



5.4.1 Drought

This section provides a hazard profile and vulnerability assessment of the drought hazard for Onondaga County.

5.4.1.1 Hazard Profile

This section presents information regarding the description, extent, location, previous occurrences and losses, and probability of future occurrences for the drought hazard.

Description

Drought is a period characterized by long durations of below normal precipitation levels. Drought is a temporary irregularity that differs from aridity, which is a permanent feature of climate restricted to regions with typically low rainfall. Drought conditions occur in virtually all climatic zones. Drought characteristics vary significantly from one region to another and are relative to the normal precipitation in that region. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life.

Droughts also have the potential to lead to water pollution due to the lack of rain water 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 top soil (North Carolina State University 2013).

Extent

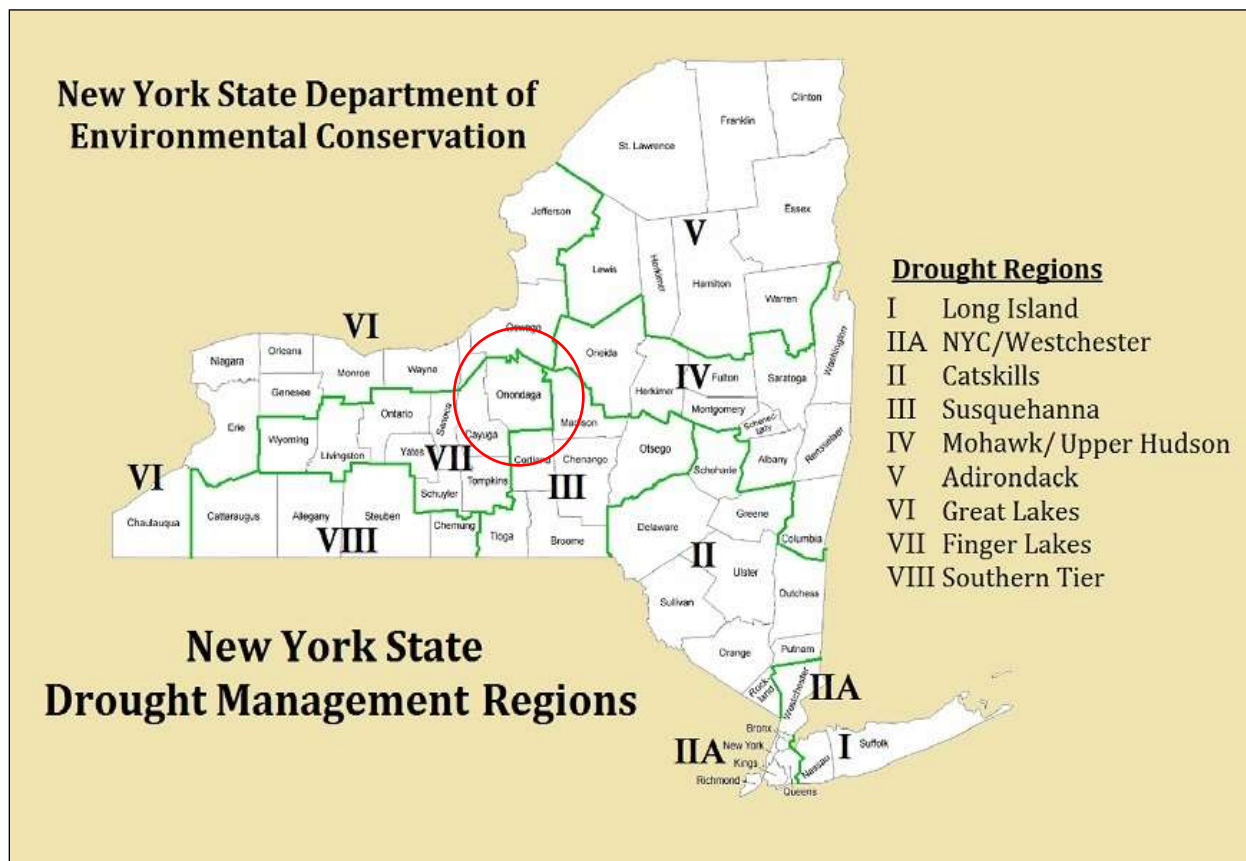
The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. New York State applies two methodologies to identify the different drought stages: the State Drought Index (SDI), and the Palmer Drought Severity Index (PDSI).

