

**NATURAL FEATURES  
AND RESILIENCY**

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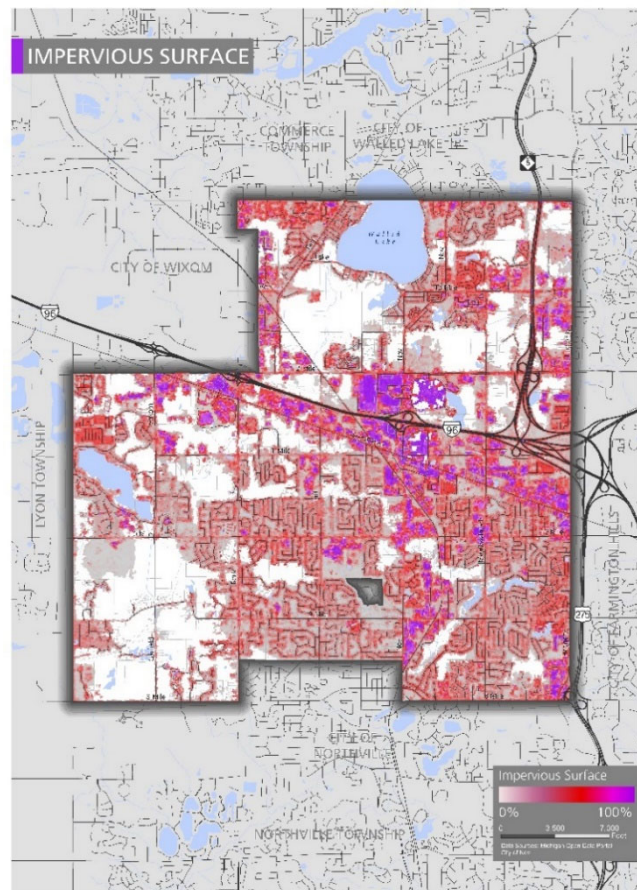
# Natural Features and Resiliency

As suburban communities have grown, the natural environment has historically been compromised to make space for large shopping malls, subdivisions, and office parks. The integrity and value of the natural environment have recently become an influential force in development, and planning decisions. As the climate continues to change, historic policies and practices are insufficient to deal with the new reality of higher temperatures, more extreme participation events, and milder winters. Therefore, planning for climate resilience is an essential part of modern-day planning practice. The following section will inventory the natural features within the City of Novi, discuss their importance to planning, quality of life, and resiliency, and provide strategies to ensure their preservation. In summary:

- » 30% of Novi is covered by an impervious surface
- » Extreme precipitation and flooding are projected to increase
- » Areas with high degrees of impervious surface experience higher ambient temperatures
- » Wetlands and woodlands are valuable assets and receive excellent protection from local ordinances
- » Climate change may impact the viability of certain trees as plant hardiness zones get warmer

## The Built Environment

The built environment is defined as manmade structures, networks, and spaces that have been substantially altered beyond their natural state. A common measure of the built environment is the presence of impervious surfaces. According to SEMCOG's 2010 land use analysis, roughly 30% of the City of Novi



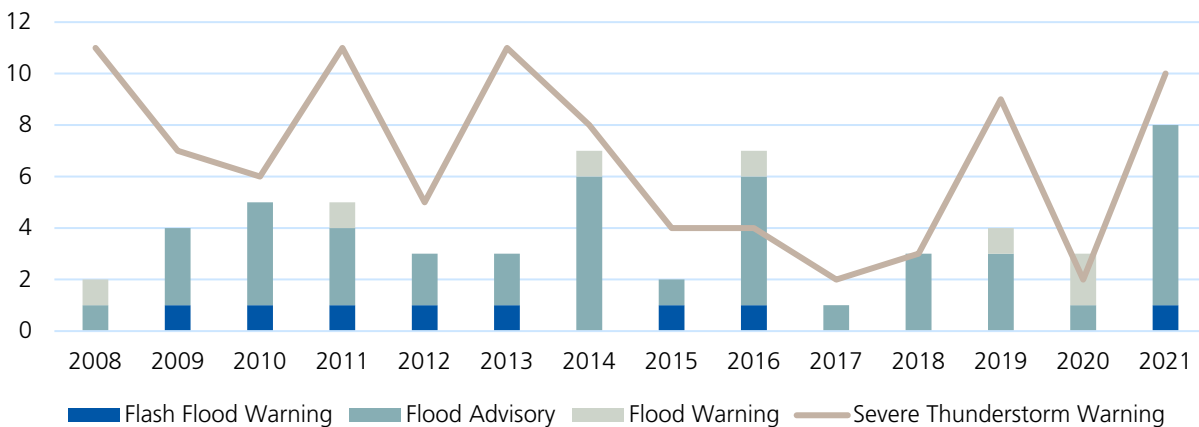
is impervious.<sup>1</sup> Regionally SEMCOG’s impervious surface coverage is 15%, but because SEMCOG includes rural and undeveloped communities, the percentage is lower compared to Novi. The adjacent communities of Farmington Hills and West Bloomfield Township have 37% and 26% impervious surface coverage, respectively.<sup>2</sup> In Novi, impervious surfaces are concentrated along transportation lines, commercial corridors, with parking lots and denser residential development as top contributors.

