chapter 1: Introduction, 1-6

Table 73: Essential facility functionality for specified return periods.

Return Period	Fire Stations	Hospitals	Police Stations	Schools
10-year Event	100%	100%	100%	100%
20-year Event	100%	100%	100%	100%
50-year Event	100%	100%	100%	100%
100-year Event	90%	100%	100%	92%
200-year Event	70%	100%	91%	84%
500-year Event	50%	62%	55%	40%
1000-year Event	0%	0%	0%	0%

Potential Mitigation Actions:

The potential mitigation actions noted are those that are Hazus-specific and would benefit refinement of Hazus analyses.

- ☐ Perform Hazus analyses based on the same data resources used to develop the inundation areas mapped in the report submitted to the Virginia General Assembly in January 2013 titled – RECURRENT FLOODING STUDY FOR TIDEWATER VIRGINIA by the Virginia Institute of Marine Science, Center for Coastal Resources Management at the College of William & Mary. This study appears to include the most widely accepted Sea Level Rise plus Storm Surge Scenario facing coastal Virginia. It would therefore be appropriate to consider 1.) The creation of depth grids from the study data and then 2.) Hazus Risk Assessment. It would also be beneficial to incorporate elements of the design storm into a combined Hazus Flood and Hurricane Scenario - in this manner benefits of the combined methodology can be realized – which includes methods to guard against over-counting or double-counting losses by simply adding damages from each respective Hazus model.
- ☐ Perform Hurricane analysis for a known and historic storm that affected the MPPDC area for comparative purposes.
- ☐ Refine and update data sets for GBS and essential facilities.
    - o Improvements in the future should aim to further refine the building stock. Notably, one improvement should include adding any new development that may not have been in the land use/land cover data; e.g., new housing developments, new construction, etc…
    - o Perform localized building-level assessments in known areas of loss and or areas subject to likely losses.

Sea Level Rise

The Hazus Flood Model analyzes both riverine and coastal flood hazards. Flood hazard within Hazus is defined by depth of flooding. Other contributing factors of damage include the duration and velocity of water in the floodplain. Other hazards associated with flooding that may contribute to flood losses include channel erosion and migration, sediment deposition, bridge scour and the impact of flood-born debris. The Hazus Flood Model allows users to estimate flood losses primarily due to flood depth to the general building stock (GBS). While velocity is also considered, it is not a separate input parameter and is accounted within depth-damage functions (i.e., expected percent damage given an expected depth) for census blocks that are defined as either coastal or riverine influenced.

Flood-specific modeling was performed in this Plan revision to determine annualized flood loss however it is important to note that the Sea Level Rise analyses while similar is not 100% the same as the multi-frequency analyses performed and presented in the Flood Section; see Flood Analysis. While this section does not intend to fully explain detailed elements of coastal flood modeling, a basic amount of information is offered to differentiate between the two report sections.

Coastal flood modeling typically includes identifying baseline tidal water levels and then computing additions or increases to water surface levels from various natural forces such as storm surge effects (i.e., water level increases as the result of a storm pushing landward) as well as other wave-related effects such as increased wave heights and the run-up of waves over the land as waves crash. Other factors of coastal storms play a part in estimating increased water surface levels such as shoreline and/or dune erosion. Consequently, each of the scenarios presented in the Flood Analysis section , includes depth grids produced from modeling that takes into account increases to water surface levels from the various forces typical of coastal storm events – a.k.a. Storm Surge.

In contrast, the Hazus analysis performed for the Sea Level Rise scenarios (this section) DO NOT include the use of depth grids that include storm surge. Rather, this Sea Level Rise section uses depth grids that 1.) Are depths from the baseline tidal water levels (Mean Higher High Water or MHHW) and 2.) Includes the addition of six-feet of water – as if the new baseline tidal water level were increased by simply adding more water into the same 'bathtub' - as it were. The two depth grids run through Hazus represent these two aforementioned scenarios developed by NOAA - Office for Coastal Management for the on-line application known as Sea Level Rise and Coastal Flooding Impacts v2.0.

Multiple resources were consulted for data that would support Sea Level Rise (SLR) risk assessments across the Middle Peninsula planning district. Primary focus was placed on the existence of Hazus-ready inputs, which would include the existence and availability of depth grids. Depth grids are able to be directly imported into the Hazus Flood model and eliminates the need to pre-process other modeling or Geographic Information Systems (GIS) data. Generally-speaking, the creation of depth grids require GIS data that represents an estimated water surface along with an associated ground surface. Thereafter, the difference between the two surfaces represents the estimated depth of flooding for a given location; i.e., water elevation less ground elevation equals depth; see Depth Grid Graphic in the Flood Analysis Section.

Considering the SLR resources researched, depth grids were only available from NOAA's Office for Coastal Management (see http://coast.noaa.gov/slr/) as part of its Sea Level Rise and Coastal Flooding Impacts v2.0 Application. An additional resource was available from VIMS – The Virginia Institute of Marine Science at the College of William & Mary, however the resource is NOT depth grids but rather a GIS mapping product that delineates the inundation areas of 1.5 Feet of Sea Level Rise plus an additional 3-Feet of storm surge.
To exemplify the various resources consulted in search of the priority SLR depth grids, the following list offers an itemization and brief description(s):

- **US EPA** - Titus, J.G., D.E. Hudgens, C.Hershner, J.M. Kassakian, P.R. Penumalli , M. Berman, and W.H. Nuckols. 2010. "Virginia". In James G. Titus and Daniel Hudgens (editors). *The Likelihood of Shore Protection along the Atlantic Coast of the United States. Volume 1: Mid-Atlantic.* Report to the U.S. Environmental Protection Agency. Washington, D.C.
    - [The] *"…study develops maps that distinguish the areas likely to be protected from erosion and inundation as the sea rises from those areas that are likely to be left to retreat naturally assuming that current policies and economics trends continue*." – page 709.
    - The study claims to be *"…literally a "first approximation" of the likelihood of shore protection*." – page 710.

- The study report includes a variety of tables culminating in and seeking to describe AREA OF LAND VULNERABLE TO SEA LEVEL RISE. However, a number of MPPDC jurisdictions are void of results with the authors citing the following:
  - "*Value omitted because the topographic information Titus and Wang used for this jurisdiction had poor vertical resolution.*" – page 777 (Note [e] of TABLE 8-10).
- The study includes GIS data that distinguishes between three (3) primary land classes; Tidal Wetlands, Tidal Open Water and Uplands. An overlay Digital Elevation Model (DEM) is also included that indicates a series of elevation bands at half-foot elevation intervals ranging from zero-feet (0.0 Ft.) to three-feet (3.0 Ft.) above the delineation of Tidal Wetlands.
- The study includes additional analyses in cooperation with Virginia Institute of Marine Science (VIMS) and mapping that characterizes the likelihood of shoreline protection; see VIMS below.
- No depth grid data available.

- **VIMS** – Virginia Institute of Marine Science, College of William & Mary.
  - RECURRENT FLOODING STUDY FOR TIDEWATER VIRGINIA. Report submitted to the Virginia General Assembly. January 2013.
    - The study, in-part, developed mapping of areas affected (i.e., expected inundation) by:
      - Projected Sea Level Rise of 1.5 Feet with…
      - Projected Storm Surge of an additional 3.0 Feet
    - The study suggests that the scenario elements noted above (SLR of 1.5 feet and Surge of +3 feet) "…*represent very moderate assumptions*…" and that the values are "…*within the range*…" of best available forecasts; - page 8.
    - Inquiry also revealed that depth grid data was not produced as part of the study.
  - Comprehensive Coastal Resource Management Tool
    - No depth grids.
- **US Fish and Wildlife Services (USFWS) (and partners)** – SLAMM View Application (Sea Level Affecting Marshes Model)
  - No depth grids.
- **Climate Central** – Surging Seas Application (Sea Level Affecting Marshes Model)
  - No depth grids.
- **The Nature Conservancy (and partners)** - Coastal Resilience Tool
  - Application utilizes the same data used in the National Oceanic and Atmospheric Administration (NOAA) Sea Level Rise and Coastal Flooding Impacts v2.0 Application; see below (NOAA – Office for Coastal Management).
  - Application does not cover Virginia.
- **NOAA** - Office for Coastal Management
  - Sea Level Rise and Coastal Flooding Impacts v2.0
    - Sea Level Rise based on Mean Higher High Water (MHHW) conditions and the addition of incremental 1-foot SLR increases to include Plus 1-Foot to Plus 6-Foot.
    - Depth grids available.
    - Depth grids obtained and used for this Plan; this Plan utilizes the Base Scenario of Mean Higher High Water (MHHW) conditions and also the Plus 6-Foot Scenario. Other scenarios were not utilized; namely the Plus 1-Foot, Plus 2-Foot, Plus 3-Foot, Plus 4-Foot and Plus 5-Foot.

Building Stock

The same dasymetric building stock (i.e., square-footage inventory of buildings) that was utilized for the Flood Analysis was also used for Sea Level Rise.

All building inventory statistics (i.e., building stock exposure by county or general building type) that were used for the Sea Level Rise Hazus scenarios are the same as defined in the Flood Analysis section. Please see Flood Analysis, Table 39. Building stock exposure for general occupancies by county and Table 37. Building stock exposure for general building type by county.

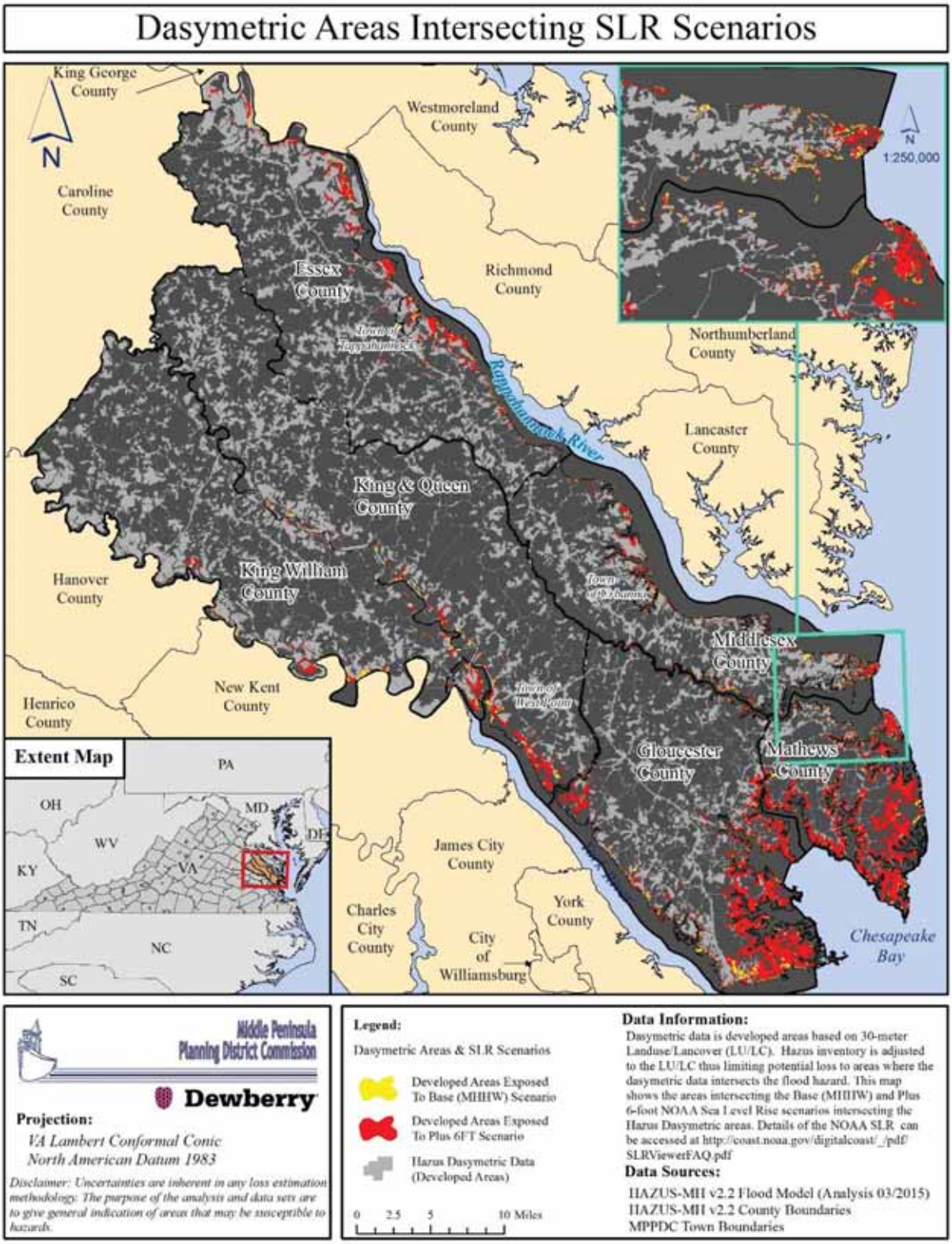
Dynamics of exposure (and also loss) are dependent on a number of variables. A key variable, for example, includes the spatial accuracy (30-meter) of the land-use/land-cover data used to create the developed areas of the dasymetric building stock inventory. Another key variable includes the spatial accuracy (i.e., horizontal accuracy) and also the vertical accuracy of the topographic data used to delineate flood inundation areas. Therefore, detailed site analyses may be appropriate and necessary to further understand local dynamics. However, noting the regional nature of the risk assessments performed, a few tables for reference are provided of the Sea Level Rise scenarios to help better understand the dasymetric building stock that is 1.) Potentially exposed and 2.) May experience potential loss. First, acreage of developed land intersecting the SLR scenarios is captured in Table 74 below:

Table 74: Acreage of Dasymetric Areas (30m Developed Areas) intersecting SLR Scenarios.

Base (MHHW) Sea Level Rise Scenario			Plus 6-Feet Sea Level Rise Scenario		
Rank MHHW	County	Acreage of Dasymetric Developed Areas	Rank Plus 6FT	County	Acreage of Dasymetric Developed Areas
1	Mathews	105	1	Mathews	4,817
2	Middlesex	96	2	Gloucester	4,155
3	Gloucester	63	3	Essex	837
4	King William	30	4	Middlesex	585
5	King and Queen	28	5	King and Queen	454
6	Essex	22	6	King William	393
	Total	**344**		**Total**	**11,242**

Figure 131 - Dasymetric Areas Intersecting SLR Scenarios (next page) shows the dasymetric developed areas intersecting both the Base (MHHW) and the Plus 6-Foot Scenario's. The map also shows an example area in closer detail (scale of 1:250,000).

Figure 131:


Dasymetric Areas Intersecting SLR Scenarios
King George County
Westmoreland County
Caroline County
Essex County
Richmond County
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
New Kent County
Henrico County
Middlesex County
Gloucester County
Mathews County
James City County
Charles City County
York County
City of Williamsburg
Chesapeake Bay
1:250,000
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Dasymetric Areas & SLR Scenarios
Developed Areas Exposed To Base (MHHW) Scenario
Developed Areas Exposed To Plus 6FT Scenario
Hazus Dasymetric Data (Developed Areas)
0 2.5 5 10 Miles
Data Information:
Dasymetric data is developed areas based on 30-meter Landuse/Lancover (LU/LC). Hazus inventory is adjusted to the LU/LC thus limiting potential loss to areas where the dasymetric data intersects the flood hazard. This map shows the areas intersecting the Base (MHHW) and Plus 6-foot NOAA Sea Level Rise scenarios intersecting the Hazus Dasymetric areas. Details of the NOAA SLR can be accessed at http://coast.noaa.gov/digitalcoast/_/pdf/SLRViewerFAQ.pdf
Data Sources:
HAZUS-MH v2.2 Flood Model (Analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Next, Table 75 and Table 76 show the Total Exposure In the Flood Hazard Area of the Hazus Dasymetric Data by General Occupancy Type for both of the Sea Level Rise scenarios.

Table 75: Exposed General Occupancy by County – Sea Level Rise Base Scenario (MHHW).

County	Residential	Commercial	Industrial	Agriculture	Religion	Govt.	Education	Total Exposure
Middlesex	$24,347	$1,121	$303	$32	$257	$15	$17	$26,092
Mathews	$19,910	$1,199	$285	$132	$95	$36	$45	$21,702
Gloucester	$17,251	$1,793	$415	$40	$176	$19	$83	$19,777
Essex	$5,553	$516	$75	$14	$34	$0	$88	$6,280
King William	$4,065	$409	$58	$13	$2	$1	$0	$4,549
King and Queen	$2,361	$1	$477	$0	$0	$0	$-0	$2,840
Total	$73,488	$5,040	$1,613	$231	$565	$70	$233	$81,241
All values in Thousands of Dollars								

Table 76: Exposed General Occupancy by County – Sea Level Rise Plus 6FT Scenario.

County	Residential	Commercial	Industrial	Agriculture	Religion	Govt.	Education	Total Exposure
Gloucester	$590,313	$72,485	$17,186	$2,934	$8,721	$653	$14,805	$707,095
Mathews	$601,918	$25,535	$15,695	$4,401	$4,251	$958	$724	$653,482
Middlesex	$156,312	$8,602	$2,355	$193	$1,800	$167	$160	$169,587
Essex	$87,087	$12,067	$4,404	$559	$221	$68	$371	$104,776
King William	$61,575	$13,675	$1,950	$70	$1,369	$426	$807	$79,873
King and Queen	$33,313	$23	$1,358	$0	$10	$4	$-0	$34,708
Total	$1,530,517	$132,388	$42,948	$8,156	$16,372	$2,275	$16,867	$1,749,521
All values in Thousands of Dollars								

Users are encouraged to consider that while one County may have a greater area of developed land intersecting the SLR flood inundation, the square-footage and/or value of structures within the developed areas may have very different value estimates. Consequently, it can be seen that Middlesex County has a great deal of development in close proximity to the Base (MHHW) Scenario flood hazard – particularly in the Residential category ($24.3 Million). However, as was mentioned earlier, the resolution or spatial accuracy of the 30-meter land-use/land-cover data used to create the dasymetric developed areas does not take into account elevation. There are areas within the District that have development on high ground near flooding sources. Middlesex County has a number of these areas. This combination in conjunction with higher residential exposure ($24.3 Million) shows Middlesex as more susceptible to the Base (MHHW) Sea Level Rise Scenario.

In contrast, development patterns in the eastern-most portion of Middlesex as well as the two most eastern counties of Gloucester and Mathews, exhibit development that is set-back away from areas of open and tidal waters – thus exhibiting less exposure to the Base (MHHW) SLR Scenario. However, as water levels rise, as would be the case of the Plus 6-Foot Scenario, the development along the low-lying fringes of the coastal plain become more susceptible to the flood hazard and therefore includes a greater proportion of building inventory exposed to the potential rising water levels.

Sea Level Rise – Hazus Level 1 Methodology General Building Stock Loss Estimation
Losses are presented similar to the Flood Analysis however, only the combined Total losses of all building categories are presented in an effort to keep the results as simple as possible for relative comparison to the more detailed multi-frequency flood analysis. To reiterate, the multi-frequency analysis (Flood Analysis) DOES include water surface levels that take into account storm surge.

Hazus Level 1 flood model losses for the Middle Peninsula planning district from the Base Sea Level Rise scenario (MHHW) are approximately $10.2 Million US Dollars and the Plus 6-Foot of Sea Level Rise are approximately $283.5 Million US Dollars which is a 96% increase in the expected Total damages. Property or "capital stock" losses of the Base Sea Level Rise accounts for all of the expected loss ($10.2 Million) whereas the Plus 6-Foot of Sea Level Rise scenario is estimated to be approximately $283.1 Million or 99.86% of the damages which includes the values for building, content, and inventory. Business interruption of the Plus 6-Foot of Sea Level Rise scenario accounts for $386,000 US Dollars (0.14%) of the losses and includes relocation, income, rental and wage costs.

Table 77 and Table 78 illustrate the expected losses broken down by county from the Sea Level Rise scenarios. Middlesex County, having the highest level of estimated exposure ($26.092 Million US Dollars) within the Base Sea Level Rise inundation area, also has the highest loss from the Base Sea Level Rise scenario at approximately $3.02 Million US Dollars which accounts for 30% of the total losses for the Middle Peninsula[7]. Gloucester County is attributed with 27% of total losses at approximately $2.76 Million, and Mathews County has losses of approximately $2.5 Million or 25% of the total – followed by King William (9%), Essex (7%) and last King and Queen (2%). The relatively higher loss percentages attributed to Middlesex, Gloucester and Mathews counties suggests that the distribution of development at-risk includes the low-lying coastal plains along the Chesapeake and Mobjack Bays as well as the York River.

The Plus 6-Foot of Sea Level Rise scenario also shows the greater combined losses in the down-east area however, Gloucester and Mathews account for the greatest combined losses (75%). Gloucester County has the highest loss from the Plus 6-Foot of Sea Level Rise scenario at approximately $116.6 Million US Dollars, accounting for 41% of the total losses for the Middle Peninsula. The Plus 6-Foot of Sea Level Rise scenario shows Mathews County at approximately $96.9 Million and ranked second (34% of Total) – followed by Middlesex County at approximately $29.2 Million (10% of Total) – and then King William (6%), Essex (6%) and last King and Queen (2%). Again, the relatively higher loss percentages attributed to Gloucester and Mathews counties suggests that the distribution of development at-risk includes the low-lying coastal plains along the Chesapeake and Mobjack Bays as well as the York River. Figure XX exemplifies the differences between the inundation extents of the SLR Base and Plus 6-Foot scenarios; the mapping of the depth grids represented by red/orange areas are the increased inundation areas of the Plus 6-Foot scenario. Development in these areas would be susceptible to greater potential losses.

[7] Readers are reminded due to the regional nature of the analysis, detailed site analyses may be entirely appropriate and necessary to fully understand local dynamics. Especially in areas where development is in close proximity to flooding sources and also marked topographic elevation changes.

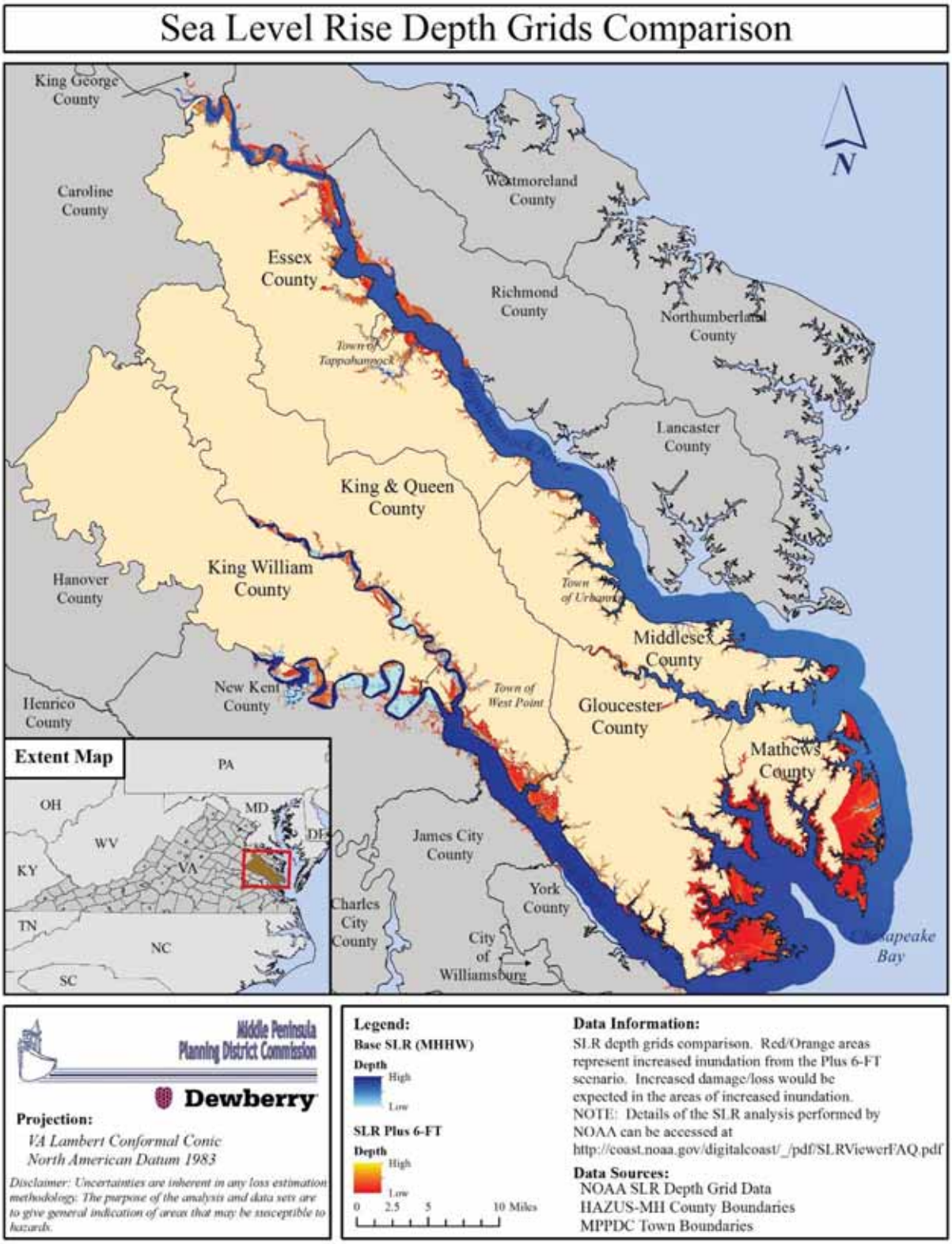
Table 77: County based Hazus loss for both Pre- and Post-FIRM – Sea Level Rise Base.

County	Building	Content	Inventory	Relocation	Income	Rental	Wage	Total Loss
Middlesex	$1,805	$1,209	$1	$0	$0	$0	$0	$3,015
Gloucester	$1,638	$1,120	$2	$0	$0	$0	$0	$2,760
Mathews	$1,494	$1,002	$0	$0	$0	$0	$0	$2,496
King William	$532	$406	$0	$0	$0	$0	$0	$938
Essex	$391	$331	$0	$0	$0	$0	$0	$722
King and Queen	$150	$97	$7	$0	$0	$0	$0	$254
Total	$6,010	$4,165	$10	$0	$0	$0	$0	$10,185
All values in Thousands of Dollars								

Table 78: County based Hazus loss for both Pre- and Post-FIRM – Sea Level Rise Plus 6FT.

