MICHIGAN WATER USE ADVISORY COUNCIL 2020 REPORT

DECEMBER 2020

EXECUTIVE SUMMARY

The Great Lakes are a vital resource supporting a globally unique ecosystem that must be protected and used responsibly by the millions of people who depend on the Lakes and live and work in their watersheds. The United States and Canada signed the Great Lakes–Saint Lawrence River Basin Sustainable Water Resources Agreement of 2005 and the Great Lakes-Saint Lawrence River Basin Water Resources Compact of 2008 to establish how the states and provinces bordering the Great Lakes would protect water resources. The Great Lakes Compact was developed to protect the Great Lakes from diversions outside the Great Lakes Basin and requires each member state and province to manage their internal water resources. In Michigan, this took the form of Part 327, Great Lakes Preservation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). Part 327 created Michigan's water withdrawal assessment program, which requires assessment to prevent adverse resource impacts (ARI) to streams and lakes from large quantity water withdrawals. The program, based in science, is only successful if supported by adequate data, advancements in modeling, and adoption of new technologies, practices, and conservation measures.

The Water Use Advisory Council (WUAC), most recently codified in 2018 PA 509 which amended Part 328, Aquifer Protection, of the NREPA, is charged to report biennially to the Legislature, the Michigan Department of Environment, Great Lakes and Energy (EGLE), the Michigan Department of Natural Resources (DNR), and the Michigan Department of Agriculture and Rural Development (MDARD). The WUAC's recommendations will advance and improve conservation, data collection, modeling, research, refinement, and administration of the water withdrawal assessment process. The following summarizes the activities the WUAC has agreed by consensus are the highest priority activities necessary to continue and improve the water withdrawal assessment program's functions and operations. We urge the Legislature to approve allocation from the State's budget to support these activities, which will help Michigan fulfil its obligation to protect both the Great Lakes' water resources for current and future generations and the ability of our states' residents, businesses, farmers, and utilities to sustainably access it.

Most of these recommendations span multiple years; some are one-time expenses and others are ongoing needs, identified in each recommendation. These recommendations therefore represent a funding request of $5,206,000 for Fiscal Year 2022 and $4,873,000 for Fiscal Year 2023. The WUAC, per its statutory charge, will report to the Legislature biennially with future requests for ongoing funding needs and new projects and programs to continue advancing the water withdrawal assessment program's important function.

WATER USE ADVISORY COUNCIL 2020 RECOMMENDATIONS

RECOMMENDATIONS TO ADVANCE WATER CONSERVATION

1. Advance Michigan's Water Conservation and Efficiency Efforts through State Climate, Energy, and Water Infrastructure Initiatives
    a. Assess current climate, energy, sustainability, and water infrastructure policies and programs to identify gaps and opportunities to incorporate water conservation and efficiency, technological improvements, other state and national programs, and education
    b. $50,000 for one year
2. Increasing Water Efficiency and Conservation Practices in the Agriculture Industry
    a. Provide funding for two Full-Time Equivalent (FTE) positions through Michigan State University Extension (MSUE) to develop and launch an educational program for agricultural water use efficiency for both plant and animal industries
    b. $600,000 over three years ($200,000 per year)

RECOMMENDATIONS TO CONTINUE AND IMPROVE CURRENT OPERATIONS AND DATA COLLECTION

1. Michigan Integrated Water Management Database
    a. A database to facilitate geologic and hydrologic data collection and modeling by making current data accessible and available in a common geospatial format
    a. $250,000 over two years ($125,000 each year)
2. Well Driller Trainings for Improved Data
    a. Information collected for the water withdrawal assessment program depends on accurate and consistent subsurface data input to the Wellogic database submitted by well drillers, who must be trained to accurately identify and submit subsurface and well data
    b. $4,000 over 2 years ($2,000 each year)
3. U.S. Geological Survey (USGS) and EGLE Streamflow Gages
    a. This program is funded from several local, state and federal sources; however two of the state sources: the Clean Michigan Initiative (CMI) and the Renew Michigan Program, will no longer provide funding after fiscal year 2022 and will need to be replaced
    b. $350,000 annually

RECOMMENDATIONS FOR NEW OPERATIONS TO IMPROVE DATA COLLECTION AND MODELING

1. Michigan Hydrologic Framework
    a. Facilitate the creation of groundwater/surface water models to improve water management decision making through centralized access to up-to-date hydrologic data, comprehensive hydrologic analysis, and other models. The framework will incorporate new data and analysis, and link GIS databases and the Michigan Integrated Water Management Database to help create regional models

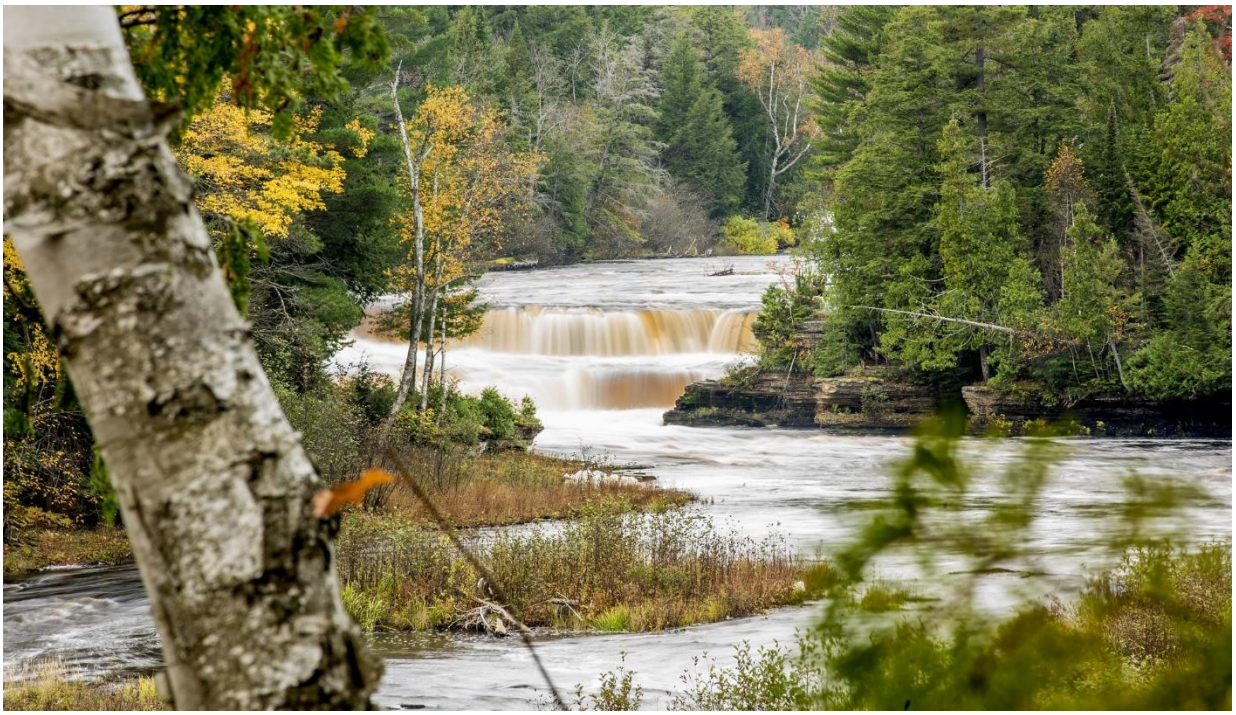
   b. Creates three regional models to more accurately assess water withdrawal impacts within the Framework, and to assess its functionality
   c. Assess metamodeling processes on a regional model to develop a rapid method to evaluate potential water use impacts
   d. $2,100,000 over three years ($900,000 in year 1, $700,000 in year 2, and $500,000 in year 3)
2. Geologic Data Collection and Mapping in up to 25 targeted areas of Michigan
   a. Expands geologic information with data from drilling, soil sampling, seismic and gamma ray logging to produce accurate geological maps, static groundwater levels, and bedrock topography
   b. Michigan Geologic Survey will conduct data collection, which can be used in multiple program areas including the water withdrawal assessment program, PFAS tracking, waste leachate tracking, sand and gravel assessments, and others
   c. $3,000,000 annually
3. Monitoring Well Network
   a. Install monitoring wells and join the National Groundwater Monitoring Network
   b. EGLE and U.S. Geological Survey to partner on effort
   c. $259,000 for first year and then $226,000 thereafter

RECOMMENDATIONS FOR ADDITIONAL ACTIVITIES TO IMPROVE DATA COLLECTION AND MODELING AS CONTINUED AND NEW OPERATIONS ARE UNDERWAY

1. Long-term planning
   a. Analysis of streamflow, groundwater, and geologic data to identify critical gaps and needs, and identify data collection priorities
   b. $100,000 over two years ($50,000 each year)
2. Water Withdrawal Assessment Tool (WWAT) user interface update
   a. Display registration information and current status of water management areas
   b. $50,000 single expense in one year
3. Compiling Key Aquifer Properties for use in the WWAT
   a. Update statewide estimates of transmissivity, and identify water management areas where storage coefficients may be changed to more accurately reflect geologic conditions
   b. $110,000 over two years ($55,000 each year)
4. 3D Glacial Aquifer Mapping in Two Counties
   a. Use transition probability geostatistical mapping in two Michigan counties: Cass and Calhoun, to assess the ability of this mapping process to identify glacial aquifer properties and compare with Geological Survey 3D interpretations
   b. $80,000 over two years ($40,000 each year)

NEW AND ONGOING ACTIVITIES THAT DO NOT NEED ADDITIONAL STATE FUNDING

1. Develop Water User Committee (WUC) User's Manual
    a. This manual will equip WUCs with information, tools, and resources to develop realistic shared solutions to sustainably manage water use
    b. $250,000 will be provided by the EGLE Office of the Great Lakes through the Michigan Great Lakes Protection Fund to develop this manual and convene one to two WUCs as case studies to inform the manual development
2. Develop standards & protocols for collection and use of new data within the program
    a. This process is ongoing with EGLE staff and the Water Use Advisory Council (WUAC)
3. Well-owner outreach on registration completion requirements
    a. This process is ongoing with EGLE staff and the WUAC
4. Continue review and work on Cass County water use pilot study model
    a. This process is ongoing with EGLE staff, partners, and steering and technical committee members for the pilot project



INTRODUCTION

In 2014, Michigan's previous Water Use Advisory Council (WUAC) spoke about the importance of water and the responsibility we all share to protect it. That responsibility has not changed:

> *A fundamental underlying reason that we address the issue of water conservation is that we love the Great Lakes and the ground water systems upon which they rely. We may ask ourselves - why do we do this work to preserve the water? … The answer lies in the fact that unlike many other endeavors where failure may be inconvenient but otherwise has little effect on our lives, failure in this work that we are doing will have major negative impacts. If we are not able to develop the process for the shift in how our State and our communities use, conserve, protect and restore the water resources in the Great Lakes region our failure will impact our lives and the lives of our children, grandchildren and generations beyond.*
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> *The indigenous nations of the Great Lakes region have traditional teachings that guide them to seek balance in personal, family, community and national life. The strengths and perils of Fire, Wind, Earth and Water and the balance among them are of fundamental importance. These teachings inform that when people disrespect this balance, our collective future is endangered. Water is the lifeblood of Mother Earth; it flows in her veins and fills her oceans, lakes, rivers and streams. It is essential for the plants and animals with whom we share this wonderful creation. It surrounds us all in our Mothers' wombs before we are born; without it, life as we know it could not exist on Earth.*[1]

The Laurentian Great Lakes are a globally unique system: bordering eight U.S. states and two Canadian provinces, they hold 20 percent of the world's surface fresh water, supply drinking water for 48 million people, and are the home of 3,500 plant and animal species found only in the Great Lakes Region.[2] The watershed supports $52 billion annually in hunting and fishing opportunities, ships 160 million metric tons of cargo each year,[3] and public water utilities, farmers, power suppliers, and industries withdraw 40 billion gallons of Great Lakes basin water per day – though more than 95 percent of that water is returned to the system.[4]

To protect this vital resource, the United States and Canada have signed a series of international agreements to preserve both the quality and quantity of the Great Lakes basin's water, including the Great Lakes–Saint Lawrence River Basin Sustainable Water Resources Agreement of 2005 and Compact

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[1] *Final Report of the Water Use Advisory Council, December 12, 2014*, p. 75. Retrieved from: https://www.michigan.gov/-/media/Project/Websites/egle/Documents/Reports/WRD/2014-Water-Use-Advisory-Council.pdf.

[2] Great Lakes Commission. 2020. *About the Lakes*. Retrieved from: https://www.glc.org/lakes/#:~:text=The%20Great%20Lakes%20%E2%80%94%20Superior%2C%20Michigan,surface%20water%20system%20on%20earth.&text=The%20system%20is%20invaluable%20as,in%20the%20U.S.%20and%20Canada.

[3] John C. Martin Associates. 2017. *Analysis of Great Lakes Pilotage Costs on Great Lakes Shipping and the Potential Impact of Increases in U.S. Pilotage Charges*. Prepared for the United States Coast Guard. Retrieved from: https://www.greatlakesports.org/wp-content/uploads/2017/09/Analysis-of-Great-Lakes-Pilotage-Costs.pdf.

[4] Great Lakes Commission. 2018. *Annual Report of the Great Lakes Regional Water Use Database Representing 2018 Water Use Data*. Retrieved from: https://waterusedata.glc.org/pdf/2018-Water-Use-Report.pdf.

of 2008. The Water Resources Agreement and Compact require states and provinces bordering the Great Lakes to responsibly manage water resources. Michigan fulfilled this obligation by adopting what is now Part 327 of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). Part 327 created a water withdrawal assessment program managed by the Michigan Department of Environment, Great Lakes and Energy (EGLE) to prevent adverse resource impacts (ARI) by water withdrawals on streams and lakes. The program requires registration for large capacity water withdrawals (withdrawals with a capacity of more than 100,000 gallons per day), creates an online process to streamline water withdrawal registration, and requires annual water use reporting and implementation of conservation measures.

To be successful, Michigan's water withdrawal assessment program must incorporate new conservation actions, data collection, model development, and advancements in technology and practices. Since the water withdrawal assessment program began, the Michigan Legislature and EGLE have organized several councils to recommend future work on the program. In 2018, PA 509, which amended Part 328, Aquifer Protection, of the NREPA, created the current WUAC and charged it to report biennially to the Legislature, EGLE, the Michigan Department of Natural Resources (DNR), and the Michigan Department of Agriculture and Rural Development (MDARD) with recommendations to advance and improve data collection, modeling, research, refinement, and administration of the water withdrawal assessment process. The WUAC is made up of representatives appointed by the Governor, the Speaker of the House, and the Senate Majority leader, representing business, agriculture, utilities, and other water users as well as conservation and environmental groups, lakes and streams associations, and local governments. The EGLE Director appoints state agency staff as ex-officio members. Technical advisors from universities, state and federal agencies, and industry professionals assist the WUAC with understanding the water withdrawal assessment program's functions, needs, and gaps. The WUAC operates by consensus to approve recommendations, and its proceedings are publicly accessible both during its meetings and from minutes and recordings housed on the WUAC website, https://www.michigan.gov/egle/about/groups/water-use-advisory-council. Previous WUAC reports, membership, and other information are also available on this website.

We are pleased to present the WUAC's recommendations for the first of its biennial reports to support and advance Michigan's water withdrawal assessment program. In 2014, the previous WUAC made 69 recommendations for actions to improve the water withdrawal assessment program but did not prioritize or clarify the amount of funding needed to implement those recommendations. Under the current WUAC's legislative charge, it has reviewed outstanding recommendations from 2014, refined and updated them to the highest priority actions the program needs to continue and improve its

operation, and recommended funding levels to implement these actions. This report therefore reflects the highest priority actions the WUAC recommends be initiated to advance the water withdrawal assessment program in Michigan. The WUAC also identified several activities and programs underway or which are anticipated will receive external funding so will not need Legislative funding, but which are important to understand the scope of work of the WUAC, state agencies, partners, and stakeholders. We are grateful for the assistance of numerous technical advisors, EGLE, DNR, and MDARD staff in developing these recommendations.

With this report, the WUAC urges Legislative funding for these priorities, to ensure both the protection of vital Great Lakes Basin waters and the accessibility of water for business, food production, energy production, and public use. We look forward to the implementation of these priorities to build the foundation for future work to continue advancing Michigan's water withdrawal assessment program. Most of these recommendations span multiple years; some are one-time expenses and others are ongoing needs, identified in each recommendation. These recommendations therefore represent a funding request of $5,206,000 for Fiscal Year 2022 and $4,873,000 for Fiscal Year 2023, with some funding requests that will continue beyond those years. The WUAC, per its statutory charge, will report to the Legislature biennially with future requests for ongoing funding needs and new projects and programs to continue advancing the water withdrawal assessment program's vital function.

RECOMMENDATIONS TO ADVANCE WATER CONSERVATION

1. ADVANCE MICHIGAN'S WATER CONSERVATION AND EFFICIENCY EFFORTS THROUGH STATE CLIMATE, ENERGY, AND WATER INFRASTRUCTURE INITIATIVES

Synopsis: Michigan Gov. Gretchen Whitmer recently ordered EGLE's Office of Climate and Energy to coordinate the state's efforts to achieve carbon neutrality by 2050 through development and implementation of the Mi Healthy Climate Plan, outlined in Executive Order 2020-182 and Directive 2020-10. The creation of the MI Healthy Climate Plan, a comprehensive plan meant to protect public health and the environment while helping to develop new clean energy jobs by making Michigan fully carbon-neutral by 2050, provides an opportunity to bring water squarely into the energy conversation.

In addition, the MI Clean Water Plan is investing $500 million in Michigan's aging water infrastructure. The MI Clean Water Plan presents an opportunity to improve drinking and wastewater infrastructure, expand green infrastructure, address water loss through leaky systems, and educate the public about water and energy efficiency and conservation. These new initiatives present an opportunity to create a greater focus on advancing Michigan's water conservation and efficiency goals and objectives under the Great Lakes Compact through strategic integration into Michigan's goals to achieve a carbon neutral footprint by 2050 to address climate change; increase energy efficiency; improve aging infrastructure; and protect the environment and public health into the future.

New technological advancements have also occurred within the various water sectors that need to be considered which can provide insight into potential water, energy, and infrastructure savings for all water user groups. Michigan should more intentionally utilize existing and new climate, energy, and water infrastructure programs and initiatives to help achieve its water conservation goals and objectives and to ensure users have the best available information, tools, and technologies to engage in activities to improve efficiency and conservation of water resources and ensure sustainable water resources. Specifically, Michigan should:

- Identify gaps and opportunities to strategically integrate water conservation and efficiency into current and future climate, energy and water infrastructure policies and programs.
- Develop knowledge of best practices and cutting-edge technological innovations for water conservation and efficiency for different water user (residential, agricultural, commercial, institutional, and industrial user groups).
- Identify programs to promote education, outreach and technical assistance to different user sectors (residential, agricultural, commercial, institutional, and industrial user sectors).

Recommended Action: The Water Conservation Committee recommends that a standing committee of diverse stakeholders be established under the WUAC to develop recommendations to strategically integrate water conservation and efficiency into Michigan's new and existing climate, energy and water infrastructure policies and programs. Stakeholders should include representatives from state and local

units of government, agriculture, water suppliers, academia, business and industry. The committee should:

- Conduct an assessment of the state of Michigan's current climate, energy, sustainability and water infrastructure policies and programs to identify current and future opportunities where water conservation and efficiency efforts may be incorporated.
- Identify gaps and opportunities to strategically integrate water conservation and efficiency into future policies and programs.
- Identify technological advancements to incorporate into water conservation and efficiency practices.
- Assess the EPA Watersense Program and other water rich state water conservation and efficiency programs including education and outreach initiatives targeting major water sectors (for example: the Minnesota Water Conservation Program).
- Identify specific innovative opportunities to improve Michigan's Water Conservation and Efficiency Program by building connections between current and new policies and programs, technological innovations, and promote education and outreach to different user sectors.

Cost Analysis and Funding Recommendation: EGLE will develop and issue a Request for Proposals in consultation with the Water Conservation and Efficiency Committee to award a $50,000 contract for a consultant to 1) conduct an assessment of Michigan's current climate, energy, sustainability and water infrastructure policies and programs; 2) identify gaps and opportunities to strategically integrate water conservation and efficiency into future policies and programs; 3) assess successful federal programs and other water rich state water conservation and efficiency programs; and 4) make policy and program recommendations to the Water Conservation and Efficiency Committee and the WUAC to improve Michigan's Water Conservation and Efficiency Program.

Implementing organization: This recommendation would require EGLE and MDARD staff time to support the standing new Water Conservation and Efficiency Committee, develop and administer the Request for proposals process, administer the contract, and make recommendations to the WUAC based on the assessment.

Legislative Changes: None at this time

Timeframe: Approximately 12 months

2. INCREASING WATER EFFICIENCY AND CONSERVATION PRACTICES IN THE AGRICULTURE INDUSTRY

Synopsis: As an important part of the conversation of advancing Michigan's water conservation and energy efforts through state climate, energy, and water infrastructure initiatives, this recommendation recognizes the importance of the role that the agricultural industry plays in reaching state objectives as one major sector of water use. Sustainability of water resources is important for the future of agriculture. The Agricultural Sector has experienced a clear expansion of new water withdrawals since initiation of the registration requirement in Michigan law. There has also been an increasing trend in irrigated acres since the 1960s, resulting in increased production of agricultural products. Improved technology has also allowed increased irrigation efficiency. New state policy focused on achieving a carbon-neutral footprint by 2050 also presents opportunities to further integrate energy efficiency practices which inextricably tied to water conservation and efficiency of use for agriculture and agribusiness.

