4.3.3 Drought

2024 HMP Changes

- New and updated figures from federal and state agencies are incorporated.
- U.S. 2020 Census data was incorporated, where appropriate.
- Previous occurrences were updated with events that occurred between 2018 and 2023.

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the drought hazard in Burlington County.

Hazard Description

As defined by the National Weather Service (NWS), drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal, recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions and can vary significantly from one region to another. Human factors, such as water demand and water management, can exacerbate the impact that a drought has on a region. There are five different ways that drought can be defined or grouped:

- *Meteorological drought* is a measure of departure of precipitation from normal. It is defined solely by the relative degree of dryness. Due to climatic differences, what might be considered a drought in one location of the country may not be a drought in another location.
- *Agricultural drought* links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced ground water or reservoir levels, and other parameters. It occurs when there is not enough water available for a particular crop to grow at a particular time. Agricultural drought is defined in terms of soil moisture deficiencies relative to water demands of plant life, primarily crops.
- *Hydrological drought* is associated with the effects of periods of precipitation shortfalls (including snowfall) on surface or subsurface water supply. It occurs when these water supplies are below normal. It is related to the effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
- *Socioeconomic drought* is associated with the supply and demand of an economic good with elements of meteorological, hydrological, and agricultural drought. This differs from the aforementioned types of drought because its occurrence depends on the time and space processes of supply and demand to identify or classify droughts. The supply of many economic goods depends on the weather (for example water, forage, food grains, fish, and hydroelectric power). Socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply.
- *Ecological drought* is a prolonged and widespread deficit in naturally available water supplies — including changes in natural and managed hydrology — that create multiple stresses across ecosystems (NDMC n.d.).

Water in hydrologic storage systems (e.g., reservoirs, rivers) is often used for multiple and competing purposes (e.g., flood control, irrigation, recreation, navigation, hydropower, or wildlife habitat), further complicating the sequence

and quantification of impacts. Competition for water in these storage systems escalates during drought and conflicts between water users increase significantly (NDMC n.d.).

Location

Climate divisions are regions within a state that are climatically homogenous. The National Oceanic and Atmospheric Administration (NOAA) has divided the U.S. into 359 climate divisions. The boundaries of these divisions typically coincide with the county boundaries, except in the western U.S., where they are based largely on drainage basins (U.S. Energy Information Administration, Date Unknown). According to NOAA, New Jersey is made up of three climate divisions: Northern, Southern, and Coastal (NOAA 2012). Burlington County is located in the Southern Climate Division.

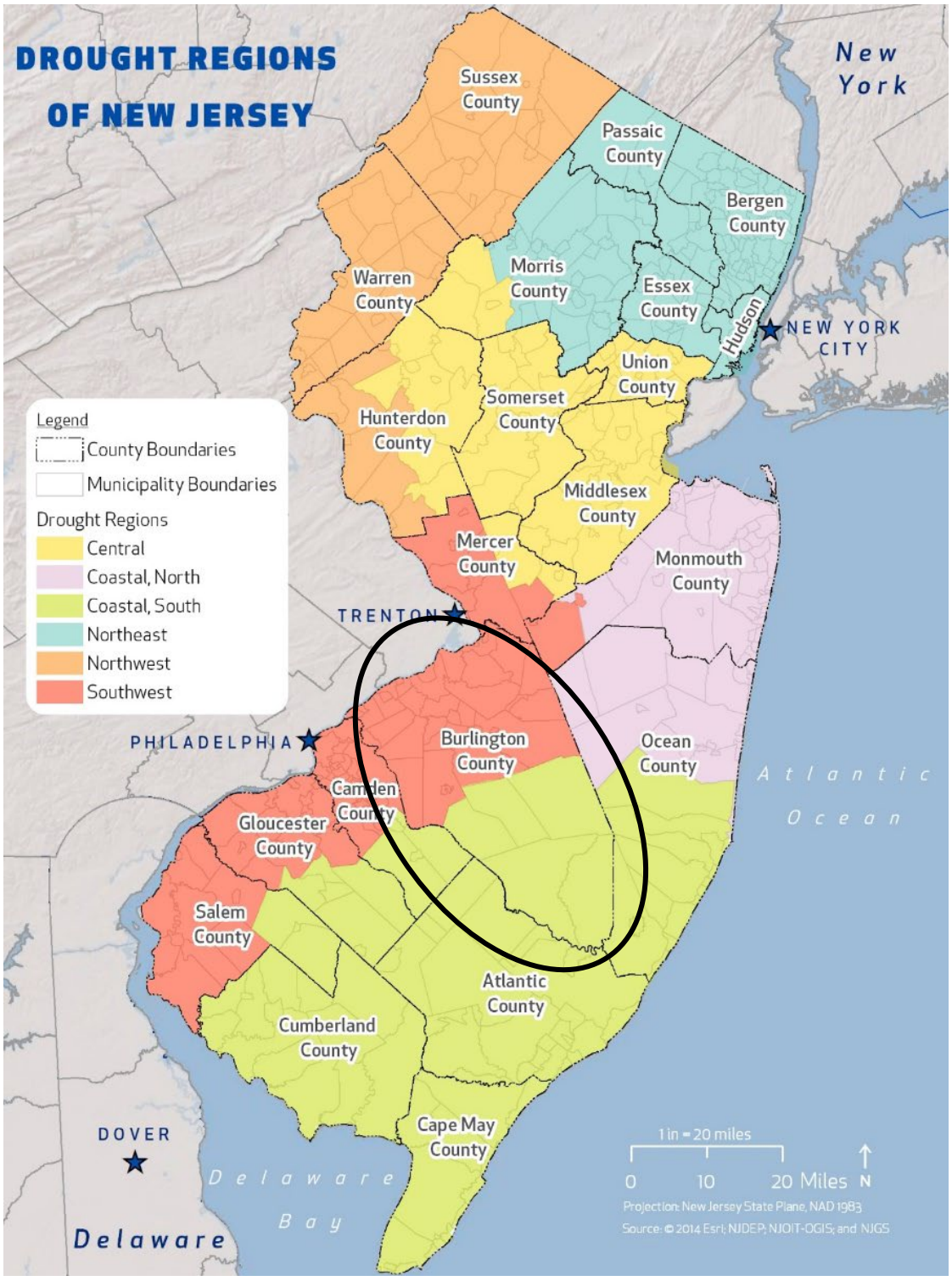
Drought regions allow New Jersey to respond to changing conditions without imposing restrictions on areas not experiencing water supply shortages. New Jersey is divided into six drought regions that are based on regional similarities in water supply sources and rainfall patterns (Hoffman and Domber 2003). These regions were developed based upon hydro-geologic conditions, watershed boundaries, municipal boundaries, and water supply characteristics. Drought region boundaries are contiguous with municipal boundaries because during a water emergency, the primary enforcement mechanism for restrictions is municipal police forces. Figure 4.3.3-1 shows the drought regions of New Jersey. Burlington County is located in both the Southwest, and the Coastal, South Drought Regions. According to the NJDEP, major water supply sources available to the Southwest Drought Region and northern portion of Burlington County include the Delaware River Basin and unconfined ground water, and rivers as a minor source. For the Coastal South Drought Region and southern portion of Burlington County, major water sources include unconfined ground water, and minor sources include rivers and the New Jersey Reservoir.

