

Crow Wing County's Lakeshore Impervious Coverage Research Project

Phase IV, July 2015

Executive Summary

The purpose of the impervious coverage research project is to determine the amount of impervious surfaces on lakeshore parcels on the County's larger lakes. The percent of impervious surfaces for each lot was calculated by using high resolution Lidar and aerial photography in ESRI's ArcMap Geographic Information System (GIS) software. The project is in its fourth phase with previous phases conducted in 2012 (1000+ acre lakes), 2013 (500-1000 acre lakes), 2014 (lakes in the Cities of Crosslake). This phase includes 400-500 acre lakes and remainder of 500+ acre lakes in municipal areas. Figure 1 (below) shows the lakes by Phase (with the colors indicating the most current date of editing).

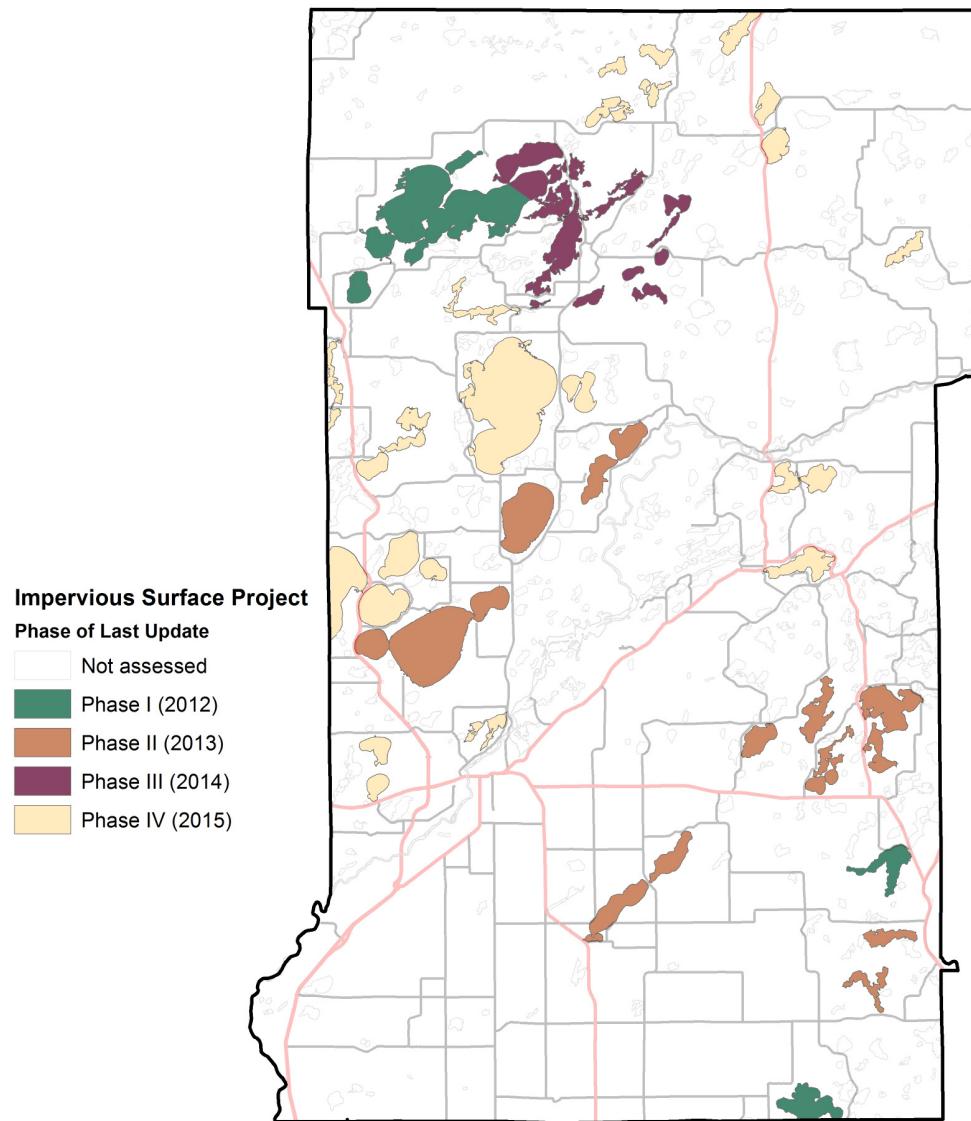


Figure 1: Phases of Impervious Surface Research Project

Background

Water is Crow Wing County's lifeblood. The county has an area of 731,000 acres and approximately 102,000 acres or 14% is covered by over 550 scenic lakes, rivers, and streams. An additional 14% is covered by wetlands as well. The abundance of surface water makes this Central Minnesota County an attraction to people.

From 1990 to 2000 the population in Crow Wing County increased by 24.5%, the eleventh fastest growth county of Minnesota's 87. The most recent census shows the population continued to grow another 13.4% from 2000 to 2010. The majority of the growth is concentrated around the deep, clear, recreational lakes where seasonal cabins are being replaced with larger year-round homes.

Crow Wing County revised its Land Use Ordinance in 2011. This ordinance placed added performance standards based on the amount of impervious surfaces per lot. Applicants are required to implement a storm water management plan if the riparian lot exceeds 15% impervious surface coverage. The ordinance prohibits more than 25% impervious surface coverage in the shoreland protection zone (per Article 41, see figure 2 below).

Table 41.1 Shoreland Protection Zone Impervious Surface Limits

Development or Use	Maximum Impervious Surface	Applicable Area
Residential lots-with no stormwater plan required as per Article 41.2 1 A	15%	Total lot area above the OHW
Residential lots with stormwater plan as per Article 41.2 1 B	20%	Total lot area above the OHW
Residential lots with stormwater plan & shoreline buffer as per Article 41.2 1 C	25%	Total lot area above the OHW
Conservation Developments with stormwater plans as per Article 41.3	30%	Average Dwelling unit lot above the OHW
Resorts with stormwater plans as per Article 34.8	25%	Total project area and any tier above the OHW
Commercial with stormwater plans as per Article 16.3	30%	Total lot area above the OHW

Figure 2. Crow Wing County Ordinance Impervious Surface Limits

Results:

The percentage of impervious surface coverage was calculated on riparian lots on approximately 60 Crow Wing County Lakes. The average impervious surface coverage by lake was calculated by summing the total impervious for all riparian lots on the lake and then dividing by the total lot area. The average impervious ranged from just under 1% (Big Bird Lake) to over 20 % (Gull Lake, *Crow Wing County portion only*), which the median value being 5.4%. The list of results are listed below along with an overall summary map and individual maps for the Phase IV lakes.

Lake Name	# of Riparian Lots / Lake	Average % Imp Per Lot
Gull	360 Lots	20.8%
Daggett	283 Lots	17.7%
Round	321 Lots	17.6%
Loon	51 Lots	15.5%
Island (18-269)	93 Lots	14.4%
Cross	1485 Lots	13.8%
Lower Whitefish	202 Lots	13.5%
Serpent	389 Lots	13.0%
Rush	402 Lots	13.0%
White Sand	153 Lots	12.4%
Little Pine	172 Lots	10.9%
Bertha	173 Lots	10.5%
Big Trout	382 Lots	9.5%
Horseshoe	310 Lots	8.7%
Lower Cullen	153 Lots	8.5%
Hubert	241 Lots	8.0%
Fawn (18-309)	169 Lots	7.9%
Ruth	184 Lots	7.5%
Bay	1242 Lots	7.2%
O'Brien	181 Lots	6.9%
Pelican	1240 Lots	6.9%
East Fox	161 Lots	6.5%
Portage	72 Lots	6.4%
North Long	735 Lots	6.2%
Emily	105 Lots	6.1%
Edward	288 Lots	6.0%
Middle Cullen	241 Lots	6.0%
Lower Hay	202 Lots	5.9%
Ossawinnamakee	600 Lots	5.8%
Lower South Long	431 Lots	5.7%
Upper Hay	160 Lots	5.6%
Rabbit	280 Lots	5.4%
Big Pine	294 Lots	5.2%
Upper Mission	159 Lots	5.2%
West Fox	175 Lots	5.0%
Gladstone	110 Lots	4.8%
Upper Whitefish	745 Lots	4.8%
Crooked	317 Lots	4.8%
Roosevelt	167 Lots	4.7%
Mitchell	152 Lots	4.6%
Hanks	129 Lots	4.4%
Gilbert	199 Lots	4.3%
Eagle	123 Lots	4.3%
Red Sand	114 Lots	4.3%
Sibley	306 Lots	4.0%
Velvet	52 Lots	3.8%
Mayo	77 Lots	3.7%
Goodrich	126 Lots	3.6%
Camp	226 Lots	3.4%
Nokay	83 Lots	3.1%

Lake Name	# of Riparian Lots / Lake	Average % Imp Per Lot
Borden	236 Lots	2.8%
McClain	24 Lots	2.8%
Clearwater	131 Lots	2.7%
Kego	40 Lots	2.3%
Platte	340 Lots	2.3%
Lower Mission	130 Lots	2.2%
Smith	128 Lots	2.2%
Pig	86 Lots	1.9%
Arrowhead	44 Lots	1.7%
Ross	91 Lots	1.6%
Greer	35 Lots	1.1%
Big Bird	9 Lots	0.9%

