10. FLOOD

10.1 HAZARD PROFILE

10.1.1 Hazard Description

A flood is the inundation of normally dry land resulting from the rising and overflowing of a body of water. Flooding is a natural hazard that typically occurs during prolonged rainfalls over several days, intense rainfalls over a short period of time, or when an ice or debris jam causes a river or stream to overflow onto the surrounding area. Flooding can also result from the failure of a water control structure, such as a dam or levee (NWS 2019). Flood can be exacerbated by changes such as sea level rise or increased precipitation.

Flood events can develop slowly over a period of days or quickly, with disastrous effects that can be local (impacting a neighborhood or community) or regional (affecting entire river basins, coastlines and multiple counties or states) (FEMA 2021). Floods are frequent and costly natural hazards in New Jersey in terms of human hardship and economic loss. They can cause widespread damage, loss of life, injury, severe water damage to buildings, bridge and road closures, transit service disruptions, and damage to electrical and communication networks.

Flooding commonly includes one or more of the following scenarios (NWS 2019):

- Riverine overbank flooding
- Flash floods
- Alluvial fan floods
- Dam- and levee-break floods
- Local draining or high groundwater levels
- Fluctuating lake levels
- Ice-jams
- Coastal flooding

For this HMP, as deemed appropriate by the Steering Committee, the main flood types of concern are riverine, flash, urban stormwater, and ice jam.

Riverine Flooding

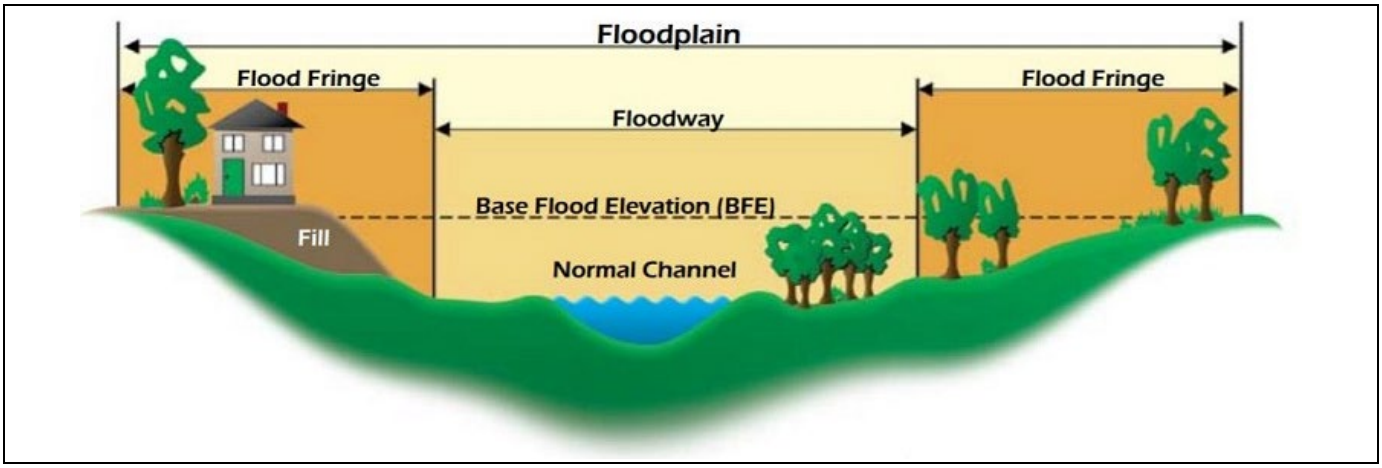
Riverine floods are the most common flood type. They occur along the channels of rivers, creeks, streams, or ditches and include overbank and flash flooding. When a channel receives too much water, the excess water flows over its banks and inundates low-lying areas (FEMA 2019).

Riverine flooding is measured by how frequently a given level of flooding occurs. The 1 percent annual chance flood, also referred to as the base flood or 100-year flood, is a flood with a level that has a 1 percent chance of being equaled or exceeded in any given year. Though commonly called the 100-year flood, this flood can occur more than once in a relatively short period of time. Similarly, the flood with a 0.2 percent chance of being equaled or exceeded each year is often called the 500-year flood but can occur more frequently than that (FEMA 2020).

The land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood is called a floodplain. These areas are typically flat land adjacent to a watercourse that is subject to periodic inundation. A floodplain is made up of the following components (refer to Figure 10-1) (FEMA 2019, US DHS 2019):

- **Floodway** is the channel of a river or other waterway and the adjacent land areas that are under water or reserved to carry and discharge the overflow of water caused by flooding.
- **Flood Fringe** is the area within the floodplain but outside the floodway. This area extends from the outer banks of a floodway to the river valley, where the elevation begins to rise.

Figure 10-1. Characteristics of a Floodplain



Sources: FEMA 2022

FEMA prepare maps of the expected floodplains along water courses, based on historical riverine and coastal flooding conditions. In FEMA flood maps, the floodplain inundated by the 1 percent annual chance flood is identified as Special Flood Hazard Area (SFHA). This is the area where flood insurance and floodplain management requirements apply (FEMA 2020). The following are additional definitions relating to flood map:

- **Special Hazard Flood Areas (SFHAs)—**Labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30.
- **Zone B or Zone X (shaded)—**Moderate flood hazard areas. These are the areas between the limits of the base flood and the 0.2 percent annual chance (or 500-year) flood.
- **Zone C or Zone X (unshaded)—**Areas of minimal flood hazard, outside the SFHA and at higher elevations than the elevation of the 0.2 percent annual chance flood.

Mapped floodplain boundaries may require updating as a result of changes in land use or the amount of impervious surface, the placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, or new hydrologic modeling techniques (USGS 2016). Flooding outside of the SFHA area may include stormwater or urban flooding and flash flooding. Urban and stormwater flooding and future conditions (e.g., sea level rise and rainfall areas) are not reflected in FEMA floodplain mapping. As such, FEMA floodplain maps may underestimate flood risk in many areas.

Flash Flooding

Flash floods are floods caused by heavy rainfall in a short period of time, generally less than 6 hours (NWS 2009). These floods are usually characterized by raging torrents after heavy rains that rip through riverbeds, urban streets, or mountain canyons. They can occur within minutes or a few hours of excessive rainfall.

Urban

Stormwater Flooding

Urban stormwater flooding is flooding caused by local drainage issues and high groundwater levels in areas other than delineated floodplains or along recognizable channels. It is generally the result of increased water runoff due to urban development and inadequate drainage systems. If local conditions cannot accommodate intense precipitation through a combination of infiltration and surface runoff, water may accumulate and cause flooding problems. During winter and spring, frozen ground and snow accumulations may contribute to inadequate drainage and localized ponding. Flooding of this nature generally occurs in areas with flat gradients and generally increases with urbanization, which speeds the accumulation of floodwaters because of impervious areas. Shallow street flooding can occur unless channels have been improved to account for increased flows. Urban flooding can inundate streets, underpasses, low lying areas, or storm drains (FEMA 2007).

Drainage systems are designed to remove surface water from developed areas as quickly as possible to prevent flooding on streets and other urban areas. Such systems often make use of a closed conveyance system that channels water away from an urban area to surrounding streams. This bypasses the natural processes of water filtration through the ground, containment, and evaporation of excess water. Because drainage systems reduce the amount of time the surface water takes to reach surrounding streams, flooding in those streams can occur more quickly and reach greater depths than prior to development in that area(Harris 2008). The growing number of extreme rainfall events that produce intense precipitation are resulting in increased urban flooding (Center for Disaster Resilience 2016).

High groundwater levels can cause problems even where there is no surface flooding. Basements are susceptible to high groundwater levels. Seasonally high groundwater is common in many areas, though it often occurs only after a long period of above-average precipitation (USGS 2016).

Ice Jam Flooding

An ice jam occurs when pieces of floating ice are carried with a stream's current and accumulate behind an obstruction to the stream flow. Obstructions may include river bends, mouths of tributaries, points where the river slope decreases, dams, or bridges. The water held back by this obstruction can cause flooding upstream, and if the obstruction suddenly breaks, flash flooding can occur (NESEC 2021). The formation of ice jams depends on the weather and physical condition of the river and stream channels. They are most likely to occur where the channel slope naturally decreases, in culverts, and along shallows where channels may freeze solid.

