

# Community Assistantship Program

*...a program of the Center for Urban and Regional Affairs (CURA)*

## Crow Wing County's Lakeshore Impervious Coverage Research Project Phase I & II

Prepared in partnership with  
Crow Wing County

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**CAP Report #**

*This report is available on the CURA website:  
<http://www.curaj.umn.edu/publications/search>*

Center for Urban and  
Regional Affairs (CURA)

UNIVERSITY OF MINNESOTA  
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## Table of Contents

I.	Executive Summary.....	4
II.	Purpose.....	4
III.	Process.....	5
IV.	Appendices.....	6

## ***Crow Wing County's Lakeshore Impervious Coverage Research Project***

### **I. Executive Summary**

The purpose of the 2012 impervious coverage research project was to determine the amount of impervious surfaces on lakeshore parcels for parcels on lakes greater than 500 acres in size. The percent impervious was calculated for the entire riparian lot. The percent impervious was also calculated within 250 feet and 500 feet of the riparian lot. The percent of impervious surfaces was calculated using high resolution Lidar and aerial photography in ESRI's ArcMap software.

The final product of the impervious coverage study is a comprehensive Geographic Information System (GIS) layer of different surfaces and a calculation of the percent impervious by parcel on the selected lakes. This will help Crow Wing County in its water planning efforts, especially in regards to the effects of stormwater management. It will also help with determining what land use performance standards may be needed for future permit applicants.

### **II. Purpose**

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 400 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 has 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 clear, deep water lakes where seasonal cabins are being replaced with larger year-round homes. With these larger homes comes the potential for more stormwater runoff into these majestic lakes.

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. It is now required to have a storm water management plan if the riparian lot exceeds 15% in impervious surfaces. The

ordinance prohibits more than 25% impervious surfaces in the shoreland protection zone (Article 41). This ordinance will help keep lakes clean for generations to come.

**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

This study defines the percent of impervious surfaces on individual lots. It is needed to maintain the integrity and build the foundation for future studies. We as individuals need to realize that our planning today will make a huge impact on the future. It does not take long to damage our natural resources, such as these waterways and lakes, but it will take generations to get them back to the way they are today.

### III. Process

The study began with Chris Pence (Land Services Supervisor), David Landecker (Survey Coordinator), and Mitch Brinks (Water Protection Specialist), all from the Crow Wing County Land Services Department, instructing me on the information needed for this study. The information needed was the amount of impervious surfaces within 500 feet of the Ordinary High Water. They wanted to know the different kinds of impervious surfaces such as bituminous driveways, gravel driveways, dirt driveways, grass driveways, boathouses, dwellings, sheds, garages, patios, and so on. This information will help determine future updates to the local water plan.

Using Arc Map, I created different layers for all the different kinds of impervious surfaces and began digitizing them. Layers are used to display and work with a specific GIS dataset. A layer in Arc Map represents geographical data such as a particular theme and in this

case it is the impervious surfaces. In certain instances, it was impossible to see the entire building on the aerial photo. In these instances I had to use county records to find out the dimensions of the structure. The Property Valuation and Classification Office has records on all the structures in the county. Using this information I could determine the percent of impervious per lot.

In extreme instances, where aerial photography and high resolution Lidar could not be used, I would have to do some ground truthing to determine the impervious coverage. I used a Geo Explorer 6000 GPS unit to calculate the amount of impervious. I also needed to ground truth parcels that were completed using Arc Map. The reasoning for this was to determine how accurate the calculations are by using the GIS software.

A calculation change specific to ^Planned Unit Developments (PUD's) will also be implemented. Impervious calculations on surface areas within a PUD unit or lot was calculated individually. The new calculation will total the impervious surface areas within the entire PUD, rather than as individual parts (an example is included in the appendices).

