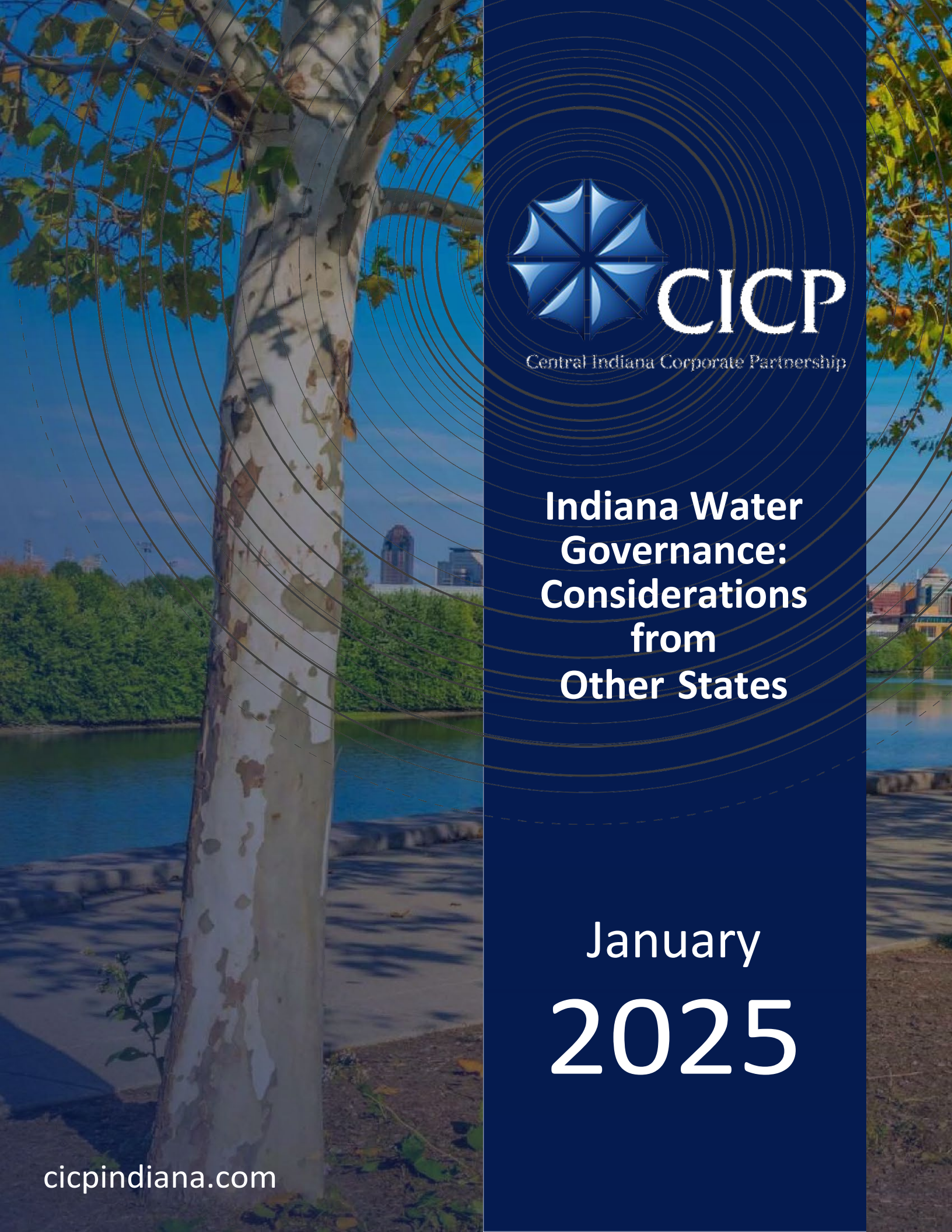

CICP

Central Indiana Corporate Partnership

Indiana Water Governance: Considerations from Other States

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REPORT

Indiana Water Governance:

Considerations From Other States

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Foreword from CICP

For more than 25 years, the Central Indiana Corporate Partnership (CICP) has brought together leaders from across the state to advance our mission of transforming the economy of Indiana in order to create a sustainable prosperity and quality of life for our citizens and future generations. To further our mission, CICP has largely focused on supporting the growth of Indiana's advanced industries and the thousands of Hoosiers they employ. Indiana's advanced industries—advanced manufacturing and logistics, agbiosciences, life sciences, and tech—have been the source of increased investment in recent years.

At the national level, technological advancements, geopolitical developments, and disruption brought about by the Covid-19 pandemic have contributed to a new wave of economic investment and industrial development leading to the promise of new employment opportunities. Indiana's public and private sector leaders have seized this moment to ensure our state's economy remains competitive and Hoosiers have access to good paying jobs well into the future.

As we look ahead to the future and a growing and changing economy, it is important that we take a refreshed look at what policies, tools and best practices might be necessary to ensure we have the resources we rely on to realize these opportunities. This is particularly so with regard to water.

Situated between the Great Lakes and one of North America's longest rivers, Indiana has long benefited from abundant water access. As we look towards future growth and prosperity in a changing economy, we need to ensure that we are planning for future demands so that we can continue to strengthen economic competitiveness and quality of life. Several organizations have stepped up in recent times to bring much needed attention to this issue in a variety of contexts including general recommendations to ensure Indiana plans for and governs water management for the here and now as well as for the long term. As these important discussions and potential actions are considered, some of our partner organizations identified a need to better understand more specifically what other jurisdictions have done around the issue of water resource planning and governance.

To this end, CICP commissioned the accompanying report with the goal of informing discussions by providing more detail on how Indiana and six other states plan for and govern water use and management. The report identifies a number of specific mechanisms from policies, processes, tools, and best practices that have been used in other jurisdictions and that in some combination may be applicable and useful to Indiana as our policy makers seek to address this important issue.

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Acronyms and Abbreviations

Act	Water Resources Management Act of 1983
ARPA	American Rescue Plan Act
ASR	Aquifer Storage and Recovery
BMPs	Best Management Practices
BWSR	Board of Water and Soil Resources
cfs	cubic feet per second
Chamber	Indiana State Chamber of Commerce
CIA	Cumulative Impact Analysis
CICP	Central Indiana Corporate Partnership
Collaborative	Central Indiana Water Utilities Collaborative
Commission	Natural Resources Commission
Committee	State Water Resources Plan Advisory Committee
DEQ	Department of Environmental Quality
DNR	Department of Natural Resources
DNR-OWR	Department of Natural Resources (Office of Water Resources)
EGLE	Environment, Great Lakes, and Energy
GIS	Geographic Information System
gpd	gallons per day
HABs	harmful algal blooms
IDEM	Indiana Department of Environmental Management
IFA	Indiana Finance Authority
IGWS	Indiana Geological and Water Survey
INTERA	INTERA Incorporated
IDOH	Indiana Department of Health
ISGS	Illinois State Geological Survey
ISWS	Illinois State Water Survey
IURC	Indiana Utility Regulatory Commission
IWIP	Illinois Water Inventory Program
LEAP	Limitless Exploration/Advanced Pace
MAR	managed aquifer recharge
MDARD	Michigan Department of Agriculture and Rural Development

mgd	million gallons per day
ODA	Ohio Department of Agriculture
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
OSDA	Ohio State Department of Agriculture
OWDA	Ohio Water Development Authority
RBC	River Basin Commissions
RFP	Request for Proposals
RWSPGs	Regional water supply planning groups
SRF	State Revolving Fund
State Plan	State Water Resources Plan
SWCB	State Water Control Board
SWMA	Surface Water Management Area Act
TNRIS	Texas Natural Resources Information System
TWDB	Texas Water Development Board
TxGIO	Texas Geographic Information Office
USGS	U.S. Geological Survey
WAMs	water availability models
WMAs	Water Management Areas
WDC	Watershed Development Commissions
WSP	Water Supply Planning
WUAC	Water Use Advisory Council
WUC	Water Use Committee
WWAT	Water Withdrawal Assessment Tool

1 Introduction

The importance of access to water cannot be overstated. In Indiana, the topic of water resource management has received a lot of attention in past years, with studies from organizations including the Indiana Utility Regulatory Commission (IURC), the Indiana Finance Authority (IFA), the Indiana State Chamber of Commerce (Chamber), and others. These studies have been motivated by several objectives including removing obstacles to economic development; ensuring continued viability of key sectors including agriculture, energy production, and other industrial uses; and ensuring reliable access to drinking water for our citizens. Most of these studies have led to specific follow-up actions that have addressed some of the identified issues.

However, other recommendations from these studies have stalled despite widespread support across diverse stakeholder groups, due in part to a lack of governance structure in the state, potentially putting these same objectives at risk. The recent events stemming from the Limitless Exploration/Advanced Pace (LEAP) district have highlighted some of the issues that come from this lack of governance structure. While Indiana's last notable drought dates back to 2012, this drought brought attention to issues related to the state's ability to respond to water shortages, and potential threats to the availability of water for existing consumers.

This report is a deeper dive into water resource governance and describes different governance options based on benchmarks of how other states have used the general principles of public policy to improve state water governance. This document makes no specific recommendations related to policy. Through examining other states' practices, it does highlight a portfolio of potential governance tools that can be used to achieve certain policy objectives. Some of these include the following:

- Regional and state level water plans,
- Permits under specific circumstances,
- Use restrictions in targeted areas under defined circumstances,
- Conservation efforts including through mandates or incentives,
- Regional collaborations among utilities and other stakeholders,
- All underpinned with data, monitoring, and analytics.

A more extensive look into these benchmark states also points to some common themes and lessons learned. Notably, while most of these sample states began their resource management efforts with tools designed to address a specific problem (e.g., permits to address potential water shortages), these same states' policies almost always evolved to include a state water plan, developed with common "top down" standards and regional "bottom up" inputs.

Some aspects of these benchmark state programs may be useful in Indiana with adaptation to the distinctive conditions of Indiana's hydrogeology and variations in the growth and development in different parts of the state. By considering these different options, Indiana can better position itself to realize economic development aspirations while also ensuring the reliable availability of drinking water for our citizens and water usage for our critical industries.

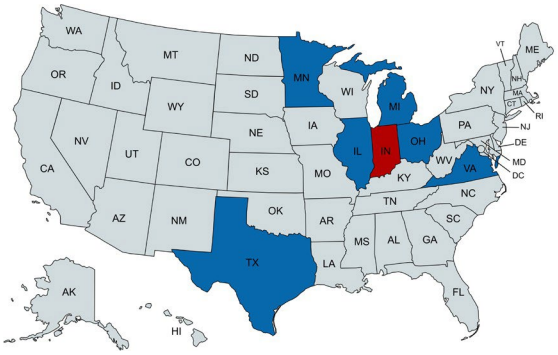
1.1 Survey Methodology

Our project was designed to learn about the structure of the selected *state's water governance*. In general, the goal is to understand how state water supply management program function, how and why the programs are developed, and how the work is being accomplished and funded. We defined state water governance to be the implementation of a set of defined water policies that include the political, economic, social, and administrative systems that manage and track the use of water resources and the rules, practices, and processes that determine how a state's water is used and managed.

A multi-state survey approach was taken to identify alternatives and policy options that could be suitable for Indiana. In consultation with the Central Indiana Corporate Partnership (CICP), INTERA Incorporated (INTERA) identified six states for comparison of alternative approaches to water governance. In-depth research and staff interviews for each state were conducted. The methods, tools, and requirements of these other state water programs informed the project team about the range of considerations for the planning process, the funding required, and the development of new water supplies.

INTERA chose these states:

- Illinois
- Michigan
- Minnesota
- Ohio
- Texas
- Virginia



Illinois, Michigan, and Ohio were chosen, in part, because of their proximity to Indiana. Minnesota and Virginia were known to have mature supply planning programs. Although Texas operates under a different set of water rights than the other states, they have a long history of regional supply planning that illustrates additional potential considerations.

The topics to be understood fall under several broad umbrellas:

- Governance
- Staffing
- Funding
- Data Collection/Mapping

The team relied on published and online material, personal experience and knowledge, and both scripted and "snowball sampling" approaches to personal interviews. A scripted sampling approach involves a non-random selection of interviewees based on the interviewees' expected knowledge of the subject in question. For this project, for example, the team sought interviews with key actors who had direct experience with water supply policy and planning functions. "Snowball sampling" is the identification of subsequent interviewees based principally on references gleaned from prior interviewees. We spoke with a total of 19 people. A summary of the questions we sought to have answered is included in Appendix I. The people interviewed within each state are listed in Appendix II.

As seen in the list, officials from numerous state agencies were interviewed, and, in one case, a participant had experience in two different state planning efforts. Section 4 provides summaries of each state's water policy experience.

1.2 Water Rights in the United States

Water rights are foundational to the evaluation of state water governance; an understanding of what type of water rights are in place is critical to any analysis of options. What makes sense in one state, may not be allowed in another.

In the United States, if we ignore some local variation, there are three basic types of water rights: 1) Riparian, 2) Prior Appropriation, and 3) a combination or hybrid of the first two. A map showing the distribution of the types of water rights is provided in **Figure 1**. In general, riparian water rights are used in the states east of Kansas City, and prior appropriation is used in the arid western states. Because of this distribution, these systems are sometimes referred to as Eastern water rights and Western water rights, respectively. The hybrid system is used in Texas and the states in a line to the north and the western coast states.

1.2.1 Riparian

The riparian system of water rights is typical in the eastern states, where water is relatively plentiful. Riparian or "reasonable use" water rights provide water rights with land ownership. A landowner who owns land that physically touches a river, stream, pond, or lake has an equal right to the use of water from that source. Riparianism allows a landowner to make reasonable use of water to the extent that it does not interfere with other riparian landowners' reasonable use. Additionally, unlike prior appropriation, the right to use the water adjacent to one's property is not lost if it is not used. In the more humid Eastern states, there is an understanding that water use replaces natural precipitation, and less water is needed in the wet years. In any basin, however, a riparian landowner has no more or less right than any other riparian landowner to the water that they can access.

Resolving disputes among neighbors with riparian rights requires balancing the reasonableness of competing uses. A reasonable use doctrine usually presumes that domestic uses are reasonable even if such uses cause diminished flow and injure downstream users. However, so-called artificial uses, such as irrigation and industrial use, may be subject to some restrictions during shortages.

Riparian water rights are generally considered "part and parcel" to the land and are included if the property is sold. In most cases, riparianism does not allow the transfer of riparian rights for use on non-riparian lands. Exceptions to this rule have been made, in some instances, to allow non-riparian landowners to use the water so long as the use is "reasonable" in relation to others.

As population and developments increase in the East, more states are moving to an adaptation of the pure riparian system to what is known as *regulated riparianism*. Seventeen of the 30 eastern states have adopted regulated riparianism, which requires water users to obtain a permit from a state agency to withdraw water. This form of riparianism aims to balance the needs of the environment with those of other uses while still maintaining reasonable use rights. In 1997, the American Society of Civil Engineers published the Regulated Riparian Model Water Code as a guidance document for states wanting to adopt this system. The document was updated in 2018 (ASCE, 2018).

As shown in **Figure 1**, Indiana is typically described as having strict riparian rights; however, given some regulations already in place in the state (like reporting withdrawals and the Great Lakes Compact), some argue that it should be considered *regulated riparian* (U.S. Department of Energy, 2014).

1.2.2 Prior Appropriation

Prior appropriation, which originated in the gold rush, is typically found in the western states (**Figure 1**). Miners developed the system when conflicts occurred due to the necessity of diverting water for the mining process. Whoever uses the water first obtains the right to use the water in perpetuity, independent of land ownership. A common saying summarizes this doctrine, "first in time, first in right." With prior appropriation, the earliest users of the available water have a "senior" priority, and, likewise, the later users have a "junior" right. This is particularly important in times of water shortage when the rights of the later user will be suspended first. However, any change of a water right (time of use, place of use, purpose of use, point of diversion, etc.) is embedded in the right. Any user cannot change their system in a way that causes harm to another water user, regardless of priority. Each state that utilizes prior appropriation has its own system of determining the relative rights of the users. (States that have appropriated water rights have an office of the State Engineer, whose job it is to administer the rights within each watershed of the state.)

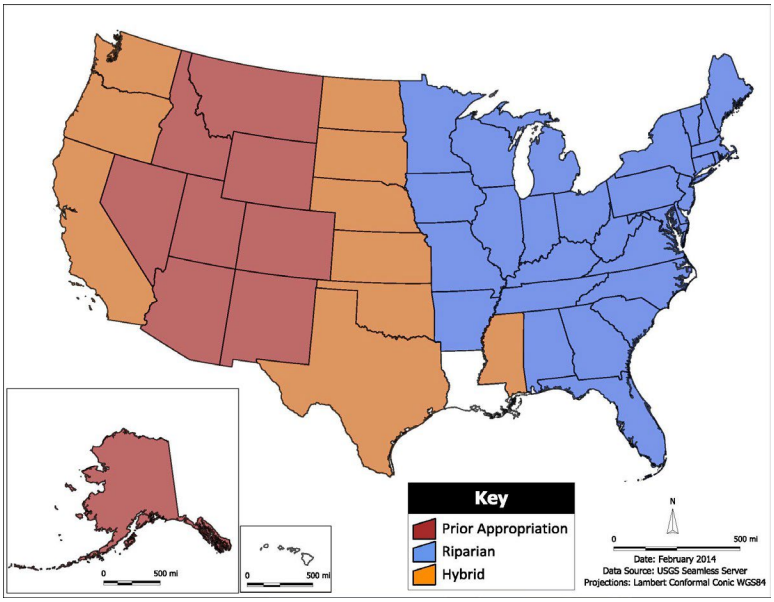


Figure 1. Water rights systems utilized by state (2014).

