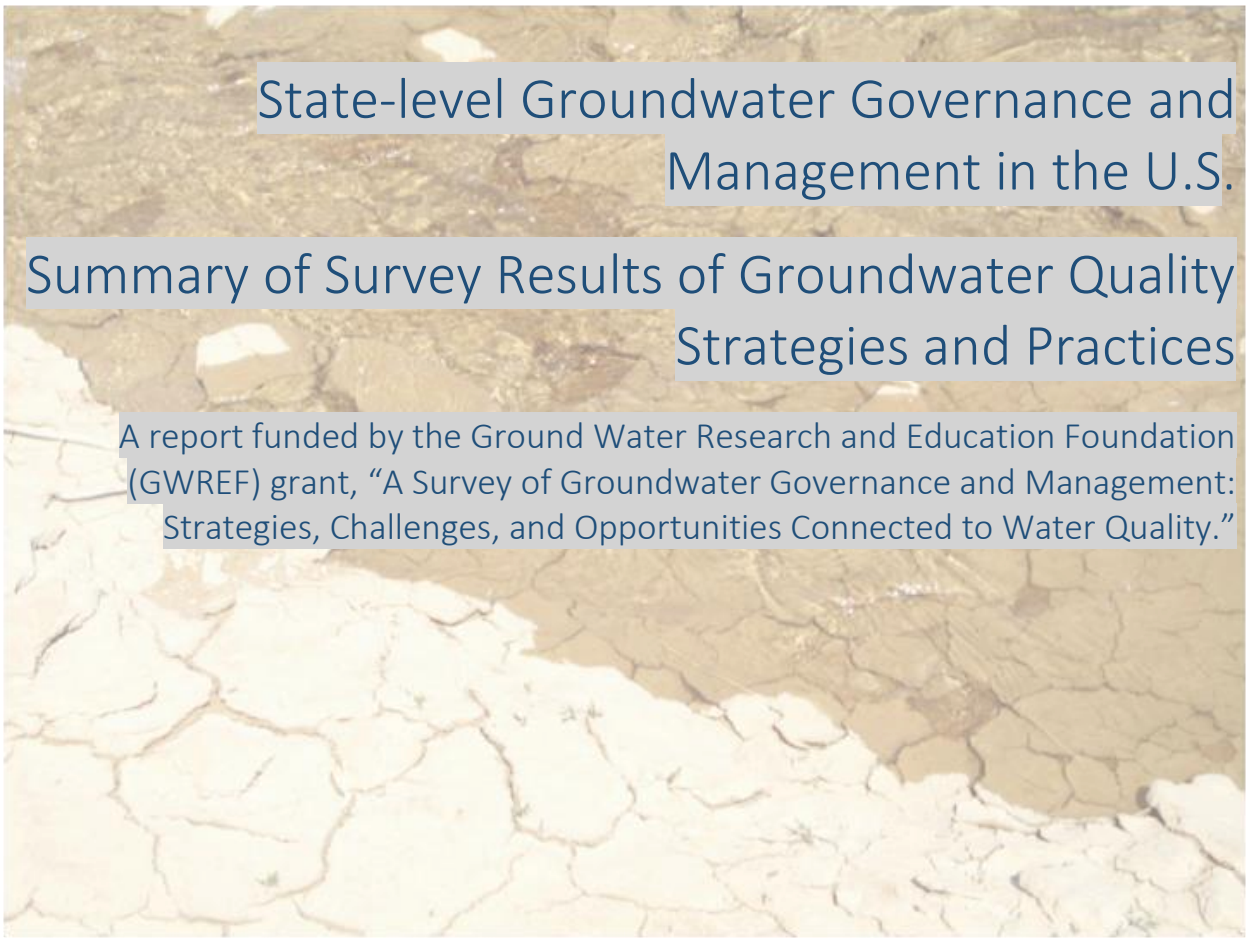

State-level Groundwater Governance and Management in the U.S.

Summary of Survey Results of Groundwater Quality Strategies and Practices

A report funded by the Ground Water Research and Education Foundation (GWREF) grant, "A Survey of Groundwater Governance and Management: Strategies, Challenges, and Opportunities Connected to Water Quality."

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The University of Arizona

Final Report

June 28, 2017

Executive Summary modified June 6, 2018

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EXECUTIVE SUMMARY

Groundwater governance and management practices vary considerably across the United States. To better understand groundwater governance strategies and practices connected to water quality in the United States, a team from the University of Arizona Water Resources Research Center designed and launched a nationwide survey in 2016. The goal of the project was to identify on-the-ground practices of groundwater governance that may help to improve and enhance management of the nation's water supplies, particularly within the realm of groundwater quality. A state water professional was recruited in each state to participate in the nationwide survey. The report was prepared as a project funded by the Ground Water Research and Education Foundation (GWREF) of the Ground Water Protection Council and benefitted from the involvement of GWREF representatives throughout the formulation of the survey. The surveys were responded to online, with no in-person interviews conducted. This report presents major findings from the survey.

State water professionals identified a wide variety of groundwater concerns, including impairment of water quality and quantity, staffing and budget issues, health/vulnerability of private well users and aquifer overdraft. There are concerns about contamination of groundwater, especially in agricultural sites, but state professionals also expressed concerns about naturally occurring contaminants, underground storage tanks, Superfund/CERCLA sites, industrial sites, and septic tanks. Nitrate was the most selected contaminant of concern, followed by chlorinated solvents. More than half (53%) of respondents indicated that unconventional oil and gas exploration and production are occurring and regulated in their states.

Most respondents indicated the existence of explicit groundwater quality management goals in their states and have observed significant changes to groundwater quality policy in the last 10 years. Most states share groundwater quality data with a multitude of user groups. Most states have groundwater quality standards and a groundwater classification system.

States have multiple sources of funding for water quality programs, with 85% receiving some form of federal funds. However, for a majority of states, groundwater quality program budgets have decreased in the last 10 years. A majority of surveyed agencies describe the number of staff as too small. Some states rely on local and federal agencies to help implement groundwater quality regulations.

Looking to the future, respondents indicated a number of issues will require more attention in the next 10 years, notably water quality/water level monitoring and increased groundwater pumping. Almost half of states anticipate that changes in groundwater regulation are likely in the next five years.

This report is available at https://wrrc.arizona.edu/groundwater. A journal article based on the report's findings has been published in *Water*. The article "Critical Issues Affecting Groundwater Quality Governance and Management in the United States" is available at http://mdpi.com/2073-4441/10/6/735.

INTRODUCTION

Groundwater is a critical component of the water budget in the United States (U.S.). Approximately 22% of total national water withdrawals come from groundwater sources; more than 27 trillion gallons (about 106 billion cubic meters) of fresh groundwater are pumped from underground sources annually (Barber 2014). It is the nation's principal reserve of freshwater and represents much of the potential supply during times of drought (Dennehy et al. 2015).

Although groundwater is relied upon as a source of water for communities, industries, and irrigators, the study of governance of the resource has been historically neglected. Yet this situation has changed somewhat in recent years, as interest in the study of groundwater governance has increased across the world (Eckstein and Eckstein 2005, Puri and Aureli 2005, Jarvis 2008, Braune and Adams 2013, Megdal et al. 2015, Sugg et al. 2015, Varady et al. 2016).

Groundwater governance can be defined as the "overarching framework of groundwater use laws, regulations, and customs, including the processes of engaging the public sector, the private sector, and civil society" (Megdal et al. 2015, p. 678). This differs from groundwater management. While groundwater governance makes laws, policies, and regulations, groundwater *management* comprises the actions to implement these laws, policies, and regulations (Megdal et al. 2015). Due to the decentralized nature of groundwater governance in the United States, one must look at the state or regional level to understand groundwater governance in the U.S.

To that end, an ongoing program at the University of Arizona Water Resources Research Center (WRRC) has aimed to provide a clearer picture of groundwater governance across the U.S. In 2013, the project team crafted and implemented an initial, nationwide survey to acquire baseline and descriptive information about state-level groundwater governance from one representative per state (Gerlak et al. 2013). Results from the initial survey were published in *Groundwater* (Megdal et al. 2015) and online. From the initial survey, a nuanced and complex picture of groundwater governance emerged, with states facing common concerns about groundwater quality and contamination and declining groundwater levels. The initial survey found that states' legal frameworks for groundwater differ widely, and states reported different capacities to enforce groundwater responsibilities. States have also experienced substantial changes in groundwater governance in the past few decades.

With the purpose of examining these findings in greater depth, a team from the WRRC developed a second nationwide survey. The goal of this project was to identify on-the-ground practices that may help improve and enhance management of the nation's water supplies, particularly with respect to groundwater quality. The findings support a timely and vital dialogue with the governmental agencies, practitioners, and the broader water resources community around the governance of groundwater. This report was prepared as a project funded by the Ground Water Research and Education Foundation (GWREF) and benefitted from the involvement of GWREF representatives throughout the formulation of the survey.

This report presents the survey methods and findings and discusses the implications for groundwater governance nationally.

METHODOLOGY

Survey questionnaire

The survey was developed to better understand the current status of groundwater use, laws and regulations, and critical management concerns across the U.S. Questions were designed in consultation with a four-member advisory committee based with the Ground Water Protection Council. The two primary members were John Kenning, the Bureau Chief of Water Protection Bureau in the Montana Department of Environmental Quality, and Mike Wireman, a retired US EPA National Groundwater Expert. With the advice of this committee, the survey was designed to focus on six substantive elements: 1) groundwater concerns and use; 2) groundwater quality management and monitoring; 3) the scopes of groundwater quality regulatory programs; 4) groundwater quality-quantity connections; 5) the scope of resources available and needed, and research and collaboration between local, state, and federal agencies; and 6) exploring future trends in groundwater management. The survey is included as Appendix A to this report.

Testing and IRB approval

The survey was pilot tested by five groundwater quality professionals, one each from Alabama, Wyoming, Arizona, South Carolina, and Nebraska. This was done to inform the designers about the time the survey would require and helped inform the design of the survey itself. Based on suggestions from the pilot tests, and in consultation with the advisory committee, some of the survey questions were altered before being sent to the respondents.

The survey was done with human subjects, which requires Institutional Review Board (IRB) approval at the University of Arizona. After finalizing the survey questions, they were submitted to the IRB and the survey was approved on February 9, 2016. It was deemed exempt from a comprehensive IRB review due to the lack of risk to the respondents, among other criteria.

Survey participants

One respondent for each of the 50 states was identified through online searches of agencies with authority for water quality in each state. The agencies in charge of water quality (and the organizational structures of these agencies) vary from state to state. In some states the unit that oversees groundwater quality is within a water resources department, while in other states the unit is under the purview of the water quality department. In states where the agency failed or declined to respond, we asked a state level employee at the federally

authorized Water Resource Research Institutes or an official at the United States Geologic Survey (USGS) Water Science Center to complete the survey.[1]

The majority of respondents (31) identified themselves as representatives of state departments of environment.[2] The respondents have an average of 21 years of experience working at their respective agencies, with a minimum of two years to a maximum of 36 years.
The backgrounds of the respondents varied, but were generally focused in the earth sciences such as hydrology and geology. A majority (58%) of respondents indicated that the agency they work for is not the sole agency at the state level that is involved in managing groundwater quality. We refer to survey respondents as "state water professionals", recognizing that not every respondent works for a state water quality agency (see footnotes 1 and 2).

Data collection and analysis

The online survey was conducted between May 2016 and May 2017 using Qualtrics. We worked over that period to achieve a response rate of 100%.

SURVEY RESULTS

This section includes a summary of the results of the survey. Compiled results are presented in the following text. Detailed responses can be found in Appendix B.

Part I: Groundwater concerns and use

Part I of the survey was designed to explore the scope and extent of groundwater concerns and use across the states.

The overall findings suggest:

- About two-fifths of states use groundwater to meet over 50% of human demands.
- Preventing / mitigating impairment of water quality is the #1 concern of state water professionals surveyed, followed closely by quantity.
- More than half of respondents surveyed also identified health/vulnerability of private well users, aquifer overdraft, budget, drought, and staffing issues as key concerns.
- Agricultural sites were the most selected contaminant source. Naturally occurring contaminants were the next most selected contaminant source. More than half of respondents surveyed also identified underground storage tanks, Superfund/CERCLA sites, industrial sites, and septic tanks as sources of contamination.

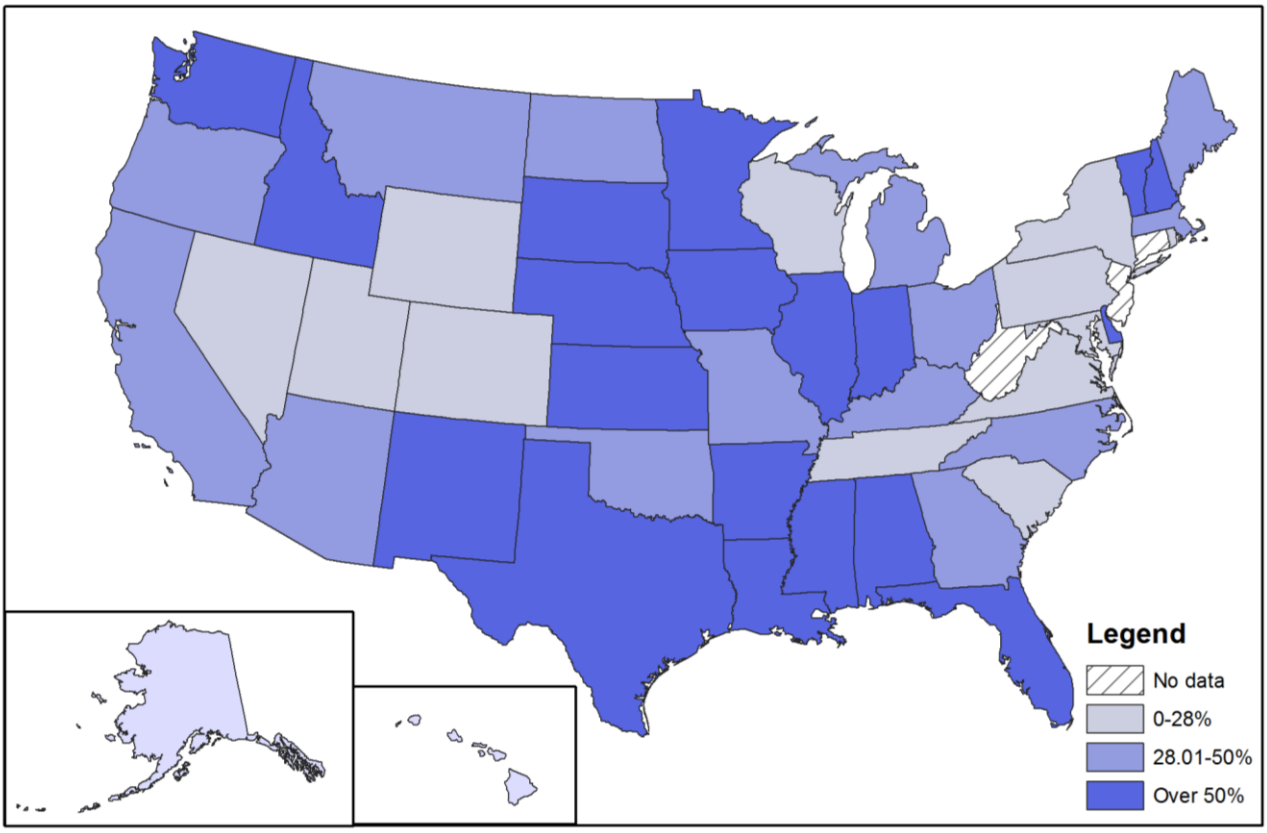
[1] Responses from five states were obtained from employees of the respective Water Resources Research Institutes/Centers. Responses from two states were obtained from USGS employees.
[2] Six respondents represent departments of natural resources, five from departments of health, one each from a resources control board and a department of ecology, three from a university through a WRRI, and two from the USGS.

- Nitrate was the most selected contaminant, which is logical given that agricultural sites were the most selected contaminant source. Chlorinated solvents were the next most selected contaminant. More than half of respondents also selected metals as a top contaminant of concern.

1.1 Groundwater use

We find that about two-fifths of the states use groundwater to meet over 50% of human demands in an average year. Most of these states are located in the north-central and south-central regions of the U.S. However, the approximate percentage of total human water demands (i.e., domestic, commercial, industrial, and agricultural) met through the use of groundwater supplies varies considerably. Only Pennsylvania indicated that less than 8% of its human demands for water are met by groundwater. Figure 1 shows the percentage of human demands met by groundwater.

Figure 1: Percentage of Human Demands Met Through Groundwater Use (Q2.7)



Respondents from a majority of states (64%) indicated that they have aquifers or parts of aquifers where withdrawals significantly exceed recharge (N=45). State water professionals from 27 states provided a description of the affected areas. Table 1 below reports the various state responses.

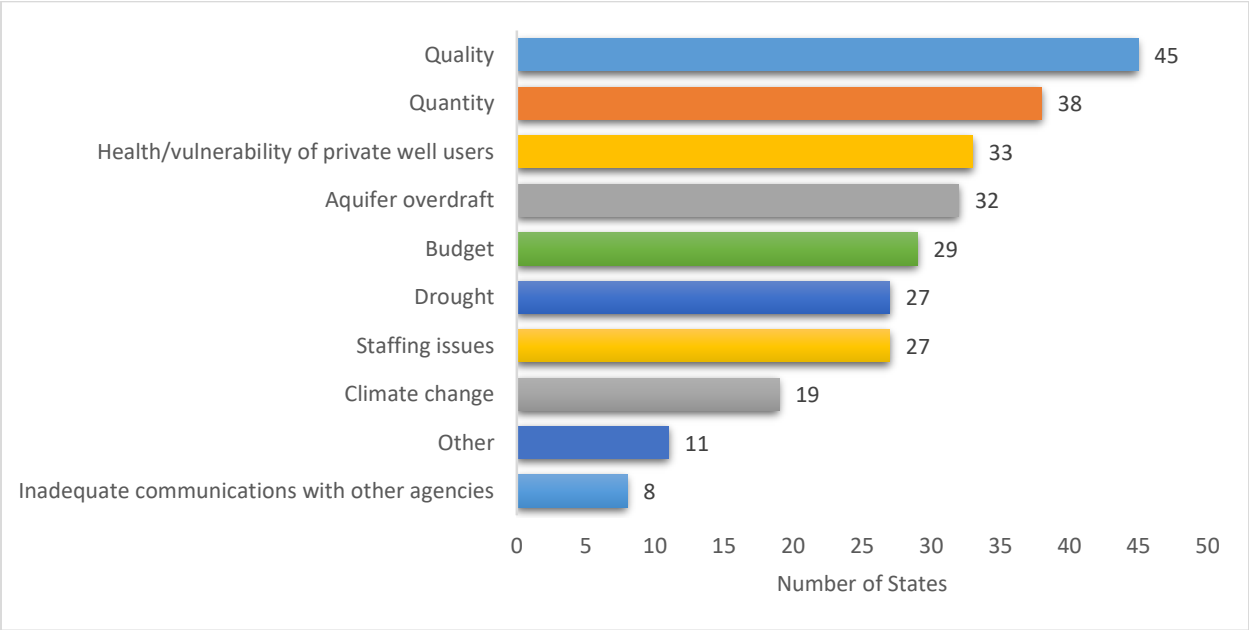
Table 1: Groundwater Withdrawals Significantly Exceeding Recharge, by State (Q2.8)

States where groundwater withdrawals exceed recharge	**State water professionals' descriptions of areas where groundwater withdrawals exceed recharge**
Arizona	Varies – statewide
Arkansas	Mississippi River Alluvial Aquifer in East Arkansas and Sparta Aquifer in East and South Arkansas
California	Most of the Central Valley as well as many coastal basins
Colorado	High Plains/Ogallala Aquifer
Florida	Floridian aquifer. In most of the Florida Peninsula. Biscayne aquifer. In southeast Florida.
Idaho	Eastern Snake Plain Aquifer
Illinois	St. Peter Sandstone Northeastern Illinois
Iowa	Cambro-Ordovician in east central Iowa
Kansas	High Plains Aquifer
Massachusetts	Ipswich and Ten Mile Basins exceeded their identified basin safe yield. MA does not have specific aquifers defined as exceeding recharge volumes.
Minnesota	Twin Cities Basin, Prairie du Chien/Jordan aquifer
Mississippi	MS River Valley Alluvial Aquifer
Missouri	The Ozark Aquifer is in decline in small scale areas around some cities/towns and where there is high industrial usage in McDonald and Pettis counties.
Nebraska	Southwest, southeast
Nevada	Central Nevada, mining areas
New Mexico	Everywhere
New York	Genessee County
North Dakota	Fox Hills - Western ND
Oklahoma	"Almost all of them...by design"
Oregon	Eastern Oregon; Willamette Valley
South Carolina	Coastal areas
South Dakota	Dakota aquifer in eastern SD. Historical overdraft but stabilized more or less today
Texas	Roughly the western half of the state
Utah	Most of the state except the far north (Cache Valley) continues to see declining water levels, some severe as in the SW part of the state.
Vermont	Individual residential developments, ski resorts
Virginia	Coastal Plain Aquifer System
Washington	Columbia River Basalts, Walla Walla Basin
Wyoming	High Plains aquifer in SE WY

