

Augmenting Michigan's Water Conservation and Efficiency Efforts: Climate, Energy, and Water Infrastructure

Prepared for the Michigan Department of Environment, Great Lakes and Energy (EGLE)

December 2021

Acknowledgements

This report was developed by a team of interdisciplinary Masters candidates from the University of Michigan's Medical School, School for Environment and Sustainability (SEAS), A. Alfred Taubman College of Architecture and Urban Planning, and the Gerald R. Ford School of Public Policy on behalf of the Michigan Department of Environment, Great Lakes and Energy (EGLE). This one-year collaborative project was funded by the Dow Sustainability Fellows Program at the University of Michigan and was guided by our client Emily Finnell at EGLE. We are grateful for the support of our faculty advisor Dr. Jennifer Read and our Dow Fellows project advisor Dr. Margaret Wooldridge. During this project, we also received insight from subject-matter experts in the field of water conservation and efficiency.

Table of Contents

Project Charge	4
Methodology	4
<i>Literature & Matrix Review Methodology</i>	5
<i>Interview Methodology</i>	8
Findings	11
Common Themes Across Interviews	11
Opportunities for Water Conservation and Efficiency Program Enhancement	11
References	17
Colorado	17
Florida	17
Illinois	18
Indiana	18
Louisiana	19
Michigan	19
Minnesota	22
Missouri	22
New York	22
Ohio	24
Ontario	24
Pennsylvania	24
Federal Government and National Organizations	25

Project Charge

The State of Michigan has policies and programs to address climate, energy, and water that will also help to achieve Michigan's water conservation and efficiency goals and objectives established under the Great Lakes-St Lawrence River Basin Water Resources Compact (Compact). The Water Use Advisory Council (WUAC) is a stakeholder group appointed by the Governor, Senate and House leaders and Director of the Department of Environment, Great Lakes and Energy (EGLE). It is set up to advise the state Quality of Life agencies (EGLE, Department of Natural Resources and Department of Agriculture and Rural Development) on best ways to implement the Compact's provisions in Michigan. The Water Conservation and Efficiency Subcommittee of WUAC is responsible for advising and making recommendations to the WUAC on opportunities to improve and enhance Michigan's water conservation and efficiency program and support sustainable water use. The WCE Committee is working to ensure that businesses, industry, agriculture, utilities, communities and the public have the best available information, tools and technologies to improve efficient use, and conservation, of water resources to ensure the sustainability of our water resources.

In the [WUAC 2020 Legislative report](#) (WUAC 2020), the Council recommended conducting an assessment of Michigan's current climate, energy, sustainability and water infrastructure policies and programs to identify specific policies and programs, not already reported, that fulfill Michigan's Compact obligations and identify any gaps. The WUAC identified the following needs:

- Assess Michigan's current climate, energy, sustainability and water infrastructure policies and programs to identify specific policies and programs, not already reported, that fulfill Michigan's Compact obligations and identify any gaps.
- Review the 5-year Compact program reviews from the other Great Lakes states and provinces to identify exemplar innovative water conservation and efficiency programs, resources and initiatives that Michigan could consider to improve its program.
- Develop benchmarking or case studies of other exemplar conservation and efficiency programs, and technologies targeting major water sectors in water rich states to identify specific programs that Michigan should consider adopting.
- Review federal water conservation and efficiency programs, such as the U.S. Environmental Protection Agency's (EPA) WaterSense Program to identify programs, resources that Michigan could use to improve its water conservation and efficiency program.
- Research new and innovative programs that employ just, equitable and sustainable approaches to efficient use and conservation of water resources for communities disproportionately affected by historic inequities.

In response to this recommendation, EGLE's Office of the Great Lakes sponsored a Dow Fellows project to assist with advancing progress toward this recommendation.

Methodology

Our research objectives were accomplished by conducting a thorough literature review of programs related to water conservation and efficiency, climate, energy, water infrastructure, and sustainability in

Michigan to identify programs that contribute to the state's Water Conservation and Efficiency Program goals and objectives. We then worked with the Office of the Great Lakes to identify and interview program and policy experts from select departments of state government to augment and clarify the results from the literature review.

Following our research on Michigan's programs, we expanded our scope to look at water conservation and efficiency programs in the other Great Lakes states and four identified water-rich states outside the region. Using results from the literature review and interviews, we identified several areas where further programmatic development could enhance Michigan's efforts to achieve water conservation and efficiency goals and objectives under the Compact.

The following goals guided our research:

Goal 1: Assess the current contributions of Michigan's climate, energy, water infrastructure, and sustainability policies toward the water conservation and efficiency goals and objectives that are part of Michigan's commitments under the Great Lakes Compact. Describe any gaps between the current policies and the Compact's goals and objectives and identify opportunities to advance progress towards these goals.

Goal 2: Identify water conservation policies, programs and initiatives from other Great Lakes states/provinces that may address the identified gaps in Michigan's water conservation efforts.

Goal 3: Develop an understanding of the water conservation and efficiency programs implemented in other water-rich states that may offer additional opportunities for Michigan.

Goal 4: Determine where federal financial assistance and collaboration can be increased or established to advance the State of Michigan's water conservation objectives.

Goal 5: Develop recommendations for advancing the state of Michigan's progress on achieving the water conservation and efficiency goals and objectives under the Compact.

Literature & Matrix Review Methodology

We conducted a thorough literature review of Michigan's water conservation programs operated by the Department of Environment, Great Lakes, & Energy (EGLE) in relation to compliance with the Great Lakes Compact. This review also included programs outside of EGLE that involve water conservation aspects with the majority of which were found within the Department of Agriculture & Rural Development. We split the literature review amongst all team members to identify water conservation and efficiency programs within four overarching categories: climate, energy, sustainability, and infrastructure. The next steps involved navigating various Michigan state department websites for any programs related to water conservation and efficiency. Team members discussed findings with each other and any overlapping programming. Once complete, the team reported back to the client and

spoke to various employees involved with water conservation in EGLE to cross-check findings (see interview methodology for more information).

