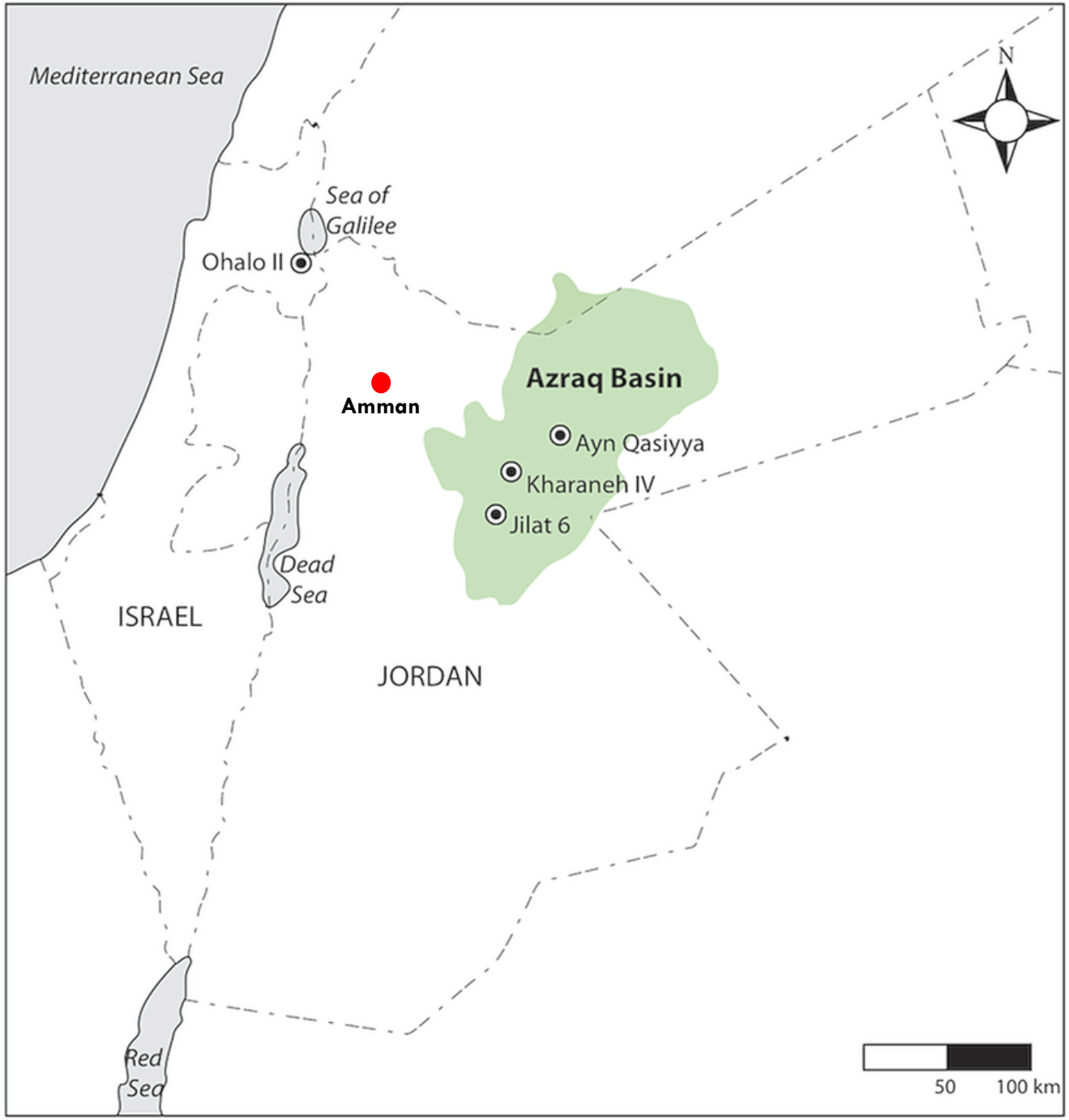
Ottawa County
Where You Belong®

ENHANCED GROUNDWATER MANAGEMENT
PROACTIVE STRATEGIES INDEX

2019 Water Quality Forum
November 21, 2019


City of Amman – circa 1950

source: worldatlas.com



source: monica ramsey, author. risk, reliability, resilience. October 2016

City of Amman - today

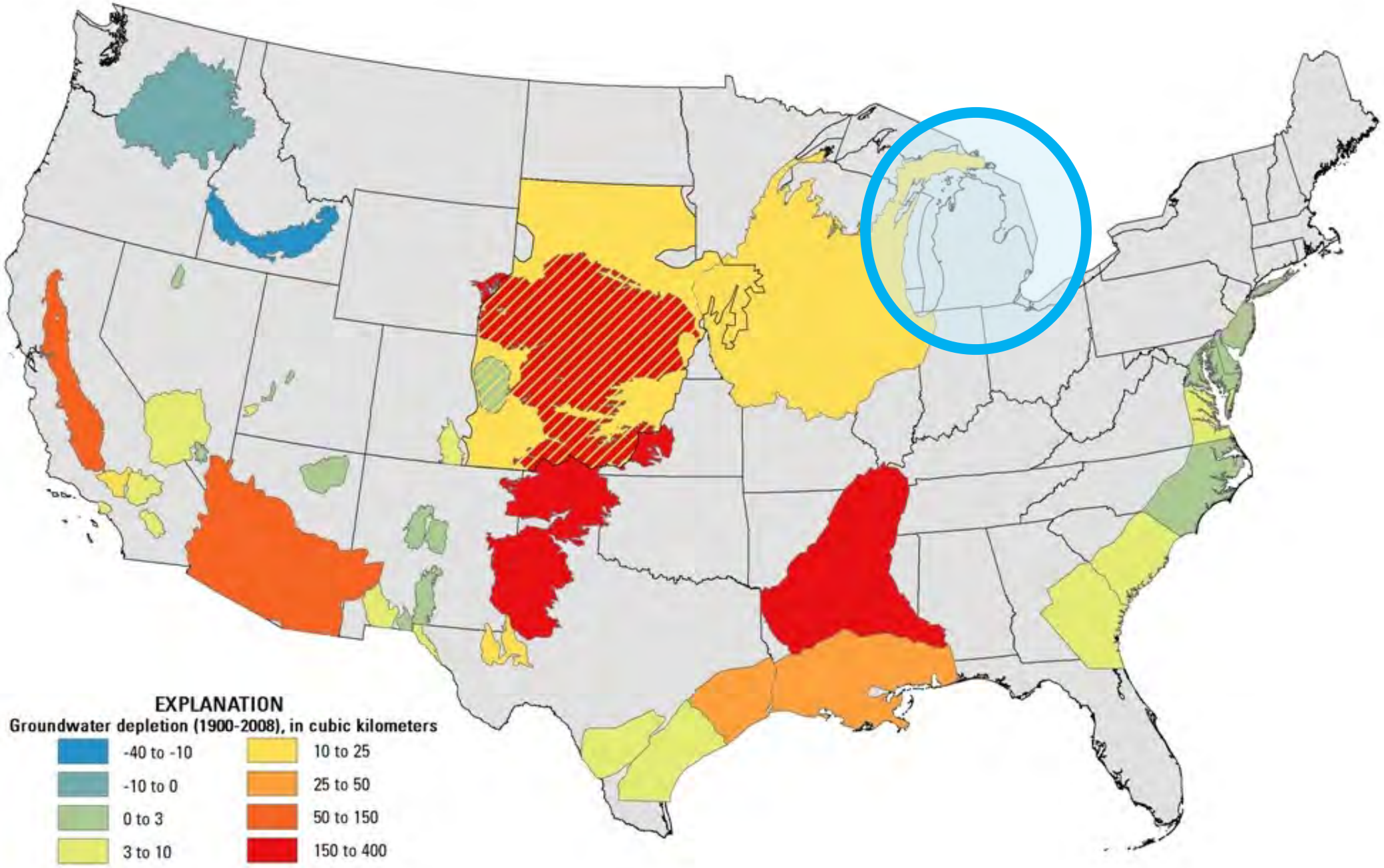
Azraq Oasis - today

Photo credit: azraq-runs-dry.com


Early 1990s
Photo credit: azraq-runs-dry.com


Today
Photo credit: azraq-runs-dry.com

source: azraq-runs-dry.com


EXPLANATION
Groundwater depletion (1900-2008), in cubic kilometers
-40 to -10
-10 to 0
0 to 3
3 to 10
10 to 25
25 to 50
50 to 150
150 to 400


Lake Superior
MICHIGAN
Lake Michigan
Lake Huron
Georgian Bay
WISCONSIN
Lake Erie
ILLINOIS
INDIANA
OHIO
EXPLANATION
Marshall aquifer—Gray where extent is buried

"We in western Michigan have no special reason to feel secure against a possible water shortage…there will have to be a more careful handling of water resources."