1.2 Groundwater concerns

When asked about their groundwater concerns, respondents identified a variety of concerns from water quality and quantity to staffing and budget issues.[3] Figure 2 below reports the top groundwater concerns identified by respondents.[4]

Figure 2: The Most Selected Groundwater Concerns identified by State Water Officials (N=48) (Q2.1)



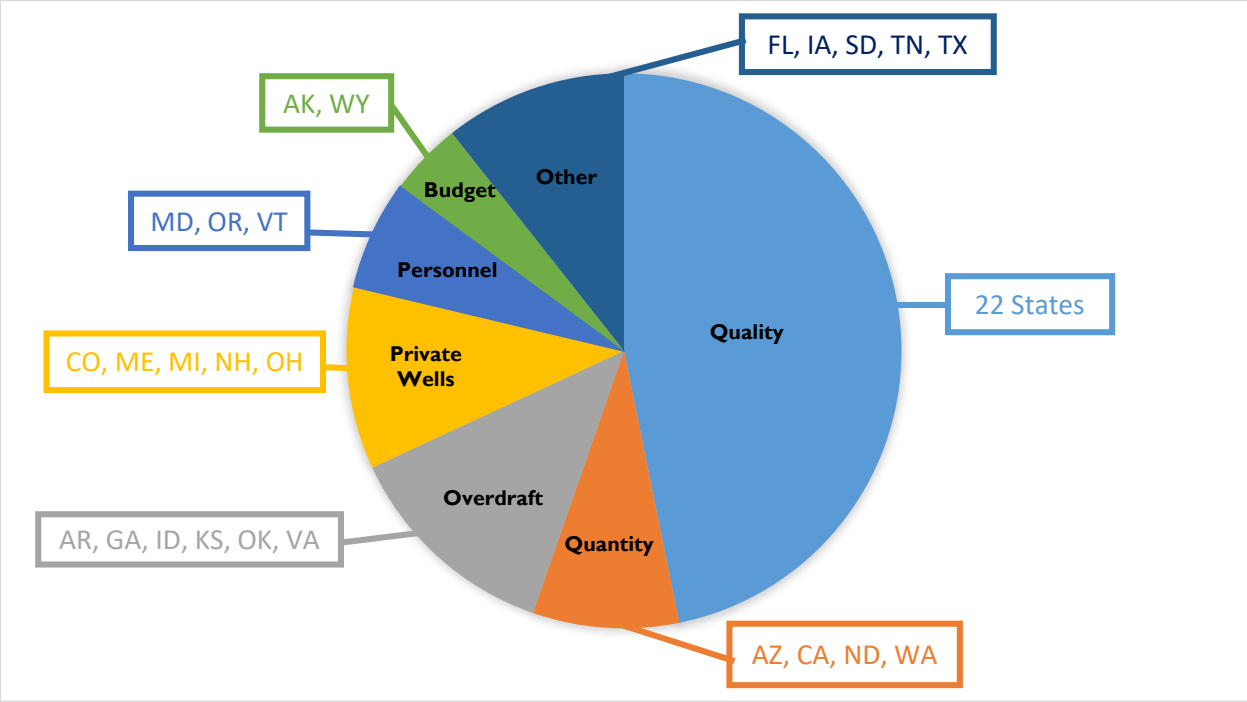
State water professionals were asked to rank the top three groundwater concerns from the list of issues identified in Figure 2. The states in callout boxes in Figure 3a (and mapped in Figure 3b) listed the concern as number one. Figure 4 shows how many respondents listed each concern in their top three groundwater concerns for their states. See Appendix B for a complete listing of ranked groundwater concerns.

[3] The remaining concerns were climate change, other concerns, and inadequate communications around water quality with other agencies. Three of 10 "other" concerns mention land use changes. Other concerns listed include agricultural impact, changing permafrost conditions, lack of permitting programs, saltwater intrusion, being expected to do more with less resources, and conflicting regulations between Federal and State rules.

[4] The concepts of water quality and quantity have been defined broadly for the purposes of this survey. We recognize that some respondents may be more interested in contamination issues or overdraft, while others are more focused on regulatory matters.

Figure 3: Number One Ranked Groundwater Concerns, by State (N=48) (Q2.2)

a) In Callout Boxes



b) Mapped

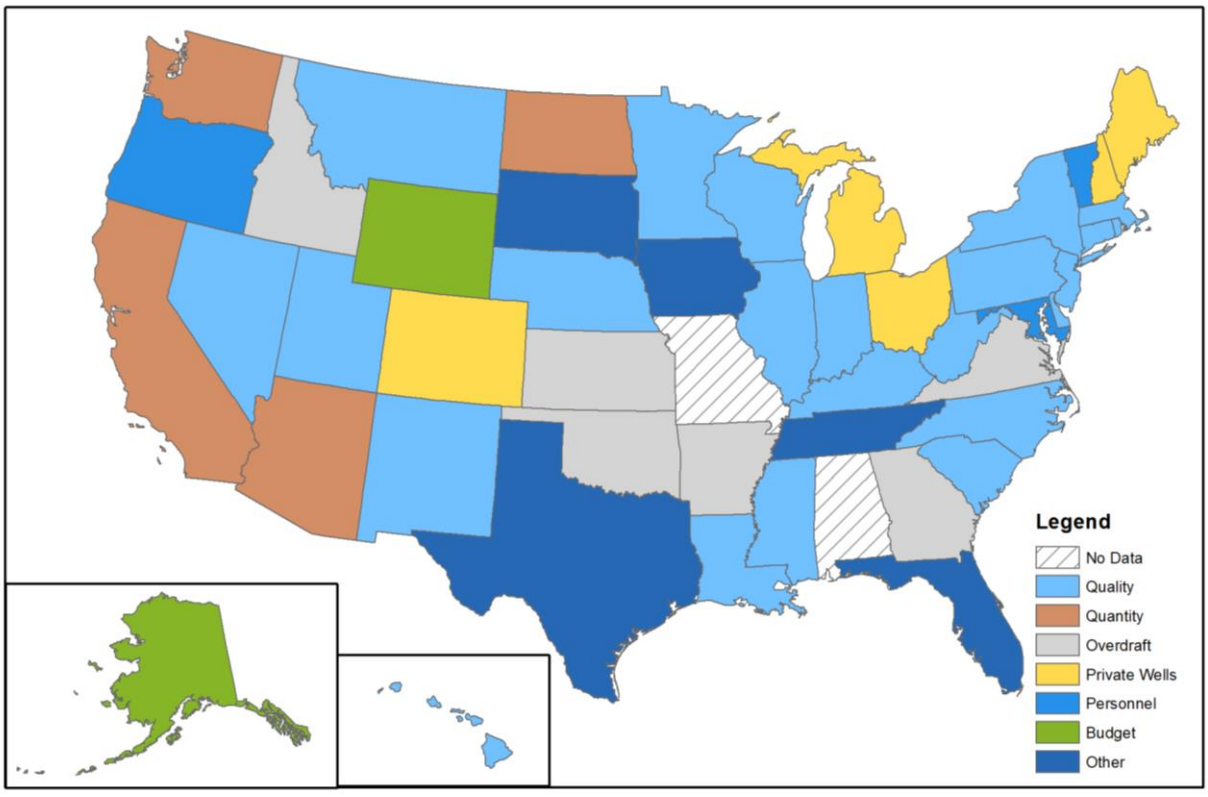
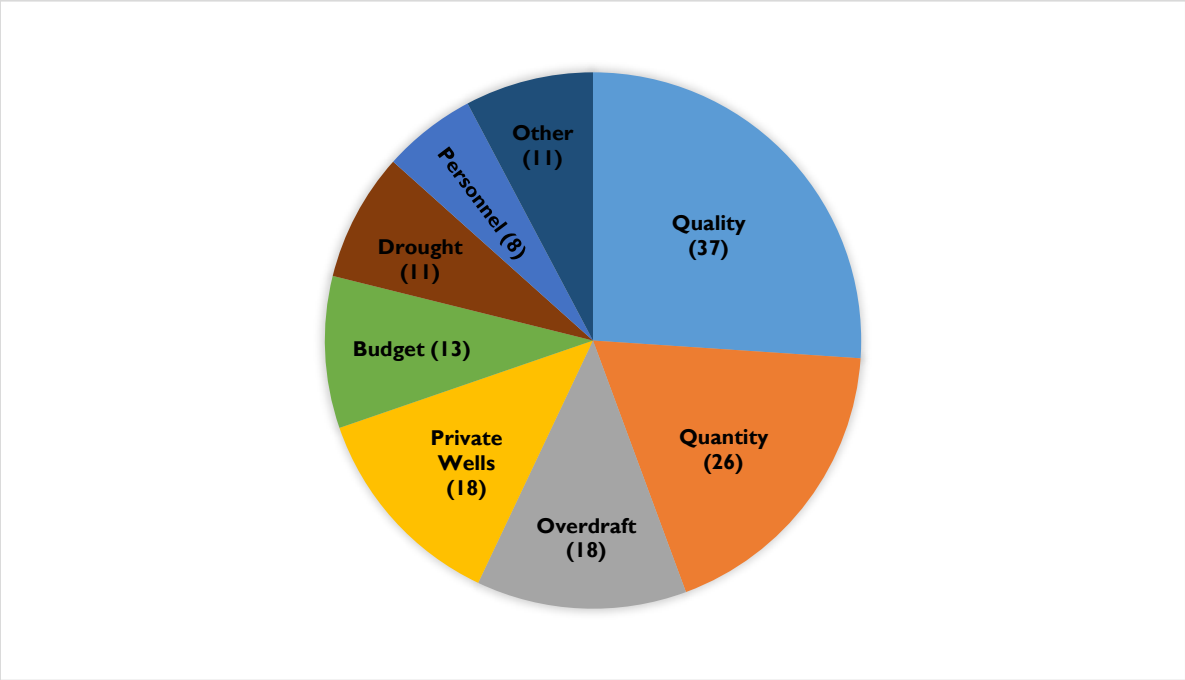


Figure 4: Frequency of Groundwater Concerns Listed in the Top Three by States (N=48) (Q2.1)



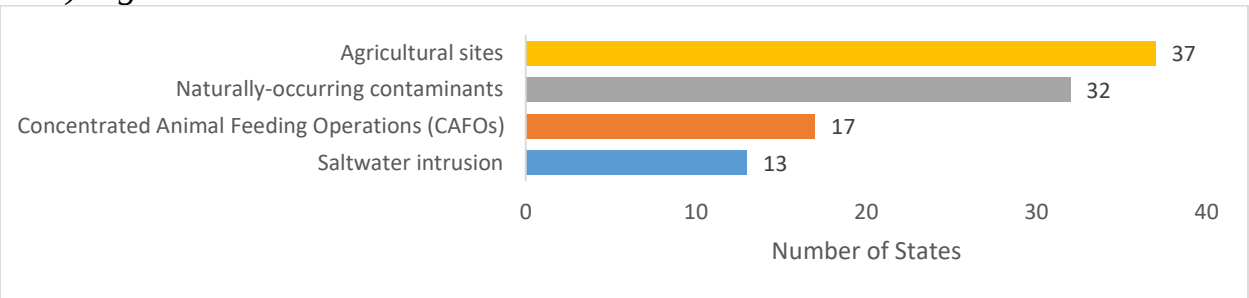
1.3 Contamination and groundwater

Respondents reported multiple and varied sources of water quality contamination, ranging from agricultural sites and underground storage tanks to naturally occurring contaminants and industrial sites.[5] State water professionals selected "agricultural sites" (74%) and naturally occurring contaminants as the most prominent contaminant sources. Underground storage tanks were identified by 58% of respondents as the most prominent industry-related contaminant source. Septic tanks were identified as the most prominent municipal and other-related contaminant source by 58% of respondents. Tennessee selected 15 out of 17 listed contaminant sources. Indiana, Kentucky, Michigan, Minnesota, Missouri, New Mexico, and West Virginia selected 10 or more contaminant sources. Arkansas, Iowa, Vermont, and Wisconsin each only selected two of the listed contaminants. Figure 5 below displays the most selected contaminant sources by general category.

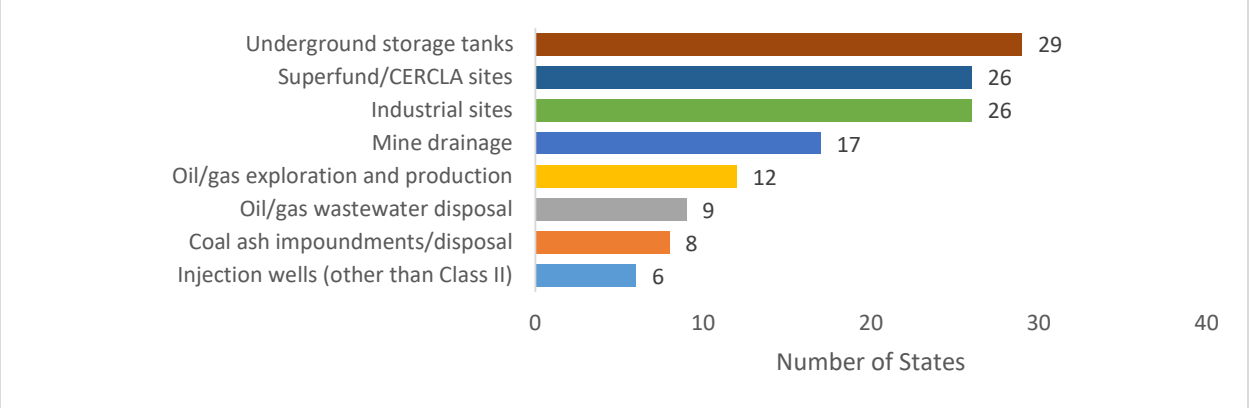
[5] Other responses include "gas well flowback water," "ASR," "fertilizer nutrient runoff from urban/suburban landscaping," "salt storage/application," "waste sites in general," "remediation sites," abandoned oil/gas wells, landfills, waste piles or tailings," "PFCs from both air and waste discharges, MtBE," "federal facilities, dry cleaners," "chloride from de-icing chemicals, water softeners," and "registered contaminated sites (non-Superfund); residential heating oil tanks; diesel power generation."

Figure 5: Contamination Sources: a) Agricultural and Natural, b) Industrial, and c) Municipal and Other (N=49) (Q2.3)

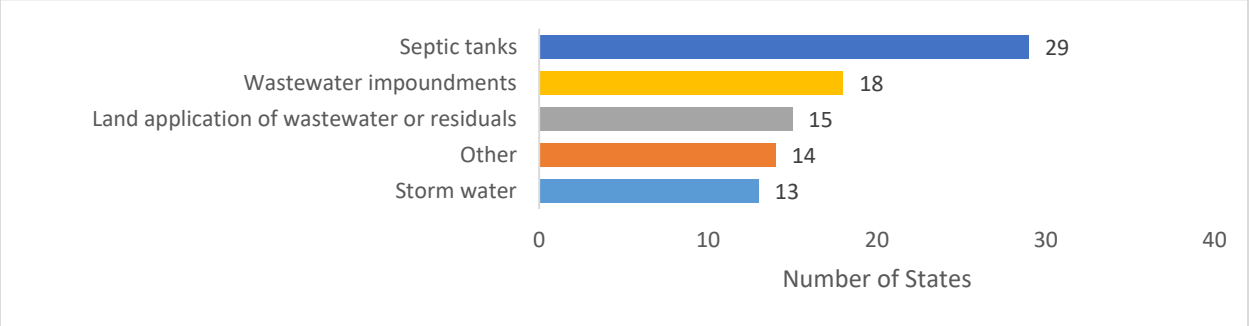
a) Agricultural and Natural



b) Industrial



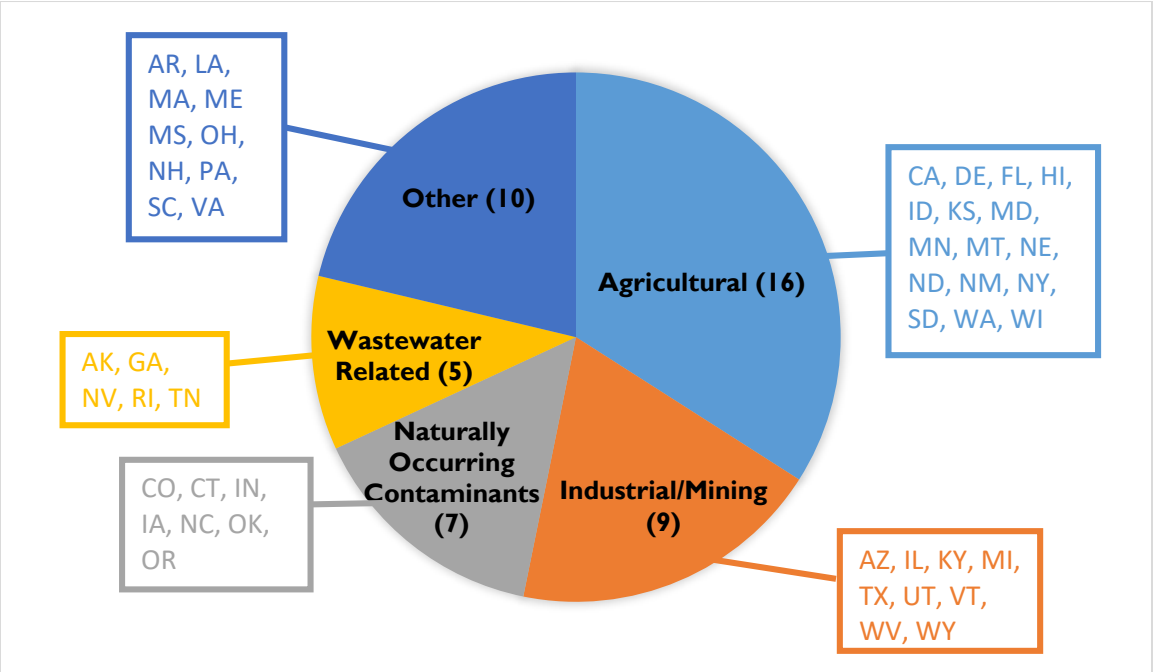
c) Municipal and Other



Respondents ranked the top three contaminants their states are managing. Figure 6 shows the contaminants listed as number one by states by callout boxes in Figure 6a and mapped in Figure 6b, and Figure 7 displays the frequency of contaminants listed in the top three by states. See Appendix B for a complete listing of ranked contaminant sources.