There are two different types of ice jams: freeze-up and breakup. Freeze-up jams occur in the early to mid-winter when floating ice may slow or stop due to a change in water slope as it reaches an obstruction to movement. Breakup jams occur during periods of thaw, generally in late winter and early spring. The ice cover breakup is usually associated with a rapid increase in runoff and corresponding river discharge due to a heavy rainfall, snowmelt, or warmer temperatures (FEMA 2023).

10.1.2 Location

Flooding potential is influenced by climatology, meteorology, and topography. Extensive development can impact flooding potential, as it leaves fewer natural surfaces available to absorb rainwater, forcing water directly into streams, rivers, and existing drainage systems and swelling them more than when natural surfaces are available to buffer the runoff. Areas that are more likely to have an increased risk of flooding include the following:

- Areas with poor drainage
- Locations on or near construction projects

- The FEMA defined SFHA
- Developed areas with excess amounts of impermeable surfaces

The most damaging floods (particularly riverine floods) in New Jersey appear to occur in the northern half of the state, including Sussex County. This is a function of several physiographic and physical features of the landscape. Sloped land in the northern half results in flowing water moving down steeper gradients and being naturally or artificially channelized through valleys and gullies. The Delaware, Raritan, and Passaic Rivers drain more than 90 percent of their waters into the northern New Jersey counties and are common locations for flooding. Floods can happen almost anywhere in Sussex County, although they tend to occur in and around areas near existing bodies of water, such as rivers and streams. Sussex County has primarily a mountainous terrain, with significant exposure to water and vulnerability to flooding.

Riverine Flooding

Flood Mapping

Locations of flood zones in Sussex County as depicted on the FEMA preliminary Digital Flood Insurance Rate Map (DFIRM) are illustrated in Figure 10-2 and the total land area in the floodplain, exclusive of water bodies, is summarized in Table 10-2. Refer to Volume II for a map of floodplains in each jurisdiction.

Primary Waterways in the County

Sussex County has several large waterways, including the Musconetcong River and Paulins Kill, as well as the Delaware River, which has a total drainage area of over 14,000 square miles. Larger lakes and reservoirs include Lake Hopatcong, Lake Musconetcong, and Lake Mohawk. Over the years, Sussex County has been impacted by flooding especially in the municipalities adjacent to these bodies of water. While flooding in Sussex County may occur during any season of the year, the most extensive flooding typically occurs in the late summer and early fall and is associated with tropical storms moving north along the Atlantic coast. Spring storms in concurrence with snowmelt can also cause extensive flooding in the County.

The New Jersey Department of Environmental Protection (NJDEP) has divided the state into 21 Watershed Management Areas (WMAs) based on large scale drainage patterns. Each WMA encompasses a particular group of major rivers. Sussex County contains parts of the following four regions:

- WMA 01: Upper Delaware - Northwest Region
- WMA 02: Wallkill - Northwest Region
- WMA 03: Pompton, Pequannock, Wanaque, Ramapo - Northeast Region
- WMA 06: Middle Passaic, Whippany – Northeast Region

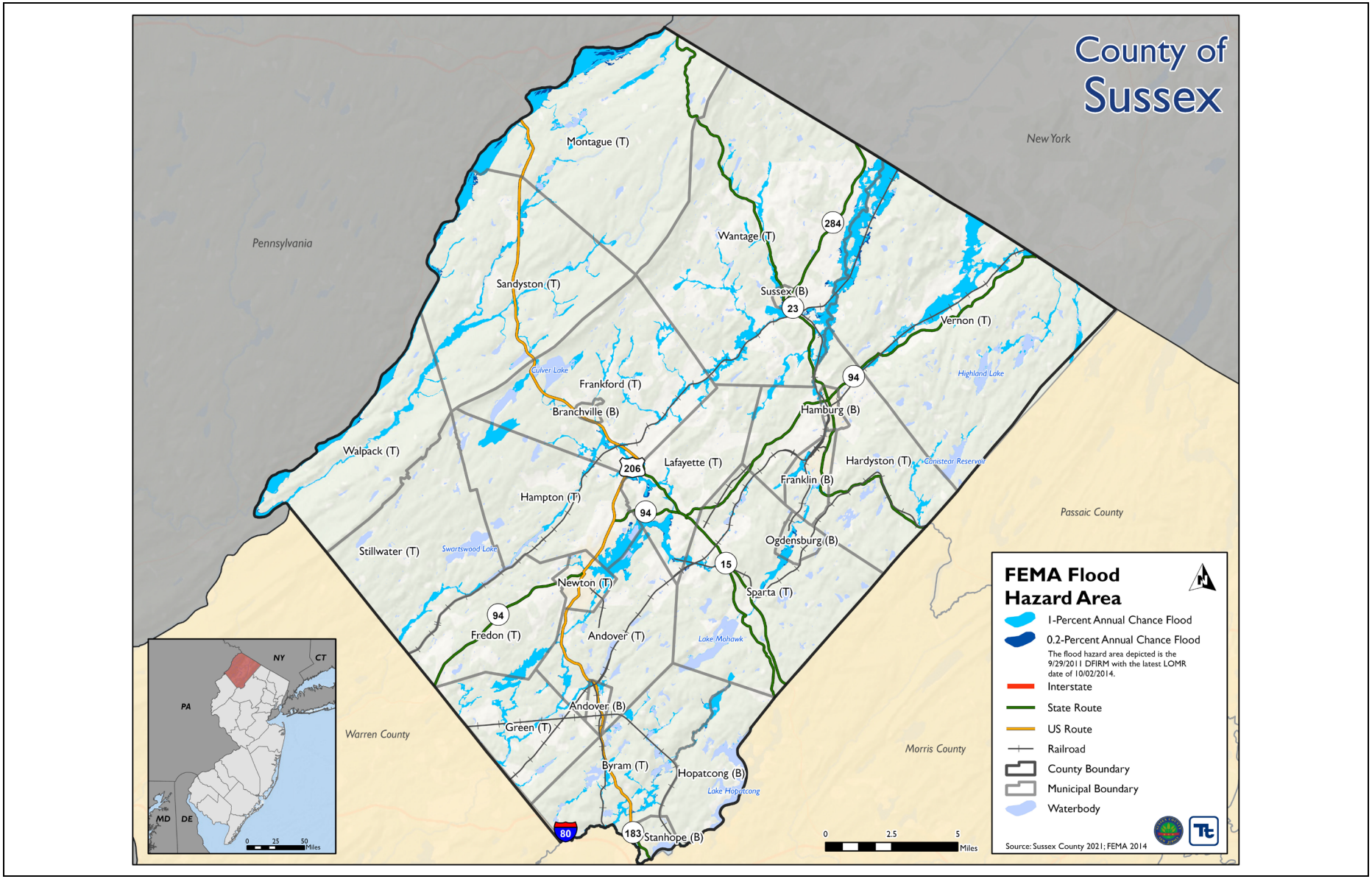
These areas delineate the principal stream systems that drain the county’s land area. Each WMA is described in the sections below (State of New Jersey 2019).

