

Wilmington Downtown Plan
Climate Vulnerability Assessment

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Introduction

Climate vulnerability refers to the degree to which a community is exposed to climate change, sensitive to its impacts, and able to adapt to those impacts.¹ This assessment explores climate-related hazards affecting Downtown Wilmington, as well as the community's projected future exposure and adaptive capacity. The vulnerabilities identified in this report will be integrated into the Wilmington Downtown Plan, which will identify a wide range of strategies for local implementers.

This assessment was developed in partnership with the National Oceanic and Atmospheric Administration (NOAA), the American Planning Association (APA), and Illinois-Indiana Sea Grant, with the goal of identifying new ways to integrate climate science into the local planning process. The methodology and data sources used to develop the assessment will be compiled by the American Planning Association and integrated into a guidebook for local planners. This project adds to the conversation about climate resilience, an emerging field in city planning.

Key Findings

- Flooding and erosion pose significant risks to Downtown Wilmington. South Island Park is the area most likely to be affected, though roads, power lines, and private businesses along the millrace, Kankakee River, and Forked Creek are also vulnerable.
- The City of Wilmington withdraws its drinking water from the Kankakee River. Surface water sources, such as the Kankakee, are more resilient than groundwater aquifers, but may be vulnerable to drought, flooding, and algae blooms.
- During the years to come, extreme heat may make North Water Street, and other areas with large amounts of impervious coverage, less attractive for shoppers, tourists, and other pedestrians.
- Downtown Wilmington's dependence on personal automobiles for most trips increases the community's exposure to health and economic impacts from weather-related traffic disruptions.

¹ Intergovernmental Panel on Climate Change, 2007, "Synthesis Report," https://www.ipcc.ch/publications_and_data/ar4/syr/en/mains5-2.html.

Community Profile

Wilmington, Illinois is located at the intersection of historic Route 66 and the Kankakee River, 50 miles southwest of downtown Chicago. As of 2015, the City of Wilmington is home to 5,700 residents, including nearly 1,000 residents in the 184-acre downtown area. Downtown Wilmington is also home to a number of businesses, which account for 309 primary jobs, mostly in the construction, information, and retail industries.

The Kankakee River was critical to Wilmington's early development, and remains an integral part of life in the city. The millrace, a channel of the Kankakee River, runs parallel to Water Street through the heart of downtown, separating the central business area from Island Park, a large, predominantly publicly owned island with a number of recreational facilities. The northern and eastern edges of downtown are defined by Forked Creek. The Kankakee River is the city's primary source of drinking water, which is withdrawn and processed at a facility just downstream of the city. The City also maintains an emergency groundwater well, which provides a backup source of water, should river water become unavailable. The well is located in South Island Park.

The demographics of Downtown Wilmington are largely similar to those of Wilmington as a whole. Ninety-two percent of downtown residents are white, compared to 86 percent in the city at large, 66 percent in Will County, and 53 percent in the Chicago region. The area is predominately middle-income, with a mean household income of \$55,698, 26 percent below the Will County average. Single-family homes account for 58 percent of downtown's housing stock, and 49 percent of all households are renter-occupied.

Figure 1: Map of Downtown Wilmington

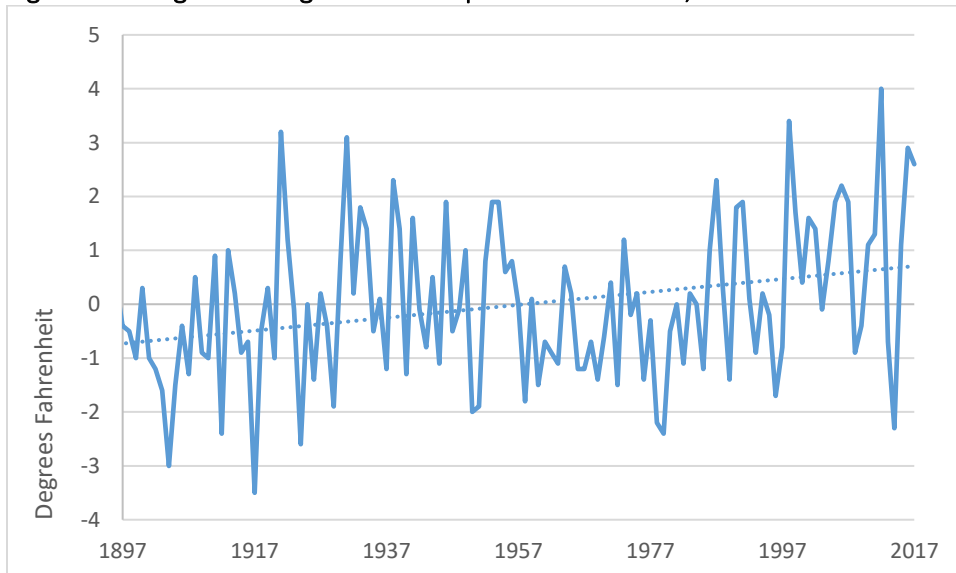


Climate and Natural Hazards

Wilmington, Illinois has a continental climate characterized by hot, humid summers and cold, dry winters. Flooding, extreme heat, drought, severe storms, heavy snowfall, and ice accumulation are the most frequently experienced natural hazards in the Wilmington area. Precipitation is greatest during the spring and summer, though large storms occur throughout the year. Weather patterns in the region have a high level of day-to-day and year-to-year variability in temperature, humidity, precipitation, and wind. Summer temperatures typically peak during the month of July, which has a daily average high temperature of 84 degrees Fahrenheit. Winter temperatures are lowest in January, which has a daily average minimum temperature of 16 degrees Fahrenheit.²

Climate change has already begun to affect annual average temperatures and weather patterns in Wilmington's region. Average annual temperatures in the Midwest have increased by approximately 1.5 degree Fahrenheit since 1900, with the most rapid increases occurring since 2000.³ Figure 2 shows average annual temperature increases in Illinois since 1897.

Figure 2: Change in average annual temperatures in Illinois, 1897-2017



Source: National Centers for Environmental Information, "Climate at a Glance," National Oceanic and Atmospheric Administration, <https://www.ncdc.noaa.gov/cag/>.

As air warms, its ability to retain water vapor increases, which allows for more frequent and more powerful storms.⁴ Due in part to this effect, the region saw a 40 percent increase in the number of storms producing more than one inch of rainfall between 1979 and 2009, compared to the previous 30-year period.⁵

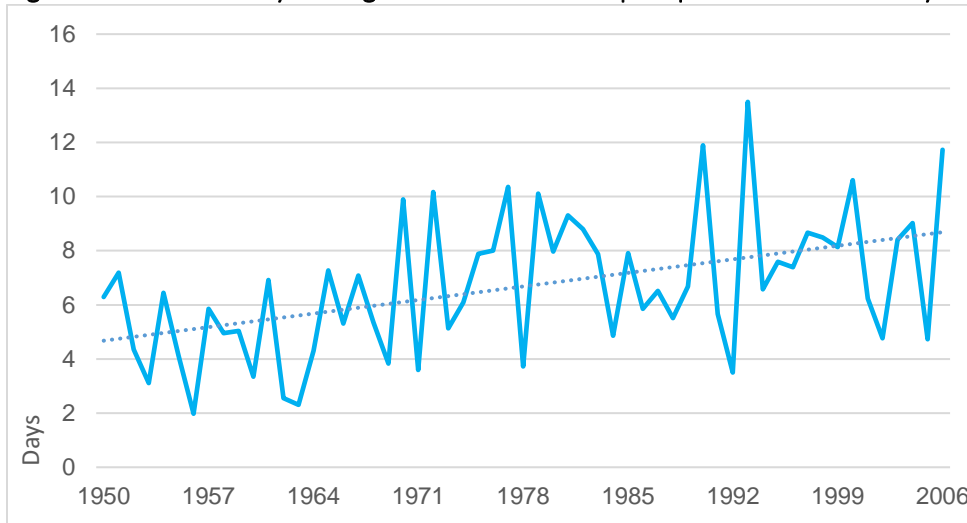
² National Centers for Environmental Information, "Data Tools: 1981-2010 Normals – Kankakee Metro WWTP, IL US," National Oceanic and Atmospheric Administration, <https://www.ncdc.noaa.gov/cdo-web/datatools/normals>.

³ National Climate Assessment, 2014, <http://nca2014.globalchange.gov/>.

⁴ Illinois Department of Natural Resources, 2015, "Urban Flooding Awareness Act," https://www.dnr.illinois.gov/WaterResources/Documents/Final_UFAA_Report.pdf.

⁵ Illinois Department of Natural Resources, 2015, "Urban Flooding Awareness Act," https://www.dnr.illinois.gov/WaterResources/Documents/Final_UFAA_Report.pdf.

