



Monitoring and controlling mosquito larvae to prevent West Nile Virus in Dane County

Updated May 2024

SUMMARY

The West Nile Virus (WNV) surveillance and control program is an effort by Public Health Madison & Dane County to better understand and reduce the risk of West Nile virus in Dane County. This program has two components: monitor human cases of West Nile virus in our community; and monitor and control the larvae of mosquitoes capable of carrying West Nile.

MOSQUITOES CAN SPREAD SERIOUS DISEASE

- We test ditches, retention ponds, and other public water sources for mosquito larvae to prevent mosquito-related illnesses, most notably West Nile virus.
- West Nile virus is carried by mosquitoes and is the [most common mosquito-borne illness in the U.S.](#) One out of 5 people who are infected show symptoms, and approximately 1 out of 150 people develop a serious and sometimes fatal illness.
- West Nile virus has been regularly found (endemic) in Dane County since 2003. Before 2020, we tested dead birds for West Nile because birds can also get the virus. You can report sightings of dead birds to the [Wisconsin Department of Natural Resources](#).

HOW WE TRACK MOSQUITOES

- In 2023, we sampled 694 locations for mosquito larvae in Madison, Middleton, Monona, Sun Prairie, and on the UW-Madison campus. We made 2,361 total inspections to those sites.
- Sites are on public property, such as in parks. 44% of sites are ditches and 40% are detention or retention ponds. Other sites include rain gardens, marshes, creeks, flooded areas, and golf course ponds.
- We sample for mosquito larvae along the water's edge by quickly skimming the surface of the water with a dipper (plastic cup on a pole). Samples at each location are a mix of one to ten dips.
- We then take the sample back to the lab and identify the species of the collected larvae. We look for two species of mosquito larvae that spread the most disease—*Culex* (most common carrier of West Nile Virus) and *Aedes* (can carry West Nile virus, but less common. They are also vectors for some other mosquito-borne illness, such as La Crosse encephalitis). *Culex* mosquito activity is defined as the presence of the species *C. Pipiens* and/or *C. Restuans*; these mosquito types are capable of transmitting WNV in Dane County.
- When three or more *Culex* larvae are found per dip, the site is treated with larvicide, a chemical that specifically kills/targets only mosquito larvae.

WHAT WE FOUND

- 5.2% of all inspected sites had high levels of *Culex* mosquito larvae present.
- 0.4% of all inspected sites had high levels of *Aedes* mosquito larvae present.
- Seven cases of West Nile virus in humans were found in 2023. Since 2002, there have been 51 total cases and 2 deaths related to West Nile virus in Dane County. These cases are an undercount and represent the most severe cases of West Nile. Most people are not tested for mild cases of West Nile.

INTRODUCTION



Public Health Madison & Dane County partners with the City of Middleton, City of Monona, City of Sun Prairie, Town of Madison, and University of Wisconsin to monitor and control the breeding activity of mosquitoes capable of carrying West Nile Virus on public property. The main mosquito species of concern is the *Culex* mosquito due to its identification as the principal vector for human transmission of WNV. If present, other mosquito species that are potential vectors for WNV are also monitored; in Dane County, this is the *Aedes* mosquito species.

Mosquito larvae sampling was performed by public health staff from late May through September to identify water sources producing large numbers of mosquito larvae. In 2023, the end of the mosquito season did not come until October when the area received its first frost/freeze. Where high levels of *Culex* mosquito larvae were found, staff treated the source with larvicide to kill the larvae.

When a person tests positive for WNV, the test is reported to the health department. This way, public health can follow-up with the person to assure they are connected to medical care and ask where they may have been exposed. Additionally, monitoring reports of WNV allows the health department to track trends of the virus in our community.

This report summarizes the results and [maps](#) of both the mosquito monitoring and treatment efforts in the metropolitan area, as well as trends in people in Dane County who tested positive for West Nile Virus.

MONITORING FOR WEST NILE VIRUS

MONITORING BIRDS FOR WEST NILE VIRUS

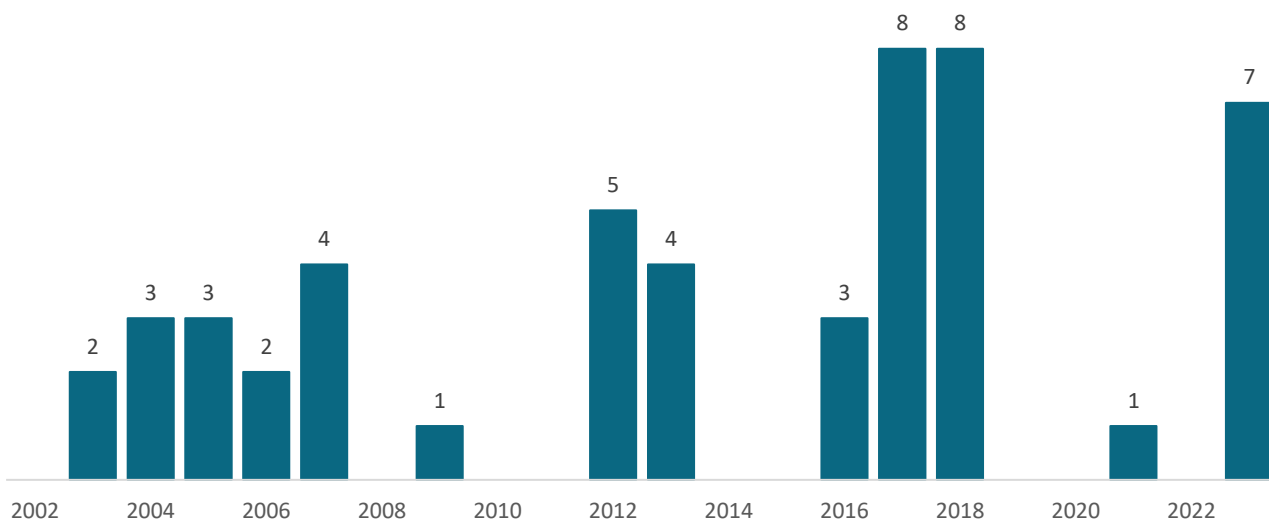
Prior to 2020, Public Health Madison & Dane County participated in statewide efforts to collect and test dead crows and blue jays for West Nile Virus. These types of birds are most likely to get WNV. Once WNV was consistently found—that is, endemic—in Dane County and throughout the state, bird monitoring was discontinued.

MONITORING PEOPLE FOR WEST NILE VIRUS

Most people (8 out of 10) infected with WNV will have no [symptoms](#), but approximately 20% will experience a fever plus other symptoms like headache, body ache, joint pain, vomiting, diarrhea, or rash. About 1 in 150 people with WNV will develop serious illness affecting the central nervous system such as brain or spinal swelling (encephalitis) with people over 60 years of age at the greatest risk.

Seven people were reported with WNV infection in Dane County in 2023, with no deaths. Interview data suggests that the majority of these seven cases were acquired locally. A total of 18 people were diagnosed with WNV infection in Wisconsin in 2023, with one death. Since CDC started keeping track of WNV infections in 1999, there have been [over 56,000 reported cases](#) in the U.S. with over 2,700 deaths through 2022. [Wisconsin](#) started reporting WNV in 2002, with 357 people reported statewide through 2022, including 23 deaths. Over this same time period, Dane County reported 51 cases, including two deaths.

Figure 1. People with West Nile Virus in Dane County



Since there is no vaccine currently available to prevent WNV, public health focuses on monitoring and controlling the mosquito populations that can carry the virus to reduce the risk to the community.

MONITORING MOSQUITO POPULATIONS

During summer mosquito surveillance of 2023, department staff made 2,361 inspections of 694 accessible sites to evaluate *Culex* and *Aedes* populations in the metro area. *Aedes* mosquito types are capable of transmitting WNV virus to humans, but the most common carriers of the disease are *Culex* mosquito species. In order to reduce the risk of potential exposure to WNV, *Culex* mosquito populations are the primary focus of mosquito treatment efforts in Dane County.