In addition to Michigan and other Great Lakes states, we analyzed programs in Florida, Louisiana, Colorado, and Missouri that may meet the needs identified in our research of Michigan's programs.¹ We created the following matrix to determine states with similarities to Michigan's water use and policy landscape.

To develop the matrix, we assessed states based on their freshwater resources, water use, demographics, and geography. We identified states with similar freshwater resources as Michigan, square miles of surface freshwater, and water use, water withdrawals (surface and groundwater) in millions of gallons per day, using water data provided by the U.S. Geological Survey's "How Wet is Your State? The Water Area of Each State" ([USGS, 2018](#)) and U.S. Geological Survey's "Total Water Use in the United States ([USGS, 2018](#)). We identified states with similar demographics to Michigan (age, race, ethnicity, education, relationship status, veteran status, income, poverty rates, occupations, and housing) using the [Election State Similarity Index](#). Finally, we identified the other seven Great Lakes states as being geographically similar to Michigan.

For the literature review of water-rich states, each team member was assigned a different state to further research. A majority of this information was collected from these states' equivalents of EGLE's Office of the Great Lakes. This information was then discussed as a team and provided the backbone of many of the questions asked of these states (see interview methodology for more information). Table 1 can be found on the next page:

¹ After conducting interviews with Michigan state employees, it was recommended we include Florida due to an interviewee's prior research and understanding of the State's policies.

Table 1. States with Similar Water Use Regimes and Policy Landscape to Michigan

	Freshwater resources	Water use	Demographics	Geography	Total Factors (1-4)
Alaska	x				1
Arkansas		x			1
California		x			1
Colorado**	x	x			2
Delaware	x				1
Florida	x	x			2
Hawaii	x				1
Idaho		x			1
Illinois*	x	x	x	x	4
Indiana*	x		x	x	3
Louisiana	x	x			2
Massachusetts	x				1
Minnesota*	x			x	2
Missouri		x	x		2
Montana		x			1
Nebraska		x			1
New York*	x	x		x	3
North Carolina		x			1
Ohio*	x		x	x	3
Pennsylvania*	x	x	x	x	4
Rhode Island	x				1
Texas		x			1
Wisconsin*	x			x	2

*Great Lakes States and Compact signatories

** While Colorado is governed by western water law, which recognizes appropriative rights, and Michigan water law recognizes riparian rights, the state ranked high enough in the matrix for us to investigate further. Upon investigation, Colorado’s public engagement and outreach is where we saw opportunities from which Michigan might benefit.

Interview Methodology

In parallel with the literature review, we conducted interviews with policy experts and program managers and staff from Michigan’s Quality of Life agencies who work with water conservation and efficiency programs as well as other programs, e.g., climate change, energy, water infrastructure, that may contribute toward the State’s water conservation and efficiency goals and objectives under the Compact. After identifying areas for further development in Michigan, we conducted interviews with policy experts and program managers in each of the other Compact states. We also interviewed experts in four water-rich states outside of the Great Lakes basin that are implementing water conservation programs -- Florida, Colorado, Louisiana and Missouri -- and the US EPA to identify potential state and federal programs that could potentially fill the identified gaps. Several individuals or state teams opted to provide written responses to our questions.

Blinded interview transcripts and written responses are in the Appendix.

We identified the following individuals for interviews:

Table 2. List of Interviewees Continued

Name	State	Title	Department
Dr. Brandy Brown**	Michigan	Former Climate and Energy Adviser	Michigan Department of Environment, Great Lakes, and Energy (EGLE), Office of Climate and Energy
Jim Milne* Andrew LeBaron*	Michigan	Water Use Assessment Unit Supervisor Environmental Quality Analyst	Michigan Department of Environment, Great Lakes, and Energy (EGLE), Water Use Program
Abigail Eaton	Michigan	Environmental Resource Specialist	Michigan Department of Agriculture and Rural Development, Environmental Stewardship Division
Ninah Sasy**	Michigan	Former Clean Water Public Advocate	Michigan Department of Environment, Great Lakes, and Energy (EGLE), Office of the Clean Water Public Advocate
James Clift	Michigan	Deputy Director	Michigan Department of Environment, Great Lakes, and Energy (EGLE)
Julie Staveland	Michigan	Sustainability Section Manager	Michigan Department of Environment, Great Lakes, and Energy (EGLE), Materials Management Division, Sustainability Section

Table 2. List of Interviewees Continued

Name	State	Title	Department
Kelly Green	Michigan	Administrator of Water Infrastructure Financing	Michigan Department of Environment, Great Lakes, and Energy (EGLE), Water Infrastructure Financing Section
Regina Strong***	Michigan	Environmental Justice Public Advocate	Michigan Department of Environment, Great Lakes, and Energy (EGLE)
Donald Zelazny	New York	Great Lakes Coordinator	New York State Department of Environmental Conservation (DEC)
RJ Pire	Wisconsin	Water Policy Advisor	Public Service Commission of Wisconsin
Shaili Pfeiffer	Wisconsin	Staff Specialist	Wisconsin Department of Natural Resources (DNR), Water Use Section
Russ Sands	Colorado	Water Supply Program Manager	Colorado Water Conservation Board
Carmel Nelson	Minnesota	Water Conservation Consultant	Minnesota Department of Natural Resources (DNR), Water Appropriations Permit Program
Tim Bruno	Pennsylvania	Chief	Pennsylvania Department of Environmental Protection (DEP), Office of the Great Lakes
Mark Basch* Allison Mann*	Indiana	Head Water Use Program Coordinator	Indiana Department of Natural Resources (DNR), Division of Water, Water Rights & Use Section
Bradley Lodge* Lori Emler*	Ohio	Program Manager Environmental Analyst	Ohio Department of Natural Resources (DNR), Water Inventory and Planning Program
Cary McElhinney	US EPA Region 5	Program Coordinator	US EPA Region 5, Ground Water and Drinking Water Branch

* Joint interview or response

** No longer serving in their listed title as of December 2021

*** Not available for interview

We asked the following questions to Michigan agency personnel:

1. Which programs/policies implemented by your unit/agency/organization contribute to water conservation and efficiency in Michigan?
2. Which programs/policies implemented by your unit/agency/organization do you believe are the most effective in supporting water conservation and/or efficiency in Michigan? Why?
3. Are there any areas where you feel that Michigan has excelled at, in terms of water conservation and efficiency? Where do you think improvements could be made?
4. What sectors and/or stakeholders do you work with to implement or create programs?
5. What sectors do you think have the greatest potential for improving conservation and efficiency and how does your unit/agency/organization work towards making improvements in these areas?
6. What are the individual motivations and incentives within sectors that your unit/agency/organization works with that drive water conservation and efficiency?
7. What challenges or issues has your unit/agency/organization faced implementing water conservation and/or efficiency programs and policies? How are you overcoming these challenges?
8. What opportunities do you see with new energy, climate and water infrastructure policies and programs to advance water conservation in Michigan?
9. What do you see as gaps or opportunities for further water conservation programming within or outside of your current program area?
10. Are there any white papers or publications in relation to the programs that we discussed that we should read?
11. Do you have any contacts that could provide more perspective on the topics we discussed?
12. What questions should have we asked that we didn't?

We asked the following questions to state and federal agency personnel outside the state of Michigan:

1. Are there any areas where you feel that your state has excelled at meeting or exceeding the requirements in the Compact in terms of water conservation and efficiency? Where do you think improvements could be made [if applicable]?
2. What sectors do you think have the greatest potential for improving conservation and efficiency and how does your state work towards making improvements in these areas?
3. What challenges or issues is your state experiencing in achieving its water conservation goals and objectives? How are you overcoming these challenges?
4. Are there any conservation initiatives that your state promotes that you think could be beneficial to other states?
5. Which programs/policies implemented by your agency/organization do you believe are the most effective in supporting water conservation and/or efficiency in your state from an environmental justice/water equity perspective? Why?
6. Are there any areas where you feel that your state has excelled in terms of water conservation and efficiency in terms of environmental justice/water equity? Where do you think improvements could be made?
7. What measures would you recommend be added to your state's water conservation efforts that are not already in place?

Findings

Common Themes Across Interviews

After considering the information gleaned through interviews and the literature review in the context of what we learned about current Michigan programs, we identified several categories where there are promising opportunities for strengthening programs that Michigan could explore. We outline the categories and key opportunities within each in the matrix below.

Table 3. Themes and Opportunities Identified in Interviews

Themes Emerging from Interviews	Opportunities	Interviews																Total	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
Public and Industry Engagement	Broad Public Education	X	X	X		X			X	X		X		X	X				9
	Community Empowerment through Engagement		X	X					X										3
	Local Watershed Conversations	X		X		X			X				X				X		6
Data and Technology	Baseline Data Collection	X			X	X				X			X					X	6
	Innovative Technology and Research	X				X				X		X		X					5
	Reporting and Auditing within Voluntary Programs	X			X					X			X	X	X			X	7
Funding and Infrastructure	Infusing Water Conservation into Goals of Other Programs		X				X	X									X		4
	Infrastructure Investment within Energy-Water Nexus		X	X	X		X	X		X	X			X			X		9

Opportunities for Water Conservation and Efficiency Program Enhancement

Public and Industry Engagement

1. *Broad public education is fundamental to widely accepted conservation practices:* To date, Michigan has not had a dedicated statewide public outreach effort targeting the general public

about the importance of water conservation compared to the effort expended in other states. A statewide public outreach program led by the State could have a profound impact on knowledge, attitudes, behaviors, which can lead to increased support for water conservation, municipal and other public water system investment; and, in education the general public on the connection between water quality and water quantity in conservation efforts. This effort requires all state departments and agencies within Michigan to address water conservation issues when possible.

Example: EGLE can leverage existing [EPA WaterSense](#) materials to engage with current water conservation-education organizations and programs. These materials provide scientifically vetted, “ready-to-go” resources to educate the public about how individuals can take steps to conserve water.

2. *Communities should be empowered to address water challenges through public engagement:* Public engagement can encourage communities to begin thinking about the potential climate scenarios that may impact water availability in the future, and how these scenarios may affect long-term sustainable water use. Michigan should develop or adapt public engagement programs that integrate new data, methods, and approaches to highlight/convey changing environmental conditions in order to help guide communities toward long-term sustainable water uses. To this end, scenario planning can support communities in the exploration of potential futures, and in creating a common vision of a desirable future.

Example: [Colorado’s Water Plan](#) (2015) describes how the state government employed scenario planning to guide the development of future policies. A collaborative and participatory process, which included stakeholders from the private, public, and non-profit sectors, developed scenarios looking 20 years into the future for each of Colorado’s nine water basins -- representing the eight major rivers in the state and the Denver Metropolitan Statistical Area. In preparation for the scenario planning, each basin developed multiple scenarios which focused on low, medium, and high future water needs and that incorporated conservation, agricultural transfers, water reuse, and other water projects. Thirty-four different scenarios at the basin level resulted from this phase. After talking with stakeholders and analyzing the plans, state personnel identified ten high-impact drivers and compared them against the 34 scenarios to create five guiding scenarios in the *Colorado Water Plan*. These were: Business As Usual, Weak Economy, Cooperative Growth, Adaptive Innovation, and Hot Growth. One of the biggest outcomes of this method was people seeing how their actions in one watershed could affect those in other watersheds across the state. People saw how high-withdrawal or failure to execute water conservation techniques in their basin affected their neighbors and people in other basins. We heard in many interviews that Michiganders continue to believe that because Michigan is a water rich state, conserving water is not a priority. A scenario planning process, such as Colorado used, could help bridge the gap in Michigan between the perception of water abundance and the local reality of water scarcity by providing a visual demonstration of the value of water conservation.

3. *Communities play an important role in local watershed conversations:* Currently, only certain areas in Michigan are experiencing water scarcity making the issue a highly localized one. Given this, community forums are fitting venues for the state to engage the public in facilitated and potentially challenging conversations about water equity that identify concrete ways people can conserve water.

