Status Report from the Subcommittee on Ground Water

Presentation to the Advisory Committee on Water Information on the National Ground Water Monitoring Network
July 13, 2011

Robert P. Schreiber, Co-Chair, (ASCE), CDM
William L. Cunningham, Co-Chair, USGS
H. Allen Wehrmann, ISWS
Nathaniel L. Booth, USGS

Representing products of the SOGW and SOGW Work Groups
Agenda

• Framework Overview
  • Bob Schreiber, SOGW/CDM

• Pilot Projects Summary
  • Bill Cunningham, SOGW/USGS

• A Pilot Example: Illinois-Indiana
  • Al Wehrmann, Pilot Leader, IL State Water Survey

• Web Data Portal
  • Nate Booth, USGS

• Next Steps and Resolution
  • Bob Schreiber, SOGW/CDM

• Q&A
Why a National GW Network?

- 2003 GAO Report
  - 36 States expect water shortages
- 2005 NGWA/AASG Survey
  - GW shortages expected in 43 states
  - Calls for cooperative monitoring
- 2006 Heinz Report
  - GW data inadequate for national reporting
Support for Network

- 2005 - NGWA facilitates development of concepts for national network
- 2007 - SWAQ report calls for water census
- 2007 – Formation of SOGW
- 2009 – SECURE Water Act calls for a national gw network
Charge to SOGW

The overall goal of the SOGW is to develop and encourage implementation of a nationwide, long-term ground-water quantity and quality monitoring framework that would provide information necessary for the planning, management, and development of ground-water supplies to meet current and future water needs, and ecosystem requirements.

Scope: This national framework for ground-water monitoring and collaboration will be developed to assist in assessments of the quantity of U.S. ground-water reserves, as constrained by ground-water quality.
SOGW Members & Supporters

- American Society of Civil Engineers
- Ground Water Protection Council
- Interstate Council on Water Policy
- Association of American State Geologists
- National Ground Water Association
- Texas Commission on Environmental Quality
- US Geological Survey
- USEPA Headquarters and Region 8
- Association of State Drinking Water Administrators
- Water Environment Federation
- USDA Forest Service
- Association of State and Interstate Water Pollution Control Administrators
- ASTM

Subcommittee & Work Groups: 70 people from 54 organizations

- NGO’s & Private Sector 40%
- State & Local Governments 35%
- Federal Government 20%
- Academia 6%
SOGW Guiding Principles

• “Walk before running”
• Reach consensus
• Retain flexibility
• Strive for inclusion
• Leverage “local knowledge”
• Encourage cross-border cooperation
SOGW Approach

- Determine “current picture” of groundwater monitoring
- Consensus network design principles
- Consensus field methods and data standards
- Determine approach for compiling data
- Consensus implementation plan
SOGW Work Groups

Subcommittee on Ground Water (14)
Bob Schreiber, ASCE
Bill Cunningham, USGS
Executive Secretary
Chris Reimer, NGWA

GW Monitoring Inventory Work Group (16)
Bill Cunningham, USGS
Mike Wireman, USEPA
Emery Cleaves, AASG

GW Data Standards and Data Management Work Group (13)
Chuck Job, USEPA
Scott Andres, DE Geological Survey

GW Field Practices Work Group (12)
Rod Sheets, USGS
Mike Nicholas, GWPC

GW Monitoring Design Work Group (27)
Bob Schreiber, ASCE
Kevin Frederick, WY DEQ

Implementation (13)
Steve Wilson, IL State Water Survey
Tim Parker, Schlumberger Water Services
Inventory Work Group – Results

- Many networks already exist
- Multiple agencies involved, sometimes multiple agencies within a state
- Ambient level networks more prevalent than quality networks
- National gaps in both
- Gap analysis work to be done
Inventory Workgroup - Quality

EXPLANATION

- **B**: Statewide and Regional
- **S**: Statewide
- **R**: Regional
- **SI**: Statewide (Inactive)
- **BI**: Regional (Inactive)
- **SI**: Statewide and Regional (Inactive)
- **NP**: No Network
- **DNR**: Did Not Respond

[Map of the United States showing various states with different symbols indicating the quality of inventory workgroups.]
Data Standards & Mgt Work Group

*Comparable - Acceptable*

- Minimum Data Elements for wells and measurements are provided*
- A Data Portal is **the most critical component**, and needed early in the process

* Methods Board
Field Practices Work Group

Comparable - Acceptable

• Few strict requirements—flexible and adaptable.

