CHAPTER 9: PUBLIC DRINKING WATER

I. Overview of public drinking water systems

Communities in Ohio began filtering and providing public water in the early 19th century. Through expansions in utility services, and advancements in filtration and treatment technologies, the number of people with access to safe and reliable drinking water has expanded tremendously. Today, many communities and regional water utilities are responsible for providing safe, reliable drinking water to their residents and customers.

The Ohio Environmental Protection Agency (OEPA) defines a public water system as any system that provides water for human consumption to at least 15 service connections or serves an average of at least 25 people for a minimum of 60-days in a year. These systems range in size from large municipalities to smaller privately-owned establishments. Public water systems are required to monitor their water regularly for contaminants.

Public water systems are classified according to the number of people they serve in a year:

- Community water systems serve at least 15 service connections used by year-round residents or regularly serve at least 25 year-round residents. Examples include cities, mobile home parks, and nursing homes.
- Non-transient, non-community systems serve at least 25 of the same people over six months per year. Examples include schools, hospitals, and factories.
- Transient non-community systems serve at least 25 different people over 60 days per year. Examples include campgrounds, restaurants, and gas stations. In addition, drinking water systems associated with agricultural migrant labor camps, as defined by the Ohio Department of Agriculture, are regulated even though they may not meet the minimum number of people or service connections.

In contrast to Public Water systems, private water systems are households and small businesses that serve fewer than 25 people per 60 days in a year (e.g., small bed and breakfasts, small day cares and small churches). Private water systems are regulated by the local health departments in both Ohio and Michigan.

Public Water Systems (PWSs) are protected by the Safe Drinking Water Act (SDWA), which includes source water protection, treatment, distribution system integrity, and public information. These approaches help to provide safe and reliable water through four key steps:

- Risk Prevention: Selecting and protecting the best source of water where possible and protecting the current source of water.
- Risk Management: Using effective treatment technologies, properly designed and constructed facilities, and employing trained and certified operators to properly run system components.

- Monitoring and Compliance: Detecting and fixing problems in the source water and distribution system.
- Individual Action: Providing customers with information on water quality and health effects so they are better informed about their water system.

The goal of drinking water treatment is to ensure that the water meets health-based standards set by the U.S. Environmental Protection Agency (U.S EPA) and state regulatory agencies, and to protect public health by preventing waterborne diseases and exposure to harmful substances.

Importance of safe and reliable drinking water

The importance of clean drinking water cannot be overstated, as it directly impacts all aspects of life and well-being. Water needs to be clean, free of disease, metals, human and animal waste, and needs to be affordable for everyone. According to a World Health Organization (2023) report, safe and reliable drinking water is important for public health, whether it is used for drinking, domestic use, food production or recreational purposes. Improved water supply and sanitation, and better management of water resources, can boost economic growth and contribute to poverty reduction (World Health Organization, 2023). Sufficient water treatment facilities and good hygiene are key measures to prevent health complications, particularly in vulnerable populations such as those with chronic health conditions. People with certain chronic medical conditions, compromised immune systems, respiratory diseases, children, and elderly people, can be more at risk of having severe effects from a water-related illness. Access to clean and safe drinking water is a cornerstone of public health. One event that demonstrates the devastating consequences of compromised water quality is the Flint water crisis in Michigan where compromised pipes caused lead exposure that resulted in negative public health impacts. Another example is the 2014 toxic algal bloom in Lake Erie that disrupted water service for over 500,000 people in northwest Ohio. While no one was directly exposed to the toxic algae in their drinking water, water service was discontinued for three days. Contaminants such as lead, per- and polyfluoroalkyl substances (PFAS), nitrates, and microcystin found in harmful algae blooms pose significant risks to human health.

Flint's 2014 water crisis exposed thousands of residents, especially children, to elevated blood lead levels and associated developmental risks, deepening environmental challenges and eroding public trust in government institutions (Hanna-Attisha et al., 2016; Pulido, 2016). The lead-contaminated water that residents were exposed to resulted in an increased risk of hypertension for pregnant women and may have interfered with their choice of whether to breastfeed. Moreover, the health effects of lead exposure in children increased the risk of impaired cognition, behavioral disorders, hearing problems, and delayed puberty. Analyzing health records from 2008 to 2015, researchers found that fertility rates in Flint dropped by 12 percent, and fetal deaths rose by 58 percent. a Additionally, babies who were born full-term in Flint during the water crisis had lower birth weights. The magnitude and long-term health consequences of the Flint crisis, particularly for low-income and marginalized communities, were severe.

The three-day "Do Not Drink" advisory in Toledo event revealed vulnerabilities in water safety monitoring and infrastructure resilience. Despite substantial improvements at the Toledo Water Treatment Plant since the 2014 microcystin event, many Toledo residents remain wary of the public water system due to the initial crisis and its perceived mishandling (Hope & Glauser, 2015; McElmurry et al., 2016). Ensuring reliable drinking water systems is essential not only to reduce the incidence of waterborne diseases but also to protect vulnerable populations and restore public confidence, ultimately enhancing overall community health.

II. Drinking Water Regulatory Frameworks

I. Federal Public Drinking Water Regulations

The Safe Drinking Water Act (SDWA) was enacted by the U.S. Congress in 1974 to protect the quality of drinking water in the U.S. It mandates the U.S. EPA to develop national standards and establish requirements for public water systems concerning treatment, monitoring, and reporting. Its overall goal is to protect public health by setting enforceable standards for specific contaminants in rivers, lakes, reservoirs, springs, and groundwater wells. The SDWA also sets the requirements for treating the contaminants detected in drinking water. For this purpose, it mandates all utilities to assess their water sources regularly. To implement it successfully, the U.S. EPA is empowered to establish and enforce national health-based standards to protect drinking water from both naturally occurring and human-caused contaminants.

II. Statewide Public Drinking Water Regulations

In accordance with the federal SDWA, both Ohio and Michigan have developed robust public drinking water programs that meet federal requirements. Each state administers these programs through their respective regulatory agencies to ensure safe and reliable drinking water for residents, businesses, and institutions. Ohio regulates public drinking water primarily through the Ohio Administrative Code (OAC) 3745-81, which aligns with the federal SDWA and sets comprehensive standards for water quality monitoring and reporting. The OAC establishes maximum contaminant levels (MCLs) for a wide range of pollutants and mandates regular water sampling, laboratory analysis, and prompt public notification if standards are exceeded. These rules apply to both community and non-community water systems, supporting a consistent, statewide approach to drinking water protection. Oversight is managed by the OEPA through its Division of Drinking and Ground Waters (DDAGW), which enforces regulations, certifies water system operators, and provides technical and financial assistance, such as the Drinking Water Assistance Fund, to help communities maintain compliance and improve infrastructure. Michigan's drinking water program is administered by the Department of Environment, Great Lakes, and Energy (EGLE), under the authority of the Michigan SDWA. The state's regulatory framework is codified in the Michigan Administrative Code (Rules R 325.10101 to R 325.12820), which, like Ohio's, sets MCLs, requires routine monitoring, and emphasizes operator certification and reporting. Michigan regulates approximately 1,400 community and 9,500 non-community systems. Its Drinking Water and Environmental Health Division (DWEHD) also supports functions such as source water protection, well construction oversight, and coordination with local health departments.

Both Michigan and Ohio have taken significant steps to tackle water quality issues posed by emerging contaminants. In Michigan, the Flint water quality crisis spurred the state into action, leading to stricter rules for lead and copper in drinking water. These changes include replacing service lines and educating the public to prevent similar situations. Ohio, on the other hand, aligns its lead and copper standards with federal requirements and is working to map and replace lead service lines throughout the state. Currently, both states are addressing issues about PFAS chemicals in drinking water. As of 2025, Michigan has set enforceable MCLs for seven PFAS compounds, while Ohio has set action levels for six compounds based in the 2024 federal MCLs. Ohio's PFAS MCLs, reflective of the federal standards, are expected to be final in 2027. Both Ohio and Michigan programs include PFAS sampling requirements guidance to help water systems navigate this issue. In terms of funding, both states offer financial assistance to communities for infrastructure improvements. Ohio’s Drinking Water Assistance Fund and Michigan’s MI Clean Water Plan both provide grants and low-interest loans to support system upgrades and long-term compliance.

Ohio and Michigan maintain comprehensive and federally compliant drinking water programs; each tailored to their state-specific needs and experiences. While individual policy emphases may differ, such as Michigan’s lead response or Ohio’s statewide technical assistance network, both programs are grounded in a shared commitment to protecting public health and ensuring high-quality drinking water.

III. Source Water Assessment and Protection

The 1974 SDWA sets enforceable standards for specific contaminants and requires that drinking water be treated. The SDWA also aims to prevent contamination of the drinking water source prior to treatment and requires utilities to assess their source of water. Ohio EPA and Michigan EGLE are charged with ensuring that public water supplies comply with the SDWA and evaluate potential threats to source waters. While the CWA and SDWA can work in tandem to protect drinking water sources, regulatory gaps present challenges to local governments charged with providing safe drinking water. Ohio's Source Water Assessment and Protection (SWAP) program, also known as Drinking Water Source Protection or “Wellhead” Protection, focuses on protecting the state's public water systems from contamination. While public systems treat water to meet health-based standards, preventive measures to avoid chemical spills near well fields or surface water intakes are crucial. These actions help communities reduce treatment costs and ensure safe, high-quality drinking water. Public water suppliers drawing from the western basin of Lake Erie face the unique challenges presented by seasonal algal toxins that emerge each year.

Michigan’s source water protection program is formulated to protect water sources for local communities that use groundwater and surface water for their municipal drinking water supply systems. This includes management strategies to reduce contamination risk, contingency and new source planning, and public education and outreach. Michigan EGLE’s source water protection program includes identification of areas where groundwater is used to supply drinking water to communities.

While source water protection plans offer a planning tool to leverage governmental and private investment to protect source water, public water systems lack the authority to control nutrients and other pollutants that impact their source of water outside of their own political boundaries.

