TOWN OF WINDHAM ANNEX DOCUMENT

Southeastern Connecticut Council of Governments
Multi-Jurisdictional Hazard Mitigation and Climate Adaptation Plan Update

March 2023

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1. Introduction

1.1. Purpose of Annex

The planning process for the multi-jurisdiction hazard mitigation plan update commenced in April 2022 and ended in December 2022, spanning a period of nine months. The planning process included 24 jurisdictions (22 municipalities and two tribal governments) with two participating together (Griswold and Jewett City) for a net total of 23 local planning teams represented. For this 4th edition of the plan, SCCOG elected to link the planning process to a parallel planning process administered by the Connecticut Institute for Resilience and Climate Adaptation (CIRCA) that is known as "Resilient Connecticut 2.0" (stylized as *Resilient Connecticut*). The *Resilient Connecticut* program is described on CIRCA's web site at https://resilientconnecticut.uconn.edu/ and the expansion of the program into southeastern Connecticut is described at https://circa.uconn.edu/2022/02/23/resilient-connecticut-expands-statewide/.

The linkage of the two planning processes was advantageous for the following reasons:

- Incorporation of climate change into the hazard mitigation plan update
- Increased interest from the local communities, especially for those interested in developing climate adaptation strategies.
- Direct incorporation of climate change vulnerability products developed by CIRCA including the Climate Change Vulnerability Index (CCVI) for flood and extreme heat vulnerabilities.
- Direct incorporation of combined sea level rise and coastal flood inundation simulations from CIRCA
- Positioning of the SCCOG jurisdictions for new funding sources in Connecticut such as the new Department of Energy and Environmental Protection (DEEP) Climate Resilience Fund (DCRF)
- Consistency with the Governor's Council for Climate Change (GC3) outcomes from the 2020-2021 planning process
- Positioning of the actions for incorporation on the State's "resilience project pipeline" per Executive Order (EO) 21-3 issued at the end of 2021.

The planning process commenced for the local communities on April 20, 2022, with a presentation to the SCCOG Board. During this presentation, the consultant and CIRCA described the planning process and the approach for incorporating the *Resilient Connecticut* program into the hazard mitigation plan update, and notified the chief elected officials that invitations to local planning meetings would follow at the end of April. Local planning team meetings commenced on May 23, 2022, and ended on July 8, 2022. Workshops with local coordinators were conducted in July and September 2022, and supplemental meetings with water utilities in the region and specific stakeholders continued through November 2022.

The purpose of this HMP annex is to provide an update to the hazard risk assessment and capability assessment provided in the previous HMP, and to evaluate potential hazard mitigation measures and prioritize hazard mitigation projects specific to mitigating the effects of hazards on the Town of Windham. Background information and the regional effects of pertinent hazards are discussed in the main body of the Southeastern Connecticut Council of Governments (SCCOG) Multi-Jurisdictional Hazard

Mitigation and Climate Adaptation Plan. Thus, this annex is designed to supplement the information presented in the Multi-Jurisdictional HMCAP with more specific detail for Windham and is not to be considered a standalone document.

1.2. Hazard Mitigation and Climate Adaptation Goals

The primary goal of the previous hazard mitigation plans adopted in 2013 and 2018 was to identify risks to hazards and potential mitigation measures for such hazards to ***reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources.*** This included the reduction of public and private damage costs. Limiting losses of and damage to life and property was also meant to reduce the social, emotional, and economic disruption associated with a natural disaster.

Coinciding with the incorporation of climate adaptation and the alignment of this HMCAP with the *Resilient Connecticut* planning process administered by CIRCA, five new goals were developed for this HMCAP:

- Ensure that critical facilities are resilient, with special attention to shelters and cooling centers.
- Address risks associated with extreme heat events, especially as they interact with other hazards.
- Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.
- Reduce losses from other hazards.
- Invest in resilient corridors to ensure that people and services are accessible during floods and that development along corridors is resilient over the long term.

2. Community Profile

The Town of Windham is a partially urbanized community in southwestern Windham County that was founded in 1692. The town contains an urbanized area comprising the former town of Willimantic which was consolidated with the town in 1983. The community grew to a population of 25,268 as of the 2010 census. Fluctuations over the next decade brought the total population of the town to 24,425 as of the 2020 census, a 3.3% decrease.

The town is approximately 27.9 square miles in area and consists of the borough of Willimantic as well as the villages of Windham Center, North Windham, and South Windham. The town is bordered by Columbia to the west, Coventry to the northwest, Mansfield and Chaplin to the north, Scotland to the east, Sprague to the southeast, Franklin to the south, and Lebanon to the southwest.

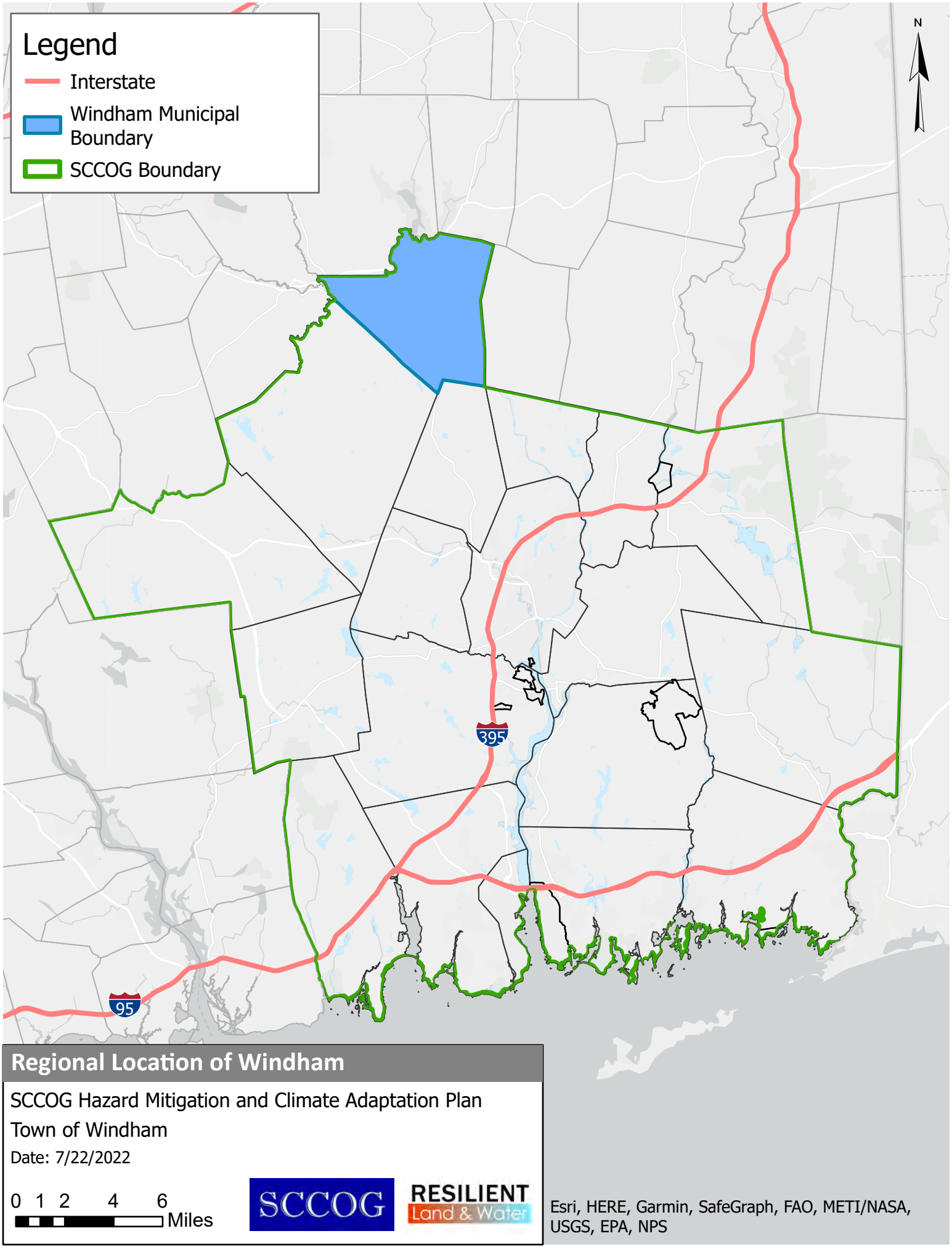
Windham is located at the focus of several major transportation corridors. Major roads and bus lines allow access to Windham and include Route 6, Route 14, Route 32, Route 66, Route 195, Route 203, and Route 289. Rail lines include the Providence/Worcester line. The rail line allows goods to travel from Windham to other communities throughout southeastern Connecticut and the eastern seaboard. Windham Airport, a local general aviation facility is located in northern Windham and averages approximately 80 aircraft operations per day.

Willimantic is located at the confluence of the Willimantic River and the Natchaug River, which join to form the Shetucket River. The Willmantic River drains from Mansfield and Coventry. The Natchaug River drains from Mansfield Hollow Reservoir in Mansfield and Windham, which is located at the confluence of the Fenton River, Mount Hope River, and the Natchaug River. The Willimantic Reservoir, an impoundment of the Natchaug River, is the source of fire protection water for Windham and southern Mansfield. The Shetucket River drains to Sprague, and it is impounded just upstream of Sprague for hydroelectric purposes.

2.1. Physical Setting

The Town of Windham is in the northwestern corner of the SCCOG region. Elevations range from approximately 100 feet along the Shetucket River to just over 650 feet on Obwebetuck Hill in the southwestern section of the town. The western area of town along the Willimantic River known as Willimantic is the most densely developed area, while outlying areas, particularly in the southeastern portion of the town, are relatively rural.

Geology is important to the occurrence and relative effects of natural hazards such as earthquakes. Thus, it is important to understand the geologic setting and variation of bedrock and surficial formations in lands underlying the Town of Windham.



Regional Location of Windham

SCCOG Hazard Mitigation and Climate Adaptation Plan

Town of Windham

Date: 7/22/2022

0 1 2 4 6 Miles

SCCOG

RESILIENT Land & Water

Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS

The Town of Windham lays above several bedrock formations which trend southwest to northeast across the area, except in northwestern Windham where the formations are more circular in nature associated with the Willimantic Dome. The Willimantic Dome is bounded by the Willimantic Window, described[1] as a window or inlier through the upper plate of the thrust fault. Each of these formations consist primarily of gneiss and schist which are relatively hard metamorphic rocks.

The town's different surficial geologic formations include glacial till and stratified drift. Refer to the Multi-Jurisdictional HMCAP for a generalized view of surficial materials. The majority of the town is underlain by glacial till. Till contains an unsorted mixture of clay, silt, sand, gravel, and boulders deposited by glaciers as a ground moraine. Areas adjacent to the Willimantic River, the Natchaug River, and the Shetucket River, and Indian Hollow Brook have fairly extensive areas underlain by sand and gravel or floodplain alluvium. The amount of stratified drift present is important as areas of stratified materials are generally coincident with floodplains. These materials were deposited at lower elevations by glacial streams, and these valleys were later inherited by the larger of our present day streams and rivers. However, the smaller glacial till watercourses can also cause flooding. The amount of stratified drift also has bearing on the relative intensity of earthquakes and the likelihood of soil subsidence in areas of fill.

The Town of Windham is considered to be at risk of damage from inland flooding, hurricanes and tropical storms, summer storms and tornadoes, winter storms, earthquakes, wildfires, and dam failure. Windham is not a coastal community and is therefore not susceptible to coastal flooding, coastal erosion, or sea level rise.

2.2. Drainage Basins and Hydrology

The Shetucket River is a significant river in Eastern Connecticut. It flows south from Willimantic approximately 16 miles to its confluence with the Quinebaug River in Windham. All land in Windham eventually drains to the Shetucket River, although approximately one-quarter of the town drains to the Willimantic or Natchaug River first. Additional sub-regional watersheds are associated with Beaver Brook (which drains to the Shetucket River in Sprague), Indian Hollow Brook (which drains to the Shetucket River in South Windham), and Sawmill Brook (which drains to the Natchaug River in Willimantic). Other notable bodies of water found throughout Windham include Big Pond, Frog Pond, Lake Marie, Mansfield Hollow Lake, and the Willimantic Reservoir.

The headwater streams of the Shetucket River are heavily flood controlled such that widespread flooding is no longer an issue along this watercourse. In particular, the Mansfield Hollow Dam in Mansfield and Windham is managed by the United States Army Corps of Engineers for flood protection purposes. The Willimantic River is also dammed in its headwaters for public water supply purposes which may reduce flooding risk. Other significant dams are located on the Natchaug River at Willimantic Reservoir, the Shetucket River at Scotland Dam, and on Big Pond in South Windham, but they do not offer any flood abatement capacities.

[1] Rodgers, John. 1985. "Bedrock Geological Map of Connecticut". Connecticut Geological and Natural History Survey.

2.3. Land Cover

According to the 2016 1-meter resolution land cover developed by the NOAA Office of Coastal Management, Windham is predominantly comprised of mixed forest, with approximately 60.41% of the town classified as such. The second largest land cover type is developed open space, which covers about 11.26%, and next is developed impervious which is about 10.53% of land cover. All land covers and their percent coverage can be found in Table 2-1.

Table 2-1 Town of Windham Land Cover

Land Cover Type (2016)	% Coverage
Barren Land	1.81
Cultivated Crops	2.61
Developed, Impervious	10.53
Developed, Open Space	11.26
Grassland/Herbaceous	3.36
Mixed Forest	60.41
Open Water	3.06
Palustrine Aquatic Bed	0.10
Palustrine Emergent Wetland	0.72
Palustrine Forested Wetland	2.30
Palustrine Scrub/Shrub Wetland	0.39
Pasture Hay	2.64
Scrub/Shrub	0.81

2.4. Population, Demographics, and Development Trends

Windham was an important county seat in the 18th and 19th centuries. Early industry in Windham consisted of water-powered sawmills, gristmills, and blacksmith shops, while farmers raised livestock and planted crops such as wheat, rye, corn, barley, flax, and hemp. Most mills developed along the Willimantic River in Willimantic and in Windham Center. Population boomed in Willimantic during the industrial revolution in the early 19th century, particularly related to the textile industry. The introduction of rail lines in the 19th century further spurred industrial development, as well as residential development as Willimantic was one of only a handful of stops between Boston and New York in the late 19th century. Residences were constructed to house the workers of these industries, and fine homes were built on hillsides (such as Prospect Hill) overlooking the commercial and industrial areas. Several notable historic structures including the former American Thread Company, the Jillson House Museum, the Windham Textile and History Museum, the town hall, and several historic homes are dispersed throughout town. The Town made a concerted effort to develop utilities (water, sewer) to provide service to the residents and businesses of the town of Willimantic beginning in the late 19th century.

The textile industry began to decline following World War II as many larger industries moved south, the primary railroad line between Boston and New York was relocated through New London, and the nation became less reliant on shipping goods via rail. In addition, Willimantic was never connected to the

interstate highway system, with only a short section of Route 6 becoming a limited access highway. Following a major downtown revitalization effort in the 1970s, the Town of Windham is again undertaking a major downtown revitalization and riverfront reclamation effort by adding parks and converting distressed factory buildings into residential space for artists and small technology startups.

