



5.4.4 Drought

This section provides a hazard profile and vulnerability assessment for the drought hazard in Cape May County.

2021 HMP Update Changes

- The drought hazard profile is a new hazard profile for this 2021 HMP update.

5.4.4.1 Profile

Hazard Description

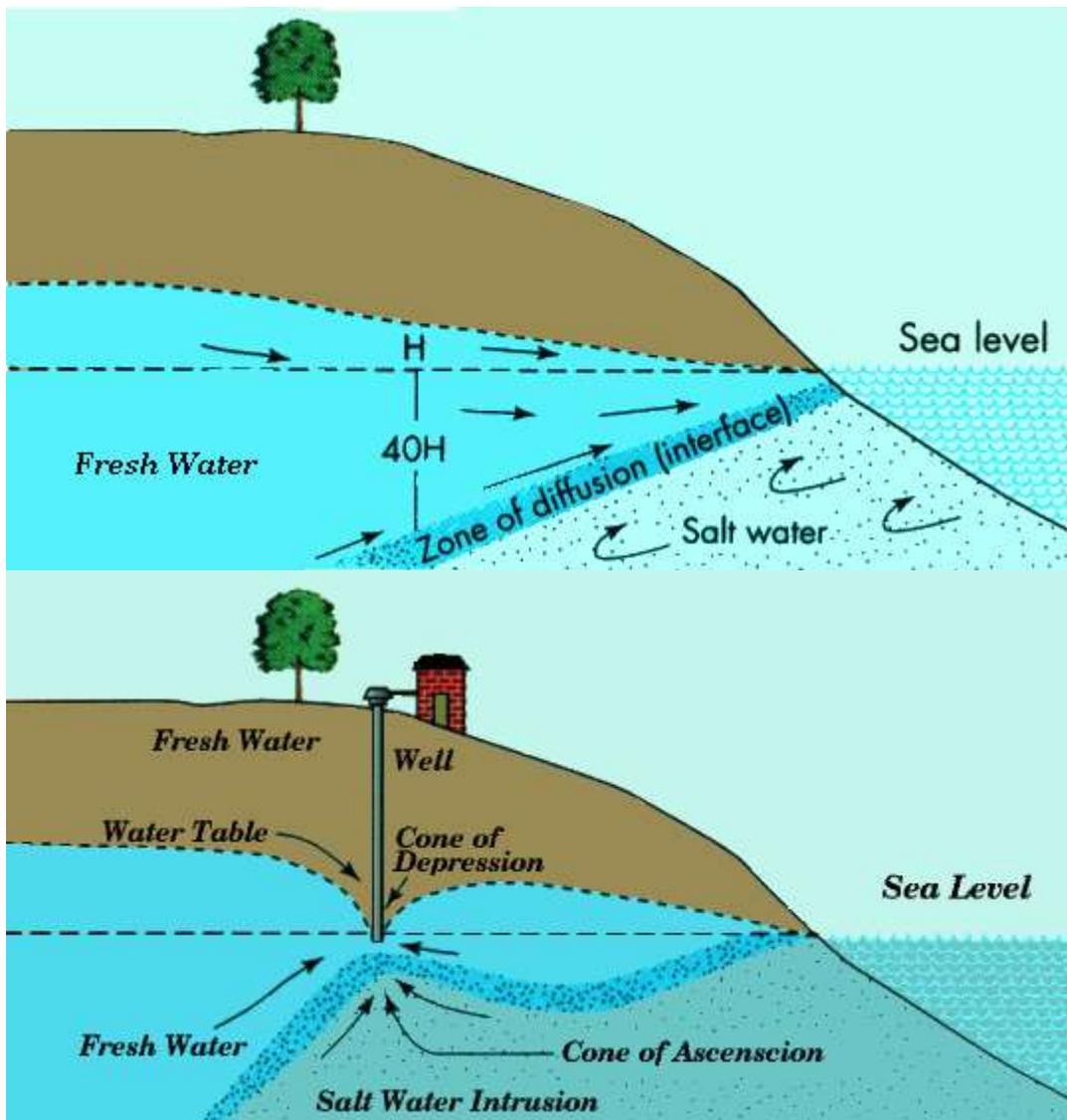
Drought is a period characterized by long durations of below normal precipitation. Drought conditions occur in virtually all climatic zones, yet characteristics of drought vary significantly from one region to another, relative to normal precipitation within respective regions. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life. Drought is a temporary irregularity in typical weather patterns and differs from aridity, which reflects low rainfall within a specific region and is a permanent feature of the climate of that area.