IV. Emerging Issues

High demand for available water resources, along with pollution of groundwater and surface water resources, has led to water quality issues in recent years. Expansion of tech industries activities such as the construction of data centers in rural areas, and an increase in industrial livestock farming in the region have led to evolving water quality and availability challenges in Ohio and Michigan. In recent years, extreme weather events have exacerbated the issue as some of the facilities available to treat polluted water are older and may struggle to handle the challenges of these weather events.

A report from the Environmental Working Group identifies high levels of more than 100 contaminants like disinfectant byproducts, nitrates and forever chemicals called PFAS in Ohio’s drinking water. As a result, Ohio and Michigan have recently accelerated efforts to address issues such as lead pipes and PFAS contamination. In October 2024, the Biden administration announced $56.2 million in funding to support Ohio's lead pipe replacement initiative, following the U.S. EPA's mandate to remove lead service lines. Meanwhile, Michigan has led efforts to regulate PFAS, establishing state-level maximum contaminant levels to safeguard public health. Beyond PFAS, emerging contaminants, including pharmaceuticals, personal care products, microplastics, and industrial chemicals are increasingly being detected in water supplies. These substances, which are not yet fully regulated, present complex challenges to drinking water systems due to limited treatment technologies and evolving health risk assessments. Compounding these issues is a nationwide shortage of qualified water treatment operators and technical staff, threatening the continuity and resilience of safe water delivery. In response, TMACOG has started a water workforce training program to train more operators and increase the number of operators for the water treatment facilities in the region.

V. Public Drinking Water Infrastructure

i. Drinking Water Treatment Plants

Drinking water treatment involves the process of removing contaminants and impurities from raw water sources to produce safe and potable water for human consumption. The process begins with coagulation and flocculation, where chemicals are added to clump particles together into larger masses, which then settle out in the sedimentation phase. Filtration follows, using materials like sand, gravel, or activated carbon to remove smaller particles, bacteria, and protozoa. Disinfection is the final critical step, where chlorine, chloramine, ozone, or ultraviolet light are used to kill any remaining pathogens. Advanced treatment technologies like activated carbon adsorption, ion exchange, and reverse osmosis may also be used to address specific contaminants (Figure 9-1).

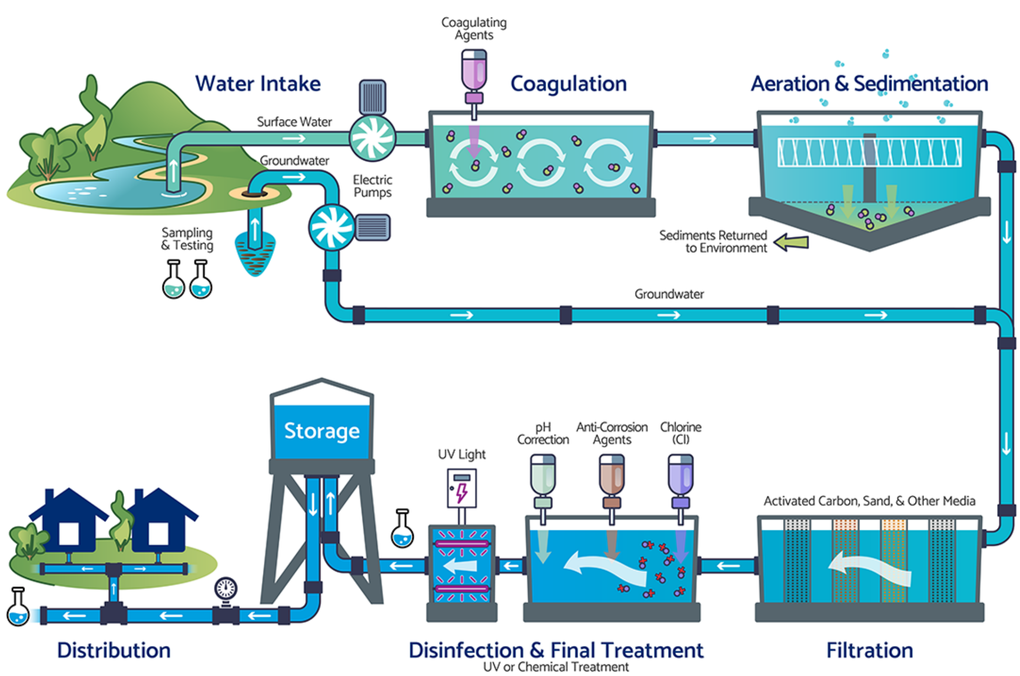

Figure 9 - 1: Drinking Water Treatment Process.
Source: Community Utilities of Pennsylvania

ii. Drinking Water Treatment Facilities in TMACOG 208 Planning Area

There are nineteen (19) Drinking Water Treatment Facilities in the TMACOG 208 planning region which serves a population of nearly 600,000 (Figure 9-2). The water treatment facilities in the TMACOG region receive their water from several types of sources. Most of the region's drinking water is sourced from Lake Erie, while several other facilities utilize intakes in nearby rivers or creeks to feed reservoirs. Some facilities utilize ground water wells as their permanent source and as an emergency source. The largest plant in the region is Toledo Collins Park Water Treatment Plant (WTP) in Lucas County, serving approximately 80% of the public drinking water in the region. The smallest plant in the region is in Whiteford Township in Monroe County, Michigan. The Whiteford Township WTP began running in 2018 to deliver drinking water to the surrounding residences and businesses and is planning to expand the service area to meet the township's demands.

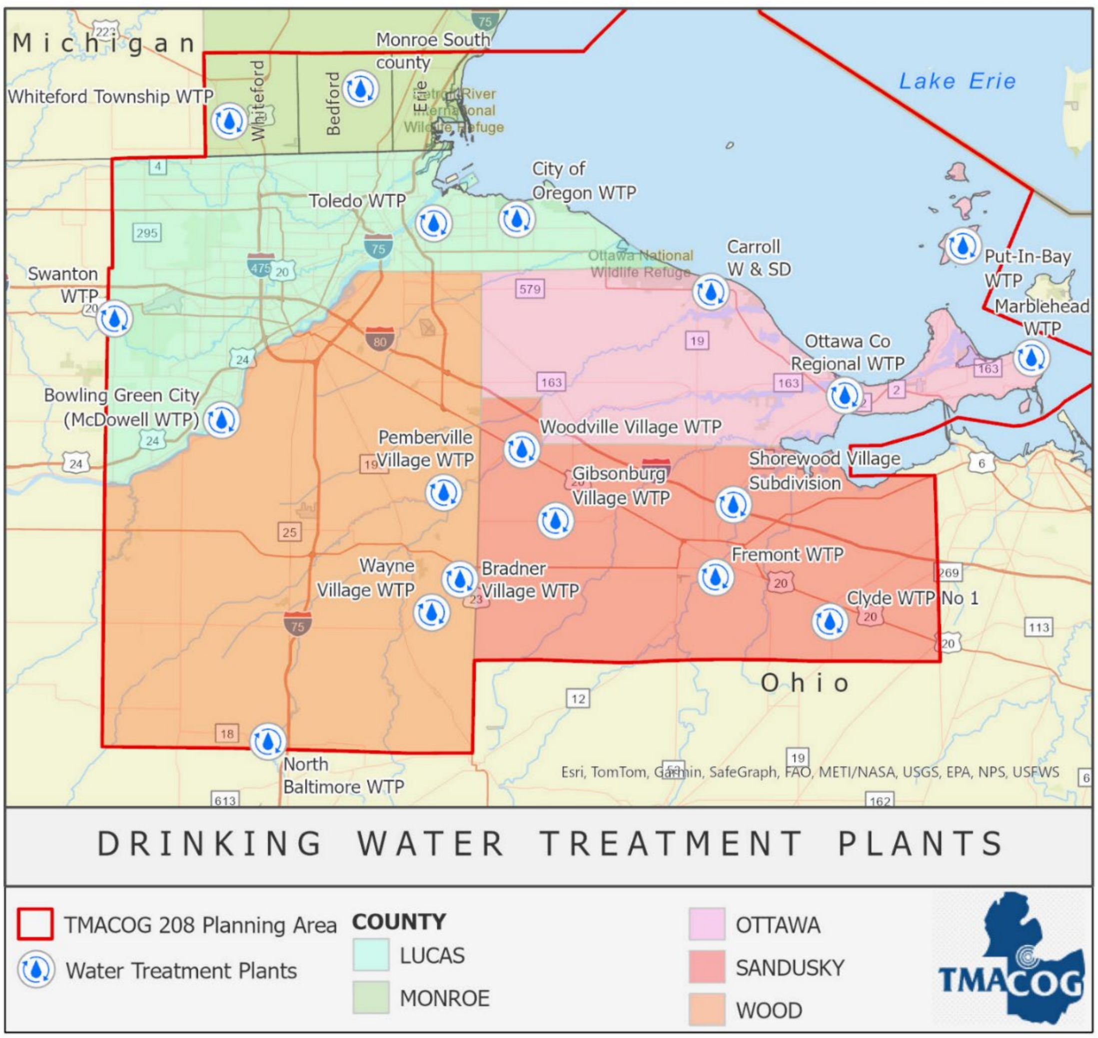

Figure 9 - 2: Water Treatment Plants in TMACOG 208 Planning Region

a. Lucas County Water Treatment

Three drinking water treatment plants serve Lucas County residents including the City of Toledo WTP, City of Oregon WTP, and Swanton WTP (Figure 9-3).

