National Ground-Water Monitoring Network
Tip Sheet on Well Selection Criteria for Water Levels

Network Design Features

The National Ground-Water Monitoring Network (NGWMN) is a network of selected wells from Federal, multistate, State, and local ground-water monitoring networks brought together under a set of defining principles. The network takes advantage of and also seeks to enhance existing Federal, multistate, State, Tribal, and local monitoring efforts. The NGWMN is not intended to replace existing monitoring systems nor is it intended to address local issues, such as contaminated industrial sites or regulated facilities. Rather, the network is focused on assessing the baseline conditions and long-term trends in water levels and water quality in important aquifers. The NGWMN is expected to provide an improved foundation and context within which to interpret information from various data-collection efforts.

The network is intended to deliver data of sufficient quality and spatial/temporal distribution to support periodic evaluation of:

- Spatial and temporal patterns of ground-water levels and quality
- The extent to which ground-water levels and quality changes are related to human activity
- Responses to climatic variation
- The extent to which ground-water availability and quality changes affect human activities or ecosystems

The overall goal of the NGWMN is to provide information essential for national and regional scale decisions to be made about current ground-water management and future ground-water development.

Well-Selection Guidance

- The role of the NGWMN is not to provide data from every water-level monitoring well in the country. The NGWMN is intended to provide ready access to selected wells that meet specific criteria that serve as indicator wells of conditions in USGS Principal or major aquifers.
- Because the goal of the NGWMN is to provide information on the national and regional scale, the selection of wells by knowledgeable local experts to represent large areas is vital to the success of the Network. Local experts should select the best sites that represent the aquifer at a national or regional scale.
- The term “network-of-networks” sometimes is used to describe efforts to “roll up” existing networks operated over smaller areas into an inclusive network operated over a larger area. This usage can cause confusion, however, because it can imply that all of the wells monitored in all of the combined networks are included in the larger-scale network. That is not the situation intended for the NGWMN. The NGWMN will combine selected wells from networks operated at local/state/regional scales into a national-scale network.
- Wells selected for the NGWMN must meet the field methods standards and minimum data requirements specified for the NGWMN in Appendix 5 of the report: “A national framework for ground water monitoring in the United States” (Subcommittee on Ground Water, 2013).
- Each well selected for the NGWMN should meet the criteria specified by the defined “Subnetworks” and the measurement frequencies defined for the “Monitoring Categories”. The “Subnetworks” and “Monitoring Categories” are described in separate tip sheets.
    - The Monitoring Categories are relevant to well selection because the density of wells selected for the Network will be different for the ‘Trend’ and ‘Surveillance’ sites.

        - 'Trend' sites are intended to assess long-term trends and seasonal variation. Ideally these will be continuously-monitored sites with a long period of record. Water-levels in these wells should be measured at least quarterly.
        - 'Surveillance' sites are intended to be sampled less frequently, but with a higher density spatial density than trend sites. Water-levels in these sites should be measured at least once every 3 years.
- A balance of wells between the subnetworks ('Background', 'Suspected Changes', and 'Documented Changes') so that both background and affected wells are both represented is desirable.
- Well Density: The density of wells (number of wells selected for the NGWMN) for any Principal or major aquifer is dependent on the conditions being experienced in the aquifer.
    - Well density is aquifer specific.
    - Well density will differ among subnetworks (Background/Suspected Changes/Documented Changes).
    - Well density will differ among monitoring category (Trend/Surveillance).
- The NGWMN relies on local experts to recommend the appropriate well density for an aquifer. However, national consistency requires that the density of monitoring within a principal aquifer does not vary too greatly from state to state. And while no explicit density of wells is prescribed, these "rules of thumb" are provided:
    - For 'Trend' sites, a density of 1 to 4 sites per 1000 square miles in each Principal aquifer within a state. More sites may be required if the Principal aquifer is made up of several major aquifers which vary with depth. Nested wells at these locations are ideal 'Trend' sites.
    - A spreadsheet that takes these into account to determine recommended NGWMN Trend network well densities by Principal aquifer and State is available at: https://cida.usgs.gov/ngwmn/doc/WellDensities.xlsx.
    - Well Densities for Trend sites are not calculated for the 'Other aquifers' or 'Alluvial aquifers' Principal aquifers or for locally significant 'major' aquifers.
    - Surveillance sites are measured less frequently, but at a higher density in order to reflect local variation. Surveillance sites should be referenced to a nearby trend site. A density of 3 to 7 surveillance sites per trend site is a reasonable rule-of-thumb range. This range allows for consideration of local conditions within the aquifer:
        - In a relatively undeveloped aquifer water levels may vary less spatially, therefore fewer surveillance wells may be required.
        - In a more developed aquifer water levels may be more spatially variable, so more surveillance sites may be required.
    - Wells measured by other agencies should be included in the determination of the adequate well density for an aquifer in each state.
- A final consideration for water-level well selection is the type of well.
    - Dedicated monitoring wells are ideal.
    - Trend wells should be wells that are not used for any other purpose so they reflect only conditions in the aquifer.
    - In order to get adequate spatial coverage, Production, irrigation, or domestic use wells may need to be measured as Surveillance sites. Care should be taken to ensure that the water-level measurement reflects the water-level in the aquifer unaffected as much as possible by recent use of the well (waiting a specified time before measurement, making sure water levels have stabilized before final measurement).

Reference

Subcommittee on Ground Water of the Advisory Committee on Water Information, 2009 (revised 2013), A national framework for ground water monitoring in the United States: Advisory Committee on Water Information, accessed October 23, 2013, at http://acwi.gov/sogw/ngwmn_framework_report_july2013.pdf.