



# **STRAIGHT OUT THE TAP:**

**Waste production in the Great Lakes Region**



Thousands gather  
massive protest  
against pollution.

## Rapid Pollution Kills Fish

WASHINGTON — Michigan's fish kill because of water pollution is declining rapidly while that of the nation as a whole is rising.

That's the report today of the New Environmental Protection Agency (EPA).

William D. Ruckelshaus, EPA administrator, said that water pollution killed an estimated 41 million fish in 43 states in 1985—a record.

For the same time, EPA said, Michigan had 10 fish kills due to water pollution, down from 11 in 1982 and 13 in 1983 to 10 in 1984.

Michigan, however, probably strongly underestimated its fish kills, safeguards to keep dangerous and hazardous materials out of our rivers, lakes and streams have been

The agency did not have figures for 1986 as yet. But indications are that the number of fish kills will be even lower.

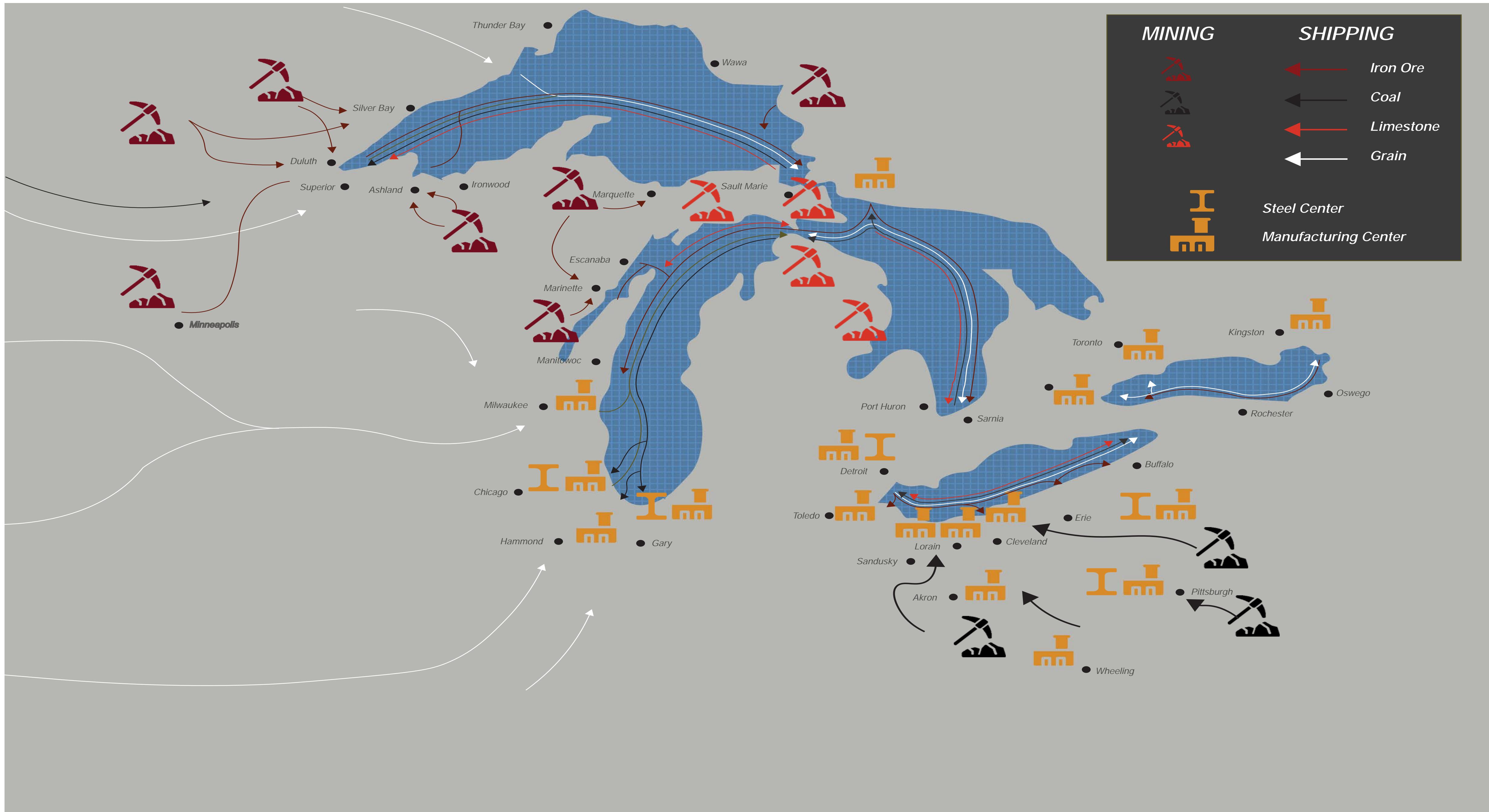


This sounds like good news after a conference in Chicago. There were high officials there along with they were drinking from Lake Michigan.

**Chicago Tribune**  
**microplast**  
How Safe Is Water Supply?

# HISTORY

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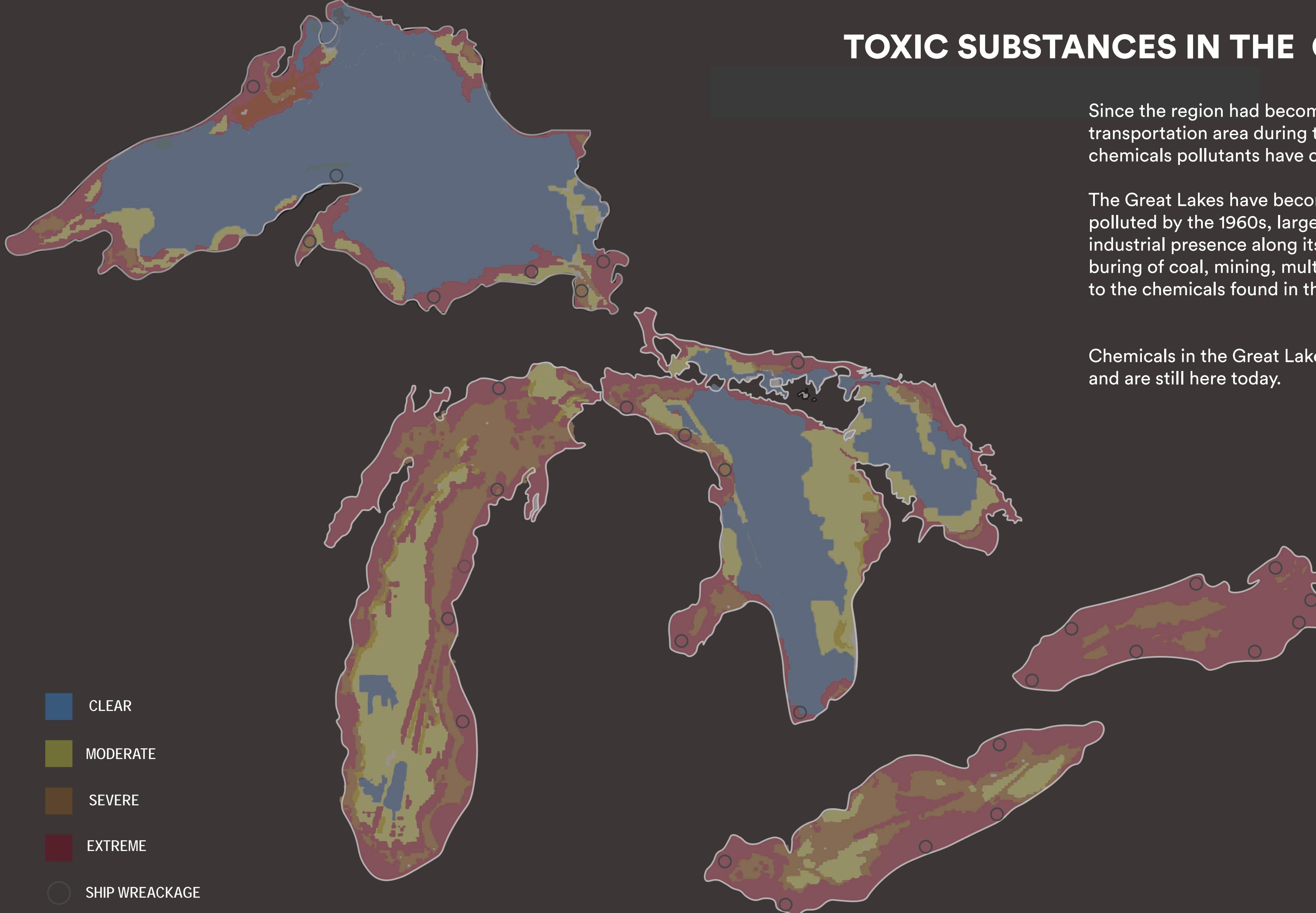


