March 2018

Water Resources Plan for Southeast Michigan

SEMCOG | SOUTHEAST MICHIGAN COUNCIL OF GOVERNMENTS

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Mission

SEMCOG, the Southeast Michigan Council of Governments, is the only organization in Southeast Michigan that brings together all governments to develop regional solutions for both now and in the future. SEMCOG:

- Promotes informed decision making to improve Southeast Michigan and its local governments by providing insightful data analysis and direct assistance to member governments;
- Promotes the efficient use of tax dollars for infrastructure investment and governmental effectiveness;
- Develops regional solutions that go beyond the boundaries of individual local governments; and
- Advocates on behalf of Southeast Michigan in Lansing and Washington

Water Resources Plan for Southeast Michigan

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Abstract

As the designated water quality management agency for Southeast Michigan, SEMCOG has been actively involved with water resource planning since the 1970s. The *Water Resources Plan for Southeast Michigan* builds upon two prior plans – the 1978 and 1999 *Water Quality Management Plans for Southeast Michigan*. While this plan builds upon these plans and ongoing regional initiatives, its focus is on integrated water resources management, including advancing the blue economy, natural resource protection and enhancement, and water infrastructure systems. This integrated water resources management approach sets the framework for 28 regional policies that address the core challenges in the region, while supporting ongoing achievements in protecting and restoring Southeast Michigan's water assets. To implement these policies and sustain this plan, recommended actions are provided.

Preparation of this document may be financed in part through grants from and in cooperation with the Michigan Department of Transportation with the assistance of the U.S. Department of Transportation's Federal Highway Administration and Federal Transit Administration; the Michigan Department of Natural Resources with the assistance of the U.S. Environmental Protection Agency; the Michigan Department of Technology, Management, and Budget; and local membership contributions.

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Acknowledgements

SEMCOG expresses appreciation to everyone who contributed their time in helping develop the *Water Resources Plan for Southeast Michigan*. Input into this plan came from multiple Pulse of the Region Surveys, stakeholder engagement meetings, and issue-specific public forums. Thank you to The Water Resources Task Force who guided the creation of this Plan, and whose collaboration and expertise were critical to developing regional policies and actions.

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Executive Summary

As part of the Great Lakes State, Southeast Michigan's lakes, rivers, and wetlands define the region's geography and are essential to its economic health, attracting visitors, and enhancing quality of life for residents. The Lake Huron to Lake Erie Corridor is an international water resource that serves both as the region's eastern boundary and as a 400-mile shoreline providing recreational access, drinking water, and economic commerce opportunities for the region's 4.7 million residents. The major river systems include the Clinton, Detroit, Huron, Raisin, Rouge, and St. Clair Rivers. This abundance of fresh water is a key economic driver attracting business investment and talent.

As the designated water quality management agency for Southeast Michigan, SEMCOG has been actively involved with water resource planning since the 1970s. The *Water Resources Plan for Southeast Michigan* builds upon two prior plans – the 1978 and 1999 *Water Quality Management Plans for Southeast Michigan*. While this plan builds upon these plans and ongoing regional initiatives, its focus is on integrated water resources management, including advancing the blue economy, natural resource protection and enhancement, and water infrastructure systems. This integrated water resources management approach sets the framework for 28 regional policies that address the core challenges in the region, while supporting ongoing achievements in protecting and restoring Southeast Michigan's water assets. To implement these policies and sustain this plan, recommended actions are provided.

This plan consists of three main chapters focused on the major aspects of water planning in Southeast Michigan – the Blue Economy, Natural Resources, and Infrastructure. The final chapter discusses the plan's call for an integrated water resource planning approach to restore and improve water resources as well as identify efficiencies and optimize investments to protect public health in the region.

Blue Economy

Southeast Michigan's water-related industries are directly connected to more than 350,000 jobs, generating $21 billion in annual earnings. The region's abundant water recreation and tourism opportunities provide significant economic benefits, offering residents and visitors more than 120 public boat launches, over 170 paddling launches, and 229 public beaches. Lake St. Clair alone is home to more than 70 marinas and 16,000 boat wells, with recreational boating contributing more than $200 million each year to the region's economy. These water resources also support valuable fish, waterfowl, and wildlife populations that are essential to sustaining Southeast Michigan's nationally recognized fisheries and globally significant natural landscapes.

Natural Resources

The quality and quantity of wetlands, woodlands, riparian corridors, and agricultural lands affects Southeast Michigan's water resources. Part of the green infrastructure network, these natural areas help reduce stormwater runoff, flooding, and erosion; replenish groundwater; and stabilize streamflow. These benefits lead to improved aquatic habitat in the region's rivers, lakes, and streams, and further support recreational and economic opportunities. With close to one million acres of tree canopy, over 50,000 acres of riparian corridors, and 340,000 acres of wetlands, it is important to expand and enhance these areas, recognizing their role in managing stormwater runoff. Strengthening programs to address agricultural runoff will reinforce the importance of the agriculture industry which contributes $10.2 billion to the state's economy. Improving coordination to manage and eliminate invasive species is also a priority to ensure long-term water quality and habitat benefits.

Infrastructure

The region's water resources and quality of life are supported by infrastructure that includes drinking water, wastewater, stormwater, dams, and transportation. This infrastructure provides drinking water to millions of people, manages wastewater from homes and businesses in addition to stormwater runoff from rainfall, and connects local and regional economies to world-class water recreational activities. With more than 25,000 miles of public roads, 13,000 road stream crossings, 377 dams, over 100 drinking water treatment facilities, 59 wastewater treatment plants, and thousands of miles of underground water infrastructure, it is vital to address the region's infrastructure in a holistic and integrated manner. The *21st Century Infrastructure Commission Report* found that there is a $4 billion gap in annual infrastructure funding for the state, while also emphasizing the need for a renewed effort to replace aging and failing infrastructure systems using new technologies, sustainable funding, and an integrated approach. Through asset management programs, local, regional, and state agencies can work collaboratively to achieve the greatest value for investment while protecting environmental and public health.

Integrated Water Resources Management

The end goal of an integrated water resources approach is strategic decision-making that achieves multiple outcomes instead of a traditional silo-based approach. Components of this integrated approach include increasing partnerships and collaboration, optimizing investments, enhancing public education, addressing climate resiliency, and improving water resource monitoring. Partnerships and collaboration are vital to implementing the policies outlined in this plan, supported by increased investments in water infrastructure, natural resources, and the blue economy. Public awareness of water resource benefits and challenges will support these increased investments and collaboration across agencies and jurisdictions. Finally, improving water resource monitoring programs will guide investments and collaboration needed to work towards state water quality standards.

Public Input Process and Engagement

SEMCOG established a Water Resources Task Force, comprised of 70 representatives from local governments, state and federal agencies, nonprofit organizations, research and education institutions, watershed councils, and other organizations and stakeholders to provide input and guide development of the *Water Resources Plan for Southeast Michigan.* The task force met nine times over an 18-month planning process. Members of the task force established the framework for this plan, deliberating on the regional policies and actions.

To complement the work of the Water Resources Task Force, smaller workgroups convened to discuss the specific topics of stormwater, climate resiliency, public education, and transportation. The public was also engaged, providing input through three issue-specific public forums addressing the blue economy, recreation, and tourism; drinking water; and water resource financing and partnerships. Four stakeholder meetings were held in Livingston, Monroe, St. Clair, and Washtenaw counties. These meetings focused on the region's more rural counties to ensure that input was received on a broad range of water resources issues and challenges from diverse stakeholders. In addition to these public meetings, two Pulse of the Region Surveys were issued (Appendix C).


SEMCOG Water Resources Forum on the Blue Economy, Recreation, and Tourism

Implementing and Sustaining the Plan

In implementing the policies and actions described in the plan, it is important to continue the collaboration and public engagement process established in its development and outlined throughout this plan. This integrated management approach supports fiscally sustainable, strategic decision-making to enhance the region's water resources. It also requires public agencies, the business community, environmental and nonprofit groups, academia and citizens to all take action to ensure the long-term viability and enjoyment of the region's water resources.

At a local level, successful implementation incorporates elements of local government, including planning, engineering and public works; recreation; public outreach; and finance departments. State and federal agencies can support local implementation through flexible regulatory programs and by allocating grant and loan resources in a manner consistent with local and regional priorities. Academia play a significant role in leading research into new and innovative water resource management approaches while the business community can support and implement best water resource management practices. Nonprofit groups are key voices in leading many public outreach efforts and can identify funding sources for implementation. Residents of Southeast Michigan must recognize the value of the region's water resources and support local implementation through volunteer initiatives, stewardship, and ensuring that their local elected officials understand the important role water resource protection and enhancement play in the region's economy.

Table 1 highlights the agencies, departments, and key stakeholders that primarily support the blue economy, natural resources, and infrastructure. Each agency and stakeholder does influence all three categories, but recognizing the primary responsibilities provides a sense of how these overlapping priorities can be addressed in a collaborative manner.

Table 1
Implementing and Sustaining the Plan

	Blue Economy	Natural Resources	Infrastructure
Local and County Agencies			
Administration & Elected Officials			
Planning			
Engineering, Public Services, Roads			
Parks & Recreation			
Community & Economic Development			
State of Michigan			
Dept. of Environmental Quality (DEQ)			
Dept. of Natural Resources (DNR)			
Dept. of Transportation (DOT)			
Dept. of Health & Human Services (DHHS)			
Economic Development Corporation (MEDC)			
Academia			
Universities & Colleges			
Not-for-Profit & Environmental Groups			
Watershed Councils, Land Conservancies, etc.			
Business Community			
			
Public			
Residents, homeowners, visitors			

Regional Water Resources Policies

The following policies provide overall guidance and support for implementation activities to protect and restore Southeast Michigan's water resources:

Blue Economy

- Promote activities that contribute to increased tourism, recreation, and water-related economic development opportunities.
- Support efforts to protect, enhance, and publicize the natural assets and water resources that strengthen the region's quality of place.
- Ensure that water-based recreation opportunities are widely available to support a variety of uses and meet the needs of the region's diverse population.
- Maintain and expand public access to the region's waterways, particularly in areas that would improve connectivity between waterfront amenities, parks and natural areas, or other areas where access is currently limited.

Natural Resources

Natural Areas

- Preserve and restore natural areas, such as wetlands, woodlands, riparian corridors, and agricultural lands, as a mechanism to protect and enhance water resources.

Aquatic Habitat

- Protect and restore aquatic habitats resulting in diverse fish population, healthy aquatic life, and enhanced recreational and economic value.

Invasive Species

- Prevent, control, and eradicate invasive species through early detection and response, research, education, public stewardship, and implementing strategic management approaches.
- Enhance collaboration and coordination across local, state, and federal agencies, and nonprofit organizations on invasive species to identify management actions, share technical expertise, and utilize resources.

Infrastructure

Overarching Infrastructure Priorities

- Enhance economic prosperity through coordinated infrastructure asset management.
- Achieve fiscally sustainable and reliable quality infrastructure through consistent funding mechanisms that support the long-term, real costs of services.

- Protect public health and environmental quality through a science-based regulatory framework at the state and local levels that supports flexible, alternative compliance approaches.
- Ensure effective infrastructure operations through workforce development and training.

Drinking Water Infrastructure

- Ensure that all have safe drinking water, monitor intakes to detect contaminants and implement coordinated and timely procedures for notification and emergency response.
- Protect groundwater resources to ensure drinking water is uncontaminated, reliable, and safe.
- Protect public health and the environment with a drinking water system that meets regulatory requirements.

Wastewater Infrastructure

- Ensure wastewater collection and treatment systems are protective of water resources and public health.

Stormwater Infrastructure

- Encourage flexibility and collaboration across jurisdictions for stormwater management through watershed approaches while achieving public health and environmental outcomes.
- Work towards achieving state water quality standards for rivers, lakes, and streams.

Dams Infrastructure

- Reduce the environmental impacts of dams on local streams and rivers.

Transportation Infrastructure

- Coordinate efforts to align water, natural resources, and transportation priorities.
- Integrate multiple outcomes, including enhanced mobility, recreational opportunities, and water quality into the designs for transportation corridors near natural and water resources.
- Reduce the impacts of transportation projects on water and natural resources.

Extraction of Oil and Gas

- Minimize the potential impacts of oil and gas extraction and distribution to our water resources through additional local government oversight as well as enhanced coordination and collaboration between local, county, regional, and state agencies. This includes siting new facilities, ensuring transparency of the operation, validating safety of the operation and distribution network, and verifying adequate emergency response preparedness.

Integrated Water Resources Management

Climate Resiliency

- Enhance community readiness for changing precipitation patterns to ensure resiliency of infrastructure systems and natural resources.

Partnerships and Collaboration

- Form collaborative partnerships among local, state, and federal agencies, as well as private businesses to implement cost-effective solutions to protect and restore Southeast Michigan's water resources.

Investments in Water Resources

- Ensure sustainable sources of funding and financing mechanisms to support the protection and restoration of Southeast Michigan's water resources.

Public Education

- Attain a greater public awareness and mutual shared responsibility of water resources throughout the region.

Water Resources Monitoring

- Achieve a long-term, sustainable monitoring program for the region's water resources.

Chapter 1: Introduction

Satellite Image of the Great Lakes region from NASA's Earth Observatory

SEMCOG has been actively involved with water resource planning since the 1970s. The initial *Water Quality Management Plan for Southeast Michigan* was adopted in 1978, with an updated plan adopted in 1999. The 1978 plan focused primarily on wastewater and reducing discharges from point sources of pollution, while the 1999 plan included a greater focus on the restoration and maintenance of designated uses of the region's surface waters.

The *Water Resources Plan for Southeast Michigan* builds upon prior plans, with an added focus on integrated water resources management. This includes priorities such as natural resource protection and enhancement, infrastructure asset management, and strategic investments in drinking water, wastewater, stormwater, dams, and transportation infrastructure. In addition to impacting water quality, these priorities also advance the blue economy, recreation, and tourism in the region. The importance of early planning and collaborating across jurisdictions and watershed boundaries is an overarching theme to maximize environmental, social, and economic benefits when implementing water resource projects.

This planning, along with intergovernmental coordination and local government assistance, are the three pillars for SEMCOG to achieve its regional vision:

The people of Southeast Michigan benefit from a connected, thriving region of small towns; dynamic urban centers; active waterfronts; diverse neighborhoods; premiere educational institutions; and abundant agricultural, recreational, and natural areas.

To ensure this vision for Southeast Michigan, the region must have:

- Unique places that offer various housing choices for a large and diverse population.
- An educated and trained workforce that supports a multi-sector economy and provides opportunities for all.
- Healthy, clean lakes, streams, air, and a connected system of trails, parks, and natural areas that support recreational and cultural amenities.
- Safe, efficient, and coordinated infrastructure systems that embrace advances in technology and focus on access for all.
- Effective local government and engaged citizenry.

As the lifeblood to the state and Southeast Michigan, water resources are a core driver to achieving this vision. Water resources are necessary for drinking and bathing, recreation and tourism, and to support the region's diverse economy. From agriculture to mining and manufacturing, and electric utilities, water resources are vital for successful economic development in the region.

These water resources also support valuable fish, waterfowl, and wildlife populations that are essential to sustaining Southeast Michigan's nationally recognized fisheries and globally significant natural landscapes. With more than 120 public boat launches, over 160 paddling launches, and 222 public beaches, increasing access to water resource amenities is a regional priority to help foster public stewardship of these valuable resources.[1]

This plan and vision is also supported by numerous other plans that connect to water resources in the region, including:

- The *Green Infrastructure Vision for Southeast Michigan* describes long-term goals for the green infrastructure network along with policies to achieve an integrated regional framework.
- *Partnering for Prosperity: Economic Development Strategy for Southeast Michigan* employs a comprehensive approach to economic development for the seven-county region, recognizing the role of water resources and green infrastructure in supporting future economic development opportunities.
- *Access to Core Services* quantifies accessibility to parks and recreation opportunities and has resulted in two interactive mapping tools to assist local governments on parks and recreation planning, along with development of a Park Finder tool.
- The *I-75 Corridor Conservation Action Plan in Monroe County* outlines strategies to address invasive species, poorly functioning road stream crossings, and improve agricultural and urban drainage and runoff during the 20-year reconstruction of I-75 in Monroe County within the Western Lake Erie Basin.
- The *2040 Transportation Plan for Southeast Michigan* guides transportation investments in Southeast Michigan to improve the quality and reliability of the transportation system, and includes an environmental sensitivity analysis to ensure road projects consider impacts on environmental resources.

The State of Michigan has also developed long-range strategies to protect and promote Michigan's water resources, including:

- *Sustaining Michigan's Water Heritage Vision* sets a 30-year plan focusing on protecting and promoting wise use of Michigan's globally unique water resources to ensure healthy citizens, vibrant communities, sustainable economies, and stewardship.

- *The 21st Century Infrastructure Commission Report* addresses the long-term infrastructure needs for the next 30-50 years in the areas of transportation, water, sewer, stormwater, wastewater treatment and drainage, energy, and communications.

The Economic Value of Water

The abundance of fresh water in the region is a key economic driver attracting business investment and talent. The Great Lakes are directly connected to more than 1.5 million jobs, generating $62 billion in annual earnings.[2] Of these, 660,000 jobs and $49 billion in annual wages are connected to large-scale, water-dependent farming, manufacturing, mining, and energy production sectors in Michigan. Manufacturing is the number-one-ranked sector in the state. The agriculture industry contributes $10.2 billion annually to the state's economy and is responsible for 22 percent of the state's employment.[3] Agricultural lands are also a significant piece of the green infrastructure network that provides economic value to Michigan.

Recreation and Tourism

Recreation and tourism industries have a large economic impact on the state and region. For example, direct and indirect spending from recreational boating adds $3.9 billion each year to the state's economy; anglers contribute $2 billion annually. Michigan's coastal tourism supports 57,000 jobs with $955 million in related earnings annually. Michigan's paddling industry is comparatively smaller but continues to grow, contributing $140 million to the state's economy each year.[4]


Kayaking in Anchor Bay

Business Site Selection

Investments to protect, restore, and enhance water resources are essential as businesses explore long-term opportunities to develop and expand in the Great Lakes state. A survey of fifty Fortune 500 companies found that 86 percent expect to consider water availability in their site selection process, up from 37 percent in 2008[5]. Michigan's plentiful water resources can serve to attract business investment and economic development. There is also long-term economic value associated with enhancing the region's natural resources, as investments in restoring shorelines can generate over 6-to-1 in returns from increased property values and local economic development. Similarly, investments to restore water quality can result in a 3-to-1 return on investment.[4]

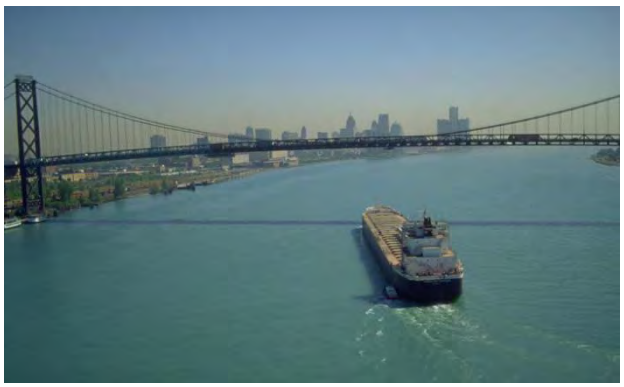
Nationally, for every $1 million invested in water utilities, 16 jobs are created. Every job in the water sector leads to another 3.68 jobs in the national economy. Every $1 spent on infrastructure improvements in the United States, generates about $6 in returns.[6]

Our Water Assets

Southeast Michigan has nearly 400 miles of Great Lakes shoreline and is home to almost half of the state's population. Often called the Lake Huron to Lake Erie Corridor, this regional resource includes Lake Huron, the St. Clair River, Lake St. Clair, the Detroit River, and Lake Erie. In addition to the Great Lakes system, Southeast Michigan has 53,377 acres of inland lakes (greater than 4.5 acres in size) and over 4,000 miles of rivers and streams. Major river systems include the Clinton, Huron, Raisin, Rouge, and St. Clair River watersheds (Figure 1).

Humbug Island, Detroit River International Wildlife Refuge

An International Resource: The Lake Huron to Lake Erie Corridor connects U.S. and Canada.



The Lake Huron to Lake Erie Corridor and the I-75 transportation corridor provide an indispensable link between the U.S. and the industrial centers of Canada. The Ambassador Bridge connects the two countries; almost 2.5 million truck trips per year account for 21 percent of all U.S. exports to Canada. The new Gordie Howe International Bridge will directly connect to I-75 and further accelerate freight movement across the Huron to Erie Corridor.

The transportation corridor's proximity to regionally significant waterways that support multiple ports and the movement of approximately 164 million tons of freight annually on barges through the Great Lakes system enhances economic prosperity in the region.[7] While economically valuable, this I-75 Corridor is adjacent to regionally significant waterways containing globally imperiled ecosystems, several major river systems, and a very productive Lake Erie nearshore and coastal zone.

The quality of the region's natural areas – wetlands, woodlands, and riparian corridors – directly impact Southeast Michigan's water resources. These natural areas include several regional assets such as the world's only international wildlife refuge – the Detroit River International Wildlife Refuge – and the largest coastal wetland system in the Great Lakes – St. Johns Marsh.

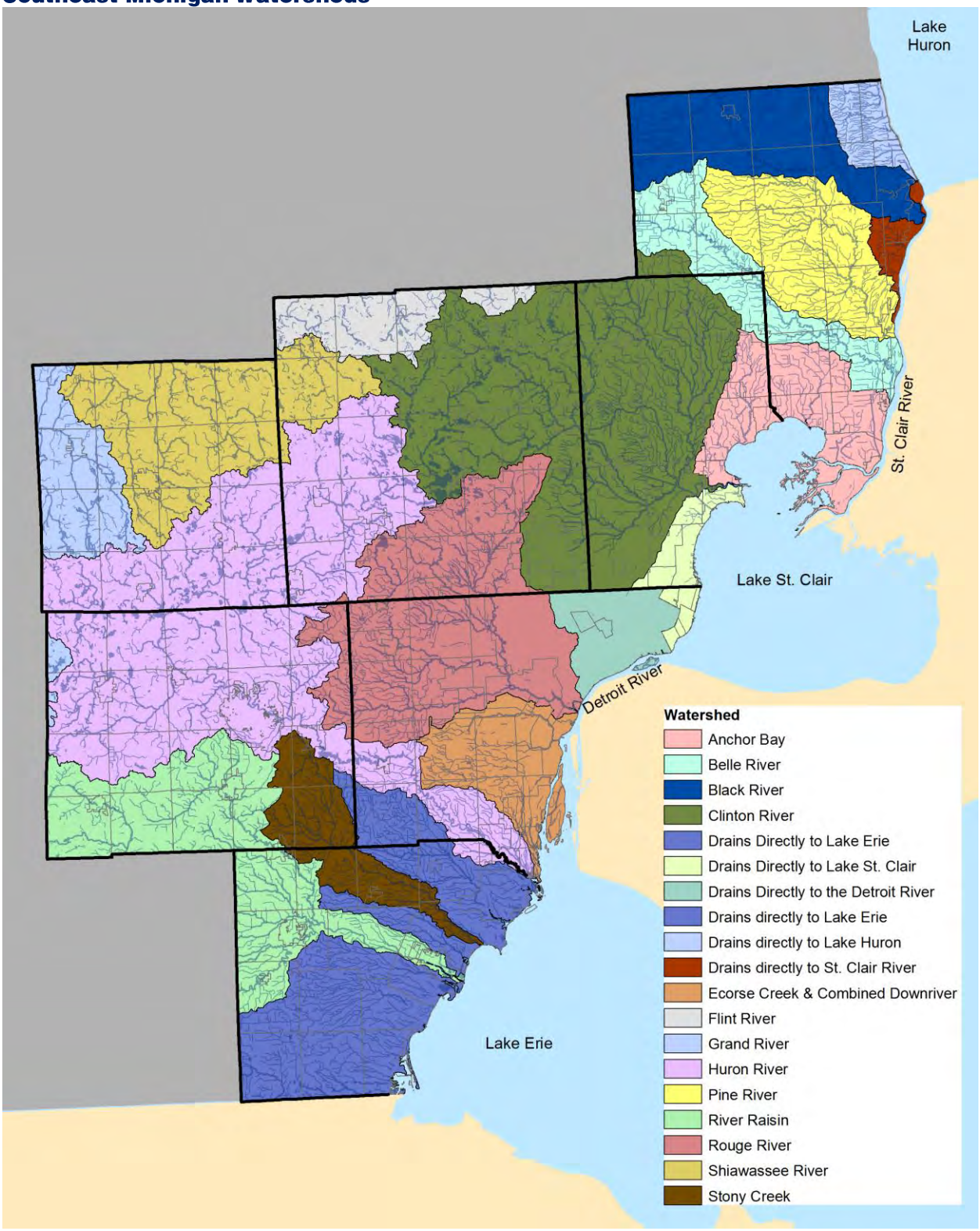
Continued investment in Southeast Michigan's water infrastructure is integral to supporting the region's public health, environmental sustainability, blue economy, and long-term economic development. With 1,390 drinking water systems and 1,080 wastewater systems in Michigan, coordinated infrastructure planning and management is the foundation for protecting and improving water resources.[8]

The Great Lakes Water Authority (GLWA), established in 2016, is a regional authority for water and wastewater services. It provides drinking water to nearly 40 percent and wastewater treatment services to nearly 30 percent of Michigan's population.[9]

By the Numbers	Michigan	Southeast Michigan
Population	over 9.8 million	over 4.7 million
Inland Lakes *(over 4.5 acres in size)*	11,000	1,137
Rivers and Streams *(miles)*	43,000	4,000
Wetlands *(acres)*	5.5 million	341,000
Freshwater Shoreline *(miles)*	3,200	396
Major Rivers *(miles)*	7,600	606
Public Beaches	1,221	229
Public Boat Launches	1,433	126

Michigan's population is less than 3% of the total United States population, but the Great Lakes make up 95% of the nation's freshwater supply, and 20% of the world's fresh surface water supply.[10]

Figure 1
Southeast Michigan Watersheds



Our Achievements in Protection and Restoration

Local governments, state and federal agencies, watershed organizations, SEMCOG, the public, and other stakeholders are working hard to improve Southeast Michigan's water resources. Over the last few decades, significant investment has been made to address challenges identified in previous regional water plans. A few highlights of these accomplishments include (Appendix B summarizes accomplishments by watershed in the region):

- Since 1988, the number of uncontrolled CSOs in the region has declined to 76 from 310. The 23 remaining suburban CSOs will be corrected by 2025 along with a goal to correct high-priority outfalls in the City of Detroit by 2037.[11]
- Great Lakes Restoration Initiative (GLRI) has supported 556 projects in Michigan, with significant funding going to Areas of Concern in Southeast Michigan. Some green infrastructure projects funded by GLRI are Restoring Tree Canopy and Expanding Grow Zones in the Rouge River; Cottrellville Township Shoreline Restoration; Krispin Drain Restoration; Blue Water River Walk and Wetlands Restoration in St. Clair County; Clinton River Spillway Restoration and Lake St. Clair Coastal Marsh Restoration; Phragmites control and prevention on Belle Isle in Detroit; and projects to educate farmers on best management practices in the Western Lake Erie Basin. In total, nearly $400 million has been invested through GLRI.[12]
- The Michigan Department of Environmental Quality's Nonpoint Source (NPS) pollution program has awarded over $22 million to support implementation of green infrastructure, stormwater management, and nonpoint source pollution reduction projects in Southeast Michigan.
- Local communities have developed asset management programs through the Stormwater, Asset Management, and Wastewater (SAW) grant program. Over $110 million has been awarded in the region through the SAW program (38 percent of the state's total funding).
- Over $430 million has been invested on regional drinking water systems through the Drinking Water Revolving Fund (DWRF); over $14 million has been awarded through the Strategic Water Quality Initiatives Fund to support drain and downspout disconnection projects; and over $2.9 billion has been invested in regional wastewater systems through the State Revolving Fund (SRF).[13]
- Implementation of Illicit Discharge Elimination Programs has resulted in nearly 2,400 people trained on how to identify and investigate illicit discharges. Additionally, 4,500 illicit discharges have been removed that contributed nearly 600 million gallons of untreated sewage per year.[14]
- The implementation of time-of-sale or transfer programs for onsite sewage systems in Macomb, Washtenaw, and Wayne counties.
- Seven dams in the region were removed (one in the Huron River, three in the Clinton River, two in the Rouge River, and one in the River Raisin). There are plans to continue removing dams to enhance fish passage, habitat connectivity, water quality, and recreational opportunities.


Dam removal on the Rouge River - Before

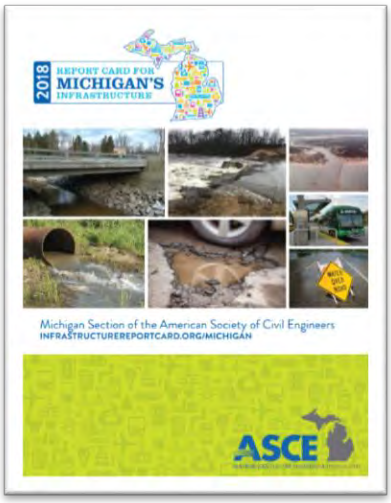

After

Our Challenges

While there has been significant investment and progress in protecting and restoring Southeast Michigan's water resources, more is needed to secure clean and healthy water resources for future generations. This is evident in the region's continued inability to meet water quality standards and the over 6,100 miles of impaired waterways throughout Southeast Michigan.[15]

Southeast Michigan has five Areas of Concern (AOCs), which have experienced a significant change in the chemical, physical, or biological integrity of the water resource, resulting in a loss of beneficial uses, or a person's ability to enjoy the benefits of the resource. These are the Rouge River watershed, Clinton River watershed, River Raisin watershed, St. Clair River, and the Detroit River.

Michigan's annual infrastructure investment gap is approximately $4 billion, of which a majority is directly tied to water infrastructure – including drinking water, wastewater, and stormwater – and the transportation network.[8]



The American Society of Civil Engineers' (ASCE) 2018 Report Card on Michigan's Infrastructure gave the state an overall grade of D+. The report card examines current infrastructure conditions and needs across 13 sectors, including drinking water, wastewater, stormwater, dams, and transportation.[16]

Priority areas to improve Southeast Michigan's water resources are documented in numerous technical and policy documents, including local watershed management plans and the State of Michigan Water Strategy. These documents highlight the importance of:

- Investing in the blue economy, natural resources, and infrastructure,
- Reducing stormwater runoff volume and improving stormwater quality,
- Eliminating sources of bacteria,
- Managing combined and sanitary sewer overflows,

- Improving instream and watershed habitat,
- Increasing natural and constructed green infrastructure,
- Enhancing recreational opportunities,
- Collaborating on infrastructure improvements,
- Connecting water resources to economic value,
- Delisting impaired waterways with Total Maximum Daily Loads, and
- Removing beneficial use impairments from areas of concern.

These priorities are reflected throughout this *Water Resources Plan for Southeast Michigan*, specifically in the regional policies and implementation actions.

Structure of the Water Resources Plan

The following four chapters of this plan – Blue Economy, Natural Resources, Infrastructure, and Integrated Water Resources Management – cover the breadth and complexity of the region's water resources. Each chapter begins with an overview of the region's assets, history, and general introduction. For the Blue Economy, Natural Resources, and Infrastructure chapters, a "By the Numbers" table of quick facts displays key data on the topic.

Each chapter also discusses in detail the individual components of the topic – data, maps, successes, and challenges. Regional case studies are included throughout the plan, describing recent and ongoing successes and progress made to improve water resources. For example, within the Natural Resources chapter, Wetlands is the first major component and included there is a case study on the City of Novi's Wetland Ordinance. Each chapter concludes with a list of adopted regional policies and recommended actions needed to protect and restore water resources in Southeast Michigan.

The final chapter in this plan, Integrated Water Resources Management, focuses on topics and challenges that transcend and "overarch" the region's Blue Economy, Natural Resources, and Infrastructure. This chapter includes the vitally important topic of partnerships and collaboration, investments in water resources, and public education. The roles of climate resiliency and water resource monitoring programs are also described in this final chapter.

Chapter 2: Blue Economy

St. Clair River – major regional asset for water recreation and commerce

By the Numbers

- More than 350,000 jobs connected to water-dependent industries
- Nearly 100,000 acres of inland lakes, rivers, and streams
- 450 miles of designated water trails
- 396 miles of Great Lakes and connecting channels shoreline
- 229 public beaches
- 171 paddling launches
- 6 deep water ports
- 5 passenger ferries
- 5 higher educational institutions with water research & technology programs

As part of the Great Lakes State, Southeast Michigan's lakes, rivers, and wetlands define the region's geography and are essential to its economic health, attracting visitors and enhancing quality of life for residents.

This chapter analyzes the role of water in economic development, including the industries and jobs that rely on it, as well as the tourism, recreation, and placemaking opportunities it provides. A stakeholder forum was held to help identify the challenges and opportunities associated with Southeast Michigan's Blue Economy. Priorities established at the forum focused on promoting the region's water assets, including:

- supporting **economic development**, innovation and water dependent industries;
- expanding water **placemaking** efforts;
- increasing **access** to water resources; and
- enhancing water **recreation** opportunities.