Areas with high degrees of impervious surface have several impacts on the natural environment and human health. Notably, impervious surfaces increase the risk of flooding because as water moves across the ground it cannot infiltrate into the soil and into the groundwater system. As a result, water flows across the ground entering stormwater systems or ponds in lower-lying areas of the city. As the water flows across the ground, it picks up contaminants which eventually enter the water system. Impervious surfaces also absorb solar radiation increasing the ambient temperatures to higher levels. These higher temperatures can be dangerous and even fatal for sensitive populations like the elderly or those with respiratory conditions.<sup>3</sup>

## Flooding

Over the past 13 years Novi has experienced, on average, 3 flood advisories and 0.5 flood warnings, and 0.6 flash flood warnings annually.<sup>4</sup> In 2021, Novi had more flood advisories than any of the previous 13 years.

Figure XX: Flood Events in Novi



Source: Iowa State University

<sup>1</sup> Environment & Land Use Profile – City of Novi, SEMCOG, <https://semcog.org/community-profiles/communities=2170#Land>

<sup>2</sup> Environment & Land Use Profile, SEMCOG, <https://semcog.org/data-and-maps/community-profiles/custom#Land>

<sup>3</sup> Heat Islands, United States Department of Environmental Protection, <https://www.epa.gov/heatislands/heat-island-impacts#:~:text=Heat%20islands%20contribute%20to%20higher,and%20non%2Dfatal%20heat%20stroke>

<sup>4</sup> Iowan Environmental Mesonet, Iowa State University, <https://mesonet.agron.iastate.edu/vtec/search.php#bypoint/-83.4759/42.4806>

While recent history has not shown any dramatic changes in local weather, the Great Lakes Integrated Science and Assessment Program (GLISA) predicts that Novi will experience an increase of 1.5" to 2" more rain in the next 20 – 40 years. While this amount of rain seems small, it could correlate to one or two more flood events per year, depending on the rate at which it falls.

Flooding can cause substantial damage to property and infrastructure. The Federal Emergency Management Agency (FEMA) quantifies flood risk by mapping various flood zones. The floodway is the channel directly adjacent to a body of water that is above water during periods of normal water elevation. **ADD DESCRIPTION OF FLOODWAY REGULATIONS.** The fringe areas of the floodplain (the entire area at risk of flooding) are either in the 1.0% or the 0.2% annual percent chance of flooding zones. These fringe areas are commonly referred to as the 100-yr and 500-yr flood areas, representing that a flood is likely to occur in each area every 100 or 500 years. However, as precipitation events increase and become more severe, the 1.0% and 0.2% annual chance zones are likely optimistic estimates. **ADD DESCRIPTION OF FLOODPLAIN REGULATIONS.** Infrastructure design and planning that accounts for the 1.0% and 0.2% annual hazards is likely underestimating the true amount of risk.

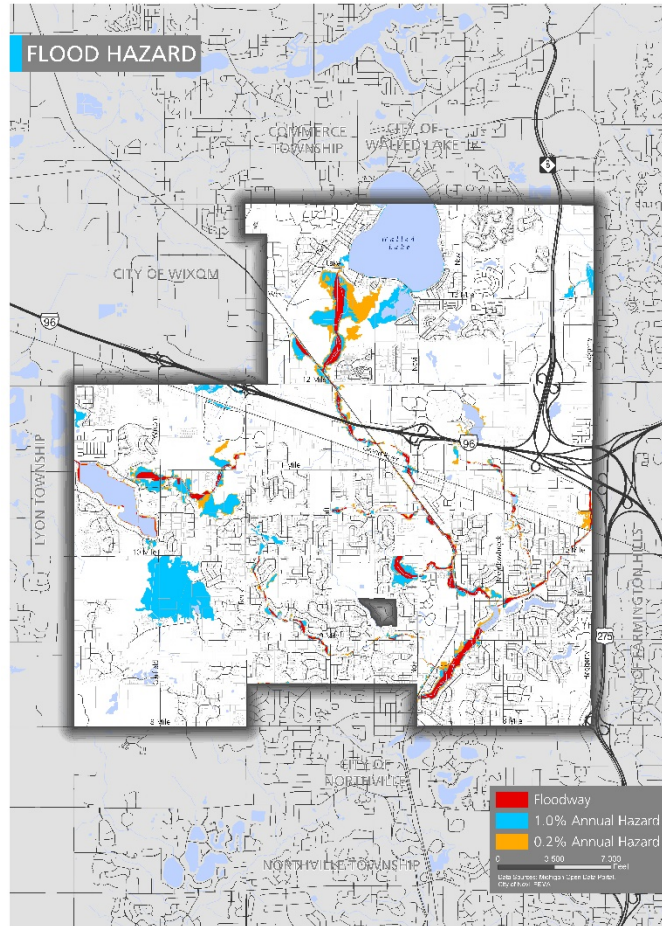
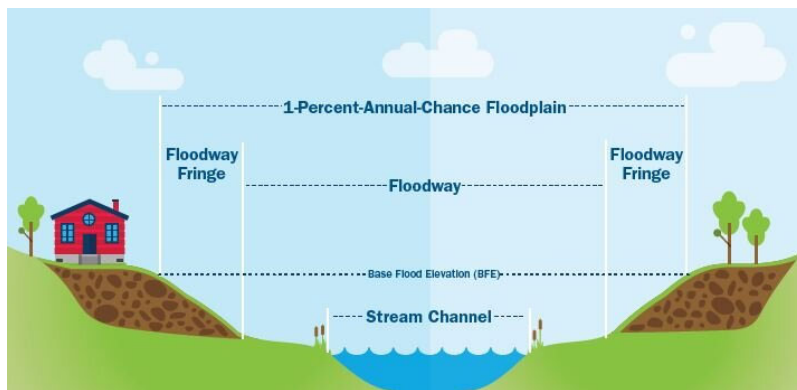