#### IV. Appendices

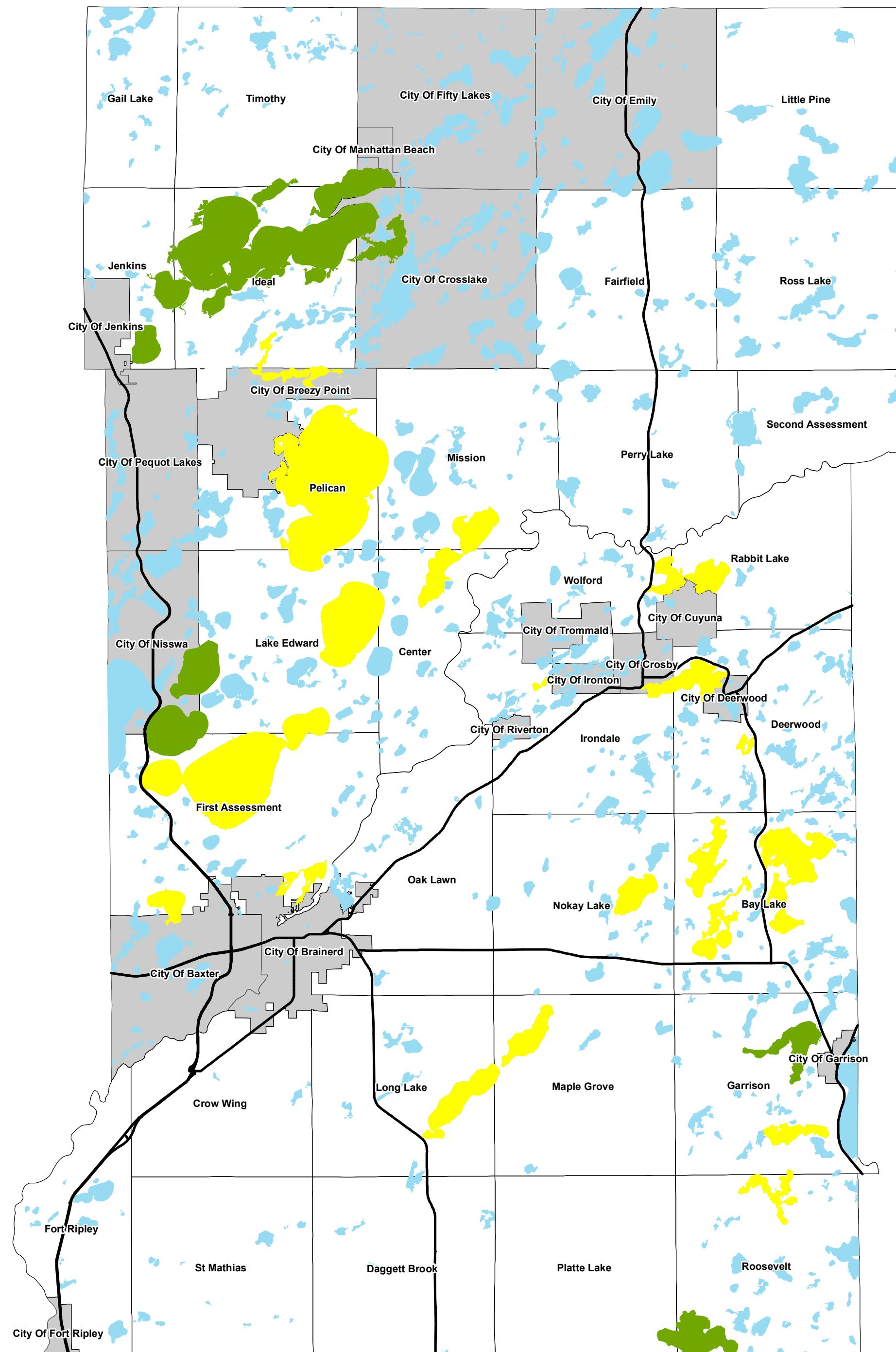
Lake Name	# of Riparian Lots Per Lake	% Imp Within 250' of OHW	% Imp Within 500' of OHW	% Total Impervious of all lots
Arrowhead	44	1.9%	2.0%	1.7%
Bay Lake	947	8.8%	12.3%	7.22%
Bertha	173	10.7%	11.4%	10.5%
Big Trout**	88	7.1%	7.0%	5.4%
Borden	236	5.0%	4.1%	2.8%
Camp	226	4.2%	4.4%	3.4%
Clearwater**	104	3.3%	3.8%	2.7%
Crooked	317	5.1%	5.4%	4.8%
Edward	288	3.8%	8.1%	6.0%
Gilbert**	144	3.8%	3.8%	3.5%
Hanks	129	3.9%	4.9%	4.4%
Hubert**	122	11.8%	9.0%	6.4%
Lower Hay	202	6.8%	6.7%	5.9%
Lower Mission	130	0.8%	2.1%	2.2%
Nokay	83	2.2%	4.0%	3.1%
North Long	735	6.5%	8.8%	6.2%
Ossawinnamakee**	242	6.9%	8.3%	7.6%
Pelican**	695	5.6%	11.3%	5.5%
Pig	86	3.1%	2.2%	1.9%
Platte	340	5.2%	4.0%	2.3%
Portage	72	9.9%	8.6%	6.4%