A claim to water rights, under this doctrine, occurs only when the water is put to beneficial use. Likewise, a water claim can be lost by non-use. When the water is no longer being put to beneficial use, the water right is suspended. Further, only the required amount of water is allowed to be diverted. If a user's needs decrease, then the claim on the water also decreases. Each state defines what constitutes "beneficial use" of the water.

According to prior appropriation, a water right is enacted by diverting water and putting it to beneficial use. However, many states have enacted a permit system which requires a user to obtain a permit prior to the withdrawal of water. Many western states are currently working to modernize these rights to remove the perverse incentives against conservation.

Unlike riparian rights, prior appropriation allows water rights to be sold or transferred, and long-term storage is not only permissible but common.

1.2.3 Hybrid

Some states utilize a hybrid or combination of both the riparian and prior appropriation system of water rights (**Figure 1**). Typically, these were states that originally utilized riparian rules of use but have changed to prior appropriation. The hybrid system varies by state, but in general, states have allowed riparian landowners to claim a water right by a certain time (usually by the date appropriation was adopted) and incorporate that claim into the state's prior appropriation system.

1.2.4 Great Lakes Compact

Over the years, during serious drought conditions, proposals were made to divert water from the Great Lakes to the arid western U.S. or other parts of the world. To combat these notions, the Great Lakes Compact, signed into law in 2008, bans the diversion of Great Lakes water outside their watershed (**Figure 2**) with two basic exceptions. These two exceptions apply to communities that straddle the Basin or lie within counties that include some area that flows into the Lakes. Any proposal for a diversion must be approved by all eight Great Lakes States and can be vetoed by any one state. The two bordering Canadian provinces can provide input.

Figure 2. Map showing the states and provinces that are part of the Great Lakes Compact.

In 2016, approval for a diversion was granted to Waukesha, WI, with restrictions. Principal among those restrictions was the requirement that any water diverted from Lake Michigan be returned to the Lake. This requirement essentially set the standard for any new diversion request by any interested party in the Great Lakes Basin – that any water removed from one of the Great Lakes be returned to that Lake.

Illinois is the only state with an arrangement that varies from this diversion requirement. By virtue of a preceding and overriding 1967 Supreme Court Decree, Illinois is allowed to divert up to 3,200 cubic feet per second (cfs) or 2,068 million gallons per day (mgd). Illinois' diversion removes water from the Great Lakes Basin and puts it into the Mississippi Basin. The diversion is divided into three major components: direct diversion, stormwater runoff, and domestic (public water) supply. In Water Year 2019, water used for public supply amounted to less than 40 percent of Illinois' diversion.

1.3 Status of Water Governance in Indiana

Indiana's recent focus has been on conducting studies of regional water availability assessments and demand projections. In the absence of a state process, the water utilities make decisions about where and how to expand public supplies, with primarily local input and some notable voluntary collaboration across regions or from other water users.

Except for areas within the Great Lakes Basin, the state does not have water withdrawal permitting/allocation process. If new groundwater supplies developed by a significant (high capacity) water user appear to impact domestic (residential) water users, the DNR may step in to investigate. For example, if a new utility well field pumping groundwater has an impact on nearby homeowner wells, the DNR will collect available information, determine the cause, and engage the water users in a dispute resolution process aimed at preserving the homeowner's riparian rights. In these cases, the state is limited to a reactive role, becoming involved only if a conflict has already occurred.

Informal coordination and collaboration between utilities has recently developed in regions of high growth, where competition for water and conflict is likely. The Central Indiana Water Utilities Collaborative (Collaborative) is a group of regional utilities that meets quarterly to share plans for growth and development and address ongoing and regional water resource challenges.

In regions where rapid growth or limited water supplies have caused concern, some counties have stepped in to provide oversight on source water protection by enacting wellhead protection ordinances. In Hamilton and Johnson Counties, for example, the water utilities and other significant water users meet on a quarterly basis. These wellhead protection meetings serve as a forum for sharing information about growth and utility improvements/changes.

Indiana counties are now playing a new and pivotal role in water supply planning by facilitating cooperation and communication with local stakeholders. County water data collection helps local officials understand the importance of water in their decision-making. Counties have begun supporting planning with several specific tools: groundwater level monitoring, water-quality testing, evaluating water availability, and public outreach efforts.

These new county efforts were made possible by federal funding through the American Rescue Plan Act (ARPA) program. With adequate continued funding, counties can lead efforts to help ensure sustainable growth and development. Both Morgan County and Hamilton County are conducting water studies to support these efforts. In addition, the City of Angola led a study of Steuben County. Dedicating this level of effort to these projects allows counties to support their communities through well-informed water management decisions that guide economic growth.

There are currently three River Basin Commissions (RBC) within Indiana and two Watershed Development Commissions (WDC). In general, they were originally formed to improve drainage and mitigate flooding along large rivers in northern Indiana. In 2023, House Bill 1639 allows for the existing RBC's to convert into WDC and for the formation of additional WDCs. WDCs are legal entities, made up of multiple counties that form a watershed basin, that address water resource management issues. These commissions can be established by one or more counties to collect special assessments to fund local projects to manage the water resources within the basin. While the WDCs have a structure in place to fund data collection for water resources management and water supply planning, they have not yet moved in this direction.

2 Water Governance Options

Water governance refers to the overarching framework of water use laws, regulations, and customs, as well as the process of engaging the public sector, private sector, and civil society. *Water management* comprises the actions to implement those laws, policies, and decisions (Megdal et al., 2014).

Common priorities for water governance include water quality and water quantity. The federal government has taken the lead in setting drinking water and wastewater quality standards but defers to the states to implement standards, allocate water quantity, and determine water use. Each state maintains significant authority and autonomy over water regulations and water governance. Here, we primarily consider state water governance related to water quantity.

Differences in water governance between states can be subtle and complex, making any classification of governance features inherently artificial and incomplete. The classification and comparisons in this report are intended to highlight the differences and similarities between states. In most cases, complete state governance fits within some range between extremes –a mixed classification.

Of the states examined here, the primary distinction between water governance frameworks is whether water withdrawals are regulated or unregulated. In the former case, the regulatory basis is also the basis for water management. In the latter case, water management is coordinated through planning only. In **Figure 3**, these management types are classified as Regulated Management and Planning Only Management.

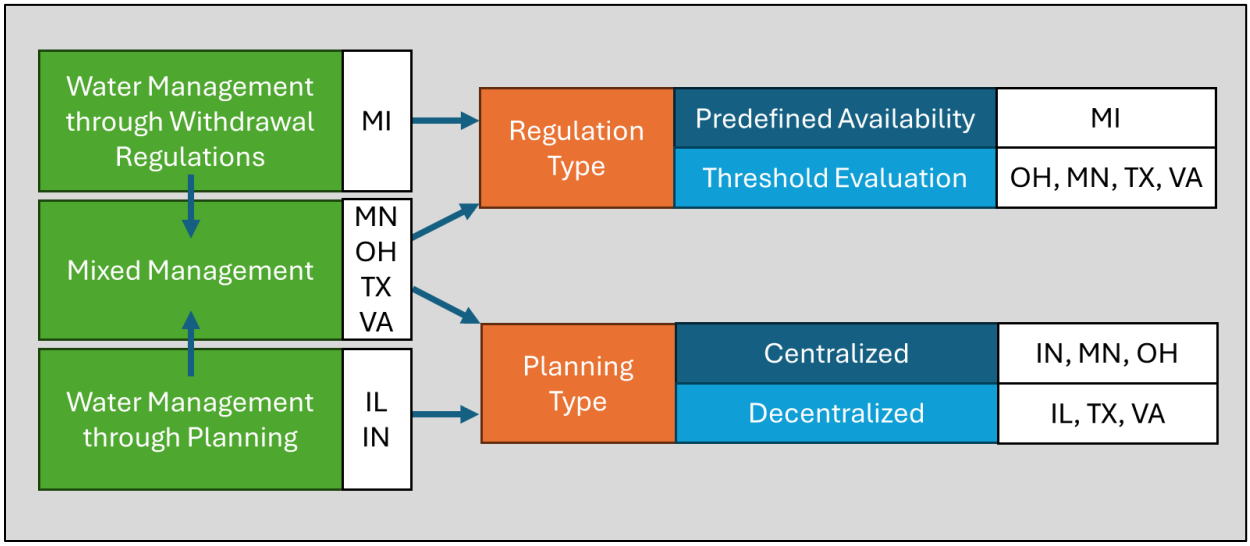


Figure 3. Classification of Water Management frameworks.

Illinois is an example of a state with unregulated water withdrawals. A significant planning effort has been put toward defining management regions and hydrologic studies to identify water availability. Because Illinois does not set clear administrative rules for groundwater withdrawals or a process for dispute resolution, comprehensive water management relies solely on planning and is elusive. Conflicts between water rights holders often lead to costly, time-consuming court fights (Kirchhoff and Dilling, 2016), as there is no clear definition of “reasonable use.”

In contrast, Michigan is a state with highly regulated water withdrawals and a clear dispute-resolution process. Both regulations and dispute resolution aim to reduce the possibility of water rights conflicts and provide a legal basis for limiting withdrawals. However, they do not eliminate the possibility of civil litigation. The same effort that was put into regional planning in Illinois was made in Michigan to define and legislate limitations of withdrawals.

As indicated in **Figure 3**, most of the states examined here include a mix of Regulated and Planning Management types. Every state within our survey that has faced a severe water supply or environmental crisis has developed a permitting process. Indiana and Illinois are the only states with no permitting process, except within the Great Lakes Basin of those states.

2.1 Regulation Type

Two broad divisions exist within Regulated Management: Pre-Defined Availability and Threshold Evaluation. Characteristics of each approach to regulation of water withdrawals are provided below.

2.1.1 Predefined Availability

The primary characteristic of Predefined Availability is that the approach provides prior knowledge of statewide water availability and the regional distribution of availability. This knowledge is then used to permit or deny a permit for new water withdrawals. In Michigan, this prior knowledge allows for the automated screening of new withdrawal proposals, streamlining the review process and permitting withdrawals. More importantly, it streamlines the planning process for major industrial developments or regional growth, as water availability is generally known in all watersheds. This allows the state to direct proposals for major development to regions with adequate water availability.

Groundwater and surface water are considered a single resource and are regulated on the same basis. In Michigan, withdrawal limits are based on a pre-defined maximum allowable reduction in the baseflow in streams. The development process in Michigan required a significant investment in statewide hydrologic, geologic, and biological studies to develop a science-based regulatory framework prior to enacting legislation. In addition to the up-front investment, ongoing costs are incurred for hydrologic and biologic monitoring, modeling, and data analysis.

2.1.2 Threshold Evaluation

In contrast, the Threshold Evaluation type of regulation does not allow for prior knowledge of statewide water availability. Groundwater and surface water are regulated separately, and while there may be prior knowledge of surface water availability, groundwater availability is not predefined. Instead, limits are placed on lowering groundwater levels at critical locations. Each proposal for new groundwater withdrawals must be evaluated case-by-case using a groundwater model, slowing the review and permitting process. This also slows the process of regional planning for growth and development. Virginia is an example of a state that uses a threshold evaluation for permitting and assessment of water availability.

Regional groundwater modeling tools must be developed to evaluate groundwater withdrawal proposals, but this can be done before or after legislation is enacted. A smaller up-front investment is

required, but the same ongoing costs are required for hydrologic and biologic monitoring, modeling, and data analysis, similar to the requirements of the Predefined Availability regulation type.

2.2 Planning Type

Two broad divisions exist within Planning Management: Centralized Planning and Decentralized Planning. The divisions reflect whether water resources management and planning is a top-down or bottom-up process. All states investigated include a combination of centralized and decentralized processes. For example, Illinois includes a centralized structure at the state level for identifying water management regions, while the individual regions are responsible for evaluating water availability and management plans. The classifications of Centralized or Decentralized are artificial but intended to reflect whether the primary controls over planning exist at a state, regional, or local level. Based on the burden of planning being placed on the regions, Illinois is classified as Decentralized.

Decentralized Planning is distinguished by regional planning stakeholders making recommendations that are subsequently followed at the local or regional level, rather than solely by the state. Illinois is a prime example of this type of planning. After the water availability and projected water demand studies are completed, and the regional stakeholder planning group has assembled its recommendations to address the supply gap, these recommendations are meant to be implemented by the various stakeholders within the existing local/regional institutional water supply planning (WSP) and management structure. The success of regional plans depends entirely on the action and cooperation of the entities identified in the recommendations. While some recommendations may be directed toward the state, the focus is on resolving local/regional issues through the efforts of local and regional stakeholders.

In contrast, Centralized Planning is characterized by the responsibility to assess, revise, and implement regional management plans that are placed at the state level. The water governance of the State of Minnesota is based on this type of centralized planning framework.

2.3 Data Collection and Mapping

Every state is involved in hydrogeologic data collection, mapping, and modeling of the type shown below. This data is critical for hydrologic investigations and data collection should be considered an ongoing process. Archival databases and hard files containing the raw data and data analyses must also be maintained perpetually, which requires substantial funding and staff.

Data collection is typically carried out by multiple state and federal agencies specific to various state and/or federal regulations and programs. Because there are many programs and permits, each containing different sets of water information, the data are often in disparate locations and formats. To further complicate matters, how and where these data are kept differs from state to state.

However, while state programs understandably vary, there are common themes. Each state works to obtain information from development activities to build a hydrologic data framework that can be used for water resource planning, prediction, and design. Field observations of stream flows and aquifer levels and withdrawals from the system are all needed to differentiate long-term trends in water availability from seasonal variations in water use and regional recharge. Some of the most common datasets collected for state water resource analysis are:

1. Surface water and groundwater withdrawals.
2. Surface water and groundwater quality.
3. Stream stage/discharge.
4. Groundwater levels.
5. Geologic well logs.
6. Glacial and bedrock geology maps; aquifer boundaries and thicknesses.
7. Aquifer hydraulic properties.
8. Reservoir capacity/stage.
9. Precipitation.
10. Population and population projection data.
11. Aquifer potentiometric surface maps.
12. Groundwater models.
13. Fish population data, stream temperature, sediment characterization.

3 Governance Considerations for Indiana

After surveying states' water management programs and exploring their history, we see the common threads in their stories. **Table 1** shows the common path and, in many ways, the cycle that all the states have followed to reach their current status of water resources management.

At some point in history, all the states we surveyed went from "everything is fine" to "something is broken." For the states surveyed, this was a challenge with either water quality or quantity. The resulting program developed by each state reflects that concern and focusses either on quantity or quality.

After determining the problem, each state had to determine the causes and consequences and ask themselves how to proceed (**Table 1**). They next took time to consider the policy options, talk to the water experts, and determine how to respond. Except for Illinois, all the states decided that making legislation to create a water management system was a judicious step.

Thereafter, many of the paths diverge. **Figure 4** shows how even though the states went through similar stages, each path was unique. Most of the states ended up with a program that results in a state water plan, but how they achieve that plan, who contributes, and who does the analysis varies. Each path is unique as each state has its own unique hydrologic and geologic setting and socio-economic drivers.

For Indiana, the drought of the 1960s was the source of water shortage concerns. Like the other states, Indiana had to figure out how to proceed, so it listened, considered policy options, and spoke to the experts. From these "listening sessions," the state defined new responsibilities for the state, agencies, and water users. In the case of Indiana, the response was new legislation—the Act.

Table 1. The common path states take during the development of water resource management programs. The cycle is often repeated in response to periodic droughts, flooding, or water supply crises.