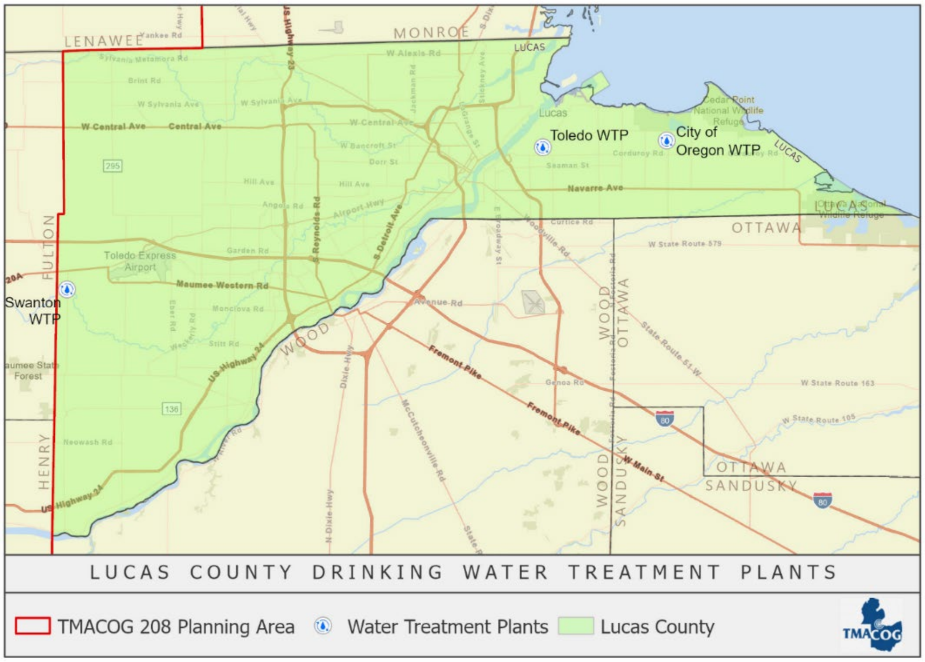

Figure 9 - 3: Water Treatment Plants in Lucas County

Table 9 - 1: Summary of Lucas County Drinking Water Treatment Facilities

Facility Name	**Toledo WTP**
Age of System	1942
Latest Major Upgrade (Year)	NA
Average-day production	65 MGD
Source water	Intake from: Toledo City Lake Erie Intake
Population served	480,000
Communities Served	Lucas County, Fulton County, City of Oregon, Toledo Refining Company along with the City of Oregon, City of Maumee, South County Water Dist. Of Monroe County, City of Perrysburg, City of Sylvania, NWRWSD (Wood County), and The Village of Whitehouse.
Facility Name	**City of Oregon WTP**
Age of System	1964
Latest Major Upgrade (Year)	2004
Average-day production	10MGD
Source water	Intake: Lake Erie, Toledo Otter CR, Emergency DS Connection
Population served	19,950
Communities Served	City of Oregon, City of Northwood, Lake Township (Wood County), Jerusalem Township (Lucas County), Village of Genoa (Ottawa County), Village of Millbury (Wood County), and the Village of Harborview (Lucas County).
Facility Name	**Swanton WTP**
Age of System	1974
Latest Major Upgrade (Year)	NA
Average-day production	0.335 MGD

Source water	Intake Reservoir, Intake Swan Creek Reservoir, Well 1, Swan Creek Water, District 2 Emergency
Population served	3,855
Communities Served	Swanton

b. Ottawa County Water Treatment

Four drinking water treatment plants serve the population of Ottawa County. These are: Carroll Water and Sanitary District (W&SD), Ottawa County Regional WTP, and Put-In-Bay WTP (Figure 9-4).

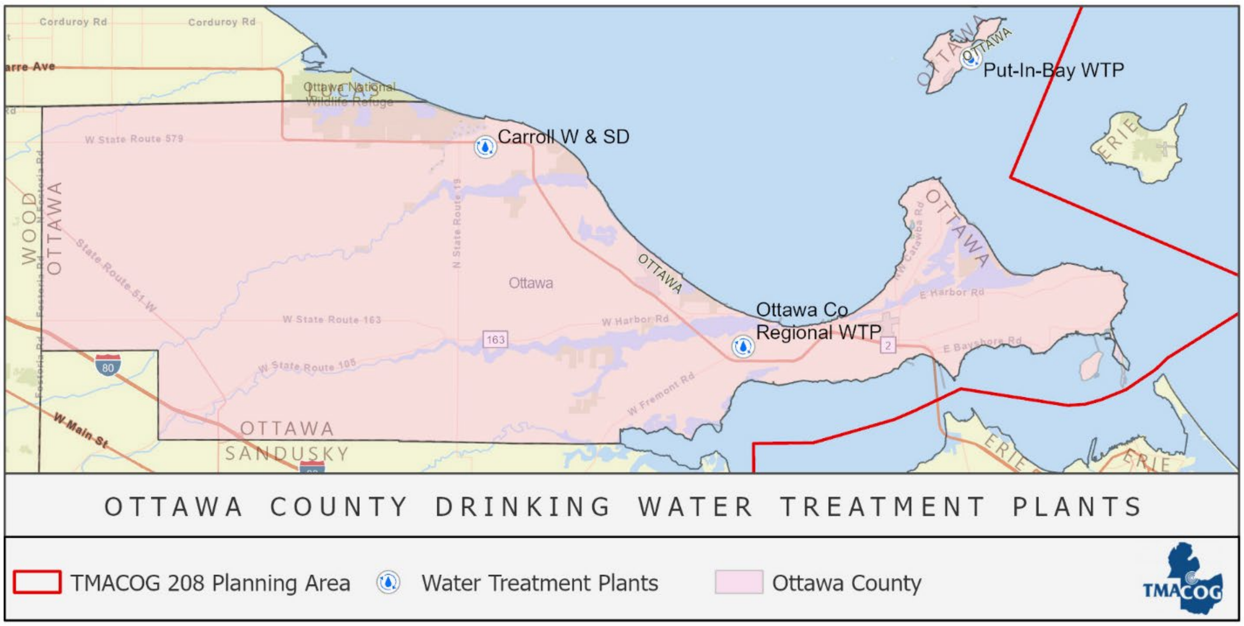

Figure 9 - 4: Water Treatment Plants in Ottawa County

Table 9 - 2: Summary of Ottawa County Drinking Water Treatment Facilities

Facility Name	**Ottawa Co Regional WTP**
Age of System	1999
Latest Major Upgrade (Year)	2005
Average-day production	3.637MGD
Source water	Intake Lake Erie, Intake from Emergency Portage River
Population served	19,556
Communities Served	Ottawa
Facility Name	**Carroll W&SD**
Age of System	1998
Latest Major Upgrade (Year)	NA
Average-day production	0.40MGD
Source water	Intake Lake Erie, CC Ottawa Regional Emergency Connection
Population served	2,288
Communities Served	Carroll Township
Facility Name	**Put-In-Bay WTP**

Age of System	1974
Latest Major Upgrade (Year)	NA
Average-day production	0.32MGD
Source water	Intake from Lake Erie
Population served	700
Communities Served	Put-In-Bay Township

c. Sandusky County Water Treatment

Sandusky County currently has five water treatment plants. These are Fremont WTP, Clyde WTP No 1, Gibsonburg Village WTP, Woodville Village WTP, and Shorewood Village Subdivision WTP (Figure 9-5).

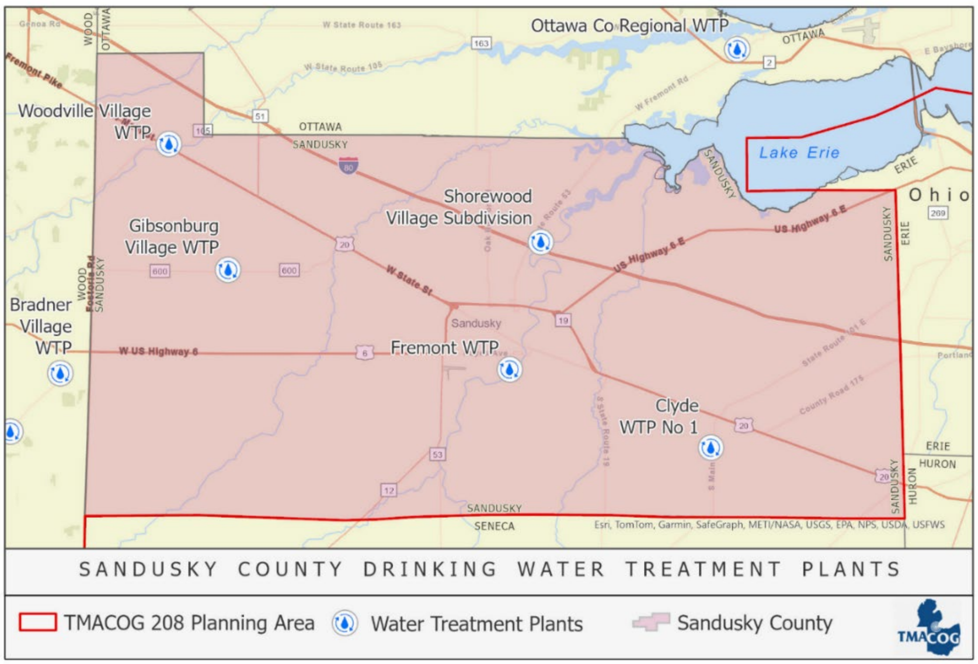

Figure 9 - 5: Water Treatment Plants in Sandusky County

Table 9 - 3: Summary of Sandusky County Drinking Water Treatment Facilities

Facility Name	**Fremont City**
Age of System	1974
Latest Major Upgrade (Year)	NA
Average-day production	6.0 MGD
Source water	Intake Reservoir, Intake Sandusky River, Reservoir, Ballville Dam
Population served	18,319
Communities Served	City of Fremont
Facility Name	**Clyde WTP No. 1**
Age of System	1997
Latest Major Upgrade (Year)	NA
Average-day production	1.25 MGD
Source water	Intake Beaver Creek, Intake Beaver Creek Reservoir, Intake Racoon Creek Reservoir, Beaver Creek Reservoir, Racoon Creek Reservoir

Population served	6,325
Communities Served	Clyde Township
Facility Name	**Gibsonburg Village**
Age of System	2001
Latest Major Upgrade (Year)	2001
Average-day production	0.31 MGD
Source water	Well 3, Well 4, Well 5, Well 6, Well 7
Population served	2,506
Communities Served	Gibsonburg community
Facility Name	**Woodville Village**
Age of System	1974
Latest Major Upgrade	Upgrades in March 2020, Phase III Waterline Replacement Project in Fall 2024, Water Tower Replacement 2025-2026, Water St. Waterline Replacement Fall 2025.
Average-day production	0.170 MGD
Source water	Well 2, Well 5, Well 6, Well 7, Well 8, Well 9, Well 10, Well 11
Population served	2,006
Communities Served	Woodville and a few Woodville Township residents
Facility Name	**Shorewood Village Subdivision**
Age of System	1971
Latest Major Upgrade (Year)	NA
Average-day production	0.015 MGD
Source water	Well 1, Well 2
Population served	359
Communities Served	Village of Shorewood

d. Wood County Water Treatment

Five drinking water treatment plants serve Wood County residents: McDowell WTP (Bowling Green), Bradner WTP, North Baltimore WTP, Pemberville Village WTP, and Wayne Village WTP (Figure 9-6).