Surface waters in New Jersey provide much of the water used for drinking supplies, as well as for recreation, fishing, tourism, and commercial uses (NJDEP 2023). The State is divided into five water regions based upon watershed management area, and HUC11 (Hydrologic Unit Code). Burlington County is located within both the Lower Delaware and Atlantic Coast water regions; refer to Figure 4.3.3-2 (NJDEP 2022). In terms of annual water withdrawal by sector in the Lower Delaware Region, the majority is for power generation, with a small percent of surface water used for potable water supply. By comparison, in the Atlantic Coast region, the majority of water withdrawals is for potable water supply, followed by agricultural and commercial uses. Water use trends, like withdrawal trends, vary from month to month with water use typically peaking during summer months when outdoor and irrigation demands are high (NJDEP 2017).

Over 1.2 billion gallons of potable water are used in New Jersey each day, with 88 percent of the State's population receiving its drinking water from public community water systems. A public water system is defined as a water system that pipes water for human consumption that has at least 15 service connections or regularly serves at least 25 individuals 60 days or more a year. About half the State's population receives its drinking water from surface water, the rest from ground water (NJDEP 2017).

Burlington County is also home to a large agricultural industry which is heavily reliant on existing water resources. According to the USDA Agricultural Census, as of 2017 the County has 915 farms which total 96,256 acres of land within Burlington County. The average size of each farm is approximately 105 acres which is an 8 percent decrease since the 2012 Agricultural Census. The total market value of products sold by farms located in Burlington County is roughly 98.6 million dollars while the average market value of products sold by each farm is 107,738 dollars on an annual basis.

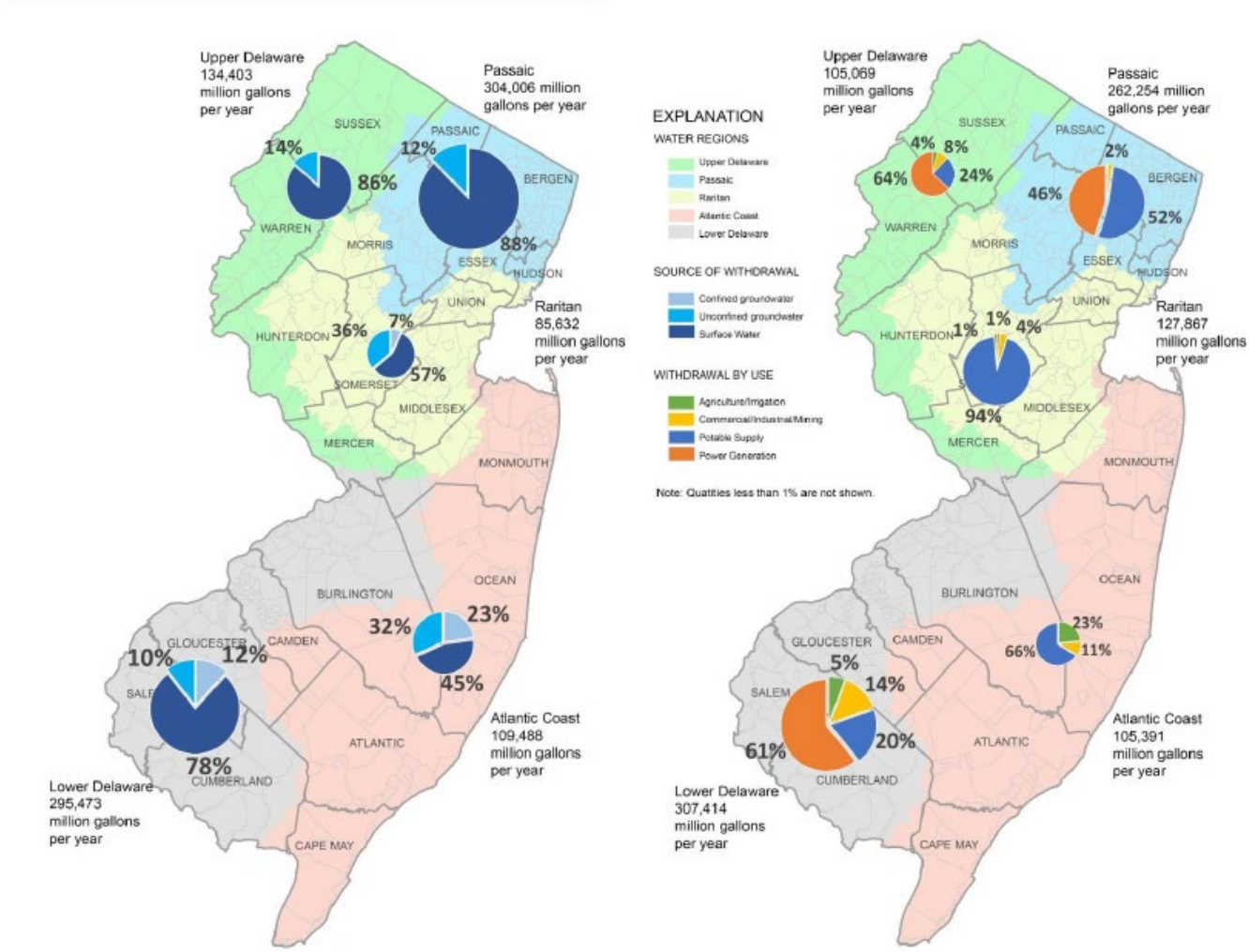
Figure 4.3.3-1. Drought Regions of New Jersey