County	Building	Content	Inventory	Relocation	Income	Rental	Wage	Total Loss
Gloucester	$63,431	$52,381	$607	$70	$38	$5	$93	$116,625
Mathews	$55,754	$40,566	$492	$73	$8	$7	$18	$96,918
Middlesex	$16,772	$12,342	$66	$13	$5	$0	$6	$29,204
King William	$8,561	$9,603	$89	$2	$12	$0	$22	$18,289
Essex	$8,202	$7,511	$140	$8	$1	$0	$4	$15,866
King and Queen	$3,999	$2,561	$61	$1	$0	$0	$0	$6,622
Total	$156,719	$124,964	$1,455	$167	$64	$12	$143	$283,524
All values in Thousands of Dollars								

Figure 132:


Sea Level Rise Depth Grids Comparison
King George County
Caroline County
Westmoreland County
Essex County
Richmond County
Northumberland County
Town of Tappahannock
Lancaster County
King & Queen County
King William County
Hanover County
Town of Urbanna
Middlesex County
New Kent County
Town of West Point
Henrico County
Gloucester County
Mathews County
James City County
York County
Charles City County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Base SLR (MHHW)
Depth
High
Low
SLR Plus 6-FT
Depth
High
Low
0 2.5 5 10 Miles
Data Information:
SLR depth grids comparison. Red/Orange areas represent increased inundation from the Plus 6-FT scenario. Increased damage/loss would be expected in the areas of increased inundation.
NOTE: Details of the SLR analysis performed by NOAA can be accessed at http://coast.noaa.gov/digitalcoast/_/pdf/SLRViewerFAQ.pdf
Data Sources:
NOAA SLR Depth Grid Data
HAZUS-MH County Boundaries
MPPDC Town Boundaries

Figures 133 through 143 on the following pages show the total losses for the planning district for both SLR scenarios, Ranking of the top ten loss of census blocks (Ranked within each respective County) and last, a map showing the comparative differences in the ranked hot spot areas representing those areas throughout the MPPDC Region that may require mitigation measures. County-specific maps are shown of the Plus 6-Foot SLR scenario.

Again, users of these maps are reminded that the scenarios shown in the following maps DO NOT include increases to water surface levels from the various natural forces typical of coastal storm events (e.g., Storm Surge). The following results are intended to offer perspective on potential damage/loss in the event that the baseline water surface were to increase by 6-Feet.

Another factor to consider while viewing Maps and Tables is that the Base Scenario is essentially the average of the highest tide that is experienced on a daily-basis over a long period of time. Typical there are two high tides in a given day, the MHHW represents the mean (or average) of the higher of the two tides as recorded over a period of record. The definition as provided by NOAA – Tides & Currents states, "The average of the higher high water height of each tidal day observed over the National Tidal Datum Epoch. For stations with shorter series, comparison of simultaneous observations with a control tide station is made in order to derive the equivalent datum of the National Tidal Datum Epoch."[8]

[8] NOAA – Tides & Currents (http://tidesandcurrents.noaa.gov/datum_options.html), accessed April 22, 2015.

Figure 133:

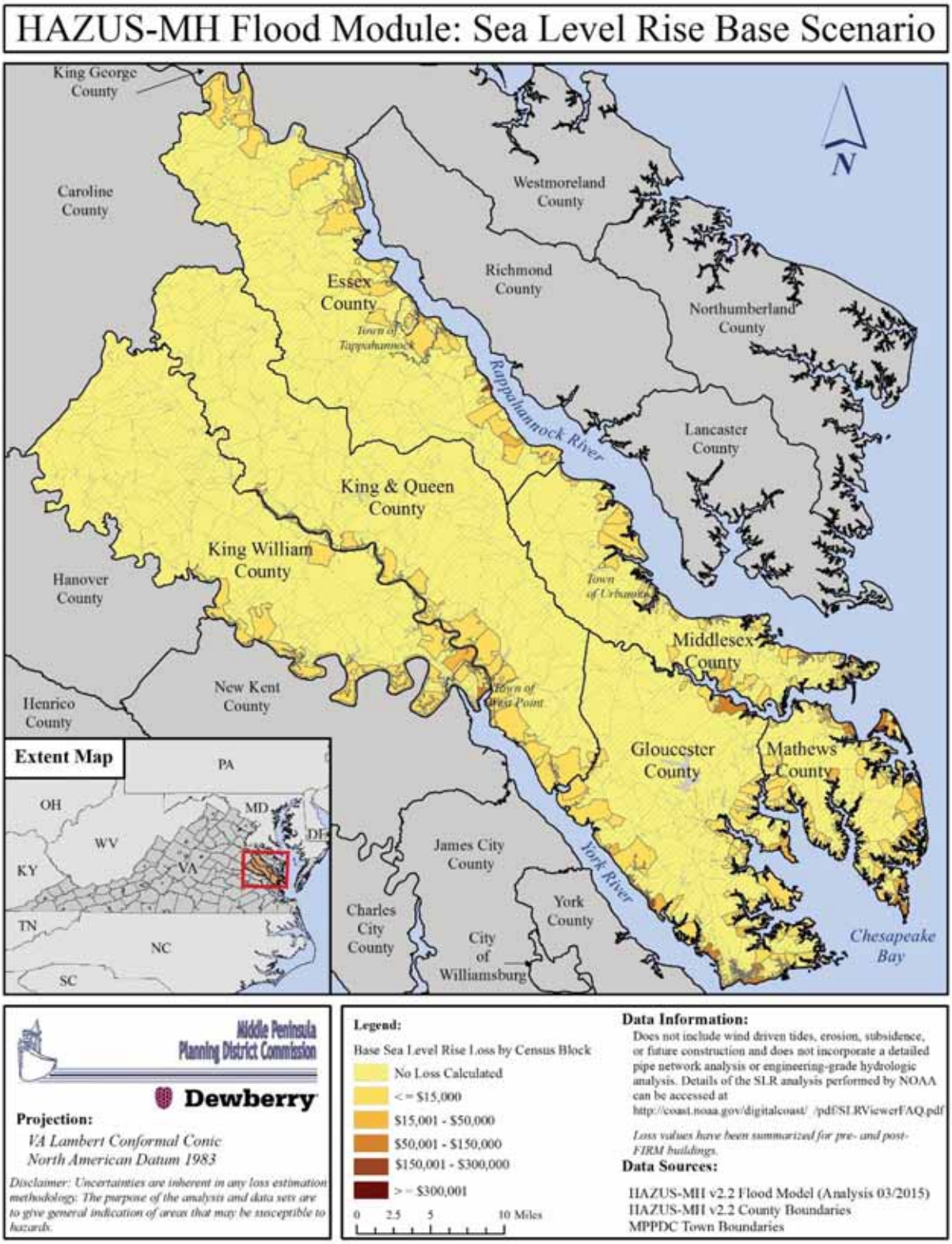

HAZUS-MH Flood Module: Sea Level Rise Base Scenario
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Town of Tappahannock
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Town of Urbanna
Middlesex County
New Kent County
Henrico County
Town of West Point
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Base Sea Level Rise Loss by Census Block
No Loss Calculated
<= $15,000
$15,001 - $50,000
$50,001 - $150,000
$150,001 - $300,000
> = $300,001
0 2.5 5 10 Miles
Data Information:
Does not include wind driven tides, erosion, subsidence, or future construction and does not incorporate a detailed pipe network analysis or engineering-grade hydrologic analysis. Details of the SLR analysis performed by NOAA can be accessed at http://coast.noaa.gov/digitalcoast/ /pdf/SLRViewerFAQ.pdf
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (Analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 134:

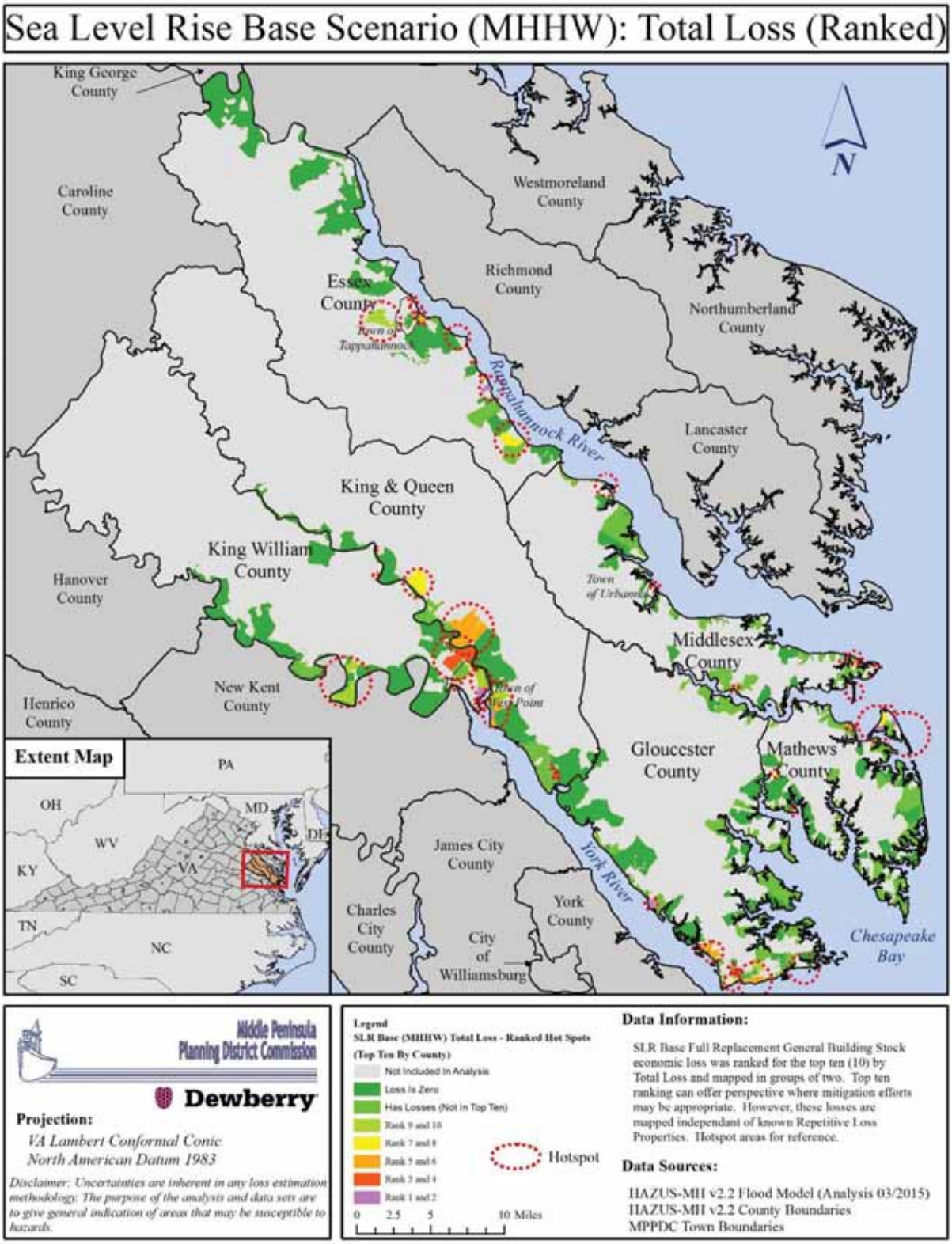

Sea Level Rise Base Scenario (MHHW): Total Loss (Ranked)
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Town of Tappahannock
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Town of Urbanna
Middlesex County
New Kent County
Henrico County
Town of West Point
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend
SLR Base (MHHW) Total Loss - Ranked Hot Spots
(Top Ten By County)
Not Included In Analysis
Loss Is Zero
Has Losses (Not In Top Ten)
Rank 9 and 10
Rank 7 and 8
Rank 5 and 6
Rank 3 and 4
Rank 1 and 2
Hotspot
0 2.5 5 10 Miles
Data Information:
SLR Base Full Replacement General Building Stock economic loss was ranked for the top ten (10) by Total Loss and mapped in groups of two. Top ten ranking can offer perspective where mitigation efforts may be appropriate. However, these losses are mapped independant of known Repetitive Loss Properties. Hotspot areas for reference.
Data Sources:
HAZUS-MH v2.2 Flood Model (Analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 135:

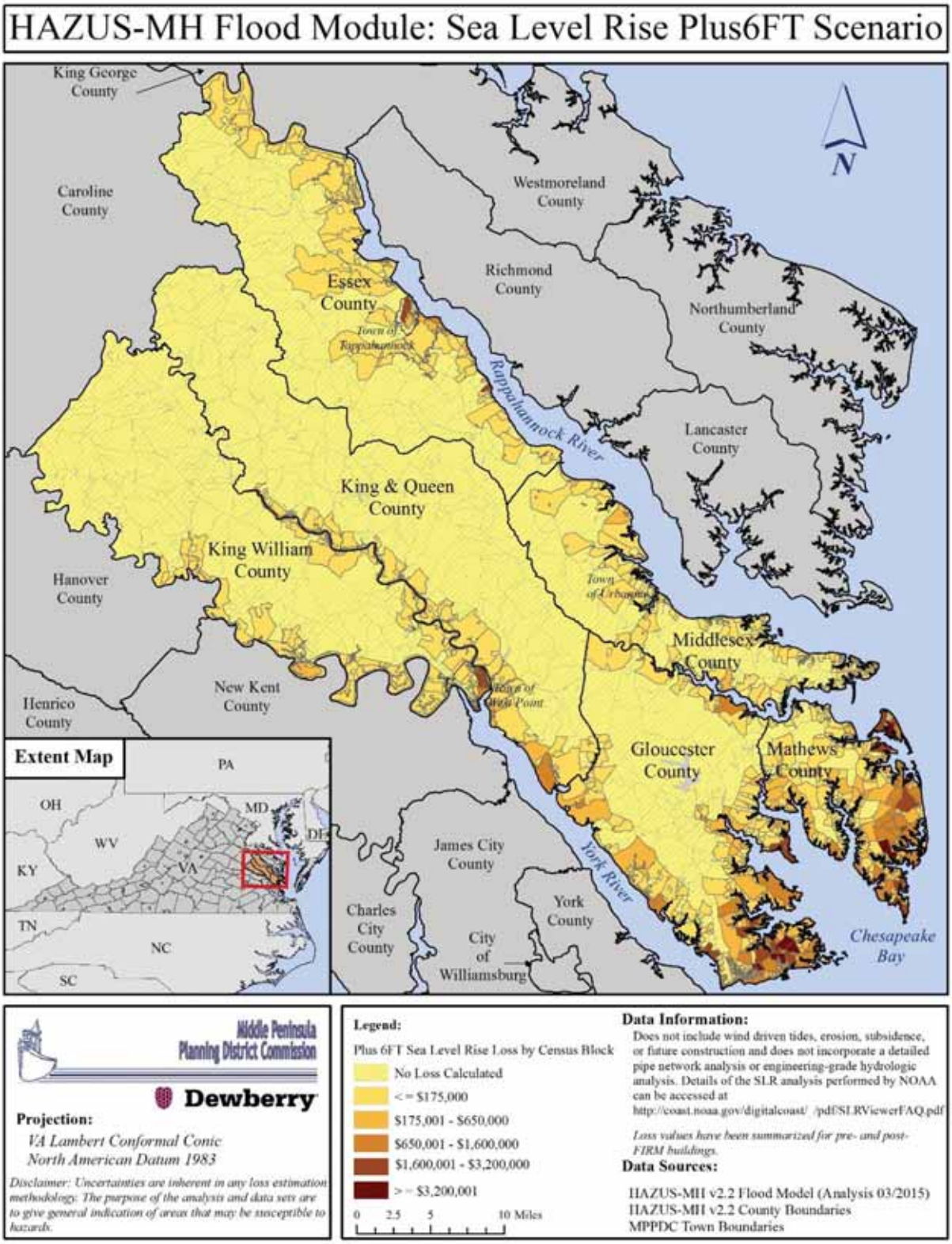

HAZUS-MH Flood Module: Sea Level Rise Plus6FT Scenario
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Town of Tappahannock
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Town of Urbanna
Middlesex County
New Kent County
Henrico County
Town of West Point
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Plus 6FT Sea Level Rise Loss by Census Block
No Loss Calculated
< = $175,000
$175,001 - $650,000
$650,001 - $1,600,000
$1,600,001 - $3,200,000
> = $3,200,001
0 2.5 5 10 Miles
Data Information:
Does not include wind driven tides, erosion, subsidence, or future construction and does not incorporate a detailed pipe network analysis or engineering-grade hydrologic analysis. Details of the SLR analysis performed by NOAA can be accessed at http://coast.noaa.gov/digitalcoast/ /pdf/SLRViewerFAQ.pdf
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (Analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 136:

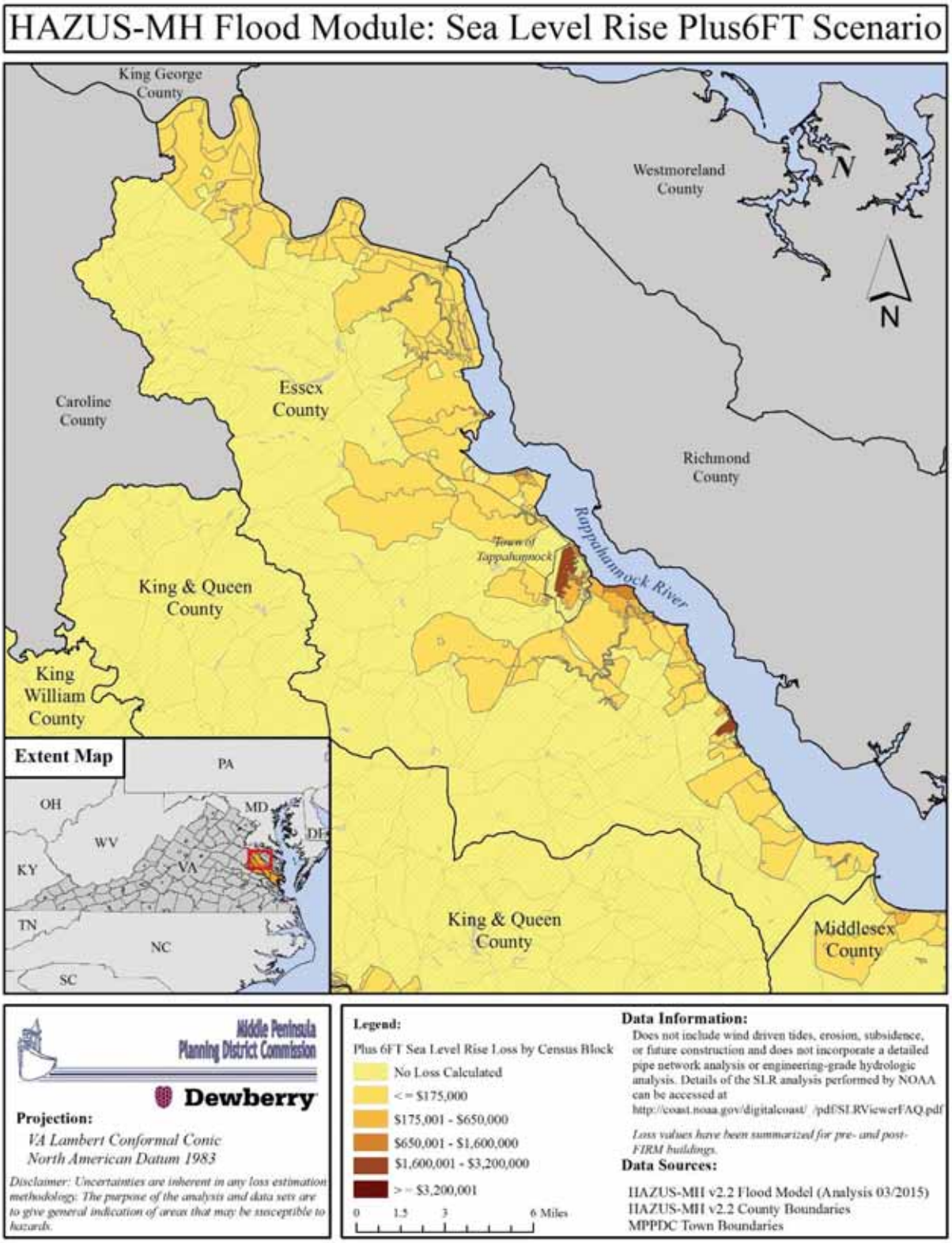

HAZUS-MH Flood Module: Sea Level Rise Plus6FT Scenario
King George County
Westmoreland County
Caroline County
Essex County
Richmond County
Rappahannock River
Town of Tappahannock
King & Queen County
King William County
Middlesex County
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Plus 6FT Sea Level Rise Loss by Census Block
No Loss Calculated
< = $175,000
$175,001 - $650,000
$650,001 - $1,600,000
$1,600,001 - $3,200,000
> = $3,200,001
0 1.5 3 6 Miles
Data Information:
Does not include wind driven tides, erosion, subsidence, or future construction and does not incorporate a detailed pipe network analysis or engineering-grade hydrologic analysis. Details of the SLR analysis performed by NOAA can be accessed at http://coast.noaa.gov/digitalcoast/ /pdf/SLRViewerFAQ.pdf
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (Analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 137:

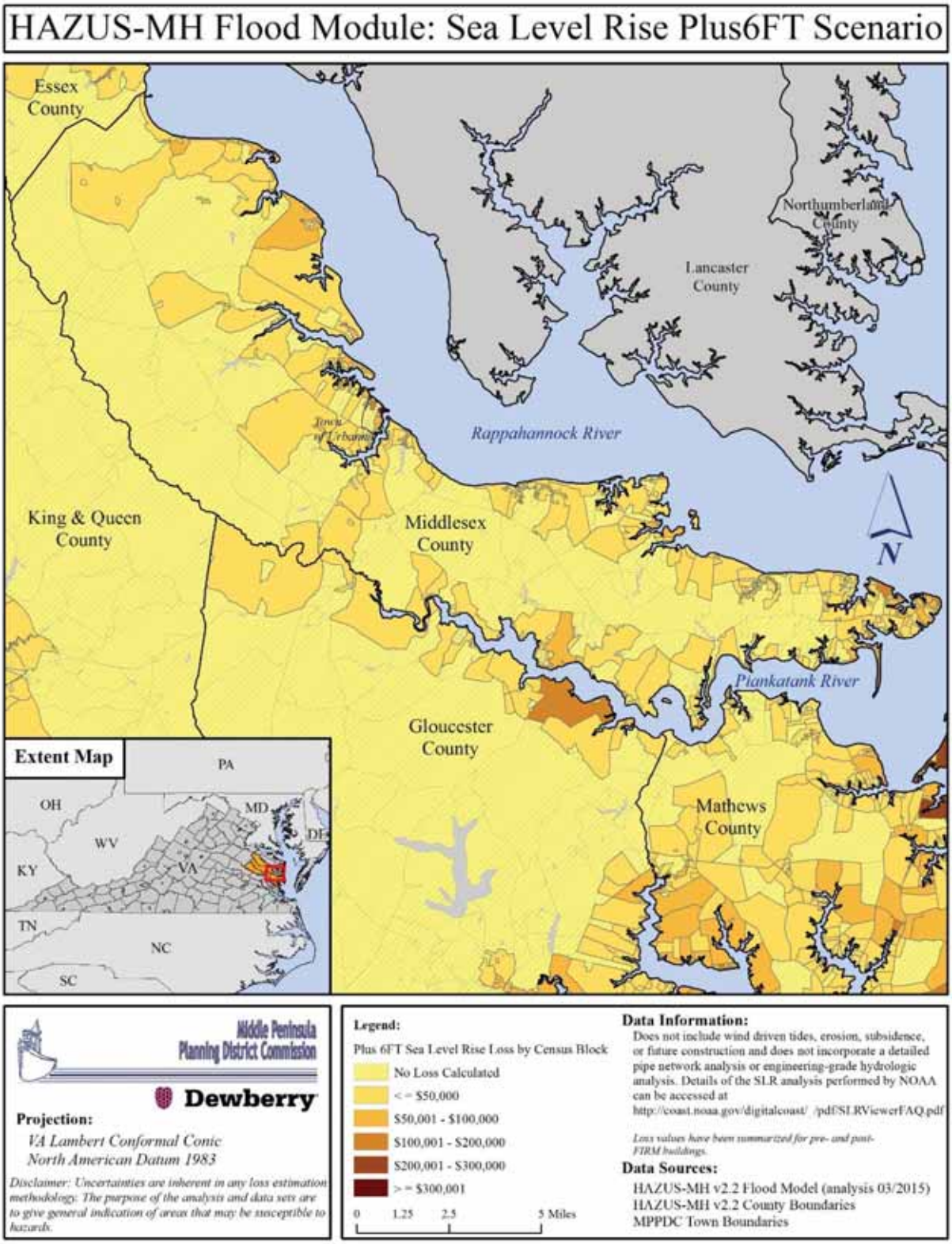

HAZUS-MH Flood Module: Sea Level Rise Plus6FT Scenario
Essex County
Northumberland County
Lancaster County
Rappahannock River
King & Queen County
Middlesex County
N
Piankatank River
Gloucester County
Mathews County
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Plus 6FT Sea Level Rise Loss by Census Block
No Loss Calculated
< = $50,000
$50,001 - $100,000
$100,001 - $200,000
$200,001 - $300,000
> = $300,001
0 1.25 2.5 5 Miles
Data Information:
Does not include wind driven tides, erosion, subsidence, or future construction and does not incorporate a detailed pipe network analysis or engineering-grade hydrologic analysis. Details of the SLR analysis performed by NOAA can be accessed at http://coast.noaa.gov/digitalcoast/ /pdf/SLRViewerFAQ.pdf
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 138:

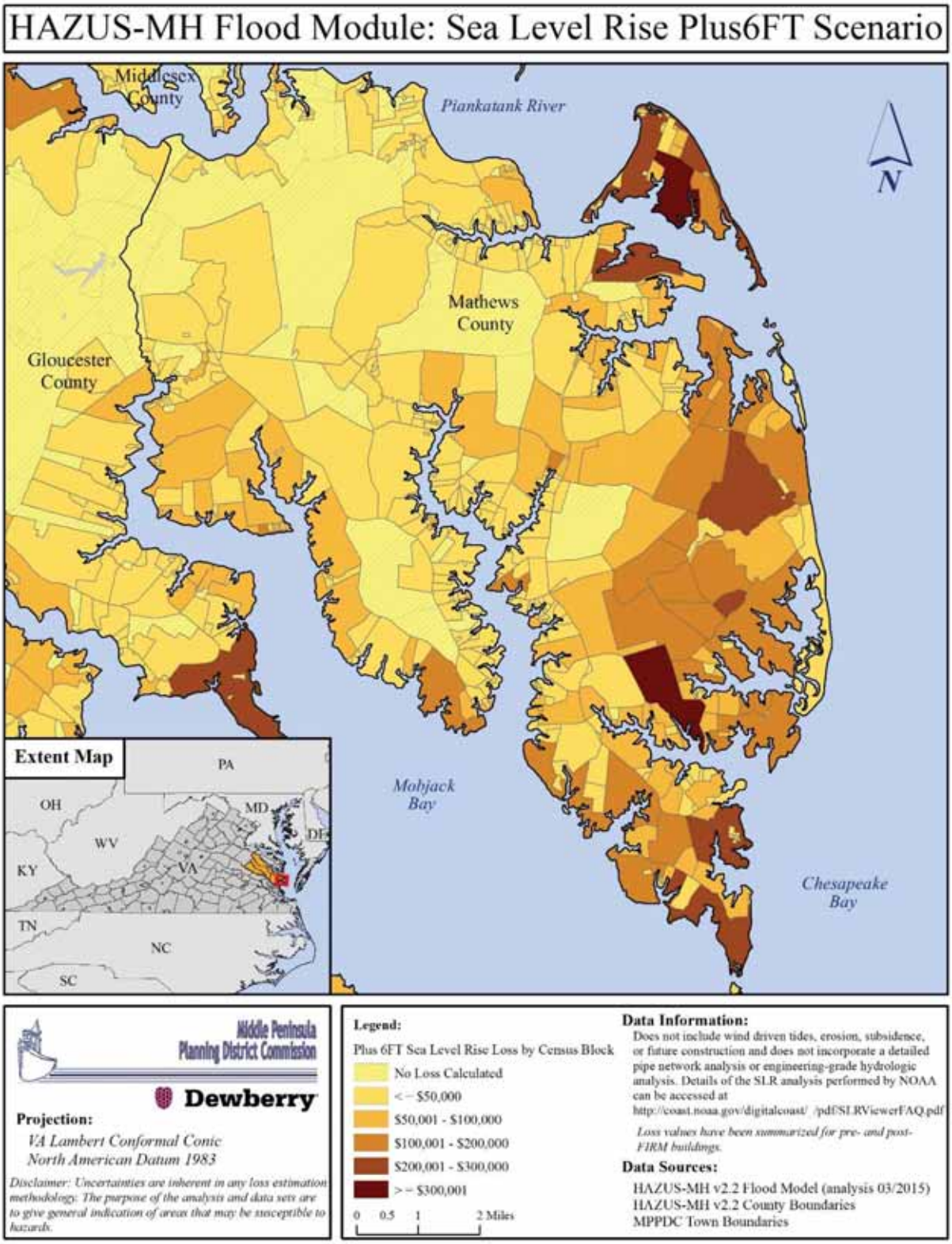

HAZUS-MH Flood Module: Sea Level Rise Plus6FT Scenario
Middlesex County
Piankatank River
N
Mathews County
Gloucester County
Mobjack Bay
Chesapeake Bay
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Plus 6FT Sea Level Rise Loss by Census Block
No Loss Calculated
< = $50,000
$50,001 - $100,000
$100,001 - $200,000
$200,001 - $300,000
> = $300,001
0 0.5 1 2 Miles
Data Information:
Does not include wind driven tides, erosion, subsidence, or future construction and does not incorporate a detailed pipe network analysis or engineering-grade hydrologic analysis. Details of the SLR analysis performed by NOAA can be accessed at http://coast.noaa.gov/digitalcoast/ /pdf/SLRViewerFAQ.pdf
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 139:

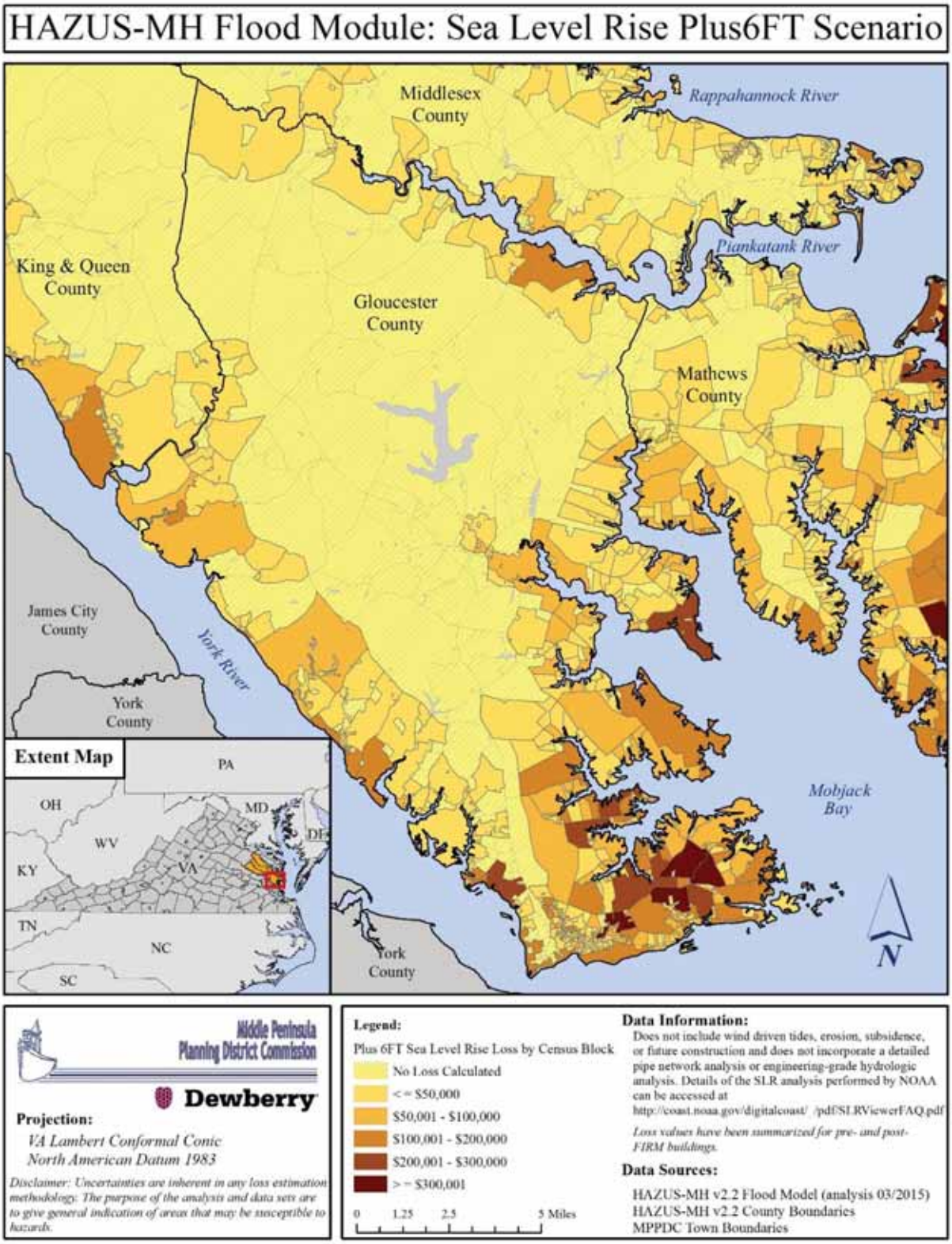

HAZUS-MH Flood Module: Sea Level Rise Plus6FT Scenario
Middlesex County
Rappahannock River
Piankatank River
King & Queen County
Gloucester County
Mathews County
James City County
York River
York County
Mobjack Bay
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
N
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Plus 6FT Sea Level Rise Loss by Census Block
No Loss Calculated
< = $50,000
$50,001 - $100,000
$100,001 - $200,000
$200,001 - $300,000
> = $300,001
0 1.25 2.5 5 Miles
Data Information:
Does not include wind driven tides, erosion, subsidence, or future construction and does not incorporate a detailed pipe network analysis or engineering-grade hydrologic analysis. Details of the SLR analysis performed by NOAA can be accessed at http://coast.noaa.gov/digitalcoast/ /pdf/SLRViewerFAQ.pdf
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 140:

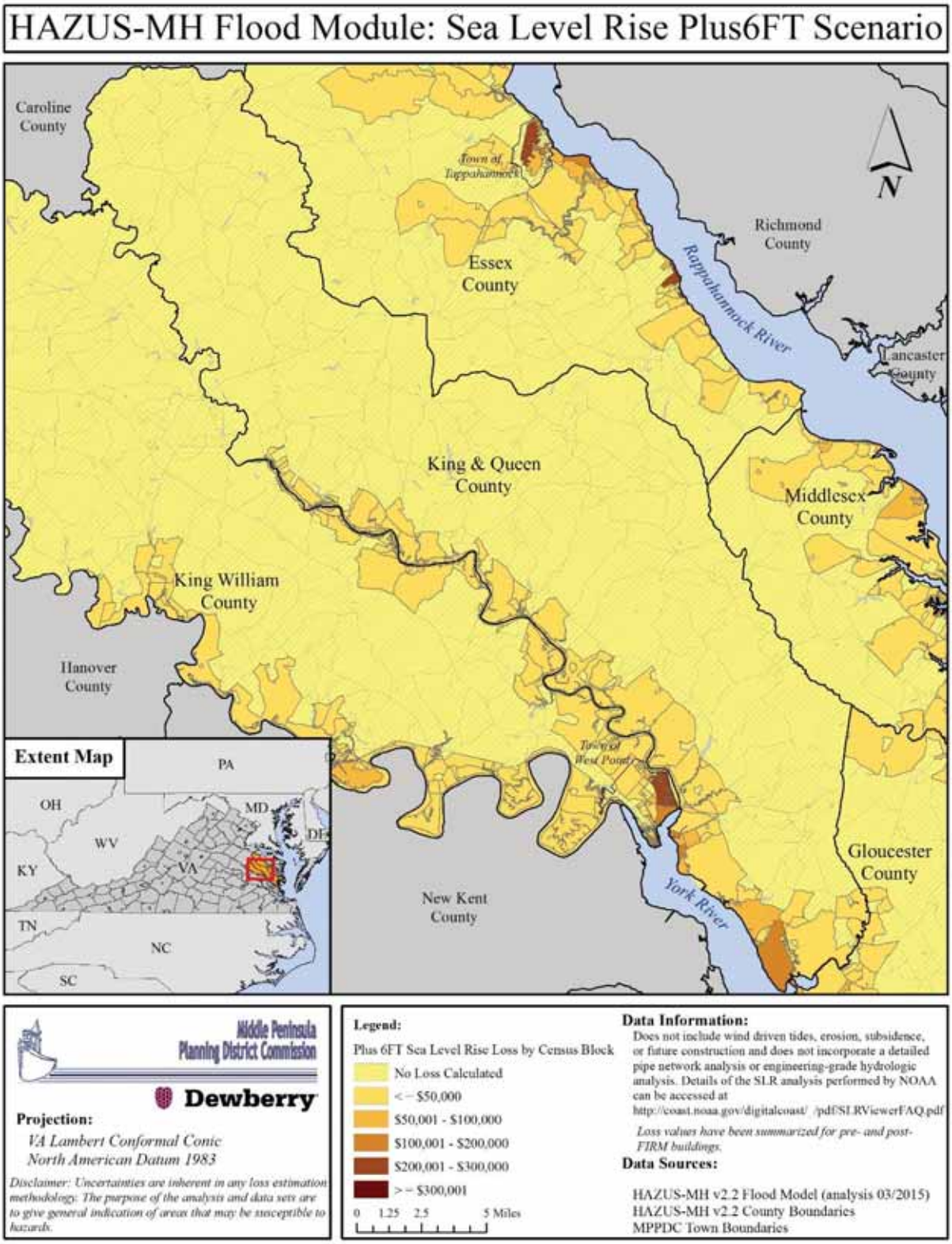

HAZUS-MH Flood Module: Sea Level Rise Plus6FT Scenario
Caroline County
Essex County
Richmond County
Rappahannock River
Lancaster County
King & Queen County
Middlesex County
King William County
Hanover County
New Kent County
Gloucester County
York River
Town of Tappahannock
Town of West Point
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Plus 6FT Sea Level Rise Loss by Census Block
No Loss Calculated
<= $50,000
$50,001 - $100,000
$100,001 - $200,000
$200,001 - $300,000
>= $300,001
0 1.25 2.5 5 Miles
Data Information:
Does not include wind driven tides, erosion, subsidence, or future construction and does not incorporate a detailed pipe network analysis or engineering-grade hydrologic analysis. Details of the SLR analysis performed by NOAA can be accessed at http://coast.noaa.gov/digitalcoast/ /pdf/SLRViewerFAQ.pdf
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 141:

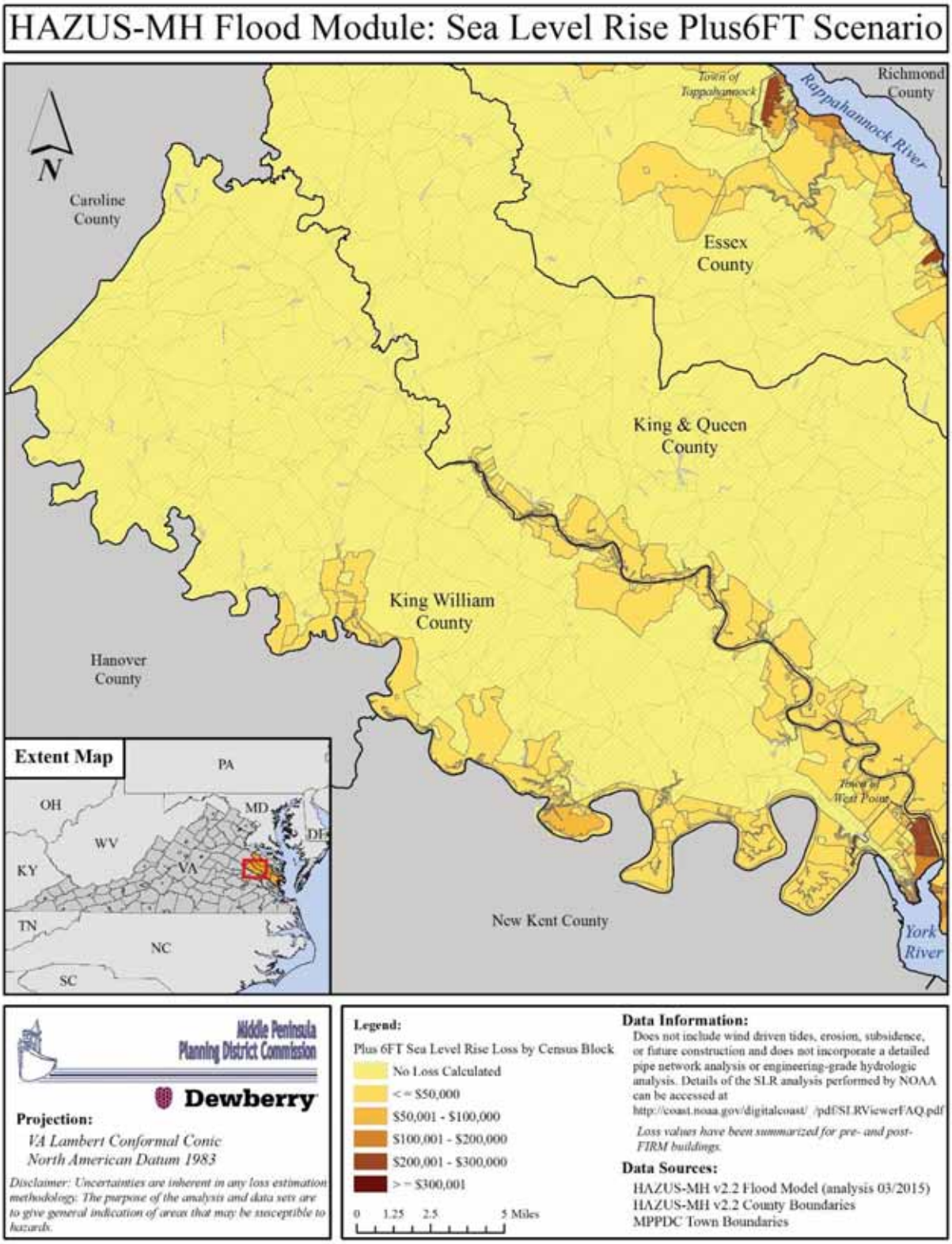

HAZUS-MH Flood Module: Sea Level Rise Plus6FT Scenario
N
Caroline County
Town of Tappahannock
Rappahannock River
Richmond County
Essex County
King & Queen County
King William County
Hanover County
New Kent County
Town of West Point
York River
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend:
Plus 6FT Sea Level Rise Loss by Census Block
No Loss Calculated
< = $50,000
$50,001 - $100,000
$100,001 - $200,000
$200,001 - $300,000
> = $300,001
0 1.25 2.5 5 Miles
Data Information:
Does not include wind driven tides, erosion, subsidence, or future construction and does not incorporate a detailed pipe network analysis or engineering-grade hydrologic analysis. Details of the SLR analysis performed by NOAA can be accessed at http://coast.noaa.gov/digitalcoast/ /pdf/SLRViewerFAQ.pdf
Loss values have been summarized for pre- and post-FIRM buildings.
Data Sources:
HAZUS-MH v2.2 Flood Model (analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 142:

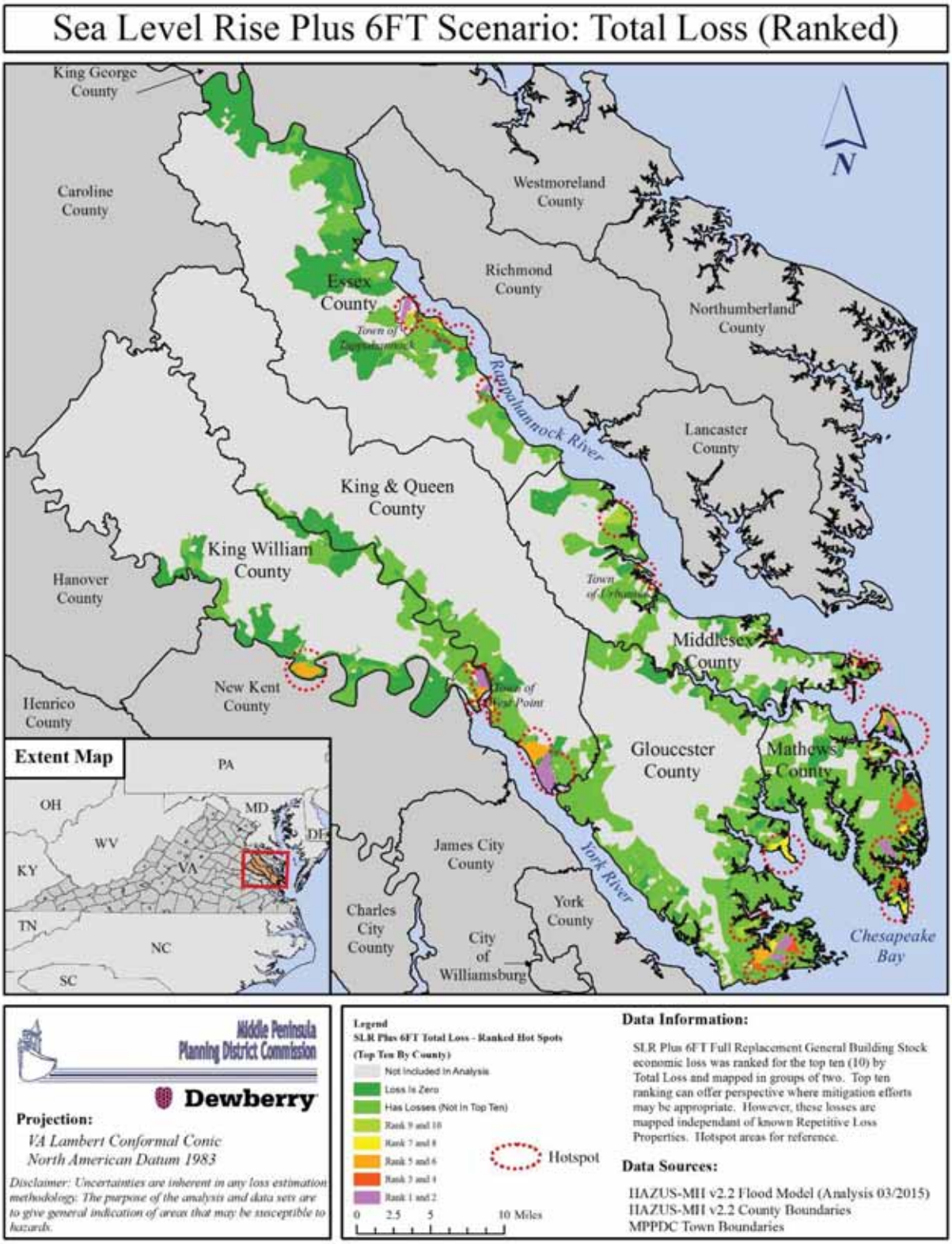
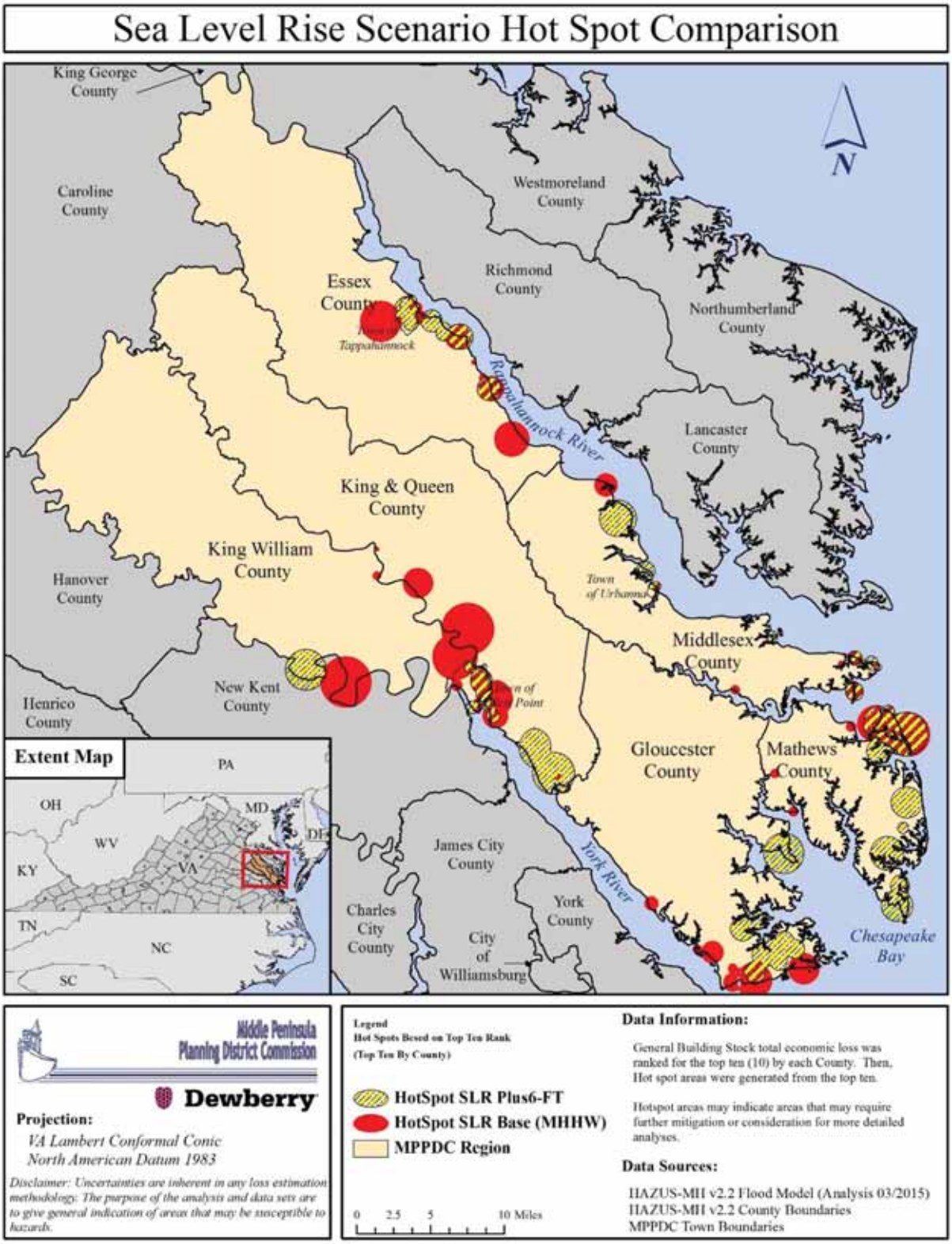

Sea Level Rise Plus 6FT Scenario: Total Loss (Ranked)
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Middlesex County
New Kent County
Henrico County
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend
SLR Plus 6FT Total Loss - Ranked Hot Spots
(Top Ten By County)
Not Included In Analysis
Loss Is Zero
Has Losses (Not In Top Ten)
Rank 9 and 10
Rank 7 and 8
Rank 5 and 6
Rank 3 and 4
Rank 1 and 2
Hotspot
0 2.5 5 10 Miles
Data Information:
SLR Plus 6FT Full Replacement General Building Stock economic loss was ranked for the top ten (10) by Total Loss and mapped in groups of two. Top ten ranking can offer perspective where mitigation efforts may be appropriate. However, these losses are mapped independant of known Repetitive Loss Properties. Hotspot areas for reference.
Data Sources:
HAZUS-MH v2.2 Flood Model (Analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Figure 143:


Sea Level Rise Scenario Hot Spot Comparison
King George County
Caroline County
Westmoreland County
Richmond County
Essex County
Tappahannock
Northumberland County
Rappahannock River
Lancaster County
King & Queen County
King William County
Hanover County
Town of Urbanna
Middlesex County
New Kent County
Henrico County
Gloucester County
Mathews County
James City County
York River
Charles City County
York County
City of Williamsburg
Chesapeake Bay
N
Extent Map
PA
OH
MD
DE
WV
KY
VA
TN
NC
SC
Middle Peninsula Planning District Commission
Dewberry
Projection:
VA Lambert Conformal Conic
North American Datum 1983
Disclaimer: Uncertainties are inherent in any loss estimation methodology. The purpose of the analysis and data sets are to give general indication of areas that may be susceptible to hazards.
Legend
Hot Spots Based on Top Ten Rank
(Top Ten By County)
HotSpot SLR Plus6-FT
HotSpot SLR Base (MHHW)
MPPDC Region
0 2.5 5 10 Miles
Data Information:
General Building Stock total economic loss was ranked for the top ten (10) by each County. Then, Hot spot areas were generated from the top ten.
Hotspot areas may indicate areas that may require further mitigation or consideration for more detailed analyses.
Data Sources:
HAZUS-MH v2.2 Flood Model (Analysis 03/2015)
HAZUS-MH v2.2 County Boundaries
MPPDC Town Boundaries

Sea Level Rise Scenario Comparison Tables:

Table 79: Hazus loss for both Pre- and Post-FIRM – Sea Level Rise Base (MHHW) and Plus 6-Feet.

Area	Scenario [A]	Total Loss	Building Loss	Contents Loss	Business [B] Disruption
MPPDC Region	SLR_Base	$10,185	$6,010	$4,165	$11
MPPDC Region	SLR_Plus6	$283,524	$156,719	$124,964	$2,660
Essex County	SLR_Base	$722	$391	$331	$1
Essex County	SLR_Plus6	$15,866	$8,202	$7,511	$178
Gloucester County	SLR_Base	$2,760	$1,638	$1,120	$1,122
Gloucester County	SLR_Plus6	$116,625	$63,431	$52,381	$53,751
King and Queen County	SLR_Base	$254	$150	$97	$7
King and Queen County	SLR_Plus6	$6,622	$3,999	$2,561	$62
King William County	SLR_Base	$938	$532	$406	$0
King William County	SLR_Plus6	$18,289	$8,561	$9,603	$208
Mathews County	SLR_Base	$2,496	$1,494	$1,002	$0
Mathews County	SLR_Plus6	$96,918	$55,754	$40,566	$711
Middlesex County	SLR_Base	$3,015	$1,805	$1,209	$1
Middlesex County	SLR_Plus6	$29,204	$16,772	$12,342	$131
		Data in Thousands of Dollars			

Notes:

[A] Scenario does not include wind driven tides nor consider natural processes such as erosion, subsidence, or future construction and does not incorporate a detailed pipe network analysis or engineering-grade hydrologic analysis. Details of the SLR analysis performed by NOAA can be accessed at http://coast.noaa.gov/digitalcoast/_/pdf/SLRViewerFAQ.pdf

B Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss

Potential Mitigation Actions:

The potential mitigation actions noted are those that are Hazus-specific and would benefit refinement of Hazus analyses.