Table 10-1. Number of Acres in Sussex County Exposed to 1 percent and 0.2 Percent Annual Chance Flood

	Total Land Area (Excluding Water Bodies) (Acres)	Land Area (Excluding Water Bodies) in the 1% Annual Chance Flood Hazard Area		Land Area (Excluding Water Bodies) in the 0.2% Annual Chance Flood Hazard Area	
		Total Area (Acres)	% of Jurisdiction Total	Total Area (Acres)	% of Jurisdiction Total
Andover (B)	855	84	9.8%	84	9.8%
Andover (Twp)	12,746	735	5.8%	756	5.9%
Branchville (B)	383	23	6.1%	25	6.5%
Byram (Twp)	13,699	918	6.7%	960	7.0%
Frankford (Twp)	21,611	1,662	7.7%	1,705	7.9%
Franklin (B)	2,778	236	8.5%	255	9.2%
Fredon (Twp)	11,314	356	3.2%	356	3.2%
Green (Twp)	10,285	811	7.9%	811	7.9%
Hamburg (B)	734	31	4.2%	34	4.6%
Hampton (Twp)	15,668	1,062	6.8%	1,103	7.0%
Hardyston (Twp)	20,409	576	2.8%	585	2.9%
Hopatcong (B)	6,943	235	3.4%	246	3.5%
Lafayette (Twp)	11,429	757	6.6%	873	7.6%
Montague (Twp)	29,343	2,436	8.3%	2,639	9.0%
Newton (T)	2,144	343	16.0%	348	16.3%
Ogdensburg (B)	1,409	175	12.4%	204	14.5%
Sandyston (Twp)	26,641	1,946	7.3%	2,060	7.7%
Sparta (Twp)	23,446	450	1.9%	482	2.1%
Stanhope (B)	1,160	23	2.0%	24	2.1%
Stillwater (Twp)	17,185	336	2.0%	337	2.0%
Sussex (B)	399	61	15.4%	68	17.1%
Vernon (Twp)	42,993	4,428	10.3%	4,543	10.6%
Walpack (Twp)	15,807	1,617	10.2%	1,668	10.6%
Wantage (Twp)	42,554	3,111	7.3%	3,199	7.5%
Sussex County (Total)	331,933	22,411	6.8%	23,365	7.0%

Source: Sussex County 2021, 2023; FEMA 2014

Figure 10-2. FEMA Flood Hazard Areas in Sussex County



Upper Delaware River (WMA 01)

The Upper Delaware River Watershed (WMA 01) is the largest watershed in the county by area, with waters draining west and southwest to the Delaware River. This watershed includes portions of Sussex, Morris, and Hunterdon Counties and all of Warren County. It encompasses 746 square miles and has six major drainage basins: Delaware River, Flat Brook, Paulins Kill, Pequest River, Lopatcong and Pohatcong River Drainage, and the Musconetcong River. Located in the western and southern sections of Sussex County, the Upper Delaware River Watershed comprises more than half of the County's land area (State of New Jersey 2019).

Waterways in this area flow southwest, roughly parallel to one another, toward the Delaware River. Montague and Sandyston Townships contain a large amount of these waterways, most of which are part of the Big and Little Flat Brook systems. The upper half of the Big Flat Brook flows through High Point State Park and Stokes State Forest. Clove Brook and Mill Brook also run through Montague Township. Walpack Township contains tributaries of the Flat Brook draining the west slope of the Kittatinny Ridge.

Wallkill River Watershed (WMA 02)

The second largest watershed in the county by area is the Wallkill River Watershed (WMA 02). The Wallkill, which flows north into Orange County, New York, drains the north-central and northeastern section of Sussex County. This watershed occupies the northern and northeastern parts of Sussex County, extending south through Sparta and northern Byram Townships.

The Wallkill River flows northeast across the state border and lets out on the Hudson River near Kingston, New York. Major tributaries of the Wallkill River that cross through Sussex County include Papakating Creek, which begins in Frankford Township, and Clove Brook, the upper reaches of which flow south from northern Wantage Township. Pochuck Creek drains parts of Vernon and Hardyston Townships east of Pochuck Mountain before merging with the Wallkill several miles over the state border. Several branches of the Black Creek flow through Vernon Township (State of New Jersey 2019).

Pompton, Pequannock, Ramapo, Wanaque River Watershed (WMA 03)

The Pequannock River Watershed (WMA 03) drains to the southeast and comprises a small area of eastern Sussex County. The Pequannock River flows south out of Vernon Township, continuing into Hardyston Township where it turns southeast, forming the border between Morris and Passaic Counties, before ultimately converging with the Passaic River in Essex County. Tributaries of the Pequannock in Sussex County include a stretch of the upper Pascack Brook and an unnamed tributary in Hardyston Township (State of New Jersey 2019).

Upper and Mid Passaic, Whippany, Rockaway River Watersheds (WMA 06)

The Rockaway River Watershed (WMA 06) drains to the southeast and comprises a small part of the County. The Rockaway River itself does not pass through Sussex County, but the system's upper reaches include many tributaries in eastern Sparta Township, where several streams merge to form Russia Brook. Russia Brook flows into Jefferson Township (Morris County) where it meets the Rockaway River (State of New Jersey 2019).

Flash Flooding

Flash flooding, like riverine flooding, occurs throughout the County, primarily along the bodies of water that flow through it.

Urban Stormwater Flooding

Urban stormwater flooding is not mapped by the state or FEMA but is most likely to occur in highly developed areas with high percentages of impervious surface that contribute to high rates of runoff. Locations that have undersized stormwater components or stormwater components that are prone to becoming clogged or failing often experience stormwater flooding.

Ice Jams

The State of New Jersey documented 109 ice jam incidents between 1867 and 2023 (USACE 2023). Areas of New Jersey that include characteristics lending to ice jam flooding, including locations where the channel slope changes from relatively steep to mild and where a tributary stream enters a large river include the northern counties that border the Delaware River and its tributaries (i.e., Hunterdon, Warren, Sussex, and Mercer).

10.1.3 Extent

Generally, floods are long-term events that can last for several days. The severity of flooding depends on the amount of water that accumulates in a period and on the land's ability to manage this water. It is related to the size of rivers and streams in an area and the surrounding land's absorbency. When it rains, soil acts as a sponge. When the land is saturated or frozen, infiltration into the ground slows and any more water that accumulates must flow as runoff (Harris 2008).

Riverine Flooding

The severity of riverine flooding is determined by stream and river basin topography, weather patterns, soil moisture conditions, vegetative clearing, and impervious surface. Generally, riverine floods are long-term events that can last for several days.

Riverine flooding is assessed based on the probability that a given river discharge (flow) level will be equaled or exceeded each year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. In the case of riverine flooding, once a river reaches flood stage, the flood extent or severity categories used by the NWS are as follows (NWS 2011):

- **Minor Flooding** can cause minimal or no property damage, with possibly some public threat or inconvenience.
- **Moderate Flooding** can cause some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- **Major Flooding** can cause extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

Flash Flooding

The extent of a flash flood is consistent with that of a riverine flood as described above.

Urban and Stormwater Flooding

Locations that have undersized stormwater components or stormwater components that are prone to becoming clogged or failing often experience stormwater flooding. Currently, there is no measurement used to further define the frequency and severity of urban stormwater flooding.

Ice Jam Flooding

Ice jam flooding events often occur suddenly and are difficult to predict, allowing for little time to prepare for and warn of an event. The size of the snowpack and the rate of snowmelt controls the extent of an ice jam (Rokaya 2018).

10.1.4 Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Sussex County has been included in 19 major disaster (DR) or emergency (EM) declarations for flood-related events, as listed in Table 10-3.

Table 10-2. FEMA Declarations for Flood Events in Sussex County

Event Date	Declaration Date	Declaration Number	Description
September 4, 1971	September 4, 1971	DR-310	Flood: Heavy Rains & Flooding
July 23, 1975	July 23, 1975	DR-477	Flood: Heavy Rains, High Winds, Hail & Tornadoes
September 16 – 18, 1999	September 17, 1999	EM-3148	New Jersey Hurricane Floyd
August 12 – 21, 2000	August 17, 2000	DR-1337	Severe Storms, Flooding and Mudslides
September 18 – October 1, 2004	October 1, 2004	DR-1563	Severe Storms and Flooding
April 1 – 3, 2005	April 19, 2005	DR 1588	Severe Storm(s): Severe Storms and Flooding
June 23 – July 10, 2006	July 7, 2006	DR-1653	Severe Storms and Flooding
April 14 – 20, 2007	April 26, 2007	DR-1694	Severe Storm(s): Severe Storms and Inland and Coastal Flooding
August 26 – September 5, 2011	August 27, 2011	EM-3332	Hurricane Irene in New Jersey
August 26 – September 5, 2011	August 27, 2011	DR-4021	Hurricane Irene in New Jersey
September 28 – October 6, 2011	October 14, 2011	DR-4039	Remnants of Tropical Storm Lee in New Jersey
October 26 – November 8, 2012	October 28, 2012	EM-3354	New Jersey Hurricane Sandy
October 26 – November 8, 2012	October 30, 2012	DR-4086	New Jersey Hurricane Sandy
August 4, 2020	December 11, 2020	DR-4574	Tropical Storm Isaias
September 1 – 3, 2021	September 2, 2021	EM-3573	Remnants of Hurricane Ida
September 1 – 3, 2021	September 5, 2021	DR-4614	Remnants of Hurricane Ida

Sources: FEMA 2024

USDA Declarations

The U.S. Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans from the U.S. Department of Agriculture (USDA) to producers suffering losses in those counties and in contiguous counties. Since the previous Sussex County HMP, the County has been included in two USDA flood-related agricultural disaster declarations, as listed in Table 10-4.