Note: The black circle indicates the location of Burlington County

Source: NJOEM 2019

Figure 4.3.3-2. Water Regions, Sources and Withdrawal by Sector in New Jersey



Source: NJDEP 2017

40 percent of all farms have a sales value of less than $2,500 while 129 have an annual value of $100,000 or more. Most sales of farms located in the County are from crop production while a small fraction of sales stem from livestock and poultry products (USDA 2019). Because this industry is heavily reliant on water, it is critical to examine the County vulnerability to drought to reduce any loss of income from farming.

Extent

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts (NOAA 2021). The State of New Jersey uses a multi-index system that takes advantage of some of these indices to determine the severity of a drought or extended period of dry conditions (NJDEP 2021).

Palmer Drought Severity Index

The Palmer Drought Severity Index (PDSI) is commonly used by drought monitoring agencies for drought reporting. The PDSI is primarily based on soil conditions. Soil with decreased moisture content is the first indicator of an overall moisture deficit. Table 4.3.3-1 lists the PDSI classifications. At the one end of the spectrum, 0 is used as normal and drought is indicated by negative numbers. For example, -2 is moderate drought, -3 is severe drought, and -4 is extreme drought. The PDSI also reflects excess precipitation using positive numbers; however, this is not shown in Table 4.3.3-1 (NCAR 2023).

Table 4.3.3-1. Palmer Drought Category Descriptions

Category	Description	Possible Impacts	Palmer Drought Index
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting and growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.99
D1	Moderate drought	Some damage to crops and pastures; fire risk high; streams, reservoirs, or wells low; some water shortages developing or imminent; voluntary water-use restrictions requested.	-2.0 to -2.99
D2	Severe drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.	-3.0 to -3.99
D3	Extreme drought	Major crop or pasture losses; extreme fire danger; widespread water shortages or restrictions.	-4.0 to -4.99
D4	Exceptional drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.	-5.0 or less

Source: NCAR 2023

Watches, Warnings, and Emergencies

The Division of Water Supply and Geoscience within the NJDEP regularly monitors various water supply conditions within the State based on the different Water Supply Regions. The water supply conditions aid NJDEP in declaring the regions as being within one of the four stages of water supply drought, Normal, Drought Watch, Drought Warning, and Drought Emergency:

- *Normal Conditions* indicate no drought conditions are present. There is routine monitoring of water supply and meteorological indicators.
- A *Drought Watch* is an administrative designation made by NJDEP when drought or other factors begin to adversely affect water supply conditions. A Drought Watch indicates that conditions are dry but not yet significantly so. During a Drought Watch, NJDEP closely monitors drought indicators (including precipitation, stream flows and reservoir and ground water levels, and water demands) and consults with affected water suppliers. The aim of a Drought Watch is to avert a more serious water shortage that would necessitate declaration of a water emergency and the imposition of mandatory water use restrictions, bans on water use, or other potentially drastic measures.
- A *Drought Warning* represents a non-emergency phase of managing available water supplies during the developing stages of drought and falls between the Drought Watch and Drought Emergency levels of drought response. Under a Drought Warning, the commissioner of the DEP may order water purveyors to develop alternative sources of water or transfer water between areas of the State with relatively more water to those

with less. While mandatory water use restrictions are not imposed under a Warning, the general public is strongly urged to use water sparingly in affected areas.

- A *Drought Emergency* can only be declared by the governor. While drought warning actions focus on increasing or shifting the supply of water, efforts initiated under a water emergency focus on reducing water demands. During a water emergency, a phased approach to restricting water consumption is typically initiated. Phase I water use restrictions typically target non-essential, outdoor water use (NJDEP 2021).

The National Weather Service Climate Prediction Center can provide seasonal outlooks for droughts that last for three month increments. To view the current seasonal outlook visit, http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale (NIDIS n.d.).

Previous Occurrences and Losses

Historical information regarding previous occurrences and losses associated with drought events throughout New Jersey and areas within Burlington County was obtained from many sources. Given so many sources reviewed for the purpose of this HMP, loss and impact information regarding many events could vary depending on the source.