Figure XX: Floodway v. Floodplain



Source: Tulsa Engineering & Planning





A challenge of FEMA data is that it can underestimate true flood risk. First Street Foundation, a climate risk assessment group that analyzes risk at a property level, estimated that nationally 14.6 million properties are at risk of substantial flooding, 70% higher than the number reported by FEMA.<sup>5</sup> First Street Foundation estimates that a 100-year flood event has a 26% chance of occurring over the next 30 years and the 500-year flood event has a 6% chance of occurring over the next 30 years. According to the First Street Foundation, an estimated 496 residential homes, 30 commercial properties, and 4 social facilities are at minor risk from flooding in Novi.<sup>6</sup> While this represents less than 1% of the city’s properties, the impacts are grave.

## Green Infrastructure

Strategies to mitigate flooding impacts include preserving natural areas and capturing/infiltrating stormwater. One of the best tools to capture and infiltrate stormwater is green infrastructure. Broadly defined, green infrastructure includes measures that use plant or soil systems, permeable pavement, or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspiration stormwater and reduce flows to sewer systems or to surface waters.<sup>7</sup> The table titled “Green Infrastructure Methods” shows several common types of green infrastructure that could be included in the city’s Zoning Ordinance or invested in with municipal funds where it found it to be strategic.





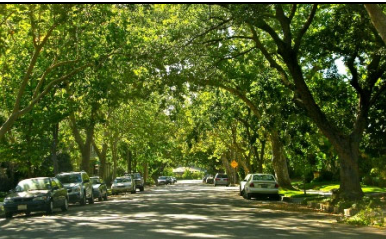
**Table XX: Green Infrastructure Methods**

Method	Description	Example
Rainwater Harvesting	Systems that collect and store rainwater for later use.	
Rain Gardens	Shallow, vegetated gardens that collect and absorb runoff from streets, sidewalks, and roofs.	

<sup>5</sup> First Street Foundation, “First Street Foundation Releases New Data Disclosing Flood Risk of Every U.S. Home”, Jun 2020, <https://firststreet.org/press/2020-first-street-foundation-flood-model-launch/>

<sup>6</sup> Novi Flood Risk, First Street Foundation, [https://riskfactor.com/city/novi/2659440\\_fsid/flood](https://riskfactor.com/city/novi/2659440_fsid/flood)

<sup>7</sup> What is Green Infrastructure?, United States Environmental Protection Agency. <https://www.epa.gov/green-infrastructure/what-green-infrastructure>

Planter Boxes	Boxes along sidewalks, streets, or parking lots that collect and absorb rainwater. These also serve as streetscaping elements.	
Bioswales	Linear and vegetated channels, typically adjacent to a road or parking lot, that slow, retain, and filter stormwater.	
Permeable Pavement	Pavement that absorbs, filters, and stores rainwater.	
Green Roofs	Vegetated roofs that absorb and filter rainwater.	
Tree Canopy	Trees reduce and slow stormwater flow.	

Source: United States Environmental Protection Agency

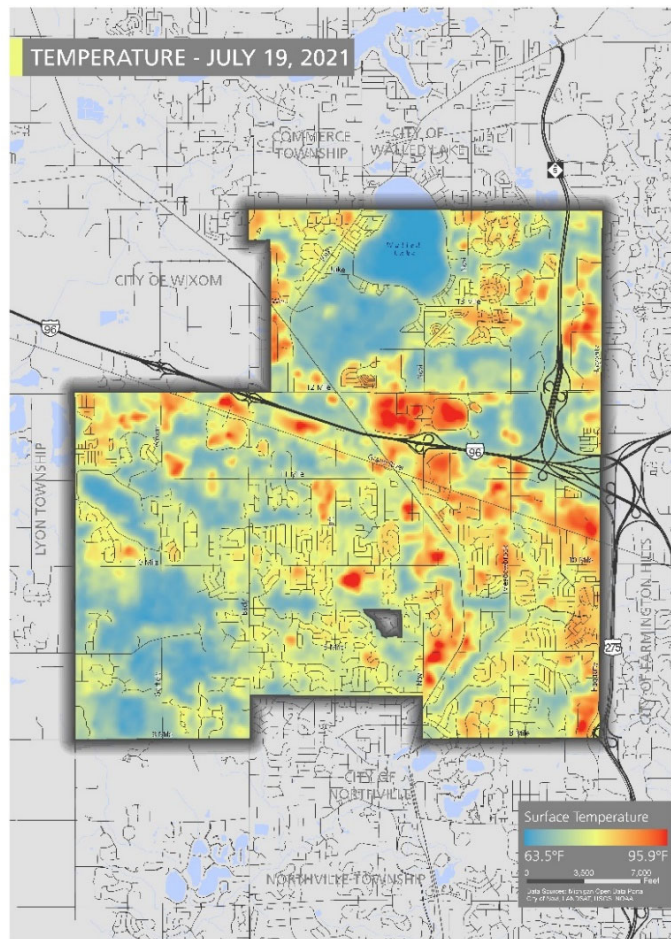
Typically, public investment leads the way in the implementation of green infrastructure. Streetscapes and public facility improvements/construction often include green infrastructure elements. **ADD EXAMPLE OF PAST WORK THE CITY HAS DONE THAT INCLUDED GREEN INFRASTRUCTURE ELEMENTS.** To incentivize private investment to adopt green stormwater practices the city could require development with a certain amount of impervious surface to

