S T A T E O F M I C H I G A N

BOARD OF COMMISSIONERS OF THE COUNTY OF ALLEGAN

PUBLIC HEALTH—APPROVE GROUND WATER STUDY PROPOSAL PHASE 1

WHEREAS, on December 12, 2019, the Board of Commissioners authorized Public Health to fully scope a Ground Water Study; and

WHEREAS, Public Health has obtained a proposal from Hydrosimulatics, Inc. for $150,000 to complete the 1st phase of the Ground Water Study, as attached; and

WHEREAS, Public Health received $113,800 from the State Local Community Stabilization Authority in December of 2019, which is a new funding source, and which became a component of Public Health fund balance.

THEREFORE BE IT RESOLVED, the Board of Commissioners approves the proposal for an amount not to exceed $150,000; and

BE IT FURTHER RESOLVED, that the County Administrator is authorized to approve up to a 15 percent ($22,500) contingency for project needs such as printing and meeting expenses; and

BE IT FURTHER RESOLVED, that the total project cost will be funded from the Public Health Fund (Fund 2210) fund balance; and

BE IT FURTHER RESOLVED, that the amount of fund balance used for this project shall be exempt from the Surplus Fund Balance calculation and transfer as proscribed in Budget Policy 4.13.6; and

BE IT FURTHER RESOLVED, the County Administrator is authorized to negotiate contract for services; and

BE IT FINALLY RESOLVED, the Board Chairperson and/or County Administrator is authorized to sign any necessary documents on behalf of the County and the Executive Director of Finance is authorized to perform the necessary budget adjustments to complete this action.

ALLEGAN COUNTY
REQUEST FOR ACTION FORM

Completed RFA form must be attached to a work order request through the Track-It System. If you have any questions regarding this process, please contact Administration @ ext. 2633.

RFA#: 189-612

Date: 2/26/20

Request Type	Contract
Department Requesting	Health
Submitted By	Randy Rapp, RS & Angelique Joynes, RN, MPH
Contact Information	rrapp@allegancounty.org & ajoynes@allegancounty.org

Select a Request Type to reveal and complete required form.

Parties:

Allegan County on behalf on Allegan County Health Department
Magnet 4 Water

Duration: Approximately 1 Year

Amount: $150,000.00

Purpose:

Respectfully request the Board of Commissioners consider for approval the attached first phase of the proposal from Magnet 4 Water regarding the Allegan County Ground Water Study. This study is necessary for Allegan County because the citizens and businesses of Allegan County rely almost 100% on ground water for drinking and manufacturing and it would be helpful to supply these findings to Local Units of Government, should they want to use them, for planning purposes. It is needed for planning for future needs or alternatives sources of water in the future.

HYDROSIMULATICS INC
https://www.magnet4water.com

January 27, 2020

PROJECT PROPOSAL

TITLE: Allegan County Groundwater Study – Phase 1: Understanding the Big Picture

BY: Hydrosimulatics Incorporated

SUMMARY

The proposed project represents the first phase (Phase I) of an overall effort to improve the management of water resources in Allegan County. In particular, we propose to perform a comprehensive review of the present and past groundwater conditions in the county, using existing data that are available from State of Michigan data storehouses. By making innovative and critical use of the vast, but severely underutilized, existing groundwater data, we will be able to "see into the earth" - visualizing the countywide subsurface geology, groundwater flow patterns and water levels, and groundwater quality. Specifically, we will i) identify and inventory potential groundwater receptors and potential sources of contamination for the entire county; ii) evaluate recharge and groundwater use over past decades and attempt to identify temporal trends and spatial patterns in groundwater quantity and quality; iii) create normalized water quality indices and water quality severity rankings, and maps of sustainable yield across the county; and iv) combine these data-driven analyses and visualizations into a thorough report - or "story" - of Allegan County's past and present groundwater conditions. This report will include a recommendation for next steps, based on the information gather from this Phase I project.

ALLEGAN'S SPECIAL CHARACTERISTICS

Allegan County is in the western Lower Peninsula of Michigan. The western portion of the county borders the Lake Michigan shoreline. The Black-Macatawa, Kalamazoo, and small parts of the Lower Grand and Thornapple watersheds drain Allegan County. Regionally, the county sits on multiple aquifers and is in the broad groundwater discharge area of the Michigan basin.

Presently, almost all of the water supply in Allegan is from groundwater. The glacial sediments, especially the outwash and lake-bed sand and gravel deposits, serve as an important aquifer in Allegan County. The major bedrock aquifer is the Marshall Formation, a sandstone unit that resembles the outer ring of a bull's eye target centered in the middle of Michigan's Lower Peninsula. The Coldwater Formation underlying Allegan County lacks effective porosity and is relatively impermeable. Fractured portions of the carbonates in the Coldwater Formation may yield small quantities of groundwater, but the water is typically highly mineralized and is not suitable as a drinking water supply.

The county's special location, coupled with significant increases in population and agricultural activities, creates unique challenges for water resources management and land use planning. In particular, the following special characteristics must be taken into account to enable effective and sustainable use of the county's land and water resources:

- A critical dependence on groundwater – an almost 100% reliance for water supply.
- Competing uses of water – for irrigation, human consumption, industry, and for environmental receptors such as trout streams, lakes and wetlands.
- Numerous / growing number of occurrences and detections of known and emerging contaminants (e.g., PFAS); in many cases, the extent of impacts is not known.
- Complex geology with a strong 3D structure of permeable surficial deposits, complicated distributions of clay lenses (and sporadic dry wells), and deeper bedrock units of varying permeability.
- A surficial aquifer with shallow water tables (i.e., depths to water table are small) and extensive groundwater withdrawals. Most wells are competed in this aquifer. Intensive agricultural activities introduce pesticides and fertilizers, making this aquifer vulnerable to nitrate contamination in parts of the county.
- Most deep bedrock wells are in the northern part of the county and draw water from the Marshall aquifer. Based on the findings from our Ottawa County groundwater study, it's possible that groundwater from these deep bedrock wells exhibits high levels of salinity (high chloride concentrations).
- The complex distribution of shallow clay lenses makes it difficult to estimate recharge to the Marshall aquifer, which is critically important to the long-term sustainability / future development.

DATA GAPS

Characterizing and understanding this special subsurface environment, however, is severely hampered by the difficulty in data collection. Hydrogeological field investigations and evaluations to understand groundwater dynamics would generally cost tens or hundreds of thousands of dollars (or even millions). Conducting such investigations at the county scale would be prohibitively expensive.

The National Science Foundation stresses that an even bigger problem in groundwater site characterization is our inability to use existing data. Although most groundwater-related investigations include an analysis of the underlying flow systems, there is no overarching agenda linking them as a unified body of work, no mechanism to aggregate local knowledge into global understanding that can in turn be used to systematically guide other local investigations, and no framework in place to disseminate the results and

share the lessons learned. Groundwater management investigations often proceed independently without all parties recognizing or taking advantage of the fact that they are managing the same resources and investigating part of the same, larger system or at different scales of resolution.

