

Ground Water Level and Quality Monitoring

National Ground Water Association (NGWA):

The National Ground Water Association (NGWA) is a not-for-profit professional society and trade association representing the ground water industry. Our headquarters are located in Westerville, Ohio. We represent more than 15,000 members from all 50 states, which include some of the country's leading public and private sector ground water scientists, engineers, water well contractors, manufacturers and suppliers of ground water related products and services. NGWA hosts numerous educational forums across the country on crucial issues impacting ground water resources. These forums provide an opportunity for leading scientists to discuss the issues and share ideas on solutions.

Twenty professionals met on April 18, 2005 during the NGWA Ground Water Summit in San Antonio, Texas to discuss the federal government's role in ground water monitoring and respond to a series of questions on the topic. Participants, reflecting the NGWA membership, included individuals working for federal, state and local government, universities, consulting and contracting firms, and equipment manufacturers. For a list of participants, see the Appendix. Subsequent to the San Antonio meeting, NGWA's Regional Ground Water Management Task Force, Ground Water Protection and Management Subcommittee and Government Affairs Committee reviewed this document.

Background:

Most states across the country are either experiencing water shortages now or predict shortages in the next 20 years. The west is facing additional pressures currently due to the drought conditions over the past few years, according to surveys conducted by the National Ground Water Association (NGWA). All of the surveys showed that there is no one cause of shortages but a combination of quality, quantity or legal issues. NGWA surveys also found that while states are gathering the necessary data to inform decision makers, no state has met its data collection goals. The nation lacks the fundamental data necessary to understand adequately the nation's ground water resources and make informed decisions regarding its use and management (NGWA 2004).

No federal agencies are collecting ground water level data on a national scale. Only the U.S. Geological Survey and National Park Service are collecting ground water level data on a regional scale (U.S. General Accounting Office, 2004). A minimum of fifteen federal agencies collect a wide variety of water quality data, according to the GAO survey. The survey did not differentiate whether water quality data were being gathered for surface water or ground water (U.S. General Accounting Office, 2004).

Questions:

Question 1 – In assessing fresh water availability and quality in the United States, what information needs does the long-term quality and quantity monitoring of ground water address?

Long-term ground water quality and quantity monitoring would provide information necessary for the planning, management, and development of ground water supplies to meet current and future water needs, both for humans and ecosystems. Specifically, monitoring would provide data needed to determine:

- The ability of the ground water resource to support current and additional population growth and development.
- The design and effectiveness of ground water management and protection programs
- Short and long-term changes in ground-water recharge, storage, flow direction and quality, as impacted by land use, land use changes, climatic variability, and water use
- Potential opportunities to artificially recharge the ground water supply, renewing the resource and providing cost effective storage of water for future use
- Ground water and surface water interactions, information critical to balancing human and ecosystem water needs
- Data for use in computer modeling of ground water flow or contaminant transport.
- The amount of ground water actually used.

Obtaining accurate data on water use and the sustainable yield of aquifers, knowing past and current land use and pumping rates as well as identifying human and ecosystem water needs are integral to managing and protecting the nation's ground water resource. We must continue and improve upon data collection, research and information dissemination in these areas as well.

Question 2 – In assessing the fresh water availability and quality in the United States, what are the long-term monitoring needs for evaluating the status and trends of the quality and quantity of the nation's ground water?

In order to evaluate the status and trends in the quality and quantity of the nation's ground water, a commitment to support and provide sustained funding for a long-term national ground water quality monitoring network and a long-term national ground water level monitoring network is critical. Given the interrelationship between ground water quality and quantity as well as funding limitations, the national monitoring effort should seek out opportunities to leverage and optimize efforts to achieve both quality and quantity data objectives. An integrated approach to monitoring is required, and a national ground water quality monitoring network and a national ground water level monitoring network should include:

- Ambient Ground Water Monitoring: National monitoring networks should include monitoring to determine ambient ground water quality or ambient ground water

levels, dependent on network purpose. Monitoring in the non-pumping sectors of aquifer systems is much less likely to occur as part of the normal management effort by water users. Major and minor water table and confined aquifers should be monitored across hydrogeologic settings and climate zones. The number of monitoring sites required to obtain the necessary ambient data may be more limited than required to achieve other data collection goals. The goal for the ambient monitoring component would be to have several hydrographs that reflect the overall long-term response of aquifers in areas as close to natural conditions as possible. Securing and maintaining funding for ambient ground water monitoring over time is especially challenging.

- **Impacted Areas Monitoring:** National networks should monitor ground water quality or ground water levels in aquifers impacted by withdrawals or anticipated future withdrawals, and overlain by various land uses including areas undergoing transition.
- **Targeted Monitoring:** National monitoring networks should include monitoring to address specific questions of state, regional or national significance. Monitoring to determine the effectiveness of specific water conservation practices on ground water levels is one example. Another example is ground water sampling in drinking water source protection zones to identify the impacts over time of protection programs on source water quality. In areas at risk for land subsidence, targeted ground water monitoring would provide valuable information for decision-makers. Monitoring of the quality and quantity of surface water bodies may be needed in order to address ground water quality and quantity questions.

