5.1 METHODOLOGY AND TOOLS

2020 HMP Changes

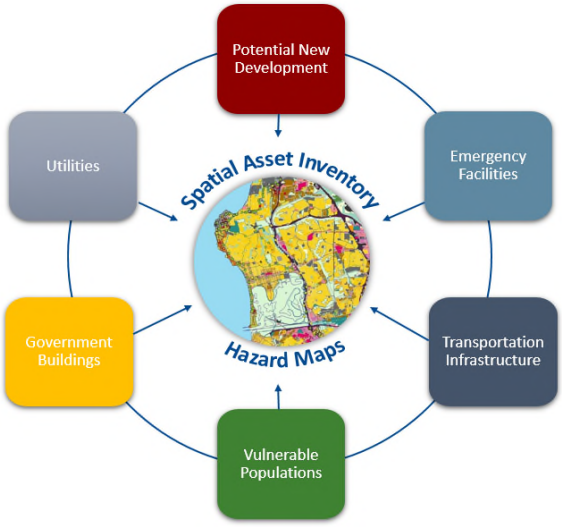
The risk assessment was updated using best available information.

- Hazard events and associated impacts were researched and summarized from 2013 to 2020.
- 2014-2018 American Community Survey 5-year estimates were utilized.
- The General Building Stock was updated with building footprints from the Suffolk County Planning Committee, the Town of East Hampton, and supplemented with the Microsoft Bing 2018 footprint dataset and 2019 Open Street Map dataset. Updated parcels were used from the 2019 New York State Public Parcel dataset created by NYS Office of Information Technology Services GIS Program Office (GPO), NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS), and provided by the following jurisdictions: the Town of Babylon, Town of East Hampton, Town of Huntington, Town of Islip, Town of Shelter Island, Town of Smithtown, Town of Southampton. Further, RS Means 2019 values were used to estimate replacement cost value for each building.
- The 2014 HMP critical facility was reviewed and updated by the Planning Partnership and County jurisdictions.
- Lifelines were identified in the critical facility inventory to align with FEMA's lifeline definition.
- HAZUS-MH v4.2 was used to estimate potential impacts to the flood, wind and seismic hazards.
- Best available hazard data was used as described in this section.

The following summarizes the asset inventories, methodology and tools used to support the risk assessment process.

5.1.1 Asset Inventories

Suffolk County assets were identified to assess potential exposure and loss associated with the hazards of concern. For the HMP update, Suffolk County assessed exposure and vulnerability of the following types of assets: population, buildings and critical facilities/infrastructure, new development, and the environment. Some assets may be more vulnerable because of their physical characteristics or socioeconomic uses. To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual personal or public properties.



The risk assessment included the collection and use of an expanded and enhanced asset inventory to estimate hazard exposure and vulnerability.

Population

Total population statistics from the 2014-2018 American Community Survey 5-year estimate were used to estimate the exposure and potential impacts to the County's population in place of the 2010 U.S. Census block estimates. Population counts at the jurisdictional level and by the two Tribal Nations were averaged among the residential structures in the County to estimate the population at the structure level. This estimate is

a more precise distribution of population across the County compared to only using the Census block or Census tract boundaries. Limitations of these analyses are recognized, and thus the results are used only to provide a general estimate for planning purposes.

As discussed in Section 4 (County Profile), research has shown that some populations are at greater risk from hazard events because of decreased resources or physical abilities. Vulnerable populations in Suffolk County included in the risk assessment are children, elderly, population below the poverty level, non-English speaking individuals, and persons institutionalized with a disability.

Buildings

The building stock inventory was updated using the 2006 building footprint data provided by the County, updated footprints provided by the Town of East Hampton and the Microsoft Bing 2018 footprint dataset and 2019 Open Street Map dataset was utilized to supplement any gaps that existed. To further assist, parcels from the 2019 NYS GIS Program Office and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS) and from the Town of Babylon, Town of East Hampton, Town of Huntington, Town of Islip, Town of Shelter Island, Town of Smithtown, and Town of Southampton were used. Attributes provided in the spatial files were used to further define each structure in terms of occupancy class, construction type, year built, foundation type, etc. Default information was used to fill in the gaps for buildings that could not be assigned attributes from the assessor's data or from the data provided by the County and jurisdictions or the NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS). The centroid of each building footprint was used to estimate the building location. If a building footprint was not located due to limited spatial data, parcels that had assessor's information supporting the presence of a building were given a centroid to represent the location of a structure. Structural and content replacement cost values (RCV) were calculated for each building utilizing available assessor data and RS Means 2019 values; a regional location factor for Suffolk County was applied (1.7 for all structure types). Replacement cost value is the current cost of returning an asset to its pre-damaged condition, using present-day cost of labor and materials. Total replacement cost value consists of both the structural cost to replace a building and the estimate value of contents of a building. The occupancy classes available in HAZUS-MH v4.2 were condensed into the following categories (residential, commercial, industrial, agricultural, religious, governmental, and educational) to facilitate the analysis and the presentation of results. Residential loss estimates address both multi-family and single-family dwellings.