FEMA Major Disasters and Emergency Declarations

Between May 1953 and June 2023, FEMA declared that the State of New Jersey experienced two drought-related disasters (DR) or emergencies (EM). Burlington County was included in both of these drought-related declarations. Table 4.3.3-2 lists declarations from May 1953 and June 2023 for this HMP update. Detailed information about all declared disasters since 1953 is provided in Section 3 (County Profile).

Table 4.3.3-2. FEMA Declarations for Drought Events in Burlington County

FEMA Declaration Number	Date of Declaration	Date of Event	Event Type	Event Title
DR-205-NJ	August 18, 1965	August 18, 1965	Drought	New Jersey Water Shortage
EM-3083-NJ	October 19, 1980	October 19, 1980	Drought	New Jersey Water Shortage

Source: FEMA 2023

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. As shown in Table 4.3.3-3, between January 2015 and June 2023, Burlington County was included in 7 drought-related agricultural disaster declarations.

Table 4.3.3-3. USDA Declarations for Drought Events in Burlington County, August 2018 – June 2023

Date of Event	Event Type	Declaration Number	Description
April 1 – September 29, 2015	Drought	S3930	Excessive Heat and Drought
July 16 – September 29, 2015	Drought	S3932	Excessive Heat and Drought

Date of Event	Event Type	Declaration Number	Description
April 1 – September 10, 2016	Drought	S4071	Combined effects of Freeze, Excessive Heat, and Drought
May 1 – December 10, 2016	Drought	S4165	Drought
April 7 – October 3, 2022	Drought	S5338	Drought
June 18 – September 5, 2022	Drought	S5347	Excessive Heat and Drought
July 1, 2022 - continuing	Drought	S5348	Excessive Heat and Drought

Source: USDA 2023

Previous Events

For the 2024 HMP update, known drought events that impacted Burlington County between August 2018 and May 2023 are listed in Table 4.3.3-4. For events prior to August 2018, refer to the 2019 Burlington County HMP.

Table 4.3.3-4. Drought Incidents in Burlington County, 2018 to 2023

Date of Event	Event Type	Declaration Number	Burlington County Designated?	Description
May 2020	Drought	NA	NA	According to the U.S. Drought Monitor, conditions held at a D0 or "abnormally dry" status across Burlington County in May 2020.
May 19 – June 18, 2021	Drought	NA	NA	Stage 3 fire restrictions took effect on May 19 in 11 of New Jersey's 21 counties. The 11 counties were Atlantic, Burlington, Cape May, Camden, Cumberland, Gloucester, Mercer, except Hopewell Township, Middlesex, south of the Raritan River, Monmouth, Ocean, and Salem. It was prohibited to light fires "within or adjacent to forested areas" unless they're contained in an elevated stove using only propane, natural gas, gas, or electricity.
April – October 2022	Drought	NA	NA	According to the U.S. Drought Monitor, conditions held at a D0 or "abnormally dry" status across Burlington County from April 2022 – October 2022.
June – September 2022	Drought	NA	NA	According to the U.S. Drought Monitor, conditions held at a D1 or "moderate drought" status across Burlington County from June 2022 – September 2022.
August 9 – November 17, 2022	Drought	NA	NA	New Jersey is under a statewide drought watch as drought and heat strain water supplies. Water conservation is urged. Stream flow and ground water levels were below normal for most of the State, and some reservoirs were dropping quickly.
February – March 2023	Drought	NA	NA	According to the U.S. Drought Monitor, conditions held at a D0 or "abnormally dry" status across Burlington County from February 2023 – March 2023.
June 20 – July 20, 2023	Drought	NA	NA	Governor Phil Murphy's administration urged residents and businesses to use water wisely due to the State's dry conditions and the start of summer. Statewide, rainfall in New Jersey has been less than half of normal over the past 30 days.

Source: NIDIS 2023*; USDA 2023; FEMA 2023; NDMC 2023*

Probability of Future Occurrence

For the 2024 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of drought events for the County. Information from NOAA-NCEI storm events database, FEMA and USDA disaster declarations, and the U.S. Drought Monitor were used to identify the number of drought events that occurred between January 1950 and May 2023. Table 4.3.3-5 presents the probability of future events for drought in Burlington County.

Table 4.3.3-5. Probability of Future Occurrences of Drought Events

Hazard Type	Occurrences Between 1965 and 2023	% Chance of Occurring in Any Given Year
Drought	53	91.37%

Source: NIDIS 2023; USDA 2023; FEMA 2023; NOAA 2023

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1965. Due to limitations in data, not all drought events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Based upon risk factors and past occurrences, it is likely that droughts will occur across New Jersey and Burlington County in the future. In addition, as temperatures increase (see climate change impacts), the probability for future droughts will likely increase as well. Therefore, it is likely that droughts will occur in New Jersey of varied severity in the future.

It is estimated that Burlington County will continue to experience direct and indirect impacts of drought and its impacts on occasion, with the secondary effects causing potential disruption or damage to agricultural activities and creating shortages in water supply within communities.

According to the US Drought Monitor, the long-term projections show that precipitation will increase in the region, which is contradictory to the statement that drought events will increase. However, it is important to note that while precipitation will increase, that is likely due to extreme preceptory events in shorter periods of time. At the same time, the number of drought events will also increase due to the longer periods of no rain. This gives a better understanding of how precipitation can increase at the same time; frequency of droughts also increases.

In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence rating for drought in the County is "rare."

Climate Change Impacts

Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes.