Economic Development

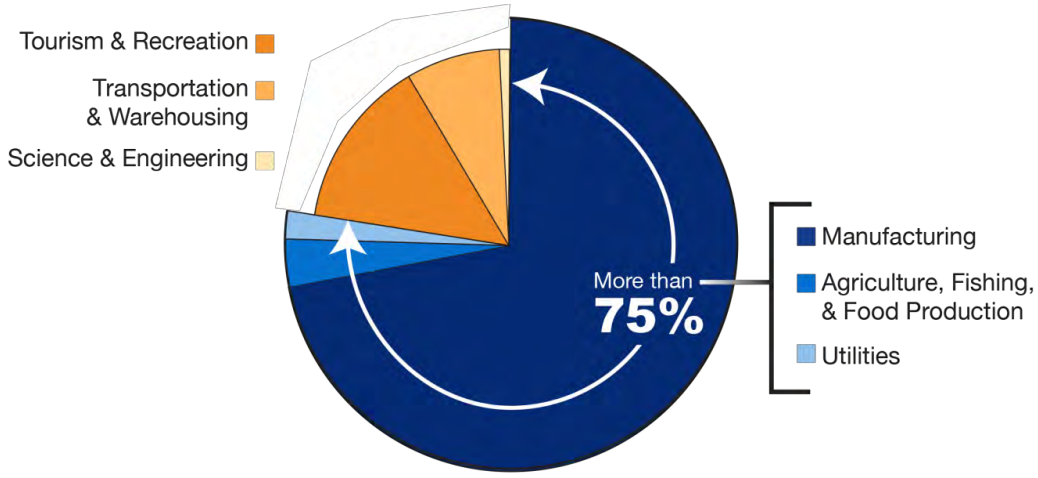
Southeast Michigan's waterways significantly impact the region's economy – as a location for commercial activity and as a resource to grow and produce goods. Together, these industries contribute more than 350,000 jobs and $21 billion in annual earnings to the region.

Water-related industries contribute 350,000 jobs to the region and $21 billion in annual earnings.

The region is a leader in technological innovation around water resources, with education and research programs at the University of Michigan, Wayne State University, Lawrence Technological University, Macomb Community College, and Monroe Community College. According to a report from the Michigan Economic Center, communities that embrace water research and new water technologies can expect to see increases in highly educated talent, cutting-edge applications for water restoration, as well as new jobs and emerging industries.

Currently, more than 75 percent of the region's water-related jobs are in industries that use water to grow and produce goods, including manufacturing, agriculture, and utility services. Of these, manufacturing accounts for the largest share of jobs and earnings. These businesses depend on a water supply that is abundant and clean. Their partnership and ongoing stewardship is important to protect water quality and mitigate potential ecological impacts from industry.

Figure 2
Southeast Michigan Jobs in Water-Related Industries

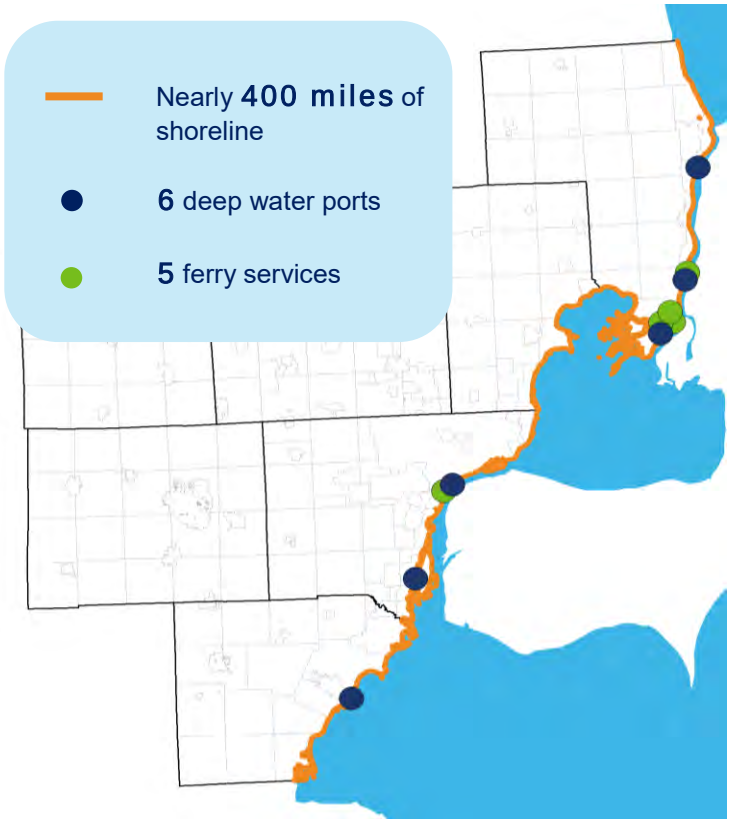


The region's second-largest share of water-related jobs is in recreation and tourism. As a result of vibrant tourism and recreation, waterfront communities are experiencing increased property values and more reclamation and other development projects that have direct economic benefits, while also creating conditions for economic growth.

With nearly 400 miles of shoreline from Lake Huron to Lake Erie, Southeast Michigan also has widespread access to the international Great Lakes shipping channels. Historically, this geographic advantage has allowed the region to grow and develop, and is still an important part of its economy. Of the state's 38 deep-water ports, six are located in Southeast Michigan. Shipping on the Great Lakes remains an efficient means of transportation for large volumes of materials.[17] A single freighter has the capacity to carry 70,000 tons, which is approximately equivalent to seven 100-car trains or 3,000 large trucks.[18]

There are also five ferry services operating on the Great Lakes and connecting channels that service passengers, bicyclists, vehicles, and commercial freight. These provide local and international connections that further enhance the region's transportation system, while also accommodating tourism and recreation opportunities along the water.

Figure 3
Great Lakes Shoreline Transportation




Rouge River Water Trail

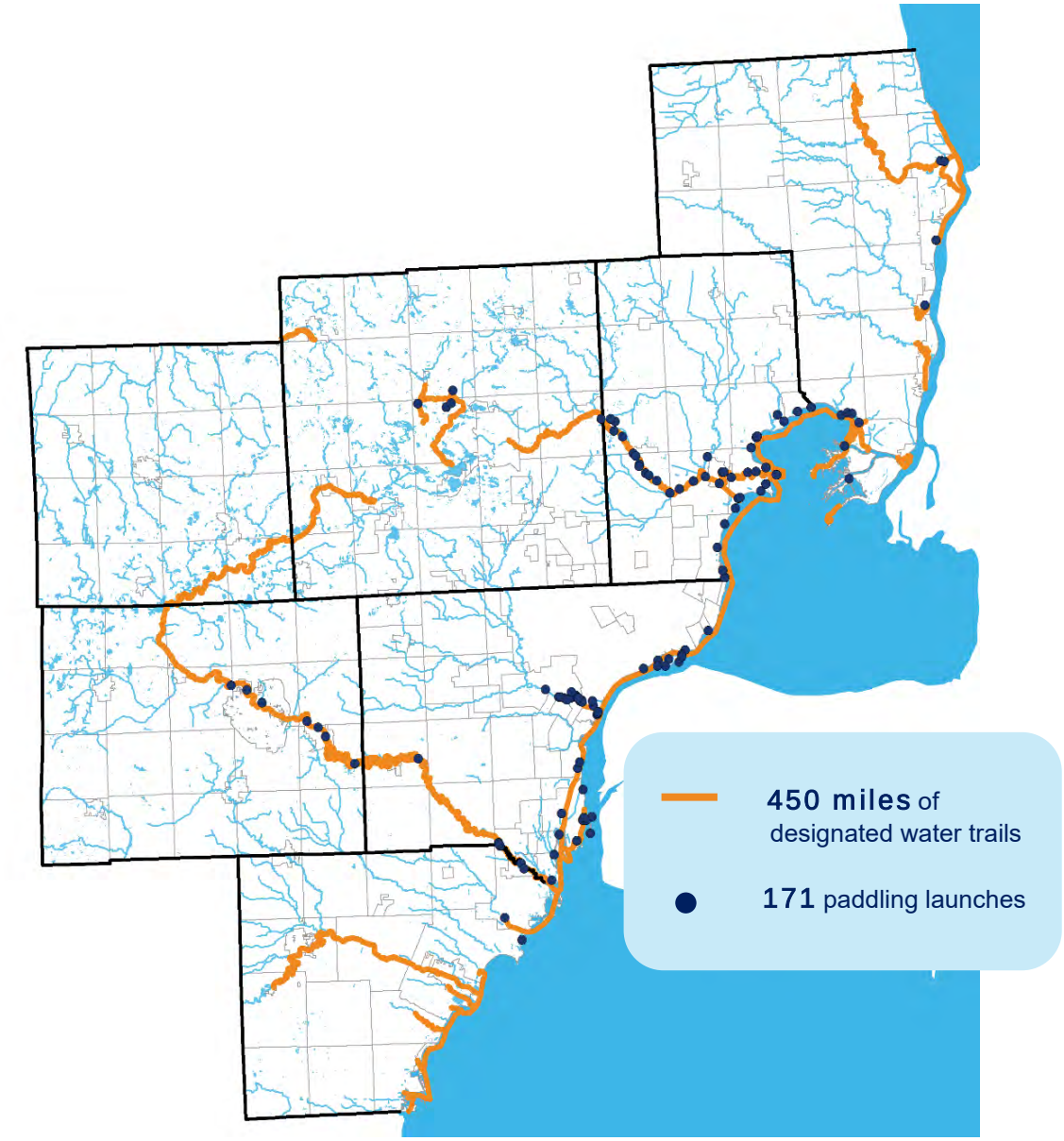
A single freighter has the capacity to carry 70,000 tons, which is approximately equivalent to seven 100-car trains or 3,000 large trucks.

Water Placemaking

Throughout Southeast Michigan, many of the attractive places for people to live, work, or visit are defined by their water resources. Community development initiatives are increasingly recognizing this and focusing on water as a natural asset that strengthens quality of place.

These initiatives include connecting waterfront communities by developing water trails. A water trail is a designated route along a lake, river, canal or bay specifically designed for people using small boats like kayaks, canoes, single sailboats or rowboats. Sometimes called "blueways," these trails are the aquatic equivalent of an off-road hiking or biking trail, or greenway. Water trails feature well-developed access and launch points, and are often located along significant historical, environmental, or cultural points of interest. Southeast Michigan has 450 miles of designated water trails with 171 launching points along their routes.

Figure 4
Southeast Michigan Water Trails



Water trails can also benefit from nearby amenities such as restaurants, shopping, parks, and campgrounds, and there are several organized initiatives that promote communities along these routes as trail towns and tourist destinations. Many waterfront areas have added services and developed public spaces, resulting in opportunities to host events, festivals, and public gatherings that highlight the water. These efforts help enhance a community's sense of place, building their reputation as a place that values natural resources and encourages active lifestyles.

Ann Arbor – Argo Canoe Livery on the Huron River

Case Study: The Economic Impact of the Huron River

The Huron River Watershed Council (HRWC) works to protect and restore the Huron River for healthy and vibrant communities. In 2017, HRWC published the report, *The Economic Impact of the Huron River* in partnership with Grand Valley State University. This report is one of the first studies completed in the region that quantifies the economic value of a major Southeast Michigan river and National Water Trail. The report found that the Huron River contributes the following economic benefits to Southeast Michigan:

- **$628 million** in added property value;
- **641** local jobs added to the region;
- **$150 million** in annual environmental value;
- **$78.6 million** in annual economic activity;
- **$53.5 million** in annual economic output from visitors, and;
- **2.6 million** visitor days.

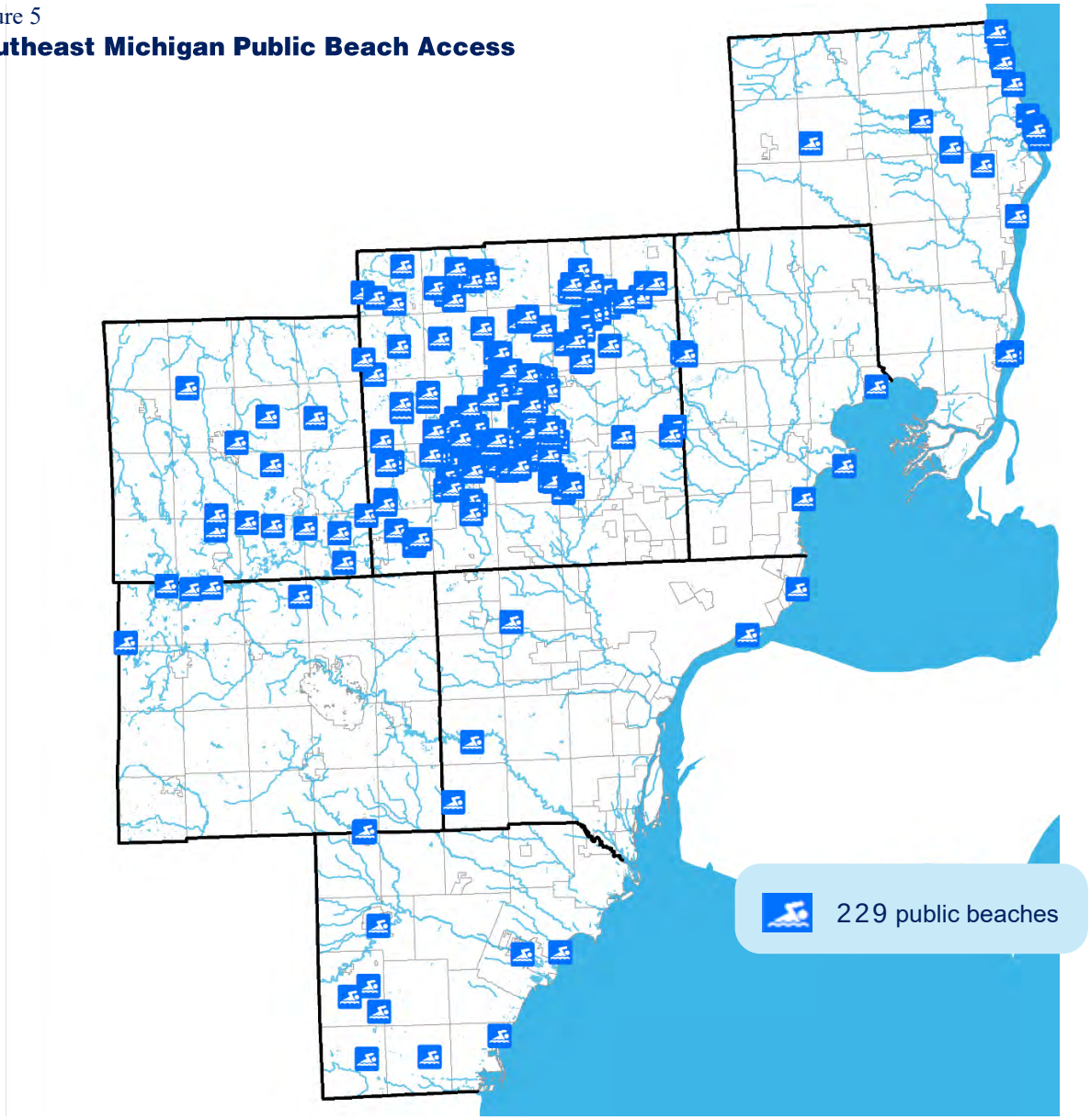
HRWC's *RiverUp!* campaign works to maintain and enhance this value. It is their signature placemaking initiative, seeking to transform the corridor into a premier destination in Michigan and the Great Lakes. *RiverUp!* is a public-private partnerships led by HRWC, implementing projects driven by a three-part strategy – improving river health, investing in river recreation, and transforming the river into a premier destination.

Access to the Water

Ensuring that the region's water resources are accessible is a focus for many of the issues discussed in this plan. Historically, many waterfront communities had water-dependent industry located along their waterfronts. Those communities are now redeveloping areas for public space, leading regional placemaking efforts, and providing a wider range of recreational opportunities.

Access to rivers and lakes across the region has increased as paddle sports have gained popularity. Removing or repurposing aging or obsolete infrastructure in the water (such as dams or mill races) has also provided new opportunities for access. As waterways are more integrated into surrounding communities, visual access and opportunities for passive recreation along the waterfront is further enhanced.

Figure 5
Southeast Michigan Public Beach Access



Source: Michigan Department of Environmental Quality (MDEQ)

City of Port Huron – Blue Water River Walk and shoreline access to the St. Clair River

Case Study: Blue Water River Walk & Shoreline Habitat Restoration

The Blue Water River Walk is almost one mile of St. Clair River shoreline immediately south of the mouth of the Black River in Port Huron. It includes a naturalized shoreline made up of rocks, boulders, and pebbles. Native plants, flowers, trees, and shrubs growing in a natural landscape make up the onshore habitat. The River Walk provides a place for natural habitat to thrive and for visitors to take a walk or bike ride along the shoreline and enjoy looking for turtles, having a picnic, and watching freighters. The core components of the Blue Water River Walk include:

- A **multiuse trail** with historic and educational interpretive features, **public art**, and other placemaking amenities. Examples of the public art to educate and engage visitors include a 7-foot-tall Iron Horse; 1,000-pound metal sturgeon; Native American themed carved large boulder; and a mural featuring native fish;
- **Restored and rehabilitated shoreline**, including shallow-water habitat, off-shore reefs, and native plants and wildlife habitat;
- A restored 1900s railroad **ferry dock** that now serves as a public gathering place;
- An **outdoor classroom** and interactive learning environment to teach the public about the St. Clair River ecosystem and the plant and wildlife habitat;
- A **County Wetlands Park**, where nearly three acres of a former brownfield was cleaned up and converted into a wetland habitat for reptiles, amphibians, and migrating waterfowl, and;
- A **fishing pier** to help enhance the public's access to fishing and recreation.

Water Recreation

Waterways appeal to a broad range of the region's population through activities such as swimming or paddling, as well as watching waterfowl or picnicking along shorelines. Water recreation depends on waterways that are ecologically healthy and accessible. Water recreation is a primary way that Southeast Michigan residents and visitors connect to the region's natural water resources. At parks, beaches, marinas, and boat launches, there are many opportunities to enjoy this resource.

The findings from SEMCOG's 2016 Pulse of the Region Survey (Appendix C) on parks further supports the connection between water and recreation in Southeast Michigan. Actively using the water for boating, paddling, swimming, and fishing were among the most popular activities residents said they participated in over the past year. Passive water recreation, or activities that are enhanced by their proximity to the water, were popular as well, with more than 60 percent of respondents reporting that they would like to see more parks near rivers and lakes.

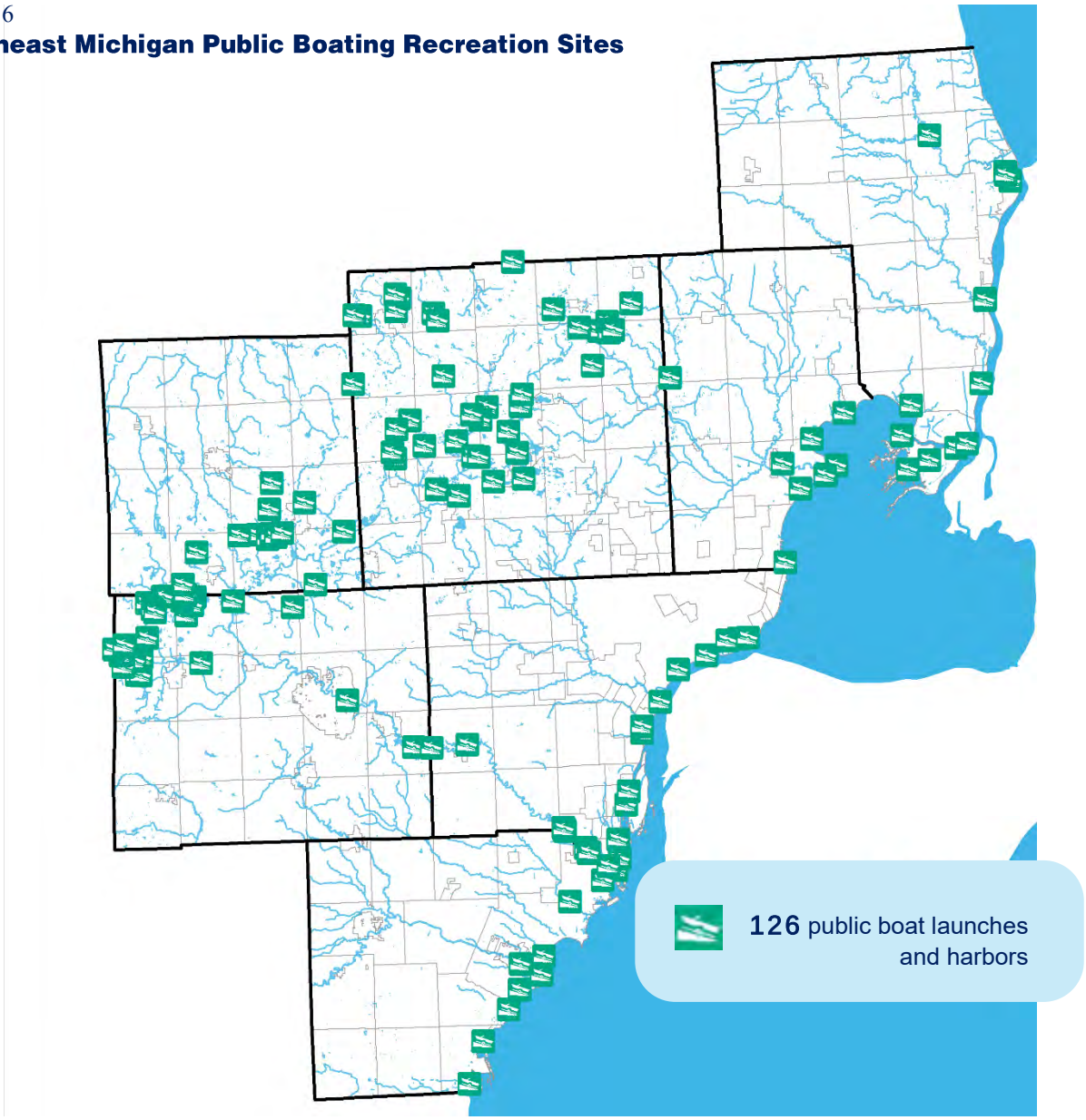
Detroit River - Kayaking under the MacArthur Bridge

Case Study: Detroit Heritage River Water Trail

The Detroit Heritage River Water Trail is one of Michigan's most dynamic and diverse water trails, traveling past the urban areas of downtown Detroit and the serene areas of the International Wildlife Refuge. The water trail meanders through the rich natural, cultural, and industrial history of the Detroit, Huron, Rouge, and Raisin rivers. There are more than 30 access and launching points along the water trail, with more added every year, including several that are universally and ADA accessible.

Since 2004, Riverside Kayak Connection has been offering kayaking tours for much of the Water Trail, providing residents and visitors with direct access and a greater understanding and appreciation of both the river's industrial past, natural resources – coastal wetlands, marshes, and islands – and amazing variety of wildlife – walleye, ducks, herons, and eagles.

Figure 6
Southeast Michigan Public Boating Recreation Sites



Source: Michigan Department of Natural Resources (MDNR)

Lake St. Clair is home to more than 70 marinas and 16,000 boat wells along its western shore in Macomb and St. Clair counties.[19] According to a 2004 study by the U.S. Army Corps of Engineers, recreational boating on Lake St. Clair contributes more than $200 million each year to Southeast Michigan's economy.[20]

The same study noted that nearly 50% of all sport fish caught in the Great Lakes Basin are caught in Lake St. Clair.

Regional Policies and Actions

Blue Economy

In order to protect and enhance the region's blue economy, the following policies and actions should be pursued:

Economic Development Policy

Promote activities that contribute to increased tourism, recreation, and water-related economic development opportunities.

Recommended Actions:

- Foster partnerships between water-related businesses, local governments, and water research and education programs to integrate new information and best practices into planning and decision making processes.
- Ensure the resilience of existing water-related business sectors by promoting opportunities for innovation and growth in newer systems.
- Partner with existing programs that promote water trail towns to maximize economic development opportunities around waterfront communities.
- Ensure that importance of water resources is recognized and integrated in community and economic development plans.

Water Placemaking Policy

Support efforts to protect, enhance, and publicize the natural assets and water resources that strengthen the region's quality of place.

Recommended Actions:

- Increase the connectivity of placemaking efforts across community borders, and explore opportunities to grow a regional sense of place that also capitalizes on its international boundary.
- Coordinate unified branding and marketing strategies that educate the public about the region's natural assets and waterfront destinations, inspire local pride, and attract visitors to the region.
- Embrace business opportunities associated with quality of place assets near regional waterways, such as paddling tours and equipment rentals.

Water Access Policy

Maintain and expand public access to the region's waterways, particularly in areas that would improve connectivity between waterfront amenities, parks and natural areas, or other areas where access is currently limited.

Recommended Actions:

- Encourage the development of a multi-modal transportation system that ensures water resources are accessible to all users and well connected to parks, trails, downtown areas, and public transit.
- Increase public access along the Great Lakes and connecting channels to enhance opportunities for a range of activities, including swimming, boating, fishing, paddling, birding, or visual access and passive recreation.
- Assess the need for additional public access on inland lakes and rivers in Southeast Michigan, including traditional boat launches, paddling launches, swimming, and visual access.
- Increase coordination between stakeholders to ensure that waterways and waterfront areas balance and support the needs of both recreational and industrial users, as well as the health of local ecosystems.

Water Recreation Policy

Ensure that water-based recreation opportunities are widely available to support a variety of uses and meet the needs of the region's diverse population.

Recommended Actions:

- Continue to expand and implement the region's network of water trails, ensuring that they are easily accessible and well-integrated with their surrounding communities.
- Support local recreation planning efforts to increase regional coordination and share resources.
- Encourage the acquisition and development of public water recreation facilities and programming.

Chapter 3: Natural Resources


Orion Charter Township – Tommy's Lake

By the Numbers

- 986,619 acres of tree canopy
- Over 340,000 acres of wetlands
- 53,434 acres of riparian corridor
- 4,000 miles of rivers and streams
- 837 lakes greater than 10 acres
- 15% of the region's land area used for agriculture – 434,055 acres
- $5.7 billion – cost per year in social, environmental, and economic losses in the Great Lakes from invasive species

Southeast Michigan's water resources are dependent on the quality and quantity of wetlands, woodlands, riparian corridors, and agricultural lands. Part of the green infrastructure network, these natural areas help reduce stormwater runoff, flooding, and erosion; replenish groundwater; and stabilize streamflow. These benefits lead to improved aquatic habitat in the region's rivers, lakes, and streams, and further support the region's recreational and economic opportunities.

Natural areas also provide a benefit to stormwater infrastructure by reducing the amount of runoff the region's infrastructure must manage. Together, the green infrastructure network and stormwater infrastructure handle precipitation events, large and small. These natural areas can improve water quality entering area waterways. At the same time, invasive species and runoff from agricultural lands continue to present challenges to local waterways. This chapter further defines the policies and actions that can be taken to directly benefit water resources that also leads to enhanced wildlife and aquatic species diversity and populations.

Wetlands, woodlands, and riparian corridors are the first line of defense during rain events, naturally intercepting, infiltrating, storing, and using precipitation.

Wetlands

Wetlands play an important role in protecting water quality, reducing localized flooding, enhancing wildlife and fish habitat, and increasing recreational opportunities. Wet meadows, prairies, fens, bogs, swamps, vernal pools, deltas, open bays, barrier beach lagoons, and floodplain forests are all considered wetlands. In Southeast Michigan, wetlands are found both inland and along the Great Lakes coastline from Lake Huron to Lake Erie.

Michigan's coastal and inland wetlands produce more wildlife and plants than any other habitat type in the state. Nationally, it is estimated that more than one-third of threatened and endangered species live only in wetlands, and nearly half use wetlands for breeding, nesting, feeding, or stopover habitat at some point in their lives.[21]

Canton Township – Wetland in Flodin Park

Coastal wetlands provide many benefits. They reduce wave energy, protect shoreline property from flooding, and improve water quality as a final filter for streams and rivers entering the Great Lakes. Along the Great Lakes shorelines, coastal wetlands play a vital role in recreation and tourism, while also providing habitat to support a world-class freshwater fishery.

Coastal wetlands are dispersed along Michigan's shoreline with 37% along Lake Huron; 28% along Lake Michigan; 13% along Lake Superior; 6% along Lake Erie, and 16% along the St. Clair River, Lake St. Clair, and the Detroit River.

All wetlands support enhanced wildlife and fish habitat resulting in healthy ecosystems and aquatic life. While these ecosystems can be fragile and public access may be limited, they often provide opportunities for bird watching, paddling, fishing, hunting, and hiking, as well as bicycling activities along trails. All of these opportunities help to diversify and further enhance Southeast Michigan's blue economy.

These multifaceted, natural functions that wetlands provide are particularly important for Southeast Michigan, where urbanization, agriculture, and other development activities have led to significant wetland loss. Less than 30 percent of the region's historic wetlands remain today, drastically reduced as a result of filling, draining, and shoreline hardening (Table 2).

Table 2
Wetland Loss by County

Area	Historic Wetland Acres	Current Wetland Acres	Percent Wetland Loss
Livingston	90,626	60,577	33%
Macomb	144,841	25,576	82%
Monroe	264,013	20,061	92%
Oakland	120,868	77,434	36%
St. Clair	292,432	61,822	79%
Washtenaw	113,888	53,245	53%
Wayne	97,278	42,073	57%
Region	1,123,946	340,788	70%

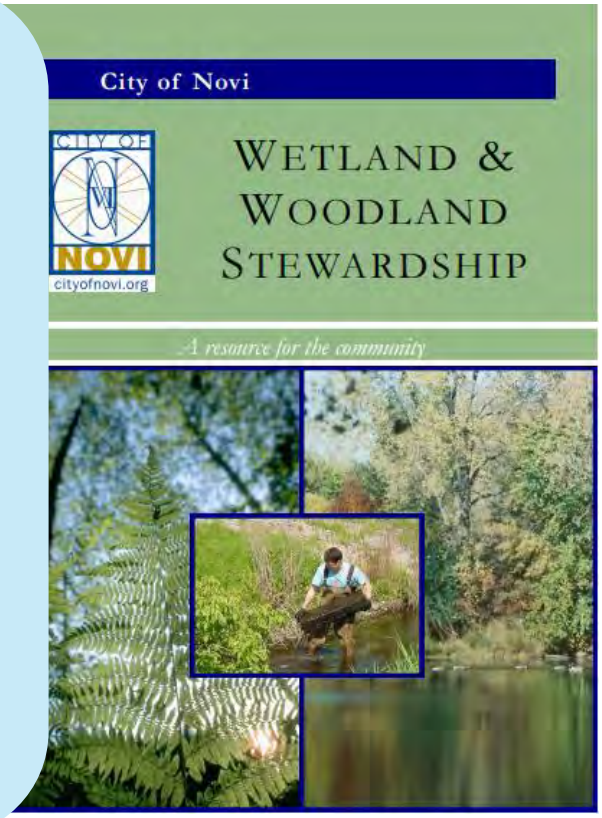
The Michigan Department of Environmental Quality regulates wetlands that are contiguous to or within a certain distance of the Great Lakes, Lake St. Clair, or inland lakes, rivers, or streams.

Wetlands are continually threatened by development; changing water quality, quantity, or flow; introduction of invasive species; and pollution. By restoring wetland areas and protecting those still intact, Southeast Michigan can improve the quality of its water resources to achieve economic, environmental, and social goals. Seeking opportunities to restore functional wetland systems that mitigate flooding improves infrastructure resiliency to extreme weather events. For example, in August 2014, more than 6 inches of rainfall occurred in Southeast Michigan over an 8-hour period, resulting in over $1.8 billion in damages and a federal disaster declaration. Efforts that are focused along streams, riparian corridors, and headwater areas are of particular importance, as their impacts reverberate downstream and throughout the watershed. Partnerships across government agencies and with other watershed stakeholders can help identify priority areas and develop innovative strategies to further sustain Southeast Michigan's wetland ecosystems.

Case Study: City of Novi Wetland Ordinance

The City of Novi provides protection above state requirements for wetlands and water resources within the city's Code of Ordinances. The goal of the city's Wetland Ordinance is to minimize further net loss of wetlands that are: (1) contiguous to a lake, pond, river, or stream; (2) two acres in size or greater; or (3) less than two acres in size, but deemed essential to the preservation of the city's natural resources.

Essential wetlands are those that exhibit one or more of the following functions: flood control and stormwater management; groundwater recharge; supports wildlife habitat; nursery grounds and fish sanctuaries; water quality improvements and erosion control; or supports threatened and endangered species.



The Michigan Water Strategy has set a wetland restoration goal of restoring 500,000 acres of inland wetlands in the state.

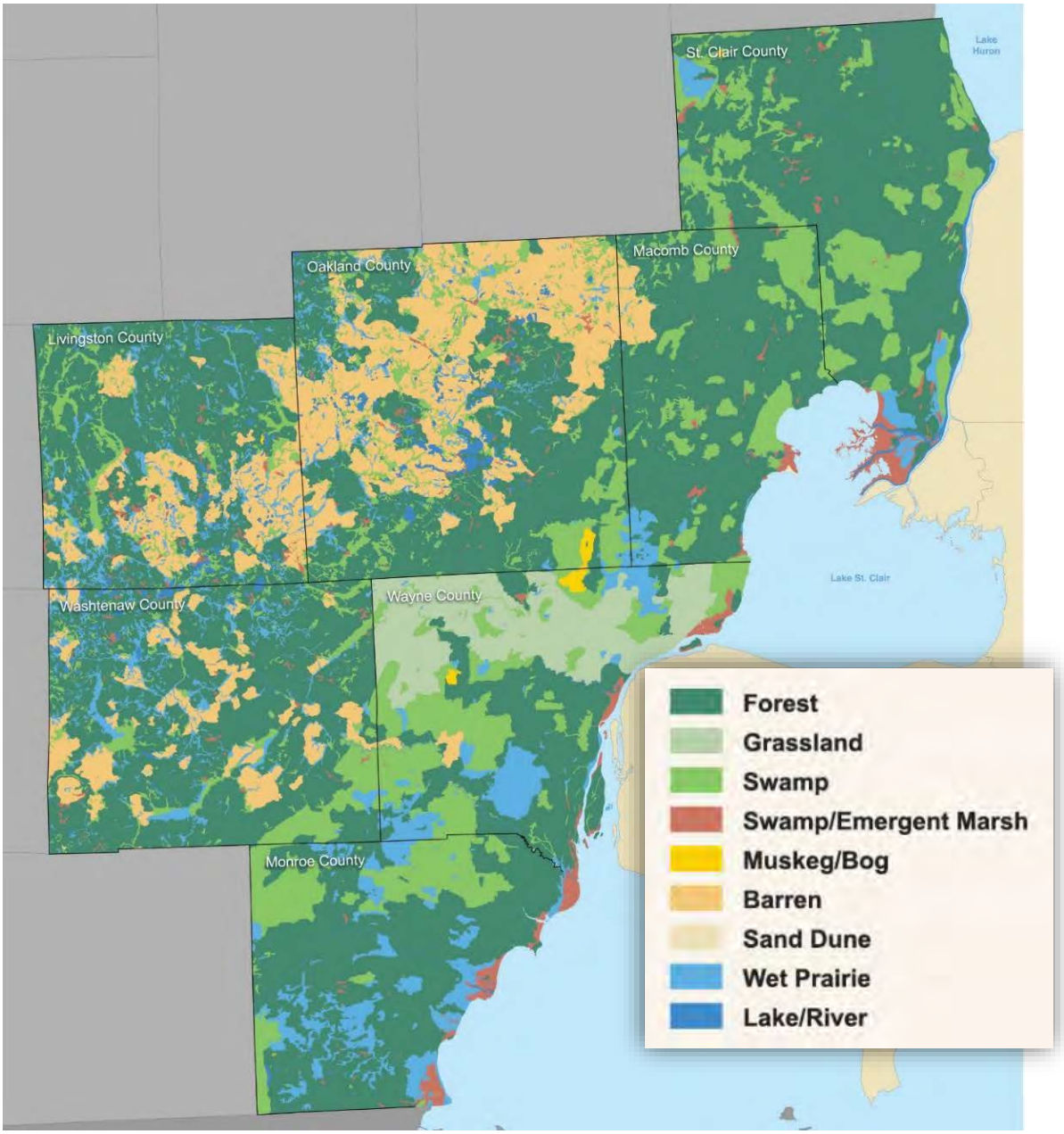
Woodlands

Woodlands are also referred to as forests and trees. Forests were the primary vegetation in Southeast Michigan prior to European settlement. Hardwood swamps, conifer swamps, shrub swamps, and floodplain

forests all grew in low-lying areas and along rivers. Oak barrens and forests of beech maple and oak hickory grew in upland areas and the headwaters of the region's watersheds. (Figure 7).