At each surface water source, public health staff sampled for mosquito larvae along the water's edge by quickly skimming the surface of the water with a dipper (plastic cup on a pole). Samples at each location consisted of a composite of one to ten dips. The number of dips depended on the size of the water source and the number of larvae present. Larvae activity for each sample was measured as the number of larvae per dip. When three or more *Culex* larvae are found per dip, the site is treated with larvicide or other action is taken to reduce the number of mosquito larvae. Most mosquito monitoring is performed at surface water sources. On occasion, catch basins are sampled when there is additional concern in a given area. The table below lists the number of sites by community with high concentrations of *Culex* or *Aedes* larvae; all other sites tested reported either low concentrations of larvae or no larvae noted.

Findings

As [displayed in this map](#) and Appendix 2, a total of 36 sites (5.2%) of inspected sites produced high numbers of *Culex* larvae and 3 (0.4%) sites produced high numbers of *Aedes* larvae, at least once during 2023 (Table 1).

Table 1: Areas with high levels of *Culex* and *Aedes* mosquitoes, 2023

	High <i>Culex</i> (% of inspected sites)	High <i>Aedes</i> (% of inspected sites)	Total number of sites inspected
City of Madison	30 (7.1%)	2 (0.5%)	421
City of Sun Prairie	0 (0%)	0 (0%)	115
City of Middleton	4 (5.2%)	1 (1.3 %)	77
UW Madison (includes campus and arboretum)	2 (7.1%)	0 (0%)	28
City of Monona	0 (0%)	0 (0%)	20
Town of Madison	0 (*)	0(*)	15
Town of Burke	0 (*)	0 (*)	3
Village of Maple Bluff	0 (*)	0 (*)	3
City of Fitchburg	0 (*)	0 (*)	3
Village of Shorewood Hills	0 (*)	0 (*)	1
Total	36 (5.2%)	3 (0.4%)	694[#]

**Percentages not calculated for sites with fewer than five samples*

Eight of the inspection sites with an undocumented location included in the total

*@ One inspection site reported high levels of both *Culex* and *Aedes* larvae in separate inspections. The site is counted only once in the Total Metro Area site total of 694 but each counted in both *Culex* and *Aedes* totals.*

Over the past decade (2014 – 2023), the percentage of sampled sites with high levels of *Culex* mosquitoes has ranged from 5.2% to 10.9%; *Aedes* larvae activity ranged from 0.4% to 9% (Table 2). Seasonal variation in temperature and rainfall can impact findings.

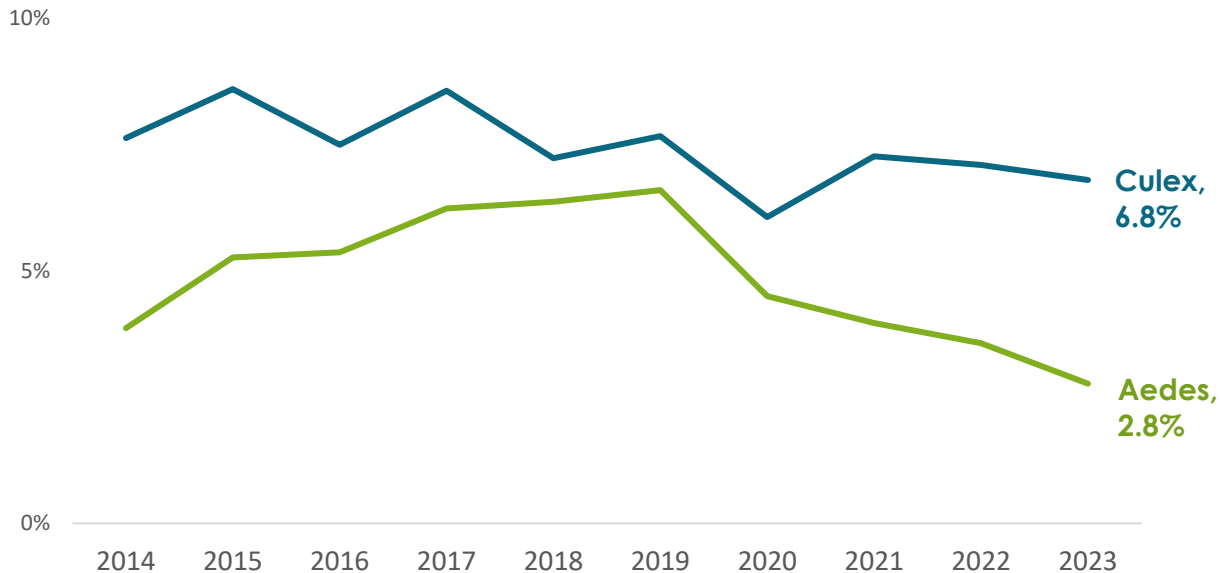
Table 2: Percentage of sites with high levels of *Culex* and *Aedes* mosquitoes by year, 2014-2023

Year	<i>Culex</i>	<i>Aedes</i>
2014	7.7%	6.4%
2015	9.4%	5.8%
2016	5.4%	3.9%
2017	10.9%	9.0%
2018	5.4%	6.2%
2019	6.7%	4.6%
2020	6.1%	2.7%
2021	9.0%	4.6%
2022	6.4%	3.5%
2023	5.2%	0.4%
Average	7.2%	4.7%

Over the past decade, a total of 186 sites have been found to produce high numbers of *Culex* larvae in at least one season during this time period. 34 (18%) of these sites have been found to produce *Culex* larvae repeatedly (four or more years) over multiple seasons. 18 of these 34 sites demonstrated high *Culex* activity each year in this ten year time period. We find *Culex* more often than we find *Aedes* (Figure 2).

Figure 2: Percentage of sites with high levels of *Culex* and *Aedes* mosquitoes, 3-year rolling averages, 2014-2023

The percentage of sites with high *Culex* or *Aedes* mosquitos has fluctuated over the past decade (3-year rolling average)



The types of water sources that produced high numbers of larvae and require treatment are generally consistent from year to year (Figure 3). Like previous monitoring seasons, ditches continue to be the most important source of mosquitoes in 2023. Detention and retention ponds were also sources of high *Culex* larvae during the current monitoring season. Detention ponds temporarily store stormwater runoff and then release it gradually until it is drained. Retention ponds, on the other hand, are designed to permanently hold water. Retention ponds are less likely than ditches and detention ponds to host problem mosquitoes because these water bodies have much more stable edges and shallow pools are not prone to develop at these sites. In addition, the presence of natural predators including fish, tadpoles, and other insects at retention ponds make these sites a less suitable habitat for mosquito larvae in comparison to ditches and detention ponds.

For comparison, *Aedes* mosquito activity demonstrated a similar pattern of site type activity to *Culex* larvae with ditches and detention ponds being important sources of exposure (Figure 4). However, in recent years, annual activity at these site types have decreased and have become more aligned with activity reported at retention ponds. Subsequent monitoring seasons of *Aedes* activity will demonstrate if this is a continuing trend or due to seasonal variation.

Several large, natural water sources, like Mud Lake, Nine Springs Marsh, the Yahara River, Lakes Mendota and Monona, and others, are not assessed because they are unlikely to produce *Culex* mosquitoes. Assessment of these areas would likely change the results for the floodwater mosquito (*Aedes vexans*) and increase the number of mosquito species identified.