Climate change includes major changes in temperature, precipitation, or wind patterns, which occur over several decades or longer. Due to the increase in greenhouse gas concentrations since the end of the 1890s, New Jersey has experienced a 3.5 °F (1.9 °C) increase in the State's average temperature, which is faster than the rest of the Northeast region (2 °F [1.1 °C]) and the world (1.5 °F [0.8 °C]). This warming trend is expected to continue. By 2050, temperatures in New Jersey are expected to increase by 4.1 to 5.7 °F (2.3 °C to 3.2 °C). Thus, New Jersey can expect to experience an average annual temperature that is warmer than any to date (low emissions scenario) and future

temperatures could be as much as 10 °F (5.6 °C) warmer (high emissions scenario). New Jersey can also expect that by the middle of the 21st century, 70 percent of summers will be hotter than the warmest summer experienced to date. The increase in temperatures is expected to be felt more during the winter months (December, January, and February), resulting in less intense cold waves, fewer sub-freezing days, and less snow accumulation (NJDEP 2020).

As temperatures increase, Earth's atmosphere can hold more water vapor which leads to a greater potential for precipitation. Currently, New Jersey receives an average of 46 inches of precipitation each year. Since the end of the twentieth century, New Jersey has experienced slight increases in the amount of precipitation it receives each year, and over the last 10 years there has been a 7.9 percent increase. By 2050, annual precipitation in New Jersey could increase by 4 percent to 11 percent. By the end of this century, heavy precipitation events are projected to occur two to five times more often and with more intensity than in the last century. New Jersey will experience more intense rain events, less snow, and more rainfalls. Also, small decreases in the amount of precipitation may occur in the summer months, resulting in greater potential for more frequent and prolonged droughts. New Jersey could also experience an increase in the number of flood events (NJDEP 2020).

By the end of this century, heavy precipitation events are projected to occur two to five times more often and with more intensity than in the last century. New Jersey will experience more intense rain events, less snow, and more rainfalls. Also, small decreases in the amount of precipitation may occur in the summer months, resulting in greater potential for more frequent and prolonged droughts (NJDEP 2020).

Droughts along with extreme precipitation have been an increasingly recurring phenomenon over the past decades. Precipitation has increased over time, which is counterintuitive given drought events are also projected to increase. However, this follows the trend of increased extreme weather. With isolated precipitation, in between long stretches of dry weather, wildfires, riverine flooding, and degraded water supply can all happen at the same time and therefore can put communities, especially those that live along a river, susceptible to structural flood damage along with potential degraded water supply due to the receding water table that cannot get replenished from such extreme precipitation. The County is thus vulnerable to droughts, especially along the Delaware River, where the temperatures increase dramatically and severe runoff from dry soils can cause degraded water supply (Cornell University 2021).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following discusses Burlington County's vulnerability, in a qualitative nature, to the drought hazard.

Impact on Life, Health, and Safety

The entire population of Burlington County (461,860) is exposed to this hazard. Drought conditions can cause a shortage of potable water for human consumption, both in quantity and quality. A decrease in available water may also impact power generation and availability to residents.

Health implications of drought are numerous. Some drought-related health effects are short-term while others can be long-term. Public health impacts may include an increase in heat-related illnesses, waterborne illnesses, recreational risks, limited food availability, and reduced living conditions. Vulnerable populations could be particularly susceptible to the drought hazard and cascading impacts due to age, health conditions, and limited ability to mobilize to shelter, cooling and medical resources. Other possible impacts to health due to drought include

increased recreational risks; effects on air quality; diminished living conditions related to energy, air quality, and sanitation and hygiene; compromised food and nutrition; and increased incidence of illness and disease (CDC 2021).

Socially Vulnerable Populations

The Centers for Disease Control and Prevention (CDC) 2020 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Burlington County's overall national score is 0.2648 and a state score of 0.3, both indicating that its communities have a low to medium level of social vulnerability (CDC 2018). This score indicates that some County residents may not have enough resources to respond to drought events. According to the 2021 5-year ACS estimates, there are 27,947 total persons living below the poverty level, 78,093 persons over the age of 65 years, 23,350 persons under the age of 5 years, 9,103 non-English speakers, and 51,899 persons with a disability in Burlington County.

As shown in Table 4.3.3-6, Evesham Township has the highest population over 65 (8,574) and highest population under the age of 5 (2,237). Pemberton Township has the largest population of non-English speaking persons (1,092). Willingboro Township has the greatest population of individuals living in poverty (2,685) and the largest disabled population (5,100). Wrightstown Township has the lowest population over 65 (58). Washington Township has the lowest population of individuals under the age of 5 (8). Bass River Township, Beverly City, Eastampton Township, Fieldsboro Borough, Medford Lakes Borough, Shamong Township, and Woodland Township all have no (0) non-English speaking persons living within the jurisdiction. Fieldsboro Borough has fewest number of disabled persons in their jurisdiction (62). Wrightstown Borough has the lowest population living in poverty (21).

Drought, often coupled with extreme heat, can cause health risks to farmers and their workers. According to the 2017 Census of Agriculture, there are over 1,500 workers on farms in Burlington County (USDA 2019). Workers who are exposed to extreme heat or work in hot environments may be at risk of heat stress. Heat stress can result in heat stroke, heat exhaustion, heat cramps, or heat rashes. Heat can also increase the risk of injuries in workers as it may result in sweaty palms, fogged-up safety glasses, and dizziness. Burns may also occur as a result of accidental contact with hot surfaces or steam. Sunlight exposure is highest during the summer and between 10:00 a.m. and 4:00 p.m. Working outdoors during these times increases the chances of getting sunburned. Workers at greater risk of heat stress include those who are 65 years of age or older, are overweight, have heart disease or high blood pressure, or take medications that may be affected by extreme heat (CDC 2020, CDC 2018).