Critical Facilities and Lifelines

> *A **lifeline** provides indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security (FEMA).*

The 2014 HMP critical facility inventory, which includes essential facilities, utilities, transportation features and user-defined facilities was updated by the Planning Partnership. The update involved a review for accuracy, additions or deletions of new/moved critical assets, identification of backup power for each asset (if known) and whether the critical facility is considered a lifeline in accordance with FEMA's definition; refer to Appendix E (Risk Assessment Supplement). To protect individual privacy and the security of assets, information is presented in aggregate, without details about specific individual properties or facilities.

Environment and Land Use Area

National land use land cover data created by the U.S. Geological Survey (USGS) in 2016 was used to assess land use characteristics of the County. This dataset was converted from a raster to a vector polygon, which informed spatial areas of residential, non-residential, and natural land use areas. Residential land-use types incorporated all classes listed as developed land use, except for those identified as vacant (i.e., Developed – Low Intensity, Developed – Medium Intensity, Developed – High Intensity). Non-residential land-use types included

all other classes. Within non-residential land-use types, natural land areas were extracted into a new category, which includes barren land, forest, water, and wetlands. The natural land areas were referenced to calculate the total acres of natural land area exposed to hazard areas of concern.

Furthermore, occupancy classes of parcels in the County were used to calculate the number of acres of assessed developed residential and non-residential land exposed to the hazard areas of concern. Parcels were assigned general occupancies based on the occupancy class of buildings that intersect the parcel area. Non-residential parcels include developed land used for commercial, industrial, government, education, religion, and education. Residential parcels include developed land used for single and multi-family housing.

New Development

In addition to assessing the vulnerability of the built environment, Suffolk County examined recent development over the last 5 years and anticipated new development in the next 5 years. Each jurisdiction was asked to provide a list by parcel ID or address of major development that has taken place within these timeframes. Furthermore, the Suffolk County Coastal Resilience Initiative (SCCRI) proposed project locations from the sanitation district polygon layer was assessed as new development for the County. New development tabular data that was provided by Suffolk County was summarized by project name and were spatially mapped.

New development was separated by anticipated in the next five years, recently developed over the last five years, and coastal resilience projects. An exposure analysis was conducted in GIS to determine hazard exposure to these development sites. Jurisdictions that provided projects with multiple parcels or addresses were assessed as one unit, so if one parcel or address within the project boundary intersected a spatial hazard layer, the entire project was considered 'exposed' to the hazard area of concern.

Identifying these changes and integrating new development into the risk assessment provides communities information to consider when developing the mitigation strategy to reduce these vulnerabilities in the future (one tool in the Mitigation Toolbox discussed in Section 6 – Mitigation Strategy). The identified new development is listed in Section 4 (County Profile) and hazard exposure analysis results are presented in Section 9 (Jurisdictional Annexes) as a table in each annex.

5.1.2 Methodology

To address the requirements of the DMA 2000 and better understand potential vulnerability and losses associated with hazards of concern, Suffolk County used standardized tools, combined with local, state, and federal data and expertise to conduct the risk assessment. Three different levels of analysis were used depending upon the data available for each hazard as described below. Table 5.1-1 summarizes the type of analysis conducted by hazard of concern.

1. **Historic Occurrences and Qualitative Analysis** – This analysis includes an examination of historic impacts to understand potential impacts of future events of similar size. In addition, potential impacts and losses are discussed qualitatively using best available data and professional judgement.
2. **Exposure Assessment** – This analysis involves overlaying available spatial hazard layers, or hazards with defined extent and locations, with assets in GIS to determine which assets are located in the impact area of the hazard. The analysis highlights which assets are located in the hazard area and may incur future impacts.
3. **Loss estimation** — The FEMA HAZUS modeling software was used to estimate potential losses for the following hazards: flood, earthquake, hurricane. In addition, an examination of historic impacts and an exposure assessment was conducted for these spatially-delineated hazards.