Rabbit**	236	7.1%	8.1%	6.5%
Red Sand**	91	7.5%	6.9%	4.8%
Round**	219	13.0%	14.6%	14.5%
Rush**	57	12.7%	13.7%	13.7%
Serpent**	278	15.4%	15.9%	14.5%
Smith	128	3.0%	2.9%	2.2%
South Long	431	8.4%	8.2%	5.7%
Upper Hay	303	8.6%	8.0%	5.6%
Upper Mission	159	3.3%	6.1%	5.2%
Upper South Long	304	9.9%	10.1%	7.1%
Whitefish**	745	6.3%	6.2%	4.8%

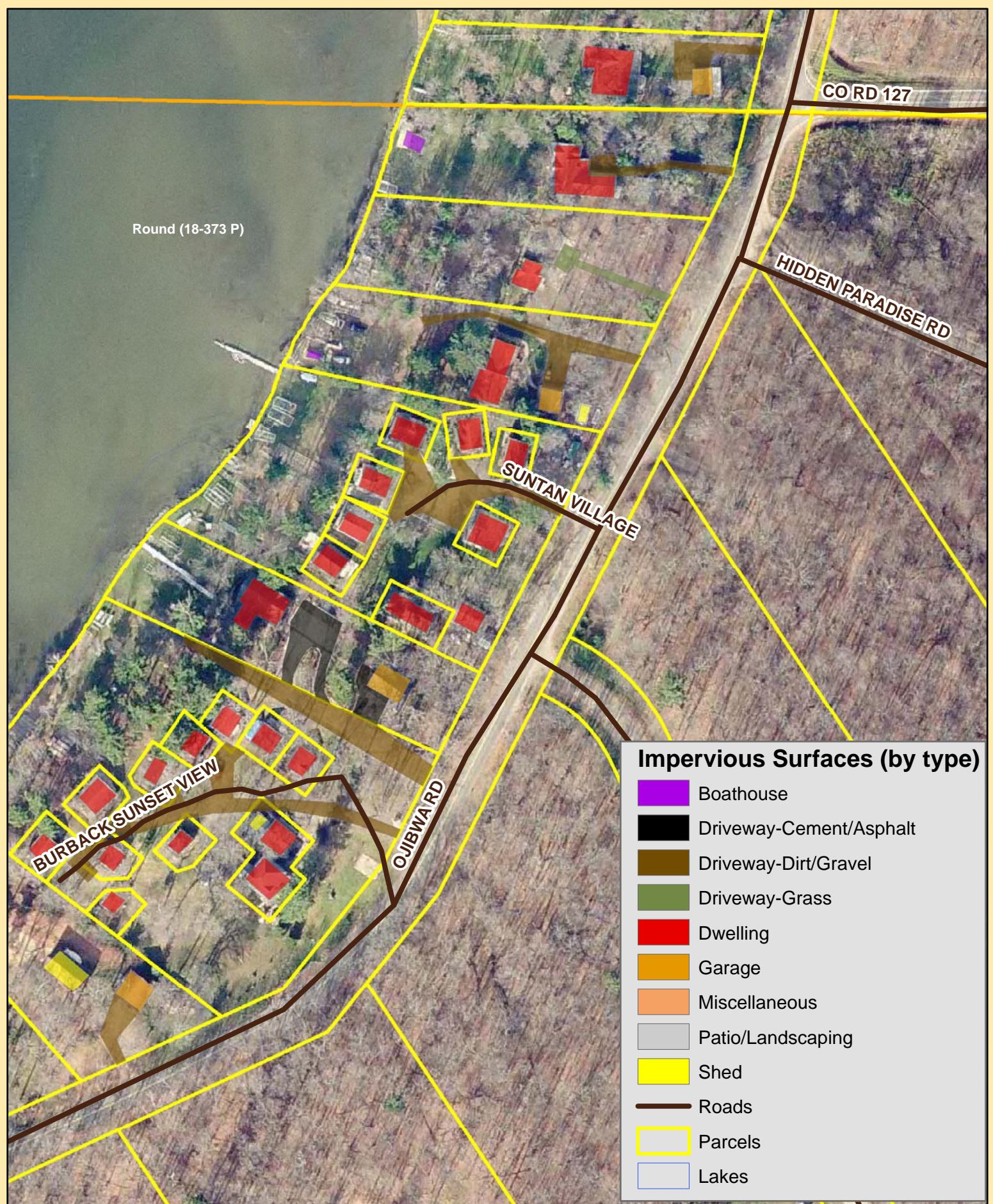
\*\* Some parcels not included because they are located inside city limits.