Figure 3: Sampled sites with high levels of *Culex* mosquito larvae, by site type, 2014-2023

Ditches and **detention ponds** are more likely to have *Culex* mosquito activity than **retention ponds** (3 year rolling average)

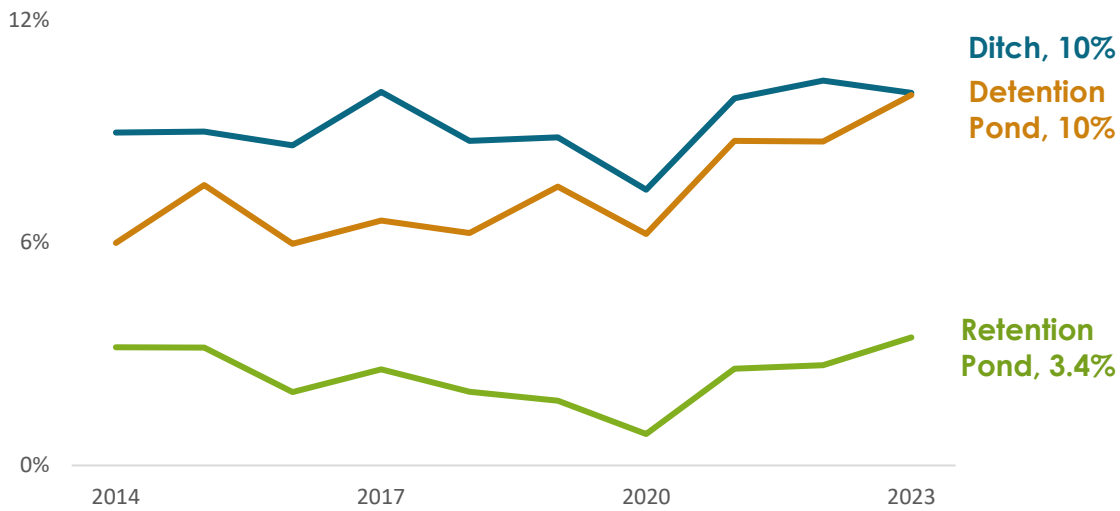
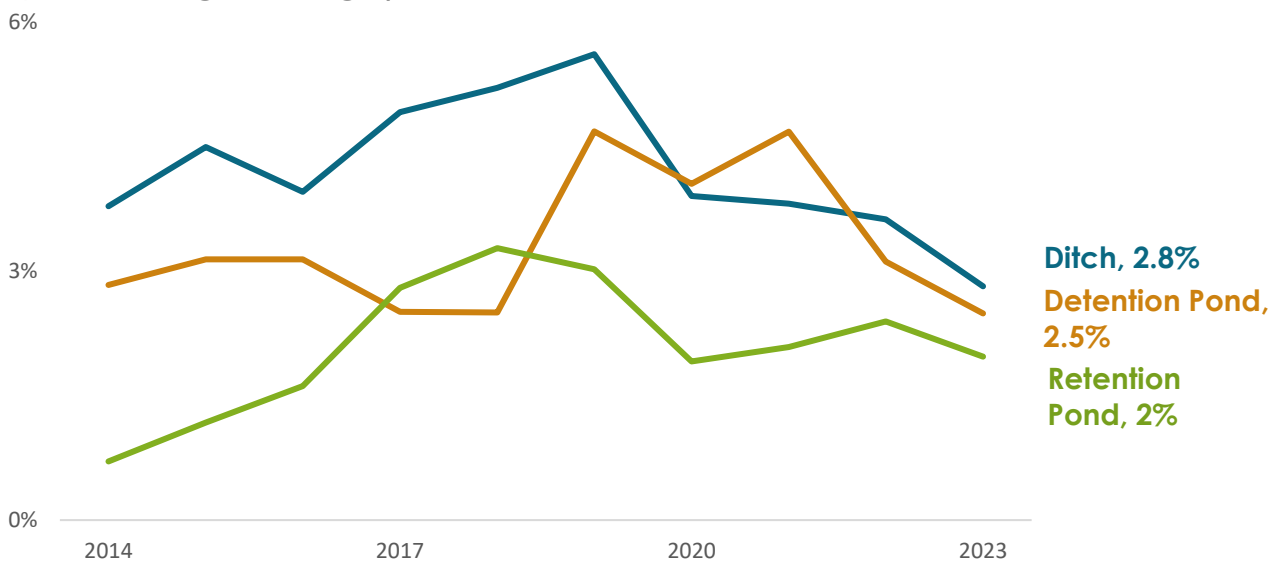


Figure 4: Sampled sites with high levels of *Aedes* mosquito larvae, by site type, 2014-2023

Ditches and **detention ponds** are also more likely to have *Aedes* mosquito activity but have declined in recent years. (3 year rolling average)



Larvicide applications

During the 2023 mosquito season, a total of 76 treatments were performed at 35 sites that reported high levels of *Culex* mosquito larvae. All treatments were effective in reducing larvae numbers below the treatment threshold of three larvae per dip when reassessed the week after a treatment. Larvicide applications are typically effective for a month. A site may need additional treatment if elevated mosquito activity returns to the site. In the 2023 monitoring season, 10 sites were considered problematic and required three or more treatments. Occasionally, some sites with high *Culex* activity were not treated due to weather and/or site conditions that reduced mosquito activity.

HOW TO PREVENT MOSQUITO-RELATED ILLNESSES

Mosquito-related illnesses, like West Nile, are preventable:

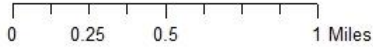
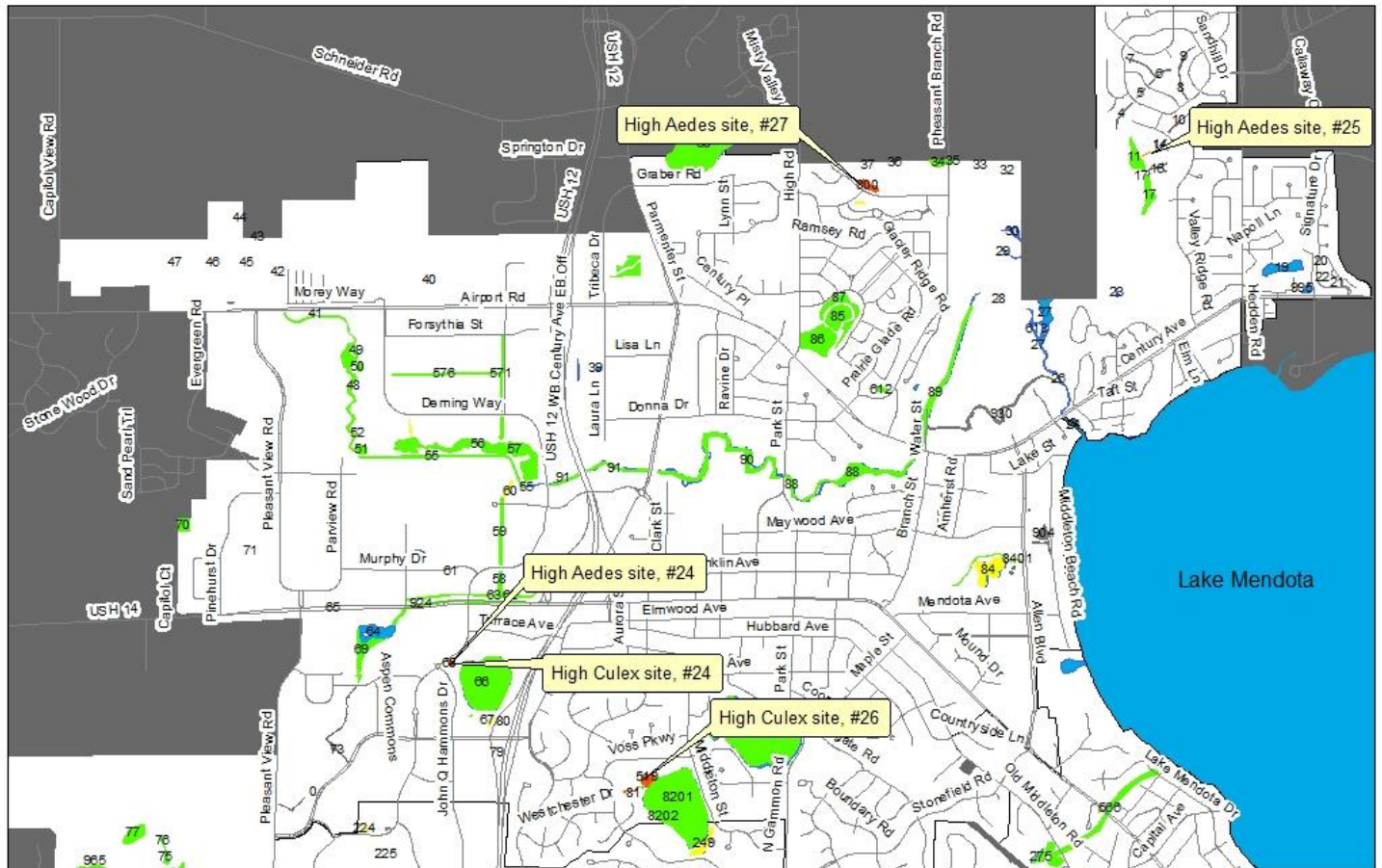
- Mosquitoes like to lay eggs in standing water. They don't need a lot, so be sure to keep things dry. Drain any standing water in your outdoor living areas. You might see water accumulating in clogged gutters, air conditioners, tarps, wheelbarrows, plant debris, flower pots, pet dishes, or birdbaths.
- Use insect repellents on skin and clothing before heading outdoors during mosquito season (May-September).
- Wear long-sleeved shirts, pants, socks, and shoes outside during peak mosquito activity hours.; usually dusk and dawn for most mosquito species in Wisconsin.
- Learn more on the [Department of Health Services website](#)