Some woodlands still remain in less developed areas and large parks, although the majority has been lost to urbanization. SEMCOG's *Green Infrastructure Vision* estimates tree canopy in the region at 33 percent (tree canopy is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above). It ranges from 20 percent in Monroe County, to 44 percent in Oakland County. The region's goal is to achieve 40 percent tree canopy; priority focus is in urban communities with less than 20 percent.

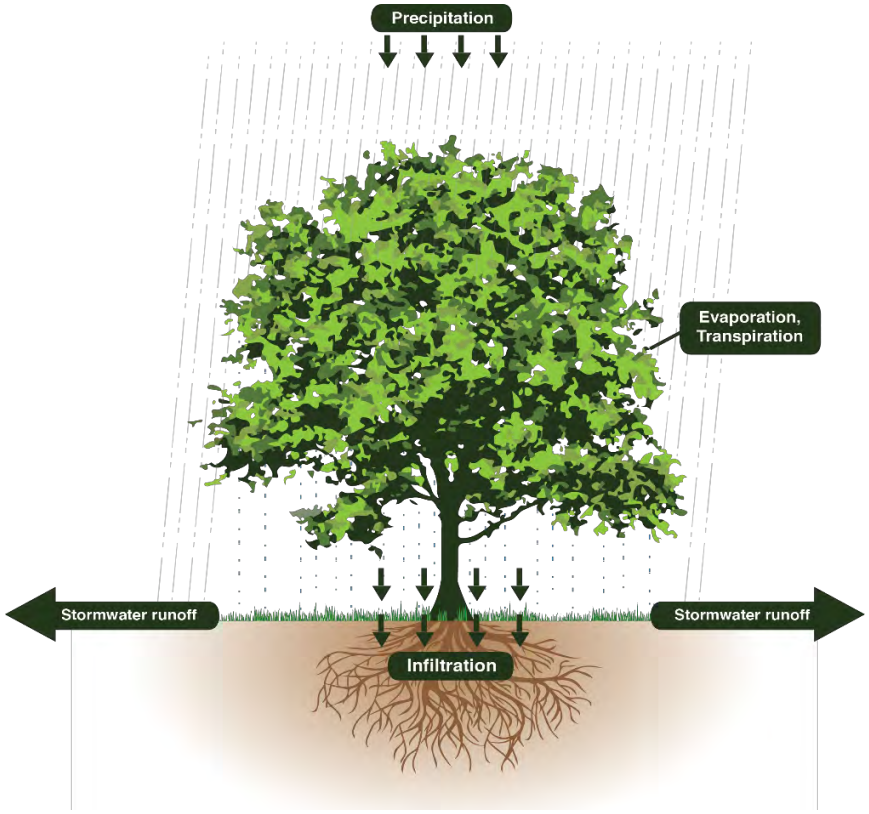
Figure 7
Land Cover circa 1800



While trees provide habitat, improve local air quality and aesthetics, and boost property values, they also benefit local waterways. At any scale – from urban street trees to large woodland areas – trees help to naturally manage stormwater.

Trees absorb the first 30 percent of most rainfall events through their leaf system, allowing evaporation back into the atmosphere. Up to 30 percent more is taken in by their root structure, then absorbed by the tree and transpired back into the air.[22] When planted in riparian corridors, the trees' root structure also help reinforce streambanks and minimize the effects of sediment runoff and bank erosion (Figure 8).

Figure 8
How Trees Naturally Manage Stormwater



For trees to realize their potential as a functional component in a watershed, it is important that the right tree is planted in the right place, and for the right purpose. Benefits can vary by tree species, just as their ability to thrive can vary by the conditions in which they are planted. Other factors such as soils, weather, and maintenance can impact a tree's productivity. As it can take several years for a sapling to reach maturity, the benefits can also be expected to grow over time.

If the right trees are not planted in the right place, they can impact utilities and other infrastructure. When trees of only one species are planted (through the practice of monoculture) they can be especially vulnerable to pests and disease such as the Emerald Ash Borer. Using trees to manage stormwater requires a different approach than traditional infrastructure or engineered systems, requiring increased education and collaboration across local agencies to better understand their role in a watershed context.

Macomb County - Demonstration Tree Plantings at Freedom Hill Park

Case Study: The Green Macomb Urban Forest Partnership

The Green Macomb initiative supports implementing green infrastructure in the county. Its first project, the Green Macomb Urban Forest Partnership, is building local capacity to manage and grow healthy urban forests in the county's most urbanized areas.

SEMCOG's *Green Infrastructure Vision* identified southern Macomb County as a priority area for increasing tree canopy. In the more developed communities south of the Clinton River, tree loss has been intensified by urban development, Dutch Elm Disease, and the Emerald Ash Borer. These highly populated areas can benefit from an extensive and well-maintained urban forest, which can lead to cleaner air and water, flood control, reduction in energy usage, improvements to public health aesthetics, increased property values, and better quality of life.

By prioritizing improvements in this area, the county is focusing on a watershed-based planning approach. To this extent, the Urban Forest Partnership is working to expand public awareness of the benefits that urban forests provide, develop technical tools and resources for sustainable local forestry programs, and advance creative partnerships to increase tree canopy by planting the right tree in the right place for the right purpose.

Riparian Corridors

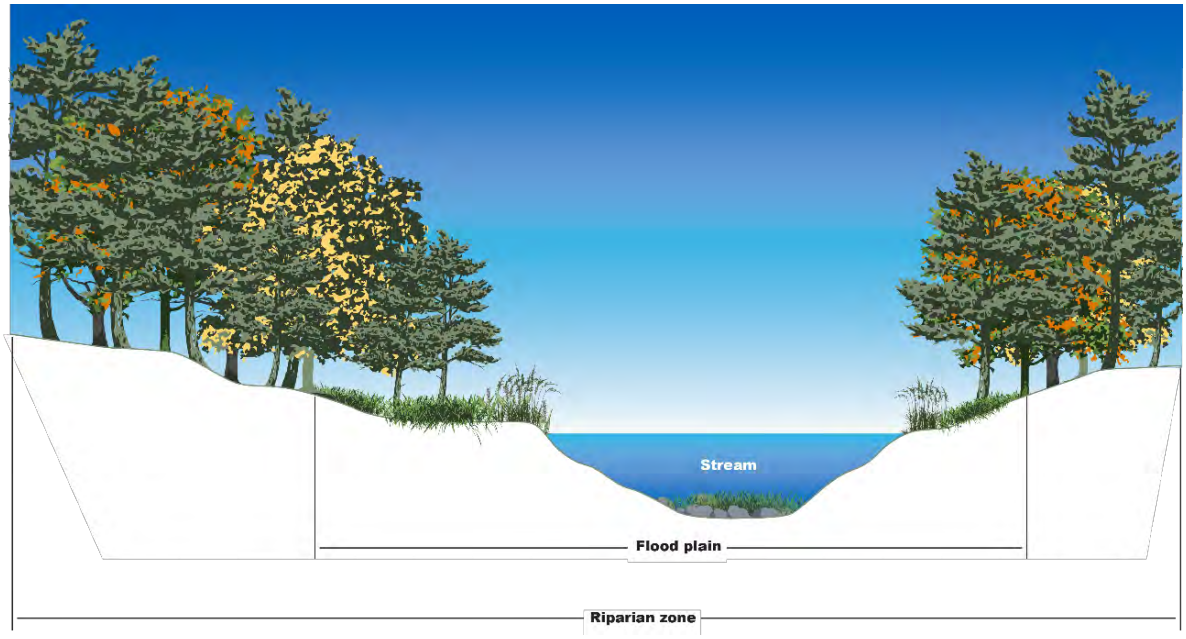
Southeast Michigan's waterways flow from their headwaters through streams, rivers, lakes, and wetlands to the Lake Huron-to-Lake Erie corridor. The adjacent lands along these waterways are known as riparian corridors, which provide critical ecosystem services, including flood control, improved water quality, aquatic habitat, streambank protection, groundwater recharge, habitat connection, and access for recreation (Figure 9).

In addition to providing habitat for wildlife, riparian corridors create pathways for migration. Many species need different habitat conditions in different seasons and at different stages in their lifecycle. These corridors allow these species to move between breeding, spawning, feeding, and reaching upland forests,

deep-water lakes, and a variety of habitat areas in between. This connectivity is particularly important in urbanized areas, where increased development and road-stream crossings can lead to habitat fragmentation.

Fish and wildlife are not the only species to benefit from a connected riparian corridor. These areas also provide outdoor recreation opportunities along the water for paddling and fishing. The scenic landscape of a riparian corridor can often enhance opportunities for hiking, photography, and wildlife observation. Many riverfront trails have been developed along these corridors, further connecting communities with their natural resources.

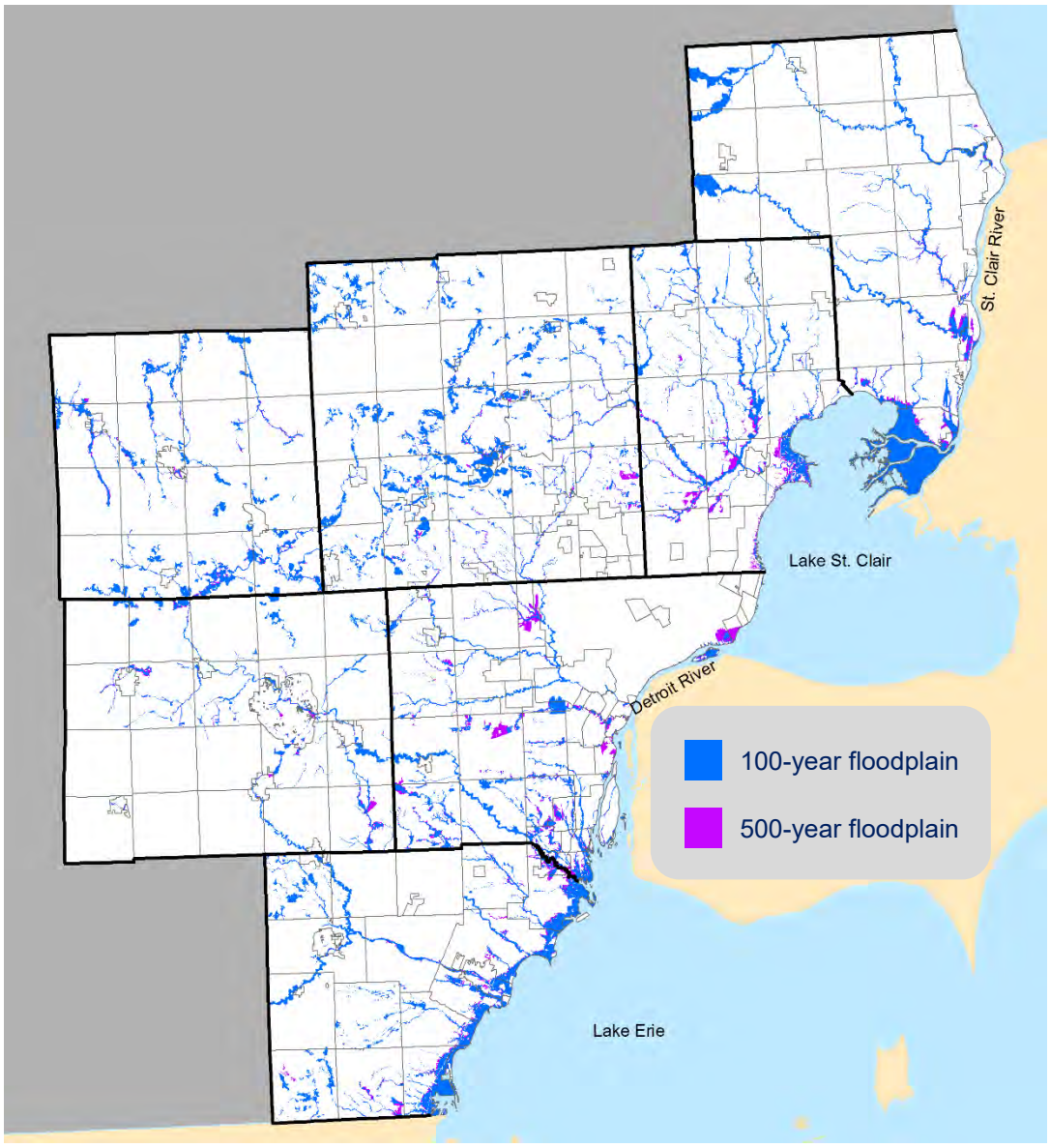
Figure 9
Riparian Corridor Cross-Section



Riparian corridors slow down overland water flow, which benefits the transportation and stormwater infrastructure by reducing the amount of runoff conveyed through road-stream crossings. Understanding the role of riparian corridors as floodplain areas is critical in addressing flooding challenges. Southeast Michigan has experienced a number of extreme precipitation events that have caused localized flooding, road closures, stream blockages, and property damage. Maintaining and restoring the connectivity between riparian corridors and adjacent floodplains is important to addressing runoff from significant rain events. Figure 10 shows the 100-year and 500-year floodplain areas for the region. Areas in the 100-year floodplain have an estimated 1 percent probability of annual flooding, while areas in the 500-year floodplain have a 0.2 percent probability.

Evaluating opportunities to remove impervious surfaces and use vacant land within riparian corridors to infiltrate water and restore with native vegetation is an important consideration when determining flood mitigation alternatives. These areas can work to withstand temporary flooding, minimizing threats to public health and safety and potential property damage. Softening shorelines with native vegetation around inland lakes and along the Huron-to-Erie corridor can also minimize erosion and improve aquatic habitat. Floodplain delineations and regulations should reflect current precipitation data and trends. This helps protect both waterfront communities and riparian ecosystems, ensuring their resilience in flooding events.

Figure 10
Southeast Michigan Floodplains



Source: Federal Emergency Management Agency (FEMA)

Table 3
Southeast Michigan Floodplain Acres by Land Cover

Area	Water	Impervious Surface	Pervious Surface	Total
100-year floodplain	45,455	9,156	148,270	202,881
500-year floodplain	371	6,357	22,285	29,013

Case Study: Marysville Shoreline Naturalization

The City of Marysville completed a living shoreline project on the banks of the St. Clair River in 2013, through funding from the Great Lakes Restoration Initiative. The project involved habitat restoration, and establishing native plant life and structures that resist erosion, but function like a natural shoreline.

To accomplish this, the city replaced a failing vertical seawall on the St. Clair River with a reinforced rocky shoreline and an improved walkway and boardwalk. The rocky shores provide spawning and nursery habitat for fish; wetland, and upland prairie vegetation to benefit birds and other wildlife.

A total of 1,885 feet of steel seawall was removed and replaced with a more naturalized shoreline. Since its implementation, additional plantings have created a transitional area between the deep waters of the St. Clair River and the wetland upland areas along the shore.

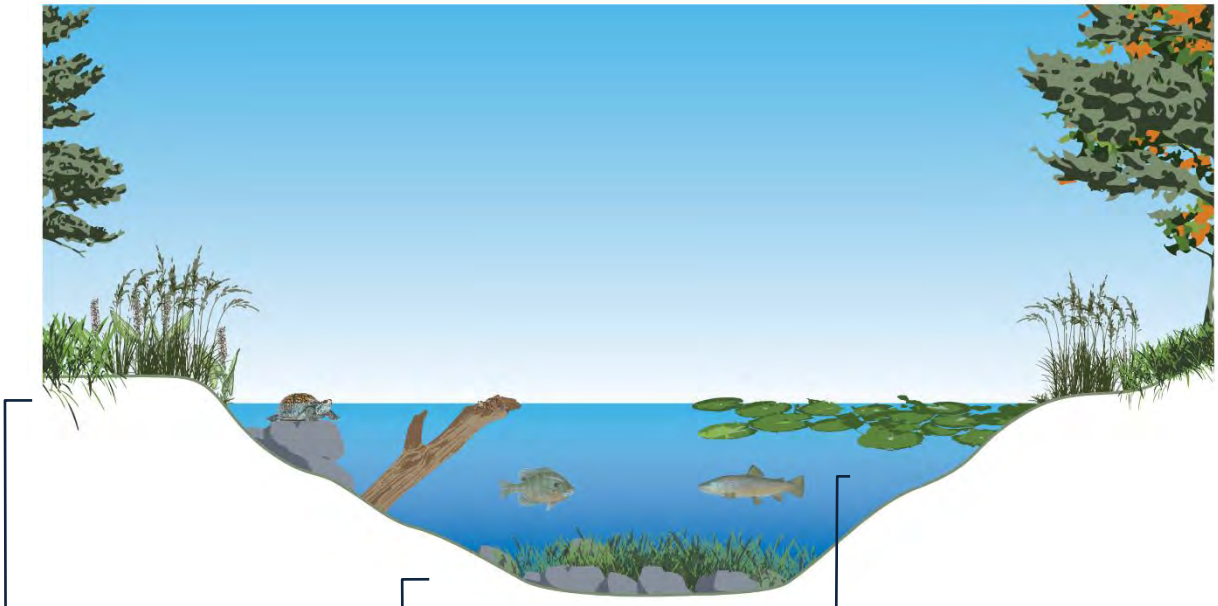
Marysville – St. Clair River Shoreline Restoration

Aquatic Habitat

Southeast Michigan is home to a diverse fish population including bass, panfish, pike, muskie, trout, walleye, and channel catfish. There are numerous recreational fishing options ranging from boat fishing to pier fishing to wading at multiple state recreational areas and community parks. For example, Johnson Creek in the Rouge River Watershed is one of three streams in Michigan that supports the endangered redside dace. Several tributaries of the Clinton River are the only streams in Southeast Michigan that support a coldwater brook trout population. Additionally, the State of Michigan Wildlife Action Plan provides a common strategic framework to coordinate the conservation of wildlife and habitats in Michigan. Priorities for southeast Michigan water resources include warmwater streams and their headwaters, particularly in the Rouge and River Raisin watersheds; littoral zones, the St-Clair-Detroit River System, and inland cisco lakes, including those in Oakland County.

These fishing opportunities are supported by quality aquatic habitat, dependent on local actions. Figure 11 displays the components of an ideal aquatic habitat, which includes a mix of riparian vegetation, submerged structures, and floating and emergent vegetation. Preserving and restoring natural resources, like wetlands, woodlands, and riparian corridors, while continuing to manage stormwater runoff from impervious surfaces are primary factors. Too much runoff, combined with nonpoint source pollution leads to degradation of the water, physical habitat, and riparian vegetation required to support aquatic life. Removing invasive species and encouraging maintenance of native aquatic plants are also important considerations. Improving stream connectivity by removing outdated and nonfunctioning dams and perched culverts leads to improved fish migration and aquatic diversity.

Figure 11
Components of Ideal Aquatic Habitat



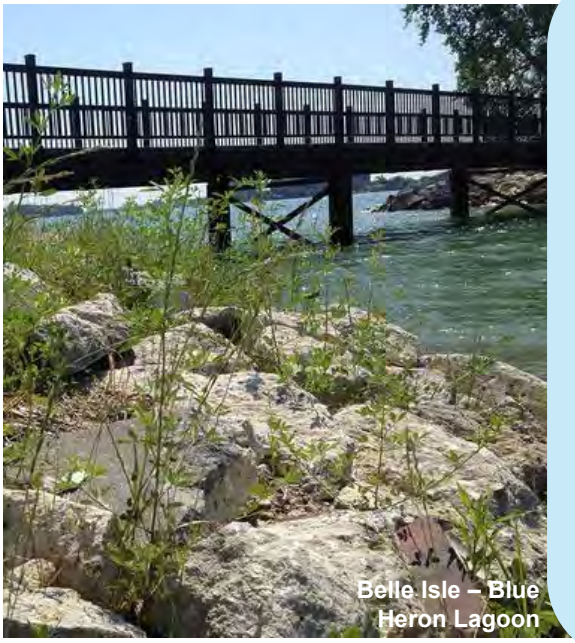
Riparian Vegetation

- *Grasses*
- *Shrubs*
- *Trees*

Submerged Structures

- *Woody Debris*
- *Plants*
- *Rocks*

Floating and Emergent Vegetation



Belle Isle – Blue Heron Lagoon

Case Study: Blue Heron Lagoon at Belle Isle

Through funding from the Great Lakes Restoration Initiative, a consortium of partners, including the Friends of the Detroit River, are working to restore fish and wildlife habitat on Belle Isle. In 2013, Blue Heron Lagoon was opened to the Detroit River at the island's easternmost point, allowing Great Lakes fish to access and reproduce in 40 acres of calm, shallow water. The opening also expanded recreational access to the island's waterways for canoes and kayaks. The soil that was excavated to create a deep-water area was reused to build a new peninsula for nesting turtles. Amphibians and reptiles – particularly the threatened eastern fox snake – benefit from new vernal pools and snake refuge. Since the project's completion, MDNR has documented a significant rise in fish populations in the lagoon.

Agricultural Lands

Southeast Michigan's water resources are vitally important for agricultural production. In addition to growing food and other resources, the agriculture industry contributes more than 12,000 jobs to the region's workforce, with more than $400 million in annual earnings. Agriculture helps define the character of Southeast Michigan's more rural areas, where u-pick farms and orchards boost local tourism and enhance placemaking initiatives. These impacts carry over to the region's more urban areas. For example, in Wayne County there are more produce, dairy, and meat processing plants than any other county in Michigan.

Agricultural land is also a component of the green infrastructure network, since its productivity benefits from stormwater infiltration as a natural porous land use. However, like most land use types, agricultural areas also create stormwater runoff challenges. Runoff from agricultural areas often contains sediment, fertilizers and bacteria that can impact local waterways.

Agricultural land covers 434,055 acres in Southeast Michigan, or approximately 15% of the total land area.

Conflicts can arise between agricultural practices and water quality when too much water saturates the soil. In heavy rainfall events, certain topography and geologic conditions can lead to flooded fields, damaged crops, and reduced soil productivity. Since the mid-1800s, more than 35,000 miles of public drains have been developed in Michigan to support agricultural use and reduce flooding.[23] While these drains remove excess stormwater from farm fields, the excess runoff often contains fertilizers, pesticides, sediments, and animal waste that can impact the watershed.

Water quality goals can be balanced with agricultural practices by implementing Generally Accepted Agricultural Management Practices (GAAMPs). These farm management practices are scientifically based and updated annually to reflect current technology and promote sound environmental stewardship on Michigan farms. Practices can include site selection for new farm operations or expansions, irrigation practices, and animal care, along with responsible management of manure, nutrients, and pesticides.

Case Study: Watershed Conservation Program in the Western Lake Erie Basin

Among the goals of the Michigan Water Strategy and Great Lakes Water Quality Agreement is to achieve a 40 percent phosphorus reduction in the Western Lake Erie Basin (WLEB). The basin is almost six million acres in size and drains portions of 29 counties in parts of Michigan, Indiana, and Ohio, into Lake Erie.[24]

A farmer-led Watershed Conservation program in the Western Lake Erie Basin (WLEB) has been established to increase farmer adoption of conservation practices to protect water quality in the WLEB and strengthen farmer leadership to encourage neighbor action. The basin is one of the most biologically diverse areas in the Great Lakes system. With funding from the Erb Family Foundation, the Michigan Association of Conservation Districts in partnership with local watershed groups, and the Michigan Department of Agriculture and Rural Development (MDARD), the Watershed Conservation program works with local farmers to install conservation practices across the WLEB.

Between 2015 and 2016, farmers have voluntarily implemented filter strips, cover crops, and conservation tillage practices that reduced pollutants, including over 50,000 tons per year of sediment and approximately 95,000 pounds per year of phosphorus.[25] MDARD manages the Michigan Agriculture Environmental Assurance Program (MAEAP) helps farms of all sizes and all commodities voluntarily prevent or minimize agricultural pollution risks.

Clay Township - Phragmities covering St. John's Marsh at Harsen's Island

Terrestrial invasive species *are non-native plants, insects, animals, and pathogens that negatively affect forested areas, grasslands, meadows, and other natural resources in rural and urban environments.*

Aquatic invasive species *are non-native plants, animals, and pathogens that negatively affect or impact lakes, rivers, streams, and wetlands in rural and urban environments.*

Invasive Species

Non-native species are plants or animals that are not native to Michigan and are located in many of Southeast Michigan's rivers, lakes, wetlands, woodlands, and riparian corridors. They are considered invasive species when they negatively affect the environment, economy, infrastructure, and public health. The most common ways invasive species enter Michigan's water and natural resources are:

- Seed distribution from wind and animals;
- Ballast water from maritime commerce;
- Water recreation (boating/fishing); and
- Trading of aquatic organisms (via pet stores, aquariums, bait shops).

Invasive plants and animals degrade fish and wildlife communities by crowding out habitat and outcompeting native species for food sources. They also impact water quality; fragment green infrastructure, habitat and water resource connectivity; and diminish other natural resource functions within watersheds.

Some invasive species impact infrastructure by impairing drainage in constructed green infrastructure and road drainage systems. For example, Phragmities can lead to increased public safety concerns by creating potential fire hazards and limiting visibility for all travelers. Ultimately, invasive species increase the costs associated with maintaining infrastructure.

Economic impacts include diminished property values and agricultural productivity. Invasive species also significantly impact recreational and commercial fishing, ecotourism, hunting, and other birding and wildlife viewing opportunities. While there are many invasive species that impact the region's water resources, three are of primary concern – Phragmities, purple loosestrife, and zebra mussels.

Primary Invasive Species in Southeast Michigan

Phragmites is most widely found in coastal and inland areas and primarily spread through seeds and root systems. Phragmites management has become a local priority due to its impacts on the environment and economy.

Purple loosestrife crowd out native species, and provide no food or habitat value for aquatic and terrestrial wildlife. Biological control mechanisms have helped slow progression across the region.

Zebra mussels pose significant challenges at drinking water intakes, and negatively affect local beaches, waterfronts, watercrafts, and other major infrastructure facilities, like power plants.

Other invasive species affecting Southeast Michigan's water resources include Eurasian water milfoil, curly-leaf pondweed, Japanese knotweed, flowering rush, European frogbit, giant hogweed, water hyacinth, and sea lamprey.

Asian Carp: A Threat to Michigan's Water Resources

Preventing Bighead and Silver Carp, commonly referred to as Asian Carp, from entering the Great Lakes is critical given the potential environmental, economic, and social impacts. There is no evidence that these species are in the Great Lakes and Michigan is still in the prevention phase. Environmental impacts include the potential for Asian Carp to become a dominant species in the Great Lakes while significantly impacting native fish species. This would lead to further economic and social impacts, many related to water recreation.

In order to prevent upstream movement of Asian Carp through the Chicago Area Waterways into the Great Lakes, the U.S. Army Corps of Engineers has outlined a plan with multiple components. This plan includes an electric barrier, complex noise, water jets, an engineered channel, a flushing lock, boat launches, a mooring area, and nonstructural measures at the Brandon Road lock and dam. The State of Michigan is supportive of this approach because it accounts for social, political and economic aspects while using current science to add control redundancy. The estimated construction cost is $275 million.[26] Regional support and partnerships are necessary to successfully address this challenge. More information can be found at www.blockasiancarp.org.

Invasive Species Management Efforts

Successful management efforts require collaboration and cooperation across multiple jurisdictions and agencies due to widespread distribution of invasive species and high costs of treatment. Cooperative Invasive Species Management Areas (CISMA) and Cooperative Weed Management Areas (CWMA) are examples of management structures that help facilitate this important collaboration.

CISMAs and CWMAs are partnerships of federal, state, and local government agencies, nonprofit organizations, and the private sector. For example, the Lake St. Clair CISMA was established in 2015; over 35 organizations are collaborating to manage invasive species around Lake St. Clair and to protect important natural resources, including the regionally significant St. Clair River Delta.

MDOT spraying herbicide on Phragmities

Invasive species in the Great Lakes cost an estimated $5.7 billion per year in social, environmental, and economic losses.[27]

Case Study: Orion Township Phragmites Ordinance

In 2015, the Charter Township of Orion in northern Oakland County, adopted a Phragmites Ordinance to address Phragmites infestations on all properties in the township. The ordinance describes a process for Phragmites treatment and removal, which includes identifying and mapping all parcels with Phragmites, notifying private property owners with invasive species on their property, and educating property owners on why they should consider voluntary Phragmites treatment by the township on their properties for a fee.

Treatment of Phragmites may be mandated by the township if the invasive plants create a fire hazard or cause a public safety concern for motorists or pedestrians. Phragmites treatment might also be mandated if it has a significant effect on habitat, water quality, and drainage.

Regional Policies and Actions

Natural Resources

In order to protect and enhance the region's natural water resources, the following policies and actions should be pursued:

Natural Areas Policy

Preserve and restore natural areas, such as wetlands, woodlands, riparian corridors, and agricultural lands, as a mechanism to protect and enhance water resources.

Recommended Actions on Wetlands:

- Identify high-priority wetlands to support local, regional, and state-decision making based on location and function, including flood control, stormwater management, habitat, and recreation.
- Encourage diverse wetland landscapes in restoration and mitigation practices that will encompass changing vegetation patterns from climate resiliency and invasive species challenges.
- Align publicly-funded wetland mitigation projects with restoration opportunities identified in local watershed and remedial action plans.
- Work with state and local agencies to strengthen wetland best practices and encourage use in master planning and local codes and ordinances.

Recommended Actions on Woodlands:

- Research methodologies to define the role of urban trees in stormwater management considering species, growth over time, crediting options, and effectiveness.
- Work with local groups, the Michigan Department of Natural Resources, and Michigan State University Extension to update optimal tree planting species for the region based on changing vegetation patterns and implementation functions.
- Evaluate and research alternatives to recognize trees as an infrastructure component that may be capitalized for long-term funding options.
- Identify critical riparian corridor areas for flood protection and stormwater management benefits.

Recommended Actions on Riparian Corridors:

- Increase the use of native vegetation, grow zones, and tree canopy in riparian corridors, especially along publicly owned property.
- Develop riparian corridor best practice recommendations and goals at the local level.

Recommended Actions on Agricultural Lands:

- Support implementation of alternative conservation and water management practices including buffer strips, wetland restoration, tile drain management, smart drain assessments, and other agricultural practices.

- Strengthen collaboration across agencies and jurisdictions to enhance opportunities for stormwater management implementation and education.
- Work towards the 40-percent phosphorus reduction target for the Western Lake Erie Basin.
- Identify high-value agricultural lands and implement innovative programs for preservation, conservation, and enhancement.

Aquatic Habitat Policy

Protect and restore aquatic habitats resulting in diverse fish population, healthy aquatic life, and enhanced recreational and economic value.

Recommended Actions:

- Reduce flow variability and improve water quality by integrating stormwater best management practices.
- Prioritize dams, perched culverts, and other road-stream crossings for retrofit, removal, or coordinated management to enhance habitat connectivity.
- Increase natural green infrastructure within subwatersheds, along shorelines, and vital riparian corridors.
- Strengthen spawning, nursery, and refuge area opportunities for aquatic species through application of woody debris, vegetation, and other structural management practices.

Invasive Species Policies

Enhance collaboration and coordination across local, state, and federal agencies, and nonprofit organizations on invasive species to identify management actions, share technical expertise, and utilize resources.

Prevent, control, and eradicate invasive species through early detection and response, research, education, public stewardship, and implementing strategic management approaches.

Recommended Actions:

- Strengthen invasive species management among CISMAs, federal, and state agencies, municipalities, nonprofits, community organizations, and private land owners. Using invasive species inventories, identify priority species and areas for targeted management efforts.
- Prevent introductions of aquatic invasive species (AIS) and minimize their presence by supporting and promoting training programs such as Clean Marina, Clean Boats, and Clean Waters.
- Expand volunteer training programs for local stakeholders that encourage identification, notification, and coordination opportunities.