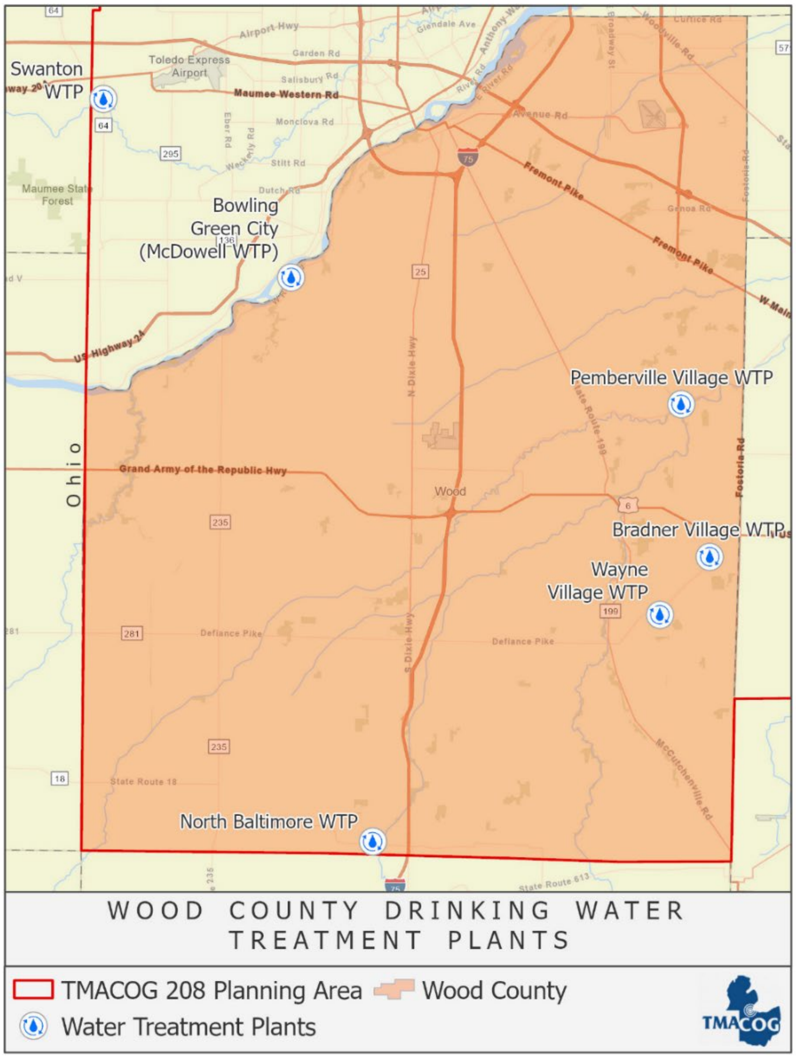

Figure 9 - 6: Water Treatment Plants in Wood County

Table 9 - 4: Summary of Wood County Drinking Water Treatment Facilities

Facility Name	**Bowling Green City (McDowell WTP)**
Age of System	1951
Latest Major Upgrade (Year)	2024
Average-day production	4.767 MGD
Source water	Intake 1 Maumee River, Intake 1 Reservoir, Intake 2 Maumee River, Intake 2 Reservoir, Reservoir
Population served	31,578
Communities Served	Bowling Green, Northwest Water, Waterville, Grand Rapids, Tontogany
Facility Name	**North Baltimore WTP**
Age of System	1970
Latest Major Upgrade (Year)	Most recent major upgrade-1998 In 2015 TTHM removal was added to the clear wells In 2022-2023 a new 500,000 gallons water tower and water main was added In 2023-2024 water mains were replaced and a loop under interstate I75 was added

Average-day production	0.680 MGD
Source water	Intake Reservoir 1, Intake Reservoir 2, Intake Rocky Ford 2, Reservoir 1, Reservoir 2
Population served	3,432
Communities Served	Also serves the Village of McComb via Northwest water district
Facility Name	**Pemberville Village**
Age of System	1974
Latest Major Upgrade (Year)	NA
Average-day production	0.100 MGD
Source water	Well 1, Well 3 Well 5, Well 7, Well 8, Well 9, Well 10, Well 11
Population served	1,360
Communities Served	Village of Pemberville
Facility Name	**Bradner Village**
Age of System	1936
Latest Major Upgrade (Year)	NA
Average-day production	0.054 MGD
Source water	Well 4, Well 5, Well 6, Well 7, Well 8
Population served	985
Communities Served	Village of Bradner
Facility Name	**Wayne Village**
Age of System	1977
Latest Major Upgrade (Year)	NA
Average-day production	NA
Source water	Well 1, Well 2, Well 3, Well 4
Population served	941
Communities Served	Village of Wayne

e. Monroe County Water Treatment Plants

Two drinking water treatment plants serve the residents of Whiteford and Bedford Townships in Monroe County, Michigan: The Whiteford Township WTP and the Monroe South County plant (Figure 9-7).

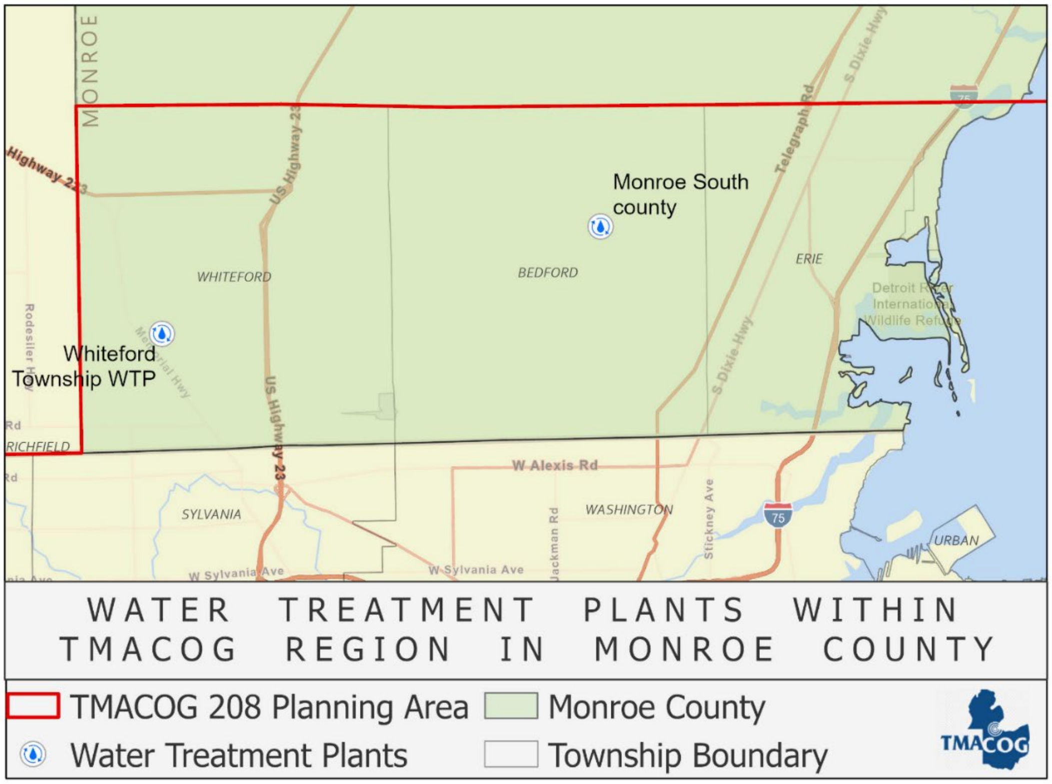

Figure 9 - 7: Water Treatment Plants within TMACOG 208 Area in Monroe County

Table 9 - 5: Summary of Monroe County Drinking Water Treatment Facilities

Facility Name	**Monroe South County**
Age of System	1970
Latest Major Upgrade (Year)	NA
Average-day production	2.32 MGD
Source water	Toledo, Ohio
Population served	42,288
Communities Served	NA
Facility Name	**Whiteford Township Water Treatment Plant**
Age of System	2018
Latest Major Upgrade (Year)	NA
Average-day production	0.50 MGD
Source water	Well 1
Population served	150 homes 7 businesses
Communities Served	Whiteford Township

VI. Drinking Water Challenges

Ensuring safe drinking water remains a critical challenge due to a range of contaminants and environmental factors. The (SDWA) defines contaminant as any “physical, chemical, biological or radiological substance or matter in water”. Drinking water may be reasonably expected to contain at least small amounts of contaminants. Some contaminants may be harmful if consumed at certain levels in drinking water. This may expose some people to toxic chemicals like lead, phosphorus, and PFAS. Low-income groups disproportionately bear the consequences of potential exposure due to several intersecting factors. These communities are more likely to live in areas with aging or poorly maintained infrastructure, which increases the risk of contamination from lead pipes, failing treatment systems, or industrial runoff. Financial constraints also limit their ability to invest in home-level solutions such as water filters or bottled alternatives.

i. Contaminants

Lead and Copper Contaminants and Public Drinking Water

On October 8, 2024, the EPA finalized a rule that mandates drinking water systems nationwide to identify and replace lead pipes within 10 years. Lead and Copper Rule Improvements introduce strict water testing requirements and a lower action threshold to enhance community protection from lead exposure. Additionally, the rule strengthens public communication by ensuring that families are informed about lead risks, pipe locations, and replacement plans.