Today, Windham is primarily a service center rather than an industrial hub. In particular, Willimantic is home to Eastern Connecticut State University (ECSU) and a branch of the Quinebaug Valley Community College. Education, including the Windham Public School system and ECSU, is one of the top employment sectors for town residents, and Windham Hospital is another major employer. Commercial corridors with restaurants and shops are located along Route 32, Route 66, and other State roads in the town, as well as in downtown areas. Manufacturing and construction jobs employ less than 1,000 people, with most such remaining jobs being in Willimantic or at locations along the Shetucket River.

In general, any influx of population and residential and non-residential development increases the town's overall vulnerability to natural hazards. According to the 2010 census, approximately 48.7% of all housing units in Windham are renter-occupied. Many were built during the housing boom of the 1960's to 1990's, but most housing structures pre-date these decades and as such do not meet current or even recent building codes. The low percentage of owner occupancy can lead to increased susceptibility to natural hazards, as owners may not be present on a daily basis to secure their properties. However, new buildings are constructed to more recent building codes (and generally away from floodplains) and are considered to be less vulnerable to natural hazards than older buildings.

In the time since the last HMP was written in 2017, there has been little development on new land (requiring clearing) in Town. Most development is demolition/rebuild projects, and renovations. The lack of developer-friendly space remaining in the town has generally slowed new development.

Overall, new development and redevelopment in Windham is not increasing risks to natural hazards. Redevelopment throughout the community offers significant opportunities for flood mitigation to be incorporated into buildings and stormwater management to be addressed on-site; and new development is constructed per the flood damage prevention, wind loading, and snow loading requirements in the State Building Code.

As of the 2020 Decennial Census, the population for the town is 24.425, which equates to about 902 people per square mile. The 2020 American Community Survey 5-year estimates identified the annual average median income for Windham to be $44,767, with an average of 20.7% of the population holding a bachelor's degree or higher, and an average unemployment rate of 8.4% throughout the town.

2.5. Governmental Structure

The Town of Windham is governed by a Council/Manager form of government. The Mayor is the chief elected official for the Town, presides over the Town Council, and with the Council appoints a Town Manager who serves as the chief executive officer of the Town and is directly responsible for the administration of all departments, agencies, and offices. Together, the Mayor and the Town Council review and approve all Town business.

The Town of Windham has several departments and commissions that provide municipal services. Authorities in the Town of Windham who play advisory, supervisory, or direct roles in hazard mitigation for the Town include the following:

Table 2-2 Authorities and Roles in Windham

Authorities	Role			Hazard Mitigated
	Advisory	Supervisory	Direct	
Building Department	X		X	All
Code Enforcement and Zoning Office	X		X	Flooding
Conservation, Open Space, and Agriculture Commission	X			Flooding
Fire Department			X	Wildfire
Fire Marshal / Emergency Management Director (under supervision of Town Manager)	X	X	X	All
Inland Wetlands & Watercourses Commission			X	Flooding
Mayor / Town Council	X	X	X	All
Planning	X		X	Flooding
Planning and Zoning Commission	X		X	Flooding
Public Works Department	X	X	X	All
Town Engineer	X	X	X	Flooding
Water Commission / Windham Water Works	X	X		Wildfire
Zoning Board of Appeals			X	Flooding

The roles of Town departments have not changed since the time of the previous HMP. Thus, the Town of Windham continues to be technically, financially, and legally capable of implementing mitigation projects for natural hazards. As discussed in the next section and the historic record throughout this annex, the Town of Windham is densely developed in certain areas (e.g., Willimantic) but practically rural in outlying areas, presenting a range of vulnerability to certain types of natural hazards.

2.6. Review of Existing Plans and Regulations

The Town has several plans and regulations that suggest or create policies related to natural hazard mitigation. These policies and regulations are outlined in the Emergency Operations Plan, *Plan of Conservation and Development*, Zoning Regulations, and Inland Wetland Regulations.

Emergency Operations Plan

The Town has an Emergency Operations Plan (EOP) that is updated and certified by the Town Manager annually. This document provides general procedures to be instituted by the Town Manager and/or designee, Emergency Management Department, Police Department, and Fire Department in case of an emergency. Emergencies can include but are not limited to natural hazard events such as hurricanes and nor'easters as noted in the Severe Weather Annex of the EOP. The EOP is directly related to providing emergency services prior to, during, and following a natural hazard event. The EOP was being updated as of December 2016 to revise some language without any content change. The Town plans to switch to the new state designated EOP format by 2019.

Plan of Conservation and Development (2007)

The *Plan of Conservation and Development* (POCD) was adopted in 2017 with contributions from local boards and commissions, citizens, and citizen groups. The 2007 POCD Vision Statement helped guide the development of the 2017 update. The purpose of the plan is to promote economic development through smart growth and forward thinking while meeting the needs of multiple stakeholders and interested parties. Recommendation strategies were noted as being long-term policies or specific actions, and those related to hazard mitigation include:

Some of the POCD strategies and recommendations related to hazard mitigation include:

- Continue to incentivize Flexible Design Subdivisions to preserve natural, scenic, historic, and other resources.
- Continue to require stormwater best management practices in new subdivisions, such as rain gardens and permeable pavement.
- Continue to employ best practices in the preservation of open space in new subdivisions, such as by implementing conservation subdivisions.
- Support the goals of the Open Space Plan, especially as it relates to possible acquisition of properties for open space.
- Continue efforts to improve water quality, such as reviewing aquifer protection zone regulations on a regular basis.
- Strive to preserve the undeveloped areas around and along our streams, rivers, and ponds in their natural state.
- Continue to require appropriate buffer zones for important water resources; extend upland review area to 200' from the water.
- Create a riparian buffer along the Shetucket River that connects South Windham to Plains Road Park and Willimantic.
- Plan for the expansion of Public Safety Complex, consider relocating to a larger property with sufficient area for future growth.
- Plan for and incorporate Low Impact Design (LID) best practices into all municipal infrastructure projects whenever appropriate.
- Continue to require, whenever possible, developers to incorporate LID techniques in private developments.
- Continue to require that new developments must consider and reduce stormwater run-off volume, reduce peak discharges, increase run-off travel time, increase groundwater recharge, and avoid impacts to natural stream flows by utilizing techniques outlined in the CT DEEP's Connecticut Stormwater Quality Manual.

Based on the above, the Windham POCD is considered somewhat consistent with the current goals and actions of the hazard mitigation plan, as it does not directly address several of the hazards such as emergency hazard response and specific flood mitigation plans, among others. The next update to the POCD will continue to reference and incorporate the elements of the hazard mitigation plan.

Zoning Regulations

The Zoning Regulations of the Town of Windham, Connecticut was last revised August 1, 2020. These regulations are applied during the permitting process for new construction and during substantial improvement of existing structures. Many of the regulations are specific to mitigating flooding damage, as noted below:

- Article V, Section 52 discusses the requirements for the Special Flood Hazard Area. The Town has adopted the FIS and FIRM released by FEMA dated November 6, 1998, and any revisions thereto with the accompanying Flood Insurance Rate Maps adopted by reference.
    - Chapter 52.7 notes that where substantial development or disturbance is proposed (i.e., disturbance of one acre or more, or removal or addition of between 1,000 cubic yards and 5,000 cubic yards of material), the commission may require more detailed information on the likely impacts on flood flow and the effect on abutting properties in the SFHA. A Special Permit is required when the proposed development may result in a substantial change in conditions (i.e., greater than 5,000 cubic yards of material or disturbance of more than five acres).
    - Chapter 52.7.3 requires that all new construction and substantial improvements have the lowest floor, including the basement, elevated to or above the base flood level. Non-residential structures may be floodproofed provided all attendant utilities and sanitary facilities and the area of the structure below the base flood elevation is watertight with walls substantially impermeable to the passage of water. Living space is not allowed below the base flood elevation. All public utilities and drainage must be located and designed to be consistent with the need to minimize flood damage.
    - Chapter 52.8 requires developments within floodways to meet certain requirements. For mapped floodways, encroachments are not allowed unless the encroachment does not result in any rise in the base flood elevation. For Zone A where a floodway has not been mapped, no encroachments are permitted unless the applicant demonstrates that the cumulative effect of the development, when combined with all other existing and anticipated development, will not increase the base flood elevation more than one foot at any point in town. The Town may request that an applicant determine the floodway if one is not present and shall adopt such floodway.
    - Chapter 52.9.2 specifies that variances will not be issued within any designated floodway if any increase in the base flood elevation would result.
- Article VII, Section 71.9 specifies design standards for stormwater management (no net runoff) and best management practices.

Inland Wetland and Watercourses Regulations

The Inland Wetlands and Watercourses Regulations in the Town of Windham were last amended on May 13, 2004. The regulations require a permit for certain regulated activities which take place within 100 feet of a wetland or watercourse, within 150 feet for any proposed subsurface disposal system, and within 200 feet of the Willimantic, Natchaug, and Shetucket Rivers, the North Atlantic White Cedar Bog,

and any vernal pool. These regulations build on the preventative flood mitigation provided by the Zoning regulations by preventing fill and sedimentation that could lead to increased flood stages.

Under Section 4.1 and 4.2 of the proposed regulations dated April 2017, withdrawals of water for fire emergency purposes are exempt from permitting, including the installation of dry hydrants by or under the authority of a municipal fire department, provided the dry hydrant is only used for firefighting purposes and there is no reasonable alternative access to a public water supply.

2.7. Critical Facilities, Sheltering Capacity, and Evacuation.

The Town of Windham considers several facilities to be critical to ensure that emergencies are addressed while day-to-day management of the Town continues. In addition, locations with populations that may be at additional risk during an emergency are also considered to be critical. Critical facilities are presented on figures throughout this annex and summarized in Table 2-3.

As shown on Table 2-3, only one critical facility (the water pollution control facility) is located within the 1% annual chance floodplain, and no critical facilities are located within potential hurricane surge zones. These facilities are described in more detail below.

Table 2-3 Town of Windham Critical Facilities

Facility	Address or Location	Emergency Power	Shelter	Cooling Center	In SFHA
Emergency Services					
Windham Center Fire Department	18 Windham Center Road	✓			
South Windham Fire Department	41 Machine Shop Hill Road	✓			
North Windham Fire Department	603 Boston Post Road	✓			
Willimantic Fire Department	13 Bank Street	✓			
Police Department/EOC	22 Meadow Street	✓			
ECSU Police Department	44 Charter Oak Road	✓			
Municipal Facilities					
Windham Senior Center	1 Jillson Square			✓	
Public Works Headquarters	8 Industrial Park Road	✓			
Windham Water Works (Public Water)	174 Storrs Road, Mansfield	✓			
Water Pollution Control Facility	2 Main Street				✓
Town Hall	979 Main Street	✓		✓	
Health Care/Senior Living					
Windham Hospital	112 Mansfield Avenue	✓			
Windham Public Schools					
Windham Early Childhood Center	322 Prospect Street				
Natchaug Elementary School	123 Jackson Street				
North Windham Elementary	112 Jordan Lane				
Windham Center Elementary	45 North Road Route 14				

Sweeney Elementary	60 Oak Hill Drive	✓			
Charles H. Barrows STEM Academy	141 Tuckie Road				
Windham Middle School	123 Quarry Street	✓			
Windham High School	355 High Street	✓	✓		
Windham Technical High School	210 Birch Street	✓	✓		
Arts at the Capitol Theater Performing Arts Magnet High School	896 Main Street				
Path Academy	832 Main Street				
Other Public Schools					
Eastern Connecticut State University	83 Windham Street	✓	✓		
Quinebaug Valley Community College (Branch)	729 Main Street				
Private Schools					
Saint Mary - Saint Joseph School	35 Valley Street				
Maranatha Sda Regional School	126 Quarry Street				
Other Facilities					
Windham Airport	15 Airport Road				

Fire Departments

The Town has four fire stations; three are volunteer companies (Windham Center, South Windham, and North Windham) while one houses career fire fighters (on Bank Street in Willimantic). The four fire departments provide excellent fire and rescue response to the town and have pump trucks, brush trucks, and boats to provide fire response and rescue services.

Municipal Facilities

Windham Water Works draws water from the Willimantic Reservoir to provide public water service throughout most of Windham and southern Mansfield. Windham Water Works has noted that the system currently does have an operational backup generator, however, it is relatively old; likely from the 1980's. Windham Water Works has a 100 KW PV system that is connected to the grid. Also, a study was conducted about ten years ago to assess the feasibility of adding a turbine to the system. While it was determined it was in fact feasible, the project has yet to be advanced.

The Town of Windham provides sewer service throughout Willimantic and parts of Windham. Electrical and natural gas service is provided by regional utilities.

The Town's Emergency Operations Center (EOC) operates out of the Police Complex and has a generator for emergency power. The Town's water pollution control facility on (at the confluence of the Willimantic River and the Natchaug River) is located within the 1% annual chance floodplain. Other municipal facilities, including public works, the senior center, and the police department are not floodprone. The two police departments include one on Meadow Street in Willimantic and one on the ECSU campus.

Literature is an important means of conveying and educating the public. Located in the main lobby of Town Hall are several pamphlets describing emergency checklists, home emergency plans, wildfires, evacuation routes, etc. This information will also be distributed to the Library once renovations are completed.

Health Care Facilities

The Windham Hospital on Mansfield Avenue is not floodprone. This facility provides emergency, advanced outpatient, and inpatient services to the Town of Windham and the surrounding region. Three convalescent homes are also located in Windham on Club Road, North Road, and Valley Street. In addition, there are five elderly and special needs housing areas.

Windham contains populations of people who are elderly and/or possess disabilities. Not surprisingly, the more populated areas include a higher percentage of individuals who may require special assistance or different means of notification before and during natural hazards.

Schools

The Town of Windham has a large school system that encompasses eight elementary schools (two of which are private) and one middle school. These facilities are considered to be critical facilities because they house a large student population who may not be as prepared for emergencies to the same extent as an adult. Windham has five high schools, including a high school education program, a technical high school, a secondary arts magnet school, and a charter high school. The high school and the technical high school are shelters and both are equipped with generators. Several private schools are also located in the town.

With the largest individual population concentration in town, ECSU's campus, located in Willimantic, had over 4500 undergraduates and several hundred graduates enrolled in the 2012 school year. ECSU's housing facilities allow the campus to accommodate approximately two-thirds of the entire student body while the university is in session. The seasonal increase in population in this area creates an elevated concern. It should be noted that the University has its own police protection but given a disaster of a large enough scale the University would require further assistance besides that which they can provide for themselves.

Shelters

The Town of Windham has two primary shelters for residents. The primary shelters (two high schools) are listed in Table 2-3. The high school has two co-generators, while the Technical school has a diesel generator. The Town completed a micro-grid project in early 2017 to create an off-grid power island for Sweeney School and the Middle School. Additional sheltering space would be needed if New London or Fishers Island, NY evacuated due to an accident at the Millstone Nuclear Facility in Waterford. Under that scenario, the Town has agreements in place to provide large-scale short-term sheltering with the assistance of ECSU.

The town has also identified three cooling centers in the event of an extreme heat wave. The Senior Center, Town Hall, or Kramer Building could be used by residents for heat respite.

Communications

The Town recently updated its Emergency Operations Center (EOC) Communication System which will allow for direct communications between ECSU, Windham Hospital, and the EOC. All departments can communicate by cell phone and email. In addition, one communication facility (operated by Frontier) providing internet and telephone service is located on High Street.