Saltwater Intrusion

Drought can exacerbate the rate of saltwater intrusion. Saltwater intrusion is a type of natural groundwater contamination, where the natural balance between freshwater and saltwater in coastal aquifers is disturbed by groundwater withdrawals and other human activities that lower groundwater levels, reduce fresh groundwater flow to coastal waters, and ultimately cause saltwater to intrude into the coastal aquifers making those aquifers no longer available for use. Other hydraulic stresses that reduce freshwater flow in coastal aquifers, such as lowered rates of groundwater recharge in sewerred or urbanized areas, also can lead to saltwater intrusion, but the impact of such stresses on saltwater intrusion, at least currently, likely is small in comparison to pumping and land drainage (Kumar, 2016).

Saltwater intrusion is a natural process, but it becomes an environmental problem when excessive pumping of fresh water from an aquifer changes the water pressure and intensifies the effect, drawing saltwater into new areas. When freshwater levels drop, the intrusion can proceed further inland until reaching a pumped well. Then one may get saltwater out of the pump, which becomes no longer available for drinking or irrigation (Ranjan, 2007). When one pumps out fresh water rapidly, one lowers the height of the freshwater in the aquifer forming a cone of depression. The salt water rises 40 feet for every 1 foot of freshwater depression and forms a cone of ascension (see Figure 5.4.4-1). Intrusion can affect the quality of water not only at the pumping well sites, but also at other well sites, and in undeveloped portions of an aquifer (Lenntech, 2020).

Figure 5.4.4-1. Salt Water Intrusion Process



Source: Lenntech, 2020

Location

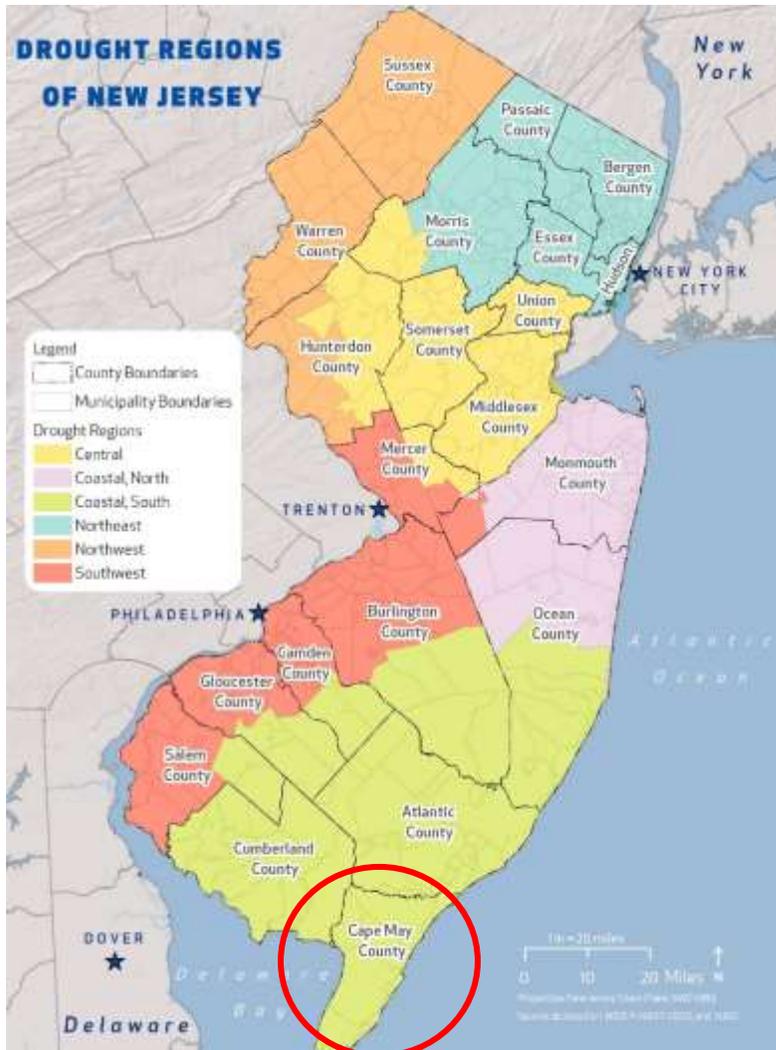
Climate divisions are regions within a state that are climatically homogenous. The National Oceanic and Atmospheric Administration (NOAA) has divided the U.S. into 35 (US Energy Information Administration, n.d.) climate divisions. The boundaries of these divisions typically coincide with the county boundaries, except in the western U.S., where they are based largely on drainage basins. According to NOAA, New Jersey is made up of three climate divisions: Northern, Southern, and Coastal (NOAA 2012). Cape May County is located in the Coastal 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 5.4.4-2 shows the drought regions of New Jersey. Cape May County is mainly located in the Coastal, South Drought Region.