Figure 3: Number of days with greater than 1 inch of precipitation in Will County



Source: U.S. Climate Resilience Toolkit, <https://toolkit.climate.gov/#climate-explorer>.

The current warming trend is primarily due to increasing concentrations of greenhouse gases in the Earth's atmosphere.⁶ To determine future climate conditions, scientists create models using greenhouse gas emissions scenarios. Generally, these models include a low-emissions scenario that assumes drastic reductions in global greenhouse gas emissions, and a high-emissions scenario that assumes emissions will continue to increase.

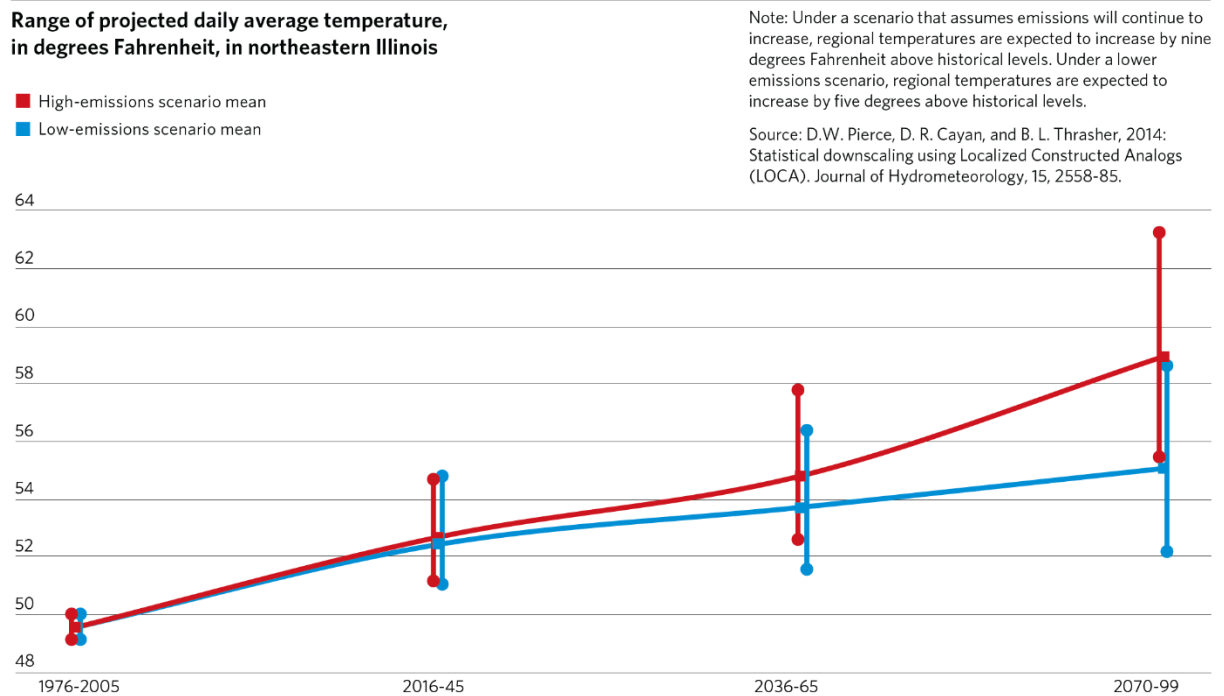
Under a low-emissions scenario, the region that includes Wilmington is expected to see an average annual temperature increase of three to nine degrees Fahrenheit. Under a high-emissions scenario, the Wilmington area could see an increase of six to thirteen degrees Fahrenheit (Figure 4).⁷ Observed increases in atmospheric carbon emissions during the last 15-20 years have been consistent with a high emissions scenario.⁸

⁶ Intergovernmental Panel on Climate Change, "Climate Change 2014: Synthesis Report," https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf.

⁷ Illinois State Climatologist, "Future Climate Change Scenarios for Illinois," <http://www.isws.illinois.edu/atmos/statecli/climate-change/scenarios.htm>.

⁸ Climate Science Special Report, Fourth National Climate Assessment, 2017, <https://science2017.globalchange.gov/>.

Figure 4: Projected temperature change in Illinois under low and high emissions scenarios



These models suggest the State of Illinois—and the Wilmington area—will continue to see greater variability in annual precipitation, with wetter wet years and drier dry years. By 2100, climate scientists project annual precipitation increases of between four to fourteen inches under a high-emissions scenario, and three to nine inches under a low-emissions scenario, with a considerable amount of variation between dry and wet years. These models also suggest that a larger proportion of precipitation will fall during a small number of very large storms, rather than being distributed evenly throughout the year.

Weather vs. Climate

The terms are sometimes confused, but weather and climate are quite different.

Weather refers to temporary atmospheric conditions, typically lasting a few hours or days. Thunderstorms, cold spells, heat waves, droughts, and blizzards are all examples of weather.

Climate refers to long-term atmospheric trends, typically measured by 30-year “normals.” Climate is the sum total of many weather events, occurring over a long period of time.

While it can be tempting to point to individual weather events as a sign that climate change is or is not happening, a single storm or heat wave is not a trend. Instead, climate scientists analyze records going back many decades to find evidence of long-term changes in weather patterns. These changing patterns may mean individual weather events are stronger, or more frequent, but individual weather events themselves do not constitute a change in climate.

Flooding

Downtown Wilmington is susceptible to flooding due to both local precipitation and precipitation in upstream areas of the Kankakee River watershed. These hazards are likely to intensify during the years to come.

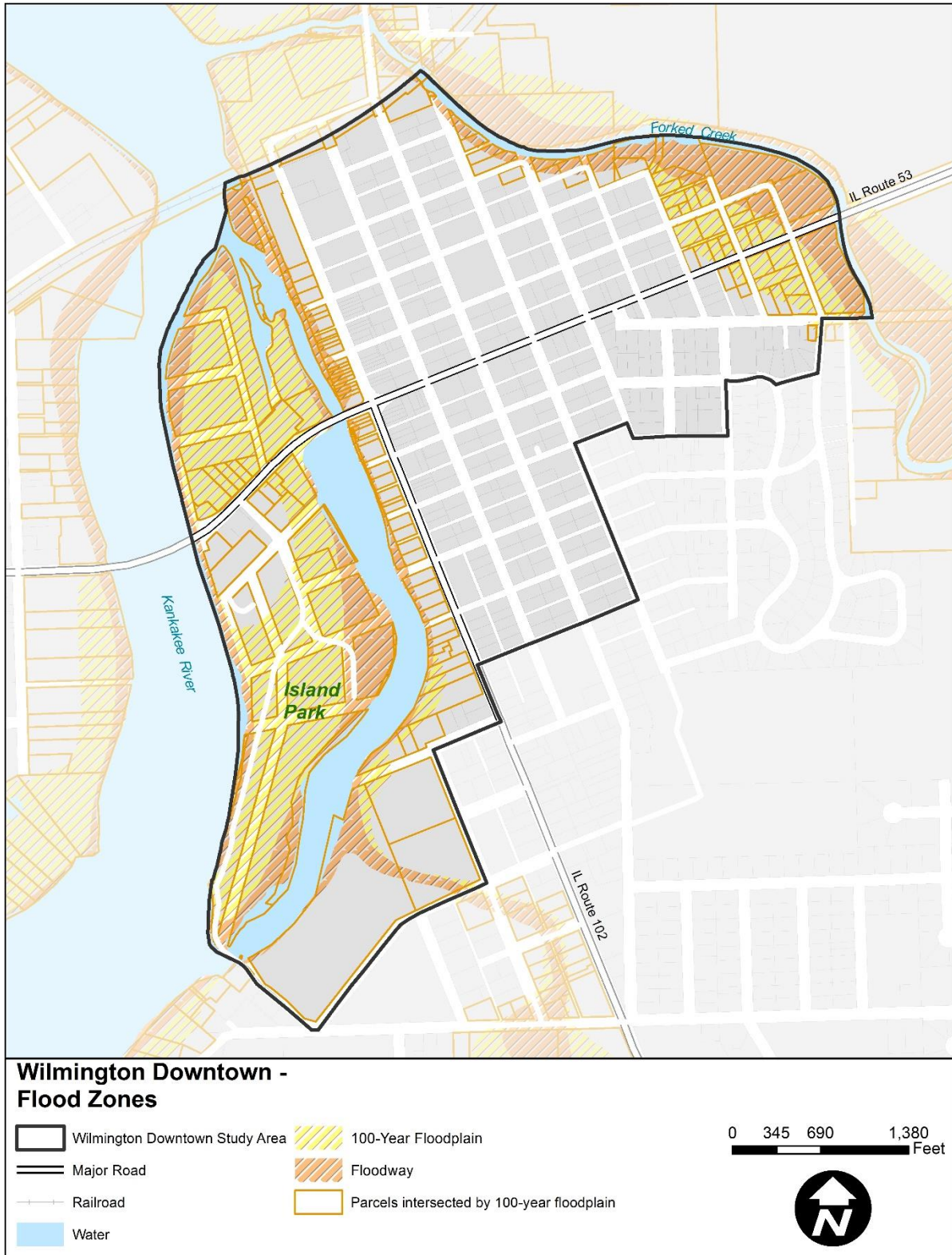
Flooding is generally divided into two types: riverine flooding and urban flooding. Riverine flooding occurs when rivers, streams, or other waterways overflow their banks, usually due to upstream precipitation. Areas along waterways that are prone to flooding are known as floodplains. Urban flooding typically occurs outside of the floodplain, and is the result of stormwater overwhelming local drainage systems, causing water to accumulate in low-lying areas.