NARRATIVE	ACTION
Everything is fine.	We have plenty of fresh water
Something is broken.	Shortage or contamination
Determine the threat.	Identify the causes and consequences
How does the State proceed?	Consider policy options, talk to everyone, seek consensus
Legislation or Executive Order	Define the responsibilities of the state and all water users
Program Created	Find leaders to carry out program and allocate funding
Collect useful data	Aquifer levels, stream flows, water withdrawals, precip, etc.
How are we doing?	Evolve based on quality, scope, effectiveness of first effort
Everything is fine.	We have enough fresh water when managed

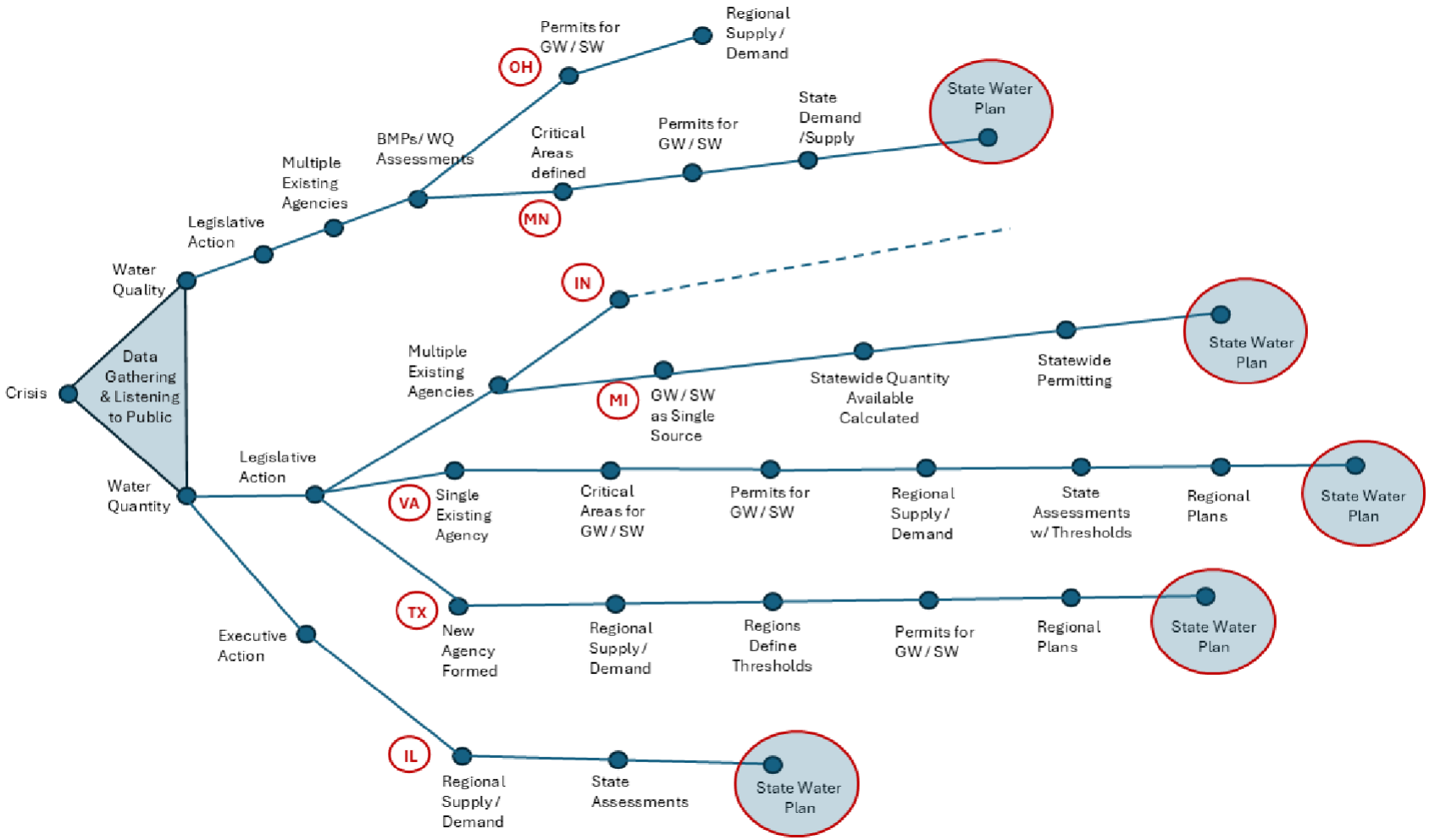


Figure 4. Paths taken by the surveyed states and the differentiating aspects of their water management journey.

Here is where the Indiana story leaves off. As shown in **Figure 4**, Indiana utilizes multiple agencies to manage the water resources of the state but hasn't determined what the next steps are or if they need to do more. As discussed, the Act provided agencies with authority to manage the water resources of the state. Some management tools, such as "restricted use areas" or determining statewide availability, have not been utilized. However, the state did begin the Significant Water Withdrawal Facilities database, which requires all significant water users to report their use.

3.1 Governance Structures

As we distilled the data collected from the state surveys, we identified the various governance decision points or dividing lines between the different programs (**Table 2**). These become the options or considerations that Indiana could discuss and reflect upon when deciding about water resource planning and management.

Section 1.2 discusses the differences between the water law landscape in the United States. As mentioned there, Indiana is considered an eastern riparian law state. However, because the state has been given the right to regulate reasonable use, some consider it *regulated* eastern riparian. In fact, the water code (IC-14-25) and the Great Lakes Compact outline specific ways the state can regulate or limit the withdrawals of water under certain conditions. In practice, however, water withdrawals are mostly unregulated within the state.

Other states, like Michigan, Minnesota, Ohio, Texas, and Virginia, utilize a permitting system (partial or full) to manage and regulate water withdrawals and are clearly regulated riparian water systems (**Table 2**). The details of the programs each of these states use are provided in Section 4; however, some characteristics are noted here that will provide insight into their differences and similarities.

Statutory authority vs. executive order – Illinois is the only state that was directed to do water supply planning from an executive order. All other states, including Indiana, were given authority to manage water resources from the legislature.

Authority to regulate withdrawals – All states, except Illinois, have been given the authority to regulate water withdrawals using a permit system. Ohio and Indiana (shown in gray in **Table 2**) have been given the authority to regulate in certain circumstances. For example, both can designate areas determined to be "restricted stress areas" (Indiana) or "groundwater stress areas" (Ohio), although neither has designated such areas. States like Virginia had very similar legislation and have had to designate "groundwater management areas" that are now regulated via permit.

New agency or integrated into existing agency/agencies – Texas is the only state that formed a new agency to manage water resources in the state. All the other states integrated the management authority into either one existing agency or expanded the authority of multiple existing agencies. Virginia, for example, gives all of the planning authority to the Department of Environmental Quality (DEQ). Indiana has given multiple agencies, such as IDEM, IDNR, and IDOH, expanded authority.

Regional planning with or without authority – Texas, Minnesota, Illinois, Virginia, and, in some ways, Indiana divide the state up into regions for the purposes of water resource planning. Texas, however, is the only state that gives decision-making authority to the regions. The other states

have designated regions that develop regional plans but no decision-making authority. Recently, Indiana has done some water availability studies on a regional basis; however, the regional aspect of the management is not legislated, and the entire state has not been completed.

Supply and demand planning – Texas, Illinois, and Virginia all have so-called bottom-up supply and demand planning. This means that the regions develop demand projections for the water users in the region. In the case of Texas and Virginia, these are then used by the state agencies to develop modeling scenarios for the regions. State agencies do the supply and demand planning in Michigan, Minnesota, Ohio, and Indiana. As mentioned, the Indiana IFA has completed regional supply and demand studies for parts of the state.

Stakeholder group representation – All states except Ohio and Indiana have regional planning groups comprised of stakeholders. Most states include local governments, water user groups, and other parties interested in their regional planning.

Table 2. Summary of differentiating characteristics of state water programs and governance.

		Regulation → Planning						
	Approach / Characteristic	**MI**	**MN**	**OH**	**TX**	**VA**	**IN**	**IL**
Water Law	Riparian				■		■	■
	Regulated Riparian	■	■	■		■		
	Prior appropriation				■			
Origin Story	Initiated due to drought				■	■	■	
	Initiated due to water shortages/anticipated growth		■	■	■	■		■
	Includes Great Lakes Compact	■	■	■			■	■
Mandate	Business/Economic Growth		■	■	■		■	■
	Sustainability		■			■		■
	Ecological health	■	■					
	Great Lakes Compact	■	■	■			■	■
Governance	Statutory authority to permit/regulate withdrawals	■	■	■	■	■		
	Statutory water management authority		■	■	■	■	■	
	Executive Order issued for water planning							■
	New agency formed				■			
	Existing environmental agencies assumed new authority	■	■	■		■	■	■
	Single agency has primary responsibility				■	■		
	Multiple agencies responsible	■	■	■			■	■
	Regional Authority (regions make management decisions)				■			
	Regional Planning (a region makes a plan)				■	■		■
	Bottom-up approach to supply/demand planning				■	■		■
	Top-down approach to supply/demand planning	■	■	■			■	
	Includes stakeholder groups	■	■		■	■		■

3.2 Decision Making

The differences in the state's governance structure provide a variety of decision-making tools and approaches to water resource management. **Table 3** provides a summary of the differentiators between the states, which is discussed below.

Program focus – Minnesota and Ohio are the only states that have a heavy focus on water-quality. Although all the other states have water-quality aspects to their programs, their primary concern is with water quantity. The concern has typically derived from drought and/or pressures from growth and development.

Surface water and groundwater treatment – Michigan and Minnesota are the only states treat surface water and groundwater as a single source, as an integrated system. The other states regulate and consider surface water and groundwater as separate sources. The rules and regulations surrounding the management of the sources are different and described separately.

Table 3. Summary of decision-making tools for the states surveyed.

Decision Making Tools / Approaches	MI	MN	OH	TX	VA	IN	IL
Approach primarily focused with water quantity / supply	■			■	■	■	■
SW and GW treated as a single resource	■	■					
SW and GW treated separately			■	■	■	■	■
Historical withdrawals grandfathered in	■			■	■		
Regional basis for planning		■		■	■		■
Water consumption versus withdrawal is considered	■		■	■	■		
Future water demand is estimated		■		■	■		■
Water availability is known or estimated	■			■			
Water availability limited by threshold (case by case)		■		■	■		■
Ability to designate Critical or Priority Management Areas	■	■	■	■	■	■	
Environment considered in planning				■	■		
Environmental flow limits exist	■	■		■	■		
High-Capacity Withdrawals must have a permit	■	■		■	■		
High-Capacity Withdrawals must be registered	■	■	■	■	■	■	■
Sustainability is defined by thresholds	■			■	■		■
Interbasin transfers are allowed	■	■	■	■	■	■	■

Regional basis for planning – Michigan is the only state with no regional planning. Ohio and Indiana have completed some regional planning assessments but do not have a statutory directive to complete the whole state (shown in gray in **Table 3**). All the other states have designated regions determined by the state. The regions in Texas and Virginia are required to develop regional water plans, which the state agency uses to build a State Water Plan on a regular cycle.

Water availability – Texas and Michigan have done availability analyses of their systems to determine the quantity of water available. This known or estimated availability is the basis for the limits imposed by the permit systems in place. On the other hand, Minnesota, Virginia, and Illinois do site-specific

analyses to determine if a system or new withdrawals are above the limit or threshold level designated. Permits in these states are approved or denied depending on the results of the site-specific analysis. In Ohio and Indiana, availability is known in some locations, but no thresholds have been determined. A threshold is a minimum flow level or a minimum groundwater level.

Critical or Priority Management Areas – All states surveyed, except Illinois, can designate critical or priority management areas. In most states, some locations have been designated. Indiana and Ohio, however, can designate these stress areas or critical locations but have not yet done so.

Environmental flow limits exist – Texas, Virginia, Minnesota, and Michigan are the only states that have designated low flow limits on streams. These limits provide a threshold for withdrawals that are regulated through a permit system. The minimum stream flows were determined by state agencies for each considerable stream in the state.

Permits/registration for withdrawals – Indiana and Illinois are the only surveyed states that do not require a permit for high-capacity withdrawals. In Ohio they require permits of large withdrawals only if the consumption exceeds an average of 2mgd over a 30-day period. All the other states issue permits for high-capacity withdrawals. Every state requires registration and reporting of water withdrawals.

3.3 Data Requirements

Data collection and analysis are required for any water governance framework; all states considered here allocate funds for ongoing monitoring, measurements, and analysis. The activities described in Section 2.3 highlight the breadth of data collection, analysis, and mapping activities conducted by the states in support of water governance and water management planning. Without these activities, water management fails to maintain an inventory of water availability or demand and cannot provide a clear dispute resolution process.

3.4 Summary of Considerations for Water Governance

While the analysis shown in the previous sections demonstrates how complex water governance can be, the considerations can be distilled into just six primary categories (**Figure 5**). The states studied have chosen from the options provided for each of these categories:

SCOPE OF GOVERNANCE – The scope of water governance falls within three major areas: quantity, infrastructure, and water quality. For water quantity, the focus is on managing significant water withdrawals, regional transfers, and risk management. Essentially, the focus is on managing water to avoid water shortages and prepare for drought.

GOVERNING BODY - The governing body of the water management programs can include creating a new agency, adding responsibility to an existing agency, or distributing the governance over a group of agencies.

GOVERNANCE TOOLS – Decisions are made by the states about how they want to handle the operational elements of regulating water. This includes use permits, allocations, regional plans, conservation, and use restrictions.

FUNDING SOURCE - The funding source controls much of the process of water governance. Without sufficient funding, any water management program struggles to collect the necessary data and/or

conduct investigations. The states we surveyed were funded by various sources, including state appropriations, permit fees, water-use fees, and state sales tax.

DATA COLLECTION – The states collect hydrologic and water use data, which is the basis of all the water management programs described in this report. As discussed in Section 2.3, the data sets are similar in each state but vary in quality and coverage.

ANALYSIS/INVESTIGATIONS – Using the data collected, hydrologic analyses and evaluations of water resources are done in each state. The typical investigations involve water availability, current and future water demand, climate impacts, minimum stream flows and aquifer levels, and determination of the impacts of withdrawals.

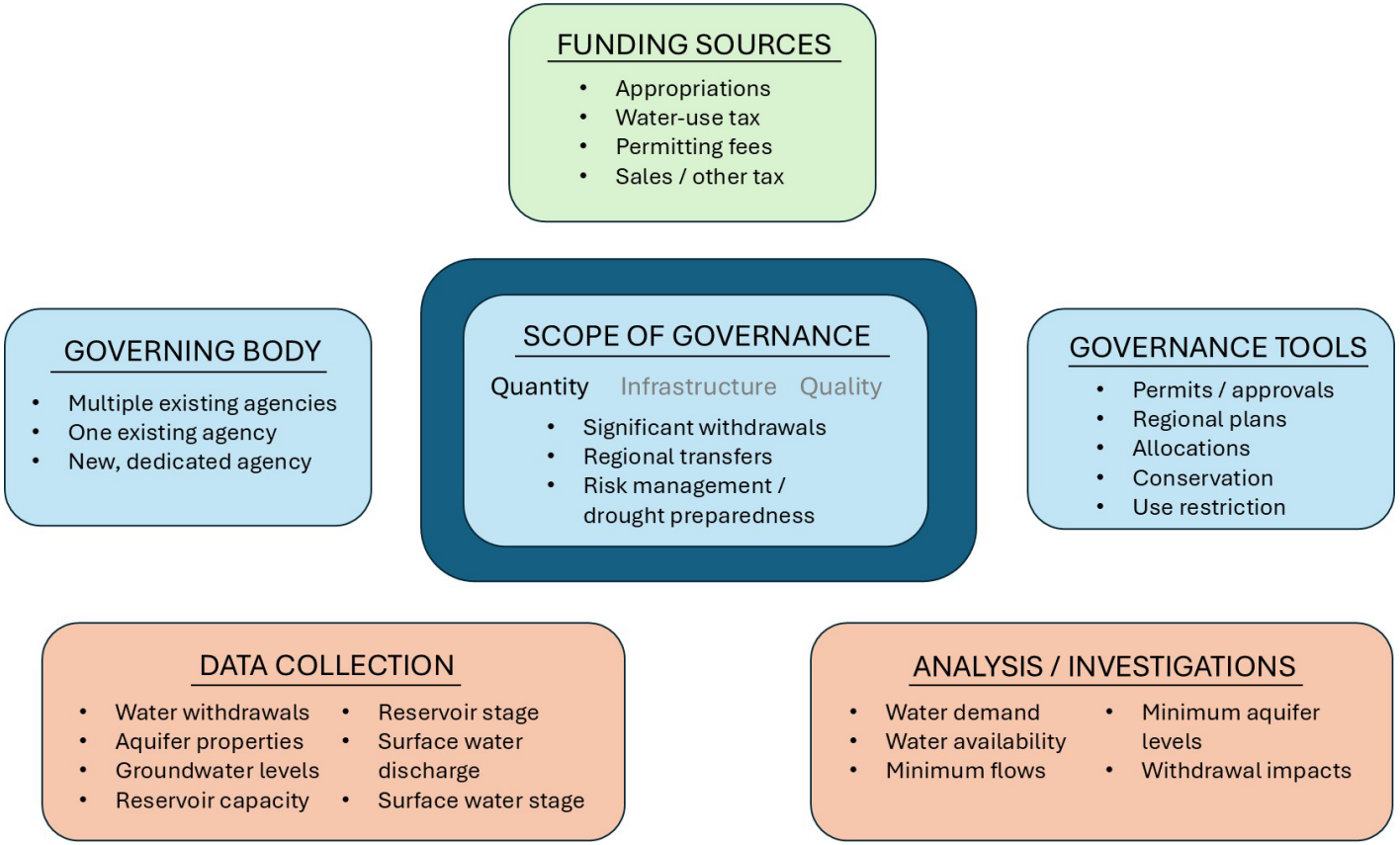


Figure 5. Summary of considerations for water governance from the six states surveyed.

4 State Case Studies

The following subsections provide summaries of our survey findings. The information is presented with similar organization and headings for ease of comparison.

4.1 Indiana

In Indiana, most of the modern era of water supply management began after the drought conditions in the late 1960s. In the summer of 1977, the state began its water management journey by establishing the Water Resources Study Commission, formed by Executive Order 11-77. The report, published after 3-years of work, was entitled "Indiana's Water Resource." It was released in two volumes. The first section outlined the general plan of study as follows:

> *"The course of investigations was divided into two phases. The first phase included the: 1) development and implementation of a strong public involvement program; 2) determination of the availability and quantity of the water resource of the state, including surface, groundwater and atmospheric water; 3) assessment of the nature, development and use of water in the state; 4) an inventory of the development and use in the state; 5) projections of the needs for water for all purposes for a period extending to the year 2000; and 6) compilation of existing water resource policies, laws institutions, and management programs at both the state and local levels, together with applicable existing federal policies, laws, institutions and programs as they relate to the ability of state and local governments to solve water resource problems.*
>
> *The second phase was an implementation plan. It included an 1) analysis of water resource availability and quantity versus present and projected water uses and needs to the degree necessary to define the general nature and types of actions and measures necessary to meet those needs; 2) analysis of the adequacy of existing state and local policies, laws, institutions, and programs, considered in the light of federal aids or constraints, to address defined problems; and 3) development of recommendations for new and / or amendatory policies, laws, institutions, and programs to provide an effective water program in Indiana."*

The Water Resources Study Commission worked for more than five years after the new reservoirs had been constructed in Southern Indiana and drought conditions from the 1960s were fresh in the public's mind. At this time, the state was calling for reform of Indiana's antiquated riparian water law. The new law drafted after these reports was the Water Resources Management Act of 1983 (Act) (IC 14-25). However, over the next 20 years, as this program was beginning to be implemented, support for the new water statute waned as Indiana struggled to balance the need for water resources against the cost of protection and management. As a result, many of the provisions outlined within the Act were not fully engaged or implemented, although the authority to do so remains.

