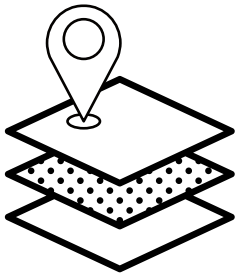
Washtenaw County Conservation District

COMMUNITY TREES MAP SET: YPSILANTI TOWNSHIP

2022

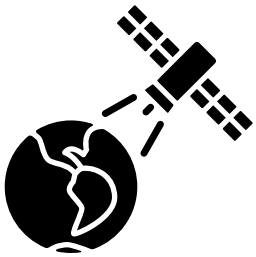
A GUIDE TO THE MAP SET

WHAT IS GIS?



GIS is the abbreviation for geographic information systems, computer software that allows the user to overlay multiple layers of information, such as streets, buildings, and vegetation, on the earth's surface. GIS can help to better understand the distribution of these elements and discover relationships and patterns.

TERMS



LiDAR is the abbreviation for light detection and ranging, a remote (i.e. satellites or planes) sensing technology that can calculate the height of an object, such as buildings or vegetation, on the earth's surface.

Aerial photographs and **satellite imagery** are both remotely sensed images distinguished by the altitude and characteristics of the sensors, namely cameras or electronic scanners. In general, data taken at low-altitude captures more detail, but covers a smaller area. Some sensors can capture energy from portions of the electromagnetic spectrum, such as infrared, that the human eye cannot see! These additional wavelengths, or bands, provide more data to help distinguish between features on the ground.

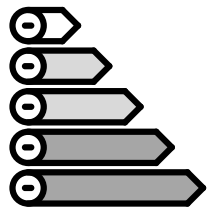
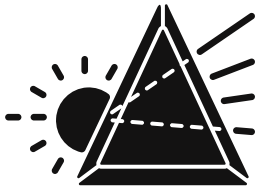


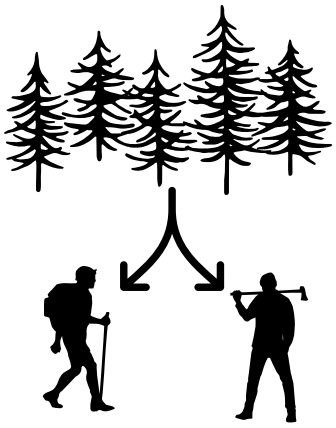
Image classification is the task of categorizing pixels based on their spectral characteristics in a raw image. **Supervised** classification means the analyst teaches the software to classify the pixels, while **unsupervised** means the classes are assigned based on the distribution of values. The final result might be a map of land cover classes (agriculture, urban, forest, etc.), impervious surfaces, or tree canopy cover.



NAIP is the abbreviation for USDA's National Agriculture Imagery Program which, every three years, collects four-band "leaf-on" data (i.e. during the growing season) at a 1-meter (about 3.2 feet) resolution. The four-bands are red, green, blue, and near infrared, which can help distinguish healthy and diseased vegetation.

Washtenaw County Conservation District

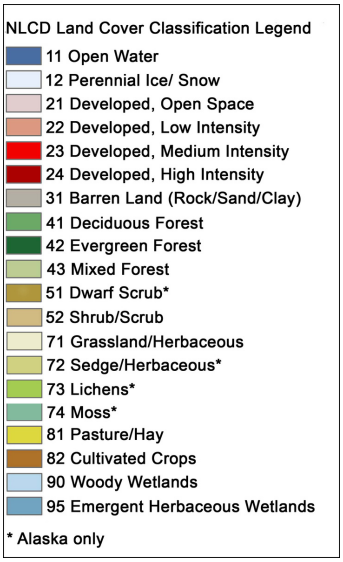
TERMS CONTINUED



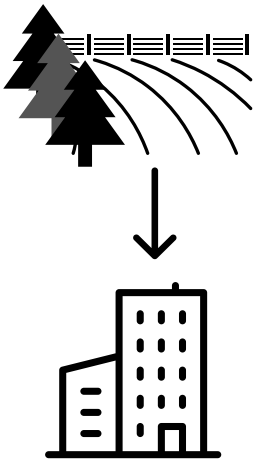
Land cover is the physical land type (forest, open water, wetlands, crops) and can be determined from remotely sensed images.

Land use is how people are using the land (recreation, industrial, residential, agriculture, commercial) and cannot necessarily be determined using satellite imagery or aerial photographs.

NLCD stands for National Land Cover Database, which provides nationwide United States data on land cover and land cover change at a 30m resolution. Since 2001, consistent methodologies and collection at 2-3 year intervals enables monitoring and trend assessments of land cover and associated changes over time. See the side bar for a brief overview of the land cover classes.



GRASS GIS, Geographic Resources Analysis Support System, is a free and open-source GIS software that began in 1982. It was developed as an international team effort that includes scientists and developers from various fields, including federal U.S. agencies, universities, and private companies. However, like most free software, it relies on users to develop new tools and applications and refine existing ones. **QGIS** is another example of a volunteer-driven, free and open-source GIS software that relies on users to improve and advance the product. **ArcGIS**, produced by Esri, is an example of a GIS software that is maintained and updated by a for-profit company. Selecting the appropriate GIS software might depend on the application, models to be integrated, and analyst/user comfort level,



FUTURES, FUTure Urban-Regional Environment Simulation, is an open-source land change model developed by the Landscape Dynamics Group at NC State University to examine regional-scale impacts of urbanization on the environment. It uses base data of land cover maps through time, as well as existing socio-economic, environmental (e.g. protected lands), or infrastructure (e.g. roads), and historical and projected population data to predict where future development is likely to occur.

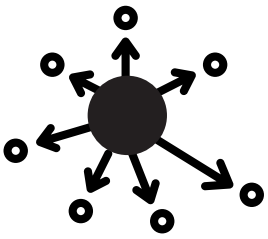
Washtenaw County Conservation District

TERMS CONTINUED

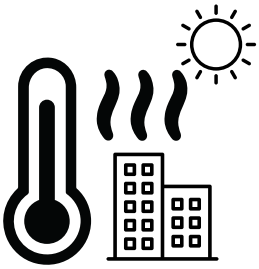
Stormwater runoff is snow melt or rainfall that, instead of soaking into the soil, flows over the ground and into stormdrains or waterbodies. Runoff doesn't receive any treatment, so anything it picks up (trash, chemicals, bacteria, sediment, etc.) can be flushed into our streams, rivers, and lakes and cause impairments for wildlife and human use. The large volume of runoff can also cause flooding, streambank erosion, and wash away habitat for wildlife.

Impervious surfaces prohibit the infiltration of water and are generally man-made structures, such as roads, sidewalks, buildings, parking lots, etc. Higher percentages of impervious surfaces in an area correspond to lower infiltration rates (ability of water to absorb into the soil) and increases in stormwater runoff.

Habitat connectivity is concerned with wildlife's ability to migrate between suitable environments necessary for survival, reproduction, and life cycle. As landscapes are increasingly developed, habitats, such as forests, may be fragmented into smaller areas which may not be suitable for a particular species or may not provide all elements necessary for a creature's life cycle.



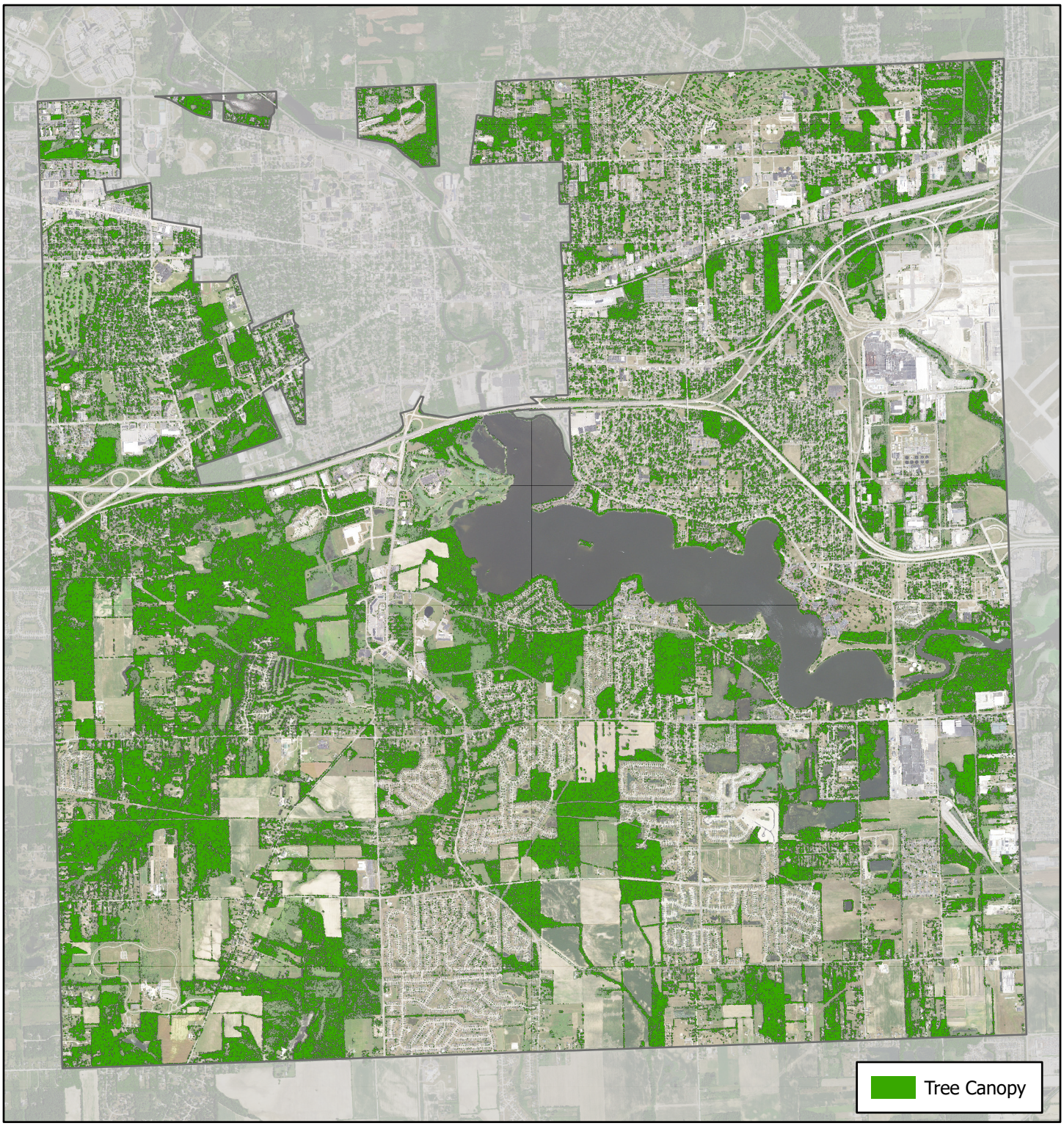
Urban heat islands (UHI) are metropolitan areas that are a lot warmer than neighboring rural areas due to a higher percentage of materials that absorb and trap heat from the sun, such as buildings and roadways. UHIs often have higher energy costs, air pollution levels, and heat-related illness and mortality. Trees and other vegetation help to counteract this effect by shading surfaces, deflecting radiation, and releasing moisture.



Census tracts are small, semi-permanent subdivisions of a county used in statistical analyses to determine trends in an area over time and managed by the US Census Bureau.

Washtenaw County Conservation District

Ypsilanti Township: Tree Canopy



This map identifies tree canopy, the leafy cover provided by branches, and illustrates density and distribution across the township. The placement of trees influences the many social, economic, and environmental benefits they provide. Tree canopy was determined using aerial photography and LiDAR data.