State Drought Index

The New York State Department of Environmental Conservation (NYSDEC) has divided New York State into nine drought management regions based roughly on drainage basins and county lines. NYSDEC monitors precipitation, lake and reservoir levels, stream flow, and groundwater level at least monthly in each region and more frequently during periods of drought. NYSDEC uses this data to assess the condition of each region, which can range from "normal" to "drought disaster" as described in Table 5.4.1-1 (NYSDEC 2018). Figure 5.4.1-1 shows the drought regions of New York State. Onondaga County (circled in red) is located within the Finger Lakes Region (Region VII).



Figure 5.4.1-1. NYSDEC Drought Management Regions of New York State



Source: NYSDEC 2015

Note: The red oval indicates the location of Onondaga County.

The State Drought Index (SDI) evaluates drought conditions comprehensively by determining whether numerous indicators reach dire thresholds. It compares the following four parameters to historical or “normal” values to evaluate drought conditions: stream flows, precipitation, lake and reservoir storage levels, and groundwater levels. The State’s Drought Management Task Force (the Task Force) uses those factors along with levels of water use, duration of the dry period, and season to assess drought within different areas of the state. The data acquired are compared to critical threshold values to indicate a normal or changeable drought condition. The indicators are weighted regionally to reflect the different circumstances within each drought management region (NYS DHSES 2014). Table 5.4.1-1 lists the SDI range of values within the normal stage and the three drought stages.

Table 5.4.1-1. State Drought Index Range of Values

| Drought Stage | Drought Index Range | NYS DEC Description |
|---------------|---------------------|--|
| Normal | 100 to 150 | Normal is considered the standard moisture soil levels found throughout New York State. |
| Watch | 75 to 100 | Drought Watch is the first stage of drought. This stage is declared by the NYSDEC and is intended to give advance notice of a developing drought. As this stage, the general public is urged to conserve water. Public water purveyors and industries are urged to update and begin to implement individual drought contingency plans. |



| Drought Stage | Drought Index Range | NYS DEC Description |
|---------------|---------------------|---|
| Warning | 50 to 70 | Drought Warning is the second stage of drought. This stage is also declared by the NYSDEC and is a notice of impending and imminent severe drought conditions. A warning declaration includes stepping up public awareness and increasing voluntary conservation. Public water supply purveyors and industries are urged to continue to implement local drought contingency plans. Federal, state, and local water resource agencies are notified to prepare for emergency response measures. |
| Emergency | 0 to 50 | Drought Emergency is the third stage of drought. This stage is declared by the New York State Division of Homeland Security & Emergency Services (NYS DHSES), based upon recommendation of the Task Force. It is a notice of existing severe and persistent drought conditions. An emergency declaration is a notice for local water resources agencies to mandate conservation and implement other emergency response measures. A continuing and worsening drought emergency may result in the New York State governor declaring a drought disaster. It is a notice of the most severe and persistent drought conditions. At this stage, a significant proportion of communities in the impacted area likely are unable to respond adequately. |

Source: NYS DHSES 2014

Palmer Drought Severity Index

The PDSI is primarily based on soil conditions. Soil with decreased moisture content is the first indicator of an overall moisture deficit. Table 5.4.1-2 lists the PDSI classifications. Zero 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 5.4.1-2 (National Drought Mitigation Center [NDMC] 2013).