4.1.1 Program Focus

Indiana has focused on issues that improve the efficiency of water utilities, including regionalization of drinking water systems, asset management to maintain existing operations, and making available low-

interest funds to develop new infrastructure. From a water supply perspective, investments have been made to monitor and assess groundwater and surface water availability for the benefit of all users.

The state of Indiana has a functional distribution of responsibilities among the state agencies: the Indiana Department of Natural Resources (DNR) maintains drilling logs of all water wells in the state, and they maintain a water use database to respond to any concerns about the impacts of new water supply development on existing homeowner wells. The Indiana Department of Environmental Management (IDEM) is responsible for source water protection, drinking water quality, and regulating discharges into the waterways from wastewater treatment plants. IDEM also regulates and manages contaminated sites where spills have polluted groundwater resources. The Indiana Department of Health (IDOH) focuses its attention on homeowner wells and domestic water users so they can protect their water quality with bacteriological sampling. The IDOH protects more than 1,000,000 Hoosiers who use their own domestic wells to access water resources from their property. The IFA responds to the need for integrated information among river basins where new water development will likely occur. The academic research needs of the state are addressed by the universities and research institutes, including the Purdue Water Center, Indiana Geological and Water Survey (IGWS), and Indiana University O'Neil School.

Beyond the state agencies and research institutions, Indiana empowers regional river basin commissions that include elected officials and stakeholders who evaluate conditions in the basin to manage water quality and water availability for landowners in their watersheds. These include the Kankakee Basin Development Commission, the St. Joseph River Basin Commission, the Maumee River Basin Commission, and the Upper Wabash River Basin Commission.

4.1.2 Program Structure

Currently, the structure of the state's water policy is organized along functional lines. The primary agencies identified above (IDNR, IDEM, IDOH, and IFA) have their own general role in the development of water resources as follows:

- IFA – Coordination and orchestration of regional water availability investigations and infrastructure funding from the federally supported State Revolving Fund (SRF).
- IDNR – Water rights, water quantity, water shortage, storage/dam safety, flooding.
- IDEM – Water quality, Clean Water and Safe Drinking Water Act regulations.
- IDOH – Domestic homeowner well water quality and domestic well/septic testing.
- IGWS – Research on the hydrogeology of the State.
- Purdue Water Resources Research Center – Funds research and serves as a resource and education center for water resource issues.

4.1.3 Staffing and Coordination

With an executive order in January 2025, the governor of Indiana added the Office of Energy and Natural Resources with a cabinet secretary to oversee the new office. Existing agencies that play a role in water management, specifically IDEM, DNR and the Natural Resources Commission, will report to the

Office of Energy and Natural Resources (among others). The following describes the agencies staff and water management role.

IDEM – The State Department of Environmental Management has approximately 900 staff to implement the various state and federal programs in its portfolio.

DNR – The Division of Water within the State DNR includes about 50 full-time staff. Some of the staff focus on some aspect of hydrology (flooding), water use, or flow and level information produced by a network of monitoring systems distributed across the state.

IDOH – The state Department of Health has approximately 800 staff, including IDOH offices in most of the 92 state counties. Less than 10% of those work on water-related topics, but their laboratories and field staff are engaged in protecting private water supplies from common bacterial and chemical pollutants across the state.

IGWS – The state Geological and Water Survey is one of the oldest agencies in the state. More than 50 people work in this university-affiliated agency located on the Indiana University campus in Bloomington. Of these employees, less than half work on water resource-related projects, and most of these are focused on the hydrogeology of the systems.

IFA – IFA is a very efficient office that employs around 30 staff. They have used consulting support and other agency staff to help manage regional studies to estimate water availability, water demand, and regional water infrastructure in the state.

4.1.4 Fiscal Commitment

The state has limited its appropriation of funds to a few programs that have public support and provide value to the public, the utilities, and all other water users in the state. Based on the staffing estimates listed above, the state (excluding the SRF) spends several million dollars a year managing water resources and working with regional stakeholders.

4.1.5 Data Collection and Mapping

Indiana has several water resource data collection initiatives occurring within different agencies. The IGWS has a state-wide mapping program that installs wells and describes the hydrogeology of the rocks and sediment that compose the aquifers of the state. The IDNR has a set of groundwater level data collected in dedicated monitoring wells to resolve disputes among water users. The IDEM has monitoring wells that collect water quality and level data that is not directly integrated into the multi-agency state system because it may be proprietary. Local governments have begun collecting their own data (Hamilton and Morgan Counties) to track groundwater levels through drought conditions with greater spatial resolution. For the past five years, the IFA has been methodically working with consultants to define regional water availability in various basins.

Indiana's Water Management Act requires the DNR to collect surface water and groundwater withdrawal data. These data have been collected since 1985 and include the estimated monthly withdrawals for all wells or surface water diversions capable of withdrawing more than 100,000 gallons per day (gpd).

4.1.6 Water Resource Management Act of 1983 (IC 14-25)

The sections above describe the current structure of the water governance in Indiana, however, as previously mentioned there are parts of the Water Resource Management Act of 1983 (Act) (IC 14-25) that have not been implemented but still provide the Natural Resources Commission (Commission) the tools with which to manage the water resources for the state.

In general, the Act declares that water is a natural resource that is subject to control and regulation for the public welfare as directed by the general assembly. Some aspects of the Act are fully implemented, for example, annual water reporting by significant water withdrawal facilities and DNR investigation and remediation of impacts to homeowner wells or private freshwater lakes from significant withdrawal facilities.

The Act gives the IDNR the ability to designate certain areas as "restricted use areas" where groundwater withdrawals exceed recharge. Within such a designated area, existing or new withdrawal facilities wishing to increase their withdrawal must apply for permission (a permit) from the DNR. To our knowledge, the DNR has never designated a restricted use area or required water withdrawal permits.

The Act also allows for injection of potable water into an aquifer with a permit. Injection of purified water into an aquifer, often called managed aquifer recharge (MAR) or Aquifer Storage and Recovery (ASR), provides additional storage for water users and another way to manage water resources, especially during times of drought or shortage. Although done in other states, Indiana has not yet developed requirements for water to be utilized in this way.

4.2 Illinois

The State of Illinois is in a unique situation with regard to understanding a state's water resources. In the late 1800s, Illinois established two research agencies dedicated to improving the state's understanding of its water and mineral resources: the Illinois State Water Survey (ISWS) and the Illinois State Geological Survey (ISGS). These two agencies have compiled decades of data and analyses on Illinois' surface water and groundwater resources. As a result, the Surveys' data, services, and expertise provide a firm technical basis to assist the people and policymakers of Illinois in making sound water supply planning decisions that many states do not have.

4.2.1 Origin story

Regional water supply planning in Illinois formally began with the Governor's Executive Order 2006-01. The Order specifically called for:

1. the definition of a comprehensive program for state and regional water supply and management and development of a strategic plan for its implementation,
2. the establishment of a scientific basis and an administrative framework for implementing state and regional water supply planning and management,
3. the development of a financial package and technical support for, and encouragement of, locally based regional water supply planning committees organized for participation in the development and approval of regional plans in the Priority Water Quantity Planning area, and

4. the initiation of Regional Water Quantity Plans for at least two Priority Water Quantity Planning areas.

Based on previous studies by the ISWS outlining potential supply problems across the state, two priority planning areas, a nine-county area in northeastern Illinois and a 15-county area in east-central Illinois, were chosen to initiate the pilot planning program (**Figure 6**). Regional water supply planning groups (RWSPGs) representing a wide variety of public and private interests were created for each area (**Table 4**). State funding was provided for plan development by each RWSPG and for technical support from the Illinois Department of Natural Resources (Office of Water Resources) (DNR-OWR), the ISWS, and the ISGS.

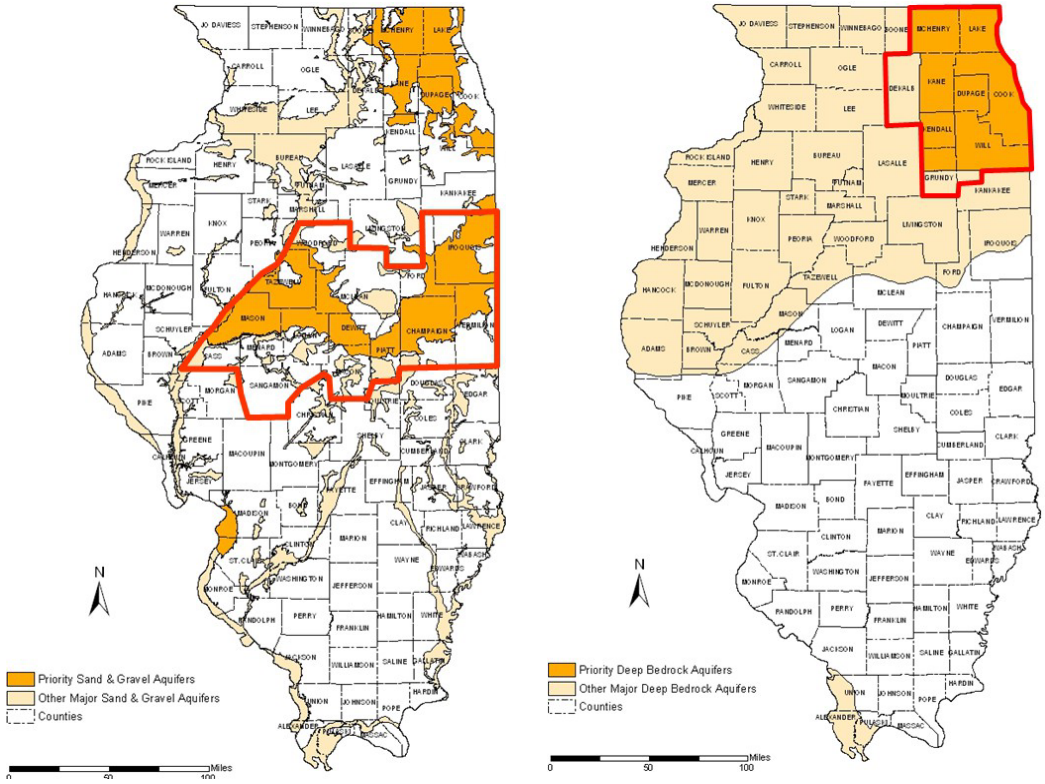


Figure 6. Illinois' initial Priority Water Supply Planning areas pursuant to Governor's Executive Order 2006-01. (a) 15 counties overlying the Mahomet Aquifer in East Central Illinois and (b) 9 counties overlying the deep bedrock in Northeast Illinois.

Ten planning areas now cover the state (**Figure 7**). Regional reports by the stakeholder committees were completed for the East Central Region in 2009, the Northeast Region in 2010, the Kaskaskia River Region in 2012, the Middle Illinois Region (2021), and the Rock River Region (2023). Technical studies summarizing projected water demand and resource availability have been completed for all those, plus the Lower Illinois and American Bottoms Regions. Work is underway for the Big Muddy River Region, leaving the Southern Illinois, Wabash/Ohio River, and Spoon/LaMoine River Regions to get started.

Table 4. Illinois stakeholder constituencies for three regional planning

Constituency	East-Central	Northeast	Kaskaskia Basin
General Public	X	X	X
Agriculture	X	X	X
Soil & Water Conservation Districts	X	X	X
Environment	X	X	X
Small Business	X	X	X
Industry	X	X	X
Electric Power Generation	X	X	X
Water Authorities*	X		X
County Government	X	X	
Municipal Government	X	X	X
Water Utilities	X	X	
Real Estate & Development		X	
Wastewater Treatment & Nonmunicipal Supplies		X	
Recreation			X
Navigation			X
Farm Bureau	X		X

*The Illinois Water Authorities Act of 1951 established a means of reviewing potential water conflicts before damage to any person is incurred and to establish a rule for mitigating water shortage conflicts. The Act was primarily established to assist the city of Effingham to develop a reservoir and the infrastructure to supply water to the Effingham residents. Since then, Authorities have been created for a variety of purposes, including the sale of water, the development of aquifer management plans, and, in many cases, by rural landowners organized against industrial and municipal users interested in developing rural high-capacity well fields for non-irrigation purposes.

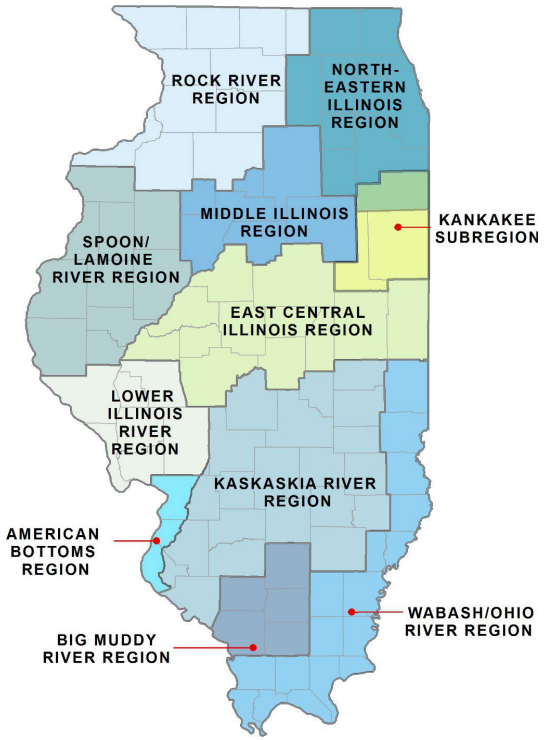


Figure 7. Illinois' eleven regional planning areas.

4.2.2 Program Focus

The planning process principally focuses on groundwater and surface water quantity through an assessment of the ability of water resources to meet projected demand, the impacts of meeting demand, and recommendations for options to address supply issues that arise when supplies cannot

meet expected demand. In the Kaskaskia River Region Basin report, IDNR-OWR succinctly outlines their charge to the RWSPGs as follows:

DNR-OWR granted state funds for each RWSPG to provide future water demand scenarios for the year 2050 for their respective regions. Why the regional groups? The RWSPG members have the best information regarding economic plans, future development, and ideas about growth for their region in the future. These growth plans and ideas for the future will require water supply. Because all water resources available for development have a finite capacity for supply, it is left to the planning regions to recommend how best to accommodate the future water supply demands from a regional point of view. The development and finalization of water demand scenarios is the primary objective for the regional planning group desired by DNR-OWR. DNR-OWR strongly suggests that this problem must be defined before meaningful solutions can be proposed.

Fundamentally, this is a water supply and demand study. Any other water issue(s) that the regional planning group may decide to examine is at its discretion.

DNR-OWR expects each RWSPG to take responsibility for ensuring the success of the planning process outlined in the Executive Order. Success with the bottom-up water supply planning process depends on the RWSPG members. This is the opportunity for local leaders, thinking regionally, to take responsibility for the success or failure of preparing a reasonable, logical plan for meeting future growth of water demands.

Each RWSPG is responsible for findings, decisions, or recommendations in a water supply plan that represent general consensus and are in the best interest of the entire region.

> *At the end of the planning period, DNR-OWR expects the regional planning group to develop a document, a regional water supply plan, that describes the water supply and water demand issues of the region. Definition of and possible solutions to issues related to the probable areas of "water supply conflict or areas of water supply deficit" will be at the discretion of the regional planning group. The Executive Order indicates the overall planning effort should be consistent with existing laws, regulations, and property rights.*
>
> *DNR-OWR suggests that the regional plan contain, but is not limited to, the following principal components:*
>
> > *A description of the planning region's currently available and possible future water supply. This section would draw extensively from the work done by the State Water and Geological Surveys in support of this initiative and include, as appropriate, their documents and deliverables.*
> >
> > *A description of the planning region's water-demand scenarios. This section would draw extensively from the technical work done for consideration by the RWSPG. Technical products should be included as appropriate in this section or as an appendix.*
> >
> > *A description of the water supply deficits or conflicts as found by work of the State Water Survey. Regional planning group findings regarding these conflicts should be included.*

> *A description or listing of possible options for water supply/demand management as determined by the RWSPG to meet the future water needs. Technical and scientific support may be requested as needed from the SWS, SGS, CMAP / MAC, and DNR-OWR. This component should include any preferred option or recommendation and accurately reflect the desires and general consensus of the RWSPG.*

> *It is anticipated that additional planning and water quantity studies will occur in subsequent planning cycles in these regions as well as in other priority water quantity planning regions of the state. The ultimate goal is an integrated mosaic of regional water supply plans, appropriate for each region, that will guide planners and water supply entities in taking appropriate courses of action to provide and assure adequate water supply of clean water at reasonable cost for all of Illinois' citizens.*

While not explicitly stated in this charge, it was understood that the planning process would not focus on capital (infrastructure) projects. Neither would there be effort extended toward recommendations aimed at changing the existing governance structure for water supply planning and management. Rather, it was desired that recommendations would be designed to be implemented by a variety of stakeholders within the existing institutional water supply planning and management structure and regional plans would depend entirely on action and cooperation among those entities identified by their recommendations.