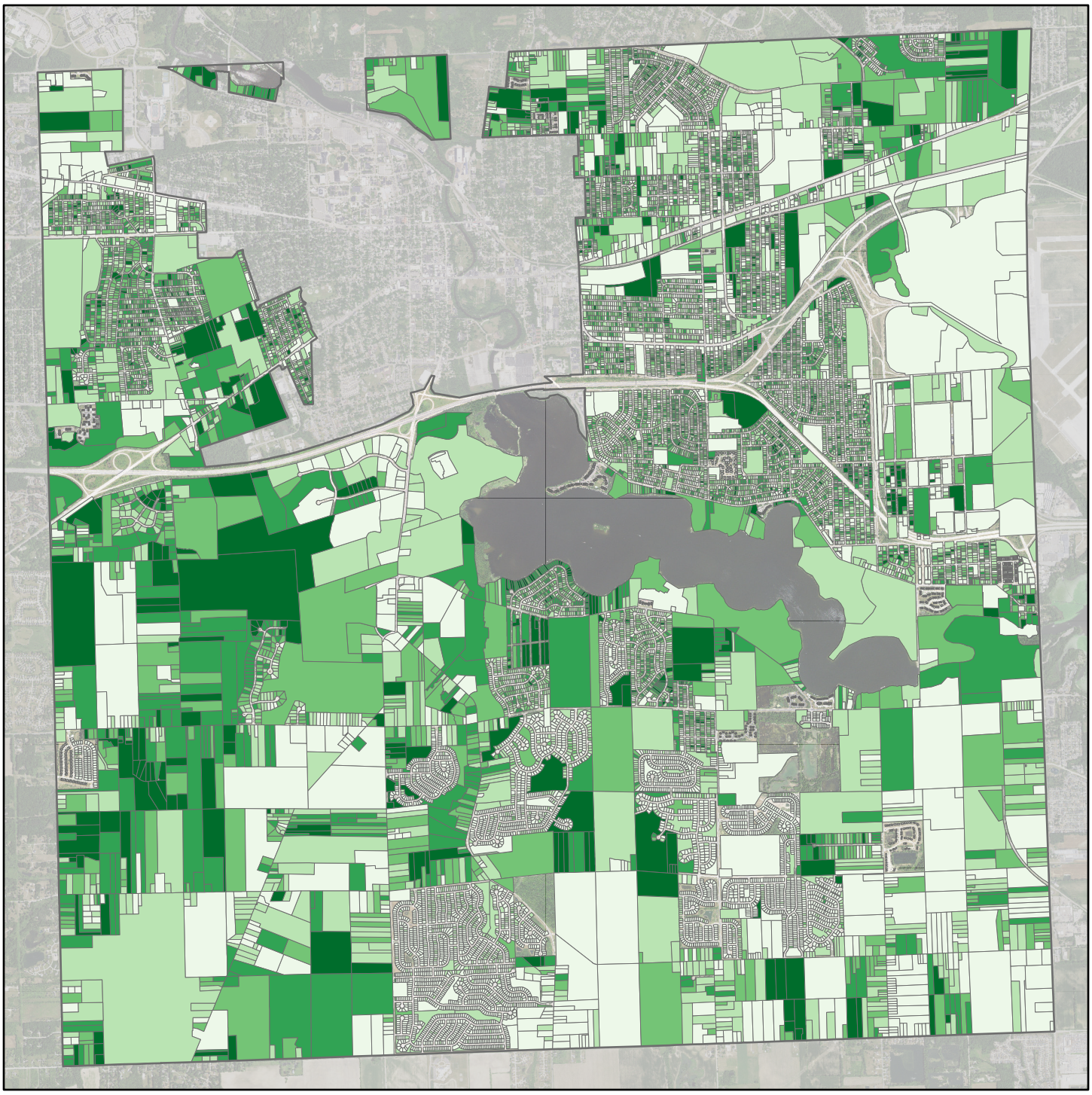
About 23% (6600 acres) of the total area of Ypsilanti Township is covered by tree canopy.

N

0 0.5 1 2 Miles

Data sources: NAIP 2020 (Basemap), Washtenaw County GIS Program (Border and LiDAR)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 2/23/2022

Ypsilanti Township: Tree Canopy Cover (All Parcels)



This map depicts percent tree canopy cover in all parcels. Tree canopy was determined using an unsupervised clustering algorithm applied to 2020 NAIP Aerial Photography in combination with 2017 LiDAR data and then aggregated by land parcel. Missing parcels are designated "open spaces" for nearby housing associations and do not get their own parcel ID, but are preserved areas.

Mean tree canopy in all parcels: 18%

Tree Canopy

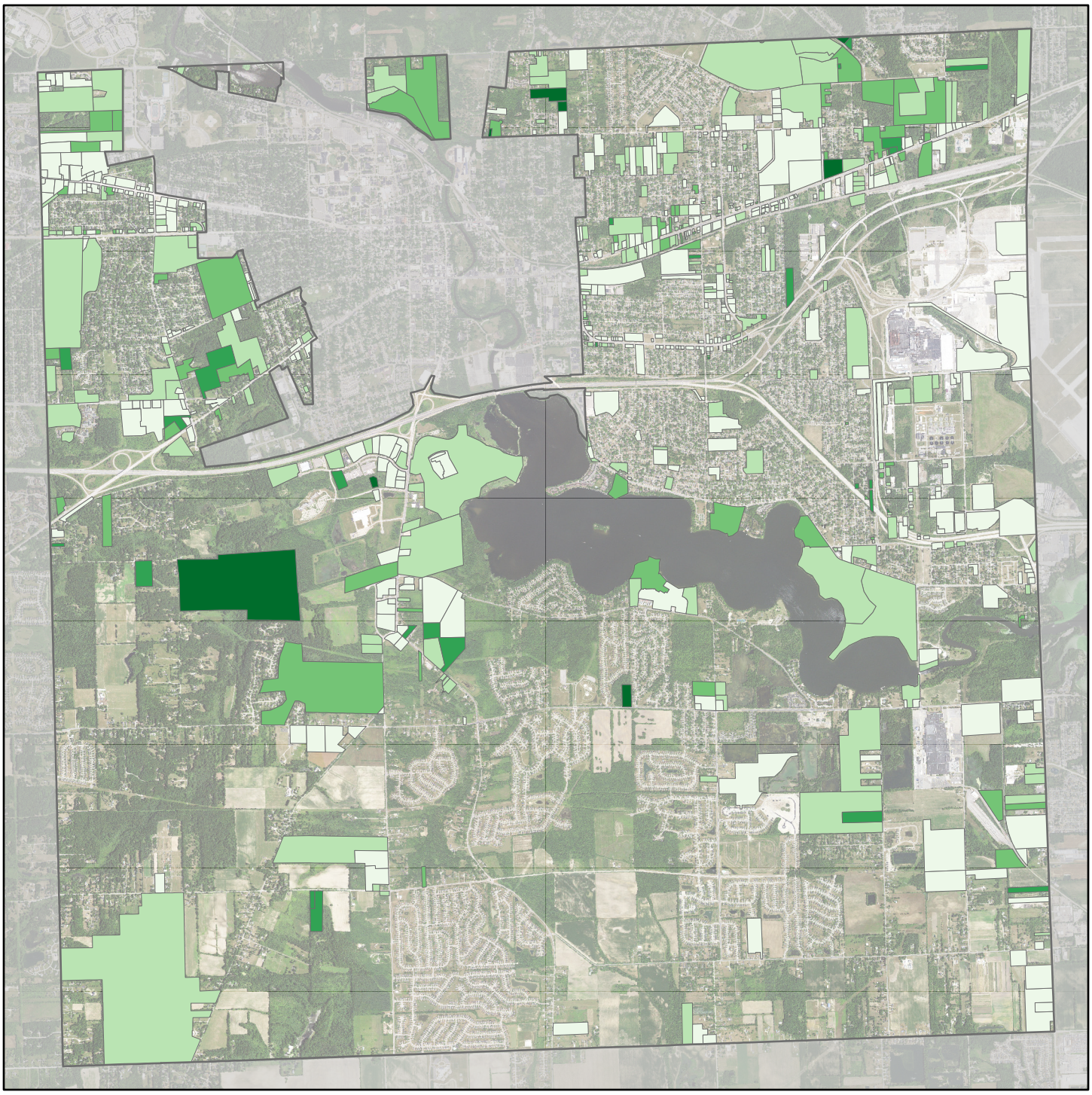
- 0-10%
- 10.1-25%
- 25.1-40%
- 40.1-60%
- 60.1-100%

N

0 0.5 1 2 Miles

Data sources: NAIP 2020 (Basemap and canopy), Washtenaw County GIS Program(LiDAR and Parcels)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 3/21/2022

Ypsilanti Township: Tree Canopy Cover (Commercial)



This map depicts percent tree canopy cover in commercial parcels. Tree canopy was determined using an unsupervised clustering algorithm applied to 2020 NAIP Aerial Photography in combination with 2017 LiDAR data and then aggregated by land parcel. Concurrent zoning revisions may have changed parcel categories. See Township's website for updates.

Mean tree canopy in commercial parcels: 12%

Tree Canopy

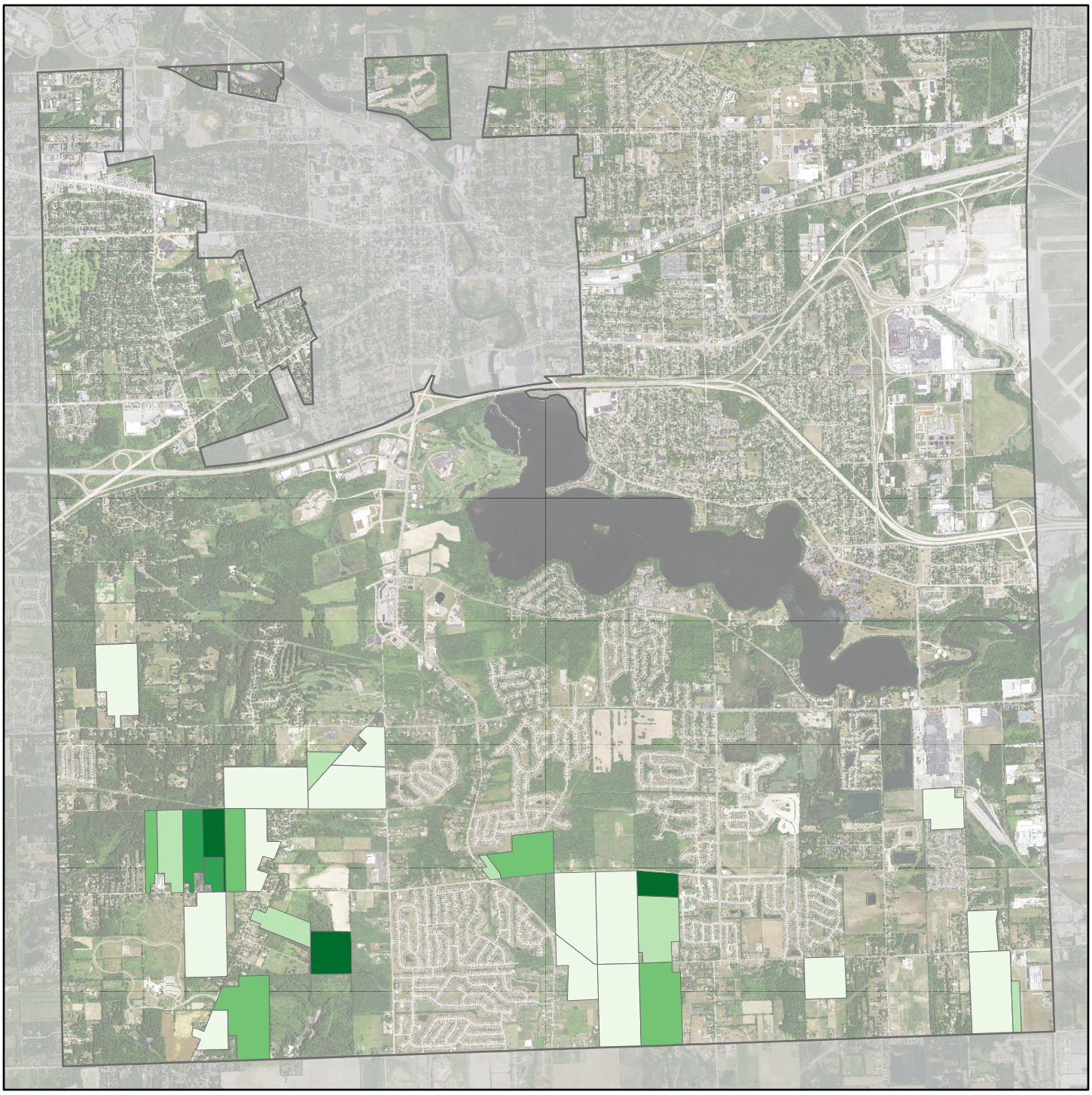
- 0-10%
- 10.1-25%
- 25.1-40%
- 40.1-60%
- 60.1-100%

N

0 0.5 1 2 Miles

Data sources: NAIP 2020 (Basemap and canopy), Washtenaw County GIS Program (LiDAR and Parcels)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 3/21/2022

Ypsilanti Township: Tree Canopy Cover (Agriculture)



This map depicts percent tree canopy cover in agricultural parcels. Tree canopy was determined using an unsupervised clustering algorithm applied to 2020 NAIP Aerial Photography in combination with 2017 LiDAR data and then aggregated by land parcel. Concurrent zoning revisions may have changed parcel categories. See Township's website for updates.