Ohio's Lead and Copper Rule align with federal regulations to protect public health by minimizing lead and copper levels in drinking water. The rule mandates that all Community and Non-Transient, Non-Community Public Water Systems implement corrosion control treatments to prevent these metals from leaching into the water supply, which applies to all drinking water treatment plants (WTPs). This involves regular monitoring of tap water for these metals and maintaining water quality parameters within specified limits. If action levels are exceeded, specifically, lead concentrations above 15ppb or copper concentrations above 1.3ppm, in more than 10% of tap samples, the WTP must undertake additional corrective actions (see Drinking Water Standards for Ohio Public Water Systems).

The Lead and Copper Rule sets action levels for these metals which require water systems in TMACOG's 208 planning area to replace lead service lines when exceedances occur. Despite regulatory efforts, lead exposure remains a risk, especially in older homes with lead plumbing components. Compliance with the updated Lead and Copper Rule Improvements will require water systems to enhance monitoring, reduce lead action thresholds, and increase transparency regarding lead service line locations and replacement plans.

Furthermore, WTPs are required to perform routine monitoring and reporting as stipulated by the Ohio Administrative Code. This includes submitting detailed reports on water quality parameters and any instances of action level exceedances to the Ohio Environmental Protection Agency (EPA).

Table 9 - 6: Annual Detected Lead and Copper Water Treatment Facility in TMACOG Region

WTP	Lead (ppb)	Copper (ppm)	Possible Source of Contaminant	Date Measured	Source
	90% of test levels were less than				
LUCAS COUNTY					
Swanton WTP	2.4 No Violation	0.26 No Violation	Erosion of natural deposits; Leaching from wood preservatives (copper only); Corrosion of household plumbing systems.	2023	Ohio EPA
Toledo WTP	4 (4 out of 131 samples exceeded action level)	0.012 No Violation		2022	Water Quality Report
City of Oregon WTP	0 No Violation	0.03 No Violation		2023	Consumer Confidence Report
OTTAWA COUNTY					
Carroll W & SD	0 No Violation	0.641 No Violation	Erosion of natural deposits; Leaching from wood	2022	Consumer Confidence Report

Marblehead WTP	1 No Violation	0.198 No Violation	preservatives (copper only); Corrosion of household plumbing	2023	Consumer Confidence Report
Ottawa Co Regional WTP	4 No Violation	0.156 No Violation		2022	Water Quality Report
Put-In-Bay WTP	5.89 No Violation	0.777 No Violation		2022	Consumer Confidence Report
SANDUSKY COUNTY					
Clyde WTP No. 1	4 No Violation	0.039 No Violation	Erosion of natural deposits; Leaching from wood preservatives (copper only); Corrosion of household plumbing.	2022	Consumer Confidence Report
Fremont City	0 No Violation	0.028 No Violation		2023	Consumer Confidence Report
Gibsonburg Village	2.9 No Violation	0.125 No Violation		2022	Consumer Confidence Report
Shorewood Village Subdivision	0.950 No Violation	0.223 No Violation		2023	Consumer Confidence Report
Woodville Village	0 No Violation	0.01 No Violation	Corrosion of household plumbing	2023	Consumer Confidence Report
WOOD COUNTY					
Bowling Green City (McDowell WTP)	4 No Violation	0.03 No Violation		2023	Consumer Confidence Report
Bradner Village	N/A	0.28 No Violation		2022	Drinking Water Report
North Baltimore WTP	N/A	0. 025 No Violation	Erosion of natural deposits; Corrosion of household plumbing	2023	Consumer Confidence Report
Pemberville Village	0.6 No Violation	0.366 No Violation	Erosion of natural deposits; Leaching from wood preservatives (copper only); Corrosion of household plumbing.	2023	Consumer Confidence Report
Wayne Village	No Data	No Data			
MONROE COUNTY					
Monroe South county	No Data	No Data			
Whiteford Township WTP	0 No Violation	0.04 No Violation	Lead service line, Erosion of natural deposits; Leaching from wood preservatives (copper only); Corrosion of household plumbing.	2022	Consumer Confidence Report

Nutrient Pollution

Nutrient pollution is one of the most predominant and costly water quality challenges in TMACOG's 208 planning area. Harmful algal blooms (HABs) fueled by nutrient pollution, primarily from agricultural sources, pose a seasonal threat to drinking water sources (See chapter 7 for details), requiring advanced treatment processes to remove algal toxins. Annual HABs are particularly challenging for drinking water facilities drawing from the western basin of Lake Erie, which can experience blooms beginning in late June and extending into October. A 2022 analysis by the Alliance for the Great Lakes found that the average family of five in Toledo pays an additional $100 per year to prevent algal toxins from contaminating their drinking water2. The Maumee Watershed Nutrient TMDL attributes the source of western Lake Erie's algae blooms largely to agricultural nutrients originating in upstream watersheds that extend past local and state boundaries. Source water protection plans can be a planning tool to leverage governmental and private investment to protect source water; however, these plans are not enforceable by state or federal agencies, and local authority to implement source water protection programs is limited to the jurisdiction of the public water system. This leaves public water systems without the authority to control nutrients and other pollutants that impact their source of water.

2 https://greatlakes.org/wp-content/uploads/2022/05/FINAL-COI-Report-051622.pdf

In response to the growing threat of harmful algal blooms (HABs), particularly those producing microcystin toxins, both Ohio and Michigan have implemented regulatory and treatment strategies to protect drinking water systems. The Ohio EPA enforces thresholds of 1.6 µg/L for sensitive populations and 3.0 µg/L for the public which requires public water systems to submit Cyanotoxin Management Plans and conduct routine sampling when bloom conditions are likely (Ohio EPA, 2023). Similarly, Michigan's Department of Environment, Great Lakes, and Energy (EGLE) follows U.S. EPA guidance for microcystin and supports risk-based monitoring, satellite tracking, and public health advisories through coordination with the Michigan Department of Health and Human Services (EGLE, 2022). In terms of treatment, many water utilities in both states have invested in powdered activated carbon (PAC) systems, advanced oxidation processes (AOPs), and membrane filtration to remove toxins from finished water. For example, the City of Toledo has continued to upgrade their system after the 2014 HAB crisis, including PAC feed systems, ozone treatment, and real-time monitoring (City of Toledo, 2020).

Significant changes will need to be made to the way agricultural and urban landscapes are managed to minimize the influx of nutrients to our waterways. Further consideration must be given to the design, construction, and operation of nutrient removal technologies at wastewater treatment facilities. The nature of these changes and the approaches taken by governmental agencies, agri-businesses, farmers, landowners, wastewater treatment service providers and researchers should be constructively debated and quickly implemented.

PFAs and Public Drinking Water

The U.S. EPA issued new PFAS drinking water regulations on April 10, 2024, which set Maximum Contaminant Levels (MCLs) at 4 parts per trillion (ppt) for PFOA and PFOS, and 10 ppt for PFHxS, PFNA, and HFPO-DA (GenX chemicals). In response to growing concerns, Ohio has taken steps to assess and mitigate PFAS contamination. In 2019, Governor DeWine directed Ohio EPA and ODH to launch the PFAS Action Plan 1.0, prioritizing testing in nearly 1,500 public water systems, establishing action levels, and providing resources for both public and private water systems. Recognizing the need for stronger protection, particularly for vulnerable communities, the state upgraded its efforts with PFAS Action Plan 2.0, which expanded sampling, investigations, and funding to support communities at risk. Michigan similarly adopted new PFAS drinking water regulations in August 2020, requiring sampling for seven PFAS compounds across 2,700 water supplies statewide. As PFAS regulations continue to evolve, ensuring that mitigation efforts prioritize the most impacted and underserved populations will be essential in advancing equitable access to safe drinking water.

Table 9 - 7: PFAS Standards in Ohio and Michigan

PFAS Chemicals* Parts per trillion (ppt)	PFOA	PFOS	GenX	PFBS	PFHxS	PFNA	PFHxA
Ohio New 2024 Action Levels	4.0	4.0	10	2,000**	10	10	
Michigan	8	16	370	420	51	6	400,000

*PFOA (Perfluorooctanoic Acid), PFOS (perfluorooctane Sulfonate), GenX (HFPO dimer acid), PFBS (perfluorobutanesulfonic acid), PFHxS (perfluorohexane sulfonic acid), PFNA (perfluorononanoic acid). and PFHxA (Perfluorohexanoic Acid)

**Health Based Water Reference Concentration (U.S. EPA 2023)

VII. Impact of Severe Weather on Water Infrastructure

Though the TMACOG planning region has not had as many severe weather event impacts as compared to other regions in the United States, it is likely that drinking water systems will be impacted by extreme weather events in the future (USEPA) Changing weather patterns and aging drinking water infrastructure increases their vulnerability. There has been an increase in the rates of severe weather events such as heat waves, extreme winter weather, cold snaps, ice storms, droughts, and floods. Water availability, quality, and distribution could all be impacted. Extreme weather events also increase the risk of pipe failures, treatment inefficiencies, and contamination. Analyzing water treatment facilities' exposure to severe weather will inform policy decisions and provide solutions to ensure safe and sustainable drinking water for communities now and in the future. This section explores the potential of extreme weather events impacting water treatment facilities in the TMACOG region using spatial analysis and treatment facility operators' perspectives collected via a survey.

i. Exposure to Extreme Heat

A GIS-based analysis was conducted to assess the exposure of public drinking water treatment facilities to severe weather events, including high summer temperatures, winter weather events such as snow and cold snaps, drought, and flooding. MODIS satellite data accessed through Google Earth Engine (GEE) was used to extract summer temperature averages, minimum winter temperatures, average snow cover, and drought indices for the period 2020–2024. All datasets were projected to a common coordinate system, resampled to a 1 km resolution, and normalized using the formula (Pixels-Min)/(Max-Min) to convert pixel values for all the data from 0-1 to ensure comparability across variables.