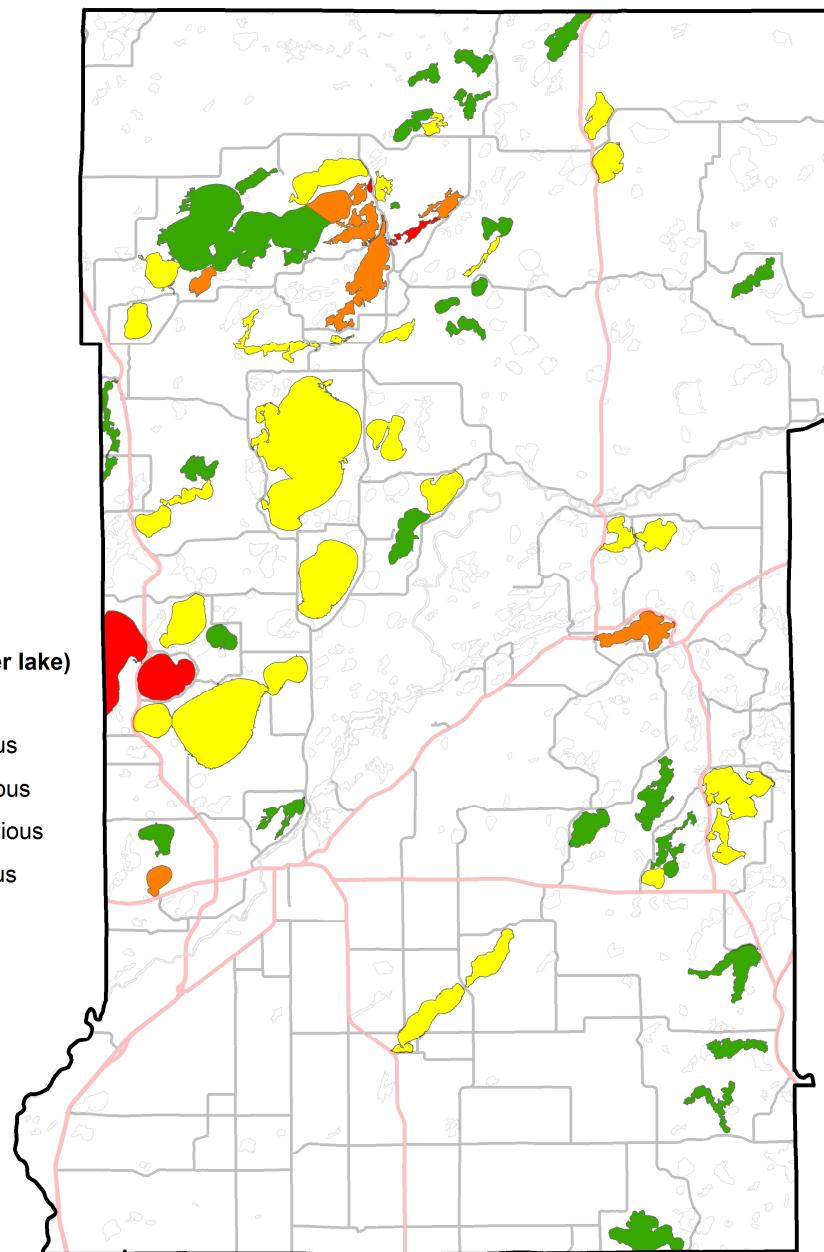
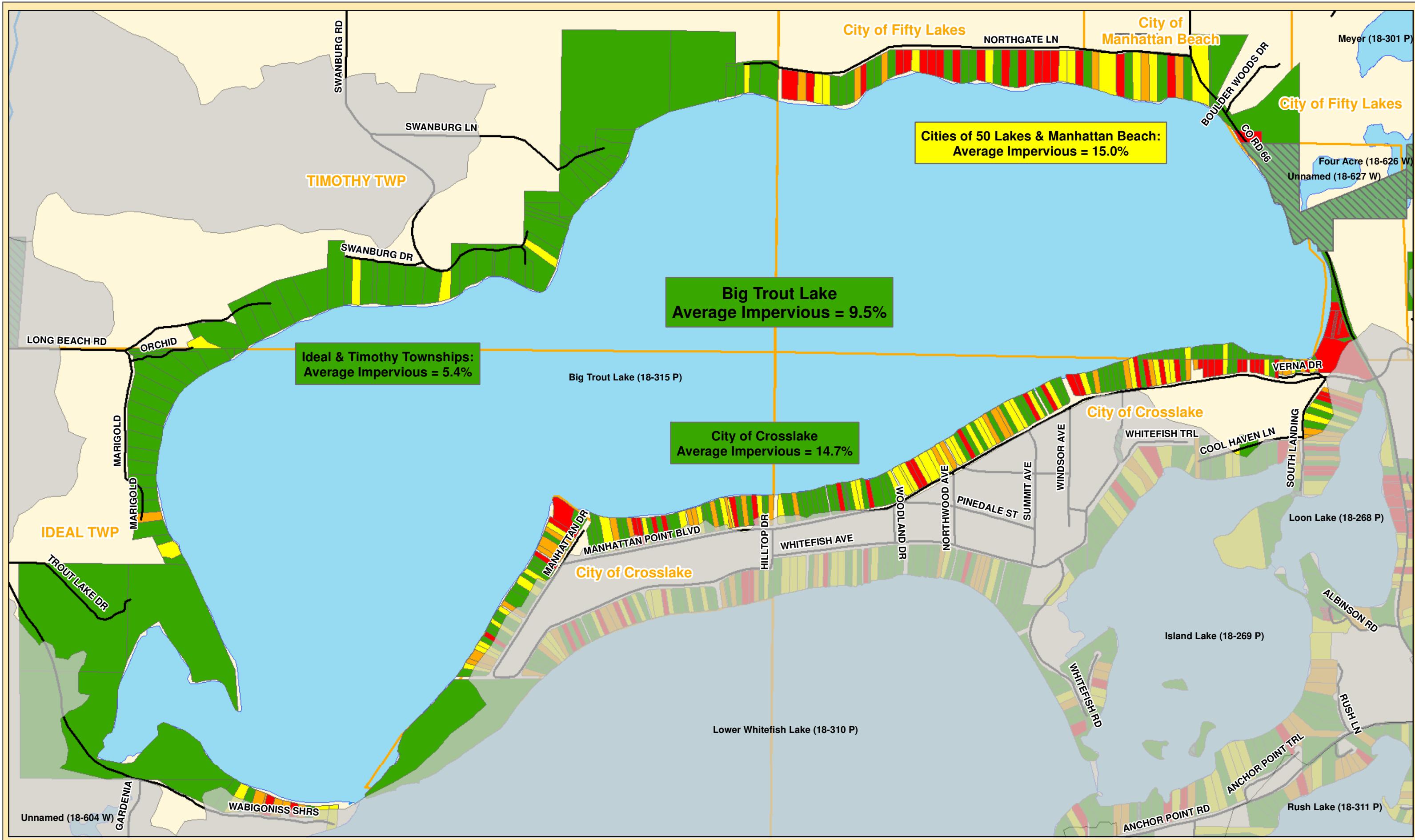


Figure 3: Average % Impervious for all Lakes in the Study (2012 to current)

Phase IV Maps:

- Big Trout
- Cullen Chain
- Gilbert
- Gladstone
- Gull (Crow Wing County portion only)
- Horseshoe
- Hubert
- Kego-Mitchell-Eagle-Fox
- Ossawinnamakee
- Pelican
- Rabbit
- Red-White Sand
- Roosevelt (Crow Wing County Portion only)
- Ross
- Round
- Ruth-Emily
- Serpent
- Sibley-Mayo



Big Trout Lake Impervious Surface Coverage

Areas in gray are not within the watershed of Big Trout Lake

A horizontal bar chart with four categories: 0-15%, 15-20%, 20-25%, and 25+%. The bars are colored green, yellow, orange, and red respectively. The red bar is the longest, followed by orange, yellow, and green.

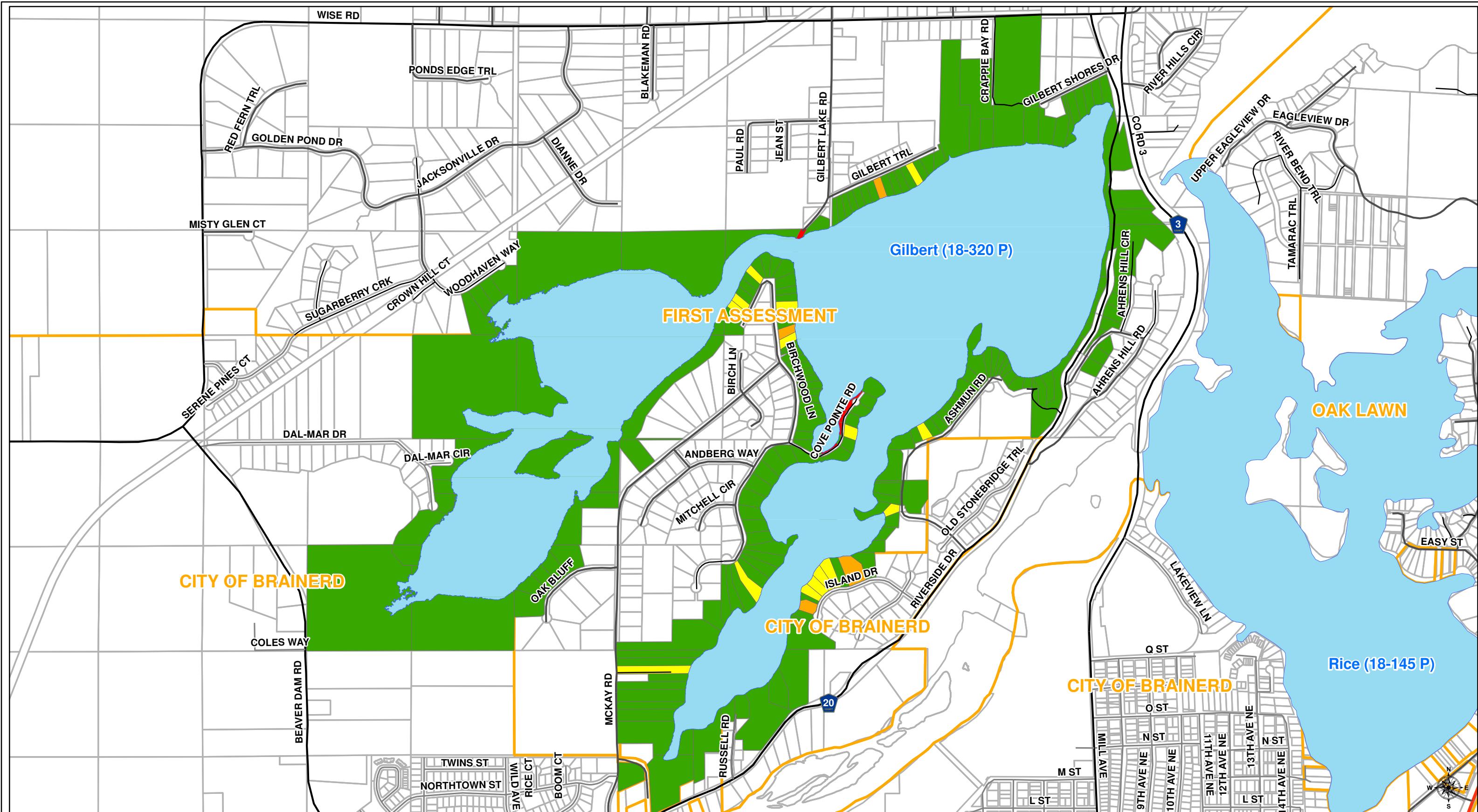
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Cullen Lakes