• Requires documentation of techniques to ensure comparability and assure quality in ground-water measurement and sampling activities.

• New technologies will be incorporated into the NGWMN as appropriate.
Network Design Work Group

Data Flow for Analysis & Mgt Purposes

National Ground-Water Network

Network data

Data analysis

Analysis results

Explanation of observed conditions

Ground-Water Levels

Spatial Descriptions

Temporal Descriptions

Statistical measures

Ground-Water Quality

Spatial Descriptions

Temporal Descriptions

Statistical measures

Insufficient data/need for more study

Identify areas of ambient or unstressed supply

Identify areas with adequate quantity/quality

Identify areas “at risk” of overdraft/contamination

Identify areas of overdraft/contamination

Water availability related to natural and human factors

Definition of causes of observed spatial and temporal variations

Basis for predicting the effects of water management actions

Spatial Descriptions

Temporal Descriptions

Statistical measures
Network Design Work Group

Principal and Major Aquifers
Network Design Work Group

**Types of Networks & Sub-Networks**

- **Unstressed Subnetwork**
  - Nonpumped or uncontaminated aquifers
  - Baseline Period (5 years of data)
  - Surveillance Monitoring Points (Synoptic wells)
  - Trend Monitoring Points (Backbone wells)
  - Special Studies (Rare in this network)

- **Targeted Subnetwork**
  - Impacted aquifers
  - Baseline Period (5 years of data)
  - Surveillance Monitoring Points (Synoptic wells)
  - Trend Monitoring Points (Backbone wells)
  - Special Studies

**EXPLANATION**
- At least 5 years of data are collected to establish background conditions
- Periodic census of ground-water levels and/or quality (i.e., “mass measurements” for potentiometric surface mapping)
- Fewer wells monitored regularly (i.e., seasonal variability of water levels and/or quality)
- Smaller areas to evaluate ground-water resources at risk of depletion or impairment

*ACWI*
Advisory Committee on Water Information
Implementation Sub-Group

⇒ Stepwise Approach

- Initiate Pilot Programs
- Develop Portal System
- Establish Management Structure
- Provide foundation for federal funding
- Facilitate participation by data providers
Implementation Sub-Group

→ *Pilot Program Strategy*

- Conduct gap analysis – cost estimate
- Evaluate water-level, WQ, and combo networks
- Assess “robustness”
- Establish ground-water data portal
  - Data flows through portal
  - But not stored in central database
- Improve Framework Document
- Leverage significant state expertise
Implementation Sub-Group

Recommended Management Structure

Management of the National Ground-Water Monitoring Network (NGWMN)

Data Providers
[Networks and Individual Sites That Meet NGWMN Criteria]

[Federal] [State] [Tribal] [Regional] [Local] [Other]

Advisory Committee on Water Information
Subcommittee on Ground Water
[Federal Interface]

U.S. Geological Survey
Management and Operations Group
[Day-to-day operations]

NGWMN Program Board
[Representatives from Data Providers]
[Guidance and Direction]
Framework Report to ACWI

- Available to NWQMC in Jan 2009
- Report approved by the ACWI in February 2009
- Available at http://acwi.gov/sogw/pubs
ACWI Resolution, Feb 2009

Now Therefore Be it Resolved that........

• ACWI accepts the Framework Document,
• ACWI adopts the conceptual implementation plan for the National Ground Water Monitoring Network, and
• ACWI charges SOGW to move forward with development and initiation of pilot testing, patterned after the preceding efforts related to the National Water Quality Monitoring Network for U.S. Coastal Waters and Their Tributaries.
Schedule

- Pilot-Testing RFP → Fall 2009
- Evaluation and Selection → same
- Pilot-Testing → FY10
- Reporting → FY11
  - Recommended Updates
  - Suggested "Next Steps"
- Full-Scale Implementation → FY12?
Pilot Projects Summary
National Ground Water Monitoring Network

Bill Cunningham
Co-Chair, Subcommittee on Ground Water
U.S. Geological Survey
NGWMN Pilot Studies

• Pilot phase followed Framework approval.
• Solicitation yielded 9 statements of interest
• Evaluation team selected 5 pilots to represent different scope/scale/IT
• Volunteer effort with 1-year timeline.
Why Pilot Projects?