The Town has subscribed to the CodeRED Reverse 9-1-1 system to provide emergency notification and response to areas affected by a natural hazard or other emergency. This system is separate from the Reverse 9-1-1 system utilized by ECSU. The backup method of disseminating information is to drive along streets making announcements over public address systems. Residents can communicate issues by directly calling municipal departments. The Town also provides educational pamphlets and literature on natural disasters at the Town Hall and Library.

Evacuation Routes

The Emergency Management Director has a coastal evacuation plan on file that can be activated because of an emergency at the Millstone Nuclear Power Plant in Waterford. The evacuation map includes evacuation routes connected to the shelters in Windham. If the Town of Windham needed to evacuate, residents would utilize Route 6, Route 14, Route 32, Route 66, Route 195, Route 203, or Route 289 to leave the town. However, several bridges could be a concern during severe flooding events.

Additional Groups and Facilities

In addition to Town offices, The American Red Cross and the Salvation Army help provide shelter and vital services during disasters and participate in public education activities. Windham Airport is also considered a critical facility as supplies could be airlifted to this facility following a natural disaster. Two manufactured home parks off Route 6 and other mobile homes throughout town are also of concern due to their heightened risk of being damaged by natural hazards. Other commercial and industrial facilities are also a concern for emergency responders due to their size and use of propane gas.

2.8. Repetitive Loss Properties

A repetitive loss (RL) property is defined as any insurable building that has had two or more claims exceeding $1,000 that were paid by the National Flood Insurance Program (NFIP) within a ten-year period. As of June 2022, the Town of Windham has no RL properties.

2.9. Exposure to Climate-Affected Natural Hazards

Properties, people, historic resources, and critical facilities in the Town are exposed to natural hazards affected by climate change (i.e., severe storms, coastal flooding, droughts) as well as hazards that are not affected by climate change (i.e., earthquakes). As an initial screening of exposure to hazards, areas of risk have been overlaid onto parcel and point data in a GIS to understand the maximum potential exposure to hazards. The results of this analysis are found in Table 2-4.

Table 2-4 Town of Windham Exposure Analysis

Hazard	At-Risk Parcels		At-Risk Facilities		At-Risk Historic Assets	
	Value	Number	Value	Number	Value	Number
Hurricane/Tropical ,Storm	$1,099,841,834	7,098	$112,256,460	21	$1,640,490	5
Severe Thunderstorm	$1,099,841,834	7,098	$112,256,460	21	$1,640,490	5

Severe Winter Storm	$1,099,841,834	7,098	$112,256,460	21	$1,640,490	5
Tornado	$1,099,841,834	7,098	$112,256,460	21	$1,640,490	5
Drought	$408,141,584	2,752	$340,770	4	$106,620	1
Flood						
1% Annual Chance	$75,409,970	383	-	-	-	-
0.2% Annual Chance	$241,542,410	628	$6,904,270	1	-	-
Earthquakes	$1,099,841,834	7,098	$112,256,460	21	$1,640,490	5
Wildfire	$145,418,934	2,045	$340,770	3	$1,640,490	5

2.10. Community Climate Change Challenges

As is with all of the SCCOG communities, the Town of Windham has several concerns regarding climate change challenges. Most communities in the region are typically most concerned with the impacts of increased flooding and extreme heat events, however, there are often concerns about other climate driven hazards. The following summary sheet identifies the top flooding, heat, and other climate change concerns for the town, along with the hazard mitigation and climate adaptation actions that will work to address these concerns.

Climate Change Summary Sheet for Town of Windham

What are the Town's Top Climate Change Concerns?

Flooding: The wastewater treatment plant (WWTP) and a sewer pumping station are at risk of future riverine flooding which is projected to continue or worsen even with an upstream flood control dam in place.

Extreme Heat: The Town has a large socially vulnerable population that cannot be without access to viable cooling centers. The Town Hall and Senior Center, which are cooling centers, need standby power such as generators.

Others: The Town's water utility, Windham Water Works, has a complex set of climate change challenges related to sedimentation, water quality, the reservoir dam, and power redundancies.

Which Hazard Mitigation and Climate Adaptation Actions Will Address Climate Change Concerns?

Flooding: Compare elevations of WWTP assets and the pumping station to the base flood elevations associated with the Natchaug River and Willimantic River plus applicable freeboard (likely two feet); and determine if funds should be set aside for resiliency projects.

Extreme Heat: Acquire generators for the Town Hall and the Community Center/Rec Center/Senior Center. Ensure that cooling centers are accessible using transit or alternate transportation options.

Others: Execute the FEMA BRIC Scoping Grant for Windham Water Works and determine appropriate next steps for climate resiliency strategies, whether related to sediment removal, dam and intake modifications, or other needs.

3. Extreme and Severe Storms

3.1. Climate Change Impacts

Climate change projections indicate varying changes in the frequency and intensity of severe storms and their relative hazards like precipitation and wind. It is expected that as global mean temperatures continue to rise, storms like hurricanes, tropical storms, and severe thunderstorms, may become more frequent and more intense. The degree to which these events might change, and the confidence levels in the models, vary by event type.

Hurricanes and tropical storms are likely to be accompanied by higher wind speeds and an overall increase in intensity. Warm water and air temperatures are essentially the fuel source for the storm, therefore warmer temperatures mean an increase in fuel which can produce more intense winds and high precipitation levels.

While the future behavior of tornado and high wind events is a little more challenging to predict in comparison to hurricanes, it has been noted that the number of days of tornadic activity has decreased in recent decades, though the number of tornadoes in a single day has increased.[2] There is a similar lack in confidence when projecting severe thunderstorm and wind events. Because these events are short-lived and relatively small-scale, monitoring and modeling are more challenging. Overall, however, future climate conditions are likely to become more conducive to the development of such events, therefore increasing the potential for occurrence.

Severe winter storm events, similar to hurricanes, are expected to become more intense under future climate conditions, however they are expected to become less frequent. These storms will continue to be capable of producing large amounts of precipitation, though in future decades this precipitation will consist of less snow and more wintry mix or rain.

These changes in storms could mean an increase in risk throughout town or for specific populations, more severe storm damages and impacts, or an increase in flooding occurrences.

3.2. Hurricanes and Tropical Storms

3.2.1 Setting and Recent Occurrences

Several types of hazards may be associated with tropical storms and hurricanes including heavy winds, heavy rains, and flooding. Flooding hazards are discussed in Section 0 of this annex. Wind hazards are widespread and can affect any part of the town. However, some buildings in the town are more susceptible to wind damage than others.

Super Storm Sandy in 2012 and Tropical Storm Irene in 2011 remain two of the most impactful events for the region and the Town of Windham. The Town of Windham and non-profits received $50,652.92 in wind damages due to Storm Sandy, and $30,788.28 in damages from Tropical Storm Irene.

The region has experienced multiple tropical events in the past five years. On August 2, 2020, Tropical Strom Isaias swept through the State brining severe winds which resulted in the highest number of

[2] https://nca2018.globalchange.gov/chapter/2/

outage events Connecticut has ever experienced. With over 620,000 outages reported by Eversource alone, the state's largest electric supplier, residents across the SCCOG region were without power, cable, and internet for extended periods of time. While this storm did not generate typical amounts of rainfall experienced during a tropical storm event, the wind damage exceeded expectations bringing down trees and power lines across the state.

In 2021, there were four tropical storm events that passed through, or within 50 miles of, the state. Some of these events, which are described in more detail below, resulted in flooding along several brooks and stream crossings, including roadway washouts.

The 2021 events included Elsa, Fred, Henri, and Ida.

- July 9, 2021 (T.S. Elsa) – Elsa made landfall as a tropical storm in Florida and traveled along the eastern seaboard. It passed through Southeastern New England bringing high winds and rainfall. Gusts were reported over 40 mph, and residents throughout the region and state were left without power.
- August 19, 2021 (Extratropical Storm Fred) – This tropical event passed north of the state bringing heavy rain to some areas in Connecticut; there was a reported 5.14 inches in West Hartford. Fred also produced an EF-0 tornado in Windham County.
- August 22, 2021 (T.D. Henri) – Hurricane Henri made landfall in Rhode Island as a tropical storm and then traveled northwest across the State of Connecticut. While the impacts for Henri were projected to be more severe than they actually were, the storm did result in heavy rainfall and thousands of power outages.
- September 1, 2021 (Extratropical Storm Ida) – Though Hurricane Ida made landfall in Louisiana as a category 1, the storm moved south of Long Island as an extratropical storm and is reported to be costliest storm even since Hurricane Sandy a decade earlier. Ida caused major flooding across Connecticut and the Southeastern Region. For the first time, a statewide flash flood warning was issued. Several communities in the state, including the City of Norwich, warned residents to have minimal contact with surface waters due to the discharge of untreated sewage. There were reports of 7 to 8 inches of rainfall in the Southeastern Region, and as high as 8.58 inches in Uncasville.

3.2.2 Existing Capabilities

Wind loading requirements are addressed through the state building code. The Connecticut State Building Code was most recently adopted with an effective date of October 1, 2022. The code specifies the design wind speed for construction in all the Connecticut municipalities. The basic design wind speed for Windham ranges from 115 to 135 miles per hour, and the ultimate design wind speed is 125 miles per hour. The design speed used varies depending on the building use (for example, hospitals must be designed to the higher wind speed). Note that changes in design wind speed figures since the previous HMP are largely the result of a shift from "nominal" to "ultimate" wind speeds, for compatibility purposes; see the Connecticut Building Code or the American Society of Civil Engineers website for more information. Windham has adopted the Connecticut Building Code as its building code.

Parts of trees (limbs) or entire tall and older trees may fall during heavy wind events, potentially damaging structures, utility lines, and vehicles. Utility lines are located underground in only a couple

areas of the town. The Tree Warden posts notification and schedule tree removal. Most tree services are contracted out of town and the budget of tree removal is built into the Public Works Department budget and is not stand-alone.

In response to the major power-outages caused by Tropical Storm Irene and Hurricane Sandy, as well as significant winter storm events, Eversource has taken an aggressive approach to tree maintenance and has improved communication and coordination with municipalities. Municipal staff report that Eversource has enhanced its tree clearing efforts, has updated its facilities, and has been working to strengthen the power grid and build in redundancies. Communication and coordination have improved due to Eversource's liaison program.

Warning is one of the best ways to prevent damage from hurricanes and tropical storms, as these storms often are tracked well in advance of reaching Connecticut. Windham can access National Weather Service forecasts via the internet as well as listening to local media outlets (television, radio) to receive information about the relative strength of the approaching storm. This information provides the resources needed to determine whether or not to implement its EOP and encourage residents to take protective or evacuation measures if appropriate.

As noted previously, Windham subscribes to a Reverse 9-1-1 system. Residents are able to sign up to receive warnings through CodeRED as well as from the statewide CT Alert "Everbridge" Emergency Notification System and receive critical information from the town.

Although hurricanes that have impacted Windham have historically passed in a day's time, additional regional shelters could be outfitted following a storm with the assistance of the American Red Cross on an as-needed basis for long-term evacuees.

Summary

The Town maintains shelter facilities and performs debris management through Public Works with the assistance of the local electrical utility when necessary. The Town's capabilities are considered to be effective with regard to mitigating hurricane damage. Overall, the Town of Windham's capability to mitigate for hurricanes and prevent loss of life and property has not significantly increased since 2017.

3.2.3 Vulnerabilities and Risk Assessment

The overall risk of Windham to hurricanes is considered to be high. The entire town is vulnerable to hurricane and tropical storm wind damage and from any tornadoes (Section 3.3) accompanying the storm, as well as inland flooding (Section 0). Of particular concern are the blockage of roads and the damage to the electrical power supply from falling trees and tree limbs. The town is concerned that relatively extensive outages could occur in some areas because of tree damage to utility lines.

Direct wind damage to newer buildings from hurricane or tropical storm-level winds is rare in the town since the new buildings were constructed to meet or exceed current building codes. Many buildings in the town were built in the 1970s and 1980s and do not meet current building codes. Older buildings in the town and mobile homes are particularly susceptible to roof and window damage from high wind events, particularly in the many historic districts in the town. This risk will be reduced with time as these buildings are remodeled or replaced with buildings that meet current codes.

3.2.3.1 Hazard Losses

The Town of Windham did not receive FEMA PA funds in the wake of Tropical Storm Isaias. Since 2012, the town has received $56,985 in FEMA PA reimbursement for project costs of $75,979. This was all received for Super Storm Sandy. These funds were received for debris removal and donated resources.

FEMA HAZUS-MH 6.0 was used to develop losses associated with seven probabilistic hurricane scenarios from the 10 year to 1,000 year return period. Losses include economic loss, building damages, debris, and sheltering needs. Table 3-1 through Table 3-3 presents hurricane related damages for the Town of Windham. Additional HAZUS-generated losses for the town and region can be found in the Multi-Jurisdictional document.

Downscaled tropical storm losses based on the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document.

Table 3-1 HAZUS-MH Hurricane Related Economic Impacts

Windham	Return Period	Residential	Commercial	Industrial	Others	Total
	10-year	$104,950	$0	$0	$0	$104,950
	20-year	$1,871,470	$120,230	$23,800	$92,750	$2,108,250
	50-year	$13,999,610	$1,659,780	$258,100	$849,270	$16,766,760
	100-year	$28,824,800	$5,389,160	$976,030	$3,884,640	$39,074,630
	200-year	$50,548,850	$14,645,230	$2,988,580	$12,256,230	$80,438,890
	500-year	$90,381,960	$34,850,730	$7,494,760	$30,650,580	$163,378,030
	1,000-year	$134,570,390	$58,866,170	$13,798,530	$45,624,350	$252,859,440

Table 3-2 HAZUS-MH Hurricane Related Building Damage

Windham	Return Period	Minor	Moderate	Severe	Destruction	Total
	10-year	6	0	0	0	6
	20-year	20	1	0	0	21
	50-year	226	30	2	0	258
	100-year	580	100	8	2	690
	200-year	1,043	244	25	8	1,320
	500-year	1,584	515	74	26	2,199
	1,000-year	1,936	778	139	57	2,910

Table 3-3 HAZUS-MH Hurricane Related Debris and Sheltering Needs

Windham	Return Period	Debris Generated (Tons)	Households Displaced	Individuals Seeking Temporary Shelter
	10-year	25	0	0

	20-year	318	0	0
	50-year	2,996	0	0
	100-year	5,731	2	1
	200-year	9,498	10	7
	500-year	16,177	43	36
	1,000-year	22,691	107	93

3.3. Tornadoes and High Wind Events

3.3.1 Setting and Recent Occurrences

Similar to hurricanes and winter storms, wind damage associated with severe thunder or summer storms and tornadoes has the potential to affect any area of the Town. Furthermore, because these types of storms and the hazards that result (flash flooding, wind, hail, and lightning) might have limited geographic extent, it is possible for a summer storm to harm one area within the town without harming another. Such storms occur in the town each year, although hail and direct lightning strikes to the town are rarer. No tornadoes have occurred in the town since the last HMP.