The one percent annual chance floodplain, sometimes referred to as the 100-year regulatory floodplain, includes areas with a one percent or greater chance of experiencing a riverine flood during a given year. These areas are identified by the Federal Emergency Management Agency (FEMA), which uses historical rainfall data and hydrologic modeling programs to generate maps for every community in the United States. All structures within this regulatory floodplain are required to purchase flood insurance through the National Flood Insurance Program (NFIP) to be eligible for a federally insured mortgage. According to the most recent FEMA maps, Downtown Wilmington is surrounded by regulatory floodplain on three sides (figure 5).

Because floodplain maps are generated using historical data, they do not reflect recent changes in land use and precipitation patterns, both of which have significant impacts on local and regional flooding. Furthermore, the one percent threshold does not reflect the true frequency of flooding in these areas, as some parts of the floodplain will experience flood conditions much more frequently than others.

Riverine flooding in Downtown Wilmington is further influenced by historical development patterns. During the early 20th century, the entirety of the Kankakee River's course in Indiana was channelized, and the surrounding wetlands were drained for agricultural development. The loss of these wetlands greatly reduced the upper watershed's ability to filter and retain stormwater, and made downstream communities—such as Wilmington—more vulnerable to flooding.

Figure 5: Flood zones in Downtown Wilmington



In interviews, residents and City officials have stated that Island Park is the most frequently flooded area in Wilmington. Flooding in South Island Park occurs primarily due to high river levels, and occasionally results in the formation of a channel bisecting the island from the millrace to the main branch of the Kankakee River. Flooding in North Island Park is caused by both high river levels and inadequate drainage on IL Route 53.

Historically, ice jams have been a major cause of flooding in the area. Ice jams occur when a river freezes and then rapidly warms, causing large blocks of ice to break apart. As these blocks move downstream, they sometimes accumulate at narrow points, such as bridges and bends, creating natural dams that rapidly increase water levels. In recent years, the Illinois Department of Natural Resources has allowed Will County to divert heated water from nearby power plants into the Kankakee River, dramatically reducing the risk of ice accumulation.

Municipalities manage flood risk through a variety of policies, including floodplain and stormwater regulations designed to promote responsible floodplain development, limit impervious surfaces, and ensure proper drainage during rainfall events. Stormwater regulations are based on historical data that do not reflect recent changes in precipitation, or future potential precipitation patterns. As the climate continues to change, these standards, including the regulatory, 100-year floodplain, will likely become increasingly out of date, elevating the community's exposure to flood damages and other impacts.

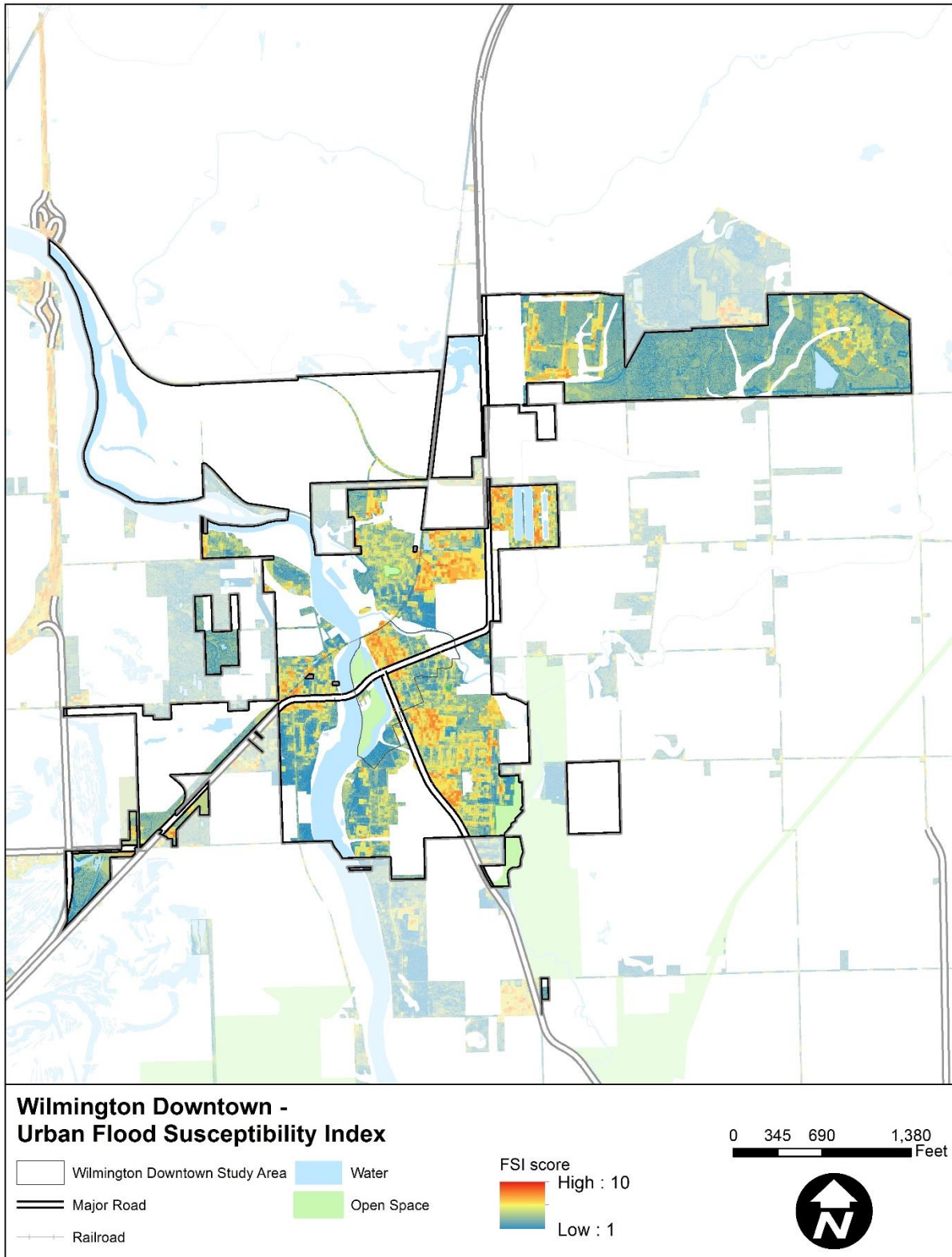
Flood Susceptibility Index (FSI)

To gain a better understanding of urban flooding in northeastern Illinois, CMAP staff created a regional urban flooding susceptibility index (FSI) for developed areas that uses reported flood locations and topographic, land cover, and other data to determine the relative flood susceptibility of communities in the region.⁹ The index is not intended to replace more technical floodplain mapping or modeling efforts, and should instead be used to identify areas where these technical studies and may be needed.

Figure 6 shows urban FSI scores for the City of Wilmington. The index is scaled to the seven-county region. The map shows Downtown Wilmington to be one of four priority areas for urban flooding interventions within city limits. Although stakeholder interviews have indicated that urban flooding is not currently a major concern in the city, the index results show that the downtown area has a higher relative susceptibility to urban flooding than other parts of the city, and may be more vulnerable to flooding if precipitation patterns continue to change.