• Test the concepts and produce information to evaluate the costs and technical feasibility of the NGWMN

• Improve the “Framework Document” of the NGWMN

• Use this information in the Implementation Phase of the National Ground Water Monitoring Network
National Ground Water Monitoring Network Pilot Projects
Minnesota

- Principal/Major Aquifers
  - Cambrian-Ordovician aquifer system
    - Upper Ordovician aquifers
    - Prairie du Chien-Jordan aquifers
    - Tunnel City/Wonewoc aquifers
    - Mt. Simon aquifer

- Primary Agencies
  - Minnesota DNR
  - Minnesota Pollution Control Agency

- Pilot Authors
  - Michael MacDonald (DNR) and Sharon Kroening (PCA)

- NGWMN Wells
  - Selected 52 of the 157 wells in the Cambrian-Ordovician aquifer system
Montana

• Statewide Principal Aquifers
  • Alluvial aquifers
  • Glacial aquifers
  • Lower Tertiary,
  • Northern Rocky Mountains Intermontane Basins
  • Paleozoic aquifer systems

• Primary Agency
  • Montana Bureau of Mines and Geology

• Pilot Authors
  • Thomas Patton and Luke Buckley

• NGWMN Wells
  • Selected 271 of more than 940 wells in the statewide network.
New Jersey

• **Statewide Principal/Major Aquifers**
  - Northern Atlantic Coastal Plain
    - 10 major subunits
  - Early Mesozoic Basin
  - Piedmont and Blue Ridge crystalline rock
  - Piedmont and Blue Ridge carbonate rock
  - Valley and Ridge aquifers
  - NY and NE carbonate rock aquifers

• **Primary Agencies**
  - New Jersey Geological Survey
  - USGS NJ Water Science Center

• **Pilot Authors**
  - Steven Domber, Raymond Bousenberry, and Karl Meussig (NJGS); Daryll Pope and Anthony Navoy (USGS)

• **NGWMN Wells**
  - Selected 982 of 19,000 wells
Texas

- Principal/Major Aquifers
  - Edwards-Trinity aquifer system,
    - 3 major subunits
  - Seymour aquifer,
  - Pecos River Basin alluvial aquifer,
  - Coastal lowlands aquifer system,
  - Texas coastal uplands aquifer system,

- Primary Agencies
  - Texas Water Development Board (TWDB)

- Pilot Authors
  - Janie Hopkins, Radu Boghici, and Bryan Anderson

- NGWMN Wells
  - Selected 425 of the 2,250 available wells
Summary of Pilot Tasks

- Evaluate the network within the concepts in “Framework for a Nationwide Ground Water Monitoring Network”
  - Select aquifers, well characteristics, frequency, analytes, “flagging”, spatial distribution
- Evaluate field practices, data elements stored in the GW database, and data management procedures and their documentation,
- Evaluate ability to transmit data to the data portal
- Identify all costs of potential participation in the NGWMN
- Identify network gaps
Network Gaps

- **Spatial gaps**: additional monitoring points identified to provide an adequate areal and depth distribution of wells or springs.
- **Temporal gaps**: an increase in the frequency of water-level or water-quality measurements.
- **Field practice gaps**: changes in water-level or water-quality measurement techniques.
- **Data management gaps**: missing data elements, or other data-handling issues.
## WL Network Gaps

<table>
<thead>
<tr>
<th>Gap</th>
<th>IL-IN</th>
<th>Minnesota</th>
<th>Montana</th>
<th>New Jersey</th>
<th>Texas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spatial</strong></td>
<td>12 wells</td>
<td>98 wells</td>
<td>245 wells</td>
<td>3 wells</td>
<td>32 wells</td>
</tr>
<tr>
<td><strong>Temporal</strong></td>
<td>Additional data loggers and/or telemetry</td>
<td>None</td>
<td><strong>Additional 2,400 site visits needed</strong></td>
<td>Increase frequency from 1 per 5 yrs to 1 per year on 844 wells</td>
<td><strong>Additional 2,200 site visits needed</strong></td>
</tr>
<tr>
<td><strong>Field Practice</strong></td>
<td>None reported</td>
<td>8 minor differences</td>
<td>Minimal differences reported.</td>
<td>4 minor differences</td>
<td>Minimal differences reported.</td>
</tr>
<tr>
<td><strong>Data Management</strong></td>
<td>Missing some MDE’s; Surveyed elevations</td>
<td>Database is missing 75% of MDE’s, though most available</td>
<td>None (addressed during pilot)</td>
<td>Minimal gaps reported.</td>
<td>Missing some MDE’s, including screened interval and completion data</td>
</tr>
</tbody>
</table>
## WQ Network Gaps