incorporate green infrastructure or offer development bonuses (additional buildable area, landscaping credits, etc.) for projects that incorporate green infrastructure.

Natural areas, open space, and parks, while not explicitly green infrastructure, serve a similar purpose. These areas are often better at capturing stormwater because they more closely resemble or are a natural system. Unlike the green infrastructure examples discussed previously, natural spaces are not retrofitting existing space to serve a stormwater purpose but are inherently stormwater infiltration systems. In addition to providing recreational and aesthetic enhancements natural areas, open space, and parks should be planned for as stormwater resources.

## Urban Heat Island

The higher temperatures created by impervious and large surfaces absorbing solar radiation are called the urban heat island effect. Urban and developed areas tend to experience higher temperatures compared to more natural areas. The map titled “Temperature – July 19, 2021” shows the surface temperature in Novi. The temperature was derived from satellite data captured on July 19, 2021. Temperature ranges vary across the city, swinging over 30 degrees depending on where you are. As evident on the map, the mall and big-box commercial center along 12 Mile and Novi Rd is the hottest area in the city, a result of the vast parking and large structures. The industrial areas and high school also experience higher temperatures compared to the rest of the city. The reported high temperature on July 19, 2021, was 83 degrees Fahrenheit indicating that areas of Novi experience temperatures over 10 degrees higher than the reported high.<sup>8</sup>



High ambient temperatures have implications for human health and contribute to heat-related illness and complications. The elderly, children, and low-income populations are particularly susceptible to complications resulting from high temperatures. From 2004 to 2018, there were an

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<sup>8</sup> Weather Underground – History, <https://www.wunderground.com/history/daily/KPTK/date/2021-7-19>

average of 704 heat-related deaths annually in the United States.<sup>9</sup> Additionally, elevated ambient temperatures require climate control systems (air conditioners) to work harder to keep indoor temperatures at a comfortable level, requiring more energy. Given that the current energy grid is still reliant on fossil fuels, increased energy needs correlate to increased greenhouse gas production, which drives temperatures higher over time. . The primary mitigation strategy to reduce the impact of urban heat islands is increasing the tree canopy and vegetation. Plants cool ambient temperatures in several ways, shading and releasing water vapor into the air through evapotranspiration. Shade trees are estimated to reduce household energy consumption by 5% - 15%.<sup>10</sup> To reduce the heat islands around Novi's shopping centers and industrial areas parking should be broken up with vegetated parking islands. Additionally, reducing parking requirements overall can decrease the urban heat island by limiting the amount of impervious surface that absorbs and radiates solar radiation.

## Renewable Energy

Critical to transitioning to a sustainable and climate resilient future is the transition of the electricity grid away from fossil fuels and towards renewable sources. In suburban communities, like Novi, there is limited opportunity for the adoption of utility grade renewable energy like solar arrays or wind farms. However, personal systems like rooftop solar panels are an effective way of incorporating renewable energy into Novi's existing land use fabric. Novi's zoning ordinance permits rooftop solar panels in all districts as an accessory use, allowing for the widespread adoption of solar facilities across the city. It is estimated that rooftop solar systems can offset household energy costs by 73% - 99%, reducing supplemental energy needs.<sup>11</sup>

## The Natural Environment

The natural environment includes natural areas both native and constructed. The preservation and enhancement of the natural environment is an essential part of community planning because of the numerous ecosystem services natural spaces provide humans. Generally, ecosystem services fall into one of four categories supporting (soil formation, photosynthesis), provisioning (food, water, materials), regulating (pollination, flood control), and cultural (aesthetics, recreation, education). These benefits are essential for human existence and for creating healthy and vibrant communities.

## Wetlands

Wetlands are one of the most unique and fragile ecosystems, they provide numerous ecosystem services ranging from water filtration/capture to critical animal habitats. Wetlands have the unique capacity to retain large amounts of water and during periods of excessive precipitation. and slowly release it into the environment over time, reducing the impacts of flooding. Because of their

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<sup>9</sup> Heat Islands, United States Department of Environmental Protection, <https://www.epa.gov/heatislands/heat-island-impacts#:~:text=Heat%20islands%20contribute%20to%20higher,and%20non%2Dfatal%20heat%20stroke.>

<sup>10</sup> Palmer, L., "Shade Trees help Save Energy", Yale Climate Connections, Mar. 2016, <https://yaleclimateconnections.org/2016/03/shade-trees-help-save-energy/>