Table 10-3. USDA Declarations for Flood Events in Sussex County (2020 to 2024)

Event Date	USDA Declaration Number	Description
August 3 – 4, 2020	S4892	High Winds and Heavy Rain from Hurricane Isaias
August 21 – September 2, 2021	S5092	Excessive Rain

Sources: USDA 2024

Previous Events

Known flood events that impacted Sussex County between January 2020 and June 2024 are listed in Table 10-5. For events prior to 2020, refer to the 2021 Sussex County HMP.

Table 10-4. Flood Events in Sussex County (2020 to 2024)

Event Date	FEMA Declaration or State Proclamation Number	Sussex County included in declaration?	Location Impacted	Description
September 1, 2021	EM-3573-NJ, DR-4614-NJ	Yes	Flatbrookville	Post Tropical Cyclone Ida brought heavy rain to New Jersey. Rainfall totals were as high as 10 inches. The heavy rain caused significant flash flooding, mainly in the northern half of the state. It resulted in widespread property damage. There were several fatalities. Widespread flash flooding occurred in Sussex County with numerous road closures.
June 26, 2023	N/A	N/A	Andover Junction	Thunderstorms produced locally heavy rain in northern New Jersey. Rainfall totals were as high as 5 inches. U.S. Route 206 in Andover Township was closed due to flooding near Goodale Road.
July 14, 2023	N/A	N/A	Newton	Thunderstorms brought heavy rain to northern New Jersey from the late afternoon into the evening of July 14. Rainfall totals were as high as 7 inches. High Street was closed between West End Avenue and Church Street in Newton due to flooding.

Sources: NOAA 2023

10.1.5 Probability of Future Occurrences

Probability Based on Previous Occurrences

Information on previous flood occurrences in the County was used to calculate the probability of future occurrence of such events, as summarized in Table 10-6. Based on historical records and input from the Steering Committee, the probability of occurrence for flood in the County is considered “frequent.”

Table 10-5. Probability of Future Flood Events in Sussex County

Hazard Type	Number of Occurrences Between 1996[a] and 2023	Percent Chance of Occurring in Any Given Year
Flood	23	82.14%
Flash Flood	30	100%
Ice Jams	1	3.57%
Total	**54**	**100%**

Sources: FEMA 2023; NOAA 2023; USACE 2023

a. Events prior to 1996 are not included because sources of earlier data are not considered to be complete.

Effect of Climate Change on Future Probability

Projections of climate change for New Jersey predict more intense rainfall events and increases in total annual precipitation (see Section 3.3.4). This could result in an increased probability of flood events. In New Jersey, extreme storms typically include coastal nor'easters, snowstorms, spring and summer thunderstorms, tropical storms, and on rare occasions hurricanes. Most of these events occur in the warmer months between April and October, with nor'easters occurring between September and April.

10.1.6 Cascading Impacts on Other Hazards

Erosion and Landslides

Riverine flooding often results in bank erosion. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly, scouring the banks and edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail.

Public Health

Floodwaters also can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. Common public health risks associated with flood events include the following (FEMA 2022):

- Unsafe food
- Contaminated drinking and washing water and poor sanitation
- Mosquitos and animals
- Carbon monoxide poisoning
- Secondary hazards associated with re-entering and cleaning flooded structures
- Mental stress and fatigue

After flood events, excess moisture and standing water contribute to the growth of mold in buildings. Mold may present a health risk to building occupants, especially infants, children, older people, pregnant women, and those with already compromised immune systems. Mold spores can grow in as little as 24 hours in wet and damaged areas of buildings that have not been properly cleaned. Very small mold spores can be inhaled, creating the potential for allergic reactions and respiratory problems (CDC 2020).

The best mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with them in flood disaster response.

Utility Disruption

Floodwater picks up debris, bacteria, sewage, and other industrial waste and chemicals and can contaminate private drinking water sources, such as wells and springs. Excess water also makes it more difficult for water treatment plants to treat water adequately. Contamination in the water supply puts consumers at risk of exposure to toxins that could result in serious harm. In extreme cases, death may occur (Andrew 2021).

Consumers without access to clean water are unable to cook or clean in their homes. Depending on the severity of the flood and the storm, this could last for days, weeks, or months. Cconsumers ultimately become reliant on bottled water, which is especially detrimental in impoverished communities where residents may not have the economic means to purchase bottled water. Moreover, in a flood, retail locations are often inaccessible or low on water supply (Andrew 2021).

Flooded buildings may have their power disrupted if the service panel, generator, meter, etc. are not elevated above the flood level. Oversaturated soils from periods of heavy rain and flooding may cause utility poles to tip over or fall completely, interrupting the power grid for a potentially large area, especially if a transformer is impacted.

Dam Failure

Flooding can result in large quantities of rain upstream of a dam that raise water levels behind the dam, potentially leading to overtopping of the dam or flooding of properties upstream of the dam. Should the flooding result in a dam failure, the water behind the dam, including flood waters, may inundate jurisdictions downstream of the dam.

10.2 VULNERABILITY AND IMPACT ASSESSMENT

The 1 percent and 0.2 percent annual chance flood events were examined to evaluate the county's risk from the flood hazard. The following data were used:

- FEMA's effective Sussex County DFIRM dated September 29, 2011, with a latest letter of map revision dated October 2, 2014. This was used to evaluate vulnerability and determine potential future losses.
- A depth grid created from the 2011 effective DFIRM and a 2-foot cell size digital elevation map (DEM) model provided by NJDEP Bureau of GIS. This was integrated into the Hazus riverine flood model and used to estimate potential losses for the 1 percent annual chance flood event.

To estimate vulnerability to the 1 percent and 0.2 percent annual chance flood events, the DFIRM flood boundaries were overlaid on the centroids of assets in the updated inventories. Centroids that intersected the flood boundaries were totaled to estimate the building RCV and population located in flood inundation areas.

A Level 2 Hazus riverine flood analysis was performed. The critical facility and building inventories were formatted to be compatible with Hazus, and the Hazus riverine flood model was run to estimate potential losses for the 1 percent annual chance flood. Hazus calculated estimated population losses (for the default 2020 U.S. Census data across dasymetric blocks), potential damage to the general building stock, and potential damage to critical facilities based on the depth grids and the default damage functions in the Hazus flood model. Urban stormwater flooding was not evaluated because no mapping is available for it. Therefore, this assessment can be assumed to underestimate flooding risk in Sussex County.

10.2.1 Life, Health, and Safety

Overall Population

Hazard exposure was estimated as the population living in or near floodplain areas. The exposure of other individuals who may be traveling in flooded areas or have their access to emergency services compromised by a flood is not strictly measurable. Table 10-7 summarizes the population exposed to the flood hazard by jurisdiction. There are 682 residents living in the 1 percent annual chance floodplain or 0.5 percent of the County's total population. There are 856 residents living in the 0.2 percent annual chance floodplain, or 0.6 percent of the County's total population. The Borough of Hopatcong has the greatest number of residents living in both evaluated floodplains—204 in both the 1 percent and 2 percent annual chance floodplains.