Even Our Own Water Supply Will Need Conservation

GRAND RAPIDS will take its first big step toward expanding its water supply next April, when work will begin on a new $5,000,000 filtration plant on Lake Michigan. That's a fairly large sum of money, and the full cost of completing the program will run much higher. Grand Rapids' water supply needs are not unusual, however. They form a part of the figure which the United States senate's water committee was told a few days ago the country must spend to increase its water supply if it is to meet 1980 demands.

Resources for the Future, Inc., an independent research foundation retained by the committee, estimates that the country will have to lay out at least $54,000,000,000 in the next 20 years to prevent water shortages, and that this figure may very well go as high as $74,000,000,000.

These estimates are based on the assumption that daily water consumption will average 559,000,000,000 gallons by 1980. In 1954 it was 300,000,000,000 gallons a day.

For those who still think of the nation's water supply as being unlimited, it may be noted that 559,000,000,000 gallons equals almost half of the total average daily streamflow from rain and snow in the 48 states that make up the continental United States.

The estimated 1980 consumption figure is based not only on the projected growth of the population, but also on expected increases for manufacturing, steam-electric, municipal and mining uses.

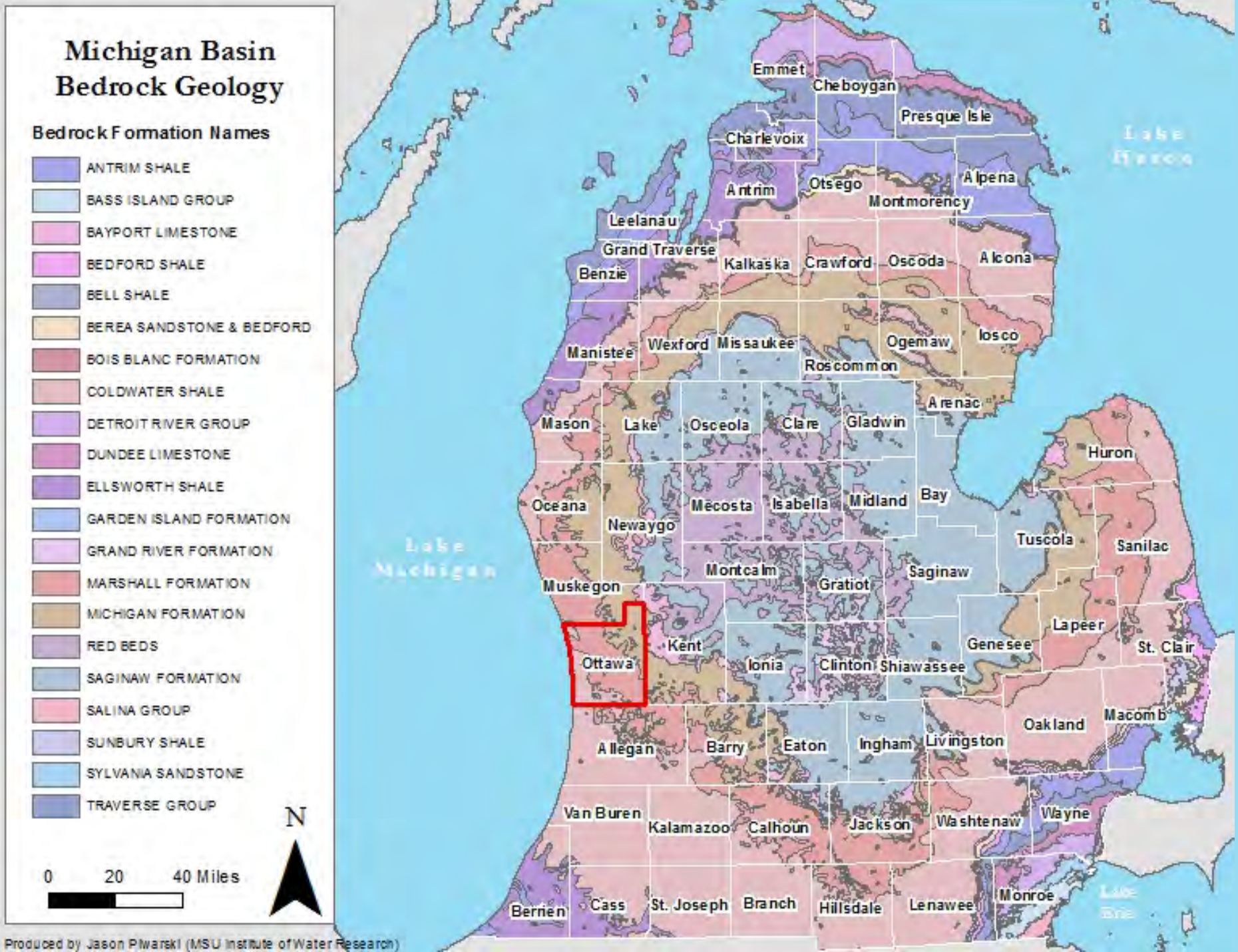
Drastic steps will have to be taken in some areas to prevent a water famine. Water conservation dams and reservoirs will have to be constructed in the western states. And sewage treatment facilities will have to be expanded and improved in the densely-populated areas to remove contaminating wastes.

We in western Michigan have no special reason to feel secure against a possible water shortage. Here, too, the experts says, there will have to be a more careful husbanding of water resources. In addition to five large river basins out west that will "require maximum waste treatment, plus full conservation of streamflows," Dr. Nathaniel Wollman, of the research foundation, says that by the year 2000 similar measures will have to be taken in the western Great lakes area from eastern Minnesota to southern Michigan.

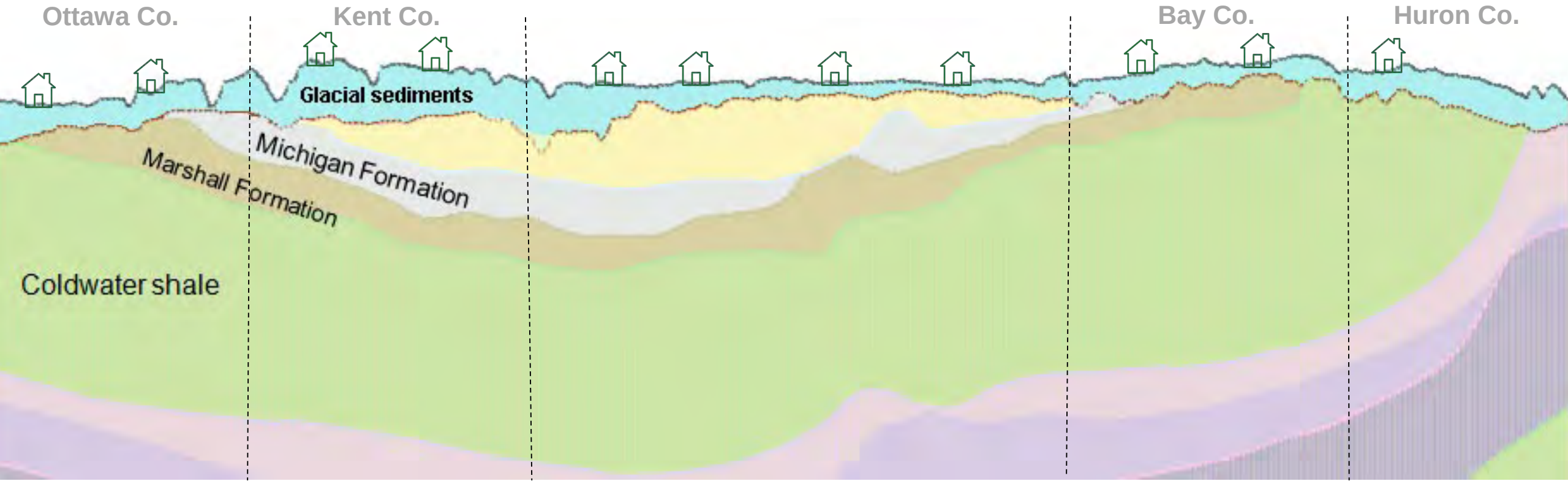
Michigan hasn't been unaware of the threat to Lake Michigan levels. It has vigorously opposed Chicago's attempts to divert permanently from the lake a larger flow of water to flush its sewage downstream. It is exactly the dissipating of water resources in this manner that must be curbed if we are to protect western Michigan's supply. Fortunately no part of this state faces a water problem such as afflicts most of the western states; the supply is still more than adequate here. But without vigilance against waste, this condition can change. We shall be investing heavily in an expanded water system. We should be conscious at the same time that we must help protect that investment by supporting sound water conservation measures.