The map (Figure 9-8) illustrates the varying levels of exposure to extreme heat across the TMACOG region. Areas shaded in red and orange represent zones of very high and high exposure; yellow indicates moderate exposure, and green and blue areas indicate lower levels of exposure. Several water treatment plants such as those in Fremont, Clyde, Wayne Village, and North Baltimore are located in areas of very high heat exposure. This suggests that these facilities may be more vulnerable to the impacts of extreme heat and may require prioritized attention to resilience and adaptation planning for heat-related impacts. In contrast, facilities located in areas shaded green or blue, such as those near the Lake Erie shoreline, face comparatively lower levels of exposure.

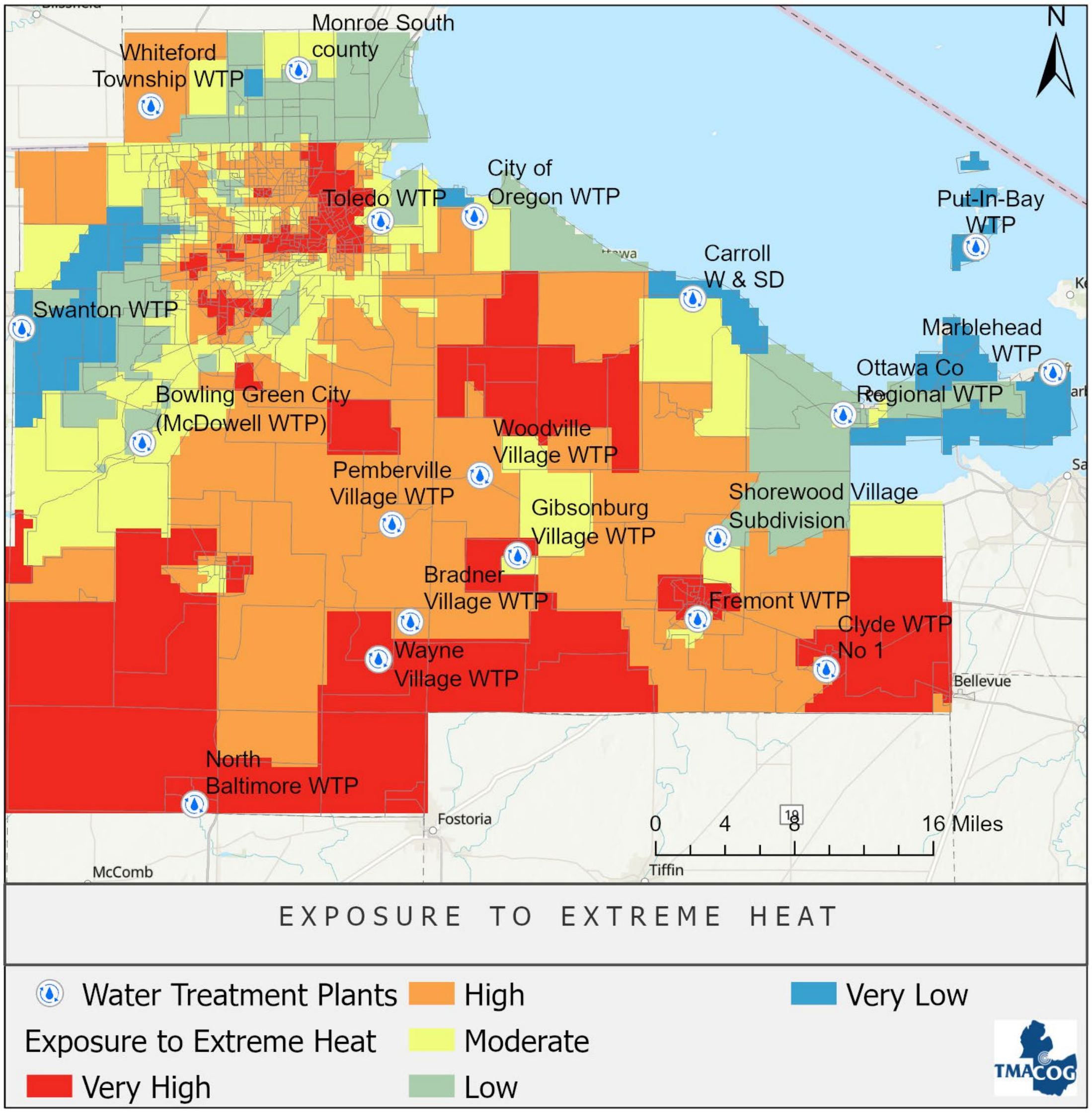

Figure 9 - 8: Water Treatment Facilities Exposure to Extreme Heat

ii. Exposure to Drought

Figure 9-9 shows the distribution of drought exposure across the TMACOG region. Areas shaded in red and orange represent zones of very high and high exposure; yellow indicates moderate exposure, and light green and dark green areas indicate lower levels of exposure. Several water treatment facilities, including those in Toledo, Pemberville, Swanton, and Bradner are located in high or very high drought exposure zones. This indicates a potential vulnerability of these facilities to prolonged dry conditions. In contrast, many of the plants near the Lake Erie shoreline, such as Ottawa County Regional WTP and Put-In-Bay WTP, are situated in areas of low to very low exposure. This spatial pattern highlights the areas that need targeted mitigation strategies for drought stress.

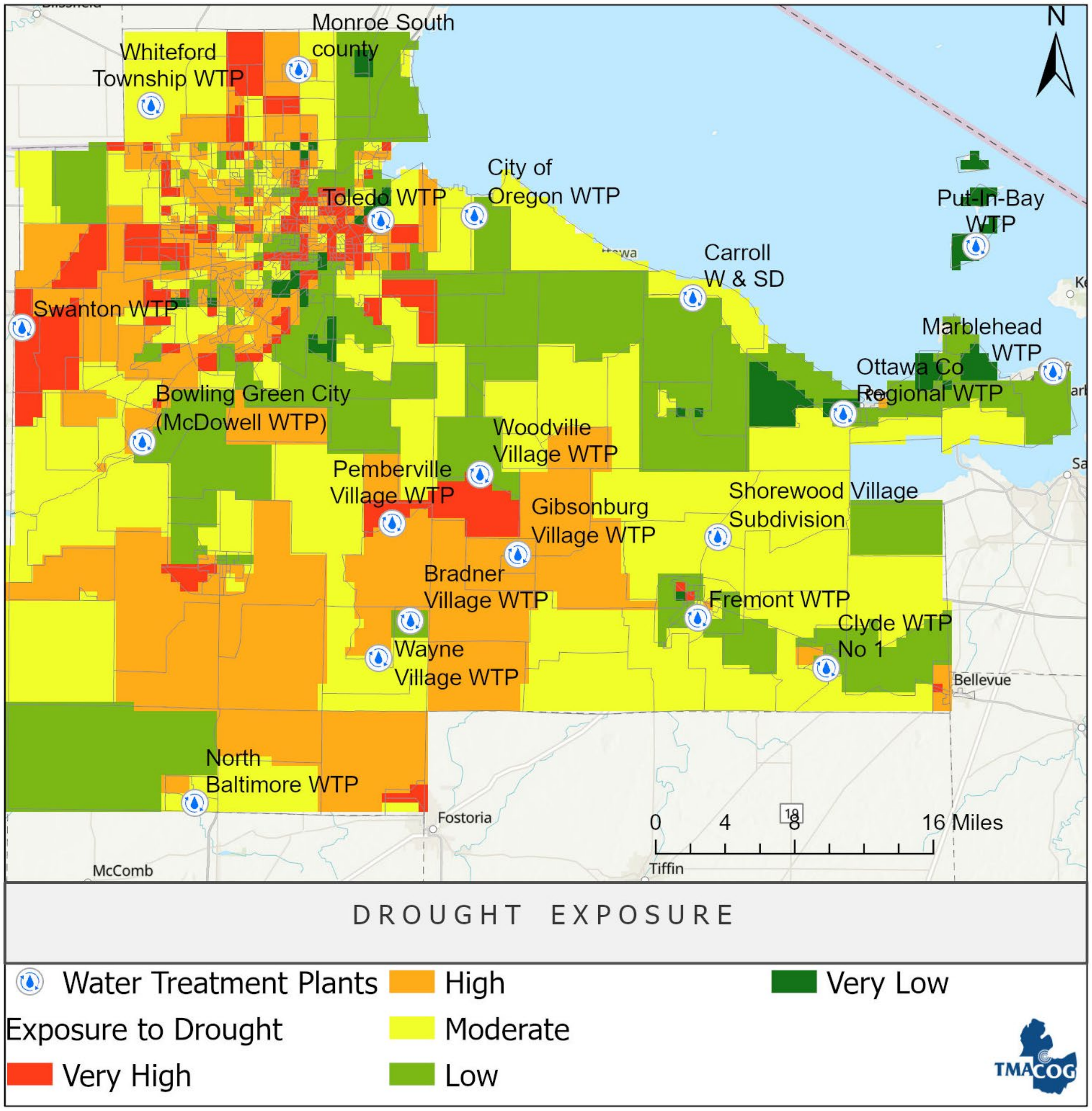

Figure 9 - 9: Water Treatment Facilities Exposure to Drought

iii. Exposure to Winter Weather

A composite winter weather indicator was created by combining winter temperatures and snow cover. Figure 9-10 illustrates the regional exposure of water treatment facilities to winter weather events within the TMACOG area. The color gradient ranges from very low (lightest green) to very high exposure (dark blue). A significant number of facilities, including Ottawa County Regional WTP, Clyde No. 1, and Gibsonburg Village facilities, are located in areas with high to very high exposure, indicating increased susceptibility to cold temperatures and snow-related disruptions. Conversely, facilities like Swanton WTP and Bowling Green City WTP are located in zones of low to very low exposure.