Mean tree canopy in agricultural parcels: 20%

Tree Canopy

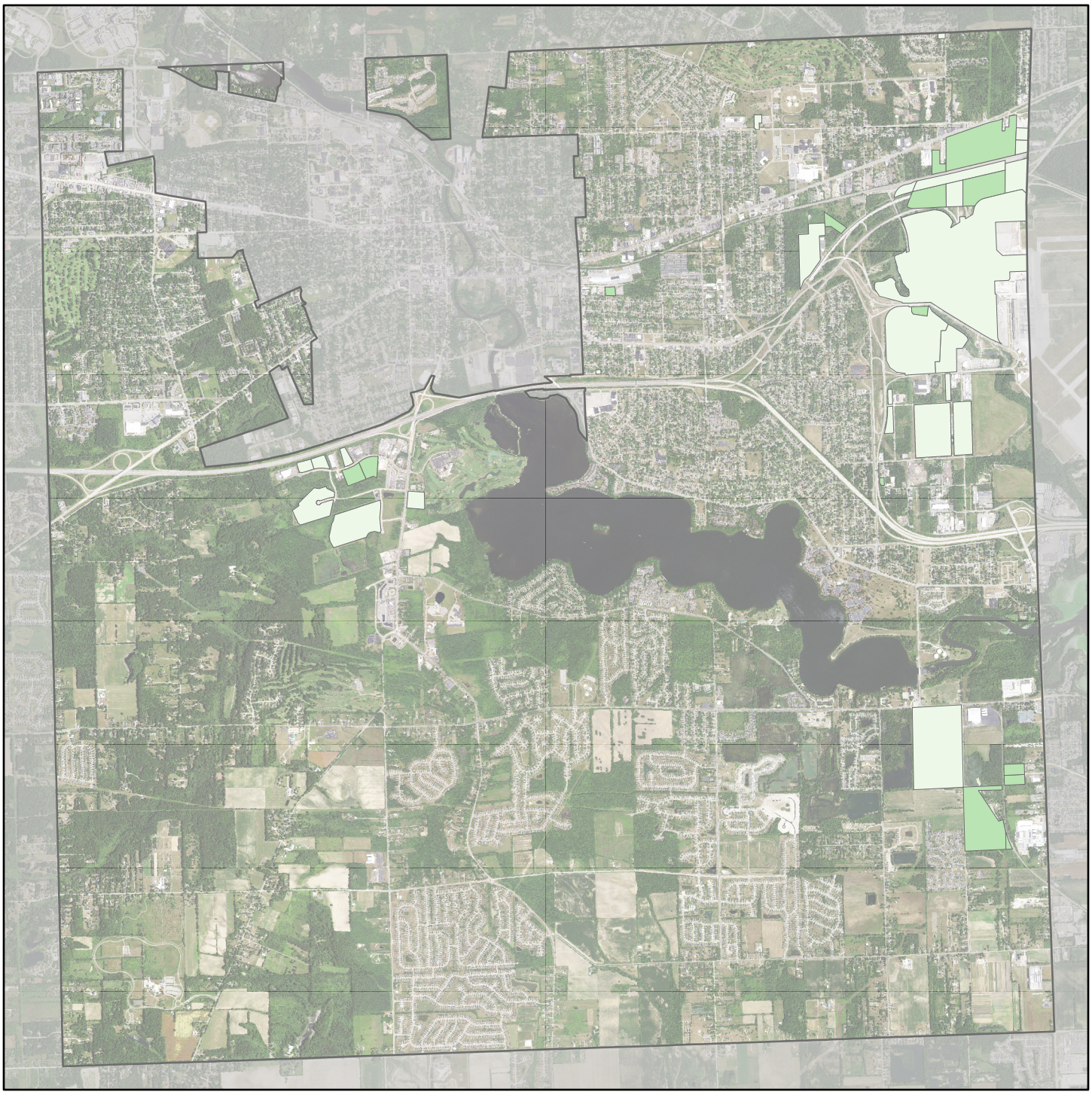
- 0-10%
- 10.1-25%
- 25.1-40%
- 40.1-60%
- 60.1-100%

N

0 0.5 1 2 Miles

Data sources: NAIP 2020 (Basemap and canopy), Washtenaw County GIS Program (LiDAR and Parcels)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 3/21/2022

Ypsilanti Township: Tree Canopy Cover (Industrial)



This map depicts percent tree canopy cover in industrial parcels. Tree canopy was determined using an unsupervised clustering algorithm applied to 2020 NAIP Aerial Photography in combination with 2017 LiDAR data and then aggregated by land parcel. Concurrent zoning revisions may have changed parcel categories. See Township's website for updates.

Mean tree canopy in all parcels: 9%

Tree Canopy

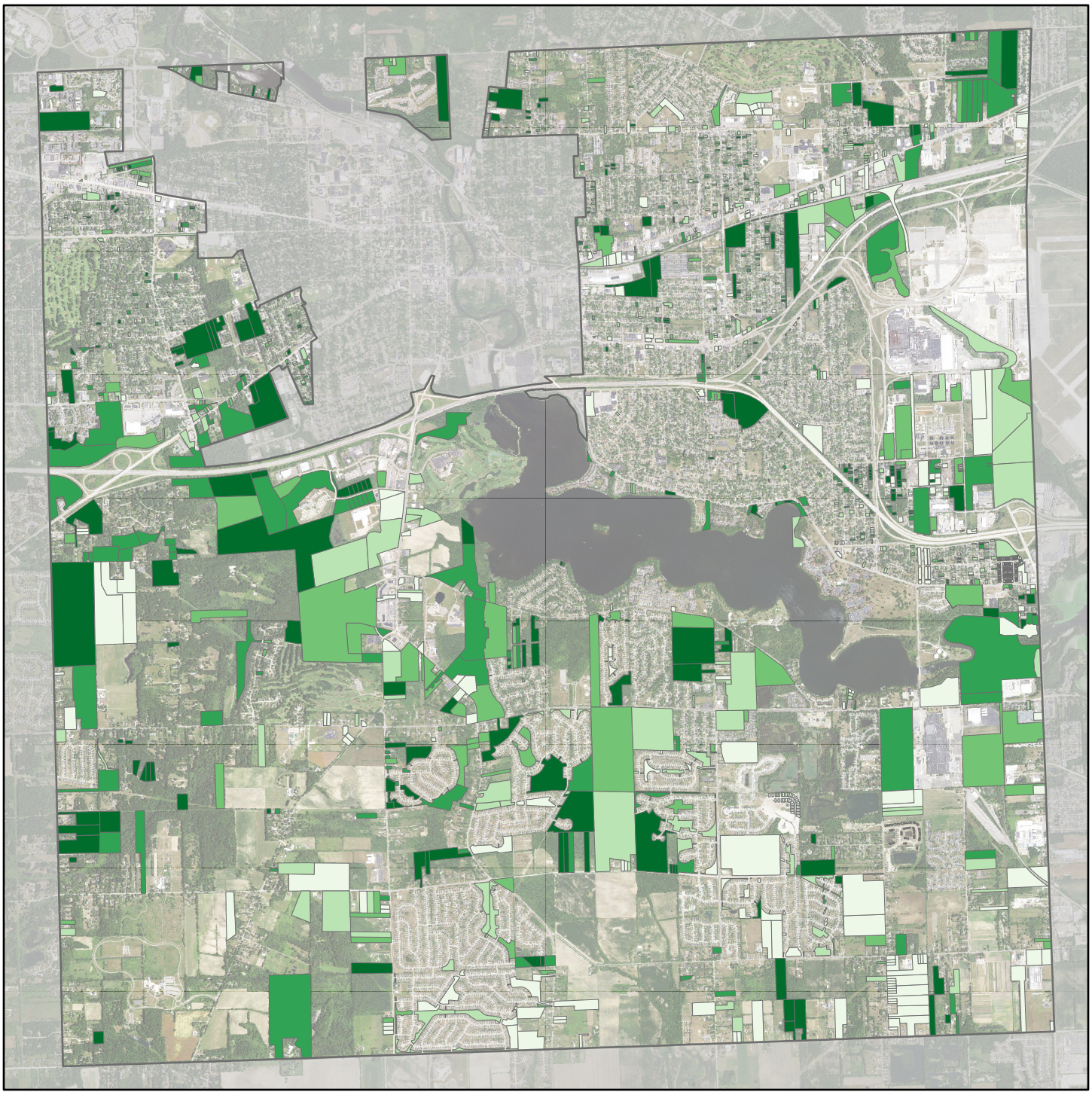
- 0-10%
- 10.1-25%
- 25.1-40%
- 40.1-60%
- 60.1-100%

N

0 0.5 1 2 Miles

Data sources: NAIP 2020 (Basemap and canopy), Washtenaw County GIS Program (LiDAR and Parcels)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 3/21/2022

Ypsilanti Township: Tree Canopy Cover (Vacant)



This map depicts percent tree canopy cover in vacant parcels. Tree canopy was determined using an unsupervised clustering algorithm applied to 2020 NAIP Aerial Photography in combination with 2017 LiDAR data and then aggregated by land parcel. Concurrent zoning revisions may have changed parcel categories. See Township's website for updates.

Mean tree canopy in all vacant parcels: 29%

Tree Canopy

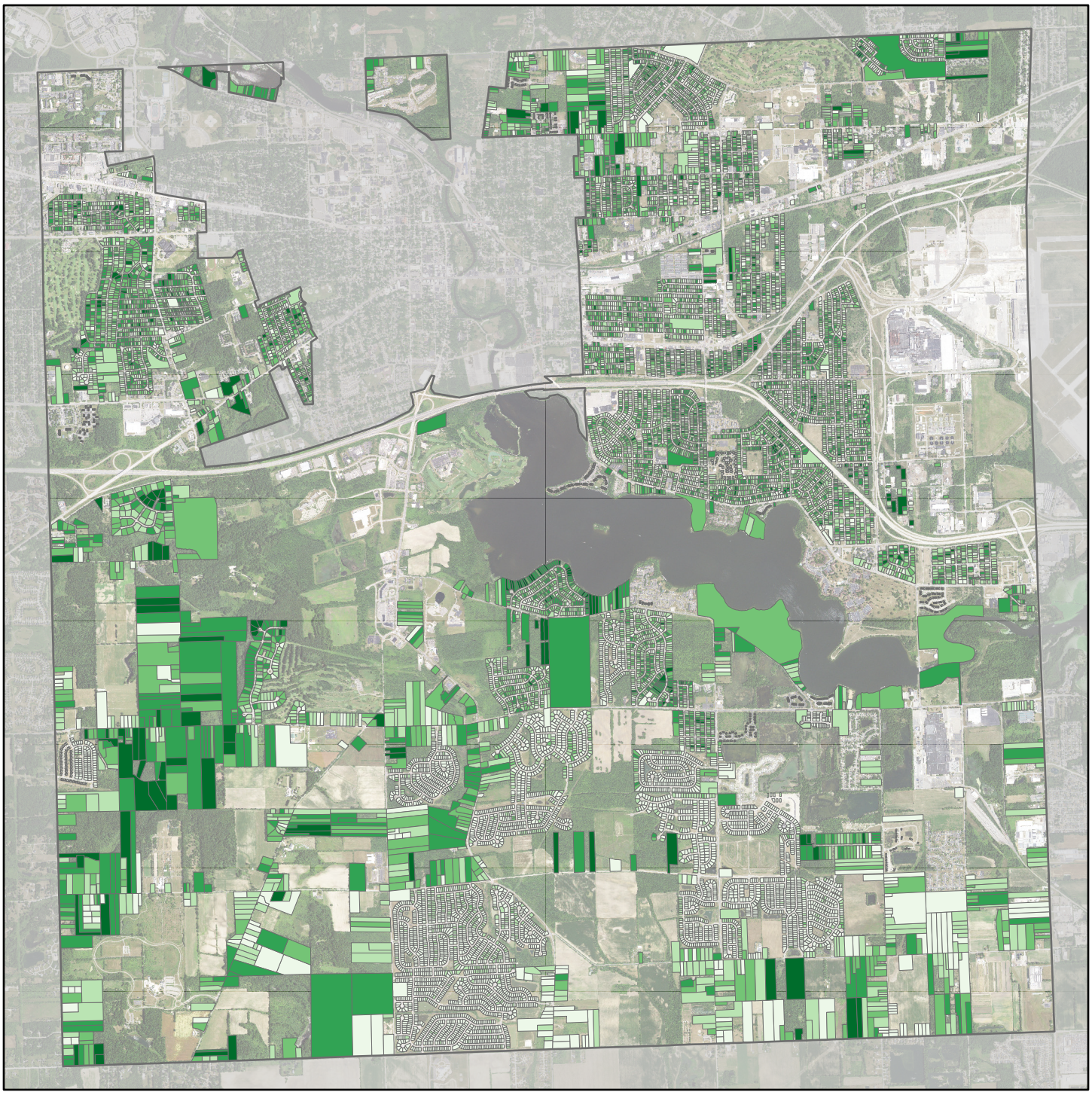
- 0-10%
- 10.1-25%
- 25.1-40%
- 40.1-60%
- 60.1-100%

N

0 0.5 1 2 Miles

Data sources: NAIP 2020 (Basemap and canopy), Washtenaw County GIS Program (LiDAR and Parcels)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 3/21/2022

Ypsilanti Township: Tree Canopy Cover (Residential)



This map depicts percent tree canopy cover in residential parcels. Tree canopy was determined using an unsupervised clustering algorithm applied to 2020 NAIP Aerial Photography in combination with 2017 LiDAR data and then aggregated by land parcel. Concurrent zoning revisions may have changed parcel categories. See Township's website for updates.