Current state and local ground water monitoring programs are in varying stages of development. While efforts are underway, insufficient ground water quality and ground water quantity data are currently being generated. Additionally, most of the data are not readily available to anyone but the person generating it and perhaps the agency to whom it is sent.

National ground water monitoring networks may require adjustment periodically in response to changing conditions, such as significant changes to land or water use. Network evolution is necessary to ensure pertinent data, at the appropriate level of resolution, remains available for national, state and local decision-making.

Question 3 – In assessing fresh water availability and quality in the United States, what should be the federal government’s role as regards to long-term quality and quantity monitoring of the nation’s ground water resource? The response should focus on assessing the availability and quality of the ground water resource rather than looking at statutory mandates unless those mandates are relevant:

Ground water management decisions are best made at a local level, whether that is the aquifer or ground water basin level, some government subunit, or a state level. State and local government should lead in monitoring ground water to inform that decision-making. The Federal government is currently and must continue to play a vital role as well. The NGWA membership acknowledges the data collection and monitoring related work of federal agencies such as the

U.S. Department of Agriculture, the U.S. Department of Interior, the U.S. Geological Survey, and the U.S. EPA. These federal agencies serve as positive models. NGWA believes the federal government's role as regards long-term ground water quality and quantity monitoring should be to:

- Support a collaborative framework among federal, state, local and non-government entities to assess available data, identify ground water monitoring level and quality data gaps, and ground water level and quality data needs (NGWA, 2004). A Ground Water Monitoring Subcommittee under the Advisory Committee for Water Information (ACWI) should be explored as a possible framework for federal agency, inter-governmental and non-governmental collaboration. Because of potential differences in the issues and entities involved in ground water quality versus ground water quantity monitoring, additional discussion of Subcommittee structure would be valuable. Further, establishment of or the inclusion of existing local coordinating bodies under the Subcommittee may be of benefit and should be investigated. An August 2003 U.S. EPA report concludes that state and regional water quality monitoring councils "yield substantial benefits" (U.S. EPA 2003).
- Develop guidelines for ground water use, quantity, and quality data collection, quality control, storage, and retrieval. A control step is needed prior to data storage to assure data quality. However, developing a complicated oversight function that unnecessarily impedes data flow should be avoided. Development and adherence to the guidelines should lessen, although not eliminate, the extent of quality control oversight needed prior to data storage.

The content of the guidelines may, in some cases, need to vary by monitoring purpose. For example, guidelines for a minimum sampling set may differ depending on whether the monitoring purpose is to assess ground water quality or quantity. Early identification of what content should be common for both monitoring purposes and what content should vary would help in organizing and expediting guidelines development. Guidelines development should consider, and incorporate, as appropriate, on-going efforts at the national and international level

- Provide federal funding, along the lines of the National Cooperative Geologic Mapping Program, for the cooperative development and operation of (1) a national ground water quality monitoring network and (2) a national ground water level monitoring network that addresses the needs identified in Question 2 above. The National Cooperative Geologic Mapping Program is suggested as a model because it includes federal, state, and educational components with federal money requiring a match. Additional programs that provide grants or which feature federal-state cooperative funding are the Water Resources Research Institutes Program and the Cooperative Water Program, respectively. Federal funding to support the cooperative development and operation of the national networks should be distributed as follows.
 - Federal Monitoring Component: A portion of the federal funding should go to federal agencies to support the federal backbone of the national ground water quality

- monitoring network and the federal backbone of the national ground water level monitoring network. The funding would be used by federal agencies to build on and augment, as needed, state and local ground water monitoring data collection so as to help address national and regional (multi-state) scale questions.
- State Monitoring Component: A portion of the federal funding should be designated for grants to the states. The federal grants to the states would be used to help support state ground water quality monitoring networks and state ground water level monitoring networks. The state monitoring networks would be designed to help address state and local scale questions. The state monitoring networks, which are partially supported by federal funding, would serve as the state and local component of the national ground water quality monitoring network and national ground water level monitoring network, as applicable. In return for receiving federal grants, the states would be required to commit to cooperative development and operation of the long-term national ground water quality monitoring network and the long term national ground water level monitoring network, as applicable.
 - Education Component: A portion of federal funding should be set aside for guidelines development, and education programming. Education programming would include, among other activities, train-the-trainer sessions by the federal government on the national guidelines. Training grants under the education portion would be available to state, local or not-for-profit entities to provide the training at local levels using federally trained trainers. Public-awareness programming and outreach should also be eligible for federal funding under the education component. Public education provides the necessary background to understand monitoring results. With analytical capabilities in the parts-per-trillion range, public education will help avoid unnecessary confusion and concern while building support for needed actions as appropriate.

Additional research is needed to determine what efficiencies would be provided by coordination of funding sources, among federal agencies, and in program design and implementation.