Example: Part 312, Watershed Alliances, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, states, “two or more municipalities, by resolution of their respective governing bodies, may establish a watershed alliance for the purpose of studying problems and planning and implementing activities designed to address surface water quality or water flow issues of mutual concern within the portion of a watershed located within their boundaries.” Encouraging the early establishment of watershed alliances could ease future water use conflicts. In these watersheds, users will have already built relationships with other water users in the watershed and therefore may have the ability to make decisions together as a group on the foundation of that established trust and communication. Promoting and leveraging the development of watershed alliances can help establish long-term water use as a foundational piece of community and economic development strategies.

Example: As outlined Part 327, Great Lakes Preservation, of the NREPA, water users making large quantity withdrawals in the same watershed are encouraged to establish Water User Committees to work cooperatively in order to resolve water conflicts or potential adverse resource impacts. Committees can work together to evaluate the status of current water resources, water use trends in the watershed, and identify voluntary actions to manage trends that could lead to adverse resource impacts.

Data and Technology

4. *Baseline data collection is valuable for users tracking their conservation and efficiency measures:* Metering water usage allows for the establishment of baseline metrics so users can better understand their water usage. Metering may be an opportunity for water users to further understand their water use -- including daily and seasonal patterns as well as total amounts used, and therefore identify areas where water conservation and efficiency could result in monetary savings. Additionally, more widespread use of metering could help identify gaps between authorized water use volumes and actual water use volumes which could, in turn, aid water user committees in identifying potential solutions to water use disputes in depleted sub-watersheds. With appropriate education and training, metering can aid in data-driven decision making and provide water users the ability to measure their conservation and efficiency practices.

Example: Wisconsin requires all [high-capacity water withdrawals](#) to report the amount of water withdrawn every year. Ninety-five percent of all property owners report their water withdrawals through metering every year, while the other five percent of all property users use estimates. This data, which indicates that six percent of all water withdrawn in 2018 went to agricultural purposes, is compiled into an ArcGIS story map for transparency to all residents in Wisconsin and to aid in a public understanding about water use in the state.

5. *Innovative technology and research are essential to effective water conservation and efficiency strategies:* The literature and our interviews indicated that there are opportunities for improving both the implementation of innovative water conservation technology and information sharing between scientists and government agencies. Expanded collaboration and communication with the state's public universities could allow for new research opportunities and the increased application of new science and technology in pursuit of the state's water conservation and efficiency goals.

Example: [The State of Minnesota's Technical Assistance Program](#) has an internship program that pairs engineering students with businesses to implement new conservation and efficiency measures that apply to water, energy, and waste. This program brings new science and technology to the consumer to support efforts to reduce water use and water loss, and provides students with experience in real world settings.

6. *Reporting and Auditing within voluntary programs can complement existing processes:* Michigan water use regulations administered by EGLE are the primary water conservation and efficiency programs in the state. The process of applying for and receiving a large quantity water use authorization from EGLE imposes limits on water use, and includes recommended voluntary conservation and efficiency measures. With additional resources, including more personnel and budget, EGLE could implement a reporting or even an auditing system that would augment the existing regulations to better track and encourage voluntary conservation practices.

Example: EGLE's Materials Management Division, Sustainability Section, Energy Services provides [grants](#) to various entities for the purpose of energy efficiency. Energy Services then collects data from grantees at the end of a grant related to kilowatt hours saved, reduction in electricity consumption, as well as reduction in water consumption related to the project. These data suggest that water savings go hand-in-hand with energy savings, and the collection of water data as a part of programs in other sectors could be expanded to further understand intersections of water and energy conservation across programs.

Example: Under [Louisiana's Rural Water Energy Conservation Program \(LRWA\)](#), individual audit visits are performed by field technicians. The LRWA technicians visit water and waste-water treatment plant facilities on a regular basis to evaluate each facility for ways to increase energy efficiency as an integral part of the state's total conservation educational goals. Reinvigorating

Michigan's Retired Engineers Technical Assistance Program and extending resources to the private sector and large consumers would be beneficial.

Funding and Infrastructure

- 7. Infusing water conservation into the goals of other programs is an important step in addressing funding challenges:* Insufficient funding at the federal level, and limited staffing at the state level, have meant the state is not able to provide supplemental programming that supports users in implementing voluntary water conservation and efficiency practices. To leverage existing resources, Michigan can infuse water conservation and efficiency goals into overarching climate and sustainability goals and programs. State policy, such as Executive Directive 2020-10 which set a formal goal of achieving carbon neutrality by 2050, creates the opportunity to capitalize on overlap among all the programs that will be involved in achieving carbon neutrality, such as climate, sustainability, energy and water conservation and efficiency programming.

Example: Several interviewees identified utility-led energy waste reduction programs as a template for effective water conservation and efficiency programs, including the replacement of plumbing fixtures as part of waste reduction efforts. EGLE could partner with utilities to help promote those programs and help the public understand where these programs are available and how they might participate. This would establish a cooperative public-private partnership to promote existing opportunities to the public. The state could also expand the use of these types of programs to accomplish infrastructure improvements, energy savings, and wastewater reduction. For example, a partnership with the state's energy utilities could ensure that contractors, already in homes to conduct energy audits, also address water use and efficiency.

Example: Technical support programs offered by EGLE ([Energy Services](#)) are designed around the best practices of energy management and use tracking tools such as ENERGY STAR Portfolio Manager (ESPM). Part of energy management includes tracking water usage, and ESPM has a section specifically designed for water. Through continued outreach to grantees and stakeholders and the promotion of the use of tools such as ESPM, EGLE can emphasize the connection between energy and water savings to help reinforce this nexus for water and energy users.

- 8. The energy-water nexus provides a platform for targeted infrastructure investment:* Michigan's aging water infrastructure impacts both water quality and conservation efforts. A recent study by the Michigan Municipal Association for Utility Issues analyzed energy savings accomplished by addressing water service line leaks. Findings revealed that measurable energy savings can be realized through service line replacements that also address water loss before the meter and therefore not billable to the consumer. Water-energy nexus projects such as these could have tremendous benefits across the state, by providing programs for utilities to perform service-line replacements that save energy, money, and water.