Table 4.3.3-6. Burlington County Socially Vulnerable Populations by Municipality

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Bass River (T)	1,355	0.3%	248	18.3%	67	4.9%	0	0.0%	175	12.9%	95	7.0%
Beverly (C)	2,499	0.5%	292	11.7%	183	7.3%	0	0.0%	249	10.0%	300	12.0%
Bordentown (C)	3,993	0.9%	772	19.3%	216	5.4%	16	0.4%	422	10.6%	227	5.7%
Bordentown (T)	11,791	2.6%	1,601	13.6%	472	4.0%	289	2.4%	1,092	9.3%	194	1.6%
Burlington (C)	9,743	2.1%	1,301	13.4%	661	6.8%	208	2.1%	1,251	12.8%	1,422	14.6%
Burlington (T)	23,983	5.2%	3,526	14.7%	1,497	6.2%	385	1.6%	2,366	9.9%	2,185	9.1%
Chesterfield (T)	9,422	2.0%	760	8.1%	578	6.1%	153	1.6%	423	4.5%	165	1.8%
Cinnaminson (T)	17,064	3.7%	3,103	18.2%	929	5.4%	208	1.2%	1,661	9.7%	584	3.4%
Delanco (T)	4,824	1.0%	1,297	26.9%	191	4.0%	42	0.9%	676	14.0%	322	6.7%
Delran (T)	17,882	3.9%	2,570	14.4%	1,047	5.9%	723	4.0%	1,548	8.7%	902	5.0%
Eastampton (T)	6,191	1.3%	557	9.0%	264	4.3%	0	0.0%	478	7.7%	488	7.9%
Edgewater Park (T)	8,930	1.9%	1,571	17.6%	700	7.8%	367	4.1%	1,465	16.4%	1,645	18.4%
Evesham (T)	46,826	10.1%	8,574	18.3%	2,237	4.8%	749	1.6%	4,504	9.6%	1,476	3.2%
Fieldsboro (B)	526	0.1%	82	15.6%	64	12.2%	0	0.0%	62	11.8%	36	6.8%
Florence (T)	12,812	2.8%	2,122	16.6%	645	5.0%	260	2.0%	1,460	11.4%	827	6.5%
Hainesport (T)	6,035	1.3%	1,327	22.0%	58	1.0%	0	0.0%	744	12.3%	250	4.1%
Lumberton (T)	12,803	2.8%	2,048	16.0%	661	5.2%	107	0.8%	1,490	11.6%	805	6.3%
Mansfield (T)	8,897	1.9%	2,506	28.2%	394	4.4%	330	3.7%	1,465	16.5%	181	2.0%
Maple Shade (T)	19,980	4.3%	2,897	14.5%	1,159	5.8%	694	3.5%	2,433	12.2%	1,971	9.9%
Medford (T)	24,497	5.3%	5,151	21.0%	1,085	4.4%	31	0.1%	2,775	11.3%	724	3.0%
Medford Lakes (B)	4,264	0.9%	879	20.6%	211	4.9%	0	0.0%	407	9.5%	26	0.6%
Moorestown (T)	21,355	4.6%	3,480	16.3%	837	3.9%	603	2.8%	1,654	7.7%	807	3.8%
Mount Holly (T)	9,981	2.2%	1,199	12.0%	454	4.5%	133	1.3%	1,624	16.3%	958	9.6%
Mount Laurel (T)	44,633	9.7%	8,299	18.6%	2,011	4.5%	889	2.0%	4,203	9.4%	1,689	3.8%
New Hanover (T)	6,367	1.4%	311	4.9%	214	3.4%	29	0.4%	192	3.0%	116	1.8%
North Hanover (T)	7,963	1.7%	532	6.7%	975	12.2%	125	1.6%	631	7.9%	481	6.0%
Palmyra (B)	7,438	1.6%	1,077	14.5%	190	2.6%	44	0.6%	961	12.9%	616	8.3%
Pemberton (B)	1,371	0.3%	282	20.6%	56	4.1%	47	3.4%	308	22.5%	140	10.2%

Jurisdiction[a]	Decennial Population 2020		American Community Survey 5-Year Population Estimates (2021)									
			Population Over 65		Population Under 5		Non-English Speaking Population		Population with Disability		Population Below Poverty Level	
	Jurisdiction Total	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Pemberton (T)	26,903	5.8%	4,306	16.0%	1,429	5.3%	1,092	4.1%	4,006	14.9%	2,518	9.4%
Riverside (T)	8,003	1.7%	1,039	13.0%	354	4.4%	754	9.4%	972	12.1%	1,257	15.7%
Riverton (B)	2,764	0.6%	554	20.0%	80	2.9%	5	0.2%	187	6.8%	72	2.6%
Shamong (T)	6,460	1.4%	1,313	20.3%	324	5.0%	0	0.0%	671	10.4%	136	2.1%
Southampton (T)	10,317	2.2%	3,153	30.6%	293	2.8%	125	1.2%	1,551	15.0%	589	5.7%
Springfield (T)	3,245	0.7%	479	14.8%	129	4.0%	65	2.0%	311	9.6%	160	4.9%
Tabernacle (T)	6,776	1.5%	1,524	22.5%	380	5.6%	0	0.0%	747	11.0%	233	3.4%
Washington (T)	693	0.2%	138	19.9%	8	1.2%	8	1.1%	87	12.6%	21	3.0%
Westampton (T)	9,121	2.0%	1,139	12.5%	263	2.9%	81	0.9%	802	8.8%	268	2.9%
Willingboro (T)	31,889	6.9%	5,707	17.9%	1,916	6.0%	538	1.7%	5,100	16.0%	2,685	8.4%
Woodland (T)	1,544	0.3%	319	20.7%	49	3.2%	0	0.0%	627	40.6%	363	23.5%
Wrightstown (B)	720	0.2%	58	8.1%	69	9.6%	5	0.7%	119	16.5%	13	1.8%
Burlington County Total	**461,860**	**100.0%**	**78,093**	**16.9%**	**23,350**	**5.1%**	**9,103**	**2.0%**	**51,899**	**11.2%**	**27,947**	**6.1%**