Figure 6: Number One Ranked Groundwater Contaminant Source, by State (N=47) (Q2.4)

a) In Callout Boxes



b) Mapped

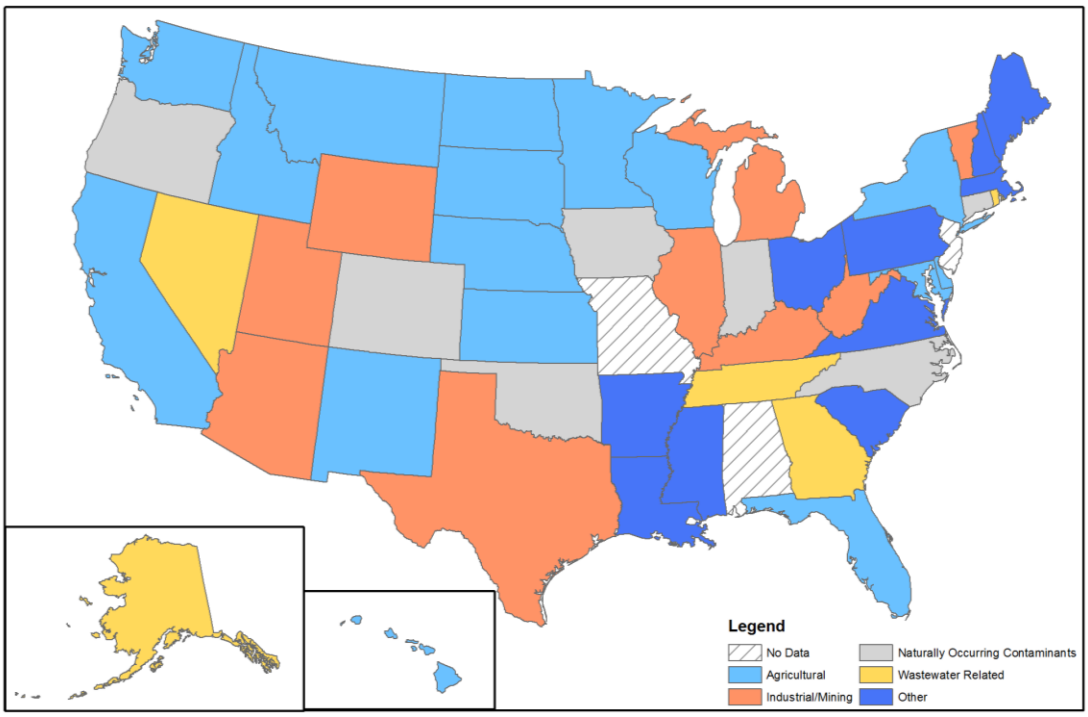
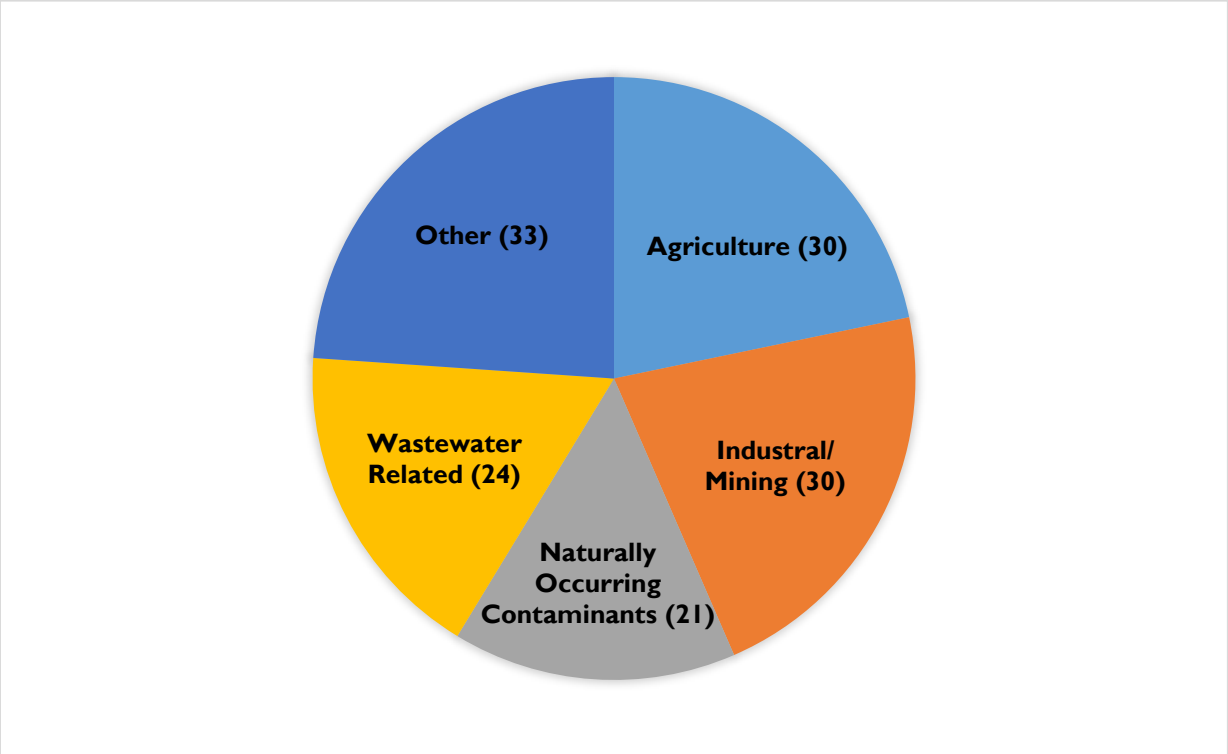


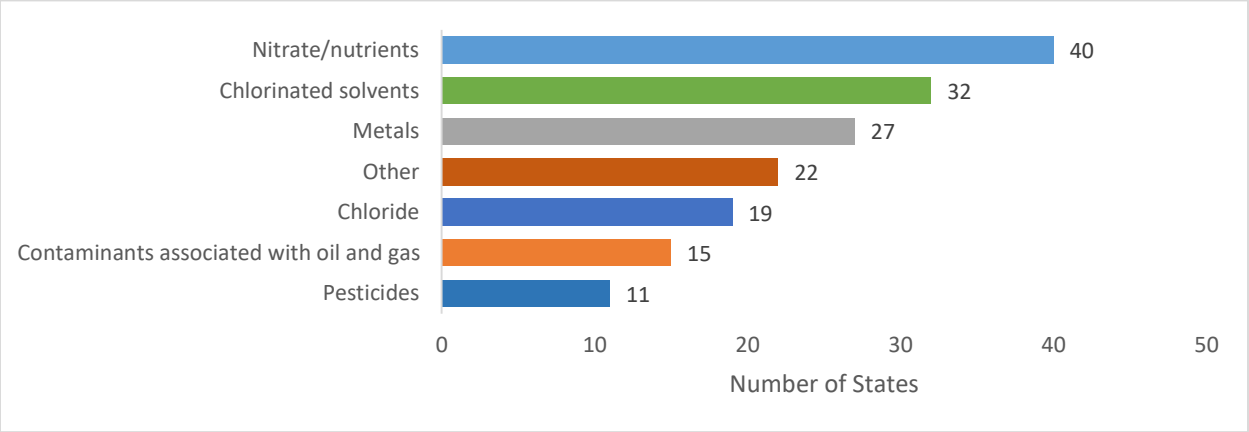
Figure 7: Frequency of Groundwater Contaminant Sources Ranked in the Top Three by States (N=47) (Q2.4)



State water professionals reported a variety of contaminants, including nitrates/nutrients, chlorinated solvents, metals, and pesticides.[6] A strong majority of respondents – some 81% -- identified "nitrate/nutrients" as a contaminant of concern in their states, making it the most selected contaminant (Figure 8).

[6] Other responses include "septic system failures," "arsenic," "PFOA and similar compounds," "radiologicals, e.coli," "PSOA and related chems and pathogens," "bacterial (coliforms)," "saltwater intrusion," "naturally occurring arsenic and other naturally occurring compounds/radionuclides," "emerging, unregulated contaminants," "Volatile Organic Chemicals (VOC), Radionuclides, Microbiological, Salinity/Brine, Sulfates/Manganese/Iron, Total Dissolved Solids," "bacteria," "MtBE, PFCs, PFOA, PFOS," "pathogens, PFOA," "Total Dissolved Solids," and "arsenic, manganese, radionuclides."

Figure 8: Most Selected Contaminants of Concern (N=49) (Q2.5)



State water professionals ranked the top three contaminants of concern their states face. Figure 9 shows the groundwater contaminants of concern listed as number one by states, and Figure 10 shows the frequency of groundwater contaminants of concern listed in the top three by states. See Appendix B for a complete listing of ranked contaminants.

Figure 9: Number One Groundwater Contaminant of Concern, by State (N=44) (Q2.6)

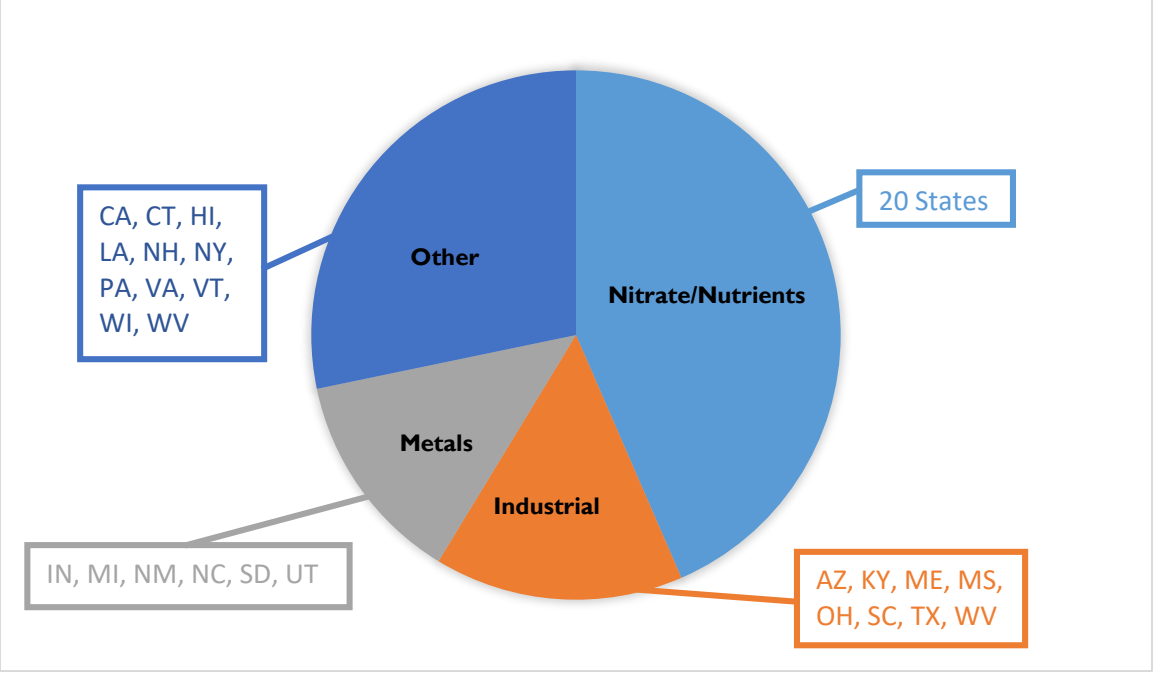
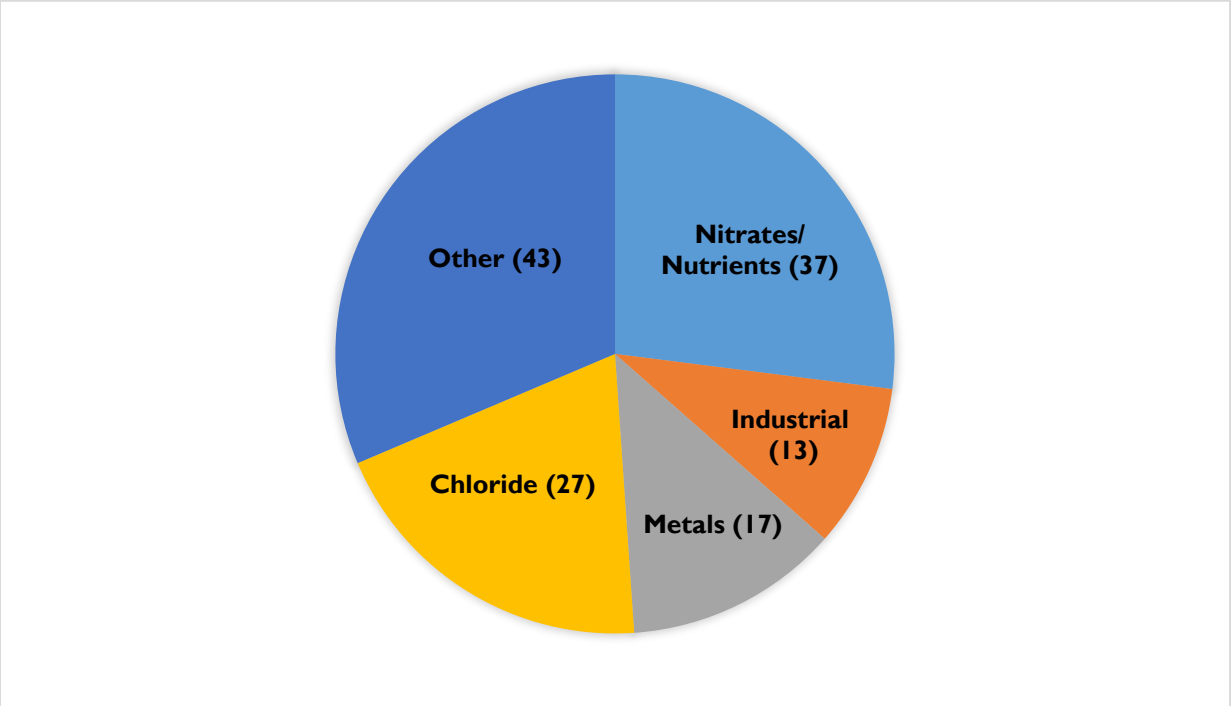


Figure 10: Frequency of Groundwater Contaminant of Concern Ranked in the Top Three by States (N=44) (Q2.6)



Part II: Groundwater quality management and monitoring

Part II of the survey was designed to explore the scope of state groundwater quality management and monitoring.

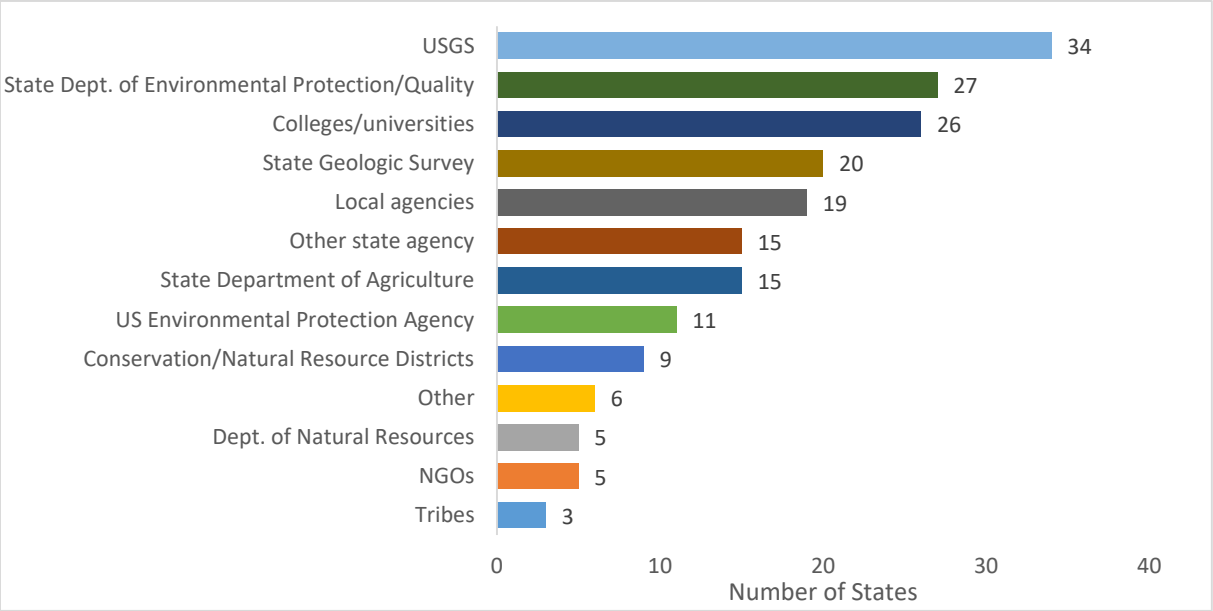
The overall findings suggest:

- Groundwater quality monitoring resides with the United States Geological Survey (USGS) for many states; however, this responsibility is often shared among multiple agencies.
- Most state water professionals indicated the presence of explicit groundwater quality management goals in their states.
- Many states have seen significant changes to groundwater quality policy in the last 10 years.
- Most states share groundwater quality data with a multitude of user groups.

2.1 Groundwater quality monitoring

In many states, multiple agencies conduct groundwater quality monitoring.[7] For example, the USGS conducts monitoring in 67% of states, state Departments of Environmental Protection/Quality conduct monitoring in 55% of states, and colleges/universities conduct monitoring in 54% of states. Figure 11 below shows organizations that conduct groundwater quality monitoring.

Figure 11: Organizations that Conduct Groundwater Quality Monitoring (N=49) (Q3.8)



Sixty-seven percent of respondents indicated that their states incorporate groundwater quality monitoring in their water resource monitoring strategies. Yet, some states' water resource monitoring strategies do not include groundwater monitoring. Fifteen percent of respondents indicated that groundwater is not incorporated in an overall water resource monitoring strategy in their states, and 17% of respondents indicated that they do not have a water quality monitoring strategy (N=46).

[7] Other entities include US Army Corps of Engineers, State Water Commission, State Health Department, State Water Survey, Water Development Board, Bureau of Mines and Geology, State Highway Department, private well owners, and local water quality districts.

2.2 Groundwater quality management

A majority of the state water professionals surveyed (74%) indicated that they have explicit groundwater quality management goals[8], with 32 of these survey respondents expanding on their state's goals.[9] Responses indicated that twelve states do not have groundwater quality management goals (N=46). See Appendix B for full text responses of goals.

Less than half of respondents (44%) expect their states to meet their groundwater quality management goals, with one state (Idaho) expecting to exceed expectations regarding their goals (N=41).

A large majority (81%) of the state water professionals indicated they have compiled vulnerability/sensitivity maps to aid in managing groundwater quality (N=47).

2.3 Recent changes to groundwater quality policy

While many respondents indicated there have not been significant changes to groundwater policy in the last 10 years (44%), other states have seen significant changes.[10] For the states that have seen significant changes to general standard/regulation-related policy, 22% of respondents indicated that their states have seen changes to Clean Water Act Maximum Daily Load requirements. Regarding industry/well-related policy, 33% have initiated limits on groundwater withdrawals in the last 10 years. Regarding other policy changes, 20% have had changes in stormwater policy (N=45). Figure 12 below shows the most selected significant changes in groundwater policy.

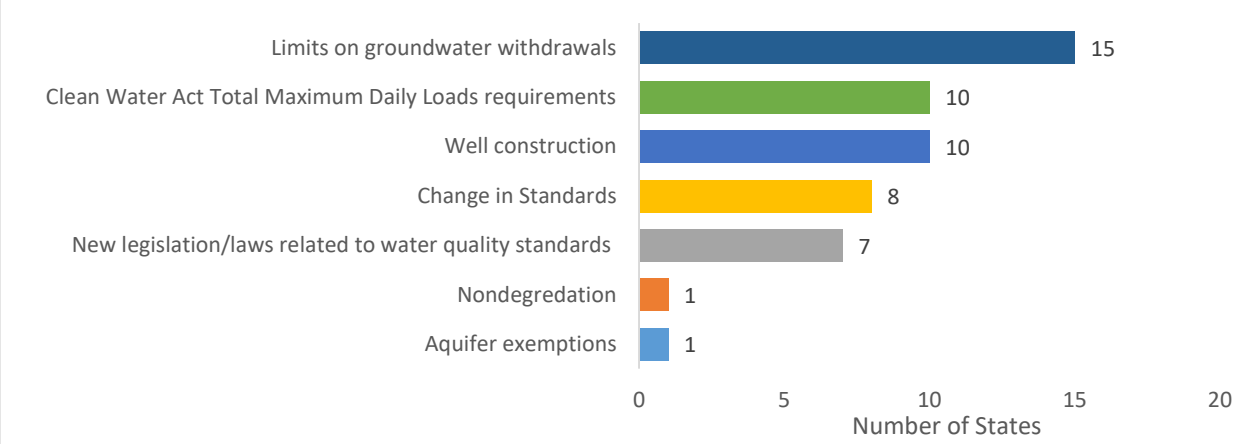
[8] "Groundwater quality management goals" are defined in this context as qualitative or quantitative endpoints toward which effort is directed in groundwater quality management. Examples of goals stated include: "control nitrate/nutrients in groundwater", "improve groundwater quality monitoring", and "to maintain the beneficial uses of groundwater in use of specific standards." Appendix B contains a complete list of respondents' goals.

[9] The word was "protect" was used 10 times. "Drinking" was used 4 times in the context of protecting drinking water, protecting groundwater as a potential drinking water source, "maintain" was used 4 times in the context of maintaining and protecting, maintain in its natural condition, and maintain the beneficial uses of groundwater. Degradation was used three times in the context of not degrading groundwater. "Nutrient" was used three times to reduce them, control them, and manage them.

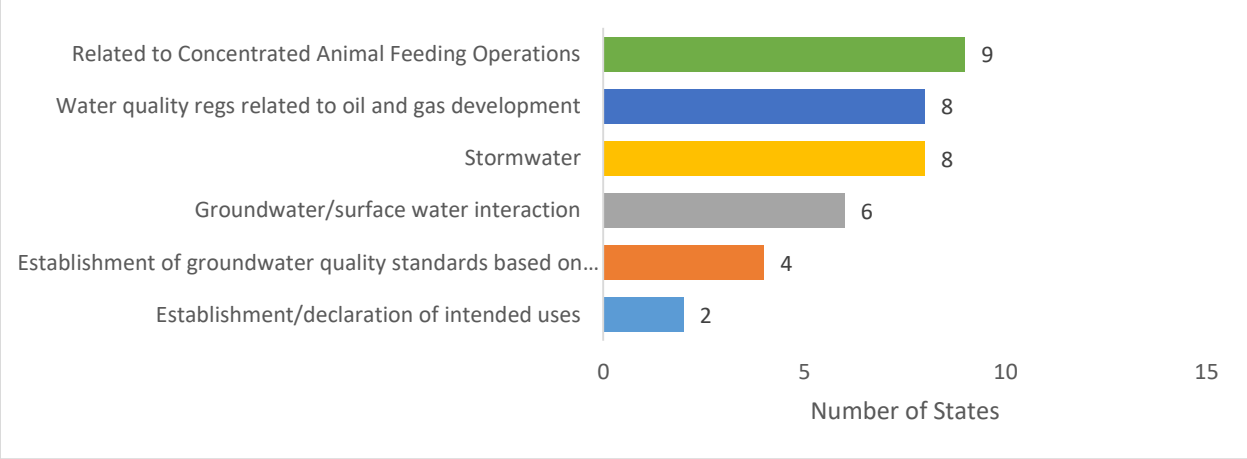
[10] Other responses include "groundwater was placed in the public trust by the legislature," "right-to-know laws and carcinogenic MCL prevention," "denitrification standards for septic systems in vulnerable coastal areas," "new groundwater quality guidelines based on human exposure," "Amendments to anti-degradation provisions establishing nitrate targets," "power plant's before applying for water withdrawal permit for cooling water, they must explore the use of reclaimed water," and "continued Emphasis on Resource Assessment e.g. mapping."