Chapter 4: Infrastructure


Monroe County - I-75 bridge over the River Raisin

By the Numbers

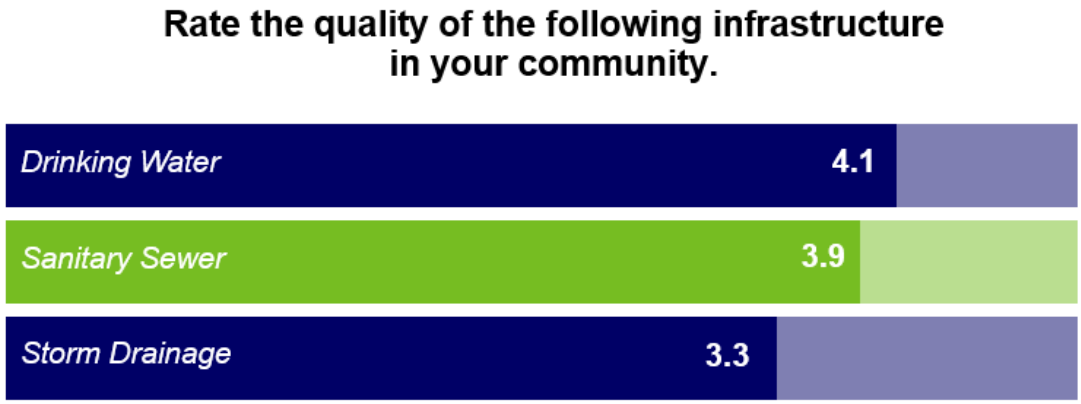
- Over 25,000 miles of public roads
- More than 2,900 bridges
- More than 13,000 road stream crossings
- Nearly 800 oil and gas extraction wells
- 377 dams
- 113 water treatment facilities
- 59 wastewater treatment plants
- 25 combined sewer overflow facilities, including retention treatment basins
- More than $1 billion invested in CSO reduction
- $4 billion gap in annual infrastructure funding

The region's water resources and quality of life are supported by infrastructure – drinking water, wastewater, stormwater and transportation. This infrastructure provides drinking water to millions of people, manages wastewater from homes and businesses, treats and conveys stormwater runoff from rainfall, and connects local and regional economies to world-class water recreational activities. Addressing the needs of these infrastructure systems, along with public and private utilities, in a strategic, cost-effective manner will protect public health, the environment, and the region's future economic growth.

Public perceptions of the quality of the region's water infrastructure remain relatively strong. However, without ongoing investment and maintenance the reliability of these systems will decline.

In a 2016 SEMCOG survey, residents ranked the quality of the region's infrastructure on a scale of 1 to 5 (Figure 12).

Figure 12
Pulse of the Region Survey Results – Infrastructure Quality



The 2018 Report Card on Michigan's Infrastructure gave the state an overall grade of D+. The report card includes specific assessments across 13 infrastructure categories, including drinking water, wastewater, stormwater, dams, and roads.[16]

Overarching Infrastructure Priorities

This chapter addresses public infrastructure that impacts the region's residents and water resources – drinking water, wastewater, stormwater, dams, and transportation infrastructure. In reviewing these topics, it became increasingly clear that these overarching priorities transcend all infrastructure topics:

- Asset management;
- Funding and financing;
- Regulatory framework; and
- Workforce development.

Addressing these priorities requires an integrated planning approach that is central to successful implementation of policies and actions throughout this plan.

Asset Management

Knowing the location and understanding the condition, criticality, and remaining useful life of the region's infrastructure are some of the first steps to work towards building a 21st Century Infrastructure System. The vast network of underground infrastructure is made up of thousands of miles of pipes and conveyance systems connected by numerous pumps, valves, tanks, and other structures. Similar information should also be evaluated for dams that are located along waterways throughout the region.

Sustaining the region's desired level of service in a strategic, cost-effective manner first requires a clear understanding of the location and condition of these assets (much of which is unknown today). This will lead to a stronger regional asset management program to support comprehensive, collaborative approaches to aligning improvements across infrastructure types. It will also enhance infrastructure and economic value in the region through coordinated decision-making.

Regulatory programs are also beginning to include asset management elements within permitting programs. It is important that the regulatory agencies work collaboratively with local and regional agencies to align priorities in asset management programs to achieve the greatest value for investment while protecting environmental and public health.

Figure 13
Asset Management

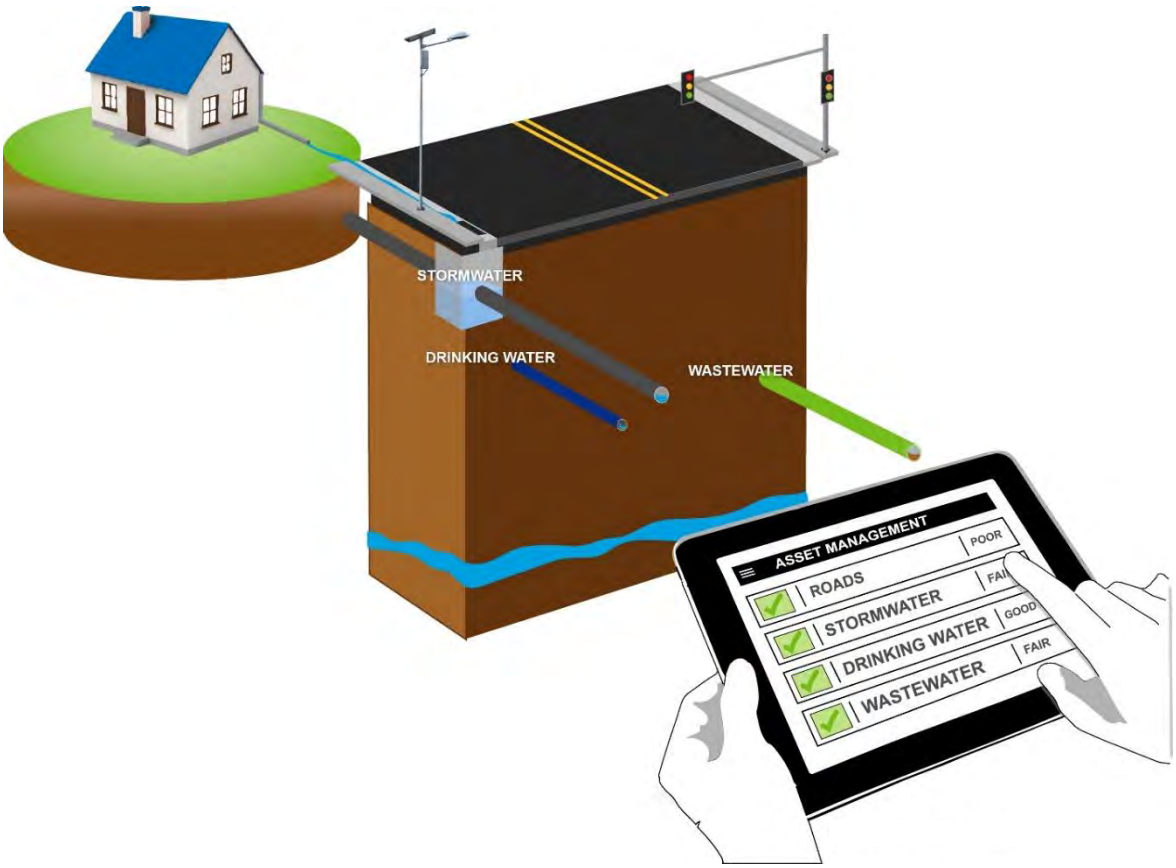


Image Credit: OHM Advisors

Case Study: Regional Asset Management Pilot

In 2017, Southeast Michigan was named one of two areas in Michigan to pilot the development of a statewide asset management program for drinking water, wastewater, stormwater and transportation systems. This program identifies challenges such as gaps in data availability, consistency in data analysis and transferability of data in current asset management programs.

It also established a baseline of information for infrastructure systems to support more informed, strategic decisions and coordinated investments. Finally, these pilot projects will estimate costs, needed training and identified best practices for developing a statewide asset management program.

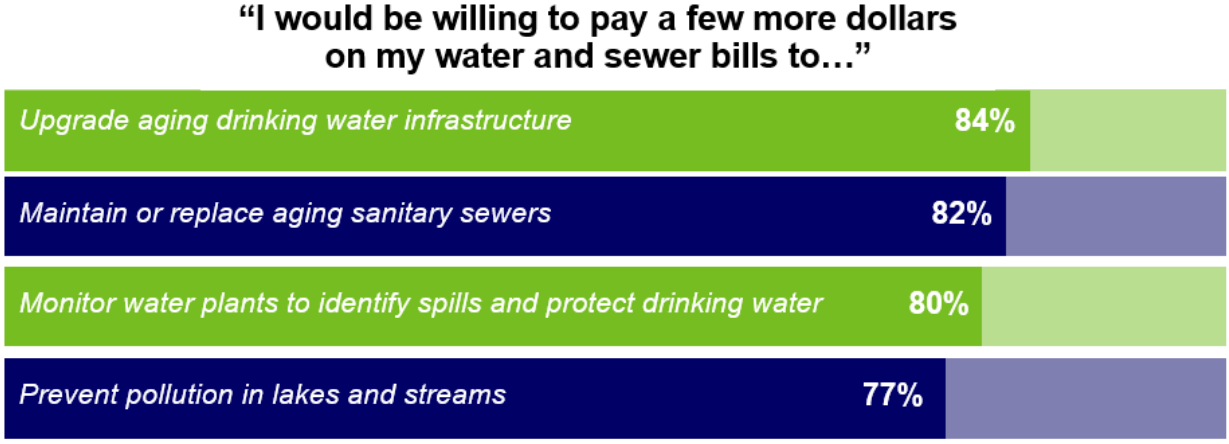
Funding and Financing

High quality, reliable, and resilient infrastructure systems are the foundation of long-term economic prosperity in Southeast Michigan. To close the $4 billion annual funding gap and bring essential funding to critical infrastructure projects, new sources of funding and financing are necessary. While state grant and loan programs work towards reducing the funding gap, they are insufficient to address water infrastructure needs. Leveraging needed investments through these multiple funding sources will build public confidence, encourage infrastructure innovation, and enhance economic value. This requires partnerships across local, county, and state agencies. SEMCOG's 2016 Pulse of the Region Survey found that the majority of residents are willing to pay a few more dollars for improved water infrastructure and to protect lakes and streams (Figure 14).

Michigan needs an estimated $4 billion annually to address the investment gap to repair and replace aging infrastructure.

Figure 14

Pulse of the Region Survey Results – Willingness to Pay

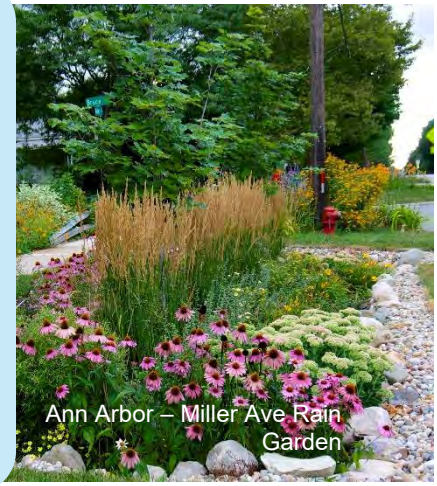


Fiscal sustainability in infrastructure systems is also reliant on the public's willingness and ability to support the true cost of service. It is important to keep in mind that while much of the public is willing to pay more to improve water infrastructure, there are residents where water affordability is an issue. Programs such as the Great Lakes Water Authority's Water Residential Affordability Program (WRAP) can provide needed relief. WRAP provides water utility assistance to eligible low-income customers of the GLWA focusing on bill assistance, conservation, and self-sufficiency initiatives.

State programs must also establish funding approaches to address privately owned critical water infrastructure needs. Linking funding opportunities to asset management programs will ensure that limited resources are spent strategically, efficiently, and in a coordinated manner.

Case Study: Leveraging Multiple Investment Sources

The Washtenaw County Water Resource Commissioner's office (WCWRC) participates in the City of Ann Arbor's annual capital improvement planning process for stormwater infrastructure projects. Through this process, multiple sources of funding, including local, county, and state programs are leveraged to implement infrastructure improvements within the city. Sources of funding include Ann Arbor's stormwater utility, rates and millages, the EPA Green Project Reserve, and the state revolving fund loan program. This holistic approach supports identifying high-priority capital improvement projects that will improve the level of service in a cost-effective manner.


Ann Arbor – Miller Ave Rain Garden

Regulatory Framework

The regulatory framework for state infrastructure is primarily guided by laws and regulations established at the federal level. Michigan has the authority to implement federal regulations through state regulatory and permitting programs; in some cases, establishing more stringent regulations than the federal government.

Regulatory programs and permit requirements should be based on sound scientific data and analyses directly benefitting public health and the environment. As regulatory agencies encourage multi-disciplinary approaches to addressing water resource challenges, it is critical that these agencies implement similar approaches through environmental regulations.

This is not accomplished through individual "silo-based" permitting programs, but rather through coordination across infrastructure systems, using alternative, flexible approaches to achieve water resource goals. This emphasizes the importance of strengthening strategic partnerships across local and state agencies to expand integrated planning approaches for infrastructure systems. Regulatory programs that unintentionally allocate significant investments towards one infrastructure issue are contrary to the principles of integrated planning and asset management.

Implementing state mandated water resource regulatory programs often involves changes in the regulatory structure at the local level, including updates to local plans and codes and ordinances. It is important for local programs to be flexible in approaches to achieving water resources and infrastructure goals.

Workforce Development: Leaders of the Future

A 21st Century infrastructure system is not complete without attracting, recruiting, and retaining talent in the water industry. Unlike many job sectors, the water industry has extensive opportunities for people with all educational backgrounds, from high school to post-secondary education. Additionally, each water infrastructure sector has multiple fields of job opportunities, including planning, design, engineering, construction, maintenance, security, and finance.

Strengthening workforce development and training in the region also includes educating elected officials, rate payers, and investors on the critical role this industry plays in the region's economy. Quality water infrastructure directly supports the economic and recreational opportunities that residents seek in their communities. Establishing a system for training, education, certifications, licensing, continuing education, and promotions should form the basis for all water infrastructure operations. Highlighting local infrastructure successes and recognizing employee achievements also helps in retaining talented staff in this industry.

Workforce Development Training; Courtesy of MWEA

Case Study: MWEA and MI-AWWA Workforce Development

The Michigan Water Environment Association (MWEA) provides over 60 conferences and training courses annually for more than 2,000 wastewater and stormwater professionals. By bringing together a diverse group of individuals whose careers involve the water environment and who have similar objectives from a variety of backgrounds, MWEA provides a forum for all water environment topics.

The American Water Works Association (AWWA) provides professional development, establishes standards and best practices, supports innovative research, and advocates for policies and regulations that allow water utilities to best safeguard public health. The Michigan Section of the American Water Works Association (MI-AWWA) is focused on providing training to ensure that the water and wastewater utility workforce is properly prepared to acquire and maintain required operator licensing. More than 2,100 drinking water utility professionals annually receive their professional development through MI-AWWA trainings and conferences. Through its dynamic seminars, standardized courses, and new Michigan Water Academy ®, MI-AWWA helps water utility professionals understand and comply with state and federal regulations and be strong stewards of public health.

Many local governments have established training and certification opportunities within their public services departments. Often they rely on water sector organizations, such as the Michigan Water Environment Association (MWEA) and the American Water Works Association (AWWA) to provide additional workforce development opportunities. The State of Michigan also oversees certification and licensing requirements for drinking water distribution systems, wastewater collection systems, and professional engineers. Coordinated efforts across local, regional, state, and water sector organizations will increase and retain the talent required to achieve a 21st Century infrastructure system in Southeast Michigan.

The remainder of this chapter outlines the region's core infrastructure issues for drinking water, wastewater, stormwater, transportation, and oil and natural gas infrastructure.

Drinking Water

Southeast Michigan's drinking water sources include both surface water and groundwater, with most of the region being served by water from the Huron-to-Erie Corridor through 14 different water treatment facilities. The Great Lakes Water Authority (GLWA) is the major water supplier in Southeast Michigan serving 127 communities and nearly four million customers.

Another drinking water supply example is the City of Ann Arbor's water treatment plant, which draws 85 percent of its water from the Huron River and 15 percent from groundwater sources to provide water to approximately 125,000 people in Ann Arbor and parts of surrounding communities.[28] Public drinking water in Livingston County is provided through multiple public entities serving portions of the county through groundwater wells. The number one priority of all drinking water suppliers – both authorities and communities – is to protect the public health of their customers.

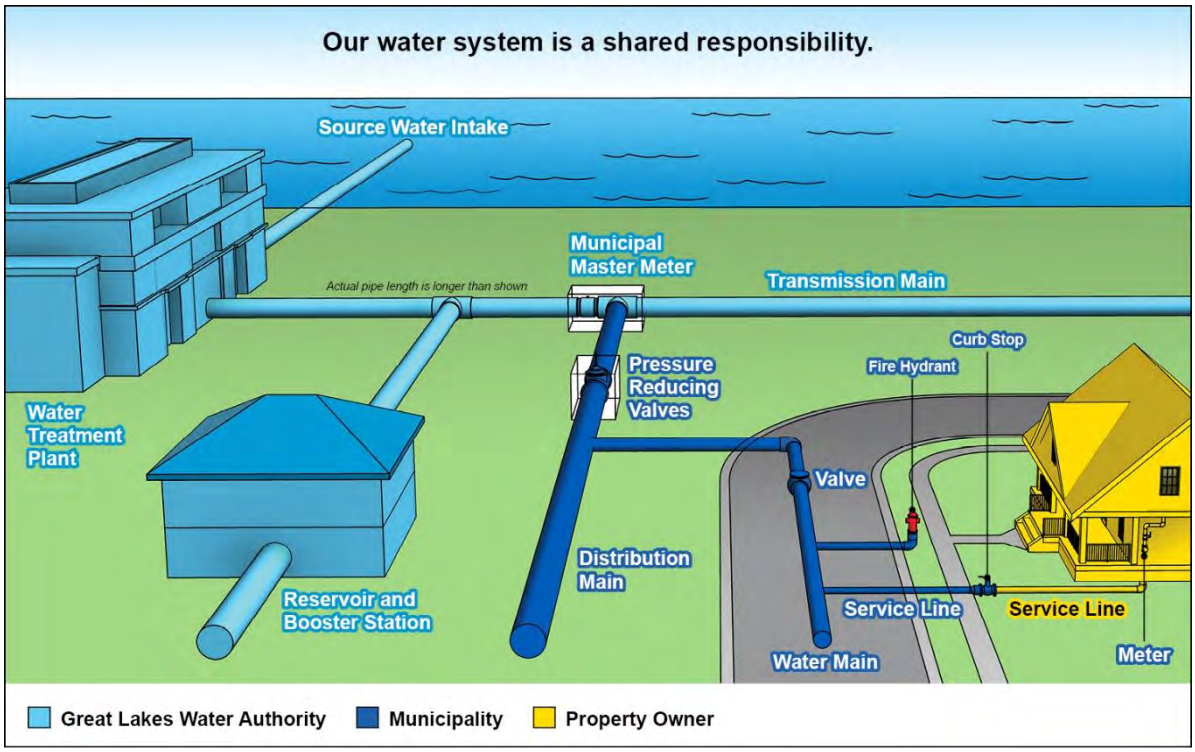
Detroit – Water Works Park

51% of respondents of SEMCOG's Pulse of the Region Survey believe it is most important to invest in drinking water infrastructure systems for future generations

A community water system is fed through a distribution system. Source water, either surface water or groundwater in Michigan, is pumped to a water treatment plant, goes through a treatment process, and is pumped out to the distribution system through transmission mains, storage tanks, and booster pump stations. From the transmission system, individual communities pull water into their local distribution water mains.

From there, individual water customers, like residents or businesses, are provided water through small service lines. Generally, the service line from the local distribution system is owned by the property owner. Service lines also provide water from the distribution system to fire hydrants (Figure 15).

Figure 15
Drinking Water Distribution System



Source: Great Lakes Water Authority

In many areas in Southeast Michigan, property owners obtain water from private drinking water wells rather than through a public drinking water supplier. Private groundwater wells are generally located in more rural areas of the region, but are also sporadically located in some of the more urban areas. Figure 16 shows the approximate public drinking water service areas for the region.

Source Water Protection

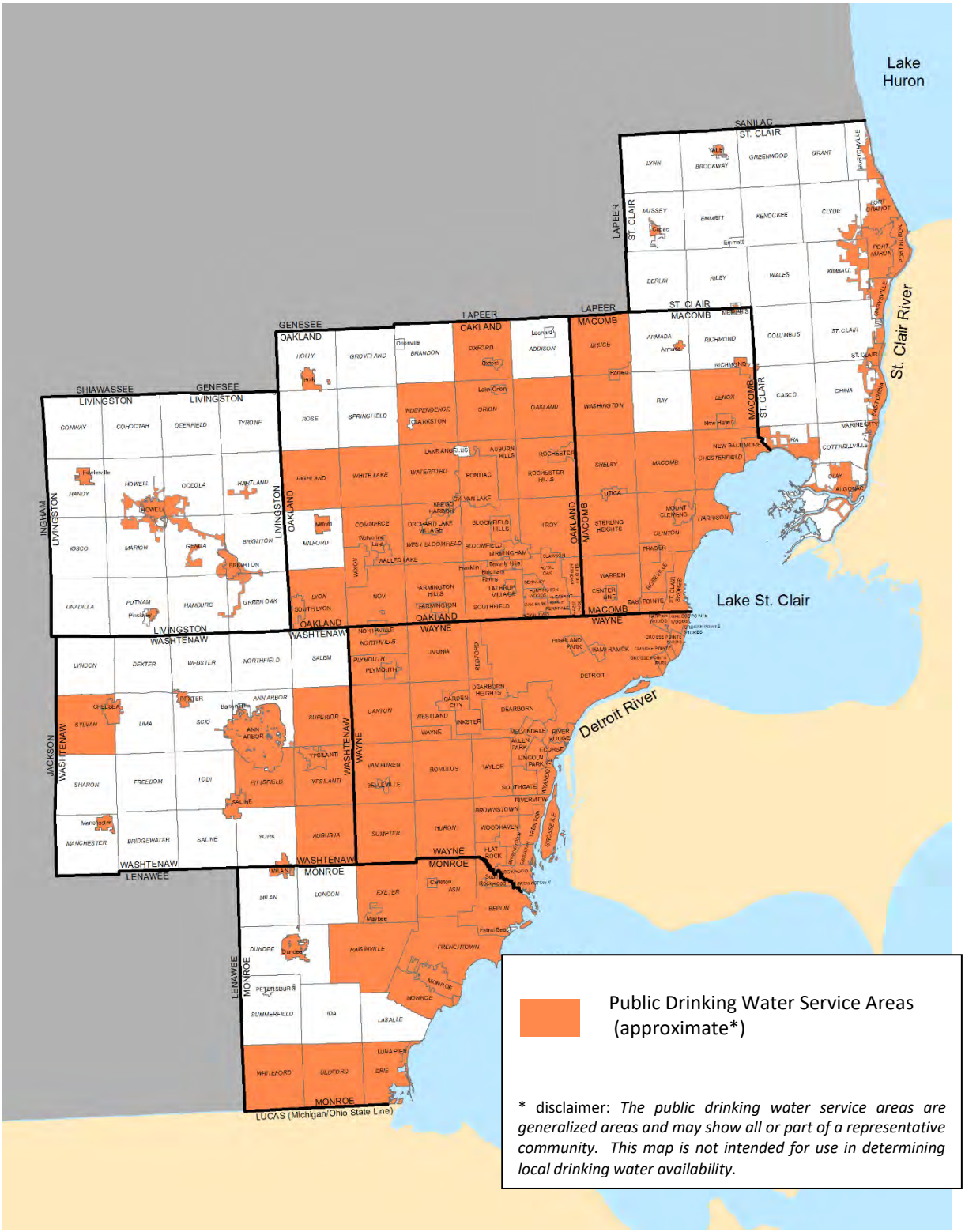
Surface Water Systems

Drinking water service providers are responsible for providing clean and safe water. In Southeast Michigan, the valuable Huron-to-Erie water resource corridor is used for many purposes, including shipping, industry, and recreation. The risks associated with accidental spills, stormwater runoff, and the presence of algal blooms make it essential to protect this source water from contamination. For example, approximately 40 percent of Canada's chemical industry is located in Sarnia, Ontario.[29] In 2014, algal blooms caused the drinking water treatment plant in Toledo, Ohio to shut down. Over 500,000 people were without access to drinking water for two days causing a roughly $65 million impact.[30]

Many water treatment plants actively monitor the source water for potential contaminants. In early 2018, the State of Michigan announced a partnership with SEMCOG and the water treatment plants to enhance monitoring along this corridor.

Figure 16

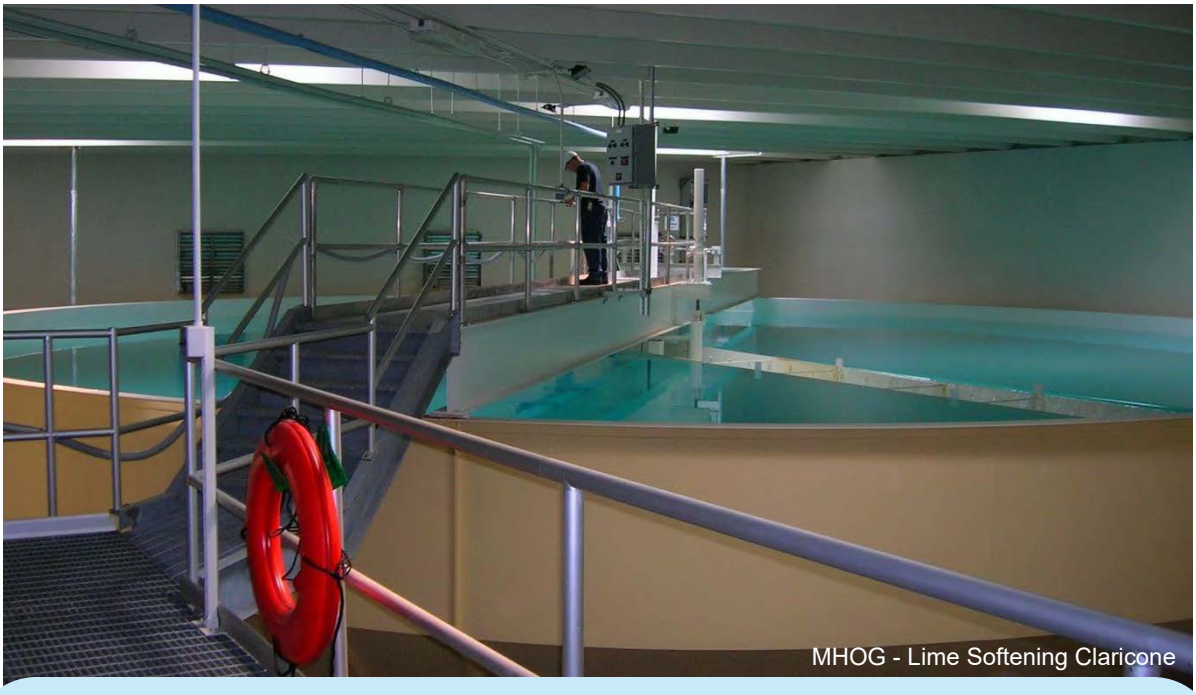
Drinking Water Service Areas in Southeast Michigan



Source: Michigan Department of Environmental Quality and public water service providers.

Groundwater Sources

It is also important to monitor areas that rely on groundwater in wellhead protection areas. In areas where there are public drinking water wells and treatment plants, monitoring enables identification of contaminants that may be coming through the groundwater. Currently, there is no continued monitoring or oversight on small, privately-owned, public water supply wells; or private, individual home wells. It is estimated that Michigan has over two million improperly abandoned water wells, which can disrupt the proper use of and lead to contaminated groundwater aquifers.[31]



MHOG - Lime Softening Claricone

Case Study: The Marion, Howell, Oceola, and Genoa (MHOG) Utility Department

Livingston County is the only county in the region with groundwater as the sole drinking water source. Drinking water is provided through privately-owned drinking water wells and publicly-owned water treatment facilities. The MHOG Utility Department operates two groundwater treatment systems, the MHOG Water Treatment Plant (MHOG Sewer & Water Authority) and the Oak Pointe Water Treatment Plant (Genoa Township); two water distribution systems with over 800,000 linear feet of water main; eight water towers; and five booster stations serving a population of over 16,000. In groundwater treatment facilities, water softening is a common priority, unlike surface water treatment facilities.

The largest groundwater withdrawals in the state are for agricultural irrigation. As the demand for high-capacity irrigation wells increases, the likelihood of interference with domestic wells and surface water systems also increases. Properly managing both irrigation and domestic wells and allowing for adequate groundwater recharge is an increasingly important issue for the state.

Water Distribution Systems

Much of Southeast Michigan's underground water infrastructure was installed in the early-to-mid-20th Century. These pipes have a lifespan of approximately 75-100 years, meaning that many are nearing the end of their useful life. As technologies in water infrastructure have improved, new materials have been developed for use in drinking water systems. Today, many drinking water systems are made with ductile iron or high-density polyethylene.

Farmington Hills - Water main break

In addition to dated materials, many communities are experiencing high numbers of water main breaks and broken or inoperable valves, both of which can cause significant water loss, property damage, and pressure or fire protection issues. Aging pipes, outdated materials, and potential harmful components are cause for an increased effort focused on infrastructure management and replacement. All of these challenges increase the financial burden on inadequately funded systems.

The Governor's 21st Century Infrastructure Plan emphasizes a renewed effort to replace aging and failing infrastructure systems – including drinking water distribution – using new technologies, sustainable funding, and an integrated approach with all underground systems. One challenging piece of this integrated infrastructure approach is to balance the need for making decisions based on aging and failing material with the need to target improvements, such as the replacement of lead and copper service lines. New infrastructure regulatory programs must align with the 21st Century infrastructure approach based on fundamental asset management principles.

Lowering peak demand for drinking water has been a priority for water suppliers and many communities in the region, as the costs of building a system to address peak periods of demand is high. This is generally accomplished with new infrastructure and public education programs. New drinking water storage tanks or elevated water towers allow a community to store water for use during high-demand periods, especially weekday mornings. Operating a water system in this way lowers water costs to communities, while also

reducing pumping efforts leading to reduced energy costs. This translates to an economic benefit for the final consumer.

In addition to lowering the peak demand from the water supplier, several communities have had success with lowering the overall water demand through public education campaigns. For example, many communities encourage or have implemented irrigation ordinances to require alternate lawn watering days and specific watering hours for residents.

Case Study: Northville Township Water Tower

Northville Township installed a 1-million-gallon elevated water tower in 2008 at a cost of approximately $1.7 million. The tank was initially installed to help improve water pressure in part of the township but, since that time, has helped to significantly reduce peak water demand.

With more recent pump improvements at the booster station that fills the tank, plus operational changes, peak hour demand has gone from what was projected in 2008 to be 19.1 million gallons per day (MGD) has decreased to 13.8 MGD in 2018. These combined infrastructure improvements, operational modifications and the implementation of the lawn irrigation ordinance have resulted in approximately $1.8 million per year in savings to the township.

Wastewater

Southeast Michigan is served by publicly- and privately-owned wastewater collection and treatment systems, which include combined and separated sanitary sewer collection systems and onsite sewage disposal systems (septic systems). Approximately eight percent of the region is served by combined sewer systems (Figure 17). All other areas of the region have separated sanitary sewer or onsite sewage disposal systems.

Case Study: Great Lakes Water Authority Wastewater Master Plan

Work on the Great Lakes Water Authority's Wastewater Master Plan (WWMP) began in 2017 with a regional steering team. The comprehensive study will chart the course for GLWA's wet weather control program, as well as provide a roadmap for the continued transformation of the Wastewater Treatment Plant into a Water Resource Recovery Facility. The WWMP will identify operational and capital improvements to achieve the following outcomes:

1. Protect public health and safety
2. Preserve natural resources and a healthy environment
3. Maintain reliable, high-quality service
4. Assure value of investment
5. Contribute to economic prosperity

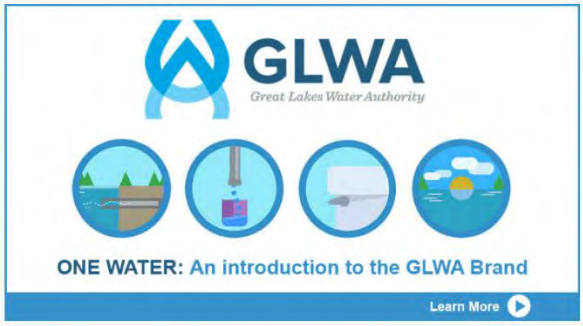
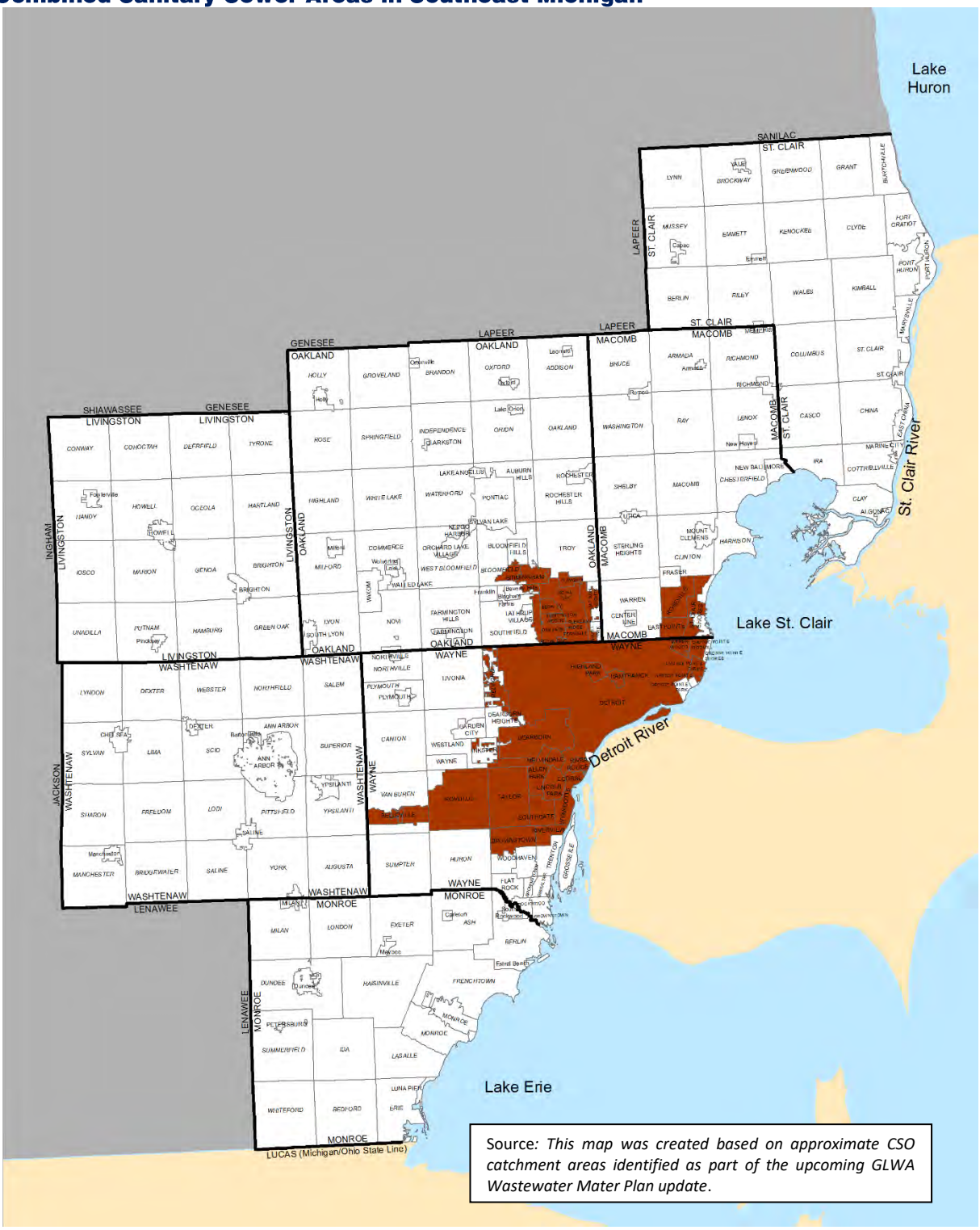


Figure 17

Combined Sanitary Sewer Areas in Southeast Michigan



Separated Sanitary Sewer Collection Systems

A separated sanitary sewer system has two different pipe systems – one for wastewater and one for stormwater. The wastewater from sinks, toilets, showers, and other drains within a home or business is collected in sanitary sewers and sent to a wastewater treatment plant. Stormwater runoff from rain events is collected and conveyed through stormwater infrastructure such as storm drains, roadside ditches, enclosed stormwater pipes, culverts, and many best management practices like detention basins and rain gardens. Unlike sanitary wastewater, stormwater runoff is not treated, but ultimately flows into our region's rivers, lakes, and streams.