Table 5.1-1. Summary of Risk Assessment Analyses

Hazard	Population	General Building Stock	Critical Facilities	New Development
Coastal Erosion	E	E	E	E
Cyber Security	Q	Q	Q	Q
Disease Outbreak	Q	Q	Q	Q
Drought	Q	Q	Q	Q
Earthquake	E, H	E, H	E, H	E
Expansive Soils	E	E	E	E
Extreme Temperature	Q	Q	Q	Q
Flood	E, H	E, H	E, H	E
Groundwater Contamination	Q	Q	Q	Q
Hurricane	E, H	E, H	E, H	E
Infestation and Invasive Species	Q	Q	Q	Q
Nor'Easter	Q	Q	Q	Q
Severe Storm	Q	Q	Q	Q
Severe Winter Storm	Q	Q	Q	Q
Shallow Groundwater Flooding	E	E	E	E
Wildfire	E	E	E	E

E – Exposure analysis; H – HAZUS analysis; Q – Qualitative analysis

Hazards U.S. – Multi-Hazard (HAZUS-MH)

In 1997, FEMA developed a standardized model for estimating losses caused by earthquakes, known as Hazards U.S. or HAZUS. HAZUS was developed in response to the need for more effective national-, state-, and community-level planning and the need to identify areas that face the highest risk and potential for loss. HAZUS was expanded into a multi-hazard methodology, HAZUS-MH with new models for estimating potential losses from wind (hurricanes) and flood (riverine and coastal) hazards. HAZUS-MH is a Geographic Information System (GIS)-based software tool that applies engineering and scientific risk calculations, which have been developed by hazard and information technology experts, to provide defensible damage and loss estimates. These methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards. The GIS framework also supports the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

HAZUS-MH uses GIS technology to produce detailed maps and analytical reports that estimate a community's direct physical damage to building stock, critical facilities, transportation systems and utility systems. To generate this information, HAZUS-MH uses default HAZUS-MH provided data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. Damage reports can include induced damage (inundation, fire, threats posed by hazardous materials and debris) and direct economic and social losses (casualties, shelter requirements, and economic impact) depending on the hazard and available local data. HAZUS-MH's open data architecture can be used to manage community GIS data in a central location. The use of this software also promotes consistency of data output now and in the future and standardization of data collection and storage. More information on HAZUS-MH is available at http://www.fema.gov/hazus.

In general, modeled losses were estimated in the program using user-defined flood depth grids for the flood analysis and probabilistic analyses were performed to develop expected/estimated distribution of losses (mean return period losses) for hurricane wind and seismic hazards. The probabilistic model generates estimated

damages and losses for specified return periods (e.g., 100- and 500-year). Table 5.1-2 displays the various levels of analyses that can be conducted using the HAZUS-MH software.

Table 5.1-2. Summary of HAZUS-MH Analysis Levels

HAZUS-MH Analysis Levels	
Level 1	HAZUS-MH provided hazard and inventory data with minimal outside data collection or mapping.
Level 2	Analysis involves augmenting the HAZUS-MH provided hazard and inventory data with more recent or detailed data for the study region, referred to as "local data"
Level 3	Analysis involves adjusting the built-in loss estimation models used for the hazard loss analyses. This Level is typical done in conjunction with the use of local data.

Coastal Erosion

Best available data was used to assess Suffolk County's vulnerability to coastal erosion. To help understand the geographic distribution of coastal risk, the New York Department of State prepared coastal and riverine risk assessment layers with assistance from the National Oceanic and Atmospheric Administration Coastal Services Center (NOAA-CSC) and FEMA were used. Coastal risk assessment areas have been identified for Nassau, Suffolk, and Westchester Counties and the New York City boroughs (NYSDOS, 2013).

The coastal risk assessment areas depict the full spectrum of coastal risk, from relatively frequent events to infrequent large storms or future changes in water levels. Risk assessment mapping uses the best currently available science and data sources to identify areas at risk from flooding, erosion, and storm surge as well as potential effects from sea level rise. As Hurricane Sandy demonstrated, areas well inland can be affected, so risk assessment mapping included sources such as the FEMA 1% and 0.2% annual risk ("100-year" and "500-year" events, respectively) flood zone and the National Hurricane Center's Sea, Lake, and Overland Surges from Hurricanes (SLOSH) zones. The risk assessment maps generated in this HMP are intended for planning purposes only. These maps can be used in conjunction with other planning tools, maps, and resources and should not be substituted for the regulatory FEMA Digital Flood Insurance Rate Maps (DFIRMs) or other associated boundaries (NYSDOS, 2013).