⁹ CMAP Regional Flooding Susceptibility Index Appendix and Data, <https://datahub.cmap.illinois.gov/dataset/on-to-2050-layer-flood-susceptibility-index>

Figure 6: Urban Flood Susceptibility Index (FSI)

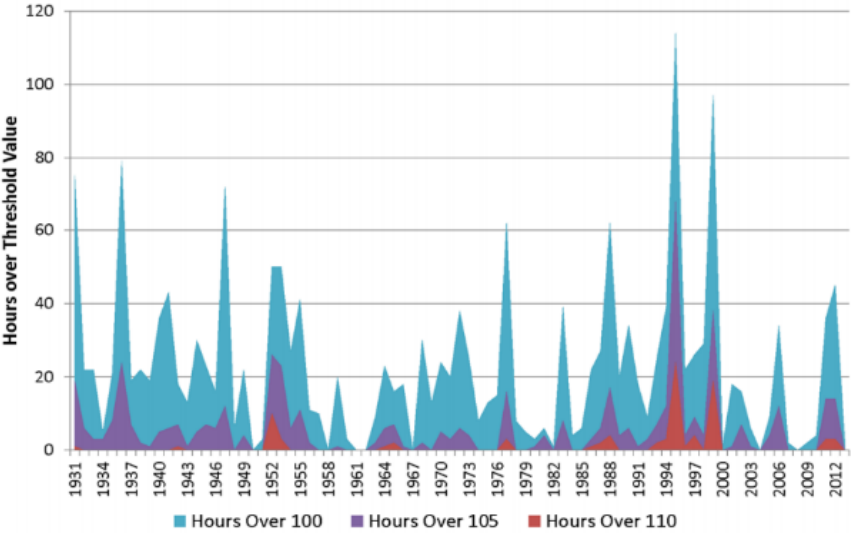


Extreme Heat

As the climate warms, Downtown Wilmington will likely experience both an increase in average temperatures and an increase in the number of very hot days. Northeastern Illinois has historically seen three days over 95 degrees Fahrenheit each year. By mid-century, the region could see between 15 to 20 days over 95 degrees annually. Average low temperatures on summer days are expected to see even larger increases, meaning that evenings and nighttime will provide less relief from high temperatures. Historically, nighttime lows over 80 degrees Fahrenheit have been extremely rare, but could occur one to eight times per year by 2100.

Figure 8 shows the region’s warming trend over the last 80 years. Heat indices (which combine heat and humidity) over 110 were once very rare, but their frequency has increased considerably during the last few decades.

Figure 7: Historical Heat Index Trends in Northeastern Illinois



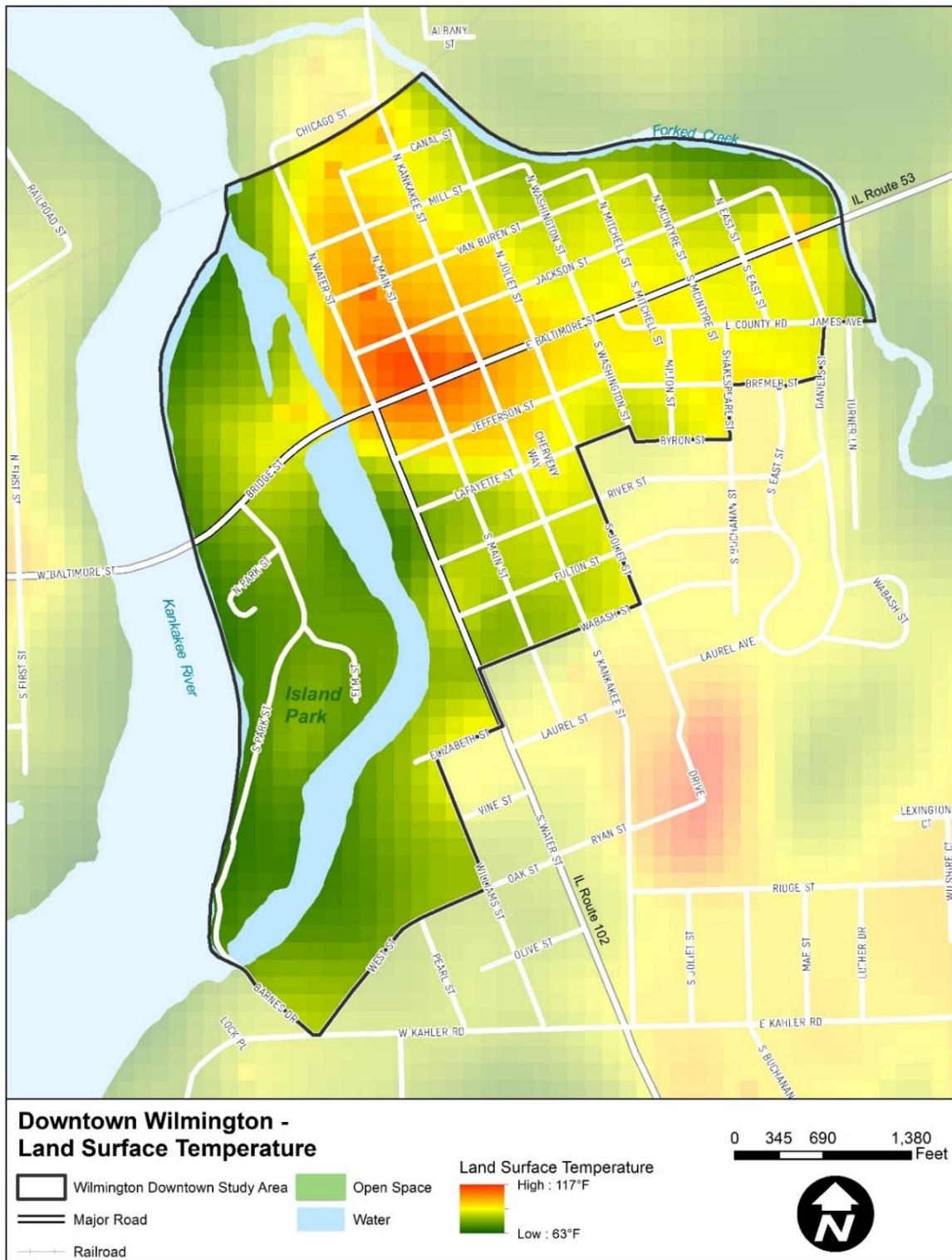
Extremely high heat indexes have increased in recent years, based on temperature readings from June-September at Chicago Midway Airport. Source: Illinois State Climatologist.

In areas with dense development, the urban heat island effect further exacerbates extreme heat. In these areas, impervious surfaces—including roads, parking lots, rooftops, and other paved surfaces—heat up during the day, and remain warm long into the night. In northeastern Illinois, areas with greater than 50 percent impervious coverage have been found to be five to six degrees warmer than the regional average.¹⁰ Under normal conditions, the impact of this increase is negligible, but during periods of extreme, persistent heat, a difference of five degrees can result in significantly higher risk of dehydration, heat exhaustion, and other health impacts.

In Downtown Wilmington, the heat island is most severe on North Water Street, North Main Street, and IL Route 53 (Figure 8). This area contains much of the downtown’s commercial property, and lacks street trees and other heat-reducing features.

¹⁰ CMAP, “Climate Resilience Strategy Paper,” <http://www.cmap.illinois.gov/documents/10180/470714/Climate%20Resilience%20Strategy%20Paper/dd610883-d00f-407d-808b-484f9800a3f6>.

Figure 8: Observed Heat Island Effect in Downtown Wilmington

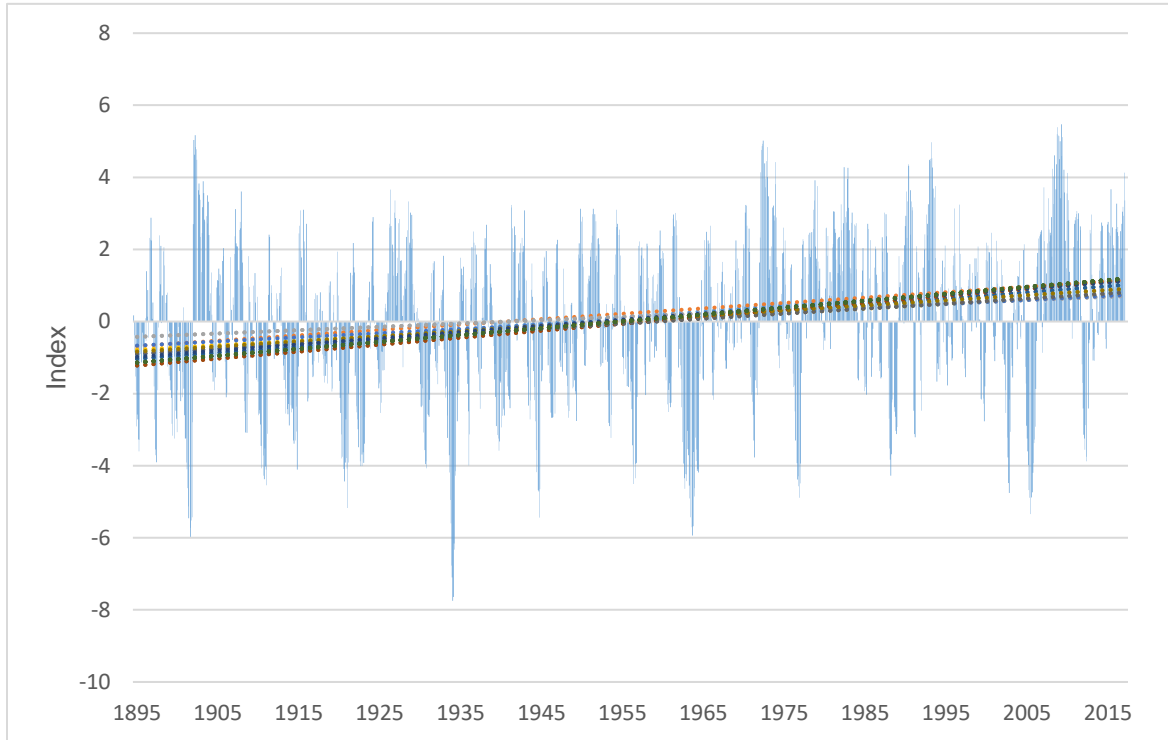


Source: CMAP analysis of [LST data](#), measurements taken July 21, 2014.