Water conservation and efficiency practices are expected to increase in importance to major water sectors and these may be part of the solutions considered by Water User Committees (WUCs) in developing realistic shared solutions to sustainably manage water. Based on water use trends and the prominence of agricultural irrigation, water conservation and efficiency practices may play a larger role in water management and potential future Water User Committee actions.

The Michigan Commission of Agriculture and Rural Development has developed through research, a comprehensive guidance in the form of Generally Accepted Agricultural and Management Practices (GAAMPs) for Irrigation Water Use, which includes guidance for proper irrigation system management and water resource stewardship. Irrigation GAAMPS are a tool that started the education process about water efficiency and conservation practices. Additional tools and programs are needed to assist the agricultural industry holistically in optimizing its water efficiency. Optimizing efficient use of water within the agricultural industry may also provide water quality benefits by reducing nutrient loss.

Recommended Action: The Water Conservation Committee recommends that additional focus be placed on conservation and efficiency education and training in the Agricultural Industry. To accomplish this, UDSA, MDARD, EGLE, and Michigan State University Extension (MSUE), under the direction of the WUAC should develop and implement a strategy with clear objectives to expand training and outreach to each Agriculture Industry sector, with a focus in Zone C watershed management areas, to improve water efficiency, and where possible, provide water quality benefits, recognizing the nature of the education is programmatic and will be delivered across the state. This program should also include education on USDA programs that address water efficiency and help irrigators navigate the application processes. This new initiative should include a systematic approach to water efficiency and conservation education and training for both plant and animal agriculture industries that can transition to a long-term institutionalized program. At the end of the three-year period, the program will be reviewed by the WUAC to determine whether it merits further long-term funding recommendations.

Implementing Organization: Michigan Commission of Agriculture and Rural Development, USDA, MDARD, EGLE and MSUE

Cost Analysis: Michigan State University and Purdue Extension jointly support an irrigation educator who holds workshops for and works directly with producers in both Indiana and Michigan. Adding two (2) additional FTE positions to this team to develop and launch the initiative into a program that can be institutionalized into a long-term program over a three-year period is $80,000-$100,000 per position annually. This cost covers the position salary, benefits, and a small operating stipend. For FY 2021-2023 the ask is for $200,000 annually.

Timeframe: A three-year timeframe is needed to develop, initiate, implement, and evaluate the program. After this initial three-year period, it is expected that the positions may become institutionalized for continued success with a favorable review by the WUAC

Legislative Changes: None

RECOMMENDATIONS TO CONTINUE AND IMPROVE CURRENT OPERATIONS AND DATA COLLECTION

1. MICHIGAN INTEGRATED WATER MANAGEMENT DATABASE

Synopsis: Michigan is steward of internationally significant water resources, located in the center of one of the largest freshwater ecosystems in the world. Part 327, Great Lakes Preservation, of the Natural Resources and Environmental Protection Act, created innovative technical and regulatory structures to protect these resources from adverse resource impacts potentially caused by localized over withdrawal of water. This program, combined with other surface water and groundwater programs, collectively seek to comprehensively identify and protect the quantity, quality, and biological integrity of our water resources. All these programs rely on sophisticated models and technical analyses to accomplish their goals. These all require high quality data, and enough data to adequately define water resources in Michigan to make proper management decisions. Because of the abundance of water in Michigan, data collection has not historically been seen as a high priority.

What data have been collected were frequently "compartmentalized" to meet the needs of narrowly defined programs. Therefore, existing data are found in many locations and formats. The creation of an *Integrated Water Management Database* will increase the effectiveness and efficiency of all water related programs in Michigan by making all these data easily accessible and in a common geospatial format. Typically, the data are housed by categories of surface water (quantity and quality), groundwater (water levels, aquifer properties and quality), geologic data (stratigraphy), climate data (precipitation, temperature and evapotranspiration), etc. These databases can be brought together, some merely linked to, while others need to be developed or transformed, to make them all readily accessible.

The Michigan Hydrologic Framework (MHF), another proposal from the WUAC, will facilitate the creation of models to support statewide sustainable water management of both surface water and groundwater. It recognizes the critical importance of accessing a wide range of water related data. Work elements will link or compile a comprehensive variety of water related databases. The proposed work will be coordinated to meet the needs of the MHF proposal, combining some of the elements to create efficiency of scale while avoiding duplication of effort. The compilation of existing data sets will include: hydrologic data, water quality (surface water and groundwater), aquifer properties, geologic lithology of strata, static water elevations, water use/water return, water infrastructure, stream channel characteristics, landscape data, and climate/weather data to name just a few.

There is also a need to develop a new data base that can be linked to the MHF. This includes data that exist only in paper files or are not in modern database structures. Much groundwater data are in this form [*e.g.*, monitoring well data collected under Parts 111 (Hazardous Waste Management), 115 (Solid Waste Management); 201 (Environmental Remediation); or 213 (Leaking Underground Storage Tanks) of the NREPA]. It will also be necessary to gather and collate data on glacial geology, static water levels and

aquifer characteristics collected by state and federal agencies, as well as by universities and private industry using a common set of accepted geologic and hydrogeologic terms and fields.

Finally, there is a need to collect new data, covered in another WUAC recommendation. The *Integrated Water Management Database* must have a process to ensure the data have standardized formatting, and are verified, stored and made accessible through the MHF.

Investment Proposed: $250,000 to be expended over two fiscal years

Recommended Actions: The WUAC recommends that the legislature appropriate $250,000 to be expended over two fiscal years by one or more external contractors who will develop, compile and derive the *Michigan Integrated Water Management Database* according to the protocols approved by the WUAC. This effort includes the rescue of groundwater and geologic data currently only available in paper form [*e.g.*, monitoring well data collected under Parts 111 (Hazardous Waste Management), 115 (Solid Waste Management); 201 (Environmental Remediation); or 213 (Leaking Underground Storage Tanks) of the NREPA].

Implementing Organization: The WUAC will coordinate with the EGLE, Water Use Program as work plans are developed and contractors selected. A multi-agency GIS committee, composed of representatives from EGLE, MDNR, MDARD, Michigan Geological Survey (MGS) and DTMB, shall be established. Through this committee, led by the EGLE, Water Resources Division, each agency will assume stewardship of selected elements of the *Integrated Water Management Database* and work with DTMB to develop an appropriate maintenance schedule for them.

Timeframe: Two years from start of contracts

2. WELL DRILLER TRAININGS FOR IMPROVED DATA

Synopsis: Wellogic is the largest and longest functioning database for all data compiled during the drilling of water wells. This database is maintained by the State of Michigan, but data submitted is provided by the entities drilling the water wells. The data from this database is used by the large-quantity water withdrawal assessment program. The driller of water wells must input the primary data into the Wellogic Database in a prescribed format. Well drillers are not trained geologists and their primary goal is to find water for their client, not to describe the lithology of the subsurface materials encountered while drilling. Through time, Wellogic had used over 5,000 terms, but has been reduced to ~180 terms currently. In 2003, at the onset of electronic reporting, well drillers were instructed how to input data correctly into the new format, but no consistent formal training to standardize how the subsurface sediments would be described by the driller and then input to Wellogic was provided. Further, there was no department or automated verification and validation of the data entered into the database, specifically the location of the well. In 2018 the well location began to be validated; however there is still no validation of the other critical data input to Wellogic. In 2019-20, the Michigan Geological Survey (MGS) proposed and obtained an EGLE contract to correct the Wellogic locations and as of December 1, 2020, over 130,000 Wellogic locations have been validated. Over 35% of the wells have been corrected because they were not on the correct property, section or township. That means

they were up to and over a mile to six plus miles away from the correct location. Note: in some counties, 50 to 80% of the wells have Wellogic data errors.

Starting in 2014- 2015, MGS and the Michigan Ground Water Association (MGWA) discussed and initiated a program of trainings, which would aid in well drillers improving the standardization of how they identified and entered data on the subsurface sediments encountered during drilling, to improve the information quality and utilization of data being entered into Wellogic. With this database being the primary source of data useable for various purposes, the standardization of lithologic descriptions, accuracy and reliability of data entered is of upmost importance, and represents a cost-effective approach to increase the accuracy of the subsurface geologic data in the state (compared with collecting new data from separate efforts). Accurately knowing the extents of sand/gravel as opposed to clay/silt is critical to understanding how groundwater and surface waters interact in Michigan. Providing the proposed trainings annually, is supported by the well drilling community, via the MGWA.

Findings/Recommendations: The WUAC endorses the MGS and MGWA training program for drillers and the county health departments. A standardized training program will provide all trainees and experienced drillers a program to better understand what is being presented and the value of quality standardized data to support decisions related to groundwater and to input valid quality data to the subsurface Wellogic database. MGWA has an annual meeting in the Spring (February or March) and MGS and MGWA will continue to provide this lithologic and document training to the new driller community and the local health department staff. MGS and MGWA support having the EGLE Drinking Water and Environmental Health Division's (DWEHD) Community Water Supply Section (responsible for Wellogic) and the Water Resource Division (WRD) Water Use Assessment Unit present and provide emphasis on quality and timely data entry. This lithologic (geology) training program as proposed would allow standardized training to the regional MGWA drillers to have a local two to three-hour training program at their winter regional quarterly meetings. These meetings would be January to March, while many drilling functions are slow during the winter before spring drilling period allows free movement of drill rigs along county roads. This would be four to six regional training sessions and would allow MGS to load 2000 to 3000 pounds of core samples and bring them to a location. These trainings would provide presentations, physical sample descriptions, applicant responsibilities, training and review, and have EGLE present the benefits of timely input of quality data to Wellogic.

Investment Proposed: $4,000 ($2,000 per year for 2 years), including:

1. Four to six, one-day training sessions each year for the next two years (suggested locations: Traverse City, Alpena, Saginaw/Midland, Grand Rapids, Mount Pleasant, Lansing)
2. MGS rents vehicle to haul 2000 to 3000 pounds of drill core samples to the training location ($100/day)
3. Students to support the set-up, layout for sample description training with rebox/take down ($100/day)
4. Incidental costs for travel for students and staff ($100/day).
5. This estimate would provide samples and for MGS to fund at least two students to assist in the training and travel
6. Estimated six training sessions per year is $2,000 per year for two years ($4,000)
7. EGLE staff time for participation, provided as part of existing core staffing support and programs

2. U. S. GEOLOGICAL SURVEY (USGS) AND EGLE STREAMFLOW GAGES

Synopsis: It has been recently estimated that Michigan contains over 70,000 miles of rivers and streams. For this program, these miles are grouped into approximately 5,600 distinct water management areas (WMAs). Each of these has a prediction of the long-term median summer baseflow, referred to as the "index flow", which the assessment process and regulatory framework is dependent on. Currently, in Michigan, there are approximately 208 active stream gages maintained by the USGS that are supported by Federal, State, and local partners. Since 2011, the USGS in cooperation with EGLE has collected miscellaneous flow measurements at 66 additional sites (no gage installed). Additional miscellaneous flow data has been collected by non-agency entities in recent years as well, in efforts to augment the sparse network of agency collected data.