OBJECTIVES

In this project, we propose to systematically and synergistically make use of existing data, with a goal to significantly improve the practical ability of the county and local decision makers to understand, manage, and protect groundwater resources. In particular, we propose to compile, process, visualize, and analyze all relevant data and information– including the vast water well datasets *Wellogic (*water levels, lithologies, well information) and *WaterChem* (water quality parameters) – of the county's aquifer system. We will utilize data-driven analyses for characterizing the current status of the aquifer system with respect to geology, water quantity and water quality. And because understanding current conditions requires a look into the past, we will also investigate potential temporal trends in water quantity (water levels and groundwater use) and water quality (distributions of different chemicals at different times).

OUTCOMES & DELIVERABLES

We will combine the data-driven analyses and visualizations into a thorough report - or "story" - of Allegan County's past and present groundwater conditions. This report will include a recommendation for next steps, based on the information gather from this Phase I project. It is expected that it will take approximately 6 (six) months to complete the data processing/analysis and prepare a final report. We propose to present our incremental progress at two meetings taking place approximately 3.5 months and 5.5 months from the start of the project. Our presentations will include publication-quality maps and will be made available in PDF format to the county so that resource managers / planners / policy makers can make use of graphics/results the moment they are ready.

Specifically, the report and related presentations will include:

- 2D and 3D graphics of the subsurface geology, including the results from a geostatistical simulation of the glacial aquifer heterogeneity.
- Maps of groundwater level distributions, flow directions and patterns in both the shallow glacial aquifer and, where applicable, the deeper bedrock aquifer.
- Maps / analyses of groundwater use across space and time (different places, different time periods)
- Maps of groundwater recharge areas and discharge areas
- Maps of land use, potential contamination sites, and groundwater receptors such as groundwater-fed streams and wetlands and public supply wells
- Maps of "background" groundwater quality (e.g., chloride) or nonpoint sources of contamination (e.g., nitrate contamination)
- Countywide map of well-specific sustainable yield (300m resolution)

Information regarding our methods and techniques for data-driven analysis are included in the METHODS section at the end of this proposal, following the SPECIFIC TASKS and BUDGET & TIMELINE sections.

SPECIFIC TASKS

Since data preparation, integration, curation, formatting, and analysis is the most difficult and time-consuming part of the groundwater characterization process and requires significant experience in hydrogeology, statistics, and geostatistics, we propose to preprocess these datasets once for the entire county. This will be carefully done in high resolution using the proposed multi-scale data filtering and interpolation technique. The results will be compressed and stored in a database for use and reuse in different management investigations, for different analysis scenarios, and by different users. This task is computationally intensive and requires taking a large amount of data through a series of processing steps.

Task 1 – Visualize Geological Structure

We will establish and visualize the subsurface geological structure in 2D and 3D so that we can next visualize/characterize the hydrology and water chemistry within a proper structural framework. Specifically, we will: map the large-scale structure of the subsurface by defining the extent and elevations of major geologic units; apply transition probability geostatistics on borehole lithologic profiles to develop a 3D geological model of the subsurface variability in the glacial drift aquifer; provide 3D maps and cross-sections of the 3D model and actual well lithologies.

Task 1.1. – Download and format the latest lithologic data in Wellogic from the State

Task 1.2 – Process and filter data into a useable form for geological modeling:

a. Digital elevation model (of different resolutions), including 1m resolution lidar DEM
b. Soil types
c. Aquifer elevations
d. Bedrock top elevations
e. Water well lithologies (downloaded data from latest Wellogic)
f. Surficial geology
g. Bedrock geology

Task 1.3 – Create a county wide 3D geological model

Task 1.4 – Create a 3D model of glacial aquifer heterogeneity (using the transition probability approach)

Task 1.5 – Prepare briefing on findings; send to Allegan County; follow up with a teleconference

Task 2 – Characterize Water Quantity

We will compute detailed spatial distributions for all water quantity / hydrogeology parameters, for the entire county (both glacial and bedrock aquifers), using all exiting data available (see Graphic 2).

Task 2.1 – Download and format static water level and other relevant data in Wellogic from the State

Task 2.2 – Process and filter data for water quantity analysis, including systematic removal of "black and white" errors and statistical outliers, and characterizing signal and noise through a non-stationary kriging technique (see METHODS below).

Task 2.3 – Prepare the following data layers for water availability analysis

a. Hydraulic conductivity / transmissivity of the glacial aquifer
b. Hydraulic conductivity / transmissivity of the bedrock aquifer
c. Depth to water table
d. Water table in the glacial drift aquifer at representative times (1960-1990; 1990-2020)
e. Potentiometric surface in the Marshall aquifer at representative times (1960-1990; 1990-2020)
f. Temporal trends in the static water levels in different areas (e.g., townships/sections where population or water use increases are significant)
g. Mean groundwater flow patterns in the glacial aquifer in 1960-1990 and 1990-2020
h. Mean groundwater flow patterns in the Marshall aquifer in 1960-1990 and 1990-2020
i. Space-time water use patterns in the glacial aquifer, 1960-2020
j. Space-time water use patterns in the bedrock aquifer, 1960-2020
k. Estimated recharge
l. Distribution of aquifer recharge areas and discharge areas
m. Distribution of critical groundwater receptors (e.g., groundwater-fed streams, public supply water wells)
n. Groundwater receptors (e.g. groundwater-fed streams and wetlands, public wells)

Task 2.4 – Calculate countywide sustainable yield (300m resolution, well-specific)

Task 2.5 - Prepare briefing on Water Quantity findings; present in Allegan County

Task 3 – Characterize Water Quality

We will compute detailed spatial distributions for water quality parameters for the entire county (see Graphic 3).

Task 3.1 – Download and format the latest water quality data from the State Waterchem database.

Task 3.2 – Process and filter data for water quality analysis, including systematic removal of "black and white" errors and statistical outliers, and characterizing signal and noise through a non-stationary kriging technique (see METHODS below).

Task 3.3 – Process/format data layers for water quality mapping and analysis

a. Nitrate concentration distribution and hotspots in different time periods
b. Chloride concentration distribution and hotspots in different time periods
c. Heavy metals distribution and hotspots (e.g., arsenic, iron, and lead if enough data is available)

d. Potential sites of groundwater contamination

Task 3.4 – Multiscale characterizations / different scales of presentations (point-based, contours, section-based, township-based, etc.) – see Graphic 4.