There are three coastal risk areas identified: extreme, high and moderate. These risk areas do not overlap each other, and do not result in cumulative results. For example, if a critical facility is in the moderate risk area, it is not also in the high risk area. More detailed definitions of the three risk areas are described below.

Extreme Risk Areas: The extreme risk areas are currently at risk of frequent inundation, vulnerable to erosion in the next 40 years, or likely to be inundated in the future due to sea level rise. In summary, these areas depict the maximum extent of the following areas:

- FEMA V zone: According to FEMA and the National Flood Insurance Program, any building located in an A or V zone is considered to be in a Special Flood Hazard Area (SFHA) and is lower than the base flood elevation. V zones are the most hazardous of the SFHAs. V zones generally include the first row of beachfront properties.
- Areas subject to Shallow Coastal Flooding per NOAA NWS's advisory threshold.
- Areas prone to erosion, natural protective feature areas susceptible to erosion.
- Added 3 feet to the MHHW shoreline and extended this elevation inland over the digital elevation model (DEM) to point of intersection with ground surface.

High Risk Areas: The high-risk areas are outside the extreme risk area that are currently at infrequent risk of inundation or at future risk from sea level rise. In summary these areas depict the maximum extent of following areas upland of the boundary of the extreme risk area:

- Area bounded by the 1% annual flood risk zone (FEMA V and A zones).
- Added 3 feet to NOAA NWS coastal flooding advisory threshold and extended this elevation inland over the DEM to point of intersection with ground surface.

Moderate Risk Areas: The moderate risk areas are outside the extreme and high-risk areas but currently at moderate risk of inundation from infrequent events or at risk in the future from sea level rise. In summary, these areas depict the maximum extent of the following areas upland of the boundary of the high-risk area.

- Area bounded by the 0.2% annual risk (500 year) flood zone, where available.
- Added 3 feet to the Base Flood Elevation for the current 1% annual risk flood event and extended this elevation inland over the DEM to point of intersection with ground surface.
- Area bounded by SLOSH category 3 hurricane inundation zone (NYSDOS, 2013).

Additionally, 2007 Coastal Erosion Hazard Area (CEHA) data provided by NYSDEC (CEHA line and the 1,000-foot seaward buffer) was examined using updated building stock data. Although the average rate of recession is not defined for Suffolk County, the buffered area of the CEHA data is incorporated into the coastal erosion risk assessment for the County. It should be noted that there are limitations with the application of this data set for assessing vulnerability. Coastal erosion is generally a hyper localized hazard dependent on the specific dynamics of a location. For example, the data does not account for coastal erosion hazards for bay-front communities like the Village of Bellport, because the data does not cover areas that are not adjacent to the Atlantic Ocean or Long Island Sound.

Cyber Security

All of Suffolk County is exposed to cyber security attack events. A qualitative assessment was conducted to assess Suffolk County's risk to cyber security attacks. Information from the U.S. Department of Homeland Security, FEMA, NYS Department of Financial Services, and the 2017 Annual Report published by the Suffolk County Planning Commission was referenced to review the County's overall risk.

Disease Outbreak

Disease outbreak is a new hazard of concern for Suffolk County. All of Suffolk County is exposed to disease outbreak events. A qualitative assessment was conducted for the disease outbreak hazard. Research from the Centers for Disease Control and Prevention was utilized to qualitatively assess the most recent COVID-19 pandemic.

Drought

To assess the vulnerability of Suffolk County to drought and its associated impacts, a qualitative assessment was conducted. The United States Department of Agriculture (USDA) Census of Agriculture 2017 was used to estimate economic impacts. Information regarding the number of farms, land area in farms, etc. was extracted from the report and summarized in the vulnerability assessment. Additional resources from Suffolk County's Office of Water Resources, New York State's 2019 Hazard Mitigation Plan, Suffolk County's 2015 Comprehensive Water Resources Management Plan, Centers for Disease Control and Prevention and the U.S. Environmental Protection Agency were used to assess the potential impacts to the population from a drought event.

Earthquake

A probabilistic assessment was conducted for Suffolk County for the 100-, 500- and 2,500-year mean return periods (MRPs) through a Level 2 analysis in HAZUS-MH v4.2 to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information from historic earthquakes and inferred faults, locations and magnitudes, and computes the probable ground shaking levels that may be experienced during a recurrence period by Census tract.