A selection of summer storm damage from the past decade in the Town of Windham as reported to the NCDC is presented below:

- June 22, 2012: A cold front moved through a hot and humid southern New England producing showers and thunderstorms. Many of these storms became severe, resulting in damaging winds, large hail, and some flash flooding. Trees and wires near a school in Windham were downed by thunderstorm winds. Approximately $15,000 in property damage was reported.
- August 10, 2012: A series of upper level disturbances rotated around a vertically stacked low pressure system in the Great Lakes. These provided a focus for showers and thunderstorms to develop across southern New England. Southerly winds drew tropical moisture over the area, resulting in very heavy rain in showers and thunderstorms that developed. In addition, strong winds in the upper levels and 30-40 knots of deep layer shear resulted in wind damage with the strongest of these storms. Trees and wires on Washington Street in Windham were downed by thunderstorm winds, resulting in approximately $15,000 in property damage.

Other recent severe storm events include:

- On September 6, 2017, a cold front triggered severe storms in the county and caused tree damage in multiple communities in the region. Nearby Colchester reported trees and wires down, and the Groton-New London Airport measured sustained winds at 44 mph and gusts of 56 mph.
- On April 13, 2020, a low pressure system resulted in high winds throughout New London County.
- On June 29, 2020, a severe storm caused $1,300 in damage in Willimantic after it brought trees and wires down on route 14.
- On November 13, 2021, a tornado touched down in Pawcatuck, and another in Plainfield. There were reports of uplifted trampolines, downed trees and powerlines, and an uplifted metal shed.

This same storm also caused damage in other surrounding communities. Downed trees and wires on Babcock Hill Road in South Windham caused $800 in damage.

3.3.2 Existing Capabilities

Warning is the most viable and therefore the primary method of existing mitigation for tornadoes and thunderstorm-related hazards. The NOAA National Weather Service issues watches and warnings when severe weather is likely to develop or has developed, respectively. The Town can access National Weather Service forecasts via the internet as well as listen to local media outlets (television, radio) to receive information about the relative strength of the approaching storm. This information allows the Town to activate its EOP and encourage residents to take protective measures if appropriate.

Aside from warnings, several other methods of mitigation for wind damage are employed by the Town as explained in Section 3.2.2 within the context of hurricanes and tropical storms. In addition, the Connecticut Building Code includes guidelines for the proper grounding of buildings and electrical boxes to protect against lightning damage.

The Town performs debris management through Public Works with the assistance of the local electrical utility when necessary. The Town's capabilities are considered to be effective in regards to response to thunderstorms, although the Town's capability to mitigate thunderstorm damage is relatively limited to town-owned facilities and rights-of-way.

The Town's policies for mitigating tornado damage are response-oriented and include maintaining shelters and debris cleanup equipment. The Town's capabilities are considered to be effective in regard to response to tornadoes.

The Town performs debris management through Public Works with the assistance of the local electrical utility when necessary. The Town's capabilities are considered to be effective in regard to response to thunderstorms, although the Town's capability to mitigate thunderstorm damage is relatively limited to town-owned facilities and rights-of-way.

Summary

Overall, capabilities for tornado and thunderstorm mitigation have not significantly increased since the 2017 HMP.

3.3.3 Vulnerabilities and Risk Assessment

Summer storms are expected to occur each year and are expected to at times produce heavy winds, heavy rainfall, lightning, and hail. All areas of the Town are equally likely to experience the effects of summer storms. The density of damage is expected to be greater near the more densely populated area of the Town.

Most thunderstorm damage is caused by straight-line winds exceeding 100 mph. Experience has generally shown that wind in excess of 50 miles per hour (mph) will cause significant tree damage during the summer season as the effects of wind on trees are exacerbated when the trees are in full leaf. The damage to buildings and overhead utilities due to downed trees has historically been the biggest problem associated with wind storms. Heavy winds can take down trees near power lines, leading to the start and spread of fires. Such fires can be extremely dangerous during the summer months during

dry and drought conditions. Fortunately, most fires are quickly extinguished due to the Town's strong fire response.

Lightning and hail are generally associated with severe thunderstorms and can produce damaging effects. All areas of the Town are equally susceptible to damage from lightning and hail, although lightning damage is typically mitigated by warnings and proper grounding of buildings and equipment. Hail is primarily mitigated by warning, although vehicles and watercraft can often not be secured prior to the relatively sudden onset of a hailstorm. Lightning and hail are considered likely events each year, but typically cause limited damage in the Town. Older buildings are most susceptible to lightning and hail damage since many are renter occupied and they were constructed prior to current building codes.

Although tornadoes pose a threat to all areas of Connecticut, their occurrence is less frequent in Windham County as compared with western and northern parts of the state. Thus, while the possibility of a tornado striking the Town exists, it is considered to be an event with a very low probability of occurrence. The Town of Windham did not report any recent damages due to tornadoes.

3.3.3.1 Hazard Losses

Since 2017, there have been two NOAA reported events associated with a severe thunderstorm and wind event. A June 2020 wind event caused $1,300 in damage from trees and wires down, and a November 2021 event caused $800 in damage again with trees and wires down.

3.4. Severe Winter Storms

3.4.1 Setting and Recent Occurrences

Similar to hurricanes and summer storms, winter storms have the potential to affect any area of the Town. However, unlike summer storms, winter storms and the hazards that result (wind, snow, and ice) have more widespread geographic extent. In general, winter storms are considered highly likely to occur each year (major storms are less frequent), and the hazards that result (nor'easter winds, snow, and blizzard conditions) can potentially have a significant effect over a large area of the town.

Winter storms and nor'easters have affected the town since the last HMP, as reported to the NCDC and reported by town officials. According to Public Assistance reimbursement data, the January Blizzard of 2015 ($217,886.07), the February Blizzard of 2013 ($151,454.09), Winter Storm Alfred in October 2011 ($7,089.12), the February 2006 snowstorm ($100,156.13), the January 2005 snowstorm ($84,849.49), the December 2003 snowstorm ($60,780.77), and the February 2003 snowstorm ($31,775.11) each caused significant damages in Windham.

According to the Town, the City of Willimantic has not had a significant power outage over the last decade due to a winter event. Winter Storm Alfred in late October 2011 caused significant tree damage and additional power outages for several days in outlying areas but not in Willimantic. Trees which were able to withstand the heavy winds of Irene were not able to withstand both wind and snow load during Storm Alfred.

Key risks associated with winter storms are the relative isolation of rural areas from emergency services, loss of electrical power to large areas from ice accumulation or high winds, and fire from improper use of alternative heating sources, candles and gas stoves. The leading cause of death is from automobile and other transportation accidents. Property damage can also occur from frozen water pipes and falling

trees or branches from ice accumulation and/or wind. The overall risk of Windham to severe winter storms is considered to be high.

The year 2013 featured exceptional snow events that severely taxed snow removal abilities of towns in the region. The blizzard of 2013 in early February dumped one to two feet of snow on the region. Another snowstorm struck the region in mid-March, 2013 dumping upwards of one to two feet of snow in some parts of the county. The public assistance reimbursement for the February 2013 storm was $110,261.

Some of the more recent significant winter events include:

- A heavy storm came through the region on February 9, 2017, bringing blizzard conditions and heavy snowfall. The Town of Colchester reported 14.5 inches of snow, and 13 inches were reported along the coast in Groton.
- A late winter storm on March 12, 2018, resulted in 23 inches of snowfall in Oakdale, with reports of one to two feet in other parts of Northern New London County. The southern part of the region experienced 10 to 18 inches of snow, and strong wind gusts. There were also reports of downs trees throughout the region as a result of this storm.
- On January 28, 2022, the region was hit by a heavy snowstorm and blizzard like conditions. Parts of the region reported up to 22 inches of snowfall, and gusts up to 65 mph. There were also several hours of less than ¼ mile visibility. Snow drifts were also reported to be a challenge, with some areas experiencing drifts up to three and a half feet deep.

3.4.2 Existing Capabilities

Existing programs applicable to winter storm winds are the same as those discussed in Sections 3.2.2 and 3.3.2. Programs that are specific to winter storms are generally those related to preparing plows and sand and salt trucks; tree trimming and maintenance to protect power lines, roads, and structures; and other associated snow removal and response preparations.

As it is almost guaranteed that winter storms will occur annually in Connecticut, it is important to locally budget fiscal resources toward snow management. Snow is the most common natural hazard requiring additional overtime effort from town staff, as parking lots and roadways need constant maintenance during storms. The Public Works Department oversees snow removal in the Town. Salt and sand are stored at the Public Works facility. The town has established plowing routes that prioritize access to and from critical facilities. The Connecticut Department of Transportation (DOT) plows State roads.

The Connecticut Building Code specifies that a pressure of 30 pounds per square foot be used as the base "ground snow load" for computing snow loading for roofs. The Town monitored and shoveled the roofs of municipal buildings, and most residents and businesses also shoveled or plowed their roofs.

The Town maintains shelters and provides plowing services through Public Works. The Public Works Department installed a new generator in 2016, increasing their resiliency to winter storm events.

Summary

The Town's capabilities are considered to be effective in regard to response to severe winter storms, although the Town's capability to mitigate severe winter storm damage is relatively limited to town-owned facilities. Overall, capacity has slightly increased since the 2017 HMP as the town continues to experience winter events.

3.4.3 Vulnerabilities and Risk Assessment

Severe winter storms can produce an array of hazardous weather conditions, including heavy snow, blizzards, freezing rain and ice pellets, flooding, heavy winds, and extreme cold. Further "flood" damage could be caused by flooding from frozen water pipes. Often, tree limbs on roadways are not suited to withstand high wind and snow or ice loads.

This section focuses on those effects commonly associated with winter storms, including those from blizzards, ice storms, heavy snow, freezing rain, and extreme cold. Warning and education can prevent most injuries from winter storms. Most deaths from winter storms are indirectly related to the storm, such as from traffic accidents on icy roads and hypothermia from prolonged exposure to cold. Damage to trees and tree limbs and the resultant downing of utility cables are a common effect of these types of events. Secondary effects can include loss of power and heat.

The majority of Town buildings were constructed relatively recently and therefore not particularly susceptible to damage from heavy snow. While some Town buildings could be susceptible to heavy snow loads, they will be cleared quickly if safety is a concern. Many buildings in the Town have flat roofs which are more susceptible to damage from heavy snow than sloped roofs.

Icing is not an issue anywhere in the Town. According to Town staff, there are few steep slopes such that extra sanding and salting of the roadways in necessary locations alleviates any trouble spots.

3.4.3.1 Hazard Losses

There have been no reported winter storm losses for the Town of Windham since 2017. In the past decade, the town has received FEMA PA funds in the amount of $272,803 for winter storms. Downscaled tropical storm losses based on the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document.

4. Sea Level Rise

4.1. Climate Change Impacts

Sea levels are rising at an increased rate across the globe. These rising waters are attributed to melting glaciers and ice sheets, as well as thermal expansion from warming ocean waters. Global sea level rise takes into account the major causes of rise, and the averages of rise around the world. Local sea level rise estimates consider the global changes, but also characterizes what is happening more locally such as changes in currents or land subsidence.

The University of Connecticut, Connecticut Institute for Resilience and Climate Adaptation (CIRCA) has, in accordance with state statute, developed local sea level rise projections for communities to use as a planning threshold (Figure 4-1). CIRCA recommends that communities plan for 0.5 meter (1.64 feet) of sea level rise above 2001 levels by 2050. CIRCA intends to revisit this estimate and update the planning thresholds in the lifespan of this plan (2023-2028).

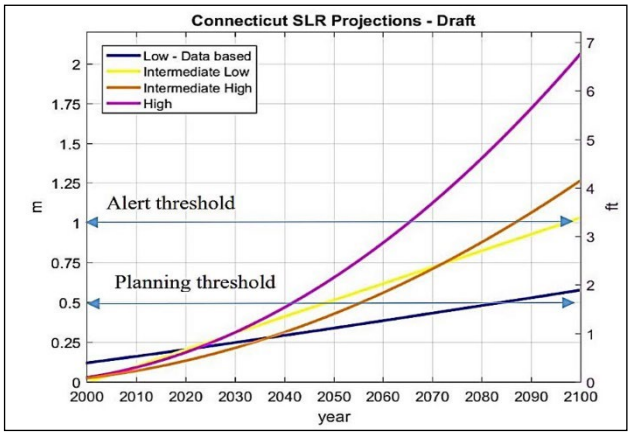


Figure 4-1 Four Localized Sea Level Rise Scenarios for

Even though sea level rise occurs over a longer time period than other hazards, coastal communities are becoming increasingly concerned with the cascading impacts. Increased sea levels can cause a greater geographic reach for coastal flooding events, an increase in frequency or extent of "sunny day" flooding, an increase in storm surge extent, and saltwater inundation along the shoreline. All of these impacts can damage properties, deteriorate infrastructure, cause access and egress challenges, and exacerbate coastal erosion processes.

4.2. Coastal Flooding

4.2.1 Setting and Recent Occurrences

Windham is not located along the coastline nor is it located in a potential hurricane surge zone. As such, no coastal flooding or storm surge has affected the town since the last HMP. Therefore, the town is not considered to be affected by coastal flooding and storm surge.

4.2.2 Existing Capabilities

Due to the town not being on the coast, it does not have and/or need regulations to restrict development due to coastal flooding hazards.

4.2.3 Vulnerabilities and Risk Assessment

No areas of the town are vulnerable to coastal flooding or storm surge.

4.2.3.1 Hazard Losses

There are no reported losses for the Town of Windham related to coastal flooding.

4.3. Shoreline Change

4.3.1 Setting and Recent Occurrences

Windham is not located along the coastline nor is it located in a potential hurricane surge zone. Therefore, the town is not considered to be affected by shoreline change.

4.3.2 Existing Capabilities

Due to the town not being on the coast, it does not have and/or need regulations to restrict development due to shoreline change.

4.3.3 Vulnerabilities and Risk Assessment

No areas of the town are vulnerable to shoreline change.

4.3.3.1 Hazard Losses

There are no reported losses for the Town of Windham related to shoreline change.

5. Changing Precipitation

5.1. Climate Change Impacts

dependent upon the region. Here in the northeast, precipitation totals and intensity are believed to have increased, and are projected to continue to increase during spring and winter months. However, climate change has also been linked to a reduction in snow cover extent, and an earlier spring melt. Winter precipitation may also change from snow to a wintry mix or rainfall due to warmer temperatures; so, while precipitation may increase it may not necessarily be an increase in snow.

Changes in precipitation can also shift the frequency and severity of droughts. As the climate warms, surface soil moisture is likely to decrease as evaporation rates rise. This decrease in soil moisture, and potentially longer periods of time between intense precipitation events, could potentially mean longer and stronger droughts.

These changes in precipitation can have various types of impacts. With an increase in intense precipitation, flooding events may become more frequent, damages to crops may occur, and spring flood trends may shift with less snow and more rain. Droughts on the other hand can also cause damage to crops, stress livestock and agricultural operations, and also reduce drinking water supplies or private wells.