Mean tree canopy in residential parcels: 18%

Tree Canopy

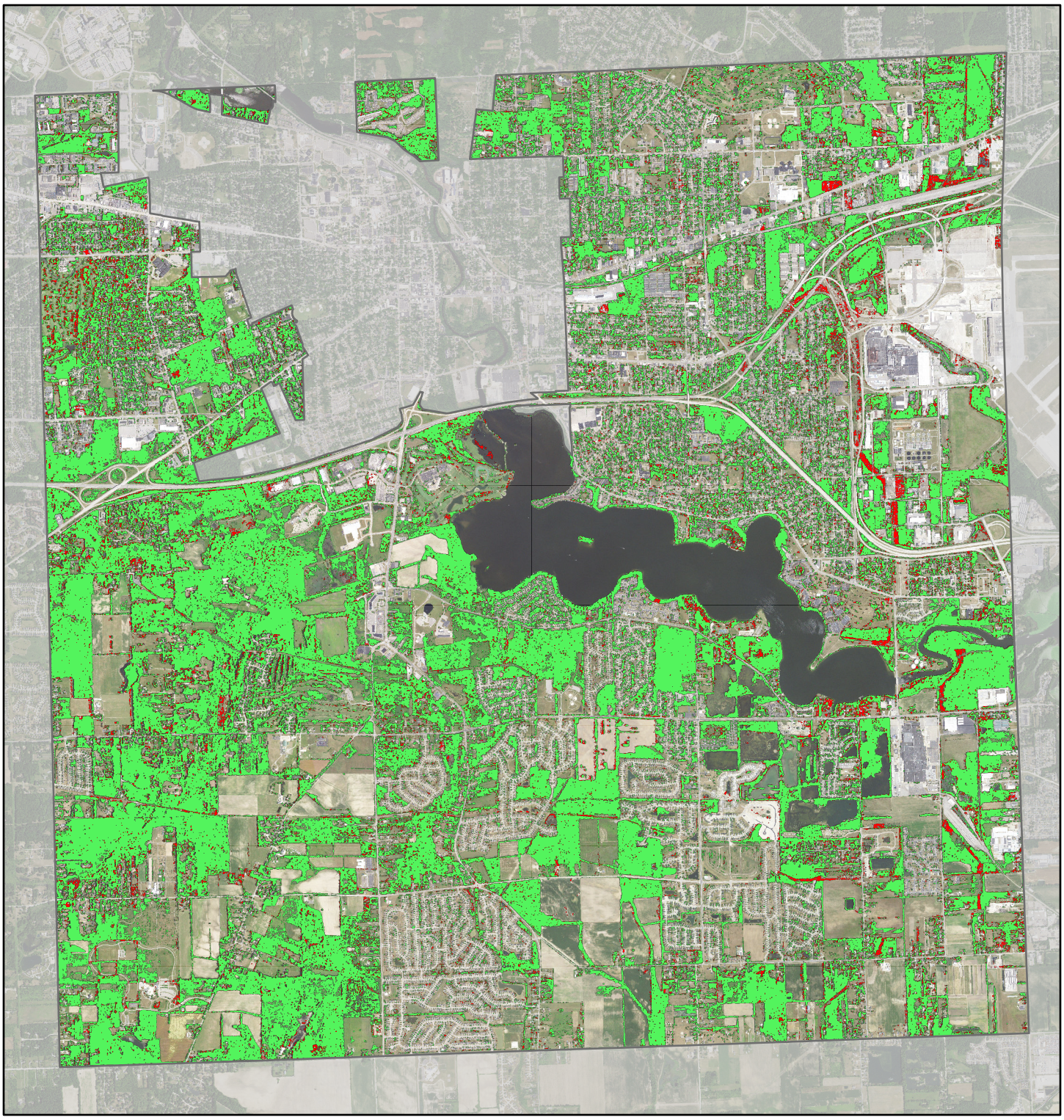
- 0-10%
- 10.1-25%
- 25.1-40%
- 40.1-60%
- 60.1-100%

N

0 0.5 1 2 Miles

Data sources: NAIP 2020 (Basemap and canopy), Washtenaw County GIS Program (LiDAR and Parcels)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 3/21/2022

Ypsilanti Township: Tree Canopy Change 2010-2020



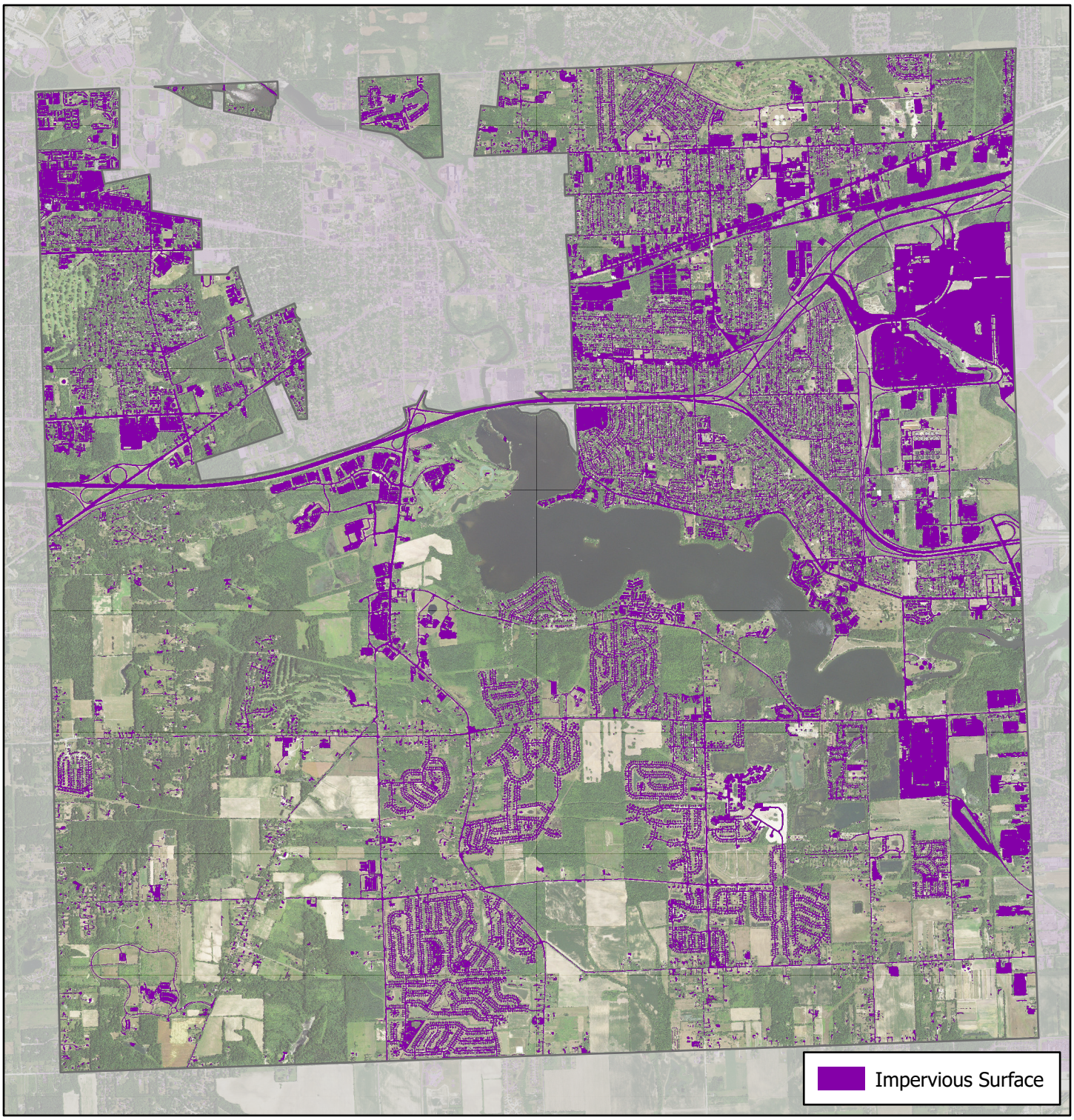
This map depicts changes in tree canopy between 2010 and 2020. Note that due to inconsistencies in available imagery, small areas of identified change may be due to differences in camera or sun angle rather than actual canopy loss. Canopy is also likely overestimated for both years due to inclusion of woody shrubs. The small amount of tree canopy gain identified was not included since it was visually undetectable at this map scale.

2020 Tree Canopy
Tree Canopy Loss

N
0 0.5 1 2 Miles

Data sources: NAIP 2020, NAIP 2010
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 5/17/2022

Ypsilanti Township: Impervious Surface



This map depicts impervious surface, which includes features such as houses, roads, and parking lots where rain cannot directly enter the soil. Bare ground, depending on compaction, can act as an impervious surface, but was classified here as pervious. Impervious surface was found by conducting a supervised classification on 2020 NAIP 4-band aerial imagery.

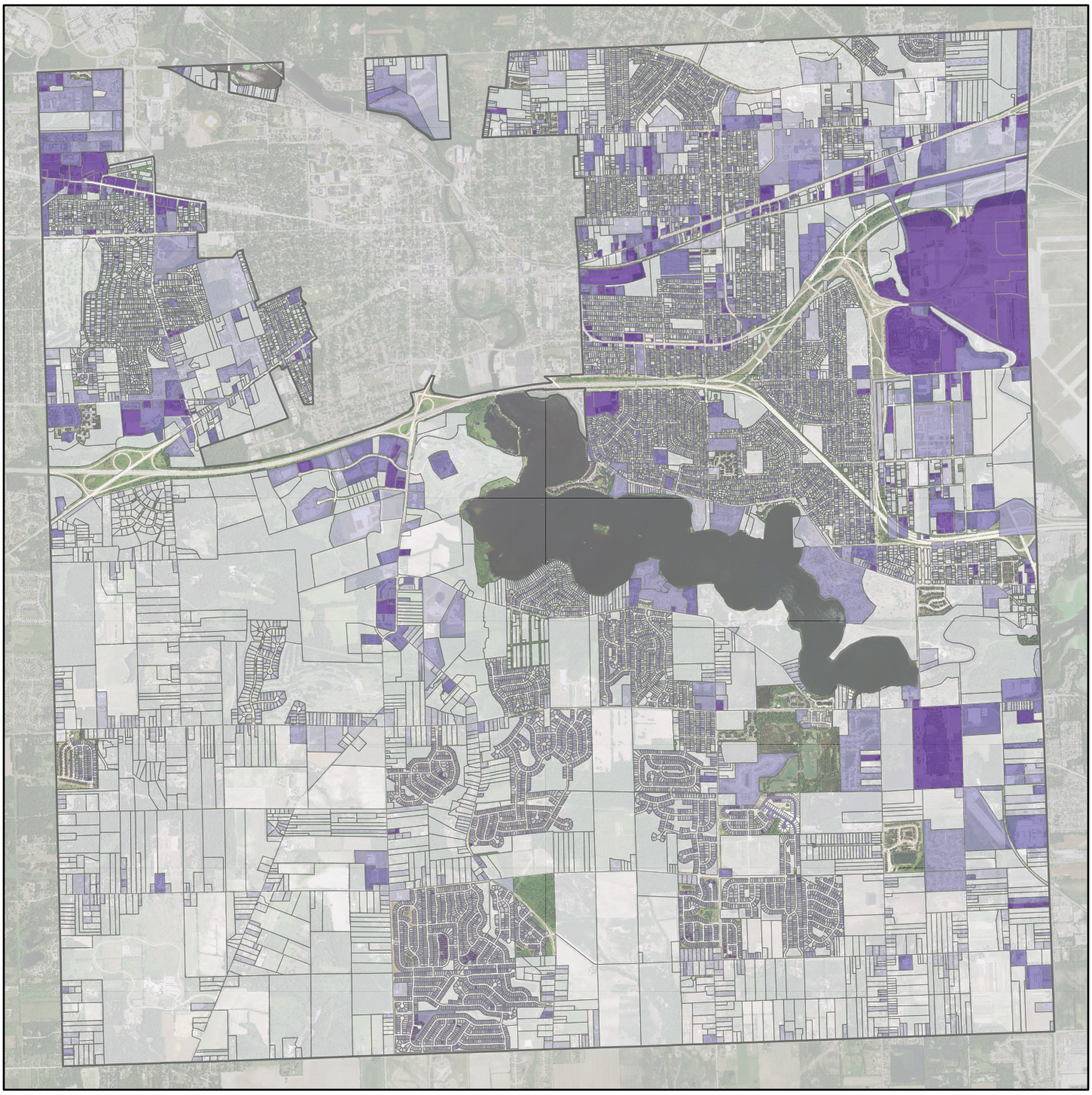
About 19% (3950 acres) of the total area of Ypsilanti Township is impervious surface.

N

0 0.5 1 2 Miles

Data sources: NAIP 2020 (Basemap and classification)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 3/20/2022

Ypsilanti Township: Impervious Surface



This map depicts the percentage of impervious surface within each parcel, or individual property. Impervious surface includes roads, buildings, parking lots, and other areas where rain cannot directly drain into the soil. Bare ground, depending on compaction, can act as an impervious surface, but was classified here as pervious. Missing parcels are designated "open spaces" for nearby housing associations and do not get their own parcel ID, but are preserved areas.