As noted in the HAZUS-MH Earthquake User Manual, "*Although the software offers users the opportunity to prepare comprehensive loss estimates, it should be recognized that uncertainties are inherent in any estimation methodology, even with state-of-the-art techniques. Any region or city studied will have an enormous variety of buildings and facilities of different sizes, shapes, and structural systems that have been constructed over a range of years under diverse seismic design codes. There are a variety of components that contribute to transportation and utility system damage estimations. These components can have differing seismic resistance.*" (FEMA 2020). However, HAZUS' potential loss estimates are acceptable for the purposes of this HMP.

Ground shaking is the primary cause of earthquake damage to man-made structures and soft soils amplify ground shaking. One contributor to the site amplification is the velocity at which the rock or soil transmits shear waves (S-waves). The National Earthquake Hazard Reductions Program (NEHRP) has developed five soil classifications defined by their shear-wave velocity that impact the severity of an earthquake. The soil classification system ranges from A to E, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Class D and E NEHRP soils are the two classes most susceptible to amplified ground motion during an earthquake. Additionally, national landslide data from USGS was referenced to assess inventory exposed to high landslide susceptible areas. Landslide susceptibility can impact the residual events caused by earthquakes.

An exposure analysis was conducted for the County's assets (population, building stock, critical facilities, and new development) using NEHRP soil data provided by New York State. The exposure analysis focused on soil types that would experience amplified ground motion during an earthquake (i.e., Class D and E). According to the NYS NEHRP data, Suffolk County does not contain NEHRP Soil Class E, so the analysis only extracted spatial data where Class D soils exist. Therefore, the Class D NEHRP soil hazard area was used to determine what assets are exposed to the soils most susceptible to seismic activity. Assets with their centroid in the hazard areas were totaled to estimate the numbers and values vulnerable to these soil types.

Data from New York State was used in HAZUS-MH v4.2 to replace default NEHRP soils. Groundwater was set at a depth of five (5) feet (default setting). The default assumption is a magnitude 7.0 earthquake for all return periods. Although damages are estimated at the Census tract level, results were presented at the jurisdiction level and for the Shinnecock Tribal Nation and Unkechaug Tribal Nation. Since there are multiple Census tracts that contain more than one jurisdiction, an area analysis was used to extract the percent of each tract that falls within individual jurisdictions. The percentage was multiplied against the results calculated for each tract and summed for each jurisdiction.

Damage estimates are calculated for losses to buildings (structural and non-structural) and contents; structural losses include load carrying components of the structure, and non-structural losses include those to architectural, mechanical, and electrical components of the structure, such as nonbearing walls, veneer and finishes, HVAC systems, boils, etc.

Furthermore, the 2010 national landslide susceptibility data from USGS where landslide susceptibility was listed as high susceptibility was used to estimate exposure to the County's assets. According to USGS, landslides are areas where mass rocks, debris, or earth move down a slope under the direct influence of gravity (USGS 2020).

USGS data estimates there are areas of high susceptibility to landsliding and low incidence in Suffolk County. Assets with their centroid in the hazard areas were totaled to estimate the numbers and values vulnerable to the landslide hazard area.

Expansive Soils

Updated soils data was used from USDA and Natural Resources Conservation Service (NRCS) to determine the expansive soils hazard areas in Suffolk County. Soil classes that have a linear extensibility, or the shrink-swell potential, of greater than 3-percent were considered expansive soils. There is only one soil type identified in the County with expansive soil properties, i.e., Canadice soil. Canadice soil has a moderate shrink-swell linear extensibility of 3-percent. This soil type is only located in the Town of Southampton, Town of East Hampton, Town of Southold, and the Village of Greenport. To assess buildings and population exposed to this hazard area, the Canadice soil layer was overlaid on the general building stock inventory data to estimate the number of buildings and persons at risk to the impacts from expansive soils.

Extreme Temperatures

All of Suffolk County is exposed to extreme temperature events, both heat and cold. A qualitative assessment was conducted for this hazard. Information from the Centers for Disease Control and Prevention, stakeholder plans/reports, the 2019 New York City Hazard Mitigation Plan, and the Planning Partnership were used to assess the potential impacts to the County's assets.

Flood

The 1- and 0.2-percent annual chance flood events were examined to evaluate Suffolk County's risk and vulnerability to the flood hazard. These flood events are generally those considered by planners and evaluated under federal programs such as the NFIP.

The effective Suffolk County FEMA DFIRM published in 2009 was used to evaluate exposure and determine potential future losses. A depth grid was generated using the effective DFIRM and a 5-foot resolution Digital Elevation Model (DEM) provided by the County from the last HMP. The final depth grid included all coastal flood areas and riverine flood areas and was integrated into the HAZUS-MH v4.2 coastal flood model used to estimate potential losses for the 1-percent and 0.2-percent annual chance flood events.