Table 5.4.1-2. Palmer Drought Category Descriptions

| Category | Description | Possible Impacts | Palmer Drought Index |
|----------|---------------------|---|----------------------|
| DO | Abnormally Dry | Going into drought: short-term dryness slowing planting, 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, 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/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

Location

Droughts can occur in Onondaga County any time of the year. Variations in the normal amounts of precipitation can lead to periods of dry weather and periods of drought (NYS DHSES 2014). Onondaga County is situated between the Great Lakes and the Atlantic Ocean. These water bodies provide significant moisture that generates precipitation throughout the region. In addition, Onondaga County has numerous lakes including two of the central New York Finger Lakes: Otisco Lake and Skaneateles Lake. Numerous streams in Onondaga County flow north to join the Seneca River or Oneida River watersheds. Major streams include Chittenango Creek,





Limestone Creek, Butternut Creek, Onondaga Creek, Ninemile Creek, and Skaneateles Creek. Based on available historical records, the communities in the planning area are equally susceptible to drought events.

Previous Occurrences and Losses

Onondaga County does not typically experience severe or extreme drought due to its proximity to the Great Lakes and Atlantic Ocean.

The NYSDEC monitors precipitation, lake and reservoir levels, stream flow, and groundwater level at least monthly in each region and more frequently during periods of drought. NYSDEC uses this data to assess the condition of each region, which can range from "normal" to "drought disaster." No drought disasters have been declared for Onondaga County.

Between 1954 and 2018, FEMA declared that New York State underwent one drought-related disaster (DR) or emergency (EM) that was classified a water shortage. Generally, drought-related disasters affect a wide region of the State and thus may have impacted many counties. However, Onondaga County was not included in the disaster declaration.

The U.S. Department of Agriculture (USDA) keeps records of agricultural disasters. In 2012, USDA Agricultural Disasters S3427 and S3441 were declared for drought and in 2016, USDA Agricultural Disaster S4023 was declared (USDA 2018). USDA reported crop losses provide another indicator of previous events. USDA records indicate that Onondaga County has experienced crop losses from drought events in 2012, 2015, 2016, 2018. Details are provided below.

- 2018: Wheat \$4,219.50
- 2018: Processing Beans, \$12,609.00
- 2016: Oats, \$654.00
- 2016: Corn, \$596,609.80
- 2016: Fresh Market Sweet Corn, \$4,995.00
- 2016: Soybeans, \$99,372.00
- 2015: Soybeans, \$10,623.98
- 2012: Corn, \$182,600.00
- 2012: Fresh Market Sweet Corn, \$6,949.00
- 2012: Soybeans, \$75,145.00 (USDA 2018a)

Based on all sources researched, Table 5.4.1-3 identifies known drought events between 1998 and 2018 that have affected Onondaga County and its municipalities.



Table 5.4.1-3. Drought Events in Onondaga County between 1998 and 2018

| Dates of Event | Event Details |
|----------------------------|---|
| September 1-30, 1999 | A very dry spring and summer caused major crop failures and some wells to run dry. Many streams and rivers were also brought to their lowest recorded levels. The crops most affected were corn and hay, which dealt a major blow to dairy farmers. |
| April, 2001 | Monthly precipitation totals were well over 2.00 inches below normal at some locations and it was the driest April on record at both Walton and the NWS office at the Binghamton Regional Airport. |
| May 8-September 24, 2001 | According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry” from May 8-21, D1 or “moderate drought” status from May 22-June 4, D0 or “abnormally dry” from June 5-August 13, D1 or “moderate drought” from August 14-September 3, and D0 or “abnormally dry” from September 4-24. |
| March 19-April 1, 2002 | According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry.” |
| July 23-August 5, 2002 | According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry.” |
| September 3-30, 2002 | According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry” from September 3-9 and D1 or “moderate drought” status from September 10-30. |
| April 19-25, 2005 | According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry.” |
| May 31-June 20, 2005 | According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry.” |
| August 9-September 5, 2005 | According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry” from August 9-15 and D1 or “moderate drought” status from August 16-September 5. |
| April 11-June 5, 2006 | According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry.” |
| August 7-November 26, 2007 | <p>According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry” from August 7-September 3, D1 or “moderate drought” status from September 4-10, D0 or “abnormally dry” from September 11-24, D1 or “moderate drought” from September 25-October 29, and D0 or “abnormally dry” from October 30-November 26.</p> <p>As a result of lack of rain in the Mohawk Valley, the Erie Canal announced they would close two weeks early.</p> |
| June 10-July 14, 2008 | According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry” from June 10-July 14. |
| April 13-May 10, 2010 | According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry” from April 13-May 10. |
| May 25-June 7, 2010 | According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry” from May 25-June 7, 2010. |
| July 26-September 12, 2011 | According to the U.S. Drought Monitor, conditions held at D0 or “abnormally dry” from July 26-August 1, D1 or “moderate drought” status from August 2-August 29, and D0 or “abnormally dry” from August 30-September 12. |