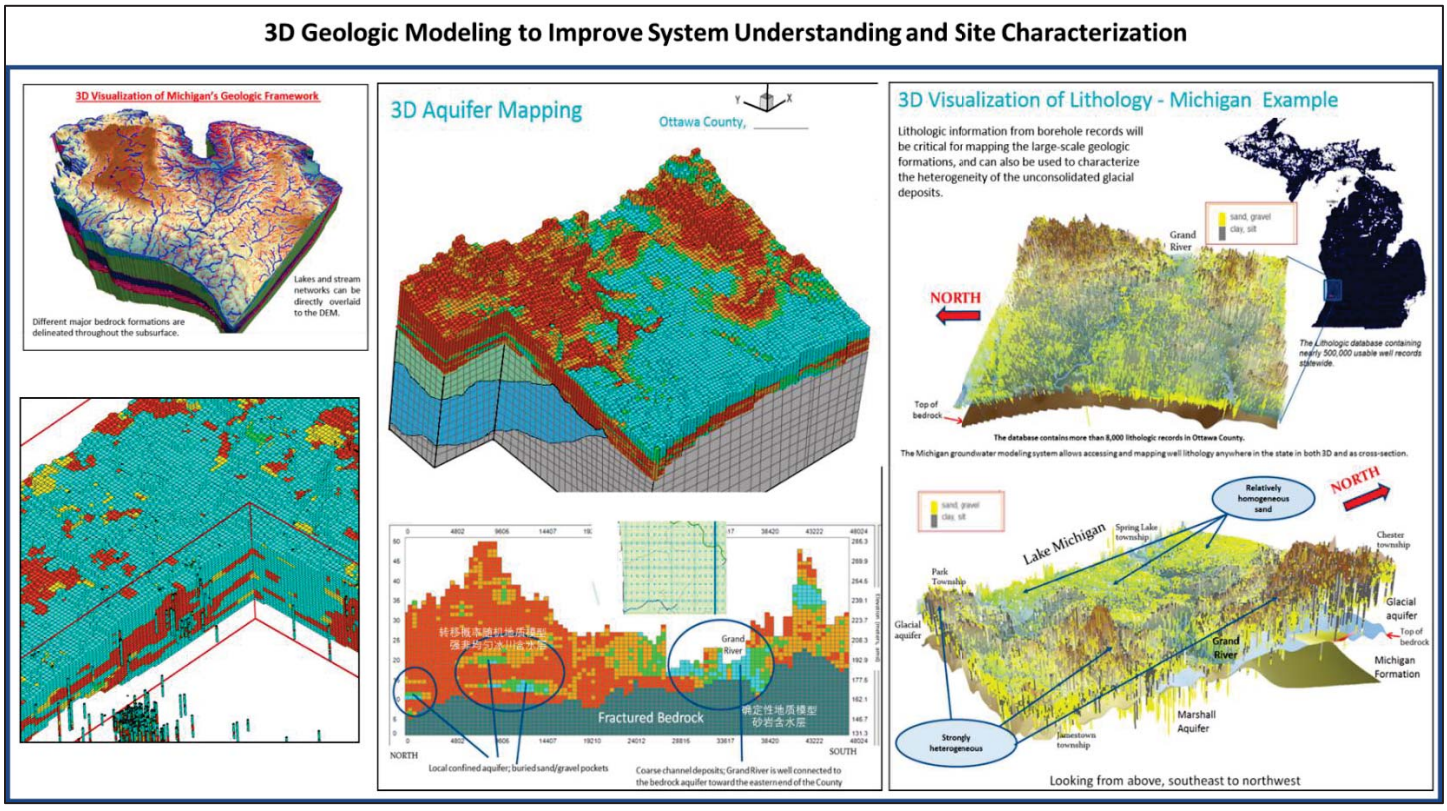
Task 3.5 – Normalized Water Quality Indices (with respect to water quality standards)

Task 3.6 – Water Quality Severity Rankings (based on results from Task 3.3 and 3.4)

Task 3.7 – Prepare briefing on Water Quality findings; present in Allegan County

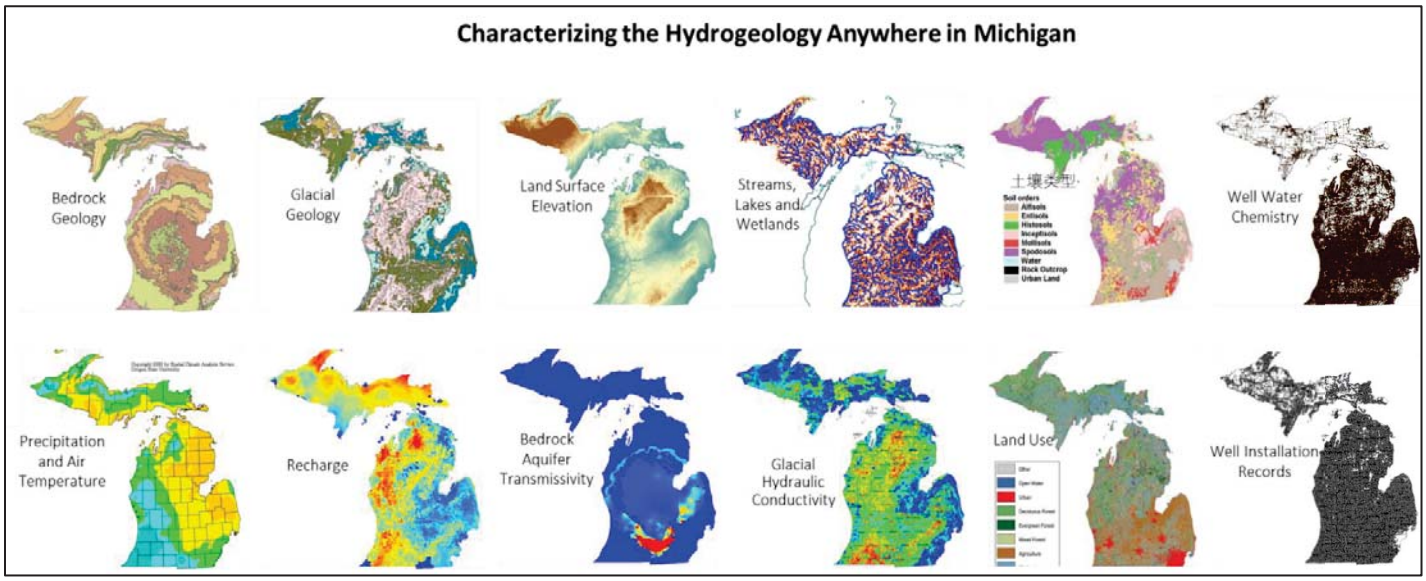
Task 4 – Final Report

Task 4.1 - Combine the data-driven analyses and visualizations into a thorough report - or "story" - of Allegan County's past and present groundwater conditions. This report will include a recommendation for next steps, based on the information gather from this Phase I project.