- Establish a national clearinghouse to store or link to data collected in the national ground water quality monitoring network and the national ground water level monitoring network. These data should be available from links on already existing National Spatial Data Infrastructure (NSDI) sites to make the information easier to find and assure that the proper documentation of these data is maintained. Metadata should also be collected and made available through the national clearinghouse so as to identify additional ground water data sources and data gathering efforts. Collecting and compiling metadata would help avoid duplication of effort.

Question 4 – In assessing the fresh water availability and quality in the United States, how does the federal government integrate its role in long-term quality and quantity ground water resource monitoring with private sector, local and state government monitoring efforts to optimize and leverage resources?

Data collection and interpretation that serves the needs of a variety of users must be objective and protected from potential bias. Such unbiased research is needed to provide an historic baseline of field conditions and is a legitimate role for governmental agencies. Together local, state and federal government are part of a mosaic with each level playing an integral role in the long-term monitoring of the nation's ground water.

- **Federal Government:** The federal government can and should serve as the “glue” that holds data collection efforts together. Federal leadership is needed to promote better coordination among federal agencies as well as among federal, state and local agencies. Promoting greater coordination and cooperation would help avoid duplication, make greater use of existing data, and pinpoint data gaps and future needs. By spearheading the cooperative development and use of national guidelines on data collection, quality control, storage and retrieval, the federal government can promote confidence in and use of data across levels of government. A national ground water monitoring clearinghouse, supported by the federal government, can identify and increase accessibility, as appropriate, to data produced by federal, state, or local government or private sector monitoring. The federal government can synthesize data produced by various levels of government and others into relevant national reports. The federal government should make use of, augmenting when necessary, state and local ground water monitoring data so as to address national, transboundary and regional (multi-state) scale questions. Prior to issuing a national or regional report, the federal government should consult with state and local government. The federal government should perform and fund basic research regarding the mechanisms that affect ground water availability and quality, such as ground water-surface water interaction, recharge, and contaminant transport. The federal government should disseminate basic research results for application by all levels of government and the private sector; thereby, maximizing the nation's investment in basic research.
- **State and Local Government:** The state and local government role should be to develop and operate state or sub-state ground water quality and ground water level monitoring networks, unless the state or local government lacks the capability. State and local governments should apply the basic research performed by the federal government. Each state should put together a statewide picture of ground water availability and quality. States should use regional models to help identify where resources are needed most.
- **Private Sector:** To the extent possible, federal, state and local governments should contract with private-sector firms for the performance of exploratory drilling, and the installation of wells for monitoring ground-water quality and elevation.

Question 5 – What are the priority actions that the federal government should take relative to its role in long-term quality and quantity monitoring of the nation's ground water resource?

A national survey of NGWA members identified federal funding for cooperative ground water quantity data collection as the most useful action for the federal government followed by

federal support of cooperative data collection of ground water quality (NGWA 2004).
Additional priorities for federal action related to ground water monitoring include:

- Demonstrating leadership and commitment to collaborative ground water quality and quantity data collection including:
 - Publicly acknowledging the importance of and committing to provide long-term sustained support and funding for ground water quality and quantity data collection, analysis and information dissemination
 - Matching declarations of federal interest with federal funding
- Ensuring the availability of quality data at appropriate scale in order to make sound ground water planning, management and development decisions including:
 - Synthesizing, in coordination with state and local government, existing data and identifying data gaps.
 - Developing guidelines setting out a consistent methodology for data collection
 - Establishing milestones to measure progress in reaching data collection goals and committing to provide adequate funding to reach those milestones.
 - Promoting the use of more robust data sets to better inform and reduce the uncertainty of incorporating federal requirements into state and local ground water decision-making, such as decisions regarding the application of the Endangered Species Act
- Supporting research and development related to ground water availability and quality including
 - Providing a forum to integrate and bring together a multi-disciplinary (e.g. economic) approach to ground water availability
 - Supporting research and development into improved sensor technology so as to lower monitoring costs
- Promoting public education and outreach so individuals have the background to interpret monitoring results, and provide informed input into decision-making.

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Version 1: March 24, 2005 announced and made available on request to NGWA Ground Water Availability Interest Group, Transboundary Ground Water Interest Group, and Internet Ground Water Data Interest Group.
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Version 5: May 9, 2005 made available to Regional Ground Water Management Task Force for review
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- Version 1: Original draft
Version 2: Original draft with formatting and non-substantive changes
Version 3: Draft with input from reviewers up to 4/1/05 incorporated
Version 4: Draft with input from working group up to 4/18/05 incorporated
Version 5: Draft with input from 4/18/05 working group meeting
Version 6: Draft with input from 5/12/05 task force conference call
Version 7: Final version
(Technical update: April 5, 2006 NGWA logo updated)

Appendix

April 18-19, 2005 Working Group Participants

The National Ground Water Association thanks the following professionals for sharing their scientific and technical expertise. The document reflects their collective input as ground water professionals, and does not necessarily state or reflect the views of their employers

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