| Dates of Event | Event Details |
|-------------------------------------|---|
| July 10-December 31, 2012 | According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Onondaga County July 10-17, 2012, D1 or “moderate drought” status from July 17-October 29, 2012, and D0 or “abnormally dry” status from October 30-December 31, 2012. |
| April 9-15, 2013 | According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Onondaga County April 9-15, 2013. |
| January 27-June 8, 2015 | According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Onondaga County January 27-June 8, 2015. |
| September 8, 2015-February 22, 2016 | According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Onondaga County September 8, 2015-February 22, 2016. |
| May 24, 2016-February 6, 2017 | <p>According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Onondaga County May 24-June 27, 2016, D1 or “moderate drought” status from June 28-July 11, 2016, D2 or “severe drought” status from July 12-November 28, 2016, D1 or “moderate drought” status from November 29, 2016-January 30, 2017, and D0 or “abnormally dry” status from January 31-February 6, 2017.</p> <p>A significant lack of rain since May found many areas in the Finger Lakes and Southern Tier New York regions with as little as 25 percent of normal rainfall through the end of July. Drought persisted and became worse over parts of the Finger Lakes region and Central Southern Tier of New York during August. Rainfall since the late Spring was only recording up to 50 to 80 percent of normal. Agricultural interests reported significant stress to non-irrigated crops, and several communities began to place voluntary and mandatory water restrictions on their residents.</p> <p>Drought worsened over parts of the Finger Lakes region and Central Southern Tier of New York during September. September rainfall amounts were again considerably below the average long term monthly trends. Agricultural interests reported significant stress to non-irrigated crops, with many areas reporting expected losses to corn, soybean and hay yields. More communities began to place voluntary and mandatory water restrictions on their residents.</p> <p>According to surveying of New York farmers, fruit growers in western New York were reported to have lost roughly 52 percent of their crop with grape growers reporting a loss of 26 percent of their crop and western berry growers lost 96 percent of their crop. The combined losses from an early freeze and the continuing drought resulted in losses of \$30,000 to a Manlius nursery. The president of the New York Apple Association predicted the crop would be 1.5 to 2 million bushels below the five-year average of 29.5 million bushels as drought caused apples to be smaller and sweeter than usual. Grape farmers were reported to be smaller and less acidic. Dairy farmers struggled financially due to low milk prices and high costs for feed due to drought.</p> <p>Private well owners throughout the northeast reported dry wells. Lawns in Onondaga County went brown and local gardens became dusty. Shallow marshes negatively impacted duck and goose hunting throughout New York.</p> <p>A drought warning was issued for Onondaga County on July 15, 2016 by NYS DEC. The drought warning was reduced to a drought watch in February of 2017.</p> |
| September 26-October 30, 2017 | According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Onondaga County. Drought caused brown lawns in Onondaga County and led farmers to irrigate late season crops. |



| Dates of Event | Event Details |
|-----------------------|---|
| June 19-July 30, 2018 | According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Onondaga County. Drought resulted in locally brown lawns and grass going dormant earlier than normal. Hot and dry conditions began to harm corn, soybean, hay, and other crop production. |

Sources: NCEI 2018, USDM 2018, NDMC 2018

Note: Many sources provide historical information regarding previous occurrences and losses associated with drought events throughout New York State and Onondaga County. Information about loss and impact resulting from each of many events can vary depending on the source.