Figure 12: Significant Changes to Policy in Last 10 Years Related to a) General Standards/Regulations and b) Other (N=45) (Q3.4)

a) General Standards/Regulations



b) Other



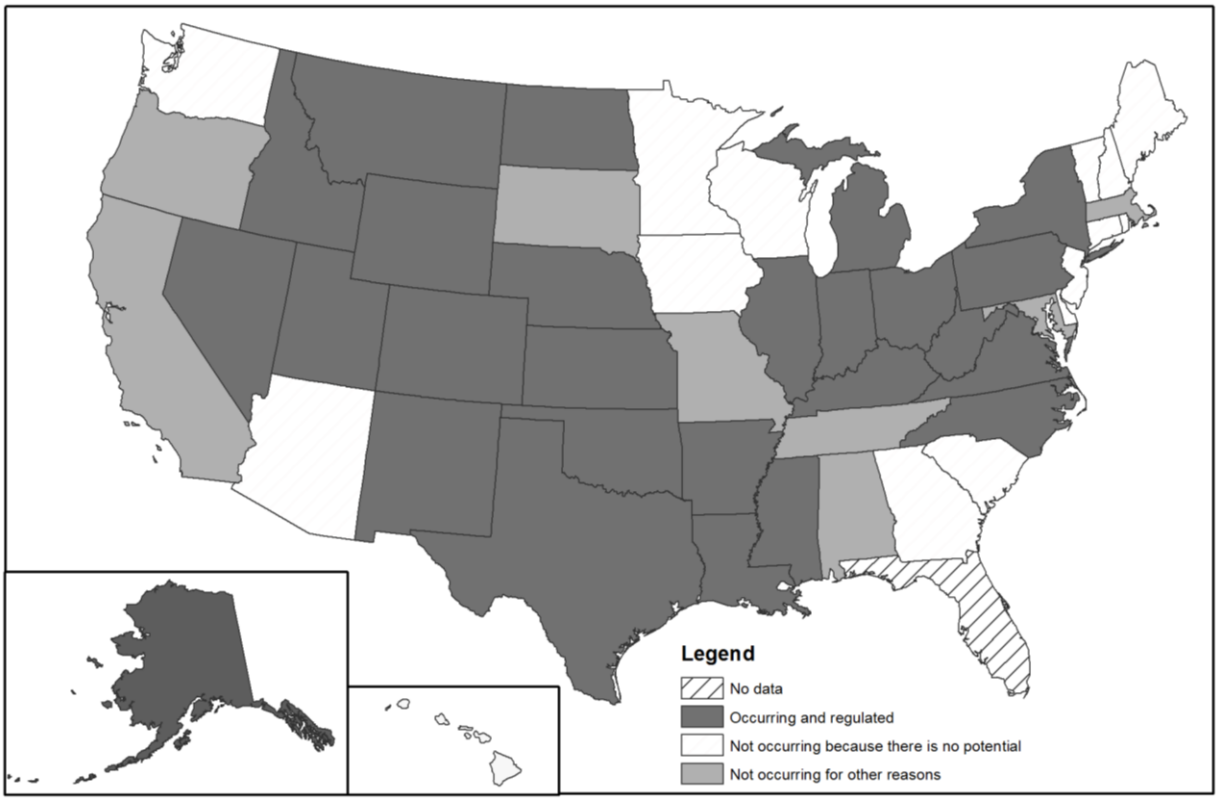
2.4 Unconventional oil and gas

More than half (53%) of state water professionals indicated that unconventional oil and gas exploration and production is occurring and regulated in their states, while 31% indicated that it is not occurring because there is no potential. Respondents from eight states indicated that it is not occurring for other reasons. [11] There are no states where unconventional oil and gas

[11] Six of the states gave other reasons why unconventional exploration/production is not occurring. Two states mentioned that there was confusion about the definition of "unconventional". One state indicated that there is horizontal drilling, but no fracking. "Proposals for banning fracking in the western part of the state" was mentioned by one state, and another indicated that this type of activity is "on hold until regulations are adopted."

exploration and production is occurring and unregulated (N=49). See Figure 13 for the status of oil and gas regulation by state.

Figure 13: Status of Unconventional Oil and Gas Exploration and Production by State (Q3.5)



2.5 Well drilling

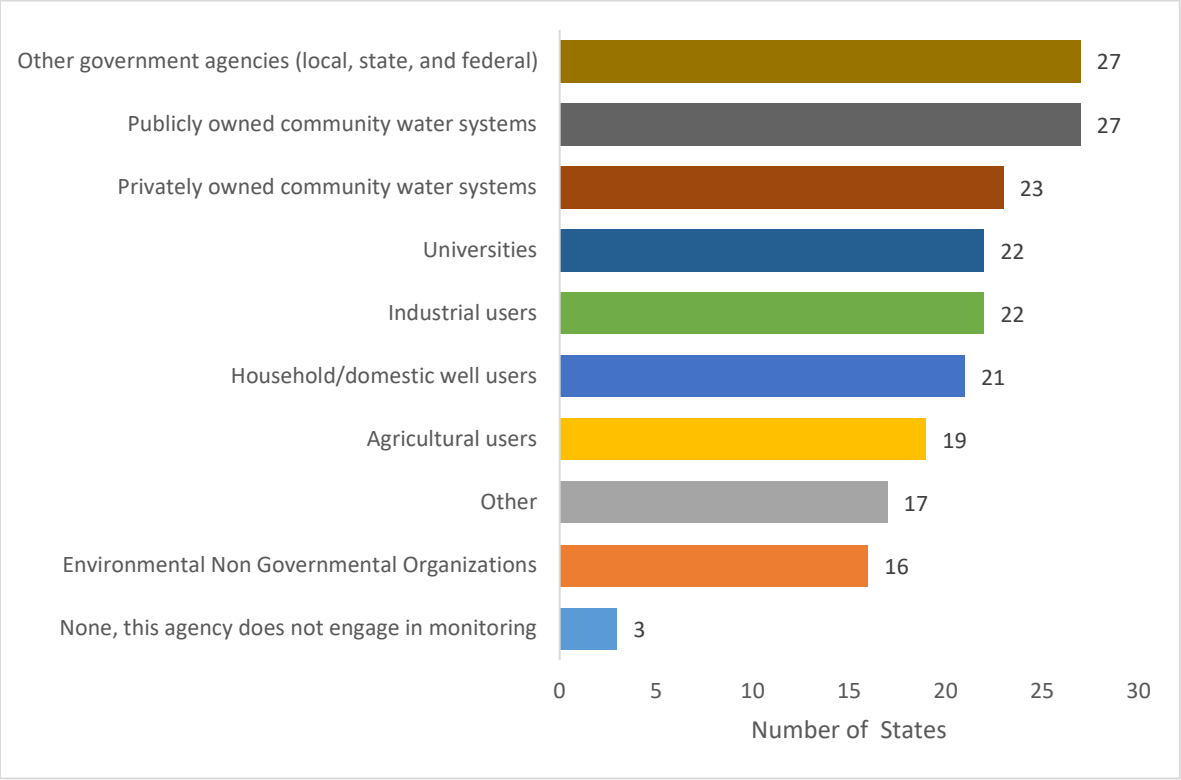
A significant majority of surveyed state water professionals (88%) indicated their state has a driller certification and that all water well drillers are required to obtain it. Only 7% indicated that their states have a certification process, but do not require all water well drillers to obtain certification (N=43). In the same vein, 71% of respondents indicated that their states require continuing education for water well drillers, while 29% of respondents indicated that their states do not require this (N=41).

2.6 Data sharing

A slight majority of respondents (55%) indicated that their agency provides groundwater quality data to publicly owned community water systems, and the same number of respondents indicated that they provide data to other government agencies. Nebraska, New Jersey, and South Dakota each provide groundwater quality data to eight out of nine listed user groups.

Eleven states (Alabama, Arizona, Florida, Idaho, Iowa, Massachusetts, New Jersey, Rhode Island, South Dakota, Texas, and Virginia) have data available to all. Figure 14 below shows the user groups with which state agencies share data.

Figure 14: User Groups that Receive Groundwater Data from State Agencies (N=49) (Q3.10)



Part III: Groundwater quality regulatory program

Part III of the survey was designed to explore the scope of state groundwater quality regulatory programs.

The overall findings suggest:

- Most states have groundwater quality standards, which are based on both qualitative and qualitative standards.
- Many states have many specific types of groundwater quality regulations related to wastewater, with wastewater residuals regulations being the most frequently implemented type of regulation.
- More than half of states (56%) have a groundwater classification system.

3.1 Groundwater quality standards

Most state water professionals (77%) indicated that their states have groundwater quality standards for all groundwater in the state. Only two respondents (Florida and Ohio) indicated that their states have these standards for selected areas or aquifers (N=47).

Less than half (46%) of respondents indicated that their states have groundwater standards based on type of use (N=48). Forty-nine percent of respondents specified that their states have groundwater quality standards that include contaminants for which there is no federal Maximum Contamination Level[12] (N=43). Most respondents (70%) indicated that their states have qualitative and quantitative groundwater quality standards, while 30% have only quantitative standards (N=40).

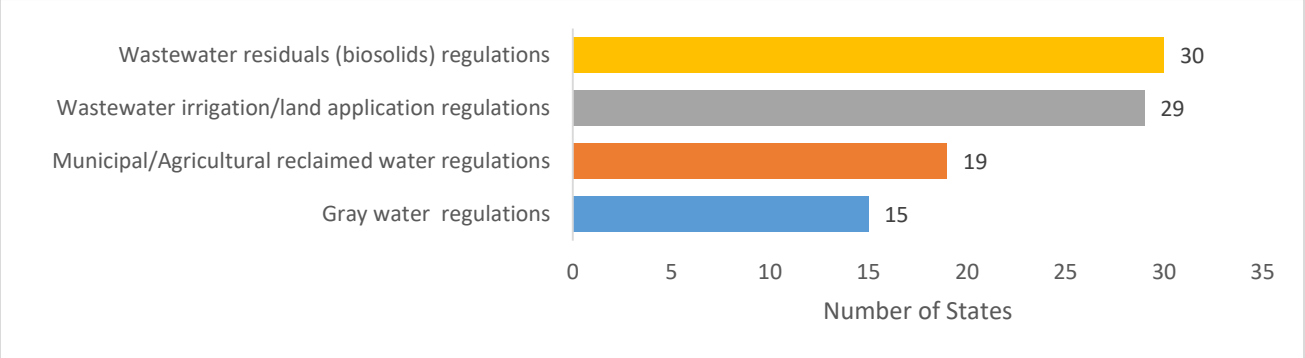
State water professionals indicated that their states have many specific types of groundwater quality regulations, including wastewater residuals regulations, groundwater management areas, groundwater classification, and nutrient management plans.[13] Respondents selected wastewater residuals regulations most frequently as a specific regulation related to reuse/wastewater in their states. Related to agriculture, the most selected specific regulation was Concentrated Animal Feeding Operation regulations, selected by 62% of respondents. Related to classification/management, groundwater management areas (special management areas designated by states to manage groundwater resources) were the most selected specific regulation, selected by 51% of respondents (N=45). Figure 15 shows specific groundwater quality regulations.

[12] Of those that have the standards beyond the federal MCL, 16 respondents gave some further information about the contaminants. "Numerous" was mentioned 4 times, "many" was mentioned 3 times. "MTBE" was mentioned 3 times, "chloride" was mentioned 2 times, "perchlorate" was mentioned 2 times, "sulfate" 2 times, and "iron" 2 times.

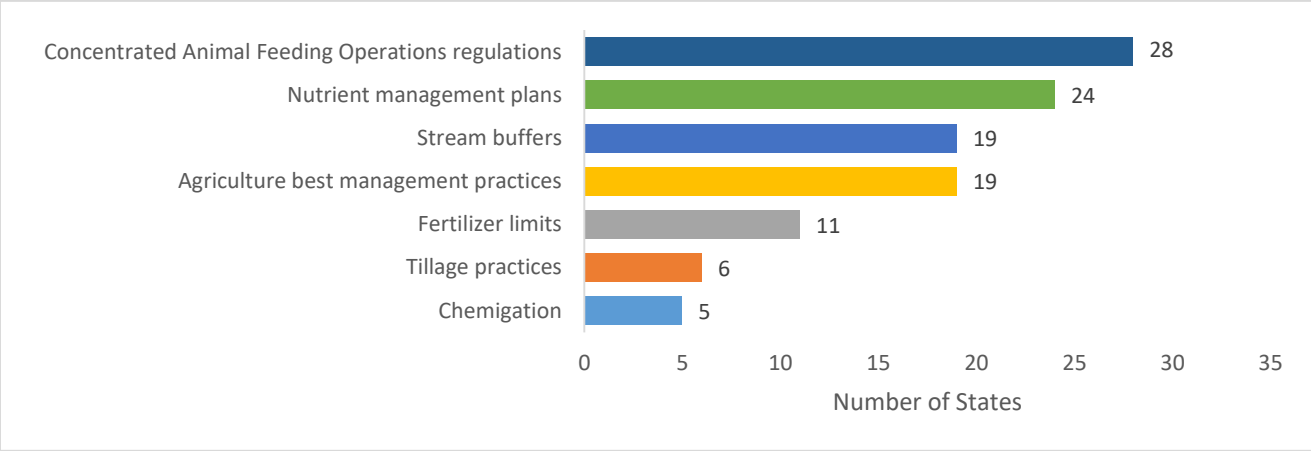
[13] Other responses include "groundwater protections incorporated in various permitting programs," "several facility specific regulations that include provisions for groundwater quality, e.g., septic systems, UIC, USTs, solid waste, upland dredge disposal, ASTs," "standards exist for groundwater sources used by Public Water Suppliers," and "CAFO permit and in the process of finalizing the Reclaimed water rule."

Figure 15: Specific Regulations Related to a) Reuse/Wastewater, b) Agriculture, and c) Classification/Management (N=45) (Q4.5)

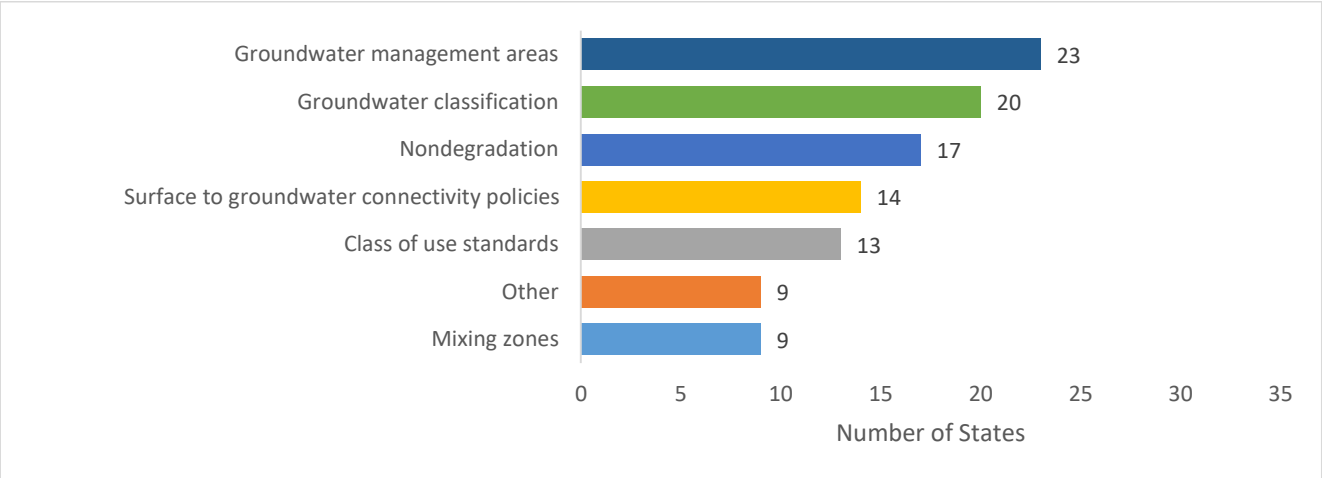
a) Reuse/Wastewater



b) Agriculture



c) Classification/Management



3.2 Groundwater management policies

Survey results indicate that 25 states have a groundwater quality classification system. The system was adopted by rule only in 7 states and by legislation only in 4 states. The system was adopted by both rule and legislation in 5 states.[14]

Fewer than half of state water professionals (43%) indicated that their states have policies or regulations aimed at managing groundwater dependent ecosystems (N=47).

Some 86% of the respondents indicated that their states have mitigation, prevention, and/or best management practice regulation for industrial, mining, and/or agriculture activities that may affect groundwater (N=42). This includes 30 states where adhering to these regulations is required and 6 states where it is voluntary.

Regarding Underground Injection Control (UIC) programs, 71% of respondents indicated that their agency implements programs under primacy arrangements in their state.[15] Very few (7%) agencies indicated that their states does not have UIC primacy, and 21% indicated that another agency implements the UIC program (N=42).[16]

In a minority of states (13, or 38%), aquifer exemptions for class I injection wells are allowed, whereas eight states (24%) do not allow exemptions. Class I injections wells are not allowed in 13 (or 38% of) states (N=34).

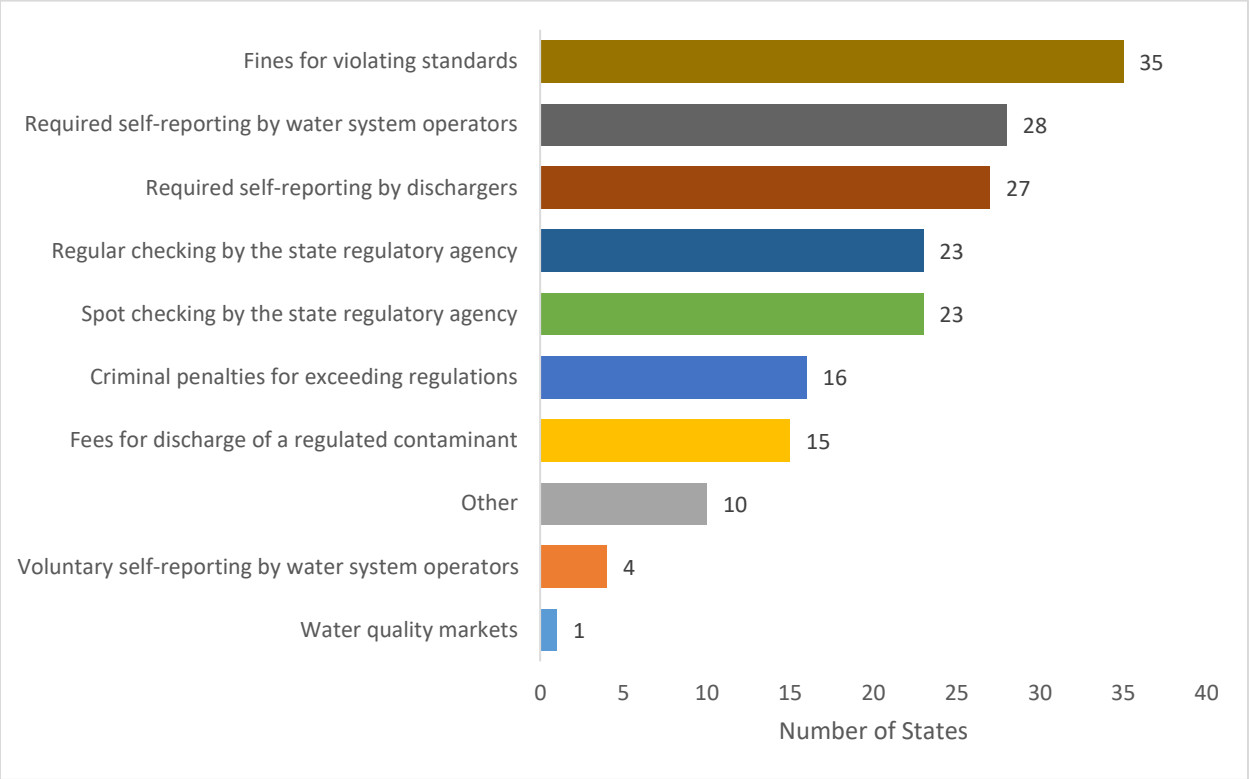
State water professionals indicated that states utilize multiple strategies to ensure compliance with groundwater quality standards. Many states (80% of respondents) use fines, and 64% require self-reporting by water system operators. Alabama, Kentucky, Tennessee, Vermont, and Wyoming each use seven of the 10 listed strategies, whereas Maine, and Pennsylvania only use one of the listed strategies. In Texas, there are no specific groundwater compliance strategies, but discharges to groundwater that result in degradation are subject to fines. In Utah, discharge permits are required for anyone who may discharge to groundwater. Figure 16 shows strategies used to ensure compliance.

[14] One respondent listed a date. Others responded “for remediation sites”, “regulations”, and “some, not comprehensive.” The remaining five states did not state how the system was adopted.

[15] There are 29 states that gave information about the classes of UIC for which they have primacy. There are 3 states that indicate they have primacy for Class VI, but are not implementing yet; 24 states have primacy for Class V, 3 states for Class IV, 13 for Class III, 11 for Class II, and 5 for Class I.