- ☐ Perform Hazus analyses based on the same data resources used to develop the inundation areas mapped in the report submitted to the Virginia General Assembly in January 2013 titled – RECURRENT FLOODING STUDY FOR TIDEWATER VIRGINIA by the Virginia Institute of Marine Science, Center for Coastal Resources Management at the College of William & Mary. This study appears to include the most widely accepted Sea Level Rise plus Storm Surge Scenario facing coastal Virginia. It would therefore be appropriate to consider 1.) The creation of depth grids from the study data and then 2.) Hazus Risk Assessment. It would also be beneficial to incorporate elements of the design storm into a combined Hazus Flood and Hurricane Scenario - in this manner benefits of the combined methodology can be realized – which includes methods to guard against over-counting or double-counting losses by simply adding damages from each respective Hazus model.
- ☐ Refine and update data sets for GBS and essential facilities.
    - o Improvements in the future should aim to further refine the building stock. Notably, one improvement should include adding any new development that may not have been in the land use/land cover data; e.g., new housing developments, new construction, etc…
    - o Perform localized building-level assessments in known areas of loss and or areas subject to likely losses.

Section 6 - Capability Assessment

According to the FEMA Local Mitigation Planning Handbook, *Each community has a unique set of capabilities, including authorities, policies, programs, staff, funding another resources available to accomplish mitigation and reduce long-term vulnerability.* In an effort to access these capabilities within each Middle Peninsula localities the regional preparedness planner worked with the AHMP Steering Committee to gather the necessary information. To provide consistency amongst the localities, the regional preparedness planner provided each locality with a Capability Assessment Worksheet to fill out. This work sheet requested feedback on the primary types of capability for reducing long-term vulnerability including planning and regulatory, administrative and technical, financial, and education and outreach.

While each locality has a variety of tools (i.e. authorities, polices, programs, staff, and funding sources) to implement mitigation goals, objectives, and strategies, each locality functions differently and therefore has a different capacity to implement such tools. Below is a breakdown of the capabilities within in each jurisdiction as it relates to planning and regulatory, administrative and technical, financial, and education and outreach.

Planning and regulatory capabilities are the plans, policies, coeds and ordinances that prevent and reduce the impacts of hazards. Table 80 shows the types of plans within each Middle Peninsula locality. This table also identifies, in green, those plans that address hazards to some degree.

Table 80: This a summary table of the plans that are implemented within their locality. The green squares indicate that plans within the localities that address hazards.

Plans	Essex	Gloucester	King & Queen	King William	Mathews	Middlesex	Town of Tappahannock	Town of Urbanna	Town of West Point
Comprehensive Plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Capital Improvements Plan	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Economic Development Plan	Yes	Yes		No	No	Yes	No	Yes	No
Local Emergency Operations Plan	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Continuity of Operations Plan		In Progress		No	In Progress	Yes	No	No	Yes
Transportation Plan	Yes	No	Yes	Yes	Yes	No	No	No	No
Stormwater Management Plan	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Community Wildfire Protection Plan		No	No	No	No	No	No	No	No
Other special plans (e.g. Brownfield's redevelopment, disaster recovery, coastal zone management, climate change adaptation)		Yes		No	No	No	No		No

**Note: Each locality had the opportunity to provide responses to available capabilities. Therefore empty squares represent no response from the locality.*

Table 81: ESSEX COUNTY		
Land Use Planning and Ordinances	**Yes/No**	**1. Is the ordinance an effective measure for reducing hazard impacts? 2. Is the ordinances adequately administered and enforced?**
Zoning ordinance	Yes	1. Yes 2. Yes
Subdivision ordinance	Yes	1. Yes 2. Yes
Floodplain ordinance	Yes	1. Yes 2. Yes
Natural hazard specific ordinance (stormwater, steep slope, wildfire)		1. Yes 2. Yes
Flood insurance rate maps	Yes	1. Yes 2. Yes
Acquisition of land for open space and public recreation uses	Yes	Landuse, parks and recreation

Table 82: GLOUCESTER COUNTY		
Land Use Planning and Ordinances	**Yes/No**	**1. Is the ordinance an effective measure for reducing hazard impacts? 2. Is the ordinances adequately administered and enforced?**
Zoning ordinance	Yes	1. Yes 2. Yes
Subdivision ordinance	Yes	1. Yes 2. Yes
Floodplain ordinance	Yes	1. Yes 2. Yes
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes	1. Yes 2. Y Yes
Flood insurance rate maps	Yes	1. Yes 2. Yes
Acquisition of land for open space and public recreation uses	Yes	1. Yes 2. Yes
Other	Yes	1. Yes 2. Y Yes

Table 83: KING & QUEEN COUNTY		
Land Use Planning and Ordinances	**Yes/No**	**1. Is the ordinance an effective measure for reducing hazard impacts?** **2. Is the ordinances adequately administered and enforced?**
Zoning ordinance	Yes	1. Requires open space, flood elevation certificates, substantial setback requirements, etc. 2. yes
Subdivision ordinance	Yes	1. Allows for limited number of by-right divisions compared to surrounding jurisdictions. Site plan requirements. 2. yes
Floodplain ordinance	Yes	1. Yes 2. Yes
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes	1. Stormwater – limits development 2. Yes - DEQ
Flood insurance rate maps	Yes	
Acquisition of land for open space and public recreation uses	Yes	Conservation Easements & DOF Public Forest

Table 84: KING WILLIAM COUNTY		
Land Use Planning and Ordinances	**Yes/No**	**1. Is the ordinance an effective measure for reducing hazard impacts?** **2. Is the ordinances adequately administered and enforced?**
Zoning ordinance	Yes	Yes
Subdivision ordinance	Yes	
Floodplain ordinance	Yes	
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes	Stormwater Ordinance Drought Ordinance
Flood insurance rate maps	Yes	
Acquisition of land for open space and public recreation uses	No	

Table 85: MATHEWS COUNTY		
Land Use Planning and Ordinances	**Yes/No**	**1. Is the ordinance an effective measure for reducing hazard impacts? 2. Is the ordinance adequately administered and enforced?**
Zoning ordinance	Yes	1. Yes 2. Yes
Subdivision ordinance	Yes	1. Yes 2. Yes
Floodplain ordinance	Yes	1. Yes 2. Yes
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	No	
Flood insurance rate maps	Yes	1. Yes, effective date 12/09/14 2. Yes
Acquisition of land for open space and public recreation uses	Yes	Only through FEMA HMGP Grant funding

How can these capabilities be expanded and improved to reduce risk?

- The Comprehensive Plan will be reviewed this year and into 2016 for potential amendments to identify future land uses for flood prone areas of the county and to adopt ordinances /policies that will reduce risks from recurrent flooding.
- We will consider land use tools such as increased setbacks and increased minimum lot sizes in the zoning ordinance and reducing the number of lots that can be created through subdivision of land to reduce development areas of land in the county subject to flooding.
- We will consider tools such as Purchase of Development Rights and Transfer of Development Rights to be included in our County Code of Ordinances to provide incentives to property owners/developers to develop outside of flood prone areas.
- We will review the Capital Improvements Plan to identify County-owned buildings/facilities that could be flood proofed or developed outside of Special Flood Hazard Areas.
- The Floodplain Management Ordinance could be expanded to identify a freeboard requirement for elevation of structures above the base flood elevation (BFE).

Table 86: MIDDLESEX COUNTY		
Land Use Planning and Ordinances	**Yes/No**	**1. Is the ordinance an effective measure for reducing hazard impacts? 2. Is the ordinance adequately administered and enforced?**
Zoning ordinance	Yes	1. Yes 2. Yes
Subdivision ordinance	Yes	1. Yes 2. Yes
Floodplain ordinance	Yes	1. Yes 2. Yes
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	No	
Flood insurance rate maps	Yes	1. Yes 2. Yes
Acquisition of land for open space and public recreation uses	No	

Table 87: TOWN OF URBANNA		
Land Use Planning and Ordinances	**Yes/No**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinances adequately administered and enforced?**
Zoning ordinance	Yes	1. Yes 2. Yes
Subdivision ordinance	Yes	1. Yes 2. Yes
Floodplain ordinance	Yes	1. Yes 2. Yes
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	No	N/A
Flood insurance rate maps	Yes	1. Yes 2. Yes
Acquisition of land for open space and public recreation uses	No	N/A

Table 88: TOWN OF TAPPAHANNOCK		
Land Use Planning and Ordinances	**Yes/No**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinances adequately administered and enforced?**
Zoning ordinance	Yes/2004	Yes
Subdivision ordinance	Yes/1999	Yes
Floodplain ordinance	Yes/2015	Yes
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes/2011	Yes
Flood insurance rate maps	Yes/2015	Yes
Acquisition of land for open space and public recreation uses	Yes	Yes

Table 89: TOWN OF WEST POINT		
Land Use Planning and Ordinances	**Yes/No**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinances adequately administered and enforced?**
Zoning ordinance	Yes	1. Yes 2. Yes
Subdivision ordinance	Yes	1. Yes 2. Yes
Floodplain ordinance	Yes	1. Yes 2. Yes
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	No	1. Yes 2. Yes
Flood insurance rate maps	Yes	1. Yes 2. Yes
Acquisition of land for open space and public recreation uses	Yes	1. Yes 2. Yes

Administrative and technical capabilities include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. For smaller jurisdictions without local staff resources, enforcing policies or conducting public outreach may be difficult. Table 90 below indicates whether or not Middle Peninsula localities have specific administrative and technical capabilities.

Table 90: This table indicates whether or not Middle Peninsula localities have specific administrative and technical capabilities.

Administration	Essex	Gloucester	King & Queen	King William	Mathews	Middlesex	Town of Tappahannock	Town of Urbanna	Town of West Point
Planning Commission	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mitigation Planning Committee	No	Yes	No	No	No	No	No	No	No
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Yes	Yes	Yes	No	Yes, Outfall Ditch Program	No	No	No	No
Mutual aid agreements	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Staff									
Chief Building Official	Yes	Yes	Yes	Yes	Yes (Full-time)	Yes	Yes	Yes	Yes (Full-time)
Floodplain Administrator	Yes	Yes	Yes	Yes	Yes (Full-time)	Yes	Yes	Yes	Yes (Full-time)
Emergency Manager	Yes	Yes		Yes	Yes (Full-time)	Yes	Yes	Yes	Yes (Full-time)
Community Planner	Yes	Yes		Yes	Yes (Full-time)	No	Yes	Yes	Yes (Full-time)
Civil Engineer	No	Yes		No	No	No	No	No	Yes (part-time)
GIS Coordinator	No	Yes		Yes	Yes (Full-time)	Yes	No	Yes	Yes (Full-time)
Other				Yes	Yes (Full-time)				
Technical									
Warning systems/services (Reverse 911, outdoor warning signals)		Yes		Yes	Yes	Yes	No	Yes	Yes
Hazard data and information	No	Yes				Yes	No	Yes	Yes
Grant Writing	No	No		Yes	Yes	Yes	No	Yes	Yes
Hazus analysis	No	No	No	No	No	No	No	Yes	Yes

**Note: Each locality had the opportunity to provide responses to available capabilities. Therefore empty squares represent no response from the locality.*

Essex County has tree trimming maintenance program with the local electric company helps to reduce risk of power outages. As for the Town of Tappahannock they have access to and benefit from the Chief Building Official, Floodplain Administrator, and Emergency Manger that is employed with Essex County.

Gloucester County identified that staffing within the County is not adequate to proactively enforce regulations, however all staff are trained on hazards and mitigation and that there is coordination between agencies, staff and committees. Gloucester County has a County hazard Mitigation Committee that meets monthly and aggressively addresses homes in the flood risk zones with FEMA's Hazard Mitigation Grant Program (HMGP) to perform property acquisitions and elevations. The County also works with Dominion for tree trimming maintenance program to reduce risk of power outages.

As the Town of Urbanna is a small coastal community, resources are limited and in many cases shared with the Middlesex County. While the Town of Urbanna has access to a Chief Building Official, Floodplain Administrator, Emergency Manger, and a GIS coordinator, Middlesex County employees these people. In addition the Town of Urbanna benefits from Middlesex County's fire and emergency medical service mutual aid agreements as well as the County's Blackboard connect and Reverse 911 system. Urbanna's Economic Development Plan and Emergency Operations Plans are incorporated into the Middlesex County Plan.

King William County has adequate staffing throughout the county, but identified that the Chief Building Official, Floodplain Administrator, Community Planner, and GIS coordinator are not trained in hazards and mitigation. As for the Town of West Point, it operates separately from the County and only benefits from the King William County warning system in place. Therefore the Town has full-time staffers, with the exception of the civil engineer, that help to adequately to enforce regulations, however the majority of them are not trained on hazards and mitigation (i.e. Chief Building Official, Floodplain administrator, Community planning and the GIS coordinator).

Mathews County identified that while County positions are filled full time positions Chief Building Official and the Floodplain Administrator are not staffed adequately. There is more work then staff hours can handle. However each staffer noted in the above table are trained on hazards and mitigation.

In addition to locality specific capabilities, all Middle Peninsula localities are active members of the Middle Peninsula Planning District Commission (MPPDC). The MPPDC is a regional planning body that can assist localities in grant writing, technical assistance, and executing a project. Depending on the need of the locality or the region, MPPDC staff may assist. For instance, through this AHMP update MPPDC hired a regional preparedness planner to coordinate localities and develop a plan. In part the Hazus analysis was conducted for all localities. So while only few localities had GIS capabilities to conduct such an assessment on their own the MPPDC was able to complete this task on regional basis that ultimately saved local resources and offered a regionally consistent deliverable.

Financial capabilities address a locality's access to or eligibility to use the following funding resources for hazard mitigation. Table 91 below indicates whether or not Middle Peninsula localities have specific financial capabilities.

Table 91: This table indicates whether or not Middle Peninsula localities have specific financial capabilities.									
Plans	**Essex**	**Gloucester**	**King & Queen**	**King William**	**Mathews**	**Middlesex**	**Town of Tappahannock**	**Town of Urbanna**	**Town of West Point**
Capital Improvement Project funding	Yes	Yes		Yes	Yes	No	Yes	Yes/ Eligible	No
Authority to levy taxes for specific purposes	No	Yes		Yes	No	No	No	No	No
Fees for water, sewer, gas, or electric services	No	Yes		No	No	No	No	Yes- Water Only	No
Impact fees for new development	No	No		No	No	No	No	No	No
Storm water utility fee	No	Yes		No	No	No	No	No	No
Incur debt through general obligation bonds and /or special tax bonds	No	Yes		Yes	Yes	No	No	No	No
Incur debt through private activities	Yes	Yes		Yes	No	No	No	No	No
Community Development Block Grant	No	No		Yes	Yes	No	No	No	No
Other federal funding programs	No	Yes		Yes	Yes	Yes	Yes	Yes	Yes
State funding programs	No	Yes		Yes	No	Yes	Yes	Yes	No
**Note: Each locality had the opportunity to provide responses to available capabilities. Therefore empty squares represent no response from the locality.*									

While there some finical options available to localities there are some cases in which these resources may not be used for mitigation. For instance according to Gloucester County it has access to stormwater utility fees, incurred debt through general obligation bonds and /or special tax bonds, as well as debt through private activities and yet Gloucester County cannot utilize these resources for mitigation. For King William County those funding resources identified as "not being used in the past and therefore are not likely to be used in the future" include Authority to levy taxes for specific purposes and incurring debt through private activities. However the King William County also noted funding resources identified as "not being used in the past, but could be in the future" to include capital improvement project funding, community development block grant, other funding programs, and state funded programs as well as incurring debt through general obligation bonds and/or special tax bonds.

The Town of Urbanna noted that while it has access to the community development block grants, other federal funding programs and state funding program these programs have not been used locally in the past and they have limited potential to be used in the future due to income eligibility.

Mathews County has utilized the Community Development Block Grant and received for a business District Revitalization project. While this project was not associated with hazard mitigation, Mathews County could use this funding for future hazard mitigation activities. In additional Mathews County has also received funding from the FEMA's HMGP Program to elevate houses and acquire properties in Special Flood Hazard Areas. The County plans to apply for additional funding from FEMA to elevate houses and acquire properties when the opportunity is available.

Education and Outreach capabilities are education and outreach programs and method already in place that could be used to implement mitigation activities and communicate hazard –related information. Table 92 below indicates whether or not Middle Peninsula localities have specific education and outreach efforts.

Table 92: This table indicates whether or not Middle Peninsula localities have specific education and outreach efforts.

Plans	Essex	Gloucester	King & Queen	King William	Mathews	Middlesex	Town of Tappahannock	Town of Urbanna	Town of West Point
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	Yes		No	No	Yes	No	Yes	No
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Yes	Yes		No	Yes	Yes	Yes	Yes	No
Natural disaster or safety related school programs	Yes	Yes			Yes	Yes	No	Yes	No
StormReady certification	No	Yes (2014-recertification)		No	No	No	No	No	No
Firewise Communities certification	No	No		No	No	No	No	No	No
Public-private partnership initiatives addressing disaster-related issues	Yes	Yes		No	No	Yes	Yes	NO	No

**Note: Each locality had the opportunity to provide responses to available capabilities. Therefore empty squares represent no response from the locality.*

Essex County has local employees that provide ongoing public education. The County has also worked with local schools to educate students about water issues, fire safety, and household preparedness. In addition the County hosts a Disaster Survivor Day each year to teach citizens how to prepare for

disasters. The Town of Tappahannock is focus on-going public education regarding water quality and water conservation.

Gloucester County offers a variety of public outreach opportunities for their citizens. As participants in the CRS program the County has developed a Program for Public Information (PPI) that includes on-going education about water issues, fire safety, household preparedness, environmental education and hazards. The Emergency Manger provides this outreach and awareness. The County has developed a public-private partnership within the Gloucester Chamber of Commerce in order to host an annual preparedness symposium. The County's Community Emergency Response Team (CERT) performs outreach and education programs for Spring Storms, Hurricane Preparedness, Flood Program Awareness, and Winter Weather Preparedness. Additionally the County has incorporated lightning safety in natural disaster and safety related school programs.

Within Mathews County the capability to provide education and outreach is limited, yet the school curriculum includes natural disaster and safety related programs. The Building Official's web page has online information and community presentations regarding building codes and floodplain management.

In Middlesex County public education is offered through the Office of Emergency Services. As for the Town of Urbanna with limited staff and funds, the Town looks to Middlesex County for the majority of its public engagement efforts. However the Town has a local citizens group, Friends of the parks (501-3-C organization) that is very interested in resource protection and preservation. The organization is in its formative stages of development but has considerable potential to assist in public outreach.

King William County does not currently have an active public education program, but it eh program currently being developed. As of the Town of West Point, they do not have education opportunities for citizens. Staff in Wet Point would need to be trained on hazard mitigation topic before providing outreach programs.

Existing Mitigation Activities - Structural Projects

Gloucester County's Hurricane Recovery/Mitigation Projects

Gloucester County has an active and on-going hurricane residential recovery program in the Jenkins Creek and Guinea communities in the southern portion of the county. This is where the York River and Mobjack Bay meet the Chesapeake Bay. The county has successfully applied for and received grant funding from HUD/VDHCD as well as FEMA/VDEM to implement their multi-phased residential mitigation program.

Since 2004, Gloucester County has participated in eleven (11) Hazard Mitigation (HMGP) grants, one (1) Repetitive Flood Claim (RFC) grant, and one (1) Community Development Block Urgent Needs (CDBG) grant. Five HMGP grants are still active. Gloucester County has been very active in the mitigation scene receiving more than 25% of the Virginia's HMA allocations since 2005. All of the grants were designed to both assist in the recovery from storm events and to help reduce the damages that could come from future events.

The 2006 CDBG Urgent Needs grant built or rehabilitated, on elevated foundations, 7 homes. The homes were all severe loss homes that were substantially damaged by Isabel. The work under this grant was completed in 2009. Under the FEMA Hazard Mitigation Assistance (HMA) program, the County has acquired 30 parcels and has funding to 2 more parcels under 4 FEMA acquisition grants. Each parcel was cleared of its structures and turned into permanent open space. The land was incorporated into an Open Space Plan. Most of the lots are now acting as natural buffers for the Guniea area. One is to be

developed as a walking trail. The County continues to look at additional recreation options for the spaces as well. In all the County owns 82 acres acquired under the FEMA HMA grant.

The FEMA HMA grants have 85 funded elevation since 2004 with 60 on new foundations. Gloucester had 7 FEMA elevation grants and 1 FEMA RFC grant. Gloucester also had 4 owners have withdrawn and we are working on completing 21 elevations. All the current grant work should be complete by next summer (2017). The elevation work places the home on a new foundation that is at least two feet above the FEMA required base flood elevation level (Figures 144-149). Although most of the homes in the grants have been in Guinea area residents in Ware Neck, Harcum (Painkatank River), Glass, and Robins Neck have also participated in the program.

The work by the County has helped reduce its total number of repetitive and severe repetitive loss lists. Of the properties in the FEMA HMA grants, 3 acquired properties were identified as repetitive loss however none of them are severe repetitive loss properties. Sixteen on the elevated homes were repetitive loss properties, 4 of which are severe. All 7 CDBG homes were considered severe repetitive loss homes. In total we have mitigated nineteen repetitive loss properties and 11 severe repetitive loss homes. County's Building Office tracks and has completed all the AW-501 worksheets in order to report to FEMA the completed mitigation activities for these homes.

The total funds allocated by all the grants is just under $12 million dollars. This includes just over $8.5 million plus in federal funds and over $2.5 million in state funds for the FEMA grants and $750,000 in funds for the CDBG program.

Most recently, in July of 2015, Gloucester County received $331,594 of HMGP funding, which is 34% of total state funding. This funding will be used to elevate 2 homes and will allow 2 properties to be acquired. In both cases this will minimize the risk of future flooding to citizens. Gloucester County has joined into a partnership with the United States Geological Service (USCG) by installing a Tide Gage on the Severn River that is used to monitor flood conditions in the southeastern section of the County.

Figure 144: House in Hayes, Gloucester County - BEFORE elevation.

Figure 145: House in Hayes, Gloucester County- AFTER elevation.

Figure146: House in Hayes, Gloucester County - BEFORE elevation.

Figure 147: House in Hayes, Gloucester County - AFTER elevation.

Figure148: House in Hayes, Gloucester County- BEFORE elevation.

Figure149: House in Hayes, Gloucester County- AFTER elevation.

Mathews County Mitigation Projects

The following are a list of FEMA HMGP grants Mathews County has received for elevation of houses and acquisitions of properties over the past five (5) years.

Project Number SLR-2009-115-002

This was a grant to elevate one house under a Severe Repetitive Loss Program funding the County received from FEMA. The total project budget for this elevation was $207,942.00. This house elevation was advertised for bid, a contract was awarded and the house was elevated above the Base Flood Elevation (BFE) for the Special Flood Hazard Area (SFHA) where the property is located. The property owner provided a ten (10) percent match of the contractor's bid amount using his funds. Ninety (90) percent of the cost for elevating the house was paid for out of the grant.

This house is on FEMA's Severe Repetitive Loss list.

Project Number SLR- 1987-008

The county applied for funding after the remnants of Tropical Storm Ida damaged properties in Mathews in November 2009. The county was awarded funding in the amount of $889,825 to acquire one property and elevate eight (8) houses. The County awarded contracts to elevate

four (4) houses and the work has been completed. One property was acquired and there is one house remaining to be elevated. Three houses were not elevated because the eligible property owners chose not to participate in the grant program.

Three of the four houses that were elevated are on FEMA's Repetitive Loss list. The property that was acquired is on the list, and the one house remaining to be elevated is on the list.

Project Number HMGP – 4045 – 002

The County applied for funding subsequent to the Tropical Storm Lee event. The County was awarded funding in the amount of $1,122,865 to elevate nine (9) homes. All nine (9) homes are located throughout the County, but primarily in the eastern and southern portions of the County that are most susceptible to flooding. To date, two homes have been elevated. One home has been awarded a contract to be elevated and one home is ready to be advertised for bid. Five property owners are not participating in the grant program.

One house that was elevated is on the Repetitive Loss List and one that is ready to be advertised for bed is on the list.

Project Number HMGP – 4092-002

The County applied for funding subsequent to the Hurricane Sandy event. The County was awarded funding in the amount of $1,774,360 to elevate eleven (11) homes and acquire one property. All twelve (12) homes were located throughout the County, but primarily in the eastern and southern portions of the County that were most susceptible to flooding. To date, three (3) homes have been elevated (Figures 150 and 151). Two homes have been awarded a contract to be elevated and four homes are ready to be advertised for bid. One house is ready to be acquired. Two property owners are not participating in the grant program.

Figure 150: Photos of an elevated home in Moon, Va during (left) and after (right) (Mathews County, 2015).

Figure 122: Photos of an elevated home in Port Haywood during (left) and after (right) being elevated (Mathews County, 2015).

One house that was elevated is one the Repetitive Loss list and one house that is ready to be advertised for bid is on the list.

Town of West Point Hurricane Recovery/Mitigation Projects

In March of 2010 the Town of West Point applied for funding through the Virginia Department of Emergency Management Hazard Mitigation Grant Program. The Town proposed a project to elevate a home on Kirby Street to base flood elevation plus 1 foot to relocate the home outside the 100 year flood plain. This would reduce flood risk from major storms (i.e. Hurricane Isabel) as well as minor nor'easters.

Upon receiving notice of funding in 2013, the Town requested bids to complete the elevation project. In 2015 the project was finally complete. Below are pictures of the house before and after elevation (Figure 152 and 153).

Figure 152: Photos of a home in the Town of West Point before being elevated.

Figure 153: Photos of a home in the Town of West Point after being elevated.

In conjunction with this elevated home, the Town of West Point received funding through the HMA to relocated the Public Works Building on 7th Street to King William Avenue due to repetitive flooding. This move created a more stable working environmental for employees.

Both the Kirby Street property and the Publics Works Building were on the repetitive loss list prior to mitigation action.
The Town of West Point also received funding through FEMA and VDEM to acquire multiple properties – including two properties on 1st Street, one property on 2nd Street, one property on Glass Island Road as well as one property on 5th street. The 5th Street properly was on the repetitive loss list.

Observations from Existing Structural Mitigation Projects

Due to the engineering and other technical aspects of structural mitigation projects as well as the limited number of county personnel available to undertake these new initiatives, Gloucester County has hired a consulting firm, Community Planning Partners, to assist them with their grant funding applications, project engineering/design as well as construction management of their multi-phased mitigation projects. Mathews County has hired the same consulting firm as Gloucester and have a total of 47 properties either they have mitigation using HMA funds or are in the process of mitigating.

