



Recommendations: Strengthening Groundwater Governance over the Next Generation

This report has described how groundwater governance in EPA region 5 consists of a complex network of policy processes that don't yet function as an integrated system, despite the importance of groundwater to the prosperity of the region as a whole. These gaps in groundwater management risk prioritizing those with the most resources or loudest voices and reproducing the marginalization of Native peoples and diverse ecosystems, with little attention to long-term sustainability. Given this, what ought we do over the next generation to make groundwater governance in the Great Lakes region more sustainable and equitable?

Investing in scientific knowledge is a cross-cutting priority that underpins all our recommendations and is as much a social as an intellectual challenge. We have discussed areas where there are still substantial gaps in understanding and traced out the various paths groundwater knowledge needs to travel to impact management practice. More broadly, though, there is a deficit of public understanding of hydrogeology and groundwater dynamics. There are compounding challenges that intersect in the social process of science: the sheer number of stakeholders that influence groundwater and may hold partial insight, the minimal understanding of existing legal principles and best practices for collaborative resource management, and the inherent limitations of understanding these complex systems even in the best of circumstances. Science policy scholar Sheila Jasanoff articulates the consequence of this kind of situation:

To serve as a basis of collective action, scientific knowledge has to be produced in tandem with social legitimation. ... The task ahead, then, is to design institutions that will promote trust as well as knowledge, community as well as participation— institutions, in short, that can repair uncertainty when it is impossible to resolve it.¹

There are examples across the region of such knowledge production. Efforts that put the staff of state agencies and science organizations in relationship with land-owners, government officials, businesses and conservation organizations should be applauded and expanded. More generally, it should be understood that developing scientific knowledge is both necessary to many of the activities recommended below and that the resulting knowledge gains legitimacy by being enmeshed with other activities. From a management and regulatory perspective, expanding the baseline knowledge around groundwater is simply essential.

We offer the following high-level recommendations as strategies that can be pursued by many different stakeholders at different levels. Some benefit especially from regional collective action while others can be pursued wherever possible.

At the regional level:

1. **Elevate groundwater sustainability and the contributions of groundwater-dependent ecosystems within regional decision-making and planning processes.** There are a number of valuable forums for science development and policy discussion at the Great Lakes level. Groundwater is a significant resource of widespread benefit in the region but has received relatively little attention. Sustainable groundwater use and groundwater-surface-water interactions are rightly emerging from the periphery, and should increasingly be a focus of conversation.
2. **Establish a rigorous definition of the Great Lakes groundwater-shed, in keeping with compact principles, and expand water accounting efforts to incorporate these waters.** A laudable aspect of the Great Lakes Compact is the way it recognizes the interactions between surface and groundwater. The boundaries of the Great Lakes Basin, though, are thought of as defined by the surface water catchment area of the lakes. However practical, these boundaries are in tension with the notion that the waters are an integrated whole. There are surely aquifers recharged by and discharging to the Great Lakes with boundaries that extend outside those derived from surface topography. If we fail to understand the groundwater-shed of the Great Lakes, we risk undermining the core shared principles of the Compact. While this may seem like a minor point, consider the case of a high capacity well placed just outside the surface watershed of a Great Lake and how its continued use could create a cone of depression and draw water from the aquifers beneath the Great Lakes.
3. **Amplify and expand on groundwater sustainability goals, to make them more specific, measurable, actionable, realistic, and time-delimited.** There are valuable state and regional goals about preserving groundwater resources, but without concrete and measurable versions they risk failing to drive management action. Shared regional goal setting would ensure mutual accountability and continue to place sustainability at the center of strategies for regional economic development.

1 Jasanoff, Sheila. "The Dilemma of Environmental Democracy." *Issues in Science & Technology* 13, no. 1 (1996): 63–71.

4. **Encourage participatory and inclusive groundwater management at the aquifer-level, establishing the knowledge necessary to define actionable management boundaries within aquifers across political boundaries.** It is fairly common for river basins or lakes to have forums that bring stakeholders together across the water-body to discuss and develop policy and practice, but very few such institutions exist for aquifers in the region. Many states have the ingredients for aquifer-based collaborative management and have piloted efforts, which should be empowered, funded and expanded. Sustainable groundwater use can also mean sustained economic prosperity and those most connected to particular places are often deeply invested in local stewardship. Additionally, where aquifers span political boundaries—across local government jurisdictions, into reservations, or across states—aquifer-level policy institutions could replace fragile informal agreements and mitigate the possibilities of costly litigation.
5. **Develop a regional strategy for reuse and recharge, incentivizing multiple cycles of use for pumped water and clean and safe aquifer replenishment.** Groundwater is a natural resource stock that is constantly changing because of inbound and outbound flows. Most of the policy attention in the Great Lakes region has been paid only to the outbound direction – withdrawals from pumping, impacts to ground-water-derived base flow in streams, and levels of lakes and wetlands. At a minimum, more attention should be paid to maximizing the value of groundwater once it is withdrawn, reusing it before discharging to surface waters. A next step is to focus on the inbound flows. Land-use practices have a direct impact on water infiltration and subsequent aquifer recharge. Managed aquifer recharge— either through infiltration basins or direct injection— is part of the management toolkit in some western states to keep withdrawals in balance with input and to maintain flow to surface water features. Caution is merited to ensure that aquifers are not contaminated when recharged, but thoughtful attention to increasing aquifer replenishment can be a win-win. Because some of the most depleted aquifers cross state lines, managed recharge will be most effective if it develops at the regional level or in cross-state partnerships.

