

Climate Vulnerability Assessment for Wethersfield, CT

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For Sustainable CT action 4.4.1

Overview:

Wethersfield, Connecticut is one of the oldest towns in the state; it was founded in 1634 and boasts a rich historic background and cultural heritage that is prized by the town to this day. Nestled next to the Connecticut River, for decades the land offered veritable agricultural opportunities. Located in Hartford County, the town experienced sustained growth throughout the 20th C and is now a developed suburb. As of the 2010 United States Census, 26,668 residents lived in Wethersfield, a number that is predicted to grow marginally over the next few decades. As of 2019, the median household income in Wethersfield was lower than the statewide median income, as well as the median town income (\$53,289, \$53,935 and \$60,556 respectively). Approximately half of town residents are members of the labor force—about 65 percent of the workforce is employed in either the services sector or the retail/wholesale sector.

Given not only the geographic location of Wethersfield but also its residents fiscal capacity, it is imperative that the local government take substantive and sustained steps to build resilience in the face of climate change. This requires both mitigation and adaptation plans to accommodate and respond to changes in the physical environment. Moving swiftly to address climate risks will benefit the town economically, as well as its residents, and avoid placing a large and undue burden on town and government officials in the future. The goals of this assessment are to discuss climate predictions for the region, identify vulnerable systems and properties in the town, and offer ways in which the foreseen impacts can be addressed.

Description of the Town of Wethersfield:

To understand more fully the makeup of Wethersfield is to better understand some of the coming challenges in the face of climate change. According to the most recent Plan of Conservation and Development (POCD, 2013), the demographics are changing. The population is projected to increase to somewhere around 28,000 residents by 2040. The population is also aging; the coming increase in older age groups can be attributed to the “baby boom” generation.

Both of these facts are important to understand in the context of land use and current housing development. At the time that the most recent POCD was drafted, 96 percent of the land in Wethersfield had been developed or was already committed to various uses. Residential properties make up the bulk of developed land, accounting for 39 percent, with committed/managed open space and public infrastructure closely following, 22 and 21 percent, respectively. Much of the housing stock was built during the mid 20th C to accommodate for the great influx in population. As a result, some housing units are not equipped for today’s household needs.

As the population both grows larger and older, it is important to make sure that the town is able to upgrade and fortify the housing stock. Maintaining a robust and well-functioning infrastructure is also important for the town moving forward.

In 2012 the town executed a survey process of its residents to identify and better understand their relationship with the town and what they would like to see the local government focus on. Residents primarily stated that they were proud of (1) the community facilities—though they recognized there was the need for upgrades to these facilities— (2) the historic character of the town and (3) the many open spaces and natural spaces offered to town residents. Some of the “top-tier” issues for residents were (1) the upkeep and revitalization of community facilities, (2) restoring the Silas Deane Highway and (3) creating a walkable community. They,

too, care about the scenic resources and overall look and feel of commercial and residential properties in the town, things which they expect the town will continue to maintain.

Understanding how, exactly, climate change is poised to alter yearly, seasonal, and daily life in Wethersfield is necessary for the town to thrive given changing demographics, limited availability of developable land, and resident desires.

Climate Change Projections:

Background

Since around 1970, the Northeast has seen myriad changes to its regional climate. Those changes are only expected to deepen, and worsen, over the coming decades. Generally, temperatures have been rising—more noticeably in the winter months—the number of extremely hot summer days has been increasing, snow cover has been decreasing while heavy precipitation events have been increasing, and seasons are changing—spring is starting to arrive earlier. While this goes for the Northeast generally and not Wethersfield specifically, climate data has proven that these changes will be felt, albeit with slight variation, across the region. Projections for Connecticut bear out this same information, finding that these trends hold for the state and will affect cities, towns and municipalities throughout Connecticut. One thing to note is that with these or any climate projections, there is variability and uncertainty as to what exactly will bear out. This is due to the fact that it is difficult to project what the level of greenhouse gas emissions will look like in a few years or few decades time. A higher-emissions scenario is one in which industry continues to boom and consumption levels are very high. This scenario tells us that there will still be heavy dependence upon fossil fuels, and little will be done to change commercial or civilian habits. It portends greater climate impacts, while a lower-emissions scenario will result in fewer, and less severe, impacts. A lower-emissions scenario predicts that

society will begin to move away from heavy reliance on fossil fuels and emissions will begin to lower as newer, cleaner technologies are utilized.

Seasonal and Annual Temperatures Changes

Overall, it is predicted that temperatures across the Northeast will rise 2.5 degrees Fahrenheit to 4 degrees Fahrenheit during winter and 1.5 degrees Fahrenheit to 3.5 degrees Fahrenheit during summer. These changes are set to happen regardless of which emissions scenario plays out.

By mid-century, though, there are fairly stark differences that begin to appear between the two scenarios. Under the higher-emissions scenario, winter temperatures are projected to be 4°F to 7°F warmer than the historic average and summers will be anywhere from 4°F to 8°F warmer. Under the lower-emissions scenario, however, an increase of only 4°F to 5°F is projected for the winter season and an increase of 2°F to 5°F is projected for the summer season.

These differences become even more pronounced when looking to the end of the century. Temperatures are projected to rise between 8°F and 12°F during the winter and anywhere from 6°F to 14°F during the summer in the higher-emissions scenario. By contrast, in the lower-emissions scenario, winters may only warm between 5°F and 8°F, with summer temperatures increasing by only 3°F to 7°F.

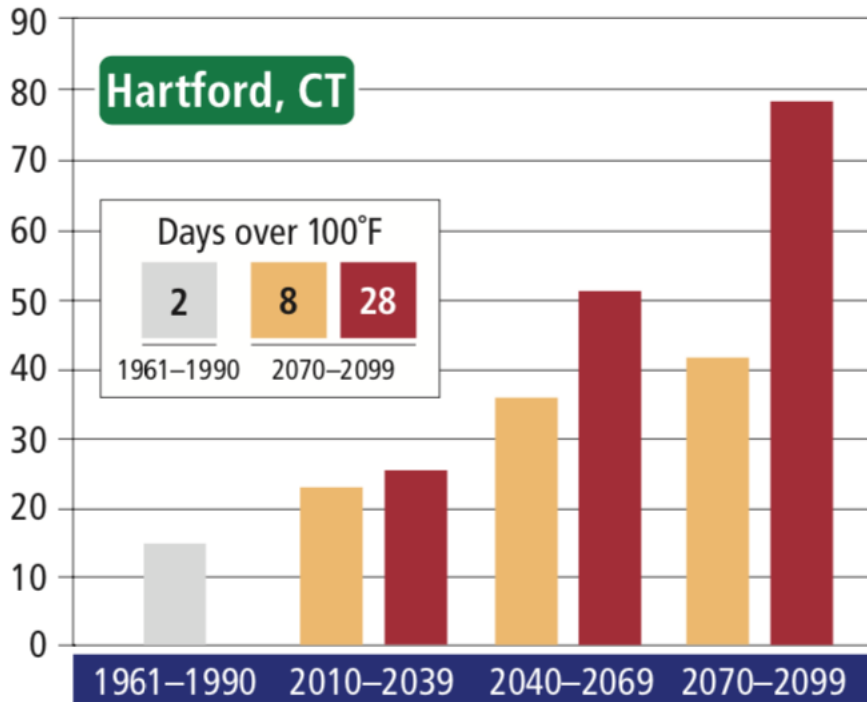
One aspect of climate and temperature important to understand alongside these predictions is the heat index. The heat index refers more so to not how hot or cold the temperature is, but how hot or cold that temperature feels. In the Northeast especially, wind and cloudy conditions in the winter can make a day feel much colder, just as humidity and direct sun can make a summer day feel much warmer. This is important, and will be discussed more later, when analyzing the human impacts of temperature increases. For example, under the higher-