<sup>^</sup>A "Planned unit development" means a type of development characterized by a unified site design for a number of dwelling units or dwelling sites on a parcel, whether for sale, rent, or lease, and also usually involving clustering of these units or sites to provide areas of common open space, density increases, and a mix of structure types and land uses. These developments may be organized and operated as condominiums, time-share condominiums, cooperatives, full fee ownership, commercial enterprises, or any combination of these, or cluster subdivisions of dwelling units, residential condominiums, townhouses, apartment buildings, campgrounds, recreational vehicle parks, resorts, hotels, motels, and conversions of structures and land uses to these uses.  
61250.2500 Subp.12, Minnesota Administrative Rules

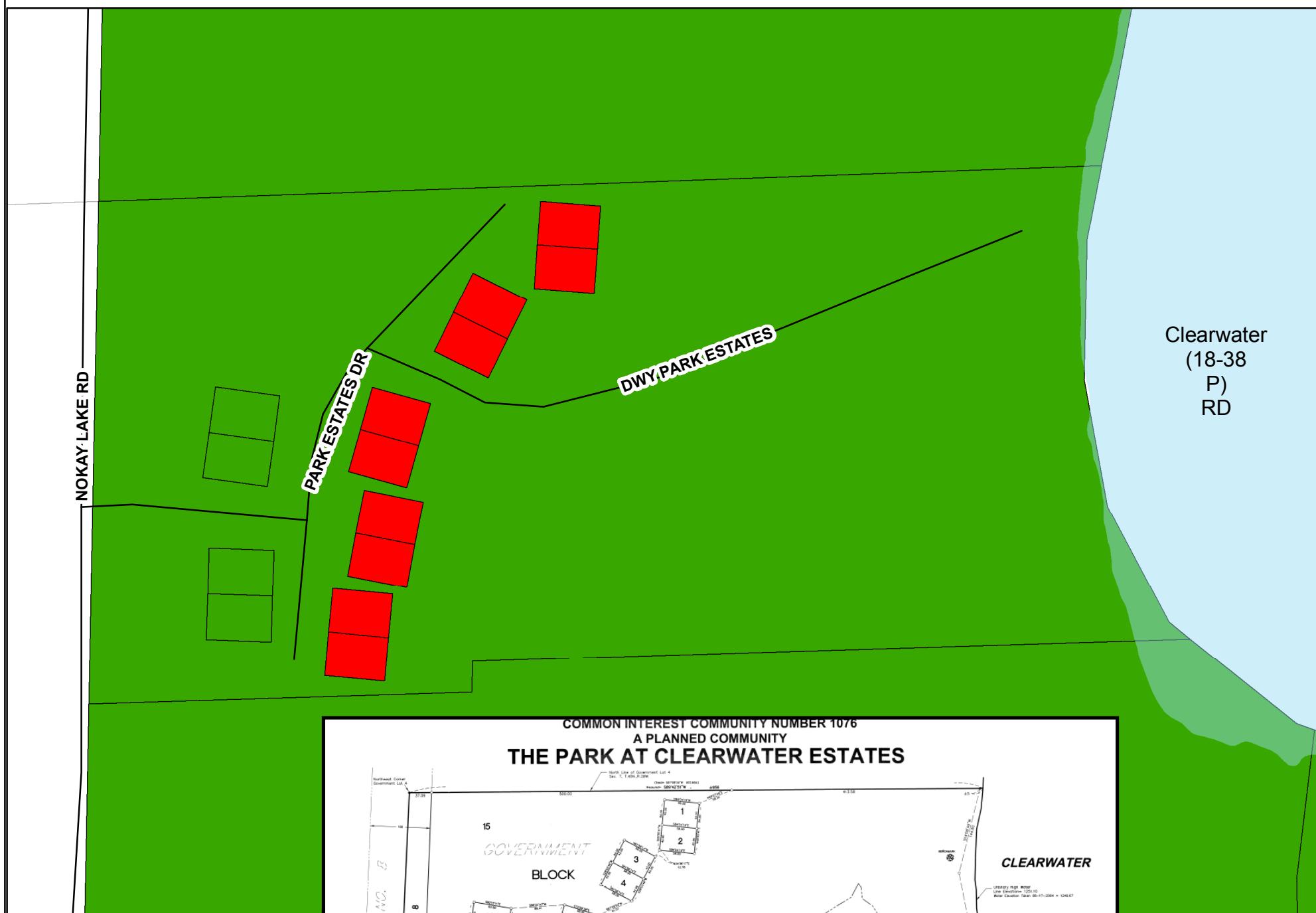
# Phase I and II Overview Map



Phase I  
 Phase II  
 Lakes  
 Township  
 City



# Before



# After



## Impervious Calculations on Planned Unit Development (PUD) on Clearwater Lake

This data is provided on an "AS-IS" basis, without warranty of any type, expressed or implied, including but not limited to any warranty as to their performance, merchantability, or fitness for any particular purpose.



0 55 110 220 330 440 Feet

Impervious % within 250 ft of Shoreline	
Roads	
Lakes	
20 - 25 %	
25+ %	
Parcels	