Additional approaches should be pursued wherever possible and can have an impact even at relatively small scales.

1. **Encourage an “all of the above” approach to groundwater conservation action.** Given how nascent groundwater governance is, leadership is needed at all levels of government. Water supply is a core concern for many very local governments and governance in the water domain typically involves action at multiple levels of the federal system. At this stage, we believe local, state, regional, tribal, federal, and international efforts can all make a difference in building a sustainable, equitable, and restorative groundwater governance system. Where interested partners lack technical expertise to wield their legal authority – as in the case of many local governments – model rules and guidance documents can facilitate their actions.
2. **Strengthen scientific capacity and groundwater leadership in Native-led organizations and Tribal Governments.** The concept of “one water”—not identifying it as different because of where it temporarily resides in a cycle—is the pervasive view among the indigenous peoples of the region. Springs and other groundwater-dependent ecosystems such as cold water streams are part of their cultural and spiritual heritage and the reserved rights that support traditional ways of life. Tribal Governments and consortia are natural partners to other conservation stewardship organizations and their governing philosophies intrinsically embrace sustainability because water is key to all life. Building hydrogeological knowledge in these organizations, including with funded positions focused on groundwater, would help integrate and magnify accumulated observational

and traditional knowledge and elevate important leadership in the region. It would also allow Tribal Governments to more meaningfully manage natural resource issues that intersect with groundwater.

3. **Establish minimum ecosystem service protections across the region and expand the suite of groundwater-ecosystem services protected from appropriation impacts.** The general scheme of groundwater appropriation policy across the states is to allow for free use while minimizing negative impacts. As long as that is the scheme, it is worth attending to which impacts are guarded against. Cold-water streams that support trout and other species are presently protected in some form in 5 of 6 states, but springs, fens and other wetland ecosystems, and even baseflow that supports streams and lake levels may also deserve special protections. In many cases, the impacts are seasonal and result from temporary aquifer depletion and lessened discharge to surface water features during summer irrigation periods which can negatively impact aquatic species survival. There will not be a one-size-fits all approach to this as ecosystems and the aquifers that support them will need to be monitored and understood to determine when species are most dependent on groundwater and when they are most vulnerable.
4. **Better align appropriation policy with measures of water value and clarify where and how trade-offs are made.** In general, groundwater appropriations are treated as though all groundwater is of equal value when this is obviously false. Some aquifers produce water so clean it requires virtually no treatment to be drinkable while others are contaminated by geogenic or anthropogenic sources. Some aquifers recharge quickly and can be genuinely thought of as renewable resources. Others recharge so slowly that their use is more comparable to mining and should trigger considerations of long-term lost opportunities and maximization of the value of the extracted resource. Groundwater users have varying degrees of choice among aquifers and the ability to substitute with surface water. Uncoordinated policy institutions encourage unreflective trade-offs between these values: encouraging the use of deeper, non-renewable aquifers to preserve streamflow, for example, even though such pumping “mines” the deeper aquifers and induces a gradient that deepens plumes of contaminants. Clear and thoughtful thinking about groundwater value is needed, as are clear ways of navigating and deciding about value tradeoffs.
5. **Leverage federal funds for groundwater science and sustainability.** Once-in-a-generation federal investments in infrastructure and climate resilience present unique opportunities to develop groundwater management tools in the region. Increased groundwater knowledge and new management practices could harness aquifers as an explicit component of green infrastructure. Such investments could demonstrate the value of improved groundwater governance and catalyze ongoing state and federal support for hydrogeologic knowledge development, especially where such knowledge lags behind.

From our vantage point, it will take concerted action from many stakeholders to build a system that is sustainable, equitable, and repairs past harm. We are fortunate to have so far avoided the scale of crises other groundwater-dependent regions have experienced. But groundwater use in our region may still imperil the opportunities of future generations. It isn't clear that we are consistently putting groundwater to use to maximize its social value or build broad-based, inclusive prosperity. In developing groundwater governance, we should also aspire to repair past harm—especially to Indigenous communities, the Tribal Governments representing them, and the ecosystems of which they are intrinsically a part. Given the likely population and climate stresses in our region's future, and pressure from outside of our region, urgent action and careful, coordinated planning is warranted.