emissions scenario, an average summer day in the region is projected to feel 12°F to 16°F warmer than it did historically.

Heat Waves and Temperature Extremes

A heat wave is when a region experiences multiple consecutive days that are above the 90-degree Fahrenheit threshold. The incidence of heat waves and incredibly hot days has been increasing over the course of the past few decades, and are projected to get worse, particularly in cities. Cities are more vulnerable to an excess of very hot days due to what is known as the “heat island effect”. This refers to areas that are very developed, with little remaining green and open space. The concrete, asphalt and other built out infrastructure absorbs a great deal of heat throughout the day. While heat is slowly released at night, this does not provide a respite from high temperatures for residents. The consequences of such an effect will be discussed more in a later section around human health.

Hartford, Connecticut, is poised to experience as many as 28 days over 100 degrees by the end of the century, under a high emissions scenario.



Precipitation and Winter Snow

Precipitation has always been variable in the Northeast. Overall, since 1900 there has been a gradual increase in the rate of precipitation experienced throughout the region. Just as temperature is set to increase regardless of higher- or lower-emissions scenario, precipitation is set to increase as well. By the end of the century, it is predicted that there will be a total increase of around 10 percent, which amounts to about four inches per year.

Under both scenarios as well, rainfall is expected to become more intense, and periods of heavy rainfall are expected to become more frequent. In terms of winter precipitation, it is expected to increase anywhere from 20 to 30 percent, with a larger majority of it occurring as rain rather than snow events.

Precipitation intensity is projected at an 8 to 9 percent by mid-century, and a 10 to 15 percent increase by the end of the century. Events with heavy precipitation are predicted to increase 8 percent by mid-century, and 12 to 13 percent by the end of the century.

Changes in winter snow patterns are part and parcel of changing precipitation patterns. As overall temperatures rise across the region, even during the winter season, the incidence of snow fall decreases. Under the higher-emissions scenario, most of the Northeast is projected to lose 10 to 15 snow-covered days per winter month; under the lower-emissions scenario those days drop to somewhere between four and eight. The more southern parts of the Northeast, of which Connecticut is a part, could even experience as few as 5 or 10 snow-covered days in the winter, a significant drop for the historic precedent of anywhere from 10 to 45 days.

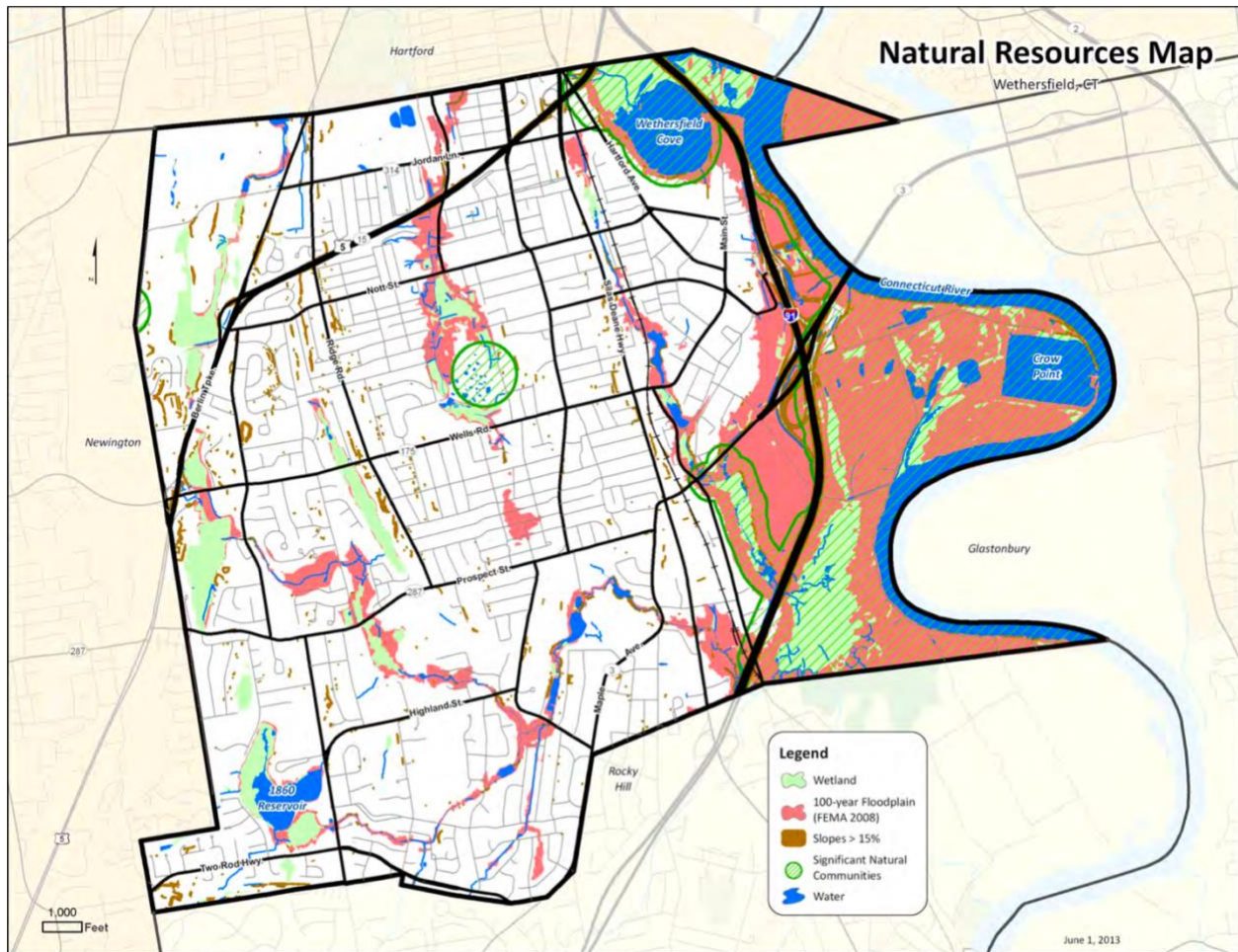
These kinds of changes in precipitation will affect runoff and drought as well. What snow does fall will melt earlier, causing increased runoff during the winter and spring seasons. This will cause a decrease in soil moisture during the summer and autumn, as increased temperatures will also increase evaporation, enhancing the probability of drought incidence.