# TOXIC SUBSTANCES IN THE GREAT LAKES

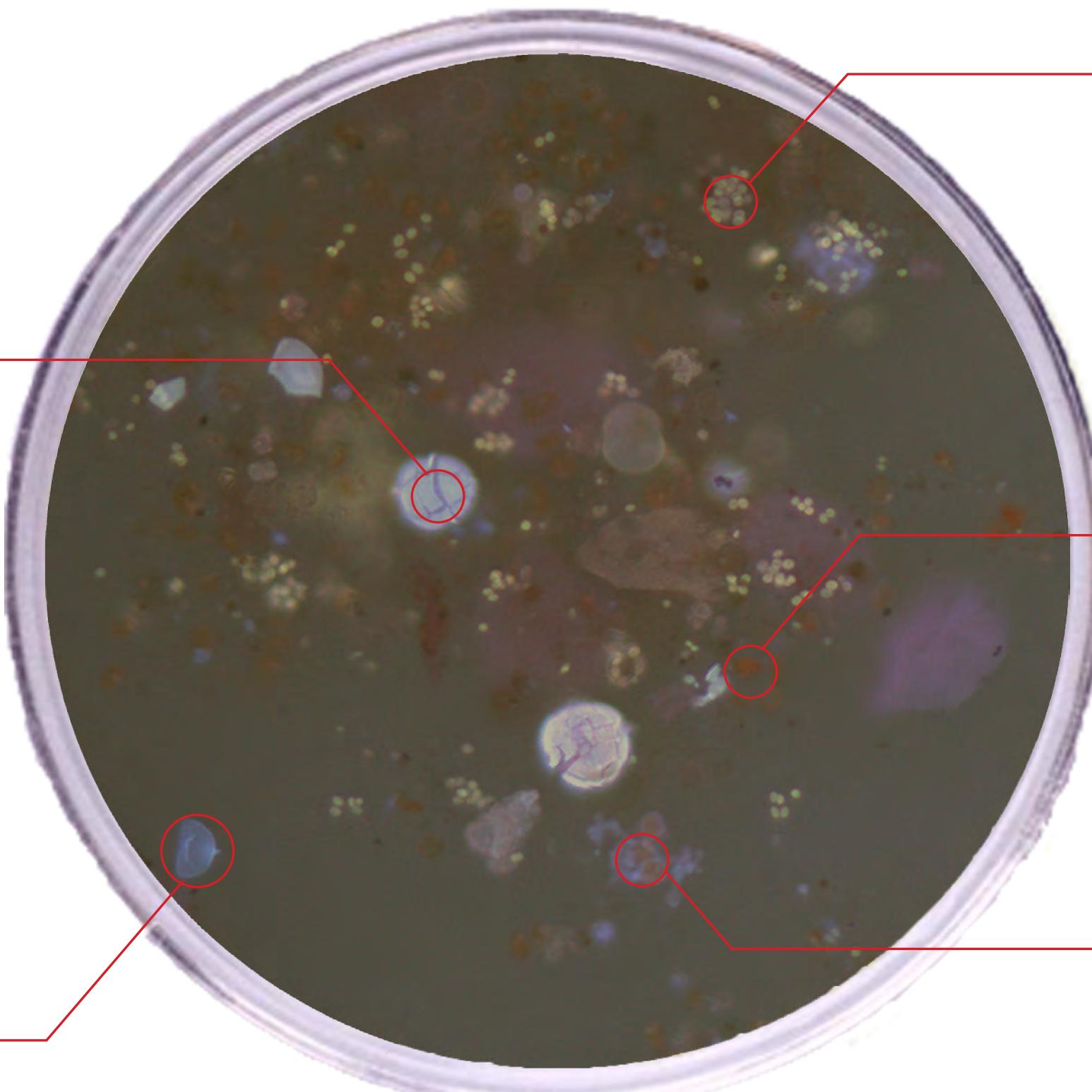
Since the region had become a mass production and transportation area during that time period, many chemicals pollutants have contaminated the region .

The Great Lakes have become predominantly polluted by the 1960s, largely due to the heavy industrial presence along its shores. Factors such as burning of coal, mining, multiple shipwrecks have led to the chemicals found in the lakes today.

Chemicals in the Great Lakes are never broken down and are still here today.



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## BENZENE

*Oil compounds from a historic SHIPWRECK that carried crude oil across Lake Erie.*

Date: September 1937  
Size: 73 moles  
Formula: C<sub>6</sub>H<sub>6</sub>

## BIPHENYL

*Compounds created when using COAL TAR and NATURAL GAS during manufacturing of products*

Date: September 1927  
Size: 23 moles  
Formula: C<sub>12</sub>H<sub>10</sub>

## MERCURY

*Particles released from human activities such as METAL SMELTING and FOSSIL FUEL COMBUSTION*

Date: April 1942  
Size: 12 moles  
Formula: Hg

## POLYFLUALKYL

*Chemical compounds broken down from a PAPER BAG from a nearby landfill into groundwater*

Date: September 1954  
Size: 14 moles  
Formula: PFAS

## DIOXINS

*Burning compounds produced from the INDUSTRIAL MANUFACTURERS nearby*

Date: April 1932  
Size: 23 moles  
Formula: C<sub>4</sub>H<sub>4</sub>O<sub>2</sub>

SAMPLE NO. 2320

*Collected: Aug 2020  
Lake Erie*

# PRESENT

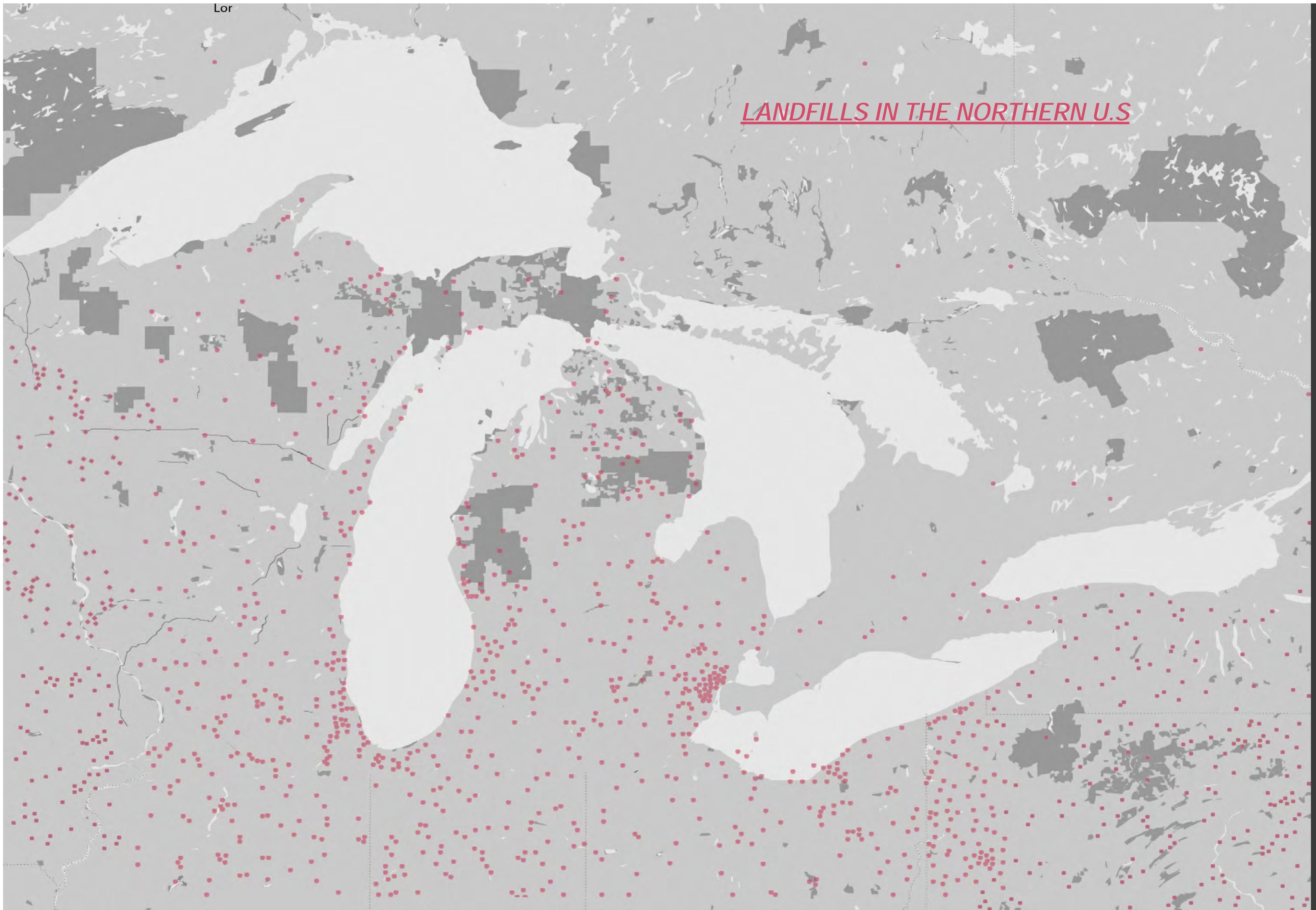
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The history of The Great Lakes has really impacted the quality of water over the years. The chemical waste left around the lake has taken a toll of the acidic quality of the water. The lower the PH level in water means a higher amount of chemical substances. In recent years, Lake Erie is known to be the most chemically contaminated, with an acidic PH level of 4.