Appendix 1: Sites within Dane County that produced high numbers of Culex and/or Aedes larvae in 2023

Site group name		Total for site			High <i>Culex</i> in site		High <i>Aedes</i> in site	
		# sites	# Inspections	acres	sites	acres	sites	acres
City of Madison								
1	Culvert drainage ditch	1	14	<0.1	1	<0.1	0	0
2	Dolphin Drive ditch	1	4	1.3	1	1.3	0	0
3	East Badger Mill Creek Greenway	15	102	7.8	3	1.2	0	0
4	Eastmoorland Park	3	22	0.6	1	0.1	0	0
5	Elver Park Greenway	12	51	15.2	1	0.5	1	0.5
6	Highpoint Estates Detention Pond	1	15	0.2	1	0.2	0	0
7	Maple Grove Greenway	7	22	5.8	1	0.2	0	0
8	McClellan Drive pond	1	15	0.7	1	0.7	0	0
9	Mendota – Pheasant Branch Greenway	26	103	30.1	2	1.3	0	0
10	Milwaukee Street Greenway	6	40	4.1	1	<0.1	0	0
11	Nob Hill Ponds	3	17	<0.1	1	<0.1	0	0
12	North Penito Creek Greenway	6	39	9.7	3	2.9	0	0
13	Owen Park Greenway	10	39	14.4	2	3.5	0	0
14	Ridgewood Ponds	2	18	0.8	1	0.5	0	0
15	University Bay ditches	1	6	<0.1	1	<0.1	0	0
16	UW Campus	2	15	<0.1	1	<0.1	0	0
17	Warner Park Lagoon	7	39	3.1	2	0.2	0	0
18	West Badger Mill Creek Greenway	12	39	8.4	1	0.4	0	0
19	West Towne ponds	5	17	6.6	2	2.1	0	0
20	Westchester Garden Park	3	23	6.5	1	<0.1	0	0
21	Whitetail Ridge Detention Center	1	15	2.0	1	2.0	0	0
22	William McFarland Park Ditch	1	3	2.2	0	0	1	2.2
23	Yellowstone catch basin	1	1	<0.1	1	<0.1	0	0
City of Middleton								
24	Esser Pond	3	13	16.0	1	0.2	0	0
25	Orchard Heights Park	12	39	4.7	0	0	1	<0.1
26	Stricker's Pond	4	31	1.1	2	1.1	0	0
27	Whittlesey Road	1	5	0.7	1	0.7	0	0
UW Madison								
28	UW Arboretum	13	37	47.1	2	1.1	0	0