Table 10-6. Sussex County Population in the 1 Percent and 0.2 Percent Annual Chance Flood Hazard Areas

	Total Population	Population in the 1% Annual Chance Flood Hazard Area		Population in the 0.2% Annual Chance Flood Hazard Area	
		Number of People	Percent Total	Number of People	Percent Total
Andover (B)	595	10	1.7%	10	1.7%
Andover (Twp)	5,996	2	<0.1%	2	<0.1%
Branchville (B)	791	4	0.5%	4	0.5%
Byram (Twp)	8,028	28	0.3%	69	0.9%
Frankford (Twp)	5,302	51	1.0%	55	1.0%
Franklin (B)	4,912	16	0.3%	21	0.4%
Fredon (Twp)	3,235	0	0.0%	0	0.0%
Green (Twp)	3,627	15	0.4%	15	0.4%
Hamburg (B)	3,266	2	0.1%	2	0.1%
Hampton (Twp)	4,893	4	0.1%	4	0.1%
Hardyston (Twp)	8,125	2	<0.1%	2	<0.1%
Hopatcong (B)	14,362	204	1.4%	204	1.4%
Lafayette (Twp)	2,358	22	0.9%	36	1.5%
Montague (Twp)	3,792	56	1.5%	87	2.3%
Newton (T)	8,374	37	0.4%	52	0.6%
Ogdensburg (B)	2,258	2	0.1%	57	2.5%
Sandyston (Twp)	1,977	14	0.7%	23	1.2%
Sparta (Twp)	19,600	69	0.4%	69	0.4%
Stanhope (B)	3,526	0	0.0%	0	0.0%
Stillwater (Twp)	4,004	4	0.1%	4	0.1%
Sussex (B)	2,024	3	0.1%	3	0.1%
Vernon (Twp)	22,358	72	0.3%	72	0.3%
Walpack (Twp)	7	1	14.3%	1	14.3%
Wantage (Twp)	10,811	64	0.6%	64	0.6%
Sussex County (Total)	**144,221**	**682**	**0.5%**	**856**	**0.6%**

Source: U.S. Census Bureau 2020, 2021; FEMA 2014; CDC/ATSDR 2020
Note: Results for population are rounded down.

The total number of injuries and casualties resulting from flooding is generally limited based on advance weather forecasting, blockades, and warnings. Therefore, injuries and deaths generally are not anticipated if proper warning and precautions are in place. Ongoing mitigation efforts should help to avoid the most likely cause of injury, which results from persons trying to cross flooded roadways or channels during a flood.

The Hazus riverine model estimates the potential sheltering needs as a result of a 1 percent annual chance flood event. The demographic data in Hazus has not been updated and the estimated sheltering needs are based on 2020 U.S. Census data. Hazus estimates 1,523 persons may be displaced and 359 people may seek short-term shelter. These statistics, by jurisdiction, are presented in Table 10-11. The estimated displaced population and number of persons seeking short-term shelter differs from the number of persons exposed to the 1 percent annual chance flood, because the displaced population numbers take into consideration that not all residents will be impacted enough to be displaced or to require short-term shelter during a flood event.

Table 10-7. Population Displaced or Neding Short-Term Shelter from the 1 Percent Annual Chance Flood Event

	Total Population (U.S. Census Bureau Decennial 2020)	1 Percent Annual Chance Flood Event Hazard Area	
		Displaced Population	Persons Seeking Short-Term Shelter
Andover (B)	595	17	2
Andover (Twp)	5,996	10	2
Branchville (B)	791	22	2
Byram (Twp)	8,028	145	34
Frankford (Twp)	5,302	130	17
Franklin (B)	4,912	53	19
Fredon (Twp)	3,235	3	2
Green (Twp)	3,627	50	4
Hamburg (B)	3,266	0	0
Hampton (Twp)	4,893	15	8
Hardyston (Twp)	8,125	14	3
Hopatcong (B)	14,362	60	29
Lafayette (Twp)	2,358	43	9
Montague (Twp)	3,792	87	49
Newton (T)	8,374	376	107
Ogdensburg (B)	2,258	30	4
Sandyston (Twp)	1,977	37	2
Sparta (Twp)	19,600	109	11
Stanhope (B)	3,526	19	2
Stillwater (Twp)	4,004	11	2
Sussex (B)	2,024	31	4
Vernon (Twp)	22,358	139	11
Walpack (Twp)	7	1	0
Wantage (Twp)	10,811	121	36
Sussex County (Total)	**144,221**	**1,523**	**359**

Source: Hazus v6.0, U.S. Census Bureau 2020; FEMA 2016
Note: Results for population are rounded down.

Socially Vulnerable Population

Economically disadvantaged populations are more vulnerable because they are likely to lack financial resources to evacuate. The population over the age of 65 is more vulnerable because they are more likely to need medical attention, which may not be available due to isolation during a flood event, and they may have more difficulty evacuating. Special consideration should be taken when planning for disaster preparation, response, and recovery for these vulnerable groups.

Table 10-10 presents the estimated socially vulnerable populations living in the 1 percent and 0.2 percent annual chance flood hazard areas. There are 106 persons over the age of 65 years, 25 persons under the age of 5 years, 5 non-English speakers, 66 persons with a disability, and 23 living in poverty located in the 1 percent annual chance flood hazard area. There are 139 persons over the age of 65 years, 32 persons under the age of 5 years, 7 non-English speakers, 82 persons with a disability, and 33 living in poverty located in the 0.2 percent annual chance flood hazard area.

10.2.2 General Building Stock

Buildings in the Flood Hazard Areas

Table 10-12 summarizes the number and value of buildings within the 1 percent and 0.2 percent annual chance flood hazard areas, as estimated by the analysis. There are 462 buildings in the 1 percent annual chance flood hazard area with an estimated $968 million of replacement cost value (building and content replacement costs). This represents 0.6 percent of the County's total general building stock inventory. There are 562 buildings in the 0.2 percent annual chance flood boundary with an estimated $1 billion of building stock and contents exposed. This represents 0.8 percent of the County's total general building stock inventory.

Table 10-14 summarizes buildings within the 1 percent or 0.2 percent annual chance flood hazard areas by general occupancy. The analysis estimates that, the residential occupancy is the most exposed for both flood hazard areas, accounting for 69 percent and 69.7 percent of the buildings within the 1 percent and 0.2 percent annual chance flood hazard areas, respectively

Potential Damage

The Hazus flood model estimated potential damage to buildings using the custom building inventory developed for this HMP and the depth grid generated for this analysis. Table 10-13 shows estimated losses by jurisdiction. The for the 1 percent annual chance flood. The countywide total is $149.7 million or 0.2 percent of the total building replacement cost value. The Borough of Hopatcong has the greatest estimated building loss—$38.5 million (1.1 percent of the total replacement cost value).

NFIP Statistics

Individual data on flood policies, claims, and repetitive loss (RL) properties was analyzed. FEMA Region 2 provided a list of residential properties with NFIP policies, past claims, and multiple claims (RLs). A property is considered an RL property when there are two or more reported losses that were paid more than $1,000 each, within 10 years of each other and at least 10 days apart. Table 10-15 summarizes the NFIP policies, claims, and RL statistics for Sussex County. Of the 15 RL properties identified in the County, one currently has NFIP insurance coverage. This information is current as of April 2024.