Figure 5.4.4-2. Drought Regions of New Jersey



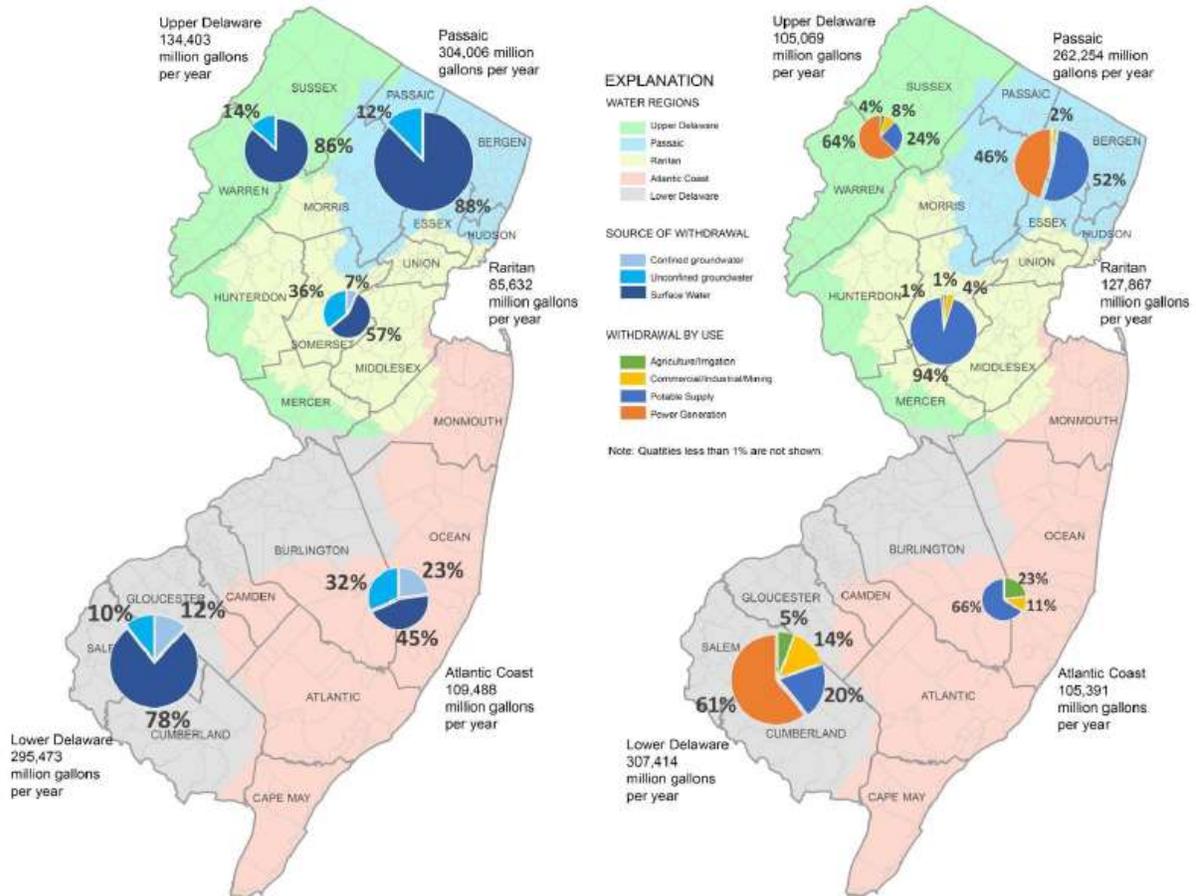
Source: NJOEM (State HMP) 2019

Note: The red circle indicates the location of Cape May County

There are five water regions across the State (compiled from HUC11 Watershed Management Areas). Cape May County is located in the Atlantic Coast water region; refer to Figure 5.4.4-3. In terms of annual water withdrawal by sector, the majority is for potable water supply, followed by agricultural irrigation, then commercial/industrial/mining. 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 (New Jersey Department of Environmental Protection).



Figure 5.4.4-3. Water Regions, Sources and Withdrawal by Sector in New Jersey



Source: NJDEP 2017

Saltwater Intrusion

Saltwater intrusion has mostly impacted water supplies at the southern end of Cape May County. A reverse osmosis desalination facility serves the City of Cape May. The facility was completed in 1998 due to saltwater intrusion of the City’s wells (Cape May County Herald 2015).

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. 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.

Palmer Drought Severity Index

The Palmer Drought Severity Index 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 4.3.4-1 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 5.4.4-1 (National Drought Mitigation Center [NDMC] 2013).

Table 5.4.4-1. 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: NDMC 2013

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 the Department in declaring the regions as being within one of the four stages of water supply drought, Normal, Drought Watch, Drought Warning, and Drought Emergency.