Climate Change Impacts

Temperatures and precipitation amounts are expected to increase within the Tug Hill Plateau region, in which Onondaga County is located. Table 5.4.1-4 lists projected seasonal precipitation changes within the Tug Hill Plateau ClimAID Region (NYSERDA 2014).

Table 5.4.1-4. Projected Seasonal Precipitation Change in Region 6, 2050s (percent change)

| Winter | Spring | Summer | Fall |
|-----------|----------|-----------|-----------|
| +5 to +15 | 0 to +10 | -5 to +10 | -5 to +10 |

Source: NYSERDA 2011

Snowfall rates in Onondaga County may increase due to reduced freezing of the Great Lakes as temperatures warm. However, as the climate continues to warm, temperatures may rise enough to the point where winter precipitation may fall as rain instead of snow (NYSERDA 2014). These fluctuations in snowfall could result in an increase or decrease in the county’s winter snowpack. Reductions in snowpack would increase the possibility of drought.

Extreme heat events are likely to increase throughout New York State, and short-duration warm season droughts will become more common. With the increase in temperatures, heat waves (defined as three or more consecutive days with maximum temperatures at or above 90 °F) will become more frequent and intense. Summer droughts are projected to increase under these conditions, affecting water supply, agriculture, ecosystems, and energy projects (NYSERDA 2014).

By the end of the 21st century, the number of droughts is likely to increase, as the effect of higher temperatures on evaporation is likely to outweigh the increase in precipitation. Droughts in the northeast United States have been associated with local and remote modes of multi-year ocean-atmosphere variability that are unpredictable and may change with climate change. Changes in distribution of precipitation throughout the year and in timing of snowmelt could increase frequency of droughts (NYSERDA 2011).

Probability of Future Occurrences

In the past, Onondaga County has experienced a range of drought conditions from abnormally dry to severe, or D0 to D2, in accordance with the Palmer Drought Category. Based on the historical occurrences and climate projections for the region, it is anticipated that Onondaga County will continue to experience drought events in the future. The county’s communities are equally susceptible to drought events and should consider mitigation actions to reduce the impacts of moderate drought. Based on the periods of time that Onondaga County spent in at least “abnormally dry” conditions from 1998 through August 2018, the probability for drought in the county is considered “frequent” (hazard event has 100% annual probability and can occur multiple times per year).

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





5.4.1.2 Vulnerability Assessment

To understand risk, a community must evaluate its assets that are exposed or vulnerable to the identified hazard. All of Onondaga County is exposed to the drought hazard; therefore, all assets in the county (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 4), are potentially vulnerable to a drought. The following text evaluates and estimates the potential impact of the drought hazard on the county.

Impact on Life, Health, and Safety

The entire population of Onondaga County is vulnerable to drought events (population of 468,050 people [US Census Bureau 2016]). Drought conditions can affect public health and safety, including reduced local firefighting capabilities due to reduced water availability, health problems related to low water flows and poor water quality, and health problems related to dust. If droughts are severe enough, these health problems can lead to loss of human life.

Other possible impacts include 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. The infirm, young, and elderly are particularly susceptible to drought and extreme temperatures, sometimes associated with drought conditions, due to their age, health conditions, and limited ability to mobilize to reach shelters, cooling, and medical resources. Some drought-related health effects are short term, while others can be long term (Center for Disease Control and Prevention [CDC] 2012). Social impacts primarily involve public safety, health, conflicts among water users, reduced quality of life, and inequities in distribution of impacts and disaster relief. Many economic and environmental effects induce social impacts as well (NYS DHSES 2014).

During dry periods, soil water can deplete quickly. If precipitation deficiencies continue, people who depend on other sources of water will begin to feel impacts of the shortage. Those who rely on surface water (and lakes) and subsurface water (groundwater) are usually the last to be affected. A short-term drought that persists for 3 to 6 months may have little impact on these people who are reliant on surface and subsurface water, depending on characteristics of the hydrologic system and intensity of water use (NYS DHSES 2014).