Sanitary sewer collection systems address many challenges related to capacity, maintenance, and asset management. Sanitary sewer overflows (SSOs) occur when the sanitary sewer has reached capacity and the wastewater backs up into the system, onto streets, or into local waterways. SSOs are primarily caused by groundwater and stormwater entering the sewer network.

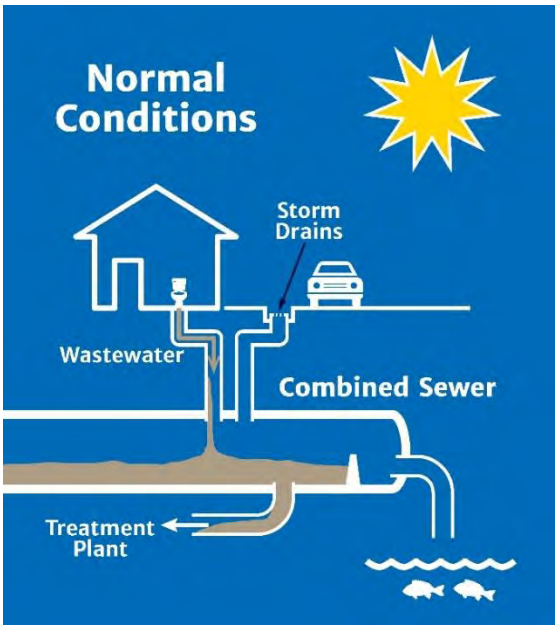
One partial solution to addressing SSOs is through Capacity Management Operations and Maintenance (CMOM) regulatory programs. The goal of these programs supports asset management approaches and is intended to help manage, operate, and maintain collection systems more efficiently; investigate bottlenecks in systems; and allow prevention and quick response to potential overflow situations. At the same time, it is important that any new regulatory requirements are accompanied by financing mechanisms to support local implementation.

Combined Sewer Collection Systems

In a combined sewer system, both wastewater and stormwater runoff are collected in the same infrastructure system. During certain rain events, stormwater takes up capacity in the sewer, causing the combined sewage to back-up into basements and overflow into rivers, lakes, and streams. Addressing combined sewer overflows is a priority for the region with respect to wastewater infrastructure. Figures 18 and 19 display the impacts of CSOs in both normal and heavy rain event scenarios.

Figure 18

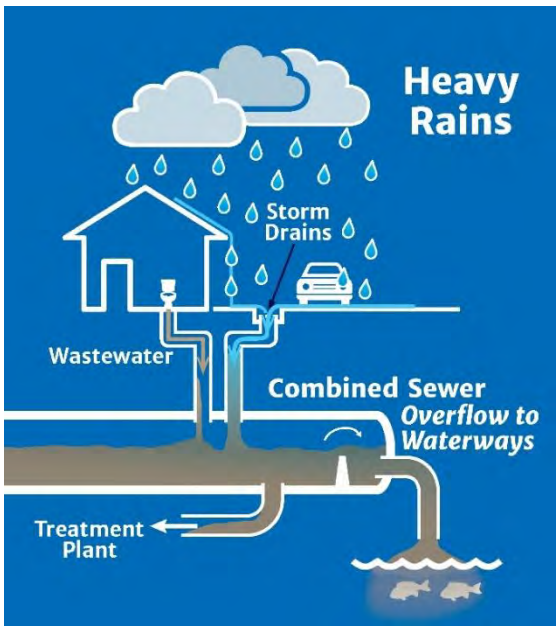
Combined Sewer System under Normal Conditions



Source: DWSD

Figure 19

Combined Sewer Overflow during Heavy Rains



Source: DWSD

Since 1988, the number of uncontrolled CSOs in the region has declined from 310 to 76. The 23 remaining suburban CSOs will be corrected by 2025, along with a goal to correct high-priority outfalls in the City of Detroit by 2037.[32]

Retention treatment basins (RTBs), also known as retention treatment facilities, are common infrastructure methods used to address CSOs. They are designed to collect excess combined sanitary sewage and stormwater runoff during heavy rain events. They usually have screens or skimming equipment, a storage basin for settling, and disinfection equipment. They are designed to meet standards under the National Pollutant Discharge Elimination System (NPDES). There are approximately 25 combined sewer overflow treatment facilities in the region, including RTBs.

Case Study: George W. Kuhn Retention Treatment Basin (RTB)

The George W. Kuhn Drainage District serves 14 communities, encompassing a 24,500-acre drainage area upstream of the Red Run Drain, a tributary of the Clinton River. Generally, wastewater is routed to the Detroit Wastewater Treatment Plant but, during heavy rainfall, high volumes of combined sewage are diverted to the RTB where it is stored, screened, and disinfected prior to discharge to the Red Run Drain. The original facility, built in 1972, was expanded in 2006 to accommodate 124 million gallons of combined sewage. The RTB now reduces overflows by approximately 875 million gallons a year, protecting water quality downstream.


George W. Kuhn RTB, Courtesy of Oakland County


Milliken State Park – Green Infrastructure treating excess stormwater

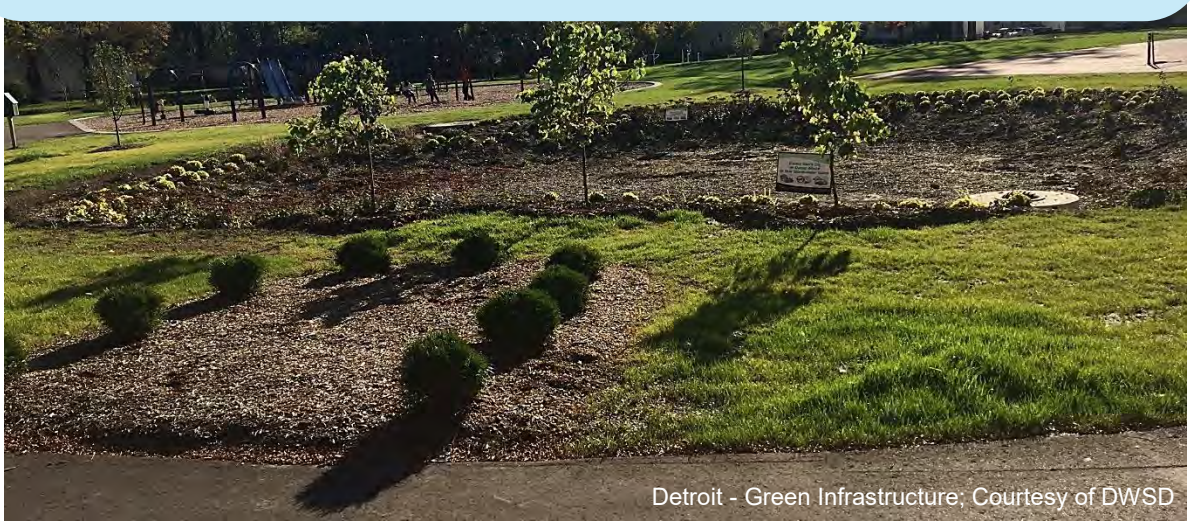
Other methods of managing excess combined sewer flows include the use of green infrastructure. While the large RTBs provide significant storage, green infrastructure reduces the amount of stormwater entering the system and is an important tool for managing combined sewer systems. With projections of increasing precipitation, these infrastructure systems will not be able to handle the quantity and intensity of runoff that exceeds the design capacities.

Managing impervious surfaces with green infrastructure can reduce that excess stormwater volume, while also providing water quality, social, and economic benefits. Disconnecting downspouts, footing drains and other direct stormwater inputs from combined sewer systems can free up capacity in the collection system, reducing the likelihood of an overflow or basement backup.

Case Study: Detroit Water and Sewerage Department (DWSD)

DWSD uses green infrastructure as part of its CSO program in the northwest portion of the City of Detroit. Comprising approximately 27 percent of the city, this 37-square-mile area currently has 17 uncontrolled CSO outfalls. Managing stormwater close to its source of origin provides a unique opportunity to foster sustainability and improve the lives of residents. Green infrastructure has the potential to reduce treatment costs, basement backups, street flooding and untreated overflows into local waterways, while also improving the local environment by beautifying and stabilizing neighborhoods.

This program has resulted in over 7,000 planted trees, more than 1,000 homes demolished and restored with vegetation, and 10 green infrastructure projects constructed in parks and along roadways. These efforts have resulted in more than 1,400 acres managed with green infrastructure, which equates to more than 44 million gallons of stormwater removed from the combined sewer system annually.



Detroit - Green Infrastructure; Courtesy of DWSD

Onsite Sewage Disposal Systems (OSDS)

A third type of system used in more rural areas is Onsite Sewage Disposal Systems (OSDS). These are small-scale treatment systems often used for individual properties. The most common OSDS is a septic tank and drain field combination. As these systems age, and the property changes ownership, it can be difficult for communities to determine if the systems are working properly. Common signs of residential drain field failure include oversaturated ground areas that are devoid of any grass as shown in the photo on the right.

Failing septic system

A 2015 Michigan State University study found that OSDS in Michigan are failing to prevent human fecal bacteria from entering the state's waterways. The research correlated high fecal bacteria in rivers to more

septic systems in the watershed.[32] MDEQ estimates that there are approximately 130,000 failing OSDS currently in use. Michigan is the only state in the country without a uniform septic code.

Michigan has developed a statewide E.coli Total Maximum Daily Load (TMDL) to address multiple sources of E. coli entering rivers, lakes, and streams in Michigan.

To improve the condition of OSDS, many counties in the region have adopted time-of-sale ordinances in order to inspect the OSDS. Additionally, strengthening maintenance programs and the availability of septic tank sludge (septage) receiving stations also reduce water resource pollution.

Livingston County Septage Receiving Station

Case Study: Livingston County Septage Receiving Station

Livingston County operates and maintains a state-of-the-art septage receiving station in Hartland Township. Septage haulers use this facility to discharge the collected waste. This wastewater is collected in the enclosed facility and conveyed to the Linden District 3 wastewater treatment plant.

Livingston County banned land application of septage in 2007 and has since reduced land application of septage by over 12 million gallons annually. Not only has this significantly reduced the potential for surface and groundwater contamination, but has increased public awareness on the importance of OSDS maintenance has improved. Today, this facility takes over 25,000 gallons of septage from five counties in Southeast and Southcentral Michigan.

Wastewater Treatment Facilities

There are approximately 59 Wastewater Treatment Plants (WWTPs) in Southeast Michigan. These facilities treat and disinfect wastewater before discharging to local waterways. Many of these facilities are transitioning to being recognized as water resource recovery facilities (WRRFs) by including other operations such as recovering nutrients, generating energy, and integrating green infrastructure. WRRFs have additional positive impacts on the region's environmental, economic, and social outcomes.

One of the operational elements at wastewater treatment plants is to limit the nutrient loading into local waterways. Excess nitrogen and phosphorus can lead to algal blooms, significantly impacting the health of the water body. The Western Lake Erie basin has experienced severe algal blooms over the past several years. Addressing nutrient loading to local waterways has been a state priority since the 1960s.While the state has focused on multiple avenues to reduce nutrient loading, a significant milestone has been achieved in the Detroit River. With a goal of reducing 506 metric tons of phosphorus annually in the Detroit River, the state estimates that over 95 percent of that target reduction has been achieved since 2008. A significant portion of the phosphorus reduction is due to modifications at the GLWA WRRF.[33]

Detroit – Water Resources Recovery Facility

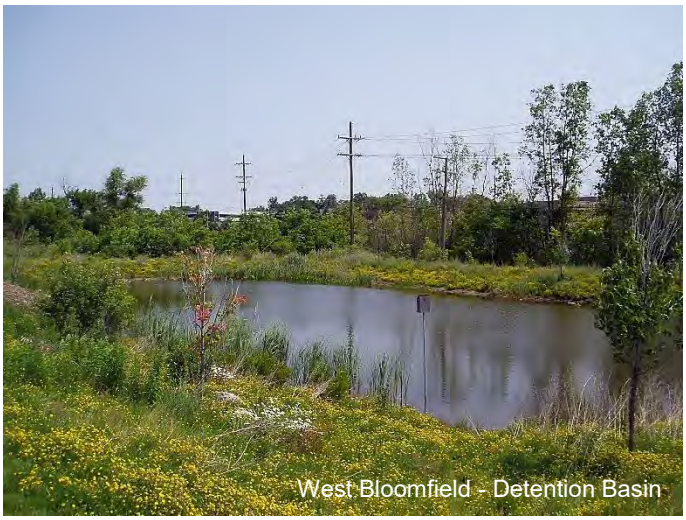
Case Study: GLWA Water Resource Recovery Facility

As the largest single-site wastewater treatment facility in the United States, the GLWA Resource Recovery Facility services 35% of the state's population. Within Southeast Michigan, the facility's service area covers over 946 square miles, including the City of Detroit and 76 other communities. In 1999, the Michigan section of the American Society of Civil Engineers named the Wastewater Treatment Plant one of the top 10 engineering projects of the 20th Century.

Stormwater

Stormwater infrastructure in Southeast Michigan is comprised of a variety of systems and management practices all designed to manage runoff from small and large rain events. Stormwater runoff is collected and conveyed through storm drains, roadside ditches, enclosed stormwater pipes and culverts. Many best management practices (BMPs) are designed to manage varying sizes of rainfall events. Ultimately, stormwater runoff flows directly into the region's rivers, lakes, and streams as represented by the local watershed boundaries (Figure 1). Stormwater infrastructure plays a critical role in enhancing the local environment and protecting public health.

Conveying runoff away from private property, buildings, and roadways to minimize local flooding and property damage is a primary role of stormwater infrastructure. Improving the quality of water resources includes integrating a variety of BMPs throughout a watershed to address the specific water quality challenges. BMPs can range from large detention basins to smaller constructed green infrastructure techniques, such as grow zones, rain gardens, and bioswales. Natural green infrastructure, such as wetlands, woodlands and riparian corridors, also provide significant stormwater management benefits. In Southeast Michigan, many local agencies are implementing smaller scale green infrastructure projects, such as native plant grow zones and tree planting projects.



West Bloomfield - Detention Basin

Green Infrastructure

Luna Pier – Bioretention

Green infrastructure can be both natural and constructed. Natural green infrastructure includes wetlands, woodlands, riparian corridors, and other natural resources that promote infiltration and detention of water resources. Constructed green infrastructure includes rain gardens, bioswales, and other bioretention systems.

With projections of increasing precipitation, these infrastructure systems will not be able to handle the quantity and intensity of runoff that exceeds the design capacities.

The amount of stormwater runoff in a watershed increases with the amount of impervious cover. Paved streets, parking lots, and rooftops prevent traditional filtering into the ground causing an increase in the amount of runoff during small and large rain events. Runoff also picks up pollutants such as sediment, fertilizers, oil, grease, and bacteria from the land. This is called nonpoint source pollution.


Detroit – Roadway stormwater runoff

The excess runoff and nonpoint source pollution degrade local water resource conditions leading to a significant decline in recreational use. In fact, impacts can range from localized flooding to beach closures and algae blooms. Other impacts can include reductions in water resource habitat and diverse fish populations. Stormwater management plays a critical role in addressing all of these challenges to protect public health and improve the quality of local water resources.


Nonpoint Source Pollution

The complicated network of stormwater management infrastructure in the region is accompanied by a diverse set of jurisdictional agencies responsible for design, construction, and maintenance. Many of these agencies work towards similar goals, but also have unique stormwater management challenges. For example, a typical community in the region will have multiple entities responsible for stormwater management, including the local jurisdiction, the water resource commission, county road commission, the State of Michigan, and private property owners.

The *1999 Water Quality Management Plan* focused significantly on the importance of watershed planning. Since then significant progress has been made to address stormwater challenges on a watershed basis. Watershed organizations, local partnerships, and SEMCOG spearheaded efforts to manage imperviousness, reduce stream flashiness, and address localized flooding. Many of these achievements are summarized in Appendix B. This watershed framework continues to influence collaborative decision-making; however, stormwater management has evolved to recognize the importance of addressing stormwater runoff at the source.

Sustainable stormwater management solutions are integral to maintaining the high standard of living and quality of life that residents enjoy in Southeast Michigan. Ongoing stormwater infrastructure management challenges include addressing changing precipitation patterns and ensuring resiliency of infrastructure systems; managing runoff from existing impervious surfaces such as parking lots, transportation corridors and institutional properties; eliminating nonpoint source pollution, removing point source pollution sources, such as illicit connections; improving stormwater maintenance programs; and enhancing public awareness.

Evolution of Stormwater Infrastructure


Southfield – Bioswale at Inglenook Park

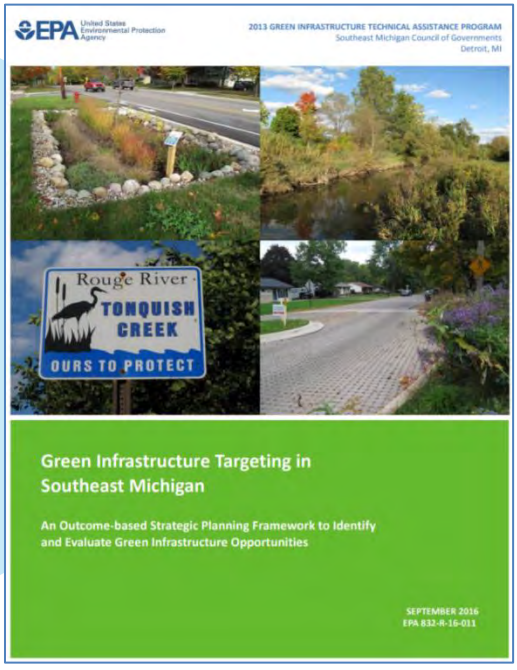
In the early 1900s stormwater was conveyed in pipes with sanitary sewage, called combined sewers. As development progressed across the region, stormwater was collected and conveyed in large pipes and open drains to local waterways. Many of the streams were straightened in an effort to convey large quantities of runoff from agricultural areas. Flood control techniques, such as detention basins, became more common in the 1980s. This transitioned to including water quality measures.

More recently, management techniques stress the importance of infiltrating stormwater at its source with green infrastructure. This decentralized approach, when applied across urban watersheds and in combination with wetlands, woodlands, and riparian corridors, has the potential to significantly work towards achieving water resource goals and recreational opportunities.

Managing stormwater runoff from existing impervious surfaces continues to be recognized as a high priority for all stormwater management programs. While significant progress has been achieved through implementation of local stormwater ordinances and updating post-construction standards to address new development and some redevelopment, challenges remain. Often, existing impervious cover from large parking lots; transportation corridors; and institutional, commercial, and residential properties are not considered in these stormwater programs. Grant funding has facilitated construction of best management practices to retrofit existing areas. However, addressing these runoff challenges requires working collaboratively across jurisdictions during capital improvement planning, transportation planning, and other infrastructure planning opportunities. This includes evaluating subwatersheds in a more detailed manner to determine the extent of runoff management required and to align capital improvement programming across all infrastructure types to achieve water resource goals.

Case Study: Identifying and Evaluating Green Infrastructure Opportunities

Green Infrastructure Target Setting in Southeast Michigan establishes a framework to estimate how much green infrastructure area is needed to work towards meeting water quality standards. This study used USGS flow gage data, macroinvertebrate monitoring data, land use, and land cover to determine how much green infrastructure area is needed to reduce stormwater runoff volume and stream flashiness to a level that will support macroinvertebrate populations.



Grow Zone; Courtesy of Wayne County

Case Study: Wayne County Green Infrastructure: Grow Zones and Trees

Wayne County has transformed over 50-acres of property turf grass to native plant grow zones along the Rouge River parkway corridors. These grow zones reduce stormwater runoff from impervious areas, such as parking lots and roads. Additionally, over 2,000 trees have been planted on county property and property owned by Alliance of Downriver Watershed member communities. Location selection for many of these greening projects was guided by SEMCOG's *Green Infrastructure Vision*, including road right-of-way areas, conservation and recreation lands, and those communities with less than 20 percent tree canopy.

Grow zones increase infiltration of rain, reduce pollution, and costs to maintain. Opportunities for grow zones exist at community parks, municipal buildings, and commercial developments. Wayne County has realized cost benefits of over $1 million from reduced landscaping and stormwater infrastructure maintenance with an annual cost savings of approximately $100,000. Additionally, aquatic diversity within river corridors has improved as evident through biological monitoring.

Green infrastructure that is designed to retain rainfall from a 1-inch event will manage 85% of the annual runoff volume and make significant strides towards achieving water quality standards and diverse biological communities in local water resources.[34]


New Baltimore – Walter & Mary Burke Park Rain Garden

Nonpoint source pollution is an ongoing challenge in combination with managing excess stormwater runoff. While stormwater best management practices (BMPs) also reduce this pollution, illicit connections and discharges are often distinct point source challenges across watershed areas. Illicit discharges can sometimes include accidental connections of building sewer leads to stormwater infrastructure resulting in discharges of raw sewage to local streams.

Implementation of Illicit Discharge Elimination Programs has resulted in the removal of 4,500 illicit discharges that contributed nearly 600 million gallons of untreated sewage per year.[35]

Runoff containing high levels of nutrients from fertilizers may also contribute to local and regional challenges with algal blooms. Different types of algal blooms can show up in small ponds and in the Great Lakes, a common occurrence in the Western Lake Erie Basin. Sources of nutrients can include all land use types – residential, commercial, industrial, and agricultural. Continuing to prioritize and surveying areas for these sources of pollution is an ongoing priority for all local agencies.


Canton Township – Catch basin cleaning

Improving stormwater inspection and maintenance programs will ensure long-term operation of stormwater infrastructure systems. This includes both publicly- and privately-owned conveyance and best management practices.

Maintenance of stormwater infrastructure can traditionally include cleaning catch basins and ditches that are located along roadways. Best management practices, such as detention basins and rain gardens are commonly the responsibility of private property owners. Guidance for property owners is necessary to ensure long-term reliable operations. One such example is the *Alliance of Rouge Communities' Maintaining Your Detention Pond: A Guidebook for Private Owners in Southeast Michigan*, which provides a "how to" guide for maintaining detention basins.

The challenges of managing stormwater runoff, eliminating nonpoint source pollution, strengthening maintenance programs and enhancing public awareness will require increased collaboration, alignment of plans and programs, and identification of priority project areas throughout the region. Public

awareness and education is an integral element of all these programs. Most importantly, a dedicated funding source for stormwater infrastructure programs is critical to continue addressing these challenges.

Additionally, climate resiliency and the importance of addressing changing precipitation patterns is described in detail in Chapter 5, Integrated Water Resources Management. As local, regional, and state agencies implement climate resiliency policies and actions, it is important to follow through with updates to local stormwater management policies, plans, and ordinances with the most accurate precipitation frequency estimates for stormwater infrastructure design. These updated standards should also incentivize the preservation and construction of green infrastructure to achieve stormwater volume reduction goals.

Dams

There are 377 recorded dams within southeast Michigan primarily built between the times of European settlement and the middle of the last century. At that time their purposes were primarily focused on power generation and water supply. Today, many dams serve as recreational reservoirs with few producing hydropower. Local governments, the State of Michigan, and residents own most of the dams.

Like all infrastructure, dams require inspections, maintenance and investments to ensure ongoing safe operation. The majority of dams in southeast Michigan exceed the recommended 40-year lifespan of the American Society of Civil Engineers. While some dams have regular inspections and maintenance, there are many that do not require inspection or the maintenance has been deferred due to lack of resources.[36]

Case Study: The Huron River Dams Network

This collaborative partnership formed to connect dam operators and owners throughout the Huron River Watershed, while piloting environmental flow recommendations to reduce the impacts of dams and climate extremes on the river. Managing in-stream flows is important to reducing economic losses from flooding and impacts to the river ecosystem. The Huron River has 17 dams in place on the main stem of the river, owned and operated by nine different entities.

Dams operate to achieve multiple goals including recreation, maintenance of lake levels, and production of hydropower. Operators adjust dam structures to respond to changes in flow upstream. There are a few stream gages throughout the watershed, but not enough to efficiently coordinate all flow conditions. The network has acquired several real-time water level sensors that increase understanding of the flow implications of dam operations and precipitation events. Coordinated dam management will decrease the impacts of dams on the river ecosystem and improve preparedness for extreme rainfall events and drought.

Barton Dam; Photo courtesy of the Huron River Watershed Council

Today, there are 2,600 dams in Michigan. Many are in poor condition due to erosion, flooding, outdated design, and lack of maintenance, earning a C- grade overall in *Michigan's 2018 Infrastructure Report Card*. Dams control water levels in rivers and lakes across the region and provide for flood control, enhanced recreational opportunities, and protection of property values. There is an increasing trend across the country for dam removals to support river restoration activities. In many cases, costs associated with dam removal are much less than for dam reconstruction and can lead to other environmental and economic benefits.

Reducing the volume of stormwater runoff will also benefit the challenges associated with dams in the region. Stormwater not only affects the condition of dams, but dams play a role in reducing flood risk by managing in-stream flows when there are large volumes of stormwater entering river systems. Dams are critically significant water management structures located throughout the region in various rivers and lakes. Figure 20 shows the approximate location of dams throughout the region.


Wayne Road Dam – Before Removal

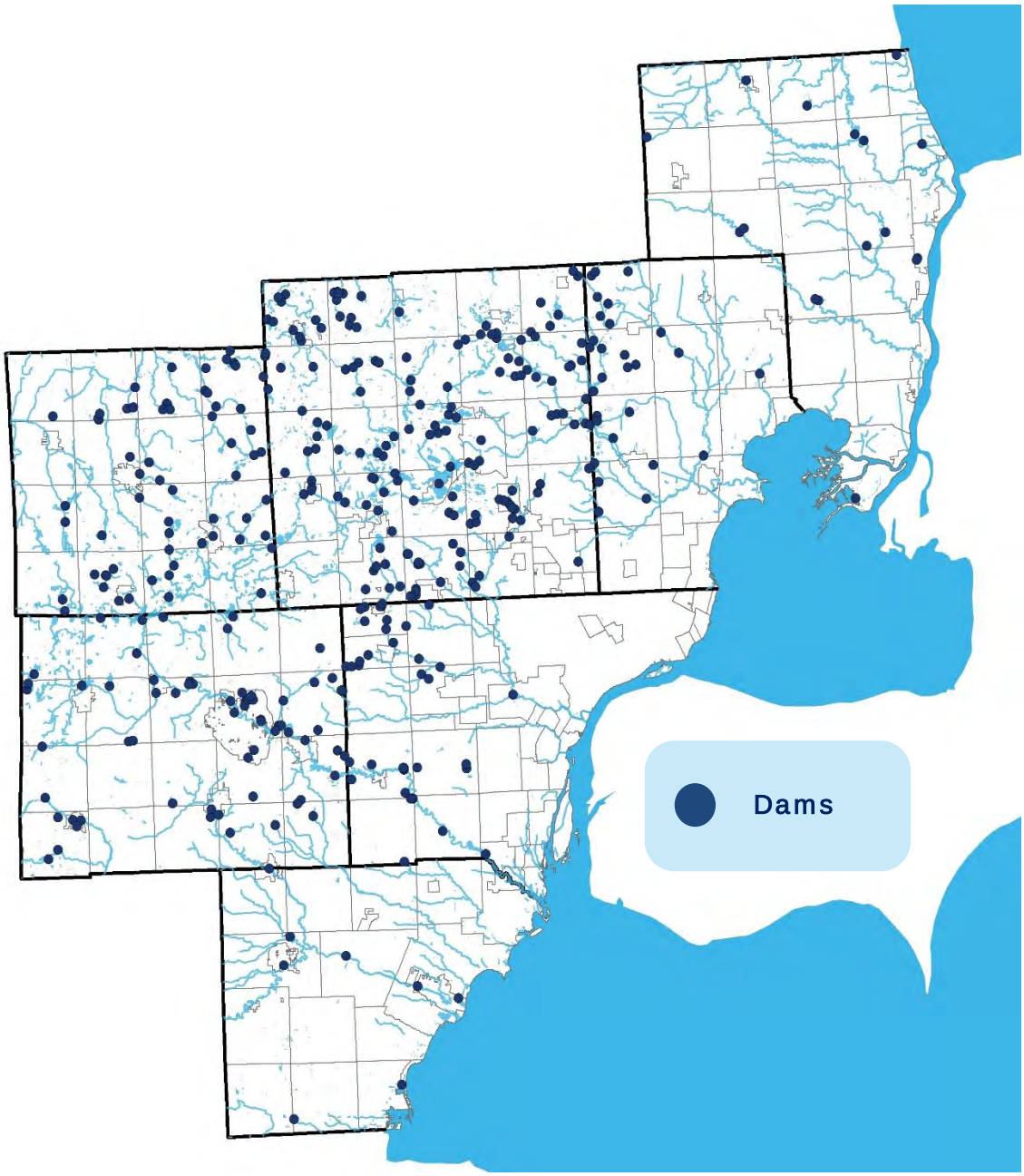
Case Study: Wayne Road Dam Removal

The Wayne Road Dam Removal and River Restoration project was one of the most important dam removal projects in the Rouge River Watershed. Removing the dam was a priority in working towards delisting the Fish and Wildlife Habitat and Population Beneficial Use Impairments (BUI) in the Rouge River Area of Concern (AOC). The project was also important to improve the diversity of fish communities in the river that were limited by the dam.

Removing the Wayne Road Dam reconnected the Rouge River to the Detroit River and Lake Erie, increasing habitat connectivity and passability for fish species living upstream from the dam. Removal also enabled warm water species such as smallmouth bass, northern pike, walleye, and suckers – flourishing downstream from the dam – to migrate upstream. In addition to the dam removal, the project stabilized flow by removing an instream island downstream from the dam, and reconstructing a more stable flow channel with bankfull benches. The total project cost over $1.1 million, co-funded by the Alliance of Rouge Communities (ARC) and the National Oceanic and Atmospheric Administration (NOAA).


After Removal

Figure 20
Dams in Southeast Michigan



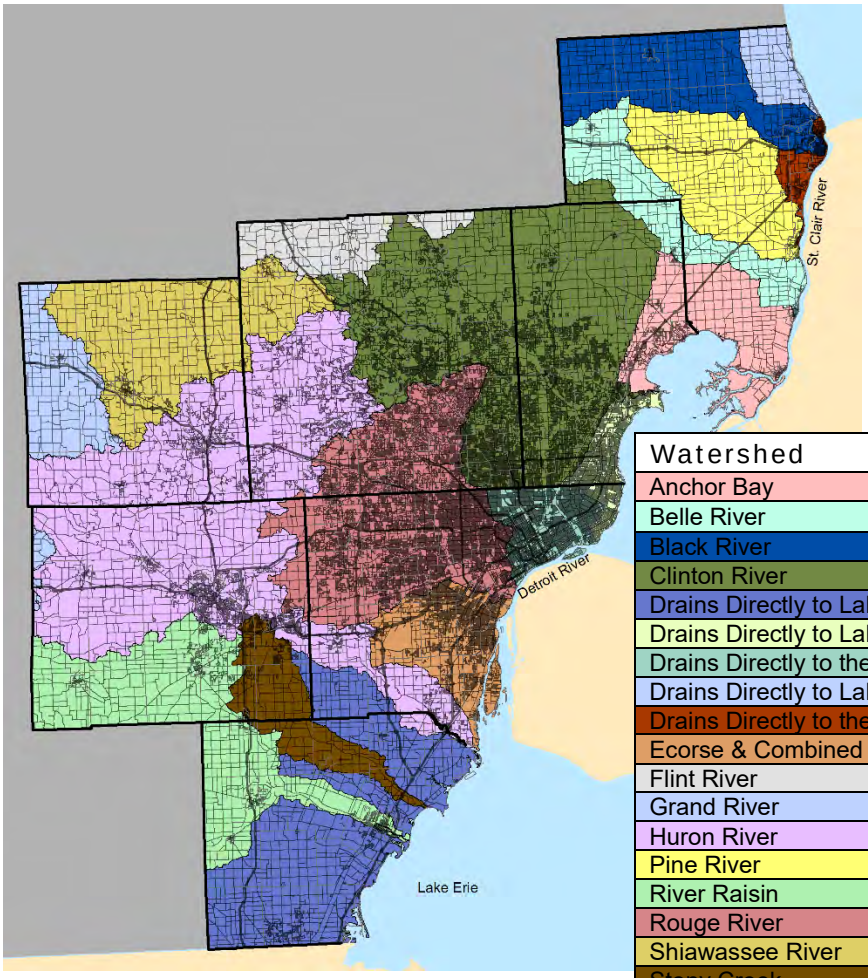
Source: MDEQ, MiWaters Database

There are 377 dams located in Southeast Michigan. Of the approximately 2,600 dams throughout the State of Michigan, most are in poor condition due to erosion, flooding, outdated design, and lack of maintenance.