- A **Drought Watch** is an administrative designation made by the Department when drought or other factors begin to adversely affect water supply conditions. A Watch indicates that conditions are dry but not yet significantly so. During a drought Watch, the Department closely monitors drought indicators (including precipitation, stream flows and reservoir and ground water levels, and water demands) and consults with affected water suppliers.
- A **Drought Warning** represents a non-emergency phase of managing available water supplies during the developing stages of drought and falls between the Watch and Emergency levels of drought response. 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 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 Division of Water Supply and Geoscience 2018).

Saltwater Intrusion

The extent of saltwater intrusion depends, among other factors, on the rate of freshwater discharge to the sea. Other factors include the total rate of groundwater that is withdrawn compared to the total freshwater recharge to the aquifer, the distance of the stresses (wells and drainage canals) from the source (or sources) of saltwater, the geologic structure and distribution of hydraulic properties of the aquifer, and the presence of confining units that may prevent saltwater from moving vertically toward or within the aquifer. Moreover, the time required for



saltwater to move through an aquifer and reach a pumping well can be quite long. The depth of the aquifer at the seaside, through which the saltwater intrudes the aquifer, also has a major effect on the degree of intrusion. Depending on the location and lateral width of the transition zone, many years may pass before a well that is unaffected by saltwater intrusion suddenly becomes contaminated (Barlow and Wild, 2002). This makes saltwater intrusion a management problem, since the freshwater discharge to the sea is the sum of the natural and the artificial recharge minus pumping. However, controlling saltwater intrusion is costly and/or management intensive. Extensive studies have been carried out in many parts of the world to clarify the mechanism of saltwater intrusion and to control it from better exploitation of coastal aquifers (Goosen and Shayya, 1999).

More than 100 water wells have already been abandoned on the Cape May peninsula of southern New Jersey because of saltwater intrusion (Hurdle 2020).

Previous Occurrences and Losses

Precipitation variability, coupled with concentrated population centers, can produce wide fluctuations in water availability and demands. The State and County have experienced several episodes of drought that have resulted in water shortages of varying degrees (e.g., mid-1960’s, early to mid-1980’s and 2001-2002) (NJDEP 2017).

FEMA Declarations

Between 1954 and 2020, the State of New Jersey experienced two FEMA declared drought-related disasters (DR) or emergencies (EM) classified as a water shortage. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Of those two declarations, Cape May County has been included in both declarations (FEMA 2020).

Table 5.4.4-2. FEMA DR and EM Declarations for Drought Events in Cape May County, 1954 to 2020

FEMA Declaration Number	Date(s) of Event	Date of Declaration	Event Type
EM-3083	October 19, 1980	October 19, 1980	Water Shortage
DR-205	August 18, 1965	August 18, 1965	Water Shortage

Source: FEMA 2020

USDA Declarations

Agriculture-related drought disasters are quite common. One-half to two-thirds of the counties in the U.S. have been designated as disaster areas in each of the past several years. The USDA Secretary of Agriculture 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. Between 2012 and 2020, Cape May County has been included in three USDA declarations related to drought as summarized in Table 5.4.4-3 (USDA 2020). Although USDA disasters were declared, there are no USDA records for historical losses from 2012-2020 (USDA 2020).

Table 5.4.4-3. USDA Disaster Declarations for Cape May County 2012-2020

Declaration	Event Date	Declaration Date	Event Description
S3487	June 28, 2012	November 8, 2012	The combined effects of drought, high winds (Derecho), hail, excessive heat, excessive rain, flash flooding, Hurricane Sandy, snowstorm, and Nor'easter
S3932	July 16, 2015	September 29, 2015	Excessive Heat and Drought
S34071	April 1, 2016	September 19, 2016	Combined effects of freeze, excessive heat, and drought

Source: USDA 2020



Previous Events

For the 2021 HMP update, known drought events that have impacted Cape May County between 2010 and 2020 are identified in Table 5.4.4-4.

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Table 5.4.4-4. Drought Incidents in Cape May County, 2010 to 2020