To estimate exposure to the 1-percent- and 0.2-percent annual chance flood events, the DFIRM flood boundaries were overlaid on centroids of updated assets (population, building stock, critical facilities, and new development). Centroids that intersected the flood boundaries were totaled to estimate the building replacement cost value and population vulnerable to the flood inundation areas. A Level 2 HAZUS-MH v4.2 coastal flood analysis was performed, which includes coastal and riverine flood hazard areas. Both the critical facility and building inventories were formatted to be compatible with HAZUS-MH v4.2 and its Comprehensive Data Management System (CDMS). Once updated with the inventories, the HAZUS-MH v4.2 coastal flood model, using both coastal and riverine flood hazard areas, was run to estimate potential losses in Suffolk County for the 1-percent and 0.2-percent annual chance flood events. A user-defined analysis was also performed for the building stock. Buildings located within the floodplain were imported as user-defined facilities to estimate potential losses to the building stock at the structural level. HAZUS-MH v4.2 calculated the estimated potential losses to the population (default 2010 U.S. Census data), potential damages to the general building stock, and potential damages to critical facility inventories based on the depth grids generated and the default HAZUS-MH v4.2 damage functions in the flood model.

Areas of forests, wetlands, and critical habitat landscapes located within the 1- and 0.2-percent annual chance flood event boundaries were calculated to estimate impacts on the environment. The boundaries of these areas

were intersected with the floodplains in ArcGIS to calculate the areas exposed to the 1- and 0.2-percent annual chance flood events.

An analysis was completed to summarize the number of acres Suffolk County Water Authority parcels and Tribal Nation assets are exposed to the flood hazard areas. The area exposed to the 1-percent and 0.2-percent flood hazard extents was summarized by property.

Furthermore, locations identified as repetitive loss properties were provided by FEMA Region 2 and summarized to obtain an understanding of repetitive flood loss areas. These repetitive loss properties were geocoded using Geocodio and displayed on maps in the flood section and Jurisdictional Annexes (Volume II Section 9). FEMA Region 2 also provided a summary of the number of NFIP policies and claims for each jurisdiction.

In addition, projected sea level rise data (in one-foot increments) available from the NOAA Office of Coastal Management (https://coast.noaa.gov/slrdata/) was used to understand the assets at risk of future sea level rise per each jurisdiction. Please note these sea level rise projections do not include additional storm surge due to a hurricane or Nor'easter. The current DFIRMs also do not include the effects of sea-level rise. Sea level rise 1-foot through 4-foot hazard area extents were referenced in the exposure analysis. Asset data (population, building stock, critical facilities, and new development) were used to support an evaluation of assets exposed and potential impacts and losses. To determine what assets are exposed to sea level rise, the County's assets were overlaid with the hazard area. Assets with their centroid located in the hazard area were totaled to estimate the number and values exposed to sea level rise.

Groundwater Contamination

All of Suffolk County is considered exposed to groundwater contamination. A qualitative analysis was complete to assess the potential risk of groundwater contamination. Resources from Suffolk County's Office of Water Resources, Suffolk County's Department of Health Services, and EPA were used to assess the potential impacts to the County's assets.

Hurricane/Coastal Storm

A HAZUS-MH v4.2 probabilistic analysis was performed to analyze the wind hazard for the 100- and 500-year mean return period events. The probabilistic HAZUS-MH hurricane model activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated with Suffolk County. HAZUS-MH contains data on historic hurricane events and wind speeds. It also includes surface roughness and vegetation (tree coverage) maps for the area. Surface roughness and vegetation data support the modeling of wind force across various types of land surfaces. Default demographic and updated building and critical facility inventories in HAZUS-MH v4.2 were used for the analysis. Although damages are estimated at the Census tract level, results were presented at the jurisdiction level and for the Shinnecock Tribal Nation and Unkechaug Tribal Nation. Since there are multiple Census tracts that contain more than one jurisdiction, an area analysis was used to extract the percent of each tract that falls within individual jurisdictions. The percentage was multiplied against the results calculated for each tract and summed for each jurisdiction.