Appendix 2: Mosquito larvae monitoring results, 2023

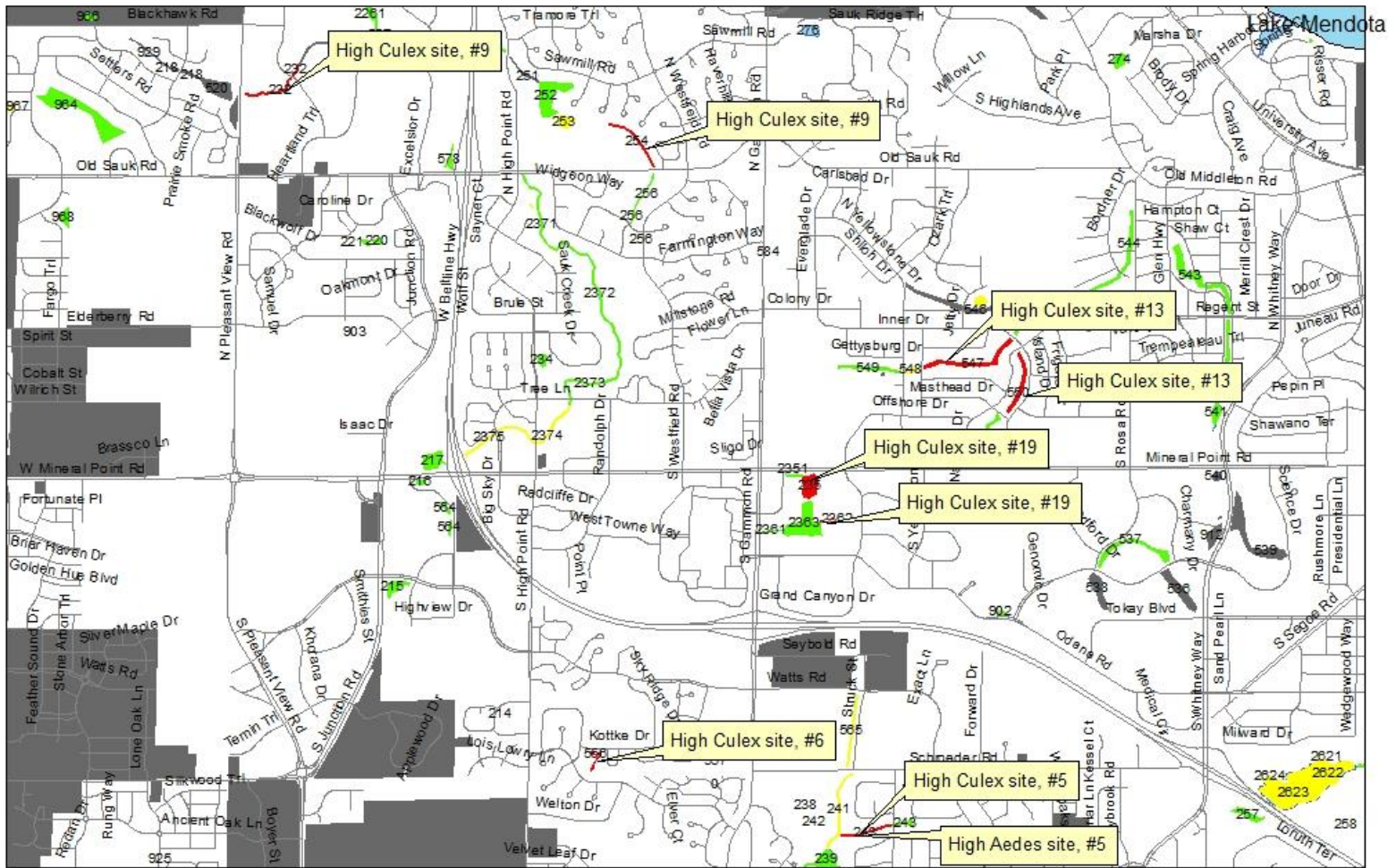
Middleton, WI



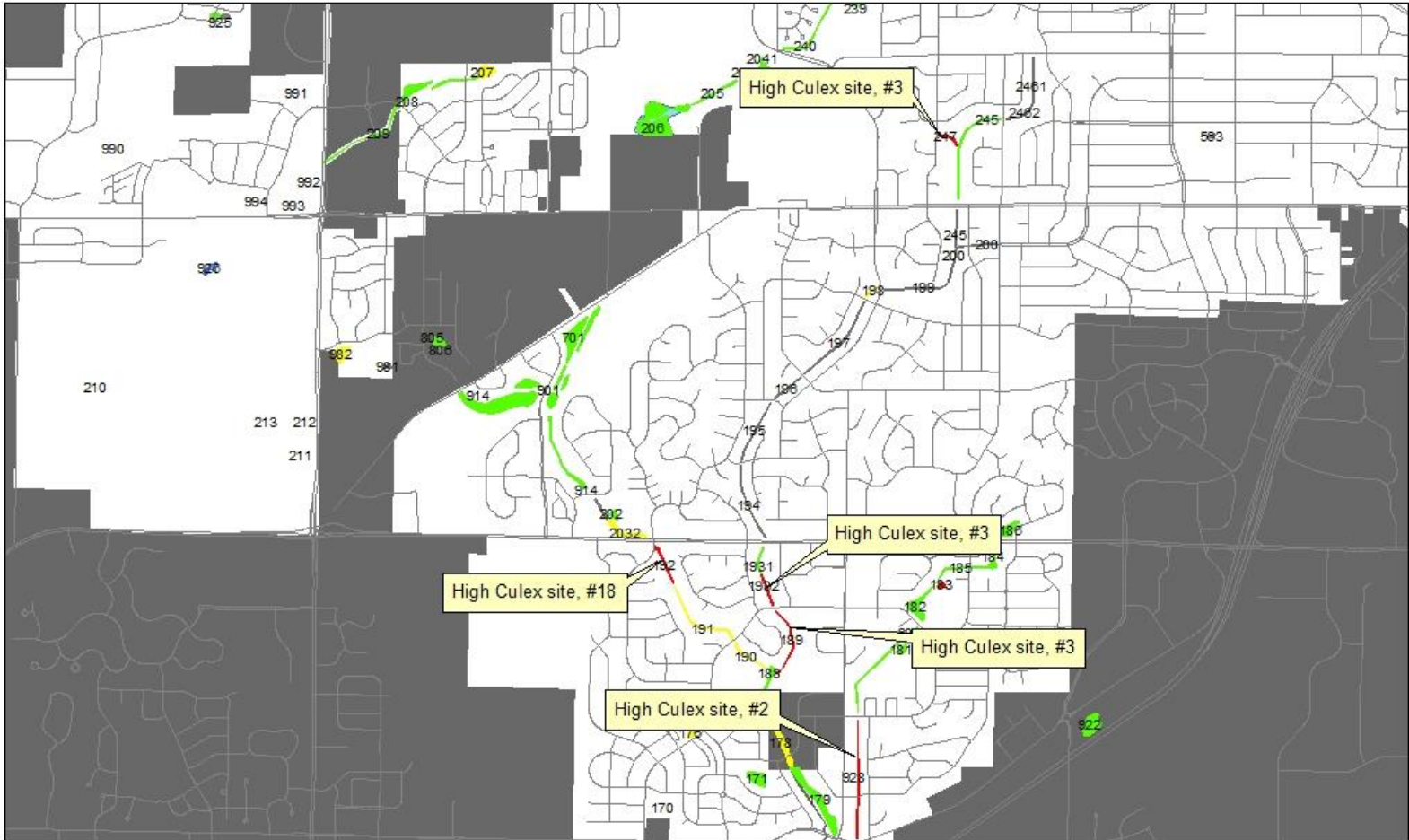
Legend

- High Culex
- High Aedes
- Low Larvae
- No Larvae
- Inaccessible or Private
- Lakes, Rivers, Streams

Madison, WI (northern west side)

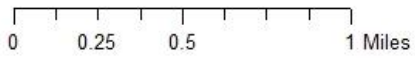


Madison, WI (southern west side)

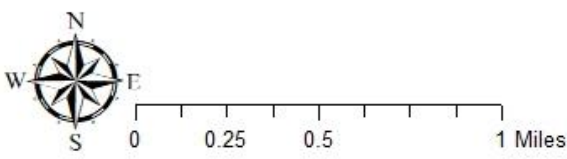
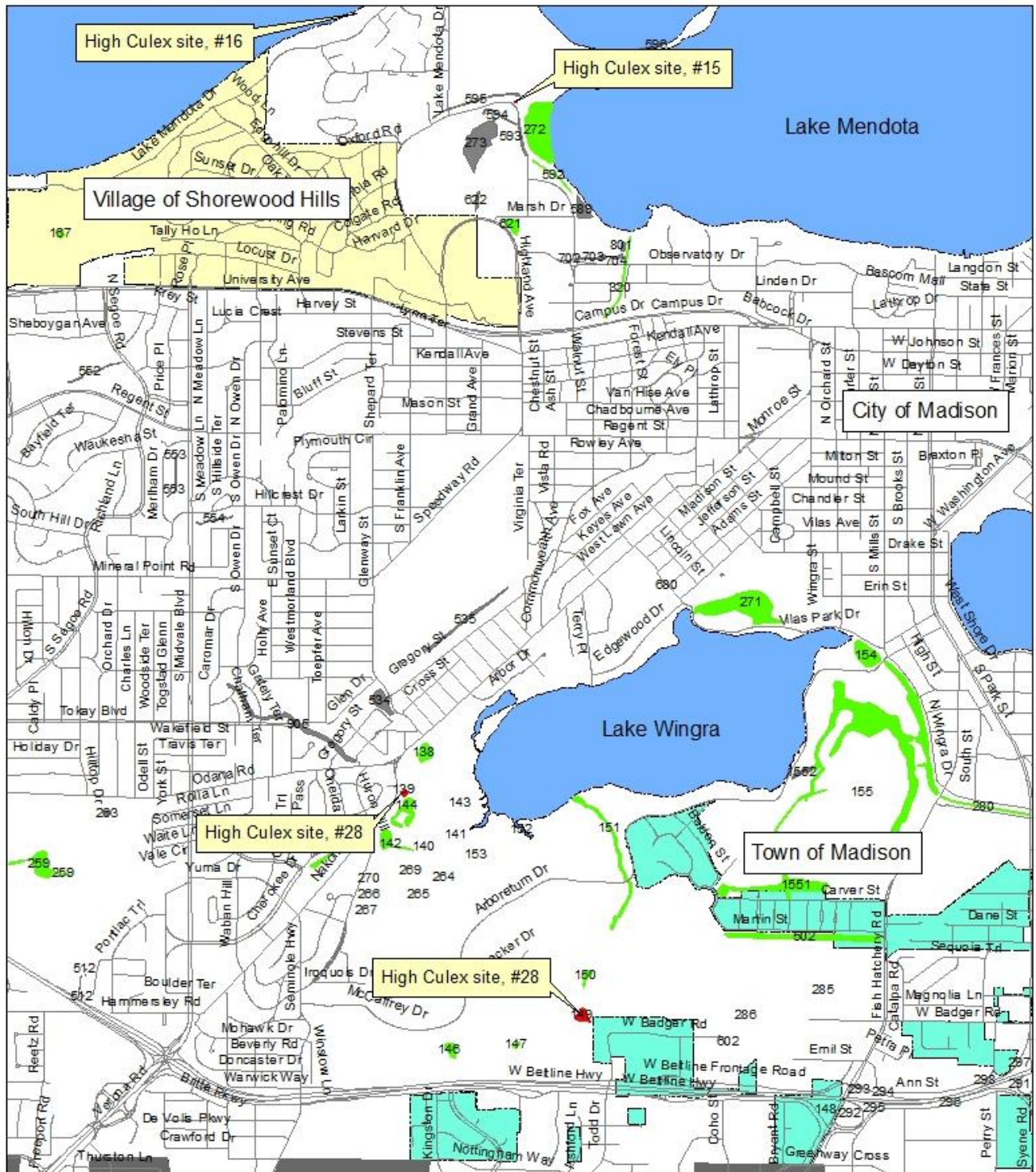


Legend

- | | | | |
|---|------------|---|-------------------------|
|  | High Culex |  | No Larvae |
|  | High Aedes |  | Inaccessible or Private |
|  | Low Larvae |  | Lakes, rivers, streams |