Transportation

Southeast Michigan's transportation system includes over 25,000 miles of roads and supports over 100 million miles of daily travel. This transportation infrastructure includes roads, bridges, nonmotorized pathways, and transit routes and facilities. This network also connects the region's water resources, including rivers, lakes, and streams and water-related recreational activities.

Figure 21
Road Miles by Watershed



Watershed	Miles
Anchor Bay	608
Belle River	400
Black River	561
Clinton River	5,483
Drains Directly to Lake Erie	1,267
Drains Directly to Lake St. Clair	904
Drains Directly to the Detroit River	1,844
Drains Directly to Lake Huron	111
Drains Directly to the St. Clair River	217
Ecorse & Combined Downriver Watersheds	1,491
Flint River	246
Grand River	307
Huron River	3,390
Pine River	509
River Raisin	953
Rouge River	5,504
Shiawassee River	840
Stony Creek	446

Southeast Michigan's transportation network includes over 25,000 miles of public roads, more than 2,900 bridges, and over 1,000 miles of shared-use paths and trails. Additionally, water trails are gaining recognition with over 450 miles of available kayaking and canoeing opportunities in the region.

Transportation infrastructure is also connected to other local priorities including drinking water, wastewater, stormwater, recreation, tourism, economic development, habitat, and invasive species. From transportation planning, design, and construction, projects must consider multiple aspects of water and natural resources, as well as environmental protection. This includes stormwater management, wetland protection and mitigation, threatened and endangered species, habitat connectivity for fish and aquatic life, and invasive species management.

With 39 percent of roads in poor condition, Michigan's road agencies are hard-pressed to develop solutions that enhance and protect environmental resources while also meeting the mobility needs of residents. It is important to focus on the following priority planning considerations:

- Include water and natural resources early in the planning process;
- Coordinate with other infrastructure providers to meet multiple goals; and
- Develop stormwater management approaches for new and existing road impervious surfaces.

A 2017 SEMCOG survey found that 63 percent of respondents believe that more spending should be directed to developing roadway infrastructure that minimizes water pollution and flooding.

Including water and natural resource priorities early in the transportation planning process will involve an increased level of collaboration across agencies and jurisdictions. The lengthy planning timeframes for transportation projects support increased cooperation between transportation agencies and watershed groups, state and local agencies, and recreational providers. This will enhance consideration of local priorities within the vicinity of transportation projects. The *I-75 Corridor Conservation Action Plan* (see case study on the following page) demonstrated many successes of this coordinated approach.

Drinking water, wastewater, stormwater, and many private utilities are all located within transportation right-of-way areas. Coordinating and aligning multiple infrastructure improvement needs will lead to cost-effective investments across all sectors. Agencies are able to seek out available funding resources in order to sequence implementation of the multiple project elements. A state asset management program can further strengthen these efforts.

Developing stormwater management approaches for new and existing impervious surfaces is a major priority for achieving water resource goals. This requires early planning considerations and coordination with other infrastructure providers. Early planning discussions should not only include stormwater BMPs for new impervious surfaces, but should also consider retrofitting existing impervious surfaces with new BMPs. Using a watershed approach to evaluate stormwater management, can identify multiple collaborative options from small green infrastructure techniques to large, regional flood control basins. Many of these opportunities are implemented through local streetscape enhancement projects.

Monroe County – I-75 and Plum Creek to Lake

Case Study: I-75 Conservation Planning: Partnerships and Early Planning Maximize Environmental and Economic Outcomes

I-75 in Monroe County is undergoing a complete reconstruction over the next 20 years. The Michigan Department of Transportation (MDOT), in partnership with SEMCOG and the Michigan Natural Features Inventory (MNFI), worked collaboratively with over 15 local, state, and federal agencies in addition to nonprofit organizations to identify environmental priorities and key strategies for this long-term reconstruction project.[1] Using an integrated Eco-Logical planning approach has led to significant economic efficiencies, and resulted in numerous early successes that address infrastructure, natural resources, and the blue economy:

- The Otter Creek Bridge was redesigned to ensure canoe and kayak passage in support of Monroe County's local water trail improvements.
- Over $1 million in cost savings was realized through MDOT partnering with MDNR for wetland mitigation areas. Additionally, MDOT brought funding to a coastal wetland project that was already identified as a local need.
- MDOT worked with the MDNR and youth corps volunteers to relocate over 1,500 Sullivant's Milkweed, a native plant, from the I-75 right-of-way to Sterling State Park.

MDOT received a grant from NOAA to help develop a transportation-related environmental curriculum. Students and teachers are being trained in this pilot program and will help develop informational materials for the MDOT Welcome Center.

These coordinated approaches can benefit transportation agencies due to the often limited areas available within road rights-of-way. One such potential funding source is the Transportation Alternatives Program (TAP), which provides funding for a number of transportation improvements, including green infrastructure and environmental mitigation projects. The case study below is one example in which a road project used TAP funds to achieve stormwater management goals.


Marine City - Broadway St. streetscape

Case Study: City of Southfield's Evergreen Road Improvement Project

In 2015, a one-mile segment of Evergreen Road in the City of Southfield was reconstructed. This project used TAP funds to successfully incorporate many new amenities that generate multiple outcomes, including a mid-block pedestrian crossing, lighting, benches, and a multi-use path for increased pedestrian and bicycle safety and access. A road diet reduced the existing six- and seven-lane road to a four-lane boulevard with a roundabout to calm and improve traffic flow.

To manage and reduce stormwater runoff, the project incorporated a 32,000-cubic-foot rain garden and pervious pavers along the length of the roadway. This rain garden generates water quality benefits, reduces burdens on the city's stormwater system, and helps extend the lifecycle of city infrastructure. Overall, the project produced multiple environmental, social, and economic benefits for local water resources, motorized and nonmotorized travelers, and businesses along the corridor that will benefit from improved mobility, walkability, safety, and aesthetic value.


Southfield – Rain Garden along Evergreen Road

Transportation corridors often carry significant amounts of runoff from surrounding areas and communities to local streams and rivers. Often times, developments along major transportation corridors carry stormwater into existing MDOT, county, and local stormwater systems, ultimately shifting the burden of stormwater management to road agencies. This challenge is exacerbated by the aging stormwater infrastructure within road right-of-way and changing precipitation events. Transportation assets, including roads, bridges, and stormwater drainage systems should be evaluated for their vulnerability to changing rain patterns and their ability to adapt to extreme conditions.

Case Study: MDOT Stormwater Management Framework

The MDOT Stormwater Management Framework establishes the roadmap for road agencies to consider stormwater management early in the transportation planning process. This framework highlights opportunities to update transportation planning processes, drainage scoping manuals, design standards, and construction requirements to holistically consider hydrologic needs early in the transportation process to benefit the health of the watershed and the lifecycle performance of the infrastructure.


Orion Township - Lake Sixteen road crossing

Road stream crossings that span less than 20-feet are classified as culverts; otherwise, they are classified as bridges.

On top of the need to manage stormwater runoff from both the roadway and adjacent areas is the need for adequate streamflow through culverts and under bridges. A reliable transportation system includes roads that are free from flooding during moderate or even heavy rainfall events. This is often dependent on the capacity of road stream crossings, like culverts, to convey larger volumes of stormwater in addition to the normal stream flow conditions. Road stream crossings are common locations where roads closures occur

due to flooding from significant rain events. Like other stormwater infrastructure, they are also reflect the aging condition of infrastructure and the need to manage increasing amounts of stormwater runoff. At the same time, their use for multiple purposes also continues to increase. It is important to establish a baseline assessment of all road stream crossings, both culverts and bridges, so that local and regional priorities can be addressed. Enhancing walking, biking, and kayaking opportunities along with improving fish and aquatic life migration all require improvements to bridge and culvert infrastructure.

Extraction of Oil and Gas

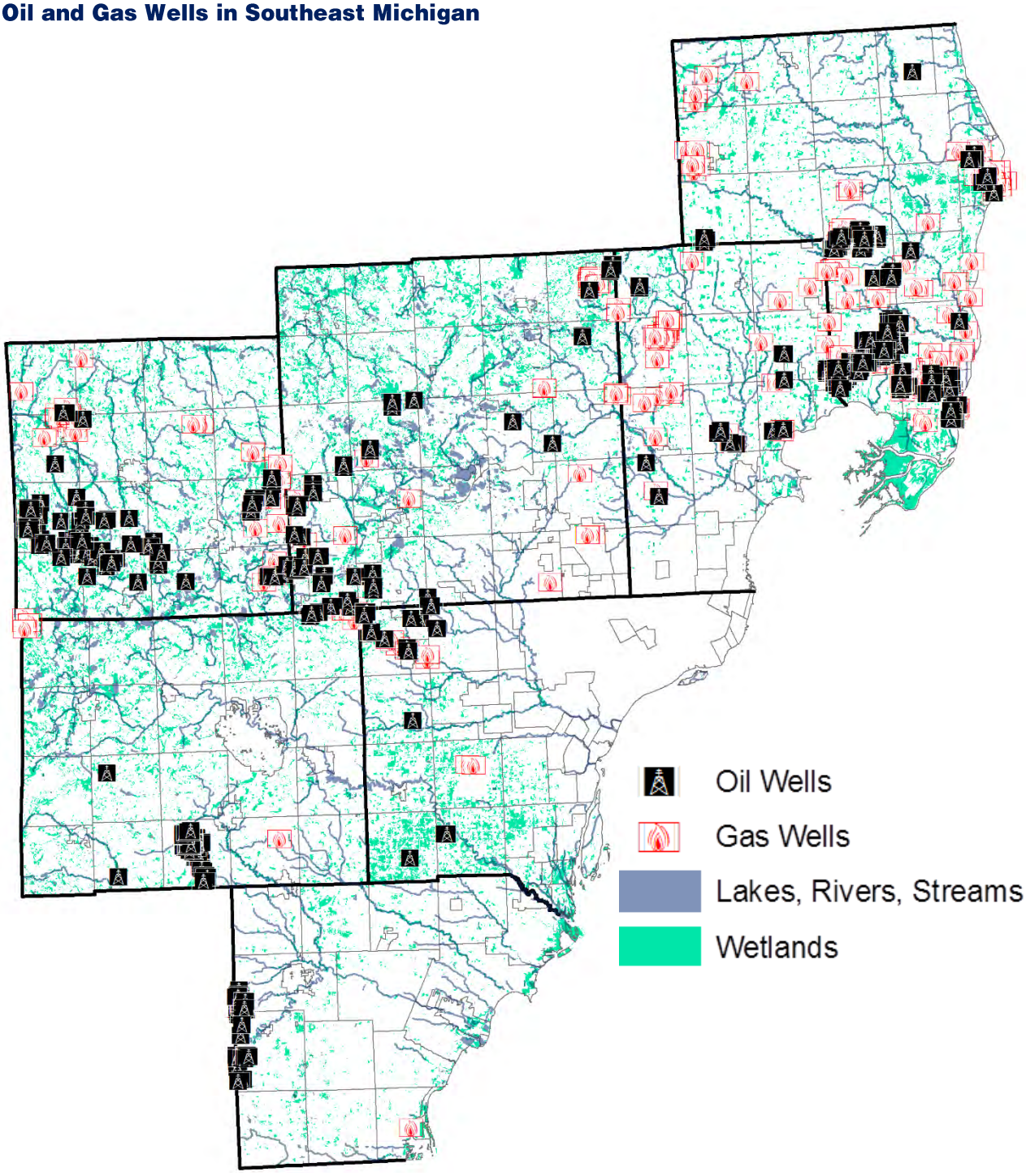
The two major components of the oil and gas industry that have the potential to impact water resources are extraction and distribution. Extraction is the process of drilling into underground wells and reservoirs to bring petroleum, hydrocarbons, or natural gas to the Earth's surface using conventional drilling or through hydraulic fracturing (fracking). Distribution is the process of transporting oil and gas using pipelines, trucks, barges, or trains from the location of extraction, to refineries, storage facilities, and ultimately to consumers.

In Southeast Michigan there are nearly 800 wells that have been drilled for oil and gas extraction. There are also a multitude of pipelines crossing the Huron to Erie Corridor, transporting crude oil, refined products, volatile liquids, and natural gas from Michigan to Canada. In recent years, oil damaging spills have occurred in other parts of the state, such as the 2010 oil spill in the Kalamazoo River where 38 miles of water resources were impacted.[37] A comparable spill in Southeast Michigan would be devastating to the region's drinking water, globally rare fish and wildlife habitat, and high quality recreational opportunities on the St. Clair and Detroit River system.

To reduce potential impacts from the oil and gas industry on the region's water resources, additional local government oversight and enhanced coordination between local, county, regional, state, and federal agencies, and private industry is needed. Enhanced coordination will ensure that siting of new facilities and any facility operations will not directly impact water resources. Updating local zoning, codes, and ordinances to address facility locations and setback requirements for oil and gas infrastructure can support collaboration between private and public agencies.

In 2017, the 21st Century Infrastructure Commission identified 6,700 miles of natural gas lines that need to be replaced in Michigan. Over 84 percent of these natural gas lines are considered at risk and should be replaced over the next 25 to 30 years. Like municipal water infrastructure, many oil and gas facilities were installed many years ago and require maintenance, upgrades, and replacement. Opportunities to identify and replace at-risk oil and gas infrastructure in coordination with local asset management programs and infrastructure improvements can maximize economic efficiencies and long-term benefits to Michigan's water environment.

Figure 22
Oil and Gas Wells in Southeast Michigan



Source: MDEQ, MiWaters Database

Regional Policies and Actions

Infrastructure

The following policies establish an overarching framework for long-term infrastructure asset management and strategic investment in Southeast Michigan to support and enhance regional water resources. Other policies focus more specifically on the region's core infrastructure issues for drinking water, wastewater, stormwater, transportation, and oil and natural gas infrastructure.

Overarching Priority: Asset Management Policy

Enhance economic prosperity through coordinated infrastructure asset management.

Recommended Actions:

- Support local and regional opportunities to expand asset management programs, including collection of data and mapping in those areas lacking information.
- Develop a regional asset management system that directs infrastructure investments in a collaborative manner, reduces costs and provides more efficient service.
- Perform regional infrastructure needs study based on asset management information and approaches.
- Ensure that state asset management programs are consistent with local and regional priorities.

Overarching Priority: Funding and Financing Policy

Achieve fiscally sustainable and reliable quality infrastructure through consistent funding mechanisms that support the long-term, real costs of services.

Recommended Actions:

- Support legislative proposals to establish alternative infrastructure financing mechanisms, including stormwater utilities.
- Expand SAW programs to encourage continued development of asset management programs.
- Increase participation in the SRF programs to implement local and regional infrastructure projects.
- Encourage additional water affordability and assistance programs, such as the GLWA's Water Residential Affordability Program, to provide financial assistance support and educational training to water users.
- Develop funding alternatives, such as low-interest loans and loan forgiveness programs, and use existing regulatory mechanisms to encourage needed infrastructure improvements on private property.
- Integrate multiple funding approaches to support coordinated decision-making on infrastructure improvements and capital improvement programs.

Overarching Priority: Regulatory Framework Policy

Protect public health and environmental quality through a science-based regulatory framework at the state and local levels that supports flexible, alternative compliance approaches.

Recommended Actions:

- Participate in infrastructure stakeholder workgroups at the state and local levels to implement regional water resource policies and actions.
- Conduct comprehensive code and ordinance audits to address land use planning elements of water infrastructure.
- Facilitate a regional stormwater technical advisory committee that identifies the development of common regional standards, details and engineering approaches for desired levels of cost and design efficiencies.

Overarching Priority: Workforce Development Policy

Ensure effective infrastructure operations through workforce development and training.

Recommended Actions:

- Develop local and regional stormwater infrastructure construction and maintenance training certification programs.
- Work with professional, educational and workforce agencies to develop regional training and licensing programs in the drinking and wastewater sectors.

Drinking Water Policies

Ensure that all have safe drinking water by monitoring intakes to detect contaminants and implement coordinated timely procedures for notification and emergency response.

Protect groundwater resources to ensure drinking water is uncontaminated, reliable and safe.

Protect public health and the environment with a drinking water system that meets regulatory requirements.

Recommended Actions:

- Identify funding alternatives to support and enhance long-term sustainability of real-time monitoring programs.
- Strengthen coordinated response and notification procedures for accidental spills or other potential impacts to source water.
- Implement well-head protection programs to protect the area that provides water to municipal drinking water supply wells.
- Prioritize remediation of contaminated sites in those areas near or within well-head protection areas.
- Work with local and state agencies to identify abandoned wells and ensure proper closure.

- Ensure that updates to the state lead and copper rule focus on protecting public health and includes asset management principles.
- Work with local governments, water and sewer service providers and the economic development community to assess option for improving the use of existing infrastructure and, where appropriate, decreasing capacity where supply far exceeds the demand in the foreseeable future.
- Support continued research for improved technologies to identify, monitor and treat emerging contaminants.

Wastewater Policy

Ensure wastewater collection and treatment systems are protective of water resources and public health.

Recommended Actions:

- Meet regulatory requirements for treatment and collection systems.
- Work towards addressing untreated CSOs with cost-effective approaches and investments.
- Continue to cost-effectively minimize the occurrences of SSOs.
- Work with GLWA to ensure regional priorities are integrated into the updated masterplan.
- Advance the use of the Water Resource Recovery Facility concept to recognize the environmental, economic and social outcomes they provide, including producing clean water, recovering nutrients, generating energy and integrating green infrastructure.
- Incorporate the strengths of green infrastructure that reduce the volume of stormwater into wastewater collection systems.
- Strengthen education of public officials on the use of green infrastructure for wastewater challenges.
- Support updates to the Michigan Statewide Sanitary code that address sustainable onsite sewage disposal system standards.
- Continue public education and outreach efforts for operation and maintenance of private onsite sewage disposal systems.

Stormwater Policies

Encourage flexibility and collaboration across jurisdictions for stormwater management through watershed approaches while achieving public health and environmental outcomes.

Work towards achieving state water quality standards for rivers, lakes and streams.

Recommended Actions:

- Pursue updates to state regulatory programs to recognize alternative compliance methods.
- Integrate green infrastructure target setting approaches across jurisdictions to work toward watershed goals.

- Seek partnerships to align capital improvement, transportation and infrastructure planning programs with water resource and recreational goals.
- Identify local opportunities to support state goals for the western Lake Erie basin.
- Seek opportunities to expand water reuse, including rainwater and stormwater.

Dams Policy

Reduce the environmental impacts of dams on local streams and rivers.

Recommended Actions:

- Inventory and assess dams for influences on hydrological and ecological conditions.
- Prioritize dams for structural improvements, operational updates or removal.

Transportation Policies

Reduce the impacts of transportation projects on water and natural resources.

Coordinate efforts to align water, natural resources, and transportation priorities.

Integrate multiple outcomes, including enhanced mobility, recreational opportunities, and water quality into the designs for transportation corridors near natural and water resources.

Recommended Actions:

- Integrate environmental elements into the early transportation planning process.
- Utilize the environmental sensitivity analysis to inform transportation agencies of potential impacts.
- Inventory and conduct condition assessment of road stream crossings.
- Categorize road stream crossings and prioritize improvements for multiple transportation modes, water trails, streamflow condition and fish migration.
- Evaluate and prioritize vulnerability and adaptive capacity of road stream crossings.
- Enhance environmental considerations within the regional transportation planning process.
- Support and facilitate collaboration between road agencies and local jurisdictions regarding stormwater management opportunities.
- Complete a climate resiliency analysis for regional transportation assets.

Extraction of Oil and Gas Policy

Minimize the potential impacts of oil and gas extraction and distribution to our water resources through additional local government oversight as well as enhanced coordination and collaboration between local, county, regional, and state agencies. This includes siting new facilities; ensuring transparency of the operation; validating safety of the operation and distribution network; and verifying adequate emergency response preparedness.

Chapter 5: Integrated Water Resources Management

Ann Arbor - Thurston Elementary School Rain Garden

Water resources in Southeast Michigan include rivers, lakes, and streams, which are directly connected to the Great Lakes through the region's watersheds. Within these watersheds are multiple economic, environmental, and social priorities that are intricately linked to water resources.

The *Water Resources Plan for Southeast Michigan* calls for an integrated water resource planning approach that identifies efficiencies and optimizes investments to protect public health, and restore and improve water resources in the region. It supports comprehensive solutions across the blue economy, natural resources, and infrastructure, enhancing community vitality and local water resources. The end goal is strategic decision-making that achieves multiple outcomes, instead of a traditional silo-based approach.

The following five major topics, covered in this chapter, establish the framework for an integrated water resources management approach. They are critical for successfully implementing this plan.

1. **Climate resiliency** is a community's ability to respond to, withstand, and recover from changing precipitation patterns and extreme rainfall events.
2. **Partnerships and collaboration** across multiple jurisdictions and permitting agencies must be strengthened to support the integrated management approach.
3. **Investments** in water infrastructure, natural resources, and the blue economy should be optimized by aligning sources of funding and financing with timing of project implementation.

4. Increasing **public education** focuses on attaining greater public awareness and shared responsibility for protecting and restoring our rivers, lakes and streams.
5. Improving **water resource monitoring** programs should respond to the programs and priorities that are developed through the integrated approach and reflect on individual watershed goals while also working towards state water quality standards.

Climate Resiliency

Climate resiliency refers to a community's ability to respond to, withstand, and recover from changing precipitation patterns and extreme rainfall events. Recognizing changing rainfall patterns and strengthening community resilience is a challenge best addressed through an integrated approach of collaborative partnerships, investments, public education, and monitoring.

Patterns in precipitation have been changing all across the Great Lakes region and are evident in the more frequent extreme precipitation events that have occurred over the last decade. For example, several 100-year events have occurred in this time period. A 100-year rainfall event can be represented by 4-5 inches of rain falling in a 24-hour period and there is a 1% chance that amount of rain, or more, will occur in any given year.

Macomb County - I-696 flooding

In August 2014, more than 6 inches of rainfall occurred in Southeast Michigan over an 8-hour period, resulting in over $1.8 billion in damages and a federal disaster declaration.[38]

The region's stormwater and transportation infrastructure systems are designed for specific rainfall events. Precipitation events larger than the designs of these systems will continue to impact property, infrastructure and water resources within the region. Seeking opportunities to improve infrastructure maintenance, increase capacity, reduce runoff entering these systems and implement contingency plans will minimize future impacts.

Recent extreme storm events have caused detrimental impacts to both public and private property. These flooding events often lead to overtaxed infrastructure, risks to public health, significant transportation delays, and stressed community budgets. According to MDOT's Climate Vulnerability Assessment Pilot Project, average annual precipitation is expected to increase by 7-10 percent by 2050, and upwards of 13-23 percent by 2100.[39]

Going forward, it is important to understand the resilience of both natural resources and infrastructure based on accurate precipitation trends. The ability of these systems to adapt to impacts associated with increased storm events, combined with an indication of how vulnerable they are to changes from normal precipitation events will help ensure that Southeast Michigan communities are ready and able to respond.

Better use of natural areas and investments in infrastructure is needed to address extreme rainfall. Infrastructure commonly affected by extreme rain events includes roads, drainage systems, culverts, and bridges. Dams, wastewater collection and treatment systems, drinking water infrastructure, and stormwater systems are also affected by these precipitation changes.

Huron River flooding; Photo courtesy of the Huron River Watershed Council

Case Study: The Huron River Watershed Council's Climate-Resilient Communities Program

The Huron River Watershed Council (HRWC) has partnered with the Great Lakes Integrated Sciences and Assessments (GLISA) to work collaboratively with resource managers from municipalities, universities, and state and federal agencies to create communities more resilient to climate change. The goal of the Climate Resilient Communities project is to produce climate information uniquely designed to help local leaders respond to precipitation changes that have resulted in overtaxed infrastructure, public health risks, and costs to already-stressed community budgets. Climate scientists and practitioners developed and implemented strategies in four different sectors – stormwater, natural infrastructure, instream flows, and hazard mitigation. Some outcomes of this project include:

- The Huron River Dams Network formed to connect dam operators and owners throughout the watershed. This network is piloting environmental flow recommendations to reduce the impacts of dams and climate extremes on the river.
- Ann Arbor revised its Hazard Mitigation Plan in 2017 to include how climate change is affecting all natural hazards with strategies intended to mitigate both current and future hazard risks.
- Washtenaw County revised its stormwater rules for development projects. The rules require the use of the *National Oceanic and Atmospheric Administration* (*NOAA) Atlas 14-Point Precipitation Frequency Data,* and added high onsite infiltration requirements to handle increased storm intensity, knowing that pipes alone will not be able to accommodate future changes.

The network of green infrastructure across the region can help buffer some of the impacts communities may face during extreme rain events. Natural resources, such as wetlands, woodlands, riparian corridors and floodplain areas, and agricultural lands can help provide excess capacity to retain and slow down stormwater that is carried to infrastructure systems, rivers, lakes, and streams.

Since 1900, total annual precipitation has increased by approximately 11% in the Great Lakes region. Since 1958, the amount of precipitation falling in the heaviest 1% of storms has increased by 37%.[40]

An integrated water resources management approach for climate adaptation will strategically identify critical infrastructure improvements and natural resource opportunities that support local economies. The first step of this integrated approach requires local planning to consider climate resiliency priorities and strategies. Numerous opportunities exist within local plans to incorporate policies and actions to address changing precipitation patterns:

- Master Plans
- Zoning Ordinance
- Watershed Management Plans
- Stormwater Management and Green Infrastructure
- Corridor Development Plans
- Invasive Species Management Plans
- Parks and Recreation Master Plans
- Capital Improvement Plans
- Water and Sewer Master Plans
- Long-Range Transportation Plan

Partnerships and Collaboration

Partnerships and collaboration is the cornerstone of integrated water resource management. Increased competition for limited fiscal and technical resources has led to strategic partnerships that pays dividends in restoring and protecting the region's water resources. *Michigan's Water Strategy* notes the fundamental importance of focusing on "actions at the community level to develop a vision, create collaborations and find local champions that can galvanize local unity."


Alliance of Rouge Communities stakeholder meeting

Since adoption of the *Water Quality Management Plan for Southeast Michigan* in 1999, partnerships have led to many successes and implementation of projects that improve the region's water resources. For example, watershed planning was formalized in the late 1990s through the National Pollutant Discharge Elimination System (NPDES) Phase 2 watershed general permit. This integrated planning approach brought together multiple agencies, jurisdictions, and stakeholders to collaboratively set goals and make strategic decisions about water resource improvements across Southeast Michigan. These included adoption of watershed management plans that still serve as a guide for water resource protection activities. While numerous challenges between state and local priorities eventually led to a jurisdictional permit, the watershed framework still provides many opportunities and lessons learned to achieve water resource objectives.

The Southeast Michigan Partners for Clean Water is another example of a successful partnership whose priorities have evolved over time. This partnership group is made up of counties, cities, villages, townships, and SEMCOG along with nonprofit watershed organizations, educational institutions, and private consulting firms. The work of the partnership initially focused on addressing compliance with the NPDES Stormwater Phase 2 permit program, but has since evolved over the last 15 years to implement and support many activities addressing public education, municipal training, local ordinance updates, and state policy advising.

Another recent partnership is the Great Lakes Water Authority's One Water Partnership. This is a partnership agreement between over 90 communities and agencies that centers on an agreed-upon mission statement, goals, and work group process. The mission statement of the One Water Partnership is to "ensure a One Water system approach to our regional water and wastewater system that will be economically, socially, and environmentally responsible and sustainable". Goals for this partnership include developing a multi-agency approach to infrastructure renewal and development and identifying and cultivating utility leaders of the future.

Sue McCormick, GLWA, addresses SEMCOG's Executive Committee

While many partnerships were initially formed to address specific silo-based water and stormwater topics or permit requirements, it is important for existing and new partnerships to strategically address all elements of water resource planning, including the blue economy, natural resources, and infrastructure.

Investments in Water Resources

While numerous sources of funding for water resources at the local, state, and federal levels are available they are not sufficient to implement all the programs needed to achieve water resource goals in Southeast Michigan.

Traditionally, investments are project specific, such as stormwater management, water main replacement, wetland enhancements, and road construction, or recreation (e.g., water access and water trails). To achieve benefits, it is important to strategically align funding sources. Even with multiple funding sources to address the blue economy, natural resources, and infrastructure, the funding and objectives are often disjointed and allocated in a silo-based manner. Coordinating the region's projects and funding across stakeholders will better situated Southeast Michigan achieving water resource goals.

The following highlights some water resource funding sources in Southeast Michigan.

Local Water Resource Investments

Investments in water resources come from numerous sources. Drinking water and wastewater systems have traditionally been constructed through bonding with monthly service changes to the customers repaying the loans. In some cases, federal and state grant programs subsidize the cost of borrowing by offering very low interest loans for local projects. Operating costs for these services are covered by usage fees charged to the customers.

Stormwater and other drainage projects are financed by County Water Resource and Drain Commissions. Properties that benefit from the drainage projects are assessed fees based on the area of the property and other attributes. Much of the drainage assessment is also paid by local governments that control the public right-of-ways that are often a major source of stormwater.

In 2014 Michigan ranked 50th in the nation for per capita infrastructure (roads, sewer, and water systems) spending[41]

Stormwater Utility

Use of stormwater utilities is increasingly desired by local governments to cover the cost of stormwater management. While Michigan law allows for the formation of municipal utilities to manage stormwater, current law is general and lacks details and restrictions stipulating how utilities must be formed and managed. The Michigan Supreme Court, in *Bolt v. City of Lansing*, outlined that stormwater fees must serve a regulatory purpose, must be proportional to service, and must be voluntary. The Michigan legislature continues to evaluate options for legislation that meets these stipulations and establishes clarification for local stormwater utilities.

Ann Arbor - Easy Street

Case Study: Ann Arbor Stormwater Utility

The City of Ann Arbor has adopted a Stormwater Utility Fee, which charges all property owners a fee for stormwater management, based on impervious surface area. A variety of crediting options are also available to property owners to reduce the stormwater fee. Funds generated from this utility are used to support planning, design, construction, and maintenance of stormwater management infrastructure systems. Green infrastructure projects and stormwater public education activities are also supported through the stormwater utility. Stormwater utility financing approaches bring essential funding for stormwater management to municipal project, augmenting the overall funding available for infrastructure improvements.

State and Federal Grant and Loan Programs

There are a variety of grants and loans that benefit water resources and are administered through multiple state agencies, such as the Department of Environmental Quality (MDEQ), Department of Natural Resources (MDNR), Department of Transportation (MDOT) and Michigan Economic Development Corporation (MEDC). Similarly, federal agencies such as the Environmental Protection Agency (EPA) and the Federal Highway Administration (FHWA) can support water resource goals.

State Revolving Fund (SRF)

Michigan's Water Pollution Control Revolving Fund, better known as the State Revolving Fund (SRF), is a low-interest loan financing program that supports construction of local municipal water infrastructure projects. The EPA provides federal capitalization grant dollars, which the state is required to provide a 20 percent match. In Michigan, roughly $150 million in loans are administered annually in the wastewater program and about $60 million for drinking water.[42] The funds can be used for wastewater, drinking water, and stormwater infrastructure improvements that have a public health benefit or reduce environmental pollution. Ongoing process improvements for the loan programs include enhancing project planning coordination and communication, streamlining project requirements, updating application criteria and providing flexibility in loan terms and interest rates.

Nonpoint Source Pollution Grants - Section 319 Federal Clean Water Act

The Michigan Department of Environmental Quality's Nonpoint Source (NPS) pollution program has awarded over $22 million to support implementation of green infrastructure, stormwater management, and

nonpoint source pollution reduction projects within approved watershed management plans in Southeast Michigan.[43] While that program has led to significant water resource successes in the region, it does not replace costs associated with implementing state regulatory programs and is limited to those projects identified within watershed management plans.

Great Lakes Restoration Initiative
Nearly $400 million from the Great Lakes Restoration Initiative (GLRI) has been spent on 556 projects in Michigan, with significant funding going to Areas of Concern in Southeast Michigan.[44] GLRI was part of national legislation passed in 2010 to accelerate efforts to protect and restore the largest system of fresh surface water in the world – the Great Lakes. In addition to cleaning up Great Lakes Areas of Concern, other focus areas of GLRI include preventing and controlling invasive species, reducing nutrient runoff that contribute to harmful algal blooms, and restoring habitat to protect native species.

Statewide Bond / Fees
The Clean Michigan Initiative (CMI) was a $675 million bond approved by Michigan voters in 1998 to improve and protect Michigan's environmental and natural resources. Funding through this state bond supported programs including local and state parks, waterfronts, lead abatement, pollution prevention, water quality monitoring, contaminated sediments, and brownfields. This bond supported implementation of federal programs at the state and local levels. Currently there is a proposal to increase tipping fees on landfills to pay for another statewide bond.

Transportation Alternatives Program (TAP)
Each year MDOT administers approximately $17 million in TAP funds. These funds are available to local communities for a number of transportation-related improvements, including environmental mitigation and green infrastructure activities. In addition to MDOT's TAP funds, Southeast Michigan receives approximately $5 million, annually, set aside specially for communities within in SEMCOG's region. TAP requires a 20 percent local match.