Drought

Seasonal droughts are common in the Wilmington area, and can occur during any time of the year. The 2004 Illinois Hazard Mitigation Plan estimates that droughts occur, on average, every 21 years in the State of Illinois. The 2013 Will County All Hazard Mitigation Plan estimates drought occurrence to be more frequent in Will County, averaging one drought every 15 years.¹¹ Figure 9 shows drought frequency in northeastern Illinois for each month from 1895 to 2015. During this period, droughts have become more frequent.

Figure 9: Monthly Palmer Modified Drought Index for Northeastern Illinois



Source: Midwestern Regional Climate Center, <http://mrcc.isws.illinois.edu/CLIMATE/>.

This image shows monthly Palmer Modified Drought Index scores for northeastern Illinois. Because scores are shown separately for each month, twelve trend lines are included. From 1895-2015, trend lines for all twelve months trended upwards.

As the climate continues to change, the Wilmington area is expected to see longer and more frequent droughts, periodically interrupted by large storms. When heavy rains or snowmelts occur during dry conditions, erosion and flooding become major concerns, as dry soils are typically less stable and have a lower capacity to absorb stormwater. The summer months are expected to see the largest increase in drought conditions.

¹¹ Will County, "Will County All Hazard Mitigation Plan," http://www.plainfield-il.org/pages/documents/2013WillCountyAHMP_10-19-14.pdf.

Severe Storms

Severe storms, some capable of producing lightning, hail, strong winds, and tornadoes, are common in the Wilmington area. Between 1996 and 2013, Will County experienced 108 severe thunderstorms, causing an estimated \$2.1 million in damages.¹² While the link between climate change, thunderstorms, and tornadoes is less well defined than some hazards, the region is expected to see modest increases in the frequency and severity of these events as the century progresses.¹³

Snow and Ice

Snow and freezing rain are two of the most commonly experienced natural hazards in the Wilmington area, resulting in road closures, traffic delays, and car crashes each year. Average annual snowfall in Will County is 28 inches. Severe snowstorms, defined as at least six inches of snow during a 48-hour period, typically occur every other year.¹⁴

Climate models suggest the Wilmington area will see an increase in winter precipitation.¹⁵ Even if warmer temperatures mean that some winter precipitation will fall as rain rather than snow, the overall increase in precipitation will likely mean there will be enough snow and ice that managing their effects will remain a significant challenge during the years to come. Heavy snowfall events may also increase due to warmer temperatures, as snow crystal size increases as temperatures approach the freezing point. Warmer average temperatures may also result in more frequent freezing rain and potentially damaging freeze-thaw events, which occur when temperatures fluctuate between just above, and just below, freezing.¹⁶

¹² Will County. "County-Wide All Hazard Mitigation Plan." 2013.

¹³ National Aeronautics and Space Administration – Global Climate Change, "Severe thunderstorms and climate change," <https://climate.nasa.gov/news/897/severe-thunderstorms-and-climate-change/>.

¹⁴ Will County, "Will County All Hazard Mitigation Plan," http://www.plainfield-il.org/pages/documents/2013WillCountyAHMP_10-19-14.pdf.

¹⁵ National Climate Assessment, 2014, <http://nca2014.globalchange.gov/>.

¹⁵ Illinois Department of Natural Resources, 2015, "Urban Flooding Awareness Act,"

¹⁶ Jaffe, Martin and Mary Woloszyn, "An Initial Assessment of Winter Climate Change Adaptation Measures for the City of Chicago," *Sea Grant Land and Policy Journal*, Vol. 6, No. 2.

Vulnerability and Risk Assessment

Natural hazards—both observed and projected—will result in meaningful challenges for Downtown Wilmington’s infrastructure, residents, and economy during the years to come. In many cases, the government and other stakeholders can mitigate the impacts of these hazards through cost-effective measures to reduce vulnerability and encourage resilience. Doing so requires careful analysis of what hazards the downtown area is likely to experience, and how vulnerable critical infrastructure, community assets, and public services are to those hazards.

The following section of this report assesses the vulnerability of the residents, infrastructure, and economy of Downtown Wilmington to the impacts of climate change based on their exposure to climate-related hazards, the likelihood of an impact occurring, and the plans and programs in place to adapt to hazards.

Critical Infrastructure

Roads, sidewalks, bridges, sewers, power lines, and other forms of infrastructure are critical for sustaining a high quality of life in Downtown Wilmington. These built infrastructure systems are complemented by natural systems, including wetlands, prairies, and forests, that help to manage stormwater, reduce air pollution, and provide recreational opportunities. Identifying what natural and human-made systems are vulnerable to climate-related hazards is an important first step to protecting them and creating a more resilient Wilmington.

Streets, roads, and sidewalks

Downtown Wilmington’s transportation system plays a critical role in both the local and regional economies. IL Routes 53 and 102 are designated state truck routes used by more than 500 trucks each day. Locally, the transportation system connects residents and visitors to jobs, services, and recreational opportunities. Because of the location of key roadways in areas that are susceptible to flooding, disruption to local transportation systems from both riverine and urban flooding is both highly probable and highly consequential.

Personal transportation for downtown stakeholders is likely to suffer from climate-related impacts. Approximately 94 percent of downtown residents commute to work by private or shared automobiles, highlighting the area’s vulnerability to road closures. Because the majority of downtown residents work outside of the downtown area, many residents have no other way to access their job. Groceries, childcare, and other errands also require residents to leave the downtown area, and many downtown businesses rely on out-of-town residents. When ponding, riverine flooding, or snowfall closes roads, these activities are interrupted.

Increased precipitation during the coming years is likely to make road closures from flooding more frequent, especially in North Island Park, where insufficient drainage already leads to occasional closures of IL Route 53. In South Island Park, higher river levels from more powerful storms will likely cause the millrace to overflow onto Park Street more frequently, forcing the closure of the park, and increasing the threat of erosion.

Maintenance of the City’s infrastructure requires the participation of several levels of government, as well as private property owners. The City of Wilmington is responsible for maintaining most roads in the downtown area, with the notable exceptions of IL Routes 53 and 102, which are maintained by the State