Top Hazards and Priorities—

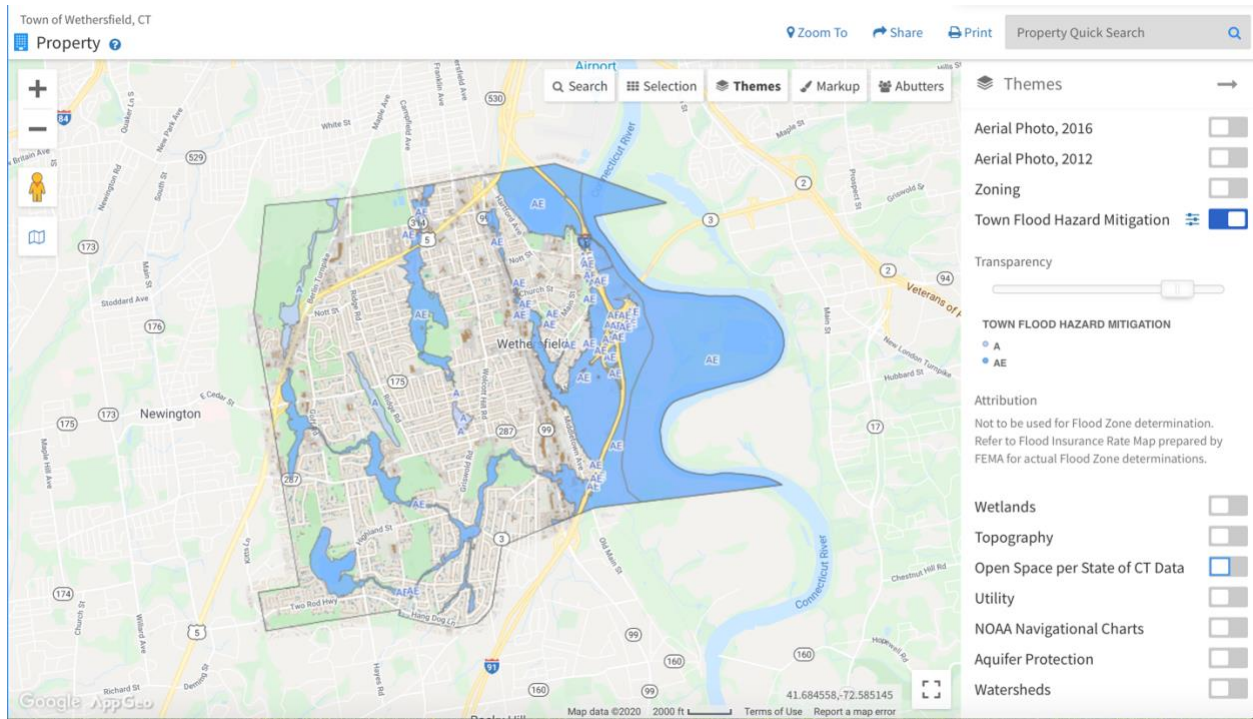
Flooding:

Background Information (information from HMP)

According to the Capitol Region Council of Government's 2019 – 2024 Hazard Mitigation Plan (HMP), “thirty percent of the Town [of Wethersfield] lies within the 1-percent annual-chance floodplains associated with the watercourses such as Folly, Beaver, Cemetery and Goff Brooks, and the Connecticut River” (HMP Wethersfield Annex, p. 3).



This map from the town’s POCD identifies bodies of water (in blue) and wetlands (in green), as well as the 100-year floodplain (in red) based off of FEMA data from 2008. The map below, which is based off of GIS mapping and data from the town, is more recent; it shows areas at risk of flooding that are essentially the same but with a little more coverage.



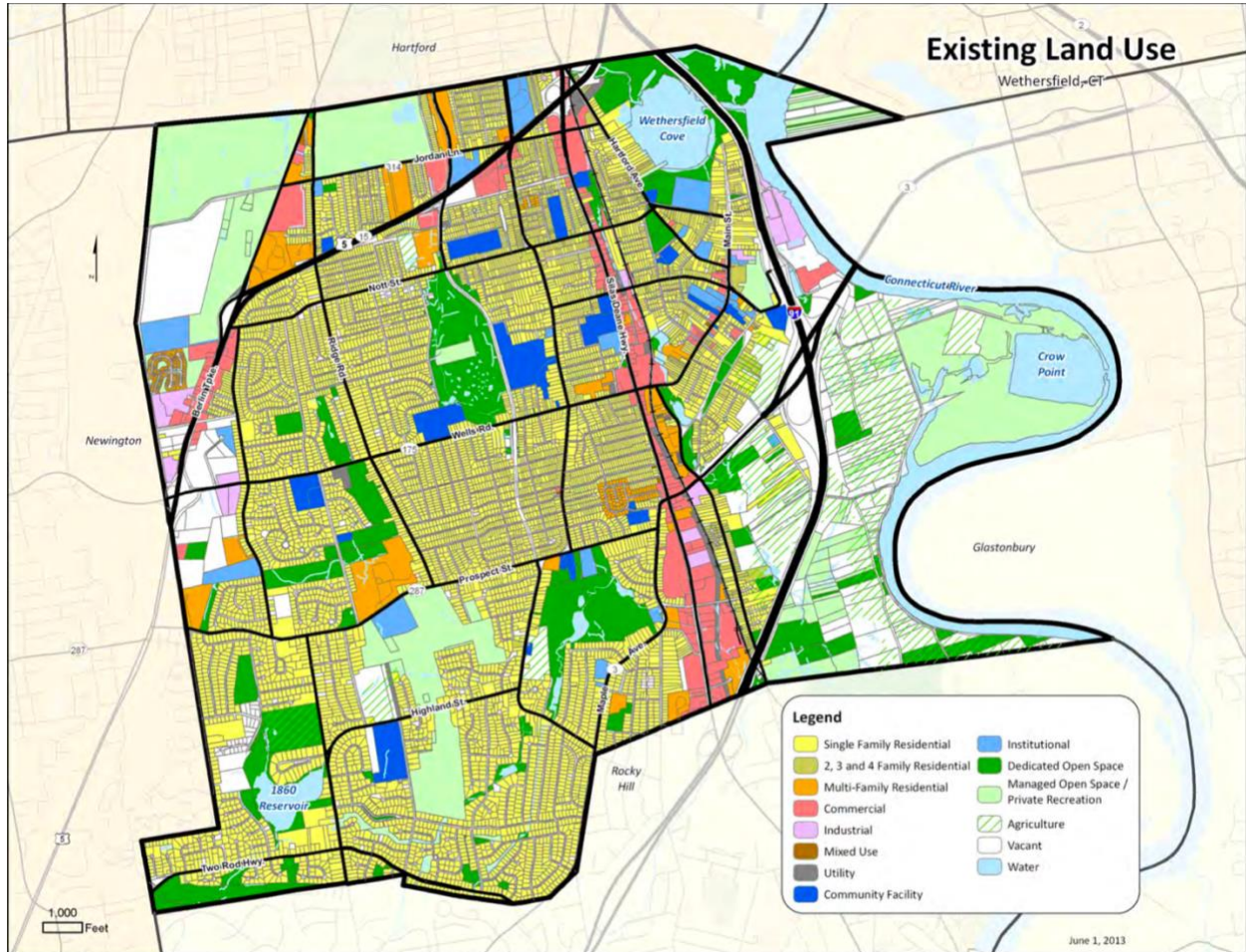
Flooding represents not only a physical but also a financial risk to the town. Data from the HMP shows that “the NFIP has paid 69 property damage claims in Wethersfield totaling \$350,144 to date” (HMP Wethersfield Annex, p. 3). There have been 11 Repetitive Loss Property claims for five properties. Public Assistance reimbursements, provided through FEMA, to the community for flood events are \$37,374 (\$1,967 annually).