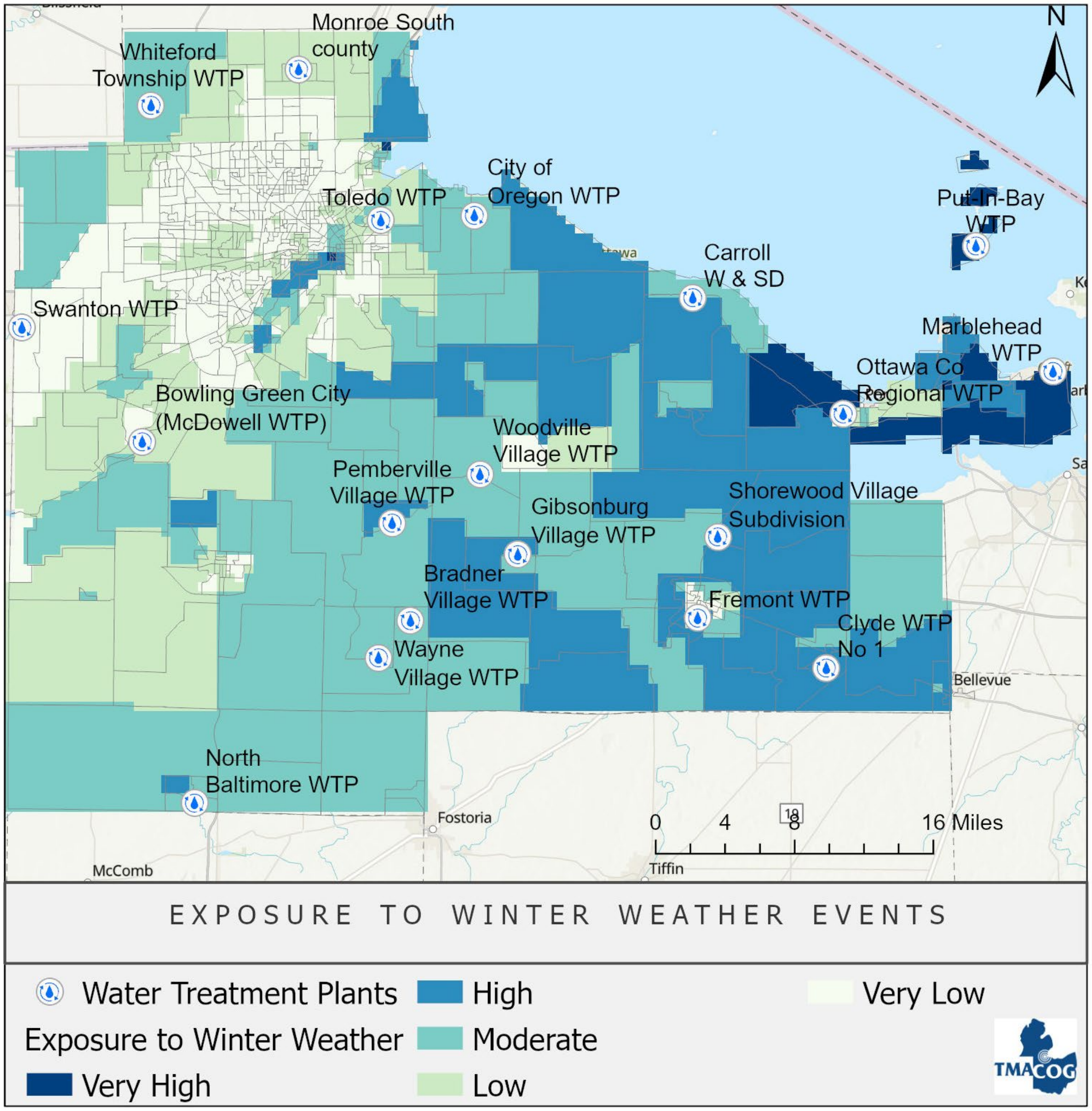

Figure 9 - 10: Water Treatment Facilities Exposure to Winter Weather Events

iv. Exposure to Flood risk

Flood exposure was modeled using precipitation, land cover, digital elevation models (DEMs), and proximity to rivers and streams. Figure 9-11 shows the distribution of flood risk exposure to public water treatment facilities in the TMACOG planning area. Areas shaded in dark blue represent very high exposure to flood risk, while lighter shades indicate lower levels of risk. A cluster of water treatment plants, including Fremont, Clyde, Shorewood, and Ottawa County Regional WTP are located in areas of high to very high flood exposure, suggesting they may be especially vulnerable to flooding events. In contrast, facilities such as North Baltimore and Wayne Village WTPs are situated in areas with low or very low flood risk. These spatial patterns are critical for guiding infrastructure reinforcement and flood mitigation strategies.

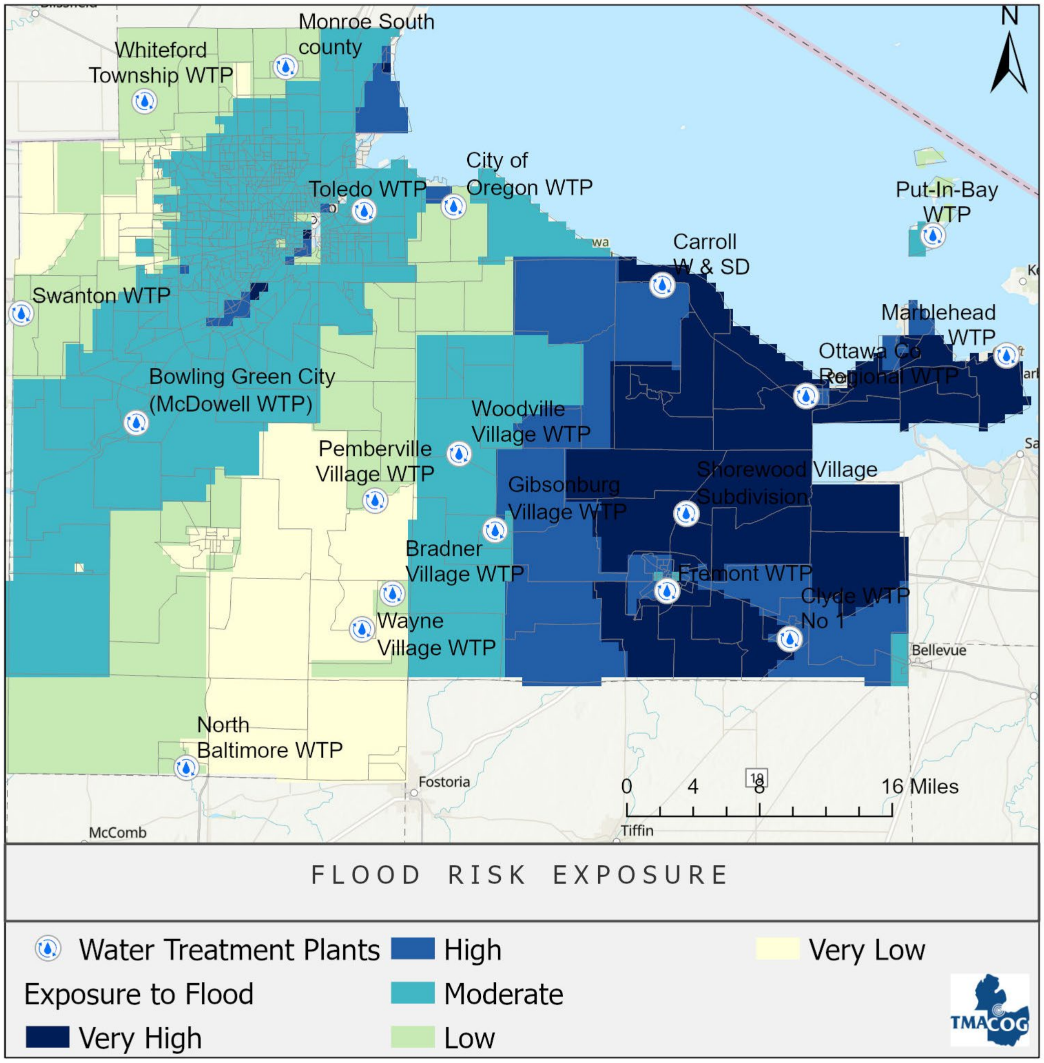

Figure 9 - 11: Water Treatment Facilities Exposure to Flood Risk

v. Total Exposure

Figure 9-12 shows the total exposure of public water treatment facilities to severe weather events across the TMACOG region. Areas shaded in dark blue represent zones of very high exposure, while lighter shades indicate decreasing levels of exposure.