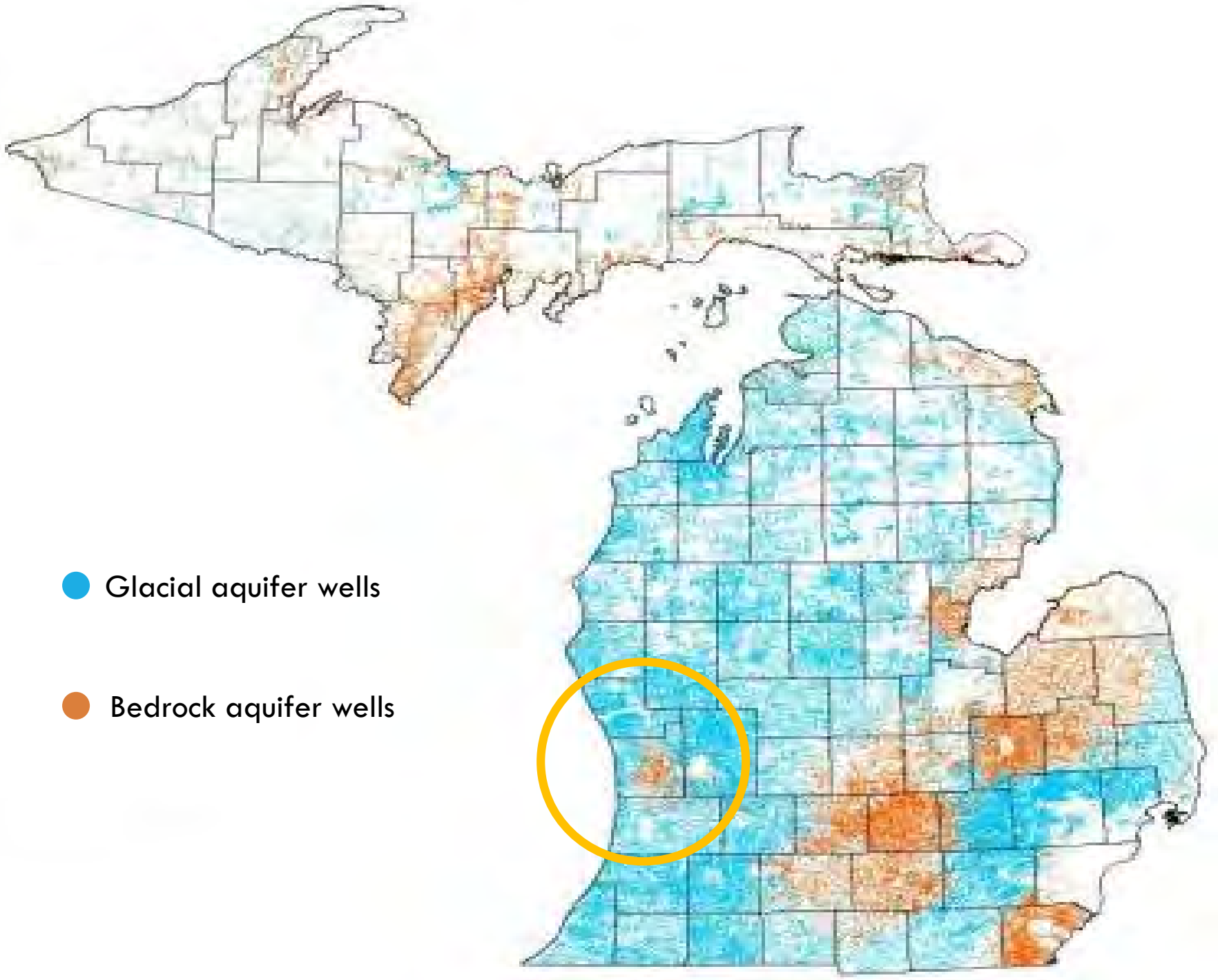
source: Grand Rapids Press, circa 1960s

Michigan Basin Bedrock Geology

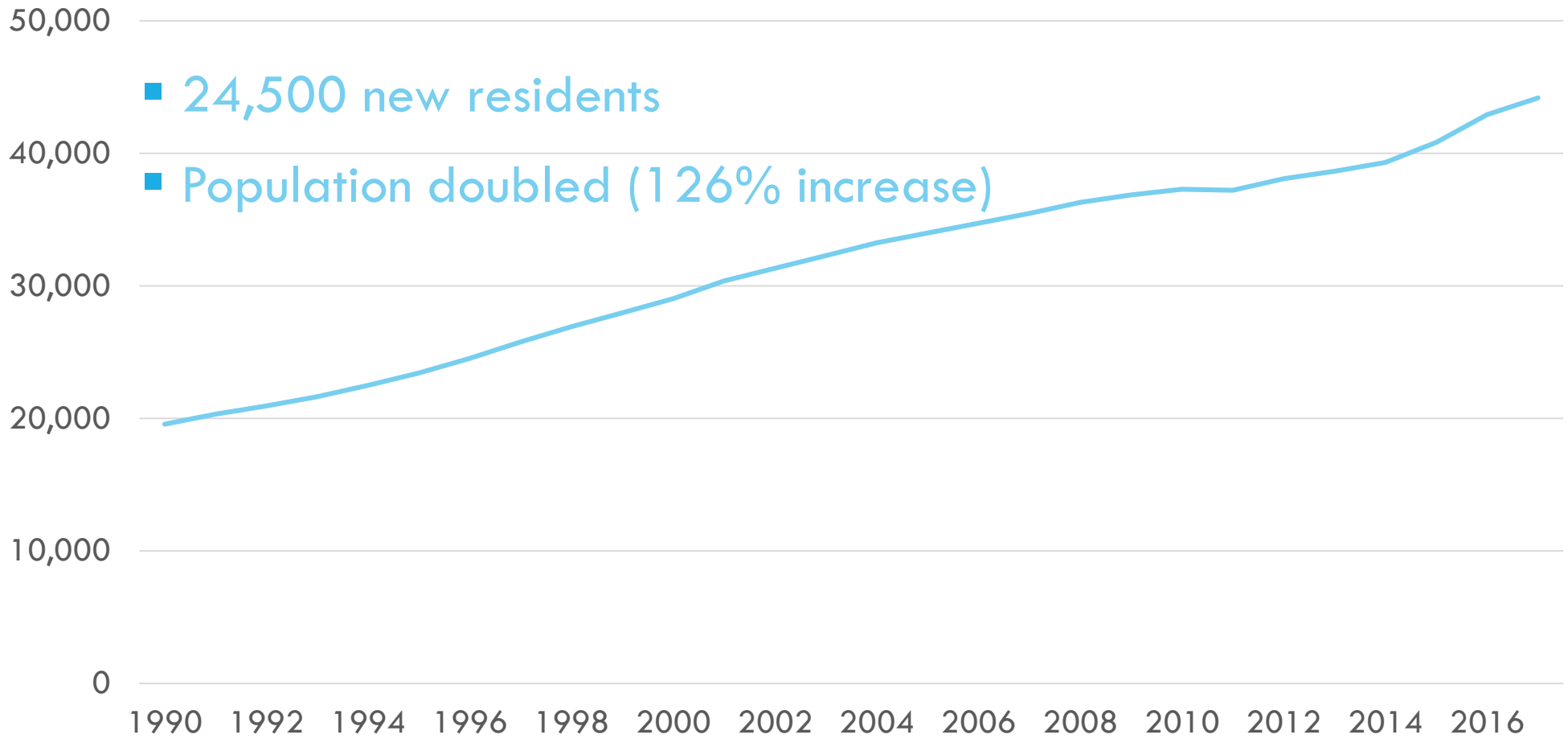


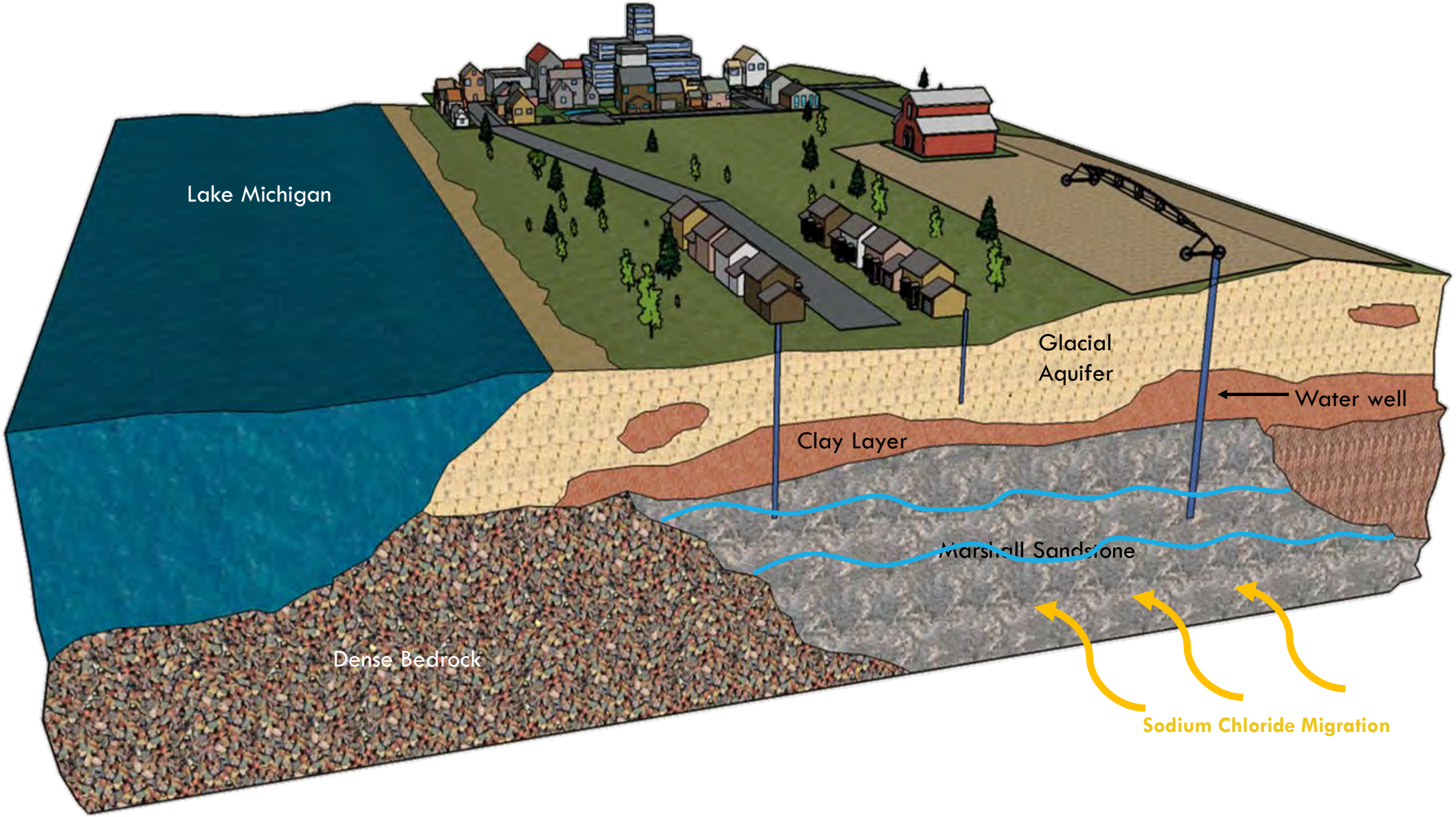
Produced by Jason Pinarski (MSU Institute of Water Research)

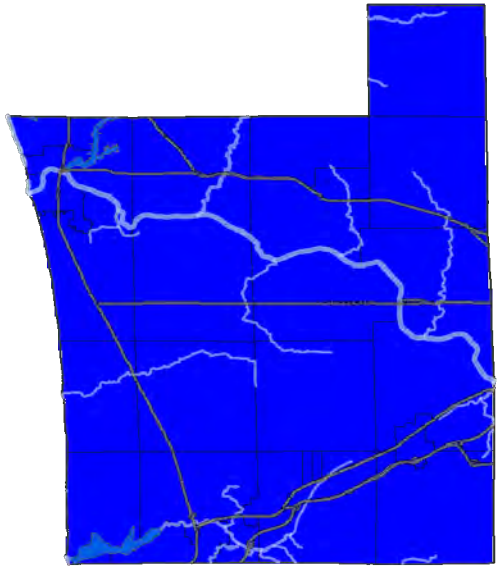

Ottawa Co.
Kent Co.
Bay Co.
Huron Co.
Glacial sediments