EGLE has been contracting with the USGS annually, to collect some additional streamflow data each year. The pace of that, while minimal, is still important progress, and the funds previously used for that expire and will need replacement by FY 2022 (when the previous funding source from the Clean Michigan Initiative ends). Many of the streamflow gages have been funded by different sources, however, the cost to replace this program's existing level of investment in streamflow data is approximately $350,000 per year. The cost of USGS streamflow gages, per gage, is approximately $18,500 (+/- $1,000) for the equipment and installation; and $15,700 for annual operation and maintenance. Average cost for the USGS to collect sufficient repeated flow measurements at a miscellaneous site ranges between $3,000 – $4,000. This existing level of data acquisition, while minimal, is critical to replace funding in the FY2022 budget.

Investment Proposed: $350,000 per year, starting in the FY2022 state budget

Implementing Organization: EGLE, with USGS

Timeframe: Annual, starting in FY2022

RECOMMENDATIONS FOR NEW OPERATIONS TO IMPROVE DATA COLLECTION AND MODELING

1. MICHIGAN HYDROLOGIC FRAMEWORK

Synopsis: The Michigan Hydrologic Framework (MHF) will facilitate statewide sustainable water management of both surface and groundwater through centralized access to integrated hydrologic models, up-to-date hydrologic data, and comprehensive hydrologic analysis. The creation of models will be expedited by Geographic Information System (GIS) linked data bases, existing models input and output, and a statewide interpretation of the water table surface. To assist professionals and the public understand and use hydrologic information, the MHF will function as a statewide "smartmap" that describes the distribution, abundance, status, and trends of the linked atmospheric, surface water and groundwater systems.

To envision how the MHF will work, consider the physical world: hydrologic data (such as streamflow, precipitation, water withdrawals and groundwater levels) can be measured, and physical attributes (such as soils, land use, water bodies, and topography) can be geographically described. These representations of the physical world can be stored in a series of GIS data layers. The geographically located data and spatial analysis can be used to create input for integrated hydrologic models. Output from the models can be analyzed and stored in GIS layers. The GIS mapping capabilities and linkage to a wide range of hydrologic data and analysis will not only make water resource data truly accessible, but also understandable (see Figure 1).

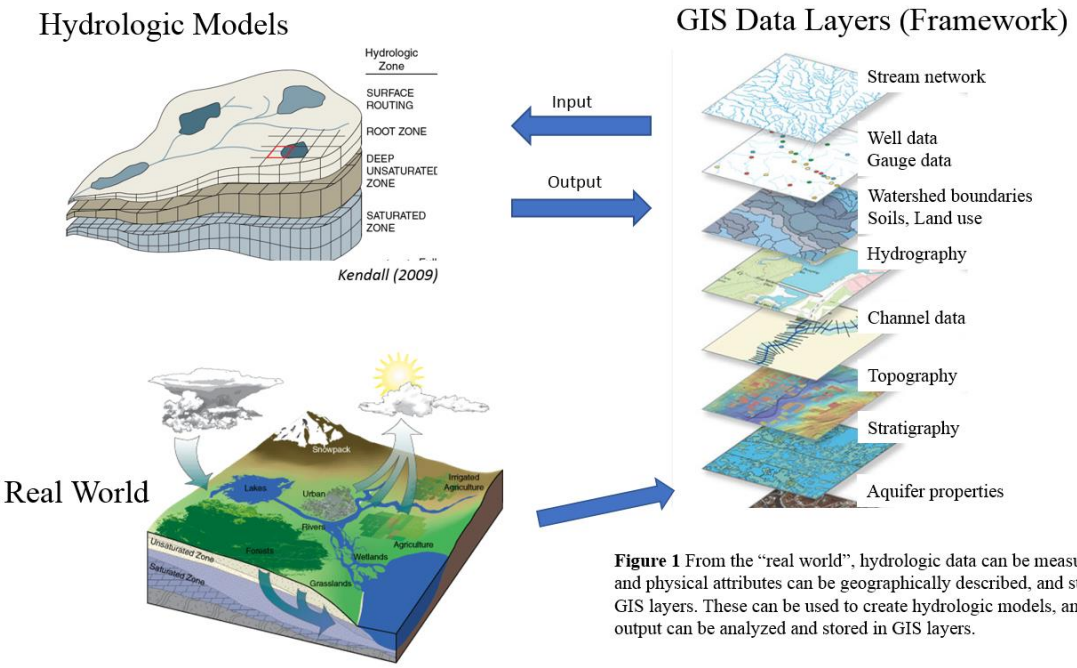


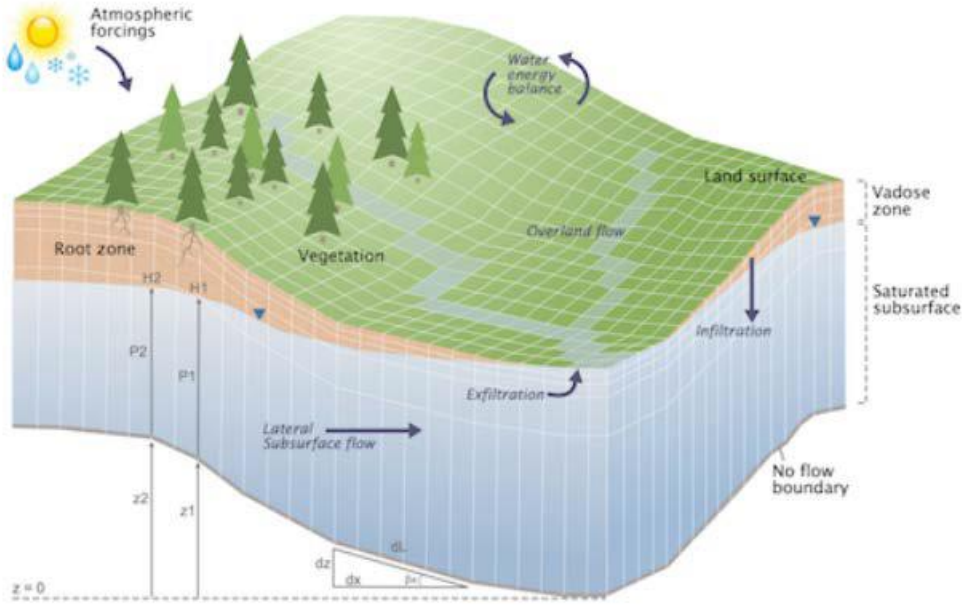
Figure 1 From the "real world", hydrologic data can be measured and physical attributes can be geographically described, and stored in GIS layers. These can be used to create hydrologic models, and the output can be analyzed and stored in GIS layers.

Our three-dimensional world is frequently modeled in two dimensions, and because of the great difference in time scale, precipitation/runoff models are generally run separate from groundwater models. But these components can never be completely separated without incurring significant errors.

Part of precipitation becomes recharge to groundwater, and groundwater eventually discharges to streams or to the atmosphere through evapotranspiration. In recent years, the ability to account for these transfers has improved, and some modelers are now coupling atmospheric, runoff, and groundwater models. Typically, the emphasis of the modeling effort is weighted either toward surface water processes or groundwater processes. And the mechanisms that account for transfer to the other domain, either to surface or groundwater, are simplified. A few model codes are fully coupled and simultaneously solve process-based equations for all domains. Figure 2 provides a simplified example of how surface and groundwater models can be coupled through an interconnected grid.

Parflow.org

Figure 2 An example of how surface and groundwater models can be coupled through an interconnected grid.



A variety of models can be developed using the resources we plan to make available in the Framework. Surface runoff process models can use statewide historical precipitation datasets, climate change scenarios, standard design precipitation patterns (such as 100 year or probable maximum precipitation), or custom designed precipitation patterns. The models can use statewide grids developed by others, with the stream network already incorporated, or use a grid generator to develop a unique design, tailored to project needs. Statewide data layers are available for: topography, soils, land use, connected stream network, lakes and wetlands, watershed boundaries and baseflow. There are several categories of data layers:

1. Climate/Weather Data includes real time precipitation data; historic precipitation data; data that have been synthesized, reanalyzed, or corrected; and climate change scenarios. There can be errors in how precipitation data are measured, especially snowfall under certain wind conditions, and at some gage locations that do not have appropriate equipment or procedures.

2. Surface process model data include static landscape data that do not readily change over time such as topography, soils, the stream network, watershed boundaries, and wetlands; and time varying landscape data that may change seasonally or annually, such as crop cover, irrigation water use, irrigation return flow, and leaf area index. Channel characteristics are important to accurately route flows through the stream network.
3. Groundwater model data includes aquifer hydraulic properties; lithologic strata; water table elevations; and recharge. Models that feature groundwater/surface water interaction incorporate streambed conductance.
4. Water use/water return includes water use routing; alteration of the hydrologic landscape by importation of water supply, or artificially moving water through a system of reservoirs and channels; and water intakes.
5. Water infrastructure could include county drains, tile drains, and urban stormwater systems.
6. Hydrologic data include flow measurements made at gaging stations, as well as analysis of those data to develop, for example, design flows for floods and droughts.

Possible sources for these data sets are researchers and agencies working with these types of data. It is important information and efforts will be made to make it available through the MHF.

Summary of MHF capabilities:

1. Handle GIS data sets statewide (expand beyond what we are doing as part of the water withdrawal assessment program).
2. Incorporate results from detailed local or regional groundwater models into a statewide decision-making framework (specifically, the water withdrawal assessment program screening tool should be upgraded as part of this).
3. Access hydrologic data, data analysis and interpretation results, model results.
4. Access these data and results through a GIS interface (smartmap).
5. Incorporate new data and analysis into data sets as they become available.
6. Create a statewide "smartmap" that describes the distribution, abundance, and dynamics of the linked surface-waters and shallow groundwater system.
7. Facilitate creation of models that link climate, surface waters, and shallow groundwater, and can show past, present, and future scenarios.

Calibrated models are the primary science output of the Framework. Site data support the modeling.