Total Impervious Coverage for all Lots:
Upper Cullen = 2.9% Middle Cullen = 6.0% Lower Cullen = 8.5%

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Gilbert Lake

Total Impervious Coverage for all Lots = 4.3%

Impervious Surface Coverage by Parcel



0 0.125 0.25 0.5 Miles

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Gladstone Lake

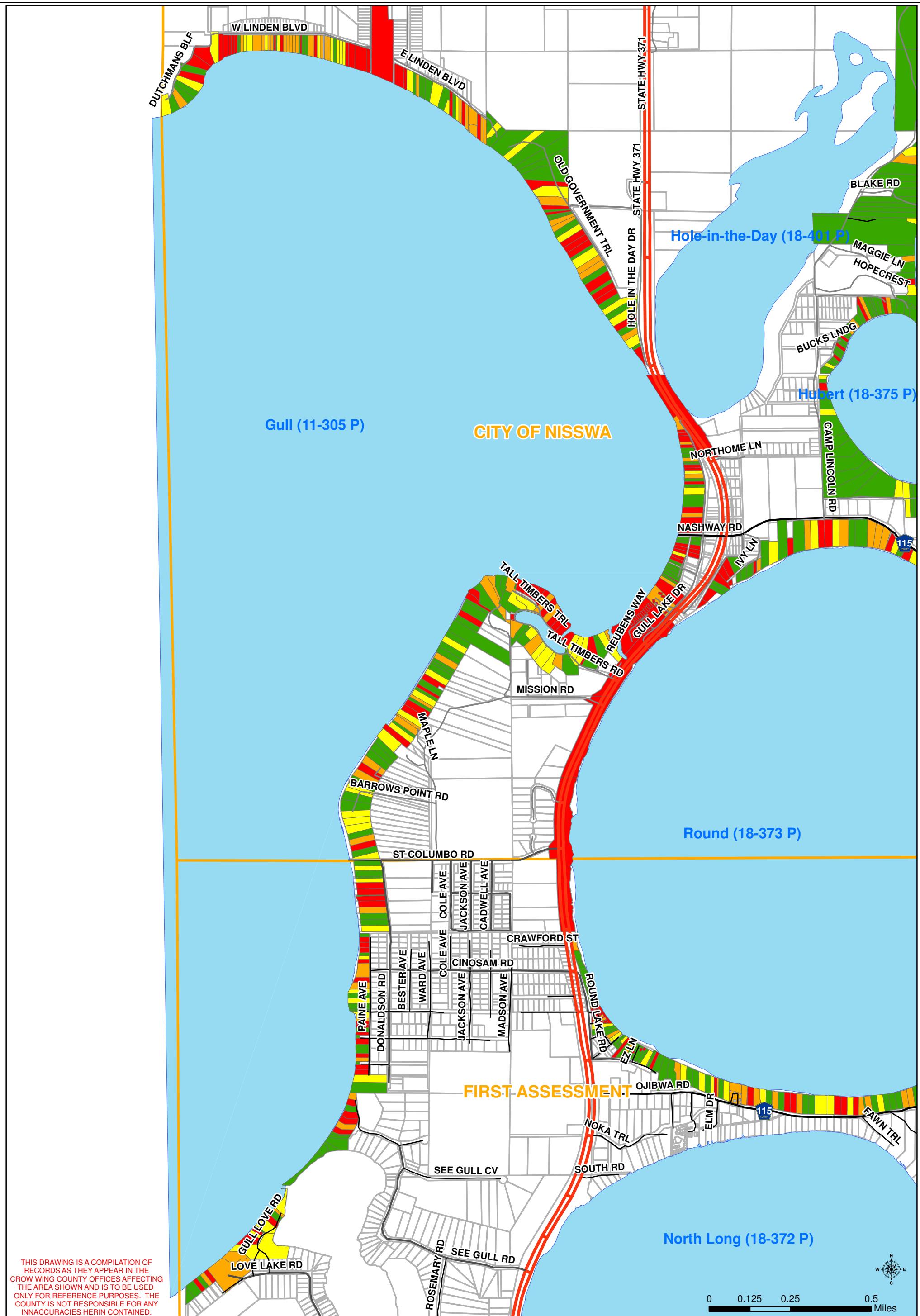
Total Impervious Coverage for all Lots = 4.8%

Impervious Surface Coverage by Parcel

	0 - 15 %		City / Township Boundaries
	15 - 20 %		Lakes
	20 - 25 %		Other Parcels
	25+ %		

0 0.125 0.25 0.5 Miles

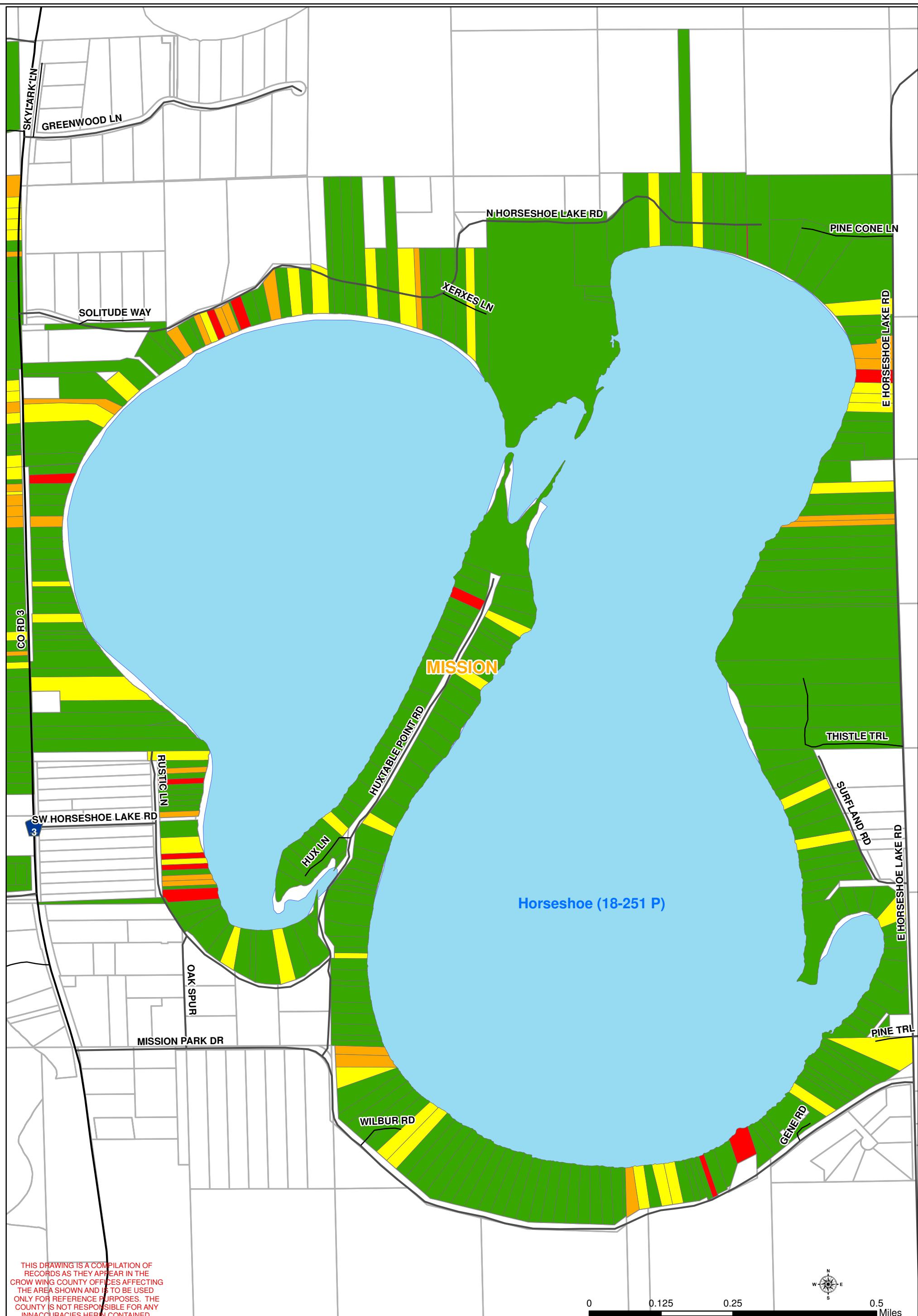
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Gull Lake
Total Impervious Coverage for all Lots = 20.8%