<table>
<thead>
<tr>
<th>Gap</th>
<th>IL-IN</th>
<th>Minnesota</th>
<th>Montana</th>
<th>New Jersey</th>
<th>Texas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial</td>
<td>Greater density needed</td>
<td>130 wells</td>
<td>245 wells</td>
<td>6-8 wells</td>
<td>In progress</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporal</td>
<td>None reported</td>
<td>Many wells do not meet baseline criteria</td>
<td>940 samples to close baseline gap; 60-80 samples annually</td>
<td>No wells meet baseline criteria</td>
<td>Gaps exist, but undefined</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Practice</td>
<td>No major differences</td>
<td>8 minor differences</td>
<td>Minimal differences reported.</td>
<td>4 minor differences</td>
<td>Minimal differences reported.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Management</td>
<td>Working on web services</td>
<td>Database is missing 75% of MDE’s, though most available</td>
<td>Establish web services</td>
<td>Minimal gaps reported.</td>
<td>Database missing some MDE’s and web services</td>
</tr>
</tbody>
</table>
Pilot Network Costs

- The SOGW provided no specific guidance on the number of wells in any subnetwork.
- Pilots selected wells from among their existing networks and identified spatial and temporal gaps using their interpretation of the goals of the NGWMN as provided in the Framework Document.
- The Pilot’s network design drives each cost estimates for network implementation.
- Cost estimates are provided for:
  - NGWMN pilot participation
  - Monitoring Network
  - Field Practices
  - Data Management
# One-Time/Capital Costs ($1K)

<table>
<thead>
<tr>
<th>Category</th>
<th>IL/IN</th>
<th>MN</th>
<th>MT</th>
<th>NJ</th>
<th>TX</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Participation (Existing wells only)</td>
<td>$32</td>
<td>$27</td>
<td>$32</td>
<td>$38</td>
<td>$36</td>
<td>$33</td>
</tr>
<tr>
<td>Monitoring Network (includes gaps) (Existing wells only)</td>
<td>$200</td>
<td>$3,525</td>
<td>$1,604</td>
<td>$1,516</td>
<td>$132</td>
<td>$1,395</td>
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<tr>
<td>Field Practice changes (Existing wells only)</td>
<td>0</td>
<td>$17</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Data Management improvements (Existing wells only)</td>
<td>$13</td>
<td>$17</td>
<td>$8</td>
<td>$0</td>
<td>$22</td>
<td>$12</td>
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<tr>
<td>Monitoring Program improvements (Existing wells only)</td>
<td>$0</td>
<td>$15</td>
<td>$553</td>
<td>$121</td>
<td>$0</td>
<td>$138</td>
</tr>
</tbody>
</table>

*(Existing wells only)*
# O&M Costs ($1K)

<table>
<thead>
<tr>
<th>Category</th>
<th>IL/IN</th>
<th>MN</th>
<th>MT</th>
<th>NJ</th>
<th>TX</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring Network (includes gaps)</td>
<td>$34</td>
<td>$13</td>
<td>$160</td>
<td>$546</td>
<td>$0</td>
<td>$151</td>
</tr>
<tr>
<td>(Existing wells only)</td>
<td>($0)</td>
<td>($13)</td>
<td>($160)</td>
<td>($0)</td>
<td>($0)</td>
<td>($35)</td>
</tr>
<tr>
<td>Field Practice (Existing wells only)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>$33</td>
<td>$.1</td>
<td>$7</td>
</tr>
<tr>
<td></td>
<td>($0)</td>
<td>($0)</td>
<td>($0)</td>
<td>($33)</td>
<td>($.1)</td>
<td>($7)</td>
</tr>
<tr>
<td>Data Management (Existing wells only)</td>
<td>$34</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$7</td>
</tr>
<tr>
<td></td>
<td>($0)</td>
<td>($0)</td>
<td>($0)</td>
<td>($0)</td>
<td>($0)</td>
<td>($0)</td>
</tr>
<tr>
<td>Monitoring Program (Existing wells only)</td>
<td>0</td>
<td>$123</td>
<td>$147</td>
<td>$4,702</td>
<td>$78</td>
<td>$1,010</td>
</tr>
<tr>
<td></td>
<td>($0)</td>
<td>($123)</td>
<td>($147)</td>
<td>($1313)</td>
<td>($78)</td>
<td>($332)</td>
</tr>
</tbody>
</table>
Pilot Benefits

• Single, consistent dataset can be used for decisions about shared interstate GW resources.