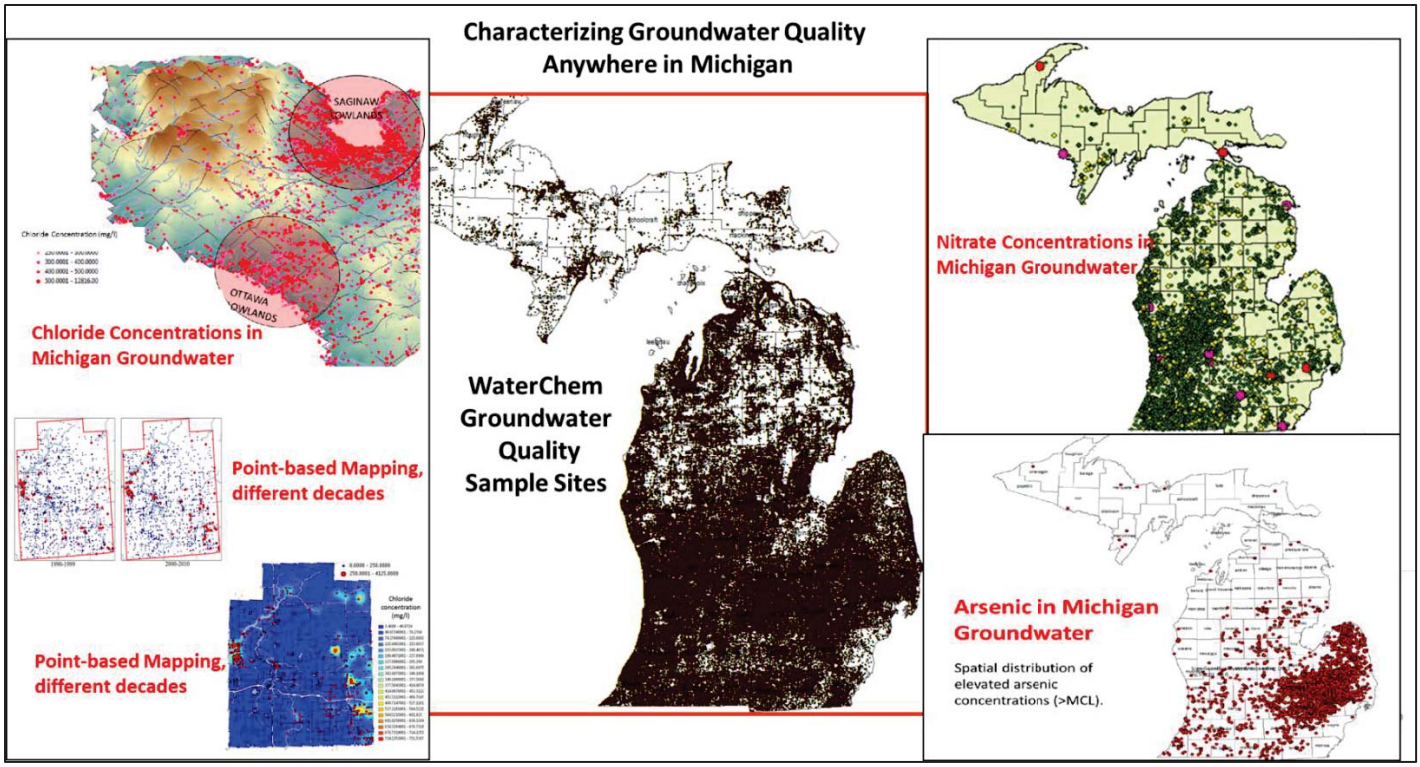


Graphic 1: Examples of 3D geologic modeling in Michigan. Borehole lithology information from the high-density statewide water well data allow for mapping, in 3D, the large-scale structure (i.e., the major geologic units in the subsurface) and the detailed intra-aquifer small-scale variability using transition probability

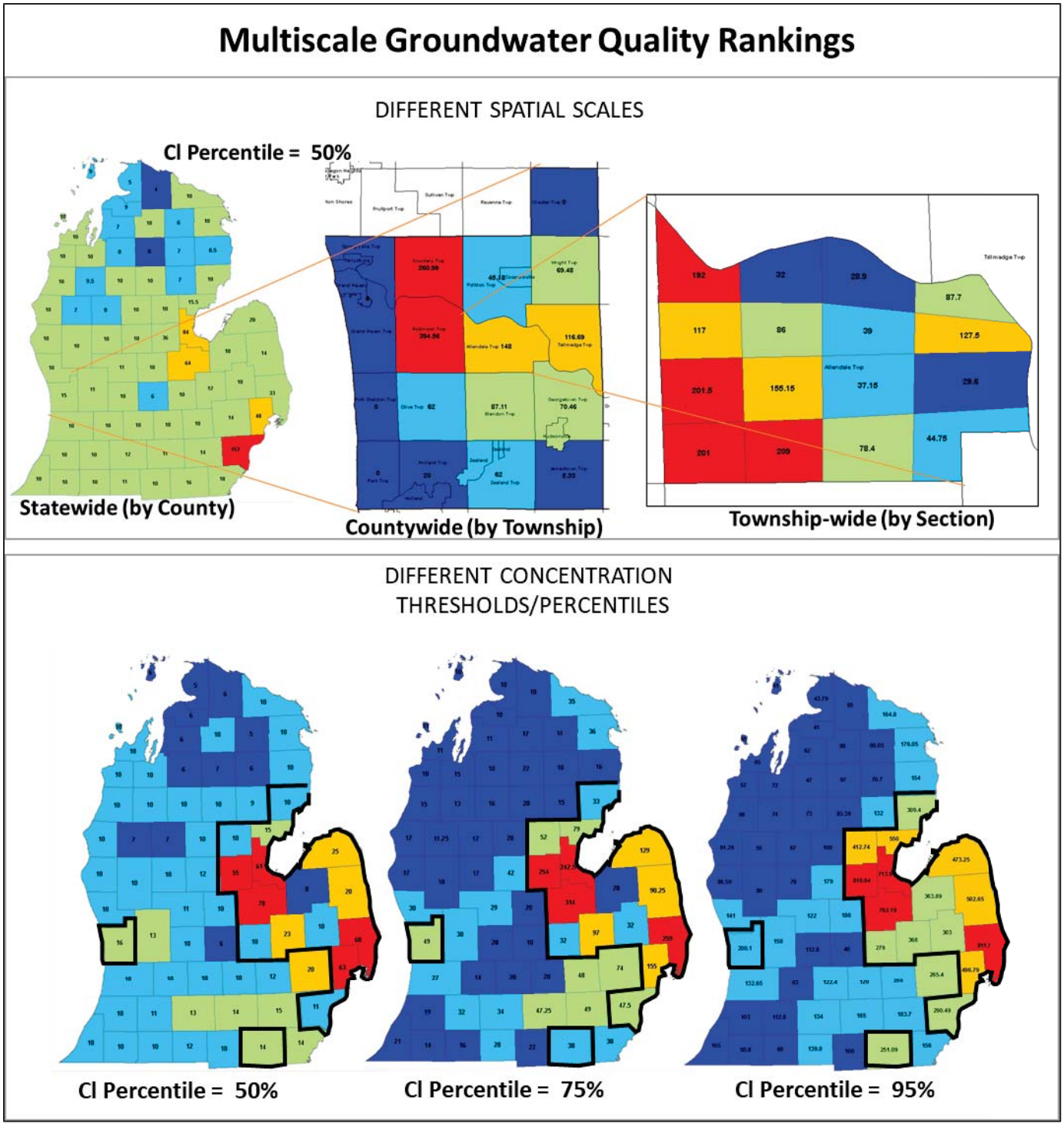
geostatistical simulations. We will develop 3D models of the large- and small-scale variability of Allegan County's subsurface. We will also map the raw lithology in 3D for this proposed project.



Graphic 2: Statewide hydrogeology datasets useful for site characterization and modeling anywhere in Michigan, including the high-density *Wellogic* and *Waterchem* water well datasets. These processed datasets will be included in the final report. These datasets are also critical for many of the proposed analyses of the project (e.g., spatial interpolation of groundwater levels and water quality and 3D geological modeling.



Graphic 3: Examples of mapping different chemical constituents in Michigan groundwater and of interest in Allegan County – chloride (salinity), arsenic (heavy metal), and nitrates (nutrients). We will map and process these point data into different types/scales of representation (contours, spatial interpolations, aggregations and rankings, etc.).