Example: Funding through the [MI Clean Water Plan](#) has the opportunity to address and achieve water conservation goals and objectives. Upcoming infrastructure investment opportunities should be explicit about capturing both water efficiency and energy metrics. For example, programs could require documentation of water savings that result from the funded work.

References

Colorado

Cohen, Aaron, and Jeff Manner. Interview with Randy Sands, September 22, 2021.

Colorado Water Conservation Board. "Read The Plan | DNR CWCB." Colorado Water Conservation Board. <https://cwcb.colorado.gov/read-plan>.

Colorado Water Conservation Board. "Home | DNR CWCB." <https://cwcb.colorado.gov/>.

Florida

Division of Water. "Water Supply | Florida Department of Environmental Protection." Florida Department of Environmental Protection, November 15, 2021. <https://floridadep.gov/water-policy/water-policy/content/water-supply>.

Division of Water REsource Management. "Florida's Reuse Program | Florida Department of Environmental Protection." Florida Department of Environmental Protection, March 24, 2020. <https://floridadep.gov/water/domestic-wastewater/content/floridas-reuse-program>.

Florida Public Service Commission. "Water Management in Florida." Florida Public Service Commission, n.d. <http://www.psc.state.fl.us/Files/PDF/publications/consumer/brochure/WMF.pdf>.

Florida Water Resources Act, Chapter 373 - Water Resources, 2016 (n.d.). http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=0300-0399/0373/0373ContentsIndex.html&StatuteYear=2016&Title=%2D%3E2016%2D%3EChapter%20373.

Office of Water Policy and Ecosystems Restoration. "Minimum Flows and Minimum Water Levels and Reservations | Florida Department of Environmental Protection." Florida Department of Environmental Protection, June 17, 2020. <https://floridadep.gov/water-policy/water-policy/content/minimum-flows-and-minimum-water-levels-and-reservations>.

— — —. "Water Conservation | Florida Department of Environmental Protection." Florida Department of Environmental Protection, January 26, 2021. <https://floridadep.gov/water-policy/water-policy/content/water-conservation>.

— — —. "Water Management Districts | Florida Department of Environmental Protection." Florida Department of Environmental Protection, May 16, 2019. <https://floridadep.gov/water-policy/water-policy/content/water-management-districts>.

— — —. "Water Management Districts | Florida Department of Environmental Protection." Florida Department of Environmental Protection. Accessed December 8, 2021. <https://floridadep.gov/water-policy/water-policy/content/water-management-districts>.

Wastewater Management Program. "Water Reuse Program | Florida Department of Environmental Protection." Florida Department of Environmental Protection. Accessed December 8, 2021. <https://floridadep.gov/water/domestic-wastewater/content/water-reuse-program>.

Illinois

Bureau of Land and Water Resources. "Sustainable Agriculture." Illinois Department of Agriculture. <https://www2.illinois.gov/sites/agr/Resources/Conservation/Pages/default.aspx>.

Casey, Jim. "Lake Michigan Water Allocation - Water Resources." Illinois Department of Natural Resources. <https://www2.illinois.gov/dnr/WaterResources/Pages/LakeMichiganWaterAllocation.aspx>.

Office of Water Resources. "Five Year Review of Illinois' Water Management and Conservation and Efficiency Programs." Report to the Compact Council and Regional Body. Illinois Department of Natural Resources, December 8, 2014.

———. "Five Year Review of Illinois' Water Management and Conservation and Efficiency Programs." Report to the Compact Council and Regional Body. Illinois Department of Natural Resources, December 30, 2019.

Indiana

Division of Water. "Great Lakes Compact." Indiana Department of Nature Resources, January 29, 2021. <https://www.in.gov/dnr/water/lake-michigan/great-lakes-compact>.

———. "Indiana's Water Shortage Plan." Indiana Department of Natural Resources, March 20, 2015. <https://www.in.gov/dnr/water/water-availability-use-rights/indianas-water-shortage-plan/>.

———. "Report on Indiana Water Use Efficiency and Conservation." Indiana Department of Nature Resources, January 29, 2021. <https://www.in.gov/dnr/water/lake-michigan/great-lakes-compact/report-on-indiana-water-use-efficiency-and-conservation>.

———. "Significant Water Withdrawal Facility Registration." Indiana Department of Nature Resources, February 4, 2021. <https://www.in.gov/dnr/water/water-availability-use-rights/significant-water-withdrawal-facility-registration>.

———. Suggested Model Ordinance, Indiana Code 14-25-14 § (n.d.). https://www.in.gov/dnr/water/files/Model_ordinance_Final_Draft_7-2-07.doc.

———. "Water Use Management for Conservation & Efficiency ~Indiana Significant Water Withdrawal Facilities~." *Indiana Department of Natural Resources* (blog), n.d. <https://www.in.gov/dnr/water/water-availability-use-rights/indianas-water-shortage-plan/>.

Smith, Chris. "State of Indiana: Five-Year Water Management and Conservation and Efficiency Program Review." Indiana Department of Natural Resources, December 20, 2019.

———. "State of Indiana: Water Management Program Review." Indiana Department of Natural Resources, December 8, 2014.

Written Response from Mark Basch and Allison Mann, October 1, 2021.

Louisiana

Louisiana Department of Agriculture and Forestry. "Conservation." Department of Agriculture and Forestry. <https://www.ldaf.state.la.us/conservation/>.

Louisiana State University - Extension. "Louisiana Master Farmer Program." LSU AgCenter, October 13, 2021. https://www.lsuagcenter.com/topics/environment/conservation/master_farmer.

Louisiana Conservation Law - Chapter 9 Soil Conservation, § 1201 (n.d.). <https://www.google.com/url?q=https://www.ldaf.state.la.us/wp-content/uploads/2014/05/LAConservationLaw.pdf&sa=D&source=editors&ust=1639090738023000&usg=AOvVaw2jWZdbX4yqJM9H7jYNAb6E>.