Source: U.S. Census Bureau 2020, 2021

Note: Persons per household = 2.6

a. (B) = borough; (C) = city; (T) = township

Impact on General Building Stock

No structures are anticipated to be directly affected by a drought event. However, droughts contribute to conditions conducive to wildfires and reduce fire-fighting capabilities. Approximately 35 percent of the County's land is forested. Due to Burlington County's largely undeveloped nature, fuel is plentiful for wildfires, particularly in the Pine Barrens. In Burlington County, fuel tends to be most plentiful in areas where development densities are lowest; this works to reduce possible property damages and loss of life. Risk to life and property is greatest in those areas where forested areas adjoin urbanized areas (high density residential, commercial, and industrial) also known as the wildfire urban interface. Therefore, all assets in and adjacent to, the wildfire urban interface zone, including population, structures, critical facilities, lifelines, and businesses are considered vulnerable to wildfire. Refer Section 4.3.9 for the Wildfire risk assessment.

Impact on Critical Facilities

As mentioned, drought events generally do not impact buildings; however, droughts have the potential to impact agriculture-related facilities and critical facilities that are associated with water supplies such as potable water used with fire-fighting services. Critical facilities in and adjacent to the wildfire hazard areas are considered vulnerable to wildfire.

Drought affects groundwater sources, but generally not as quickly as surface water supplies. Groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams also. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when steam flows are lowest (NJDEP 2021). Burlington County water supplies are primarily sourced from groundwater, while the remaining supply is sourced from surface water. Table 4.3.3-7 provides the drinking water suppliers for Burlington County (US EPA 2023):

Table 4.3.3-7. Drinking Water Suppliers in Burlington County

Name	Population Served	Source Type
Albert C Wagner Youth Co	2,500	Ground water
Allenwood Estates, LLC	135	Ground water
Aqua Nj - California Village	300	Ground water
Aqua Nj - Hanover Mobile Village	285	Ground water
Aqua Nj - Spartan Village	471	Ground water
Blueberry Estates	75	Ground water
Bordentown Water Department	15,821	Ground water
Burlington City Water De	9,835	Surface water
Burlington Twp W Dept	22,594	Surface water purchased
Buttonwood Mobile Home Park	55	Ground water
Cedar Grove Apartments	96	Ground water
Estaugh Corp T/A Medford Leas	450	Ground water
Evesham MUA	45,538	Surface water purchased
Fawn Lake Village	300	Ground water

Name	Population Served	Source Type
Fenimore Trailer Park	88	Ground water
Fenimore Woods Mobile Home Park	40	Ground water
Fieldsboro Water Department	650	Ground water purchased
Florence Twp W Dept	11,214	Ground water
Hanover East Apartments	96	Ground water
Hilltop Mobile Village	200	Ground water
Jbmdl-Dix Main System	18,420	Surface water
Jbmdl-McGuire AFB	12,227	Ground water
Maple Shade Water Department	19,400	Surface water purchased
Maplewood Apartments	55	Ground water
Medford Twp Dept Of Muni	17,272	Ground water
Millstream Apts.	128	Ground water
Mobile Estates Of Southa	700	Ground water
Moorestown Water Dept	20,700	Surface water purchased
Mt Laurel Twp Mua	41,743	Surface water purchased
New Lisbon Development Ctr	2,014	Ground water
Nj American Water - Homestead	2,420	Ground water
Nj American Water - Mount Holly	47,427	Surface water purchased
Nj American Water - Sunbury	888	Ground water
Nj American Water - Vincentown	598	Ground water
Oakview Leisure Village	250	Ground water
Pemberton Borough Water	1,610	Ground water
Pemberton Township Water - Lake Valley	3,500	Ground water
Pemberton Twp Dept Main	12,378	Ground water
Pemberton Twp Water Dept - Pemberton Hei	650	Ground water purchased
Pemberton Twp Water - New Lisbon	500	Ground water
Pinefield Apartments	120	Ground water
Pinelands Water Co	4,926	Ground water
Pineview Terrace Incorporated	300	Ground water
Richards Mobile Home Courts	100	Ground water
Souths Mobile Home Park	110	Ground water
Wagon Wheel Estates	84	Ground water
Willingboro MUA	35,000	Ground water
Wrightstown MUA	748	Ground water

Source: US EPA 2023

Water systems and thus distribution to the population may also be impacted by other hazards such as extreme weather events. A good example is Superstorm Sandy where storm surge damaged critical water supply infrastructure along the coast and high winds impacted energy distribution across the State which in turn impacted the ability to supply water. As a result, NJDEP has developed new guidance aimed to ensure that repairs, reconstruction, new facilities, and operations/maintenance are focused on enhancing the resilience of critical infrastructure (NJDEP 2021).

Impact on Economy

Drought can produce a range of impacts that span many economic sectors and can reach beyond an area experiencing physical drought. As previously discussed, water withdrawals are not only used for potable water but for use in the commercial/industrial/mining sectors and power generation. When a state of water emergency is declared by the Governor (when a potential or actual water shortage endangers the public health, safety, and welfare), the NJDEP may impose mandatory water restrictions and require specific actions to be taken by water suppliers. According to the New Jersey Water Supply Plan, a water emergency seeks to cause as little disruption as possible to commercial activity and employment (NJ Department of Environmental Protection 2017).