Graphic 4: Examples of ranking and visualizing water quality by aggregating data/statistics at different spatial scales. (Top) spatial mapping of chloride concentrations for the 50^{h} percentiles, at the statewide countywide and township-wide scales; (bottom); spatial mapping of chloride concentrations at the statewide scale for the 50th, 75th, and 90th percentiles. We will preform similar mapping techniques to the water quality parameters of interest in Allegan County (chloride, heavy metals and nutrients).

BUDGET & TIMELINE

The table below presents our budget for the proposed project, including costs for sub-tasks.

Table 1: Budget for the proposed project.

Phase I: UNDERSTANDING THE BIG PICTURE (Project Duration: 6 months)			
Task	Description	Deliverable	Cost
1	**Characterize Geology (1.5 Months)**		**36,000**
1.1	Download & format latest well data from state and/or local	--	2,000
1.2	Process & filter data for geological modeling	--	6,000
	a- DEM, including 1m LiDAR (if available)	--	
	b- Soil types	--	
	c- Aquifer elevations	--	
	d- lithologies	--	
	e- major surficial geology	--	
	f- major bedrock geology	--	
1.3	Create countywide 3D geological model	2D maps, 3D visualizations, vertical cross-sections	10,000
1.4	Create glacial aquifer heterogeneity model	2D maps, 3D visualizations, vertical cross-sections	15,000
1.5	Prepare briefing on Geology findings; send to Allegan County (1.5 months after Project start); follow-up with teleconference meeting	Copy of Presentation (PDF)	3,000
2	**Characterize Water Quantity (2 months)**		**56,000**
2.1	Download & format all Static Water Levels and other relevant data from Wellogic	--	2,000
2.2	Process and filter data (outlier removal, other geostatistics)		13,000
2.3	Create layers for water quantity analysis	2D maps	26,000
	a- Hydraulic conductivity of glacial AQ	2D maps	
	b- Hydraulic conductivity of bedrock AQ	2D maps	
	c- Depth to water table	2D maps	

	d- Water table in glacial AQ at different times	2D maps	
	e- Water levels in bedrock AQ at different times	2D maps	
	f- Mean flow patterns in glacial AQ	2D maps	
	g- Mean flow patterns in bedrock AQ	2D maps	
	h- Temporal trends in areas of growth	2D maps	
	i- Space-time water use patterns in glacial AQ	2D maps	
	j- Space-time water use patterns in bedrock AQ	2D maps	
	l- Estimated recharge	2D maps	
	m- Distribution of recharge areas / discharge areas	2D maps	
	n- Groundwater receptors (streams, public wells)	2D maps	
2.4	Calculate countywide sustainable yield (300m resolution, well-specific)	2D maps	12,000
2.5	Prepare briefing on Water Quantity findings; presentation in Allegan County (approximately 3.5 months after Project start)	Copy of Presentation (PDF)	3,000
3	**Characterize Water Quality (2 months)**		**48,000**
3.1	Download & FORMAT latest data from WaterChem	--	2,000
3.2	Process and filter data (outlier removal, other geostatistics)	--	4,000
3.3	Create layers for water quality analysis	2D maps	8,000
	a- nitrate distribution & hotspots in different time periods	2D maps	
	b- chloride distribution & hotspots in different time periods	2D maps	
	c- heavy metals distribution and hotspots (e.g., arsenic, iron, lead, etc.)	2D maps	
	d- Potential sites of contamination	2D maps	
3.4	Multiscale characterizations (point-based, section-based, township-based, etc.)	2D maps and statistical analyses	14,000
3.5	Normalized Water Quality Indices (w.r.t. water quality standards)	2D maps and statistical analyses	11,000
3.6	Water Quality Severity Rankings	2D maps and statistical analyses	6,000
3.7	Prepare briefing on Water Quality findings; presentation in Allegan County (approximately 5.5 months after Project start)	Copy of Presentation (PDF)	3,000

4	**Final Report (0.5 months)**		**10,000**
4.1	Prepare Final Technical Report with all Graphics/Maps - story of past and present groundwater conditions - Recommendations for next steps	Graphical Report (PDF)	10,000
		TOTAL:	**150,000**

The table below presents the proposed project timeline with major milestones and a payment structure.

Table 2: Proposed project timeline.

Milestone	Months from Project Start	Comment
Project Start	0	--
Task 1 completed	1.5	Briefing on Geology findings sent to Allegan County; follow-up teleconference call; Task 1 Payment sent to Hydrosimulatics
Task 2 completed	3.5	Presentation on Water Quantity findings in Allegan County; Task 2 Payment sent to Hydrosimulatics
Task 3 completed	5.5	Presentation on Water Quantity findings in Allegan County; Task 3 Payment sent to Hydrosimulatics
Task 4 completed	6	Final Report submitted to Allegan County; Final payment to Hydrosimulatics

METHODS

The most critical data components to be incorporated in the interactive decision support system are water well records in Wellogic and WaterChem (water quantity, quality and geology/lithologies), Land Use, Digital Elevation Models (DEMs), and National Hydrological Datasets (NHDs), potential sites of contamination (oil and gas wells, leaky underground storage tanks, etc.) glacial land systems, and bedrock geology. These datasets are now available for free virtually anywhere in the State of Michigan (see Graphic 2).

Innovative use of "Big Data"

In recent years, we developed a number of innovative uses of large spatial datasets for understanding groundwater conditions across multiple scales, using both data-driven modeling techniques and process-based simulation. Data-driven modeling provides an efficient method for directly characterizing

groundwater conditions and identifying patterns and relationships across different scales without the need for understanding the underlying processes. Process-based modeling – although requiring significant expertise and resources – enables testing and refining our understanding of the processes that control the observed patterns and relationships discovered through data-driven modeling

In particular, we have pioneered various applications of water well data analysis that are especially useful at the regional scale when the number of wells involved is large. Although many practitioners insist that water well data from drillers might be too crude to be useful, our recent experience in Ottawa County and our systematic analysis shows that, when properly processed, these data can be extremely effective as starting point or screening-level evaluation (Curtis et al. 2018; 2019; Liao et al. 2019). The data-driven modeling products can be used to guide site-specific process-based simulations and prioritize data worth. In fact, our extensive comparative analyses show that a large number of noisy measurements are much more useful than a limited number of precise measurements in delineating large complex groundwater patterns.

Steps to Filtering Water Well Records

Our approach to using water well records follows a three-step filtering procedure:

1. Remove "black/white" errors. This step removes data values that are clearly wrong using a simple GIS-based query analysis.
2. Remove statistical outliers. This step performs a moving window statistical data analysis and identifies and removes data values that deviate significantly from local trends based on a predefined criterion (e.g., outside three standard deviations).
3. Remove "gray" errors. This step attempts to remove "randomly" distributed data noises representing errors caused by inaccurate well location, seasonal variability, inconsistencies, measurement uncertainty, and "driller variability". We achieve this using an advanced "moving window, non-stationary multiscale Kriging technique". This filtering technique, using a location dependent variogram, enables removing noise in complex datasets in the presence of strongly non-stationary spatial trends.