Impervious Surface Coverage by Parcel

Impervious Coverage Range	Color	Parcel Examples
0 - 15 %	Green	DUTCHMANS BLF, Gull (11-305 P), Hole-in-the-Day (18-401 P), Hubert (18-375 P), Round (18-373 P), North Long (18-372 P)
15 - 20 %	Yellow	W. LINDEN BLVD, E. LINDEN BLVD, OLD GOVERNMENT TRL, HOLE IN THE DAY DR, STATE HWY 371, BUCKS LNDG, CAMP LINCOLN RD, 115 COUNTY, FAWN TRL
20 - 25 %	Orange	STATE HWY 371, BUCKS LNDG, CAMP LINCOLN RD, 115 COUNTY, FAWN TRL
25+ %	Red	W. LINDEN BLVD, E. LINDEN BLVD, OLD GOVERNMENT TRL, HOLE IN THE DAY DR, STATE HWY 371, BUCKS LNDG, CAMP LINCOLN RD, 115 COUNTY, FAWN TRL

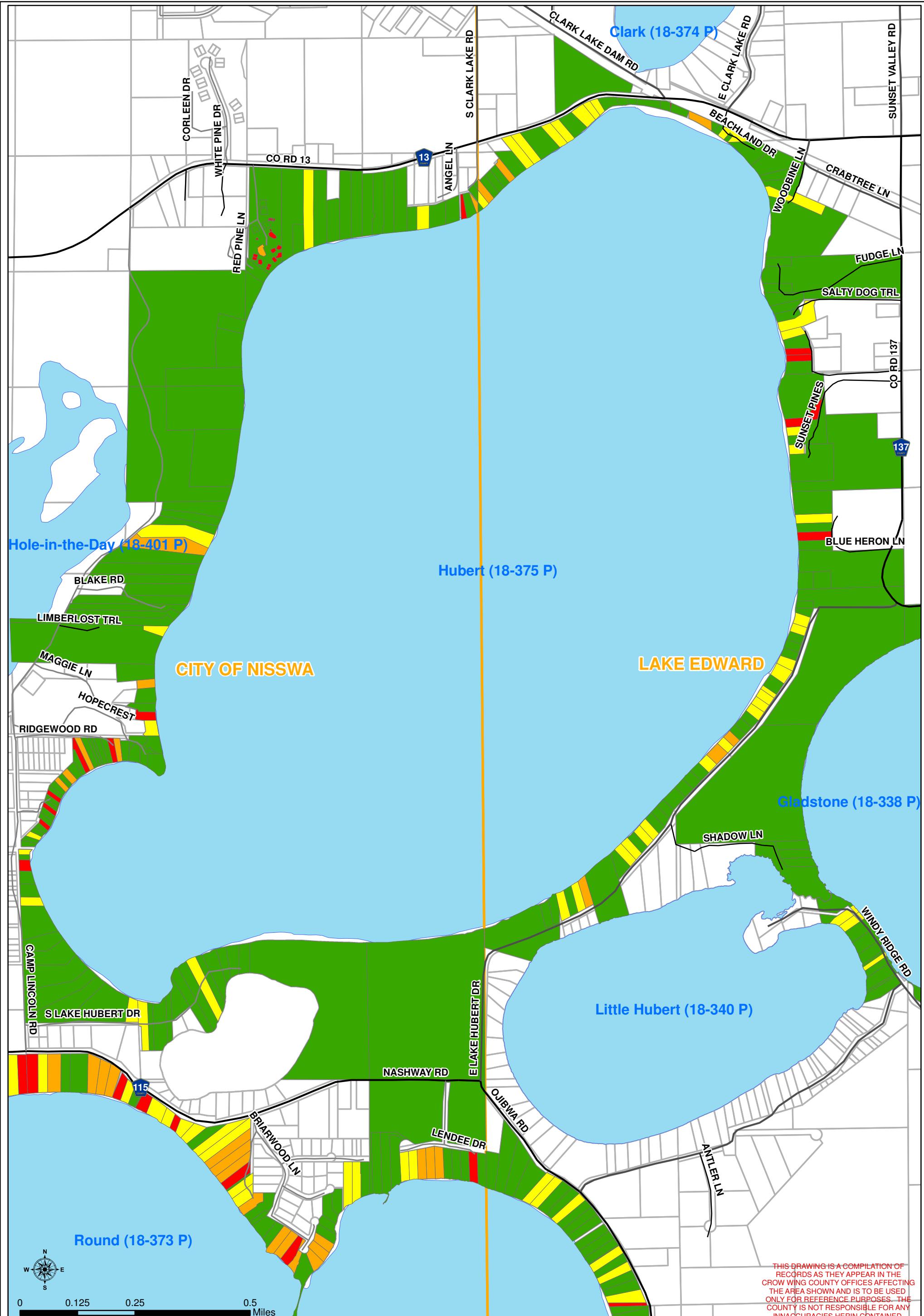


Horseshoe Lake

Total Impervious Coverage for all Lots = 8.7%

Impervious Surface Coverage by Parcel

0 - 15 %	City / Township Boundaries
15 - 20 %	Lakes
20 - 25 %	Other Parcels
25+ %	