Today, that water is under threat from chemical pollution. The contaminants such as oil, mercury, and dioxins in the lakes are difficult to filter out of such large bodies of water. The difficulty of removing shipwrecks have contributed to contamination in recent years, having the desolving process of materials such as steel slowly decimate.

Lake Erie has been plagued with blooms of toxic algae that turn its waters a bright blue-green from the build up of toxic contaminants. Local water departments filter out this freshwater from the lakes and into neighboring homes for people to drink or use.



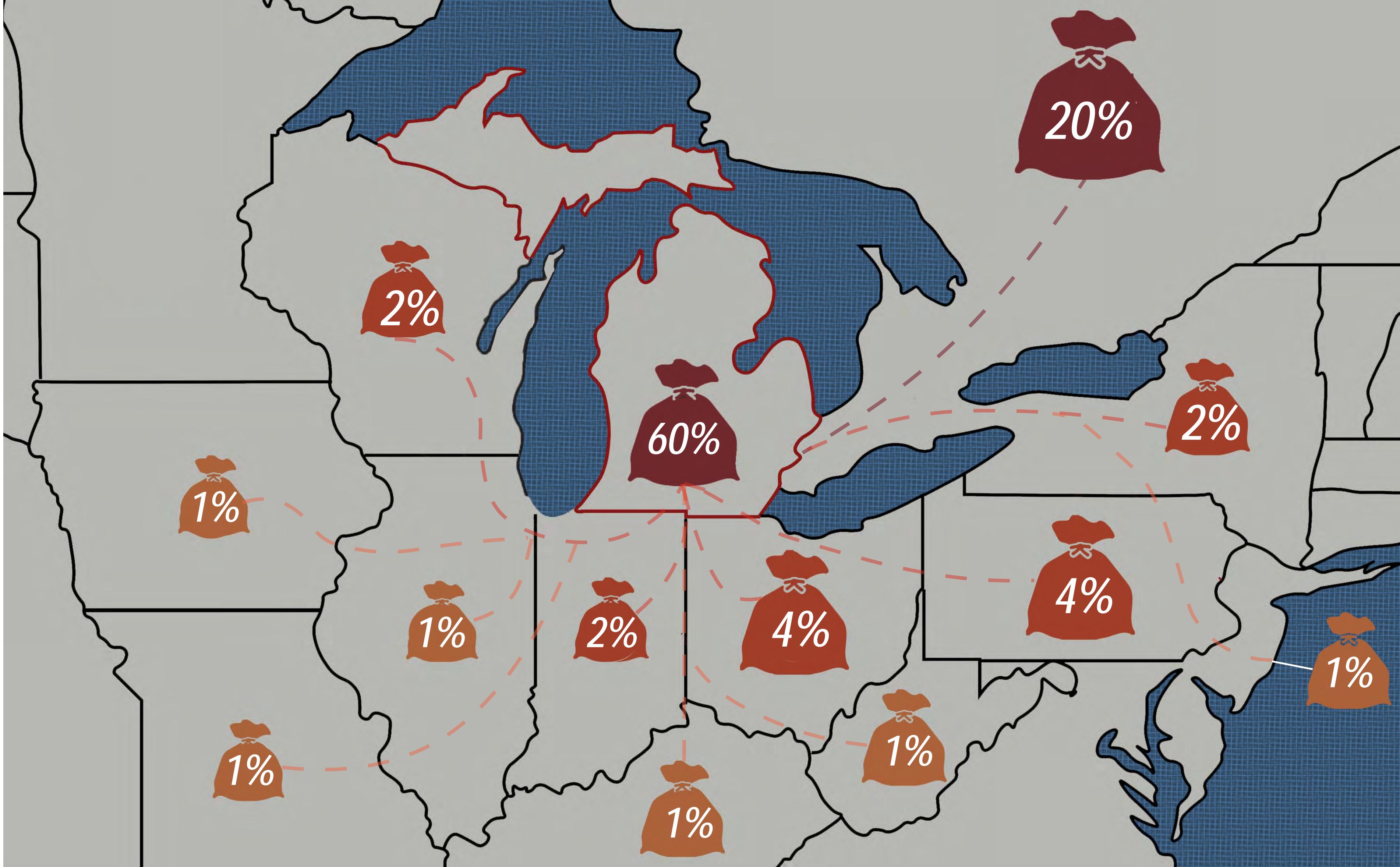
The northern part of the United States is known to accumulate the most trash than any other region. States such as Indiana, Illinois, Pennsylvania, Ohio, and the top state, Michigan, are some of the top states with the most trash per capita.

Michigan is the biggest contributor to the American Wasteland and ranks first for the state with the most buried trash per capita. The state has the most accumulated waste per person, with tons of buried waste from every man, woman, and child in the state.

The collection of landfills in this region include public, private, small, larger, and unoperated landfills. Many landfills are positioned close to the shores of The Great Lakes, endangering the quality of water and its wildlife.