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Table 10-8. Vulnerable Persons Located in the 1 Percent and 0.2 Percent Annual Chance Flood Hazard Areas

	Vulnerable Persons Located in the 1 Percent Annual Chance Flood Hazard Area					Vulnerable Persons Located in the 0.2 Percent Annual Chance Flood Hazard Area				
	Persons Over 65	Persons Under 5	Non-English Speaking Persons	Persons with a Disability	Persons in Poverty	Persons Over 65	Persons Under 5	Non-English Speaking Persons	Persons with a Disability	Persons in Poverty
Andover (B)	1	0	0	1	0	1	0	0	1	0
Andover (Twp)	0	0	0	0	0	0	0	0	0	0
Branchville (B)	0	0	0	0	0	0	0	0	0	0
Byram (Twp)	3	1	0	2	0	9	3	0	5	1
Frankford (Twp)	9	2	0	5	1	10	2	0	5	1
Franklin (B)	3	0	0	2	0	5	1	0	3	1
Fredon (Twp)	0	0	0	0	0	0	0	0	0	0
Green (Twp)	3	0	0	2	0	3	0	0	2	0
Hamburg (B)	0	0	0	0	0	0	0	0	0	0
Hampton (Twp)	1	0	0	0	0	1	0	0	0	0
Hardyston (Twp)	0	0	0	0	0	0	0	0	0	0
Hopatcong (B)	28	8	4	21	8	28	8	4	21	8
Lafayette (Twp)	4	1	0	2	1	7	2	0	3	3
Montague (Twp)	12	3	1	5	2	19	4	1	9	4
Newton (T)	7	1	0	5	3	11	1	1	7	4
Ogdensburg (B)	0	0	0	0	0	9	1	1	4	3
Sandyston (Twp)	2	0	0	1	0	3	1	0	2	0
Sparta (Twp)	9	4	0	5	2	9	4	0	5	2
Stanhope (B)	0	0	0	0	0	0	0	0	0	0
Stillwater (Twp)	1	0	0	0	0	1	0	0	0	0
Sussex (B)	0	0	0	0	0	0	0	0	0	0
Vernon (Twp)	11	3	0	7	2	11	3	0	7	2
Walpack (Twp)	1	0	0	0	0	1	0	0	0	0
Wantage (Twp)	11	2	0	8	4	11	2	0	8	4
Sussex County (Total)	**106**	**25**	**5**	**66**	**23**	**139**	**32**	**7**	**82**	**33**

Source: U.S. Census Bureau 2021; FEMA 2014
Note: Results for population are rounded down.

Table 10-9. Estimated General Building Stock Located in the 1% and 0.2% Annual Chance Flood Hazard Areas - All Occupancies

	Jurisdiction Total Buildings		1 Percent Annual Chance Flood Hazard Area				0.2 Percent Annual Chance Flood Hazard Area			
			Number of Buildings		Replacement Cost Value		Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total	Count	% of Jurisdiction Total	Value	% of Jurisdiction Total
Andover (B)	326	$693,607,785	8	2.5%	$73,800,865	10.6%	8	2.5%	$73,800,865	10.6%
Andover (Twp)	2,577	$4,012,892,721	3	0.1%	$36,392,880	0.9%	3	0.1%	$36,392,880	0.9%
Branchville (B)	426	$598,388,025	3	0.7%	$3,847,896	0.6%	3	0.7%	$3,847,896	0.6%
Byram (Twp)	3,676	$3,162,144,221	18	0.5%	$16,816,811	0.5%	35	1.0%	$23,526,288	0.7%
Frankford (Twp)	3,529	$3,491,793,002	43	1.2%	$53,967,319	1.5%	48	1.4%	$63,089,646	1.8%
Franklin (B)	2,058	$2,227,977,138	7	0.3%	$4,785,587	0.2%	13	0.6%	$11,815,836	0.5%
Fredon (Twp)	1,615	$1,542,422,915	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Green (Twp)	1,697	$1,821,582,866	14	0.8%	$10,608,668	0.6%	14	0.8%	$10,608,668	0.6%
Hamburg (B)	1,593	$1,809,235,911	1	0.1%	$446,136	<0.1%	1	0.1%	$446,136	<0.1%
Hampton (Twp)	2,761	$2,474,023,610	3	0.1%	$2,411,091	0.1%	4	0.1%	$3,625,639	0.1%
Hardyston (Twp)	4,401	$3,681,458,622	1	0.0%	$385,015	<0.1%	1	<0.1%	$385,015	<0.1%
Hopatcong (B)	8,004	$3,432,619,930	114	1.4%	$101,360,010	3.0%	114	1.4%	$101,360,010	3.0%
Lafayette (Twp)	1,463	$2,142,628,709	15	1.0%	$26,810,208	1.3%	25	1.7%	$36,003,368	1.7%
Montague (Twp)	2,175	$1,659,675,649	29	1.3%	$10,522,033	0.6%	45	2.1%	$20,426,285	1.2%
Newton (T)	2,676	$5,699,120,026	27	1.0%	$195,829,641	3.4%	35	1.3%	$218,640,318	3.8%
Ogdensburg (B)	992	$954,409,603	2	0.2%	$71,248,947	7.5%	24	2.4%	$76,607,140	8.0%
Sandyston (Twp)	1,526	$1,350,071,503	12	0.8%	$9,616,699	0.7%	25	1.6%	$18,302,706	1.4%
Sparta (Twp)	8,127	$10,316,900,290	35	0.4%	$50,014,543	0.5%	35	0.4%	$50,014,543	0.5%
Stanhope (B)	1,552	$1,228,753,628	1	0.1%	$486,280	<0.1%	1	0.1%	$486,280	<0.1%
Stillwater (Twp)	2,487	$1,611,608,776	2	0.1%	$442,101	<0.1%	2	0.1%	$442,101	<0.1%
Sussex (B)	677	$2,187,092,184	11	1.6%	$117,354,278	5.4%	13	1.9%	$122,208,003	5.6%
Vernon (Twp)	12,039	$6,816,863,576	57	0.5%	$95,723,008	1.4%	57	0.5%	$95,723,008	1.4%
Walpack (Twp)	51	$68,015,712	9	17.6%	$26,935,298	39.6%	9	17.6%	$26,935,298	39.6%
Wantage (Twp)	5,509	$5,527,803,803	47	0.9%	$58,709,782	1.1%	47	0.9%	$58,709,782	1.1%
Sussex County (Total)	**71,937**	**$68,511,090,204**	**462**	**0.6%**	**$968,515,095**	**1.4%**	**562**	**0.8%**	**$1,053,397,709**	**1.5%**

Source: Sussex County 2023; NJOGIS, Civil Solutions, Spatial Data Logic; RS Means 2022; FEMA 2014

Table 10-10. Buildings on Lands in the 1% and 0.2% Annual Chance Flood Hazard Areas, by General Occupancy Class

	1 Percent Annual Chance Flood Event Hazard Area				0.2 Percent Annual Chance Flood Event Hazard Area			
	Residential	Commercial	Industrial	Other[a]	Residential	Commercial	Industrial	Other[a]
Andover (B)	4	4	0	0	4	4	0	0
Andover (Twp)	1	1	0	1	1	1	0	1
Branchville (B)	2	1	0	0	2	1	0	0
Byram (Twp)	12	2	0	4	29	2	0	4
Frankford (Twp)	27	5	0	11	29	7	0	12
Franklin (B)	6	1	0	0	8	2	0	3
Fredon (Twp)	0	0	0	0	0	0	0	0
Green (Twp)	6	0	0	8	6	0	0	8
Hamburg (B)	1	0	0	0	1	0	0	0
Hampton (Twp)	2	0	0	1	2	0	0	2
Hardyston (Twp)	1	0	0	0	1	0	0	0
Hopatcong (B)	109	2	0	3	109	2	0	3
Lafayette (Twp)	9	3	0	3	15	4	0	6
Montague (Twp)	28	0	0	1	43	0	0	2
Newton (T)	10	11	2	4	14	14	2	5
Ogdensburg (B)	1	1	0	0	23	1	0	0
Sandyston (Twp)	8	0	0	4	13	8	0	4
Sparta (Twp)	26	5	0	4	26	5	0	4
Stanhope (B)	0	1	0	0	0	1	0	0
Stillwater (Twp)	2	0	0	0	2	0	0	0
Sussex (B)	1	2	0	8	1	3	0	9
Vernon (Twp)	36	13	3	5	36	13	3	5
Walpack (Twp)	2	0	0	7	2	0	0	7
Wantage (Twp)	25	11	2	9	25	11	2	9
Sussex County (Total)	**319**	**63**	**7**	**73**	**392**	**79**	**7**	**84**