In addition to estimating potential losses due to wind, an exposure analysis was conducted using the "Sea – Lake Overland Surge from Hurricanes – SLOSH Model, which represents potential flooding from worst-case combinations of hurricane direction, forward speed, landfall point, and high astronomical tide were used to estimate exposure. Please note these inundation zones do not include riverine flooding caused by hurricane surge or inland freshwater flooding. The model, developed by the NOAA National Hurricane Center and New

York State Hurricane Evacuation study to forecast surges that occur from wind and pressure forces of hurricanes, considers only storm surge height and does not consider the effects of waves. The SLOSH spatial data includes boundaries for Category 1 through Category 4 hurricane events.

Asset data (population, building stock, critical facilities, and new development) were used to support an evaluation of assets exposed and potential impacts and losses associated with this hazard. To determine what assets are exposed to storm surge, the County's assets were overlaid with the SLOSH hazard area. Assets with their centroid located in the hazard area were totaled to estimate the replacement cost value (structure and content) and population exposed to the hazard.

Infestation and Invasive Species

All of Suffolk County is exposed to infestation and invasive species. Resources from the New York State Department of Environmental Conservation, New York Invasive Species Clearinghouse, and NOAA were referenced to qualitatively assess the potential impacts to the County's assets.

Nor'Easter

All of Suffolk County is exposed to Nor'Easters. A qualitative assessment was conducted, supplemented with results from the SLOSH analysis complete in the Hurricane vulnerability assessment.

Severe Storm

All of Suffolk County is exposed to severe storm events. A qualitative assessment was conducted for the severe storm hazard with supporting information discussed in other hazard sections (e.g., Hurricane). Information from Suffolk County and the Planning Partnership were used to assess the potential impacts to the County's assets.

Severe Winter Storm

All of Suffolk County is exposed to the winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. A percentage of the custom-building stock structural replacement cost value was utilized to estimate damages that could result from winter storm conditions (i.e., 1-percent, 5-percent, and 10-percent of total replacement cost value). Given professional knowledge and currently available information, the potential losses for this hazard are considered to be overestimated; hence, providing a conservative estimate for losses associated with winter storm events.

Shallow Groundwater Flooding

An exposure analysis was complete for Suffolk County using the shallow groundwater spatial data created in the Smithtown H2M Study from 2007. This spatial data falls within the Town of Islip, Town of Smithtown, and the Village of the Branch. To assess buildings and population exposed to this hazard area, the shallow groundwater layer was overlaid on the general building stock inventory data to estimate the number of buildings and persons at risk to the impacts from shallow groundwater flooding.

Wildfire

The Wildland-Urban Interface (Interface and Intermix) obtained through the SILVIS Laboratory, Department of Forest Ecology and Management, University of Wisconsin – Madison, was referenced to delineate wildfire hazard areas. The University of Wisconsin – Madison wildland fire hazard areas are based on the 2010 Census and 2006 National Land Cover Dataset and the Protected Areas Database. For this risk assessment, the high-,

medium-, and low-density interface areas were combined and used as the "Interface" hazard area, and the high-, medium-, and low-density intermix areas were combined and used as the "Intermix" hazard areas.

Asset data (population, building stock, critical facilities, and new development) were used to support an evaluation of assets exposed and potential impacts and losses associated with this hazard. To determine what assets are exposed to wildfire, available and appropriate GIS data were overlaid with the hazard area. Assets with their centroid located in the hazard area were totaled to estimate the total number and values exposed to a wildfire event.

Considerations for Mitigation and Next Steps

The following items are to be discussed for considerations for the next plan update to enhance the vulnerability assessment:

- All Hazards
  - Utilize updated and current demographic data. If 2020 U.S. Census demographic data is available at the U.S. Census block level during the next plan update, use the Census block estimates and residential structures for a more precise distribution of population, or the current American Community Survey 5-Year Estimate populations counts at the Census tract level.
- Coastal Erosion
  - If available during the next plan update, update the risk assessment using a comprehensive coastal erosion hazard area map.
  - Collect data on historic costs incurred to reconstruct buildings, cultural resources and/or infrastructure due to coastal erosion impacts.
- Flood
  - The general building stock inventory can be updated to include attributes regarding first floor elevation and foundation type (basement, slab on grade, etc.) to enhance loss estimates.
  - Conduct a HAZUS-MH loss analysis for more frequent flood events (e.g., 10 and 50-year flood events).
  - Conduct a repetitive loss area analysis.
  - Continue to expand and update urban flood areas to further inform mitigation.
- Earthquake
  - Identify unreinforced masonry in critical facilities and privately-owned buildings (i.e., residences) by accessing local knowledge, tax assessor information, and/or pictometry/orthophotos. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response/recovery efforts at these properties can be developed.
  - A pilot study conducted in Schenectady County, NY (Landslide Susceptibility – A Pilot Study of Schenectady County, NY) provided a detailed methodology for delineating high-risk landslide areas. This study looked at a variety of environmental characteristics including slope and soil conditions to determine areas at risk to landslide. To coincide with the methodology of that study, the generated slopes were categorized into five classes: 0%-2%; 3%-7%; 8%-15%; 16%-25%; Greater than 25%. Should the County determine the need for a more detailed assessment of risk, the slopes greater than 25% should be used to delineate the hazard area for the vulnerability assessment. Additional environmental and soil characteristics used in the Schenectady County plan can be collected and used to follow the methodology and further delineate Suffolk County's most at risk areas.
- Extreme Temperatures
  - Track extreme temperature data for injuries, deaths, shelter needs, pipe freezing, agricultural losses, and other impacts to determine distributions of most at risk areas.