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Cape May County Designated?	Description
October 2000	Drought	N/A	N/A	<p>October 2000 was one of the driest Octobers on record in New Jersey and in a few locations, the driest month ever on record. On a county weighted average, monthly precipitation total was 0.1 inches in Atlantic and Cape May Counties Normal monthly precipitation is around 3.4 inches. At the Atlantic City Marina, the monthly precipitation total of 0.01 inches was not only the driest October on record, but also tied September 1941 as the driest month on record. Records within Atlantic City go back to 1874. At the Atlantic City International Airport, the monthly precipitation total of 0.06 inches was not only the driest October on record, but also the driest month on record ever. Records at the airport go back to 1943. In Cape May City, the monthly precipitation total of 0.34 inches was the third driest October on record. Records have been kept since 1888. While the dry weather did not cause any appreciable agricultural damage, the falling leaves left the state susceptible to forest and brush fires.</p>
November 7 – 13, 2000	Drought	N/A	N/A	<p>According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from November 7 – 13, 2000.</p> <p>Unseasonably dry weather continued through November of 2001. On a statewide average the preliminary monthly precipitation total for November was 1.03 inches, the 6th driest November on record. The combination preliminary statewide average of 2.06 inches for both October and November was the driest on record dating back to 1895. The continued dry weather, the drop in stream flow and groundwater levels and the reduced levels in the New York State reservoirs prompted the New Jersey State Department of Environmental Protection to upgrade the drought watch to a drought warning for counties in the Delaware River Basin and southern New Jersey on November 21st. The drought warning included all or part of the following counties: Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Hunterdon, Mercer, Monmouth, Ocean, Salem, Sussex and Warren. The drought warning gives the state Department of Environmental Protection (DEP) greater authority to control water distribution and transfers among the major reservoir systems and to temporarily modify water allocation permits. Individual municipalities can also set their own restrictions. The DEP asked residents to use good water conservation practices but there were no mandatory restrictions unless required by an individual township.</p> <p>The lack of adequate precipitation became more apparent as the month went along. On November 13th, the Great Egg Harbor, was at record low levels for the date. The same was true for about one quarter of all the rivers and streams in the state. The state forestry service banned all ground level campfires in wooded areas. Winter crops such as rye and grasses were struggling.</p> <p>On a county weighted average, the monthly precipitation total was 0.7 inches in Cape May County. Normal county averages are around 3.6 inches. The November monthly precipitation total at the Atlantic City International Airport was 1.06 inches, the fifth driest on record. At the Marina within Atlantic City, the monthly precipitation total of 0.85 inches was the 6th driest on record.</p>
August 7 – 13, 2000	Drought	N/A	N/A	<p>According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from August 7 – 13, 2000.</p>



Table 5.4.4-4. Drought Incidents in Cape May County, 2010 to 2020

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Cape May County Designated?	Description
September 4, 2001 – December 16, 2002	Drought	N/A	N/A	<p>According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from September 1 – October 29, 2001; D1 or “moderate drought” status from October 30 – December 17, 2001; D2 or “severe drought” from December 18, 2001 – February 18, 2002; D3 or “extreme drought” from February 19 – April 22, 2002; D2 or “severe drought” from April 23 – June 10, 2002; D1 or “moderate drought” from June 11 – July 22, 2002; D2 or “severe drought” from July 23 - August 19, 2002; D3 or “extreme drought” from August 20 – September 2, 2002; D2 of “severe drought” from September 3 – October 7, 2002; D3 or “extreme drought” from October 8 – October 14, 2002; D1 or “moderate drought” from October 15 – November 4, 2002; D0 or “abnormally dry” from November 5 – December 16, 2002.</p> <p>October 2001 was an unseasonably dry month across the state of New Jersey. The ongoing dry weather prompted the state Environmental Protection Commissioner to issue a drought watch for the entire state on October 30th. The declaration called on residents to voluntarily conserve water. By the end of the month, new Jersey reservoirs were about 10 percent below normal with groundwater levels declining and many streams approaching record low stream flow levels. The state also prohibited campfires in wooded areas (of state owned parks) unless they were kept in an elevated fireplace, grill or stove that was one foot above ground level. Other than Atlantic, Burlington and Ocean Counties, all of the other counties in the state had less than half their normal precipitation with the least precipitation in northwest New Jersey. The dry weather also led to wildfires. During the last weekend in October (the 27th and 28th), 69 wildfires burned 125 acres of forest. The monthly precipitation total of 1.00 inch at the Atlantic City International Airport was the 8th driest on record. The 0.99 inches of rain that fell at the Marina within Atlantic City was the 10th driest on record. Records at the Marina date back to 1874.</p> <p>Unseasonably dry weather continued through November of 2001. On a statewide average the preliminary monthly precipitation total for November was 1.03 inches, the 6th driest November on record. The combination preliminary statewide average of 2.06 inches for both October and November was the driest on record dating back to 1895. The continued dry weather, the drop in stream flow and groundwater levels and the reduced levels in the New York State reservoirs prompted the New Jersey State Department of Environmental Protection to upgrade the drought watch to a drought warning for counties in the Delaware River Basin and southern New Jersey on November 21st. The drought warning included Cape May. The drought warning gives the state Department of Environmental Protection (DEP) greater authority to control water distribution and transfers among the major reservoir systems and to temporarily modify water allocation permits. Individual municipalities can also set their own restrictions. The DEP asked residents to use good water conservation practices but there were no mandatory restrictions unless required by an individual township.</p> <p>The lack of adequate precipitation became more apparent as the month went along. On November 13th, the Great Egg Harbor River was at record low levels for the date. The same was true for about</p>