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## SOLID WASTE DISPOSED IN MICHIGAN LANDFILLS

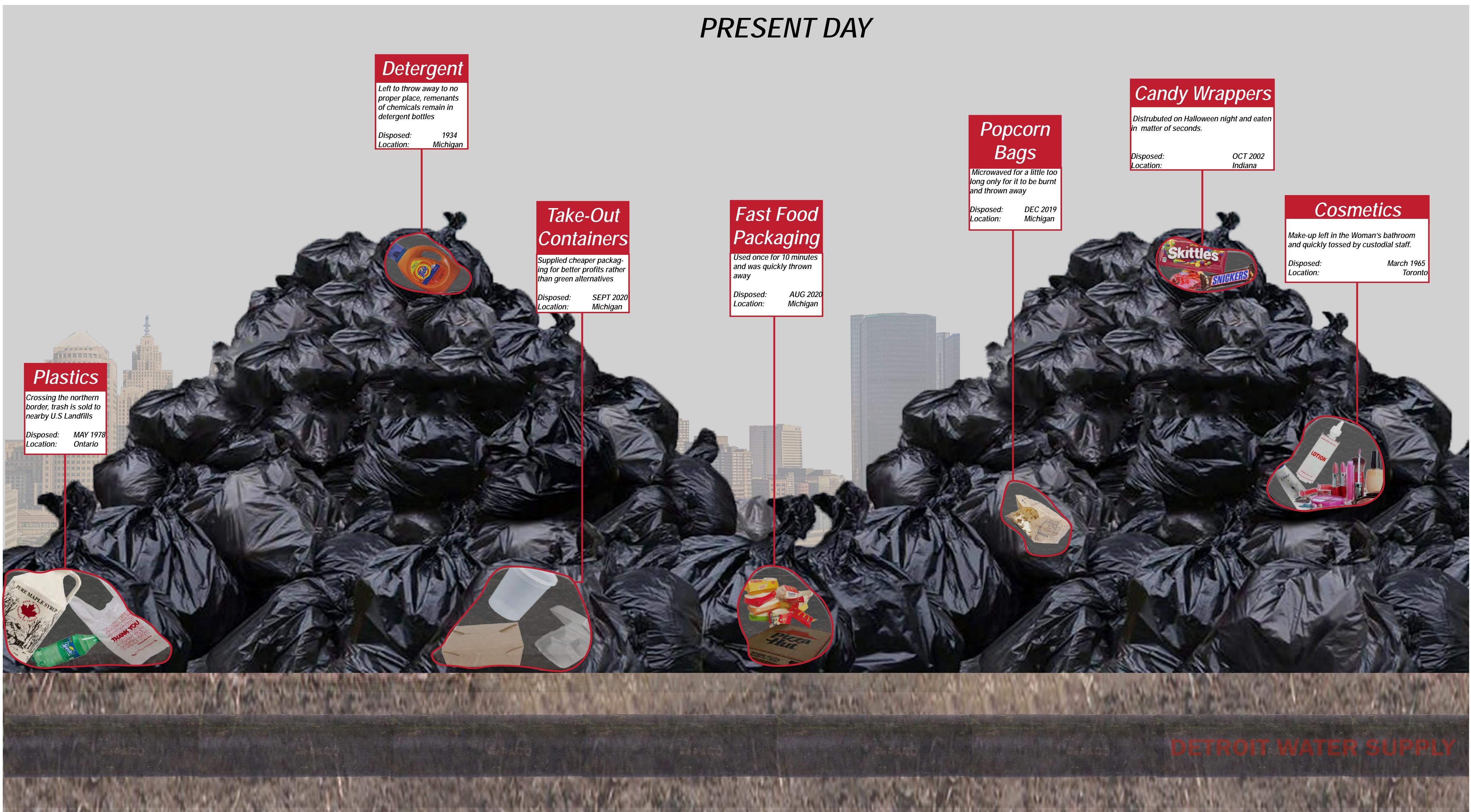


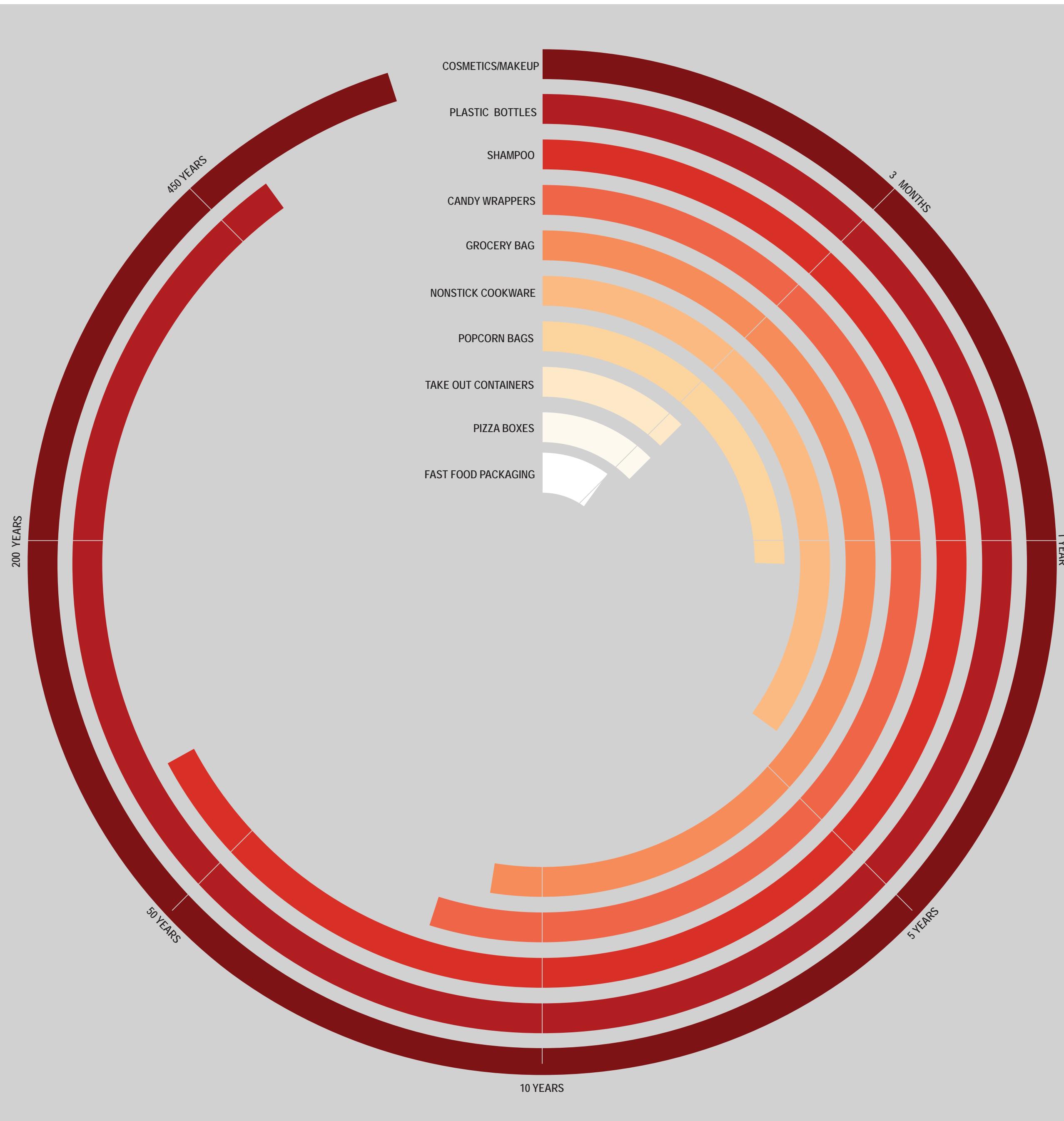
Michigan's abundant landfills and low fees make it a preferred destination for trash from other states and other countries. The surrounding states send a small percentage of their own trash to Michigan landfills, while Canada, being the main contributor, offers the largest chunk.

Canada contributes to over a fifth of Michigan landfills trash while also known to sell their trash to other countries overseas.

40% of the trash in Michigan landfills are from other states or countries in the surrounding region.

# PRESENT DAY





Products thrown away in the mid 1950's are still decomposing for many more years to come. The process of decomposition within these products are broken down from the moisture content depending on the area.

The graph shows the amount decomposition time of products that contribute PFAS contaminants from landfills. Most items listed are from a sort of packaging for only a one time use. Plastic bottles having the highest decomposition in consumption products take up to approximately 500 years to fully decompose, while fast food packaging is the lowest.

Fast food packaging makes up a huge chunk of waste within landfills and being the fastest to break down. This type of packaging contributes to a bigger spread of polyfluoralkyl (PFAS) into our ecosystems.

# FOOD PACKAGING WITH PFAS IN MICHIGAN LANDFILLS

2017

602'



694'

McDonald's

Wendy's

Sonic

Chick-Fil-A

Local Restaurants

Taco Bell

Chipotle

Pizza Hut

2019

727'