According to the USGS Water Science School, groundwater levels are dependent on recharge from infiltration of precipitation, so when a drought hits the land surface, it can impact the water levels below ground. When rainfall is less than normal for several weeks, months, or years, the flow of streams and rivers declines, water levels in lakes and reservoirs fall, and the depth to water in wells increases. If dry weather persists and water-supply problems develop, the dry period can become a drought.

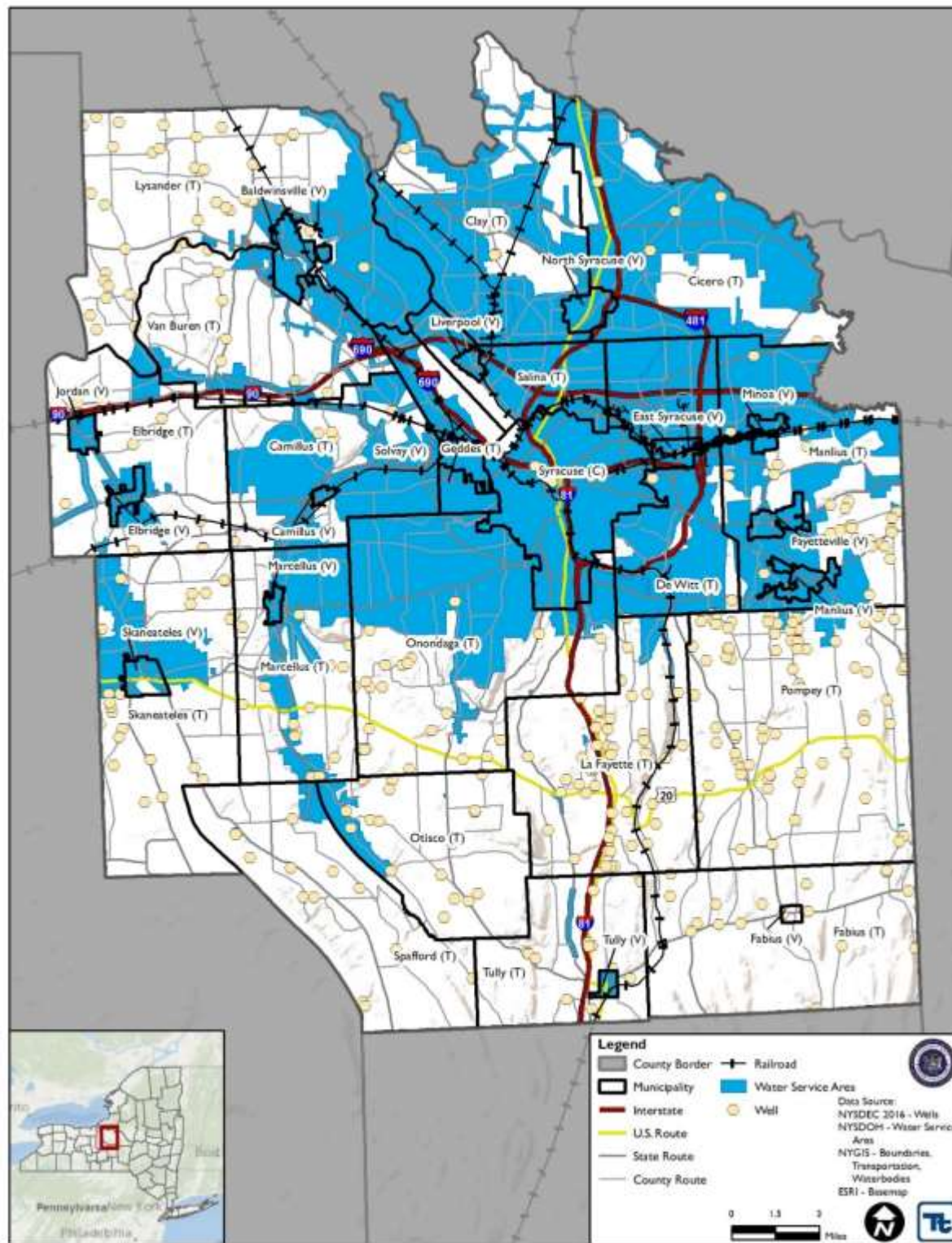
The water level in the aquifer that supplies a well does not always stay the same. Droughts, seasonal variations in rainfall, and pumping affect the height of the groundwater levels. If a well is pumped at a faster rate than the aquifer feeding it is recharged by precipitation or other underground flow, then water levels in the well can be lowered. This can happen during drought, due to the extreme deficit of rain. The water level in a well can also be lowered if other wells near it are withdrawing too much water (USGS 2019).