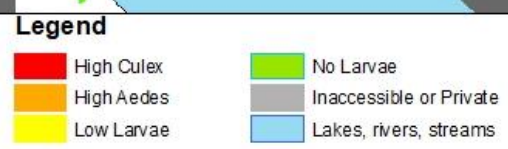
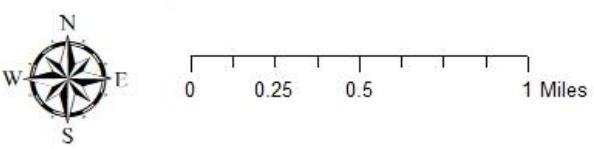
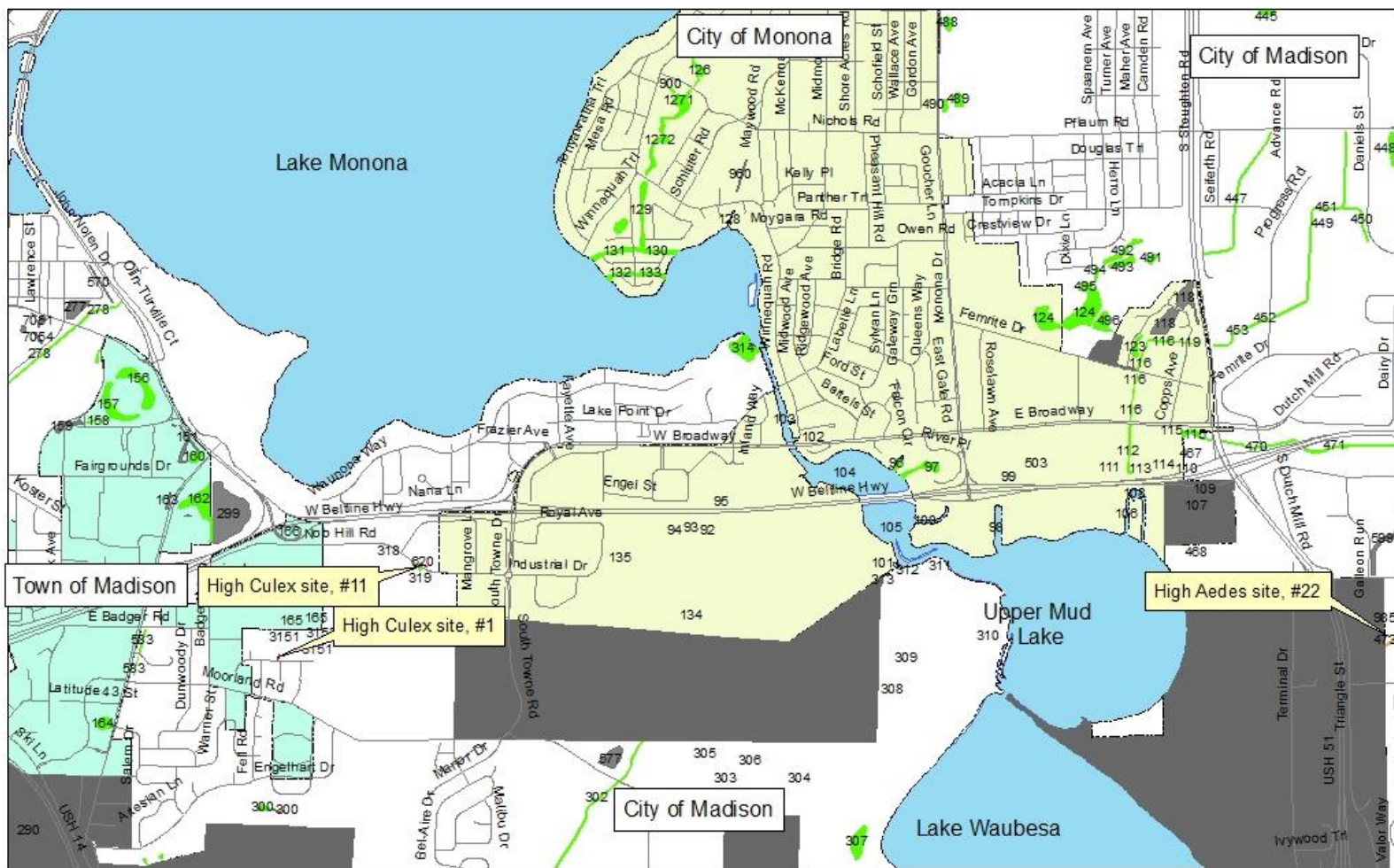
Madison (near west side), Village of Shorewood Hills, and Town of Madison, WI.



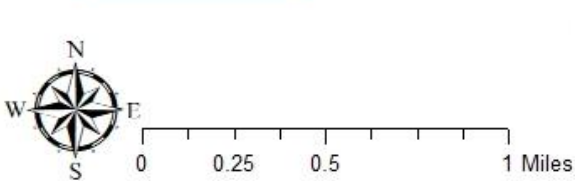
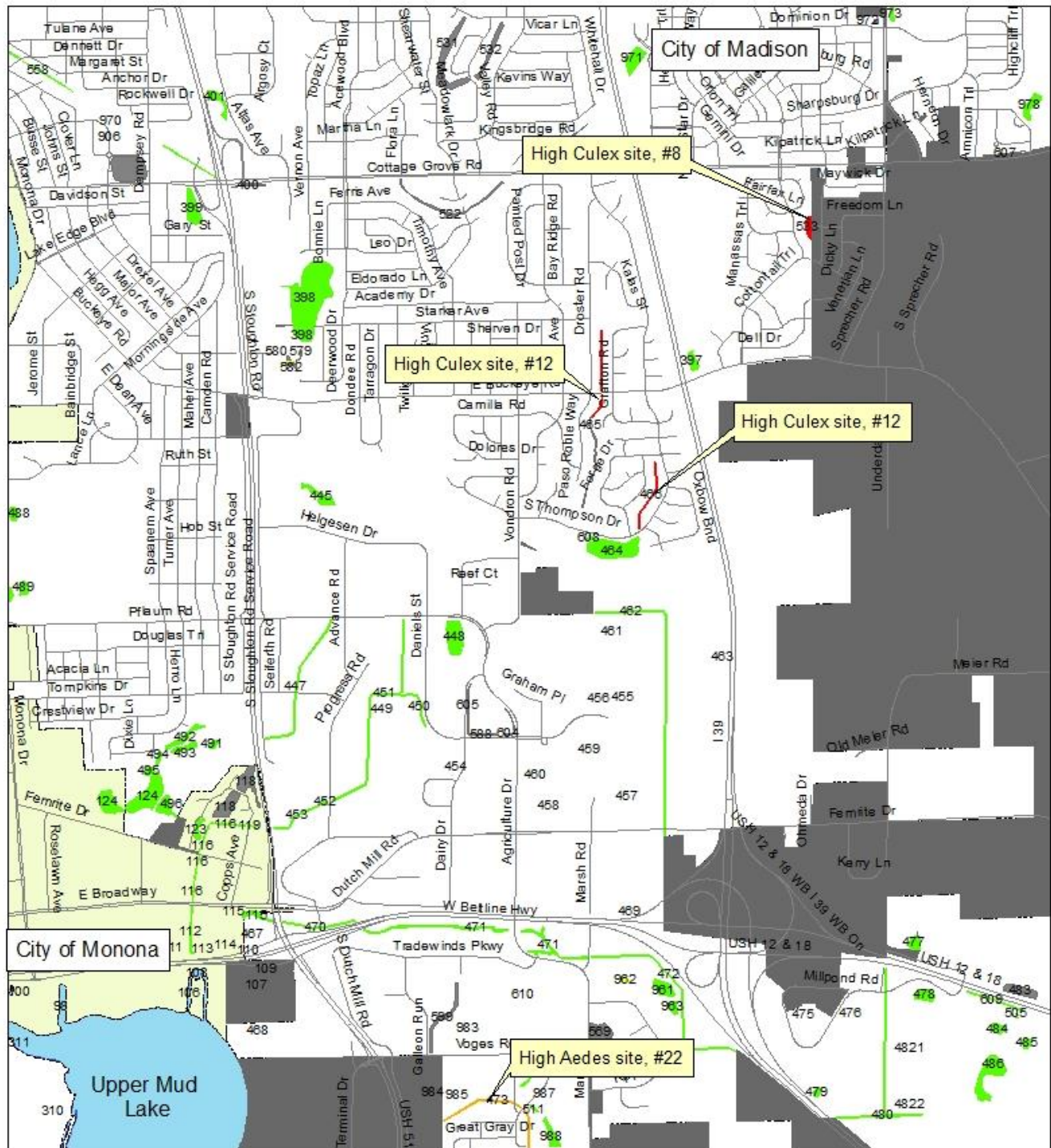
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■ High Culex	■ No Larvae
■ High Aedes	■ Inaccessible or Private
■ Low Larvae	■ Lakes, rivers, streams