- Hurricane
  - The general building stock inventory can be updated to include attributes regarding protection against strong winds, such as hurricane straps, to enhance loss estimates.
  - Estimate storm surge related losses using the HAZUS-MH flood model, if the data is available.
  - If available during the next plan update, update the risk assessment using a comprehensive coastal erosion hazard area map and updated sea level rise inundation areas.
  - Collect data on historic costs incurred to reconstruct buildings, cultural resources and/or infrastructure due to coastal erosion impacts.
  - Integrate evacuation route data that is currently being developed.
- Wildfire
  - General building stock inventory can be updated to include attributes such as roofing material or fire detection equipment or integrate distance to fuels as another measure of vulnerability.

5.1.3 Data Source Summary

Table 5.1-3 summarizes the data sources used for the risk assessment for this plan.

Table 5.1-3. Risk Assessment Data Documentation

Data	Source	Date	Format
Population data	U.S. Census Bureau; American Community Survey 5-Year Estimates	2010; 2018	Digital (GIS) format
Building footprints	Suffolk County; Microsoft; Open Street Map; Town of East Hampton	2019/2020; 2018; 2019; 2020	Digital (GIS) format
Tax Assessor data	NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS); Town of Babylon, Town of Easthampton, Town of Huntington, Town of Islip, Town of Shelter Island, Town of Smithtown, Town of Southampton	2019; 2020	Digital (GIS/Tabular) format
Critical facilities	Suffolk County Steering Committee and Planning Committee	2019/2020	Digital (GIS) format
Digitized Effective FIRM maps (2009)	FEMA	2009	Digital (GIS) format
NEHRP Soil	NYS	n.d.	Digital (GIS) format
Landslide Susceptibility	USGS	2010	Digital (GIS) format
Historical Landslide Events	USGS	2019	Digital (GIS) format
Coastal Erosion Hazard Buffer Area	NYSDEC	2007/2014	Digital (GIS) format
Coastal Risk Areas	NYDOS	2013/2014	Digital (GIS) format
Wildfire Fuel Hazard	University of Wisconsin - Madison	2010	Digital (GIS) format
Census of Agriculture	USDA	2017	Digital (PDF Report) format
Sea Level Rise Hazard Area	NOAA	2017	Digital (GIS) Format
Shallow Groundwater	Smithtown H2M Study	2007	Digital (GIS) Format
Sea-Lake Overland Surge from Hurricanes (SLOSH) Model	NYS/NOAA	2010	Digital (GIS) Format
Expansive Soils	USDA/NRCS	2019	Digital (GIS) Format

Data	Source	Date	Format
5-foot Resolution Digital Elevation Model	Suffolk County	2008	Digital (GIS) Format
New Development Data	Suffolk County Coastal Resilience Initiative/Suffolk County Planning Department; Suffolk County Planning Partnership	2020	Digital (GIS) Format

Limitations

Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

1. Approximations and simplifications necessary to conduct such a study
2. Incomplete or dated inventory, demographic, or economic parameter data
3. The unique nature, geographic extent, and severity of each hazard
4. Mitigation measures already employed by the participating municipalities
5. The amount of advance notice residents have to prepare for a specific hazard event
6. Uncertainty of climate change projections

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, Suffolk County will collect additional data to collect additional data, update and refine existing inventories, to assist in estimating potential losses.

Potential economic loss is based on the present value of the general building stock utilizing best available data. The County acknowledges significant impacts may occur to critical facilities and infrastructure as a result of these hazard events causing great economic loss. However, monetized damage estimates to critical facilities and infrastructure, and economic impacts were not quantified and require more detailed loss analyses. In addition, economic impacts to industry such as tourism and the real-estate market were not analyzed.