Mean impervious surface in all parcels: 31%

N

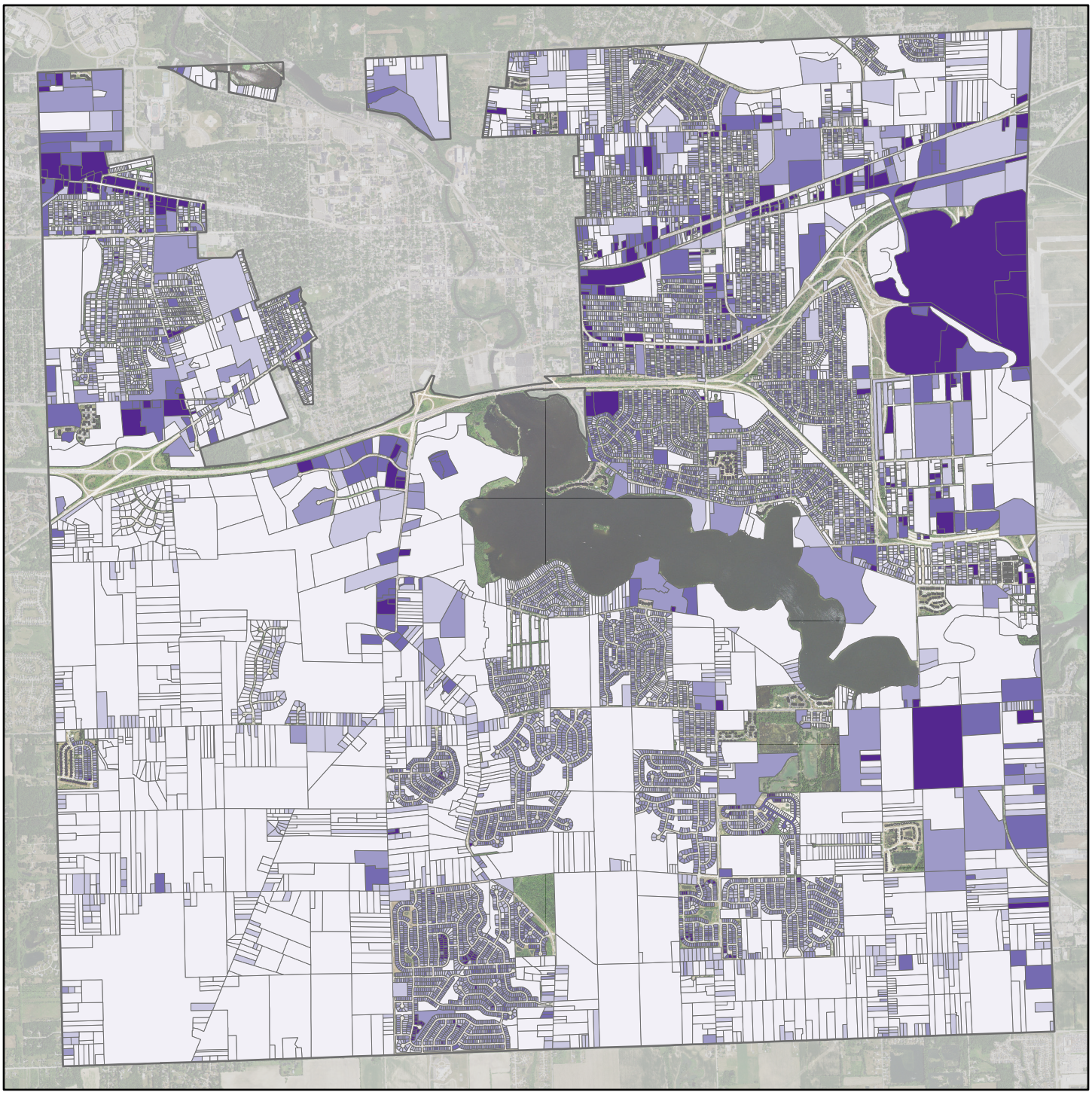
0 0.5 1 2 Miles

Impervious Surface

- 0-13%
- 13.1-29%
- 29.1-47%
- 47.1-75%
- >75%

Data sources: NAIP 2020 (basemap and impervious), Washtenaw County GIS Program (Parcels)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 5/17/2022

Ypsilanti Township: Impervious Surface



This map depicts the percentage of impervious surface within each parcel, or individual property. Impervious surface includes roads, buildings, parking lots, and other areas where rain cannot directly drain into the soil. Bare ground, depending on compaction, can act as an impervious surface, but was classified here as pervious. Missing parcels are designated "open spaces" for nearby housing associations and do not get their own parcel ID, but are preserved areas.

Mean impervious surface in all parcels: 31%

N

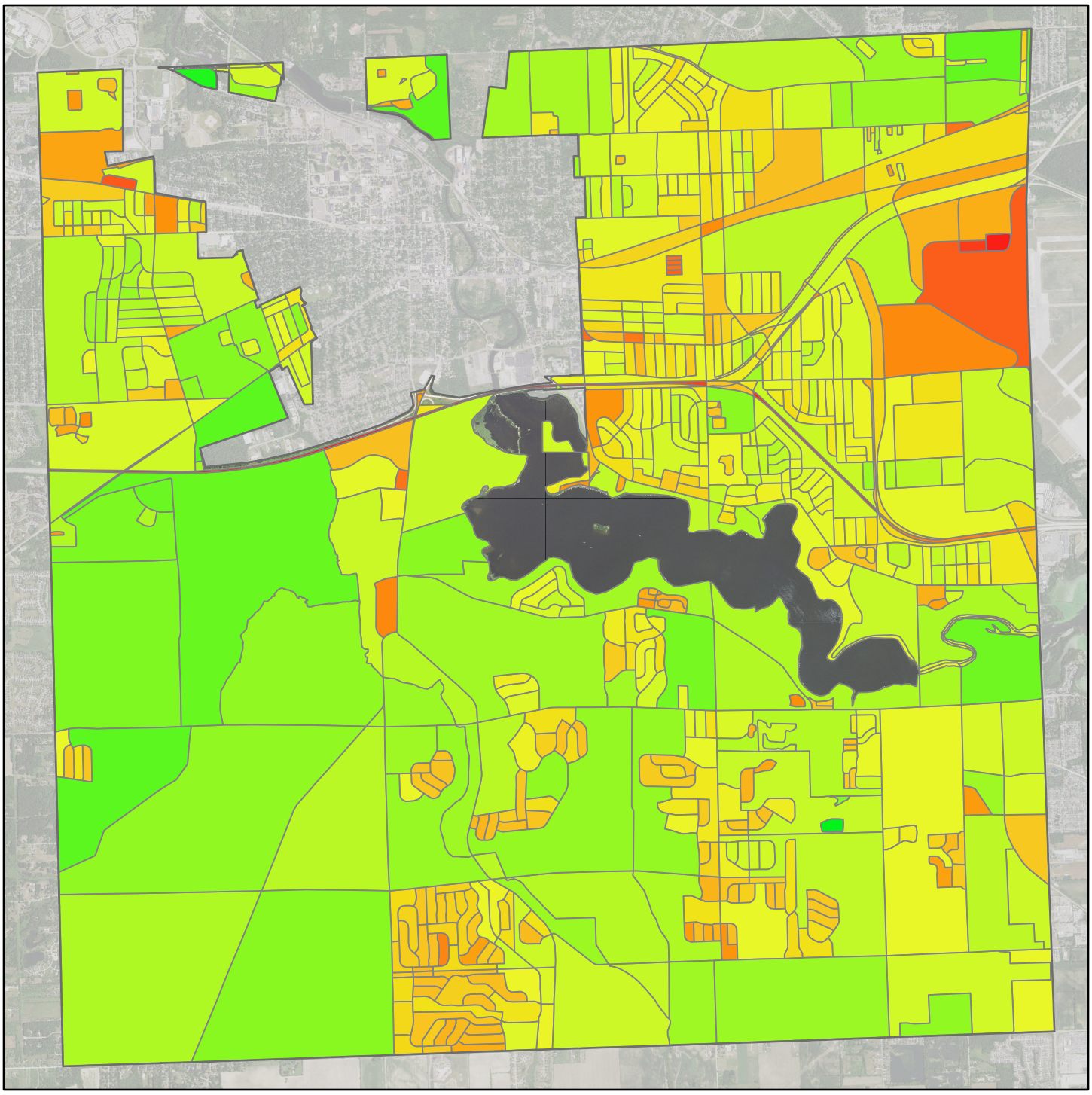
0 0.5 1 2 Miles

Impervious Surface

- 0-13%
- 13.1-29%
- 29.1-47%
- 47.1-75%
- >75%

Data sources: NAIP 2020 (basemap and impervious), Washtenaw County GIS Program (Parcels)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 5/17/2022

Ypsilanti Township: Relative Heat Risk



This map depicts the relative environmental heat risk for Ypsilanti Township by census block. As a proxy for surface temperature, heat risk was calculated as the percentage of the block covered by tree canopy subtracted from the percentage that is impervious surface. Areas in red are likely to experience higher temperatures than areas in green.

Relative Heat Risk

High

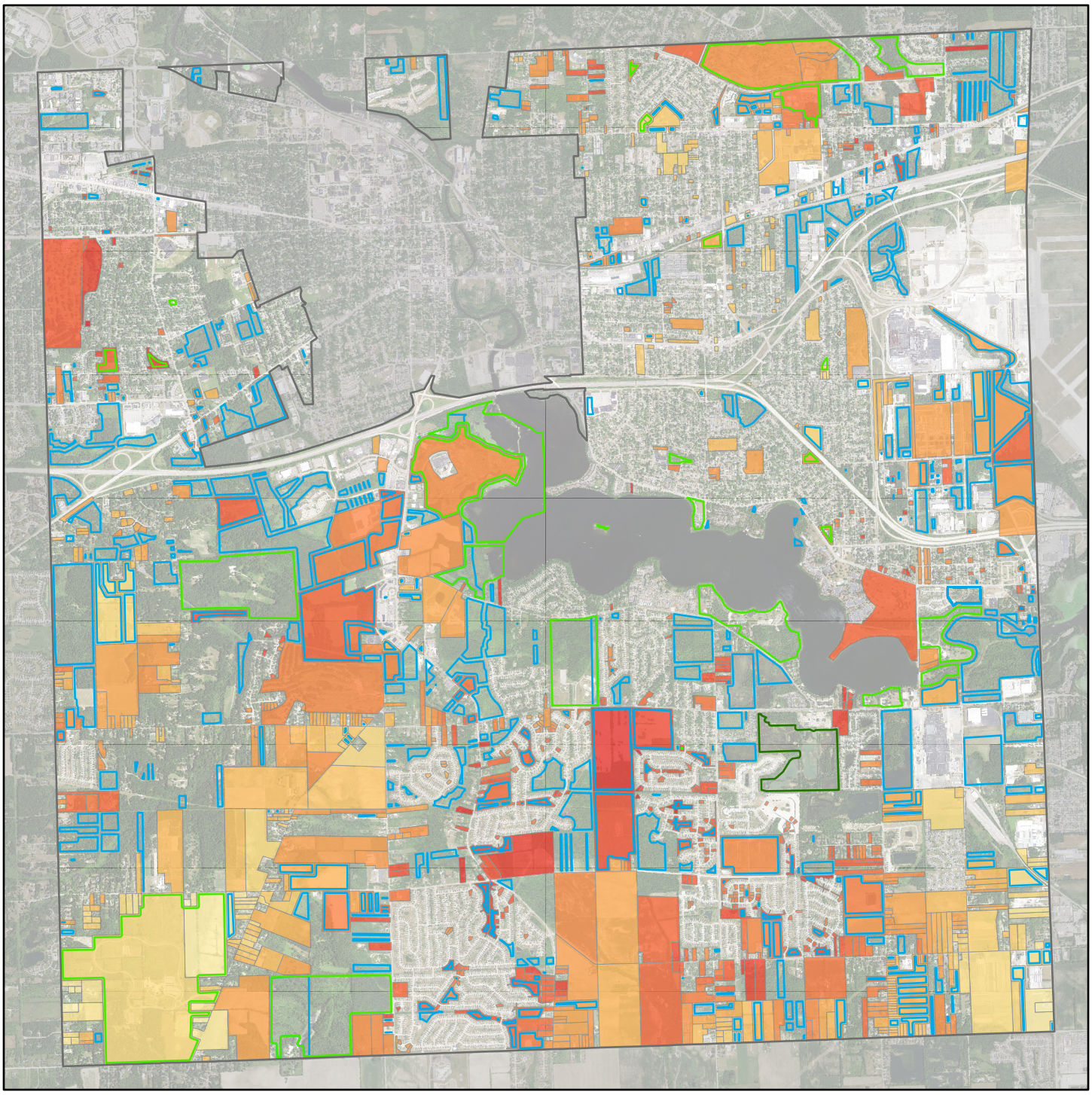
Low

N

0 0.5 1 2 Miles

Data sources: NAIP 2020 (basemap), Washtenaw County GIS Program (township boundary), US Census Bureau (blocks)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 2/23/2022

Ypsilanti Township: Tree Planting Priority (Ecology)



This map depicts tree planting priority in an ecology-focused scenario. Priority rankings for each parcel are determined from two considerations: 1) potential for stormwater runoff to impact water quality and 2) connectivity of surrounding woodlands. Ranked parcels have a minimum of 1000 square feet of turf grass or bare earth that cover at least 50% of the area. Also included are the outlines of vacant parcels, parks and recreation areas, and conservation lands.