Purpera, Daryl. "Louisiana's Management of Water Resources." Louisiana Legislative Auditor, February 5, 2020. [https://app.la.state.la.us/PublicReports.nsf/0/7AE69DA84B7F7E89862585040079C762/\\$FILE/LMWR.pdf](https://app.la.state.la.us/PublicReports.nsf/0/7AE69DA84B7F7E89862585040079C762/$FILE/LMWR.pdf).

Technology Assessment Division. "Rural Water Energy Conservation Program." Louisiana Department of Natural Resources. <http://www.dnr.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=323>.

Michigan

Assendelft, Nick. "Whitmer - Catalyst Communities Program Will Help Communities Address Climate Impacts on Public Health, Emergency Preparedness." Michigan Office of Governor Gretchen Whitmer. <https://www.michigan.gov/whitmer/news/press-releases/2020/09/16/catalyst-communities-program-will-help-communities-address-climate>.

Curtiss, Kristina, and Alex Kolenda. Interview with Abigail Eaton, July 29, 2021.

Doherty, Roger. "DSIRE." NC Clean Energy Technology Center. <https://programs.dsireusa.org/system/program/detail/5826>.

EGLE. "EGLE - Council on Climate Solutions." Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/about/Groups/Council-on-Climate-Solutions>.

———. "EGLE - RETAP." Michigan Department of Environment, Great Lakes, & Energy. *(The link provided was broken and has been removed)*.

———. "EGLE - UP Energy Task Force." Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/about/groups/up-energy-task-force>.

———. "EGLE Grants and Loans Dashboard - Fiscal Year 2019-2020 Update." Michigan Department of Environment, Great Lakes, & Energy ArcGIS Story Map. <https://egle.maps.arcgis.com/apps/dashboards/9c8c1b5ca98b40eea142dcfe07751a77>

Grants and Loans. "EGLE - Clean Water State Revolving Funds." Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/Regulatory-Assistance/Grants-and-Financing/Clean-Water-State-Revolving-Fund>.

———. "EGLE - Grants and Loans." Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/regulatory-assistance/grants-and-financing>.

———. "EGLE - MI Clean Water Plan." Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/Regulatory-Assistance/Grants-and-Financing/mi-clean-water-plan>.

———. "EGLE - Small Business Pollution Prevention Revolving Loans." Michigan Department of Environment, Great Lakes, & Energy. *(The link provided was broken and has been removed)*.

Kolenda, Alex, and Jeff Manner. Interview with Brandy Brown, September 7, 2021.

Kolenda, Alex, and Jeff Manner. Interview with Ninah Sassy, August 3, 2021.

Manner, Jeff, and Tyler Orcutt. Interview with Kelly Green, August 24, 2021.

Michigan Association of Conservation Districts. "What Districts Do." Michigan Association of Conservation Districts. https://www.macd.org/index.php?option=com_content&view=article&id=33:what-districts-do&catid=20:site-content&Itemid=125.

Michigan Department of Environment, Great Lakes, & Energy. "MI Healthy Climate Plan." <https://www.michigan.gov/egle/about/Organization/Climate-and-Energy>.

———. "Sustaining: Michigan's Water Heritage." State of Michigan, 2016.

Michigan Economic Development Corporation. "DSIRE." NC Clean Energy Technology Center. <https://programs.dsireusa.org/system/program/detail/3216/renewable-energy-renaissance-zones>.

Michigan Project WET. "Michigan Project WET - Robert B. Annis Water Resources Institute (AWRI) - Education & Outreach - Grand Valley State University." Grand Valley State University. <https://www.gvsu.edu/wri/education/michigan-project-wet-19.htm>.

Michigan Public Service Commission. "MPSC - Energy Waste Reduction." Michigan Public Service Commission. <https://www.michigan.gov/mpsc/consumer/ewr>.

Michigan State University - Extension. "MSU Extension." MSU Extension. <https://www.canr.msu.edu/outreach>.

Natural Resources and Environmental Protection Act: Act 451 of 1994 (n.d.).

- Office of Climate and Energy. "Climate and Energy - About." Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/about/organization/climate-and-energy>.
- . "Climate and Energy - Energy Security." Michigan Department of Environment, Great Lakes, & Energy. *(The link provided was broken and has been removed)*.
- . "Climate and Energy - UP Energy Waste Reduction Roadmap." Michigan Department of Environment, Great Lakes, & Energy. *(The link provided was broken and has been removed)*
- Office of the Clean Water Public Advocate. "Clean Water - Focus on Water." Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/about/organization/clean-water-public-advocate>.
- . "Clean Water - Water Leak Pilot." Michigan Department of Environment, Great Lakes, & Energy <https://www.michigan.gov/egle/about/organization/clean-water-public-advocate/water-leak-pilot>.
- Office of the Great Lakes. "Great Lakes-St. Lawrence River Basin Water Resources Compact Five-Year Program Review Report: State of Michigan." Michigan Department of Environmental Quality, December 8, 2014.
- . "Great Lakes-St. Lawrence River Basin Water Resources Compact Five-Year Program Review Report: State of Michigan." Michigan Department of Environment, Great Lakes, and Energy, December 6, 2019.
- . "OGL - Michigan Great Lakes Protection Fund." Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/about/organization/office-of-the-great-lakes/michigan-great-lakes-protection-fund>.
- Orcutt, Tyler. Interview with Julie Staveland, August 7, 2021.
- Orcutt, Tyler, and Aaron Cohen. Interview with Jim Milne and Andy LeBaron, July 28, 2021.
- Orcutt, Tyler, Jeff Manner, and Aaron Cohen. Interview with James Clift, August 12, 2021.
- Water Management. "EGLE - Hydrologic Data Collection & Analysis." Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/about/Organization/Water-Resources/hydrologic-data>.
- Water Use Advisory Council. "EGLE - Water Use Advisory Council." Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/about/groups/water-use-advisory-council>.
- . "Michigan Water Use Advisory Council 2020 Report," December 2020.
- Water Use Program. "EGLE - Michigan Water Use Data." Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/about/Organization/Water-Resources/Water-Use/water-use-data>.