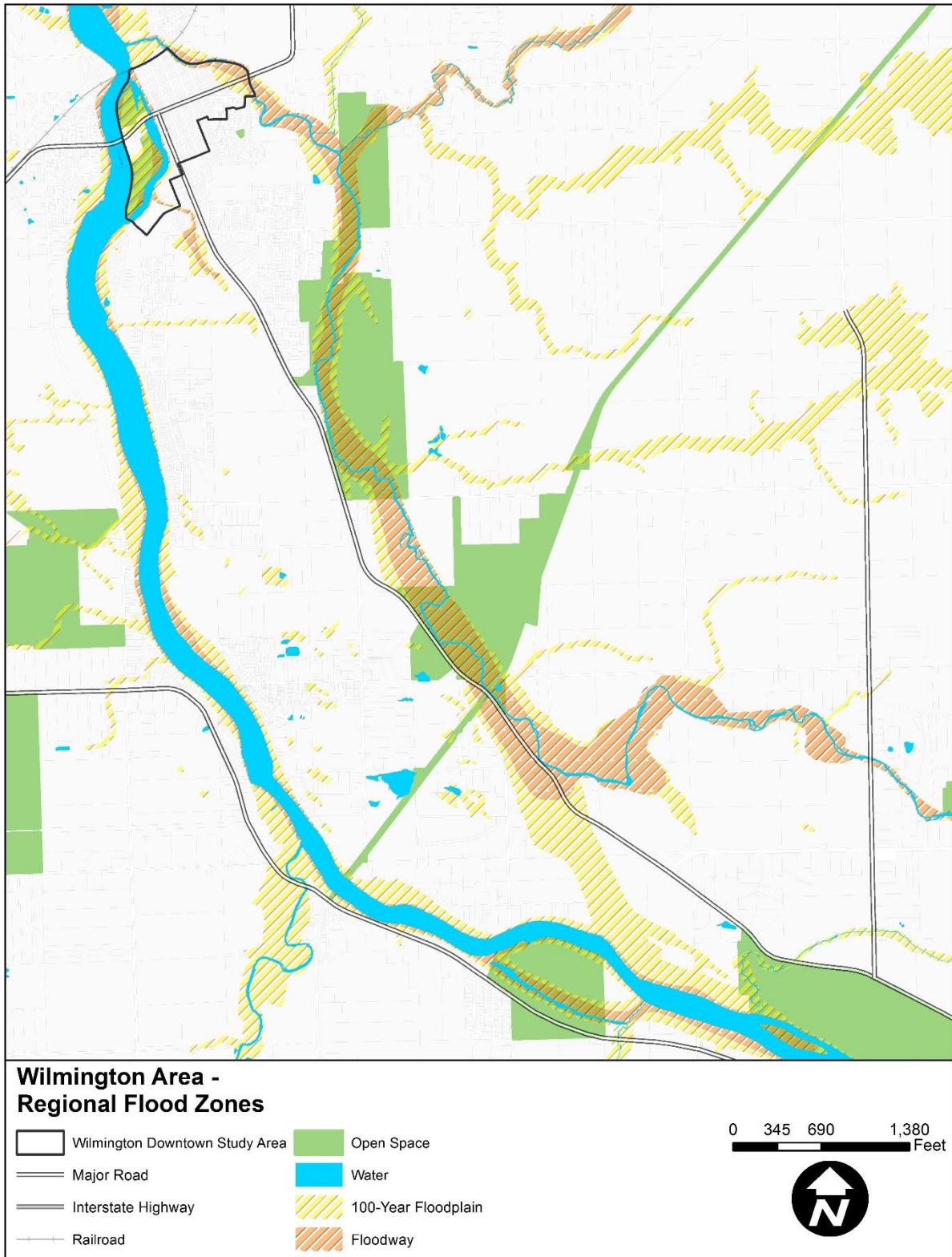
of Illinois. The City of Wilmington maintains sidewalks within city limits, but property owners are responsible for ensuring their sidewalks are clear of snow, leaves, and other debris.

At the regional level, the greater Wilmington area is surrounded on all sides by the 100-year floodplain (Figure 10). While it is unlikely that all of these floodplains would fill simultaneously, even during a large flood, there is potential for the area to become cut off from the rest of the Chicago metropolitan area. Were these areas to flood, emergency response times would increase dramatically, and some residents may attempt to cross flooded roadways in private automobiles. Crossing flooded streets is a leading cause of flood-related deaths in the United States.¹⁷

Temperature trends may lead to increasing maintenance demands for transportation infrastructure. More frequent freeze-thaw events during the winter months may accelerate the formation of cracks and potholes in roadways, parking lots, and sidewalks, increasing maintenance costs and possibly leading to more traffic delays. Roadways are also vulnerable to buckling and cracking during periods of extreme heat. Persistent heat reduces air quality, and makes walking a less attractive option. This may result in more local trips to be taken by automobile, leading to more congestion and even lower air quality. This is especially true in areas with limited pedestrian amenities, such as sidewalks, benches, and street trees.

¹⁷ National Weather Service, Turn Around, Don't Drown, <http://www.nws.noaa.gov/os/water/tadd/>.

Figure 10: Flood Zones in the Greater Wilmington Area



Emergency Services

Police, fire, and emergency first responders provide critical services to Downtown Wilmington. Future extreme weather and severe flooding will likely increase the importance of cooperation between the City of Wilmington and neighboring jurisdictions. More frequent flooding and heat waves will also require increased awareness and cooperation among residents, especially for elderly individuals and those with limited mobility.

Areas within the one percent chance floodplain are the most vulnerable to flooding, and may be difficult to access during flood events. Proactively closing Island Park before heavy rain events may reduce the likelihood of residents and visitors becoming isolated from emergency responders in these areas, but other parts of downtown, including IL Route 53 and northeastern downtown near the Gemini Giant, are less flexible. When these areas flood, the surrounding neighborhoods and commercial areas may be difficult for first responders to access, requiring cooperation and coordination with neighboring jurisdictions to ensure critical services remain available. Areas outside of the downtown area may also become isolated from Wilmington-based first responders. This threat is mitigated by the Wilmington Fire Protection District participation in Mutual Aid Box Alarm System (MABAS) Division 15, which facilitates assistance from nearby communities during large-scale emergencies.

The Wilmington Fire Protection District is located on the northern end of downtown, which enables them to provide rapid service to downtown residents. The Wilmington Police Department is located just south of town, adjacent to City Hall. The nearest emergency rooms are located in Kankakee and Joliet, approximately 20 miles to the north and southeast.

Water Supply

The City of Wilmington operates a municipal water system that withdraws surface water from the Kankakee River. Once withdrawn, the city processes the water in a plant northwest of downtown, and distributes it to residents and businesses throughout the Wilmington area. Wilmington is currently the only community in northeastern Illinois that withdraws water from the Kankakee River, which was identified by Water 2050, the region's water supply and demand plan, as an underutilized water resource.¹⁸ Surface water sources such as the Kankakee River are significantly more resilient than groundwater aquifers, which are being depleted on a regional scale. As groundwater supplies become increasingly scarce during the coming years, other communities in the Wilmington area will likely begin transitioning to inland surface water sources, such as the Kankakee River. Wilmington is well positioned to maintain its water supply going forward.

Despite the relative resilience of surface water sources, the Kankakee River is susceptible to water quality and quantity challenges related to climate change. Specifically, surface water is vulnerable to drought and rising temperatures. The Illinois Department of Natural Resources (IDNR) establishes minimum low flow standards for certain waterways within the state, known as "Q7,10" standards.¹⁹ These standards estimate the minimum quantity of water needed for rivers to maintain aquatic life and protect river users from contamination. When water levels drop below the Q7,10 standards, the City may be required to transition from river water to groundwater. An emergency well in South Island Park is maintained for this purpose. Due to its location in a flood prone area, the emergency well is sometimes inaccessible during

¹⁸ CMAP, "Water 2050: Northeastern Illinois Regional Water Supply/Demand Plan," 2010, <http://www.cmap.illinois.gov/documents/10180/14452/NE+IL+Regional+Water+Supply+Demand+Plan.pdf/26911cec-866e-4253-8d99-ef39c5653757>.

¹⁹ "7-Day 10-Year Flow Maps," Illinois State Water Survey, Prairie Research Institute, <http://www.sws.uiuc.edu/docs/maps/lowflow/background.asp>.

high-flow periods, and electrical equipment within the well house may be damaged during a one percent flood event. More variable precipitation during the years to come may increase the likelihood of drought conditions in the Kankakee River, while also putting the emergency well at greater risk of damage from floodwater.

Nitrates (a form of nitrogen) and algae pose another potential challenge to the city's water supply. Much of the Kankakee River's watershed has been developed for agriculture, which contributes to nitrogen loading through fertilizer use and agricultural runoff. Septic Leaching from septic systems and fertilizer from lawns also add nitrogen to the river. When nitrate levels exceed IEPA limits, the City is required to remove them from its drinking water using a mixture of ammonium and chlorine, resulting in higher operating costs. In the long term, nitrates in the river, combined with phosphorus, warmer temperatures, and lower summer flows from seasonal droughts, may create conditions favorable to algae growth, resulting in blooms similar to those seen on the Fox River during the summer of 2016.²⁰ When severe algae blooms are present, the City may be required to increase chemical treatment quantities (such as activated carbon) or transition to their secondary water supply source, groundwater, which is more expensive to process than river water.

Energy

Commonwealth Edison is the primary provider of electricity in the Wilmington area. All electricity in Wilmington is transmitted by overhead wires, which are vulnerable to damage from strong winds and freezing rain. A series of high voltage towers are located along the millrace, on either side of the millrace dam. These towers are located within the 100-year regulatory floodplain, and may be susceptible to damage during a severe flood or ice jam.

To address the threat of power outages, Commonwealth Edison has begun investing in smart grid infrastructure for its transmission system, which allows grid operators to isolate outages to small geographic areas, reducing the number of customers affected when power lines are damaged. Across the region, these investments have resulted in a 44 percent reduction in storm-related power outages since 2012, and a 42 percent reduction in average outage duration.²¹

Vulnerability to electricity disruptions depends on the availability of backup generators and other failsafe systems. Critical facilities, including police, fire, and the sewer and water plants, maintain backup generators that allow them to remain operation during power outages. When power outages occur, residents without electricity may be exposed to extreme heat or cold, and may have difficulty communicating with service providers. The City of Wilmington currently operates two formal heating and cooling centers—City Hall and the Lion's Club—though they are available by appointment only and are not centrally located.²² The Wilmington Library serves as an informal heating and cooling center within the downtown area, but lacks a backup generator and would not be available during a power outage.