There is almost no sector that will be exempt from flood risks. While, thankfully, most residential homes and living units are not located in the floodplain, there are residences at risk of flooding from the Connecticut River and Beaver Brook along Hartford Avenue, Main Street, Marsh Street, Middletown Avenue, Spring Street and along the Silas Deanne Highway.

The Golf Brook represents many of the flood risks on the lower-middle portion of these flood maps, affecting houses around Griswold Road, along Fairlane Drive, Springdale Road and Meadow View Drive. Its resulting floodplain eventually adjoins with the 1860 Reservoir, pictured in the Southwest corner of town, causing disparate effects along the way.

The Folly Brook will flood properties along Folly Brook Road. In the northern portion of town, it will endanger properties down Parkview Drive and the roads that run perpendicular— Stillman Road, Reed Drive and Judd Road. At it's the southern end it will cover properties along Dale Road, Clearfield Road, Brimfield Road and Bunce Road.

Much of the other flooding, thankfully, will be confined to open space.



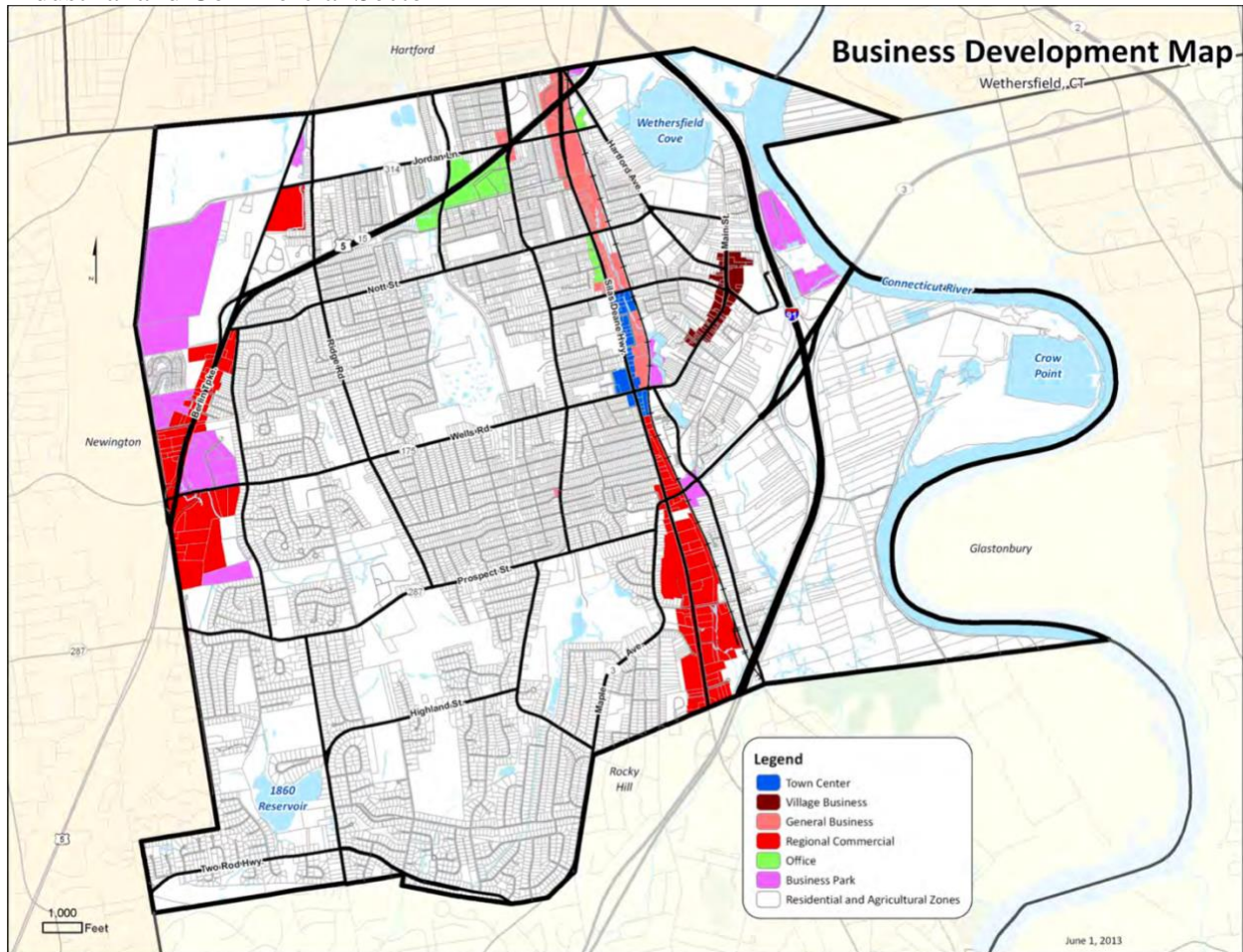
The map above is taken from the Wethersfield POCD and represents the existing land use. We can use this data as a point of comparison for the flood mapping above—it shows that almost no sector will be exempt from the flooding events that are to be more frequent and more severe as a result of climate change. This report will touch on the danger to the agricultural, industrial/commercial, natural, government and housing sectors.

Agricultural Sector—

Agricultural land, represented in the above map as white with green dashed lines, is almost all located in the Connecticut River floodplain and, as a result, a large amount of the agricultural land is located directly in the 100-year floodplain when overlapped with the FEMA data and GIS mapping data.