- — —. “EGLE - Water Conservation Measures.” Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/about/Organization/Water-Resources/Water-Use/water-conservation-measures>.
- — —. “EGLE - Water Use Program.” Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/about/Organization/Water-Resources/Water-Use>.
- — —. “EGLE - Water Withdrawal Assessment Tool.” Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/about/Organization/Water-Resources/Water-Use/water-withdrawal-assessment-tool>.

Written Responses from Julie Staveland, November 29, 2021.

- — —. “EGLE - Water Withdrawal Assessment Tool.” Michigan Department of Environment, Great Lakes, & Energy. <https://www.michigan.gov/egle/about/Organization/Water-Resources/Water-Use/water-withdrawal-assessment-tool>.

Minnesota

Division of Ecological and Water Resources. “STATE OF MINNESOTA WATER MANAGEMENT PROGRAM FIVE-YEAR REPORTING.” Minnesota Department of Natural Resources, 2014.

- — —. “Water Conservation and Efficiency Program Annual Assessment.” Minnesota Department of Natural Resources, November 1, 2019.

Ryberg, Alaina. “MnTAP - Minnesota Technical Assistance Program.” University of Minnesota. <http://www.mntap.umn.edu/>.

Water Conservation Program. “Water Conservation Reporting System.” Minnesota Department of Natural Resources. https://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/water-conservation-reporting-system.html.

Written Response from Carmelita Nelson, September 29, 2021.

Missouri

Missouri Envirothon. “Envirothon.” Missouri Association of Soil & Water Conservation Districts. <http://maswcd.net/Envirothon.htm>.

Soil and Water Conservation Program. “Soil and Water Conservation | Missouri Department of Natural Resources.” Missouri Department of Natural Resources. <https://dnr.mo.gov/land-geology/soil-water-conservation>.

New York

- Bureau of Water Resource Management. "New York Water Management Program Report." New York Department of Environmental Protection, 2019.
<https://www.google.com/url?q=https://www.glscompactcouncil.org/media/rmfnt2c/ny-water-management-program-report-2019.pdf&sa=D&source=editors&ust=1639175203003000&usg=AOvVaw0FjJROHfTKLWLUGYSioWM>.
- Bureau of Water Resource Management.. "Report to the Great Lakes-St. Lawrence River Basin Water Resources Council/Regional Body on the State of New York's Water Management Program." New York Department of Environmental Conservation, March 20, 2015.
https://www.google.com/url?q=https://www.glscompactcouncil.org/media/glsnbxzt/ny-water-management-program-report-2014-revised.pdf&sa=D&source=editors&ust=1639175339843000&usg=AOvVaw3OIs0By9-A7ygrl_SPeHHk.
- Bureau of Water Resource Management. "Certification Information For NYS Water Saving Plumbing Fixtures Law - NYS Dept. of Environmental Conservation." New York Department of Environmental Conservation. <https://www.dec.ny.gov/lands/87361.html>.
- Bureau of Water Resource Management: Division of Water. "Agricultural Water Withdrawals - NYS Dept. of Environmental Conservation." New York Department of Environmental Conservation. <https://www.dec.ny.gov/lands/86747.html>.
- . "Saving Water Makes Good Sense - NYS Dept. of Environmental Conservation." New York Department of Environmental Conservation. <https://www.dec.ny.gov/lands/5009.html>.
- . "Water Conservation Requirements - NYS Dept. of Environmental Conservation." New York Department of Environmental Conservation. <https://www.dec.ny.gov/lands/86945.html>.
- . "Water Use & Conservation - NYS Dept. of Environmental Conservation." New York Department of Environmental Conservation. <https://www.dec.ny.gov/lands/67073.html>.
- . "Water Withdrawal Permits and Reporting - NYS Dept. of Environmental Conservation." New York Department of Environmental Conservation. <https://www.dec.ny.gov/lands/55509.html>.
- New York City Department of Environmental Protection. "One Water NYC: 2021 Demand Management Annual Update." New York City, 2021.
<https://www.google.com/url?q=https://www1.nyc.gov/assets/dep/downloads/pdf/water/drinking-water/water-conservation-report2021.pdf&sa=D&source=editors&ust=1639090688164000&usg=AOvVaw0DThjf3lnBcFLachmp7yXD>.
- . "Water Conservation & Reuse Grants - DEP." New York City. <https://www1.nyc.gov/site/dep/water/water-conservation-reuse-grants.page>.

New York State Energy Research and Development Authority. "Real Time Energy Management (RTEM) Program - NYSERDA." New York State Energy Research and Development Authority. <https://www.nyserda.ny.gov/All-Programs/Real-Time-Energy-Management>.

Office of Communication Services. "Save Energy and Water - NYS Dept. of Environmental Conservation." New York Department of Environmental Conservation. <https://www.dec.ny.gov/public/43534.html>.

Written Response from Don Zelazny, September 15, 2021.

Ohio

Division of Soil & Water Resources. "STATE OF OHIO: WATER MANAGEMENT PROGRAM REPORT." Ohio Department of Natural Resources, December 8, 2014.

Division of Water Resources. "STATE OF OHIO: WATER MANAGEMENT PROGRAM REPORT." Ohio Department of Natural Resources, December 11, 2019.

Written Responses from Bradley Lodge and Lori Emler, October 12, 2021.

Ontario

Conservation Ontario. "Home // Conservation Ontario," 2021. <https://conservationontario.ca/>. Land and Water Policy Branch, Ministry of Environment, and Ministry of Natural Resources Biodiversity Branch. "Ontario's Water Conservation and Efficiency Goals, Objectives and Programs (in Accordance with the Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement)." ontario.ca. <http://www.ontario.ca/page/ontarios-water-conservation-and-efficiency-goals-objectives-and-programs-accordance-great-lakes-st>.

Land and Water Policy Branch, and Natural Resources Conservation Policy Branch. "Province of Ontario Water Conservation and Efficiency Program Annual Review 2017." Ontario Ministry of Natural Resources and Forestry, 2017.