Investment Proposed: $2,100,000 over three years ($900,000 in year 1, $700,000 in year 2, and $500,000 in year 3) to facilitate the creation of groundwater/surface water models to improve water management decision making, create three regional models to more accurately assess water withdrawal impacts within the Framework and assess its functionality, and assess regional models using metamodeling processes on a regional model to test parameters for a rapid method to evaluate potential water use impacts.

Implementing Organizations: Based on the experience of developing the Water Withdrawal Assessment Process, to be successful, this project should be overseen by a broad-based stakeholder group. It will be responsible for developing policy recommendations to state government regarding this project. This

includes overseeing the creation and implementation of the Michigan Hydrologic Framework. It is anticipated that this role would be served by the WUAC.

Timeframe: Three years to design, develop, test, roll out prototype, and finalize framework.

2. GEOLOGIC DATA COLLECTION AND MAPPING IN TARGETED AREAS OF MICHIGAN

Synopsis: Improved geologic data are needed to fine tune and verify predictions that large quantity withdrawals will not cause adverse resource impacts, and to determine whether an ARI has occurred. The best available surface geology maps in Michigan are compiled at a scale of 1:24,000 within 7.5' quadrangles. Currently, only 33 such high-quality maps exist, collectively covering less than three standard (576 mi^2) counties. Expanding state funding to the MGS in support of the STATEMAP program will dramatically improve the ability of EGLE to manage the groundwater resources of Michigan under NREPA Part 327 and will support numerous other programs in EGLE (*e.g.*, supporting the Michigan PFAS Action Response Team (MPART)), DNR and MDARD for years to come. These MGS mapping projects would expand existing geologic information with data from drilling, soil sampling, passive seismic, and gamma-ray logging to produce composite surficial geology maps that include bedrock topography, thickness and type of glacial deposits, static groundwater elevations and near-surface sand and gravel.

The WUAC recommends that the legislature allocates $3,000,000 of recurring, operating funds. This allocation would be consistent with 2019 proposed legislation in SB 403 and HB 4745 to support geologic mapping for PFAS-impacted areas by the MGS to specifically conduct the geological mapping of EGLE-designated counties in order to derive geologic and aquifer data useful to the EGLE Water Use Assessment Unit and MPART geologic subsurface data requirements. Mapping of the near-surface glacial geology also recognizes sand and gravel that represent shallow water resources that are identified and require protection from spills and environmental impacts. Such funding is necessary so that MGS can secure matching funds from the Federal USGS National Cooperative Geological Mapping Program (NCGMP) to receive up to at least $150,000 per year which ensures mapping products will meet USGS data quality standards. On the following page is a summary of the counties recommended for mapping to the Legislature in October 2019 by EGLE WRD and MPART with an estimated 20 Counties completed in 10 years at that allocation. The WUAC urges that such an appropriation also require that the MGS-sponsored geologic mapping projects continue to collect and analyze the glacial core samples in order to estimate the hydraulic conductivity of the glacial deposits and that MGS enter these data into the appropriate, publicly available database that will be part of the Michigan Hydrologic Framework (the Hydrologic-Geologic Data Set).

Investment Proposed: $3,000,000 per year, recurring budget (these mapping products would be publicly available to be used by multiple EGLE divisions, DNR and MDARD programs)

Implementing Organization*:* Michigan Geological Survey at Western Michigan University

Timeframe: This recommendation is for recurring, operating funds for the Michigan Geological Survey for a ten-year period.

Recommended Counties for mapping:

MICHIGAN GEOLOGICAL SURVEY
SUMMARY OF COUNTY MAPPING PRIORITIES
RESULTING IN VALIDATED GEOLOGIC MAPPING PRODUCTS

	Priority Counties (Mapping data needed)	EGLE WRD Water Use Priority list	EGLE MPART PFAS Areas	
1	**Montcalm**	Branch	Kalamazoo	
2	**Ottawa**	Cass	Muskegon	
3	**Allegan**	St. Joseph	Oakland	
4	**Calhoun**	Calhoun	Kent	
5	**Berrien**	Van Buren	Montcalm	
6	**Jackson**	Ottawa	Ottawa	
7	**Branch**	Berrien	Allegan	
8	**Cass**	Allegan	Calhoun	
9	**St. Joseph**	Montcalm	Ionia	
10	**Washtenaw**	Hillsdale	Monroe	
11	**Kent**	Jackson	Livingston	
12	**Barry**	Gratiot	Lenawee	
13	**Oakland**	Isabella	Marquette	
14	**Ionia**		Washtenaw	
15			Barry	
16			Berrien	
17			Charlevoix	
18			Delta	
19	Top Priority		Jackson	
20	Second Priority		Newaygo	
21	Third Priority			

NOTE: MGS has received specific priority county designations from WRD and MPART, when asked. **The United Tribes of Michigan endorsement was for mapping of water resources where needed in the State.**

3. MONITORING WELL NETWORK

Synopsis: The State's ability to monitor groundwater levels is limited by an inadequate network of groundwater monitoring observation wells. The proposal here is to implement a plan for a more comprehensive groundwater network throughout Michigan. This will be accomplished in a four-task approach of initial evaluation, field evaluation, network implementation, and operation and maintenance. The initial evaluation task will include development of a small stakeholder group to determine objectives and approach of implementing the groundwater monitoring network. The network will be established incrementally starting with approximately ten existing or new observation wells in the first year and adding ten additional wells per year. To the extent possible, citizen science volunteers will be trained and equipped to make the water-level measurements themselves to keep network costs down. Unknown in this proposal is the number of new wells necessary to complete the monitoring network; however, initial discussions have focused on having at least two wells per county for a total of

160 to 170 wells. This will presumably be determined in the initial and field evaluation portion of the proposal.

Recommended Action: For the full network implementation across the State of Michigan, the first year of establishing the network is roughly estimated to cost approximately $259,000 with subsequent years costing approximately $226,000. We project increases in project costs of five to ten percent each year thereafter to account for operation and maintenance of ten additional wells per year and adjustments for inflation. Approximate costs of new wells are as follows, per USGS:

1. Estimated cost for drilling a new observation well: Average is about $5,500 but depends on depth. Estimate about $25-$50 per foot depending on difficulty
2. Estimated cost for equipment for non-real time / transducer and data logger only observation well: $1,800
3. Estimated cost for equipment for real-time observation well: $7,500
4. Annual operation and maintenance for non-real time / transducer and data logger only observation well: $2,400
5. Annual operation and maintenance for real-time observation well: $4,840

Additionally, the WUAC recommends that EGLE join the National Groundwater Monitoring Network (NGWMN) to increase awareness among various divisions in EGLE on existing groundwater monitoring wells and data to allow for interdepartmental efficiencies. USGS has outlined requirements of each state for data to be accepted into the network. By meeting USGS requirements for the network, EGLE will improve the organization and accessibility of existing groundwater monitoring data within the Department. For example, groundwater data is currently housed in multiple databases across EGLE but the inclusion in the NGWMN will provide translators to restructure files into common data formats. Additionally, inclusion in the NGWMN makes Michigan eligible for additional funding that can cover costs associated with rehabilitating existing and installing new monitoring wells during future rounds of funding.

Investment Proposed: $259,000 during the first year; $226,000 in subsequent years subject to cost increases due to inflation. USGS will consider up to 25 percent match through its Cooperative Matching Funds program (subject to availability).

Implementing Organization: USGS

Timeframe: Program could start immediately, and annual costs would continue for the life of the program.

RECOMMENDATIONS FOR ADDITIONAL ACTIVITIES TO IMPROVE DATA COLLECTION AND MODELING AS CONTINUED AND NEW OPERATIONS ARE UNDERWAY

1. LONG-TERM PLANNING

Synopsis: The WUAC recommends that it coordinate development of an overall long-term plan for the acquisition of water management data needs. This entails formal analysis and communication of all forms of existing streamflow, groundwater and geological data by type and locations within Michigan, identification of critical data gaps and needs, and development of priority needs and cost-efficient strategies for data collection. The WUAC can coordinate this and support its development, but additional financial resources are also required to engage necessary technical resources required to support this project. While participants in the WUAC will contribute significantly to this effort, we are requesting an investment of $100,000 to support acquisition of appropriate technical resources contracting to accomplish this project. These funds would be appropriated to EGLE, with the WUAC assisting the department in contracting and management of the work.

Investment Proposed: $100,000 one time.

Implementing Organizations: WUAC, EGLE, USGS, MGS

Timeframe: 12- 18 months

2. WATER WITHDRAWAL ASSESSMENT TOOL (WWAT) USER INTERFACE UPDATE

Problem Statement: The WWAT was designed for assessment and registration of new large quantity water withdrawals. The user submits the intended withdrawal construction and operation characteristics as an application to obtain a registration. The withdrawal's characteristics, and the projected impact of operating the withdrawal on the local WMAs as calculated by the WWAT, are stored in the WWAT's supporting database. The cumulative impact of registered withdrawals is also stored in the database in a numerical accounting table and is accessed internally by the WWAT to produce the results output to the user. None of the WWAT's data on registrations, their individual impact, or their cumulative impact and the current status of a watershed is available to the user in a readily accessible form. This information could be useful to WWAT users for proposing prospective withdrawals, existing water users for watershed planning, or to other interested parties.

Project Description: EGLE and DTMB staff will develop a methodology to effectively communicate information from the WWAT database to users through the WWAT's interactive map interface. Minimally, a GIS layer of point data sourced from the WWAT database will be created by EGLE. DTMB will program the WWAT application code to access the layer and make it available for interactive user query.

Investigators: EGLE Water Use Assessment Unit, multiple DTMB staff to be determined

Contract Budget: $50,000 in a one-time expense. This project is a collaboration among Michigan EGLE program staff and DTMB application development and enterprise GIS staff. Analysis and project development will be accomplished via existing EGLE resources and interagency billing with DTMB. Additional input will also be sought from experts associated with technical aspects of the WWAT (*e.g.*, J. Asher, MSU Institute for Water Research) as needed.

3. COMPILING KEY AQUIFER PROPERTIES FOR USE IN THE WWAT

Synopsis: Transmissivity is an important aquifer characteristic to determine a well's drawdown and potential impacts on nearby streams. In 2005, the Groundwater Inventory and Map Project only had 282,802 records in the State of Michigan's Wellogic database to estimate transmissivity for both the glacial and bedrock aquifers throughout Michigan. These estimates were built into the WWAT. Today, there are over 575,000 records in the Wellogic-2 database and many of these contain automatically derived estimates of the effective transmissivity of both unconfined and confined aquifers. The doubling of the number of Wellogic records, combined with the standardized estimation of aquifer properties in the Wellogic-2 database, will allow the statewide estimates of transmissivity for both the glacial and bedrock aquifers, key components of the WWAT, to be significantly improved. On an ongoing basis, Sec. 32706a (6), Part 327, P.A. 451 (1994) requires EGLE to add verified data about the geologic and water resources to the WWAT database. Currently, scores of aquifer tests associated with irrigation wells have been conducted by private consultants (*e.g.*, 50 aquifer tests were conducted as part of the Cass County Pilot Project).