As of yet, none of the other Middle Peninsula localities have undertaken structural mitigation projects. However, 5 private property owners in the town of Urbanna, with their own financial resources, have rebuilt their homes that were damaged by flooding from Hurricane Isabel. These structures were rebuilt in accordance with the locality's floodplain regulations and they were elevated by either being built on stilts or with block crawl spaces having the required vented openings in the foundation.
When Middle Peninsula localities undertake future structural mitigation projects, it can be expected that they will continue to utilize the services of either consulting engineering firms or local agencies that have the technical capacity to undertake housing elevation projects.

The localities have the capacity to offer operational support services such as office space and some administrative support services in their role as the official FEMA grantee. Once again, project management will in all likelihood be a contracted service due to the dependency on grant funding and the technical complexity of elevating houses.

National Flood Insurance Program (NFIP)

The AHMP Steering Committee was given an opportunity to share progress made on implementing the National Flood Insurance Program (NFIP) locally. Information was received through a spread sheet developed by FEMA. The questions inquire about actions taken within the communality with regards to floodplain identification and mapping, floodplain management, and flood insurance.

As all 9 Middle Peninsula jurisdictions participate in the NFIP as administered by FEMA, each jurisdiction has implemented local floodplain ordinances that include requirement that comply with the minimum FEMA – or in some case exceed the minimum requirements prescribed by FEMA. As seen in Section 7 of this plan update, 8 of the 9 Middle Peninsula jurisdictions have implemented Base Floor Elevation (BFE) regulations that require structures to be an additional 1' or over BFE. The 8 Middle Peninsula jurisdictions that require this more restrictive regulation are Essex, Gloucester, King William, King & Queen, and Middlesex Counties and the Towns of Urbanna, West Point, and Tappahannock.

Enforcement of the floodplain regulations are undertaken by the locality's Zoning Administrator and Building Official.

All 9 Middle Peninsula localities remain in full compliance with their floodplain and building code regulations as evidenced by their periodic reviews of their NFIP related activities by FEMA and VDCR evaluators.

For additional details about locality NFIP, please visit Appendix K.

Stormwater Management Ordinances

During the 2012 General Assembly session, the Virginia General Assembly passed legislation (HB 1065) that requires localities throughout the state to develop, adopt, and implement local a Virginia Stormwater Management Program (VSMP) by July 1, 2014. This bill integrated elements of the Erosion and Sediment Control Act, the Stormwater Management Act, and the Chesapeake Bay Preservation Act so that these regulatory programs could be implemented in a consolidated and consistent manner, resulting in greater efficiencies (one-stop shopping) for those being regulated. However in 2014, additional action by the General Assembly, with the passing of House Bill 1173/Senate Bill 423, localities were provided an "Opt-Out" option that would leave the administration of the VSMP to the Virginia Department of Environmental Quality (DEQ) instead of local administration. As a result, only Gloucester County has chosen to develop and administer a local VSMP. All other localities within the Middle Peninsula as decided to "opt-out" and have DEQ administer the program. While this is the

current status of the VSMP, the program is still influx as DEQ wants to relinquish administrative power and give it back to the localities.

Please see Appendix L for Gloucester County's Stormwater Management Ordinance.

Future Mitigation Capabilities and Opportunities

Local governing bodies are charged with protecting the health, safety and welfare of its residents. The 6 Boards of Supervisors and the 3 Town Council are legally empowered to develop ordinances and policies to implement this charge based on sound and comprehensive review and analysis of flood mitigation proposals and strategies.

In general, the localities will continue to facilitate federal and state grant funded flood mitigation projects for private property owners with the understanding that the property owners will pay for all costs – construction and administration – that are not covered by grant funds.

Public infrastructure flood mitigation projects will be undertaken by the local governing bodies when they determine that the benefits outweigh the costs. Typically, these projects will be incorporated into the locality's Capital Improvement Program and considered for funding by the governing body during their annual budget development and approval process.

Section 7 - Review of Strategies from the 2010 Middle Peninsula Natural Hazards Mitigation Plan (MPNHMP)

As Middle Peninsula localities transition from the 2010 natural hazard plan strategies into the 2016 plan strategies, it is critical to look at the progress made over the last 5 years in order to provide a more clear direction moving forward. Therefore to capture the progress made by localities, the Regional Preparedness Planner reviewed the 2010 Mitigation Strategies with the AHMP Steering Committee and requested status updates on each 2010 mitigation strategy. Tables 93 - 101 display the responses and the strategy statuses. Please note that the shaded red boxes identify the completed strategies.

Table 93: Essex County – 2010 Mitigation Strategy Status

2010 Strategy	2010 Priority	Status	Comment
1.1.1	Low	By request	
1.1.2	Low	Yearly	
1.1.5	High	In-progress	Should be completed in 2017
1.1.6	Moderate	In-progress – will be completed 2017	Should be completed in 2017
1.1.8	Moderate	Completed 2015	
1.1.9	Low	In-progress	
1.1.10	Low	Did not adopt	
1.1.11	High	On-going	
1.1.13	Moderate	In-progress	
1.1.15	Low	In-progress	
1.2.1	Low	Completed	Appendix M
2.2.1	High	Partially Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the CountyTown level.
2.2.2	High	Partially Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level
3.1.1	High	Completed	Code Red/ radio station/ PSA
3.1.2	Moderate	On-going	
3.1.3	Moderate	In-progress	
3.1.4	High	Completed	
3.1.5	High		
3.1.6	Moderate	Ongoing & In-progress	
3.1.7	High		
3.1.8	Moderate	Ongoing	
3.2.1	Moderate	In-progress	
3.2.2	Low	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3. 2010 Census was not included in HAZUS.
4.1.1	High	In-progress	Adopted a floodplain overlay district as a component of the County's zoning ordinance.

Table 94: Town of Tappahannock – 2010 Mitigation Strategy status			
2010 Strategy	**2010 Priority**	**Status**	**Comments**
1.1.1	Low	Completed - 2015	
1.1.3	High	Completed - 2014	
1.1.5	High	Delayed	Delayed because of VDOT
1.1.7	High	Delayed	Delayed because of VDOT
1.1.8	Moderate	Completed – 2015	
1.1.9	Low	Delayed	Delayed because of Essex County
1.1.10	Low	w/in 2 years	
1.1.11	High	Not started	
1.1.15	Low	w/in 2 years	
1.2.1	Low	Completed	Appendix M
2.2.1	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level
2.2.2	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level
3.1.1	High	Completed	
3.1.2	Moderate	On-going	
3.1.3	Moderate	w/in 1 years	
3.1.4	High	Completed - 2015	
3.1.5	High	Not started	
3.1.6	Moderate	Not started	
3.2.1	Moderate	w/in 2 years	
3.2.2	Low	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.
4.1.1	High	On-going	Adopted a Floodplain overlay district as a component of the County's zoning ordinance

Table 95: Gloucester County – 2010 Mitigation Strategy Status			
2010 Strategy	**2010 Priority**	**Status**	**Comments**
1.1.1	High	On-going	Ongoing education for business – working with Gloucester Chamber Annual Outcomes
1.1.2	Moderate	On-going	Same as above
1.1.3	Moderate	On-going	Same as above
1.1.4	High	On-going	County Open Space Plan – FEMA Mitigation Grants
1.1.6	Low	On-going	Working with VDOT to ensure road maintenance and reconstruction projects are addressed.
1.1.8	Low	On-going	Next review scheduled for October 2015; County has entered into CRS – progress is documented and monitored by FEMA
1.1.11	High	On-going	County Building Officials follow codes and ensure strict adherence to the County Floodplain Management Plan; The Board of Supervisors voted to include VE Construction
1.1.13	Low	On-going	David Moore, Extensive Service, works with the Department of Agriculture, state level and local county Farmers.
1.1.14	Moderate	Completed	
1.1.15	Low	On-going	Promotes public education and awareness through current floodplain management committee.
1.2.1	Low	Completed	Appendix M
2.2.1	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level. In 2015, Gloucester County also participates in the Hampton Roads Fire and Rescue MOU.
2.2.2	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level. In 2015, Gloucester County also participates in the Hampton Roads Fire and Rescue MOU.
3.1.1	High	Completed	
3.1.2	Moderate	On-going	Added a Program for Public Information (PPI) to CRS that includes public awareness and outreach.
3.1.3	Moderate	On-going	
3.1.4	High	On-going	PPI-CRS and Floodplain Management Committee
3.1.5	High	On-going	Same as above
3.1.6	Moderate	On-going	Same as above; Gloucester Volunteer Fire and Rescue also trained response personnel in ice rescue.
3.1.7	Low	On-going	Same as above
3.1.8	Moderate	On-going	Work with Virginia Department of Forestry on public awareness on fire prevention every October.
3.2.1	Moderate	Completed- January 2015	New FEMA maps. Flood and storm Inundation Maps were updated and on County's emergency management webpage.
3.2.2	Low	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.
4.1.1	High	In-progress	Adopted a floodplain overlay district as a component of the County's zoning ordinance.

Table 96: King and Queen County -2010 Mitigation Strategy Status			
2010 Strategy	**2010 Priority**	**Status**	**Comments**
1.1.6	Moderate	On-going	Route 17 at Parkers Marina completed and now open. Road was raised.
1.1.8	Moderate	Every 2-years	
1.1.9	Low	Not Started	
1.1.10	Low	In-progress	Currently requires flood elevation certificates and looking to propose freeboard with the new maps in May of 2016
1.1.13	Moderate	w/in 2-years	
1.1.15	Low	In-progress	VE zone properties will have high construction requirements once new maps are adopted and effective May of 2016
1.2.1	Low	Completed	Appendix M
2.2.1	High	Partially- Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level
2.2.2	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level
3.1.1	High	Completed	
3.1.2	Moderate	Not Started	Roadways in VDOT system needs ditch cleanouts to prevent roadway flooding
3.1.3	Moderate	In-Progress	REC does a great job of this
3.1.4	High	w/in 1 year	
3.1.6	Moderate	Not started	
3.1.8	Moderate	On-going	
3.2.1	Moderate	In-Progress	New maps to be adopted and effective may of 2016. GIS online to become available to the public Fall of 2015
3.2.2	Low	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.
4.1.1	High	In-Progress	Adopted a floodplain overlay district as a component of the County's zoning ordinance.

Table 97: King William – 2010 Mitigation Strategy Status			
2010 Strategy	**2010 Priority**	**Status**	**Comments**
1.1.5	High		
1.1.6	Moderate	On-going	
1.1.8	Moderate	Completed – Spring 2015	
1.1.9	Low	Completed- Spring 2015	County not interested in joining.
1.1.10	Low	Completed- Spring 2015	Adopted 1.5' freeboard
1.1.12	Moderate		
1.1.13	Moderate		
1.1.14	Moderate	Completed	
1.1.15	Low	On-going	
1.1.16	Moderate	Not Started	Delayed due to lack of funding
1.1.17	Moderate	Completed	
1.1.18	Moderate	On-going	GIS layer developed; Added stormwater BMP layer
1.2.1	Low	Completed	Ordinance adopted 1-23-2012 (Appendix M)
2.2.1	High	Partially- Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level
2.2.2	High	Partially -Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level
3.1.1	High	Completed	
3.1.2	Moderate	Not started	
3.1.3	Moderate	w/in 1 years	
3.1.4	High	Not started	Very little development around flood plains
3.1.6	Moderate	w/in 2 years	
3.1.8	Moderate	Not started	
3.2.1	Moderate	Completed	
3.2.2	Low	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3. 2010 Census was not included in HAZUS.
4.1.1	High	In-progress	Adopted a floodplain overlay district as a component of the County's zoning ordinance.

Table 98: Town of West Point -2010 Mitigation Strategy Status			
2010 Strategy	**2010 Priority**	**Status**	**Comments**
1.1.1	Low	On-going	Waiting to hear from FEMA on application
1.1.2	Moderate	Annually	
1.1.3	High	On-going	Relocated public works building to higher ground
1.1.8	Moderate	Completed	Done by Charles Kline with Virginia Department of Conservation and Recreation
1.1.9	Low	Not started	
1.1.10	Low	Completed - 2015	
1.1.11	High	Ongoing	Review of zone and building applications
1.1.15	Low	Not Started	
1.2.1	Low	Completed	Appendix M
2.2.1	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level.
2.2.2	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level.
3.1.1	High	On-going	King William Dispatch has the capability of doing this for the Town if needed
3.1.2	Moderate	Completed	
3.1.3	Moderate	Not started	
3.1.4	High	Completed - 2015	The town held a public meeting with citizens to explain new FEMA maps. The town denied the residential elevation by FEMA.
3.1.5	High	Completed	The town held a public meeting with citizens to explain new FEMA maps. The town denied the residential elevation by FEMA.
3.1.6	Moderate	Not started	
3.1.7	Moderate	Not started	
3.2.1	Moderate	On-going	Received new GIS information from FEMA, updated as received from FEMA
3.2.2	Low	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.
4.1.1	High	In-progress	Adopted a Floodplain overlay district as a component of the County's zoning ordinance

Table 99: Mathews County- 2010 Mitigation Strategy Status			
2010 Strategy	**2010 Priority**	**Status**	**Comments**
1.1.1	High	In-progress/ ongoing	Four FEMA HMGP grants were awarded to the County for the elevation of houses for thirty-four repetitive loss properties and acquisition of three properties. The elevations and acquisitions in these four grants are in progress and are expected to be completed in 2017. Another FEMA HMGP grant for one severe repetitive loss property was used to elevate the house in 2014.
1.1.2	Moderate	Not started	Delayed because of lack of funding
1.1.3	Moderate	Not started	Delayed because of lack of funding
1.1.4	Moderate	In-progress/ ongoing	FEMA HMGP funds have been used to acquire one repetitive loss property. Two others are in the process of being acquired
1.1.6	Moderate	Not started	Delayed because of lack of VDOT funding
1.1.8	Moderate	Completed – December 2014	
1.1.9	Low	Not started	Delayed because of lack of staff to apply for inclusion and ongoing participation in the CRS Program.
1.1.10	Low	Delayed	Increased elevation requirements proposed for updated floodplain management ordinance, but not adopted. Potential to be addressed in the future.
1.1.11	High	In-progress/ ongoing	County's Building Official is enforcing adopted Floodplain Management Ordinance. Zoning amendments will be considered by the Planning Commission to address recurrent flooding after the five-year review of the Comprehensive Plan.
1.1.13	Moderate	Not started	No request has been made to the NRCS or Tidewater Soil and Water Conservation District for an inventory of farm pond dams.
1.1.15	Low	In-progress/ ongoing	The County's Wetlands Projects Coordinator and the Wetlands Board are promoting "Living Shorelines" as a shoreline erosion control method to property owners by utilizing information provided by VIMS and VMRC.
1.2.1	Low	Completed	Appendix M
2.2.1	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level
2.2.2	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level
3.1.1	High	Completed	
3.1.2	Moderate	In-progress/ ongoing	The County encourages property owners to participate in its Outfall Ditch Maintenance Program. Local VDOT maintenance crews periodically clean ditches in their right-of-way. A Ditching Committee comprised of County residents was also formed to address this problem.
3.1.3	Moderate	Not started	No request has been made to Dominion Power for information and guidance about the importance of keeping trees and brush away from power lines.
3.1.4	High	In-progress/ ongoing	The County's Building Official regularly posts information on the County's website regarding flood hazards.
3.1.5	High	In-progress/ ongoing	The County's Building Official and the Department of Planning & Zoning inform residents about FEMA HMGP grants to elevate their houses or acquire properties. Also,

			the Building Official, along with a local contractor, has conducted a meeting for residents regarding the steps involved in elevating a house.
3.1.6	Moderate	Not started	Delayed because of lack of staff
3.1.7	Moderate	In-progress/ ongoing	Department of Planning & Zoning staff provided this information to residents when the Comprehensive Plan was updated in 2010. On-going information has been provided to the Planning Commission regarding this topic in advance of the five-year review of the Comprehensive Plan.
3.1.8	Moderate	Not started	Delayed because of lack of staff
3.2.1	Moderate	Completed	
3.2.2	Low	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new Dasymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.
4.1.1	High	Completed	Adopted an amended Floodplain Management Ordinance and updated the County's Floodplain Insurance Rate Maps

Table 100: Middlesex County -2010 Mitigation Strategy Status			
2010 Strategy	**2010 Priority**	**Status**	**Comments**
1.1.1	Low	On-going	Managed by Staff on an on-going basis
1.1.2	Low	Not Started	Delayed because lack of staff; any concerns are forwarded to VDOT
1.1.6	Moderate	On-going	Managed by VDOT
1.1.8	Moderate	On-going	Active program; Ordinance recently readopted
1.1.9	Low	Not Started	Delayed because lack of staff
1.1.10	Low		
1.1.11	High	On-going	Managed by staff on an on-going basis
1.1.13	Moderate	On-going	Coordinate with USDA Staff when required
1.1.15	Low	On-going	Managed by Staff on an on-going basis
1.2.1	Low	Completed	Drought Ordinance adopted in 2011 (Appendix M)
2.2.1	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level.
2.2.2	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level.
3.1.1	High	Completed	Active Program
3.1.2	Moderate	On-going	This occurs as needed
3.1.3	Moderate	On-going	Managed by Staff on an as needed basis
3.1.4	High	On-going	Managed by staff during public education deliveries
3.1.5	High	On-going	This occurs as requested
3.1.6	Moderate	On-going	Managed by staff during public education deliveries
3.1.7	Moderate	Not Started	Reactionary only
3.1.8	Moderate	On-going	Managed by Staff during public education deliveries
3.2.1	Moderate	Completed	
3.2.2	Low	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.
4.1.1	High	In-progress	Adopted a floodplain overlay district as a component of the County's zoning ordinance.

Table 101: Town of Urbanna -2010 Mitigation Strategy Status			
2010 Strategy	**2010 Priority**	**Status**	**Comments**
1.1.1	Low	On-going	Greatly increased freeboard requirements in new floodplain ordinance beyond minimum requirement.
1.1.2	Moderate	On-going	
1.1.8	Moderate	Completed - 12/2014	Greatly increased freeboard requirements in new floodplain ordinance beyond minimum requirement.
1.1.9	Low	Not Started	
1.1.10	Low	Completed – 12/2014	Manpower constraints
1.1.11	High	On-going	Enforcement of all floodplain/zoning/building regulations in flood zones is actively pursued on an on-going basis.
1.1.15	Low	On-going	Conducted jointly with Middlesex County
1.2.1	Low	Completed	Appendix M
2.2.1	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level
2.2.2	High	Partially - Completed	In 2009, the Rappahannock Volunteer Firefighters Association signed a mutual agreement but this only consists of a few volunteer departments within the locality (Appendix N). This is not a mutual aid agreement at the County/Town level
3.1.1	High	Completed	Waiting for final guidance from DEQ for stormwater reg. implementation.
3.1.2	Moderate	On-going	Educational materials periodically placed on web site to encourage maintenance.
3.1.3	Moderate	On-going	Town encourages Dominion line maintenance at every opportunity.
3.1.4	High	Completed –12/2014	Materials were on web site and sent to landowners as part of new Floodplain ordinance adoption.
3.1.5	High	Completed – 12/2014	Materials were on web site and sent to landowners as part of new Floodplain ordinance adoption.
3.1.6	Moderate	Delayed	Manpower constraints
3.1.7	Moderate	In-progress	Materials are being developed for distribution
3.2.1	Moderate	Completed	See Middlesex County
3.2.2	Low	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.
4.1.1	High	In-progress	Adopted a Floodplain overlay district as a component of the County's zoning ordinance

The following is a more descriptive version of the mitigation strategies that have been implemented by Middle Peninsula jurisdictions:

Strategies that have been completed since 2010 by the local governments under **Goal 1: Prevent Future Hazard Related Losses** include the following:

1. The Town of Urbanna amended their floodplain ordinance to increase the freeboard requirements, which is above the minimum requirement. The Base Flood Elevation (BFE) plus a minimum of two feet of freeboard is the new requirement.

2. King William amended their floodplain ordinance to increase the freeboard requirement to 1.5 feet.
3. All Middle Peninsula localities, with the exception of King & Queen County, had Boards of Supervisors/Town Councils adopt the most current DFIRM/FIRM and FIS. King & Queen is still working with FEMA to finalize the maps. Localities adopted these maps on the respective dates: Essex County, April 2015; Town of Tappahannock, May 2015; Gloucester County, November 2015; King William County, September 2014; Town of West Point, August 2015; Mathews County, December 2014; Middlesex County, March 2015; and Town of Urbanna, April 2015.
4. Residential flood mitigation projects in Gloucester and Mathews County as well as the Town of West Counties (2007 to present).
5. Eliminated flooding at the Mathews' County Sewage Treatment Facility by taking the facility off-line and replacing it with a flood-proof pump station/force main for transport and treatment at the HRSD's York River Wastewater Treatment Plant in York County (2010).
6. Town of West Point relocated the public works building out of flood-prone areas (2009).
7. Town of West Point elevated one home to base flood elevation plus 1 foot (2014). The elevation will allow the home to be located outside the 100 year flood plain and will no longer be prone to damage and effects of flooding caused by major storms (i.e. Hurricane Isabel) and minor nor'easters.
8. Middle Peninsula localities have adopted an ordinance to implement a Drought Response and Contingency Plan that is presented in the Middle Peninsula Regional Water Supply Plan as well as the corresponding section in the Hampton Roads Drought Response and Contingency Plan (for the case of Gloucester County). Localities have adopted these ordinances on the respective dates: Essex County, 2011; Town of Tappahannock, 2011; Gloucester County, 2009; King and Queen County, 2011; King William County, 2012; Town of West Point, 2011; Mathews County, 2013; Middlesex County, 2011; and Town of Urbanna, 2011(See Appendix L for copies of the Drought Ordinances).
9. Gloucester County updated and readopted their Coastal Floodplain Management Plan in September 2014.

Strategies that have been completed by the local governments under **Goal 2: Improve Community Emergency Management Capability** include the following:

1. King William implemented Code Red, Radio Station, and Public Service Announcements to notify residents of hazards and emergencies.
2. Formalized mutual aid agreements amongst all Middle Peninsula localities to coordinate the region's fire and emergency medical units to ensure a quick and efficient response to severe weather events (2009).
3. Formalized mutual aid agreements amongst all Middle Peninsula localities to coordinate the region's fire units to ensure a quick and efficient response to wildfires.

A strategy that has been completed under **Goal 3: Increase Public Awareness of Vulnerability to Hazards** includes the following:

1. To improve the hazard assessment within the region, a HAZUS analysis was run with the 2.2 version software. This analysis included HAZUS flood runs for the 1 square mile threshold as well as new dasymetric Census data. A strategy that has been completed under.
2. The Gloucester County website offers a variety of educational resources on their website (http://www.gloucesterva.info/emergencymanagement) for the general public to look at.
3. King William, Essex, Gloucester, King & Queen, and Mathews County as well as the Towns of Urbanna and West Point informed community property owners about changes to the DFIRM/FIRM that would impact their insurance rates.

Regional Summary of Completed 2010 Strategies

To provide a quick snapshot of the completed strategies, below are a list of the strategies and the localities that have completed them.

- **Strategy 1.1.14: Develop Storm Water Management Plans and Policies for Urban Development Areas in both King William and Gloucester Counties.**

  Both of the localities listed above have been designed by the Virginia General Assembly as Urban Development Areas for land use planning purposes. Both localities have experienced rapid growth as they are located near the Hampton Roads and Richmond Metropolitan areas, respectively.

  Planning staff from each of these counties will formulate a plan using guidance regulations and policies promulgated by the General Assembly and as managed by the Virginia Department of Environmental Quality.

  Planning and Administrative Staff will develop a strategy to incorporate the Storm Water Management Plan into the locality's next update their Comprehensive Plan.

  Strategy 1.1.14 was completed by the following Middle Peninsula localities:

  1. ***Gloucester County and***
  2. ***King William County.***

- **Strategy 1.1.16: Add evacuation route insignia to public streets that are part of the hurricane evacuation route.**

  Strategy 1.1.16 was completed by the following Middle Peninsula locality:

  1. ***King William County***

- **Strategy 1.1.17: Install flood gauges and create erosion monitoring locations to inspect at regular intervals.**

  Strategy 1.1.17 was completed by the following Middle Peninsula locality:

1. King William County

- **Strategy 1.2.1 Decrease the adverse affects of drought conditions for residents - many of whom rely on individual wells as their only water source in many parts of the rural Middle Peninsula region by adopting the ordinance to implement the Drought Response and Contingency Plan contained in Section 10 of the Regional Water Supply Plan for the Middle Peninsula of Virginia as well as its corresponding section in the recently completed Hampton Roads Drought Response and Contingency Plan.**

  The County Administrator/Town Manager, with the assistance of the locality's designated Emergency Services Coordinator/Emergency Manager, will implement the actions specified at the Drought Watch, Drought Warning and Drought Emergency stages of this natural hazard.

  Strategy 1.2.1 was completed by the following Middle Peninsula localities:

  1. ***Essex County,***
  2. ***Gloucester County,***
  3. ***King and Queen County,***
  4. ***King William County,***
  5. ***Mathews County,***
  6. ***Middlesex County,***
  7. ***Town of Tappahannock,***
  8. ***Town of Urbanna, and***
  9. ***Town of West Point.***

- **Strategy 3.1.1: Enhance/implement the use of rapid notification systems to warn residents of approaching flood waters and mandatory evacuation notices.**

  Recorded warnings and instructional messages concerning flooding and resulting evacuation notices will be sent to all wired and wireless phone devices using Dispatch Center E-911 Databases at the emergency dispatch centers covering the localities listed above.

  The local Emergency Services Coordinators will be responsible for coordinating this initiative with the Sheriff Department and Dispatch Center Staff.

  Strategy 3.1.1 was completed by the following Middle Peninsula localities:

  1. ***Essex County,***
  2. ***Gloucester County,***
  3. ***King and Queen County,***
  4. ***King William County,***
  5. ***Mathews County,***
  6. ***Middlesex County,***
  7. ***Town of Tappahannock,***
  8. ***Town of West Point, and***
  9. ***Town of Urbanna.***

- **Strategy 3.2.1: Incorporate the newly digitized local floodplain maps into each County's GIS database after adoption by the local governing body, to the extent possible.**

  Each county's GIS technician/consultant will incorporate the digitized floodplain map data into their system when a GIS system becomes available to the locality.

  County planning/zoning officials will ensure that this floodplain data is readily available to property owners so that they are aware of the 100-year flood boundaries on their land.