Starbucks

Burger King

Taco Bell

Chipotle

Pizza Hut

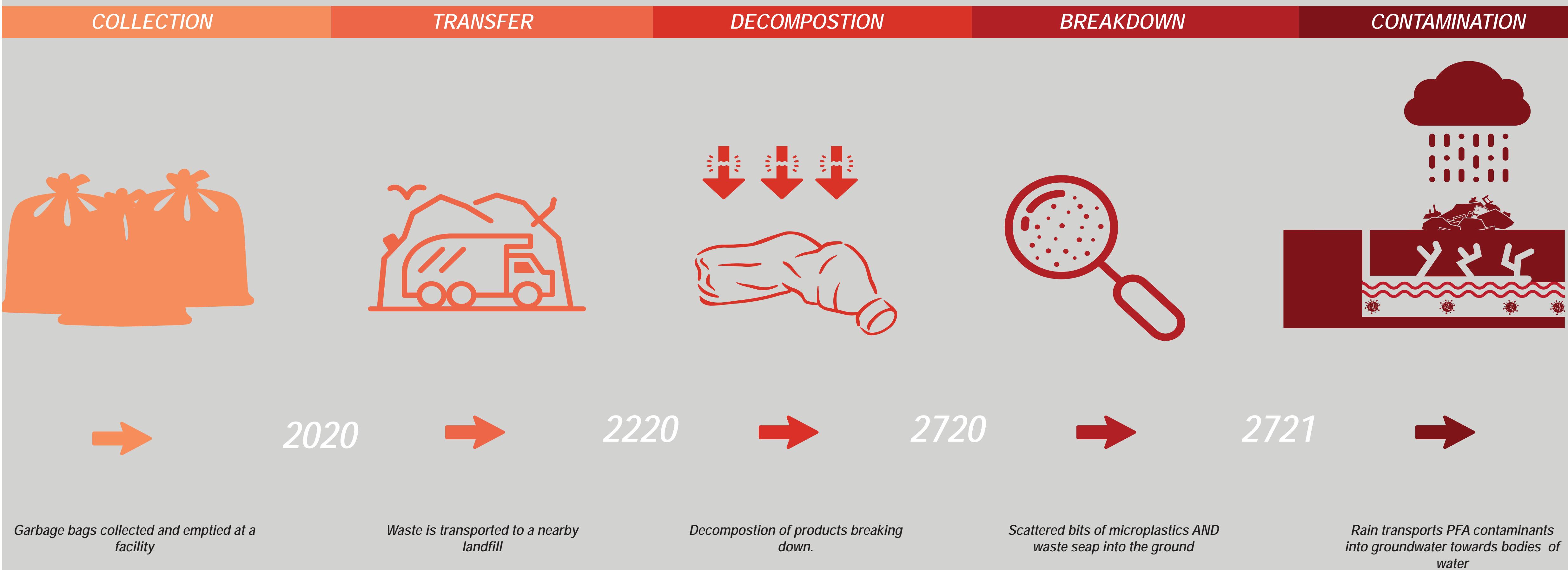
2021

Detroit Marriott At The Renaissance Center

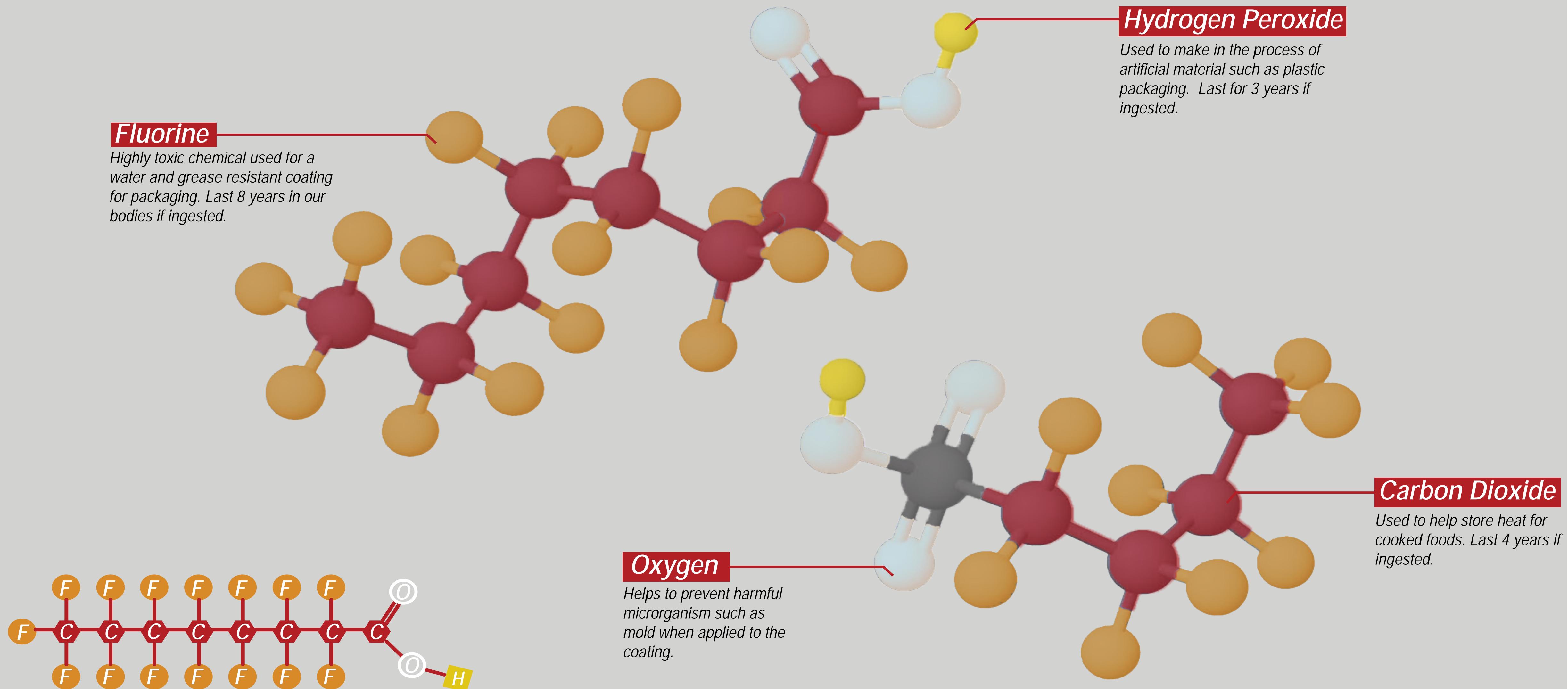
Tallest building in Detroit, Michigan



# PROCESS OF PFAS GROUNDWATER CONTAMINATION



# MOLECULAR STRUCTURE OF PFAS



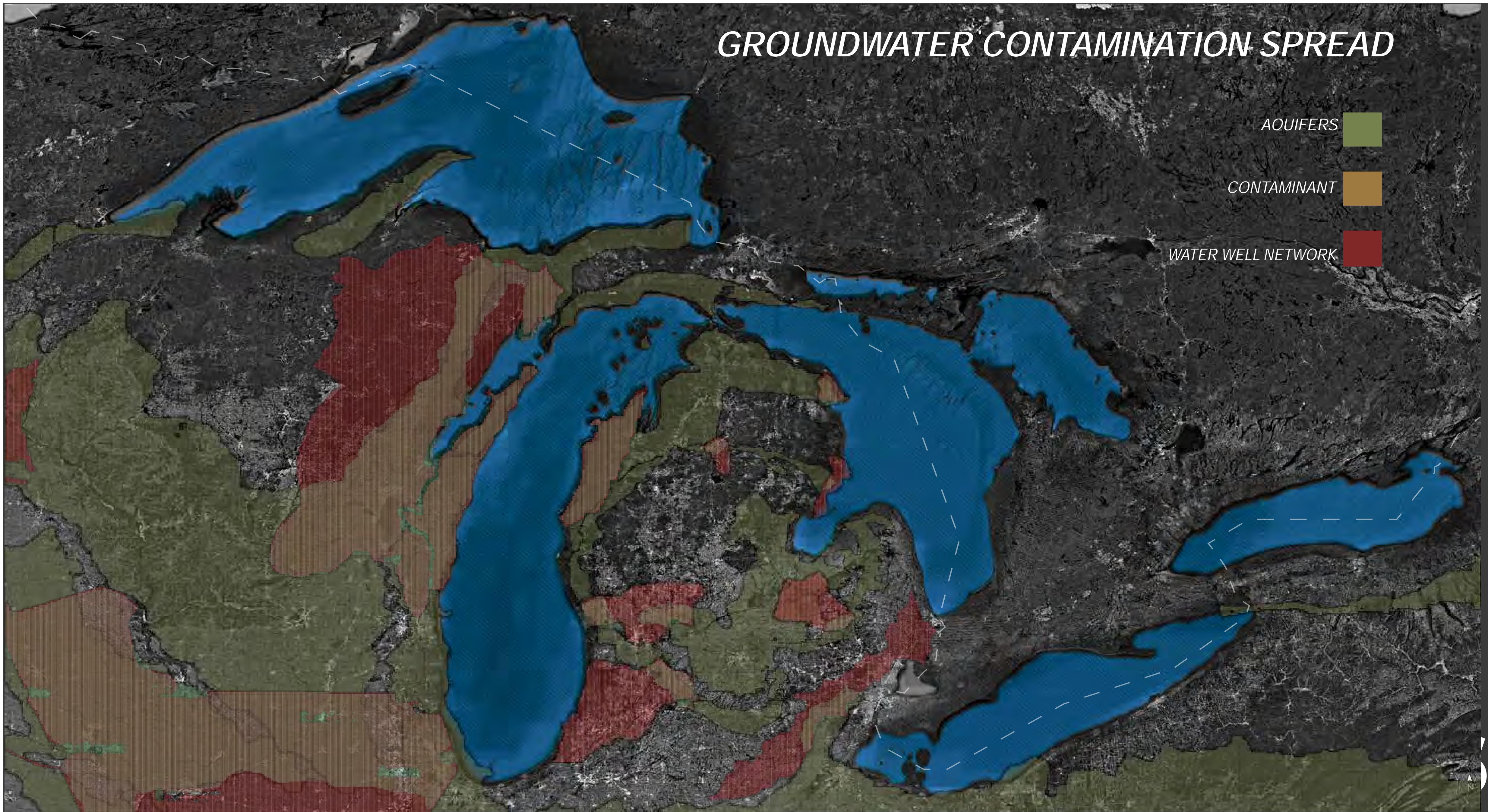
More than 95 percent of the U.S. population has PFAS molecules in their bodies due to chemicals being unable to break down in the environment

