SAFER
Methodologies for Determining “At-risk” Public Water Systems and Domestic Wells
Session 2
Welcome and Meeting Logistics

Amanda Ford, Office of Public Participation, SWRCB
Questions or comments

- Email SAFER@waterboards.ca.gov
  - Subject: At Risk Webinar
  - Name
  - Org/affiliation
  - Your question or a sentence describing the topic of your comment or question
SB-200 Public Workshop
Aquifer Risk Map - Introduction

April 17th, 2020 SAFER Webinar
Scott Seyfried
Aquifer Risk Map - Introduction

- Requirements of SB 200
- Timeline and Process
- Key Issues
- Relationship with Needs Assessment Work
- Introduce other Presentations
116772. (a) (1) By January 1, 2021, the board, in consultation with local health officers and other relevant stakeholders, shall use available data to make available a map of aquifers that are at high risk of containing contaminants that exceed safe drinking water standards that are used or likely to be used as a source of drinking water for a state small water system or a domestic well. The board shall update the map annually based on new and relevant data.
(2) The board shall make the map of high-risk areas, as well as the data used to make the map, **publicly accessible on its internet website** in a manner that complies with the Information Practices Act of 1977 (Chapter 1 (commencing with Section 1798) of Title 1.8 of Part 4 of Division 3 of the Civil Code). The board shall notify local health officers and county planning agencies of high-risk areas within their jurisdictions.
## Aquifer Risk Map Timing (Tentative)

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 17 Webinar</td>
<td></td>
<td>Project Kick Off – Staff Receives Initial Feedback</td>
</tr>
<tr>
<td>June 16 Workshop</td>
<td></td>
<td>Follow up Workshop - Staff presents proposed approaches</td>
</tr>
<tr>
<td>November Board Meeting</td>
<td></td>
<td>Staff presents draft map to SWRCB</td>
</tr>
<tr>
<td>January 1, 2021</td>
<td></td>
<td>Map is made available to the public</td>
</tr>
</tbody>
</table>

**Outreach – develop approach**

- Stakeholder input – feedback on approaches
- Implement approach – focused stakeholder input
- Finalize and post (Update Annually)
Summary of Key Issues and Challenges

- **DATA AVAILABILITY**
  - variability
  - gaps
  - depth filtering

- **GEOSTATISTICS**
  - averaging
  - boundaries

- **RISK RANKING**
  - risk = likelihood
  - thresholds
  - ranking

- **RECEPTORS**
  - domestic wells
  - state small systems

- **DISPLAY**
  - map interface

- **AQUIFER RISK MAP**
  - annual updates

- **RISK RANKING**
  - data availability

- **DATA AVAILABILITY**
  - geostatistics

- **GEOSTATISTICS**
  - risk ranking

- **RECEPTORS**
  - display

- **DISPLAY**
  - aquifer risk map
Comparison

Aquifer Risk Map

Characterizes “aquifers”
Used to Inform Fund Expenditure Plan
First iteration January 2021
Updated annually per SB-200

Needs Assessment

Characterizes domestic wells
Used to support cost estimate
First iteration Fall 2019
Updated annually per SB-200
Afternoon Technical Presentations

The next three presentations are intended to provide you with examples of how some of the challenges associated with this type of project have been addressed by others:

**Julie Ekstrom** (DWR) - assessing drought risk to rural communities

**Clare Pace** (WESS) - identifying domestic well communities

**Emily Houlihan** (SWB) - estimating domestic well water quality
Estimating Risk of Drought & Water Shortage

Rural Communities & Small Water Suppliers

Julie Ekstrom, PhD
Water Use Efficiency Branch
California Department of Water Resources
AB 1668: Drought & Water Shortage Risk
Small Water Suppliers and Rural Communities

Legal Directive to DWR

1. Who’s at risk?
   - Small Water Suppliers
   - Rural Communities (i.e. Self-Supplied Households)

2. How can risks be reduced?
AB 1668: Drought & Water Shortage Risk
Small Water Suppliers and Rural Communities

Legal Directive to DWR

1. Who’s at risk?
   - Small Water Suppliers
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2. How can risks be reduced?
Risk Concept
Risk Concept