• Opportunity to share data among state agencies.

• Impetus for a critical review of field procedures and data management procedures.

• Public education: opportunity to raise awareness for GW monitoring.

• Opportunity to learn from other states.

• Opportunity to improve consistency among states.

• New way of getting data to the public (critical mission).
Pilot Summary

• GW monitoring is done by many federal, tribal, state, and local agencies for many purposes.
• A collaborative NGWMN is feasible.
• Pilot states record data differently and use different database platforms, but most “minimum data elements” are available.
• Incremental costs of using existing state monitoring systems are low. Existing monitoring will not fill all gaps.
• The NGWMN Internet data portal is a key element to the success of a NGWMN
• A convergence of IT improvements, increased information needs, and interest in collaboration have come together to make this the ideal time to pursue a NGWMN.
Results of the Illinois-Indiana Pilot Study for the National Ground Water Monitoring Network

Allen Wehrmann (ISWS), Jerry Unterreiner (InDNR), George Roadcap (ISWS), Jim Sullivan (InDEM), Rick Cobb (IEPA), Dave Larson (ISGS), Greg Rogers (ISWS), and Robert Schmidt (InDNR)
Pilot Tasks

- Evaluate monitoring points within each important aquifer for potential inclusion in the NGWMN
- “Flag” all or a subset of proposed monitoring points as “stressed” or “unstressed”
- Identify data gaps
- Assess field practices against NGWMN criteria
- Assess data management practices and ability to interface with the NGWMN data portal
- Estimate costs
The Mahomet-Teays Bedrock Valley
The Mahomet-Teays Aquifer
Illinois/Indiana Pilot
Existing Water Level Ob-Wells in Illinois and Indiana

Open symbols are individual wells; closed symbols are nested well sites

- USGS Real-time Instrumentation of ISWS/ISGS Wells
Conceptualizing Water Movement into and within the Mahomet-Teays Aquifer System
Simulated drawdown 2005 – 2050 across Illinois portion of the Mahomet-Teays Aquifer
Well Selection Process for IL/IN

• Plot well hydrographs
• Assess hydrographs for:
  • Length of record
  • Similarities/differences among wells within locales
  • Exclude wells with odd behavior
  • Prefer wells exhibiting long-term trends or natural fluctuations
  • Include wells representative of SW/GW interaction
• Prefer wells with good logs & construction details
• Assess spatial distribution
• Classify as “unstressed” or “targeted” after selection
Existing Water Level Ob-Wells in Illinois and Indiana

Open symbols are individual wells; closed symbols are nested well sites

◆ USGS Real-time Instrumentation of ISWS/ISGS Wells
Spatial Data Gaps in the IL-IN Water-Level Subnetwork

Open symbols are individual wells; closed symbols are nested well sites
IL-IN Water-Quality Subnetwork
Benton 4 (IN) Hydrograph

Unstressed Aquifer 1
FRD-94 (IL) Hydrographs
Unstressed Aquifer 1 and Aquifer 2

Groundwater elevation, feet

Year


FRD-94B (197' deep)
FRD-94A (372' deep)
Petro North (IL) Hydrograph

Targeted Aquifer 1
Wabash 4 (IN) Hydrograph
Targeted Aquifer 1
Benefits

• Interstate communication – “crossing the state line”
  • Aquifer does not recognize political boundaries
  • Different importance to each state (i.e., size, yield)
  • Understanding, & possible management, of the aquifer needs to transcend political boundaries

• Interagency communication – “crossing agency boundaries”
  • Data sharing and collection coordination across agencies (states)
  • Data “wealth” and local knowledge can be shared nationally

• Critical review of methods & data management

• Public education (also, a certain “pride” factor in being part of the NGWMN)
Web Data Portal

National Ground Water Monitoring Network

Nate Booth
Center for Integrated Data Analytics
U.S. Geological Survey
Web Data Portal

Goal

A web-accessible data portal to automatically relay National GW Monitoring Network groundwater levels, groundwater-quality data and associated metadata from distributed state databases through a map-based interface.
Web Data Portal