²⁰ LaVito, Angelica, "Algae blooms create foul odor along Fox River," Lake County News-Sun, <http://www.chicagotribune.com/suburbs/lake-county-news-sun/news/ct-Ins-chain-o-lakes-clean-water-st-0824-20160826-story.html>.

²¹ "ComEd Reports to the ICC on 2015 Record Results and Summer Preparedness Strategy," Commonwealth Edison Company, http://www.comed.com/News/Pages/NewsReleases/2016_05_26.aspx.

²² Will County Emergency Management Agency, "Warming & Cooling Centers," <https://www.willcountyema.org/warmingcooling>.

Private Property

One hundred and one structures in the downtown area are located within the 100-year floodplain, including 43 structures in the floodway, which is the highest risk zone for structural damage. Buildings located within the 100-year floodplain have a one-in-four chance of experiencing flood damage during the life of a typical, 30-year mortgage. Since Wilmington joined the National Flood Insurance Program (NFIP) in 1974, 128 damage claims have been paid, totaling \$1,150,000.²³ These funds are critical for replacing damaged property, but do not address the immediate costs of emergency response, temporary relocation, or lost income and financial stress.

Urban flooding also poses a risk to private property. As shown in Figure 6, a large portion of the downtown area has a relatively high-level susceptibility to urban flooding. Currently, urban flooding is minimal in these areas, but this may change as the climate becomes warmer and wetter. Buildings exposed to floodwaters are vulnerable to both acute structural damage, and chronic challenges related to mildew and mold, and because few buildings located outside of the floodplain have flood insurance, property owners in these areas often must cover the full cost of flood cleanup on their own.

The City of Wilmington does not currently have impervious coverage standards for its residential districts or the business district spanning North Water Street and a portion of IL Route 102, meaning property owners in these districts are not required to limit the footprint of buildings, parking, or other impervious surfaces on their lot. Impervious coverage standards help to ensure that sufficient open space is provided, and can serve stormwater management tools. High impervious coverage allowances may be appropriate in some areas, but may lead to more stormwater runoff, exacerbating current flood concerns.

Green Infrastructure and Open Space

Island Park, one of Downtown Wilmington's most distinctive features, faces serious challenges from flooding and erosion. The majority of the island is located within the one percent chance floodplain, though flooding most frequently occurs in South Island Park, where the millrace frequently overflows its banks, and North Island Park at IL Route 53, where insufficient drainage causes moderate to severe ponding.

Flooding in South Island Park likely results from a combination of high water levels from upstream precipitation and outflow from a creek located in Mt. Olivet Cemetery on the eastern bank of the millrace. During heavy rain, the creek discharges water and sediment into the millrace, in which can create a channel that sometimes reaches the main branch of the Kankakee River, fully bifurcating the island and forcing a closure of the park. Erosion resulting from this flow has the potential to damage Park Street, and may reduce the integrity of the island itself. Informal parking during high-capacity events on the island may also contribute to erosion and reduce the ability of local soils to absorb water and sustain plant life.

At the regional scale, Wilmington is closely connected to a large network of high-quality open space, including Midewin National Tallgrass Prairie, the Kankakee River, and numerous properties owned by IDNR and the Forest Preserve District of Will County. These areas provide Downtown Wilmington with a range of ecosystem services, including flood control, water purification, groundwater recharge, and carbon sequestration, in addition to recreational and ecotourism opportunities. The plants and animals that live in these areas evolved to local conditions over thousands of years, and may face significant challenges as the region's climate becomes warmer, wetter, and more variable. Changes in the regional

²³ Will County, "Will County All Hazard Mitigation Plan," http://www.plainfield-il.org/pages/documents/2013WillCountyAHMP_10-19-14.pdf.

climate may reduce the ability of these ecosystems to provide critical services, and create an opening for new invasive species, such as the aggressive kudzu vine, to crowd out native species.²⁴

While residential neighborhoods in the downtown area have a healthy tree canopy, the central business districts has no street trees or other vegetation, resulting in a localized heat island. Local soil conditions—including the presence of underground vaults—may hinder root growth in some areas, though these conditions can typically be overcome through planters, bump outs, and other treatments.

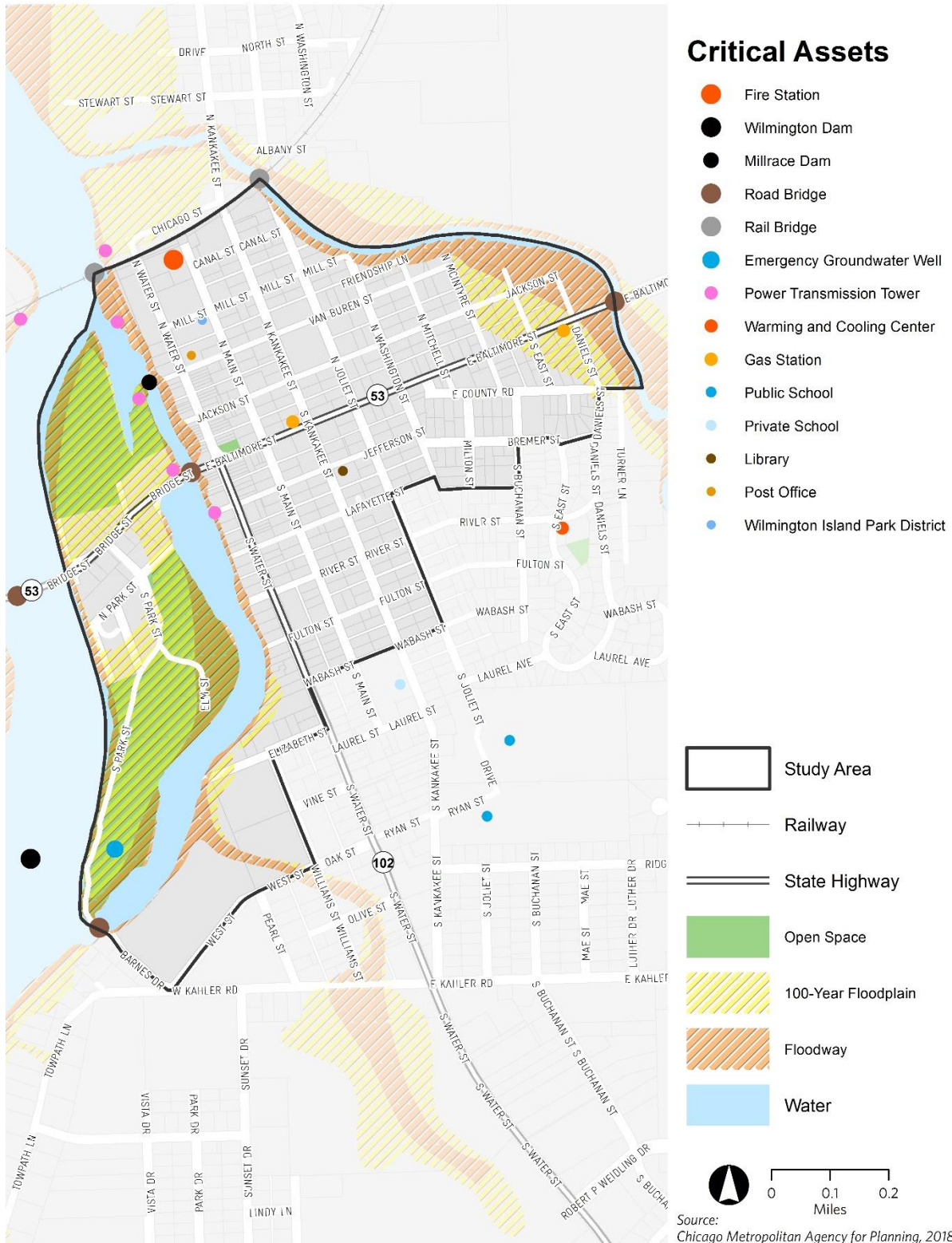
Community Assets

Understanding the relative location and geographic vulnerability of key community assets in Downtown Wilmington is critical for assessing the community's relative exposure to natural hazards. In this context, key community assets refer to critical infrastructure or public facilities. Figure 10 shows the location of these key assets in relation to flood hazard zones. The City's emergency groundwater well, several power transmission lines, and one gas station are located within the 100-year floodplain.