Source: Sussex County 2023; NJOGIS, Civil Solutions, Spatial Data Logic; FEMA 2014

a. Other = Government, Religion, Agricultural, and Education

Table 10-11. Estimated General Building Stock Potential Loss to the 1 Percent Annual Chance Flood Event

	Total Replacement Cost Value	1 Percent Annual Chance Flood Event Impact on Buildings				
		Estimated Loss for All Occupancies	Percent of Total	Estimated Loss for Residential Properties	Estimated Loss for Commercial Properties	Estimated Loss for All Other Occupancies
Andover (B)	$693,607,785	$7,483,884	1.1%	$306,631	$7,177,253	$0
Andover (Twp)	$4,012,892,721	$166,763	<0.1%	$5,178	$160,332	$1,253
Branchville (B)	$598,388,025	$214,971	<0.1%	$34,898	$180,072	$1
Byram (Twp)	$3,162,144,222	$2,293,188	0.1%	$417,161	$186,864	$1,689,163
Frankford (Twp)	$3,491,793,002	$5,205,087	0.1%	$2,391,381	$402,171	$2,411,535
Franklin (B)	$2,227,977,138	$590,132	<0.1%	$465,232	$124,900	$0
Fredon (Twp)	$1,542,422,915	$0	0.0%	$0	$0	$0
Green (Twp)	$1,821,582,867	$2,843,263	0.2%	$248,234	$0	$2,595,029
Hamburg (B)	$1,809,235,911	$0	0.0%	$0	$0	$0
Hampton (Twp)	$2,474,023,610	$255,632	<0.1%	$117,408	$0	$138,224
Hardyston (Twp)	$3,681,458,622	$116,131	<0.1%	$116,131	$0	$0
Hopatcong (B)	$3,432,619,929	$38,597,608	1.1%	$5,289,268	$32,968,054	$340,286
Lafayette (Twp)	$2,142,628,709	$9,664,809	0.5%	$428,838	$982,625	$8,253,346
Montague (Twp)	$1,659,675,648	$2,032,497	0.1%	$1,923,726	$0	$108,771
Newton (T)	$5,699,120,027	$12,875,345	0.2%	$471,331	$1,574,255	$10,829,759
Ogdensburg (B)	$954,409,603	$6,486,264	0.7%	$74,167	$6,412,097	$0
Sandyston (Twp)	$1,350,071,503	$3,606,318	0.3%	$440,653	$0	$3,165,665
Sparta (Twp)	$10,316,900,290	$10,803,857	0.1%	$1,188,939	$9,149,006	$465,912
Stanhope (B)	$1,228,753,628	$19,086	<0.1%	$0	$19,086	$0
Stillwater (Twp)	$1,611,608,775	$37,742	<0.1%	$37,742	$0	$0
Sussex (B)	$2,187,092,184	$894,900	<0.1%	$44,936	$804,296	$45,668
Vernon (Twp)	$6,816,863,576	$26,495,071	0.4%	$2,476,782	$20,601,385	$3,416,904
Walpack (Twp)	$68,015,712	$5,406,843	7.9%	$56,016	$0	$5,350,827
Wantage (Twp)	$5,527,803,803	$13,627,304	0.2%	$2,383,450	$5,302,506	$5,941,348
Sussex County (Total)	**$68,511,090,205**	**$149,716,695**	**0.2%**	**$18,918,102**	**$86,044,902**	**$44,753,691**

Source: Hazus v6.0, Sussex County 2023; RS Means 2022; NJOGIS, Civil Solutions, Spatial Data Logic; FEMA 2016

Table 10-12. Repetitive Loss Properties and NFIP Data for Sussex County

	Total Number of Policies	Total Premium + Policy Fee	Total Claims	Total Payments	Number of NFIP Repetitive Loss (RL) Properties
Andover (B)	3	$6,988	1	$4,313.60	0
Andover (Twp)	3	$2,339	2	$303.65	0
Branchville (B)	3	$2,576	9	$57,588.67	2
Byram (Twp)	13	$13,896	14	$129,877.78	3
Frankford (Twp)	12	$14,415	13	$74,895.88	0
Franklin (B)	5	$7,108	9	$42,743.97	0
Fredon (Twp)	2	$1,170	2	$6,936.73	0
Green (Twp)	5	$3,657	3	$21,582.77	0
Hamburg (B)	2	$1,590	0	$0.00	0
Hampton (Twp)	3	$4,023	1	$0.00	0
Hardyston (Twp)	4	$2,957	3	$60,786.68	0
Hopatcong (B)	8	$4,065	12	$54,192.61	1
Lafayette (Twp)	2	$1,367	7	$24,565.66	1
Montague (Twp)	13	$22,373	17	$178,247.79	3
Newton (T)	10	$15,542	8	$295,504.96	0
Ogdensburg (B)	8	$5,114	9	$49,121.63	1
Sandyston (Twp)	5	$6,596	5	$209,805.75	1
Sparta (Twp)	28	$22,928	14	$32,999.07	0
Stanhope (B)	3	$10,379	2	$16,257.13	0
Stillwater (Twp)	5	$3,680	5	$87,322.80	0
Sussex (B)	3	$2,270	4	$65,202.14	1
Vernon (Twp)	19	$18,380	21	$121,236.16	2
Walpack (Twp)	0	$0	1	$7,076.41	0
Wantage (Twp)	9	$8,854	10	$180,963.26	0
Sussex County (Total)	**168**	**$182,267**	**172**	**$1,721,525**	**15**

Source: FEMA Region 2 2024
B – Borough; T – Town; Twp – Township
Notes: NFIP statistics provided by FEMA Region 2 and are current as of April 2024. The statistics were summarized using the Community Name provided by FEMA Region 2

Data on severe repetitive loss properties was not available for this update. These are residential properties covered under an NFIP flood insurance policy that satisfy either of conditions 1 and 2, as well as condition 3:

1. At least four NFIP claim payments for the property (including building and contents) over $5,000 each have occurred, and the cumulative amount of such claims payments exceeded $20,000.
2. At least two separate claims payments for the property (building payments only) have occurred, and the cumulative amount of the building portion of such claims exceeded the market value of the building.
3. For either of the above, at least two of the referenced claims occurred within any 10 year period and more than 10 days apart.

10.2.3 Community Lifelines and Other Critical Facilities

Critical services may not be available during and after a flood event if critical facilities are directly damaged or transportation routes to access these critical facilities are impacted. Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area to many service providers needing to reach vulnerable populations or to make repairs. Utilities such as overhead power, cable, and phone lines could also be vulnerable due to utility poles damaged by standing water. Loss of these utilities could create additional isolation issues for the inundation zones. When short-term functionality at a critical facility is impacted by flooding, facilities of neighboring municipalities may need to increase support response.

In Sussex County, 1.4 percent of all roadways are in the 1 percent annual chance flood event, and 1.7 percent are in the 0.2 percent annual chance flood event. The major highways exposed to the 1 percent annual chance flood include portions of: I-80, NJ 181, NJ 23, NJ 15, NJ 94, NJ 183, and US 206. Table 10-16 summarizes the total number of miles of exposed roadways by jurisdiction.