Michigan Formation
Marshall Formation
Coldwater shale


Glacial aquifer wells
Bedrock aquifer wells

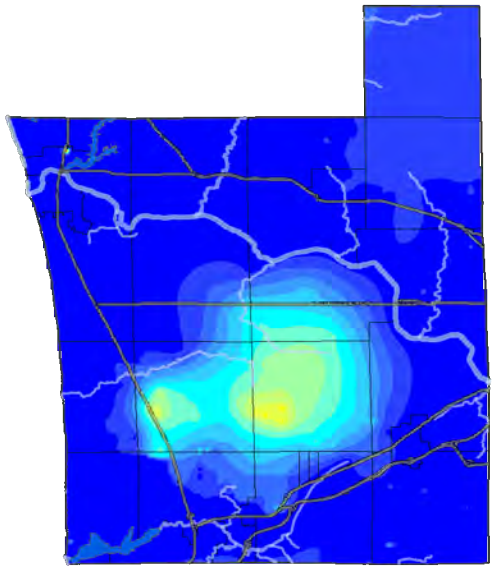
Population growth – Central Ottawa County



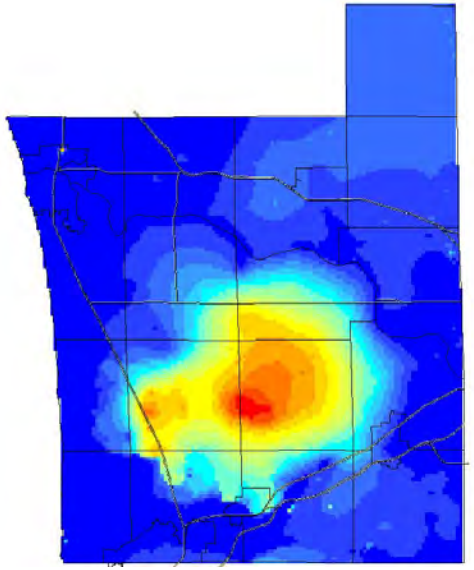

Lake Michigan
Glacial
Aquifer
Water well
Clay Layer
Marshall Sandstone
Dense Bedrock
Sodium Chloride Migration