Winding Brook Farm and Anderson Farms, for instance, one a main producer of sod for Wethersfield and the other a producer of corn and vegetables, are operations that lie directly within this flood plain. While agriculture will most likely be impacted in other ways due to climate change, which will be touched on later in this report, flooding poses a direct risk to this type of land use.

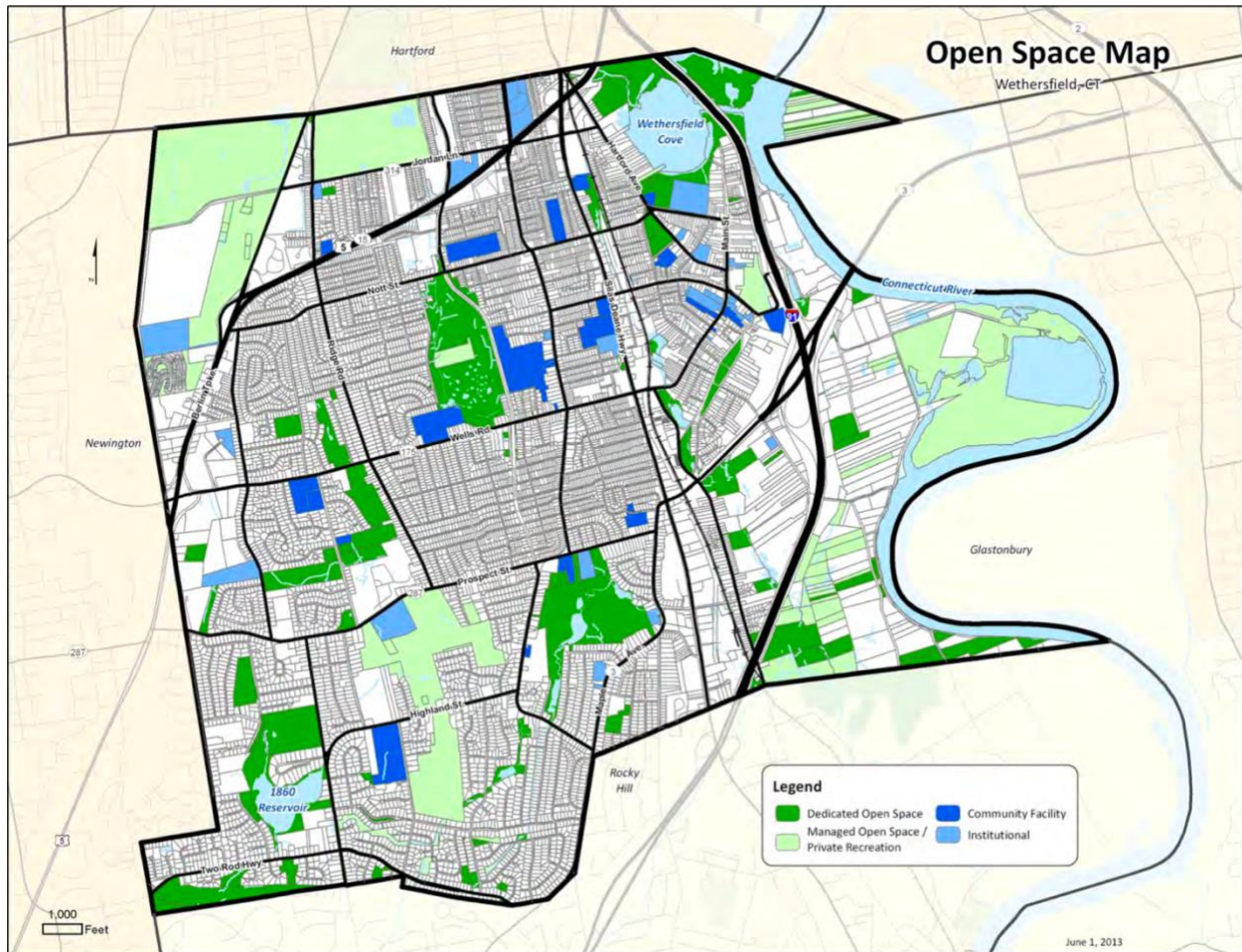
Industrial and Commercial Sector—



The above map shows business development in the town of Wethersfield. One can see that much of the zoned regional commercial businesses are located in the floodplain, as well as some of the zoned general businesses located near the center of town along the Silas Deane Highway. This also means that several **major roadways** are located in the floodplain, which will inhibit access to businesses and movement throughout the more commercial areas of town.

As for industrial properties, the Public Works Facility in the town is right along the Connecticut River, seen on the existing land use map in light pink, and is within the floodplain. The town's Salt Storage Shed is also vulnerable to flooding.

Environmental Sector—



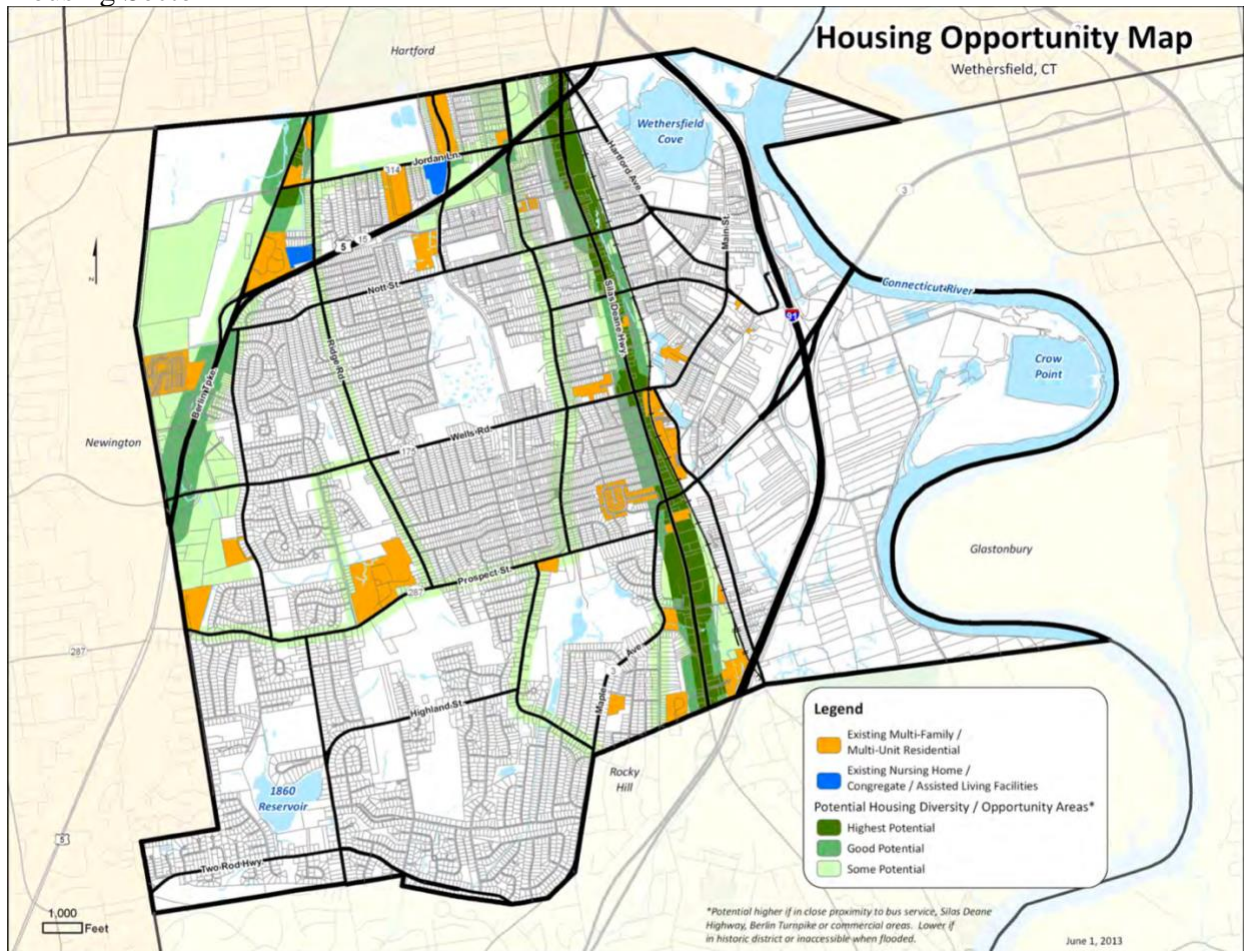
This open space map shows that many of the local attractions and greenspaces used for recreation and leisure are at risk of flooding. The Bell Pond Dam, for instance, is high priority.