Ontario Water Resources Act, R.S.O. 1990, c. O.40

O. Reg. 387/04: Water Taking and Transfer filed December 10, 2004 under Ontario Water Resources Act, R.S.O. 1990, c. O.40

Resources Planning and Development Policy Branch. "Province of Ontario 2020 Water Conservation and Efficiency Program Assessment." Ontario Ministry of Natural Resources and Forestry, 2020.

Water Opportunities and Water Conservation Act, 2010, S.O. 2010, c. 19 - Bill 72

Pennsylvania

Curtiss, Kristina. Interview with Tim Bruno, September 28, 2021.

Great Lakes Program. "PENNSYLVANIA GREAT LAKES WATER MANAGEMENT PROGRAM: Five Year Report (2014-2019)." Pennsylvania Department of Environmental Protection, 2019.

Office of the Great Lakes. "PENNSYLVANIA GREAT LAKES WATER MANAGEMENT PROGRAM: Five Year Report." Pennsylvania Department of Environmental Protection, December 8, 2014.

Quebec

Direction des politiques de l'eau. "Québec Water Conservation and Efficiency Program: Under the Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement." MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT, DE LA FAUNE ET DES PARCS, Septembre 2013.

Directrice générale des politiques de l'eau. "Province of Québec Water Conservation and Efficiency Program Annual Report 2020." Ministère de l'Environnement et de la Lutte contre les changements climatiques, 2020.

Environment Quality Act, CQLR c Q-2, <<https://canlii.ca/t/555vz>> retrieved on 2021-12-10

Regulation respecting the declaration of water withdrawals, Environment Quality Act (chapter Q-2, ss. 46, 115.27, 115.34 and 124.1).

Water Withdrawal and Protection Regulation, Environment Quality Act (chapter Q-2, s. 31.81, 2nd par., s. 46, pars. 15 and 16, subpars. d, i, k and m, s. 95.1, 1st par., subpars. 7, 14, ss. 115.27 and 115.34).

Wisconsin

Manner, Jeff, and Aaron Cohen. Interview with RJ Pire, September 13, 2021.

———. Interview with Shaili Pfeiffer, September 8, 2021.

Section, A. product of the DNR, Water Use. "Wisconsin Water Use." ArcGIS StoryMaps, June 16, 2020. <https://storymaps.arcgis.com/stories/746865c012064b6e8f0a89a4affe6499>.

Water Use Program. "WATER MANAGEMENT PROGRAM REVIEW WISCONSIN DEPARTMENT OF NATURAL RESOURCES." Wisconsin Department of Natural Resources, December 3, 2014.

———. "WISCONSIN DEPARTMENT OF NATURAL RESOURCES WATER MANAGEMENT AND CONSERVATION AND EFFICIENCY PROGRAM REVIEW." Wisconsin Department of Natural Resources, December 11, 2019.

Water Use Section. "Wisconsin Water Withdrawals | Wisconsin DNR." Wisconsin Department of Natural Resources. <https://dnr.wisconsin.gov/topic/WaterUse/WithdrawalSummary.html>.

Federal Government and National Organizations

Energy, Department of. "Energy- and Water-Efficient Product Efficiency Programs." Energy.gov. <https://www.energy.gov/eere/femp/energy-and-water-efficient-product-efficiency-programs>.

Environmental Protection Association. "WaterSense | US EPA." United States Environmental Protection Agency. <https://www.epa.gov/watersense>.

Governor of Illinois, Governor of Michigan, Governor of New York, Governor of Indiana, Governor of Ohio, Governor of Pennsylvania, Governor of Wisconsin, Premier of Ontario, and Premier of Québec. GREAT LAKES—ST. LAWRENCE RIVER BASIN SUSTAINABLE WATER RESOURCES AGREEMENT (2005).

Great Lakes Compact Council. “Science Strategy,” December 11, 2019.

Great Lakes St. Lawrence Governors & Premiers. “Great Lakes Agreement and Compact Great Lakes Governors and Premiers.” gsgp.org. <https://gsgp.org/projects/water-management/great-lakes-agreement-and-compact/>.

Jarman, David. “How Similar Is Each State to Every Other? Daily Kos Elections’ State Similarity Index Will Tell You.” Daily Kos, February 19, 2020.

<https://www.dailykos.com/story/2020/2/19/1917029/-How-similar-is-each-state-to-every-other-Daily-Kos-Elections-State-Similarity-Index-will-tell-you>.

Kilbert, Kenneth, Aubrey Merkle, and Forrest Miller. “An Assessment of the Great Lakes States’ Implementation of the Water Management and Conservation Provisions of the Great Lakes – St. Lawrence River Basin Water Resources Compact.” University of Toledo College of Law: Legal Institute of the Great Lakes, 2019.

https://www.google.com/url?q=https://www.utoledo.edu/law/academics/ligl/pdf/2019/whitpaper-water-resources-compact-10-19.pdf&sa=D&source=editors&ust=1639089903174000&usg=AOvVaw37qlxO6keZKTb_pq4TX3sa.

National Association of Conservation Districts. “Stewardship and Education.” National Association of Conservation Districts. NACD (blog). Accessed December 9, 2021.

<https://www.nacdnet.org/general-resources/stewardship-and-education-materials/>.

Project WET. “Home | Project Wet.” Project WET. Accessed December 9, 2021.

<https://www.projectwet.org/>.

RESOURCES COMPACT. GREAT LAKES—ST. LAWRENCE RIVER BASIN WATER Resources Compact, Pub. L. No. PUBLIC LAW 110–342, S.J. Res 45 122 STAT. 3740 3739 (2008).

United States Climate Alliance. “U.S. Climate Alliance.” U.S. Climate Alliance. Accessed December 8, 2021. <http://www.usclimatealliance.org>.

Water Science School. “How Wet Is Your State? The Water Area of Each State | U.S. Geological Survey.” United States Geological Survey, June 8, 2018. https://www.usgs.gov/special-topics/water-science-school/science/how-wet-your-state-water-area-each-state?qt-science_center_objects=0#qt-science_center_objects.

———. “Total Water Use in the United States | U.S. Geological Survey.” United States Geological Survey, June 8, 2018. <https://www.usgs.gov/special-topics/water-science-school/science/total-water-use-united-states>.