Lake Hubert

Total Impervious Coverage for all Lots = 8.0%

Impervious Surface Coverage by Parcel

0 - 15 %

15 - 20 %

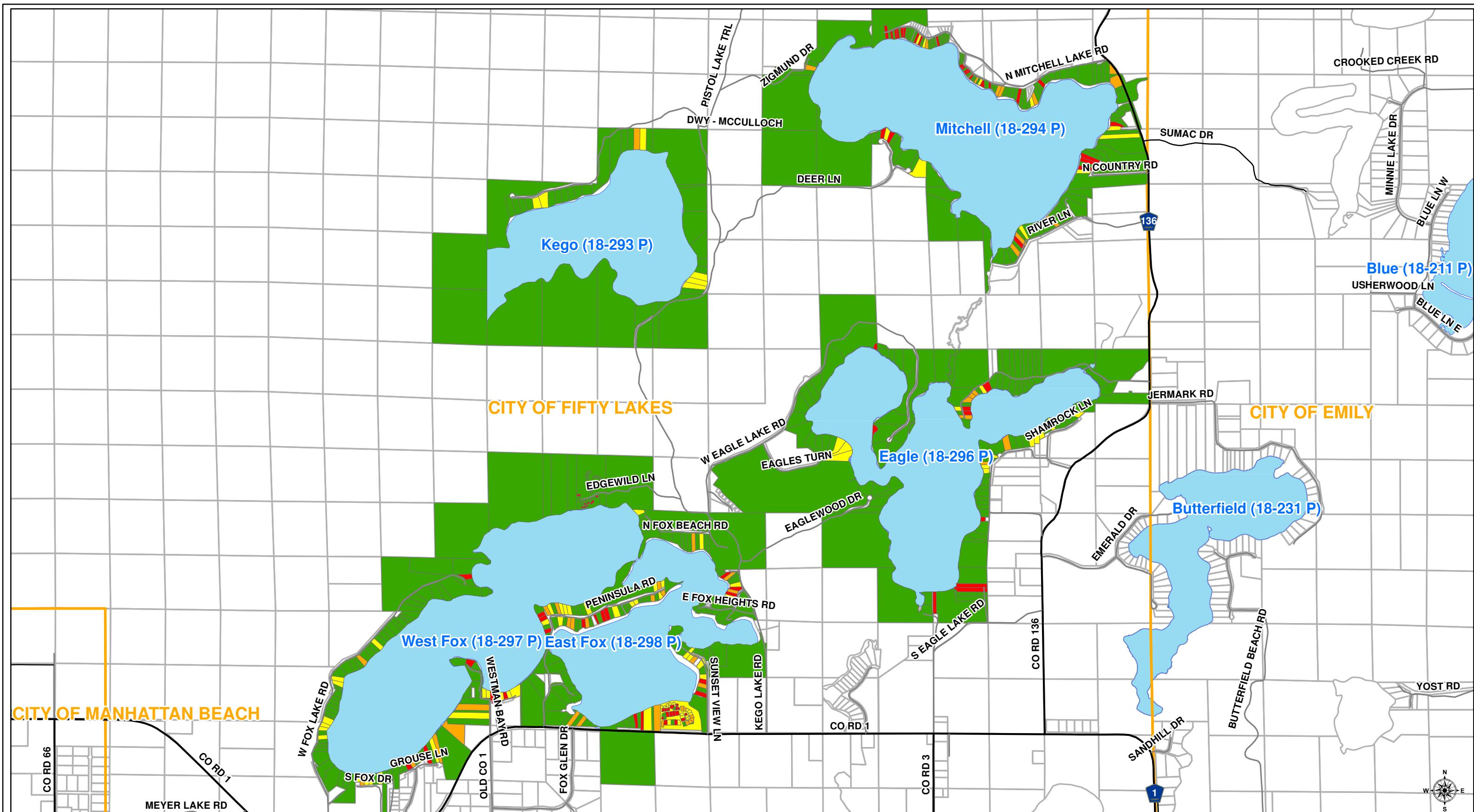
20 - 25 %

25+ %

City / Township Boundaries

Lakes

Other Parcels



Kego, Mitchell, Eagle, East/West Fox Lakes

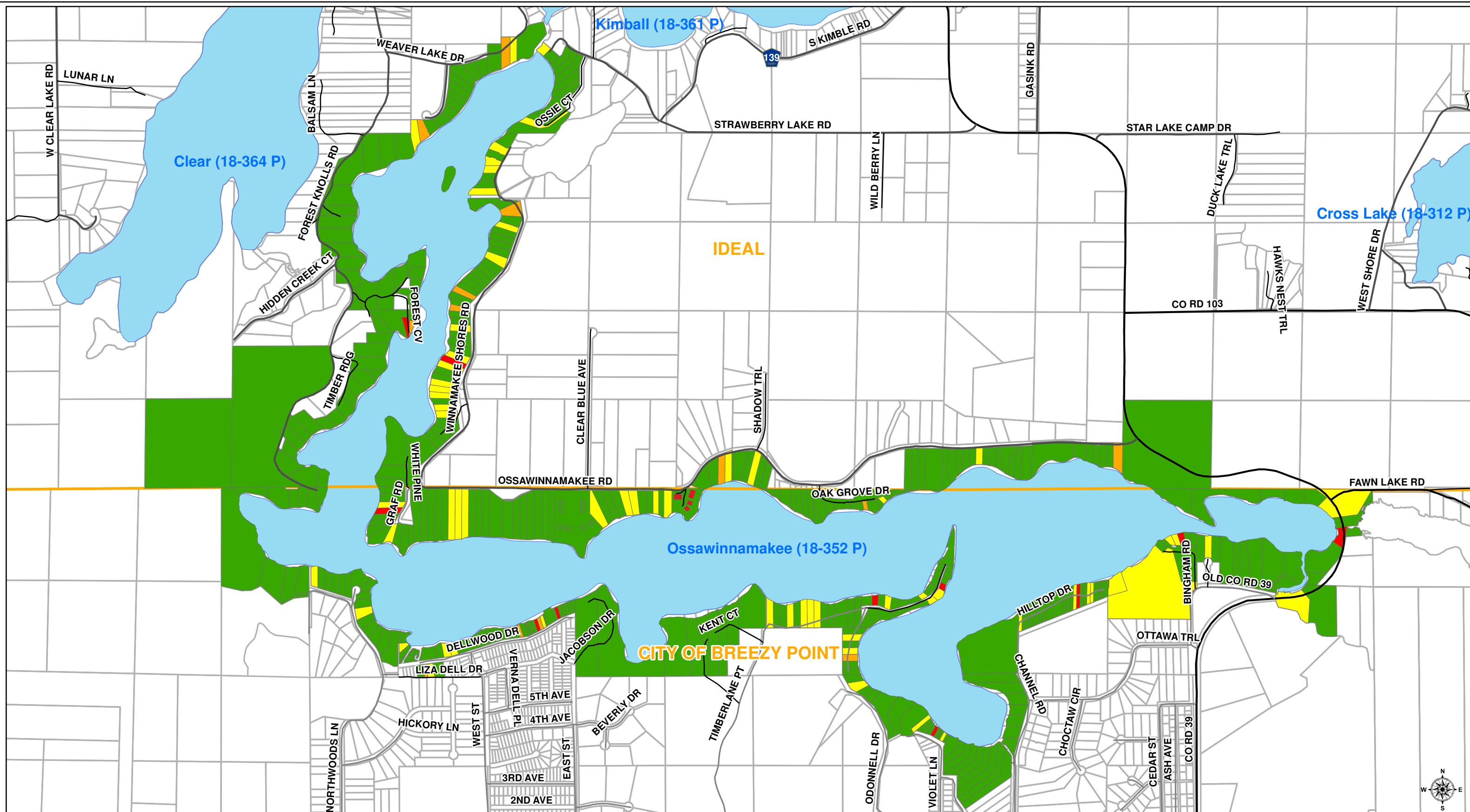
Total Impervious Coverage for all Lots:
 Kego = 2.3% Mitchell = 4.6% Eagle = 4.3 % East Fox = 6.5% West Fox = 5.0%

Impervious Surface Coverage by Parcel

0 - 15 %	City / Township Boundaries
15 - 20 %	Lakes
20 - 25 %	Other Parcels
25+ %	

0 0.25 0.5 1 Miles

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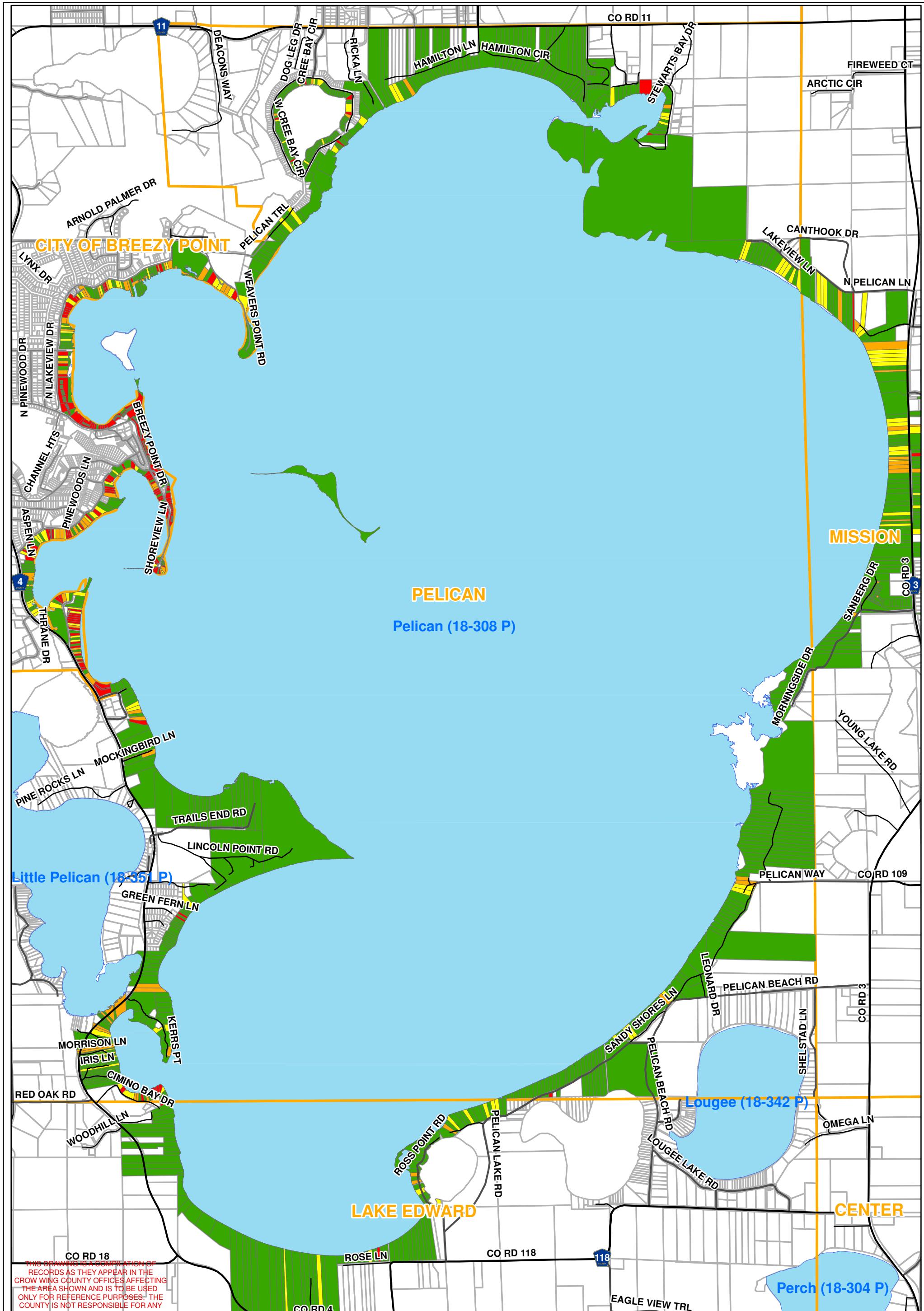
Lake Ossawinnamakee

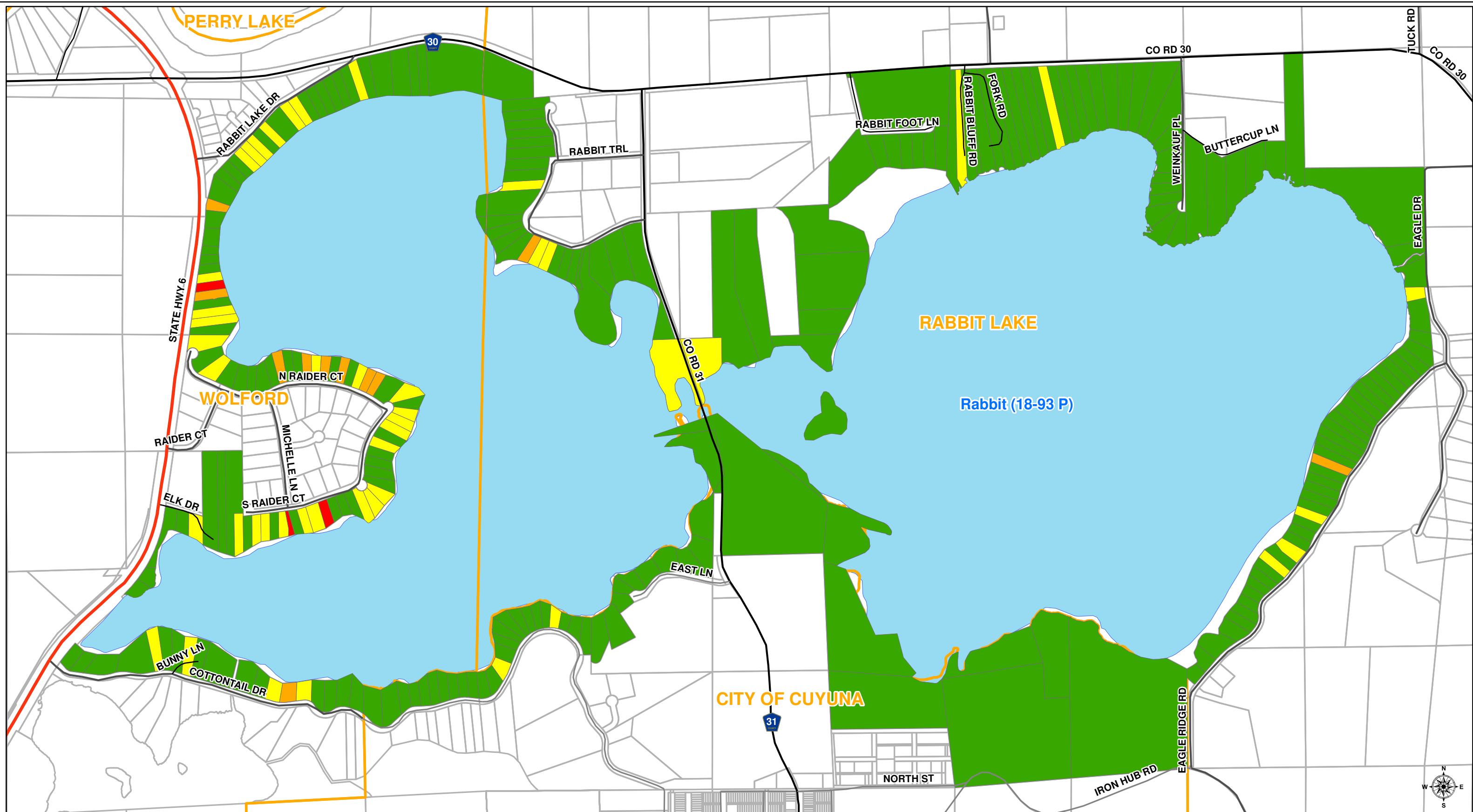
Total Impervious Coverage for all Lots = 5.8%