# GROUNDWATER CONTAMINATION SPREAD

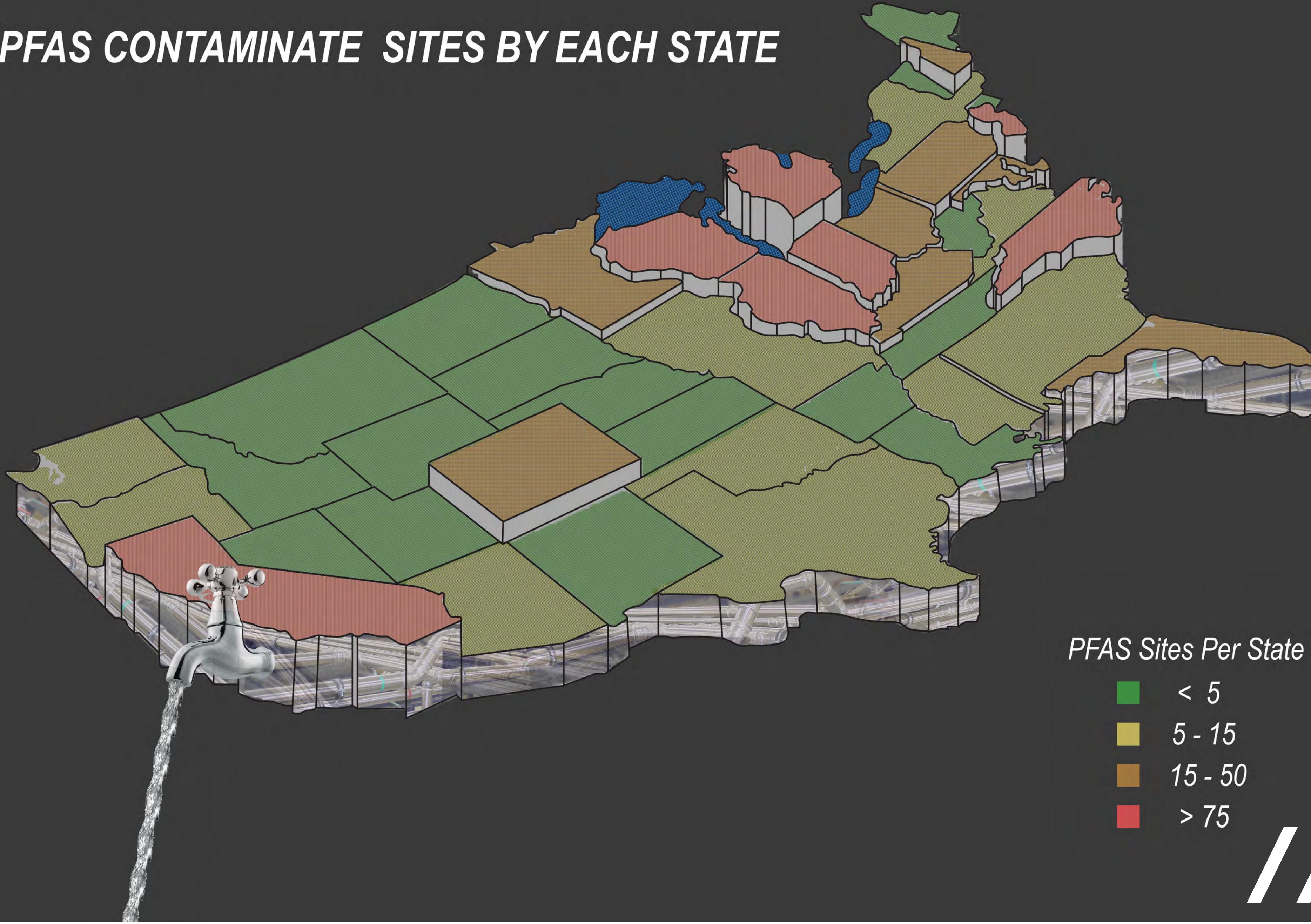
AQUIFERS

CONTAMINANT

WATER WELL NETWORK



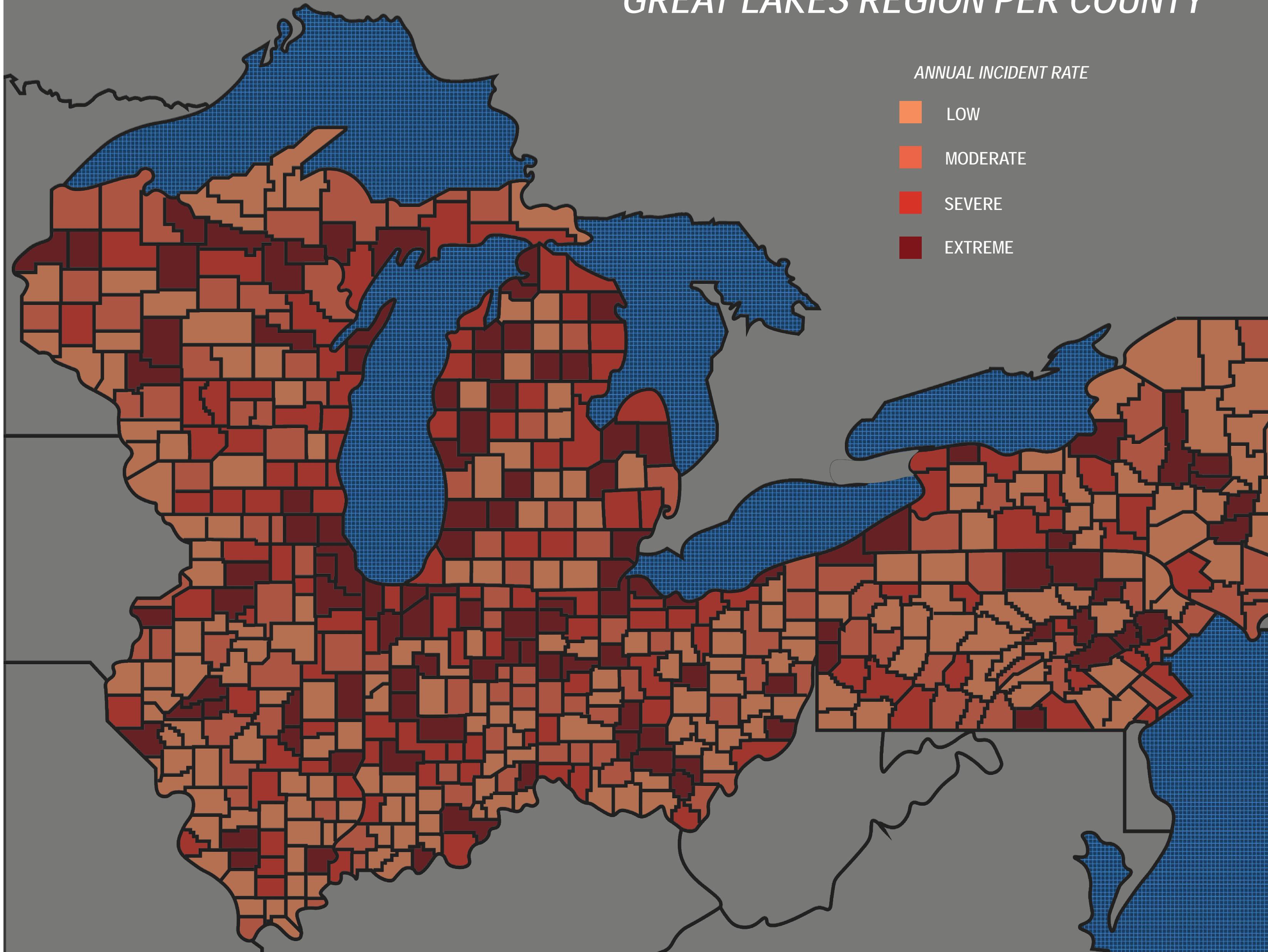
# U.S PFAS CONTAMINATE SITES BY EACH STATE