5.2. Riverine and Pluvial Floods

5.2.1 Setting and Recent Occurrences

The Town of Windham is at risk of flooding because of a number of streams, brooks and ponds in the town. According to the 1998 Federal Emergency Management Agency's (FEMA's) updated Flood Insurance Study (FIS) for the town:

> *"Floods in the Town of Windham can occur in any season of the year. Spring floods are common due to a combination of rainfall and snowmelt. Floods in late summer are usually the result of hurricanes or other storms moving northeast along the Atlantic coast. Winter floods result from occasional thaws, particularly in years of heavy snowfall.*
>
> *Major floods of the past 50 years have occurred in March 1936 (a 20-year frequency event), September 1938, and August 1955 (in excess of a 100-year event). The operation of Mansfield Hollow Lake aided the downstream basin in avoiding serious flooding. The Shetucket River at the USGS gaging station (No. 01122500, with 70 years of operation), located at Plains Road, recorded a peak discharge of 52,200 cubic feet per second (cfs) on September 21, 1938. This same quantity of runoff, occurring today, would produce a significantly lower flow at the gage, due to the operation of the Mansfield Hollow Dam.*
>
> *The Willimantic River, at the USGS gaging station No. 0111950, just upstream of State Route 31 in Coventry, Connecticut, recorded a peak discharge of 24,200 cfs on August 19, 1955. The recurrence interval of the flood, at this gaging station, was in excess of a 200-year flood."*

The region has, however, seen some severe rainstorm events since the 2017 plan, with many neighboring communities having experienced serious flooding as a result.

The September 2018 rain event caused severe flooding throughout the state, with several communities in the SCCOG region receiving FEMA funding for the event. Neighboring Norwich received 4.85 inches of rainfall and Lebanon had a reported 6.79 inches.

Hurricane Ida, which produced several inches of rain across the state, caused flooding in many SCCOG communities. Norwich Public Utilities recorded 6.34 inches of rainfall and Groton-New London Airport recorded 2.05 inches. Washouts did occur in Town as a result of flooding near the former State Hospital and the future Riverwalk development.

After a period of prolonged drought, a severe rainstorm event on September 5, 2022, caused flooding throughout southeastern Connecticut. Nearby Lebanon experienced road closures and washouts, while Norwich Public Utilities observed 5.85 inches of rainfall. There were flood and flash flood warnings throughout the region and across the state. Neighboring Rhode Island reported 11 inches of rainfall in some communities.

5.2.2 Existing Capabilities

The Town of Windham has consistently participated in the NFIP since February 3, 1982. The most recent FIRM was published on November 6, 1998. The current Town of Windham FIS was published on November 6, 1998. The original FIS and FIRMs for flooding sources in the Town are based on work completed in June 1980 (Town), July 1980 (City of Willimantic), and May 1996 (Willimantic River update). Many of the local flooding problems are consistent with the floodplains mapped by FEMA.

Flood Control Structural Projects

As noted in the Multi-Jurisdictional HMCAP, the Mansfield Hollow Dam was constructed by the USACE upstream of Windham on the Natchaug River. This flood protection project was completed and greatly reduces the incidence and severity of flooding in Windham. The dam is designed to reduce the volume of the 1938 flood by one-half.

Bridge Replacements, Drainage, and Maintenance

Stormwater runoff can significantly exacerbate flooding; therefore, managing stormwater runoff is a priority mitigation measure. Residential and commercial development increases impervious land area, reduces the infiltration of stormwater runoff into the ground, and increases the volume and velocity of stormwater runoff causing flooding. Enforcing appropriate maintenance programs for stormwater facilities will therefore help reduce the impact of these events and subsequently reduce the damage caused by flooding. The Town currently contracts out silt removal services for its catch basins.

The town has performed several maintenance programs recently, with more in the works. The Plains Road Bridge over Shetucket was resurfaced in 2015/2016, while DOT plans to replace the Route 66 Bridge in 2017. The Town of Windham monitors scour critical bridges such as the Plains Road Bridge that crosses the Willimantic River.

Regulations, Codes, and Ordinances

Section 52 of the Town of Windham's current zoning regulations are the Town's Special Flood Hazard Area regulations which were most recently updated on August 1, 2020. These include, but are not limited to, the following limitations in the flood zone[3]:

- Where disturbance of one acre or more, or removal or addition of more than 1,000 cubic yards but less than 5,000 cubic yards, the Commission may require more detailed information on the likely impacts of the proposed development on flood flow and the effect on abutting properties (Section 52.7(b)). When the proposed development may result in disturbance of more than five acres or the removal or addition of more than 5,000 cubic yards of material, the Commission shall process the application as a Special Permit in accordance with Section 62 (Section 52.7(c)).
- All new construction and substantial improvements, including prefabricated or manufactured buildings or structures shall have the lowest floor, including the basement, elevated to or above the base flood level (100 year flood level) (Section 52.7.3.b).
- Non-residential structures located in all A-Zones may be flood-proofed in lieu of being elevated provided that together with all attendant utilities and sanitary facilities, the areas of the structure below the required elevation are water tight with walls substantially impermeable to the passage of water, and structural components are used which have the capability of resisting hydrostatic and hydrodynamic loads and the effect of buoyancy (Section 52.7.3.c).
- Any new construction, including prefabricated buildings and manufactured homes, and substantial improvements shall be designed and anchored to prevent flotation collapse or lateral movement and constructed with flood-resistant materials and methods. The placement of manufactured homes or manufactured home parks and subdivisions shall be prohibited within any Special Flood Hazard Area of an 'A' or 'B' zone. New construction and substantial improvements shall be constructed using methods and practices that minimize flood damage (Section 52.7.3.g).
- Any development or activity within the floodway must be capable of conveying the base flood without increasing the water surface elevation more than one foot at any point (Section 52.8.a).
- Encroachments, including fill, new construction, substantial improvements, and any other development is prohibited unless certification (with supporting technical data) is provided by a Registered Professional Engineer demonstrating that such encroachments will not result in any increase in flood levels during occurrence of the base flood discharge (Section 52.8.b).
- If the proposal involves development within an 'A' Zone, and a floodway has not been identified, no new construction, substantial improvements to existing structures, or other development (including fill) shall be permitted unless it is demonstrated by the applicant that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point in the town (Section 52.8.1).

Windham's regulations prohibit manufactured (mobile) homes within any special flood hazard area of an 'A' or 'B' zone. Other proposed structures within the flood plain are required to meet elevation

[3] The flood zone being the Area of Special Flood Hazard, designated as the land in the flood plain within a community subject to a one percent or greater chance of flooding in any given year. The areas of Special Flood Hazard contain all A Zones (areas of the 100-year flood) as designated on the Flood Insurance Rate Map. (Windham Zoning Regulations Section 52.5.1)

requirements and strict construction demands. Structures may be required to be constructed with certain materials, elevated, flood proofed, watertight or anchored. It must be shown with not only proposed structures, but with any activity in the 100-year flood plain that encroachment will not alter the flood levels in the floodway. Also any development or activity within the floodway must not increase the water surface elevation more than one foot at any point. These types of regulations help to keep structures out of areas at risk of flooding. Structures that are allowed in the flood plain must meet requirements put in place to greatly reduce the risk of damage to property and the loss of life, should a flood occur.

The degree of flood protection established by the variety of regulations in the Town meets the minimum reasonable for regulatory purposes under the NFIP. The Town plans to remain compliant with the NFIP and will continue to participate in the NFIP.

Acquisitions, Elevations, and Property Protection

No property acquisitions, elevations or protection projects have been recently completed nor are currently proposed by the town.

Flood Watches and Warnings

The Emergency Management Director, Fire Department, and Police Department access weather reports through the National Weather Service and utilize Reverse 9-1-1 systems to telephone warnings into affected areas when flooding is imminent.

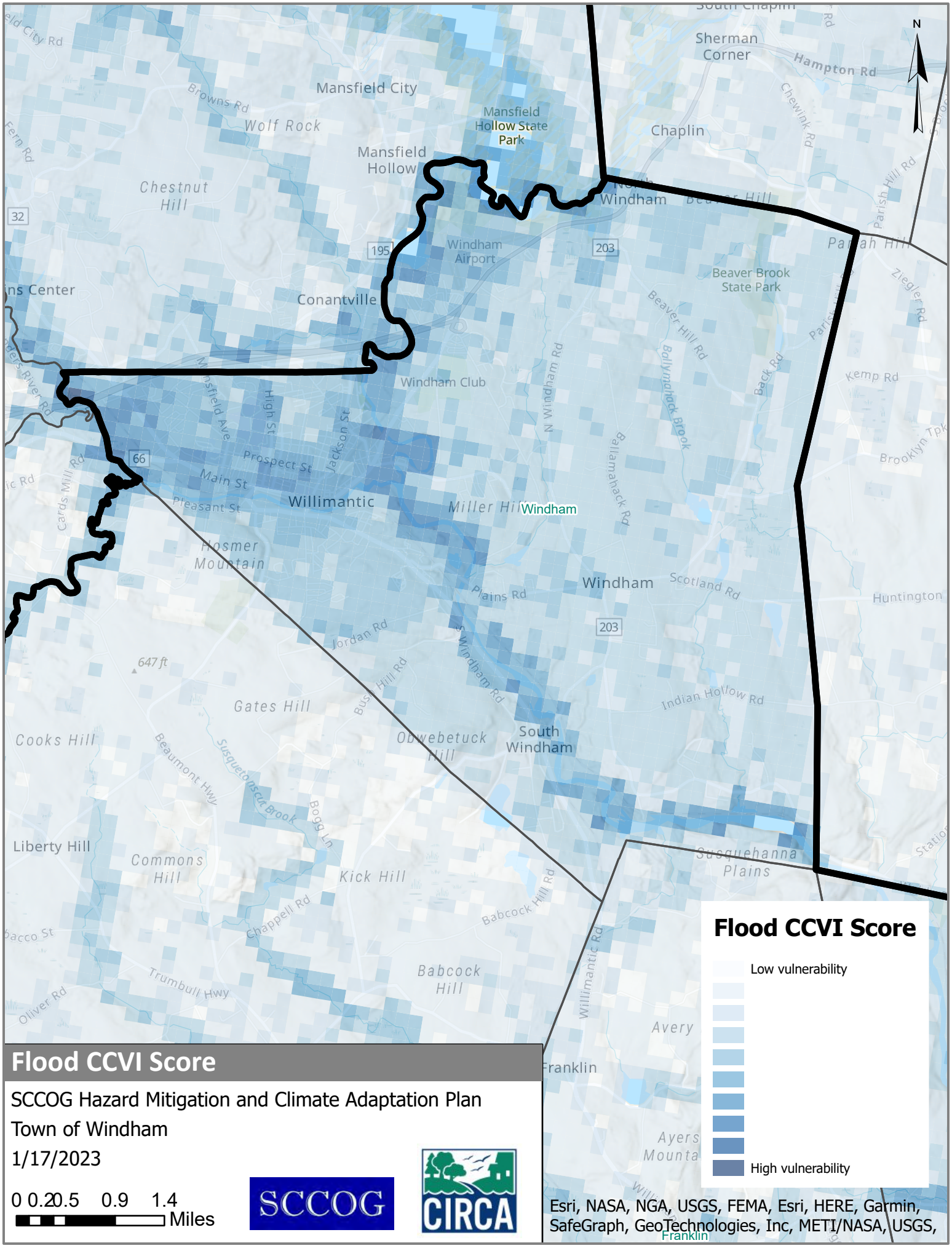
Summary

The Town's capabilities are considered to be effective in regard to response to flood damage, and the Town's capability to mitigate flood hazard damage is also considered effective for preventing damage to new development and substantial improvements. Overall, town capacity has not significantly increased since the 2017 HMP.

5.2.3 Vulnerabilities and Risk Assessment

This section discusses specific areas at risk of inland flooding within the town. Overall, the Town of Windham's capability to mitigate flooding and prevent loss of life and property has slightly improved since the initial hazard mitigation plan was adopted. This is because new flooding problems were not identified, and the CodeRED emergency notification system was enacted by the Town.

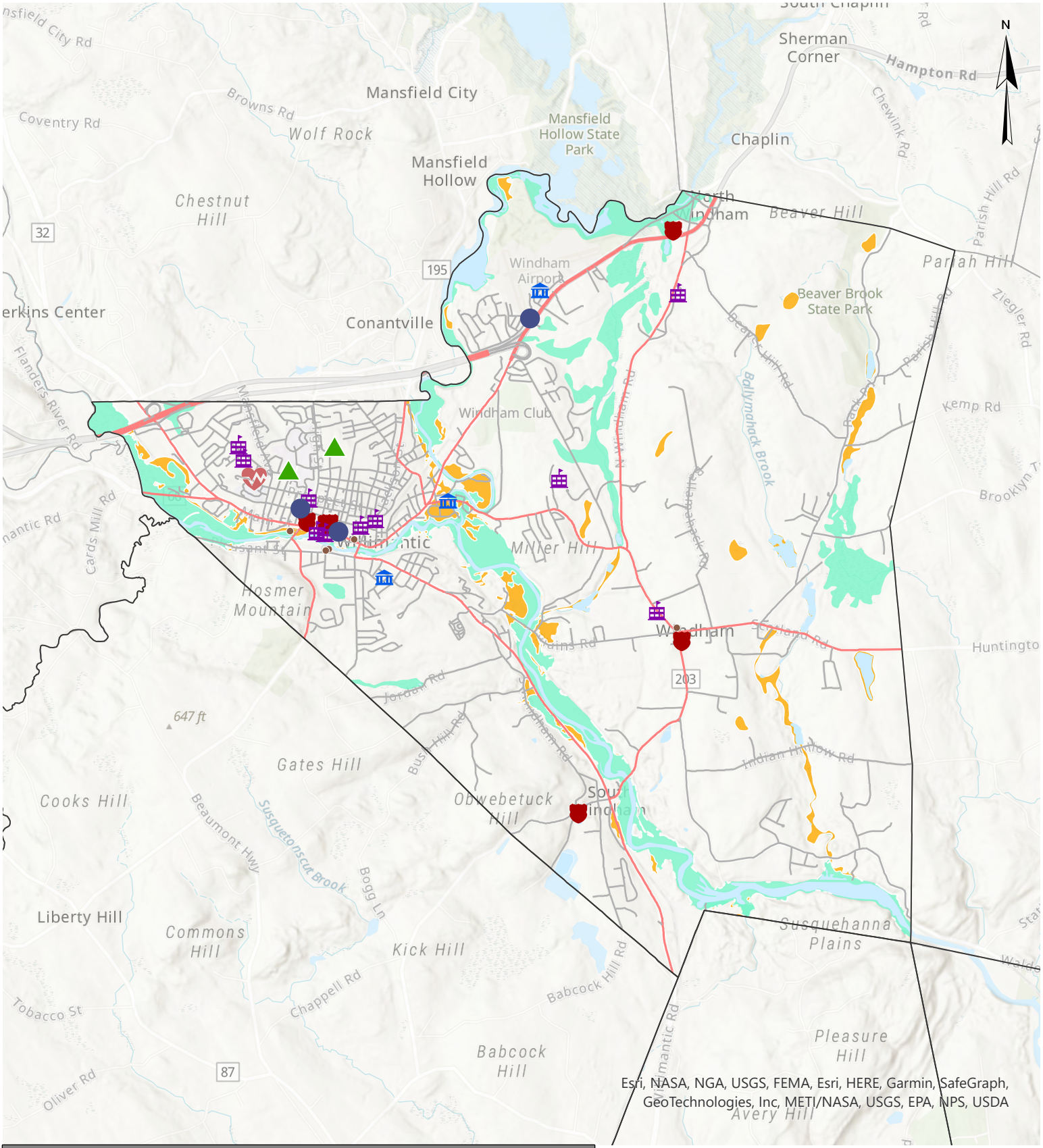
UConn CIRCA has developed a tool to aid in understanding flood vulnerability for communities across the state. This tool, known as the Climate Change Vulnerability Index (CCVI), is comprised of dozens of factors that contribute to a community's flood sensitivity, exposure, adaptive capacity, and ultimately the overall flood vulnerability. The CCVI has been used as a tool to characterize flood vulnerability for the town. The distribution of flood vulnerability throughout the community can be seen in Figure 5-1. The CCVI demonstrates that flood vulnerability in the town ranges from low to moderate. Most of the vulnerability score is due to the coastal areas, and the Fourmile River.