Impervious Surface Coverage by Parcel

- Green: 0 - 15 %
- Yellow: 15 - 20 %
- Orange: 20 - 25 %
- Red: 25+ %
- White: City / Township Boundaries
- Light Blue: Lakes
- Grey: Other Parcels

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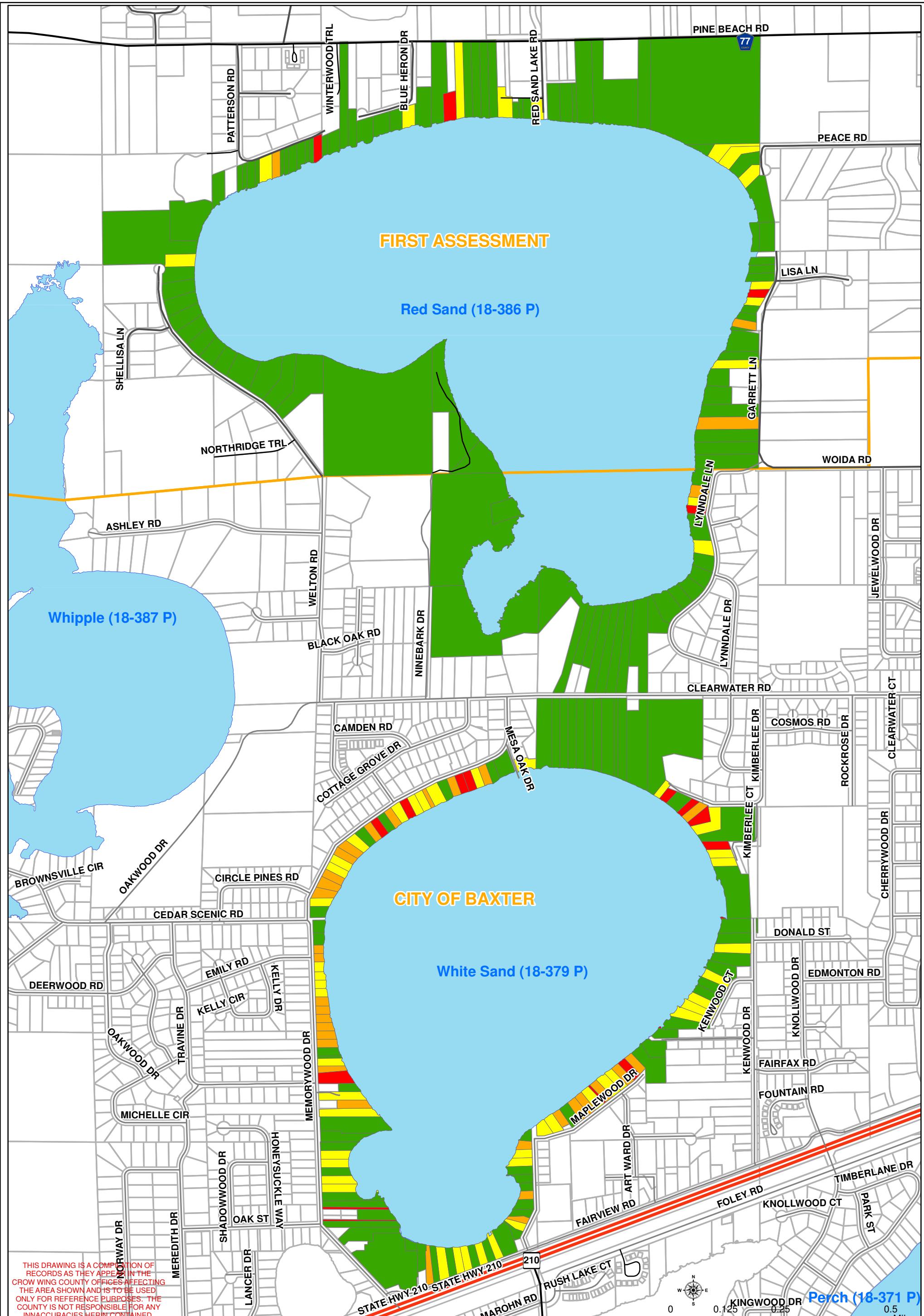


Impervious Surface Coverage by Parcel

- 0 - 15 %
- 15 - 20 %
- 20 - 25 %
- 25+ %

- City / Township Boundaries
- Lakes
- Other Parcels

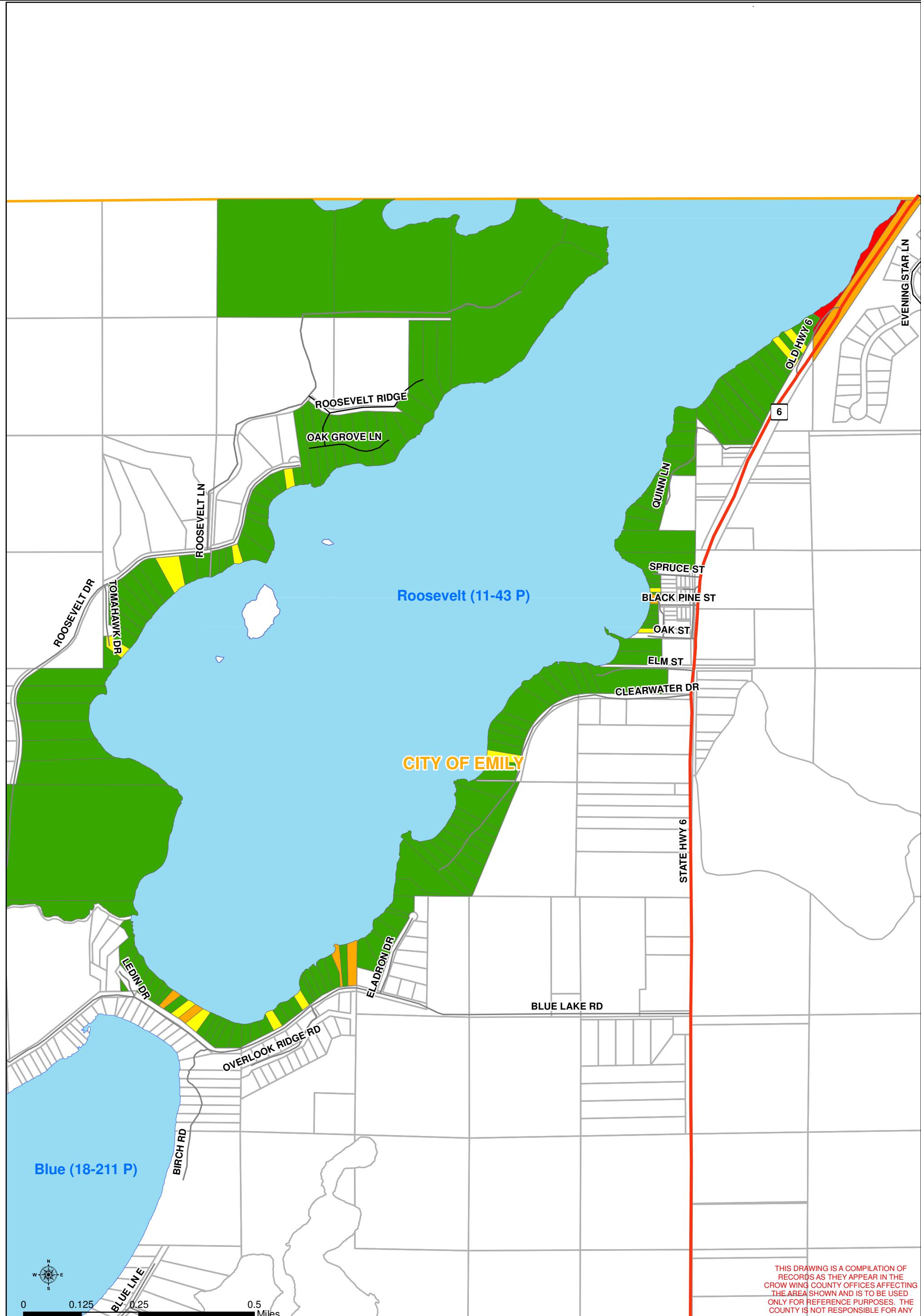
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Red/White Sand Lakes