As previously stated, drought conditions can cause shortages of water for human consumption. The drought hazard is a concern for Onondaga County because rural populations within the county rely upon private water supply from local groundwater resources. Figure 5.4.1-2 displays the water service areas and distribution of wells throughout the county. Public water service areas are primarily located in the City of Syracuse and the surrounding municipalities and in the villages around the county. The distribution of wells outside these water



service areas is apparent, and shows the rural populations and the Village of Baldwinsville's reliance on these wells for their water supply.

Figure 5.4.1-2. Water Service Areas and Well Distribution





Impact on General Building Stock

A drought event is not expected to directly affect any structures; however, a secondary hazard most commonly associated with drought is wildfire. Prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. Though some structures can become vulnerable to wildfire that are within or near the wildland-urban interface, this is more likely following long periods of drought. Therefore, all assets within wildland urban interface (WUI) areas—including population, structures, critical facilities, lifelines, and businesses—are considered vulnerable to wildfire. The WUI is the area where houses and wildland vegetation meet or intermingle, and where wildfire problems are most pronounced (Radeloff et al 2018). A detailed WUI, divided into interface and intermix areas: intermix WUI are areas where housing and vegetation intermingle; interface WUI are areas with housing in the vicinity of contiguous wildland vegetation.

Impact on Critical Facilities

Water supply facilities may be affected by drought events. The County’s water supply system is a mix of public and privately-owned water systems, but much of the rural populations are served by private wells and can be significantly affected by periods of diminished groundwater resources. A short-term drought that persists for 3 to 6 months may have little impact on surface water and subsurface water, depending on characteristics of the hydrologic system and intensity of water use (NYS DHSES 2014).

As mentioned, drought events generally do not impact buildings; however, droughts can impact agriculture-related facilities and critical facilities associated with potable water supplies. Also, those critical facilities in and adjacent to the WUI zone are considered vulnerable to wildfire.

Impact on the Economy

Drought events impact the economy including loss of business function and damage and loss of inventory. Industries that rely on water for business may be impacted the hardest (e.g., agriculture, forestry, fisheries, and waterborne activities). In addition to losses in crop yields and livestock production, drought is associated with increased insect infestations, plant diseases, and wind erosion. Drought may lead to reduced income for farmers and reduced business for retailers and others who provide goods and services to farmers. This may lead to unemployment, increased credit risk for financial institutions, capital shortfalls, and loss of tax revenue. Prices for food, energy, and other products may also increase as supplies decrease (NYS DHSES 2014).

Direct and indirect losses to agricultural producers, livestock producers, timber producers, fishery producers, and tourism may include:

- 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
- Reduced productivity of livestock due to unavailability of feed and mortality rates (e.g., milk production, meat)
- Reduction in tourism and outdoor activities such as hunting, fishing, and boating
- 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 for economic impact and damage. Crops do not mature during droughts, which results in smaller crop yield, undernourishment of wildlife and livestock, decreases in land values, and ultimately financial loss to the farmer (FEMA 1997). A large majority of the state’s agriculture is rain-fed without irrigation; however, summer precipitation is currently not sufficient to fully meet



crop water needs during most years (NYSERDA 2011). Based on the 2012 Census of Agriculture (the most recent version available), 681 farms were present in Onondaga County, encompassing 150,269 acres of total farmland. The average farm size was 221 acres. Onondaga County farms had a total market value of products sold of \$152 million (\$48.3 million in crop sales; and \$103.7 million in livestock, poultry, and related products), averaging \$223,275 per farm. The Census indicated that 374 farm operators reported farming as their primary occupation (USDA 2012). Table 5.4.1-5 lists the acreage of agricultural land exposed to the drought hazard.