Flood CCVI Score
Low vulnerability
High vulnerability
N
Mansfield City
Mansfield Hollow State Park
Mansfield Hollow
Wolf Rock
Chestnut Hill
Sherman Corner
Hampton Rd
Chaplin
Windham
Windham Airport
Beaver Brook State Park
Conantville
Windham Club
Willimantic
Windham
Miller Hill
Hosmer Mountain
Plains Rd
Scotland Rd
Huntington
Jordan Rd
Gates Hill
Cooks Hill
Obwebetuck Hill
South Windham
Indian Hollow Rd
Liberty Hill
Commons Hill
Kick Hill
Babcock Hill
Susquehanna Plains
Avery
Franklin
Ayers Mountain
Main St
Prospect St
Pleasant St
High St
Jackson St
Mansfield Ave
Cards Mill Rd
Windham Rd
Ballamahack Rd
Beaver Hill Rd
Back Rd
Kemp Rd
Brooklyn Tpk
Parish Hill Rd
Ziegler Rd
Chewink Rd
Browns Rd
Fern Rd
Willimantic Rd
Trumbull Hwy
Oliver Rd
Chappell Rd
Bogg Ln
Beaumont Hwy
Susquetonscut Brook
Babcock Hill Rd
Bush Hill Rd
647 ft
32
66
195
203
Flood CCVI Score
SCCOG Hazard Mitigation and Climate Adaptation Plan
Town of Windham
1/17/2023
0 0.20.5 0.9 1.4
Miles
SCCOG
CIRCA
Esri, NASA, NGA, USGS, FEMA, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS,

Areas studied for vulnerability, as noted in FEMA's 1998 FIS for the town, are as follows:

> *"For the 1981 Windham FIS, the Natchaug and Shetucket Rivers were studied by detailed methods for their entire lengths within the town.*
>
> *For the 1982 Willimantic FIS, the Natchaug, Shetucket, and Willimantic Rivers were studied for their entire lengths within the town.*
>
> *All or portions of the following streams were studied by approximate methods; Willimantic Reservoir, Potash Brook, Ballymark Brook, Beaver Brook, Lake Marie, Bibbins Pond, Lymans Pond, Chestnut Hill Brook, Frog Pond, Jordan Brook, Indian Hollow Pond, Big Pond, a swamp east of Main Street, a swamp east of State Route 289, and a small pond west of Chestnut Hill Brook.*
>
> *The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through June 1985. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA."*

The town has reported that the wastewater treatment plant has come within several feet of flooding during past events, but has not given its position down stream of flood control dams. However, it is thought that risks remain to the facility and the system. There is one pumping station near the Natchaug River that has an increased flood risk. Figure 5-2 depicts the FEMA special flood hazard areas.



Critical Facilities and Historic Resources with Flood Zones

SCCOG Hazard Mitigation and Climate Adaptation Plan

Town of Windham

Date: 8/2/2022

0 0.4 0.8 1.2 1.6 Miles

SCCOG

RESILIENT Land & Water

Legend

- Historic Resources
- Emergency Services
- Municipal
- Other Infrastructure and Facilities
- School
- Shelter or Cooling Center
- Care and Medical Facility
- 1% Annual Chance Flood Hazard Area
- .2% Annual Chance Flood Hazard Area
- Floodway

5.2.3.1 Hazard Losses

According to NFIP statistics, as of June 30, 2022, the Town of Windham has had a total of eight flood related losses, with a total of $243,476 paid towards the claims.

Since 2017 there have also been seven NOAA reported flood events, all having occurred on September 25, 2018. There were several road closures and stranded vehicles. Damages reported totaled $125,000.

FEMA HAZUS-MH 6.0 was used to develop losses associated with the 100-year riverine flood event. Table 5-1 presents flood related damages for the Town of Windham. Additional HAZUS-generated losses for the town and region can be found in the Multi-Jurisdictional document.

Table 5-1 HAZUS-MH Riverine Flood Related Economic Impacts

Windham	2022 Results				
	Residential	Commercial	Industrial	Other	Total
Direct					
Building	$30,560,000	$34,080,000	$11,840,000	$3,070,000	$79,550,000
Contents	$17,160,000	$100,650,000	$32,650,000	$12,690,000	$163,150,000
Inventory	$0	$21,200,000	$4,110,000	$460,000	$25,770,000
Subtotal	$47,720,000	$155,930,000	$48,600,000	$16,220,000	$268,470,000
Business Interruption					
Income	$130,000	$41,330,000	$770,000	$3,460,000	$45,690,000
Relocation	$6,260,000	$16,240,000	$1,040,000	$2,130,000	$25,670,000
Rental Income	$6,010,000	$11,630,000	$330,000	$420,000	$18,390,000
Wage	$320,000	$67,800,000	$1,290,000	$24,080,000	$93,490,000
Subtotal	$12,720,000	$137,000,000	$3,430,000	$30,090,000	$183,240,000
Total	**$60,440,000**	**$292,930,000**	**$52,030,000**	**$46,310,000**	**$451,710,000**

5.3. Drought

5.3.1 Setting and Recent Occurrences

A drought can occur during any season when there is a long, abnormally dry period of time. These events naturally occur during periods of limited precipitation. The effects of drought may vary throughout Town, with some being impacted more than others.

In recent years, droughts have become flashier and more frequent throughout the region. During recent events, there have been reports in the region of wells going dry on residential and farming properties. Some of the more severe and impactful events include:

- **2016 –** A statewide drought that lasted almost two years and peaked in 2016, resulted in water conservation efforts throughout the southeastern part of the region, elevated fire risks in some areas, and was noted as the 11th driest spring on record.
- **2020 –** From June to December, New London County experienced a moderate to severe drought, with the county being declared a Stage 3 by the Connecticut Interagency Drought Work Group.

- **2022 –** During the development of this plan, the region was in an ongoing drought, with severe drought conditions in August 2022. New London County was declared a Stage 3 drought emergency on August 18, 2022, and Windham County was declared a Stage 2 drought.

5.3.2 Existing Capabilities

The Town of Windham, like many communities, does not have specific regulations geared toward drought mitigation. One of the main purposes of the town's zoning regulations is, however, to facilitate the adequate provision of water throughout the town, and to protect groundwater and drinking water supplies.

In Section 74.4.1 of the zoning regulations, the town promotes the use of drought tolerant landscaping. While this is framed as "easier to maintain", the use of these drought tolerant plants can maintain the health of the soils, which plays a role in groundwater retention. The town also has an Aquifer Protection Zone (Section 54) which aims to protect the degradation of groundwater resources to ensure present and future drinking water supply. Though these regulations are not specifically enforced for drought mitigation, these regulations indirectly aid in drought mitigation by way of groundwater protection.

The Town is also pursuing funding for *project scoping* under the FEMA BRIC program. It is the hopes that with this funding, the town can better characterize and describe the benefits of anticipated projects, including improved water quality, improved drought management, and intake redundancy.

The U.S. Drought Monitor is a national resource that many state and local entities use to monitor regional conditions in relation to drought development. The weekly reporting issued by the partnership includes a drought intensity scale which includes five stages from "abnormally dry" to "exceptional drought". While this resource is available to Town for determining drought conditions, the Connecticut Interagency Drought Workgroup (IDW) uses this and other resources to monitor drought conditions specifically for the state. The Town of Windham has this IDW and state-specific drought emergency declarations as a resource to prepare for, and respond to, droughts.

Summary

Overall, the town's capacity to mitigate droughts has increased since the 2017 HMP as cooling centers have been designated and because the town is pursuing funding to further mitigation efforts.

5.3.3 Vulnerabilities and Risk Assessment

The entire Town of Windham is vulnerable to drought, but the degree of vulnerability varies. A majority of the properties in town rely on private wells for their residential or commercial drinking water. These private well users may face challenges relative to water supply during periods of drought. Those that are serviced by Windham Water Works have a high level of resilience because of system redundancies, however, during extreme droughts these residents may face water use restrictions to conserve the system supply.

Certain parts of Windham are also somewhat rural in character, and likely have some smaller agricultural operations. These operations could face challenges associated with irrigation during times of drought as wells and surface water supplies run low.

5.3.3.1 Hazard Losses

There have been no reported drought losses for the Town of Windham. Downscaled drought losses from the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi Jurisdiction document.

5.4. Dam Failure

5.4.1 Setting and Recent Occurrences

Dam failures can be triggered suddenly with little or no warning and often in connection with natural disasters such as floods and earthquakes. Dam failures can occur during flooding when the dam breaks under the additional force of floodwaters. In addition, a dam failure can cause a chain reaction where the sudden release of floodwaters causes the next dam downstream to fail. While flooding from a dam failure generally has a limited geographic extent, the effects are potentially catastrophic depending on the downstream population.

There are 23 dams in Windham, 11 of which are registered with DEEP. These dams range from Hazard Class AA (negligible hazard) to Hazard Class C (high hazard). A total of four dams in the town are classified as negligible or low hazard (Class AA or Class A) including one unclassified; failure of any of these dams would hardly be of concern. Three dams are classified as moderate hazard (Class BB) and their failure would cause some damage, but no major disruptions. Two dams are classified as a significant hazard (Class B), and two as a high hazard (Class C). Failure of either Class B or C could cause serious damage, and potentially be catastrophic.

A dam failure affecting the Town of Windham is considered a possible event each year with potentially critical effects. No dam failures have affected the Town since the time of the last HMP.

5.4.2 Existing Capabilities

Dams in the region whose failure could impact the Town of Windham are under the jurisdiction of the Connecticut DEEP. The dam safety statutes are codified in Section 22a-401 through 22a-411 inclusive of the Connecticut General Statutes. Sections 22a-409-1 and 22a-409-2 of the Regulations of Connecticut State Agencies have been enacted, which govern the registration, classification, and inspection of dams. Dams must be registered by the owner with the DEEP according to Connecticut Public Act 83-38. The Connecticut DEEP administers the Dam Safety Section and designates a classification to each state-registered dam based on its potential hazard as detailed in the regional plan. Owners of high and significant hazard dams are required to maintain EAPs for such dams.

While the state is assuming less responsibility for routine inspection of dams, DEEP will continue recommending measures to lessen the risk of dam failure, and the municipality can take the following mitigation actions:

- For municipally-owned dams, make sure that EAPs are in place and current, and implement recommendations resulting from state inspections; and
- For privately-owned dams, encourage each dam owner to have an EAP in place and current, and implement recommendations resulting from inspections; monitor compliance as much as possible.

Windham Water Works maintains an EAP for its dam, as does the USACE. The status of EAPs for private dams is not known.

The Town of Windham has limited policies, programs, and resources dedicated to dam failure since most of these efforts are performed at the State level. The Town of Windham owns one dam (Hosmer Mountain Reservoir Dam) that is rated Class B.

Summary

The Town's ability to mitigate dam failure is considered to be good for the town-owned dam but limited to privately owned dams. Overall, the Town of Windham's capability to mitigate dam failures has remained consistent since the 2017 HMP.

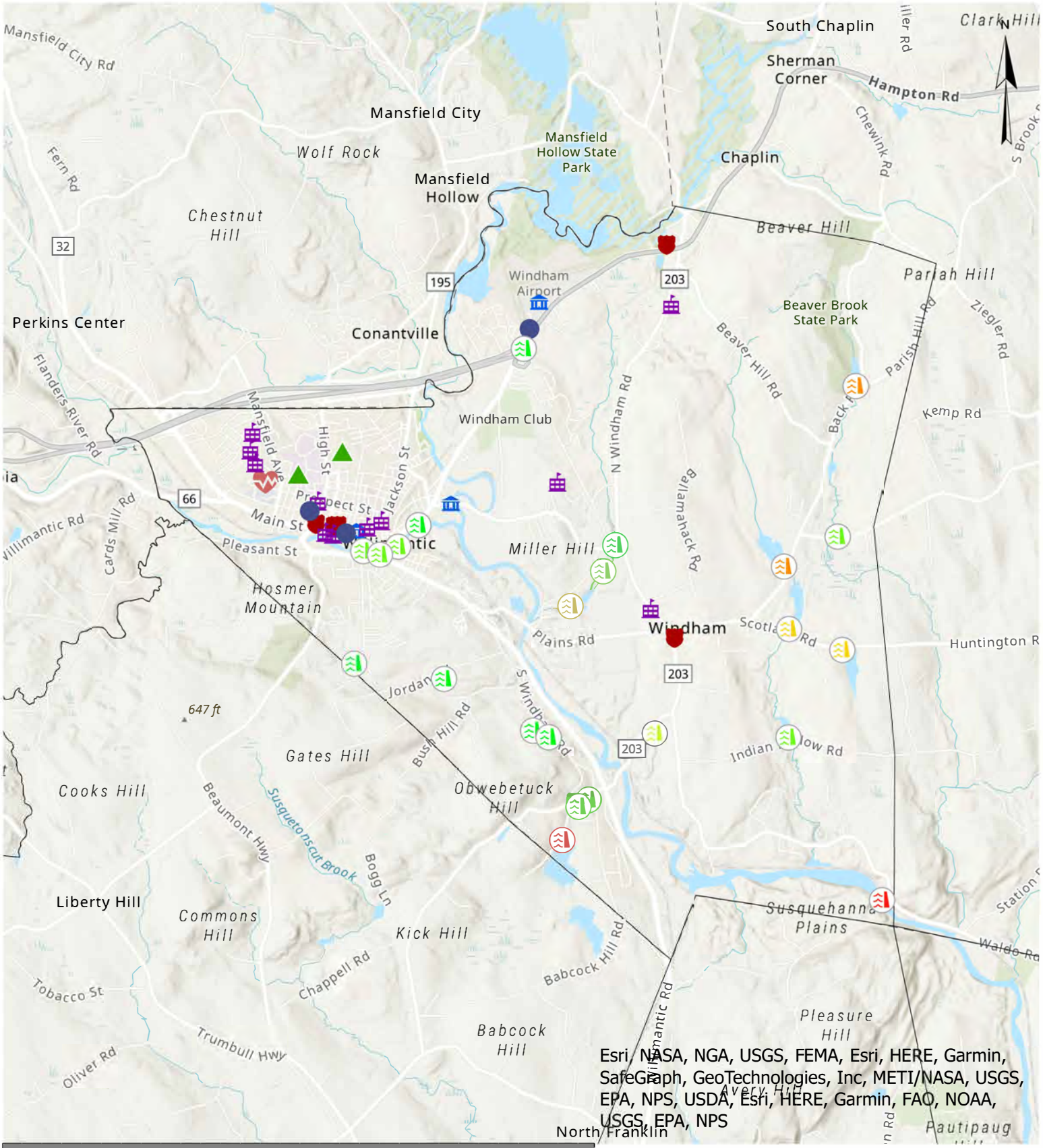
Table 5-2 Dams Registered with DEEP in the Town of Windham

CT Dam#	Dam Name	Dam Class	Owner Type
16324	Morgan Pond Dam		Private
16315	Indian Hollow Pond Dam	A	Private
16323	Foehrenbach Pond Dam	A	Private
16322	Ice Pond Dam	AA	Private Corporation
16303	Potash Pond Dam	B	Private
16318	Robinson Pond Dam	B	Private
16306	Frog Pond Dam	BB	Private
16316	Lake Marie Dam	BB	Private
16317	Bibbins Pond Dam	BB	State Owned
16301	Scotland Dam	C	Power Utility

5.4.3 Vulnerabilities and Risk Assessment

The failure of any of the two dams classified as significant hazard (Class B), or the two high hazard (Class C) dams could cause serious damage. The failure of the significant hazard (Class B) dams could cause severe damage and is of great concern in the town; however the greatest concern would be the failure of the high hazard dams in the town, Big Pond Dam or Scotland Dam, or the Mansfield Hollow dam upstream. There are also three unassigned dams in the town, but the fact that close watch is kept over significant and high hazard dams suggests that these structures are either moderate, low, or negligible hazards. These dams are listed on Table 5-2.