The current storage coefficient used in the WWAT for glacial aquifers is 0.01. This value was based on the 2004 database of aquifer tests from public water supplies (PWS). The most recent aquifer test data for PWS at DWEHD, EGLE (October 2015) contains more than twice the number of test results and these conclusively show that a storage coefficient of 0.10 is much more appropriate for unconfined glacial aquifers. A GIS method to identify all WMAs used in the WWAT that are dominated by unconfined, glacial aquifer conditions was recently developed and approved by the WUAC. All WMAs selected by this method shall have their storage coefficients increased to 0.10 in the WWAT. Applying a higher storage coefficient will better reflect the local aquifer characteristics, make more water available for use, and provide better estimates of streamflow depletion.

Recommended Actions: The WUAC recommends that the legislature allocates $110,000 to the EGLE Water Use Assessment Unit to be expended across two fiscal years for:

1. EGLE Water Use Assessment Unit staff to compile all available irrigation aquifer test data and make them available to the contractor who will develop new statewide map of estimated transmissivity (no additional funding needed).
2. An external contractor ($15,000) who will (a) compile and derive statewide estimates of transmissivity for both the glacial and bedrock aquifers according to the protocol already approved by the WUAC and incorporate the transmissivity values from irrigation aquifer tests that EGLE provides; and (b) identify all WMAs statewide that are dominated by unconfined, glacial aquifer conditions using the GIS method already approved by the WUAC.

3. The EGLE Water Use Assessment Unit ($10,000) shall use the new transmissivity and storage coefficient values in those WMAs that were identified as being dominated by unconfined, glacial aquifer conditions to assess the impact of these changes on all registered and permitted large-quantity groundwater withdrawals in those WMAs, and report the results to the WUAC. Following this assessment, the EGLE Water Use Assessment Unit shall propose an implementation strategy for using the updated transmissivity and storage coefficient values to the WUAC, which must approve the implementation plan before changes are made to WWAT.
4. DTMB ($85,000) to incorporate the new estimates of transmissivity values into the WWAT and to alter the WWAT to utilize a storage coefficient of 0.10 in all WMAs that the contractor determined to be dominated by unconfined, glacial aquifer conditions.

Implementing Organizations: The EGLE Water Use Assessment Unit will work through the DTMB to solicit bids from qualified contractors to (1) compile and derive statewide estimates of transmissivity for both the glacial and bedrock aquifers and (2) identify all WMAs statewide that are dominated by unconfined, glacial aquifer conditions. The EGLE Water Use Assessment Unit will be the point of contact for the State of Michigan to manage the subsequent contract. The EGLE Water Use Assessment Unit will assess the impact of using the new transmissivity and storage coefficient values in those WMAs that were identified as being dominated by unconfined, glacial aquifer conditions on all registered and permitted large-quantity groundwater withdrawals in those WMAs. The EGLE Water Use Assessment Unit will develop a work order with DTMB, Center For Shared Solutions (CSS) to have CSS incorporate the new estimates of transmissivity into the WWAT and to alter the WWAT to utilize a storage coefficient of 0.10 in all WMAs that the contractor determined are dominated by unconfined, glacial aquifer conditions.

Timeframe: This recommendation encompasses a 24-month project which includes the following overlapping tasks:

1. Twelve-month contract for the successful contractor
2. Three-month effort by EGLE Water Use Assessment Unit to compile irrigation aquifer test data and develop a workplan with DTMB
3. Three-month effort by EGLE Water Use Assessment Unit to assess the impacts of using the new data and develop an implementation plan
4. Three-month effort by the WUAC to approve the implementation plan
5. Nine-month period for DTMB CSS to incorporate the approved changes into the WWAT.

4. 3D GLACIAL AQUIFER MAPPING IN TWO COUNTIES

Synopsis: 3D glacial aquifer data, currently unavailable in most of Michigan, would help EGLE Water Use Assessment Unit staff, as well as private contractors, to predict whether or not proposed large quantity withdrawals are likely to cause adverse resource impacts using groundwater flow modelling. One of most robust methods of mapping the 3D aquifer properties of an area is the use of the transition probability/Markov geostatistical approach (TP).[5] The lithologic descriptions for given depth intervals in

[5] Carle, S. F. 1996. A transition probability-based approach to geostatistical characterization of hydrostratigraphic architecture. Ph. D. dissertation, University of California, Davis, 248 p.

the Wellogic lithology file are pre-classified into four different geologic material types: aquifer material (AQ); marginal aquifer material (MAQ); partially confining material (PCM); and confining material (CM). These lithologic classifications can be analyzed using the transition probability/Markov geostatistical approach to produce a 3D Lego®-block-like geologic model of aquifer material types throughout an area of interest.

The WUAC recommends that the legislature allocates $80,000 to the EGLE Water Use Assessment Unit to be expended across two fiscal years by an external contractor who will map the 3D aquifer properties of Cass and Calhoun counties using the TP geostatistical approach. The contractor will develop an ensemble 3D realization of the glacial aquifer materials that extends from the land surface to the bottom of the screened interval in all the wells. Only Wellogic well records that have been location verified shall be used. The geologic model cells should have a vertical height of not more than 4 m and a horizontal extent of 500 x 500 m or less. Anisotropy ratios for AQ, MAQ, PCM, and CM should be 10, 10, 10 and 8.5, respectively. Each cell will be categorized as one of the four material types (AQ, MAQ, PCM, or CM) for each model realization. At least 1000 realizations must be executed to produce a final ensemble geologic model by assigning the most frequently occurring geologic material at each grid cell. The contractor will derive the spatially variable horizontal and vertical effective hydraulic conductivities of each layer in the output model from the Wellogic data base. The final 3D aquifer properties model must be in a format compatible with the USGS MODFLOW 6 software.

The contractor shall propose and conduct one or more statistical comparisons of the TP-derived geologic model with a subjectively derived geologic model, to be provided by the EGLE Water Use Assessment Unit for each county. The proposed statistical comparisons must be approved by the WUAC before they are implemented. The contractor shall submit a written report and make a presentation of their findings to WUAC. This probability/Markov geostatistical approach will also be compared to the MGS mapping completed in these two counties, resulting in a comparison of the 3D products.

Investment Proposed: $80,000 across two fiscal years.

Implementing Organization: The EGLE Water Use Assessment Unit will work through the DTMB to solicit bids from qualified contractors to map the 3D aquifer properties of Cass and Calhoun counties and will serve as the point of contact for the State of Michigan to manage the subsequent contract. EGLE Water Use Assessment Unit staff will engage with the WUAC as they develop the Request for Proposals for DTMB. The contractor's quarterly progress reports submitted to the Water Use Program should also be shared with the WUAC.

Timeframe: This recommendation is for funds to be expended across two fiscal years by an external contractor who will map the 3D aquifer properties in Cass and Calhoun counties.

NEW AND ONGOING ACTIVITIES THAT DO NOT NEED ADDITIONAL STATE FUNDING

1. DEVELOP WATER USER COMMITTEE (WUC) USER'S MANUAL

Problem Statement: The EGLE Water Use Program has seen an increase in the number of WMAs classified as Zone C. WUCs can be effective tools for water users to cooperatively resolve water conflicts or potential ARIs.

Part 327 Great Lakes Preservation of the Natural Resources and Environmental Protection Act requires EGLE to convene a meeting of registered and permitted large quantity water users within a watershed when it has determined that ARIs are occurring or are likely to occur due to one or more large quantity withdrawals. The purpose of the meeting is to attempt to facilitate an agreement on voluntary measures to prevent ARIs.

In addition, under Part 327, all persons making large quantity withdrawals within a watershed are encouraged to establish a WUC to evaluate the status of current water resources, water use, and trends in water use within the watershed and to assist in long-term water resources planning before a potential adverse resource impact occurs.

A WUC may be composed of all registrants, permit holders, and local government officials within the watershed. WUCs work collaboratively to identify and implement voluntary agreements to collectively reduce their impact on the watershed and accommodate new or increased use by existing users. Water users provide direct input to determine solutions that provide equitable water access and prevent or resolve water use conflicts and ARI. The process is expected to emulate what would likely transpire in civil litigation, with the advantage of avoiding legal expenses and delays.

WUCs have the potential to play an important role in preventing or resolving water use conflicts and ARIs. EGLE will likely need to convene one or more WUCs soon and currently lacks the tools and tactics to convene a successful WUC. In addition, WUCs may choose to come together proactively and would also benefit from a user manual to assist them in managing local water resources.

Recommendation: Given the complexity of Michigan's water rights and laws, the state's water resources, and the potential for conflict, the WUAC recommends that EGLE develop a WUC User's Manual to equip WUCs with information, tools, and resources to develop realistic shared solutions to sustainably manage water use. The goal of this manual is to provide steps that will assist the WUCs with successfully developing shared solutions for managing water resources.

The WUC manual will be an essential tool for the EGLE Water Use Program and future WUCs. It will educate people about Michigan's water laws and water rights; the role of state agencies and various water user groups; and strategies and best practices for WUCs to achieve success.

The manual should address the three scenarios where WUCs may be convened:

1. Following a denial by EGLE of a proposed new large withdrawal due to the likelihood of it causing an ARI. The WUC would be convened by the water user(s).

2. Following a determination by EGLE that an ARI is occurring or is likely to occur and no WUC already exists. The WUC would be convened by EGLE.
3. Large quantity water users choose to self-convene to proactively manage local water resources and plan for future use.

Steps Needed to Achieve the Task: The WUAC recommends that EGLE issue a competitive funding opportunity to solicit grant proposals using a similar approach to the Sustainable Small Harbor Initiative which used an Integrated Assessment Approach involving a multidisciplinary project team that works collaboratively with state agency natural resource managers; policy makers; stakeholders and other interested parties to develop the WUC manual; implement a comprehensive stakeholder engagement strategy to ensure meaningful input and feedback on the manual; and conduct one or more case studies of WUCs in watershed management areas where there is the potential for an ARI.

Using a similar approach to the Integrated Assessment, the project team would collaborate with state natural resource managers and policy makers, stakeholders and other interested parties to develop tools and strategies to equip WUCs in their development of shared solutions to sustainably manage water use within their water management area. The project would be based on existing research and technical information about Michigan's water laws and water rights, water governance, Michigan's water resources, effective community engagement and collaborative decision-making process.

Desired Outcome: EGLE and WUCs are equipped with the resources, information, tools, tactics, and steps to successfully establish and function WUCs to develop shared solutions for managing water resources to prevent or resolve water use conflicts and ARI.