Table 5.4.1-5. Agricultural Land in Onondaga County in 2012

| Number of Farms | Land in Farms (acres) | Total Cropland (acres) | Harvested Cropland (acres) | Total Cropland Used Only For Pasture/Grazing (acres) |
|-----------------|-----------------------|------------------------|----------------------------|--|
| 681 | 150,269 | 101,800 | 94,478 | 7,838 |

Source: USDA 2012

In 2012, the top three agricultural products sold in Onondaga County were milk from cows at \$79.5 million; other poultry and eggs at \$13.7 million; and vegetables, melons, potatoes, and sweet potatoes at \$6.7 million (USDA 2012).

If the average production (dollar value) per crop type could be identified on a per-acre basis, loss estimates could be developed based on assumed percent damage that could result from a drought. If a drought impacted 40 percent of the agricultural products sold from Onondaga County farms, based on 2012 market values, this would be a loss of \$60.8 million.

A prolonged drought can have a serious economic impact on a community. Increased demand for water and electricity may result in shortages and higher costs for these resources. Industries that rely on water for business may be impacted the most (for example, 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/price of food for residents within the county.

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, relatively modest areas targeted for future growth and development have been identified across the county. Any areas of growth could be potentially impacted by the drought hazard because the entire county is exposed and vulnerable to droughts. Future growth could impact the amount of potable water available due to an increased drain on the available water resources. Other areas that could be impacted include agriculture and recreational facilities such as golf courses, farms, and nurseries.





Projected Changes in Population

According to population projections from the Cornell Program on Applied Demographics, Onondaga County will experience a slight population decrease through 2040 (less than 10,000 people in total by 2040). Population change is not expected to have a measurable effect on the overall vulnerability of the county's population over time. As discussed in *Long Range Transportation Plan 2050: Moving Towards a Greater Syracuse*, the population of Syracuse has decreased as the other municipalities in the county have seen an increase, which has led to an increased reliance on motor vehicles to travel around the county (Syracuse Metropolitan Transportation Council, 2015). This trend shows populations moving into the more rural areas of the county, which might require water system upgrades to keep up with demands during a drought. Refer to Section 4.6.2 - Population Trends in the County Profile for a discussion on trends for the County.

Climate Change

As discussed earlier, summer droughts are projected to increase which may affect water supply, agriculture and ecosystems (NYSERDA 2014). An increased incidence of drought may impact availability of water supplies, primarily placing an increased stress on the population. It is unlikely that structure exposure and vulnerability would increase as a direct result of drought, although secondary impacts of drought, such as wildfire, may increase and threaten structures. If a wildfire were to occur during a drought, emergency services may face complications from a water shortage depending on their water source. Critical water-related service sectors may need to adjust management practices and actively manage resources. Increased incidence of drought may also increase the potential for impacts on the local economy including the production of agricultural products.

Change of Vulnerability

The 2013 plan did not include the drought hazard; therefore a change in vulnerability over the performance period of the plan cannot be assessed.

Issues Identified

The following drought-related issues have been identified:

- Drought events can have significant impact on residents and businesses who rely upon surface and subsurface water supplies within Onondaga County.
- Drought events can have significant impact on agriculture within Onondaga County and markets that rely on agricultural products for their businesses outside of the county.
- Climate change may increase the frequency of drought, increasing the need for mitigation actions.
- The promotion of active water conservation even during non-drought periods should be encouraged.
- The potential drought effects on the sustainability of the significant agricultural base in the county provides a potential issue to be addressed by the county.
- Droughts contribute to conditions conducive to wildfires and reduce fire-fighting capabilities.