The City's fire station is located within the downtown area, which reduces response time for local residents. City hall and the police department are both located a short drive south of downtown. There are no formal warming and cooling centers in Downtown Wilmington.

²⁴ Hellmann, Jessica J., Knute J. Nadelhoffer, Louis R Iverson, Lewis H. Ziska, Stephen N Mathews, Philip Myers, Anantha M. Prasad, and Matthew P. Peters, "Climate change impacts on terrestrial ecosystems in metropolitan Chicago and its surrounding, multi-state region," *Journal of Great Lakes Research*, 2010, 36, 74-85, <https://naldc.nal.usda.gov/download/49775/PDF>.

Figure 10: Key community assets in Downtown Wilmington



Social Vulnerability

Natural hazards do not affect everyone in the same way, or to the same degree. Key social, demographic, and economic characteristics may cause certain residents and visitors to be more vulnerable to the impacts of natural hazards than others; identifying these groups is crucial for developing an inclusive strategy for addressing these hazards.

Community and health

Natural hazards often have the most severe impacts in communities already experiencing economic, social, or environmental challenges. Low-income and minority communities tend to experience more flooding than more affluent communities, and in the Chicago region, the top ten hottest census tracts by average land surface temperature tend to be disproportionately low-income, minority, and limited-English speaking.²⁵ These areas are not only more vulnerable to climate impacts, but the residents themselves are often less able to adapt to weather-related challenges due to limited financial resources.

Downtown Wilmington has a median household income of \$55,000, which is comparable to the City of Wilmington (\$56,000), but well below the median for Will County (\$76,000). This discrepancy indicates that local residents may have limited ability to prepare for or recover from severe weather events. The majority of residents in Downtown Wilmington are white and English speaking, though Wilmington parks and shops attract a diverse range of visitors, including some with limited English proficiency. To accommodate these guests, cautionary signage at Wilmington Dam is bilingual in English and Spanish. Temporary signage, including road closures and emergency notices, may not be bilingual in all situations.

Residents in the downtown area are more likely to rent their homes than residents in the city at large. Almost 50 percent of downtown residents rent, compared to 35 percent in the entire City of Wilmington. Renters generally have less control over the environmental conditions of their homes than homeowners, which makes them more vulnerable to long-term flood-related impacts, such as mold and mildew. Renters also have less ability to insulate their homes, which may increase the quality of life impacts of extreme heat and cold.

At the individual level, several key characteristics influence vulnerability beyond income, ethnicity, and language. Elderly residents and individuals with disabilities—especially those requiring on going care—are often the most severely affected by natural hazards. Power outages due to thunderstorms, floods, or heat waves can leave residents exposed to extreme heat or cold, which can increase the severity of background health issues.

Approximately 11 percent of downtown residents are over the age of 65, compared to 8.6 percent in the city at large, and 8.1 percent in Will County. Statistics for disabled residents are less readily available. Residents with limited mobility—due to physical limitations or lack of an automobile—face additional challenges. Daily errands, medical care, and checking in with family can be difficult without a car, especially in areas with limited public transportation and pedestrian and bicycle facilities.

²⁵ CMAP, Climate Resilience Strategy Paper, 2016, <http://www.cmap.illinois.gov/documents/10180/517388/Climate+Resilience+Strategy+Paper/dd610883-d00f-407d-808b-484f9800a3f6>.

Municipal Capacity

Wilmington is a small community with limited municipal staff. City policies are developed by the Mayor and City Council, and implemented by the City Administrator and various departments and commissions. The City does not have a planning department, but does retain a private planner for consultation. Because of its small size, the City has a limited tax base, and must make efficient use of its resources. During the years to come, the impacts of climate change will likely increase operating costs for streets, sewers, and other infrastructure, putting further strain on the City's budget. This will require increased coordination, efficiency, and cooperation with partner agencies and neighboring communities. The City already collaborates with surrounding communities for emergency services. In the future, shared services agreements for road maintenance, water supply, or other services may become increasingly necessary.

When assessing vulnerability, it is important to consider that climate change multiplies risks across multiple systems. Wilmington faces a number of non-climate related challenges that require significant investments in both staff hours and municipal funds. In some cases, these competing priorities pose more immediate challenges than climate change and natural hazards. Nonetheless, planning and investing to address the social, economic, and environmental challenges associated with climate change presents an opportunity to mitigate existing challenges as well.

Economic Impacts

Wilmington's economy relies on high-performing infrastructure, natural systems, and human capital. When natural hazards interrupt one of these systems, even temporarily, the city and region can experience meaningful economic impacts. Often, these impacts can be mitigated in advance through cost-effective interventions. Identifying the most critical economic impacts is a useful strategy for prioritizing these strategies.

Travel delays

The most immediate impacts of natural hazards are often road closures and transportation delays. Even in areas where roads remain passable, strong winds, heavy rain, ice, and snow accumulation can increase travel times and reduce road safety. Up to 70 percent of all winter storm-related injuries occur in auto crashes, and 22 percent of all crashes nationwide are weather-related.^{26, 27} Downtown Wilmington is particularly vulnerable to weather-related transportation delays because of the area's high rate of auto commuting (94 percent). While there is no data available for non-work related trips, the limited number of resident-oriented businesses in downtown suggests the majority of these trips are also made by car. Road closures and other delays may result in lost hours of work, or even business closures.

IL Routes 53 and 102 are state designated truck routes that serve nearby intermodal facilities, including CenterPoint Intermodal Center in Joliet/Elwood and RidgePort Logistics Center in Wilmington. Both routes carry more than 500 trucks per day. Local businesses, including the intermodal and logistics centers, rely on efficiently moving trucks through Wilmington. When climate and infrastructure problems interfere with the movement of these trucks, businesses lose revenue, and employees may lose wages. Heavy truck traffic on city streets may also increase maintenance costs for the city, as more frequent freeze-thaw and extreme heat events increase the likelihood of road buckling.

²⁶ Will County, "Will County All Hazard Mitigation Plan," http://www.plainfield-il.org/pages/documents/2013WillCountyAHMP_10-19-14.pdf.

²⁷ Federal Highway Administration, "How Do Weather Events Impact Roads?" U.S. Department of Transportation, https://ops.fhwa.dot.gov/weather/q1_roadimpact.htm.

Business closures and lost revenue

FEMA statistics show that 40-60 percent of small businesses never reopen after closing due to a disaster.²⁸ In Downtown Wilmington, businesses on the western side of Water Street are vulnerable to flooding from the millrace. The majority of these businesses are located within the 100-year regulatory floodplain, and would be required to obtain flood insurance through the NFIP to receive a mortgage, but these policies do not compensate for business interruptions or lost revenue.²⁹ Business closures also result in lost tax revenue for the City and lost wages for employees.

Severe weather, including thunderstorms, winter storms, and extreme heat, can reduce tourism revenue even when businesses remain open. Downtown Wilmington is regionally famous for its antiques cluster, and regularly attracts shoppers from across northeastern Illinois to shop, visit restaurants, and see Route 66 attractions like the Gemini Giant. Increasingly, natural areas such as Midewin National Tallgrass Prairie and the Kankakee River—now a designated National Water Trail—are being seen as ecotourism destinations that could attract cyclists, paddlers, and hikers from across the Midwest. When the weather makes tourism and shopping unattractive, these visitors stay home. During the years to come, a warmer, wetter climate may mean more days with suboptimal weather. The region’s green spaces may also be impacted by habitat shift caused by changing precipitation and rising temperatures.

Looking forward

The analysis contained within this report will inform the recommendations presented in the Wilmington Downtown Plan. Specifically, the plan will highlight green infrastructure recommendations for reducing flooding and shoreline erosion in Island Park, as well as strategies for mitigating the urban heat island effect and creating new pedestrian amenities, such as crosswalks, street trees, and benches. The plan will also call for prioritizing the relocation of the City’s emergency groundwater well, which is currently located in South Island Park, a high-risk flood zone that will likely be affected by increased flooding due to climate change. Together, these strategies will improve the city’s overall resilience and create a stable foundation for continued economic growth.

Implementation of these strategies will require community leaders to implement best practices to address flooding, extreme heat, and other climate-related hazards. A number of organizations in the Chicago region, including the Metropolitan Planning Council, Center for Neighborhood Technology, Openlands, The Morton Arboretum, and Chicago Wilderness, have developed a range of toolkits, model ordinances, and white papers to aid in this process. When using these tools, it is important to remember the City’s unique, local context, including environmental, economic, and demographic factors.

²⁸ FEMA, Make Your Business Resilient,” <https://www.fema.gov/media-library/assets/images/116921>.

²⁹ Federal Alliance for Safe Homes, “Floods: FAQ’s – National Flood Insurance Program,” http://flash.org/peril_inside.php?id=56.