Table 10-13. Roadway Miles Exposed to the 1% and 0.2% Annual Chance Flood Hazard Areas

		1 Percent Annual Chance Flood		0.2 Percent Annual Chance Flood	
	Total Road Miles	Total Road Miles	% of Jurisdiction Total	Total Road Miles	% of Jurisdiction Total
Andover (B)	7.0	0.2	2.3%	0.2	2.3%
Andover (Twp)	68.3	0.1	0.1%	0.1	0.2%
Branchville (B)	7.1	0.1	0.8%	0.1	1.1%
Byram (Twp)	70.1	1.2	1.7%	1.8	2.6%
Frankford (Twp)	98.5	2.7	2.7%	2.8	2.9%
Franklin (B)	27.3	0.3	1.3%	0.4	1.6%
Fredon (Twp)	50.9	0.0	0.0%	0.0	0.0%
Green (Twp)	49.6	0.8	1.7%	0.8	1.7%
Hamburg (B)	11.5	<0.1%	<0.1%	<0.1%	<0.1%
Hampton (Twp)	52.5	0.5	0.9%	0.5	1.0%
Hardyston (Twp)	64.4	0.3	0.5%	0.3	0.5%
Hopatcong (B)	80.0	0.1	0.2%	0.1	0.2%
Lafayette (Twp)	44.3	1.9	4.2%	2.5	5.6%
Montague (Twp)	57.2	1.4	2.4%	1.7	2.9%
Newton (T)	30.3	0.4	1.3%	0.5	1.6%
Ogdensburg (B)	14.8	0.2	1.1%	0.3	2.2%
Sandyston (Twp)	51.9	1.3	2.5%	1.6	3.0%
Sparta (Twp)	139.1	0.3	0.2%	0.5	0.4%
Stanhope (B)	17.6	<0.1%	<0.1%	<0.1%	<0.1%
Stillwater (Twp)	60.3	0.5	0.9%	0.5	0.9%
Sussex (B)	9.1	0.2	2.7%	0.3	3.5%
Vernon (Twp)	126.8	1.1	0.9%	1.2	1.0%
Walpack (Twp)	20.2	2.6	12.7%	4.2	20.5%
Wantage (Twp)	174.2	2.5	1.4%	2.6	1.5%
Sussex County (Total)	**1,333.2**	**18.6**	**1.4%**	**23.1**	**1.7%**

Source: Sussex County 2021, 2023; FEMA 2014

Issues associated with flooding of critical facilities include isolation, health problems caused by water and sewer systems that are flooded or backed up, and drinking water contamination caused by floodwaters carrying pollutants in water supplies. Debris from flood events may also affect culverts and sewer systems by creating bottlenecks in the wastewater system. This could cause or exacerbate localized urban flooding and cause wastewater to spill into homes and neighborhoods or contaminate local rivers and streams. As a result, contamination of drinking water supplies can be a significant secondary event created by major flood events.

10.2.4 Economy

Flood impacts on the local and regional economy include general building stock damage and associated tax loss, loss of use of utilities and infrastructure, agricultural losses, business interruption, and impacts on tourism. R enovations of commercial and industrial buildings may be necessary, disrupting associated services. Extensive flood damage to public utilities can cause disruptions to delivery of services. Loss of power and communications may occur, and drinking water and wastewater treatment facilities may be temporarily out of operation.

Hazus estimates the amount of debris generated from the 1 percent annual chance event. The model breaks down debris into three categories based on the types of equipment needed to handle the debris: finishes (dry wall, insulation, etc.); structural (wood, brick, etc.); and foundations (concrete slab and block, rebar, etc.). This does not include non-structural debris or additional potential damage and debris possibly generated by wind that may be associated with a flood event or storm that causes flooding. Table 10-17 summarizes the debris Hazus estimates for Sussex County. Hazus estimates 2,786 tons of debris will be generated in total.

10.2.5 Natural, Historic and Cultural Resources

Natural

The environmental impacts of a flood can include significant water quality and debris-disposal issues. Floodwaters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to floodwaters. Hazardous materials may be released and distributed widely across the floodplain. After floodwaters subside, contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties. In addition, severe erosion caused by flooding can negatively impact local ecosystems. The erosion of sediment can deteriorate riverbanks, causing additional flooding into locations that may not otherwise have experienced flooding conditions.

Historic

Historic places, community facilities, and religious institutions are all vulnerable to impacts from flooding. Museums and historic buildings face structural damage during flood events. Historic structures often are not built to modern building code requirements, including design flood elevation and construction standards. Historic resources and structures were often built close to waterways, increasing their flood risk. Depending on severity, flood events affecting the County could bring devastating loss of life and property to the area in and around historical landmarks.

Table 10-14. Estimated Debris Generated from the 1 Percent Annual Chance Flood Event

	1 Percent Annual Chance Flood Event Hazard Area			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Andover (B)	69	69	0	0
Andover (Twp)	7	6	1	0
Branchville (B)	30	28	1	1
Byram (Twp)	105	90	9	7
Frankford (Twp)	105	104	0	0
Franklin (B)	80	68	7	6
Fredon (Twp)	1	1	0	0
Green (Twp)	16	12	2	1
Hamburg (B)	54	54	0	0
Hampton (Twp)	15	13	1	1
Hardyston (Twp)	7	6	0	0
Hopatcong (B)	300	122	103	75
Lafayette (Twp)	34	32	1	1
Montague (Twp)	118	56	36	26
Newton (T)	263	262	1	0
Ogdensburg (B)	33	33	0	0
Sandyston (Twp)	49	32	10	7
Sparta (Twp)	325	259	40	26
Stanhope (B)	37	20	11	7
Stillwater (Twp)	91	28	37	26
Sussex (B)	436	198	132	106
Vernon (Twp)	326	217	62	47
Walpack (Twp)	116	24	51	41
Wantage (Twp)	168	94	42	32
Sussex County (Total)	**2,786**	**1,830**	**546**	**410**

Source: Hazus v6.0; Sussex County 2023; NJOGIS, Civil Solutions, Spatial Data Logic

Cultural

Cultural institutions, parks and open spaces, community facilities, and religious institutions are all vulnerable to impacts from flooding. Floods pose the risk of damage to cultural artifacts that are not easily replaceable. Parks, recreation, and community space closures due to flood events can disrupt residents' lives and hinder access to critical community services. Parks and recreational areas are often located near waterways. Depending on severity, flood events affecting the County could bring devastating loss of life and property to the area in and around cultural landmarks.

10.3 CHANGE OF VULNERABILITY SINCE 2021 HMP

Overall, the County's vulnerability to the flood hazard has not changed, and the entire County will continue to be vulnerable to this hazard. Any change in vulnerability since the previous HMP would be attributed to changes in

population density and new development. This updated HMP used updated building stock and critical asset inventories to assess the County's risk to these assets. The building inventory was updated using RSMeans 2022 values, which are more current and reflect replacement cost rather than the building stock improvement values reported in the 2021 HMP. Further, the 2021 5-year population estimates from the American Community Survey were used to evaluate the population exposed to the hazard areas.

10.4 FUTURE CHANGES THAT MAY AFFECT RISK

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

10.4.1 Potential or Planned Development

As Sussex County communities grow, flood events may increase in frequency and/or severity as land use changes, more structures are built, and impervious surfaces expand. Being aware of flood extents and requirements of protection will be critical for all future projects. The Sussex County Planning Board (SCPB) is responsible for review or approval of site plan and subdivision applications and implementing the Sussex County Land Development Standards. Further, a site plan review process is done at the municipal level to ensure compliance with local ordinances. The State of New Jersey's 2023 Inland Flood Rule which, among other protections, increases building freeboard requirements to 3 feet above the base flood elevation. This amount of freeboard better protects new development from flooding impacts.

10.4.2 Projected Changes in Population

The New Jersey Department of Labor and Workforce Development produced population projections by County from 2014 to 2019, 2024, 2029, and 2034. Sussex County is projected to have a decrease in population in the upcoming years. These projections estimate a population of 140,400 by 2024, 137,300 by 2029, and 136,600 by 2034 (State of New Jersey 2017).

Changes in the density of population can create issues for local residents during evacuation for a flood event. Historically, flooding and debris have severely impacted transportation corridors as well as infrastructure. As areas continue to be cleared for new development and run-off persists, the population in the County will remain exposed to this hazard.

10.4.3 Climate Change

Flood extents for the 1 percent and 0.2 percent annual chance flood events will continue to evolve alongside natural occurrences such as climate change and/or severity of storms. Annual precipitation amounts in the region are projected to increase, primarily in the form of heavy rainfalls, which have the potential to increase the risk to flash flooding and riverine flooding, and flood critical transportation corridors and infrastructure. Increases in precipitation may alter and expand the floodplain boundaries and runoff patterns, resulting in the exposure of populations, buildings, and critical facilities that were previously outside the floodplain. This increase in exposure would result in an increased risk to life and health, an increase in structural losses, a diversion of additional resources to response and recovery efforts, and an increase in business closures affected by future flooding events due to loss of service or access.