  Strategy 3.2.1 was completed by the following Middle Peninsula localities:

  1. ***Gloucester County,***
  2. ***King William, and***
  3. ***Middlesex County.***

- **Strategy 3.2.2: When the Natural Hazards Mitigation Plan is updated in the future, complete:**
  1. **HAZUS flood runs for the 1 sq. mi. threshold. In most cases, this will need to be done on priority stream reaches as the program does not run efficiently at this level.**
  2. **Re-run HAZUS for plan update to reflect 2010 census data.**

  Strategy 3.2.2 was completed by the following Middle Peninsula localities:

  1. ***Essex County,***
  2. ***Gloucester County,***
  3. ***King and Queen County,***
  4. ***King William County,***
  5. ***Mathews County,***
  6. ***Middlesex County,***
  7. ***Town of Tappahannock,***
  8. ***Town of Urbanna, and***
  9. ***Town of West Point.***

- **Strategy 4.1.1: All Natural Hazards: Adopt an Implementation Plan that includes one or more of the following:**
  Consider adopting a Floodplain Overlay District as a component of the County's Zoning Ordinance.
  1. **Essex County,**
  2. **Gloucester County,**
  3. **King William County,**
  4. **Mathews County,**
  5. **Middlesex County,**
  6. **Town of Tappahannock,**
  7. **Town of Urbanna, and**
  8. **Town of West Point.**

While Middle Peninsula Localities have worked to complete 2010 mitigation strategies within their jurisdiction to benefit the general public and create a more hazard resilient community, each locality will continue working toward comprehensive hazard mitigation. This review of 2010 mitigation strategies highlights some of the actions taken by localities and it offers insight into what objectives, goals, and strategies that still need to be accomplished or worked on.

Section 8 - New Mitigation Goals, Objectives and Strategies

Taking into account the update of the vulnerability assessment using the Kaiser Permanente methodology as well as the results of the recently completed HAZUS damage assessments, the Steering Committee members propose that new or updated mitigation strategies be developed for the following natural hazards affecting the Middle Peninsula region:

Goal 1: Prevent future losses resulting from natural hazard events.

Objective 1.1: Provide protection for future development to the greatest extent possible.

Strategy 1.1.1: Reduce or eliminate flood damage to residential/business structures that are highly vulnerable for continual flood damage.

Strategy 1.1.1 will be undertaken by the following Middle Peninsula localities:

1. **Essex County,**
2. **Middlesex County,**
3. **Gloucester County,**
4. **Mathews County,**
5. **King William,**
6. **Town of West Point,**
7. **Town of Urbanna, and**
8. **Town of Tappahannock.**

If requested by citizen living in FEMA Repetitive Loss or Severe Repetitive Loss structure, the Middle Peninsula localities listed above will apply on behalf of the citizen for FEMA grant funds that lessen/eliminate flood damages. Project costs, including both construction and administrative costs, will be covered entirely by FEMA grant funds or by the property owners who are benefitting directly from the flood mitigation project.

Some of the localities listed above may want to undertake mitigation projects in one "neighborhood" at a time for consistency/uniformity in the community as well as for some economies-of-scale savings in some of our more rural low-lying areas.

According to FEMA data as of 2015, the following is a summary of the number of Repetitive Loss and Severe Repetitive Loss Properties in each locality (Table 102). If the locality is not listed there are no Repetitive Loss or Severe Repetitive Loss Properties.

Table 102: Repetitive Loss Properties and severe repetitive loss properties in the Middle Peninsula.

Locality	Repetitive Loss Properties	Severe Repetitive Loss Properties
Essex County	32	2
Gloucester County	146	13
Mathews County	169	11
Middlesex County	35	2
Tappahannock	2	0
Urbanna	2	0
West Point	9	0

Properties to be mitigated will receive a higher priority ranking by the locality using the following criteria:

1. Severe Repetitive Loss Properties over Repetitive Loss Properties.
2. Willingness and ability of the property owner to pay for the non-FEMA grant funded portion of their share of the project costs.
3. Higher benefit/cost ratio properties over lower benefit/cost ratio properties.
4. Projects that reduce flood risks to other nearby properties over those that don't.

Cost/Benefit Implications of Implementing Strategy 1.1.1

This strategy will have direct:

1. Benefits for private property owners by reducing/eliminating the severity of structural flood damage to their homes and businesses.
2. Benefits for private property owners with possible reductions in their future flood insurance premiums.
3. Benefits for FEMA by reducing the number of properties on the Repetitive Loss and Severe Repetitive Loss Lists and subsequent flood insurance claims.
4. Costs for private property owners who will directly benefit from the mitigation work on their property as well as by the federal government through expenditure of FEMA Hazard Mitigation Funds.

Mitigation Strategy addresses the following hazards: hurricanes, ice storms, coastal flooding/ nor'easters, snow storms, riverine flooding, sea level rise, tsunamis, ditch flooding, and summer storms.

Strategy 1.1.2: Flood proof, to the greatest extent possible, existing water dependent commercial buildings against flooding, including surge velocities, to insure continuity and viability of the seafood industry and other water dependent businesses.

Strategy 1.1.2 will be undertaken by the following Middle Peninsula localities:

1. **Essex County,**
2. **Middlesex County,**
3. **Gloucester County,**
4. **Mathews County,**
5. **Town of Urbanna and**
6. **Town of West Point.**

Each locality listed above will work with the owners of water dependent commercial properties to communicate the full range of flood proofing techniques available to them to decrease their vulnerability to flood losses. For water dependent commercial properties in the Town of Urbanna, Middlesex County will help accomplish this.

Each locality will advertise and conduct an annual workshop for contractors and property owners to provide instructions on how they can undertake specific flood proofing techniques on their buildings.

Cost/Benefit Implications of Implementing Strategy 1.1.2

This strategy will have direct:

1. Benefits for private business owners by reducing/eliminating the severity of structural flood damage that will allow them to maintain the viability of the coastal seafood industry.

2. Benefits for private property owners with possible reductions in their future flood insurance premiums.
3. Benefits for FEMA by reducing the number of properties on the Repetitive Loss and Severe Repetitive Loss Lists eligible for subsequent flood insurance claims.

Mitigation Strategy addresses the following hazards: hurricanes, ice storms, coastal flooding/ nor'easters, snow storms, riverine flooding, sea level rise, tsunamis, ditch flooding, and summer storms.

Strategy 1.1.3: Protect public buildings and public infrastructure from flood waters resulting from 100-year flood storm events.

Strategy 1.1.3 will be undertaken by the following Middle Peninsula localities:

1. **Gloucester County,**
2. **Mathews County,**
3. **Town of Tappahannock, and**
4. **Town of West Point.**

The Middle Peninsula localities, as well as other political subdivisions of the state providing public infrastructure in our region, including the Hampton Roads Sanitation District (HRSD), shall incorporate flood protection measures into their critical public buildings and public infrastructure if deemed feasible by local officials.

These flood protection measures should be incorporated into their local Capital Improvements Program (CIP) for funding consideration by the governing body during their annual budget development and approval process, if possible.

A list of the critical public buildings and public infrastructure within localities include the following:

- Flood proof and/or elevate the following public sewerage pump stations:

Locality	Pump Station Name
Gloucester County	Pump Station #11 and Pump Station #13
Town of West Point	Second Street Pump Station
Town of West Point	Bagby Street and Mattaponi Ave Pump Station
Town of West Point	Thompson Avenue Pump Station at West Point Creek

- Provide additional shoreline stabilization material at the base of the New Point Comfort Lighthouse in Mathews County.
- Consider mitigation retrofit projects at fire stations in Mathews County at-
    - Bohannon
    - New Point
    - Gwynn's Island
    - Mathews Court House

Cost/Benefit Implications of Implementing Strategy 1.1.3

This strategy will have direct:

1. Benefits for local governments and the HRSD by reducing/eliminating flood damage to public sewage systems.

2. Benefits to the public by maintaining public health standards by reducing/eliminating sewage system overflows into public water bodies during severe weather events.
3. Costs to local governments/HRSD to design and construct waterproofing and stabilization improvements to local buildings/infrastructure.

Mitigation Strategy addresses the following hazards: hurricanes, coastal flooding/ nor'easters, riverine flooding, tsunamis, ditch flooding, and summer storms.

Strategy 1.1.4: When elevating or flood proofing is not feasible for existing buildings threatened by flooding, land purchase and conversion to non-residential recreation/conservation land uses should be pursued by the locality using FEMA Grant Funds.

Strategy 1.1.4 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King William County,**
4. **Mathews County, and**
5. **Middlesex County.**

Cost/Benefit Implications of Implementing Strategy 1.1.4

This strategy will have direct:

1. Benefits for residential neighborhoods by reducing/eliminating storm construction debris that results from structures that are habitually damaged or destroyed by flood waters.
2. Benefits to the locality and general public by increasing vegetative buffering materials in storm surge zones when land is converted from residential use to conservation/preservation use.
3. Benefits for FEMA by reducing the number of properties on the Repetitive Loss and Severe Repetitive Loss Lists and subsequent flood insurance claims.
4. Cost for localities may include the maintenance of the property or properties acquired through this grant program.
5. Costs for FEMA through expenditure of Hazard Mitigation Funds for land use conversion program.

Mitigation Strategy addresses the following hazards: hurricanes, coastal flooding/nor'easters, riverine flooding, ditch flooding, and summer storms.

Strategy 1.1.5: Improve/maintain main evacuation routes (Table 103) used by Middle Peninsula residents as well as Tidewater residents evacuating severe coastal weather events and add evacuation route insignia to public streets that are part of the hurricane evacuation route.

Strategy 1.1.5 will be undertaken in the following Middle Peninsula localities using available grant funds:

1. **Essex County,**
2. **Gloucester County,**
3. **King William County,**

4. **Mathews County,**
5. **Middlesex County,**
6. **Town of Tappahannock, and**
7. **Town of West Point.**

Table 103: Main Evacuation Routes	
Locality	**Road Name/Location**
Essex/Tappahannock	Route 17 at June Parker Marina
King William County	King William Drive (Route 30) at Cypress Swamp at Olson's Pond
Gloucester County	Route 17 N
Mathews County	Route 14 to Rt 198 N to 17 N
Town of West Point	When Bridges are Closed due to Winds above 45 miles per hour: Route 30, however Rt 30 can close due to flooding at Cypress Swamp. When bridges are open: Rt 33 Wet to Route 64

Cost/Benefit Implications of Implementing Strategy 1.1.5

This strategy will have direct:

1. Benefits for both public motorists and the VDOT Primary Road System by decreasing flooding and flood damage to the Middle Peninsula's primary hurricane evacuation routes.
2. Benefits Local resident to better visualize routes as well as seasonal visitors who may not be aware that the route exists.
3. Substantial costs in federal and state transportation construction funds to elevate Route 17 and Route 30.
4. Costs of producing and erecting the signs.

Mitigation Strategy addresses the following hazards: hurricanes, coastal flooding/ nor'easters, and riverine flooding,.

Strategy 1.1.6: Improve/maintain/reconstruct public roads that hinder the evacuation of Middle Peninsula and Tidewater residents fleeing flood waters from coastal storms.

Strategy 1.1.6 will be undertaken in the following Middle Peninsula localities using available grant funds (i.e. VDOT and VDEM):

1. **Essex County,**
2. **Gloucester County,**
3. **King and Queen County,**
4. **King William County,**
5. **Middlesex County, and**
6. **Mathews County.**

Table 104: VDOT Maintained Collector Roads in King and Queen County.		
Route	**Road Name**	**Location of Flooding**
749	Kays Lane	at Root Swamp
721	Newtown Road	Near Bradley Farm Road
721	Newtown Road	Near Level Green Road
721	Newtown Road	Near Cedar Plane Road
721	Newtown Road	Near Glebe Road
623	Indian Neck Road	Near Rappahannock Culture Center
625	Poplar Hill Road	Nar Spring Cottage Road
628	Spring Cottage Road	Near Eastern View Road

628	Todds Bridge Road	Near Gunsmoke Lane
628	Pattie Swamp Road	At swamp
631	Fleets Mill Road	At Fleets Millpond
636	Minter Lane	At Walkerton Creek
631	Norwood Road	At Dickeys Swamp
620	Powcan Road	At Poor House Lane
634	Mt. Elba Road	At Flat Areas
620	Duck Pond Road	At Garnetts Creek
633	Mantua Road	At Garnetts Creek
617	Exol Road	At Exol Swamp
14	The Trail	At Truhart
614	Devils Three Jump Road	At Mt. Olive Road
613	Dabney Road	At Little Tastine Swamp
611	Tastine Road	At little tastine swamp
603	Lombardy Road	At Little Tastine Swamp
608	Clancie Road	At Bugan Villa Drive
601	Stratton Major Road	Near Union Prospect Baptist Church
601	Stratton Major Road	Near Union Road
644	Jonestown Road	At Meadow Swamp
605	Plain View Lane	At Guthrie Creek
601	Cherry Row Lane	At Guthrie Creek and swamp
666	Tuckers Road	entire Road including Tuckers R.P.
667	Wrights Dock Road	Entire road
640	Lyneville Road	At 36" cross-pipes
625	Bryds Mill	At cross-pipes
615	Union Hope Road	At Exol Swamp
604	Bryds Bridge Road	At Bryds Bridge
612	Lilly Pond Road	At Dragons Swamp Bridge
610	Dragonville Road	At Timber Brook Swamp
614	Rock Springs Road	At bridge
14	Buena Vista Road	At King & Queen/Gloucester County Line

Table 105: VDOT Maintained Collector Roads in Essex County

Route	Road Name	Location
617	Island Farm Road	Piscataway Creek
646	Fort Lowery Lane	Rappahannock River
680	River Place	Rappahannock River

Table 106: VDOT Maintained Collector Roads in King William County/West Point

Route	Road Name	Location
636	VFW Road	Cypress Swamp
632	Mt. Olive-Cohoke Road	Intersection of Route 633
609	Smokey Road	Herring Creek
628	Dorrel Road	Herring Creek
1006	Thompson Avenue	West Point Creek
1003	Chelsea Road	West oint Creek to dead end
1130	Glass Island Road	Mattaponi River
1107	Kirby Street	1st to 7th Street
n/a	1st to 7th Street	Between Kirby Street and Pamunkey River
n/a	2nd to 5th Street	Between Lee Street and Mattaponi River

Table 107: VDOT Maintained Collector Roads in Gloucester County

Route	Road Name	Location of Floodwaters

684	Starvation Road	From Big Oak Lane to ESM
662	Allmondsville Road	From Rt. 606 to Rt.618
618	Chappahosic Road	From Rt. 662 to Rt. 639
636	Brays Point Road	From Eagle Lane to ESM
1303	Carmines Island Road	From Gardner Lane to ESM
646	Jenkins Neck Road	Various spots from Owens Road to ESM
648	Maundys Creek Road	From Rt. 649 to ESM
649	Maryus Road	From Haywood Seafood Lane to ESM
652	Rowes Point Road	From 653 to ESM
649	Severn Wharf Road	Various spots from 653 to ESM
602	Burkes Pond Road	From Friendship Road to Burkes Mill Drive
623	Ware Neck Road	From Rt. 14 to Ware Point Road
3	John Clayton Memorial Highway	From Cow Creek to Crab Thicket Road
17	George Washington Memorial Hwy	From Woods Cross Road to Adner Road, and at the Gloucester / Middlesex line at Dragon Run
614	Corduroy Road	Robins Neck to dead end

Table 108: VDOT Maintained Collector Roads in Mathews County

Route	Road Name	Location
610	Marsh Hawk Road	From Rt. 614 to Rt. 611
600	Circle Drive	From Rt. 14 to Rt. 14
600	Light House Road	From Rt. 14 to ESM
611	Tabernacle Road	From Rt. 613 to Rt. 610
611	Tabernacle Road	From Rt. 610 to 609
609	Bethel Beach Road	From Rt. 610 to ESM
609	Bethel Beach Road	From Rt.614 to Rt. 611
643	Haven Beach Road	From Rt. 704 to ESM
633	Old Ferry Road	From Rt. 663 to Gwynn's Island Bridge
608	Potato Neck Road	From Rt. 649 to ESM
644	Bandy Ridge Road	From Rt. 611 to Rt. 614

Table 109: VDOT Maintained Collector Roads in Middlesex County

Route	Road Name	Location
648	Montague Island Road	From Rt. 604 to ESM
651	Smokey Point	From Rt. 640 to Rt. 685
1103	Irma's Lane	From Rt. 33 to Rt. 1102
628	Mill Creek Road	From Rt. 702 to ESM
636	Timber Neck Road	From 643 to Rt. 659
604	Bayport Road	At Masons Mill Swamp
648	Montague Island Road	At Mud Creek
604	Nesting Road	At Mud Creek
610	Burchs Mill Road	At Burch Pond
606	Briery Swamp Road	At Briery Swamp
602	Wares Bridge Road	At Wares Bridge
602	Wares Bridge Road	At Briery Swamp
603	Farley Park Road	At New Dragon Bridge
618	Lovers Retreat Lane	At Dragon Run Swamp
602	Old Virginia Street	At LaGrange Creek/Hilliards Mill Pond
17	Tidewater Trail	Nickleberry Swamp
17	Tidewater Trail	At Dragon Swamp
616	Town Bridge Road	At Glebe Swamp
616	Town Bridge Road	At Town Bridge Swamp
629	Stormont Road	At My Lady Swamp

629	Stormont Road	At Healy's Mill Pond
620	Philpot Road	At Healy's Mill Pond Swamp
625	Bob's Hole Road	At Mill Creek
624	Regent Road	At Mill Creek
622	Dirt Bridge Road	At Locklies Creek
625	Barracks Mill Road	At Barracks Mill Pond
33	General Puller Highway	At Conrad Pond/Wilton Creek
631	North End Road	At Sturgeon Creek
688/ 622/ 654/ 1113/33	All Stingray Point Roads	

Cost/Benefit Implications of Implementing Strategy 1.1.6

This strategy will have direct:

1. Benefits to local residents who will be better able to safely leave their neighborhoods during evacuations when requested by emergency response officials.
2. Benefits to the longevity of the VDOT Secondary Road System as the state struggles to maintain their existing public road network from future flood damages.
3. Substantial costs in federal and state transportation construction funds to make roadway and drainage structure improvements to the many low-lying roads in the Middle Peninsula Region.

Mitigation Strategy addresses the following hazards: hurricanes, coastal flooding/nor'easters, riverine flooding, sea level rise, tsunamis, ditch flooding, and summer storms.

Strategy 1.1.7: Improve public roads that adversely affect critical public infrastructure in the floodplain.

Strategy 1.1.7 will be undertaken in the following Middle Peninsula localities:

1. **Gloucester County,**
2. **Mathews County,**
3. **Town of Tappahannock, and**
4. **Town of West Point.**

Locality	Road Name/ Location
Tappahannock	Newbill Drive
Town of West Point	Second Street
Town of West Point	Bagby Street and Mattaponi Ave
Town of West Point	Thompson Avenue at West Point Creek

Significant storm water runoff from the downtown Tappahannock Business District combined with storm surge activity from the adjacent Rappahannock River causes inundation and the undermining of Newbill Drive. The Town of West Point is focused on improving public roads where sewer pump stations are located in order to reduce flooding inundation that could impact how the pump functions. Within Gloucester County two segments of Route 17 – George Washington Memorial Highway are located in a flood zone and are potentially affected by storm surge. The first is near the Court House area of the County and would be potentially inundated by a storm surge from a Category 1 hurricane. The second area is located at the southern end of the County and has potential to be inundated by a storm surge from a Category 3 or 4 hurricane. Improving these road segments could protect the public infrastructure located in the Court House Area, including government buildings as well as pump stations

(#11 and #13). In addition to these two segments, all roads in Gloucester County used to access critical infrastructure are important and may be improved when needed.

Cost/Benefit Implications of Implementing Strategy 1.1.7
This strategy will have direct:

1. Benefits to the local residents of the Town of West Point that utilize the sewer pump stations. The pump station will remain fully functional during and after severe flooding events.
2. Capital costs to improve storm water drainage in order to avoid future damage to roadway and pump stations.

Mitigation Strategy addresses the following hazards: hurricanes, coastal flooding/nor'easters, riverine flooding, sea level rise, tsunamis, ditch flooding, ice storms, snow storms, dam failure, and summer storms.

Strategy 1.1.8: Review locality's compliance with the National Flood Insurance Program with a bi-annual review of their Floodplain Ordinance and any newly permitted activities in the 100-year floodplain.

Strategy 1.1.8 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King and Queen County,**
4. **King William County,**
5. **Mathews County,**
6. **Middlesex County**
7. **Town of Tappahannock,**
8. **Town of Urbanna and**
9. **Town of West Point.**

Based on the results of their compliance review, County officials responsible for managing the locality's floodplain program will recommend amendments to the local Floodplain Ordinance and/or departmental policies/procedures as requested by compliance officials in a timely manner after the review.
In addition, Gloucester County officials will continue to update any floodplain ordinance, policy or procedural changes in order to keep their Floodplain Management Plan and their Community Rating System Program current.

Cost/Benefit Implications of Implementing Strategy 1.1.8
This strategy will have direct:

1. Benefits to localities by regularly and systematically tracking development activity in the flood zones to enable timely and effective changes to the locality's Floodplain Ordinance and other associated local land development ordinances and regulations.
2. Minimal costs to locality since the review is done by staff at the VDCR and recommended changes are completed by the local government body after consultation with local government zoning and floodplain management employees.

Strategy 1.1.9: Investigate the FEMA Community Rating System (CRS) Program in the Middle Peninsula localities that are not currently participating in it, which can ensure a less flood hazard prone community and thereby lower flood insurance rates for its residents.

Strategy 1.1.9 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **King and Queen County**
3. **King William County,**
4. **Mathews County,**
5. **Middlesex County,**
6. **Town of Tappahannock,**
7. **Town of Urbanna, and**
8. **Town of West Point.**

With the exception of Gloucester County which is already involved in the CRS Program, locality staff from the other localities listed above will determine the steps and resources needed to become a certified CRS Program Community.

Locality staff will take their findings to the County Administrator/Town Manager with a recommendation to either enter into the CRS Program, or not, based on the costs and benefits to its residents.

Cost/Benefit Implications of Implementing Strategy 1.1.9
This strategy will have direct:

1. Benefits to residents living in flood prone areas if the locality adopts a CRS Program with lower property insurance rates.
2. Costs of dedicating additional staff time to develop, implement, and manage the CRS Program.

Mitigation Strategy addresses the following hazards: hurricanes, coastal flooding/nor'easters, riverine flooding, sea level rise, tsunamis, ditch flooding, dam failure, and summer storms.

Strategy 1.1.10: Investigate increasing building elevation requirements for structures proposed in flood zones.

Strategy 1.1.10 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **King and Queen County,**
3. **King William County,**
4. **Mathews County,**
5. **Middlesex County,**
6. **Town of Tappahannock,**
7. **Town of Urbanna, and**
8. **Town of West Point.**

Middle Peninsula localities are adversely affected by flood water surges from coastal storms to some extent - with decreasing severity as you move from the southeastern-most areas to the northwestern-most portions of the region.

The Building/Zoning Officials in each of the localities should undertake a feasibility study to determine if increasing the elevation requirements for proposed structures to be built in flood zones would lessen flood damage as well as lower flood insurance premiums for residents. The lower insurance premiums were analyzed in a 2006 FEMA-commissioned study entitled *Evaluation of the National Flood Insurance Program's Building Standards* (www.fema.gov/library/viewRecord.do?id=2592). The feasibility study should be undertaken using local data sources including the latest FIRM data, FEMA Severe Repetitive Loss and Repetitive Loss Lists and known flood water depths from building permit files in the Building Department's records.

Beginning in September 2010, Gloucester County has updated their ordinances to require new structures to be constructed 2 feet above the Base Flood Elevation. This is a best practice for the County and it is not feasible to go any higher through current ordinances.

Cost/Benefit Implications of Implementing Strategy 1.1.10
This strategy will have direct:

1. Benefits of reduced flood insurance premiums for Middle Peninsula residents if the locality adopts more stringent regulations.
2. Benefit of lowering future flood insurance claims during severe flooding events if the locality implements greater freeboard requirements.
3. Costs of dedicating locality staff time in the Building/Zoning Departments to develop, implement, and manage the building elevation program.

Mitigation Strategy addresses the following hazards: hurricanes, coastal flooding/nor'easters, riverine flooding, sea level rise, tsunamis, ditch flooding, dam failure, and summer storms.

Strategy 1.1.11 Continue to insure that floodplain/zoning/building regulations in flood prone areas are strictly enforced to prevent non-compliant development and the need to invest in additional public infrastructure in these areas in the future.

Strategy 1.1.11 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King William County,**
4. **Mathews County**
5. **Middlesex County,**
6. **Town of Tappahannock,**
7. **Town of Urbanna, and**
8. **Town of West Point.**

Utilize location information gleaned from the FEMA-generated Severe Repetitive Loss List and the Repetitive Loss List as an additional source of data when county officials guide local property owners about proposed construction/development projects in flood-prone areas.

Cost/Benefit Implications of Implementing Strategy 1.1.11
This strategy will have direct:

1. Benefits local officials with being able to provide historical flood occurrence data to prospective home owners/builders in flood prone areas.

2. Costs of dedicating locality staff time in the Planning/GIS Department to map these properties into the locality's data base.

Mitigation Strategy addresses the following hazards: hurricanes, coastal flooding/nor'easters, riverine flooding, sea level rise, tsunamis, ditch flooding, dam failure, and summer storms.

Strategy 1.1.12: Limit future development in inundation areas located below large water impoundments.

Strategy 1.1.12 will be undertaken in the following Middle Peninsula locality:

1. **King William County**

The impoundment with the greatest likelihood for adverse flooding impacts downstream from the dam includes the following:

Locality	Facility
King William County	Lake Anne- Located in Louisa County

King William County officials should request Dominion/Virginia Power to assist them with mapping those land areas in the county that are adversely impacted by flood waters from their periodic release of water from Lake Anna. Those maps could then be used by county officials for incorporation into future Comprehensive Plan updates as well as for creating perhaps a possible zoning ordinance overlay district showing periodic inundation areas where future development should be avoided.

Cost/Benefit Implications of Implementing Strategy 1.1.12
This strategy will have direct:

1. Benefits to local officials with being able to guide future land use planning and development in these periodically affected properties.
2. Costs of dedicating locality staff time in the Planning/GIS Department to map these properties into the locality's data base.

Mitigation Strategy addresses the following hazards: dam failure.

Strategy 1.1.13 Strongly encourage the USDA - Natural Resources Conservation Services staff, Virginia Department of Conservation and Recreation's Regional Dam Safety Engineer, and the Virginia Soil and Water Conservation District Office staff to ensure that farm pond dams remain structurally sound.

Strategy 1.1.13 will be undertaken in the following Middle Peninsula localities by the aforementioned agencies:

1. **Essex County,**
2. **Gloucester County,**
3. **King and Queen County,**
4. **King William County,**
5. **Mathews County, and**
6. **Middlesex County.**

There is no organized database of farm pond dams in the Middle Peninsula. Since catastrophic failure of farm pond dams could have a hazardous flooding outcome for those living below them, it is critical that a database be developed by each locality to ensure emergency response actions and mitigation activities are undertaken.

The agencies listed above have a working knowledge within Middle Peninsula communities of where some of the larger dam structures may be located since they have a history of working with farmers on various farmland enhancement and subsidy projects.

For the USDA and the Virginia Soil and water Conservation Districts King and Queen, King William and Essex Counties are served by an office in Tappahannock while Middlesex, Gloucester and Mathews Counties are served by these agencies located in Gloucester County. As for Virginia Department of Conservation and Recreation's there is one Regional Dam Safety Engineer that serves all Middle Peninsula.