A prolonged drought can have a serious economic impact on a community. One impact of drought is its impact on water supply. When drought conditions persist with little to no relief, water restrictions may be put into place by local or state governments. These restrictions may include placing limitations on when or how frequently lawns can be watered, car washing services, or any other recreational/commercial outdoor use of water supplies. In exceptional drought conditions, watering of lawns and crops may not be an option. If crops are not able to receive water, farmland will dry out and crops will die. This can lead to crop shortages, which, in turn, increases the price of food (NC State University 2013).

Increased demand for water and electricity can also result in shortages and higher costs for these resources. Industries that rely on water for business could be impacted the most (e.g., landscaping businesses). Although most businesses will still be operational, they may be impacted aesthetically. These aesthetic impacts are most significant within the recreation and tourism industry. Moreover, droughts within another area could impact the food supply and price of food for residents within the county.

Direct impacts of drought include reduced crop yield, increased fire hazard, reduced water levels, and damage to wildlife and fish habitat. The many impacts of drought can be listed as economic, environmental, or social. Direct and indirect losses include the following (FAO 2019):

- Damage to crop quality and crop losses.
- Insect infestation leading to crop and tree losses.
- Plant diseases leading to loss of agricultural crops and trees.
- Reduction in outdoor recreational activities.

When a drought occurs, the agricultural industry is most at risk in terms of economic impact and damage. For example, crops may not mature leading to a lessened crop yield, wildlife and livestock may become undernourished, land values could decrease, and ultimately there could be a financial loss for the farmer (IPCC 2016). Based on the 2017 Census of Agriculture, there were 915 farms in Burlington County, a 9 percent increase from the 2012 reports. The average farm size was 105 acres. Burlington County farms had a total market value of products sold of approximately $91 million in crop sales and approximately $7.5 million in livestock sales (USDA 2019). Table 4.3.3-8 summarizes the acreage of agricultural land exposed to the drought hazard.

Table 4.3.3-8. Agricultural Land in Burlington County in 2017

Number of Farms	Land in Farms (acres)	Total Cropland (percent)	Pastureland (percent)	Irrigated Land (acres)
915	96,256	52	7	12,434

Source: USDA 2019

Impact on Environment

Droughts can impact the environment because these events can trigger wildfires, increase insect infestations, and exacerbate the spread of disease (IPCC 2016). Droughts will also impact water resources that are relied upon by aquatic and terrestrial species. Ecologically sensitive areas, such as wetlands, can be particularly vulnerable to drought periods because they are dependent on steady water levels and soil moisture availability to sustain growth. As a result, these types of habitats can be negatively impacted after long periods of dryness (NJDEP 2017).

Droughts also have the potential to lead to water pollution due to the lack of rainwater to dilute any chemicals in water sources. Contaminated water supplies may be harmful to plans and animals. If water is not getting into the soils, the ground will dry up and become unstable. Unstable soils increase the risk of erosion and loss of topsoil (NC State University 2013).

Cascading Impacts on Other Hazards

Drought increases conditions that may trigger fires in the County, such as dead and dying trees, and grasses. Drought can lead to increasing temperatures and evaporation of moisture, which are ideal dry conditions for wildfire events to occur. Dry, hot, and windy weather combined with dry vegetation makes some areas more susceptible to sparking wildfires when met with a spark created by humans or natural events, including lightning. Additionally, droughts can lead to the following (NIDIS 2019):

- Long-term damage to crop quality and crop losses,
- Insect infestation leading to crop losses and reduced tree canopy, and
- Reduction in the ability to perform outdoor activities, which could result in loss of tourism and recreation opportunities.

Further Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

As discussed in Section 3 (County Profile), areas targeted for future growth and development have been identified across Burlington County. The New Jersey Water Supply Plan indicates seasonal outdoor water use is rising and is attributable to continued suburbanization and increases in residential and commercial lawn and landscape maintenance. Changes in water demands by commercial/industrial users will depend on future development of this water type use and how effectively efficiency techniques are implemented (NJDEP 2017).

Projected Changes in Population

Potable water use is the second largest water use sector and largest consumptive use in New Jersey. As such, population projections, per capital water use and percent non-residential water use by water system are important factors to consider when assessing future water needs. Burlington County has experienced an increase in its population since 2010. According to the U.S. Census Bureau, the County's population increased by approximately

3-percent between 2010 and 2020 (U.S. Census Bureau 2020). The New Jersey Department of Labor and Workforce Development produced populations projections by County from 2014 to 2019, 2024, 2029, and 2034. According to these projections, Burlington County is projected to have a population of 460,400 by 2024, 464,900 by 2029, and 472,700 by 2034 (State of New Jersey 2017). Increases in population may create greater strain on water resources in those communities, throughout Burlington County and the region.

Climate Change

As discussed above, most studies project that the State of New Jersey will see an increase in average annual temperatures. Additionally, the State is projected to experience more frequency droughts which may affect the availability of water supplies, primarily placing an increased stress on the population and their available potable water. Agricultural needs may increase if the climate grows warmer but may decrease if more efficient irrigation techniques are adopted broadly or if precipitation increases. A decrease in water supply, or increase in water supply demand, may increase the County's vulnerability to structural fire and wildfire events. Critical water-related service sectors may need to adjust management practices and actively manage resources to accommodate for future changes.

Change of Vulnerability Since 2019 HMP

When examining the change in the County's vulnerability to drought events from the 2019 HMP to this update, it is important to look at each entity that is exposed and vulnerable. The total population across the County has experienced a slight increase, which can place a greater stress on the water supply during a drought event. In terms of the agricultural industry for Burlington County, there has been a 9 percent increase in the number of farms since the 2012 USDA report (USDA 2019).