A total of 15 privately-owned dams are in Windham. Private owners of dams are generally reluctant to make repairs, which tend to be costly. In these instances, needed repairs may not be done in a timely manner. Two state-owned dams are located in Windham. These are the Hale Dam owned by Connecticut DOT (Class A), and the Bibbins Pond Dam owned by Connecticut DEEP (Class BB). State-owned dams are typically maintained in good condition.



Esri, NASA, NGA, USGS, FEMA, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS

Dams and Dam Failure Inundation Areas

Southeastern Connecticut Council of Governments

Town of Windham

Date: 2/23/2023

0 0.45 0.9 1.35 1.8 Miles

SCCOG

RESILIENT Land & Water

Legend

Dams

- Unknown/Unclassified
- A
- AA
- B
- BB
- C
- Emergency Services
- Municipal
- Other Infrastructure and Facilities
- School
- Shelter or Cooling Center
- Care and Medical Facility

The potential impacts related to the failure of Class C and Class B dams within and upstream of Windham are described below. Where information was available, the descriptions below are based on information available at the Connecticut DEEP Dam Safety Section. For dams without a formal dam failure analysis, a qualitative assessment was prepared for this HMP.

- The Scotland Dam is a Class C dam located on the Shetucket River near the Windham, Scotland, and Franklin boundary that is privately owned and used for hydroelectric power generation. Failure of this dam would likely result in an inundation area similar to the 0.2% annual chance flood event for areas downstream along the Shetucket River, with minimal damages in Windham. More details regarding potential damage are provided in the Sprague and Norwich annexes. The Town has encouraged the dam owner to develop an EAP and share it with the Town. Town personnel plan to continue to coordinate with FirstLight on this. However, the downstream hazard area is not within the Town of Windham, so this is not a top priority.

- Big Pond is a Class C dam located in southwestern Windham that impounds an unnamed tributary to the Shetucket River. The failure of this dam could potentially cause flooding damage along Pigeon Swamp Road and Machine Shop Road and cause the failure of two additional small downstream dams. Additional damage would likely occur along Babcock Hill Road, Type Road, Route 32, and the railroad tracks.

- The Willimantic Reservoir is a run-of-the-river impoundment on the Natchaug River that is used for Water Supply Purposes. The dam was built in the late 19th century. According to the dam failure inundation area for this dam on file at Connecticut DEEP, failure of this dam could cause damages along Route 195, North Frontage Road, Route 6, and Riverview Road in Mansfield. Further downstream in Windham, damages could occur to Lauter Park, to properties on Gordon Avenue, along Boston Post Road (Route 66), Natchaug Street, the Windham Heights area, Fire School Road, Brick Top Road (Route 14), and Union Avenue. Damaging floodwaters are expected to be attenuated to being within the banks of the Natchaug River downstream of Route 14. An EAP for the dam was completed within the last few years since 2017.

  Windham Water Works has reported challenges associated with this reservoir. It was reported that when the upstream Mansfield Hollow Dam is used to manage floods, larger flows into the Willimantic reservoir, downstream scour occurs, and sediment settles in the Willimantic Reservoir. Ultimately, this sedimentation is reducing the water supply's capacity. Windham Water Works noted that there are potential opportunities for funding from the United States Army Corps of Engineers (USACE) to address this problem.

- Mansfield Hollow Lake Dam is a Class C dam used for flood control. It is managed by the USACE. Failure of this dam would be expected to cause widespread flood damage in Mansfield and Windham, including potential failure of the Willimantic Reservoir Dam. It is likely that floodwaters would continue down the Shetucket River to the vicinity of Scotland Dam.

The failure of any Class B or Class C dam brings with it damage, economic loss and the potential for loss of life. The high hazard (Class C) classification means that in the event of their failure, besides the definite loss of property and economic losses, the loss of life is probable.

While a minor failure of any of the Class B dams would likely cause relatively minor flooding downstream, a complete failure could cause more significant flooding along these downstream brooks which could cause significant damage to bridge crossings, cars, and potentially private properties.

Note that this estimate does not take into account site specific details or particular dam failure damages that may have affected the Town of Windham in the historic record. For example, Bibbins Pond Dam (Class BB) was estimated by the Connecticut DEP (now DEEP) to have experienced $2,000 in damage from the June 1982 flood. Therefore, this number should be used with caution. Nevertheless, it provides a useful planning number to consider the overall vulnerability of the Town to dam failure.

Town staff did not indicate that there has not been any damage to municipal and private structures and infrastructure due to dam failure in recent memory. Given the condition and classification of dams within and upstream of Windham, as well as the structures and infrastructure located downstream, it is likely that the actual annualized loss for dam failure is consistent with the estimated annualized loss from the State Plan.

5.4.3.1 Hazard Losses

There are no reported losses for the Town of Windham related to dam failure. Downscaled losses from the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document.

6. Rising Temperatures

6.1. Climate Change Impacts

On average, the annual temperature across the U.S. has increased by 1.8 degrees Fahrenheit when looking at the entire period of record. Accelerated warming patterns between 1979 and 2016 have been observed with satellite and surface data, and paleoclimate records show that some of the recent decades have been the warmest in the past 1,500 years.[4]

In general, periods of freeze and frost have decreased, therefore lengthening the period of time between the first winter freeze and spring thaw, since the early 1900's. These warming temperatures impact snowfall and accumulation, alter seasonal patterns, and can disrupt certain natural processes. In addition, warming temperatures can act as fuel for other natural hazards such as wildfires, droughts, hurricanes, and severe storms, and also play a role in changing precipitation patterns.

In addition to exacerbating some natural hazards, extreme heat waves are becoming more frequent, which can also have a serious impact on public health. In recent years, the region has experienced numerous heat waves, with several consecutive days of extremely hot temperatures and high heat indexes. Infrastructure can also be at risk during heat waves as some components, such as roadways or bridges, have not been designed to withstand ongoing, extreme temperatures.

6.2. Extreme Heat

6.2.1 Setting and Recent Occurrences

An extreme heat event can occur at any time during the warmer months and can be defined as temperatures that hover 10 degrees or more above the average high temperature for the region. These events typically last for a prolonged period of time and are accompanied by high humidity. A heat wave typically lasts three or more days with temperatures over 90 degrees for those days.

Since 2012, 480 days over 85 degrees have been recorded at the Norwich Public Utilities weather stations, 165 of which were over 90 degrees. During the summer of 2022, 45 days over 85 degrees were recorded, 21 of which were at least 90 degrees. A majority of these high temperature days occurred in July and August, with some of these extreme temperatures occurring outside summer months in May and October. Table 6-1 presents the daily maximum temperatures recorded at the Groton New London Airport and Norwich Public Utilities weather stations. Those values that are bold are above 90 degrees.

Table 6-1 Daily Maximum Temperatures from May to September Since 2017

	May		June		July		August		September	
	GNL	*NPU*	*GNL*	*NPU*	*GNL*	*NPU*	*GNL*	*NPU*	*GNL*	*NPU*
2017	85	**93**	89	**94**	88	**92**	87	89	86	89
2018	80	**91**	87	**90**	89	**101**	91	**94**	90	92
2019	83	85	88	**91**	94	**96**	88	**91**	87	84
2020	75	81	82	**91**	**92**	**96**	89	**92**	87	87
2021	88	87	86	**96**	86	**94**	88	**96**	82	85
2022	**93**	**92**	85	**92**	**91**	**96**	**91**	**94**	**94**	85
GNL = Groton New London station & NPU = Norwich Public Utilities station										

[4] https://nca201758.globalchange.gov/chapter/2/

6.2.2 Existing Capabilities

Similar to the monitoring methods used for hurricanes, severe storms, and winter storms, the Town monitors National Weather Service and local forecasts for anticipated extreme heat event, and also monitors for NWS heat warnings and advisories. The Town of Windham has identified the Senior Center, Town Hall, and Kramer Elementary as cooling centers in town. In the event of a projected heat event or heat wave, the Town is prepared to open up the cooling centers for resident cooling use.

Summary

In general, the capabilities of mitigating extreme heat have increased since the 2017 edition of this plan as the town has identified cooling centers for use during an extreme heat event.

6.2.3 Vulnerabilities and Risk Assessment

While the entire town is at risk of an extreme heat event, vulnerability can widely vary based on age, health, or the type of property owned. The elderly populations in town are more vulnerable to extreme heat events, particularly when in home cooling is not available. Also, those in town with certain health conditions may also be more vulnerable to the health factors associated with extreme temperatures.

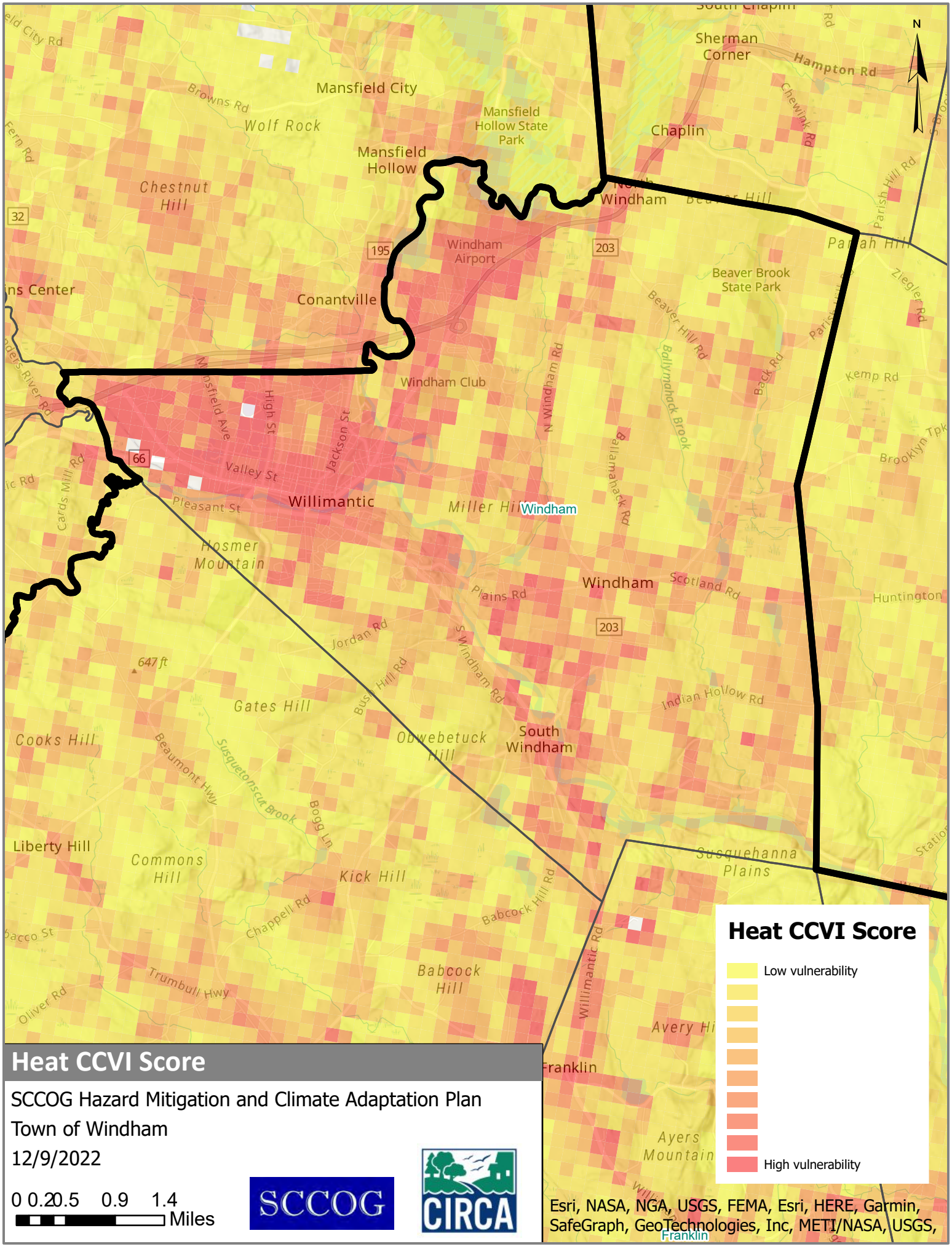
Similar to drought, there is concern for livestock operations during these heat events, particularly those that rely on wells for watering (if coincident with drought) and without cooling mechanisms. If an extreme heat event coincided with a power outage or drought there could be a serious public health concern and economic impact to the farmers.

UConn CIRCA has developed a tool to aid in understanding extreme heat vulnerability for communities across the state. This tool, known as the Climate Change Vulnerability Index (CCVI), is comprised of dozens of factors that contribute to a community's heat sensitivity, exposure, adaptive capacity, and ultimately the overall heat vulnerability. The CCVI has been used as a tool to characterize heat vulnerability for Windham. The distribution of heat vulnerability throughout the community can be seen in Figure 6-1.

Heat exposure in Windham is particularly high in the Willimantic area, which is the most urbanized area within the town and also has the highest heat sensitivity due to social vulnerabilities. The rest of the town has relatively low exposure and sensitivity. Adaptive capacity is relatively high due to three potential cooling centers, all in close proximity to the Willimantic area. Therefore, the overall heat vulnerability for Windham is moderate to high depending on the location.

6.2.3.1 Hazard Losses

There are no reported losses for the Town of Windham related to extreme temperatures. Future editions of this plan will revisit this topic.



Heat CCVI Score

SCCOG Hazard Mitigation and Climate Adaptation Plan

Town of Windham

12/9/2022

0 0.20.5 0.9 1.4 Miles

SCCOG

CIRCA

6.3. Wildfires

6.3.1 Setting and Historic Occurrences

Wildfires are considered to be highly destructive, uncontrollable fires. The most common causes of wildfires are arson, lightning strikes, and fires started from downed trees hitting electrical lines. Thus, wildfires have the potential to occur anywhere and at any time in both undeveloped and lightly developed areas of the Town. Structural fires in higher density areas of the Town are not directly addressed herein. No wildfires have occurred in the Town since the last HMP.

A Small brush fire was reported in the northern part of town on March 5, 2020. This fire was quickly extinguished without injury or damage.