# *CONSUMPTION OF TAP WATER VS BOTTLED WATER*

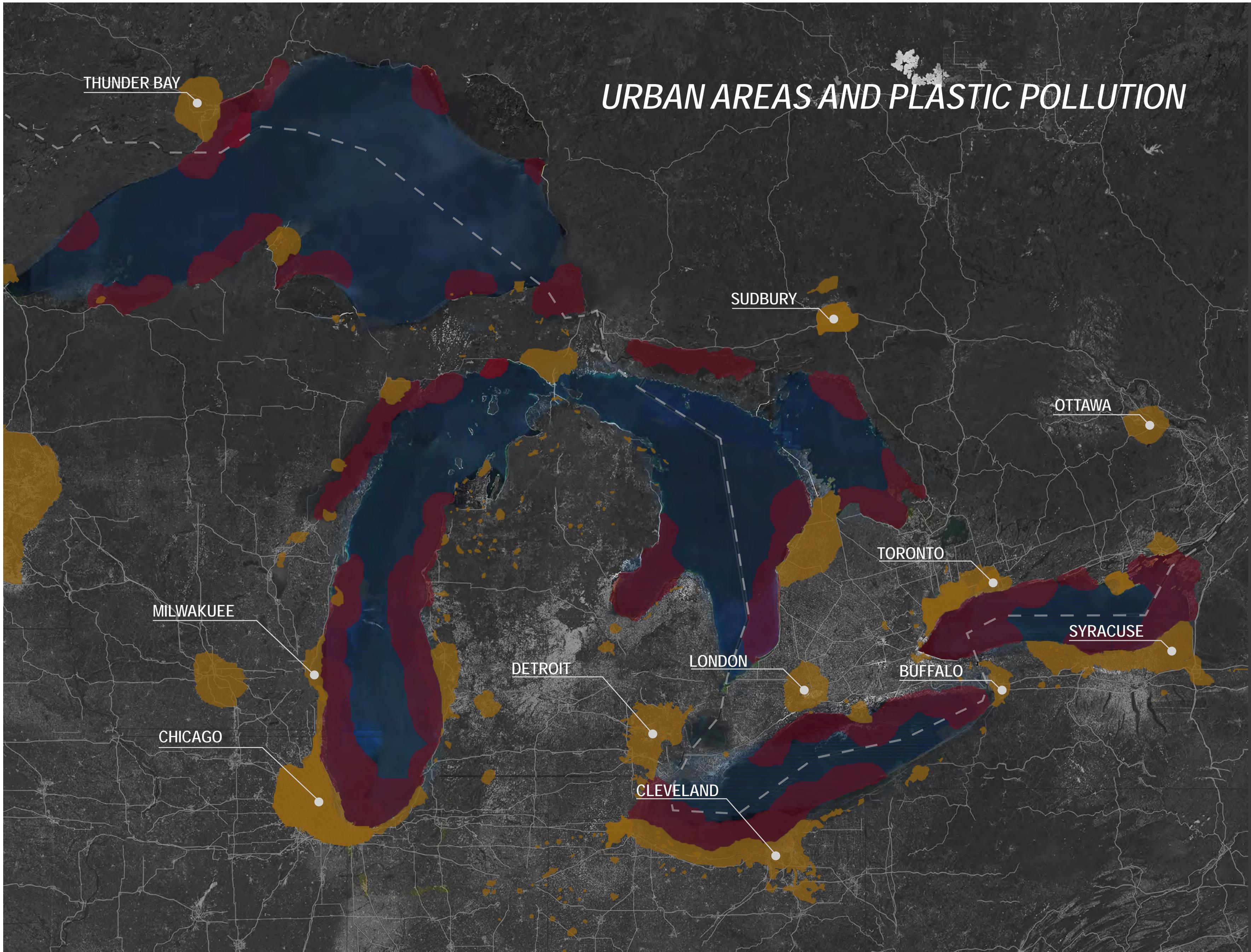


## THYROID DISEASE INCIDENT RATES OF THE GREAT LAKES REGION PER COUNTY



Thyroid disease is a type of cancer that affects almost all of the metabolic processes in your body. PFAS chemicals are known to be a major cause of cancer, having Thyroid disease be the most common in the Great Lakes Region.

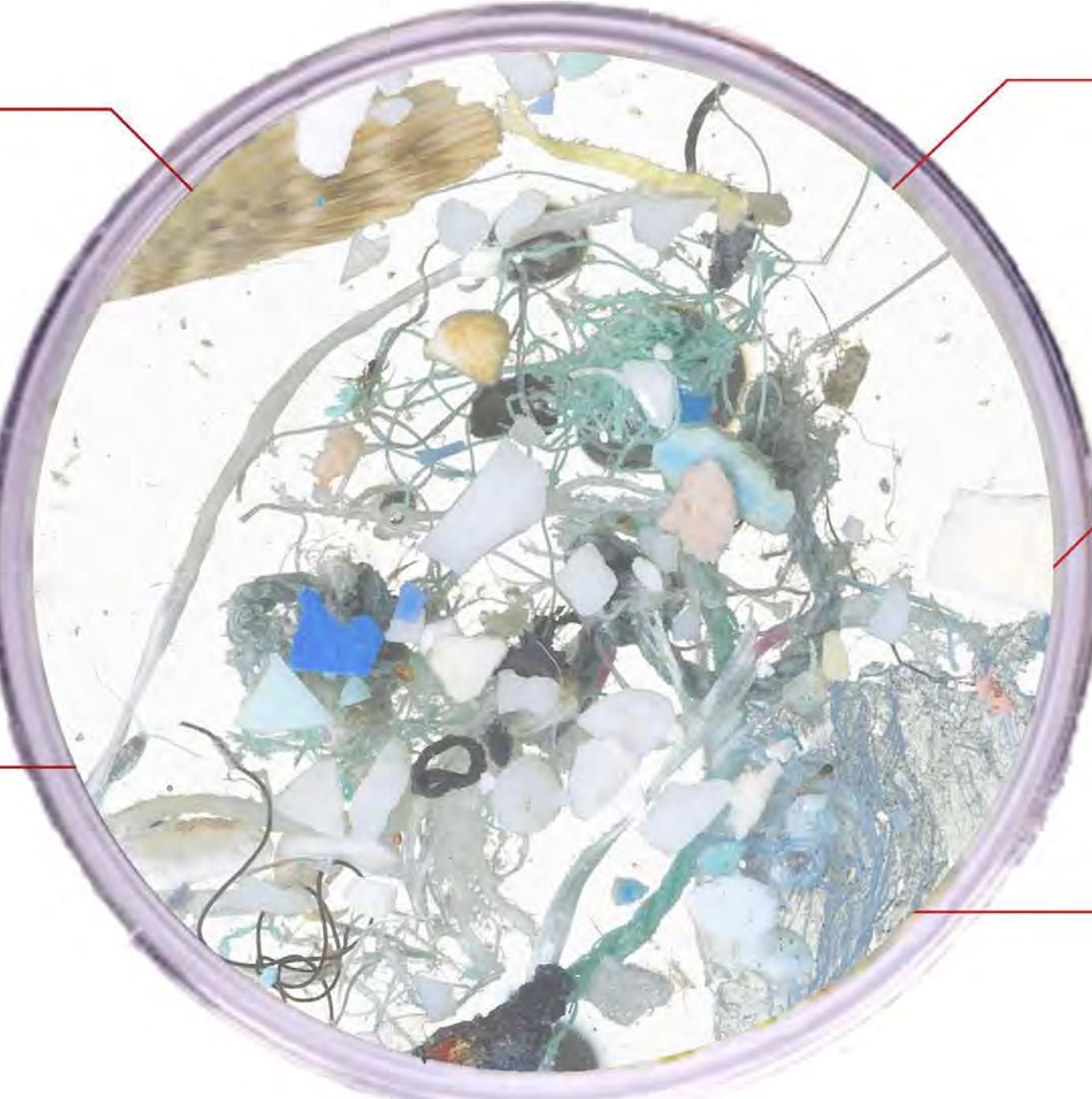
The map shows the annual rate at which people develop thyroid cancer in the Great Lakes Region per county. Areas of extreme and severe case levels can be found closer to the lakes where local water departments filter and send to neighboring homes. Lower incident levels can be seen further away from the lakes.



Urban areas are a huge contribution to the ongoing plastic pollution in The Great Lakes. Most of the plastic pollutants can be found closer to developed areas that are left closer to a cities shoreline.

Unlike ocean plastics, the material swirling in the Great Lakes has nowhere to go. The larger plastic chunks break down into microplastics and tend to concentrate on the shores closest to big cities like Cleveland and Chicago.

Plastic pollutants are able to break down within the water and spread PFAS contaminates within The Great Lakes. Overtime the plastic become micro-sized particles that can bypass filtering and enter your watersupply.



### BURBOT FISH SCALE

Native to the Great lakes, samples of Burbot scales are found closer to shorelines

Date: July 2020  
Size: 5.406 PPM  
Material: Cosmine

### PLASTIC FIBER

Strand of a JELLO CUP belonging to Hayden Rose (9) of Chicago, Illinois

Date: Feb 2008  
Size: 0.129 PPM  
Material: Polyurethane

### ROTIFER ZOOPLANKTON

Crucial for the ecosystem of bodies of water, Zooplankton span all across the Great Lakes.