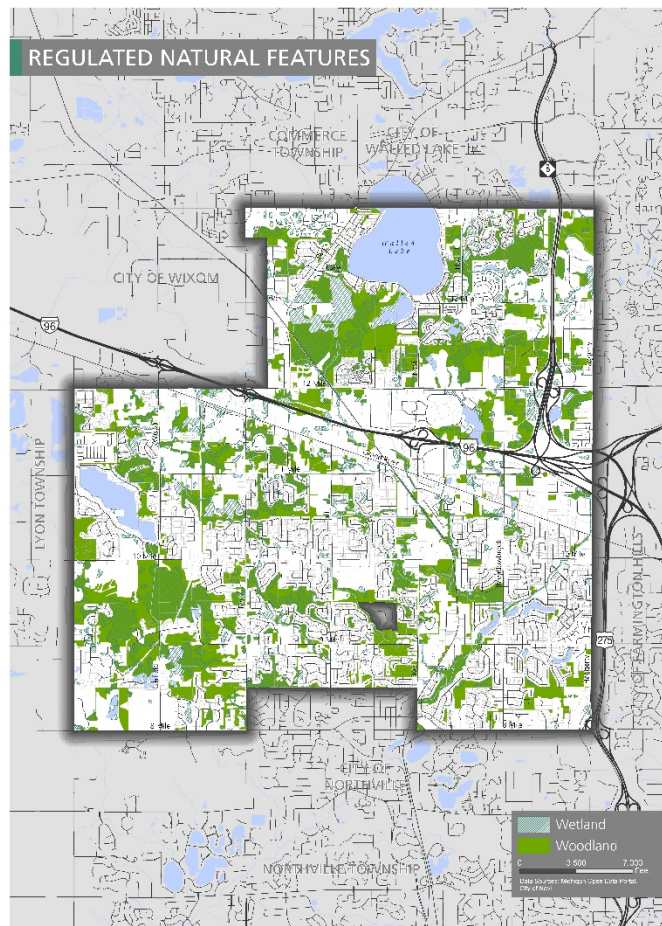
<sup>11</sup> Michigan Solar, EnergySage, <https://www.energysage.com/solar-panels/mi/>



sensitivity and importance to the broader ecosystem wetlands are tightly regulated. Wetlands larger than five acres or located within 500 feet of a stream are regulated by the Michigan Department of Environment, Great Lakes, and Energy (EGLE). Wetlands that are not regulated by EGLE are regulated by Novi. Activity within the wetlands is tightly restricted by the city ensuring the preservation of these sensitive features, however, the areas adjacent to wetlands do not receive such protection. The lack of buffering around Novi's designated wetlands means they are missing a layer of physical and environmental protection as buffers can aid in the filtering of pollutants and contaminants before they reach the wetlands. Additionally, many areas next to wetlands are mowed lawns and common lawn fertilizers can negatively alter the delicate nutrient balance of a wetland. **Requiring a 15-foot native vegetated buffer around a wetland through a revision to the Zoning Ordinance can ensure the health of Novi's wetlands.**

## Woodlands & Trees

Woodlands and trees are one of the most valuable natural features. Woodlands and trees provide natural screening, buffer noise and wind, stabilize soil, provide wildlife habitat, reduce energy consumption through shading, and naturally cool the surrounding air. It is estimated that a single tree can provide an equivalent value of \$73 of air conditioning, \$75 of erosion control, \$75 of wildlife habitat, and \$50 of air pollution reduction. Over 50 years, a single tree can provide a \$57,151 equivalent value of ecosystem services.<sup>12</sup> In Novi, woodlands and trees are protected through the Woodlands Protection Ordinance which was adopted to preserve woodlands and trees in the face of spreading development and increasing demand for land. The ordinance applies to land designated as a regulated woodland, as shown in the map titled "Regulated Natural Features," and any tree with a diameter breast height (DBH) of 36" or greater. Requirements of the ordinance include obtaining a permit to remove, damage, or significantly alter any tree or land regulated by the ordinance, protecting designated woodlands during the construction process, and mandatory tree relocation if land must be cleared. Novi's Woodland Protection Ordinance is a



<sup>12</sup> Kuhns, M., "What is a Tree Worth", Utah State University Forestry Extension, <https://forestry.usu.edu/trees-cities-towns/urban-forestry/what-is-a-tree-worth#:~:text=They%20have%20found%20that%20a,a%20tree%20value%20of%20%2457%2C151.>