Government Sector—

Several community and government facilities are either adjacent to or located in floodplain areas. For instance, the Transfer Station at 100 Marsh Street is in the floodplain. The Solomon Welles House at 220 Hartford Avenue lies very close to the edge of the floodplain associated with the Connecticut River and Wethersfield Cove. Other town facilities like the Town Hall and the Police Department along the Silas Deane Highway could, in the future, be at risk in severe flood events.

Old historic District, an integral part of the town’s culture and identify, and something which residents have identified as being very important for preservation, is surrounded on three sides by the floodplain.

Housing Sector—



This housing opportunities map reveals several things about residential properties at risk of flooding. While some street names were mentioned above, this data is important for representing the various demographic groups that are at risk of flooding as a result of housing location.

The above map also has data to show that a majority of the existing multi-family/multi-unit residential housing in Wethersfield lie in the floodplains. While none of the low-income Housing Authority properties owned by the town of Wethersfield are located within this floodplain, some such as 1532 Berlin Turnpike are located in close proximity to flood zones, and the Executive Square housing at 100 Executive Square is directly within the Goff Brook flood zone.

This map also identifies areas where future development, in the way of upgrading and revitalizing current housing stock, could take place. It should be said that consideration of flood patterns and flood projections should be taken into account when augmenting existing buildings or building new structures for the future. While, thankfully, the majority of the housing sector will not be affected by flood events, some densely populated areas and properties that are multi-family rather than single-family are more at risk. In particular, many of the areas identified as being “highest potential” for revitalization and construction of housing will be vulnerable to flooding, so caution will have to be taken when addressing housing opportunities in those areas.

Winter Storm Events:

Background Information:

Over the past two decades, Wethersfield has experienced seven intense winter storm events that have caused them to seek assistance from FEMA through Public Assistance. These reimbursements to the community for winter storms, for events in 2003 (2), 2005, 2006, 2011 (2), and 2013 amount to \$2,510,561 (\$132,135 annually).

These large sums of money are due to the associated costs from snow removal, icy conditions, debris, and power outages. The town of Wethersfield has identified snow removal and icy conditions as areas that they need to address for the future in response to climate change.

It should be said that the climate data mentioned above also shows that heavy precipitation events are likely trending to be more rain rather than snow. This is due to an increase in overall temperatures during the winter and spring. While snow may prove to be less of an issue for the town, heavy rain events can affect water quality and be associated with outbreaks of waterborne disease, soil erosion, and flood risks both in urban areas and agricultural fields.

Thunderstorms and High Winds:

Background Information:

In the Hazard Mitigation Plan for Wethersfield, thunderstorms and high winds were identified as a priority for the town to focus on. The National Centers for Environmental Information (NCEI) severe storm database calculated losses since 2012 are \$16,500 total-- \$15,000 for thunderstorm wind, \$1,500 for strong wind.

On a related note, up until this point FEMA has provided reimbursements to the community through the Public Assistance program that total \$225,979 (\$11,894 annually) for hurricane events. Hurricane events, though also producing heavy precipitation and other associated dangers, create very high wind speeds. To put these reimbursements in context, they were for Tropical Storm Irene (2011) and Storm Sandy (2012).

Many of the associated costs from thunderstorms and high winds are due to debris and power outages. Debris can not only fall on streets and roads, making it more difficult for residents and town officials alike to travel around Wethersfield, it can fall directly on residential and commercial properties. These damages cannot be directly controlled for or predicted. Power

outages cause similar problems in that any town resident or commercial business can be subject to a loss of power, putting a halt to normal daily life or normal business function.

Responses to Top Hazards and Priorities—

The following actions were identified by the Town of Wethersfield and listed in the CRCOG Hazard Mitigation Plan. Out of 25 actions listed, these are a few to illustrate what the town is doing or is planning on doing in response to these threats posed by climate change.

Action 3 (High Priority): develop a long-range plan for expansion of the Public Works building capacity and relocation outside of flood zone

Action 5 (High Priority: *Accomplished*): add a double catch basin at 222 Ridge Road to address road flooding, which overflows and floods downstream homes in Ridge Crest Place

Action 8 (Medium Priority): conduct outreach to local small businesses with the aim of preventing the accidental release and pollution from chemicals stored and used at their facilities during or following natural hazard events

Action 9 (Medium Priority): coordinate with NEMO and CRCOG to share resources and gain technical support for hazard mitigation actions involving stormwater management and public outreach, which have parallel benefits related to MS4 stormwater permit compliance

Action 20 (Low Priority): identify additional space for snow storage and disposal

4.4.2 Secondary Impacts on the Community

As mentioned in section 4.4.1, large changes to seasonal and annual temperatures as well as precipitation are predicted for the Northeast over the course of the next century. These changes not alter the physiological conditions experience on a day-to-day or season to season basis, they will also alter the physical conditions. This section will talk about the secondary impacts of climate change; primary impacts are those that change weather and climate patterns, while the secondary impacts are the indirect effects of a changing climate and environment. The impacts on agriculture and impacts on human health will be the primary focus of this section. Included in the information about human health will be information focused on the specific dangers posed to vulnerable communities as a result of climate change.