Parcel Type

- Conservation Lands
- Parks and Recreation Areas
- Vacant Parcels

Tree Planting Priority

High

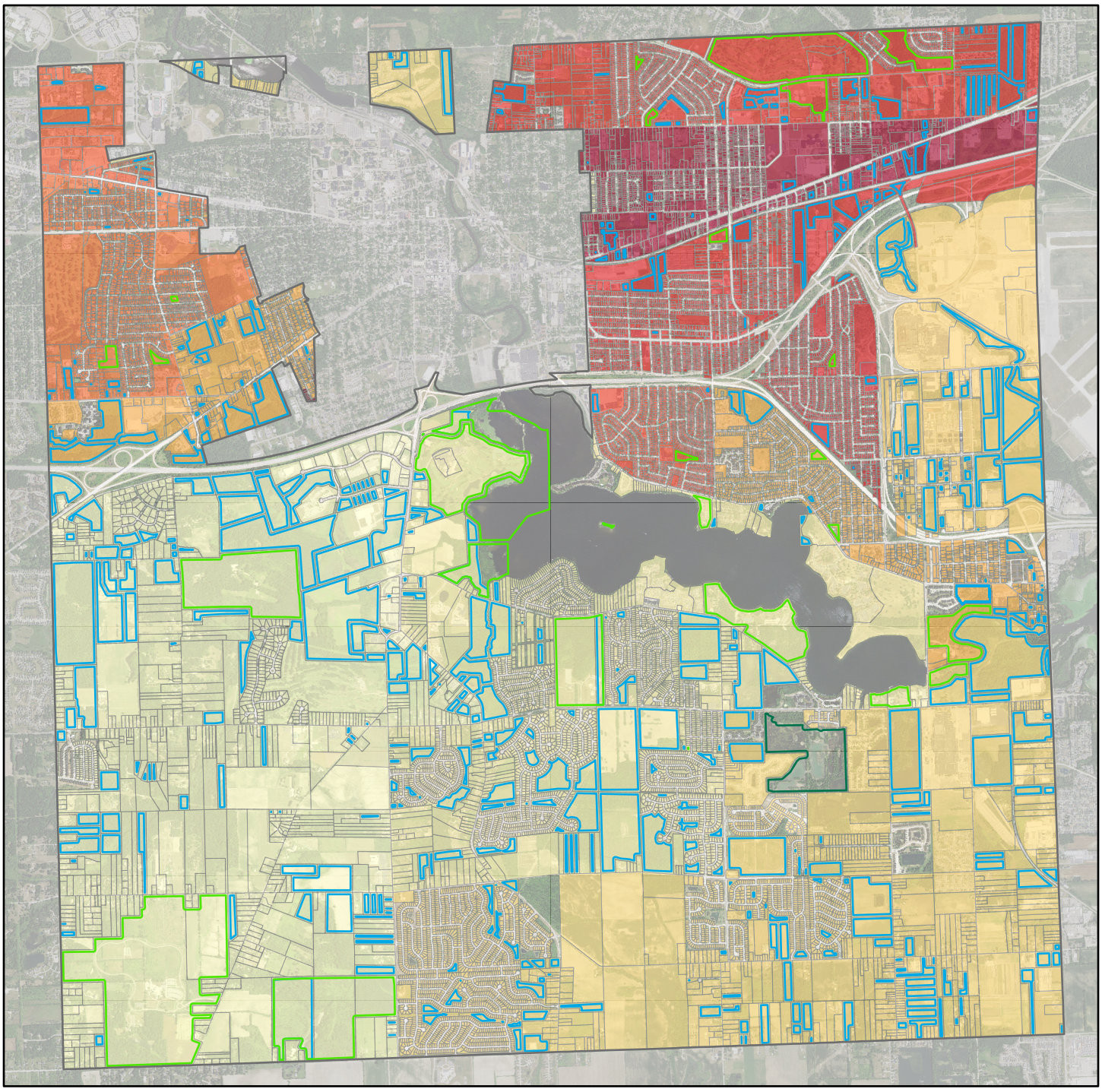
Low

N

0 0.5 1 2 Miles

Data sources: NAIP 2020 (basemap and canopy analysis), National Wetland Inventory (proximity to wetlands), Washtenaw County GIS Program (conservation lands, recreation lands, parcels), Washtenaw County Water Resources Commissioner's Office (storm drains)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 5/17/2022

Ypsilanti Township: Tree Planting Priority (Equity)



This map depicts tree planting priority in an equity-focused scenario. Priority rankings are derived from three equally weighted considerations: 1) environmental urban heat island risk, 2) the CDC's Social Vulnerability Index, and 3) an index of susceptibility to heat, emphasizing age and lifestyle factors. Also included are the outlines of vacant parcels, parks and recreation areas, and conservation lands. All rankings were calculated at the census tract level.

Parcel Type

- Conservation Lands
- Parks and Recreation Areas
- Vacant Parcels

Tree Planting Priority

High

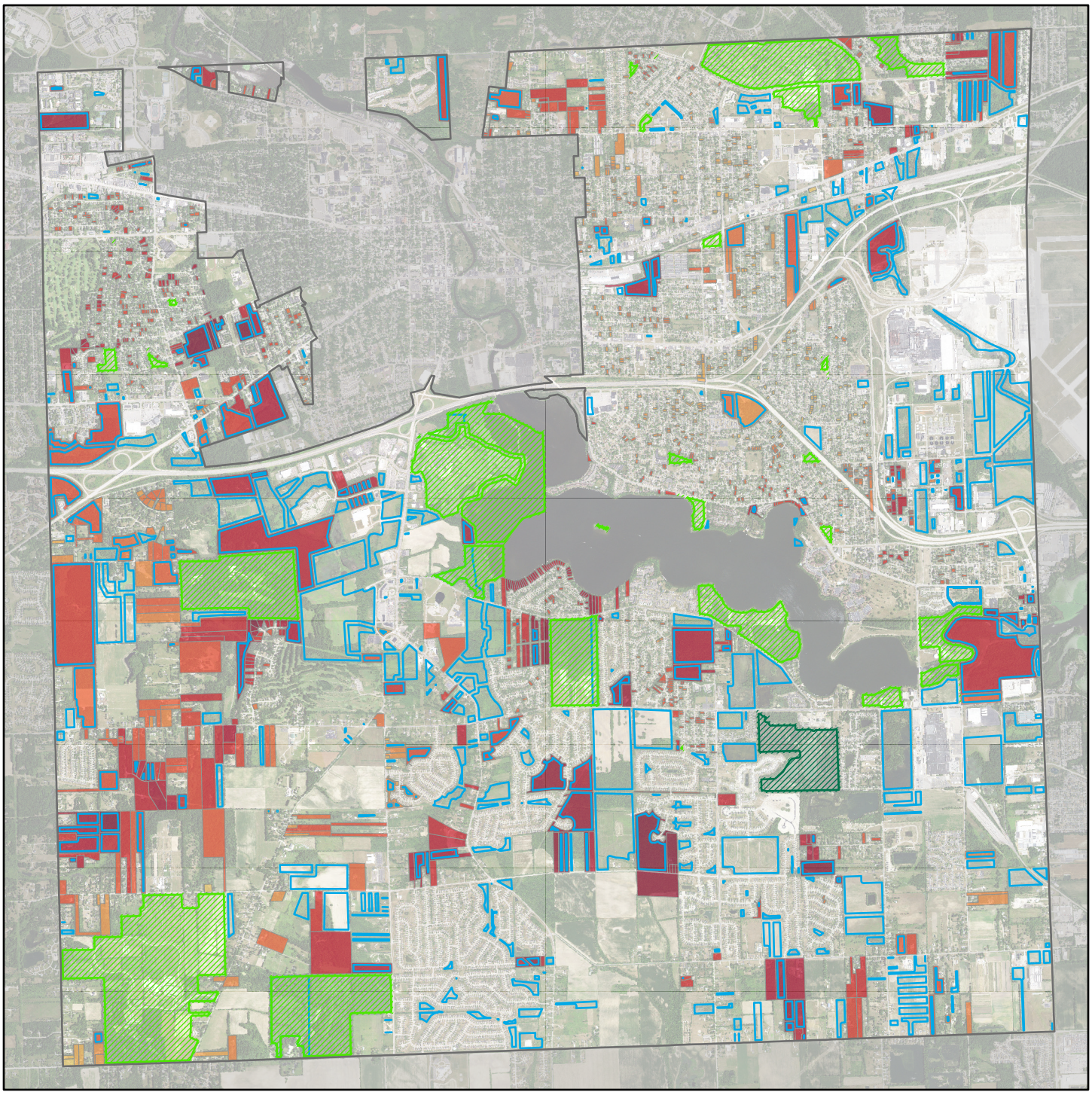
Low

N

0 0.5 1 2 Miles

Data sources: NAIP 2020 (basemap and heat island analysis), US Census Bureau, CDC (social vulnerability index), Washtenaw County GIS Program (parks and conservation lands, parcels)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 5/17/2022

Ypsilanti Township: Tree Preservation Priority



This map depicts an ecology-focused scenario prioritizing woodland preservation. Priority rankings for each parcel are determined from two considerations: 1) potential for stormwater runoff to impact water quality and 2) connectivity of surrounding woodlands. Ranked parcels have at least 50% canopy cover, suggesting they should be considered for preservation. Also included are the outlines of vacant parcels, parks and recreation areas, and conservation lands.

Parcel Type

- Conservation Lands
- Parks and Recreation Areas
- Vacant Parcels

Tree Preservation Priority

High

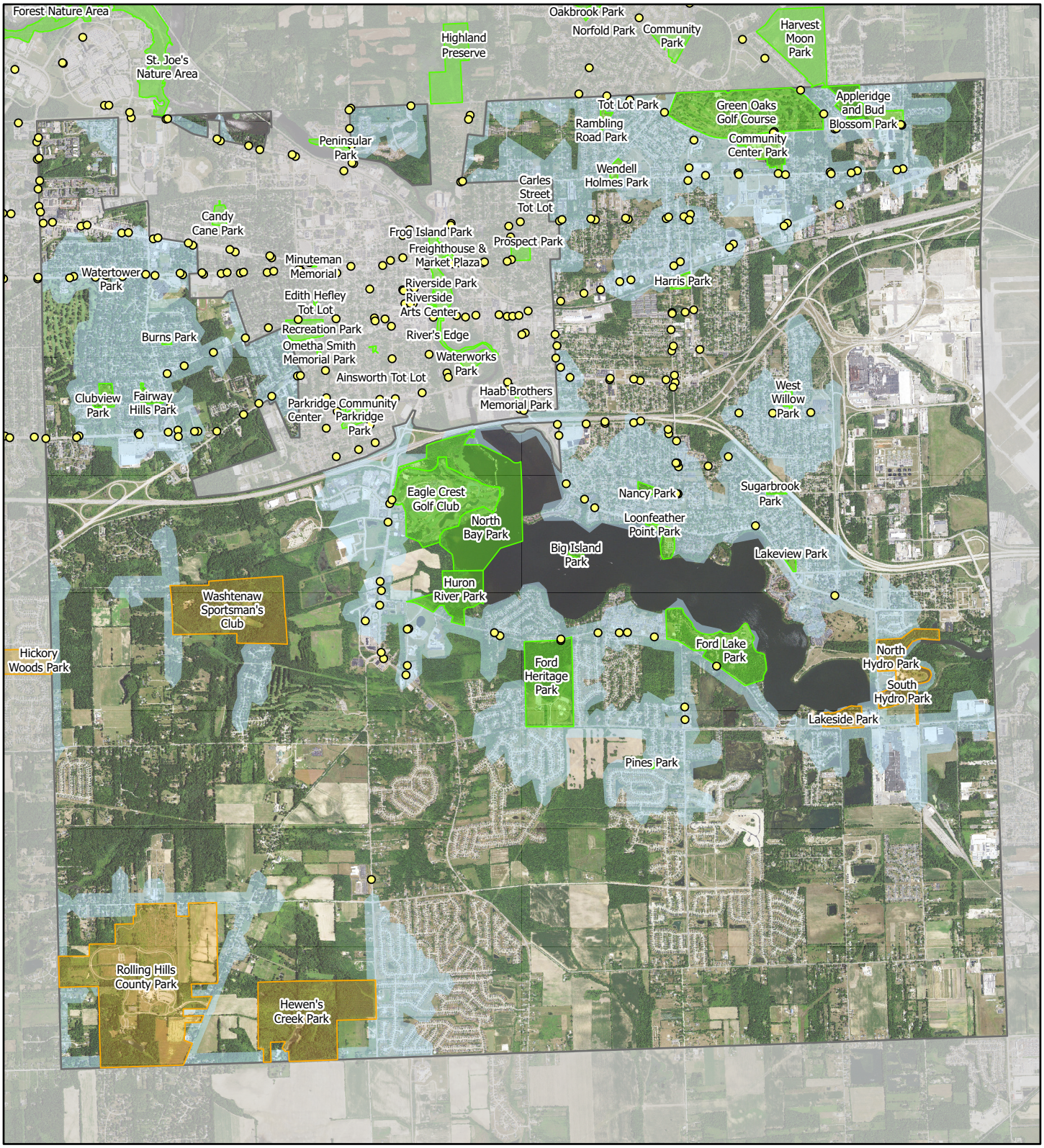
Low

N

0 0.5 1 2 Miles

Data sources: NAIP 2020 (basemap and canopy analysis), National Wetland Inventory (proximity to wetlands), Washtenaw County GIS Program (conservation lands, recreation lands, parcels), Washtenaw County Water Resources Commissioner's Office (storm drains)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 5/17/2022

Ypsilanti Township: Park Accessibility



This map highlights areas within a ten minute walk to the entrance of a public park or recreation area. Bus stops are included to provide a sense of which parks are accessible via public transportation.