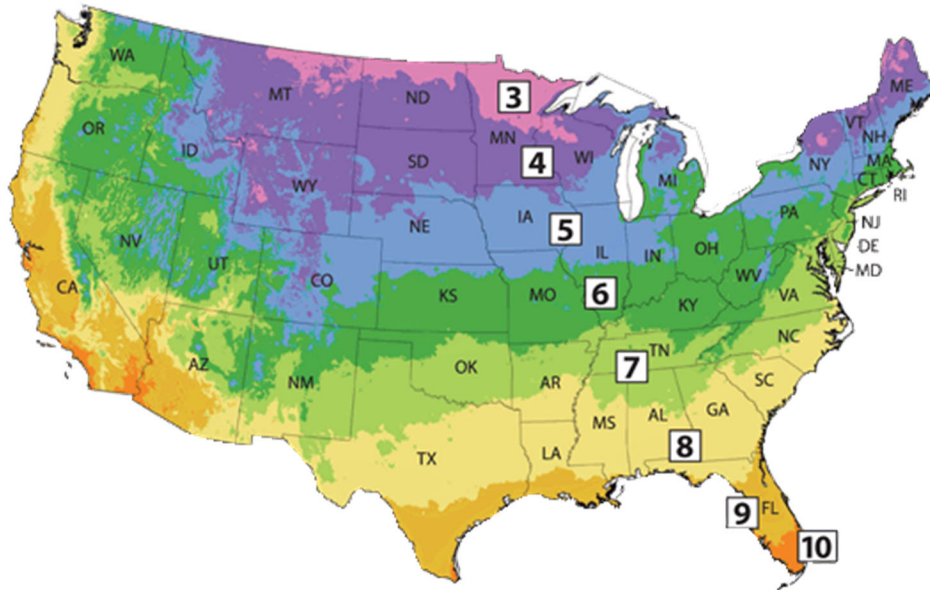


model for woodland and tree preservation and ensures that these vital natural features are preserved into the future.

In recognition of the efforts Novi has undertaken to preserve the woodlands and trees, the city received Tree City USA designation. Novi has been a Tree City for the past 30 years and over the past 12 years has received the Growth Award which recognizes additional efforts and ongoing preservation and maintenance of woodlands and trees.<sup>13</sup> *The city should continue its efforts to preserve, support, and expand woodland and tree preservation.*

While the city has adopted policies to preserve the woodlands and trees from development and direct human action, climate change poses an additional threat. Rising temperatures can make it challenging for trees, especially those native to cooler environments, to survive. Hardiness zones are a standard measurement ranging from 1 to 11 that can be used to determine what plants will survive in the local area. Currently, Novi is in zone 6 but by the end of the century it is estimated that Novi will be in zone 8.<sup>14</sup> *Planting requirements in the Zoning Ordinance, Woodland Protection Ordinance, and city policies should be reviewed to ensure that plants being recommended for planting can tolerate warmer hardiness zones.*

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*Source: MichiganBulb*

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<sup>13</sup> Tree City USA, <https://www.arboday.org/programs/treecityusa/growth-award/>

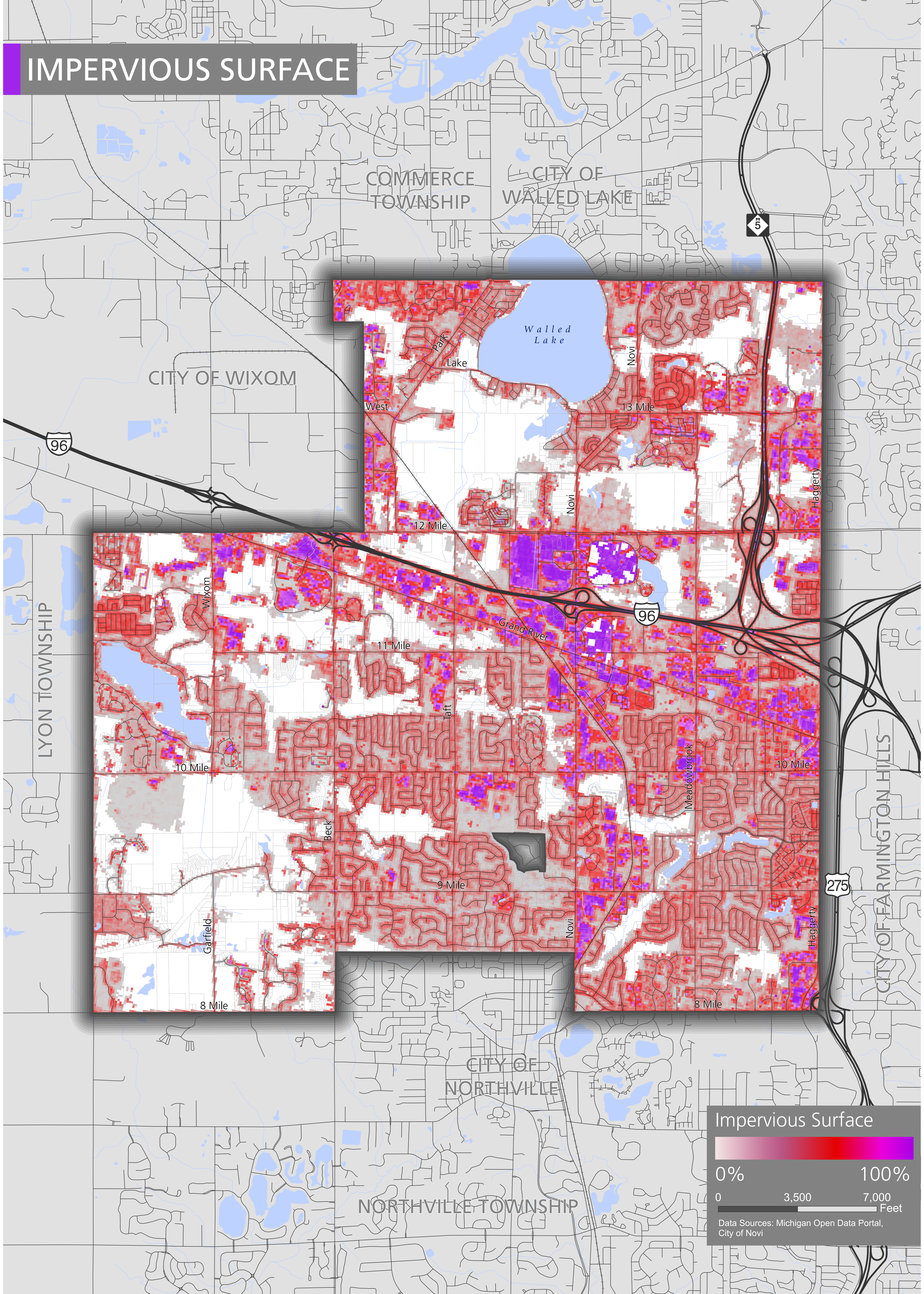
<sup>14</sup> United States Geologic Survey – Office of Sustainability and Climate, Climate Change Pressures in the 21<sup>st</sup> Century, <https://storymaps.arcgis.com/stories/9ee0cc0a070c409cbde0e3a1d87a487c>