4.2.3 Program Structure

Illinois has taken a tiered approach to water supply planning:

Tier 1. Takes a statewide view to identifying potential problem areas. For example, an ISWS report comparing groundwater use to aquifer potential yield (Wehrmann et al., 2003) showed deep aquifer withdrawals in northeast Illinois greatly exceeded aquifer yield, leading to the designation of that area for priority planning.

Tier 2. Uses a regional approach where local stakeholders (RWSPGs) provide recommendations to address gaps between projected water demand and available water resources. Illinois' eleven regional planning areas (**Figure 7**) form the basis for this level of assessment. Technical support for demand projections and water resource availability is provided by the state.

Tier 3. Takes a deeper dive to address specific local supply vs. demand issues not addressed at the regional level. This level is not typically funded by the State, but rather by local funding such as by a county, municipality, or utility. Data, information, and models assembled at the regional level provide a basis for more in-depth analysis. For example, two utilities in east-central Illinois provide funds to the ISWS to operate an observation well network to monitor aquifer water levels in the aquifer they use.

4.2.4 Staffing and Coordination

The IDNR-OWR coordinates the regional planning activities, including selecting a local agent to receive state funds for the RWSPG meetings and report compilation and the ISWS for expertise and RWSPG technical support. No new agency was created. The water supply planning program is managed by a single member of the IDNR-OWR Engineering Study Section. The Executive Order that initiated the planning program was purposefully written to operate within the existing authorities of the IDNR-OWR and State Surveys. No new powers were extended to these agencies.

4.2.5 Fiscal Commitment

According to our interview with the DNR-OWR program manager, the state provides $750,000 - $1,000,000 annually for water supply planning. Funding stability has been a concern since the program was initiated in 2006 but has been relatively stable over the last decade.

Most of these funds are awarded to the ISWS for technical water supply studies, including surface water assessments of stream flow, reservoir capacity, and groundwater models. In addition, ISWS funding supports the Illinois Water Inventory Program (IWIP) which collects statewide annual water use data for all users withdrawing 100,000 gpd or more.

Funds also go to the entity, agency, or consultant coordinating the RWSPG meetings and report preparation. The regional planning process starts with a Request for Proposals (RFP) sent out by DNR-OWR to local agencies and consultants interested in coordinating a stakeholder planning group, holding planning group meetings, and writing a report containing the elements outlined in their charge to the RWSPG. Examples of local entities that received DNR-OWR funding for RWSPG coordination include the Chicago Metropolitan Agency for Planning (for Northeast Illinois), the Mahomet Aquifer Consortium (for East-Central Illinois), and the Heartlands Conservancy (for the Kaskaskia River Region).

A lack of sufficient funding has hampered RWSPG continuity throughout most planning regions. As a result, planning recommendations are not consistently followed. However, in some cases, technical studies showing supply deficiencies have resulted in action by those affected. A prime example is the Joliet area in northeast Illinois, where it was found that their sandstone aquifer source would not keep up with projected future demand. After considering all available sources, the city decided to switch source water to Lake Michigan; five neighboring communities have joined Joliet, and a major pipeline project is under construction for completion in 2030.

4.2.6 Data Collection and Mapping

Data collection and mapping needs are typical for what would be expected for any water resource assessment. These include:

- Groundwater-level data are continually collected by the ISWS from a statewide network of approximately 113 active observation wells. Historical data on 127 inactive observation wells are also available. Of the active observation wells, 49 are equipped with continuous water-level recorders. Groundwater levels in the remaining wells are measured monthly.
- Aquifer hydraulic properties.

- Surface water stage/discharge.
- Reservoir capacity/stage
- Water withdrawals by major user groups (public supply, industrial & commercial self-supplied, agriculture & irrigation, power generation) - statewide water use data is collected through the IWIP initiated in 1978. Data is available to the public on request (i.e., not online). Industrial/commercial data is considered proprietary and is only provided in aggregated form (such as all self-supplied industrial/commercial withdrawals per township).
- Geologic well logs – well logs are available online at the ISGS' ILWATER website.
- Precipitation.
- Population.
- Maps of aquifer boundaries and thicknesses.
- Maps of aquifer potentiometric surfaces.

4.2.7 Illinois Sources

Chicago Metropolitan Agency for Planning. 2010. Water 2050. Northeastern Illinois Regional Water Supply/Demand Plan. NE-IL-Regional-Water-Supply-Demand-Plan.pdf

East Central Illinois Regional Water Supply Planning Committee. 2009. A Plan to Improve the Planning and Management of Water Supplies in East-Central Illinois ECI-WaterPlan_062909.pdf

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4.3 Ohio

4.3.1 Origin Story

On August 2nd, 2014, half a million residents of Toledo, Ohio, awoke to urgent warnings not to drink or use their tap water. The cause of the warnings was the presence of toxins from a harmful algal bloom that was mixed into the water column by wind and waves as it moved toward the treatment plant intake for the City of Toledo. The plant's capacity to treat microcystin concentrations was overwhelmed. The primary cause of the algal bloom of blue-green cyanobacteria growth in western Lake Erie was phosphorous runoff from the agricultural and suburban basins that drain into the Lake. The State of Ohio needed to change its approach to water management.

For the next few years, the state environmental and natural resource agencies focused on a regulatory approach that failed. Given the problem and the land use in the watershed, the agricultural community, the growers who use the fertilizer, had to be active participants. Everyone needed to work for the same outcome–clean water.

4.3.2 Program Focus

Three agencies are leading different elements of the effort to manage the resource and protect water quality in the state. The Ohio Environmental Protection Agency (OEPA), along with the Ohio Department of Agriculture (ODA) and the Ohio Department of Natural Resources (ODNR), is working to reduce nutrient runoff from farm fields and to limit the residuals in the soil that, in some watersheds, becomes a legacy pollutant. Because of its role in photosynthesis, excess phosphorus in a stream or lake can accelerate harmful algal blooms (HABs) like the one in Lake Erie. Consequently, the State is working with farmers to make sure they are using best management practices that are science-based to reduce nutrient runoff and improve water quality. ODNR is helping to create and restore wetlands to help maintain their ability to act as natural filters statewide. Meanwhile, the OEPA is working to track the loads to the stream as a part of their responsibility under the Clean Water Act.

Separate from the work focused on water quality, in 2024 the OEPA initiated its first regional water planning and infrastructure study in Central Ohio. It plans to do the remaining four regions in succession over the next few years. The regional study evaluated the existing water and wastewater infrastructure to accommodate the future demands of growth, development, and climate variability. The outcome of the study is an online tool that shows potential gaps and can help counties, utilities, and local governments evaluate their infrastructure needs. The tool can also aid in regionalization and cooperation between entities. The project was funded in partnership with the Ohio Water Development Authority (OWDA) and managed by the OEPA.

The ODNR manages the water-use reporting program. All high-capacity water users need to report their use, and permits are needed for some specific withdrawals, including:

- diverting more than 100,000 gpd out of the Ohio River watershed into another basin.
- new or increased consumptive use of more than an average of two million gallons of water per day in any 30-day period.

- new or increased consumptive use totaling more than five million gallons per day from the Lake Erie drainage basin. To obtain a permit a steady state groundwater model analysis is also required.

4.3.3 Program Structure

A multi-agency program was developed by the State to respond to the water-quality problems in Lake Erie. The agencies that had significant roles in the effort included the ODNR, the Ohio State Department of Agriculture (OSDA), the OEPA, and the OWDA, all of whom provided special funding to perform their roles in the state. In addition to the BMPs being implemented for agriculture and wetlands restoration, the OWDA supplies funds for infrastructure, especially in the northwestern part of the state, and the OEPA provides funds for treatment plants for drinking water systems. As the program developed, the state coordinated with the Ohio Lake Erie Commission to better track progress.

4.3.4 Staffing and Coordination

Additional staff have begun implementing new water quality strategies, but these new positions are distributed among the water-connected agencies. The H2Ohio public-private-non-governmental organization approach is a novel initiative that coordinates the actions of stakeholders and holds the state accountable. Each agency has been forced to innovate and re-think how to administer water quality programs. The State has changed the problem of water management and water quality improvement as an opportunity to reorganize the work by watershed. These newly identified DOA watershed managers will help track changes in each basin.

The ODNR, Division of Water Resources manages statewide oversight of dams, levee, floodplains, and the collection and management of data related to the state' water resources.

4.3.5 Fiscal Commitment

In a statement from the Governor in 2020, Mike DeWine thanked the Ohio General Assembly for investing $172 million in the H2Ohio Initiative, a comprehensive, data-driven effort to address Ohio's water challenges, as well as the support from numerous communities, nongovernmental groups, businesses, and universities to implement the program. That investment was more than $100 million in subsequent years.

4.3.6 Data Collection and Mapping

All data collection and mapping efforts are managed by the ODNR, and include:

Ohio Groundwater Observation Well Network – long-term monitoring of groundwater levels in northeast Ohio by the Division of Geological Survey.

Water Well Database – Well records for almost 900,000 water wells drilled in Ohio. The records contain well logs or well-sealing reports for any well drilled. The division of the Geological Survey maintains the database.

Water Withdrawal Facilities Database – Established in H.B. 662 by the Ohio General Assembly in 1988, it implements one of the objectives of the Great Lakes Charter in Ohio. Water withdrawal facility

registration is also a requirement of the Great Lakes Water Resources Compact. Section 1521.16 of the Ohio Revised Code requires any owner of a facility, or combination of facilities, with the capacity to withdraw water at a quantity greater than 100,000 gpd to register such facilities with the ODNR, Division of Water.

Water Withdrawal Atlas – Shows how and where water is used in the state and water withdrawals by water-use sector annually by county, by Hydrologic Unit Code 8 (HUC8) basin, and statewide.

In response to the nutrient-driven blue-green algae bloom, additional land and water data are being collected to better understand the effect of new agricultural practices and existing hydrologic conditions on water availability in the state. In addition, the state universities are engaged in specific research and development that may lead to new ways to track change in the state's basins.

4.3.7 Ohio Sources

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Correspondence with Brad Lodge, Program Manager, Division of Water Resources, Ohio Department of Natural Resources (ODNR). December 2024 through January 2025.

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4.4 Michigan

Water rights in Michigan are subject to the reasonable use doctrine and correlative rights rule. The reasonable use doctrine allows a landowner to use groundwater beneath their property and surface water adjacent to their property if it does not interfere with the rights of reasonable use of neighboring landowners, decrease the value of their land, or unreasonably impair water quality. As in other riparian states, it is the burden of the State to define reasonable use. The correlative rights rule requires that during water shortages, water use must be prorated among all users.

4.4.1 Origin Story

Michigan and the other Great Lakes states and Canadian provinces have enacted laws to regulate water use within the Great Lakes Basin. In accordance with the Great Lakes Basin Water Resources Compact, the laws manage the groundwater and surface water resources within the Great Lakes Basin and prohibit water diversions from the Basin. In Michigan, it took eight years to fully develop, legislate, and implement the water management process.

In 2001, the Great Lakes governors and premiers signed a non-binding agreement known as the Great Lakes Charter Annex 2001. The Annex calls for coordinated standards to guide water use decisions to protect and enhance the Great Lakes ecosystem. Of the Great Lakes States, Michigan is unique in that nearly the entire state is part of the Great Lakes Basin. In response to the Annex, Michigan began a

deliberate, thoughtful and rational process to manage the water resources of the state through regulation of water withdrawals.

The Great Lakes Conservation Task Force was created to recommend policy changes to the legislature that would improve the Great Lakes ecosystem. In 2002 the Task Force recommended the enactment of comprehensive water withdrawal laws. In response to the Annex, the recommendations of the Task Force, and local groundwater shortages, the State began enacting legislation in 2003. In particular, one Public Act created the Groundwater Conservation Advisory Council to study the sustainability of the States's groundwater use and monitor the implementation of Annex 2001.

In 2005, the Great Lakes governors signed the Great Lakes Basin Water Resources Compact. The Compact established the decision-making standard to evaluate proposed water uses within the Great Lakes Basin. In 2006, Michigan Public Acts 33 through 36 began the process of implementing the provisions of the Great Lakes Charter, including taking the following steps:

- Required the Groundwater Conservation Advisory Council to develop an assessment tool to evaluate proposed water withdrawals and determine if they will create an adverse resource impact.
- Prohibited withdrawals causing adverse resource impacts to designated trout streams.
- Established a permit requirement for some large quantity water users.
- Required each water use sector to design water management practices and conservation measures.
- Authorized large quantity of water users within a watershed to form a Water Users Committee to facilitate any situation where a withdrawal is determined to cause an adverse resource impact.

In 2007, the Advisory Council's final report was submitted to the Legislature. The report outlined a water assessment process that defined adverse resource impacts caused by water withdrawals, included an automatic screening tool for assessing impacts, and required site-specific analysis of withdrawals that could create adverse impacts. The responsibilities of the Council were then transferred to the state DEQ, which was later renamed the Department of Environment, Great Lakes, and Energy (EGLE).

In 2008, a series of Senate Bills were passed implementing the Compact and the water management and regulation process initiated by the Advisory Council. The Water Use Program of EGLE is currently responsible for registering large quantity withdrawals, collecting annual water use data, making determinations on the potential impacts to water resources due to proposed withdrawals, and processing water withdrawal permits. The information managed by the Program provides an environmental baseline for the integrated management of water resources in the state and strengthens the legal basis for opposing unwarranted diversions of Great Lakes water.

4.4.2 Authority and Structure

Michigan's Water Use Program is housed in EGLE but is jointly administered by the State's three Quality of Life Agencies: The Michigan Department of Agriculture and Rural Development (MDARD), the EGLE, and the DNR. MDARD was formerly known as the Department of Agriculture, and EGLE was formerly the

DEQ; the basic administrative responsibilities and structures of the agencies have not changed. The Agency Directors are appointed by the Governor, subject to legislative confirmation. The Directors lead a staff of non-partisan professionals.

The success of the Water Use Program depends on the cooperation and interaction of the three agencies and partners: EGLE administers and enforces the program, DNR conducts research and provides data on stream characteristics and fish habitats, MDARD collects water usage information and resolves conflicts for the agricultural users. In addition, universities, the Michigan Geological Survey, and the U.S. Geological Survey (USGS) conduct research, collect and analyze data, and create and review models to inform water use analysis. Stakeholders make recommendations for needs and program improvements and assist in outreach efforts.

In the past, temporary advisory councils were convened for specific purposes and disbanded when their work was concluded. In 2018, the Water Use Advisory Council (WUAC) was created as a permanent body and charged to report biennially to the Legislature, EGLE, DNR, and MDARD. Reporting includes recommendations and funding requests to improve the Water Use Program through data collection and analysis, modeling, research, education, and outreach. The WUAC is appointed by the Governor, the Speaker of the House, the Senate Majority Leader, and the Director of EGLE. Council members represent business, agriculture, utilities, conservation and environmental groups, lakes and streams associations, local governments, state agency staff, technical advisors from universities, state and federal agencies, and industry professionals. The WUAC makes its recommendations by consensus, holds meetings in accordance with the Open Meetings Act, and publishes its materials on a publicly accessible website.

Funding for the Water Use Program comes from several sources, including State General Fund appropriations, State Restrictive Funds, Information Technology funding, license fees, water use reporting fees, and federal funding sources. The WUAC also requests that the legislature fund the recommended improvement activities. The WUAC funding recommendation for Fiscal years 2023 and 2024, requested in 2022, was $7.2 Million.

4.4.3 Water Withdrawal Assessment Process

Michigan's assessment process regulates new or increased large-quantity withdrawals from any source to prevent Adverse Resource Impact on streams. The approach is scientifically based on the ecological impacts of reduced streamflow and is explicitly quantitative. The process is built around a stream classification system consisting of eleven possible habitat types assigned to all streams in the state (**Figure 8**). Expected fish communities are defined for each classification, and fish community responses to changes in streamflow were modeled for each stream type. The fish response models were used to determine and define in statute the maximum withdrawals allowed for each stream type as a percentage of an Index Flow, representative of low flow conditions in the stream. The maximum allowable withdrawal defines the onset of Adverse Resource Impacts.

To assist in regulating withdrawal and processing applications, an online screening tool (the Water Withdrawal Assessment Tool (WWAT)) was developed to estimate the impact of withdrawing water near any stream in the state on stream ecosystems. If the WWAT indicates that adverse impacts of a proposed withdrawal are not likely, the user proceeds with registering their withdrawal without further

contact with the EGLE. If the WWAT indicates there is an increased likelihood of an adverse impact due to a proposed withdrawal, the user is referred to the Water Use Program, which conducts a more detailed, site-specific assessment.

The Water Withdrawal Assessment Tool—along with water use reporting—is the cornerstone of water management in Michigan. While the tool is regulatory in nature, it streamlines the registration of water users and maintains records of withdrawals throughout the state. The ecological and hydrological studies and analyses that went into developing the tool define water management in the state.