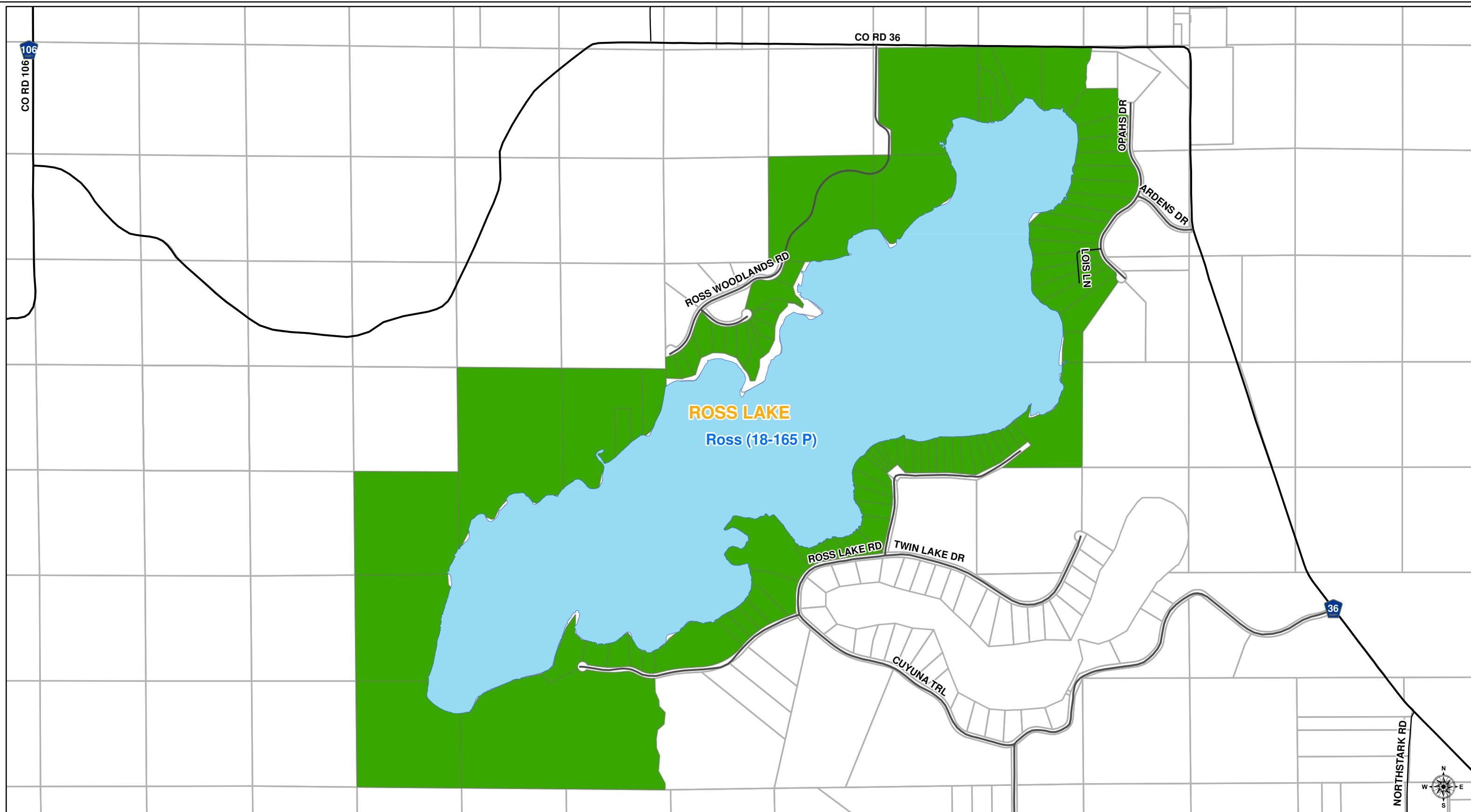
Total Impervious Coverage for all Lots:
Red Sand = 4.3% White Sand = 12.4%

Impervious Surface Coverage by Parcel	
0 - 15 %	City / Township Boundaries
15 - 20 %	Lakes
20 - 25 %	Other Parcels
25+ %	



Roosevelt Lake

Total Impervious Coverage for all Lots = 4.7%



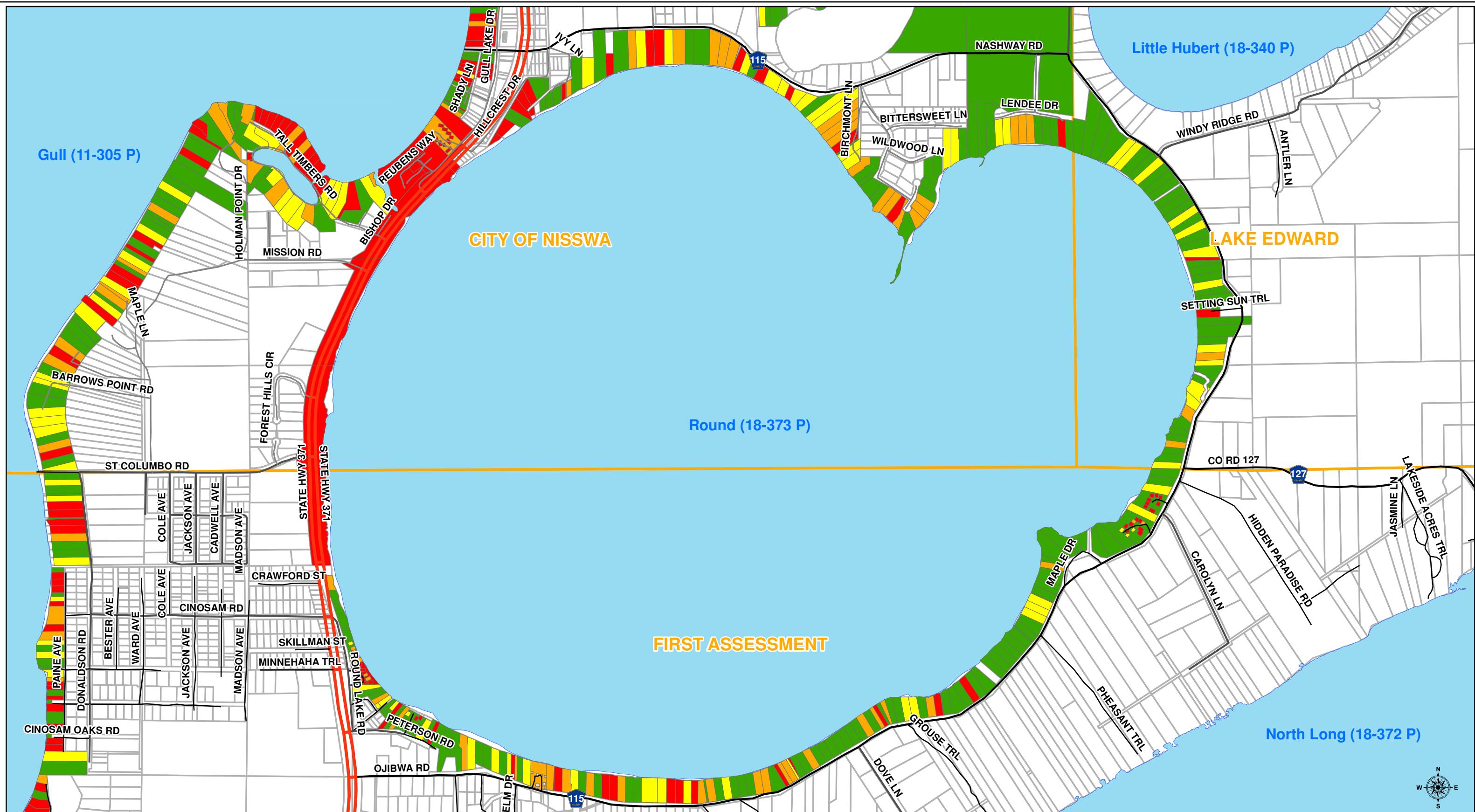
Ross Lake

Total Impervious Coverage for all Lots = 1.6%

Impervious Surface Coverage by Parcel

0 - 15 %	Lakes
15 - 20 %	City / Township Boundaries
20 - 25 %	Other Parcels
25+ %	

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Round Lake

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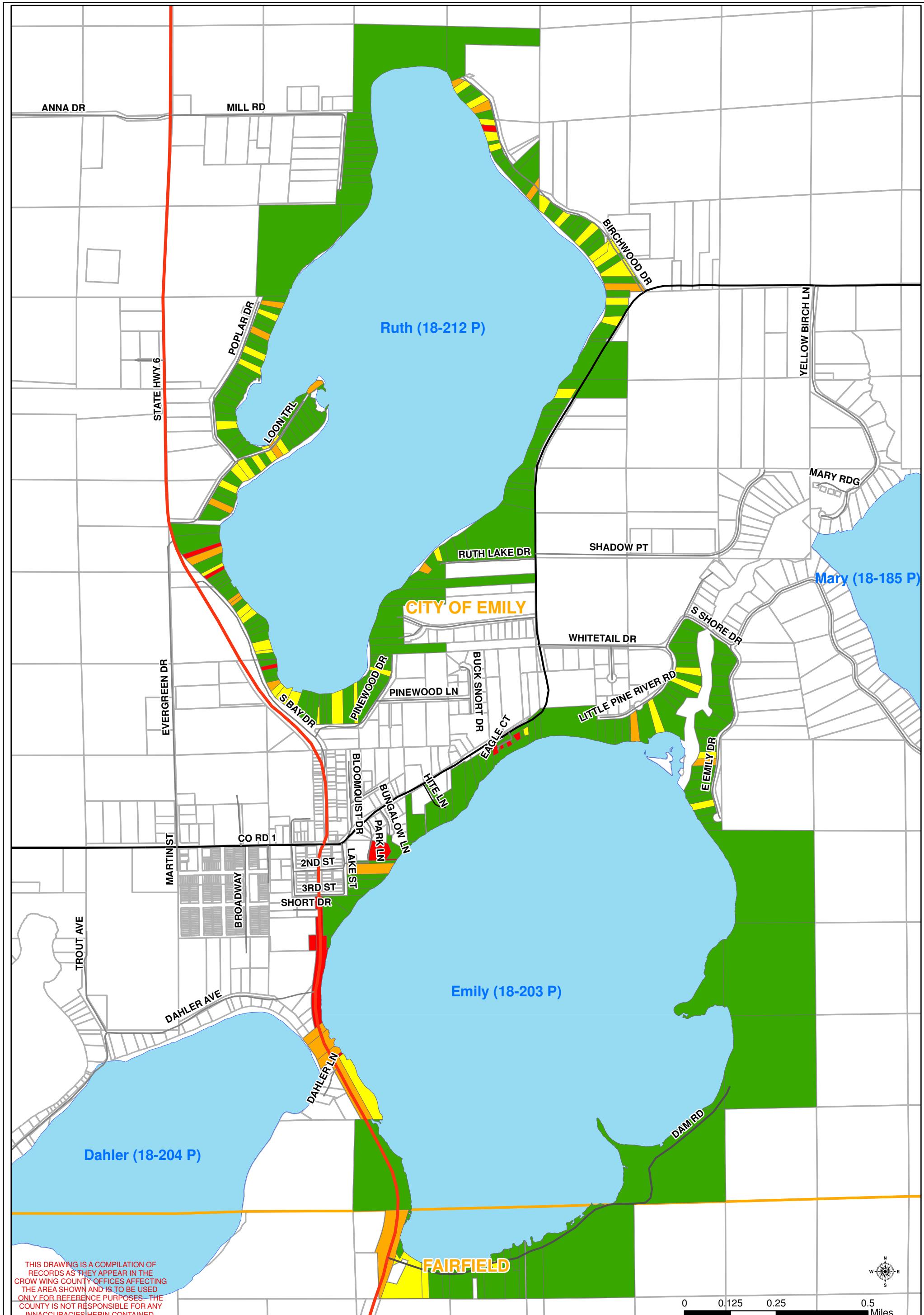
Impervious Surface Coverage by Parcel