## Invasive Species

Species that are non-native and whose introduction to a new area will cause harm to the local ecosystem are considered invasive species. Invasive species can outcompete native species and overwhelm local ecosystems, so it is important to monitor their spread and introduction. Novi has taken aggressive steps to prevent the spread of invasive species by physically removing invasive species in city parks. Warming temperatures, as a result of climate change, can broaden the spread of invasive species. The milder winters allow plants, animals, and insects that may have been restricted by the cold to move farther north. These invasive species that may not be a current threat will become increasingly more common in the future. **Novi should continue efforts to remove and control existing invasive species and monitor any new invasive species being reported in central and northern Ohio.**



# IMPERVIOUS SURFACE



COMMERCE TOWNSHIP

CITY OF WALLED LAKE

CITY OF WIXOM

LYON TOWNSHIP

CITY OF FARMINGTON HILLS

CITY OF NORTHVILLE

NORTHVILLE TOWNSHIP

Impervious Surface

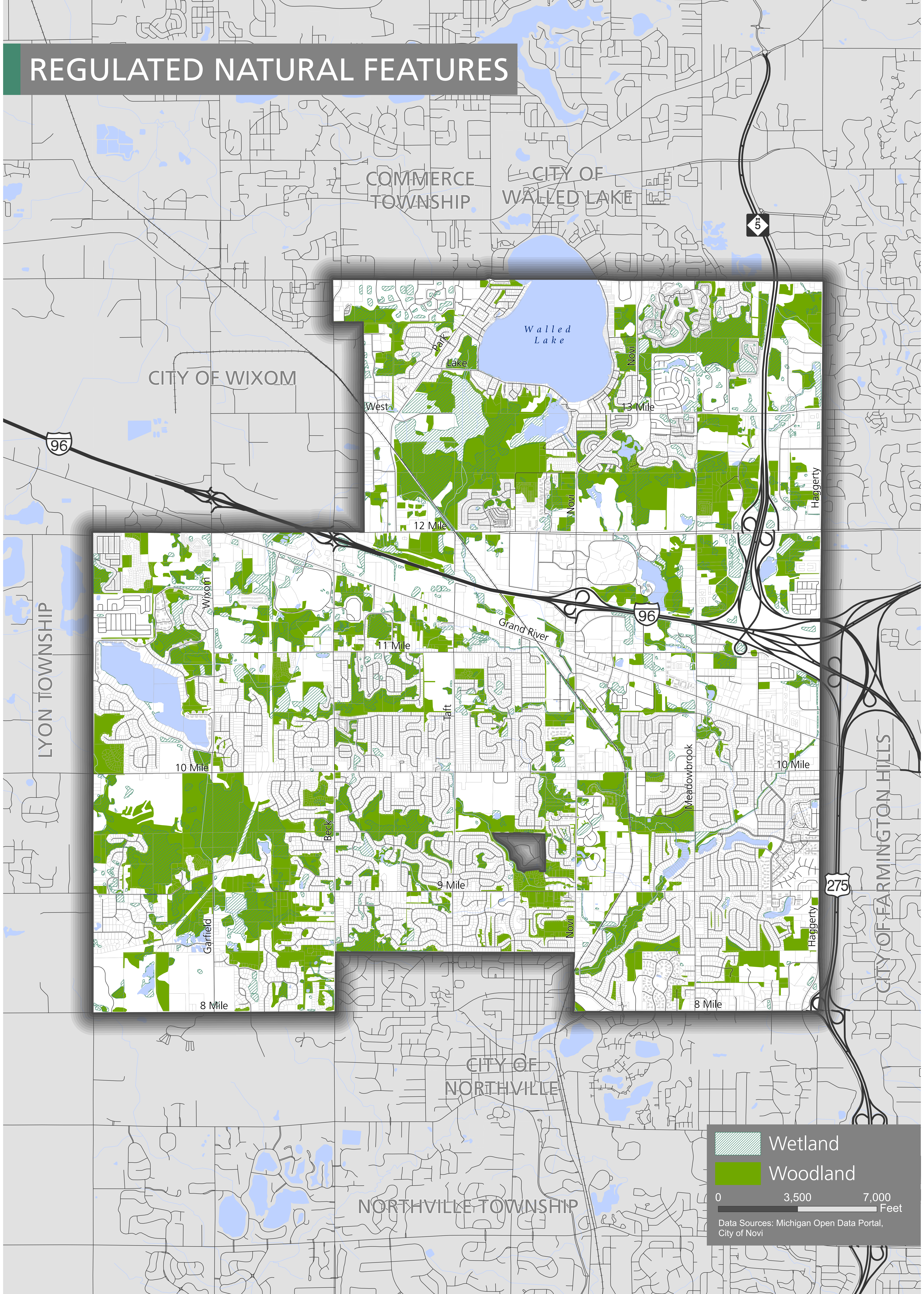
0% 100%

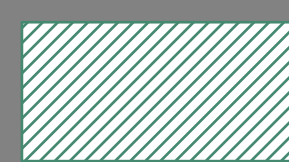
0 3,500 7,000 Feet

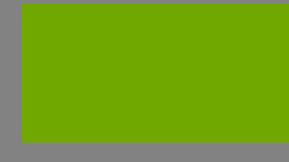
Data Sources: Michigan Open Data Portal, City of Novi



# REGULATED NATURAL FEATURES



 Wetland

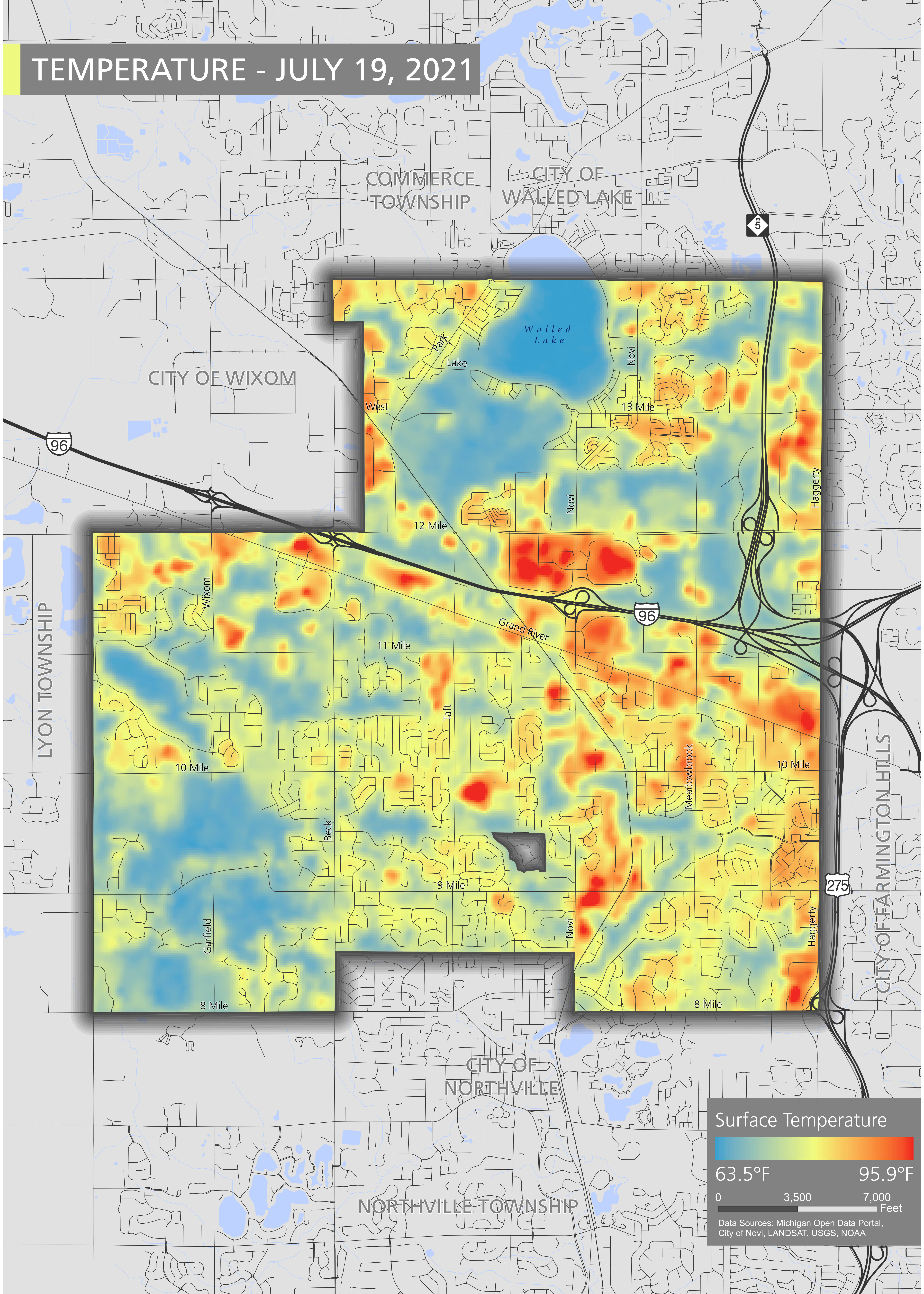
 Woodland

0 3,500 7,000 Feet

Data Sources: Michigan Open Data Portal, City of Novi



# TEMPERATURE - JULY 19, 2021



Surface Temperature

63.5°F 95.9°F

0 3,500 7,000 Feet

Data Sources: Michigan Open Data Portal, City of Novi, LANDSAT, USGS, NOAA