Estimated Cost: Based on the Sustainable Small Harbors Initiative, the estimated cost to develop the manual; implement a stakeholder engagement process; and conduct one or two case studies is approximately $250,000. Funding for this project may be provided by EGLE Office of the Great Lakes through the Michigan Great Lakes Protection Fund.

2. DEVELOP STANDARDS & PROTOCOLS FOR COLLECTION AND USE OF NEW DATA WITHIN THE PROGRAM

Background: The WWAT and assessment process both rely on the use of existing data sets, and the use of new additional data. To provide a means for continually refining the assessment process and its outcomes, the program was structured to allow for the use of new data in the program. This both aids in water user applicants being able to provide more accurate location specific data in their registration assessments, and for improvements in data to be used by the program to aid in preventing ARIs. The statute laid forth general conditions for the collection and use of these new data types, and the previous WUAC (2014) recommended further development and publication of specific protocols for the collection and use of new data for different purposes within this program.

Findings & Recommendations: For collection of new data, standards have been developed for this program. For streamflows, the standards for data collection are the USGS standards, which are published and maintained on the USGS website. For aquifer performance tests (which allow for inferences of how geology and groundwater dynamics exist in relation to water withdrawal pumping at specific locations), EGLE has developed standards for the collection of these tests for use in this program and is currently working with this WUAC to finalize them. In the future, we anticipate also needing to

further develop data collection procedures for other types of data that are emerging in location-specific modeling refinement efforts. In this regard, the WUAC will continue to evaluate the results of the Cass County Pilot Study, to review and determine whether additional data collection standards need to be developed, adopted and published soon.

Data use protocols involve details of how new data, once collected, are to be adjusted, summarized, and used for different purposes within the program. We find that currently, some of these protocols for data use are developed, and others are not yet fully developed. One example of data use protocols needing further development, is in the use of streamflow data for the purpose of modifying stream index flows used both in the assessment tool and assessment processes. Following USGS standards for collection of streamflow data does not fully by itself, establish needed protocols for how much data needs to be presented, how it should be adjusted for appropriate analogy to statutory definitions, and conditions for modifying index flows given new data. Filling these gaps in data use protocols will require the additional work by the WUAC in conjunction with EGLE. We are recommending that the WUAC address these needs through its work in 2021.

Investment Proposed: No additional new investment requested. Work needed will be conducted by WUAC members and EGLE/USGS staff though the WUAC process in 2021. Recommendations developed will be brought to the WUAC for consensus approval, and adopted for use by EGLE and published online, when complete.

3. WELL-OWNER OUTREACH ON REGISTRATION COMPLETION REQUIREMENTS

Background: The WUAC identified data entry to the High Capacity (HC) Wellogic records were routinely not being completed correctly or in the required timeframe. The completed Wellogic/HC form is needed to complete the application for the HC well. The WUAC established a sub-committee to review the HC well records and to prepare a summary document defining who and what needs to be inserted in the Wellogic well records and who is responsible and time frame to complete.

Findings/Recommendations*:* The application and data entry for HC wells is the responsibility of the permit applicant, *i.e.*, the owner of the well. Accurate data entry can be done by irrigation providers, well drillers, consultants or the owner, however the final data entry and submittal of the completed form is the sole responsibility of the applicant. The following draft letter was developed and agreed upon, and is planned to be distributed in newsletters from the Farm Bureau, irrigation providers, MGWA, and local farming associations to make certain the applicant understands they can contract for or request others to input the data but the final submittal is the applicant's responsibility. If not, they can be subject to fines and denials of the application. This letter and its distribution is intended to help clarify the responsibilities for completed well registrations, to reduce non-compliance, and to reduce the need and expenses of agency compliance follow ups regarding these completed registrations.

Investment Proposed: None

Letter Information:

- <u>What Property Owners Need to Know About High-Capacity Wells</u>

  The review of the Water Withdrawals Assessment program has shown that there are many data gaps in the submitted information and any of these can cause you to have your application

delayed or possibly denied. The high-capacity water well regulations require the applicant to submit all the documentation and well completion records accurately and within the required timeframes. Presented below is a summary of some questions and responses that can assist you in successfully completing the application process.

- What is a High-Capacity Well?

  Part 317, Aquifer Protection and Dispute Resolution, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA) defines a high-capacity well as one or more water wells that, in total, have the capacity of withdrawing 100,000 or more gallons per day (gpd) in one day. Part 327, Great Lakes Preservation, of the NREPA has a related definition of a large quantity withdrawal (LQW), one or more cumulative total withdrawals of over 100,000 gpd averaged over any 30-day period. A daily pumping rate of 100,000 gpd equates to a continuous pumping rate of 70 gallons per minute (gpm).

- What do EGLE and the well driller use as the pump capacity?

  To determine whether a well is regulated as a high-capacity well under Part 317 of the NREPA or as an LQW under Part 327 of the NREPA, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) uses the manufacturer's rated pump capacity (in gpm) that the well driller or pump installer lists on the well log. See the example well log in Figure 1.

- Do I need to register my high-capacity well?

  If you are installing a new well (either a new well or replacing an existing well) or are increasing the pump capacity of an existing well by 70 gpm or more, you must get authorization under Part 327 of the NREPA.

- How do I register my well under Part 327?

  You, the applicant, (property owner) are required to register your well using the on-line Water Withdrawal Assessment Tool (WWAT; http://www.egle.state.mi.us/wwat). Your authorized representative (e.g., employee, well driller, consultant, agricultural irrigation equipment supplier, agricultural extension service agent) can and should assist you in this process to insert accurate information regarding flow, well casing depths, type of well such as bedrock or glacier drift well, and the location of the well. If you pass the WWAT, click on the link on the WWAT's results page to create a registration receipt for your records. If you do not pass the WWAT, your well must be authorized by either a site-specific review (SSR) or an alternative analysis under MCL 324.32706c before the well can be put into operation. There is a link to request an SSR on the WWAT's results page. Please be aware that your well's registration (through the WWAT, an SSR, or an alternative analysis under MCL 324.32706c) must be put into operation (i.e., installing the well and the pump) within 18 months of the well's registration date or the registration expires and you must obtain a new authorization under Part 327.

  Good communication with your well driller or authorized representative is essential – If the information you register is wrong, this violates the statute and your permit will not be valid until the permit matches the well information, pump information and the correct location of the well. This is very important for your registration to be valid!

When you meet with your well driller or authorized representative to discuss your water supply needs be sure to provide him or her with a copy of your LQW registration receipt if you or your authorized representative already registered your well. If you have not registered your well yet, discuss whether you, your driller, or some other authorized representative is going to register the well once it's been drilled. Those discussions should include whether the driller is going to install a pump in the well or whether you or someone else is going to install the pump later.

- What should I do if the well is installed differently than it was originally registered?

  Your well may end up being installed differently than it was originally registered for a variety of reasons. The well's location may have changed. Your driller may install the well screen or the casing is set at a different depth to provide the best water yield. Your driller, or someone else later, may install a pump with a different rated pump capacity. All of these changes require you to submit an accurate change to your application.

  If you have made any of these changes, Part 327 requires that the property owner rerun the WWAT and notify EGLE of the results [MCL 324.32706b (5)] and that the property owner notify EGLE if the well was registered through an SSR or alternative analysis [MCL 324.32706c (10)]. These notification requirements also apply if your pumping schedule changes from your original registration. The purpose of these requirements is to allow EGLE the opportunity to verify that the changes as installed and as operated characteristics for your well are not going to create an adverse resource impact (ARI) to fish populations or stream flow. EGLE also needs to know your well's as installed and as operated characteristics so that EGLE can accurately keep track of the projected cumulative stream flow depletions in the affected sub-watersheds to continue to avoid causing adverse resource impacts and to determine if additional stream flow is available to authorize any future LQWs in the affected sub-watersheds.

- Requirement to file well records

  Part 127, Water Supply and Sewer Systems, of the Michigan Public Health Code, 1978 PA 368, as amended, requires your well driller or authorized representative to submit water well and pump installation records to the local health department within 60 days following completion. See the example well drilling record form in Figure 1. Your well driller can enter the water well and pump records directly into the Wellogic database. If you or someone else installs the pump later, you are required to submit the pump records to the local health department within 60 days following completion.

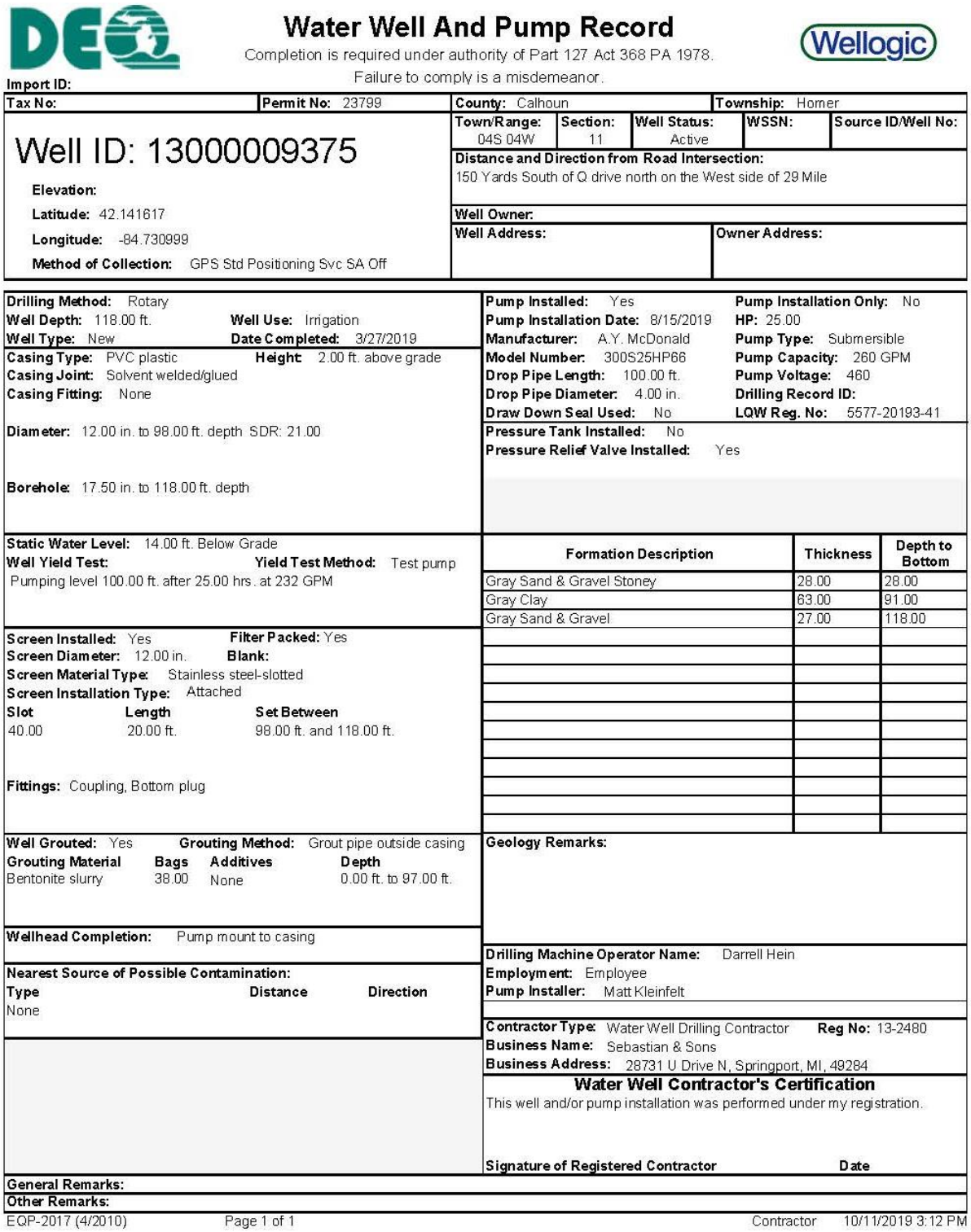
- Changes to well records can be made by emailing the Wellogic Help at wellogic@michigan.gov.