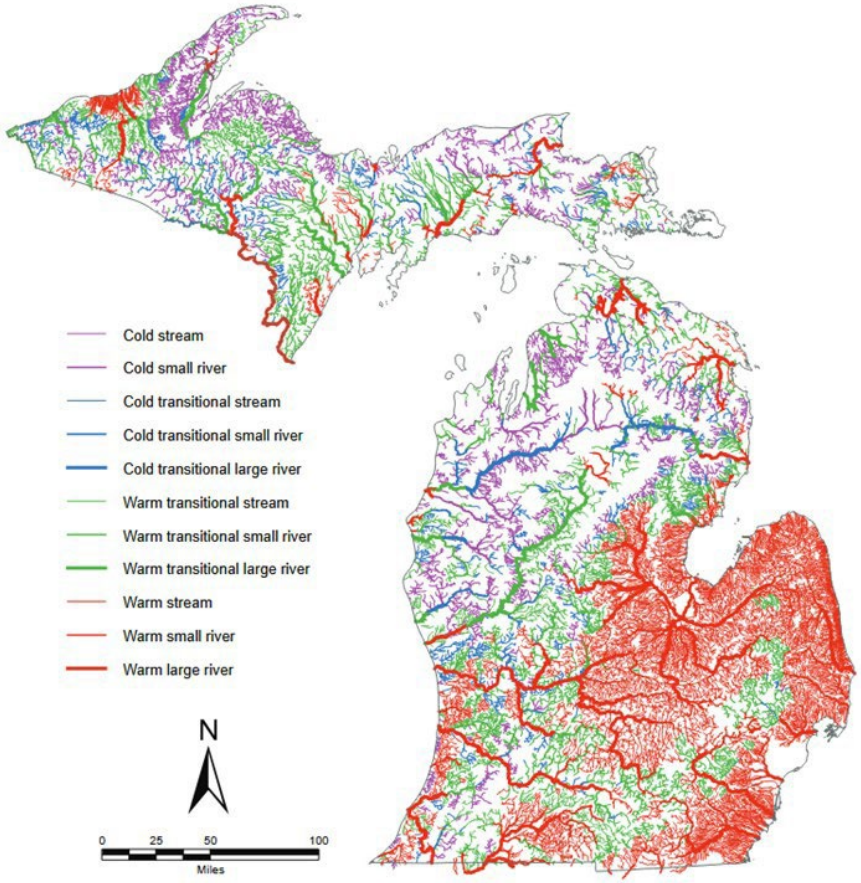

Figure 8. Ecological classification of Michigan's streams into 11 categories. From Zorn, et. al (2008).

4.4.4 Components of the Assessment Process

The development of each aspect of the assessment process was science-based, included public and stakeholder input, and the results were incorporated into legislation. Development of the process included the following components, all of which relied on the work of expert surface water hydrologists, groundwater hydrologists, and fisheries biologists in the state:

Delineation of Water Management Areas (WMAs) based on ecological stream classification. The state was divided into WMAs defined by similar stream properties using a Geographic Information System

(GIS) approach. The state is divided into over 4500 WMAs whose boundaries correspond to watershed boundaries.

Evaluating an Index Flow for all Water Management Areas. The impact of withdrawing water from a WMA is measured against a standard or Index Flow representing some measure of baseflow in the stream. By state statute, the Index Flow is defined as the median flow for the lowest summer flow month.

Statewide Streamflow Model. Index Flows can be evaluated by standard hydrologic methods for WMAs that include a long-term continuous record streamflow gage. Unfortunately, the USGS only maintains 147 streamflow gages in the state suitable for this purpose. A streamflow model was developed to extrapolate Index Flows from gaged to ungaged sites using the multiple linear regression method. The streamflow model was used to estimate Index Flows for all ungaged river segments in the State.

Defining fish assemblage types for all stream segments in the state. A fish assemblage classification system was applied to each WMA stream segment by fishery biologists according to stream size and summer water temperature. This resulted in 11 ecological stream types in Michigan, and characteristic fish populations were determined for each type.

Development of Fish Population Response Curves. A fish population response model was built using a dataset describing the abundance of fishes at 1,700 stream locations in Michigan, collected over 30 years. The model tracks the expected changes in species abundance caused by (hypothetical) incremental 10% decreases in the Index Flow. The results produced Fish Response Curves relating decreases in Index Flow to a reduction in fish population metric for Michigan's 11 stream types.

Define acceptable ecological and streamflow withdrawal thresholds. Four risk management zones were defined to reflect the gradient of ecological threats created by reduction of baseflow. Zone A reflects little risk, while Zone D reflects Adverse Resource Impacts. Response and requirements of the Water Use Program increase from Zone A to Zone D.

Groundwater Withdrawal Model. Groundwater modeling tools are necessary to tie groundwater withdrawals to reductions in streamflow. Initially, analytical stream depletion models were implemented by the USGS for use in the Water Withdrawal Assessment Tool. Later, numerical groundwater flow models were implemented for some WMAs.

Water Accounting Database. A water accounting database is linked to the screening tool. The database tracks how much water is available in each WMA across the state and adjusts as new withdrawals are registered, and site-specific reviews provide more accurate index flow determinations. All large-quantity water users are required to report withdrawals annually.

4.4.5 Dispute Resolution

The statutes enacted for the assessment and permitting of water withdrawals do not interfere with the state's Common Law water rights or property rights. If a new proposed withdrawal triggers a permit requirement, EGLE must determine reasonable use. This may require a reassessment of all water withdrawals within a WMA so that a new withdrawal may be permitted.

To address this possibility, legislation provides for a Water Use Committee (WUC) to help manage water use on the local scale. A Water Use Committee provides a framework for water users within a WMA to

reach an agreement on how water resources will be equitably shared. A WUC includes all large-quantity water withdrawers and local government officials within a watershed and may have subcommittees that include residents. The intent of the WUC is to give water users direct input into managing water resources in their watersheds to resolve water use conflicts and ultimately avoid litigating water rights. The concept of the WUC appears to be an elegant solution to defining reasonable use in a watershed nearing the Adverse Resource Impact threshold. Fifteen years into the program, however, Water Use Committees remain untested.

In addition to permitting disputes, groundwater disputes may arise when a high-capacity well disrupts the normal operation of nearby residential wells. The disruption may be due to the lowering of groundwater levels or changing water quality. Legislation has created a formal groundwater dispute resolution process administered by EGLE and MDARD to address these conflicts.

4.4.6 Water Management Through Withdrawal Regulation

While the process described above focuses on permitting and regulating water withdrawals and compliance with the Great Lakes Compact, the work of the Water Use Program impacts all aspects of water management in the state.

The framework built for regulation and data management provides a statewide inventory of water availability and excess water availability, which is continuously updated. This is possible as the framework treats surface water and groundwater as a single resource and is based on limiting depletion of streamflow rather than, for example, limiting aquifer drawdown. Limiting drawdown requires case-by-case investigations to address water withdrawal proposals and provides only an indirect method of evaluating water availability. Knowledge of statewide water availability can be used to identify and address immediate opportunities or needs for economic development, protection of the state's agricultural production, and to inform urban and regional planning.

Data collection, modeling, and education also serve a much larger role than regulation. The Water Use Program combines data sets from multiple divisions and agencies to serve a common purpose. This improves the state's ability to protect sensitive habitats, assess threats to native species, and track the impacts of legacy pollution. Further, the continuing data collection and analysis provide information on climate variability. Index Flows are evaluated based on historical streamflow records, which assumes hydrologic stationarity – the assumption that, statistically, what has happened in the past reflects what is possible today. Michigan's process includes an ongoing review of streamflow records to determine if low-flow statistics have changed and a process to update Index Flows if needed.

These outcomes of withdrawal regulation inform the State Water Strategy, which is a 30-year plan to protect, manage, and enhance Michigan's water resources for current and future generations.

4.4.7 Data Collection and Analysis

Data collection and analysis are integral to the ongoing generation and distribution of scientific information to characterize the quantity and quality of water resources in the state. This requires ongoing funding for data collection and research. The WUAC biennial report summarizes the recommended data collection and research activities as well as their costs. In addition, the standard

duties of the EGLE and DNR are to generate hydrologic and biologic data sets through site-specific reviews and water-use reporting. Critical ongoing activities are summarized below.

Water Use Records. Registered water users are required to provide water use reports. The Water Use Program maintains and analyzes the data.

Site Specific Reviews. Data collected while performing an SSI may include periodic stream flow measurements, updated estimates of Index Flow, fish population data, sediment characterization, aquifer properties, and glacial and bedrock geology data.

Well Driller Logging Records. Quality control and digitization of well log records, and database updating and maintenance.

Streamflow Monitoring. Continuous records stream gages are maintained and operated by the USGS and supported with funds provided by the state. Statistical analyses of the stream flow data are made to update Index Flows and investigate non-stationarity. The siting and installation of new stream gages occur on the recommendation of the WUAC. USGS and EGLE staff also collect one-time stream flow measurements along stream channel transects at several other locations around the state.

Groundwater Level Monitoring. Continuous, daily, and miscellaneous groundwater level monitoring data is collected by the USGS and EGLE. Siting and installation of new monitoring wells occurs on recommendation of the WUAC.

Geologic Data Collection and Mapping. 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.

Modeling. Both surface water and groundwater modeling are required for the permitting process. Improvements and expansion of modeling tools have been ongoing.

4.4.8 Michigan Sources

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Zorn T, Paul W. Seelbach, Edward S. Rutheford, Todd C. Wills, Su-Ting Cheng, and Michael J. Wiley (2008). A Regional-scale Habitat Suitability Model to Assess the Effects of Flow Reduction on Fish Assemblages in Michigan Streams. Research Report 2089, Fisheries Division, State of Michigan Department of Natural Resources (DNR), November 2008.

4.5 Minnesota

4.5.1 Origin Story

Like other midwestern states, Minnesota began re-examining statewide water resources following droughts in the 1960s, 1970s, and 1980s. Over that time, various state and local efforts were established to address the state's emerging water issues. One approach unique to Minnesota was the passing of the Metropolitan Land Planning Act, which directed the Metropolitan Council to prepare a long-range development plan for the seven-county Twin Cities metro region, home to around half of Minnesota's population. Long-range plans for growth and development were first completed in 1979 and most recently updated in 2025. This regional development guide includes planning and direction for growth in the region as well as policy and planning direction specific to wastewater, water supply, and surface water management.

In 1991, the state adopted the first Minnesota Water Plan, which served as the foundation to coordinate and integrate water programs across the state. A key part of this plan was the state's commitment to local water planning as a key to managing water.

As the state continued to develop, pressure on water resources also grew. In 2008, the state's citizens passed the Clean Water Land and Legacy Amendment, a self-imposed 3/8% sales tax. Funds from this amendment are used for water management activities such as enhanced monitoring, watershed study, planning, and on-the-ground restoration and protection activities. The administration of these funds has also led to increased collaboration across Minnesota's water agencies and local partners.

New issues with groundwater withdrawals for drinking water interfering with surface waters started to occur in areas of the state in the early 2000s. In 2011, the local suburbs that included White Bear Lake joined forces with several state agencies to understand why water levels had fallen in the 2,400-acre lake. Increased withdrawals for drinking water from the surrounding growing communities, as well as decreased annual precipitation, were the main causes identified (**Figure 9**). Why was the lake level falling when precipitation was not changed?

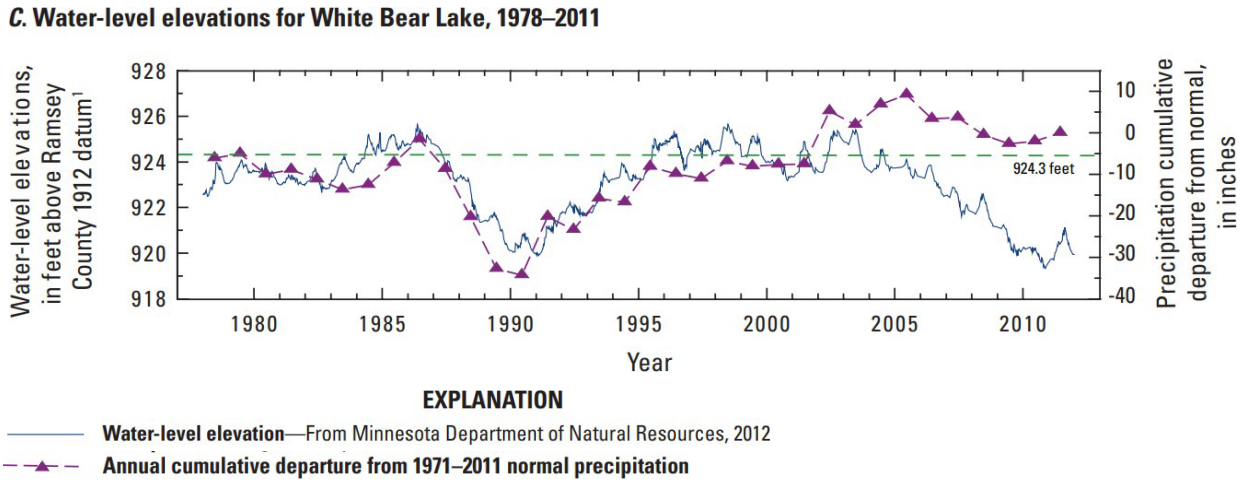

Figure 9. Water-level elevations for White Bear Lake in Minnesota, 1978-2011.

Lake levels were reflecting declining groundwater levels. Those lowered groundwater levels in the shallow rock deposits were caused by leakage into the regional sandstone aquifer that supplies the neighboring suburban public water systems and increased pumping for water supplies. To make matters worse, research found that climate change was potentially accelerating that decline. The State of Minnesota has mandated that a study be completed for this area to rethink existing water policies and how the state can better manage its groundwater and surface water resources in this area. Other parts of the state are seeing similar patterns and undergoing additional studies.

4.5.2 Program Focus

Sustainability — A new state-funded Clean Water, Land, and Legacy program was established to protect drinking water sources; to protect, enhance, and restore wetlands, prairies, forests, and fish, game, and wildlife habitat; to preserve arts and cultural heritage; to support parks and trails; and to protect, enhance, and restore lakes, rivers, streams, and groundwater. This program is supported by four funds: the Clean Water Fund, the Outdoor Heritage Fund, the Arts and Cultural Heritage Fund, and the Parks and Trails Fund. The Clean Water Fund is specifically dedicated to protecting, enhancing, and restoring water quality in lakes, rivers, and streams and protecting groundwater from degradation. This includes support for work focusing on water planning and conservation efforts across Minnesota. The overarching goal of the Clean Water Fund program is to achieve cross-sector sustainability in water resources. Minnesota is working to enhance and modernize all relevant agencies with the data and science to inform insights across agencies and regions of the state. Recognizing the gaps in basic understanding of the resource, the Clean Water, Land, and Legacy Fund Minnesota included support for a comprehensive “One Water” approach.

The Minnesota Department of Health describes the fund this way:

> *“The Clean Water, Land Legacy initiative is a state constitutional amendment passed by voters in 2008, which dedicates a portion of increased sales tax revenue to a "Clean Water Fund" aimed at protecting, enhancing, and restoring water quality in Minnesota's lakes, rivers, streams, and groundwater, with a specific focus on safeguarding drinking water sources; essentially, it's a*

significant state-funded program focused on clean water conservation efforts across Minnesota."

4.5.3 Program Structure

The organizational structure of the Clean Water, Land, and Legacy program did not result in any new state institutions. The structure was guided by the multi-year listening sessions that had already occurred and built upon the existing agencies familiar with the issues and conditions causing public concern. And, given the fact that there was a natural lag-time between the passage of the new sales tax-supported Land and Water Fund and the revenues to begin work, the state had time to consider options. Rather than create a single water program in the state, the existing agencies were funded to connect and communicate as a part of the planning and implementation process. In the next few years, the key agencies worked with their stakeholders to create plans to expand water-related programs within each defined hydrologic region.

4.5.4 Staffing and Coordination

Program staffing varies by agency, and communication among the agencies is continuous. The Minnesota Board of Water and Soil Resources (BWSR) receives more than $65 million per year (based on 2021 reporting), and most of that money flowed through existing county and local governments to implement field programs that were locally designed and developed. The Minnesota Pollution Control Agency has received more than $25 million annually (based on 2021 reports) that have gone into already identified basins for intensive water quality and flow monitoring. The coordination of the teams is being driven by a commitment to openness and accountability to the public. The coordination needed to manage the work is done by the Clean Water Council, which works with each agency to identify their role in the overall program.

4.5.5 Fiscal Commitment

The state has generated over $200 million yearly based on reported sales tax revenue. In this most recent year (2024-2025), the Clean Water Fund will exceed $300 million. This dedicated fiscal commitment has stabilized the process of identifying and managing water quality and quantity problems that had been causing problems in the state for decades. Recently, the priority investment at this stage has been non-point source pollution affecting stream water quality throughout the state.

4.5.6 Data Collection and Mapping

As a part of this overall effort, Minnesota has used each funded agency to collect additional data needed to track trends in quality and quantity in the basins being addressed. For some agencies, this additional funding has supported thousands of samples of domestic wells as the first step in an initial assessment of nutrient loss in shallow groundwater in agricultural areas. Hundreds of new monitoring wells have been installed to track seasonal and short-term changes, and tens of thousands of wells will be sampled to understand the risks of nitrate in shallow groundwater. This work has been accompanied by mapping efforts within each agency.