Michigan Department of Natural Resources Trust Fund Grants (MNRTF)
MNRTF grants provide a funding source for the public acquisition and development of land for resource protection and public outdoor recreation. Since 2006, MNRTF has awarded over $289 million for acquisition and over $109 million for development.[45] MNRTF grants require a 25 percent local match and are available to local units of governments with an adopted five-year recreation plan. There is no maximum grant amount for acquisition grants; development grants are capped at $300,000. Priority projects identified by the MNRTF board include trails and greenways, wildlife and ecological corridors, and projects located in urban areas.

Clean Water Fee (alternative concept, under consideration)
The Clean Water Fee is a concept highlighted in the Governor's 21st Century Infrastructure Commission. Under this concept, a fee would be assessed on retail water sales and wastewater management. As a Bolt compliant alternative, the fee would be reset annually based on projected needs, deposited in a separate enterprise fund and provided as grants for eligible projects, including drinking water, wastewater, and stormwater management.

Local and National Foundations

Southeast Michigan is fortunate to have several local and national foundations with missions to improve and maintain water resources and support economic development programs and projects. For example, the Erb Family Foundation has a funding priority to improve water quality in the Great Lakes basin, especially the watersheds impacting Metro Detroit, through projects that address stormwater management, climate

resiliency, and individual and institutional stewardship. Since 2009, Erb has made 153 Great Lakes grants totaling $29.7 million.

Public-Private Partnerships

Public-private partnerships (P3) are generally long-term, performance-based, contractual arrangements between a public agency and a private sector entity. These partnerships can achieve multiple community objectives such as faster project completion, lower project cost, and utilizing private sector capital. Funding from private entities can help leverage existing funding from government, grants, and foundations, to maximize environmental, social, and economic outcomes from water resource projects. Through the Private Investment Infrastructure Funding Act of 2010, Michigan became one of only two Great Lakes states, to enact P3 legislation providing for financing public infrastructure through public and private sources. P3s are supported through the *Governor's 21st Century Infrastructure Commission Report* and the *Michigan Water Strategy*, both of which recommend expansion of these opportunities.

Recent P3 examples in Southeast Michigan, include:

- Marathon Petroleum Company has partnered with the City of Dearborn and Detroit, and multiple local not-for profit organizations on a proposed Ford-Rouge Gateway (FRoG) project. This project incorporates green infrastructure into an area adjacent to its refinery to provide a green buffer for its business operations, providing habitat for plants and wildlife, while also increasing access to the Rouge River for paddlers.
- MDOT's reconstruction of I-75 in Oakland County will use P3s to contract design, construction, financing, and maintenance. This project will be the largest public-private transportation project in the state's history, and is being undertaken in part to significantly speed-up the construction schedule, condenses what was an estimated 17-year construction project to five.

Public Education

Increasing public education is an essential component of integrated water resource management, focusing on attaining greater public awareness and mutual shared responsibility for protecting and restoring Southeast Michigan's rivers, lakes, and streams.

Numerous organizations, including educational institutions, watershed organizations, and local communities are engaged in educating the public on water resource issues. At the local level, many of the educational programs assist in meeting stormwater permit requirements. To implement these programs, successful partnerships are formed with watershed groups.

The Southeast Michigan Partners for Clean Water meets regularly to coordinate regional public education efforts beyond watershed boundaries, and share information and resources on water quality, stormwater management, and green infrastructure.

One public education success was installing uniform and recognizable education signage that transcended watershed boundaries at road stream crossings throughout the region. This program helped ensure that residents travelling throughout the region would recognize which watersheds they were in and better connect with the local stream or river in their community.

Public Education: Then and Now

Significant progress has been made to help residents, businesses, and governments understand their relationship to the region's water. In a 2016 SEMCOG Pulse of the Region Survey, residents were asked whether they thought the quality of lakes, rivers, and streams in their community was improving. Forty percent of survey respondents felt that water quality was getting better compared to 20 percent in 2004. The majority of respondents also understood that the quality of local streams where they lived affects the Great Lakes and Lake St. Clair. These results demonstrate that Southeast Michigan residents understand that considerable progress has been made on water resource protection and enhancement and that their individual household activities have an effect on local water quality in the region.

Ensuring that Southeast Michigan's 4.7 million residents understand the value of fresh water will involve building on past public education efforts and partnership, as well as new strategies for public education be explored and implemented. These public education strategies need to embrace the integrated water management approach to help residents understand that water resource protection and enhancement is a shared responsibility. Specific messaging could include:

- Focusing future education efforts on GLWA's *One Water* concept, including how individual actions to improve stormwater and wastewater systems can simultaneously generate benefits for Southeast Michigan's drinking water resource and globally renowned recreational opportunities.
- Linking water resources to critical infrastructure and asset management can help achieve increased appreciation and support for water resource investments

St. Clair County – 2017 Blue Water Sturgeon Festival

Case Study: Collaborative Public Education Programs

Watershed organizations across the region facilitate collaborative public education programming for hundreds of municipalities and agencies. These programs educate residents, business owners, and municipal staff about their role in protecting local water resources and individual actions they can take to reduce water resource impacts. They also host educational summits, forums, festivals, river clean-ups, adopt-a-stream events, and volunteer water quality monitoring programs to inspire water resources stewardship across Southeast Michigan. These are examples of some of the programs:

- Clinton River Watershed Council's WaterTowns™ program helps educate municipal leaders and residents on the long-term placemaking value of increasing access to water, and incorporating green infrastructure into economic development.
- Huron River Watershed Council's Insect and Habitat Monitoring program allows for families and individuals to volunteer and help collect river creatures, take water samples, or map changes in the river. Volunteers learn to identify bugs and animals that live in the river, figure out what makes a stretch of river healthy or unhealthy, and learn how river ecology works.
- The Friends of the Rouge has been coordinating the Rouge Education Project (REP) since 1987. REP is a school-based environmental education program providing hands-on scientific exploration and water quality monitoring opportunities to elementary, middle, and high school students across the region.
- The Friends of the St. Clair River organize the annual Blue Water Sturgeon Festival; a free one-day event where visitors can browse a dozen indoor and outdoor displays with hands-on activities, drop-in on a workshop, and touch live sturgeon and other native fish. A major goal of the festival is to educate residents on the importance of restoring fish and wildlife populations to higher levels and abundance in the St Clair River.

Water Resources Monitoring

Water resources monitoring enables stakeholders to measure, identify, and understand progress made on water resources management. This can ultimately direct water resource planning and implementation efforts. An integrated monitoring approach will assist in making strategic investments in water resources.

Stream Leaders Waldon Middle School; Photo courtesy of the Clinton River Watershed Council

Case Study: Volunteer Stream Monitoring

Watershed organizations such as the Huron River Watershed Council, Friends of the Rouge, and the Clinton River Watershed Council have been instrumental in engaging local communities, businesses, and the public to participate in monitoring the quality of local streams and rivers. Their programs include monitoring the quality and diversity of aquatic organisms that provide indicators of stream health.

Volunteers have the opportunity to collect a variety of water samples within local streams and identify different aquatic organisms. The presence or absence of specific species often provides indicators of water quality conditions. For example, the presence of stoneflies, sensitive aquatic organism, can depict a stream with good water quality; whereas streams that do not contain stoneflies nor a diverse aquatic population indicate the presence of potential pollution sources.

Existing monitoring programs must support decision-making across multiple water resource topic areas. This requires collaboration across monitoring programs, including monitoring for water quality, habitat, biology, streamflow, and physical stream characteristics. These programs are conducted by a variety of stakeholders, including local watershed groups, the State of Michigan, county health departments and federal agencies.

Rouge River - E. coli monitoring

Case Study: E. coli Monitoring in the Rouge – From Data to Action!

The Alliance of Rouge Communities (ARC), in collaboration with the United States Geological Survey (USGS), MDEQ, and the Friends of the Rouge (FOTR) is implementing a robust monitoring program in the Rouge River watershed. Notably, widespread E. coli sampling was completed in 2017. This sampling effort, in combination with outfalls surveys, has helped municipalities in this watershed eliminate illicit discharges, protect public health, and support municipal stormwater permitting regulations.

The E. coli data helps identify priority areas for implementing best management practices including illicit discharge investigations. Rather than diluting limited resources across the watershed, this collaborative partnership targets funding to hot spots where sources of bacteria are tracked upstream, often through complicated networks of stormwater infrastructure, in order to identify and remove illicit discharges. As a result, lower bacteria levels have been measured across the watershed.

Regional Policies and Actions

Integrated Water Resources Management

In order to ensure an integrated approach to regional water resources management, the following policies and actions should be pursued:

Climate Resiliency Policy

Enhance community readiness for changing precipitation patterns to ensure resiliency of infrastructure and natural resources.

Recommended Actions:

- Identify vulnerable infrastructure assets and improve adaptive capacity of these systems
- Update precipitation frequency estimates for the region consistent with the National Oceanic and Atmospheric Administration (NOAA)
- Integrate resiliency priorities into local policies, plans and projects
- Evaluate opportunities to use natural resource areas for improving management of runoff from extreme precipitation events.

Partnerships and Collaboration Policy

Form collaborative partnerships among local, state, and federal agencies; the private sector; nonprofit organizations; and other stakeholders to implement cost-effective solutions to protect and restore Southeast Michigan's water resources.

Recommended Actions:

- Work across jurisdictional boundaries and agencies to develop and implement capital improvement programs.
- Support efforts of existing partnership's including the GLWA's One Water Partnership and the Southeast Michigan Partners for Clean Water.
- Seek opportunities to strengthen public-private partnerships to address unique water resource challenges.
- Ensure economic development and infrastructure planning are aligned.
- Evaluate opportunities to align shared goals and measure progress across other Great Lakes partnerships, including the Great Lakes Commission Blue Accounting program.

Investments in Water Resources Policy

Ensure sustainable sources of funding and financing mechanisms to support the protection and restoration of Southeast Michigan's water resources.

Recommended Actions:

- Evaluate and review the structure of SEMCOG's Designated Management Agency program that supports regional water planning efforts.
- Work with state agencies to ensure that new regulatory programs are supported through direct funding sources to local agencies.
- Ensure that funding agencies recognize that local and regional planning programs provide a framework for funding water resource projects.
- Work with local agencies and the legislature to support dedicated funding sources for water resource programs, including the possibility of a statewide bond
- Develop a funding resource that categorizes grants, loans and financing structures across water resource topic areas.

Public Education Policy

Attain a greater public awareness and mutual shared responsibility of water resources.

Recommended Actions:

- Create a regional public education campaign led by local stakeholders and educational institutions that transcends local watersheds with common water resource messaging focused on water education that includes stormwater, wastewater and drinking water education.
- Continue existing collaborative public education efforts between watershed organizations and local communities to meet stormwater permit requirements.

Water Resources Monitoring Policy

Implement a long-term, sustainable monitoring program for the region's water resources.

Recommended Actions:

- Align water resource monitoring programs with desired goals in local watersheds.
- Encourage use of volunteer monitoring program data that provides indicators and trends demonstrating long-term improvements and potential pollution sources.
- Encourage collaborative partnerships between local, state and watershed agencies for cost-effective, integrated programs.
- Work with the MDEQ and other state agencies to strengthen and expand monitoring programs that align with local watershed approaches.

Appendix A – Regional Policies and Actions

Blue Economy

Economic Development Policy

Promote activities that contribute to increased tourism, recreation, and water-related economic development opportunities.

Recommended Actions:

- Foster partnerships between water-related businesses, local governments, and water research and education programs to integrate new information and best practices into planning and decision making processes.
- Ensure the resilience of existing water-related business sectors by promoting opportunities for innovation and growth in newer systems.
- Partner with existing programs that promote water trail towns to maximize economic development opportunities around waterfront communities.
- Ensure that importance of water resources is recognized and integrated in community and economic development plans.

Water Placemaking Policy

Support efforts to protect, enhance, and publicize the natural assets and water resources that strengthen the region's quality of place.

Recommended Actions:

- Increase the connectivity of placemaking efforts across community borders, and explore opportunities to grow a regional sense of place that also capitalizes on its international boundary.
- Coordinate unified branding and marketing strategies that educate the public about the region's natural assets and waterfront destinations, inspire local pride, and attract visitors to the region.
- Embrace business opportunities associated with quality of place assets near regional waterways, such as paddling tours and equipment rentals.

Water Access Policy

Maintain and expand public access to the region's waterways, particularly in areas that would improve connectivity between waterfront amenities, parks and natural areas, or other areas where access is currently limited.

Recommended Actions:

- Encourage the development of a multi-modal transportation system that ensures water resources are accessible to all users and well connected to parks, trails, downtown areas, and public transit.
- Increase public access along the Great Lakes and connecting channels to enhance opportunities for a range of activities, including swimming, boating, fishing, paddling, birding, or visual access and passive recreation.
- Assess the need for additional public access on inland lakes and rivers in Southeast Michigan, including traditional boat launches, paddling launches, swimming, and visual access.
- Increase coordination between stakeholders to ensure that waterways and waterfront areas balance and support the needs of both recreational and industrial users, as well as the health of local ecosystems.

Water Recreation Policy

Ensure that water-based recreation opportunities are widely available to support a variety of uses and meet the needs of the region's diverse population.

Recommended Actions:

- Continue to expand and implement the region's network of water trails, ensuring that they are easily accessible and well-integrated with their surrounding communities.
- Support local recreation planning efforts to increase regional coordination and share resources.
- Encourage the acquisition and development of public water recreation facilities and programming.

Natural Resources

Natural Areas Policy

Preserve and restore natural areas, such as wetlands, woodlands, riparian corridors, and agricultural lands, as a mechanism to protect and enhance water resources.

Recommended Actions on Wetlands:

- Identify high-priority wetlands to support local, regional, and state-decision making based on location and function, including flood control, stormwater management, habitat, and recreation.
- Encourage diverse wetland landscapes in restoration and mitigation practices that will encompass changing vegetation patterns from climate resiliency and invasive species challenges.
- Align publicly-funded wetland mitigation projects with restoration opportunities identified in local watershed and remedial action plans.

- Work with state and local agencies to strengthen wetland best practices and encourage use in master planning and local codes and ordinances.

Recommended Actions on Woodlands:

- Research methodologies to define the role of urban trees in stormwater management considering species, growth over time, crediting options, and effectiveness.
- Work with local groups, the Michigan Department of Natural Resources, and Michigan State University Extension to update optimal tree planting species for the region based on changing vegetation patterns and implementation functions.
- Evaluate and research alternatives to recognize trees as an infrastructure component that may be capitalized for long-term funding options.
- Identify critical riparian corridor areas for flood protection and stormwater management benefits.

Recommended Actions on Riparian Corridors:

- Increase the use of native vegetation, grow zones, and tree canopy in riparian corridors, especially along publicly owned property.
- Develop riparian corridor best practice recommendations and goals at the local level.

Recommended Actions on Agricultural Lands:

- Support implementation of alternative conservation and water management practices including buffer strips, wetland restoration, tile drain management, smart drain assessments, and other agricultural practices.
- Strengthen collaboration across agencies and jurisdictions to enhance opportunities for stormwater management implementation and education.
- Work towards the 40-percent phosphorus reduction target for the Western Lake Erie Basin.
- Identify high-value agricultural lands and implement innovative programs for preservation, conservation, and enhancement.

Aquatic Habitat Policy

Protect and restore aquatic habitats resulting in diverse fish population, healthy aquatic life, and enhanced recreational and economic value.

Recommended Actions:

- Reduce flow variability and improve water quality by integrating stormwater best management practices.
- Prioritize dams, perched culverts, and other road-stream crossings for retrofit, removal, or coordinated management to enhance habitat connectivity.
- Increase natural green infrastructure within subwatersheds, along shorelines, and vital riparian corridors.
- Strengthen spawning, nursery, and refuge area opportunities for aquatic species through application of woody debris, vegetation, and other structural management practices.

Invasive Species Policies

Enhance collaboration and coordination across local, state, and federal agencies, and nonprofit organizations on invasive species to identify management actions, share technical expertise, and utilize resources.

Prevent, control, and eradicate invasive species through early detection and response, research, education, public stewardship, and implementing strategic management approaches.

Recommended Actions:

- Strengthen invasive species management among CISMAs, federal, and state agencies, municipalities, nonprofits, community organizations, and private land owners. Using invasive species inventories, identify priority species and areas for targeted management efforts.
- Prevent introductions of aquatic invasive species (AIS) and minimize their presence by supporting and promoting training programs such as Clean Marina, Clean Boats, and Clean Waters.
- Expand volunteer training programs for local stakeholders that encourage identification, notification, and coordination opportunities.

Infrastructure

Overarching Priority: Asset Management Policy

Enhance economic prosperity through coordinated infrastructure asset management.

Recommended Actions:

- Support local and regional opportunities to expand asset management programs, including collection of data and mapping in those areas lacking information.
- Develop a regional asset management system that directs infrastructure investments in a collaborative manner, reduces costs and provides more efficient service.
- Perform regional infrastructure needs study based on asset management information and approaches.
- Ensure that state asset management programs are consistent with local and regional priorities.

Overarching Priority: Funding and Financing Policy

Achieve fiscally sustainable and reliable quality infrastructure through consistent funding mechanisms that support the long-term, real costs of services.

Recommended Actions:

- Support legislative proposals to establish alternative infrastructure financing mechanisms, including stormwater utilities.

- Expand SAW programs to encourage continued development of asset management programs.
- Increase participation in the SRF programs to implement local and regional infrastructure projects.
- Encourage additional water affordability and assistance programs, such as the GLWA's Water Residential Affordability Program, to provide financial assistance support and educational training to water users.
- Develop funding alternatives, such as low-interest loans and loan forgiveness programs, and use existing regulatory mechanisms to encourage needed infrastructure improvements on private property.
- Integrate multiple funding approaches to support coordinated decision-making on infrastructure improvements and capital improvement programs.

Overarching Priority: Regulatory Framework Policy

Protect public health and environmental quality through a science-based regulatory framework at the state and local levels that supports flexible, alternative compliance approaches.

Recommended Actions:

- Participate in infrastructure stakeholder workgroups at the state and local levels to implement regional water resource policies and actions.
- Conduct comprehensive code and ordinance audits to address land use planning elements of water infrastructure.
- Facilitate a regional stormwater technical advisory committee that identifies the development of common regional standards, details and engineering approaches for desired levels of cost and design efficiencies.

Overarching Priority: Workforce Development Policy

Ensure effective infrastructure operations through workforce development and training.

Recommended Actions:

- Develop local and regional stormwater infrastructure construction and maintenance training certification programs.
- Work with professional, educational and workforce agencies to develop regional training and licensing programs in the drinking and wastewater sectors.

Drinking Water Policies

Ensure that all have safe drinking water by monitoring intakes to detect contaminants and implement coordinated timely procedures for notification and emergency response.

Protect groundwater resources to ensure drinking water is uncontaminated, reliable and safe.

Protect public health and the environment with a drinking water system that meets regulatory requirements.

Recommended Actions:

- Identify funding alternatives to support and enhance long-term sustainability of real-time monitoring programs.
- Strengthen coordinated response and notification procedures for accidental spills or other potential impacts to source water.
- Implement well-head protection programs to protect the area that provides water to municipal drinking water supply wells.
- Prioritize remediation of contaminated sites in those areas near or within well-head protection areas.
- Work with local and state agencies to identify abandoned wells and ensure proper closure.
- Ensure that updates to the state lead and copper rule focus on protecting public health and includes asset management principles.
- Work with local governments, water and sewer service providers and the economic development community to assess option for improving the use of existing infrastructure and, where appropriate, decreasing capacity where supply far exceeds the demand in the foreseeable future.
- Support continued research for improved technologies to identify, monitor and treat emerging contaminants.

Wastewater Policy

Ensure wastewater collection and treatment systems are protective of water resources and public health.

Recommended Actions:

- Meet regulatory requirements for treatment and collection systems.
- Work towards addressing untreated CSOs with cost-effective approaches and investments.
- Continue to cost-effectively minimize the occurrences of SSOs.
- Work with GLWA to ensure regional priorities are integrated into the updated masterplan.

- Advance the use of the Water Resource Recovery Facility concept to recognize the environmental, economic and social outcomes they provide, including producing clean water, recovering nutrients, generating energy and integrating green infrastructure.
- Incorporate the strengths of green infrastructure that reduce the volume of stormwater into wastewater collection systems.
- Strengthen education of public officials on the use of green infrastructure for wastewater challenges.
- Support updates to the Michigan Statewide Sanitary code that address sustainable onsite sewage disposal system standards.
- Continue public education and outreach efforts for operation and maintenance of private onsite sewage disposal systems.

Stormwater Policies

Encourage flexibility and collaboration across jurisdictions for stormwater management through watershed approaches while achieving public health and environmental outcomes.

Work towards achieving state water quality standards for rivers, lakes and streams.

Recommended Actions:

- Pursue updates to state regulatory programs to recognize alternative compliance methods.
- Integrate green infrastructure target setting approaches across jurisdictions to work toward watershed goals.
- Seek partnerships to align capital improvement, transportation and infrastructure planning programs with water resource and recreational goals.
- Identify local opportunities to support state goals for the western Lake Erie basin.
- Seek opportunities to expand water reuse, including rainwater and stormwater.

Dams Policy

Reduce the environmental impacts of dams on local streams and rivers.

Recommended Actions:

- Inventory and assess dams for influences on hydrological and ecological conditions.
- Prioritize dams for structural improvements, operational updates or removal.

Transportation Policies

Reduce the impacts of transportation projects on water and natural resources.

Coordinate efforts to align water, natural resources, and transportation priorities.

Integrate multiple outcomes, including enhanced mobility, recreational opportunities, and water quality into the designs for transportation corridors near natural and water resources.

Recommended Actions:

- Integrate environmental elements into the early transportation planning process.
- Utilize the environmental sensitivity analysis to inform transportation agencies of potential impacts.
- Inventory and conduct condition assessment of road stream crossings.
- Categorize road stream crossings and prioritize improvements for multiple transportation modes, water trails, streamflow condition and fish migration.
- Evaluate and prioritize vulnerability and adaptive capacity of road stream crossings.
- Enhance environmental considerations within the regional transportation planning process.
- Support and facilitate collaboration between road agencies and local jurisdictions regarding stormwater management opportunities.
- Complete a climate resiliency analysis for regional transportation assets.

Extraction of Oil and Gas Policy

Minimize the potential impacts of oil and gas extraction and distribution to our water resources through additional local government oversight as well as enhanced coordination and collaboration between local, county, regional, and state agencies. This includes siting new facilities; ensuring transparency of the operation; validating safety of the operation and distribution network; and verifying adequate emergency response preparedness.

Integrated Water Resources Management

Climate Resiliency Policy

Enhance community readiness for changing precipitation patterns to ensure resiliency of infrastructure and natural resources.

Recommended Actions:

- Identify vulnerable infrastructure assets and improve adaptive capacity of these systems.
- Update precipitation frequency estimates for the region consistent with the National Oceanic and Atmospheric Administration (NOAA).
- Integrate resiliency priorities into local policies, plans and projects.
- Evaluate opportunities to use natural resource areas for improving management of runoff from extreme precipitation events.

Partnerships and Collaboration Policy

Form collaborative partnerships among local, state, and federal agencies; the private sector; nonprofit organizations; and other stakeholders to implement cost-effective solutions to protect and restore Southeast Michigan's water resources.

Recommended Actions:

- Work across jurisdictional boundaries and agencies to develop and implement capital improvement programs.
- Support efforts of existing partnership's including the GLWA's One Water Partnership and the Southeast Michigan Partners for Clean Water.
- Seek opportunities to strengthen public-private partnerships to address unique water resource challenges.
- Ensure economic development and infrastructure planning are aligned.
- Evaluate opportunities to align shared goals and measure progress across other Great Lakes partnerships, including the Great Lakes Commission Blue Accounting program.

Investments in Water Resources Policy

Ensure sustainable sources of funding and financing mechanisms to support the protection and restoration of Southeast Michigan's water resources.

Recommended Actions:

- Evaluate and review the structure of SEMCOG's Designated Management Agency program that supports regional water planning efforts.
- Work with state agencies to ensure that new regulatory programs are supported through direct funding sources to local agencies.
- Ensure that funding agencies recognize that local and regional planning programs provide a framework for funding water resource projects.
- Work with local agencies and the legislature to support dedicated funding sources for water resource programs, including the possibility of a statewide bond.
- Develop a funding resource that categorizes grants, loans and financing structures across water resource topic areas.

Public Education Policy

Attain a greater public awareness and mutual shared responsibility of water resources.

Recommended Actions:

- Create a regional public education campaign led by local stakeholders and educational institutions that transcends local watersheds with common water resource messaging focused on water education that includes stormwater, wastewater and drinking water education.

- Continue existing collaborative public education efforts between watershed organizations and local communities to meet stormwater permit requirements.

Water Resources Monitoring Policy

Implement a long-term, sustainable monitoring program for the region's water resources.

Recommended Actions:

- Align water resource monitoring programs with desired goals in local watersheds.
- Encourage use of volunteer monitoring program data that provides indicators and trends demonstrating long-term improvements and potential pollution sources.
- Encourage collaborative partnerships between local, state and watershed agencies for cost-effective, integrated programs.
- Work with the MDEQ and other state agencies to strengthen and expand monitoring programs that align with local watershed approaches.

Appendix B – Regional Watershed Summaries

Alliance of Downriver Watersheds: Ecorse Creek, Combined Downriver, and Lower Huron River

The Alliance of Downriver Watersheds (ADW) consists of the Ecorse Creek, Combined Downriver, and Lower Huron River Watersheds within Wayne County. The watersheds are relatively urban in nature. Major watercourses drain to the Detroit River and Lake Erie and include the Ecorse Creek, Sexton Kilfoil Drain, Frank and Poet Drain, Blakely Drain, Brownstown Creek, Huron River, Silver Creek, and Woods Creek. The challenges in these watersheds are typical of urban watersheds. Stream flows are much more erratic than state average; nutrient runoff is high; pathogen levels are high in Ecorse and Combined Downriver creeks; and conductivity levels (a general measure of chemical pollution) are high.

Milestones

Long-term monitoring efforts have indicated some improvements as a result of efforts within the watershed:

- **Good oxygen levels**. The vast majority of time, dissolved oxygen in ADW sites is above the state standard for aquatic life. However, several sites have experienced occasional low levels, and Brownstown Creek averages below the standard.
- **Mixed pathogen levels**. Pathogen concentrations are typically measured to be well above the state standard at most ADW sites. However, sites in the Lower Huron in Woods and Smith Creeks and the Huron River average below this standard.
- **Better bugs**. Aquatic insect diversity has improved slightly, with more insect types and more sensitive types being discovered. This is especially true at Ecorse and Combined Downriver sites in the spring, with site ratings moving from "poor" to "fair." Lower Huron sites have remained in the "good" rating range.

By the Numbers

Area	136,813 acres
Miles of Rivers/Streams	252
Number of Lakes	22
Number of Dams	9
Percent Tree Canopy	26.5%
Percent Impervious Cover	30%

- **Lower erosion**. Stream banks across the ADW watersheds show evidence of past erosion due to erratic stream flows. Currently, erosion events (measured by Total Suspended Solids above 80 mg/L) are quite rare. Lower erosion may have led to more stable aquatic habitat.
- **Invasive Species Removal**. In partnership with Wayne County Department of Public Services, an integrated pest management program for invasive species along the Rouge River and on Wayne County properties was developed resulting in the control of Phragmites, Eurasian milfoil, buckthorn, garlic mustard, and other invasive species on 250 acres resulting in the removal of over 25,620 cubic yards of invasive species.

Humbug Island at the Detroit River International Wildlife Refuge

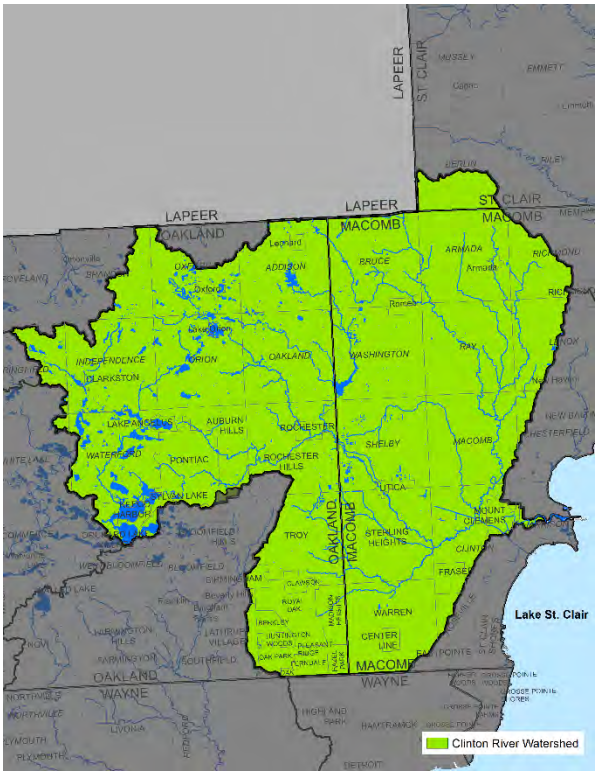
Clinton River Watershed

The Clinton River Watershed drains 477,635 acres of land in Southeast Michigan before entering Lake St. Clair at Harrison Township. While the watershed is home to many urbanized communities in Oakland, Macomb, and St. Clair counties, it has a number of pristine stretches of stream. Paint Creek, for example, is one of the only cold-water trout streams in Southeast Michigan, and is currently under management of the Michigan Department of Natural Resources. Paint Creek is stocked with brown trout and has shown success with natural reproduction of fish populations. Removal of the Paint Creek Dam resulted in restoring fish passage to 7.25 miles of Paint Creek, restoring stream banks, and reconnecting the creek to floodplain and wetlands. As a result, the entire 16 miles of Paint Creek have had fish passage and ecosystem functions restored.

Milestones

Significant efforts have been made to restore stream connectivity for fish and wildlife and recreationalists in the watershed. Notable achievements include the Cascade and Wolcott Dam removals that opened up 94 stream miles for aquatic species travelling upstream from Lake St. Clair. Similarly, in the North Branch of the Clinton River, 10 miles of fish passage was restored and 40 acres of wetlands were re-established. In the main branch of the Clinton River, nine miles of stream were restored and flood plain was reconnected as it flows through the cities of Utica and Sterling Heights.

In addition to high-quality fishing opportunities, the Clinton River Watershed Council (CRWC) has made significant strides to increase public recreation on the river by establishing an 81.5-mile-long water trail, and increasing public accessibility through the installation of American with Disabilities Act (ADA) universally accessible canoe and kayak launches. CRWC's WaterTowns™ Program has continued to connect people living along the Clinton River and Lake St. Clair to recreational opportunities and has focused on leveraging water placemaking to support local economic development.



By the Numbers

Area	477,635 acres
Miles of Rivers/Streams	635
Number of Lakes	295
Number of Dams	86
Percent Tree Canopy	31%
Percent Impervious Cover	22%

City of Auburn Hills – Clinton River at Riverside Park

Priorities

CRWC has worked for over 45 years to improve environmental quality in the watershed and has also played an integral role in the Clinton River Area of Concern (AOC) Public Advisory Council (PAC), which is focused on removing Beneficial Use Impairments from the AOC. Priorities in the Clinton River still include:

- Elimination of combined and sanitary sewer overflows,
- Nonpoint source pollution control,
- Superfund waste site and contaminated sediments remediation,
- Spill notification,
- Habitat restoration, and
- Elimination of illicit connections and failing septic systems.

Detroit River Direct Drainage

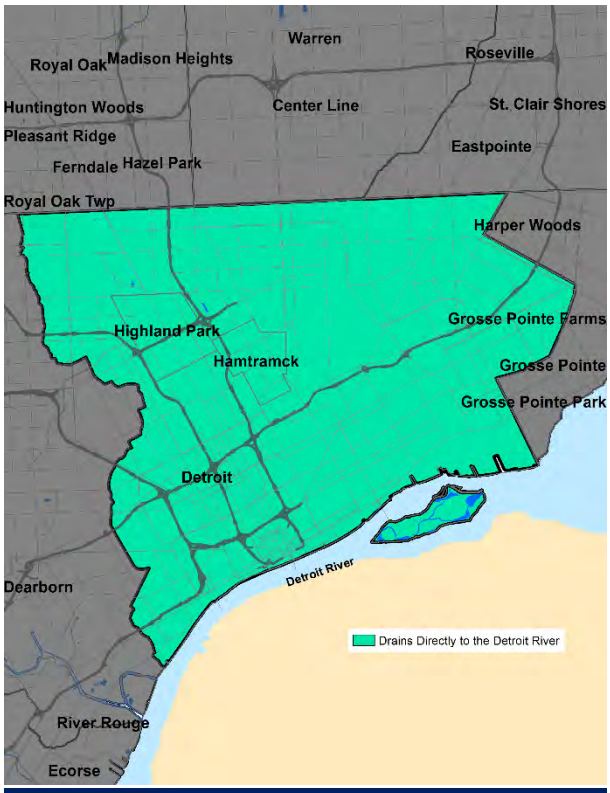
The Detroit River is a 32-mile international waterway connecting the upper Great Lakes and Lake St. Clair to Lake Erie and the lower Great Lakes. Over 54,000 acres of the SEMCOG region drains directly to the Detroit River, which is also influenced by other watersheds that drain to the Huron to Erie Corridor.

The Detroit River supports the region's growing blue economy through its support of the multiple freighters that move cargo on the Great Lakes; the provision of critical habitat for lake sturgeon, walleye, and other native fish; and the public recreation, water placemaking, and water access amenities it provides through the Detroit River Walk and Belle Isle.

In 1987, the river was designated a binational Area of Concern (AOC) based on eleven beneficial use impairments (BUIs), significant urban and industrial development, combined sewer overflows, municipal and industrial discharges, stormwater runoff, and the loss of nearly 95 percent of original coastal wetlands on the Detroit River.