- EGLE compliance reviews

  EGLE Water Resources Division compliance staff conduct compliance reviews on a sub-watershed scale to make sure that EGLE has the most accurate cumulative stream flow depletion tracking figures that are used by the WWAT and by EGLE staff to determine whether proposed LQWs can be authorized under Part 327 of the NREPA. During a compliance review, EGLE staff compare the LQW registration records, well records, and the annual water use reporting data submitted to EGLE or the Michigan Department of Agriculture and Rural Development for agriculture LQWs. When the compliance review discovers unregistered wells,

well records with missing pump information, wells that were installed differently than were authorized by the WWAT, SSR, or an alternative analysis, or LQWs that pumped more water than the maximum authorized annual withdrawal volumes, then EGLE must resolve those violations to bring the LQWs back into compliance with Part 327 of the NREPA. EGLE sends the missing pump information compliance communication and encloses the pump information form for the property owner or his/her authorized representative to complete and return to the local health department. EGLE sends an amended registration compliance communication to property owners if there is enough stream flow available to authorize the LQW as it was installed and operated. If there is not enough stream flow available to authorize the LQW as installed and/or operated, then EGLE will send a violation notice to the property and provide the property owner with a list of options to bring the LQW back into compliance with Part 327 of the NREPA. EGLE copies the well driller and other interested parties (when known) on the compliance communications and violation letters as well as the local health departments.

Figure 1: High Capacity Wellogic form completed per Part 327 regulation:



Water Well And Pump Record

Completion is required under authority of Part 127 Act 368 PA 1978.
Failure to comply is a misdemeanor.

Wellogic

Import ID:

Tax No:	**Permit No:** 23799	**County:** Calhoun		**Township:** Homer	
		Town/Range: 04S 04W	**Section:** 11	**Well Status:** Active	**WSSN:**

Source ID/Well No:

Well ID: 13000009375

Elevation:
Latitude: 42.141617
Longitude: -84.730999
Method of Collection: GPS Std Positioning Svc SA Off

Distance and Direction from Road Intersection:
150 Yards South of Q drive north on the West side of 29 Mile

Well Owner:

Well Address:

Owner Address:

Drilling Method: Rotary
Well Depth: 118.00 ft. **Well Use:** Irrigation
Well Type: New **Date Completed:** 3/27/2019

Casing Type: PVC plastic **Height:** 2.00 ft. above grade
Casing Joint: Solvent welded/glued
Casing Fitting: None

Diameter: 12.00 in. to 98.00 ft. depth SDR: 21.00

Borehole: 17.50 in. to 118.00 ft. depth

Pump Installed: Yes **Pump Installation Only:** No
Pump Installation Date: 8/15/2019 **HP:** 25.00
Manufacturer: A.Y. McDonald **Pump Type:** Submersible
Model Number: 300S25HP66 **Pump Capacity:** 260 GPM
Drop Pipe Length: 100.00 ft. **Pump Voltage:** 460
Drop Pipe Diameter: 4.00 in. **Drilling Record ID:**
Draw Down Seal Used: No **LQW Reg. No:** 5577-20193-41
Pressure Tank Installed: No
Pressure Relief Valve Installed: Yes

Static Water Level: 14.00 ft. Below Grade
Well Yield Test: **Yield Test Method:** Test pump
Pumping level 100.00 ft. after 25.00 hrs. at 232 GPM

Formation Description	Thickness	Depth to Bottom
Gray Sand & Gravel Stoney	28.00	28.00
Gray Clay	63.00	91.00
Gray Sand & Gravel	27.00	118.00

Screen Installed: Yes **Filter Packed:** Yes
Screen Diameter: 12.00 in. **Blank:**
Screen Material Type: Stainless steel-slotted
Screen Installation Type: Attached

Slot	Length	Set Between
40.00	20.00 ft.	98.00 ft. and 118.00 ft.

Fittings: Coupling, Bottom plug

Well Grouted: Yes **Grouting Method:** Grout pipe outside casing

Grouting Material	Bags	Additives	Depth
Bentonite slurry	38.00	None	0.00 ft. to 97.00 ft.

Wellhead Completion: Pump mount to casing

Nearest Source of Possible Contamination:

Type	Distance	Direction
None		

Geology Remarks:

Drilling Machine Operator Name: Darrell Hein
Employment: Employee
Pump Installer: Matt Kleinfelt

Contractor Type: Water Well Drilling Contractor **Reg No:** 13-2480
Business Name: Sebastian & Sons
Business Address: 28731 U Drive N, Springport, MI, 49284

Water Well Contractor's Certification
This well and/or pump installation was performed under my registration.

Signature of Registered Contractor **Date**

General Remarks:
Other Remarks:

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4. CONTINUE REVIEW AND WORK ON CASS COUNTY WATER USE PILOT STUDY MODEL

Synopsis*:* In 2019, a study of five watersheds in Cass County was completed by Tritium, Inc. for a pilot project funded by Corn Marketing Program of Michigan (CMPM), EGLE, DNR, MDARD, Michigan Soybean Promotion Committee (MSPM), and Southwest Michigan Farmer's for Responsible Water Use (SMF). The purpose of the three-year study was to:

1. Collect hydrogeologic data to be used in the SSR process.
2. Create groundwater models for use in the SSR process.
3. Evaluate field methods, analyses, and modeling for technology transfer to other areas in the State.

A wide variety of field data regarding the geology, groundwater, and surface water across Cass County was collected and analyzed over the three-year study period. Data collected included more than 50 aquifer performance tests, a well log database with over 21,000 well logs, static water level surveys of 36 water wells and 64 stream stage stations, 7 regional and nearly 80 local geologic cross-sections, water level data from 51 monitoring wells, stream stage and discharge records, conductivity tests and velocity profiles, and irrigation system flow checks.

Tritium created and calibrated a groundwater flow model to simulate groundwater flow. The model simulates a five-layer system with an upper unconfined sand and gravel aquifer, a middle aquitard divided into three layers, and an underlying confined sand and gravel aquifer. The model provides a tool for predicting groundwater levels and flow directions across the nearly 970 square mile study area, focusing on portions of five watersheds including: Dowagiac Creek, McKinzie Creek, Osborn Drain, Pokagon Creek, and the Rocky River.

EGLE staff reviewed the data collection and modeling and developed a series of questions about the modeling process for further review, including adding stream data from water management areas, and questions about model calibration and boundary conditions. The WUAC met in 2020 to review the study report and EGLE's responses.

Findings/Recommendations: Tritium is developing a work plan and assembling a review group to address EGLE's questions about the model. Once the work plan and review group have been completed, additional work can be performed on the model to address questions and assess its utility for the Water Use Program.

Investment Proposed: The total cost for completing this model review must be confirmed through completion of the work plan, but the estimated total cost is $100,000. Funding for this model review could potentially be provided by agricultural groups in the state, including organizations who financially supported the original study.

Implementing Organization: Tritium, Inc. will lead the model review work, with assistance from a selected review group to be identified in the work plan and EGLE staff to provide feedback.

Timeframe: Estimated time to completion of this review is six to twelve months.

WATER USE ADVISORY COUNCIL

Council Member	Appointed By	Organization	Representing
Margaret Bettenhausen*	Attorney General	State of Michigan	Michigan Attorney General
Tammy Newcomb*	DNR Director	Senior Water Policy Advisor	DNR
Charlie Scott	EGLE Director	Owner, Gull Lake View Golf Course (for Michigan Golf Course Owners Association)	Nonagricultural Irrigators
Christine Alexander*	EGLE Director	Manager, Permits Section	Environment, Great Lakes and Energy
Doug Needham	EGLE Director	Michigan Aggregates Association	Aggregate Industry
James Clift*	EGLE Director	Deputy Director	Office of the Great Lakes
Steve Kohler	EGLE Director	Kalamazoo River Watershed Council	Local Watershed Councils
Tom Zimnicki	EGLE Director	Michigan Environmental Council	Environmental Organizations
Dave Hamilton	Governor	The Nature Conservancy	Statewide Conservation Organization
Frank Ettawageshik	Governor	United Tribes of Michigan	Indian Tribes
Jim Nicholas	Governor	Nicholas-H2O	Professional Hydrologists and Hydrogeologists
Mike Gallagher	Governor	Michigan Lake Stewardship Associations	Statewide Riparian Landowners Association
Pat Staskiewicz	Governor	Public Utilities Director Ottawa County Road Commission (for Michigan AWWA)	Municipal Water Suppliers
Jim Johnson*	MDARD Director	Director, Environmental Stewardship Division	MDARD
John Yellich*	MGS Director	Michigan Geological Survey - Director	Michigan Geological Survey

Brian Eggers	Senate Majority Leader	AKT Peerless	Business and Manufacturing Interests
Bryan Burroughs	Senate Majority Leader	Michigan Trout Unlimited	Statewide Angler Association
Laura Campbell	Senate Majority Leader	Michigan Farm Bureau	Statewide Agricultural Organization
Scott DeBoe	Senate Majority Leader	Consumers Energy	Consumers Energy
Buddy Sebastian	Speaker of the House of Representatives	Sebastian and Sons Well Drilling (for Michigan Groundwater Association)	Registered Well Drilling Contractors with Hydrology and Drilling Field Experience
Jason Walther	Speaker of the House of Representatives	Walther Farms	Agricultural Irrigators
Kyle Rorah	Speaker of the House of Representatives	Ducks Unlimited	Wetlands Conservation Organization
Tom Frazier	Speaker of the House of Representatives	Michigan Townships Association	Local Units of Government

***** *Ex Officio Member*