A written request from the County Administrator/Emergency Services Coordinator in each of the six Middle Peninsula counties should be made to these two agencies requesting an inventory of all dams that they are aware of as well as any structural design/physical condition information that they may have about the dam.

This information will be used by County Planning Officials when they evaluate land development requests during the early planning stages of a proposed project.

Cost/Benefit Implications of Implementing Strategy 1.1.13
This strategy will have direct:

1. Benefits local officials with being able to locate and provide a vulnerability assessment of these structures for future emergency planning strategies.
2. Costs to the USDA and VSWCD agencies with the dedication of staff time and resources to gather and synthesize this data for local government use.

Mitigation Strategy addresses the following hazards: dam failure.

Strategy 1.1.15: Promote coastal construction techniques that will minimize soil erosion and shoreline damage caused by coastal storm surges.

Strategy 1.1.15 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King and Queen County,**
4. **King William County,**
5. **Mathews County,**
6. **Middlesex County,**
7. **Town of Tappahannock,**
8. **Town of Urbanna, and**
9. **Town of West Point.**

Locality staff will work with engineers from the Virginia Marine Resources Commission (VMRC) to determine what coastal construction techniques can be used by waterfront property owners to lessen coastal erosion/flooding along the water's edge during severe storm events.

Additionally as FEMA developed new Flood Insurance Rate Maps a new information layer was added called the Limit of Moderate Wave Action (LiMWA) that identifies the 1.5-foot wave height. With this new information communities and property owners can make more informed decision about reducing their coastal flood risk.

Cost/Benefit Implications of Implementing Strategy 1.1.15
This strategy will have direct:

1. Benefits local residents with waterfront property by providing design options that will lessen adverse impacts from flood waters resulting from storm surges.
2. Costs of dedicating locality staff time to work with VMRC staff to develop best management design solutions that will mitigate soil erosion and other environmental damages.

Mitigation Strategy addresses the following hazards: coastal/shoreline erosion.

Strategy 1.1.18: Create a GIS layer of data showing pond locations, their size, inspection data, and dry hydrant information to improve fire response.

Strategy 1.1.18 will be undertaken in the following Middle Peninsula locality:

1. **Gloucester County,**
2. **Middlesex County, and**
3. **King William County.**

Cost/Benefit Implications of Implementing Strategy 1.1.18
This strategy will have direct:

1. Benefits to local fire departments by having a data base of water bodies and dry fire hydrant information when responding to fires.
2. Costs of GIS/Community Development staff time with data gathering, data input and data maintenance of the County's GIS system.

Mitigation Strategy addresses the following hazards: wildfires, droughts, lightning volcanoes, HAZMAT

Strategy 1.1.19: Integrate mitigation strategies into locality plans, policies, codes and programs across disciplines and departments.

Strategy 1.1.19 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King and Queen County,**
4. **King William County,**
5. **Mathews County,**
6. **Middlesex County,**
7. **Town of Tappahannock,**

8. **Town of Urbanna, and**
9. **Town of West Point.**

The localities listed above will work to continue integrating mitigation strategies into regional, county, and/or town plans (ie. Comprehensive Plan, Stormwater Management Plan, Water Supply Plan, etc), policies, codes (ie. ordinances) and programs to help support hazard risk reduction. According to FEMA there are two primary ways to effectively accomplish Plan Integration:

1. Integrate natural hazard information and mitigation policies and principles into local planning mechanism and vise versa.
    - Include information on natural hazards (past events, potential impacts, and vulnerabilities)
    - Identify hazard-prone areas throughout the community.
    - Develop appropriate goals, objectives, policies, and projects.

2. Encourage collaborative planning and implementation and inter-agency coordination:
    - Involve key community officials who have the authority to execute policies and programs to reduce risk.
    - Collaborate across department s and agencies with key staff to help share knowledge and build relationships that are important to the successful implementation of mitigation activities.

Cost/Benefit Implications of Implementing 1.1.19

This Strategy will have direct:

1. Benefits to localities will include enhanced risk reduction through improved coordination.
2. Benefits to localities will include better defined roles of locality staff (ie. planners, emergency mangers, engineers, etc.) in improving disaster resiliency.
3. Cost is the staff time required to develop and integrate mitigation strategies into locality plans and policies.

Mitigation Strategy addresses the following hazards: hurricanes, ice storms, tornadoes, coastal flooding/nor'easters, coastal/shoreline erosion, sea level rise, snow storms, riverine flooding, wildfires, high winds/windstorms, dam failure, droughts, lightning, earthquakes, shrink0swell soils, extreme cold, extreme heat, land subsidence/karsts, landslides, tsunamis, volcanoes, air quality, HAZMAT, ditching flooding, and summer storms.

Objective 1.2: Provide protection for critical public facilities and essential services.

Objective 1.3: Middle Peninsula localities will support implementation of structural and nonstructural mitigation activities to reduce exposure to natural and man-made hazards.

Strategy 1.3.1: Mitigation projects that will result in protection of public or private property from natural hazards. Eligible projects include, but are not limited to:

- **Acquisition of hazard prone properties,**
- **Elevation of structures in flood prone areas,**
- **Minor structural flood control projects,**
- **Relocation of structures from hazard prone areas,**
- **Retrofitting of existing buildings and facilities,**
- **Retrofitting of existing buildings and facilities for shelters,**

- **Infrastructure protection measures,**
- **Storm water management improvements,**
- **Advanced warning systems and hazard gauging systems (weather radios, reverse-911, stream gauges, I-flows),**
- **Targeted hazard education, and**
- **Installation of generator connections for shelters.**

Strategy 1.3.1 will be undertaken in the following Middle Peninsula localities:

1. Gloucester County

As numerous county buildings have experienced repetitive damage due to flooding and storm events these structures will be mitigated to reduce or eliminate the potential for damage associated with natural hazards.

Cost/Benefit Implications of Implementing Strategy 1.3.1
This strategy will have direct:

1. Benefits to the private and public infrastructure by mitigating impacts from natural hazards.
2. Benefits to the general public through hazard education programs to prepare for impacts.
3. Benefits for FEMA by reducing the number of properties on the Repetitive Loss and Severe Repetitive Loss Lists and subsequent flood insurance claims.
4. Cost for localities include retrofitting existing buildings and facilities, implementing advanced warning systems, maintenance of acquired hazard prone properties, installation of stormwater management practices, as well as deploying hazard education.
5. Costs for FEMA through expenditure of Hazard Mitigation Funds for home elevations and land acquisitions in flood prone areas.

Mitigation Strategy addresses the following hazards: hurricanes, ice storms, tornadoes, coastal flooding/nor'easters, coastal/shoreline erosion, sea level rise, snow storms, riverine flooding, wildfires, high winds/windstorms, dam failure, droughts, lightning, earthquakes, shrink0swell soils, extreme cold, extreme heat, land subsidence/karsts, landslides, tsunamis, volcanoes, air quality, HAZMAT, ditching flooding, and summer storms.

Goal 2: Improve community emergency management capabilities.

Objective 2.1: Improve the ability of the jurisdictional emergency managers to communicate with residents and businesses during and following natural hazard emergencies.

Objective 2.2: Improve communications between the emergency managers working in the Middle Peninsula jurisdictions and other nearby localities.

Strategy 2.2.1: Formalize mutual aid agreements to coordinate the region's fire and emergency medical units to ensure a quick and efficient response to these severe weather events.

Strategy 2.2.1 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**

3. **King and Queen County,**
4. **King William County,**
5. **Mathews County,**
6. **Middlesex County,**
7. **Town of Tappahannock, and**
8. **Town of West Point.**

With these little-notice storm events, time is of the essence with the ability to provide life-saving aid to as many residents as possible quickly after the severe storms strike. Currently there is a mutual aid agreement amongst participants of the Rappahannock Volunteer Fire Association, which includes the following Middle Peninsula volunteer fire and rescue departments: Gloucester Volunteer Fire and Rescue, King William Volunteer Fire Department, Lower Middlesex Volunteer Fire, Mathews Volunteer Fire Department, Tappahannock Volunteer Fire Department, Upper Middlesex Volunteer Fire Department, West Point Volunteer Fire and Rescue, Middlesex Volunteer Fire Department, Lower King and Queen Volunteer Fire Department, and Central King and Queen Volunteer Fire Department. While this in inclusive of some fire and rescue department within Middle Peninsula localities, this is not inclusive of all and therefore cannot be labeled as complete. Please note that this strategy focuses on creating mutual aid agreements at the County level.

Cost/Benefit Implications of Implementing Strategy 2.2.1

This strategy will have direct:

1. Benefits for local fire and rescue units since having formalized agreements in place will help to coordinate the dispatching of first response units as needed when there may be limited supply and high demand for assistance.
2. Benefits for local residents with coordinated emergency response services during these damaging and potentially life threatening natural hazards.
3. Costs to implement the mutual aid agreements should be minimal for the jurisdiction with the dedication of a small amount of emergency management and legal staff time.

Mitigation Strategy addresses the following hazards: hurricanes, ice storms, tornadoes, coastal flooding/nor'easters, coastal/shoreline erosion, sea level rise, snow storms, riverine flooding, wildfires, high winds/windstorms, dam failure, droughts, lightning, earthquakes, shrink/swell soils, extreme cold, extreme heat, land subsidence/karsts, landslides, tsunamis, volcanoes, air quality, HAZMAT, ditching flooding, and summer storms.

Strategy 2.2.2: Formalize mutual aid agreements to coordinate the region's fire units to ensure a quick and efficient response to wildfires.

Strategy 2.2.2 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King and Queen County,**
4. **King William County,**
5. **Mathews County,**
6. **Middlesex County,**
7. **Town of Tappahannock, and**
8. **Town of West Point.**

Since numerous wildfire sites can erupt in multiple locations when dry and windy conditions are present throughout the Middle Peninsula, a coordinated regional response by all of the fire departments serving the area is required to combat this natural hazard. Clearly written and uniform mutual aid agreements can insure a greater degree of a well coordinated regional response to this natural hazard.

Currently there is a mutual aid agreement amongst participants of the Rappahannock Volunteer Fire Association, which includes the following Middle Peninsula volunteer fire and rescue departments: Gloucester Volunteer Fire and Rescue, King William Volunteer Fire Department, Lower Middlesex Volunteer Fire, Mathews Volunteer Fire Department, Tappahannock Volunteer Fire Department, Upper Middlesex Volunteer Fire Department, West Point Volunteer Fire and Rescue, Middlesex Volunteer Fire Department, Lower King and Queen Volunteer Fire Department, and Central King and Queen Volunteer Fire Department. While this in inclusive of some fire and rescue department within Middle Peninsula localities, this is not inclusive of all and therefore cannot be labeled as complete. Please note that this strategy focuses on creating mutual aid agreements at the County level.

Cost/Benefit Implications of Implementing Strategy 2.2.2
This strategy will have direct:

1. Benefits for local and nearby fire units since having formalized agreements in place will help to coordinate the dispatching of first response units as needed when there may be a limited supply and a high demand for assistance during times of multiple wildfires.
2. Benefits the local residents with coordinated emergency response services during this damaging and potentially life threatening natural hazard.
3. Costs to implement the mutual aid agreements should be minimal for the jurisdiction's emergency management and legal staff.

Mitigation Strategy addresses the following hazards: wildfires.

Objective 2.3: Improve the ability of localities to communicate with the Virginia Emergency Operations Center during state and federally declared disasters.

Goal 3: Increase the public's awareness and educational level of their vulnerabilities to natural hazards.

Objective 3.1: Provide information to residents and businesses about the types of natural hazards that they may be exposed to, where they are likely to occur and what they can do to better prepare for them to avoid their adverse affects.

Strategy 3.1.2: Encourage private property owners to perform regular and routine maintenance of ditches and culverts in order to keep them free of debris, with a special emphasis on road sections where there are chronic flooding problems, including those listed earlier in the plan.

Strategy 3.1.2 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King and Queen County,**

4. **King William County,**
5. **Mathews County,**
6. **Middlesex County,**
7. **Town of Tappahannock,**
8. **Town of Urbanna, and**
9. **Town of West Point.**

As previous noted, there are many VDOT Secondary Roads that are inundated by flood waters during significant storm events. Oftentimes, the flooding occurs at low-lying section of these roads where the drainage pipes and ditches have been partially or completely blocked by vegetative debris.

Property owners with road frontage should be actively encouraged by local Emergency Management staff, by developing a proactive public information program, to keep ditch lines free of vegetative debris which would lessen the flooding at these stressed road crossings and better allow for vehicles to evacuate during severe storm events.

Cost/Benefit Implications of Implementing Strategy 3.1.2

This strategy will have direct:

1. Benefits for residents living in flood prone areas that will allow them safer evacuation and return routes during severe flooding events.
2. Costs for public information notifications via printed media, reverse 911 systems, County websites or e-mail messages.

Mitigation Strategy addresses the following hazards: ditching flooding, summer storms, coastal flooding/nor'easters, hurricanes, and sea level rise.

Strategy 3.1.3: Encourage the two power companies operating in the Middle Peninsula Region to maintain system components, including power line rights-of–way, to minimize interruptions of the electrical power grid for severe weather.

Strategy 3.1.3 will be undertaken in the following Middle Peninsula localities:

1. **Essex County**
2. **Gloucester County**
3. **King and Queen County,**
4. **King William County,**
5. **Mathews County,**
6. **Middlesex County,**
7. **Town of Tappahannock,**
8. **Town of Urbanna, and**
9. **Town of West Point.**

Local Emergency Service Coordinators will work closely with Community Relations/Education employees at Dominion/Virginia Power and Rappahannock Electric Cooperative to information and guidance to their customers about the importance of keeping trees and brush away from electric power lines on their property in order to decrease the possibility of storm damage to the power grid during severe rain/wind storm events.

Educational mailings, such as landscape design techniques as well as a list of plants to grow under power lines to promote attractive landscaping while protecting the power lines from damaging vegetative growth, could be developed by Dominion/Virginia Power and Rappahannock Electric Cooperative staff and mailed as insert with property owners' monthly electric bills.

Cost/Benefit Implications of Implementing Strategy 3.1.3

This strategy will have direct:

1. Benefits local residents with more reliable electric services during severe weather events.
2. Benefits power companies with lower maintenance and repair costs for their rights-of-way and power system equipment.
3. Costs to the 2 power companies to produce and disseminate educational materials to their customers.

Mitigation Strategy addresses the following hazards: hurricanes, ice storms, tornadoes, coastal flooding/nor'easters, coastal/shoreline erosion, snow storms, high winds/windstorms, earthquakes, and summer storms.

Strategy 3.1.4: Promote public education programs to ensure that property owners are fully informed about the flood hazards on the property that they own.

Strategy 3.1.4 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King and Queen County,**
4. **King William County,**
5. **Mathews County,**
6. **Middlesex County,**
7. **Town of Tappahannock,**
8. **Town of Urbanna, and**
9. **Town of West Point.**

Each local government will develop and post flood mitigation materials on the Emergency Services Section of their web-site. Posted information will include a list of the locality's mitigation strategies as well as technical information that the local property owners can use to help alleviate flood damage to their properties.

Cost/Benefit Implications of Implementing Strategy 3.1.4

This strategy will have direct:

1. Benefits local residents with property in the flood plain about measures they can take to lessen flood damages to their property.
2. Costs of dedicating emergency management and public information officer's staff time to developing and distributing mitigation information.

Mitigation Strategy addresses the following hazards: hurricanes, ice storms, coastal flooding/nor'easters, snow storms, sea level rise, riverine flooding, dam failure, ditch flooding, and summer storms.

Strategy 3.1.5: Develop a public education campaign for residents living in the 100-year floodplain, especially those living on FEMA's list of SRL and RL properties, listing methods for them to decrease flood damage including the availability of any FEMA grant funds for elevation or relocation projects.

Strategy 3.1.5 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King William County,**
4. **Mathews County,**
5. **Middlesex County,**
6. **Town of Tappahannock,**
7. **Town of Urbanna, and**
8. **Town of West Point.**

Technical information should specify design considerations for how to handle all household utility components in flood prone areas as well as breakaway walls and venting options that allow automatic entry and exit of flood waters.

Cost/Benefit Implications of Implementing Strategy 3.1.5
This strategy will have direct:

1. Benefits local residents with property in the flood plain about measures they can take to lessen flood damages to their property.
2. Costs of dedicating emergency management and public information officer's staff time to developing and distributing mitigation information.

Mitigation Strategy addresses the following hazards: hurricanes, ice storms, coastal flooding/nor'easters, sea level rise, riverine flooding, ditch flooding, and summer storms.

Strategy 3.1.6: Increase resident and emergency responder safety during severe winter ice storm events by developing a public education campaign to inform residents about the importance of keeping tree limbs away from their homes and electric lines.

Strategy 3.1.6 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King and Queen County,**
4. **King William County,**
5. **Mathews County,**
6. **Middlesex County,**
7. **Town of Tappahannock,**
8. **Town of Urbanna, and**
9. **Town of West Point.**

By decreasing the potential for structures to incur damage during ice storms, this will allow the structures to remain occupied thereby lessening the number of emergency responder calls to remove

occupants from damaged homes during times when roads are dangerous and/or impassable. Localities will work with utility companies within the region to educate the public.

Cost/Benefit Implications of Implementing Strategy 3.1.6
This strategy will have direct:

1. Benefits for local residents since they will be able to stay in their undamaged homes with electric lines in tact which will allow for quicker restoration of electric service after severe winter storms.
2. Benefits for first responders with fewer risky fire and rescue calls on ice covered roads during and after severe weather events.
3. Costs of dedicating emergency management and public information officer staff time to develop and distribute ice storm related mitigation information on the locality's website and other social media sites.

Mitigation Strategy addresses the following hazards: extreme cold, ice storms, and snow storms.

Strategy 3.1.7: Develop public information and inform property owners about the long range affects that sea level rise will have on low-lying property that they own.

Strategy 3.1.7 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King William County,**
4. **Mathews County,**
5. **Middlesex County,**
6. **Town of Urbanna, and**
7. **Town of West Point.**

The local governments noted above will provide information about the potential physical impacts of sea level rise on the Emergency Management Homepage of their jurisdictional web-site. Posted information will include areas in the locality that are expected to be affected, the time frame within which the impacts will be anticipated, the public infrastructure that may be impacted and what measures can be taken to mitigate future adverse impacts.

Cost/Benefit Implications of Implementing Strategy 3.1.7
This strategy will have direct:

1. Benefits for local residents with property located in low lying areas about measures they can take to lessen future damages from this natural hazard.
2. Benefits to local governments with reduced damages to both public infrastructure and private property.
3. Cost in staff time to assemble, post and update website information on the locality's Emergency Management Homepage about sea level rise.

Mitigation Strategy addresses the following hazards: sea level rise.

Strategy 3.1.8 Promote a public education program to ensure that property owners protect their property by decreasing flammable forest fuels surrounding homes located in wooded settings.

Strategy 3.1.8 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King and Queen County,**
4. **King William County,**
5. **Mathews County, and**
6. **Middlesex County.**

Each of these local governments will develop and post information about wildfire risks on the Emergency Management Homepage of their website. Posted information will include safety tips to minimize threats to homes/property that the Virginia Department of Forestry has developed as well as other existing wildfire reduction strategies that are available on related websites.

Mitigation Strategy addresses the following hazards: wildfires and drought.

Cost/Benefit Implications of Implementing Strategy 3.1.8

This strategy will have direct:

1. Benefits for local residents with property located in wooded areas to lessen the potential for fire damage to their homes and property.
2. Benefits to local and state fire responders with fewer calls to save structures and rescue residents in perilous situations.

Cost in staff time to assemble, post and update website information on the locality's Emergency Management Homepage.

Objective 3.2: Improve jurisdictional mapping capabilities to show the physical areas in their locality that may be affected by natural hazard events including storm surge areas from coastal storms.

Strategy 3.2.1: Incorporate the newly digitized local floodplain maps into each County's GIS database after adoption by the local governing body, to the extent possible.

Strategy 3.2.1 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **King and Queen County,**
3. **Mathews County,**
4. **Town of Tappahannock,**
5. **Town of Urbanna, and**
6. **Town of West Point.**

Each county's GIS technician/consultant will incorporate the digitized floodplain map data into their system when a GIS system becomes available to the locality.

County planning/zoning officials will ensure that this floodplain data is readily available to property owners so that they are aware of the 100-year flood boundaries on their land.

Cost/Benefit Implications of Implementing Strategy 3.2.1
This strategy will have direct:

1. Benefits of more accurate flood plain data that will enable local officials to better guide development in flood prone areas.
2. Benefits for better data to incorporate into locality Comprehensive Plan Updates. Costs of dedicating locality staff time in the GIS Department to incorporate the mapping products into the locality's IT system.

Strategy 3.2.2: When the Natural Hazards Mitigation Plan is updated in the future, complete:

1. **Refine and update data sets for GBS and essential facilities.**

Strategy 3.2.2 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King and Queen County,**
4. **King William County,**
5. **Mathews County,**
6. **Middlesex County,**
7. **Town of Tappahannock,**
8. **Town of Urbanna, and**
9. **Town of West Point.**

Cost/Benefit Implications of Implementing Strategy 3.2.2
This strategy will have direct:

1. Benefits to locality Zoning Administrators/Floodplain Managers/Building Officials with more precise costs when reviewing locality-wide mitigation projects and policies.
2. Costs to local government officials to contract with engineering firms to run HAZUS models since it is a more technically specific application than more localities in the Middle Peninsula can perform with their own staff capabilities.

Mitigation Strategy addresses the following hazards: hurricanes, ice storms, tornadoes, coastal flooding/nor'easters, coastal/shoreline erosion, sea level rise, snow storms, riverine flooding, wildfires, high winds/windstorms, dam failure, droughts, lightning, earthquakes, shrink/swell soils, extreme cold, extreme heat, land subsidence/karsts, landslides, tsunamis, volcanoes, air quality, HAZMAT, ditching flooding, and summer storms.

Goal 4: Ensure that the strategies developed in this plan are incorporated into other local planning documents, ordinances, policies and procedures.

Objective 4.1: Develop an Implementation Plan within the MPNHMP Update that identifies the locality employees/officials who will be responsible for implementing each strategy that they will undertake, the local regulatory tools that the jurisdiction will use to

implement the strategies, the resources that will be needed and the time frame within which the strategy will be completed.

Strategy 4.1.1: All Natural Hazards: Adopt an Implementation Plan that includes one or more of the following:

1. **Assigns locality officials/employees with the ability and authority to implement or cause to be implemented the mitigation strategies that they have agreed to in the update,**
2. **Determines a low, moderate and high priority for each strategy in the locality,**
3. **Establishes realistic timeframes for completing each strategy.**
4. **Appoints a natural hazard mitigation advisory committee to work with the Board of Supervisors, Planning Commission and Planning Staff to monitor progress on adopted strategies and to suggest additional mitigation strategies within the five year review period of the MPNHMP Update by 2016 and the update of the jurisdiction's next Comprehensive Plan.**
5. **Consider including the mitigation strategies in an Implementation Matrix as part of the jurisdiction's next Comprehensive Plan update.**
6. **Amend the locality's Zoning Ordinance and Subdivision Ordinance to include natural hazard mitigation strategies as they relate to land development requirements, policies and procedures.**
7. **Submit capital projects to the Planning Commission/Board of Supervisors for their consideration when they review the locality's Capital Improvement Program (CIP).**
8. **Seeks funding from various state and federal agencies for mitigation strategies that require an infusion of funds beyond what the jurisdiction can provide.**

Strategy 4.1.1 will be undertaken in the following Middle Peninsula localities:

1. **Essex County,**
2. **Gloucester County,**
3. **King William County,**
4. **Mathews County,**
5. **Middlesex County,**
6. **Town of Tappahannock,**
7. **Town of Urbanna, and**
8. **Town of West Point.**

Cost/Benefit Implications of Implementing Strategy 4.1.1

This strategy will have direct:

1. Benefits for the elected officials and locality staff since it gives them specific expectations with implementing the numerous strategies in the plan.
2. Costs to local governments have been kept within reason considering the limited financial resources and the many funding responsibilities that the rural Middle Peninsula jurisdictions face.

Mitigation Strategy addresses the following hazards: hurricanes, ice storms, tornadoes, coastal flooding/nor'easters, coastal/shoreline erosion, sea level rise, snow storms, riverine flooding, wildfires, high winds/windstorms, dam failure, droughts, lightning, earthquakes, shrink/swell soils, extreme cold, extreme heat, land subsidence/karsts, landslides, tsunamis, volcanoes, air quality, HAZMAT, ditching flooding, and summer storms.

Section 9 – Implementation Plan

Overview

The Steering Committee members assigned a **low, moderate or high priority** to each of the strategies that have been proposed to lessen the adverse impacts from natural hazards in their respective communities. These priority ratings were assigned after reviewing the evaluation criteria listed at the beginning of Section 8 as well as their historical insight and knowledge of how their jurisdiction operates.

Strategies that were assigned a **higher priority** are ones that the Steering Committee members determined that their localities could implement:

1. in a timely manner,
2. with limited financial and staff resources, and
3. would reduce or eliminate losses to public infrastructure or private structures that have a history of damage from natural causes.

Strategies that were assigned a **moderate priority** are ones that the Steering Committee members determined that their localities could implement:

1. with a greater commitment of staff time,
2. a higher level of financial support from the locality, and
3. would increase public safety for a significant number of residents.

Strategies that were assigned a **low priority** are ones that Steering Committee members determined would:

1. require assistance from agencies/organizations outside of the direct control of the local government, and
2. have a lower potential to reduce or eliminate direct losses from natural hazards.

Responsible Party

The local Emergency Services Coordinator/Emergency Manager (ESC/EM) will be the primary person responsible for implementing the strategies in this plan as adopted by their jurisdiction. The ESC/EM will need to work closely with the locality's Chief Administrative Officer (CAO) since many of the strategies will require Board of Supervisor or Town Council action.

Local governing body action will include implementation of new policies or ordinances as well as the possibility of amending some existing ones. In addition, the governing body will need to approve grant applications for FEMA Hazard Mitigation Funds and/or other funding sources.

The ESC/EM and CAO will need to work closely with the locality's Building, Planning and Zoning Department staff members as well as with FEMA and VDEM Disaster Mitigation staff in order to implement a successful and comprehensive natural hazards mitigation program.

Changes to the locality's zoning ordinance, comprehensive plan, building regulations and/or capital improvements programs can be anticipated. The CAO and ESC/EM in each locality will spearhead the effort to amend existing ordinances/polices or develop new ones to help implement mitigation strategies adopted for their locality in the MPAHMP update.

Communications

The ESC/EM will develop and implement their county-wide natural hazards mitigation outreach and public awareness campaigns using local media and other proven informational outlets in their locality – including their county websites that includes additional information about their Emergency Services Department.

Each locality's website will list and briefly describe all of the mitigation strategies that they have adopted in this plan and the timeframes by which they plan to implement them. Additionally, the website will include technical information and diagrams that residents can use to implement low-cost/low-tech construction measures to lessen potential future losses from natural hazards.