[16] In two states the department of natural resources implements UIC, in three states the US EPA does so, in three states an oil and gas commission/board does so, and in one the department of environmental quality does so.

Figure 16: Strategies to Ensure Compliance with State Quality Standards (N=44) (Q4.11)



Part IV: Groundwater quality-quantity connections

Part IV of the survey was designed to explore the scope and extent of connections between state groundwater quantity and quality departments.

The overall findings suggest:

- State water professionals from a majority of states (57%) indicated that the groundwater quality and quantity agencies have separate jurisdictions.
- Coordination between agencies is varied, but primarily occurs through personal networks.

4.1 Agency connections

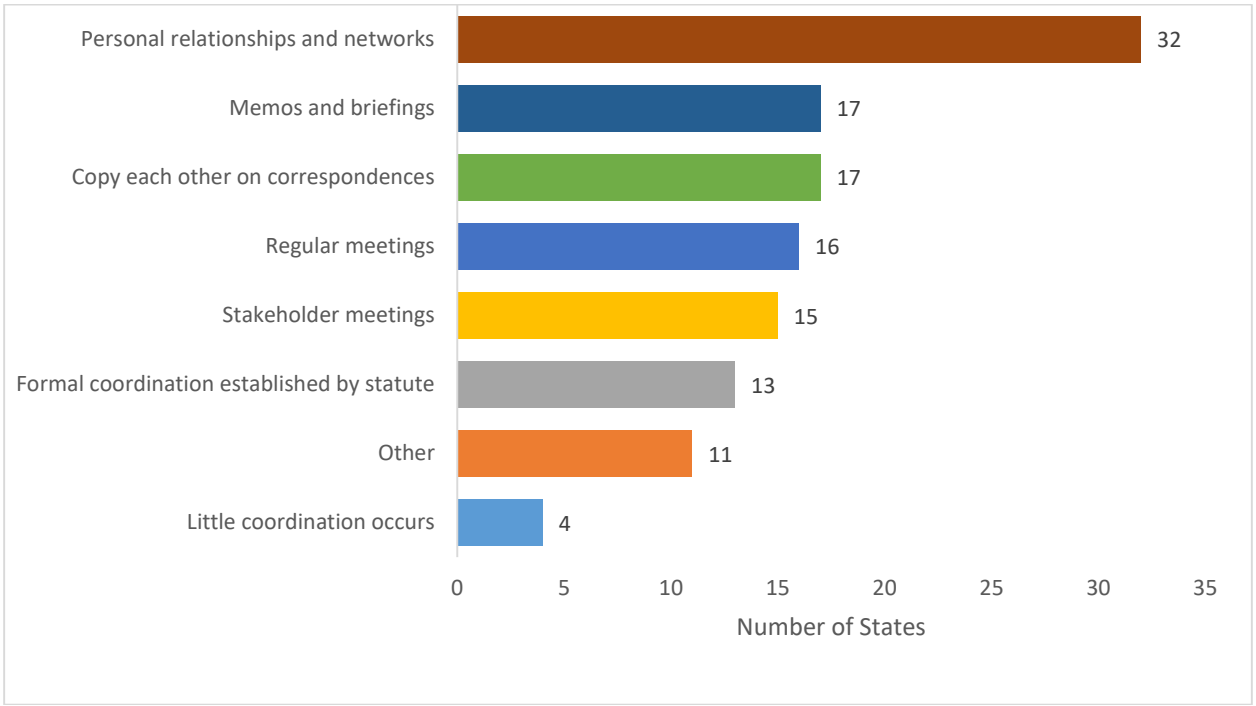
Respondents indicated that the groundwater quantity and quality agencies have separate jurisdictions in a slight majority of states (57%; N=49).

Forty-four percent of respondents indicate that their agency also manages groundwater quantity, 44% of respondents indicated they do not, and 12% indicated that their agency shares the responsibility with another agency (N=50).

A majority of respondents indicated that groundwater quantity management is also the responsibility of at least one other State agency, other than their own. For instance, in Utah, the Department of Natural Resources and the State Engineer both oversee quantity. In contrast, some other states indicate a lack of regulation. Missouri "does not regulate the quantity of water that can be produced." In Texas, "no state agency has the authority to manage groundwater resources." The Illinois respondent indicated that no state agency oversees groundwater quantity management due to the common law doctrine being utilized in its legal system. California's groundwater quantity has not been monitored by a state agency. Groundwater is required to be overseen by a system of local groundwater sustainability agencies. By either 2020 or 2022 (depending on state classification), local agencies unable to meet management criteria laid out by state law will be overseen by the Water Resources Control Board and Department of Water Resources.

Coordination between groundwater quantity and groundwater quality agencies is the norm in most states.[17] Coordination occurs through a variety of means. The most common way is via personal relationships and networks, as indicated by 67% of state water professionals. Figure 17 shows interagency coordination methods.

Figure 17: Methods of Coordination Between Quantity and Quality Agencies (N=48) (Q5.2)



[17] Other responses include "the ASR regulation requires WQ review," "ad hoc committees and projects," and "internal circulation of permit applications prior to public review."

4.2 Interaction of groundwater quantity and quality goals

State water professionals were asked about the degree that groundwater development and managed aquifer recharge/aquifer storage and recovery regulations consider groundwater quality goals. Water professionals from 27 states indicated that groundwater use and managed aquifer recharge regulations mesh with quality goals to some degree, and 5 states indicated groundwater use and managed aquifer recharge regulations do not work well with quality goals to some degree (N=34).

Part V: Resources, research, and collaboration

Part V of the survey was designed to explore the scope of resources available and needed, research activities, and collaboration between local, state, and federal agencies.

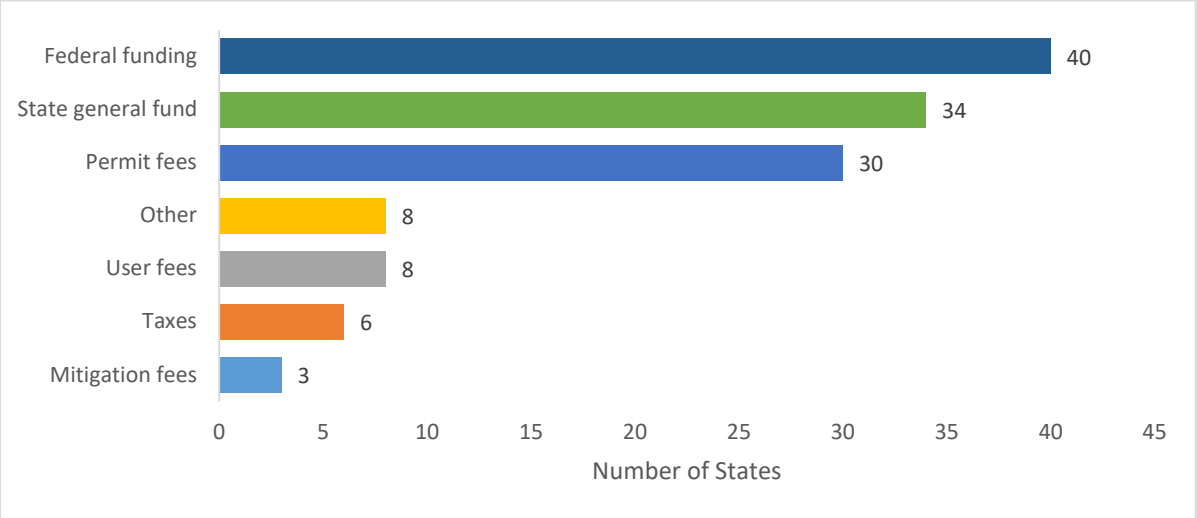
The overall findings suggest:

- States have multiple sources of funding for water quality programs, with 85% of responding states receiving some form of federal funds.
- A majority of the groundwater quality budgets for states have decreased in the last 10 years.
- A majority of surveyed agencies describe the number of staff as too little, and indicated that their staffs have a variety of technical backgrounds.
- The level of reliance on local and federal agencies to implement groundwater quality regulations varies from state to state, with the majority (60%) of responding states "rarely" relying on federal agencies for implementation and the majority (58%) of responding states stated that county agencies played "no" or a "little" role in groundwater quality management.
- The most important sources of information utilized by the various agencies tend to be professional meeting and associations, but government reports also play a role.

5.1 Funding, budget, and staff

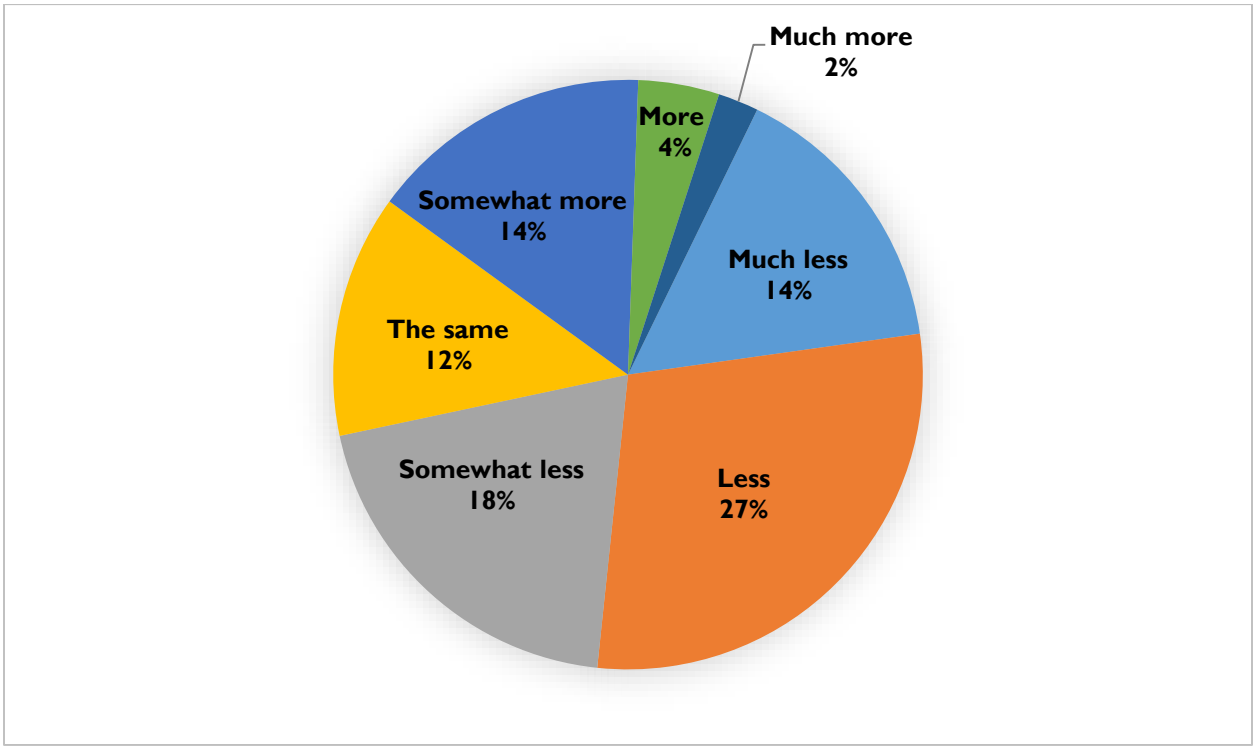
Funding for groundwater quality management varies by state. A large majority, some 85%, of respondents reported using federal funding to fund their water quality programs. In addition, 72% of respondents report use of the state general fund, and 64% rely on permit fees (N=47). Alaska has a fuel surcharge for Spill Prevention and Response; Massachusetts uses annual compliance fees; Minnesota allocates a fraction of sales tax for clean water programs; and West Virginia uses civil penalties. Figure 18 shows funding sources for water quality programs.

Figure 18: State Funding Sources for Water Quality Programs (N=47) (Q6.1)



Regarding budgetary trends of surveyed agencies, 65% of state water professionals indicated their budget for water quality programs is less than it was 10 years ago by varying degrees. Figure 19 shows budgets compared to 10 years ago.

Figure 19: Current Budget Compared to the Budget 10 Years Ago (N=45) (Q6.2)



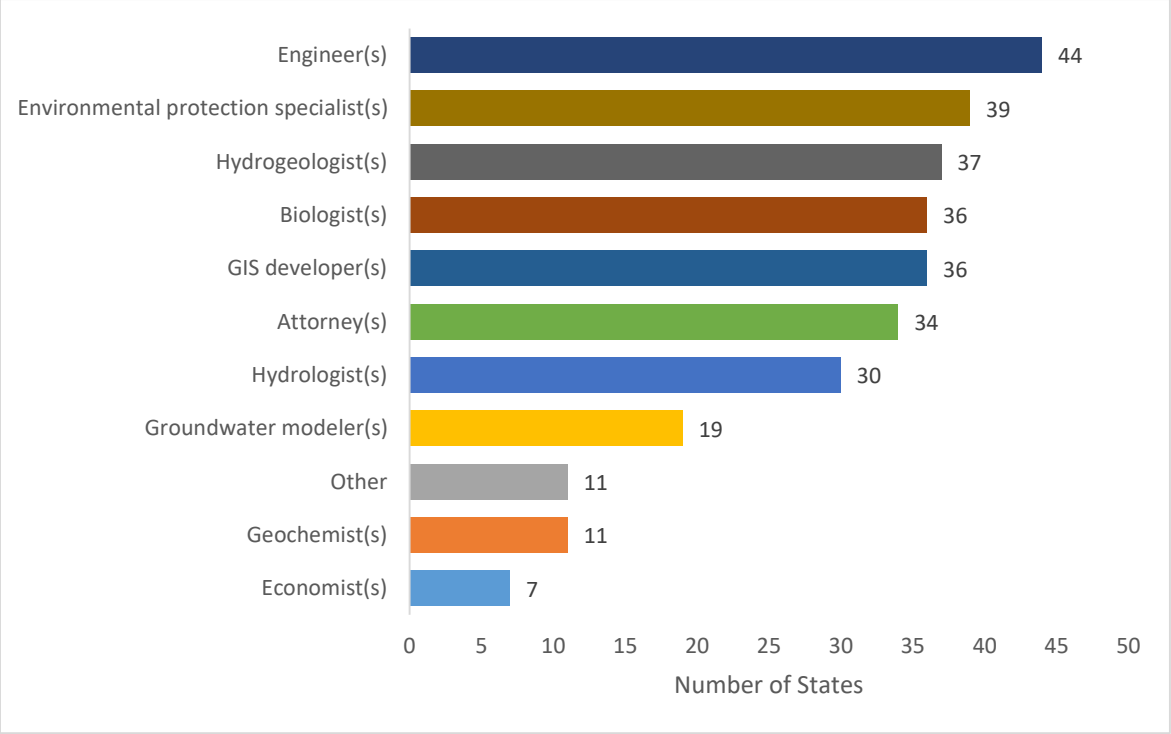
Staffing varies across states. The average number of full-time staff among the agencies surveyed is 792.[18] The smallest agency has only 20 employees (Louisiana), while the largest agency employs 3,000 (Texas).

The average number of full-time staff on groundwater-related programs is 46. The minimum of full-time staff is 0, and the maximum is 200.

A majority of state water professionals (63%) described the number of staff in their agencies as "too little." "About right" was selected by 30% of respondents, and "far too little" was selected by 7% of respondents (N=46).

Most agencies (96%) employ full-time engineers, while 85% employ full-time environmental protection specialists, and 80% employ full-time hydrogeologists.[19] Figure 20 shows backgrounds of full-time employees (N=46).

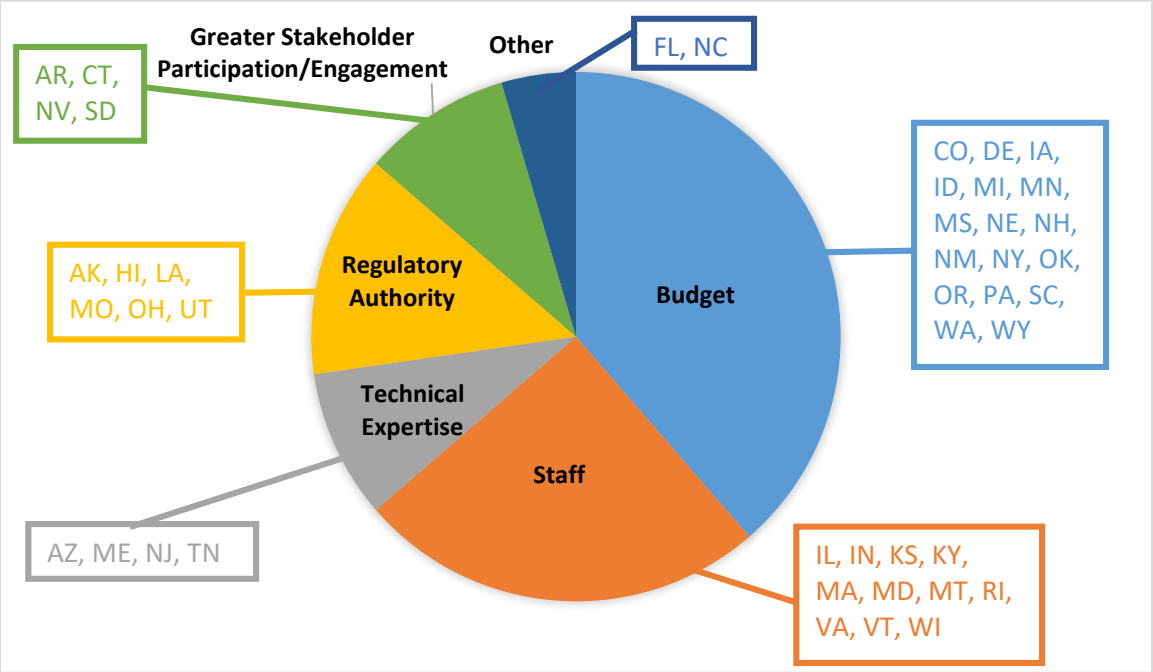
Figure 20: Backgrounds of Employees Selected by States (N=46) (Q6.6)



[18] See the "Survey Respondents" section of the Methodology for information on which agencies were surveyed.
[19] Other responses include geologists, statisticians, administrators, analysts, planners, chemists, ecologists, public health specialists, risk assessors, meteorologists, agriculture specialists, computers scientists, bookkeepers, and library scientists.

Respondents ranked resources that are most needed to better accomplish their goals, with respondents indicating that budget and staff are most needed. Figure 21 shows the most needed resources listed as #1 by states. The states in callout boxes listed the resource as number one. See Appendix B for a complete listing of ranked resources.

Figure 21: Most Needed Resource, by State (N=44) (Q6.7)



5.2 Coordination with local agencies

Nearly all state agencies surveyed (92%) rely on local agencies to implement groundwater quality regulations to some extent. Forty-six percent of respondents do this "sometimes," 42% do this "rarely," and 11% do this "always" (N=45).

Similarly, 92% of state agencies rely on federal agencies to some extent, but 60% do so "rarely," and 40% only do so "sometimes" (N=45).

The extent that county agencies play a role in groundwater management varies somewhat. County agencies have "some" role according to 38% of agencies, "little" role according to 31%, "none" according to 27%, and "a lot" according to 4% (N=45). Table 2 includes selected counties that are heavily involved in groundwater management.

Table 2: County Agencies Heavily Involved in Groundwater Management (Q6.10)

States	**Counties**
Alaska	Municipality of Anchorage
Indiana	Johnson
Kentucky	Jefferson
Minnesota	Washington, Dakota, and Olmsted
Missouri	Greene
Montana	Gallatin, Missoula, Lewis and Clark
Nebraska	Lancaster, Douglas
Nevada	Washoe, Churchill, Clark
New Mexico	Bernalillo
New York	Jefferson, Genesee, and Cayuga
North Carolina	Mecklenberg, New Hanover, Wake
Pennsylvania	Chester

5.3 Importance of sources of information

State water professionals ranked sources of information in terms of importance for learning about emerging groundwater management issues. The most important sources listed include professional meetings/conferences, professional associations, and government reports. Table 3 shows ranked sources of information for learning about emerging groundwater management issues. The highest percentage response for each category is highlighted in green.

Table 3: Ranked Sources of Information for Learning about Emerging Groundwater Issues (N=46) (Q6.11)

Source	Most Important		More Important		Important		Less Important		Least Important	
	%	# of States	%	# of States	%	# of States	%	# of States	%	# of States
Professional meetings/ conferences	**35%**	**16**	28%	13	28%	13	11%	5	7%	3
Government reports	17%	8	**52%**	**24**	22%	10	9%	4	2%	1
Webpages	7%	3	26%	12	**37%**	**17**	13%	6	11%	5
Trade journals	7%	3	15%	7	17%	8	**41%**	**19**	9%	4
Popular news	7%	3	11%	5	20%	9	30%	14	**30%**	**14**
Continuing education	17%	8	15%	7	20%	9	24%	11	15%	7
Peer-reviewed journal articles	20%	9	24%	11	33%	15	17%	8	7%	3
Universities	15%	7	26%	12	30%	14	17%	8	7%	3
Professional associations	20%	9	30%	14	22%	10	15%	7	7%	3
Internal memos and briefings	20%	9	26%	12	20%	9	11%	5	17%	8
Other	4%	2	0%	0	0%	0	0%	0	0%	0

Agencies also ranked sources of information in terms of being influential in shaping agency management or policy decisions on groundwater. Important sources include internal memos and briefings, government reports, and professional meetings and conferences. Table 4 shows ranked sources of information for shaping agency management or policy decisions. The highest percentage response for each category is highlighted in green.