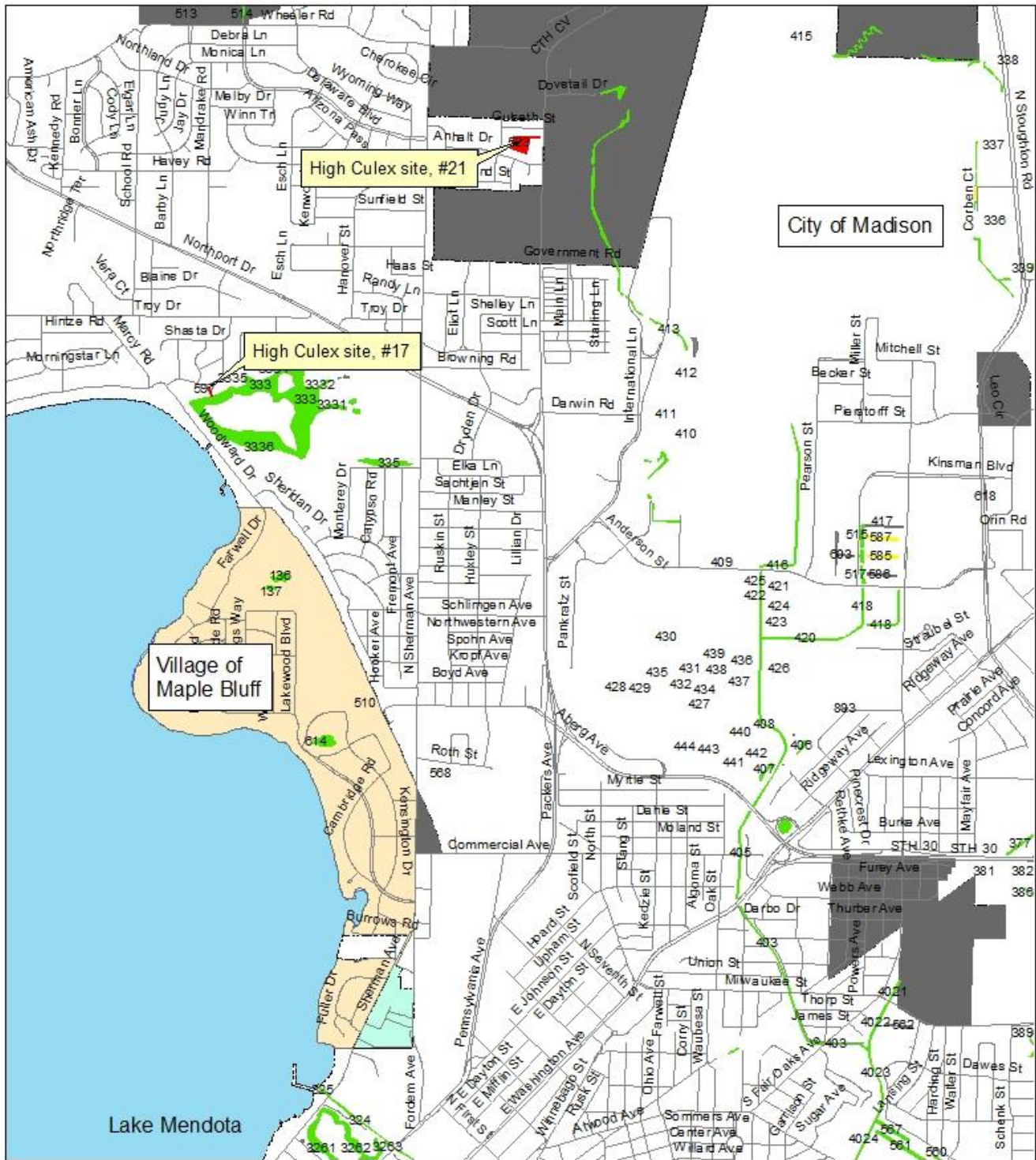
Madison (south side), City of Monona, and Town of Madison, WI.



Madison (southeast) and City of Monona, WI.

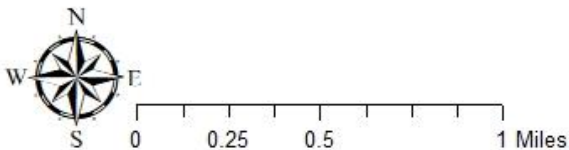


Madison (north), and Village of Maple Bluff, WI.

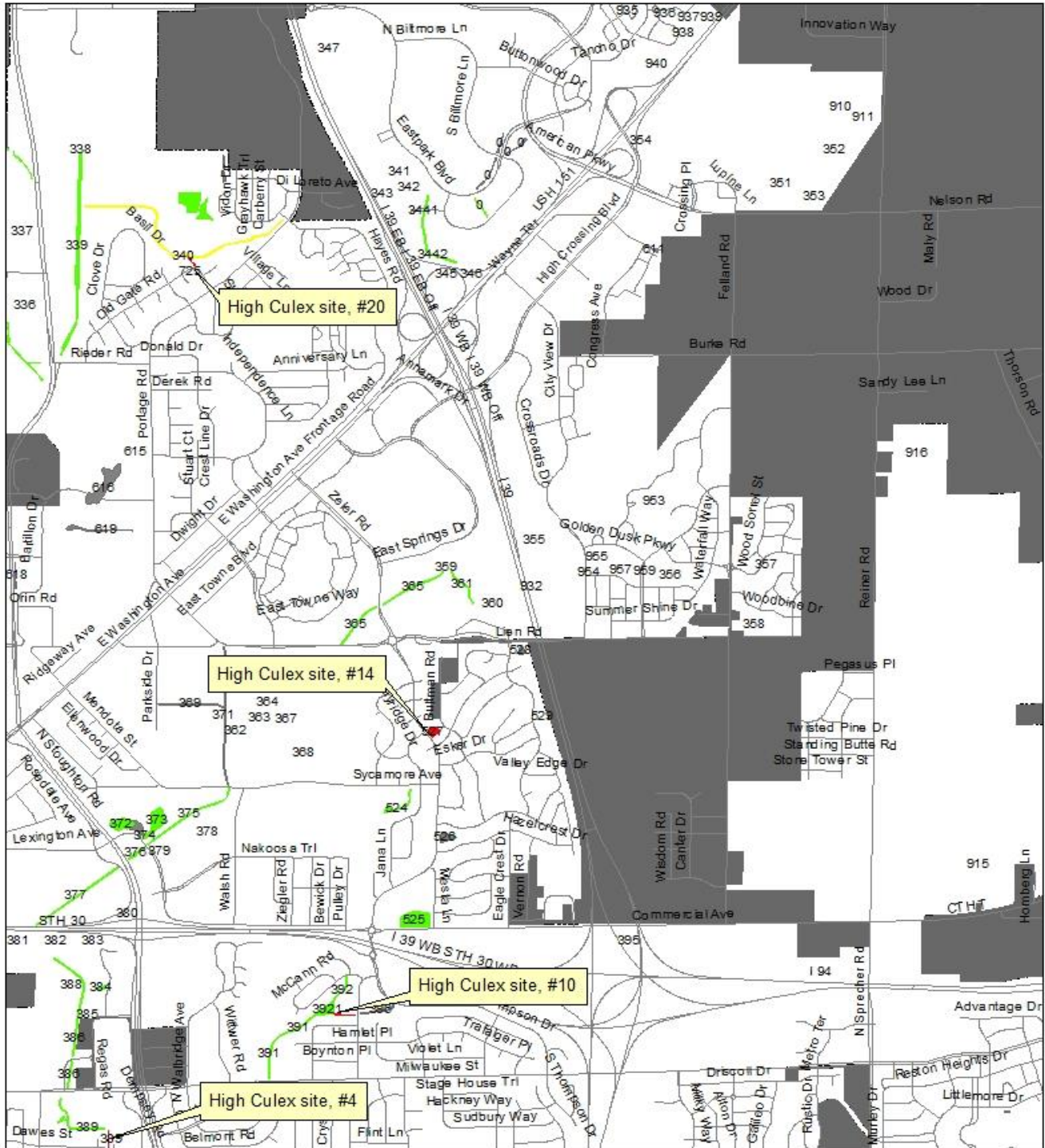


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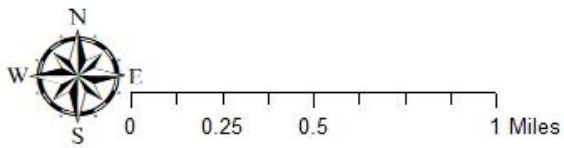


Madison (northeast), WI.