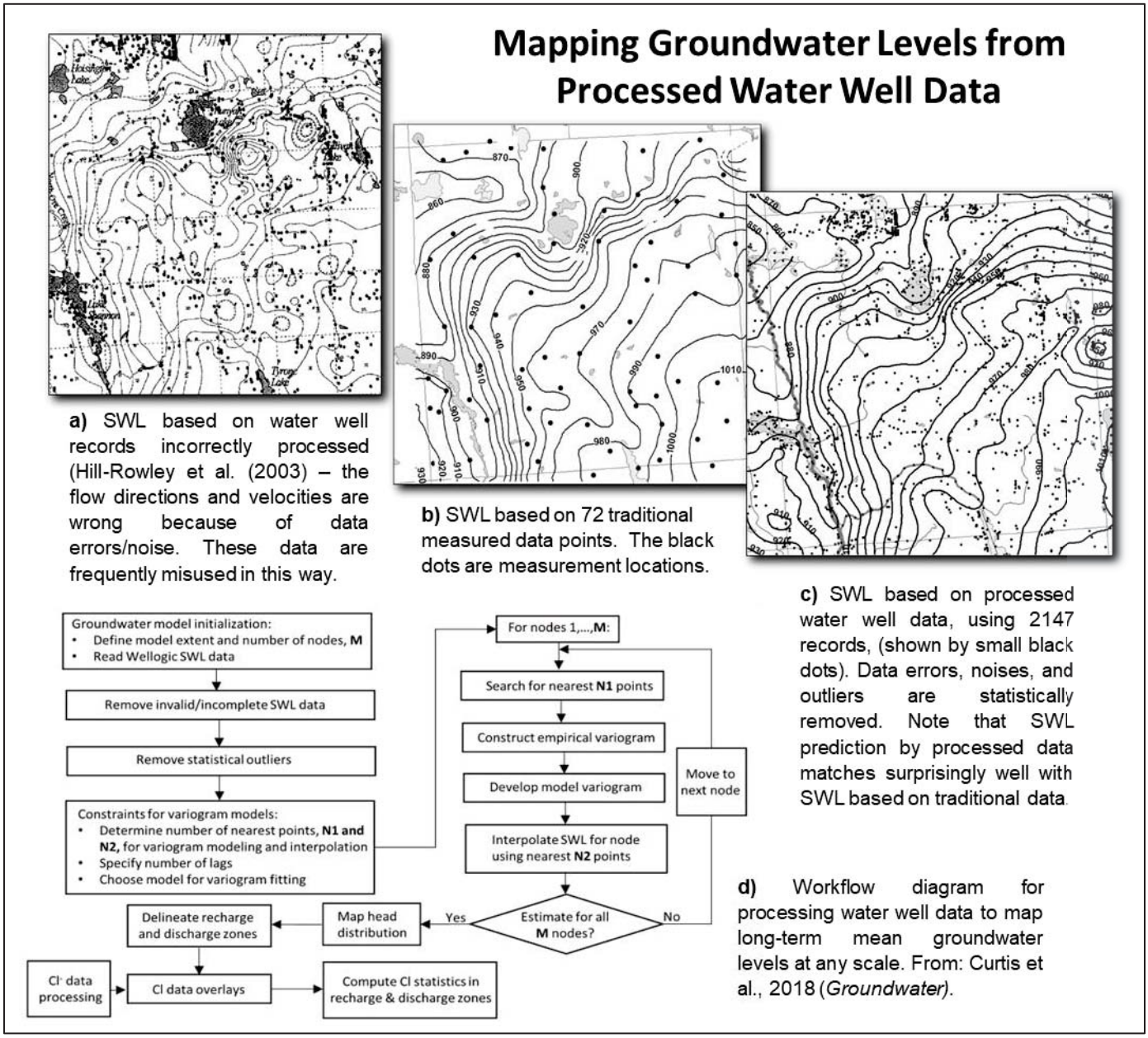
An example comparison of using traditional water level data and Static Water Level (SWL) data is shown in Graphic 5.

New Opportunities for Allegan

Since the big data products – including water well records - are now available for free virtually anywhere in the State of Michigan (see Graphics 1), our improved ability in characterizing groundwater conditions creates new possibilities. By systematically making use of this vast data source, we have the potential to drastically reduce the cost of site characterization and will finally be able to expand our "world view" by informing management practices from a "local site" to a "region", a "watershed", and a "basin", transforming "passive, site-based actions" that "react to problems" into "proactive, synergistic, and multiscale management paradigm".

The American Society of Civil Engineers' Civil Engineering Magazine recently recognized Michigan's innovative use of water well records for cost effective resources management (2009 October Issue). Our innovations also won "the '2009 Michigan Department of Environmental Quality (MDEQ) Director's Award", the First Place in the "2009 Michigan American Water Works Association (AWWA) 'Fresh Idea' Competition", and the Third Place in the "2009 National AWWA 'Fresh Idea' Competition". James

Cleland, Chief of the MDEQ's Water Bureau, calls the contribution a "breakthrough the barriers" type of research that "will revolutionize how the DEQ evaluates groundwater in the years to come". Our work in Ottawa County has sparked a major long-term planning initiative that includes partnerships with local governments and municipalities, developers and producers, and leaders from local industry and other institutions. They datasets, interpretations and recommendations from our study have been pivotal to Ottawa County's on-going management and policy-making.



Graphic 5: Comparison of static water level (SWL) distribution based on traditional data and free water well records, Tyrone Township, Livingston County, Michigan; and a workflow diagram of the water well processing scheme. We will apply our data processing scheme to map groundwater levels for the entire the glacial aquifer and in the bedrock where the Marshall aquifer is available. The resulting data layers can

be used for flow tracking (forward or reverse) and to guide more detailed site-specific analysis and data collection.

BIOGRAPHIC SKETCH OF THE PROJECT DIRECTOR

Dr. Li earned his Ph.D. in Water Resources and Environmental Engineering in 1993 from the Massachusetts Institute of Technology. His research covers a range of technical interests in hydrology and water resources, from theoretical to computational to technological, on fundamental as well as applied problems. His innovative integration of scientific hydrology, applied mathematics, computational sciences, “big data”, and information technologies has advanced the ability to model complex groundwater systems and expanded the utility of modeling as a tool for research, education, and professional investigation. Prof. Li's research has been funded by the National Science Foundation (NSF) through a number of cross-cutting programs, including: Hydrological Sciences, Environmental Engineering, Computer Sciences and Information Engineering, Engineering Education & Centers, Undergraduate Education, and Industrial Innovations and Partnerships. Prof. Li's research has also been funded by the Michigan Department of Environmental Quality, the Michigan Department of Agriculture for Rural Service, the Michigan Department of Military and Veteran Affairs, the US Fish and Wildlife Service, the US Environmental Protection Agency, the US Geological Survey, the Great Lakes Protection Fund, and local government agencies, industries, corporations, law firms, and citizen groups. Prof. Li is an associate editor for the ASCE Journal of Hydrologic Engineering, the National Groundwater Association's Journal of Ground Water, and the Journal of Stochastic Environmental Research and Risk Assessment. He is a registered professional engineer and an elected Fellow of the American Society of Civil Engineers and of the Geological Society of America.

REFERENCES

Curtis, Z.K., Li, S.G., Liao, H.S. and Lusch, D., 2018. Data-driven approach for analyzing hydrogeology and groundwater quality across multiple scales. Groundwater, 56(3), pp.377-398.