4.5.7 Minnesota Sources

Correspondence with the following Minnesota state agency staff, October 2024 – January 2025:

- Jason Moeckel, Section Manager, Ecological and Water Resources - Central Office; Inventory, Monitoring, and Analysis Section, Minnesota Department of Natural Resources (DNR)
- Jennifer Kostrzewski, Water Policy and Planning Assistant Manager, Metropolitan Council of the Twin Cities
- Judy Sventek, Manager Water Resources, Metropolitan Council of the Twin Cities
- Lanya Ross, Environmental Analyst, Metropolitan Council of the Twin Cities
- Emily Schon, Principal Engineer, Wastewater Planning and Community Programs, Metropolitan Council Environmental Services

4.6 Texas

The State of Texas has been planning for water resources since the 1960s. The history of water resources planning in Texas largely follows that of Texas weather, a story dominated by drought with infrequent periods of flooding (Rubinstein, 2015). Lessons learned during their five-plus decades of planning have resulted in significant changes to the process, described in detail herein. Two themes have remained constant throughout Texas' water planning history: (1) continuous, rapid population growth that contributes to the widening gap between supply and demand, and (2) the concept of private property rights, which are paramount in Texas.

4.6.1 Origin Story

The extreme drought of the 1950s paved the way for legislative action and, ultimately, the creation of a new agency to conduct water resources planning for the state: the Texas Water Development Board (TWDB). The first State Water Plan was published in 1961. Initially, water resources planning for the entire state was conducted by the new agency, and the initial centralized, top-down planning approach continued for several decades, with State Water Plans being published in 1961, 1968, 1984, 1990, and 1997. Each State Water Plan was designed to ensure that the State had sufficient water during a repeat of the 1950s drought, defined as the "drought of record."

Pressure from another serious drought in 1996 led to the passage of Senate Bill 1 in 1997, which laid out a new, bottom-up regional planning process for the state. The regional planning process was designed to be a consensus-driven approach to address the needs of all water users in the State. The new State Water Plans are based on the 16 regional water plans, compiled by TWDB staff and submitted to the Governor, Lieutenant Governor, and the Texas Legislature. The first State Water Plan developed from the 16 regional water plans was adopted in 2001. Since then, the regional plans have been updated in 2006, 2011, 2016, and 2021. The State is currently in the sixth cycle of regional planning.

4.6.2 Program Focus

The purpose of the Regional Planning Process is to ensure the ongoing vitality of the Texas economy by planning so that all water users in Texas have enough water during a drought of record. The 16 Regional

Planning Areas (**Figure 10**) are geographic regions of the state defined by hydrologic and political boundaries. The Regional Plans are created on a five-year cycle and represent a consensus of the Regional Planning Area Members, which are required by statute to include members from at least 12 of the following interests: public, counties, municipalities, industries, agriculture, environmental, small business, electric-generating utilities, river authorities, water districts, water utilities, and groundwater management areas. These members collectively represent the water supply interests of their respective regions.

Each Regional Water Planning Group is charged with the responsibility to evaluate the region's population projections, water demand projections, and existing water supplies for a 50-year planning horizon. The Regional Water Planning Groups identify water shortages under drought of record conditions and recommend water management strategies. This planning is performed in accordance with regional and state water planning requirements of the TWDB.

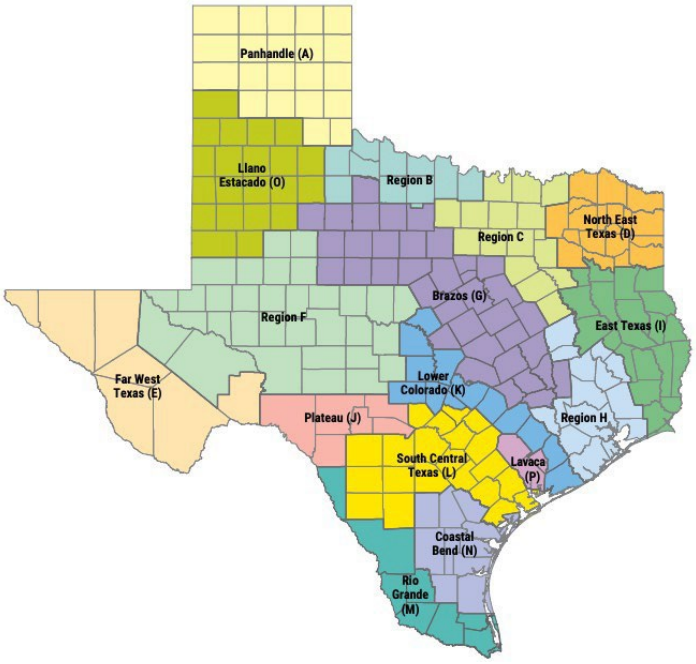

Figure 10. Regional planning areas of Texas.

4.6.3 Program Structure

The Texas planning process is designed to address the needs of all water users in the state—municipal, irrigation, manufacturing, livestock, mining, and steam-electric power—during a repeat of the drought of record. For most of the 50-year planning history, the 1950s drought was considered the drought of record. However, many regions experienced even more extreme drought conditions during 2011-2014, and those conditions are now used to define the drought of record. Both the regional and state water plans are done for a 50-year planning horizon.

The planning process is conducted through open meetings in a transparent manner designed for stakeholder input. The Planning Groups must publish draft plans and hold public hearings before the final plans are adopted. The work of the planning groups consists of the following tasks:

- Describing the regional water planning area.
- Quantifying current and projected population and water demand over a 50-year planning horizon.
- Evaluating and quantifying water availability and current water supplies.
- Identifying water surpluses and needs (potential shortages).

- Identifying and removing infeasible water management strategies from the previous regional water plan.
- Approving and submitting a technical memorandum.
- Identifying, evaluating, and recommending water management strategies and projects to meet the identified water needs.
- Evaluating impacts of the regional water plan on water quality, agricultural and natural resources, as well as water resources of the state, and describing how the plan is consistent with the long-term protection of the state's water, agricultural, and natural resources.
- Developing drought response information and recommendations.
- Recommending regulatory, administrative, and legislative changes.
- Describing the level of implementation of the previous regional water plan and providing a comparison to the previous regional water plan.
- Adopting the draft and final regional water plan, including the required level of public participation.

Once the regional planning groups adopt their final plans, they are sent to TWDB for review and approval. Then, TWDB staff will incorporate all the regional plans into a single State Water Plan.

As part of the planning process, each water planning group must identify all water sources within their planning area and their associated annual availability volumes. Surface water and groundwater are the primary water sources for all water users in the state. Surface water is owned by the State and groundwater is a private property right.

Surface water availability is determined using the Texas Commission on Environmental Quality's surface water availability models (WAMs), which estimate the monthly and annual water volumes that can be diverted each year in the drought of record conditions, all of which assume a repeat of the historic hydrologic record.

Groundwater availability is estimated through a combination of policy decisions made by groundwater conservation districts through joint groundwater planning and the ability of an aquifer to transmit water to wells. In areas where Groundwater Conservation Districts or Subsidence Districts do not exist, the rule of capture applies. In areas where districts exist, the districts have the authority to regulate groundwater withdrawals and well spacing. The Districts in a Groundwater Management Area work together to determine groundwater management policies and set the desired future conditions of their aquifers (such as maximum change in water levels or reduction of spring flow). Then TWDB staff and technical experts use groundwater availability models along with the desired future conditions to determine the modeled available groundwater for planning purposes. This separate and parallel process, called Joint Planning, provides important input to the regional and state water plans.

4.6.4 Staffing and Coordination

Initially, planning was conducted at the state level by the TWDB. Starting in 1992, the agency expanded participation by including stakeholders and other state agencies, including the Texas Parks and Wildlife

Department and the Texas Commission on Environmental Quality. The purpose was to increase transparency and efficiency in planning and solicit input from a wider range of interests.

The adoption of Senate Bill 1 in 1997 shifted the planning process from a top-down, centralized approach to a regional, bottom-up method that, by design and necessity, requires input from more stakeholders at the regional level. The 16 regional planning groups include at least 20 members from the statutorily-defined interest groups and some up to 30. The planning groups typically contract with technical experts for each five-year cycle. Additionally, each planning group includes non-voting members from the Texas Parks and Wildlife Department, the Texas Department of Agriculture, and the Texas State Soil and Water Conservation Board.

4.6.5 Fiscal Commitment

All planning activities are funded by the State's general revenue funds. The funding level varies from year to year. The total annual budget for planning and managing the state's water resources was $19 million and $21 million for the 2021 and 2022 fiscal years. Full-time staff vary from 300-450, partly due to changes in funding availability (TWDB, 2007).

4.6.6 Data Collection and Mapping

Texas' planning process relies on data from various state and federal sources for water, climate, population, and economic data. Key to the development of the regional and state water plans is the TWDB's annual Water Use Survey, which gathers data from entities using groundwater, surface water, or reclaimed water supplies for municipal, industrial, power generation, or mining purposes. Data collected through this annual effort support estimating current water use in the state and the projection of future use for the state water plan. Operating in conjunction with the annual survey is the Texas Water Service Boundary Viewer, an online mapping application to house the active water service boundaries for all retail water suppliers to support more accurate estimates of per capita water use.

The state water plan is supported by an interactive website part of the TWDB's approved and adopted plan. The interactive plan allows water users to take an up-close look at data thematically and at discrete levels not found in the electronic and bound versions of the plan. The TWDB administers the state water planning database that facilitates the interactive state water plan and is directly populated by the planning groups as they produce their regional water plans. Some of the planning data, such as water demand projections and modeled available groundwater volumes, are developed and entered directly by the TWDB.

The TWDB developed the TexMesonet network (https://www.texmesonet.org/About), a statewide earth observation data collection network. The TWDB works with partners across the state to improve state coverage.

The Texas Natural Resources Information System (TNRIS) is a division of the TWDB. It was recently renamed as the Texas Geographic Information Office (TxGIO), serves as the state's clearinghouse and referral center for statewide geographic data, including digital ortho-imagery, digital elevation data, historical aerial photography, as well as data for Texas land parcels, address points, and emergency management.

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4.7 Virginia

Like Indiana, the State of Virginia has a temperate climate and is often considered a wet state. Historically, Virginia's water governance has followed riparian law and is now considered to be an eastern *regulated* riparian state. The state uses permits to regulate how much water is withdrawn and from where. The state also has begun to use state-wide regional water supply planning to plan and evaluate future water demands and climate conditions. These state-wide regional water supply plans will be rolled into a state water supply plan every five years.

4.7.1 Origin Story

Water is managed through four regulatory programs: 1) the Virginia Water Protection Program, 2) the Ground Water Management Act of 1992, 3) Local and Regional Water Supply Planning, and 4) the Water Use Reporting Program.

4.7.1.1 Groundwater

The Groundwater Act of 1973 was the first piece of legislation which gave the state authority to assert "reasonable control of all groundwater resources [sic] in order to conserve, protect, and beneficially utilize the groundwater of this Commonwealth" (Va. Code Ann. § 62.1-44.84 (repealed)). Under this statute, the State Water Control Board (SWCB) could designate groundwater management areas and require a permit for withdrawals within those groundwater management areas.

Groundwater management areas were designated for areas at risk of continued water-level and water-quality decline through unrestricted usage. There are currently two groundwater management areas, the Eastern Virginia Groundwater Management Area and the Eastern Shore Groundwater Management Area (**Figure 11**). The Eastern Virginia Groundwater Management Advisory Committee was established pursuant to legislation enacted following the 2020 Virginia General Assembly session (2015 Va. Acts Chs. 262 and 613) and has been active since. This management area has advisory committees made up of citizen members with representatives of water users, developers, agencies, universities and water experts that work with the Department of Environmental Quality (DEQ) to manage the basin.

The Eastern Shore Groundwater Committee meets periodically, but is not a State committee. The DEQ attends meetings often to address permitting questions. It is made up of representatives from Accomack and Northampton Counties.

The Groundwater Act of 1973 was replaced by the Act of 1992 which provided more specific criteria for the issuance of permits and required additional management and conservation plans for groundwater users in the designated areas. As of the Act of 1992, reporting was only required within the management areas, however, pursuant regulation VAC25-200 water withdrawal reporting is now required of water users outside of the management areas (if use is greater than 300,000 gallons per month). This change was due to the continued decline of water levels in certain areas of the state.

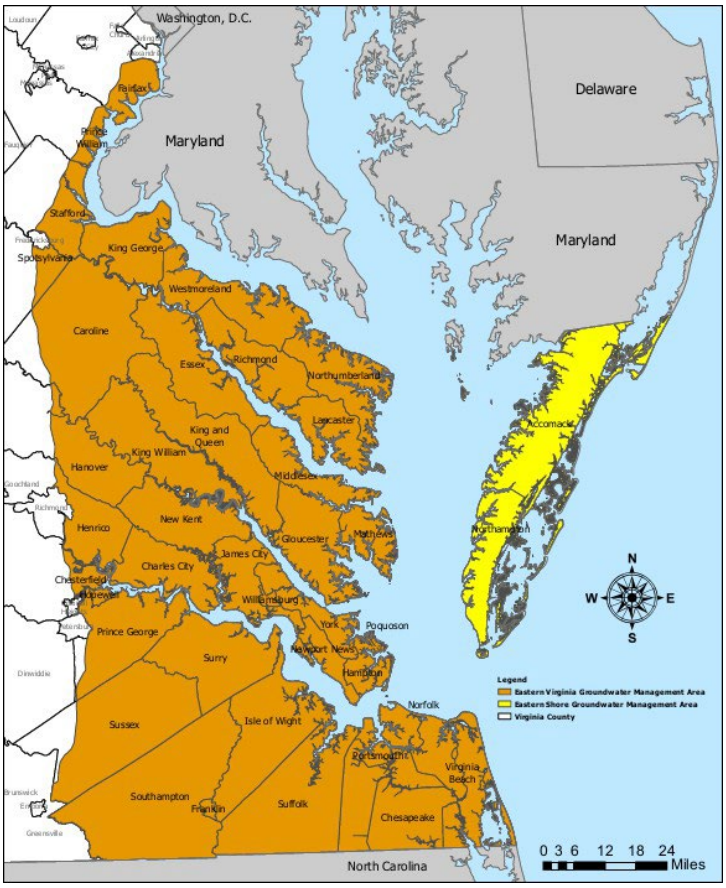

Figure 11. Designated groundwater management areas in Virginia.

4.7.1.2 Surface Water

Surface waters are permitted separately in Virginia through the Office of Water Withdrawal Permitting. All non-agricultural surface water users are required to obtain a permit if withdrawing greater than 10,000 gallons per month (or 2,000,000 gallons per day in tidal waters). Agricultural withdrawals of greater than 1,000,000 gallons per month (or 60,000,000 gallons per month in tidal waters) must get a permit from the state. Certain withdrawals are not required to obtain a permit, including any water withdrawal in existence on July 1, 1989 (§62.1-44.15:22).

4.7.1.3 Water Supply Planning

The Virginia Water Supply Planning (WSP) program was created in 2005 after an extensive drought in 2001-2002. The WSP program is responsible for the development of a periodic state water supply plan that includes contributions from all counties, cities, and towns (VA-DEQ, 2024). The DEQ vision of the program is to "*achieve the full economic and environmental potential of Virginia's water resources through sustainable water supply planning to meet current and future beneficial uses of water*" (VA-DEQ, 2009).

The WSP process is a collaborative effort between state and local stakeholders. Local governments are responsible for identifying their communities' needs and developing local water supply plans.

The original water supply regulation (9VAC25-780) became effective in November 2005 and specified that local governments would submit local water supply plans or participate in regional planning efforts.

Planning regions were not specifically determined based on river basin or with respect to shared sources of water supply, and localities could choose to develop a plan independently (local plan) or regionally with other localities (regional plans). Plans were to be reviewed/revised no later than five years from the promulgation of the regulation and placed into effect after a compliance determination had been completed and from there, plans would be resubmitted every 10 years. From this initial effort, a total of 48 water supply plans were submitted between 2008 – 2011 of which 10 were local plans, and 38 were regional plans. The majority of the regional plans submitted consisted of one county and one or more cities/incorporated towns located within the boundaries of that county. Based on these submitted plans, the first State Water Resources Plan was published in 2015. This document was the synthesis of all local and regional Water Supply Plans within the Commonwealth. Subsequently, in 2016, a report was published in response to a directive by the General Assembly to evaluate Virginia's water resources management and planning programs. In this report, the Virginia Joint Legislative Audit and Review Commission concluded that plans developed under the existing regulation were not sufficiently regional and that as a result, localities may have missed opportunities for collaboration to improve access to water across the Commonwealth. Legislation passed in 2020, 2022, and 2023 addressed the findings of the JLARC study and shifted the Water Supply Planning framework to a true regional approach. Amendments to the Local and Regional Water Supply Planning Regulation (9VAC25-780) became effective in October 2024 and designated 26 Regional Planning Areas based on river basins, common water supply sources, and existing or planned cross-jurisdictional relationships. (Figure 11). The amendments now require localities within a regional planning area to submit a single, jointly developed regional water supply plan, and requires that regional water supply plans identify water supply risks and propose regional strategies to address the risks. These 26 regional plans are due October 2029 and will be used to develop the next Virginia State Water Resources Plan.

The regional plans must contain the following information: a description of existing water sources; a description of existing water uses; an assessment of projected water demands; a statement of future need; an analysis that identifies potential alternatives to address projected deficits in supplies; a description of existing water resources conditions; a description of water demand management actions; and a drought contingency and response plan.