Milestones

Although the river has faced challenges, significant progress has been made within the St. Clair Detroit River System Initiative (SCDRS) to remediate fish and wildlife BUIs. Some projects that have been completed include the Blue Heron Lagoon Restoration, the South Fishing Pier Restoration, the U.S. Steel Shoreline Restoration, and the Shoreline Restoration at Wayne County's Refuge Gateway. Other projects underway include Detroit River Reefs, Belle Isle Forested Wetland Restoration, Lake Okonoka Restoration with River Connection and Shoreline Restoration, Milliken State Park Upland Habitat Restoration, Stony Island Shoal Reconstruction, Sugar Island Habitat Restoration, and the Celeron Island Restoration and Shoal Construction.

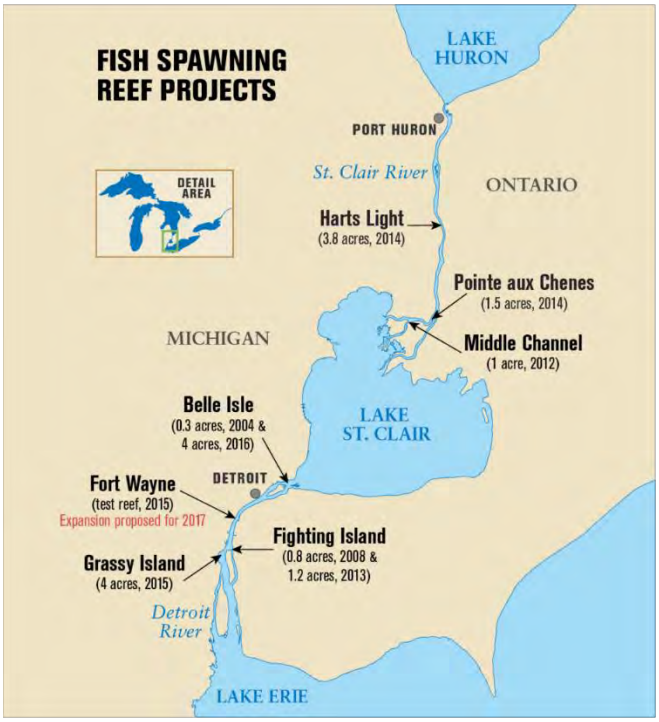


By the Numbers

Area - Detroit River Direct Drainage	54,086 acres
Miles of Rivers/Streams	0
Number of Lakes	5
Number of Dams	0
Percent Tree Canopy	14%
Percent Impervious Cover	55%

Other Milestones

- Multiple **Fish Spawning Reef Projects** have also been implemented in the Detroit River to help restore lake sturgeon populations, walleye, and other native fish.
- The **South Fishing Pier on Belle Isle** helps advance the region's blue economy by increasing recreational access to the Detroit River for anglers.
- The **Blue Heron Lagoon on Belle Isle** enhances spawning habitat for fish, and habitat for amphibians and reptiles, while also providing recreational access for paddlers on the Detroit River to explore Belle Isle's internal waterways and Lake Okonoka.



Priorities

The Friends of the Detroit River (FDR) has been working to improve fish and wildlife habitat and enhance quality of life in Southeast Michigan and southwest Ontario since the 1990s. FDR has received numerous grants to support habitat improvements and invasive species removal in the Detroit River and on Belle Isle. Significant progress has been made, and the final Hennepin Marsh project is anticipated to begin in 2018.

In addition to habitat restoration, FDR has been successful in its support of the Detroit Riverkeeper program, which was established in 2002 to enable citizen patrol of the Detroit River in a Riverkeeper boat to monitor its ecological integrity, identify issues, and serve as the, "eyes and the ears" for the public on the river. The program also focuses on public education, communication, partnerships, preserving natural resources, and supporting monitoring and research programs.

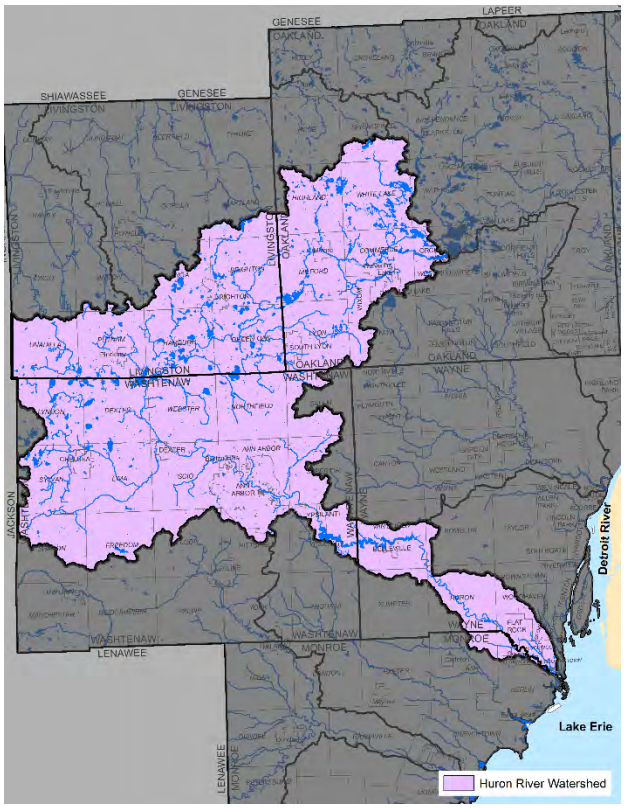
Huron River Watershed

The Huron River Watershed spans a land area of more than 900 square miles and drains water to the Huron River through hundreds of tributary creeks and streams. The river flows more than 125 miles from its headwaters at Big Lake, near Pontiac, to its mouth at Lake Erie. About 1200 miles of creeks and streams flow into the Huron's main branch. The river's drainage area includes seven Michigan counties (Oakland, Livingston, Ingham, Jackson, Washtenaw, Wayne, Monroe), 63 municipal governments, and 650,000 residents. The spectrum of land use and water environments ranges across remote natural preserves, cultivated farmland, urban and industrial centers, suburban sprawl, and an equal diversity of lakes, ponds, wetlands, creeks, and streams.

The Huron River watershed separates into three sections that are fed by 24 tributaries, which flow into Lake Erie. The upper section has the most natural flows and regularly achieves water quality standards for a majority of designated and desired uses. The middle section is more flashy, and has been impacted by phosphorous and bacteria from agricultural and urban development near Ann Arbor and Ypsilanti, however dissolved oxygen levels remain healthy and macroinvertebrate sampling in Washtenaw County demonstrates improvement in water quality. The lower section of the Huron River is the most urbanized, with consistently flashy hydrology, high phosphorous concentrations and bacteria levels, and some dissolved oxygen impairments.

Milestones

In 2014 the Huron was designated a national water trail with over 40 access sites for paddling and the regionally significant Argo Cascades. The Water Trail Towns of Milford, Dexter, Ann Arbor, Ypsilanti, and Flat Rock provide excellent destinations for trail users arriving by water and on land through the many hike-bike-equestrian trails that pass through the watershed. The Huron River Watershed generates significant economic value in Southeast Michigan. HRWC has invested $3 million in river and riverfront projects to help communities embrace the Huron River as an asset that benefits



By the Numbers

Area	574,088 acres
Miles of Rivers/Streams	749
Number of Lakes	486
Number of Dams	109
Percent Tree Canopy	38%
Percent Impervious Cover	10%

local economies and residents. In return, residents and visitors spend 2.6 million days at the river every year and recreational users contribute $53.5 million in economic output annually. The total value of the Huron River is estimated at $3.8 billion dollars from its recreational amenities, aesthetic value, its support of biological diversity, and flood reduction benefits from wetlands.

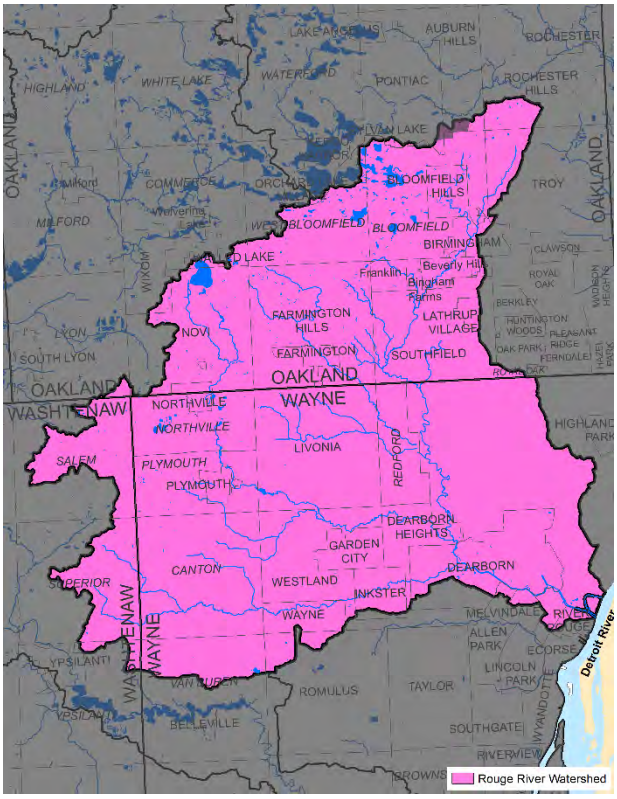
Norton Creek Volunteers– Huron River Watershed Council

Priorities

Significant investment has been made in the Watershed through the State Revolving Fund (SRF), the Great Lakes Restoration Initiative (GLRI), and the MDEQ Nonpoint Source Pollution (NPS) program. One dam removal has been completed at Mill Pond in Dexter improving water quality, flow, habitat connectivity, and fisheries. More dam removals and dam portages for water trail users are planned for the future. Through the implementation of BMPs and watershed management plans HRWC has documented reductions in phosphorus, e. coli, and flow extremes.

Rouge River Watershed

The Rouge River and its tributaries have realized tremendous improvements in water quality, flow moderation, habitat, and recreational opportunities over the last few decades. Much of the success is due to the Rouge River National Wet Weather Demonstration Project and the commitment of the contributing communities. The federal government invested over $350 million between 1992 and 2014 to control untreated sewage, manage stormwater, restore habitat, educate the public, and monitor progress. The local communities matched those grant dollars one-for-one.



Milestones

The Rouge River Watershed has achieved many milestones since it was designated an AOC in 1985, including:

- **More oxygen:** From 1994-2013, the percent of time that the dissolved oxygen met or exceeded the state minimum standard increased from 43 to 98 percent. This resulted in removing 400 stream miles from the state's impaired waters list in 2016.
- **Lower bacteria:** The bacteria in the Middle Branch (measured as *E. coli*) met or exceeded state standards 79 percent of the time in 2007-2009, as compared to 51 percent in 1994-1997.
- **Better bugs**: Sensitive aquatic insects such as stoneflies and caddisflies are returning throughout the watershed, and improving trends in stream quality indicators have been demonstrated in the Middle Branch and Johnson Creek. (FOTR, 2016)
- **Higher quality fish**: Improved habitat, dissolved oxygen, and desirable aquatic insects have led to trout being caught in the Middle and Lower Branches and salmon spawning in the Lower Branch in Canton Township.
- **Safer fish to eat**: Fish consumption advisories have been lifted or relaxed for part of the river, including the popular Newburgh Lake which underwent a significant restoration in 1999.

By the Numbers

Area	291,340 acres
Miles of Rivers/Streams	382
Number of Lakes	81
Number of Dams	67
Percent Tree Canopy	32%
Percent Impervious Cover	38%

- **Paddling opportunities**: The canoe livery on Newburgh Lake in Livonia was recently reopened due, in part, to significant improvements in water quality. In addition, Friends of the Rouge (FOTR) sponsor several canoe/kayak events each year.

Rouge River Water Trail

Priorities

Despite dramatic improvements, stormwater management remains a priority as runoff continues to degrade the river leading to bacteria, sediment, and nutrient challenges as well as threats to aquatic habitat as detailed in the Rouge River Watershed Management Plan (ARC, 2012).

These challenges are being tackled by the members of the Alliance of Rouge Communities (ARC), FOTR, and the Rouge River Advisory Council (RRAC). Collectively, these groups are encouraging the use of green infrastructure; seeking out and correcting illicit connections; monitoring water and habitat quality; educating the public to be better stewards of the river, and increasing recreational use of the river by establishing a 25-mile water trail on the Lower Branch. In addition, 26 restoration projects have been identified to improve habitat conditions. These projects will restore fish passage, habitat, streambanks, and wetlands along the Main, Middle, Lower, and Upper Branches (RRAC, 2016).

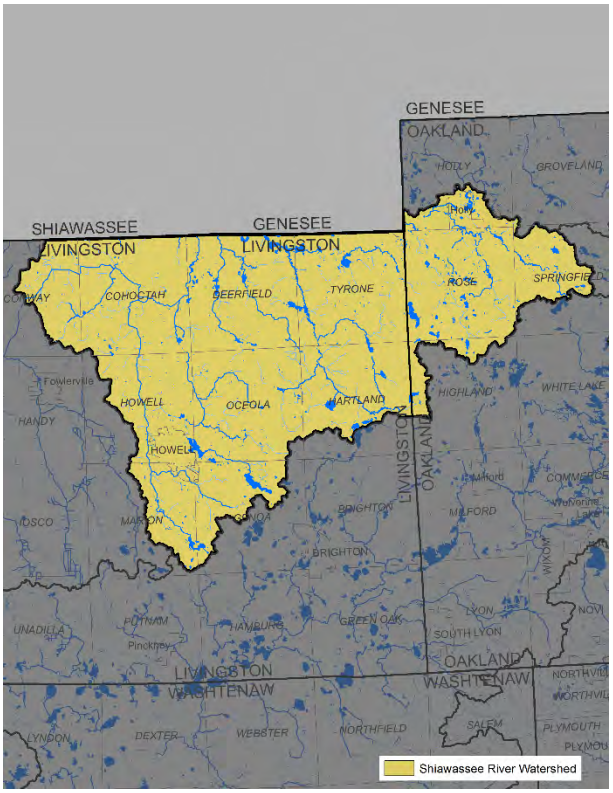
Shiawassee River Watershed

The Shiawassee River Watershed is 1,160 square miles and drains almost 199,844 acres in Southeast Michigan. The Shiawassee is the principle river flowing into the Shiawassee National Wildlife Refuge, a wetland sanctuary for an array of migratory bird species and other wildlife. The Shiawassee River flows through largely rural regions of the state before merging with the Flint, Cass, and Tittabawassee River to form the Saginaw River, which drains into the Saginaw Bay of Lake Huron. The Shiawassee River Watershed contributes to sedimentation and nutrient loading issues in the bay. Though most of the watershed is agricultural and residential land use, urban land use has begun to increase in recent years

Protecting and enhancing the Shiawassee River is a conservation priority in the region as the river has been identified as one of the best remaining examples of a warm-water river system within its ecoregion (a geographically-cohesive natural area that covers the southern half of the Lower Peninsula and reaches beyond Michigan's southern-most border). Of great ecological significance are the wetland systems located within the headwaters region of the Shiawassee River, which support a diverse assemblage of rare plants and animals.

Milestones

Monitoring data has shown that the 12 sites along the Shiawassee River are typically ranking from "good" to "excellent" for the total Stream Quality Score. To encourage more people to recreate on the river, in 2016 many organizations and municipalities came together to form the Shiawassee River Water Trail Coalition. This group has made many efforts to improve the Shiawassee River and has submitted an application to the National Park Service for National Water Trail designation for an 88-mile portion of the Shiawassee River which includes these communities in the watershed: Holly, Fenton, Linden, Argentine, Byron, Vernon, Corunna, Owosso, and Chesaning. By establishing the Shiawassee River as a National Water Trail, the long-term goal is that this designation will help to improve public perception of the watershed and also encourage other communities to get involved in conservation efforts.



By the Numbers

Area	199,844 acres
Miles of Rivers/Streams	243
Number of Lakes	150
Number of Dams	44
Percent Tree Canopy	39.5%
Percent Impervious Cover	6%

Shiawassee River; Photo courtesy of the Friends of the Shiawassee River

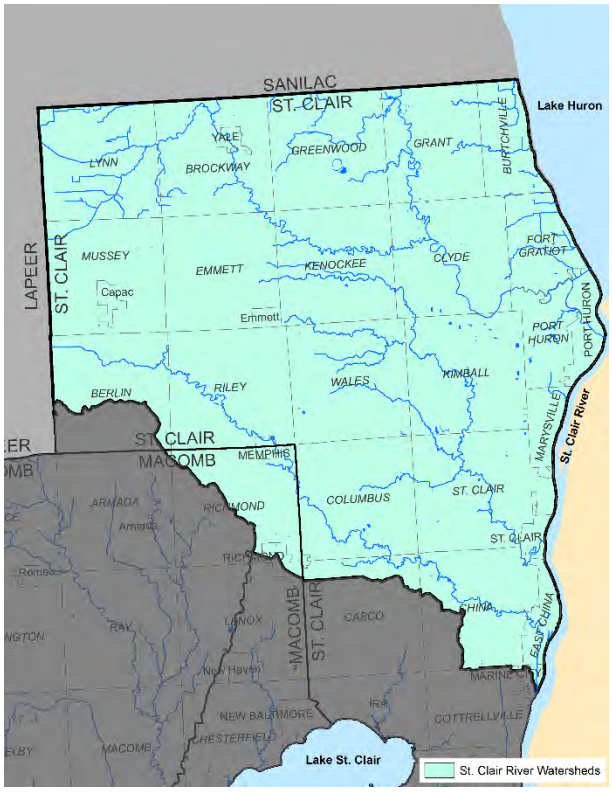
Priorities

The Friends of the Shiawassee River (FOSR), a volunteer-based organization, has been monitoring benthic macroinvertebrate communities within the Shiawassee River watershed. Monitoring is conducted twice annually (spring and fall) with the goal to collect baseline data and develop a long-term data set characterizing the health of the Shiawassee River.

Engaging community organizations, local government officials, and other volunteers in data collection to foster appreciation of the Shiawassee River and its habitats is a priority. In order to create lasting water quality improvements for the bay, local governments within the watershed must be engage in water quality protection.

St. Clair River Watersheds

The St. Clair River carries Great Lakes water 44 miles from Lake Huron to Lake St. Clair, forming the international boundary between the United States and Canada. The United States side of the St. Clair River includes six subwatersheds that span St. Clair County, including the Black River, Bunce Creek, Cuttle Creek, Pine River, Belle River and Marine City Drain. The river boasts the largest population of Lake Sturgeon, a threatened species, in the Great Lakes, has 10 islands, forms the largest fresh water delta in North America (the St. Clair Flats), and provides drinking water to 60 percent of the county's residents.



Milestones

Due to local investments and Great Lakes Restoration Initiative (GLRI) funding, exceeding a combined $21 million, tremendous progress has been made in restoring the river's Area of Concern (AOC) status. The river began with 10 impairments, eight of which have been restored to a healthy condition, and only two remain today. Restoration of the *Beach Closings* impairment was made possible by reducing pathogen sources through infrastructure improvements separating 48 of 49 combined sewer overflows (CSOs), elimination of illicit discharges, and creation of green infrastructure projects at Chrysler Park Beach.

A historic milestone was achieved with completion of 12 projects along the St. Clair River shoreline to restore habitat for fish and wildlife, including several threatened and endangered species. These projects showcase 5,000 feet of shoreline softening and enhancements, 3,000 feet of tributary restoration, fish nursery habitat, invasive species removal, three acres of wetland restoration, and six acres of fish spawning reefs at three sites on the river's bottomland.

Recent studies looking at PCBs (a group of man-made organic chemicals consisting of carbon, hydrogen, and chlorine atoms), mercury and other contaminants in tree swallows, fish, bald eagles, and mink indicate populations are no longer being adversely impacted, leading to the restoration of the

By the Numbers

Area	398,890 acres
Miles of Rivers/Streams	590
Number of Lakes	29
Number of Dams	15
Percent Tree Canopy	30%
Percent Impervious Cover	5%

Bird and Animal Deformities & Reproductive Problems impairment.

Aimed at increasing recreation opportunities, the Blueways of St. Clair provides over 150 miles of water trails and 45 public water access points across the watershed. The most popular water trail, the 10-mile Island Loop, has been designated a National Water Trail. In addition to 17 water trails, St. Clair County has eight ADA universally accessible kayak launches on five different bodies of water.

Marysville – St. Clair River Shoreline Restoration

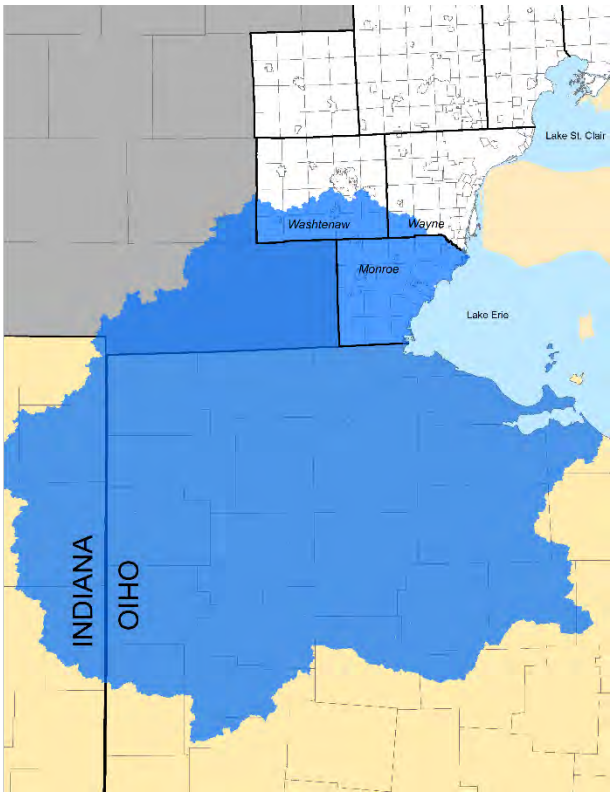
Priorities

Moving forward, priorities for the St. Clair River watershed include:

- Fully restoring its AOC status;
- Protecting drinking water from spills;
- Securing funding to implement watershed management plans;
- Continuing region-wide collaboration on Municipal Separate Storm Sewer System plans; and
- Raising awareness and participation in St. Clair River protection efforts.

Western Lake Erie Basin

The Western Lake Erie Basin (WLEB) drainage area includes land in both Michigan and Ohio. The majority of the almost six-million-acre WLEB drainage area is outside of the SEMCOG region; however, there are 557,640 acres in Monroe, Washtenaw, and Wayne counties that drain to western Lake Erie through the River Raisin and Lake Erie Direct Drainage watersheds. The dominant land use in the WLEB is agriculture, with 26,000 farms contributing to a multi-billion dollar economy. The majority of the remaining phosphorous loading challenges and implementation focus are within the Maumee River Watershed, located outside of the SEMCOG region.



In the western portion of the WLEB there are significant natural features that have been preserved. In Monroe County, the Oak Openings Region containing sandy soils, numerous rare and wild plants, and threatened and endangered species, extends from Ohio into Southeast Michigan providing environmental benefits for water quality, native plants, fish, and wildlife. This region is considered one of The Nature Conservancy's (TNC) "Last Great Places on Earth." On the Lake Erie coast there are comparable natural areas that are under public management of the Michigan Department of Natural Resources, TNC, and the U.S. Fish and Wildlife Services including the Detroit International Wildlife Refuge, Sterling State Park, and the Erie and Petersburg State Game Areas. These areas are integral to advancing the blue economy in the region as coastal wetlands in the WLEB support a fishing industry worth 10s of millions of dollars; and annual bird watching revenues are estimated at $26 million (Xie, 2012). These two activities alone support a $9.6 billion coastal tourism industry in Michigan and an $11.5 billion tourism industry in Ohio's seven coastal counties (Michigan SeaGrant, 2013).

Efforts to improve the quality of the WLEB are ongoing. Through the Great Lakes Water Quality Agreement (GLWQA), governments in Canada and the United States committed to managing phosphorous concentrations and loading in the WLEB by 40 percent by 2025. The goal of reducing phosphorous loading is to reduce harmful algal

By the Numbers

Area	557,640 acres
Miles of Rivers/Streams	912
Number of Lakes	139
Number of Dams	26
Percent Tree Canopy	22%
Percent Impervious Cover	6%

blooms that affected over 500,000 people in 2014 when algal toxins closed the Toledo, Ohio, drinking water treatment plant.

The *Cooling the Hotspots: Motivating Farmers to Reduce Nutrient Pollution* project funded by GLRI, is tackling nonpoint source phosphorous pollution through economic incentives, farmer engagement, nutrient load modeling, and technology. The project is on track to meet the goals of reducing nutrients and sediments in the South Branch of River Raisin and subsequently Lake Erie by 8,500 pounds of phosphorous (500 soluble reactive phosphorus), 7,300 pounds of nitrogen, and 6,800,000 pounds of soil erosion.

The River Raisin


River Raisin Bridge

The River Raisin is one watershed in the WLEB. Local efforts within the Monroe community have played a significant role in working to remove Beneficial Use Impairments (BUIs) in the River Raisin AOC area. As of now, the Degradation of Aesthetics, beach closings, eutrophication or undesirable algae, the Loss of Fish and Wildlife habitat and Degradation of Fish and Wildlife Populations BUIs have been removed.

Other successes in the River Raisin include the River Raisin Dam Remediation project to remove Monroe's lowhead dams to reconnect Lake Erie to Dundee, benefiting migratory fish habitat connectivity and passability for recreationalists on the River Raisin Water Trail. The River Raisin has also reduced phosphorous loading by 25-35 percent due to implementation of drainage management, buffers, filer strips, conservation tillage, and the use of cover crops.

St. Clair-Detroit River System Initiative

The St. Clair-Detroit River System (SCDRS) is an international border between Michigan and Ontario, Canada, comprised of four distinct water bodies – the St. Clair River, Lake St. Clair, the Detroit River, and the Western Basin of Lake Erie. The region's five designated Areas of Concern (AOCs), as well as the Maumee River, influence this system. The SCDRS is the receiving waterbody for most of the watersheds in Southeast Michigan. Additionally, waters from the three upper Great Lakes (Superior, Michigan, and Huron) flow through the SCDRS and into Lake Erie at a rate of about 120 billion gallons per day.

The St. Clair-Detroit River System Initiative (SCDRSI) was formed in 2004 and is comprised of representatives from almost every operating tribal, management, and governmental agency within the corridor, as well as non-governmental organizations, nonprofit organizations, and private consulting firms from the surrounding region. These organizations share the common goal of restoring the natural structure and function of habitats, populations, and biological communities in the SCDRS; and also focuses on water quality, wildlife, wetlands and fisheries, reptiles and amphibians, and recognizing the significant socio-economic impact of the corridor.

Shared Vision Statement: *The St. Clair-Detroit River System is a thriving ecosystem managed with science-based principles and broad social support, providing desired environmental services for the region and the Great Lakes basin.*

Milestones

Notable achievements in SCDRS include the implementation of the Partnership Agreement that provides a foundation of continued collaboration to advance the 2014-2023 Strategic Vision for SCDRS. Elements of this blueprint include the adoption of a Common Agenda of integrated Strategic Priorities for the next decade, with Guiding Principles to provide a consistent basis for achieving Desired Outcomes through defined strategies that are linked by Theme Areas of mutual interest to direct a Science Strategy, and a Monitoring Plan that help to inform, evaluate, and coordinate decisions of the Partnership. A comprehensive Viability Assessment has also been completed to help the Initiative benchmark its progress towards achieving management priorities.

City of Port Huron - Blue Water Bridge

Priorities

In 2014, the Steering Committee established five management priorities to guide coordinated management, science, and monitoring efforts toward the Common Agenda.

- Address Beneficial Use Impairments to de-list the Detroit River and St. Clair River AOCs in both countries.
- Improve water quality through reductions in pollutants from SCDRS sources.
- Increase overall biodiversity through protection and improvements to a connected mosaic of habitats in the system.
- Increase production of indigenous fish stocks through protection and improvements to functional habitats in the system.
- Reduce impacts on habitats, biodiversity, and fisheries from Aquatic Invasive Species threats.

Appendix C – Outreach and Survey Results

Pulse of the Region Survey on Water Resources

In Summer 2016, SEMCOG and the Metropolitan Affairs Coalition (MAC) administered an online survey on water resources. Here are the key findings from this survey:

- More than 40 percent of respondents thought the quality of lakes, rivers, and streams in their community is getting somewhat or much better. This is compared to 20 percent in a previous survey.
- Residents strongly agree that the quality of local streams impact Lake St. Clair and the Great Lakes.
- Residents strongly agree that it is important to monitor the quality of water entering drinking water treatment plants to identify spills and other pollution sources.
- In rating the quality of the infrastructure systems in their community(1-5 scale; 1=poor; 5=excellent), respondents said the following:
  - Drinking water = 4.1
  - Sanitary sewer = 3.9
  - Storm drainage = 3.3

    These findings are similar to a previous survey where 65 percent believed sewer conditions to be good or excellent and 72 percent believed water infrastructure to be in good or excellent condition.
- Drinking water was the infrastructure system that residents deemed most important to invest in for the next generation (51 percent).
- Residents would be willing to pay a few dollars more to:
  - Upgrade aging drinking water infrastructure – 84 percent
  - Maintain or replace aging sanitary sewers – 82 percent
  - Monitor at the intakes of drinking water plants to identify spills, protect water quality – 80 percent
  - Prevent pollution to lakes and streams – 77 percent

Pulse of the Region Survey on Parks and Recreation

In Spring 2016, SEMCOG and the Metropolitan Affairs Coalition (MAC) administered an online survey on the region's parks and recreation system. Key findings related to water recreation included:

- In the past year:
  - 53 percent of respondents swam at a beach
  - 50 percent of respondents canoed, kayaked, or paddle boarded

- 53 percent of respondents wish there were more canoe, kayak, and paddle board launches in the region
- 57 percent of respondents do not believe there is enough parks near water features (lakes, rivers) in the region

Water Resources Forum on the Blue Economy

In May 2016, SEMCOG hosted a forum on "The Blue Economy, Recreation, & Tourism." Participants were asked to address strategies for promoting blue economic development; expanding water placemaking, enhancing water-based recreation opportunities, and increasing access to water resources. Common regional priorities from the forum included:

- Water resources drive water-related economic development, commerce, support small businesses, increase local tax revenues, create jobs, and help build the region's brand, especially for tourism.
- A comprehensive strategy should focus on a mix of water-based industries, including:
  - Great Lakes freight and shipping
  - Manufacturing
  - Energy
  - Agriculture
  - Technology and innovation
  - Recreation and tourism
- Education, coordination, and stewardship among both the public and private businesses will help continue to protect water quality.
- Water placemaking initiatives should focus on enhancing gathering places and multi-modal connections along key corridors. Efforts should be inclusive, highlighting our natural resources and wildlife, as well as community history.
- Enhance public recreation amenities and events, creating centers of activity around our waterways.
  - Continue efforts to repurpose the region's historically industrial water resources as places for people to use and enjoy, while maintaining vital industries and working to meet the needs of our evolving economy.
- Universal access should be an important component of all new facilities and waterfront developments. Improving access to waterfronts will make it easier for all people to use and enjoy the region's water resources, regardless of age, income, or mobility. Visual access is another often overlooked amenity, and should be preserved and enhanced wherever possible.
- Materials marketing our regional recreation activities would help promote special events and increase awareness about what opportunities are available. Focusing on our existing resources can also help enhance travel and tourism within the region.
- Funding remains a challenge for recreation programs, public access improvements, maintenance, enforcement, and other related development activities.

Public Stakeholder Outreach Meetings

In Fall 2016, SEMCOG held four public stakeholder meetings in Livingston, Monroe, St. Clair, and Washtenaw counties to learn more about local priorities.

Drinking water was the number one priority in three (Livingston, Monroe, and St. Clair) out of the four counties. Similarly, pollution prevention was in the top five priorities for three of the counties (Livingston, St. Clair, and Washtenaw).

At each public meeting, attendees voted on their top five water related priorities.

	Washtenaw County	Monroe County	St Clair County	Livingston County
1	Stormwater	Drinking Water	Drinking Water	Drinking Water
2	Green Infrastructure	Stormwater	Recreation/Access to Water	Pollution Prevention
3	Recreation/Access to Water	Wastewater	Stormwater	Recreation/Access to Water
4	Collaboration	Recreation/Access to Water	Pollution Prevention	Stormwater
5	Pollution Prevention	Invasive Species	Invasive Species	Waterwater

General Assembly Surveys

At SEMCOG's Fall 2016 General Assembly, attendees participated in an input survey. Below is a summary of the results.

- The quality of their communities' storm drainage systems.
    1. Good (34 percent)
    2. Satisfactory (25 percent)
    3. Fair (13 percent)
    4. Poor (12 percent)
    5. Excellent (11 percent)
    6. Not applicable (4 percent)
- The quality of sanitary sewer systems in their communities.
    1. Good (40 percent)
    2. Excellent (20 percent)
    3. Satisfactory (17 percent)
    4. Fair (13 percent)
    5. Poor (7 percent)
    6. Not applicable (3 percent)

At SEMCOG's Fall 2017 General Assembly meeting, attendees participated in an input survey. Respondents were asked in which infrastructure system investment would be most important.

1. Drinking water infrastructure (35 percent)
2. Roads and bridges (30 percent)
3. Sanitary sewer (15 percent)
4. Stormwater and flood control (13 percent)
5. Transit (7 percent)

Public Outreach Report 2045 Regional Transportation Plan

In the Fall 2017, SEMCOG conducted a statistically representative random sample survey of residents in each of the region's seven counties and the City of Detroit to collect input on transportation priorities. Below are water- and infrastructure-related results:

- 83 percent of respondents said that roadway infrastructure is "very important" or "important" to minimizing water pollution and flooding
- 63 percent of respondents said that developing roadway infrastructure that minimizes water pollution and flooding should receive "much more spending" or "more spending"
- In indicating which four components of the region's transportation system they think should be top priorities for improvement over the next 5-10 years; 50 percent included air and water quality

In the Summer and Fall 2017 an interactive public online survey was conducted to provide education and collect data on prevailing experiences and priorities on the region's transportation system.

- When asked to rate the importance of approaches to preserving Southeast Michigan's water and natural resources as they relate to the transportation network, respondents rated "stormwater management" and "invasive species: with the highest average rating of 3.9 out five. "Wetlands" also rated highly, receiving a 3.8 out of five.

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