Curtis, Z.K., Liao, H.S., Li, S.G., Sampath, P.V. and Lusch, D.P., 2019. A multiscale assessment of shallow groundwater salinization in Michigan. Groundwater.

Hill-Rowley, R., T. McClain, and M. Malone. 2003. Static Water Level Mapping in East Central Michigan. Journal of the American Water Resources Association (JAWRA) 39(1): 99-111.

Liao, H.S., Curtis, Z.K., Sampath, P.V. and Li, S.G., 2019. Simulation of Flow in a Complex Aquifer System Subjected to Long-term Well Network Growth. Groundwater.

Project Scoping Form

Version 2.0

PURPOSE: The purpose of this document is to gauge the value this project idea has in reaching a desired future state, gauging the project's impact on budget and resources, and charting a course for next steps.

Project Name: Allegan County Ground Water Study	
Project Sponsor: Environmental Health	
Project Manager: Randy Rapp	
Date Initial Scope Submitted: February 19, 2020	
Date Scope Completed:	

To be shovel ready, the following outstanding items should be resolved:

Who has the answer?	What is the question?	Who will find out?
	What is the make-up of the ground water of Allegan County?	Magnet 4 Water Environmental Health Allegan County

PART A – PROJECT SUMMARY

1. CURRENT STATE

Fully describe the current state and list all associated issues, concerns and/or deficiencies.

- List concerns / deficiencies in current state
- Reliable data is not easily accessible to assist in informed decision making and planned development regarding water availability and quality. As such, stakeholders may not be aware of water related risks and issues they may be facing within their respective areas. Specifically, necessary data includes but is not limited to:
  - The direction of the ground water flow.
  - The direction of ground water flow along the Lake Michigan Shoreline and impact to shoreline erosion.
  - The areas of poor quality ground water.
  - The areas of contamination and the areas they will be effecting.
  - The areas of low or no water production.
  - The areas where ground water is being used at a faster rate than its being recharged.

- A compilation of the areas of well head protection for Type I Water Supplies.

- Reliable data is not easily accessible to assist in determining current and future water demands and sustainability of water supply relative to growth trends.
  - The areas where the ground water quality or quantity may affect growth.
  - The effects, if any, farming and irrigation have on ground water.
  - Overall population growth planning.
  - Identification of major water demand businesses or areas.
  - The effects, if any, on ground water resulting from agricultural, residential, commercial and industrial use and growth.

2. DESIRED FUTURE STATE

Describe the action(s) desired to address or change the current state, your expectations, proposed solution and the desired outcomes.

Address issues with current state by … (include any additional scope of work).

- List outcomes without which the project will not be considered a success.
- As a result of this initial project the data outlined in section 1 above and visual aids such as maps, charts, etc. will be made available to all government agencies within Allegan County.
- The distribution of this data will increase awareness and may lead to:
  - Identification of ground water quantity and quality issues
  - Increased planning for back-up water supply should a problem arise.
  - Informed decisions regarding development.
  - Increased planning for shoreline erosion protection.
  - A greater sense of cooperation and planning between government agencies.
  - Increased protection of all water supplies.
  - Increased planning for agriculture throughout the County.

3. ADDITIONAL BACKGROUND

Provide any additional background information relevant to this project not already mentioned above if necessary to give a broader context for this project.

None (or describe).

- The only portions of Allegan County which do not utilize ground water are small portions of the cities of Holland and South Haven and Laketown Township which are in Allegan County which use water from Lake Michigan.
- There are over 14,000 wells in Allegan County. All of these wells can be used in this study. This will provide a great data base to ensure the outcomes viable and accurate.
- The Health Department, in 2018, wrote the 5th most number of well permits in Michigan.

4. SCHEDULING CONSIDERATIONS

List any scheduling factors to be considered such as new regulations coming into effect, timing project with cyclical business processes, seasonal requirements, increasing risk, etc. that have an impact on when this project is started, completed and/or work on it may be performed.

None (or describe).

When planning for this project there are many factors which will need to be considered.

- We will need to meet with and gain cooperation from the LUGs.
- We will need to meet with the LUGs to explain the project, the anticipated outcomes and how this will be a benefit to them.
- To assist in the planning, the LUGs will need to provide us their long-term or future plans for development.
- We will need to work with Magnet 4 Water which is supplying the technical data for the project.
- The Health Department will begin survey distribution in September of 2020.

5. PRIORITY CONSIDERATIONS

Is the primary objective of this project to (check one or both):

☐ address an **operational** need necessary to maintain the status quo.

☒ address a **strategic** desire to change or enhance the status quo.

Fill out the Priority Matrix in Part D to help prioritize this project and enter the score here: **Score = 70**

6. ATTACHMENTS AND REFERENCES

6.1 List any relevant supporting or reference materials such as product quotes, legislation, photos, budget calculations, etc. and attach to the track it request as separate documents. Photos can be inserted directly into this scoping document.

- Proposal from Magnet 4 Water

6.2 List hyperlinks to any relevant information that can be found online with a brief description.

- https://www.miottawa.org/GroundWater/study.htm

PART B – PROJECT DETAIL

7. PROJECT BUDGET

Does your project involve expenditures, revenues or fees? ☒ **Yes** ☐ **No** - If "Yes":

7.1 Initial Project Funding:

Where is the proposed initial funding for this project coming from?

☐ Existing budgeted operational funds to be used

☐ New operational funds requested in next year's budget

☐ Capital / project / contingency funds requested

☐ Existing grant funds available

☐ New grant funding to be applied for

☒ Other: (describe)

7.2 Capital / Grant / Contingency Expenditures:

Expenditure Item	Year	Budget Account	Estimated Cost
Distributing surveys - operational/salaries	2020	Operational	

Compiling surveys - operational/salaries	2021	Operational	
Magnet 4 Water Study	2020		$150,000.00
Total Estimated Expenditure	2020		$150,000.00
Total Funding Request			**$150,000.00**

Insert narrative, notes and clarifications for initial expenditure(s) if needed.

7.3 How was the cost estimate determined? Was the full scope considered in estimating cost? Attaching quotes or cost breakdowns from other projects is desirable.

Describe:

7.4 **Operational Expenditure Changes if Any (include year's 1 – 5 if applicable):**

Expenditure Item	Year	Budget Account	Estimated Change
None			$0

Insert narrative, notes and clarifications for continued expenditure(s) if needed.

7.5 If project has associated operational expenditures, are they incorporated and sufficiently funded in your most recent or pending five-year budget submittal? ☐ **Yes** ☐ **No** ☒ **N/A**

7.6 **Estimated Revenue Changes if Any (include year's 1-5 if applicable):**

Revenue Item	Year	Budget Account	Estimated Change
None (or itemize)	1		$0

Insert narrative, notes and clarifications for projected revenue.

7.7 Are anticipated revenues incorporated in your most recent or pending five-year budget submittal?
☐ **Yes** ☐ **No** ☒ **N/A**

7.8 If any fees are impacted by or associated with this project describe any changes:

Not Applicable (or describe proposed changes).

7.9 **Funding Approval Authority:**

What levels of approval are needed to authorize funding for this project?