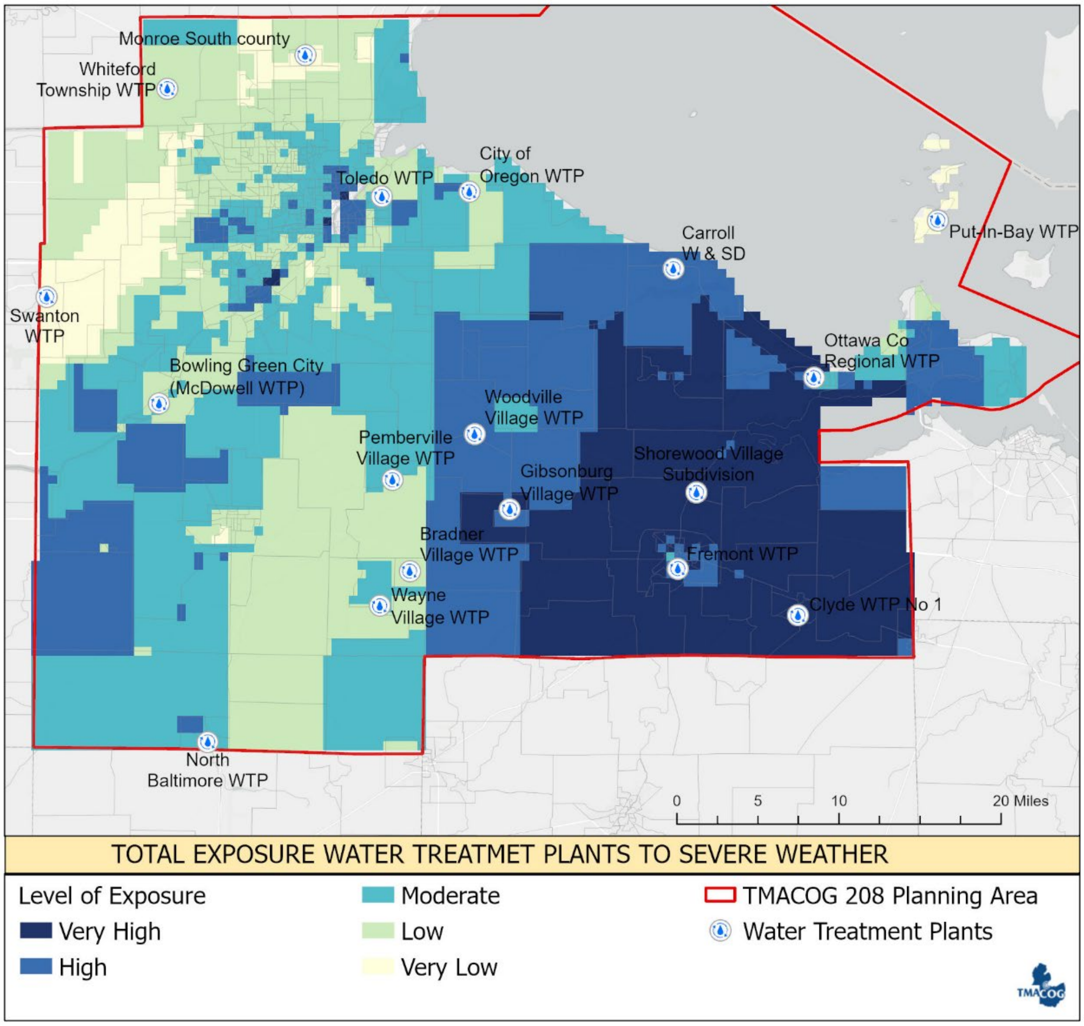

Figure 9 - 12: Total Exposure of Water Treatment Facilities to Extreme Weather Events

vi. Sensitivity of Water Treatment Facilities to Severe Weather Events

A survey was conducted to gather perspectives from water treatment operators on which weather events are likely to impact their facilities. The following are the percentages of respondents who claimed that each weather event has an impact on their facility:

- Extreme Heat =0.7
- Drought =1.0
- Winter Weather = 0.8
- Flooding = 0.6

Facility sensitivity was characterized by using these operator-reported survey responses reflecting observed operational impacts during severe weather events. These responses capture process-level and system-level susceptibility to hazards (severe weather), including treatment disruptions, power reliability concerns, and staffing constraints. Unlike exposure metrics derived from climatological data, the survey-based sensitivity indicators represent empirically observed facility responses to weather stressors and therefore provide a complementary and necessary component of vulnerability assessment.

vii. Vulnerability of Water Treatment Facilities to Severe Weather Events

Vulnerability was quantified by multiplying the sensitivity values by exposure and a weighted sum overlay analysis was used to generate a composite vulnerability index surface, which was then classified into five categories, Very Low to Very High, using the Natural Breaks (Jenks) method. Water treatment facility locations were overlaid on the vulnerability map to identify facilities in high-vulnerability zones. To support decision-making at the census block level, zonal statistics were calculated by aggregating vulnerability values within census block boundaries containing facilities. Figure 9-9 shows the vulnerability surfaces and the water treatments.

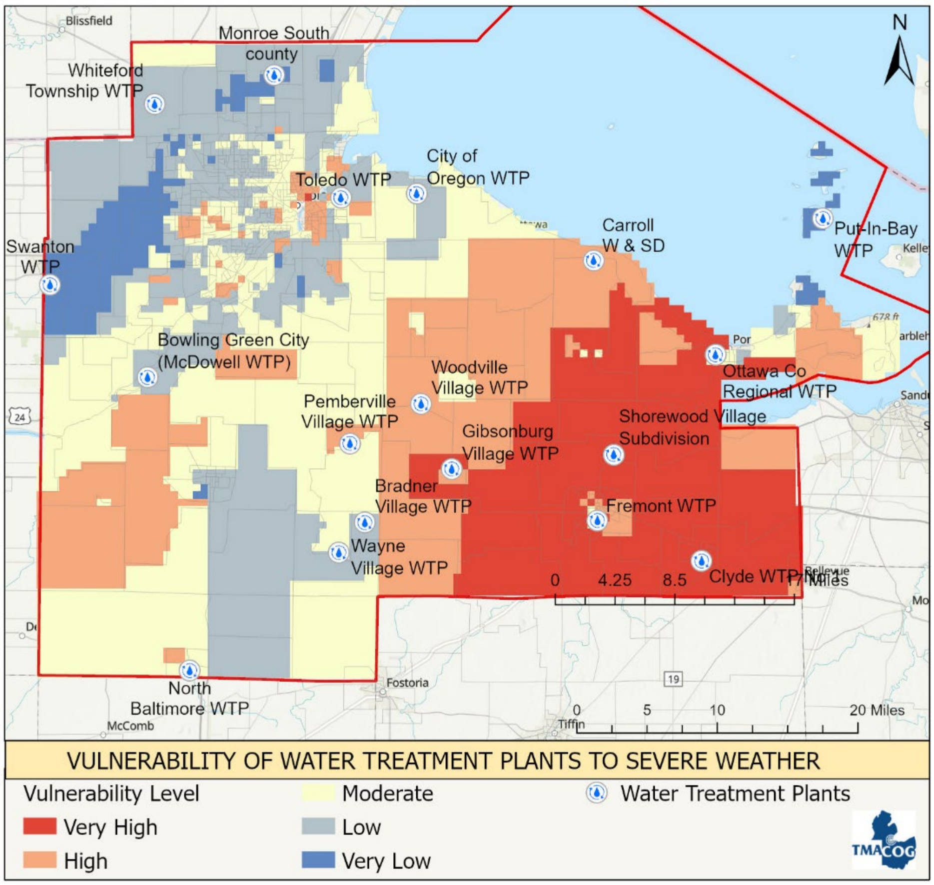

Figure 9 - 13: Vulnerability of Water Treatment Facilities to Extreme Weather Events

VIII. Resources and Support Needs

Strengthening infrastructure resilience to severe weather-related challenges requires key resources and support mechanisms. The operators who responded to the TMACOG survey identified several of these that would enhance their infrastructure's capacity to adapt to extreme weather-related challenges:

- Backup Power and Generators: Reliable backup power systems are critical to preventing service disruptions during extreme weather, yet securing funding for generators remains a challenge.

Several facilities, including Toledo Public Utilities, emphasized the need for federal and state grants to support emergency power generators to prevent disruptions from severe weather.

- Flood Protection Measures: Flood mitigation efforts, such as barriers and improved drainage, require greater investment to protect vulnerable facilities. Facilities that experience flood-related risks expressed the need for increased investment in flood mitigation infrastructure, such as barriers, elevated structures, and improved drainage systems.
- Funding for Equipment and Repairs: Rising equipment and repair costs makes financial assistance essential for maintaining operational capacity. Many facilities reported that equipment costs have risen significantly, and this makes government funding for capital improvements a top priority. Sandusky County, for instance, noted that costs for vehicles and replacement parts have increased due to the reduction of government discounts on procurement.
- Stormwater Drainage System Maintenance: Neglected stormwater drainage systems exacerbate flooding and lead to secondary impacts on water infrastructure. The Village of Whitehouse reported that decades of neglected stormwater ditch maintenance have exacerbated stormwater flooding, leading to secondary impacts on water and wastewater infrastructure.

These indicate that financial support, improved infrastructure maintenance, and investment in resilience strategies are essential to reducing vulnerabilities of water treatment facilities to severe weather events.

IX. Conclusion

The focus of this plan is the structure, regulation, and challenges of public drinking water systems in the TMACOG 208 planning area. While regulatory frameworks under the Safe Drinking Water Act and corresponding state laws in Ohio and Michigan have provided a strong baseline for water safety, there are still concerns that need to be addressed. These include persistent legacy contaminants like lead and copper, emerging contaminants such as PFAS, and increasing threats from harmful algal blooms (HABs) driven by nutrient pollution. Additionally, weather-induced stressors such as extreme heat, drought, winter events, and flooding pose growing threats to aging infrastructure across the region. The extreme weather vulnerable analysis confirmed that some of the key water treatment plants, including those in Fremont, Clyde, Ottawa County, and Shorewood, are highly vulnerable to extreme weather events. Water utilities also face systemic challenges such as rising equipment costs, gaps in stormwater infrastructure, limited authority to manage pollution at the watershed scale, and a shortage of certified water operators. These environmental, financial, and institutional challenges require coordinated, data-driven, and equity-centered action across local, state, and regional partners to ensure the long-term integrity of drinking water services.

- **Policy Recommendations**
    - Local water utilities should prioritize backup power installations at high-weather exposed facilities. The water treatment facility operators should coordinate with state emergency management agencies to install or upgrade backup generators for facilities that are highly vulnerable to extreme weather events. [VIII]

- Flood mitigation infrastructure development should be prioritized at facilities that are highly vulnerable to floods.
    - Allocate capital improvement funding to install flood protection barriers, raise critical system components, and upgrade site drainage systems at the above facilities [VII, & VIII].
- Targeted Resilience Planning for Facilities in Very High Vulnerable Zones
    - Require these facilities to develop and submit climate resilience adaptation plans that address site-specific risks (e.g., drought-resistant intakes, cooling for heat)[VII]
- Local governments in the TMACOG region should develop PFAS Response Plans for Systems with Known Detections. [VI (i)]
- Local governments in the TMACOG region should work collaboratively to evaluate all options to create redundancy in the regional water supply and source of water. [V (ii)]
- TMACOG should continue to collaborate to create and maintain an inventory of water supply infrastructure to facilitate emergency water supplies and serve as a resource for asset management planning. [VII]
- Asset management plans should ensure the long-term sustainability of managerial, technical, and financial capability of all drinking water systems in the region and should include emergency preparedness plans and risk and resiliency assessments [VIII]

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