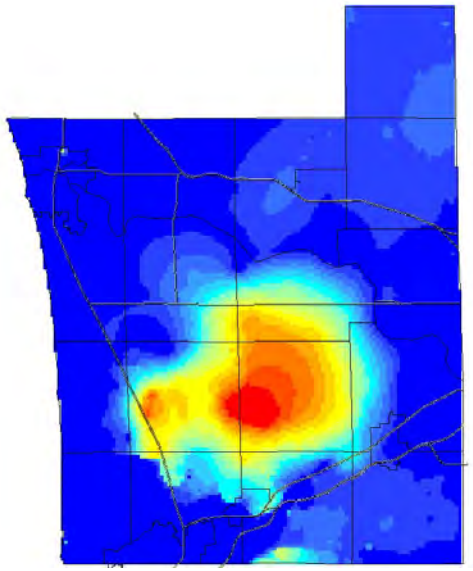
1970



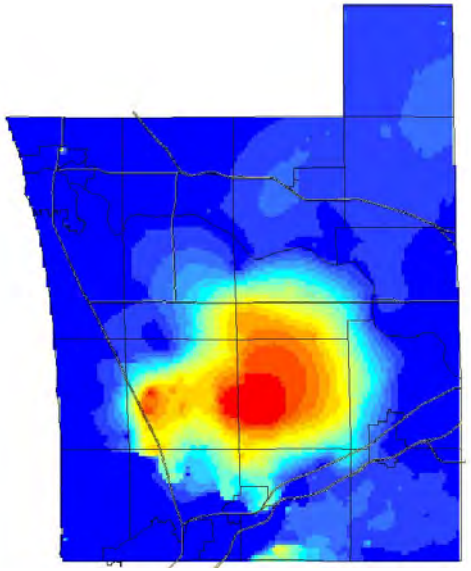
2000



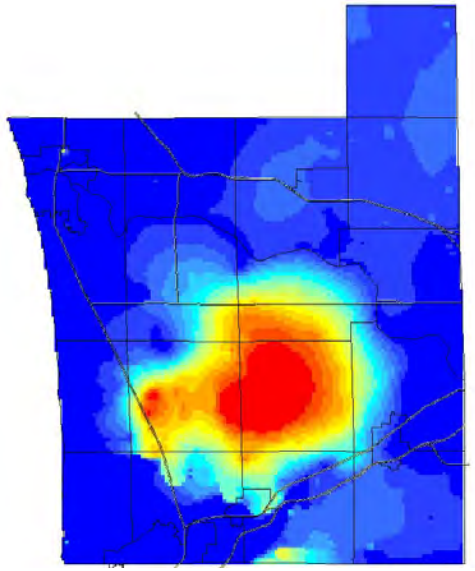
2015



2020



2025



2035

Drawdown (ft.)

- -16.5 - -15
- -14.9 - -14
- -13.9 - -13
- -12.9 - -12
- -11.9 - -11
- -10.9 - -10
- -9.9 - -9
- -8.9 - -8
- -7.9 - -7
- -6.9 - -6
- -5.9 - -5
- -4.9 - -4
- -3.9 - -3
- -2.9 - -2
- -1.9 - -1

College of Engineering
MICHIGAN STATE UNIVERSITY

PLANNING FOR GROUNDWATER SUSTAINABILITY

LAND USE PLANNING

BUILDING & SITE DEVELOPMENT

WATER USE

PRIMARY GOAL OF MANAGEMENT PLAN

1) Reduce dependency on deep bedrock aquifer system

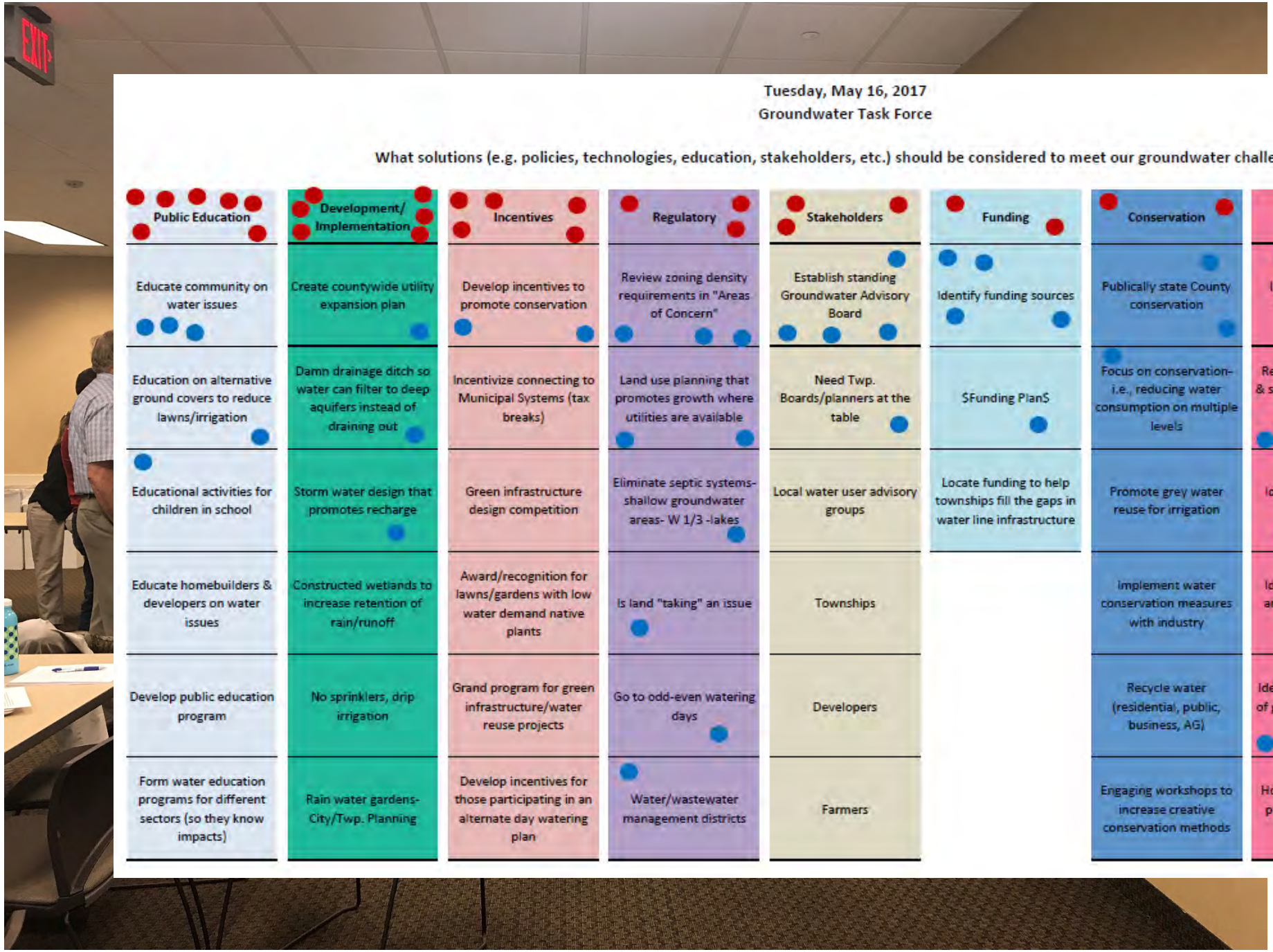
Objectives:

a) Implement creative solutions to offset new withdrawals from bedrock aquifer

b) Protect and enhance recharge of bedrock aquifer

c) Embrace water conservation and reuse

Ottawa County
Groundwater Sustainability Initiative



Tuesday, May 16, 2017
Groundwater Task Force

What solutions (e.g. policies, technologies, education, stakeholders, etc.) should be considered to meet our groundwater challenges?

Public Education	Development/ Implementation	Incentives	Regulatory	Stakeholders	Funding	Conservation	R & D	Water Budget
Educate community on water issues	Create countywide utility expansion plan	Develop incentives to promote conservation	Review zoning density requirements in "Areas of Concern"	Establish standing Groundwater Advisory Board	Identify funding sources	Publically state County conservation	Identify the range of solutions available	Develop a water budget
Education on alternative ground covers to reduce lawns/irrigation	Damn drainage ditch so water can filter to deep aquifers instead of draining out	Incentivize connecting to Municipal Systems (tax breaks)	Land use planning that promotes growth where utilities are available	Need Twp. Boards/planners at the table	$Funding Plan$	Focus on conservation- i.e., reducing water consumption on multiple levels	Review/research policy & solutions implemented in low H2O states (Arizona, CA, etc.)	Develop target goals for water usage (begin w/ areas/industries of most concern)
Educational activities for children in school	Storm water design that promotes recharge	Green infrastructure design competition	Eliminate septic systems- shallow groundwater areas- W 1/3 -lakes	Local water user advisory groups	Locate funding to help townships fill the gaps in water line infrastructure	Promote grey water reuse for irrigation	Identify ways to reuse wastewater	Utilize high large (Michigan) water levels
Educate homebuilders & developers on water issues	Constructed wetlands to increase retention of rain/runoff	Award/recognition for lawns/gardens with low water demand native plants	Is land "taking" an issue	Townships		Implement water conservation measures with industry	Identify obstacles that are preventing aquifer replenishment	Develop a water budget- County
Develop public education program	No sprinklers, drip irrigation	Grand program for green infrastructure/water reuse projects	Go to odd-even watering days	Developers		Recycle water (residential, public, business, AG)	Identify and utilize areas of groundwater recharge in the county	Define max. water use in problem areas
Form water education programs for different sectors (so they know impacts)	Rain water gardens- City/Twp. Planning	Develop incentives for those participating in an alternate day watering plan	Water/wastewater management districts	Farmers		Engaging workshops to increase creative conservation methods	How can water lines be privatized to promote solutions?	Water budget by County/Twp./City