The Town also experienced a large brush fire in September 2020. The fire consumed an estimated 100 acres between Route 203 to Harbor Freight in the Natchaug State Forest. The North Windham Elementary School was closed during the event as air quality in the school was impacted.

6.3.2 Existing Capabilities

Monitoring of potential fire conditions is an important part of mitigation. The Connecticut DEEP Forestry Division uses the rainfall data recorded to compile forest fire probability forecasts. This allows the DEEP to monitor drier areas to be prepared for forest fire conditions. The Town can access this information over the internet. The Town also receives "Red Flag" warnings via local media outlets.

Existing mitigation for wildland fire control is typically focused on building codes, public education, Fire Department training, and maintaining an adequate supply of equipment. The Fire Department goes to fires as quickly as possible in the Town. Windham Water Works provides fire protection water. Fire pumps are tested weekly and are considered to provide excellent pressure. Coordination between Windham Water Works and the fire departments occurs such that responders know how much pressure is available. The Town also has several dry hydrants in outlying areas that are not connected to public water service.

The Connecticut DEEP has recently changed its Open Burning Program. It now requires individuals to be nominated and designated by the Chief Executive Officer in each municipality that allows open burning and to take an online training course and exam to become certified as an "Open Burning Official." Permit template forms were also revised that provide permit requirements so that the applicant/permittee is made aware of the requirements prior to, during, and after burn activity. The regulated activity is then overseen by the Town.

Summary

The Town uses a variety of regulatory, preparedness, and public information programs to mitigate the effect of wildfires, including the Open Burning Program, maintenance of hydrants, dry hydrants and cisterns, and educational programs on fire safety. The Town's capabilities are considered to be effective in regard to response to wildfires. Overall, the Town of Windham's capability to mitigate wildfires has remained consistent since the 2017 HMP.

6.3.3 Vulnerabilities and Risk Assessment

The risk for wildlife in the town is considered low for most areas for several reasons. First, the Town has widespread development such that there are few outlying areas where a wildfire could advance undetected. As such, there have been no major fires in recent history. Secondly, most developed areas of the Town have public water service provided by Windham Water Works. This public water service provides sufficient water volume and pressure to fight nearly any fire. Outlying areas have dry hydrants that provide additional firefighting water. Secondly, the Willimantic, Natchaug, and Shetucket Rivers are near the most developed areas if additional firefighting water was necessary. Fourth, there are few notable dead ends or one-way roads that are difficult to access in the Town, and emergency vehicles can typically turn around in private driveways on these roads. Finally, the Town has agreements with its neighbors to provide assistance in case of an emergency. Thus, if a wildfire did occur, it would likely be contained within only a few acres.

6.3.3.1 Hazard Losses

There are no reported losses for the Town of Windham related to wildfires. Downscaled losses from the 2019 Connecticut Natural Hazard Mitigation Plan using WUI acreage are developed in the Multi-Jurisdictional document.

7. Earthquakes

7.1. Climate Change Impacts

Earthquakes are not a climate related hazard, therefore there are no expected impacts as a result of climate change. There are however secondary impacts that could be a concern and amplify the damages of an earthquake. The deterioration of infrastructure from extreme heat or salt water as a result of coastal flooding or sea level rise may weaken certain components making them more prone to damage or collapse during an earthquake event. Flooding events can also leave some landscapes at a higher risk of landslides; an earthquake could potentially prompt a landslide in post-flooded areas.

7.2. Earthquakes

7.2.1 Setting and Recent Occurrences

An earthquake is a sudden rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse; disrupt gas, electric, and telephone lines; and often cause landslides, flash floods, fires, avalanches, and tsunamis. Earthquakes can occur at any time and often without warning. Detailed descriptions of earthquakes, scales, and effects can be found in Section 3.3.5 of the Multi-Jurisdictional HMCAP. Despite the low probability of an earthquake occurrence, earthquake damage presents a potentially catastrophic hazard to the Town. However, it is very unlikely that the Town would be at the epicenter of such a damaging earthquake. No major earthquakes have affected the Town since the last HMP.

7.2.2 Existing Capabilities

The Connecticut Building Codes include design criteria for buildings specific to each region as adopted by Building Officials and Code Administrators (BOCA). These include the seismic coefficients for building design in the Town. The Town has adopted these codes for new construction, and they are enforced by the Zoning and Building Department.

Due to the infrequent nature of damaging earthquakes, Town land use policies do not directly address earthquake hazards. However, the potential for an earthquake and emergency response procedures is addressed in the Town's EOP.

Summary

The Town does not specifically mitigate for earthquake hazards. Overall, the Town of Windham's capability to mitigate earthquakes and prevent loss of life and property is limited and generally unchanged since the 2017 HMP.

7.2.3 Vulnerabilities and Risk Assessment

Surficial earth materials behave differently in response to seismic activity. Unconsolidated materials such as sand and artificial fill can amplify the shaking associated with an earthquake. As noted in Section 2.1, very few areas of the Town are underlain by stratified drift. These areas are potentially more at risk of earthquake damage than the areas of the Town underlain by glacial till. The best mitigation for future development in areas of sandy material is the application of the most stringent standards in the Connecticut Building Code, exceeding the building code requirements, or, if the Town

deems necessary, the possible prohibition of new construction. The areas that are not at increased risk during an earthquake due to unstable soils are the areas underlain by glacial till.

Windham lies partially on the Willimantic Window, which is a bedrock formation surrounded by a thrust fault. Unlike seismic activity in California, earthquakes in Connecticut are not associated with specific known active faults. However, bedrock in Connecticut and New England in general is typically formed from relatively hard metamorphic rock that is highly capable of transmitting seismic energy over great distances. For example, the relatively strong earthquake that occurred recently in Virginia was felt in Connecticut because the energy was transmitted over a great distance through such hard bedrock.

The built environment in the Town primarily includes some more recent construction that is seismically designed. However, most buildings were built in the 1970s and 1980s or before and therefore are not built to current building codes. Thus, it is believed that most buildings would be at least moderately damaged by a significant earthquake. Those Town residents who live or work in older, non-reinforced masonry buildings are at the highest risk for experiencing earthquake damage.

Areas of steep slopes can collapse during an earthquake, creating landslides. The Town has a few areas of steep slopes and bluffs particularly overlooking the Shetucket River. Thus, landslides are a concern in the town.

The Town of Windham did not report any municipal or private damages or losses due to recent earthquakes. Seismic activity can also break utility lines such as water mains, gas mains, electric and telephone lines, and stormwater management systems. Damage to utility lines can lead to fires, especially in electric and gas mains. Dam failure can also pose a significant threat to developed areas during an earthquake. For this HMCAP, dam failure has been addressed separately in Section 5.4. As noted previously, several types of utility infrastructure in the Town are located above ground. A quick and coordinated response with local utilities will be necessary to inspect damaged utilities following an earthquake, to isolate damaged areas, and to bring backup systems online. This is covered in the Town's and EOP.

7.2.4 Hazard Losses

There are no reported losses for the Town of Windham related to earthquakes. Downscaled losses from the 2019 Connecticut Natural Hazard Mitigation Plan are developed in the Multi-Jurisdictional document. In addition, a *HAZUS-MH* analysis of the potential economic and societal impacts to the SCCOG region from earthquake damage is detailed in the Multi-Jurisdictional HMCAP. The analysis addresses a range of potential impacts from any earthquake scenario, estimated damage to buildings by building type, potential damage to utilities and infrastructure, predicted sheltering requirements, estimated casualties, and total estimated losses and direct economic impact that may result from various earthquake scenarios. Potential economic impacts can be seen in Table 7-1, with additional information developed in the Multi-Jurisdictional document.

Table 7-1 HAZUS-MH Earthquake Related Economic Impacts

Windham	Residential	Commercial	Industrial	Others	Total
	$180,480,000	$526,080,000	$92,570,000	$411,350,000	1,210,480,000

8. Mitigation Strategies and Actions

8.1. Status of Mitigation Strategies and Actions

A total of seven hazard mitigation actions were developed in the previous edition of this plan. The status of each is listed below.

#	Mitigation Actions and Strategies for Windham 2016 - 2021	Status	Status Details
1	Upgrade or Acquire Generators at Critical Facilities	Carry Forward	Not complete. The Town plans to secure generators for the Town Hall and the Community Center/Rec Center/Senior Center.
2	Install Roller Doors to Protect Windows in Town EOC from Damage	Carry Forward	This action will be completed using ARPA funds in the near future.
3	Provide Educational Materials and Links Regarding Natural Hazard Preparedness on Town Website	Carry Forward	This is likely not complete and will be carried forward or retired.
4	Procure Silt Removal Equipment to Remove Silt from the Town's Storm Drainage Systems	Complete	Complete.
5	Upgrade Stone Box Culvert on Old Brooklyn Turnpike	Complete	Complete.
6	Improve Low-Lying Bridge Street Bridge Crossing Over the Willimantic River	Carry Forward with Revision	Bryan previously explained that this is a State bridge (Route 32). If is carried forward, the wording should be changed to bring DOT into the action.
7	Encourage Development of an EAP and/or Acquire a Copy of the EAP for Scotland Dam	Complete	All necessary EAPs are complete, and Mike Licata is planning to locate a copy of the EAP for the Scotland Dam. The Willimantic Reservoir dam EAP was completed in the last few years,

During the planning process, CIRCA and consultant staff facilitated a discussion with the Town staff to identify the greatest climate change concerns and challenges. The previous actions were re-evaluated in this context. Elements of four prior actions have been carried forward into the new hazard mitigation and climate adaptation actions.

8.2. Prioritization of Specific Actions

The proposed actions for the Town of Windham to undertake from 2023 through 2028 are listed in Table 8-1 on the next page. The full list of actions for the region with buildups for the PERSISTS and STAPLEE scores are available in the multi-jurisdiction document.

The actions with the highest PERSISTS score and the highest STAPLEE score are different, which is consistent with the intent of the two scores. PERSISTS scores tend to be higher for actions that maximize public safety while advancing climate science and being transferable to other communities, whereas STAPLEE scores tend to be higher for actions that are highly cost effective and technically feasible for reducing losses from hazards. The actions with the highest combined scores are:

- Compare elevations of WWTP assets and infrastructure to the base flood elevations associated with the Natchaug River and Willimantic River plus applicable freeboard (likely two feet); and determine if funds should be set aside for resiliency projects.
- Compare elevations of sewer pumping station infrastructure to the base flood elevations associated with nearby flood sources, plus applicable freeboard (likely two feet); and determine if funds should be set aside for resiliency projects.

The Town intends to focus on the above actions, along with the sole action about cooling centers:

- Ensure that the cooling centers (Community Center/Senior Center, Town Hall, and Kramer Elementary School) are accessible using transit or alternate transportation options.

This is consistent with the State's emphasis on cooling center resilience.

Table 8-1 Town of WIndham Actions and STAPLEE and PERSISTS Scores

Number	Hazard Mitigation and Climate Adaptation Actions	Hazard Mitigation and Climate Adaptation Goal	Type of Action	Responsible Department	Approx. Cost Range	Potential Funding Sources	Timeframe	Priority	PERISTS Score	STAPLEE Score	PERSISTS x STAPLEE =
WD1	Acquire generators for the Town Hall and the Community Center/Rec Center/Senior Center.	Ensure that critical facilities are resilient, with special attention to shelters and cooling centers.	Preparedness & Emergency Response	Public Works	$100,000 - $500,000	FEMA HMA; Other Preparedness Grants	7/2023 - 6/2025	High	16	6	96
WD2	Ensure that the cooling centers (Community Center/Senior Center, Town Hall, and Kramer Elementary School) are accessible using transit or alternate transportation options.	Ensure that critical facilities are resilient, with special attention to shelters and cooling centers.	Preparedness & Emergency Response	Office of the Chief Elected Official	$10,000 - $25,000	Transit District; IIJA BBFP	7/2023 - 6/2025	High	16	3	48
WD3	Provide Educational Materials and Links Regarding Natural Hazard Preparedness on Town Website.	More than one goal	Education & Awareness	Emergency Management	$0 - $10,000	Municipal Operating Budget	7/2023 - 6/2024	Medium	13	4	52
WD4	Execute FEMA HMA BRIC grant for scoping related to flood mitigation, water quality, and other resiliency needs for the Willimantic Reservoir, dam, and treatment facility.	More than one goal	More than one category	Windham Water Works	$100,000 - $500,000	FEMA HMA Scoping	1/2023 - 12/2024	High	19	5	95
WD4A	Evaluate feasibility of hydropower operations at Willimantic Reservoir dam.	More than one goal	More than one category	Windham Water Works	$50,000 - $100,000	DEEP Climate Resilience Fund	1/2023 - 12/2024	Low	18	5	90
WD4B	Identify funding sources and partner agencies to evaluate sedimentation challenges in the Willimantic Reservoir associated with releases from Mansfield Hollow Dam.	More than one goal	Water & Wastewater Utility Projects	Windham Water Works	$10,000 - $25,000	LISFF; DWSRF	1/2023 - 12/2024	Medium	16	3	48
WD4C	Determine the feasibility of a Windham Water Works microgrid that could support the nearby supermarket and pharmacy in southern Mansfield.	More than one goal	Preparedness & Emergency Response	Windham Water Works	$10,000 - $25,000	DEEP Climate Resilience Fund	1/2023 - 12/2024	Low	13	4	52

Number	Hazard Mitigation and Climate Adaptation Actions	Hazard Mitigation and Climate Adaptation Goal	Type of Action	Responsible Department	Approx. Cost Range	Potential Funding Sources	Timeframe	Priority	PERISTS Score	STAPLEE Score	PERSISTS x STAPLEE =
WD4D	In the lifespan of this HMCAP (before 2027), conduct at least one set of meetings with UConn and CWC about potential interconnections in Mansfield.	More than one goal	Water & Wastewater Utility Projects	Windham Water Works	$0 - $10,000	WWW Operating Budget	7/2023 - 6/2028	Medium	14	6	84
WD5	Partner with DOT to improve the Bridge Street Bridge crossing over the Willimantic River, targeting DOT's enhanced funding for resiliency projects.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Structural Projects	Public Works	>$1M	CT DOT; IIJA BIP	7/2024 - 6/2026	Low	12	5	60
WD6	Compare elevations of WWTP assets and infrastructure to the base flood elevations associated with the Natchaug River and Willimantic River plus applicable freeboard (likely two feet); and determine if funds should be set aside for resiliency projects.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Water & Wastewater Utility Projects	WPCA	$0 - $10,000	Municipal Operating Budget	7/2023 - 6/2024	High	14	10	140
WD7	Compare elevations of sewer pumping station infrastructure to the base flood elevations associated with nearby flood sources, plus applicable freeboard (likely two feet); and determine if funds should be set aside for resiliency projects.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Water & Wastewater Utility Projects	WPCA	$0 - $10,000	Municipal Operating Budget	7/2023 - 6/2024	High	14	10	140
WD8	Require floodplain manager and land use staff to take free training at https://portal.ct.gov/DEEP/P2/Chemical-Management-and-Climate-Resilience/Chemical-Management-and-Climate-Resilience to reduce risks of spills from businesses during floods.	Reduce flood and erosion risks by reducing vulnerabilities and consequences, even as climate change increases frequency and severity of floods.	Education & Awareness	Land Use Staff	$0 - $10,000	Municipal Operating Budget	7/2023 - 12/2023	Low	14	6	84