Impacts on Agriculture:

Background:

Analysis of agricultural trends over recent decades have found that commodity prices for agricultural products in the Northeast have fallen, on average, by two-thirds on average over the past 50 years. This is even while productivity has been improving by 1 percent per year. Farmers and producers, then, are already facing smaller returns on their inputs. Climate change will complicate profitability even further. The future of productivity depends on the complex interplay of these temperature and rainfall averages, daily and seasonal extremes in weather, changing atmospheric CO₂ concentrations, and competition from weeds, pests, and invasive species. As Wethersfield has several local producers of agricultural products, it is necessary to understand how their livelihoods, as well as their outputs, will be affected.

Temperature:

Just as was discussed previously, temperatures across the board will rise until the end of the century, regardless of whether society follows the higher- or lower-emissions scenario. This means that farmers in the southern half of the region of the Northeast, of which Connecticut is a

part could see 5 to 10 additional July days of heat stress within the next several decades. An increase like this tracks with what is predicted for cities like Hartford, which could see as many as 28 extremely hot days during the summer season. Heat stress, particularly that which is sustained during the growing period, can be very detrimental to crops—like cabbage or potatoes—that are adapted to cooler conditions. Late in the century, the prevalence of heat stress days will only increase in the region, harming farmers and agricultural producer even further.

Another aspect of the interplay between temperature and agriculture is that of winter chill. Chilling requirements exist for plant varieties like apples and blueberries. These requirements necessitate that crops have ample time to lay dormant, allowing for optimal growth. Earlier warming and a lessening of chilling time portends that yields will be reduced.

Finally, crop growth will also be altered by the rising carbon dioxide levels, the primary greenhouse gas contributing to warming temperatures. Carbon dioxide is an essential input for plant growth, in addition to sunlight and water and various soil nutrients. An increase in more available carbon dioxide means that plants will take up more of this input and less of the others. It is yet unclear whether this will be detrimental or beneficial for crop growth in the Northeast. Some open-air studies have found that growth increased between 10 and 20 percent. Attaining gains like this, however, is predicated on more fertilizer use, optimum temperatures, and careful and effective control of weeds, insect pests and disease.

Rainfall and Drought:

It is material to not only talk about temperature changes and how these will alter agricultural outcomes, but also changing precipitation patterns. As was previously mentioned, the Northeast and Connecticut should be expecting an increase in precipitation events and their severity. Precipitation is also trending towards primarily rain, rather than snow. As more frequent and intense rainstorms are expected, climate experts suspect that they will likely cause more field

flooding, possible crop losses due to a lack of oxygen for plant roots in waterlogged fields, increased crop susceptibility to root diseases, increased soil compaction when heavy farm equipment is used on wet fields, and more runoff and leaching of nutrients and agricultural chemicals into ground and surface water. Given that Wethersfield's zoned agricultural areas are within the floodplain of the Connecticut river, they are very susceptible to many of these outcomes.

Weeds and Insect Pests:

Pest varieties and densities are projected to change over the course of the century as a result of changes in temperature and rainfall. The mix of weed species in the Northeast and their competitive abilities will change, due largely to the migration of growing seasons. As temperatures warm in the Northeast, the climate will become more favorable to species of pests that previously found a sympathetic home in more southern regions. This will mean not only that native varieties will have more competition, but also that the growth indigenous to the Northeast is not necessarily equipped to out-compete new species. An influx of a plant to a new region that it is rapidly able to colonize is what is known as an invasive species. For example, the weed Kudzu primarily grows in the Southeast, but has already appeared in parts of Connecticut. It carries a fungal disease that threatens soybean production and will threaten conservation land as well as farmland. As early as the middle of the century, Kudzu and other invasive species will find suitable habitation in across all of Connecticut.

Not only will new weed and insect pest varieties find a more favorable habitat to grow in in the Northeast and Connecticut, evidence also suggests that rising CO₂ levels will make it harder to manage and control pest outbreaks. An increase in carbon dioxide, just as will crop varieties, will augment growth for weeds. However, it will generally spur greater growth in weeds than in crops. While weeds will be growing more due to higher levels of carbon dioxide,

those same higher CO₂ levels seem to reduce the effectiveness of widely used herbicides. While herbicides may still be effective in combating weed growth, chemical use is expected to increase.

Overall:

In conclusion agricultural producers in Wethersfield will be faced with warmer weather that is largely unfavorable to the crop varieties that are currently grown, an increase in precipitation which will likely caused increased flooding of fields and increase vulnerability to diseases, and new and varied pest varieties that will find it easier to proliferate than their native counterparts. These secondary impacts of climate change are important to understand not only to protect the livelihood of farmers and producers, but also the food and products Wethersfield supplies for its own and surrounding communities. Anderson Farms, for instance, is known to grow both vegetables, like tomatoes, and also apples. Their yields for apples could be severely affected because of rising temperatures and a disappearing winter chill. Farms in the area will also need to account for an increase in precipitation and adapt to coming increases in flooding. Anderson farms, as well as others like Morris Farms, registered as producing vegetables and melons, will likely face a spur of weed growth and insect pests. Ways to adjust to and combat these problems will be discusses more at the end of this report.

Impacts on Human Health:

Background:

Climate change, more particularly global warming, is expected to increase the risk of many types of weather- and climate-related illnesses for people living in the Northeast. It also is correlated to an increased chance of death. Increased temperatures and frequent extremely hot days and more severe and longer heat ways will likely cause greater incidences of illness and death. This is particularly true for people living in cities, and vulnerable communities like the elderly and low-income.

While issues surrounding heat will be primarily discussed in this next section, it is important to mention as well that that flooding due to increased precipitation also harms human health. Higher incidences of flooding can strain waste water systems, harm public infrastructure as well as residential homes, cut off access to necessary resources and power, and carry dangerous runoff and chemicals that harm human health.

Impacts of Extreme Heat

Heat and heat stress kill more people in the United States than many would expect. Between 1993 and 2003, heat was the leading weather-related killer for six out of those ten years. During 2006 when two heat waves hit New York City, 46 people died—of those more than 80 were age 50 or older, 68 percent had multiple medical conditions. There's a very clear threat society is facing now in the face of increasing temperatures. An aging population—something which Wethersfield is experiencing now and will continue to experience in the future—aging infrastructure—something Wethersfield is, too, facing—and a healthcare system already under strain means that heat-related illness and death is something that needs to be addressed and dealt with. The added burden of climate change on the social services must be recognized and discussed in order for Wethersfield to be equipped to deal with this over the coming decades.

Heat waves are most dangerous in urban areas like Hartford because of the urban heat-island effect, which drives both day and nighttime temperatures higher. While cities experience this to a greater extent than suburbs, Wethersfield is very developed and in close proximity to Hartford and many major roadways like I-91. More travel and emissions released by vehicles and a population living close together in a relatively densely populated area means that heat is more likely to be retained rather than let off. Especially in a community like Wethersfield that

has a large concentration of potentially vulnerable people—low-income and elderly populations—heat puts people at greater risk because they are less able to cope with it. Temperature increases and other climate changes are also likely to exacerbate air-pollution problems. Groups that suffer from asthma and other such related health issues are likely to feel climate change burdens even more acutely.