Pilot Portal Capabilities

- NGWMN well registry
- Translates heterogeneous state data formats to common standard formats
- Display real-time or nearly real-time data
  - Well characteristics (lithology, construction, aquifer)
  - Water levels
  - Water-quality
- Acceptable data download performance
- Map-based interface
Web Data Portal
Architecture
Web Data Portal

View maps and select wells
Web Data Portal

Assemble and mediate data
Web Data Portal

Repurposing portal services

Can be accessed as though one database
Jointly with World Meteorological Organization

"Welcome to the Hydrology Domain Working Group"

Work Plan

Evolving WaterML into an International Standard

MEMORANDUM OF UNDERSTANDING
BETWEEN
THE WORLD METEOROLOGICAL
ORGANIZATION
AND
THE OPEN GEOSPATIAL CONSORTIUM, INC.

November 2009

- Toulouse OGC TC Meeting - 22 September 2010
- Toulouse Hydrology DWG Workshop - 21-22 September 2010 - Agenda
- Sydney Hydrology DWG Meeting - 1 December 2010

Interoperability Experiments

- GroundwaterInteroperabilityExperiment
- SurfacewaterInteroperabilityExperiment

Documents from Members

Meets every 3 months
Teleconferences most weeks

WaterML Version 2 standard being proposed
US / Canadian Groundwater Data Exchange Experiment

- Test and enhance OGC standards for water observations
- Exchange groundwater well characteristics and water levels with Canada
- Start with Lake Superior Basin
Web Data Portal Architecture

Native Format
- Well Log Data
- Water Level Data
- Water-Quality Data

Mediator

Mediated Format
- WFS 1.0
- SOS 1.0
- De-facto Standard
- GWML
- WaterML2.0
- WQX
## Web Data Portal

### Pilot Results

- 5 Pilots provided data (from 6 states)
- 9 Agencies provided data
- 17 Web Services created to serve data

<table>
<thead>
<tr>
<th>State</th>
<th>Water Levels</th>
<th>Well Log Information</th>
<th>Lithology</th>
<th>Water Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL</td>
<td>Import/WFS</td>
<td>NA</td>
<td>Import/WFS</td>
<td>Import/WFS</td>
</tr>
<tr>
<td>IN</td>
<td>NWIS</td>
<td>NWIS</td>
<td>NWIS</td>
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<tr>
<td>MT</td>
<td>WFS</td>
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<tr>
<td>MN</td>
<td>WFS</td>
<td>WFS</td>
<td>WFS</td>
<td>STORET</td>
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<tr>
<td>NJ</td>
<td>NWIS</td>
<td>NWIS</td>
<td>NWIS</td>
<td>NWIS</td>
</tr>
<tr>
<td>TX</td>
<td>SOAP</td>
<td>SOAP</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>
Web Data Portal

Benefits of approach

• Common, inexpensive and well-supported software components for data providers
• Leverage other activities (OGC, NR Canada’s Groundwater Information Network)
• Data providers can re-purpose services for other applications
• Flexibility for data providers to store and serve data in local formats
Web Data Portal Final Product
Ground-Water Data Portal Pilot States

National Ground Water Monitoring Network Data Portal (BETA)
Ground-Water Data Portal

Well Selection

8 sites were identified nearby. Select one...

<table>
<thead>
<tr>
<th>Site Name</th>
<th>N/A Aquifer Name</th>
<th>Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>200649—PVT 1</td>
<td>Northern Atlantic Coastal Plain aquifer</td>
<td>USGS NJ/NJGS</td>
</tr>
<tr>
<td>290590—Test 1900</td>
<td>Northern Atlantic Coastal Plain aquifer</td>
<td>USGS NJ/NJGS</td>
</tr>
<tr>
<td>291077—6 Long Beach Blvd 2101</td>
<td>Northern Atlantic Coastal Plain aquifer</td>
<td>USGS NJ/NJGS</td>
</tr>
<tr>
<td>291078—Stafford Stream Trunk Road</td>
<td>Northern Atlantic Coastal Plain aquifer</td>
<td>USGS NJ/NJGS</td>
</tr>
<tr>
<td>291024—Ship Bottoms NYP</td>
<td>Northern Atlantic Coastal Plain aquifer</td>
<td>USGS NJ/NJGS</td>
</tr>
</tbody>
</table>

Number of points meeting criteria: 302
Ground-Water Data Portal

Lithology

Longitudes: 74.3467
Latitudes: 39.5960
Elevation: 19.95 ft.
Well Depth: 339.11 ft.