☐ Manager / Director / Elected Official
☐ Commission, Committee, Team or other group: InsertName
☐ County Administrator
☒ Board of Commissioners

7.10 **Funding Approval Process:**

What process will be used to approve project funding?

☐ Internal to Service Area / Department

☐ Through Annual Budget Process - Year:

☒ Budget Adjustment - Request for Action (RFA)

☐ Personnel Request - Request for Action (RFA)

☒ Other: (describe)

Insert narrative, notes and clarifications about the funding approval process.

Through consideration by the Board of Commissioners funding would be authorized through resolution and would allocate the combination of Local Community Stabilization Authority (LCSA) funds with fund balance.

8. ASSET MANAGEMENT

Will your project result in a change to the assets owned by the County? ☒ **Yes** ☐ **No** - If "YES":

8.1 Assets Added:

Asset description and detail	Quantity	Useful Life
A map will be created which will provide the County with valuable information regarding the ground water of Allegan County. (See Task #1 of proposal)	1	No end

Asset addition notes and clarifications:

8.2 Assets Removed:

Asset description and detail	Quantity	Disposition	Revenue
None: This asset does not currently exist.			$0

Asset removal notes and clarifications:

9. PROCUREMENT AND CONTRACTING

Will you need to procure products and/or contract for services? ☒ **Yes** ☐ **No** - If "YES":

9.1 What is the estimated cost of products or services to be procured? **$150,000.00**

9.2 If this an emergency purchase, provide a rationale supported by the Purchasing Policy:

Not Applicable (or provide a rationale)

9.3 Which procurement strategy is being proposed?

☒ Sole Source

☐ Reverse Auction

☐ Cooperative Purchase (note Coop Agency and Contract #)

☐ Product/services procured through quotes

☐ Request for Proposal (RFP) for products and/or services

☐ Other

Insert narrative, notes and clarifications about the procurement strategy.

9.4 If this is a sole source procurement, provide a rationale supported by the Purchasing Policy:

Not Applicable (or provide a rationale)

This vendor, Magnet 4 Water, performed a similar project in Ottawa County from 2016 – 2018. To my knowledge this is the only company in Michigan which compiles the ground water data into usable maps and disseminates the outcomes to the LUGs. Considering the familiarity the vendor has with the area and the work already presented for Allegan County it is recommended that the project proceed with the vendor as previously presented to the Board of Commissioners.

9.5 What level of approval will be needed to purchase product and/or award service contract based on account authority and approval thresholds?

☐ Manager / Director / Elected Official

☐ Commission, Committee, Team or other group: InsertName

☐ County Administrator (RFA needed)

☒ Board of Commissioners (RFA needed)

Insert narrative, notes and clarifications about the procurement strategy.

10. PROCESS, PROCEDURE, POLICY and PERSONNEL CHANGES

If any processes, procedures or polices will be impacted by pursuing this project, please describe and elaborate:

Not Applicable (or describe the process, procedure or policy and how it will be impacted)

If any personnel changes will be needed to realize this project, please describe and elaborate:

Not Applicable (or describe the changes)

PART C – PROJECT MANAGEMENT SECTION

11. TRAINING AND TESTING

11.1 If any training will be needed in order to implement this project, describe:

Not Applicable (or describe)

11.2 If any testing / verification will be needed in order to implement this project, describe:

Not Applicable (or describe)

12. RESOURCE NEEDS ESTIMATES

12.1 Taking into consideration all other sections of this Project Scoping Form, estimate the number of months to complete each stage of the project including lag times. If the project has multiple phases, add additional tables. PMT will assist you in putting together an Activity Schedule to estimate resource needs.

Estimated Months for each Project Stage						
Project Stage:	Total	Scoping	Development	Contracting	Execution	Monitoring
Duration:	12	2	.5	.5	8	1

Estimated Resource Hours by Project Stage

Resource Name	Total	Scoping	Development	Contracting	Execution	Monitoring
Randy Rapp	170	20	80	2	58	10
Angelique Joynes	100	10	80	2	4	4
Rob Sarro	20	4	10	2	2	2
EH Support Staff	30		10		20	
EH PIO	80		40		40	

13. MISCELLANEOUS PROJECT MANAGEMENT NOTES

PART D – PROJECT PRIORITIZATION MATRIX

Legislative Compliance			
Category	**Scoring Criteria**	**Project Relevance**	**Points**
State/Federal Mandate	20 = Complies with a State or Federal mandate / ordinance / law, 0 = not applicable or not mandated		0

Employee Impact			
Category	**Scoring Criteria**	**Project Relevance**	**Points**
Safety and Security	5 = increases or would result in a decrease without this action, 0 = not applicable or no impact	The employees will have a tool which will enhance their ability to issue permits.	5
Capabilities of employees (skills, abilities and knowledge)	10 = increases or would result in a decrease without this action, 0 = not applicable or no impact	This will allow employees to better provide the customers with a knowledge of the ground water in the area.	10
Employee Wellness	5 = increases or would result in a decrease without this action, 0 = not applicable or no impact		0

Operational Impact			
Category	**Scoring Criteria**	**Project Relevance**	**Points**
Efficiency / Capacity	10 = increases or would result in a decrease without this action, 0 = not applicable or no impact	This will give the sanitarians one map to refer to instead of multiple websites with multiple maps, when issuing well permits.	10
Scope	5 = impact multiple service areas 2 = impacts a single service area	This will impact all of the PGU's and well drillers who work in the County.	5
Prevention Planning	5 = Aligns to an existing plan (i.e. maintenance, improvement, replacement), or prolongs/preserves the life of an asset and prevents greater expenditure later, 0 = Not applicable or no impact	This study will help preserve and protect the existing wells and protect the ground water supply in the County.	5

Financial Impact			
Category	**Scoring Criteria**	**Project Relevance**	**Points**
Expenditures	5 = Decreases expenditures or would result in an increase without this action, 0 = Not applicable or no impact	There will be a one-time pay out for this study.	5
Return on Investment (ROI)	5 = ROI within 2 years, 2 = ROI within 5 years 0 = Not applicable or no impact	The ROI will be seen immediately upon completing of the study.	5
Revenue	5 = Increases revenue or would result in a decrease without this action, 0 = Not applicable or no impact		0

Risk Management & Liability	5 = decreases liability or would result in an increase without this action, 0 = not applicable or no impact	This will decrease the liability of the County by enhancing the tolls for writing permits and the sanitarians will know where the problem areas are located.	5

Service Impact			
Category	**Scoring Criteria**	**Project Relevance**	**Points**
Level of Service	5 = increases or would result in a decrease without this action, 0 = not applicable or no impact	This project will allow the sanitarians to be more efficient by visiting one site for researching ground water when issuing permits.	5
Quality of Service	5 = increases or would result in a decrease without this action, 0 = not applicable or no impact	This will allow the sanitarians to provide a quality service by being able to refer to the map.	5
Accessibility of Service	5 = increases or would result in a decrease without this action, 0 = not applicable or no impact	The well drillers, customers, PGU's, etc. will be able to access the map.	5
Collaboration	5 = increases or would result in a decrease without this action, 0 = not applicable or no impact	This will increase collaboration with the PGU's, businesses, well drillers and farmers in the area.	5

GROUND WATER STUDY TIMELINE

ALLEGAN COUNTY