Table 5.4.4-4. Drought Incidents in Cape May County, 2010 to 2020

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Cape May County Designated?	Description
				<p>one quarter of all the rivers and streams in the state. The state forestry service banned all ground level campfires in wooded areas.</p> <p>Unseasonably dry weather continued across New Jersey during the month of December. While more precipitation fell during December than either October or November, it was still drier than normal. On a county weighted average, the monthly precipitation total was 1.6 inches in Cape May County. Signs of the drought were apparent across the state. On December 3rd, 20 percent of all streams were at record low flow for the calendar day. Another 40 percent were threatening record lows.</p> <p>Unseasonably dry weather continued across New Jersey during the month of January. While more precipitation fell during January than any month since last September, it was still drier than normal.</p> <p>Unseasonably dry weather intensified across New Jersey during the month of February. It was the driest February on record across the state. Farmers stated that the winter wheat crop was struggling. They expected a reduced yield. One stated that this was the driest the fields in February have been in his 49 years of farming. Christmas tree farms were also suffering as were other evergreens at nurseries. Irrigation ponds were well below normal (3 to 4 feet) for February. Another result of the drought was increased bear sightings and nuisance calls in the northwest part of the state.</p> <p>New Jersey entered March 2002 with considerably dry conditions and a drought warning in effect for most of the state. Most of the state's shallow groundwater wells were at the lowest levels ever for this time of year. Most of the surface streams and rivers were flowing at only about 25 percent of normal. There was a record number (500) of wells being replaced throughout the state through early March. All precipitated Governor Jim McGreevey to declare a drought emergency for the state of New Jersey on March 4th. The drought emergency placed an immediate ban on non-essential use of water. Water could be served in restaurants only by request. Vehicles and boats could only be washed commercially. Grass watering was banned. There was a limit to the amount of watering for newly seeded or sodded grass. Gardens, trees and shrubs could only be watered using a hose or watering can. Golf courses must cut back usage by 50 percent. Athletic fields could only be watered overnight. Washing of streets, roads, sidewalks, driveways, garages, parking areas and patios with potable water was banned. Only commercial power washing of surfaces permitted. Running water through fountains, artificial waterfalls and reflection pools were prohibited except to support wildlife. Flushing of sewer lines with potable water was banned. The spring allergy season started earlier and stronger because of the dry, warm weather.</p> <p>New Jersey entered April 2002 with a drought emergency in effect for the entire state with mandatory watering restrictions in place. Water usage statewide was down about 5 to 10 percent. March 2002 was the first month since June of 2001 where the statewide average precipitation was wetter than normal.</p>



Table 5.4.4-4. Drought Incidents in Cape May County, 2010 to 2020

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Cape May County Designated?	Description
				<p>New Jersey entered May 2002 with a drought emergency in effect for the entire state with mandatory watering restrictions in place. Water usage statewide was down about 5 to 10 percent.</p> <p>New Jersey entered June 2002 with a drought emergency in effect for the entire state with mandatory watering restrictions in place. Water usage statewide was down by as much as 20 percent. In response to the improving conditions, some of the watering restrictions were relaxed.</p> <p>The unseasonably warm and dry month of July intensified drought conditions across the state. In spite of mandatory restrictions, water usage increased as the month wore on. Water usage statewide was down by as much as 20 percent in May and June.</p> <p>The unseasonably warm and dry month of August intensified drought conditions across the state. In fact very little precipitation fell across the state between August 2nd and the 24th.</p> <p>September began with drought conditions intensifying across New Jersey. The month though saw a return of near normal precipitation. This was too late for farmers. On the 3rd, Governor James McGreevey requested to Congress a federal farm disaster declaration. It was estimated that the drought will cost farmers about \$125 million in revenue.</p> <p>October 2002 saw the return of well above normal precipitation to New Jersey. It was also the first month since June that precipitation was above normal in every county. An unseasonably wet November ended the meteorological drought across New Jersey.</p>
September 6 – 12, 2005	Drought	N/A	N/A	<p>According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from September 6 – 12, D1 or “moderate drought” from September 13 – October 10, and D0 or “abnormally dry” from October 11 – 17, 2005.</p> <p>September 2005 was an unseasonably warm and dry month across the state of New Jersey. The unseasonably dry weather began for most in mid-August and continued throughout the month. The lack of rain affected both the agriculture and water supplies. Acting Governor Richard Codey declared a drought watch on September 13th and called for voluntary conservation methods. Residents were urged to limit lawn watering, to only run their washers and dishwashers with full loads and to purchase and install water saving shower heads and faucets. The state's Forestry Service also prohibited the creating of recreational fires that burn directly on the ground and in all wooded areas. Because of the higher cost for fuel, irrigation costs increased. Another problem with the drought affected power lines near the coast. The lack of rain permitted salt to build on power lines. When it rained at the end of the month, blown fuses, arcing wires and pole fires occurred. About 9,000 homes and businesses mainly in Atlantic and Cape May Counties lost power.</p>
March 21 – June 26, 2006	Drought	N/A	N/A	<p>According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from March 21 – April 10, D1 or “moderate drought” from April 11 – April 24, and D0 or “abnormally dry” from April 25 – June 26, 2006.</p>