Resource: USGS NWIS Database

<table>
<thead>
<tr>
<th>Depth From (ft)</th>
<th>Depth To (ft)</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>209.24</td>
<td>202.12</td>
<td>Sand and gravel</td>
</tr>
<tr>
<td>202.12</td>
<td>265.49</td>
<td>Clay</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth From (ft)</th>
<th>Depth To (ft)</th>
<th>Screen/Casing</th>
</tr>
</thead>
<tbody>
<tr>
<td>334.31</td>
<td>331.31</td>
<td>Stainless steel</td>
</tr>
</tbody>
</table>
Ground-Water Data Portal

Water Quality

<table>
<thead>
<tr>
<th>Characteristic Name</th>
<th>Detection Condition</th>
<th>Measure Value</th>
<th>Units</th>
<th>Value Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td></td>
<td>258</td>
<td>mg/L</td>
<td>Calculated</td>
</tr>
<tr>
<td>Specific conductance</td>
<td>764</td>
<td>U.S. g/USC</td>
<td>Actual</td>
<td></td>
</tr>
<tr>
<td>Depth to water level below land surface</td>
<td>26.66</td>
<td>ft</td>
<td>Actual</td>
<td></td>
</tr>
<tr>
<td>Phosphate</td>
<td>0.01</td>
<td>mg/L as P</td>
<td>Actual</td>
<td></td>
</tr>
<tr>
<td>Total dissolved solids</td>
<td>0.59</td>
<td>tomoset ft</td>
<td>Calculated</td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>2.40</td>
<td>mg/L</td>
<td>Actual</td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>2.7</td>
<td>mg/L</td>
<td>Actual</td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>36.0</td>
<td>mg/L</td>
<td>Actual</td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>67.9</td>
<td>mg/L</td>
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<tr>
<td>Total hardness = SDWA HRSM</td>
<td>128</td>
<td>mg/L as CaCO3</td>
<td>Calculated</td>
<td></td>
</tr>
<tr>
<td>Phosphate-phosphorus</td>
<td>0.631</td>
<td>mg/L</td>
<td>Calculated</td>
<td></td>
</tr>
<tr>
<td>Nitrate (aq)</td>
<td>Not Detected</td>
<td>ng/L</td>
<td>Not Detected</td>
<td></td>
</tr>
<tr>
<td>Total solids</td>
<td>462</td>
<td>mg/L</td>
<td>Actual</td>
<td></td>
</tr>
<tr>
<td>Alkalinity</td>
<td>365</td>
<td>mg/L as CaCO3</td>
<td>Actual</td>
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</tr>
<tr>
<td>Carbon dioxide</td>
<td>26</td>
<td>mg/L</td>
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<tr>
<td>pH</td>
<td>7.7</td>
<td>pH units</td>
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<tr>
<td>Oxygen</td>
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</tr>
<tr>
<td>Hydrogen ion</td>
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<td>mg/L</td>
<td>Actual</td>
<td></td>
</tr>
<tr>
<td>Specific conductance</td>
<td>734</td>
<td>U.S. g/USC</td>
<td>Actual</td>
<td></td>
</tr>
</tbody>
</table>
Acknowledgements:
Next Steps and Presentation of Resolution
National Ground Water Monitoring Network

Bob Schreiber, Non-Federal Co-Chair, SOGW
ASCE Representative to ACWI
(CDM’s Groundwater Subdiscipline Leader)
Post-Pilot Updates to: A National Framework for Ground-Water Monitoring in the United States (June 2009):

Changes Needed To:
• accommodate new understandings;
• results of 5 State pilot monitoring projects
• to remove redundancy; make necessary corrections; address concerns of SOGW members

Key Areas for Revision:
• Monitoring program design
• Well classification issues
• Portal issues
• Use of output data
Next Steps

- Present pilot-test synthesis report (July 2011)
  - Recommendations for full-scale implementation
  - Indications of pilot-state suggested improvements
- Update Framework Document (Summer 2011)
- Open pilot GW portal for public access (Summer 2011)
- Continue portal development (Summer 2011 +)
- Begin (incremental) full-scale implementation (Fall 2011)
- Incorporate new data providers (Fall 2011 +)
ACWI Resolution

SOGW is requesting

- Approval of the Pilot summary report
- Approval of the implementation strategy
  - Update Framework Document
  - Continue Portal Development
  - Additional data providers
Q&A and Discussion