EXECUTIVE COMMITTEE — SCIENTISTS, ENGINEERS, HEALTH, LEGAL, POLICY

Grand Valley State University
Robert B. Annis Water Resources Institute

Ottawa County
Where You Belong®

Michigan Geological Survey
Western Michigan University Geosciences
Established 1837

miOttawa Department of Public Health

Ottawa County Road Commission
Public Utilities Department


MICHIGAN GEOLOGICAL SURVEY
WESTERN MICHIGAN UNIVERSITY GEOSCIENCES
Established 1837


NRCS
Natural
Resources
Conservation
Service


GEI
Consultants


OTTAWA COUNTY
FARM BUREAU


DRUMMOND
CARPENTER
engineering + research


USDA
Natural
Resources
Conservation
Service


miOttawa Department of
Public Health


OTTAWA COUNTY
ROAD
COMMISSION


MICHIGAN GROUND WATER
Association


WEST MICHIGAN NURSERY AND
WMNLA
LANDSCAPE ASSOCIATION


MICHIGAN
CONSERVATION DISTRICTS


Promoting Stewardship
MAEAP
Protecting the Environment


green
michigan
.org


Ottawa Area ISD


GRAND VALLEY
STATE UNIVERSITY


MACC
Macatawa Area
Coordinating Council
A Cooperative Effort Among Units of Government


HOLLAND-HOPE COLLEGE
SUSTAINABILITY
INSTITUTE

STRATEGY AREAS

Ottawa County
Groundwater Sustainability Initiative

Ottawa County

Groundwater Sustainability Initiative

Proactive Strategies Index

Fall 2019

Education Strategies

Advocating for change in regional water conservation perceptions

Strategy
1

Outreach Campaign

Current Partners

EPA WaterSense PARTNER

miOttawa Department of Public Health


FOX
17
WEST MICHIGAN


wood
tv
8


WZZM 13
abc
ON YOUR SIDE


Bridge
bridgemi.com


m
LIVE


Grand Rapids
Business
Journal


GRAND VALLEY
Lanthorn


MiBiz®


GRAND HAVEN ★ SPRING LAKE ★ FERRYSBURG
the TRIBUNE
www.grandhaventribune.com


holland
sentinel


WQP
WATER QUALITY PRODUCTS


circle of blue
where water speaks

Strategy
2

Online Resources

www.miottawa.org/groundwater

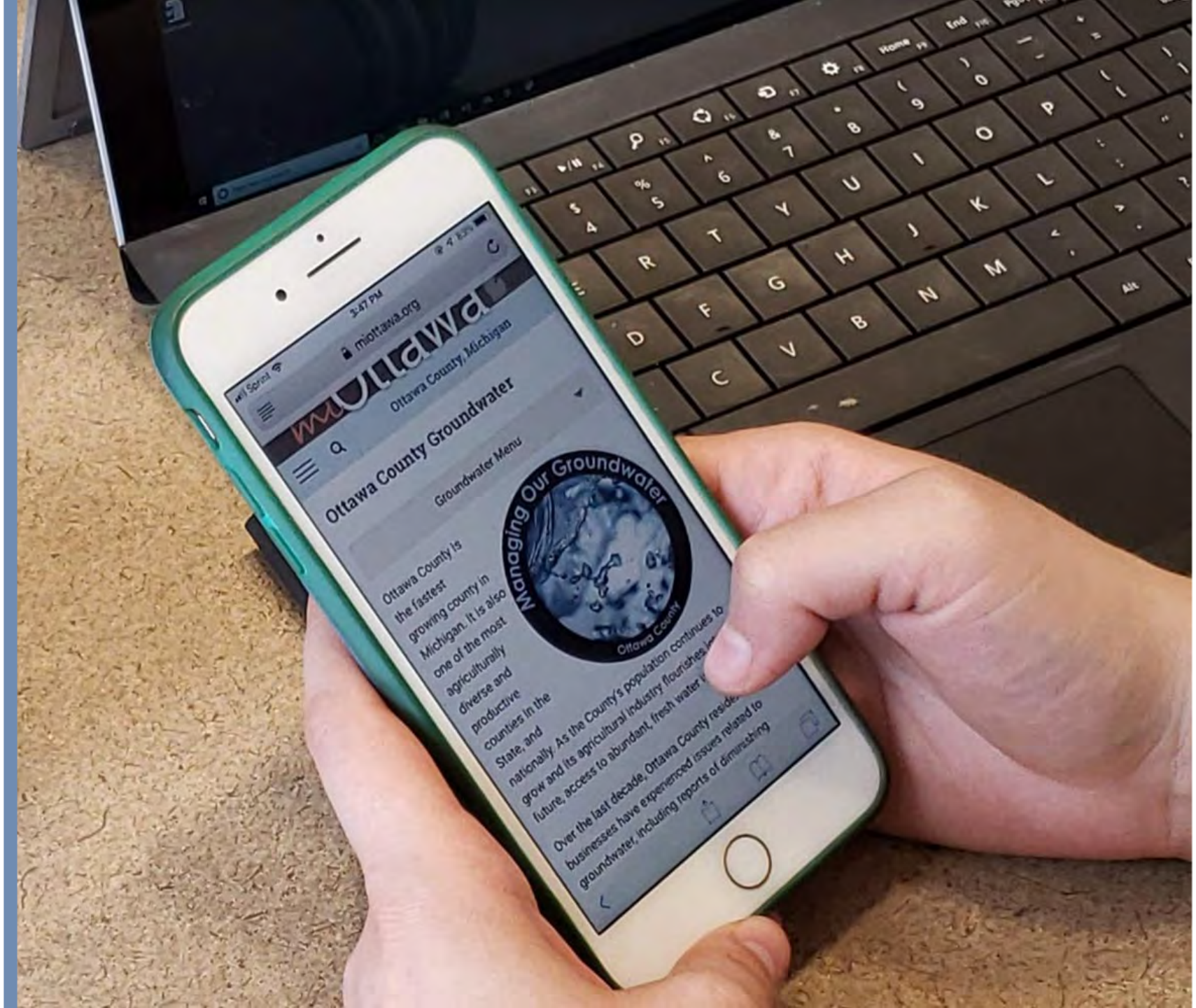


Photo credit: USACE

Strategy
3

Partnerships for Youth Education

Current Partners

Ottawa Area ISD

ACS
Allendale Christian School

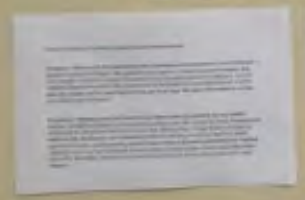
My Deep Hope is that we could practice Earth Keeping and Community Building as we discover ways to decrease our impact on the water around us.

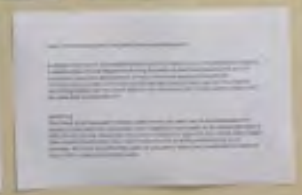
How can Allendale Christian take action to address water problems in Ottawa County?

I can be an Earth Keeper and Community Builder by helping Allendale Christian address water problems in Ottawa County.

I can explain how our study of water around us fits into God's story.

I can model, explain, and provide evidence for how humans impact the water around them.





Strategy
4

Partnerships for College Education

Current Partners

Grand Valley State University

Hope College

GVSU Annis Water Research Institute (Muskegon)

Photo Credit: Bernadine Carey-Tucker

Photo credit: Mode Shift

Strategy
5

Partnerships for Community Education

- **Libraries**
- **Rotaries**
- **Chambers of Commerce**
- **Neighborhood associations**
- **Environmental groups**

Current Partners

Howard Miller Public Library

Coopersville Area District Library

Georgetown Township Public Library

Herrick District Library

Holland-Hope College Sustainability Institute

Patmos Library

Loutit District Library

Allendale Township Library

Spring Lake District Library

Library of Hudsonville

Strategy
6

Community Presence

- **Informational kiosks at events**
- **Educational signage in parks**
- **Hands-on mobile exhibits**

Current Partners

Macatawa Area Coordinating Council
A Cooperative Effort Among Units of Government

Holland-Hope College Sustainability Institute

Grand Valley State University

Integration Strategies

Partner-managed programs designed to make a difference

Strategy
7

Stakeholder Integration

- **Homeowners**
- **Landscapers**
- **Business owners**
- **Realtors**
- **Environmental stewards**
- **Land developers**
- **Golf course managers**

Strategy
8

Household Conservation Strategies

- **Informational pamphlets and brochures**
- **Social media messaging/website**
- **Posters and signage**
- **Public service announcements**