Table 4: Ranked Sources of Information for Shaping Agency Management or Policy Decisions (N=46) (Q6.12)

Source	Most Influential		More Influential		Influential		Less Influential		Not at all Influential	
	%	# of states	%	# of states	%	# of states	%	# of states	%	# of states
Internal memos and briefings	**35%**	**16**	22%	10	13%	6	4%	2	13%	6
Government reports	20%	9	**43%**	**20**	15%	7	11%	5	2%	1
Webpages	2%	1	2%	1	**37%**	**17**	20%	9	20%	9
Trade journals	4%	2	2%	1	15%	7	**39%**	**18**	17%	8
Popular news	4%	2	7%	3	15%	7	30%	14	**28%**	**13**
Continuing education	7%	3	4%	2	22%	10	28%	13	20%	9
Peer-reviewed journal articles	7%	3	22%	10	30%	14	24%	11	4%	2
Universities	4%	2	22%	10	35%	16	20%	9	4%	2
Professional meetings/ conferences	7%	3	30%	14	33%	15	20%	9	2%	1
Professional associations	7%	3	26%	12	33%	15	13%	6	7%	3
Other	4%	2	0%	0	0%	0	0%	0	0%	0

Part VI: Looking Forward

Part VI of the survey was designed to explore future trends in groundwater management.

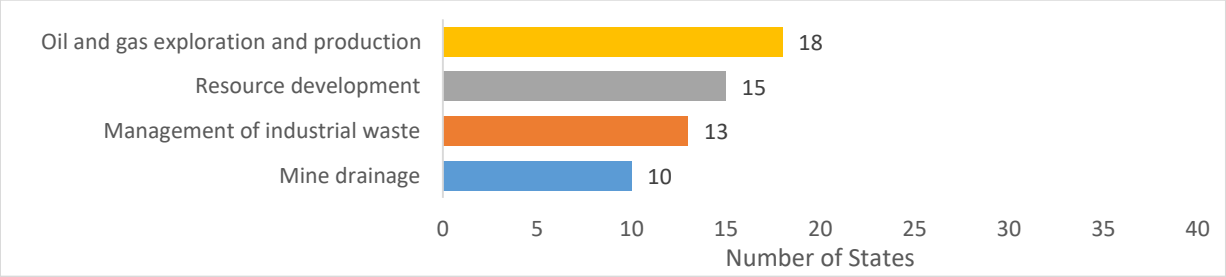
The overall findings suggest:

- Surveyed state water professionals indicated that some issues will require more attention in the next ten years, notably water quality monitoring, increased groundwater pumping, and water level monitoring.
- State water professionals from over half of the states (55%) indicated that changes in groundwater regulation are likely to be considered in the next five years. The nature of these changes varies considerably.

Respondents in 37% of states indicated that the most likely industry-related issue requiring attention in the next 10 years will be oil and gas exploration and production.[20] Respondents indicated that the most likely policy/politics-related issue requiring attention in the next 10 years will be water quality monitoring (71%). For the most likely physical change/other related issue requiring attention in the next 10 years, respondents indicated the issue of increased groundwater pumping (69%). Figure 22 shows issues that will require more attention in the next 10 years.

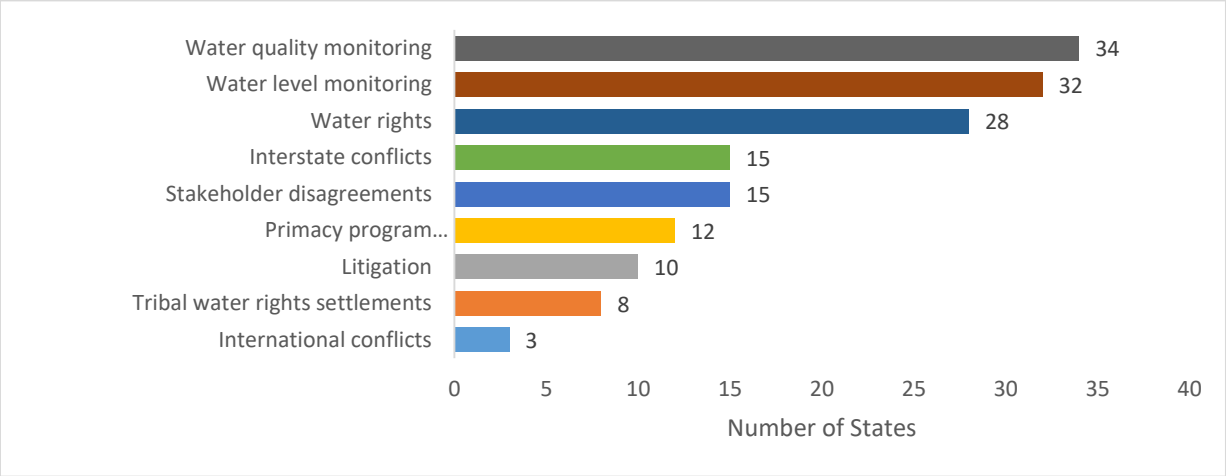
Figure 22: Likely Issues Requiring Attention in the Next 10 Years a) Industry-Related, b) Policy/Regulations-Related, c) Physical Change/Other-Related (N=49) (Q7.1)

a) Industry-Related

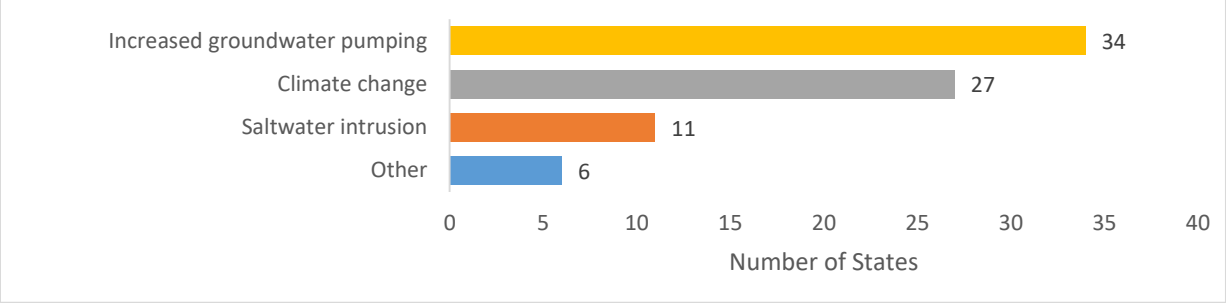


[20] Other responses include legacy contaminant issues, nitrates, emerging contaminants, agricultural irrigation competing with other users, and conversion of forest lands into row-crop agriculture near vulnerable aquifers.

b) Policy/Regulations-Related



c) Physical Change/Other-Related



Ranked Future Concerns: State water professionals ranked the top issues requiring attention in the next 10 years from the above choices. Figure 23 shows the ranked future concerns listed as number one by states, and Figure 24 shows the future concerns listed in the top three by states. See Appendix B for a complete listing of ranked groundwater concerns.

Figure 23: Number One Likely Future Issues, by State (N=44) (Q7.2)

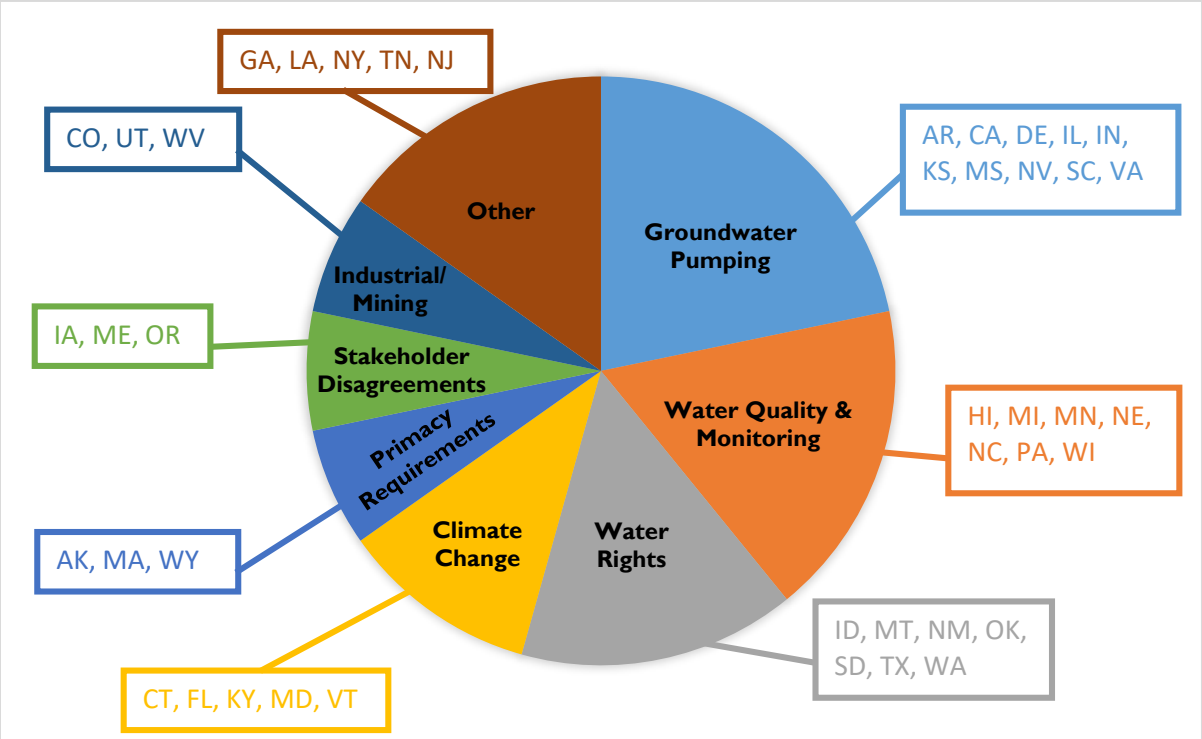
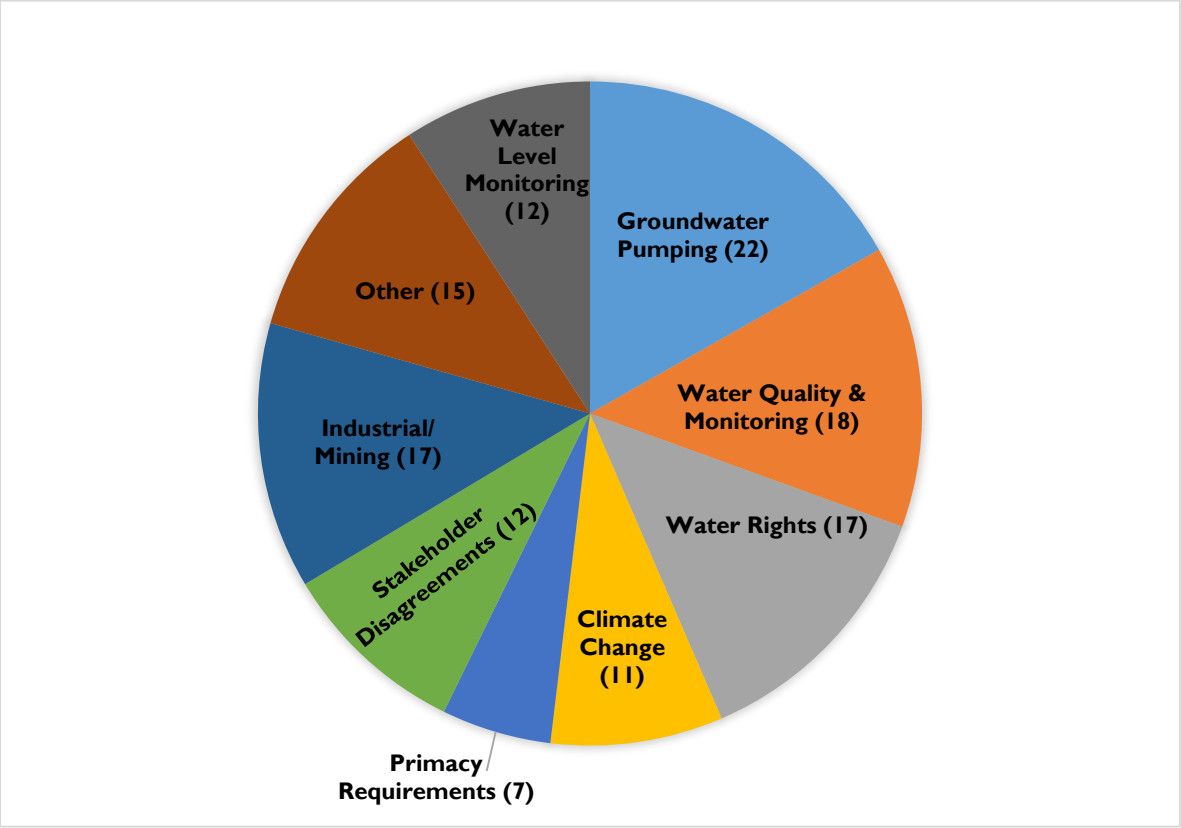
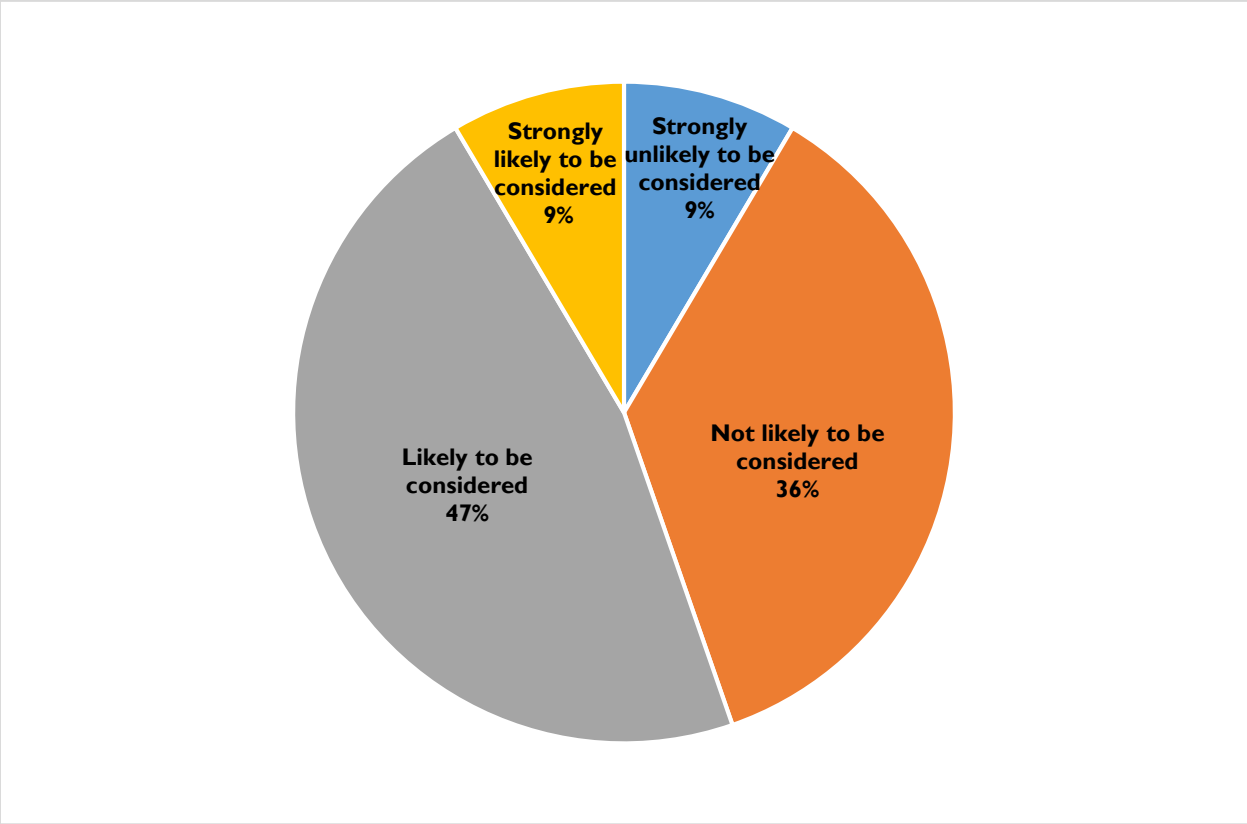


Figure 24: Frequency of Likely Issues Listed in the Top Three by States (N=44) (Q7.2)



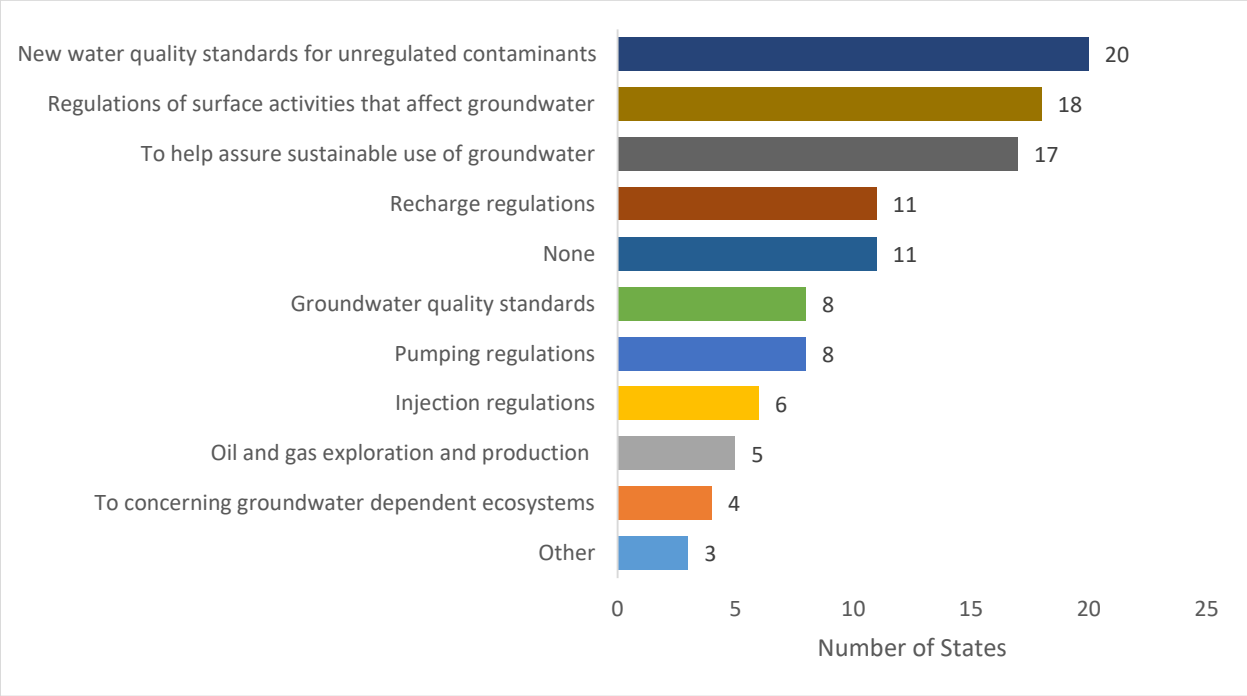
Survey results indicate that changes in groundwater quality regulation are expected to be considered in the next five years in 47% of states. Nine percent of the state water professionals indicated that changes are strongly likely to be considered, 36% of the water professionals indicated that changes are not likely to be considered and 9% of the professionals indicated that it is strongly unlikely that changes will be considered (N=47). See Figure 25.

Figure 25: Likelihood of Changes in Groundwater Quality Regulation (N=47) (Q7.3)



State water professionals suggested a broad array of groundwater regulations and/or policies that are likely to be promulgated or amended in their states in the next five years.[21] The top three regulations include: new water quality standards for unregulated contaminants (43%), regulations of surface activities that affect groundwater (38%), and regulations/policies to help assure sustainable use of groundwater (36%; N=47). Figure 26 shows likely regulations/policies in the next five years.

Figure 26: Likely Groundwater Regulations/Policies in Next 5 Years (N=47) (Q7.4)



Seventy-eight percent of respondents predicted that groundwater quality regulations will stay about the same in their states. Only 16% predicted that groundwater quality regulations will become more stringent (N=49).

CONCLUDING REMARKS

This survey is evidence of the many commonalities and differences between states regarding state-level groundwater governance and management in the context of groundwater quality strategies and practices. The results also reveal the diversity of management and regulatory regimes that exist across states.

[21] Other responses include aquifer storage and recovery and "general assembly created an advisory committee to look at sustainability."

Many states share similar concerns about their groundwater supplies. Over half of the respondents selected quality, quantity, health/vulnerability of private well users, aquifer overdraft, budget, drought, and staffing issues as concerns affecting their states. Moreover, almost half of survey respondents (22) selected quality as the top concern facing their state. The results corroborate earlier survey results that water quality is the top concern.

State respondents were less consistent in reporting top groundwater contaminant sources. Agriculture and industrial/mining sources were reported to be the top sources of contamination. This is consistent with 19 respondents listing nitrate/nutrients as the top contaminant, followed by eight respondents citing industry and six respondents citing metals as top contaminants.