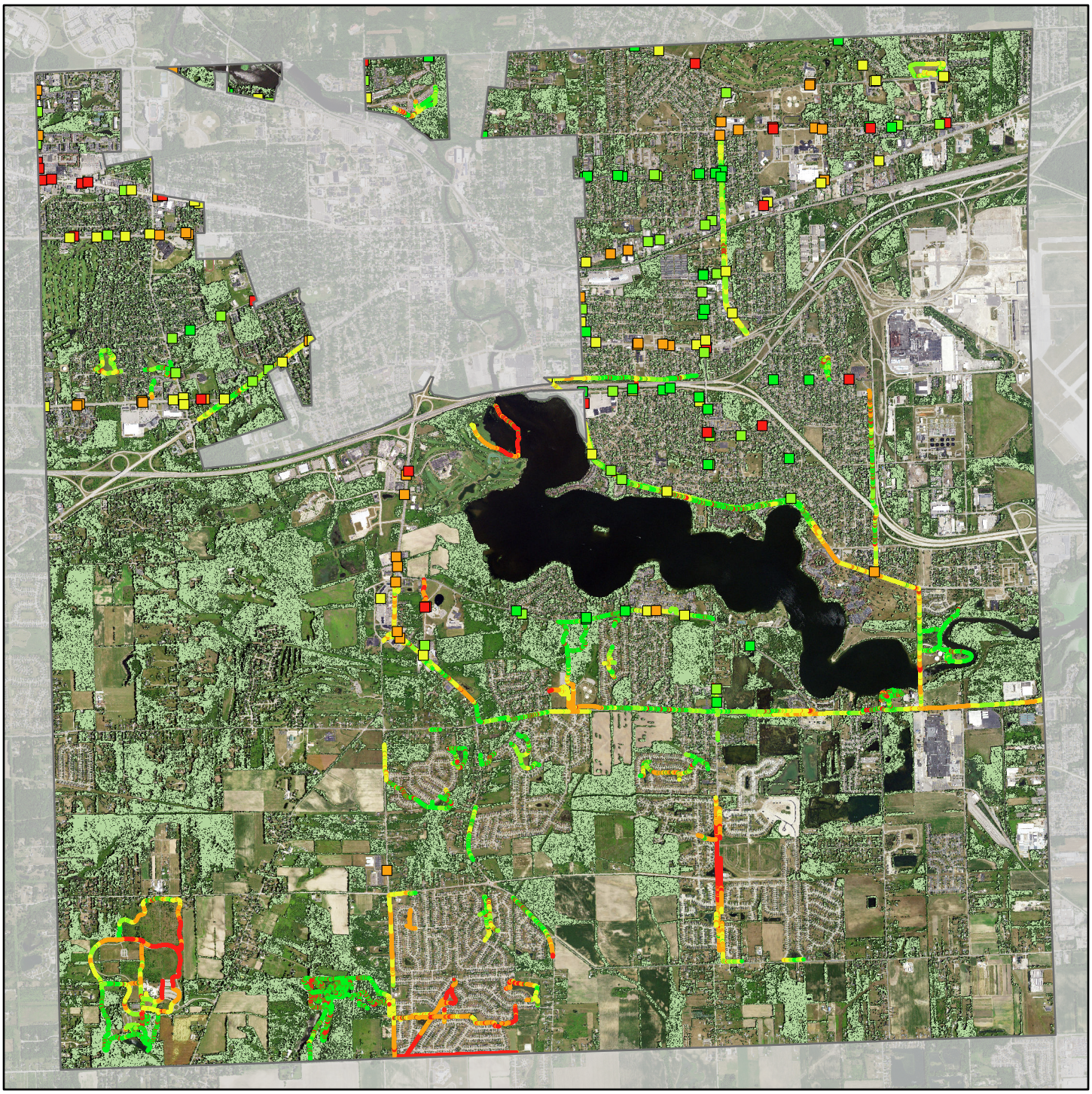
- AAATA Bus stops
- Parks within 10 minute walk of a bus stop
- Parks not within 10 minute walk of a bus stop
- Areas within 10 minute walk of a park

N

0 0.5 1 2 Miles

Data sources: Washtenaw County GIS Program (recreation lands), Ann Arbor Area Transit Authority (bus stops), NAIP 2020 (basemap)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 5/17/2022

Ypsilanti Township: Viewshed Greenness Index



This map depicts the Viewshed Greenness Index (VGI) for bus stops and walking trails in Ypsilanti Township. VGI measures the amount of greenspace around a point, such as a bus stop. For this map, "greenspace" exclusively refers to tree canopy cover. In order to find areas that would benefit from additional shade, nearby trees were weighted heavily over distant trees. Hence, areas in red are less likely to have shade or nearby canopy cover than areas in green.

Limitations: The tool used to calculate VGI is still in development and has difficulty calculating viewsheds directly under tree canopy. About 3-6% of the 168 bus stops in Ypsilanti Township may be impacted and ground truthing in person or with Google Street View is recommended.

Bus Stops

VGI - Tree Canopy Cover

- Most Shade
- Least Shade

Trails and Walking Paths

VGI - Tree Canopy Cover

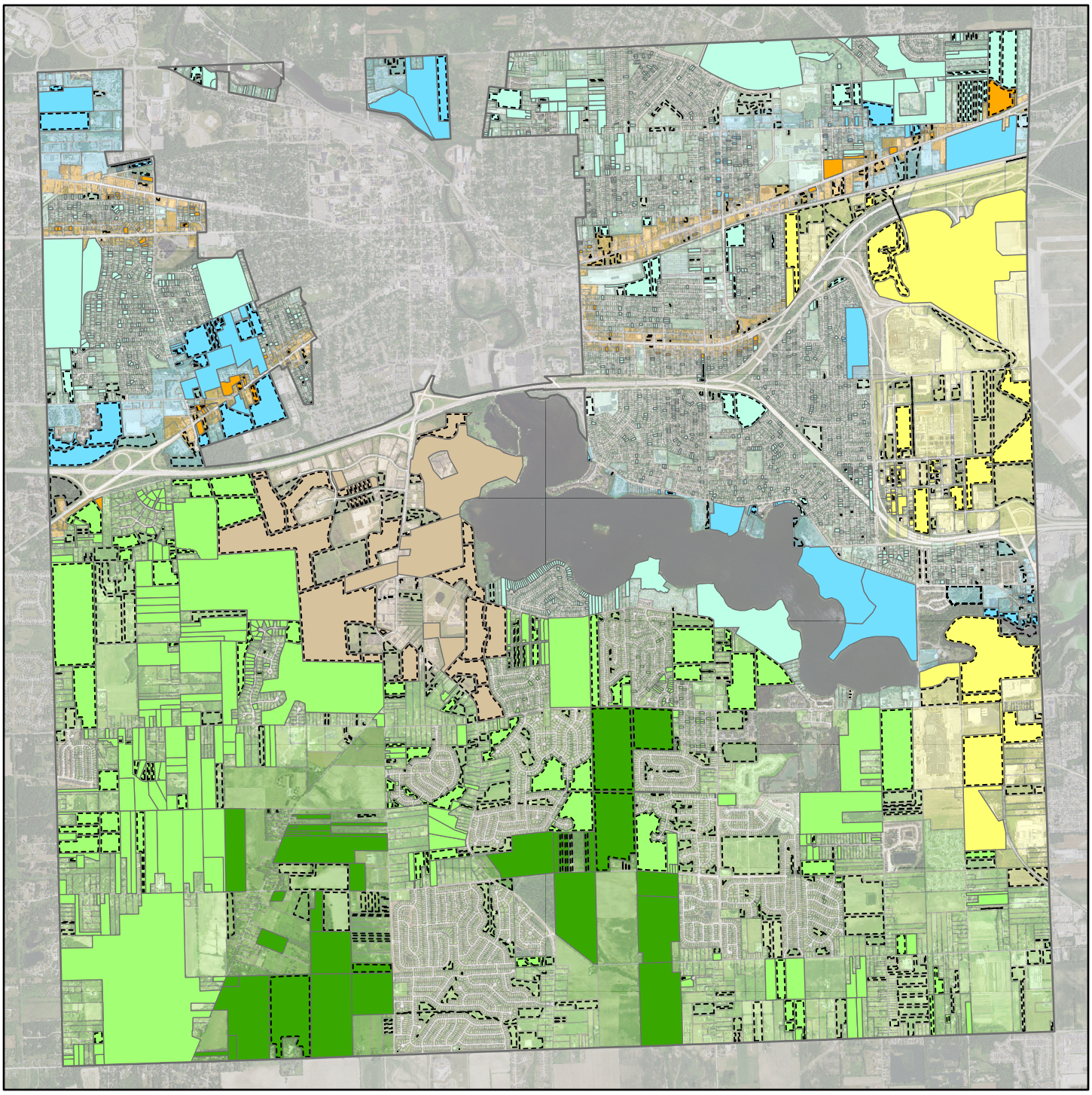
- Most Shade
- Least Shade
- Tree Canopy

N

0 0.5 1 2 Miles

Data sources: Brinkmann et. al. (VGI package), NAIP 2020 (basemap and canopy), Washtenaw County GIS Program (LiDAR, trails), Ann Arbor Area Transit Authority (bus stops)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 2/23/2022

Ypsilanti Township: Future Land Use



This map depicts parcels according to their planned future land use (Ypsilanti Township Master Plan, page 50). Opaque parcels have either: 1) a minimum of 50% tree canopy coverage or 2) a minimum of five acres of tree canopy. Parcels not meeting these conditions are transparent. Vacant parcels have a dashed black outline.

Vacancy Status

Vacant Parcels

Future Land Use

- Open Space, Neighborhood, Cluster
- Agricultural Preservation
- Innovation and Employment
- Mixed Use Corridor
- Neighborhood Preservation
- Neighborhood Transition
- Township Core

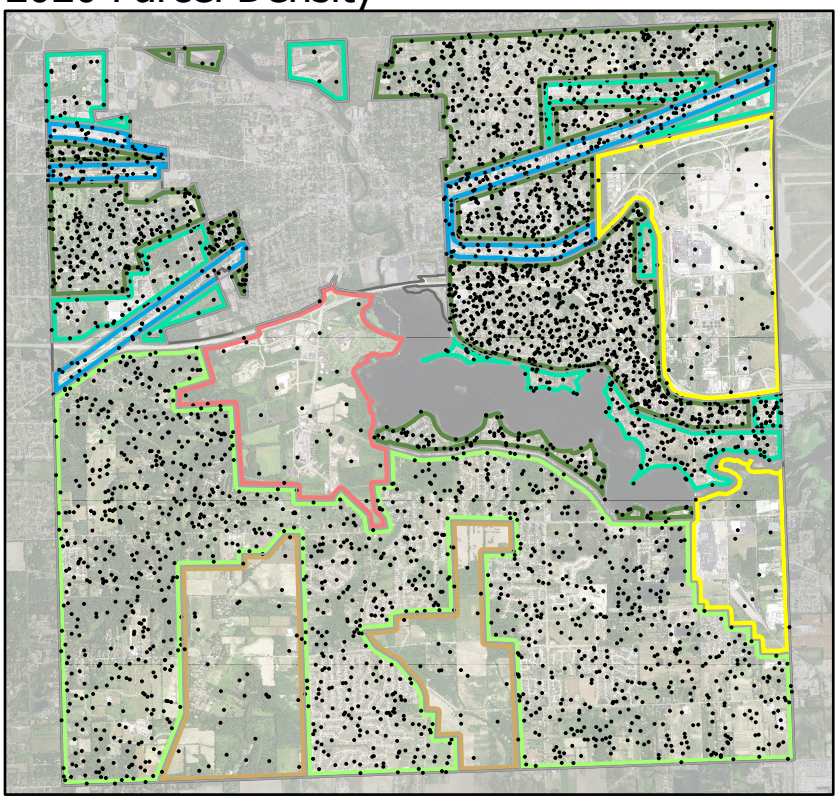
N

0 0.5 1 2 Miles

Data sources: Washtenaw County GIS Program (parcels), Ypsilanti Township Master Plan (future land use)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 5/18/2022