Current Partners

EPA WaterSense PARTNER

green michigan .org

Strategy
9

Alternative Landscapes

- **Developing best management practices**
- **Distributing messaging and literature**
- **Facilitating workshops**
- **Exploring cost-rebate options**
- **Demonstration sites**
- **Contests**

Current Partners

GEI Consultants

West Michigan Nursery and Landscape Association

Strategy
10

Alternative Irrigation Recommendations

- **Developing best management practices**
- **Distributing messaging and literature**
- **Facilitating workshops**

Current Partners

NRCS Natural Resources Conservation Service

GEI Consultants

Ottawa Conservation District

Macatawa Area Coordinating Council
A Cooperative Effort Among Units of Government

Strategy
11

Service-Provider Training

Current Partners

EPA WaterSense PARTNER

GEI Consultants

WEST MICHIGAN NURSERY AND LANDSCAPE ASSOCIATION WMNLA

Strategy
16

Certified *Blue*

Current Partners

EPA WaterSense PARTNER

green michigan .org

Strategy
17

Agricultural Partnerships

- **Promote best management practices**
- **Logistical support**
- **Connections to financial resources**

Current Partners

Promoting Stewardship MAEAP Protecting the Environment

OTTAWA CONSERVATION DISTRICT

NRCS Natural Resources Conservation Service

OTTAWA COUNTY FARM BUREAU

MSU Extension

Mitigation Strategies

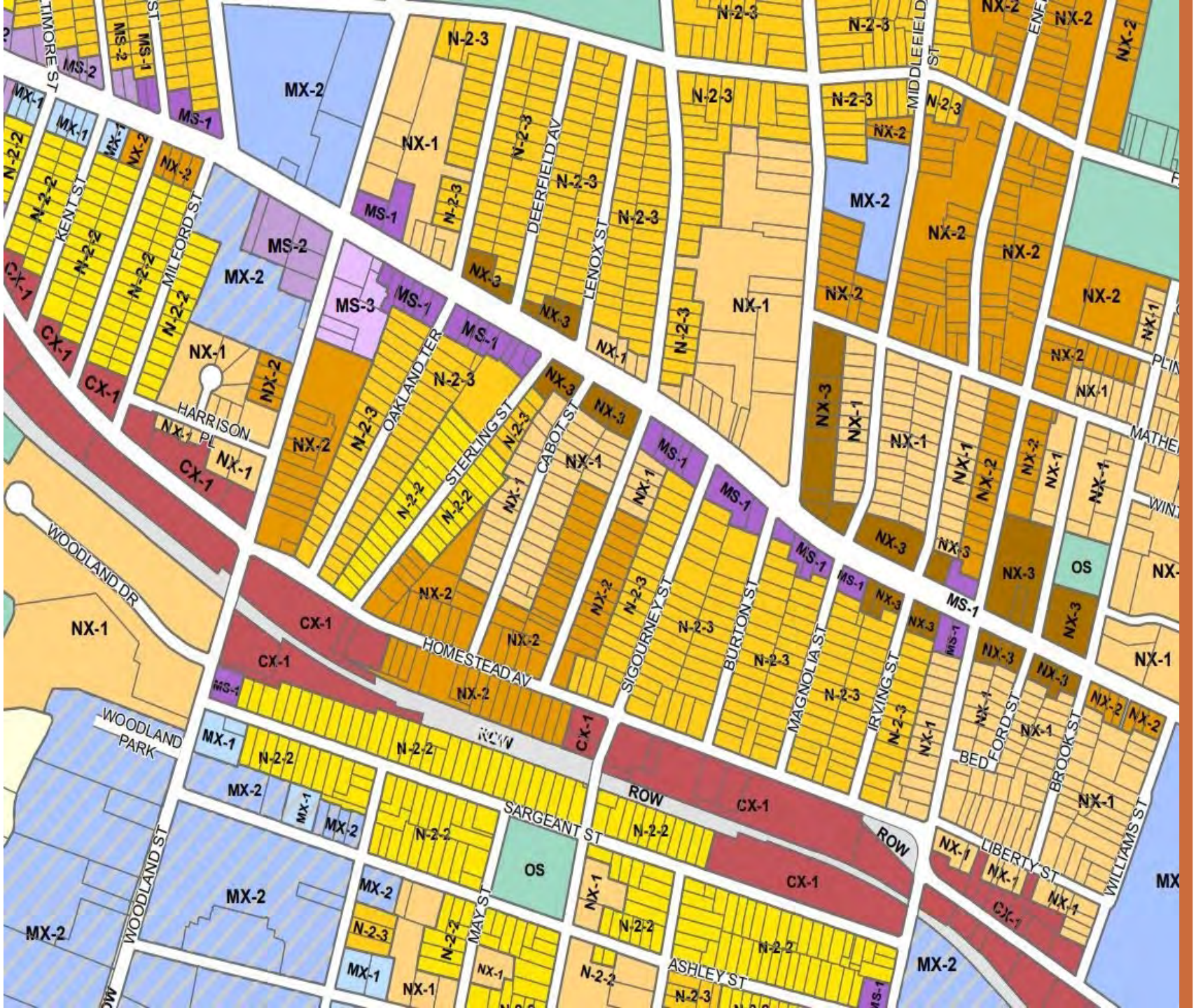
Using policy to enhance groundwater sustainability

Strategy
18

Model Zoning Guidelines

- **Lot size/density requirements**
- **Landscaping requirements**
- **Allowable uses**

Zoning Overlay Districts




Ravenna
Wright
Comstock Park
Grand River
East Grand Rapids
Grand Rapids
Marne
Walker
Coopersville
Wyoming
Fruitport Charter Twp
Polkton Charter Twp
Nunica
Grandville
Grand River
Allendale Charter Twp
Georgetown Twp
Ferrysburg
Spring Lake
Grand River
Hudsonville
Grand Haven
Jamestown
Pigeon Creek Park
Borculo
Agnew
West Olive
Zeeland Charter Township
Noordeloos
Consumers Energy JH Campbell...
Port Sheldon
Port Sheldon Natural Area
Zeeland
Nelis' Dutch Village
Windmill Island Gardens
Beechwood
Holland
Overisel
Tunnel Park
Fillmore
MICHIGAN GROUND WATER Association

Strategy
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County Groundwater Ordinance

- **Prioritized development credit programs**
- **Expanding municipal water infrastructure with new funding sources**
- **Rebate options for connecting to municipal water**

Current Partners

miOttawa Department of Public Health

OTTAWA COUNTY ROAD COMMISSION

Strategy
22

Exploring Other Policies

- **Road de-icing policy**
- **Development guidelines for stormwater management**
- **Enhanced well drilling records**
- **Real Estate Transfer Evaluation Program**
- **Runoff storage solutions**