Table 5.4.4-4. Drought Incidents in Cape May County, 2010 to 2020

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Cape May County Designated?	Description
August 22 – 28, 2006	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from August 22 – 28, 2006.
July 17, 2007 – March 10, 2008	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from July 17 – August 13, D1 or “moderate drought” from August 14 – October 29, and D0 or “abnormally dry” from October 30, 2007 – March 10, 2008
July 22 – December 1, 2008	Drought	N/A	N/A	<p>According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from July 22 – September 1, D1 or “moderate drought” from September 2 – 8, and D0 or “abnormally dry” from September 9 – December 1, 2008.</p> <p>An unseasonably dry August occurred across the state of New Jersey with the greatest departures from normal in the central part of the state. This exacerbated crop damage that was already inflicted by the heat and the large hail storm in the southern part of the state on August 10th. The combination of the June heat and the August hail storm and drought led the United States Secretary of Agriculture Edward Schafer to declare ten central and southern New Jersey Counties a natural disaster. Cape May County was included in the declaration.</p>
March 24 – May 4, 2009	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from March 24 – May 4, 2009.
June 29 – October 25, 2010	Drought	N/A	N/A	<p>According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from June 29 – July 12, D1 or “moderate drought” status from July 13 – October 4, and D0 or “abnormally dry” status from October 5 – October 25, 2010.</p> <p>On September 8, 2010, the New Jersey Department of Environmental Protection extended a drought watch throughout the entire state. The Department of Environmental Protection asked all state residents to voluntarily conserve water. The hot and dry summer taxed reservoir stream and groundwater levels. Shallow groundwater (private) wells were also starting to show stress.</p> <p>September was another unseasonably warm month in New Jersey. Statewide it was the 4th warmest September on record since 1895 with an average temperature of 69.2 degrees. Because of the heavy rain on the last day of the month, September averaged closer to normal rainfall. It was the 7th warmest (71.0 degrees) September on record at the Atlantic City International Airport and the warm season as a whole established a new record for the number of days that the maximum temperature reached or exceeded 90 degrees (46 days).</p> <p>The wet weather on September 30th and October 1st started to recharge water supplies in the state of New Jersey. On October 26th, the New Jersey Department of Environmental Protection cancelled the drought watch for Cape May County.</p> <p>The summer drought took its toll on New Jersey farmers and the United States Secretary of Agriculture Thomas Vilsack declared all counties in southern, central and northwest New Jersey natural disaster areas in November. The declaration made farm operators eligible for assistance from</p>



Table 5.4.4-4. Drought Incidents in Cape May County, 2010 to 2020

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Cape May County Designated?	Description
				the Farm Service Agency. The assistance included low interest loans which could cover up to 100 percent of the dollar value of the crop losses.
June 7 – July 11, 2011	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from June 7 – July 11, 2011.
August 2 – 22, 2011	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from August 2 – 22, 2011.
January 31 – July 23, 2012	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from January 31– April 2, 2012, D1 or “moderate drought” status from April 3 – June 18, 2012, and D0 or “abnormally dry” status from June 19 – July 23, 2012.
August 21 – October 29, 2012	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from August 21 – October 29, 2012.
May 26 -June 1, 2015	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from May 26 – June 1, 2015.
September 1 – October 5, 2015	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from September 1 – October 5, 2015
August 2 – August 22, 2016	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from August 2 – August 22, 2016.
September 13 – 19, 2016	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from September 13 – 29, 2016.
December 6, 2016 – March 13, 2017	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from December 6, 2016 – March 13, 2017.
July 17 - 23, 2018	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from July 17 - 23, 2018.
September 17 – December 9, 2019	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from September 17 – October 14, D1 or “moderate drought” status from October 15 - 21, and D0 or “abnormally dry” status from October 22 – December 9, 2019.
June 30 – July 13, 2020	Drought	N/A	N/A	According to the U.S. Drought Monitor, conditions held at a D0 or “abnormally dry” status across Cape May County from June 30 – July 13, 2020

Source: NOAA NCEI 2020, USDA 2020, NDMC 2020



Probability of Future Occurrences

Based upon risk factors for and past occurrences, it is likely that droughts will occur across New Jersey and Cape May 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 Cape May 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.

In Section 5.3 (Hazard Ranking), the identified hazards of concern for Cape May County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee and Planning Committee, the probability of occurrence for drought in the County is considered 'occasional' (between 10% and 100% annual chance of occurring).

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.