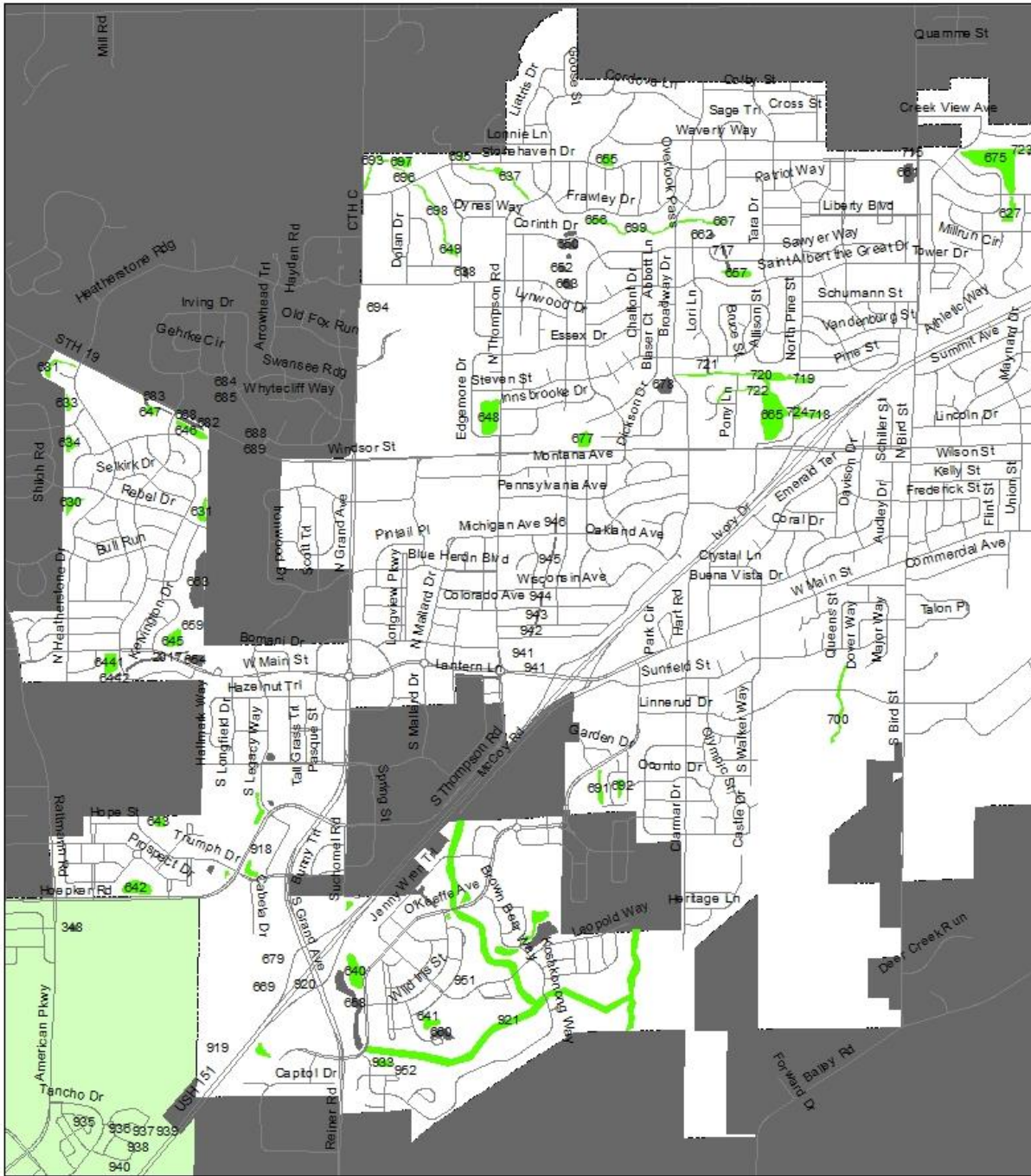


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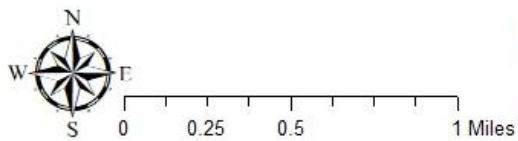


Sun Prairie (West), WI.

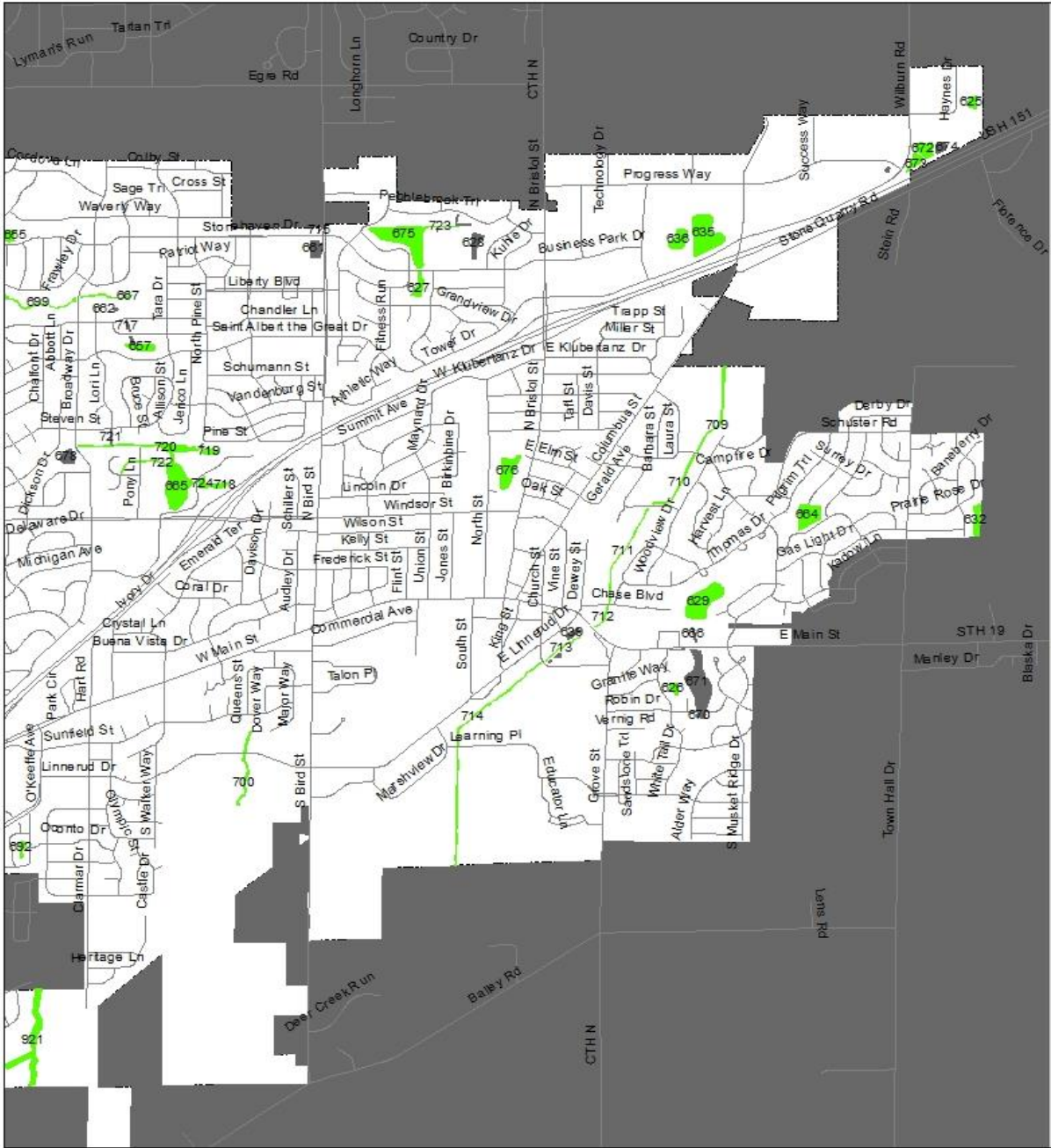


Legend

- | | |
|--|---|
| ■ High Culex | ■ No Larvae |
| ■ High Aedes | ■ Inaccessible or Private |
| ■ Low Larvae | ■ Lakes, rivers, streams |



Sun Prairie (East), WI.



For more information, contact:
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