Over half of state respondents listed water quality monitoring, water level monitoring, increased groundwater pumping, water rights, and climate change as likely issues requiring attention in the next 10 years. The majority of respondents think that groundwater quality regulation changes are likely or very likely in their states in the next five years. Future regulation changes in states would continue the trend of many states seeing significant changes in their regulations within the past ten years, including changes to Clean Water Act Maximum Daily Load requirements, limits in groundwater withdrawals, and stormwater policy, among other areas.

While states face a wide variety of challenges in groundwater quality governance and management, financial and human resources available to face these challenges have become more limited. A majority of budgets for groundwater quality have decreased within states, and most surveyed describe that the number of staff as “too little”. Respondents also indicated many issues will require more attention in coming years. Over half of the respondents also indicated that their states would likely consider changes in groundwater regulation in the next five years. The challenges of resolving more issues and meeting more regulations would seem to be difficult for state agencies, given the current lack of financial and human resources as indicated by respondents.

States also face challenges of non-integrated management for groundwater quality. Many states reported that the responsibility for groundwater quality monitoring is non-integrated, often shared among multiple agencies. States also face challenges between different levels of government; 85% of responding states receive some form of federal funds, and the majority of responding states rarely rely on federal agencies for implementing groundwater quality regulations. The majority of responding states also stated that county agencies played “no” or a “little” role in groundwater quality management.

Future research directions include conducting a more in-depth survey with more respondents on groundwater governance and management practices concerning water quality. Research covering state laws, rules, and practices concerning managed aquifer recharge is also needed.

Surveying multiple parties from different water using sectors yield additional insights into what is working, along with opportunities for improving groundwater governance and management.

ACKNOWLEDGEMENTS

This work was funded primarily by the Ground Water Research and Education Foundation (GWREF) through a grant entitled "A Survey of Groundwater Governance and Management: Strategies, Challenges, and Opportunities Connected to Water Quality." We thank Mike Wireman and Jon Kenning for valuable input throughout the project. We also thank those who tested the survey and the state water professionals for their responses. Additional support was provided by the Technology & Research Initiative Fund administered by the University of Arizona Office for Research, Discovery & Innovation, funded under Proposition 301, the Arizona Sales Tax for Education Act in 2000.

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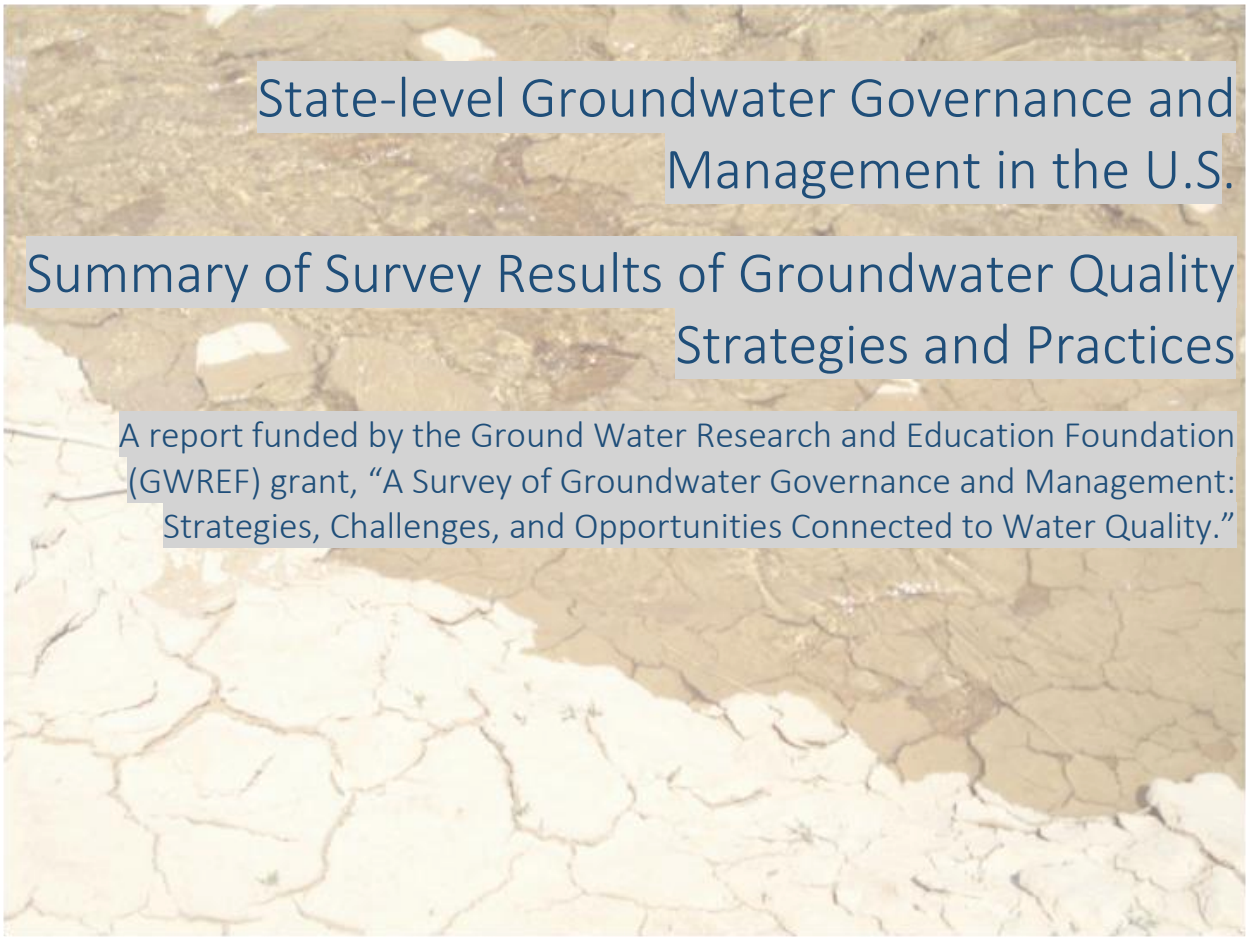

State-level Groundwater Governance and Management in the U.S.

Summary of Survey Results of Groundwater Quality Strategies and Practices

A report funded by the Ground Water Research and Education Foundation (GWREF) grant, "A Survey of Groundwater Governance and Management: Strategies, Challenges, and Opportunities Connected to Water Quality."

APPENDICES

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Appendix A - Survey

S1 Section 1 Background Agency Information

Q1.1 Which state do you work in?

- ❍ Alabama
- ❍ Alaska
- ❍ Arizona
- ❍ Arkansas
- ❍ California
- ❍ Colorado
- ❍ Connecticut
- ❍ Delaware
- ❍ Florida
- ❍ Georgia
- ❍ Hawaii
- ❍ Idaho
- ❍ Illinois
- ❍ Indiana
- ❍ Iowa
- ❍ Kansas
- ❍ Kentucky
- ❍ Louisiana
- ❍ Maine
- ❍ Maryland
- ❍ Massachusetts
- ❍ Michigan
- ❍ Minnesota
- ❍ Mississippi
- ❍ Missouri
- ❍ Montana
- ❍ Nebraska
- ❍ Nevada
- ❍ New Hampshire
- ❍ New Jersey
- ❍ New Mexico
- ❍ New York
- ❍ North Carolina
- ❍ North Dakota
- ❍ Ohio
- ❍ Oklahoma
- ❍ Oregon

- ❍ Pennsylvania
- ❍ Rhode Island
- ❍ South Carolina
- ❍ South Dakota
- ❍ Tennessee
- ❍ Texas
- ❍ Utah
- ❍ Vermont
- ❍ Virginia
- ❍ Washington
- ❍ West Virginia
- ❍ Wisconsin
- ❍ Wyoming

Q1.2 For whom do you work? The answer to this question will be referred to as "agency" hereafter.

Q1.3 For how many years have you worked for this agency?

Q1.4 For how many years have you worked in the water resources sector?

Q1.5 What is your disciplinary background? Please include degree and discipline.

Q1.6 Is your agency the sole agency at the state level that manages groundwater quality? If not, please list other agencies involved.

- ❍ Yes
- ❍ No _____

Q1.7 Does your agency also manage groundwater quantity? If not, which agency manages groundwater quantity?

- ❍ Yes
- ❍ No (please indicate the agency in the space provided) _____
- ❍ Shares responsibility with another agency (please indicate which agency or agencies in the space provided) _____

Q1.8 Are you able to answer questions about state regulation of groundwater quality?

- ❍ Yes
- ❍ No

Answer If Are you able to answer questions about state regulation of groundwater quality? No Is Selected

Q71 Please submit the survey at this time, and we will contact you to follow up.

If Please submit the survey at... Is Displayed, Then Skip to End of Survey

S2 Section 2 Groundwater Concerns and Use

Q2.1 What are the groundwater concerns in your state? Select all that apply.

- ❑ Quality
- ❑ Quantity
- ❑ Aquifer overdraft
- ❑ Inadequate communications around water quality with other agencies
- ❑ Budget
- ❑ Staffing issues
- ❑ Climate change
- ❑ Drought
- ❑ Health/vulnerability of private well users
- ❑ Other (please specify) _____

Q2.2 Please rank the top three concerns from question 2.1. 1 being of most concern.

- ❑ 1. _____
- ❑ 2. _____
- ❑ 3. _____

Q2.3 What contaminant sources are your state's top groundwater quality concerns? Select all that apply.

- ❑ Land application of wastewater or residuals
- ❑ Oil/gas exploration and production
- ❑ Oil/gas wastewater disposal (Class II injection wells)
- ❑ Injection wells (other than Class II)
- ❑ Coal ash impoundments/disposal
- ❑ Wastewater impoundments
- ❑ Naturally-occurring contaminants
- ❑ Saltwater intrusion
- ❑ Concentrated Animal Feeding Operations (CAFOs)
- ❑ Agricultural sites
- ❑ Underground storage tanks
- ❑ Septic tanks
- ❑ Industrial sites
- ❑ Storm water
- ❑ Mine drainage (abandoned or active)
- ❑ Superfund/CERCLA sites
- ❑ Other (please specify) _____

Q2.4 Please rank the top three concerns from question 2.3. 1 being of most concern

- ❑ 1. _____
- ❑ 2. _____
- ❑ 3. _____

Q2.5 What contaminants are your state's top groundwater quality concerns? Select all that apply.

- ❑ Metals
- ❑ Nitrate/nutrients
- ❑ Contaminants associated with production, transport and use of oil and gas
- ❑ Chlorinated solvents
- ❑ Chloride
- ❑ Pesticides
- ❑ Other (please specify) _____

Q2.6 Please rank the top three concerns from question 2.5. 1 being of most concern

- ❑ 1. _____
- ❑ 2. _____
- ❑ 3. _____

Q2.7 In an average year, what approximate percentage of total human demands (i.e. domestic, commercial, industrial, and agricultural) is met through use of groundwater supplies in your state?

- ❍ 0-8%
- ❍ 8.01-14%
- ❍ 14.01-28%
- ❍ 28.01-50%
- ❍ 50.01% and above

Q2.8 Are there aquifers or parts of aquifers in your state where withdrawals significantly exceed recharge? If so, please indicate the aquifers and/or geographic location in which this occurs.

- ❍ Yes _____
- ❍ No

S3 Section 3 Groundwater Quality Management and Monitoring

Q3.1 Does your state have explicit groundwater quality management goals? If so, please indicate your state's top three goals.

- ❑ 1. _____
- ❑ 2. _____
- ❑ 3. _____
- ❑ This state does not have explicit groundwater quality management goals.

Q3.2 If you indicated groundwater quality management goals above, to what extent do you expect your agency will meet these goals and expectations?

- ❍ N/A
- ❍ Fall far short of expectations
- ❍ Fall short of expectations
- ❍ Meet expectations
- ❍ Exceed expectations
- ❍ Far exceed expectations

Q3.3 Has your state compiled groundwater vulnerability/sensitivity maps to aid in managing groundwater quality?

- ❍ Yes
- ❍ No

Q3.4 Have there been significant changes to groundwater quality policy in the last 10 years? If so, please indicate what changes there have been. Select all that apply.

- ❑ There have been no significant changes
- ❑ Establishment/declaration of intended uses
- ❑ Removal of intended uses
- ❑ Establishment of groundwater quality standards based on intended use
- ❑ Repeal of standards
- ❑ Aquifer exemptions
- ❑ New legislation/laws related to water quality standards
- ❑ Policy/procedures related to the Clean Water Act Total Maximum Daily Loads requirements
- ❑ New water quality regulations related to oil and gas development
- ❑ New rules/regulations related to Concentrated Animal Feeding Operations
- ❑ Change in Standards
- ❑ Groundwater/surface water interaction
- ❑ Nondegredation
- ❑ Mixing zones
- ❑ Stormwater
- ❑ Well construction
- ❑ Limits on groundwater withdrawals
- ❑ Other (please specify) _____

Q3.5 What is the status of exploration/production of unconventional oil or gas resources in your state?

- ❍ Occurring and regulated
- ❍ Occurring but unregulated
- ❍ Not occurring because there is no potential
- ❍ Not occurring for other reasons (please specify) _____

Q3.6 Is there a driller certification process? If so, are all water well drillers required to obtain this certification?

- ❍ Yes, but not all water well drillers are required to obtain this certification
- ❍ Yes, all water well drillers are required to obtain this certification
- ❍ No

Q3.7 Is continuing education required for water well drillers?

- ❍ Yes
- ❍ No

Q3.8 Which agencies and/or organizations in your state conduct groundwater quality monitoring? Select all that apply.

- ❑ N/A, there is no groundwater quality monitoring in this state
- ❑ This agency
- ❑ State Geologic Survey
- ❑ State Department of Agriculture
- ❑ State Engineers Office
- ❑ US Geologic Survey
- ❑ US Environmental Protection Agency
- ❑ Local agencies
- ❑ Colleges/universities
- ❑ NGOs
- ❑ Conservation/Natural Resource Districts
- ❑ Tribes
- ❑ Other federal agency (please specify) _____
- ❑ Other state agency (please specify) _____
- ❑ Other (please specify) _____

Q3.9 Does your state incorporate groundwater monitoring into its overall water resource quality monitoring strategy?

- ❍ Yes
- ❍ No
- ❍ N/A This state does not have a water quality monitoring strategy

Q3.10 To which of the following user groups is groundwater quality data provided by your agency? Select all that apply.

- ❑ Household/domestic well users
- ❑ Industrial users
- ❑ Privately owned community water systems
- ❑ Publicly owned community water systems
- ❑ Agricultural users
- ❑ Environmental Non-Governmental Organizations
- ❑ Universities
- ❑ Other government agencies
- ❑ None, this agency does not engage in monitoring
- ❑ Other (please specify) _____

S4 Section 4 Groundwater Quality Regulatory Program

Q4.1 Does your state have groundwater quality standards? If so, what is their applicability? (all groundwater in the state or selected areas or aquifers only?)

- ❍ Yes, for all groundwater in the state
- ❍ Yes, for selected areas or aquifers
- ❍ No

Q4.2 Does your state have groundwater quality standards based on type of use?

- ❍ Yes
- ❍ No

Q4.3 Do your state's groundwater quality standards include contaminants for which there is no federal Maximum Contamination Level? If so, please list the contaminants.

- ❍ Yes _____
- ❍ No

Q4.4 Are groundwater quality standards narrative (qualitative) numerically based (quantitative), or both?

- ❍ Qualitative
- ❍ Quantitative
- ❍ Both qualitative and quantitative

Q4.5 Which of the following groundwater quality regulations does your state have? Select all that apply.

- ❑ Class of use standards
- ❑ Municipal/Agricultural reclaimed water regulations
- ❑ Gray water regulations
- ❑ Chemigation
- ❑ Agriculture best management practices
- ❑ Nutrient management plans
- ❑ Stream buffers
- ❑ Tillage practices
- ❑ Fertilizer limits
- ❑ Concentrated Animal Feeding Operations regulations
- ❑ Wastewater irrigation/land application regulations
- ❑ Wastewater residuals (biosolids) regulations
- ❑ Nondegradation
- ❑ Groundwater classification
- ❑ Groundwater management areas
- ❑ Mixing zones
- ❑ Surface to groundwater connectivity policies
- ❑ Other (please specify) _____

Q4.6 Does your state have a groundwater classification system? If so, was it adopted by rule or legislation?

- ❍ Yes _____
- ❍ No

Q4.7 Does your state have policy or regulations aimed at managing groundwater dependent ecosystems? (e.g. fens, springs, wetlands)

- ❍ Yes
- ❍ No

Q4.8 If there are mitigation, prevention, and/or best management practice regulations for industrial, mining, and/or agriculture activities that may impact groundwater, are they voluntary or required?

- ❍ Yes, they are required
- ❍ Yes, they are voluntary
- ❍ No, this state does not have such regulations

Q4.9 Does your agency implement programs under primacy arrangements of the Underground Injection Control (UIC) program in your state? If so, for which Classes of UIC wells?

- ❍ Yes _____
- ❍ No, this state does not have UIC primacy
- ❍ No, another agency implements UIC (please indicate which agency) _____

Q4.10 If your state allows Class I injection wells, are aquifer exemptions allowed for these wells?

- ❍ Yes
- ❍ No
- ❍ Class I injection wells are not allowed

Q4.11 Which of the following strategies does your state utilize to ensure compliance with state quality standards? Select all that apply.

- ❑ Fines for violating standards
- ❑ Criminal penalties for exceeding regulations
- ❑ Fees for discharge of a regulated contaminant
- ❑ Water quality markets
- ❑ Voluntary self-reporting by water system operators
- ❑ Required self-reporting by water system operators
- ❑ Required self-reporting by dischargers
- ❑ Spot checking by the state regulatory agency
- ❑ Regular checking by the state regulatory agency
- ❑ Other (please specify) _____

S5 Section 5 Groundwater Quality-Quantity Connections

Q5.1 Are the groundwater quantity and groundwater quality agencies in your state under the same umbrella department? If so, what is the umbrella department?

- ❍ Yes
- ❍ No

Q5.2 How do you typically coordinate with the state agency responsible for groundwater quantity management? Select all that apply.

- ❑ Little coordination occurs
- ❑ Regular meetings
- ❑ Copy each other on correspondences
- ❑ Stakeholder meetings
- ❑ Memos and briefings
- ❑ Personal relationships and networks
- ❑ Formal coordination established by statute
- ❑ Other (please specify) _____

Q5.3 To what degree do both groundwater development and managed aquifer recharge/aquifer storage and recovery regulations consider groundwater quality standards?

- ❍ Groundwater use and managed aquifer recharge regulations do not work well with quality goals
- ❍ Groundwater use and managed aquifer recharge regulations mesh with quality goals
- ❍ Groundwater use and managed aquifer recharge regulations generally mesh with quality goals, but some aspects work against quality goals
- ❍ Groundwater use and managed aquifer recharge regulations generally work against quality goals, but some aspects work well

S6 Section 6 Resources, Research, and Collaboration

Q6.1 How are the water quality programs of your agency funded? Select all that apply.

- ❑ User fees
- ❑ Permit fees
- ❑ Taxes
- ❑ State general fund
- ❑ Mitigation fees
- ❑ Federal funding
- ❑ Other (please specify) _____

Q6.2 How does your agency's budget compare today to 10 years ago?

- ❍ Much less
- ❍ Less
- ❍ Somewhat less
- ❍ The same
- ❍ Somewhat more
- ❍ More
- ❍ Much more

Q6.3 How many FTE staff work in your agency?

Q6.4 How many staff in your agency work in groundwater related programs?

Q6.5 How would you describe the number of staff in your agency?

- ❍ Far too little
- ❍ Too little
- ❍ About right
- ❍ Too much
- ❍ Far too much

Q6.6 Which of the following full time staff does your agency employ? Select all that apply.

- ❑ GIS developer(s)
- ❑ Groundwater modeler(s)
- ❑ Hydrogeologist(s)
- ❑ Environmental protection specialist(s)
- ❑ Engineer(s)
- ❑ Biologist(s)
- ❑ Attorney(s)
- ❑ Hydrologist(s)
- ❑ Economist(s)
- ❑ Geochemist(s)
- ❑ Other (please specify) _____

Q6.7 Please rank the following resources most needed for your department to better accomplish its goals?1 being most needed

_____ Budget
_____ Equipment or tools
_____ Staff
_____ Regulatory authority
_____ Technical expertise
_____ Greater stakeholder participation/engagement
_____ Other (please specify)

Q6.8 To what extent does your agency rely on local agencies (e.g. County Health Department or Water Conservancy District) to implement groundwater quality regulations?

- ❍ Rarely
- ❍ Sometimes
- ❍ Always

Q6.9 To what extent does your agency rely on federal agencies to implement groundwater quality regulations?

- ❍ Rarely
- ❍ Sometimes
- ❍ Always

Q6.10 To what extent do county agencies in your state play a role in groundwater quality management? Please indicate any counties that are heavily involved in groundwater quality management.

- ❍ None
- ❍ Little _____
- ❍ Some _____
- ❍ A lot _____

Q6.11 To what degree are the following sources information about groundwater influential for you (or your organization) in learning about emerging groundwater management issues? On a scale of 1-5 (5 = very influential; 1 = not at all influential).