Current Partners

OTTAWA COUNTY ROAD COMMISSION

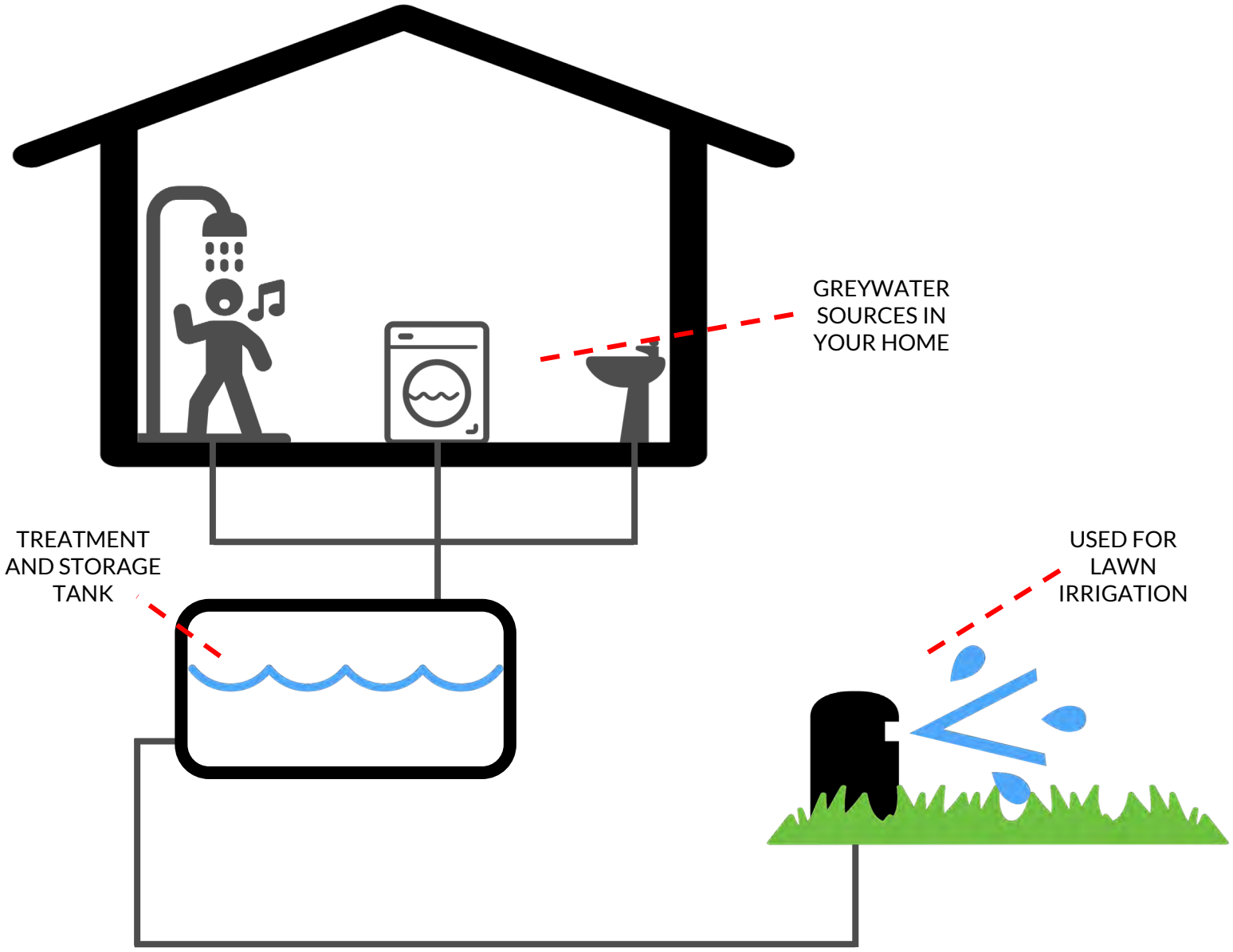
Ottawa County
Water Resources Commissioner

miOttawa Department of Public Health

MICHIGAN GROUND WATER Association

DRUMMOND CARPENTER
engineering + research

EXAMPLE OF A RESIDENTIAL GREYWATER SYSTEM



Strategy 23

Water Recycling Strategies

- **Household and industrial greywater systems**
- **Dewatering bags from various sources**
- **Sump collection systems**
- **Stormwater collection & storage**

Current Partners

DRUMMOND CARPENTER engineering + research

MICHIGAN GEOLOGICAL SURVEY Established 1837

miOttawa Department of Public Health

Strategy
24

Groundwater Monitoring Network

- **Establishing a substantial network of monitoring wells**
- **Identifying areas that naturally facilitate bedrock aquifer recharge**
- **Examining our ability to augment groundwater recharge**
- **Calculating a groundwater budget**

Current Partners

MICHIGAN GEOLOGICAL SURVEY
Established 1837

MICHIGAN GROUND WATER Association

Strategy
25

Infrastructure Mapping and Planning

- **Detailed map creation**
- **Availability and demand analysis**
- **Strategic planning of future system expansions**

Current Partners

OTTAWA COUNTY ROAD COMMISSION

Ottawa County
Geospatial Insights & Solutions

Strategy
26

Coordinated Future Land Use Plan

Coordination Strategies

Creating accountability through organization structure

Strategy
27

County Support Personnel

- **Research & development of various ordinances and policies**
- **Zoning standards and overlays recommendations**
- **Facilitating communications and programs between various partners**
- **Managing implementation of plan**
- **Handling public relations**

Strategy
28

Groundwater Technical Advisory Board

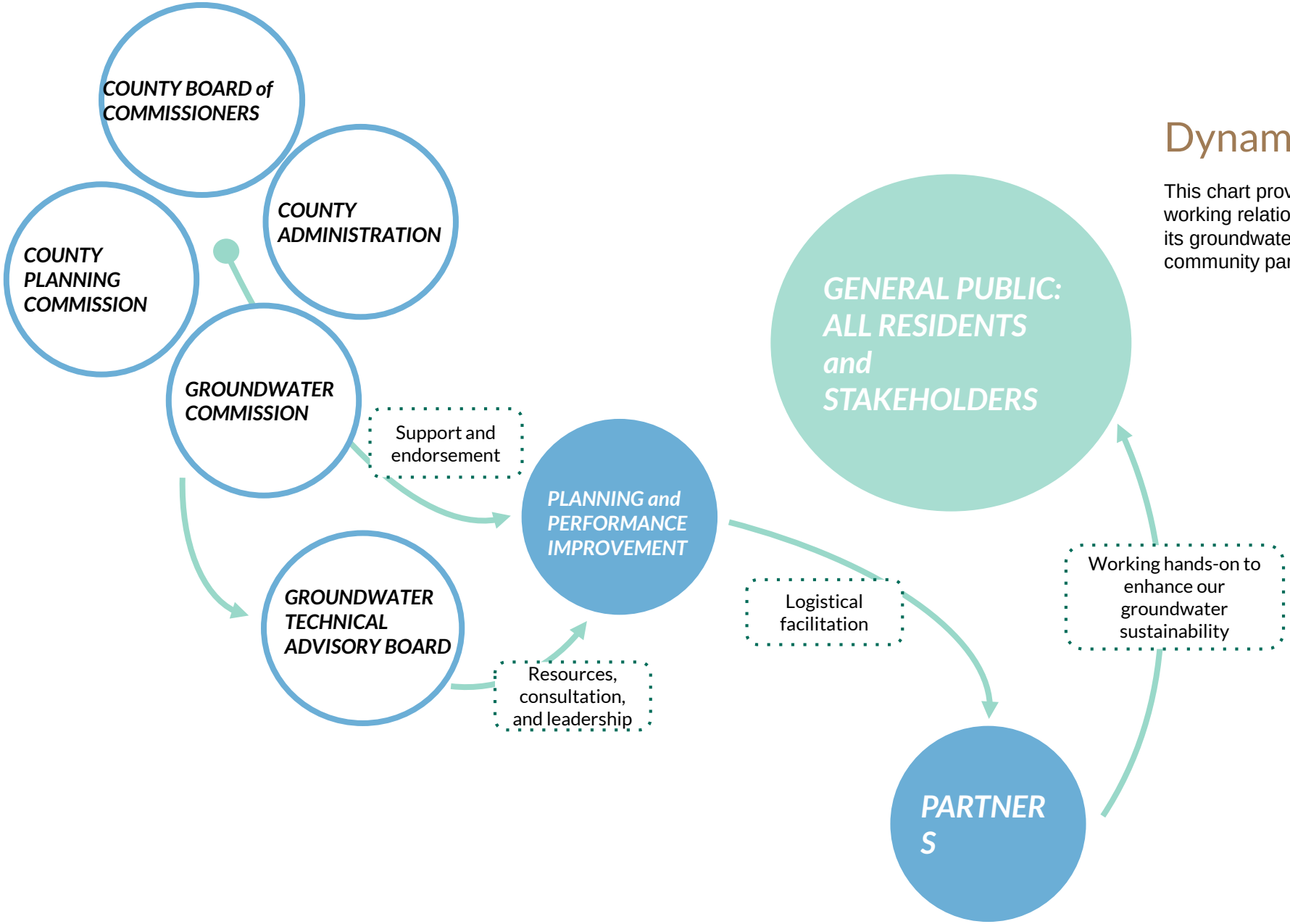
- **Providing technical support and recommendations**
- **Helping diagnose and solve unique groundwater challenges**
- **Advising residents, developers, and business owners on water conservation techniques, technologies, and methods best suited for the area**

Groundwater Commission

- **Ottawa County**
- **Local units of government**
- **State-level agencies**
- **Engineering/science firms**
- **Scientists**
- **Well drillers**
- **Land developers**
- **Educational institutions**
- **Non-profit sector**
- **General public**

Dynamic Relationships

This chart provides a brief summary of the working relationship between Ottawa County, its groundwater advocacy teams, and community partners.



Get Involved!

Ottawa County
Groundwater Sustainability Initiative

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www.miottawa.org/groundwater

Ottawa County
Where You Belong

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