Table 110: Essex County - Locality Specific Plan of Action

Strategy	Priority	Responsible Party	Funding Source	Status	Comment
1.1.1	Moderate	Zoning	FEMA/land owners	By request	
1.1.2	Low	Building	Local	Yearly	
1.1.4					
1.1.5	High	BOS/VDOT	VDOT	In-progress	Should be completed in 2017
1.1.6	High	BOS/VDOT	VDOT	In-progress	Should be completed in 2017
1.1.9	High	Building/Zoning	Local	In-progress	
1.1.10	Low	Building	Local	Did not adopt	
1.1.11	High	Zoning	Local	On-going	
1.1.13	High	ESC/Planning	Local	In-progress	
1.1.15	High	Building/Wetlands	Local	In-progress	
1.1.19					
3.1.2	Moderate	ESC	n/a	On-going	
2.2.1	High	ESC	Local	In-progress	Currently participate in mutual aid, no formal MOU's
2.2.2	High	ESC	Local	In-progress	Currently participate in mutual aid, no formal MOU's
3.1.3	High	ESC/power co	n/a	In-progress	
3.1.5	Moderate	ESC	n/a		
3.1.6	High	ESC	n/a	Ongoing & In-progress	
3.1.7					
3.1.8	Low	ESC	n/a	Ongoing	
3.2.1	High	Planning	n/a	In-progress	
3.2.2	Low	ESC	n/a	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3. 2010 Census was not included in HAZUS.
4.1.1	High	ESC	Local	In-progress	Adopted a floodplain overlay district as a component of the County's zoning ordinance.

Table 111: Town of Tappahannock Locality Specific Plan of Action

Strategy	Priority	Responsible Party	Funding Source	Status	Comments
1.1.5	High	Town/County	VDOT	ASAP	Delayed because of VDOT
1.1.7	High	Town	VDOT	ASAP	Delayed because of VDOT
1.1.9	Low	Building/Zoning	Local	W/in 2 years	Delayed because of Essex County
1.1.10	Low	Building	Essex County	w/in 2 years	
1.1.11	Low	Zoning	Local	Not started	
1.1.15	Low	Building/Wetlands	Local	w/in 2 years	
1.1.19					
2.2.1	High	ESC	Local	In-progress	Currently participate in mutual aid, no formal MOU's
2.2.2	High	ESC	Local	In-progress	Currently participate in mutual aid, no formal MOU's
3.1.2	Moderate	ESC	n/a	On-going	
3.1.3	Moderate	ESC/power co	n/a	w/in 1 years	
3.1.5	Low	ESC	n/a	Not started	
3.1.6	Low	ESC	n/a	Not started	
3.2.1	High	Planning	n/a	w/in 2 years	
3.2.2	Low	ESC	n/a	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.
4.1.1	High	ESC	Local	On-going	Adopted a Floodplain overlay district as a component of the County's zoning ordinance

Table 112: Gloucester County Locality Specific Plan of Action.

Strategy	Priority	Status	Plan to complete this strategy	Responsible Party	Funding Source	Schedule
1.1.1	Moderate	On-going	Continued progress on the strategy as part of the Hazard Mitigation Management Team combined with our Floodplain Management Committee and Program Public Information.	Hazard Mitigation Management Team and Floodplain Management Committee and Program Public Information	FEMA /landowners	Strategy will be continual on an annual scheduled basis
1.1.2	Moderate	On-going	Same as above	Same as above	FEMA	Strategy will be continual on an annual scheduled basis
1.1.3	M	On-going	Same as above	Engineering and Building & Grounds Departments	Federal grant	Strategy will be continual on an annual scheduled basis
1.1.4	H	On-going	Same as above	Engineering and Building & Grounds Departments	FEMA	Strategy will be continual on an annual scheduled basis as grants are available.
1.1.5 (newly added strategy)	H	In-progress	Same as above	BOS/VDOT	VDOT	Strategy will be continual on an annual scheduled basis
1.1.6	H	On-going	Same as above	BOS/VDOT	VDOT	Strategy will be continual on an annual scheduled basis
1.1.7 (newly added strategy)	M	In-progress	Same as above	BOS/VDOT	VDOT	Strategy will be continual on an annual scheduled basis
1.1.8	M	On-going	Same as above	Building Inspections and Planning & Zoning Departments	Local	Strategy will be continual on a bi-annual scheduled basis
1.1.11	H	On-going	Same as above	Building Inspections and Planning & Zoning Departments	Local	Strategy will be continual on an annual scheduled basis
1.1.13	M	On-going	Same as above	BOS/ Environmental Programs /Extension Service	Local	Strategy will be continual on an annual scheduled basis and updated on a regular basis.
1.1.15	M	On-going	Continued progress on the strategy as part of the Hazard Mitigation Management Team combined with our Floodplain Management Committee and Program Public Information.	Wetlands Board Environmental Programs	Local	Strategy will be continual on an annual scheduled basis
1.1.18 (newly added strategy)	M	In-progress	Same as above	DIT / GIS	Local	Strategy will be continual on an annual scheduled basis
1.1.19 (newly added strategy)	M	In-progress	Same as above	BOS, Building Inspections, Planning & Zoning Departments, VDOT	Local	Strategy will be continual on an annual scheduled basis and revised when plans are reviewed

1.3.1	High	In-progress	Same as above	Emergency Management, Hazard Mitigation Management Team and Floodplain Management Committee, Building Inspections and Planning & Zoning Departments	Local	
2.2.1	High	In-progress	Same as above	Emergency Management	Local	Strategy will be continual on an annual scheduled basis
2.2.2	High	In-progress	Same as above	Emergency Management	Local	Strategy will be continual on an annual scheduled basis
3.1.2	M	On-going	Same as above	VDOT, Floodplain Management Committee and Program Public Information	VDOT & Local grants	Strategy will be continual on an annual scheduled basis and upgraded when VDOT make road improvements as approved by BOS.
3.1.3	Low	On-going	Same as above	Emergency Management, Hazard Mitigation Management Team and Floodplain Management Committee and Program Public Information	Dominion Power	Strategy will be continual on an annual scheduled basis as contract requires by Dominion Power.
3.1.4	Moderate	On-going	Same as above	Same as above	Program Public Information	Strategy will be continual on an annual scheduled basis
3.1.5	High	On-going	Same as above	Emergency Management, Hazard Mitigation Management Team and Floodplain Management Committee and Program Public Information	Program Public Information	Strategy will be continual on an annual scheduled basis and will apply for grants to fund PPI.
3.1.6	Moderate	On-going	Same as above	Emergency Management, Dominion Power	Dominion Power	Strategy will be continual on an annual scheduled basis
3.1.7	Low	On-going	Same as above	Middle Peninsula Planning District Commission	MP PDC	Strategy will be continual on an annual scheduled basis as part of PDC funding
3.1.8	Moderate	On-going	Same as above	Emergency Management, US Forestry Service, and Volunteer Fire Departments	USFS	Strategy will be continual on an annual scheduled basis and will seek grant opportunities.
3.2.2	Low	In-progress	Same as above	Middle Peninsula Planning District Commission	MP PDC	Strategy will be continual as the MPRHMP is scheduled for review 2016
4.1.1	High	In-progress	Same as above	Emergency Management and BOS	local	Strategy will be continual as the MPRHMP is scheduled for review 2016

Table 113: King and Queen County - Locality Specific Plan of Action

Strategy	Priority	Responsible Party	Funding Source	Status	Comments
1.1.6	Moderate	BOS/VDOT	VDOT	On-going	Route 17 at Parkers Marina completed and now open. Road was raised.
1.1.8	Moderate	Zoning	Local	Every 2-years	
1.1.9	Low	Building/Zoning	Local	Not Started	
1.1.10	Low	Building	VDOT	In-progress	Currently requires flood elevation certificates and looking to propose freeboard with the new maps in May of 2016
1.1.13	Moderate	ESC/Planning	VDOT	w/in 2-years	
1.1.15	Low	Building/Wetlands	Local	In-progress	VE zone properties will have high construction requirements once new maps are adopted and effective May of 2016
1.1.19					
1.2.1	Low	ESC/CAO	Local	On-going	
2.2.1	High	ESC	Local	On-going	Currently participate in mutual aid, no formal MOU's
2.2.2	High	ESC	Local	On-going	Currently participate in mutual aid, no formal MOU's
3.1.2	Moderate	ESC	n/a	Not Started	Roadways in VDOT system needs ditch cleanouts to prevent roadway flooding
3.1.3	Moderate	ESC/power co	n/a	In-Progress	REC does a great job of this
3.1.4	High	ESC	n/a	w/in 1 year	
3.1.6	Moderate	ESC	n/a	Not started	
3.1.8	Moderate	ESC	n/a	On-going	
3.2.1	Moderate	Planning/GIS	n/a	In-Progress	New maps to be adopted and effective may of 2016. GIS online to become available to the public Fall of 2015
3.2.2	Low	ESC	n/a	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.
4.1.1	High	ESC	Local	In-Progress	Adopted a floodplain overlay district as a component of the County's zoning ordinance.

Table 114: King William County - Locality Specific Plan of Action

Strategy	Priority	Responsible Party	Funding Source	Status	Comments
1.1.5	High	BOS/VDOT	VDOT		
1.1.6	Moderate	BOS/VDOT	VDOT	On-going	
1.1.12	Low	Zoning	Local		
1.1.13	Moderate	ESC/Planning	Local		
1.1.15	Low	Building/Wetlands	Local	On-going	
1.1.16	Moderate	Community Development	Local	Not Started	Delayed due to lack of funding
1.1.18	Low	GIS/Community Development	Local	On-going	GIS layer developed; Added stormwater BMP layer
1.1.19					
2.2.1	High	ESC	Local	On-going	Currently participate in mutual aid, no formal MOU's
2.2.2	High	ESC	Local	On-going	Currently participate in mutual aid, no formal MOU's
3.1.2	Moderate	ESC	n/a	Not started	
3.1.3	Moderate	ESC/power co	n/a	w/in 1 years	
3.1.4	Moderate	ESC	n/a	Not started	Very little development around flood plains
3.1.5				Not started	Very little development around flood plains
3.1.6	Low	ESC	n/a	w/in 2 years	
3.1.7					Threat level of sea rise limited in this community.
3.1.8	Moderate	ESC	n/a	Not started	
3.2.2	Low	ESC	n/a	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3. 2010 Census was not included in HAZUS.
4.1.1	High	ESC	Local	In-progress	Adopted a floodplain overlay district as a component of the County's zoning ordinance.

Table 115: Town of West Point - Locality Specific Plan of Action

Strategy	Priority	Responsible Party	Funding Source	Status	Comments
1.1.1	Moderate	Planning	FEMA/land owners	On-going	Waiting to hear from FEMA on application
1.1.2	High	Building	Local	Annually	
1.1.3	Moderate	HRSD	HRSD/Local	On-going	Relocated public works building to higher ground
1.1.9	Moderate	Building/Zoning	Local	Not started	
1.1.11	Moderate	Zoning	Local	Ongoing	Review of zone and building applications
1.1.15	Low	Building/Wetlands	Local	Not Started	
2.2.1	High	ESC	Local	On-going	Currently participate in mutual aid, no formal MOU's
2.2.2	High	ESC	Local	On-going	Currently participate in mutual aid, no formal MOU's
3.1.1	Moderate	ESC	King William	On-going	King William Dispatch has the capability of doing this for the Town if needed
3.1.3	Low	ESC/power co	n/a	Not started	
3.1.6	Moderate	ESC	Local	Not started	
3.1.7	Low	ESC	n/a	Not started	
3.2.1	High	Planning	n/a	On-going	Received new GIS information from FEMA, updated as received from FEMA
3.2.2	Low	ESC	Local	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.
4.1.1	High	ESC	Local	In-progress	Adopted a Floodplain overlay district as a component of the County's zoning ordinance

Table 116. Mathews County - Locality Specific Plan of Action					
Strategy	**Priority**	**Responsible Party**	**Funding Source**	**Status**	**Comments**
1.1.1	High	Zoning	FEMA/land owners	In-progress/ ongoing	Four FEMA HMGP grants were awarded to the County for the elevation of houses for thirty-four repetitive loss properties and acquisition of three properties. The elevations and acquisitions in these four grants are in progress and are expected to be completed in 2017. Another FEMA HMGP grant for one severe repetitive loss property was used to elevate the house in 2014.
1.1.2	Low	Public Works	Local	Not started	Delayed because of lack of funding
1.1.3	Moderate	Public Works	Local	Not started	Delayed because of lack of funding
1.1.4	High	Town/County	VDOT	In-progress/ ongoing	FEMA HMGP funds have been used to acquire one repetitive loss property. Two others are in the process of being acquired
1.1.6	Low	Town	VDOT	Not started	Delayed because of lack of VDOT funding
1.1.9	Low	Building/Zoning	Local	Not started	Delayed because of lack of staff to apply for inclusion and ongoing participation in the CRS Program.
1.1.10	High	Building	Essex County	Delayed	Increased elevation requirements proposed for updated floodplain management ordinance, but not adopted. Potential to be addressed in the future.
1.1.11	High	Zoning	Local	In-progress/ ongoing	County's Building Official is enforcing adopted Floodplain Management Ordinance. Zoning amendments will be considered by the Planning Commission to address recurrent flooding after the five-year review of the Comprehensive Plan.
1.1.13	Low	Building/Wetlands	Local	Not started	No request has been made to the NRCS or Tidewater Soil and Water Conservation District for an inventory of farm pond dams.
1.1.15	Moderate	Building/Wetlands	Local	In-progress/ ongoing	The County's Wetlands Projects Coordinator and the Wetlands Board are promoting "Living Shorelines" as a shoreline erosion control method to property owners by utilizing information provided by VIMS and VMRC.

2.2.1	High	ESC	Local	On-going	Currently participate in mutual aid, no formal MOU's
2.2.2	High	ESC	Local	On-going	Currently participate in mutual aid, no formal MOU's
3.1.2	Moderate	ESC	n/a	In-progress/ ongoing	The County encourages property owners to participate in its Outfall Ditch Maintenance Program. Local VDOT maintenance crews periodically clean ditches in their right-of-way. A Ditching Committee comprised of County residents was also formed to address this problem.
3.1.3	Low	ESC/power co	n/a	Not started	No request has been made to Dominion Power for information and guidance about the importance of keeping trees and brush away from power lines.
3.1.4	High	ESC	n/a	In-progress/ ongoing	The County's Building Official regularly posts information on the County's website regarding flood hazards.
3.1.5	High	ESC	n/a	In-progress/ ongoing	The County's Building Official and the Department of Planning & Zoning inform residents about FEMA HMGP grants to elevate their houses or acquire properties. Also, the Building Official, along with a local contractor, has conducted a meeting for residents regarding the steps involved in elevating a house.
3.1.6	Low	ESC	n/a	Not started	Delayed because of lack of staff
3.1.7	High	ESC	local	In-progress/ ongoing	Department of Planning & Zoning staff provided this information to residents when the Comprehensive Plan was updated in 2010. On-going information has been provided to the Planning Commission regarding this topic in advance of the five-year review of the Comprehensive Plan.
3.1.8	Low	Public Works	Local	Not started	Delayed because of lack of staff
3.2.2	Low	ESC	n/a	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new asymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.

Table 117: Middlesex County - Locality Specific Plan of Action

Strategy	Priority	Responsible Party	Funding Source	Status	Comments
1.1.1	High	Zoning	FEMA/land owners	On-going	Managed by Staff on an on-going basis
1.1.2	Low	Building	Local	Not Started	Delayed because lack of staff; any concerns are forwarded to VDOT
1.1.6	Low	BOS/VDOT	VDOT	On-going	Managed by VDOT
1.1.8	High	Zoning	VDOT	On-going	Active program; Ordinance recently readopted
1.1.9	Low	Building/Zoning	Local	Not Started	Delayed because lack of staff
1.1.11	High	Zoning	Local	On-going	Managed by staff on an on-going basis
1.1.13	Moderate	ESC/Planning		On-going	Coordinate with USDA Staff when required
1.1.15	High	Building/Wetlands	Local	On-going	Managed by Staff on an on-going basis
1.2.1	Low	ESC/CAO	Local	Not Started	
2.2.1	High	ESC	Local	On-going	Currently participate in mutual aid, no formal MOU's
2.2.2	High	ESC	Local	On-going	Currently participate in mutual aid, no formal MOU's
3.1.2	Low	ESC	n/a	On-going	This occurs as needed
3.1.3	Moderate	ESC/power co	n/a	On-going	Managed by Staff on an as needed basis
3.1.4	High	ESC	n/a	On-going	Managed by staff during public education deliveries
3.1.5	Low	ESC	n/a	On-going	This occurs as requested
3.1.6	High	ESC	n/a	On-going	Managed by staff during public education deliveries
3.1.7	Low	ESC	Local	Not Started	Reactionary only
3.1.8	High	ESC	n/a	On-going	Managed by Staff during public education deliveries
3.2.2	Low	ESC	n/a	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.
4.1.1	High	ESC	Local	In-progress	Adopted a floodplain overlay district as a component of the County's zoning ordinance.

Table 118: Town of Urbanna - Locality Specific Plan of Action

Strategy	Priority	Responsible Party	Funding Source	Status	Comments
1.1.1	High	Zoning	FEMA/land owners	On-going	Greatly increased freeboard requirements in new floodplain ordinance beyond minimum requirement.
1.1.2	High	Building	Local	On-going	
1.1.9	Moderate	Building/Zoning	VDOT	Not Started	
1.1.11	High	Zoning	Local	On-going	Enforcement of all floodplain/zoning/building regulations in flood zones is actively pursued on an on-going basis.
1.1.14	Moderate			Delayed	
1.1.15	High	Building/Wetlands	Local	On-going	Conducted jointly with Middlesex County
2.2.1	High	ESC	Local	On-going	Currently participate in mutual aid, no formal MOU's
2.2.2	High	ESC	Local	On-going	Currently participate in mutual aid, no formal MOU's
3.1.2	Low	ESC	n/a	On-going	Educational materials periodically placed on web site to encourage maintenance.
3.1.3	Low	ESC/power co	n/a	On-going	Town encourages Dominion line maintenance at every opportunity.
3.1.6	Low	ESC	n/a	Delayed	Manpower constraints
3.1.7	Moderate	ESC	Local	In-progress	Materials are being developed for distribution
3.2.1	Moderate	Zoning/GIS	n/a	n/a	See Middlesex County
3.2.2	Low	ESC	n/a	In-progress	1.HAZUS flood runs for the 1 square mile threshold was completed in the 2015 HAZUS completed by Dewberry 2. During the 2015 HAZUS completed by Dewberry the newest version of HAZUS software (version 2.2) which consisted of new dasymetric Census data (ie. general building stock). 3.2010 Census was not included in HAZUS.
4.1.1	High	ESC	Local	In-progress	Adopted a Floodplain overlay district as a component of the County's zoning ordinance

Local Plan Coordination and Integration

During this update the AHMP Steering added strategy 1.1.19 that focuses on integrating mitigation strategies into locality plans, policies, codes and programs across disciplines and departments. While this is a new strategy, Middle Peninsula localities have already been working toward this goal:

Essex County has developed zoning, subdivision, and floodplain ordinances that effectively reduce hazard impacts. Additionally they have adopted flood insurance rate maps and they have acquired land for open space and public recreation uses that assist in reducing hazard impacts.

Gloucester County is currently developing a Continuity of Operations Plan and has developed zoning, subdivision, floodplain, and natural hazard specific ordinances that effectively reduce hazard impacts. Additionally they have adopted flood insurance rate maps and they have acquired land for open space and public recreation. The County has referenced the AHMP in the Comprehensive Plan, Floodplain Management Plan as well as the Open Space Management Plan. In conjunction with County plans, they have also adopted ordinances (zoning, subdivision, floodplain, and natural hazard) as well as flood insurance rate maps and have acquired land for open space and public recreates uses that assist in reducing hazard impacts.

King and Queen County has developed zoning, subdivision, floodplain, and natural hazard specific (ie. stormwater) ordinances that effectively reduce hazard impacts. Additionally they have adopted flood insurance rate maps and they have acquired land for open space and public recreation (ie. conservation easements and Department of Forestry public forests) uses that assist in reducing hazard impacts.

King William County has included references to hazard mitigation in a variety of plans including the County Comprehensive Plan and the Local emergency Operations Plan. Additionally King William County adopted ordinances (zoning, subdivision, floodplain, and natural hazard) as well as flood insurance rate maps that assist in reducing hazard impacts. For more information visit

Mathews County adopted their Comprehensive Plan 2030 in January 2011 that includes a chapter on hazard mitigation. Other plans that address hazards include the Capital Improvements Plan (Adopted in 2014), Local Emergency Operations Plan (Adopted December 20, 2011), and the Transportation Plan. Additionally Mathews County adopted ordinances (zoning, subdivision, floodplain, and natural hazard) as well as flood insurance rate maps and acquired land for open space through FEMA HMGP grant funding that assist in reducing hazard impacts.

Middlesex County has developed zoning, subdivision, and floodplain ordinances that effectively reduce hazard impacts. Additionally they have adopted flood insurance rate maps to assist in reducing hazard impacts.

In conjunction with integrating hazards and mitigation into local policies and plans, Middle Peninsula localities are interested in public involvement and several localities have specifically identified additional public participation steps above the required steps to explore over the next five years:

- King William County- The County has established an All-Hazards Emergency Planning Committee to insure that the public is involved.

- Gloucester County- The public will be involved with natural hazard planning through the Local Emergency Planning Committee (LEPC) and the Floodplain Management Committee (FMC). Both of these groups are open to the public and speak to hazard identification and mitigation strategies. Copies of The Plan will be made available at both County Public Libraries.

- Tappahannock County- Monthly Town Council meetings

- Mathews County- County will, from time to time, include pertinent information and opportunities for input on our website www.mathewscountyva.gov.

- King and Queen County- Copies of The Plan will be made available at the Public Library. Comments from the public will be encouraged with a submission procedure outlined. The plan will be discussed at open public Board of Supervisors meetings when up for review. References to the Plan will be on the County's future Emergency Services Web Page

While the localities make an effort to engage and educate the public on hazards and mitigation, Gloucester and Mathews County school districts have participated in the Climate Education for a Changing Bay (CECB) program hosted by the Chesapeake Bay National Estuarine Research Reserve in Virginia (CBNERR). This is an effort to strengthen the public's and K-12 students' environmental literacy to enable informed decision-making necessary for community resilience to extreme weather events and other environmental hazard. Participating students and teachers are equipped with the knowledge and materials needed to increase their climate literacy. Climate literate people understand the essential principles of Earth's climate system, including sea level rise, know how to assess scientifically credible information, communicate about climate, and make informed and responsible decisions to actions that may affect climate. Community members need to understand the climate system in order to apply that knowledge in their careers and in their engagement as active members of society, creating a resilient community. In the future, CBNERR will introduce this curriculum to King and Queen County, Middlesex County, and West Point as well as have students collect locally relevant data that will be shared with community members through the next Middle Peninsula All Hazards Mitigation Plan.

Section 10 - Plan Adoption

Each of the 9 localities participating in the MPAHMP update held a public informational session during one of their regularly scheduled local governing board/council meetings.

Subsequent to these informational sessions, the 9 governing bodies adopted the MPNHMP update by resolution on the dates noted below:

Locality	Date of Adoption
Essex County	Once FEMA approves the plan, the County will bring the plan to the BOS for adoption. Date will be updated.
Town of Tappahannock	Once FEMA approves the plan, the County will bring the plan to the Town Council for adoption. Date will be updated.
Gloucester County	Once FEMA approves the plan, the County will bring the plan to the BOS for adoption. Date will be updated.
King and Queen County	Once FEMA approves the plan, the County will bring the plan to the BOS for adoption.
King William County	Once FEMA approves the plan, the County will bring the plan to the BOS for adoption. Date will be updated.
Town of West Point	Once FEMA approves the plan, the County will bring the plan to the Town Council for adoption. Date will be updated.
Mathews	Once FEMA approves the plan, the County will bring the plan to the BOS for adoption. Date will be updated.
Middlesex County	Once FEMA approves the plan, the County will bring the plan to the BOS for adoption. Date will be updated.
Town of Urbanna	Once FEMA approves the plan, the County will bring the plan to the Town Council for adoption. Date will be updated.

Copies of meeting minutes from Board of Supervisors/ Town Council meetings relevant to the All Hazards Mitigation Plan will be included in Appendix O. Copies of resolutions adopting the MPAHMP Update from each of the localities will also be included in Appendix O.

Section 11 - Plan Maintenance

The monitoring, evaluating, and updating of this plan shall be done on an annual basis and shall be the responsibility of the locality's Emergency Services Coordinator/Emergency Manager (ESC/EM), with the assistance of the Chief Executive Officer - the County Administrator or Town Manager. In some of the Middle Peninsula localities, these two positions are held by the Chief Executive Officer.

The first annual evaluation of the MPAHMP update by localities will be completed on the 1-year anniversary date after FEMA's approval of the plan. For consistency purposes, the same evaluation spreadsheet tool will be used by all of the Middle Peninsula localities and the focus of the evaluation will be on what strategies/projects have been completed, obstacles that have been encountered and new-mini-strategies that are being proposed to overcome the identified obstacles. See Appendix P for a sample of the spreadsheet.

A Regional Planner at the MPPDC will be available to coordinate the annual evaluation process of the updated MPAHMP at the request of the 9 member jurisdictions. The Planner will work with Steering Committee Members, who actively participated in the development of the AHMP. As these committee members are the most knowledgeable from their locality regarding mitigation projects, they will be able to provide the most up-to-date information from their jurisdiction.

The Regional Planner will assist Middle Peninsula localities with the annual evaluation process in the following ways:

1. Distribute an evaluation spreadsheet tool to each ESC/EM approximately one month before the annual anniversary date of the plan. Each ESC/EM will receive the spreadsheet that lists their locality-specific mitigation strategies.
2. Collate and edit the completed evaluation spreadsheets returned to MPPDC after the Steering Committee Members have solicited input from residents in their community who have benefitted from flood mitigation projects as well as co-workers and outside agencies that have undertaken mitigation projects. More specifically, over the next 5-year cycle the MPAHMP will remain posted on the MPPDC website (www.mppdc.com) and will be available at the MPPDC office in Saluda to provide an opportunity for the public to continually review and provide feedback on the Plan.
3. Convene a meeting of the Steering Committee Members to go over their evaluations before submittal to FEMA/VDEM.
4. Develop goals and mini-strategies to be accomplished in the next year for their mitigation programs.
5. Provide FEMA/VDEM with a written evaluation report of progress/obstacles/opportunities in implementing the mitigation strategies in the plan.
6. Identify possible future revisions to the plan and notify FEMA/VDEM in writing of any proposed revisions.
7. Provide follow-up assistance as requested by Steering Committee Members with strategy implementation.

The 2021 MPAHMP Update

Due to the limited jurisdictional staff and funds it can be anticipated that the 9 Middle Peninsula localities will once again undertake the 2021 update as a regional planning project. It can also be anticipated that MPPDC participating localities will ask MPPDC staff to seek funding from FEMA for this joint project. With or without partial FEMA grant funding, the update will be undertaken and completed within the 5-year mandated federal requirement.