Date: Aug 2020  
Size: 0.856 PPM  
Material: Bacteria

### MICROFIBER

Particle of a COFFEE CUP belonging to Vira Boone (20) of Cleveland, Ohio

Date: Dec 2012  
Size: 0.235 PPM  
Material: Polystyrene

### NANOFIBER

Particle of a GROCERY BAG belonging to Ryan Kol (22) of Detroit, Michigan

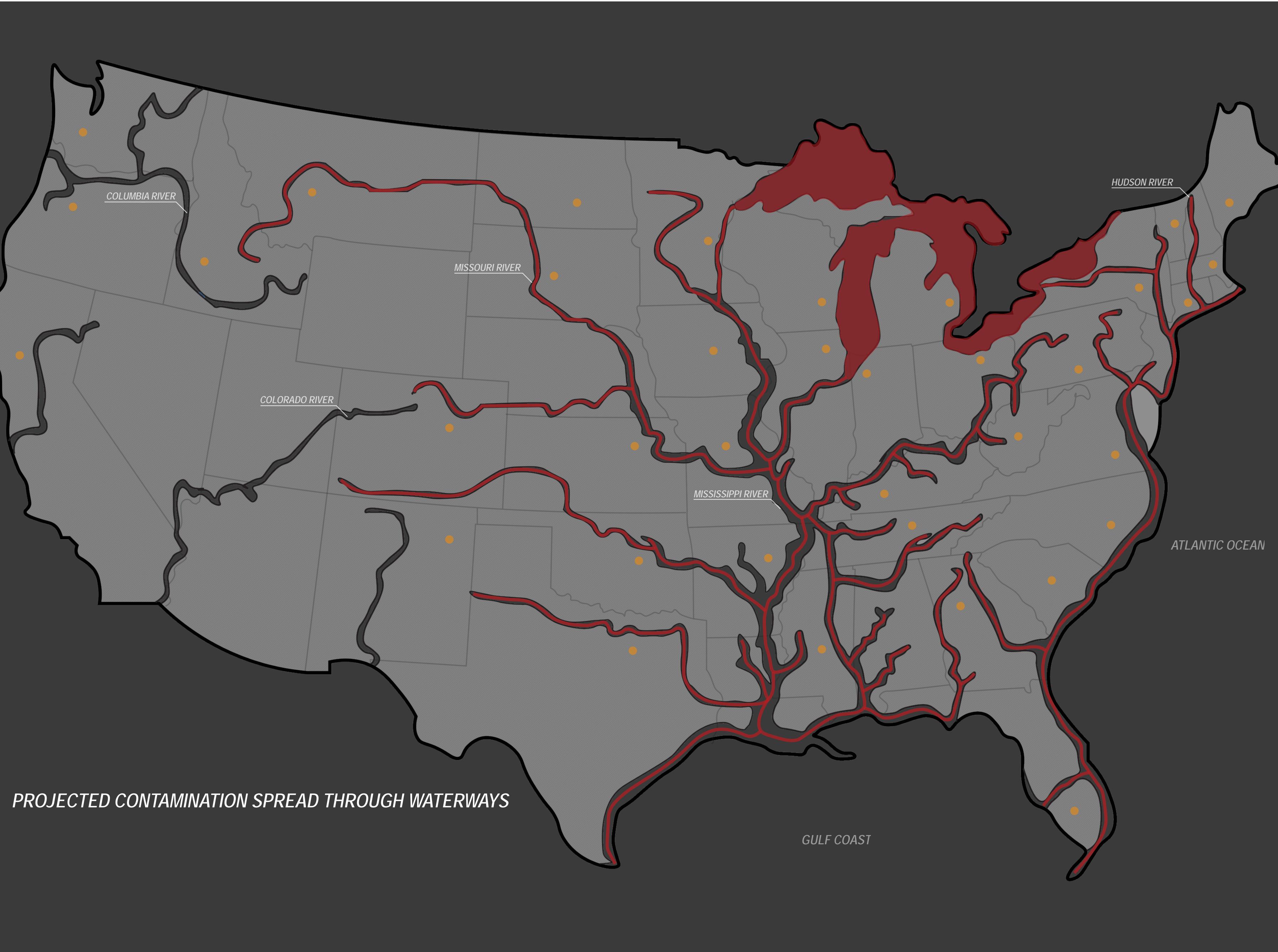
Date: July 1998  
Size: 0.012 PPM  
Material: Polystyrene

SAMPLE NO. 2319

Collected: Aug 2020  
Lake Michigan

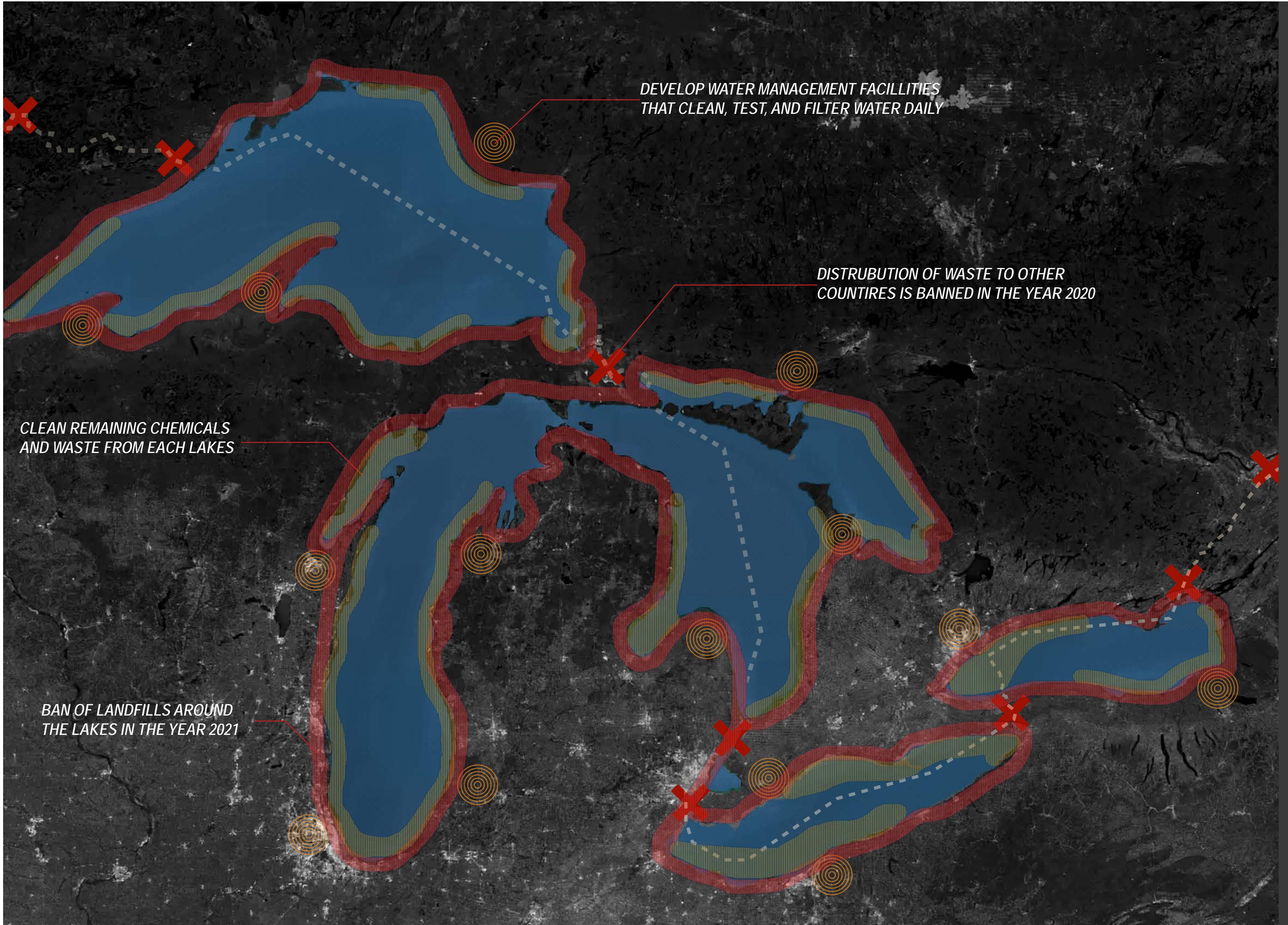
# FUTURE

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The Great Lakes is the largest body of water that is connected to major waterways that stretch across the region. Waterways are made up of multiple canals, rivers, and streams that branch off into different directions .

The map is projection of the future where contaminants are able to travel through these streams and infect water supplies in major cities throughout the course of the stream.



The present problems causing pollution to The Great Lakes are effecting the region's health and leaving ecosystems suffering. As the problem continues to grow in this area, possible solutions can be used into slowing / stopping the spread.

The map diagrams solutions in order to save the water quality within The Great Lakes region. Testing centers for the water can be located closer to the shores with current problems of chemical and plastic pollutants. Landfills closer to the lakes are to be removed from the area and are restricted for waste purposes.



**EXPIRATION TAG**

MATERIAL	FUNGUS ROOTS			
SOURCE	MUSHROOMS			
CHEMICALS	N/A			
Prep Date	4/7/20	Time	10:36	<input checked="" type="checkbox"/> AM
Use By	7/7/20	Time	10:36	<input checked="" type="checkbox"/> AM



**EXPIRATION TAG**

MATERIAL	POLYLACTIC ACID			
SOURCE	CORN			
CHEMICALS	N/A			
Prep Date	1/9/20	Time	2:36	<input type="checkbox"/> AM
Use By	8/9/20	Time	2:36	<input checked="" type="checkbox"/> PM



**EXPIRATION TAG**

MATERIAL	AGAR			
SOURCE	SEAWEED			
CHEMICALS	N/A			
Prep Date	8/9/20	Time	7:36	<input checked="" type="checkbox"/> AM
Use By	6/5/22	Time	2:36	<input checked="" type="checkbox"/> PM

Current packaging for food has a one time use system, where most of the material being used is toxic to the environment. Plastic, Fast Food packaging, and To Go boxes are some of the main sources in contributing PFAS in tap water.

Biodegradable food packaging is a potential solution that will benefit everyone in the long run. Materials with no chemicals used in production will allow for the packaging products to decompose without contaminating the water supply.

Replacing current materials used now for consumption packaging will bring less decomposition time, less landfills, and eventually a cleaner water supply.

Waste production in the Great Lakes region has effected the water quality to millions of people in the surrounding area. In order to prevent contamination to the water quality, major industries are needed to reconsider change. The material used in today's packaging products could be exchanged into a biodegradable material for a clearer future. Following up, restrictions are needed to be put in place to prevent polluted waste in the water. Water management centers should be put in place to help clean, test, and filter the water to ensure the overall health of the Great Lakes. Developing these solutions will result in a cleaner future for the Great Lakes region.