The State Water Resources Plan (State Plan) is typically published at five-year intervals and has in the past two iterations, compiled information provided to DEQ by localities through Local and Regional Water Supply Plans, Annual Water Withdrawal Reporting, and Surface & Groundwater permitting into a central document. Localities and regions took the lead role in identifying the needs of their communities and DEQ provides technical analysis and oversight. Due to the recent amendments shifting the paradigm to a state-wide regional approach, the next State Water Resources Plan will be published soon after the 26 Regional Water Supply Plans are submitted in 2029 (**Figure 12**).

In addition, DEQ analyzes the information and data contained in the water supply plans by using established models of surface water and groundwater resources. These analyses evaluate the water demand projections included for each locality and determines if the withdrawals exceed the established thresholds. The groundwater threshold (within the groundwater management areas) is a critical water level previously established as the limit. The surface water thresholds are minimum flow requirement established for each stream. The DEQ is also able to analyze potential impacts of climate change and other risk factors determined by the regions. These analyses are also critical to the water withdrawal permitting process. The DEQ conducts surface water assessments and works with a consultant to complete the groundwater modeling efforts.

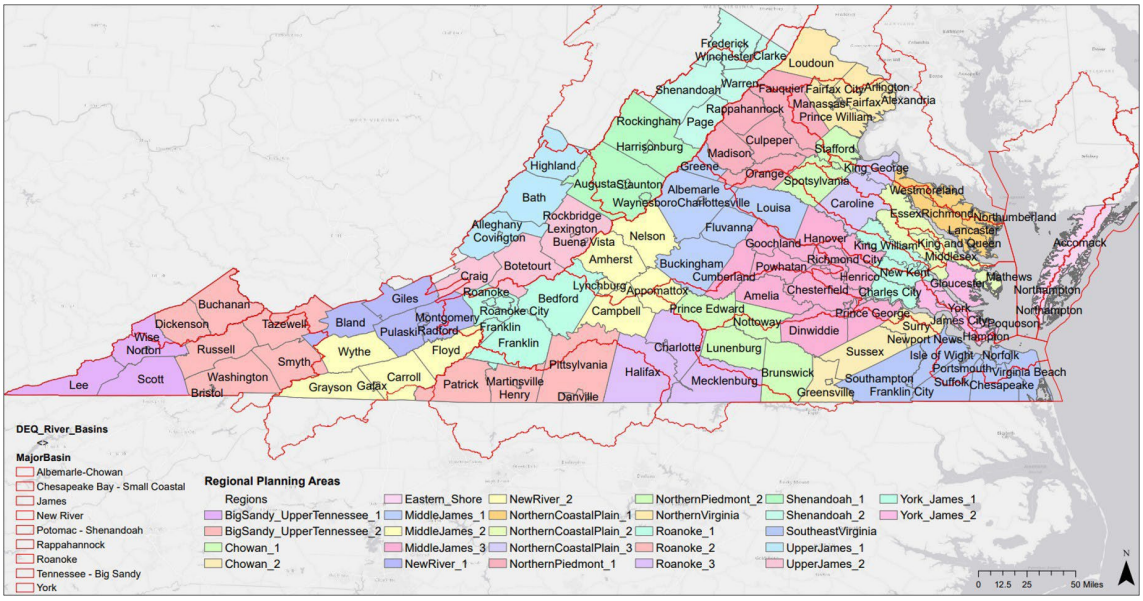

Figure 12. Virginia's 26 Regional Water Planning Areas.

4.7.1.4 Water Reuse Regulation

In 2008, Virginia passed legislation encouraging the reclamation of wastewater and water reuse. The legislation outlines permit requirements, water quality standards, and approved uses. The goal is to reduce the amount of treated effluent in the state's waters. As a result of this regulation, Virginia is home to the nation's first program to augment a reservoir with recycled water, preventing 500 million gallons a year of treated wastewater from being discharged into the Chesapeake Bay, which has nutrient concerns.

4.7.2 Program Focus

The WSP process and the permits for surface water and groundwater withdrawals are predominantly centered around water quantity. The goal is to ensure "adequate and safe drinking water is available to all Virginians while encouraging, promoting, and protecting aquatic life, recreation, and other beneficial uses." However, groundwater management areas actively try to protect the water quality from saltwater intrusion. Other departments within the DEQ deal specifically with water quality and sampling of the state's waters.

4.7.3 Program Structure

The DEQ is responsible for water-resource planning, although the regional plans are developed by the local representatives. The DEQ develops the state water plan from the regional plans and it performs impact analyses using future demand scenarios. DEQ's regulations are promulgated by the State Water Control Board with the agency getting assistance from Advisory Committees.

Department of Environmental Quality

The Department of Environmental Quality (DEQ) is responsible for administering laws and regulations related to air quality, water quality, water supply, renewable energy and land protection. With over 800

employees and six regional offices across the state, the DEQ issues permits, conducts monitoring and inspections, and carries out its mission to "protect and improve the environment for the health, well-being and quality of life of all Virginians." The DEQ is the agency tasked with implementing programs to protect the water quantity and water quality of the waters of the State.

State Water Control Board

The State Water Control Board (SWCB) is a seven-member, governor-appointed board of citizens responsible for promulgating Virginia water regulations. Members are appointed for the terms of four years each. (Code of Virginia, Title 62.1, Chapter 3.1). The DEQ provides updates to the SWCB on a quarterly basis.

Technical Advisory Committees

In 2020, the Virginia General Assembly re-established the Eastern Virginia Groundwater Management Advisory Committee (EVGMAC) to assist DEQ in the management specific to the Groundwater Management Area. The EVGMAC is comprised of various stakeholder groups including water users, water providers, agriculture, conservation and environmental organizations, state and federal agencies, and university faculty.

4.7.4 Staffing and Coordination

The water supply planning, regulatory permitting program, and water withdrawal reporting program are all staffed by employees of the DEQ. However, as described above, stakeholder groups play a role in advising and directing the DEQ.

4.7.5 Fiscal Commitment

The regulatory, reporting, and WSP process is funded through the annual budgets of the DEQ. However, periodic funding is approved for specific projects and investigations. For example, a budget amendment in 2024 appropriated grant funds for activities proposed by the regional planning areas. The application for funding and mechanisms for distribution are currently being developed.

Another example is from the 2023 budget, which provided funding to a joint project by DEQ & USGS to install new monitoring facilities within the Virginia Coastal Plain. This project will enable DEQ to evaluate trends in land subsidence, aquifer recovery, groundwater levels, and to continue collecting other data important for planning and decision making. Additionally, the DEQ is installing 20 Climate Response Network wells in the hard rock provinces of the Commonwealth west of the fall line. These 20 wells will ultimately assist in drought monitoring and forecasting.

4.7.6 Data Collection and Mapping

DEQs responsibilities for regulating and managing the groundwater and surface water supply rely on extensive and regular data collection and the development and ongoing maintenance of evaluation models.

Water Withdrawal Reporting. The registration and annual reporting of surface water and groundwater withdrawals. Registered water users are required to provide water use reports. The DEQ evaluates the effect of the withdrawals and summarizes the data in the Annual Water Resources Report and the State Water Plan.

Well Completion Report. All private wells constructed in the Virginia Groundwater Management Area must submit a well completion report within 30 days of construction.

The **Virginia Coastal Plain Hydrogeologic Framework** contains borehole geophysical logs and other data for the Coastal Plain of Virginia.

Streamflow Monitoring. Continuous records stream gages are maintained and operated cooperatively by the USGS and DEQ and supported with funds provided by the state.

Groundwater Level Monitoring. Real-time groundwater level monitoring data is collected from the state water-level network. The monitoring wells are maintained cooperatively by the USGS and DEQ.

Geologic Data Collection and Mapping. The Groundwater Characterization Program of the DEQ collects, evaluates and interprets the location, quantity, and quality of groundwater throughout the state. 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.

Modeling. Both surface water and groundwater modeling are required for the permitting process and the development of the State Water Plan. The DEQ conducts surface water modeling and works with a consultant to complete the groundwater modeling analyses.

Ambient Groundwater Quality Monitoring Program collects groundwater samples from across the state to determine natural groundwater quality. This information is used to monitor potential saltwater intrusion near the coast and for water supply management and planning.

Surface Water Quality Monitoring. DEQ staff in each of the regional offices collect water samples at more than 1,000 locations across the Commonwealth. These water samples are shipped to a state laboratory for chemical and bacterial tests. The samples are tested for a wide range of substances, including nutrients, solids, bacteria associated with human and animal wastes, toxic metals, some pesticides and harmful organic compounds. In addition, DEQ scientists perform on-the-spot field tests for dissolved oxygen, pH, temperature, salinity and additional indications of water quality.

4.7.7 Virginia Sources

Correspondence with Virginia Department of Environmental Quality (DEQ) staff; Weedon Cloe (Office of Water Supply Manager), Hannah Somers (Water Supply Planning (WSP) & Analysis Team Lead), Scott Morris (Director of Water), and Brandon Bull (Policy Division Director). November through December 2024.

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5 Conclusions

Indiana is privileged to be a state with relatively abundant water access in many parts of the state. Today, a number of entities in Indiana play an important role in the overall water management framework including state agencies, local commissions, and many others. Through some of these entities, Indiana does complete some level of regional water planning assessments, but without any long-term statutory directive to complete the whole state and without a set of common standards across regions. Informal coordination and collaboration between utilities has recently developed in regions of high growth, where competition for water and conflict is possible, such as the Central Indiana Water Utilities Collaborative, which has been useful. Some counties have been implementing local protections through local ordinances. These actions, while lacking the stability that can come from statutory directives, provide value in their own right and could be models for statewide action that could better ensure statewide planning for the future.

As shown in this report, most of the other states build upon a comprehensive state-wide water plan that serves as the overall guidance to these varying entities and regions. Indiana's last major water governance structure was enacted more than 40 years ago in 1983 with the Water Resources Management Act. While the Act provided agencies with tools to manage the water resources of the state, some of those management tools, such as determining statewide availability, are only now begun in a few regions. However, the state did initiate the Significant Water Withdrawal Facilities database, which requires all significant water users to report their use.

Looking at other states and how they have tackled long term water governance provide Indiana with opportunities to make the current construct more robust to plan for and protect this critical resource into the future. Tools and best practices identified in this report may be useful for Indiana to adopt as policy makers work to improve our current water governance. They include but are not limited to the following:

- Regional and state level water plans directed to be completed on a regular basis,
- Permits under specific circumstances,
- Use restrictions in targeted areas under defined circumstances,
- Conservation efforts including through mandates or incentives,
- Regional collaborations among utilities and other stakeholders,
- All underpinned with proper funding, data, monitoring, and analytics.

This report was intended to highlight other jurisdictions and their tools and best practices to inform policy makers and others as they evaluate potential options to consider in Indiana.

Recently, with an executive order in January 2025, the governor of Indiana added the Office of Energy and Natural Resources with a cabinet secretary to oversee the new office that will include many of the existing agencies that play a role in water management, specifically IDEM, DNR and the Natural Resources Commission, and may allow even further collaboration and planning together in this important space. With this development and building upon some of the tools and constructs adopted in Indiana over time, along with consideration of what other jurisdictions have done, Indiana is ripe for continued progress to ensure that our precious water resources are protected now and into the future.

6 References

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Appendix I. State Interview Questions

- How did your planning program start? What was the impetus for starting?
  - Origin story – how did the start impact the focus of the governance?
  - What is the scope of the state's governance & programs? Is it focused on quantity only, or are quality and infrastructure included?
  - Does this program meet statutory requirements crafted in the legislature, or is it an executive order? Who directs the program?
  - Does this program determine infrastructure funding?
  - How are the planning areas determined? Do planning regions collaborate?
  - How are the decision makers/stakeholders chosen? Are they elected or appointed?
  - Was the initiation of this program from the legislative or executive branch?
  - Is there a state water plan? What does it address? How often is it updated?
  - Is there a water availability assessment process?
  - Are there definitions for sustainability or environmental flows?
  - Are there withdrawal permits, allocations, and/or interbasin transfers?
  - How are basin-specific concerns addressed (e.g., growth, industrial development, irrigation)?
  - Is MAR/ASR and water reuse allowable?
  - Consumption vs withdrawal? Is it regulated, and if so, how is it regulated?
  - What is the impact of the Great Lakes Compact on planning?
- Staffing
  - Was a new agency and/or appointee created?
  - What powers do the water staff have?
  - Are there terms and/or limits for the staff?
- Budget
  - What is the source of funding for these activities?
  - Is the funding stable? Does it vary from year to year?
  - What does the budget pay for?
- Data Collection / Mapping
  - What data sets are collected? Is water quality included?
  - What types of investigations (models) are performed? By whom?
  - Are water uses prioritized in the planning process?
  - Are infrastructure plans integrated into the planning process?
  - Is climate change or climate resiliency considered?
  - Is surface water/groundwater interaction considered, or are they assessed separately?
- Problems/Conflicts
  - Have there been issues/concerns since the program was initiated?
  - How are issues resolved?

Appendix II. List of State Agency Interviewees

Illinois

- Gary Clark, former Director of the Illinois Department of Natural Resources (Office of Water Resources) (IDNR-OWR)
- Wes Cattoor, former Water Supply Program Manager, IDNR-OWR
- Dr. Wei Han, Water Supply Program Manager, IDNR- OWR
- Dr. Tim Loftus, former Project Manager for the Northeast Illinois Water Supply Regional Planning stakeholder group at Chicago Metropolitan Agency for Planning; currently General Manager of the Barton Springs Edwards Aquifer Conservation District

Michigan

- Jim Milne, Water Use Assessment Unit Supervisor, Michigan Department of Environment, Great Lakes, and Energy (EGLE)

Minnesota

- Jason Moeckel, Section Manager, Ecological and Water Resources - Central Office; Inventory, Monitoring, and Analysis Section, Minnesota Department of Natural Resources
- Jennifer Kostrzewski, Water Policy and Planning Assistant Manager, Metropolitan Council of the Twin Cities
- Judy Sventek, Manager Water Resources, Metropolitan Council of the Twin Cities
- Lanya Ross, Environmental Analyst, Metropolitan Council of the Twin Cities
- Emily Schon, Principal Engineer, Wastewater Planning and Community Programs, Metropolitan Council Environmental Services

Ohio

- Jim Samuels, Executive Director, Ohio Water Partnership,
- Brad Lodge, Manager of the Water Inventory and Mining Program, Ohio Department of Natural Resources
- Dan Gill, Director, Ohio Water Development Authority
- Tiffani Kavelec, Policy Director, Ohio Environmental Protection Agency (OEPA)

Virginia

- Virginia Department of Environmental Quality
- William (Weedon) Cloe – Manager, Office of Water Supply
- Hannah Somers – Water Supply Planning (WSP) & Analysis Team Lead
- Scott Morris – Director of Water
- Brandon Bull – Director of Policy

Texas

- Carlos Rubinstein, former Chairman of the Texas Water Development Board, former Commissioner of Texas Commission on Environmental Quality and Rio Grande Water Master, current Principal for RSAH2O Consultants. carlos@rsah2o.com
- Tim Loftus, former project manager for Northeast Illinois WSP at Chicago Metropolitan Agency for Planning, current General Manager of the Barton Springs Edwards Aquifer Conservation District tloftus@bseacd.org

Appendix III. Selected Sections of the Indiana Water Resource Management Act of 1983

The following are selected sections of the Indiana Water Resource Management Act of 1983. These identify important aspects of water resource management that are part of Indiana's code, but parts of which are largely undone due to lack of funding and/or necessity. It is critical to have an understanding of what is already in place before changes are discussed.

The Indiana Natural Resources Commission (Commission) is an autonomous board that addresses issues pertaining to the Department of Natural Resources. This twelve-member board includes six citizens chosen by the governor on a bipartisan basis, three ex officio members from state agencies, the director of the Department of Natural Resources, the chair of the advisory council, and a representative of the Indiana Academy of Science. (See IC 14-10). The Commission meets at least four times annually.

*The **commission** shall do the following:*

(1) Conduct a continuing assessment of the availability of the water resource.

(2) Take and maintain an inventory of significant uses of water withdrawn from the surface or ground.

(3) Plan for the development, conservation, and use of the water resource for beneficial uses.

*The **commission** shall make and maintain an inventory of the water resource of Indiana. The inventory must include an assessment of the following:*

(1) The capabilities of streams to support instream and withdrawal uses and of aquifers to support withdrawal uses.

(2) Low stream flow characteristics.

(3) Existing uses and projections of beneficial use requirements.

(4) The potential in watersheds for managing flood water for beneficial uses.

(5) Potential sources and amounts of surplus water available for transfers.

(6) Other assessment and information considered necessary to properly define water resource availability.

(c) The commission shall maintain, on a continuing basis and with opportunity for participation and consultation with all interested persons, plans and recommendations for the development, conservation, and use of the water resource to best serve the needs of the people of Indiana for beneficial uses.

(d) The commission shall prepare a compilation and mapping of all community public water supplies in Indiana that serve at least five hundred (500) customers. The commission shall update the compilation and mapping at least one (1) time every five (5) years. The commission may use funds from the water resources development fund established by IC 14-25-2-4 to prepare compilations and mappings under this subsection. The compilations and mappings prepared under this subsection must include the following information:

(1) The location of water sources for community public water supplies.

(2) The location of treatment facilities used to treat raw water before the water is distributed to community public water supply customers.

(3) The extent of water mains in territories served by community public water supplies.

(4) The population served by community public water supplies.

(5) The total amount of water produced by community public water supplies for the most recent calendar year.

CICP

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