Legend for Land Cover Categories:

- 0 - 15 %
- 15 - 20 %
- 20 - 25 %
- 25+ %
- City / Township Boundaries
- Lakes
- Other Parcels

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Emily/Ruth Lakes

Total Impervious Coverage for all Lots:
Emily = 6.1% Ruth = 7.5%

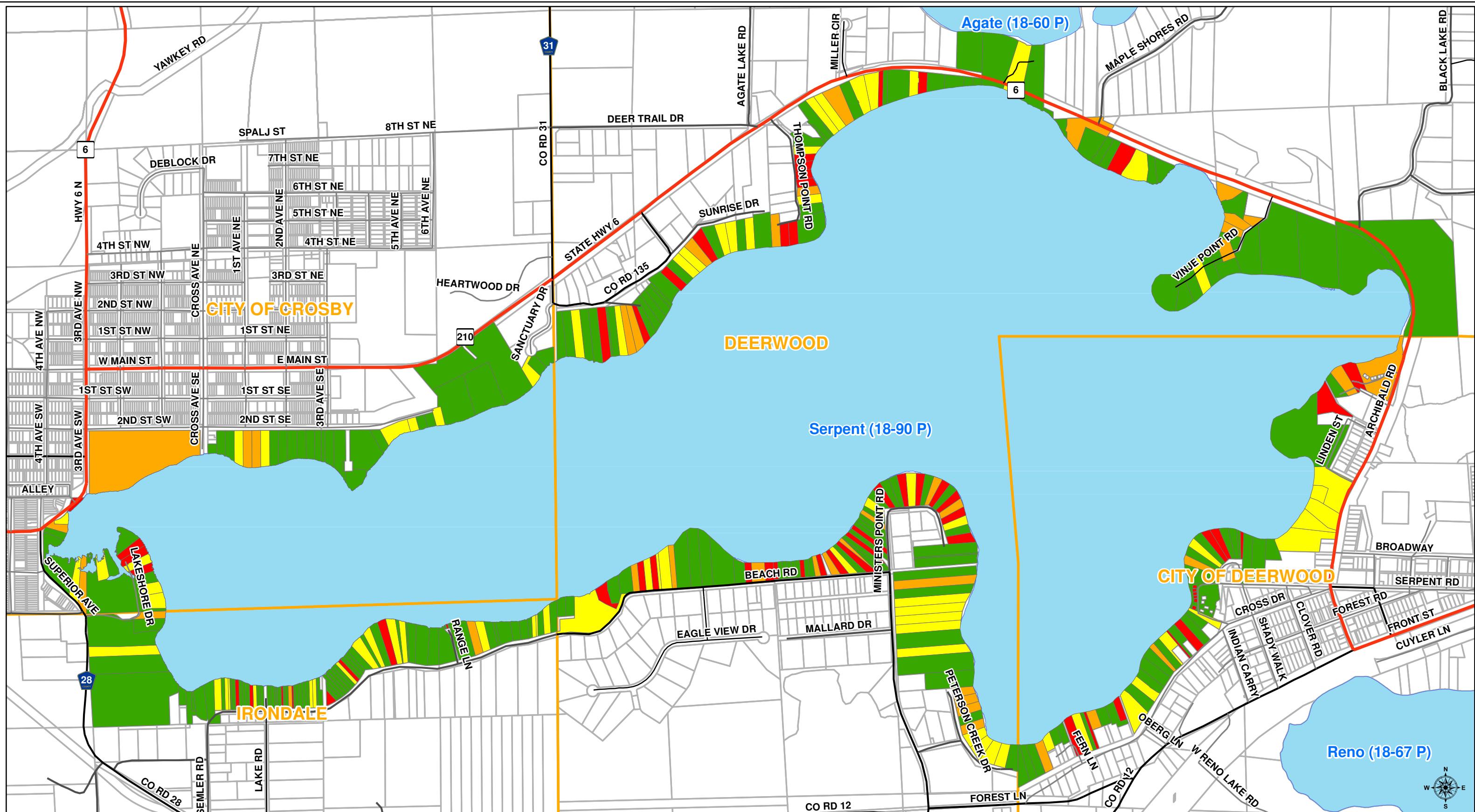
Impervious Surface Coverage by Parcel

Color	Impervious Surface Coverage Range (%)
Green	0 - 15 %
Yellow	15 - 20 %
Orange	20 - 25 %
Red	25+ %

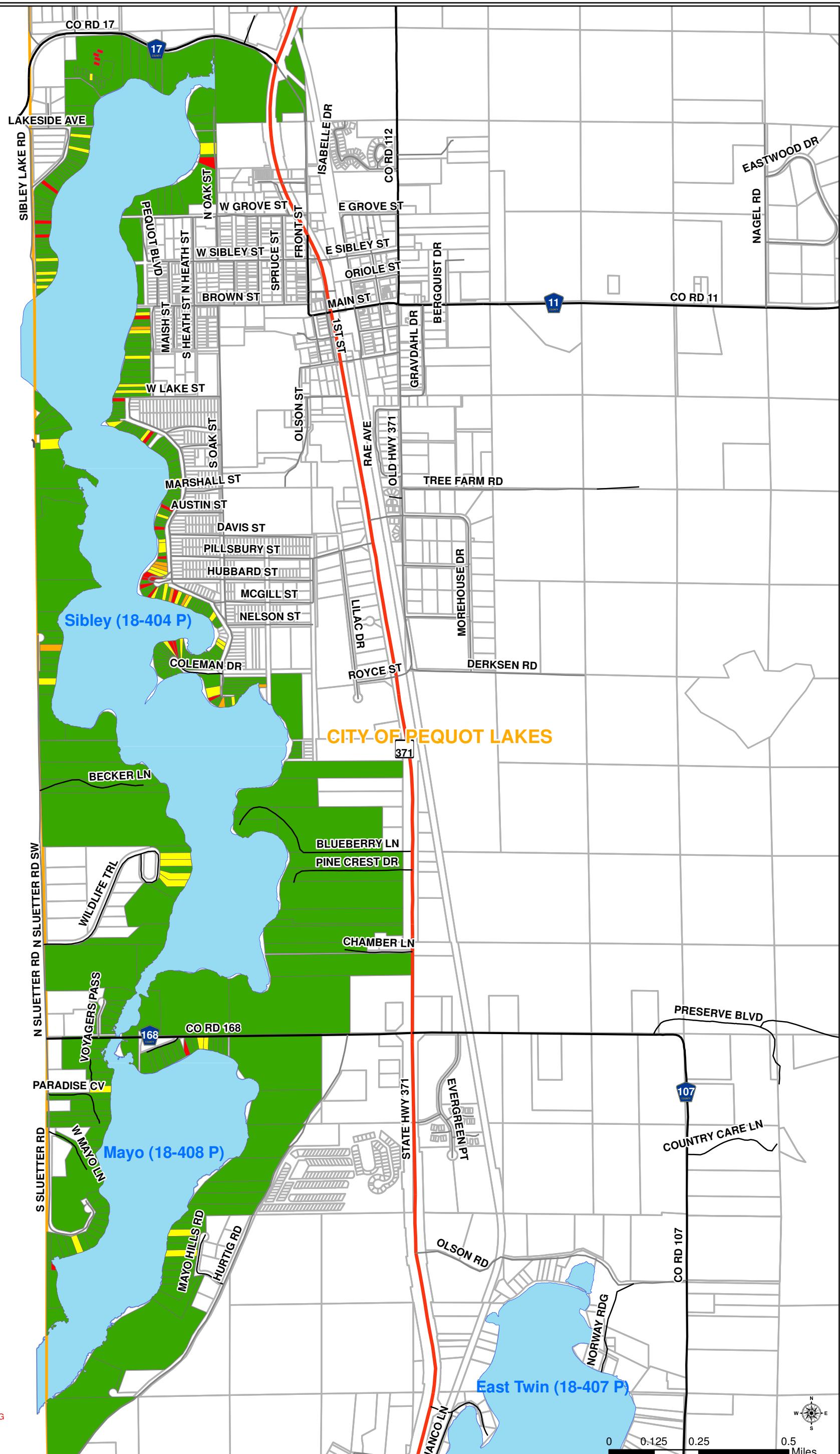
City / Township Boundaries

Lakes

Other Parcels



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Sibley/Mayo Lakes

Total Impervious Coverage for all Lots:
Sibley = 4.0% Mayo = 3.7%

Impervious Surface Coverage by Parcel

Coverage Range	Symbol	Description
0 - 15 %	Dark Green	City / Township Boundaries
15 - 20 %	Yellow	Lakes
20 - 25 %	Orange	Other Parcels
25+ %	Red	