_____ Internal memos and briefings
_____ Popular news
_____ Professional associations
_____ Professional meetings/conferences
_____ Continuing education
_____ Trade journals
_____ Universities
_____ Peer-reviewed journal articles
_____ Professional meetings/conferences
_____ Webpages
_____ Government reports
_____ Other (please specify)

Q6.12 What sources of information are most likely to be influential in shaping agency management or policy decisions on groundwater? On a scale of 1-5 (5 = very influential; 1 = not at all influential).

_____ Internal memos and briefings
_____ Popular news
_____ Professional associations
_____ Professional meetings/conferences
_____ Continuing education
_____ Trade journals
_____ Universities
_____ Peer-reviewed journal articles
_____ Professional meetings/conferences
_____ Webpages
_____ Government reports
_____ Other (please specify)

S7 Section 7 Looking Forward

Q7.1 Which of the following issues in your state will require more attention in the next 10 years? Select all that apply.

- ❑ Litigation
- ❑ Interstate conflicts
- ❑ Water rights
- ❑ Increased groundwater pumping
- ❑ Resource development (oil/gas, mining, timber)
- ❑ Climate change
- ❑ Primacy program requirements/responsibilities
- ❑ Tribal water rights settlements
- ❑ Stakeholder disagreements
- ❑ International conflicts
- ❑ Management of industrial waste
- ❑ Oil and gas exploration and production
- ❑ Mine drainage
- ❑ Saltwater intrusion
- ❑ Water quality monitoring
- ❑ Water level monitoring
- ❑ Other (please specify) _____

Q7.2 Please rank the top three concerns from question 7.1. 1 being of most concern

- ❑ 1. _____
- ❑ 2. _____
- ❑ 3. _____

Q7.3 In the next five years, to what extent do you think changes in groundwater quality regulation will be considered by the regulatory agency in charge of groundwater quality?

- ❍ Strongly unlikely to be considered
- ❍ Not likely to be considered
- ❍ Likely to be considered
- ❍ Strongly likely to be considered

Q7.4 Based on current aquifer water levels, water use projections, contamination issues and water planning efforts -what kinds of new groundwater regulations and/or policies do you think will be likely to occur in the next 5 years? Select all that apply.

- ❑ None
- ❑ Pumping regulations
- ❑ Injection regulations
- ❑ New water quality standards for unregulated contaminants
- ❑ Regulations/policies to better manage groundwater dependent ecosystems
- ❑ Regulations/policies to help assure sustainable use of groundwater
- ❑ Recharge regulations
- ❑ Regulations of surface activities that affect groundwater
- ❑ Oil and gas exploration and production
- ❑ Groundwater classification
- ❑ Groundwater quality standards
- ❑ Other (please specify) _____

Q7.5 Do you see existing groundwater quality regulations becoming more stringent, less stringent, or staying about the same in the next five years?

- ❍ More stringent
- ❍ Less stringent
- ❍ About the same

Q7.6 Please write any additional comments you think might be of interest.

Q7.7 If there were questions you were unable to answer; whom do you recommend we contact for responses?

Appendix B: Qualitative Survey Responses

Part I

Section 1.2

Q2.2 - Please rank the top three concerns from question 2.1. 1 being of most concern.

Rank 1

AK	Budget
AZ	Quantity
AR	Depletion of the alluvial and Sparta aquifers in East Arkansas
CA	Quantity and overdraft
CO	Private Wells
CT	Quality
DE	Quality
FL	Degradation of groundwater-fed natural systems
GA	Aquifer overdraft
HI	Quality
ID	Aquifer Overdraft
IL	Quality
IN	Quality
IA	Conflicting regulatory requirements between Federal and State Rules
KS	Aquifer Overdraft
KY	Quality
LA	quality
ME	Health/Vulnerability of private well users
MD	staffing issue
MA	Quality
MI	Health/vulnerability of private well users
MN	Nitrates in ground water & surface water
MS	Quality
MT	Quality
NE	quality
NV	quality
NH	Health/Vulnerability of private well owners
NJ	Quality
NM	quality
NY	Quality
NC	Quality
ND	Quantity
OH	Health/vulnerability of private well users
OK	Overdraft

OR Staffing
PA Quality
RI Quality
SC Quality
SD Sustainable supplies such as from the Madison Limestone
TN communication with other agencies
TX Drought
UT Quality
VT staffing
VA Coastal Aquifer overdraft
WA Quantity
WV Quality
WI Quality
WY Budget

Rank 2

AK Health/vulnerability of private well users
AZ Overdrafting
AR Depletion of the Sparta aquifer in South Arkansas
CA Quality
CO Budget
CT Quantity
DE Drought
FL Drought (tied to climate change)
GA Groundwater quantity
HI Drought
ID Quantity
IL Aquifer Overdraft
IN Health/vulnerability of private well users
IA Inadequate communications around water quality with other agencies
KS Drought
KY Quantity
LA vulnerability of well users
ME Quality
MD quantity
MA Quantity
MI Quality
MN increasing chloride concentrations in groundwater in urban areas, also affects surface waters
MS Quantity
MT Health of private well users

NE budget
NV quantity
NH Quality
NJ Quantity
NM quantity
NY Heath
NC Aquifer overdraft
ND Aquifer overdraft
OH quality
OK quality
OR Overdraft
PA Staffing issues
RI Private well users
SC Quantity
SD Water Quality; human contamination threats and naturally occurring
TN staffing
TX Quantity
UT Quantity
VT budget
VA Saltwater upconing
WA Overdraft
WV health/vulnerability of private well users
WI Quantity
WY Health/Vulnerability of private well users

Rank 3

AK Lack of private well permitting/regulations
AZ Drought
AR Completion of surface-water delivery projects before aquifers are depleted
CA budget
CO Staffing
CT Land use changes, development, threat of pollution
DE Budget
FL Budget
GA Groundwater quality
HI Quantity
ID Quality
IL Private wells
IN Quantity
IA Budget

KS Quantity
KY Drought
LA budget
ME Staffing Issues
MD aquifer overdraft
MA Budget
MI Quantity
MN Unsustainable aquifer pumping in some areas
MS Aquifer overdraft
MT Budget
NE quantity
NV drought
NH Climate change
NM budget
NY Drought
NC Drought
ND Quality
OK drought
OR Private wells
PA Health/vulnerability of private well users
RI Quantity
SC Aquifer overdraft
SD Nutrient enrichment
TN private well users
TX Quality
UT Communication
VT climate change
VA Staffing
WA Quality
WV quantity
WI Health/vulnerability of private well users
WY Aquifer overdraft

Section 1.3

Q2.4 - Please rank the top three concerns from question 2.3. 1 being of most concern.

Rank 1

AK Septic tanks
AZ Industrial
AR Saltwater intrusion where aquifers are overdrafted

CA Agriculture
CO Naturally-occurring contaminants
CT naturally occurring contaminants
DE Agricultural
FL Agricultural sites
GA Wastewater impoundments
HI Agriculture sites
ID Nitrate contamination
IL Industrial
IN naturally-occurring contaminants
IA Naturally occurring "contaminants"
KS Land Application of Manure
KY Coal Ash Impoundments
LA saltwater intrusion
ME Under Ground Tanks
MD Agriculture
MA Stormwater
MI Oil/gas exploration and production
MN Agricultural sites
MS superfund
MT Agriculture/Non-point Sources
NE agricultural sites = nonpoint source
NV wastewater impoundments
NH PFCs, PFOA, PFOS
NM CAFOs
NY CAFO
NC Naturally-occurring contaminants
ND Agricultural sites
OH Superfund/CERCLA
OK naturally occurring contaminants
OR Naturally occurring
PA Underground storage tanks
RI Septic tanks
SC UST
SD CAFO / Agricultural sites
TN septic
TX Oil/gas exploration and production
UT Mine/Industrial wastewater impoundments and drainage
VT industrial sites
VA Saltwater intrusion

WA Agricultural sites
WV mine drainage
WI Agricultural practices
WY Injection wells other than Class II

Rank 2

AK Naturally-occurring contaminants
AZ Mine Drainage
AR UST leaks
CA CAFOs
CO Mine Drainage
CT septic systems
DE Underground Storage Tanks
FL Septic tanks
GA Industrial sites
HI Septic tanks
ID Agriculture
IL Agriculture
IN Industrial sites
IA Agricultural sites
KS Naturally occurring contaminants (arsenic)
KY Agriculture Sites
LA industrial sites
ME Industrial Sites
MD underground storage tanks
MA Septic
MI land application of wastewater or residuals
MN Other - chloride from de-icing chemicals
MS industrial
MT Superfund Sites
NE naturally occurring contaminants
NV Septics
NH MtBE
NM mines
NY Superfund
NC Saltwater intrusion
ND Septic tanks
OH Industrial Sites
OK Industrial sites
OR Agricultural sites

PA Agricultural sites
RI Waste sites
SC Industrial sites
SD Naturally occurring
TN superfund
TX Oil/gas wastewater disposal
UT Industrial Agriculture and CAFOs
VT naturally occurring
VA Large injection well project
WA CAFOs
WV wastewater impoundments
WI Naturally occurring contaminants
WY Underground storage tanks

Rank 3

AK Registered contaminated sites (non-Superfund)
AZ Superfund
CA Oil and Gas
CO Agriculture
CT industrial sites/historic industrial contamination
DE Naturally occurring
FL Stormwater
GA Saltwater intrusion
HI Land application of wastewater
ID Wastewater impoundments
IL Coal ash
IN Agricultural sites
KS Underground Storage Tanks
KY Underground Storage Tanks
LA naturally occurring contaminants
ME naturally-occurring contaminants
MD naturally occurring
MA Remediation
MI concentrated animal feeding operations
MN Septic systems
MS stormwater
MT Mine drainage
NE septic systems
NV CAFOs
NH Naturally occurring contaminants

NM wastewater
NY Other
NC Septic tanks
ND Naturally-occurring contaminants
OH Septic Tanks
OK agricultural sites
OR Mines
PA Mine drainage (abandoned or active)
RI Underground Storage Tanks
SC Land app ww and residuals
SD Mine drainage
TN storm water
TX Naturally occurring contaminants
UT Septic systems and LUWDS
VA Nat. Cont.=Fluoride
WA Cleanup sites including state managed sites
WV oil/gas production
WY Septic tanks

Q2.6 - Please rank the top three concerns from question 2.5. 1 being of most concern.

Rank 1

AK nitrates/nutrients
AZ Chlorinated solvents
CA nitrogen
CO Nitrate/Nutrients
CT E.coli
DE Nitrate/Nutrients
FL Nutrients (nitrates and phosphorus)
GA Nitrate/nutrients
HI Pesticides
ID Nitrates
IL Nitrates
IN Metals/specifically arsenic
IA nitrate/nutrients
KS nitrate
KY Chlorinated Solvents
LA saltwater intrusion
ME Contaminants associated with use of oil, heating oil in particular
MD Nitrate

MA nutrients/nitrogen
MI metals
MN Nitrates
MS chlorinated solvents
MT Nutrients
NE nitrates
NV nutrients
NH PFCs
NM metals
NY Other
NC Metals (esp. naturally occurring)
ND Nutrients
OH chlorinated solvents
OK Nitrates/nutrients
PA VOCs
RI Nitrate
SC Petroleum products
SD Metals
TN nutrients
TX Contaminants associated with production, transport and use of oil and gas
UT Metals
VT PSOA
VA chloride
WV cl-solvents
WI bacteria
WY Nitrate/nutrients

Rank 2

AK fecal coliform
AZ Nitrates
CA oil and gas
CO Total Dissolved Solids
CT chlorinated solvents
DE Chlorinated solvents
FL Bacterial
GA Chlorinated solvents
HI Chlorinated solvents
ID Metals
IL Chlorinated solvents
IN Nitrates/nutrients

IA naturally occurring arsenic
KS arsenic
KY Nitrate/Nutrients
LA chlorinated solvents
ME Chlorinated solvents
MD petroleum products
MA chlorinated solvents
MI nitrate/nutrients
MN chloride
MS oil and gas contaminants
MT Metals
NE uranium+selenium+arsnic liberated by nitrogen fertilizer
NV TDS
NH Nutrients
NM chlorinated solvents
NY Nitrate
NC Chloride
ND Metals
OH chloride
OK chlorides
PA Contaminants associated with production, transport and use of oil and gas
RI chlorinated solvents
SC Chlorinated solvents
SD Nitrate/nutrients
TN solvents
TX metals
UT Nitrates
VT Chlorinated Solvents
WV pesticides
WI nitrate
WY Chlorinated solvents

Rank 3

AK metals (inorganics)
CA solvents
CO Metals (selenium)
CT nitrates
DE Metals (including naturally occurring iron)
FL Chloride (and other halogens in sea water)
GA Chloride

HI Nitrate/nutrients
ID Arsenic
IL chlorides
IN Chlorinated solvents
KS chloride
KY Metals
LA oil/gas
ME Chloride
MD pathogens
MI contaminants associated with production, transport and use of oil and gas
MN chlorinated solvents
MS nutrients
MT Solvents
NE metals
NV solvents
NH chloride
NM nutrients
NY Pesticides
NC Septic system failures
ND Pesticides
OH nitrates
PA Nitrate/nutrients
RI Chloride
SC Nitrates/nutrients
SD Arsenic
TN pesticides
TX chlorinated solvents
UT TDS
VT pathogens
WV nitrate/nutrients
WI metals
WY Metals

Part II

Section 2.2

Q3.1 - Does your state have explicit groundwater quality management goals? If so, please indicate your state's top three goals.

CA Safe Drinking Water

DE Reduce nutrients to meet human health and surface water goals

FL Achieve 0.35 mg/L nitrate concentration in priority springs within 20 years.

GA Control nitrate/nutrients in groundwater

ID protection

IL Good quality groundwater

IN Monitor ground water quality to determine hydrogeological setting specific ground water quality

KS the prevention of the pollution of the water supplies of the state;

KY Manage

LA unknown - other agency

ME Maintain groundwater quality below Maine Maximum Exposure Guidelines (concentration of contaminants

MD To protect physical, chemical and biological integrity of GW resources

MA Nutrient management

MI Michigan's Water resources are safe and clean

MN Maintain groundwater in its natural condition, free from any degradation caused by human activities. (MN Statutes Ch. 103H)

MT To maintain the beneficial uses of ground water in use of specific standards.

NE Each of the 23 Natural Resources Districts develops local gw quality mgt goals

NV protect to drinking water standards

NH All groundwater must be protected as a potential drinking water source.

NJ Restore

NM number of facility inspections

NC Improve groundwater quality monitoring.

OR Nitrates

RI Protect high quality groundwaters

SC All groundwater should be drinking water quality

TX It is the goal of groundwater policy in this state that the existing quality of groundwater not be degraded. This goal of nondegradation does not mean zero-contaminant discharge.

VT not to exceed recharge

VA Groundwater protection policy/anti-degradation

WA Protect background/ antidegradation

WV WV Code Â§22-12-2(1) "Maintain and protect the state's groundwater resources consistent with this article to protect the present and future beneficial uses of the groundwater"

WI We have groundwater quality standards. They are listed in NR140, Wisconsin Administrative Code.

WY Protect groundwater quality

Part VI

Q7.2 - Please rank the top three concerns from question 7.1. 1 being of most concern.

Rank 1

AK	primacy program requirements/responsibilities
AR	Overpumping
CA	increased pumping
CO	Mine Drainage
CT	climate change
DE	Increased Ground Water Pumpage
GA	Water level monitoring
HI	water quality monitoring
ID	Water rights
IL	increased groundwater pumping
IN	Increased groundwater pumping
IA	Stakeholder disagreements
KS	Increased pumping
KY	Climate change
LA	saltwater intrusion
ME	stakeholder disagreements
MD	Climate Change
MA	Primacy requirements
MI	water quality monitoring
MN	Water quality monitoring - nitrate contam
MS	increased gw pumping
MT	Water Rights
NE	water quality monitoring
NV	increased GW pumping
NJ	Unregulated contaminants
NM	Tribal
NY	Other
NC	Water quality monitoring
OK	water rights
OR	Stakeholder disagreements
PA	Water quality monitoring
RI	Nutrients and emerging contaminants in groundwater
SC	Increased groundwater pumping
SD	Water Rights
TN	internal
TX	Water Rights

UT Mine Drainage
VT climate change
VA increased groundwater pumping
WA Water rights
WV resource development
WI Water quality
WY Primacy program requirements/responsibilities

Rank 2

AK climate change
AR Interstate compacts
CA water quality monitoring
CO Climate Change
CT water rights
DE Water Level Monitoring
FL Degradation of groundwater-dependent natural systems
GA Increased groundwater pumping
HI water level monitoring
ID Ground Water Pumping
IL water rights
IN water quality monitoring
IA Water level monitoring
KS Primacy issues
KY Increased groundwater pumping
LA oil/gas production
ME Climate Change
MD oil- gas exploration
MA water quality monitoring
MI oil and gas exploration and production
MN Increased pumping for pop. growth
MS Water quality monitoring
MT Litigation
NE primacy program requirements/responsibilities
NV water rights
NJ Increased groundwater pumping
NM increased pumping
NY Water Quality
NC Water rights
OK tribal
OR Tribes

PA Oil and gas exploration and production
RI groundwater quality monitoring
SC Water level monitoring
SD climate change
TN litigation
TX Interstate Conflicts
UT Industrial Waste
VT primacy program requirements
VA water level monitoring
WA Increased groundwater pumping
WV industrial waste
WI water level monitoring
WY Litigation

Rank 3

AK Resource development (oil/gas, mining, timber)
AR Litigation
CA climate change
CO Interstate Conflicts
CT stakeholder disagreements
DE Salt water intrusion
FL Stakeholder disagreements
GA Interstate conflicts
HI climate change
ID Managed Aquifer Recharge
IL water level monitoring
IN water level monitoring
IA Water Rights
KS Management of industrial waste
KY Water level monitoring
LA resource development
ME Water quality monitoring
MD Agricultural water use
MA Increased GW pumping
MI increased groundwater pumping
MN Other - forest land conversions to agric.
MS resource development
MT Primacy
NV industrial waste management
NJ Water rights

NM water rights
NY Water Level
NC Stakeholder disagreements
OK oil and gas
OR water level monitoring
PA Climate change
RI groundwater pumping
SC Water rights
SD mine drainage
TN water rights
TX Resource Development
UT Over allocation and water quality degradation
VT stakeholder disagreements
VA water rights
WA Water quality monitoring
WV oil & gas production
WI increased groundwater pumping
WY Stakeholder disagreements

Q7.6 - Please write any additional comments you think might be of interest.

AK The state is facing a multi-billion dollar deficit and has relied heavily on oil revenue to fund state programs. Oil prices are not projected to recover any time soon. There is no state income or sales tax. Therefore, the future of state programs is highly uncertain at this time.

CA Please research the Sustainable Groundwater Management Act to learn more.

CT Recommend contacting Department of Energy and Environmental Protection. I left a number of responses blank as they would be more appropriately answered by DEEP staff.

DE 1. Delaware has adopted as state MCL's some contaminants that are currently unregulated at the federal level such as BCEE, MTBE, and possibly PFOS/PFOA. This may continue on a case by case basis as newer unregulated contaminants are identified in the state in potable sources. These regulatory steps then have spillover effects on the regulation of sites, clean up standards, etc. 2. I also anticipate improvements in our aquifer water level monitoring efforts over the next 5-6 years due to some recent state funded projects setting up groundwater monitoring statewide. This is a geographically phased effort.

FL Last year the Florida legislature adopted a Springs Protection bill that addresses groundwater quality issues, so the state is unlikely to address groundwater quality again in the next 5 years. We are not FL DEP, which is the state agency that should have completed this survey. We answered questions about which we were knowledgeable.

ME My work is in the investigation and remediation of contaminated soil and groundwater at industrial sites and private homes (heating oil tanks spills). We also monitor licensed landfills. I did not find this questionnaire to be relevant to the work I do and had difficulty answering the questions

MN We have a current report (January 2016) that might be helpful, a Groundwater Protection Recommendations Report. Here's the link:

Groundwater Protection Recommendations Report to the Legislature:

https://www.pca.state.mn.us/sites/default/files/lrwq-gw-1sy16.pdf.

NJ These responses were prepared by a variety of NJDEP programs including the Water Resource Management Divisions of Water Supply and Geoscience, Water Monitoring and Standards, and Water Quality as well as the Site Remediation Program.

NM NM is grappling with our mining of GW aquifers and the quality of the water that is left. Aquifer storage will become much more popular and much more utilized in short order. A huge problem that we have in the quality realm is that we have no state superfund/orphan site fund. All orphan sites are unmanaged and uncharacterized unless they qualify for CERCLA/Superfund NPL listing.

PA Several of the questions were unanswered because PA does not have explicit groundwater quality regulations.

SC Please note that the answers to this survey are my opinions (including FTE estimates) and not the opinions, policies or official FTE counts for the SC Dept. of Health and Environmental Control.

VA Dept. of Occupational Regulation certifies water well systems providers.

Department of Health oversees SDWA and source water protection/wellhead protection

Department of Mines, Minerals, and Energy regulates mining

WA Q4.8 Agriculture has voluntary BMPs except for CAFOs and industrial business BMPs are required through a permit.