Ypsilanti Township: Development Scenario

2020 Parcel Density

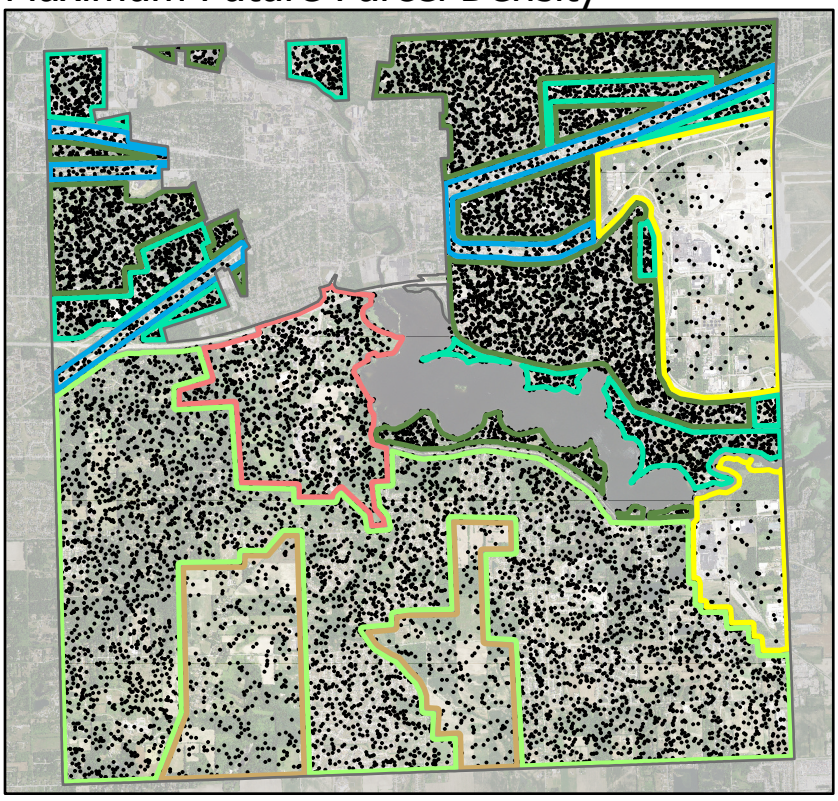


These maps illustrate a hypothetical densest development or "build-out" scenario based on the future land use (FLU) plains laid out in Ypsilanti Township's Master Plan.

The first map depicts current parcel density - each dot represents five existing parcels. Dots are placed randomly within the FLU zones and do not represent actual parcel locations.

The second map depicts parcel density if each FLU zone was divided up into as many parcels as possible based on the minimum lot size for the densest zoning type corresponding to that FLU category. For example, the "Open Space, Neighborhood Preservation, and Cluster Development" category allows for R-1, R-2, and R-3 zoning. For this map, we assume that everything is zoned as R-3 with a minimum lot size of 14,000 square feet. For zoning categories where a minimum lot size is not given, the mean of the bottom quartile of present day parcel sizes was used as a stand-in.

Maximum Future Parcel Density



Future Land Use

- Open Space, Neighborhood, Cluster
- Agricultural Preservation
- Innovation and Employment
- Mixed Use
- Neighborhood Preservation
- Neighborhood Transition
- Township Core

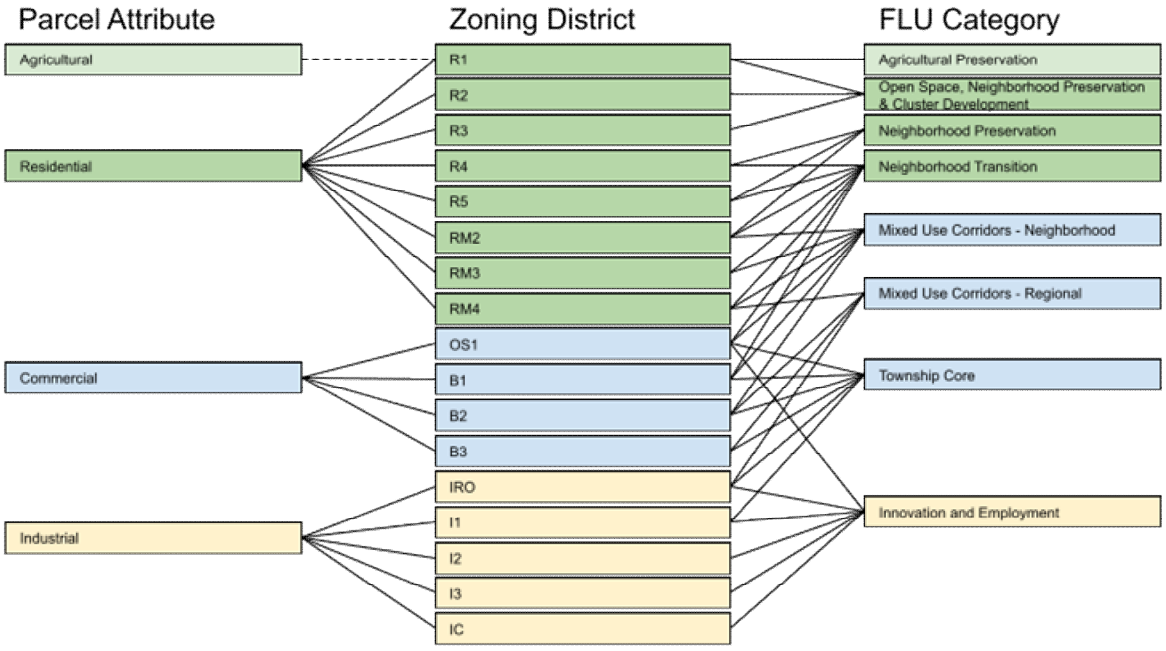
1 Dot = 5 Parcels

- Parcel Density

N

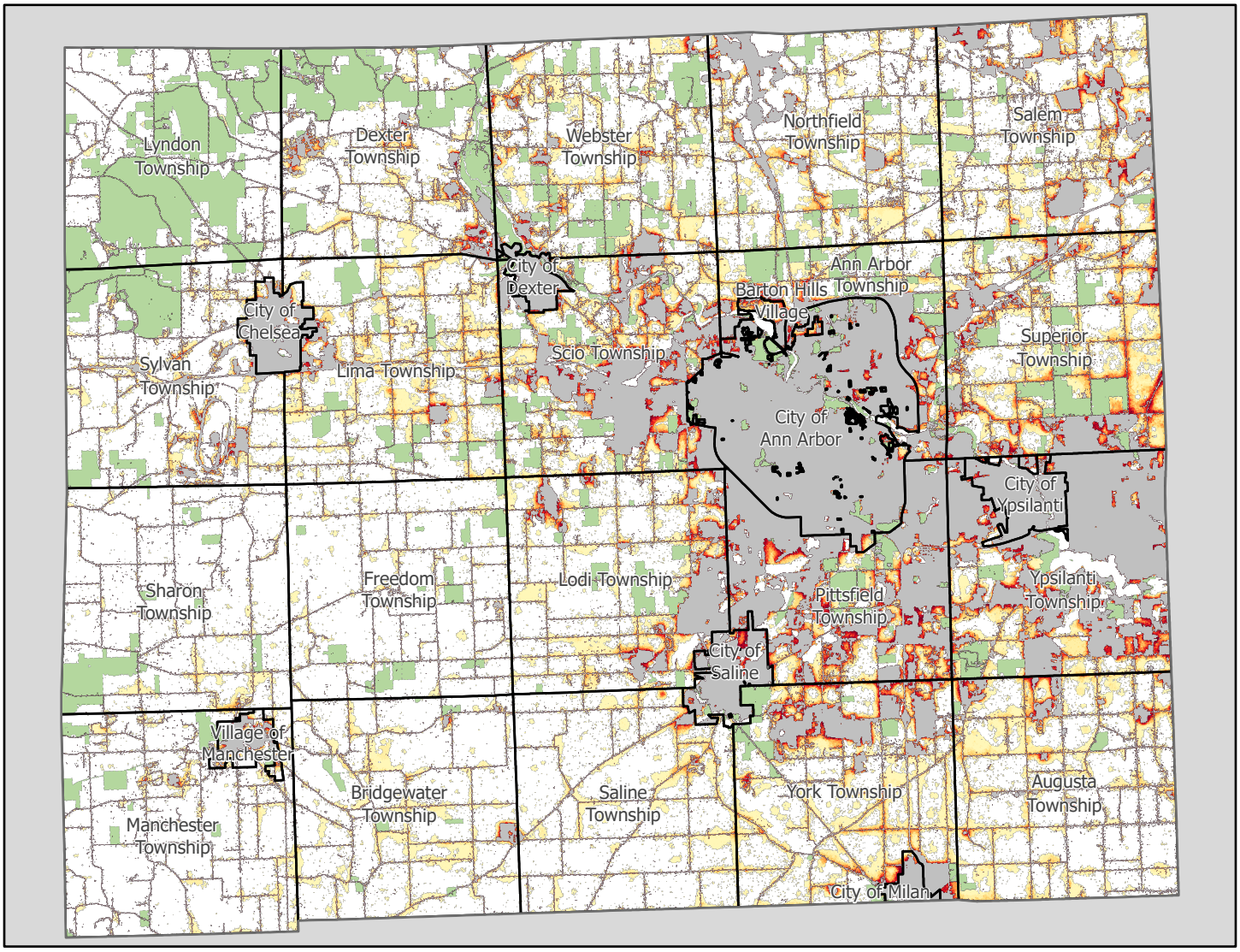
0 0.75 1.5 3 Miles

Data sources: Ypsilanti Township Master Plan (future land use), Ypsilanti Charter Township Municode Library (zoning ordinances), Washtenaw County GIS Program (current parcels)
Datum/Projection: NAD83 Michigan State Plane (South)
Layout: Thomas Estabrook, 5/18/2022



Future Land Use	Minimum parcel size (sq ft)	Total area (sq ft)	2020: # of Parcels	Maximum # of Parcels	% Built Out
Agricultural Preservation	32,500	87,160,916.51	262	2,681.87	9.77
Open Space, Neighborhood, Cluster	14,000	322,425,691.7	6697	23,030.41	29.08
Neighborhood Preservation	5,400	174,702,559.9	8947	32,352.33	27.65
Neighborhood Transition	5,400	66,383,881.63	1546	12,293.31	12.58
Mixed Use	10,824	36,686,646.63	1158	3,389.38	34.17
Township Core	10,824	55,638,167.32	146	5,140.26	2.84
Innovation and Employment	83,785	97,110,505.08	311	1,159.04	26.83

FUTURES Urban Projections for 2045
Washtenaw County



This map shows the potential growth of urban development in Washtenaw County by 2045. The projections were created in GRASS GIS using the FUTURES model, which takes into account factors such as relationships between population growth and past development, road density, distance to water, distance to highway interchanges, canopy cover, and proximity to existing development. NLCD classes 21-24 were considered urban. Due to randomness in the model, ten runs were executed in which the darkness of a pixel increases with the number of runs predicting it will be developed. The table below shows the predicted mean (and standard deviation) loss in acres for each landcover type. Forest includes deciduous, evergreen, and mixed forest. Agriculture includes pasture and crops.

Land Cover	Barren	Forest total	Scrub/shrub	Grassland	Ag total
Mean (acres)	94.78	6422.29	78.35	207.15	16059.25
SD(acres)	24.8	225.67	10.54	15.36	206.01

Protected Areas
2019 Urban Areas

Number of Model Runs

No Runs
1
2
3
4
5
6
7
8
9
10

N
0 2.5 5 10 Miles

Data sources: NLCD (2019 urbanization), Washtenaw County Open Data (township borders, protected areas), SEMCOG (population projections)
Datum/Projection: NAD83 Albers Conical Equal Area
Layout: Thomas Estabrook, 5/17/2022

Washtenaw County Conservation District

ACKNOWLEDGEMENT OF CONTRIBUTIONS

THANK YOU...

Grant Support

Michigan Department of Natural Resources' Urban and Community Forestry Program

Data and Project Support

Washtenaw County GIS Program

Washtenaw County Water Resources Commissioner's Office

Ann Arbor Area Transit Authority

Carlisle Wortman

Huron River Watershed Council

Pilot Municipalities

Bridgewater Township | Sharon Township | City of Ypsilanti | Ypsilanti Township

Project Team

Summer Roberts, WCCD Community Forester - Project Coordinator

Shannon Brines, UM GIS Lecturer and WCCD Board Member - Project Advisor

Thomas Estabrook, UM Student Contractor - GIS Analyst

Lyndsay Zemanek, UM Student Contractor - GIS Analyst