Rising temperatures also affects the prevalence of vector borne diseases—not only the incidence of such diseases that are already endemic to the region, but also the introduction of new diseases. Lyme disease is, for instance, a problem that the Northeast has always experienced with ticks. However, cases of Lyme disease have been growing at an alarming rate over recent years; tick populations thrive more in mild and wetter winters. They are likely to see an increase during this time, placing more individuals at risk.

Overall:

It is critical for communities to identify dangers posed by climate change not just in terms of generalities—higher temperatures, increased flooding—but also in terms of how that change can harm human institutions. The productivity of the town of Wethersfield is predicated on having healthy citizens and healthy, functioning systems. More than half of the workforce of Wethersfield is employed in service sector professions, meaning that increases in illness and death will harm the economy of the town and place a strain on social institutions. The town government, in coordination with other regional and state bodies will need to address these problems in order to avoid negative consequences for their people and their economy.

4.4.3 Adaptation to Unavoidable Climate Change Secondary

Adapting Agriculture:

There are several steps which can be taken to adapt agriculture to changing climactic conditions. The possibly easiest and first steps to be taken may involve new planting dates, harvest dates, and/or crop varieties. Each of these aims at adjusting to changing growing seasons as a result of warming temperatures and disappearing winter chill. While some foods that were once easily growable in the Northeast region and in Wethersfield may no longer be viable, there are new crops that can be grown in their place to maintain productivity and output levels.

Some more opportunities that exist for producers are increasing organic matter in soils, using nitrogen fertilizers more efficiently (if at all), conserving energy, and using marginal land to produce renewable energy such as biomass fuels or wind power. Increasing organic matter not only means that soils are more productive, it also means that agricultural land can increase its carbon-capture capacity and reduce the density of greenhouse gasses in the local atmosphere. Using fertilizers more effectively will reduce runoff and decrease harm to the surrounding environment and biodiversity, as will conserving energy by decreasing practices like tilling. “No-till” or reduced-tillage farming methods cause less soil disturbance and erosion, reducing carbon dioxide emissions helping to increase the organic matter in soils and water-holding capacity.

Engaging in more forms of sustainable agriculture will allow the land to more easily absorb climate impacts, without too significantly harming productivity in the process.

Adapting Transportation, Energy and Infrastructure:

The transportation sector is the Northeast’s largest source of heat-trapping emissions, followed by electricity generation. Together, the two account for nearly two-thirds of the region’s emissions. Combustion of fossil fuels for water and space heating in homes and businesses and for powering industrial activities account for the remaining third. While it

impossible for Wethersfield to address these facts substantively on their own—without the cooperation of other surrounding towns in Connecticut, the state as a whole, and other regional players throughout the Northeast—it is important to recognize these facts so that small changes can be made on the local level.

One of the most effective ways to reduce energy consumption as a whole is to reduce demand. This is also the most cost-effective and easy to implement. Much of this change should be encouraged by government bodies and enacted by the government and citizens alike. Wethersfield can encourage its residents to take part in becoming more conscious of their own personal emissions. This applies to driving habits, energy use habits, as well as consumption of goods like food and wood products. By increasing messaging to town residents about the importance of their own personal part of the energy equation, costs and demand can be reduced.

Another issue to address is the disparity in energy use and availability. While it may seem counterintuitive, people in more vulnerable and low-income populations often use more energy than their affluent counterparts. This is because the residences available to these people are not equipped with efficient energy systems or good insulation. In most cases, they are forced to use more as a result, meaning both they and the environment are paying a price. Confronting the disparity in energy use across vulnerable communities is imperative when tackling energy use as it relates to climate change and the future of climate change responses.

It should also be said that the community of Wethersfield recognizes the need to upgrade many of their buildings, both residential and commercial. This is not only at the behest of residents who want to see the character of the community upheld, but also the town officials themselves who recognize that increased housing capacity is necessary for a growing population. One way to exact this kind of growth while meeting the issues of climate change is to engage in

green building practices. This is something the community has already done, as can be seen in their work on the public high school. Studies have found that the financial benefits of green design and construction amount to more than 10 times the additional up-front cost. Projects of this sort not only reduce emissions and environmental damage, but also operating costs around and energy, waste, water and maintenance.

Adapting for Vulnerable Communities:

Taking steps to protect vulnerable communities is crucial for the town of Wethersfield. The most effective way to formulate appropriate responses in the face of climate change is by working on three factors. Vulnerability is linked to exposure to risk, sensibility to risk, and the ability to cope with and recover from climate events. Exposure can be as little as living in an older home, or as much as living within the floodplain. Sensibility can appear as small as having asthma, or as large as being elderly and having a chronic health condition. Coping and recovering is everything ranging from access to transportation, access to electricity, and having appropriate financial resources. It is important for the community to take into account all the factors so that they can have both a broad and a deep response.

While it is difficult to dig into the minutia of all of the problems and present solutions for each and every one, there is some general guidance that can be given. First and foremost, poor communities, communities of color and elderly communities offer suffer from poor political representation. Creating policy solutions that are focused around the needs of these populations will arm with government with a better understanding of needs, and a wider array of resources with which to address them. Understanding that poverty, unemployment and low levels of education are factors that often lead to climate vulnerability will help in creating robust local systems that watch out for these socially vulnerable communities.

Some of these issues can first be combated by increasing public messaging and raising awareness around climate issues and incoming climate impacts. Providing increased access to public aid, institutions and spaces that offer support will also help to alleviate some of the negative consequences associated with severe weather and extreme events. Appropriate responses would be helping to evacuate residents from their homes in case of flooding, offering cool public spaces in times of heat waves, and offering financial assistance to account for disparate effects of heat and precipitation changes.

Some more concrete guidance can be applied to issues surrounding extreme heat, as that has already been extensively discussed in this report. The government can help people to adapt to increases in extreme heat by improving access to air conditioning, providing better insulation for homes and buildings and expanding public health education. Public systems should see the implementation of warning systems for town residents and increased access to cool public spaces. Another, more long-term way to reduce exposure to extreme heat is by increasing green space in Wethersfield and reducing the necessity for single-person transportation. Wethersfield already boasts many open and green spaces, and plans to move towards a more walkable and bikeable town that depends less on greenhouse gas emitting transportation options.

Adaption Strategies for Wethersfield Generally:

While it is important to offer more specific guidance for certain sectors of Wethersfield, it is also important to offer a sweeping view of what needs to be done in the face of climate change. Some of the most important things are monitoring and recording the physical and physiological changes the community experiences, strengthen social institutions and the community's safety net, acting in coordination with regional and state bodies to reduce emissions and come up with successful strategies for implementing change.