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 (Office of the New Jersey State Climatologist 2020), which is faster than the rest of the Northeast region (2° F [1.1° C]) (Melillo et al. 2014) and the world (1.5° F [0.8° C]) (IPCC 2014). 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) (Horton et al. 2015). 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) (Runkle et al. 2017). New Jersey can also expect that by the middle of the 21st century, 70% of summers will be hotter than the warmest summer experienced to date (Runkle et al. 2017). 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.

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 (Office of the New Jersey State Climatologist 2020). 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% increase. By 2050, annual precipitation in New Jersey could increase by 4% to 11% (Horton et al. 2015). By the end of this century, heavy precipitation events are projected to occur two to five times more often (Walsh et al. 2014) and with more intensity (Huang et al. 2017) than in the last century. New Jersey will experience more intense rain events, less snow, and more rainfalls (Fan et al. 2014, Demaria et al. 2016, Runkle et al. 2017). Also, small decreases in the amount of precipitation may occur in the summer months, resulting in greater potential for more frequent and prolonged droughts (Trenberth 2011).

Sea level has been gradually rising for the past 100 year and the rate of sea level rise is predicted to accelerate as a result of climate change (refer to the Extent section of this profile). Rising sea levels will continue to increase occurrences of inundation and erosion along the coastal areas of Cape May County. Coastal communities in the County may also see an increase risk of flood-related damages to homes, businesses and infrastructure. An increase in sea level also implies that storm surges will operate from an elevated base, so severe coastal flooding



may be more frequent in the future (NJ Climate Adaptation Alliance 2016). Increased sea levels are connected to saltwater intrusion.

5.4.4.2 Vulnerability Assessment

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

Impact on Life, Health and Safety

The entire population of Cape May County is exposed to drought events. The population is estimated to be 93,705 people as of 2018 and is anticipated to be several times higher during the summer season. 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.

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. Health implications of drought are numerous. Some drought-related health effects are short-term while others can be long-term (CDC 2020).

Surface water supplies are affected more quickly during droughts than groundwater sources; however, groundwater supplies generally take longer to recover. Droughts can also lead to reduced local firefighting capabilities. The drought hazard is a concern for Cape May County because the County’s water is supplied by groundwater.

The Centers for Disease Control and Prevention’s (CDC) 2016 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Cape May County’s overall score is 0.3438, indicating that its communities have low to moderate social vulnerability and impacts from a drought event may be exacerbated (CDC 2016).

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. 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 (WUI). Therefore, all assets in and adjacent to, the WUI zone, including population, structures, critical facilities, lifelines, and businesses are considered vulnerable to wildfire. Refer Section 4.3.13 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.

Water systems and thus distribution to the population may also be impacted by other hazards such as extreme weather events. For example, storm surge from Superstorm Sandy 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 2017).

Impact on the 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 (NJDEP 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 frequent 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.

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:

- 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 activities.
- Increased risk of brush fires and wildfires due to dried crops, grasses, and dying trees.

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 undernourished livestock and wildlife, decreased crop yield, declining land values, and financial losses to farmers (Western Drought Coordination Council, 1998). Based on the 2017 Census of Agriculture, there were 164 farms in Cape May County, a 7.8% increase from the 2012 reports. The average farm size was 50 acres. The County farms had a total market value of products sold of \$9.8 million in crop sales and \$1 million in livestock-related sales. Table 4.3.4-6 summarizes the acreage of agricultural land exposed to the drought hazard.

Table 5.4.4-5. Agricultural Land in Cape May County in 2017

Number of Farms	Land in Farms (acres)	Total Cropland (acres)	Harvested Cropland (acres)	Irrigated Land (acres)
164	8,135	3,823	3,086	1,433



Source: USDA 2017

Impact on the Environment

Droughts can impact the environment because these events can trigger wildfires, increase insect infestations, and exacerbate the spread of disease (NOAA 2020). 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). Nearly two-thirds of Cape May County's land area is forest or wetlands. Though freshwater wetlands are not as prevalent as saltwater wetlands in the County, the sensitive ecosystems remain vulnerable to drought.

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 plants 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 (North Carolina State University 2013).

Future 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 4 (County Profile), areas targeted for future growth and development have been identified across Cape May 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. Cape May County has experienced population declines since 2010. Moreover, the County has a highly variable seasonal population that is estimated to be an eight-fold increase from its year-round population. These population increases are most noticeable in barrier island communities such as Ocean City, where the Census population of 11,701 people in 2010 explodes to an estimated 147,612 people when factoring day-trippers, marina slips, and hotel/motel units. Increases in seasonal population may create greater strain on water resources in those communities, throughout Cape May County and the region as a whole (Cape May County 2020).

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 the 2016 HMP

Drought is a new hazard for the 2021 Hazard Mitigation Plan Update. Overall, the County’s vulnerability has not changed, and the entire County will continue to be exposed and vulnerable to drought events.

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