Exposure

Vulnerability
Stakeholder Process
Self-Supplied Communities

Analysis Units

• Use Census Block Groups that have >0 population estimated (ACS 2012-2016)

AND

• >1 domestic well
Component 1: Exposure to Climate Change Impacts

Climate Change
Self-Supplied Population Exposed to

Future – Climate Change

- Temperature shift
- Wildfire acreage burned
- Sea level rise into coastal aquifers
Exposure to Climate Change

Wildfire – acreage burned

Temperature Change

SLR into Coastal Aquifers

Westerling, UC Merced
10+GCMs, RCP 8.5 midcentury

Pierce, Cayan et al. Scripps
RCP 8.5 midcentury

Befus et al. in prep –Univ Wyoming, USGS Aquifer intrusion from 1m SLR
Component 2: Exposure to Environmental Conditions & Events

Current Events & Conditions
Self-Supplied Population Exposed to

Events and Environmental
• Current Wildfire Risk
• Early Drought Forecast WY
• Fractured Rock Area
• Water Quality Risk (domestic wells, SWRCB DWQ)
• Population growth

Basin Conditions
• Basin subsidence
• Basin salts presence
• Critically overdrafted
• Chronic declining groundwater level
• Surrounding irrigated agriculture
Exposure to Current Environmental Conditions

- Annual Local Drought Forecast
- Current Wildfire Risk
- Fractured Rock Areas
- Human Health Score: Basin Water Quality
- Irrigated Ag

- Population growth
- Subsidence areas
- Depleted groundwater
- Salt
Exposure + Vulnerability + Record of Shortage = Risk
More Details?

• Methods described in Appendix 2 of report
• Proposed to be updated annually
• First iteration, will continue to be developed
Risk Scoring for Small Water Suppliers

**Exposure**
- Climate Change
  - SC1a: Projected Temperature Shift
  - SC1b: Projected Sea Level Rise
- Current Events & Conditions
  - SC2a: Current Wildfire Risk
  - SC2b: Drought Early Warning 2019 WY
  - SC2c: Fractured Rock Area (Supplier Water Type)
- Basin Conditions
  - SC3: Water Quality in Surrounding Basin
- Future - Climate Change
  - SC4: Projected Wildfire Risk

**Vulnerability**
- Infrastructure-Related
  - SC3a: Interties
  - SC3b: Emergency Interties
  - SC3c: Baseline Monitoring
  - SC3d: Customers Metered
- SC3e: # Water Sources
  - SC3f: Source Types
  - SC3g: Distribution Outage Record
  - SC3h: Water Level
- Organizational-Related
  - Financial
    - SC4a: Rate Updated
    - SC4b: Rate Type
    - SC4c: Drought Preparedness Plan
  - SC4d: Customer Base Socio-Economics
  - SC4e: Supplier Size

**Observed Shortages**
- Recent Record of Water Shortage
  - SC3h: Shortage: Supplier-Reported Projected Shortage
  - SC3i: Shortage: Curtailment and Compliance Order
  - SC3j: Shortage: Drought Assistance Record
Thank you

For more information and questions:
https://water.ca.gov/Programs/Water-Use-And-Efficiency/Making-Conservation-a-California-Way-of-Life/County-Drought-Planning

droughtrisk@water.ca.gov
The Drinking Water Tool
New ideas to identify domestic well communities

Clare Pace, PhD, MPH
UC Berkeley
Water Equity Science Shop
4-17-2020
Water Equity Science Shop (WESS)

Support community organizations, research, and policy
WESS is a community-academic partnership that conducts research and multi-level public health actions to address the health risks associated with drinking water contamination.

Collaborators:
- Community Water Center
- San Francisco State University
- CA Office of Environmental Health Hazard Assessment

Funder: NIEHS Superfund Program, Community Engagement Core
Many California residents in rural, agricultural, and socioeconomically disadvantaged communities are served by small drinking water systems and private wells that fall outside the purview of drinking water regulations and monitoring requirements.

**Project Goals:**
- Identify and map domestic well communities
- Identify their water quality
- Conduct assessment of water quality and equity impacts in domestic well regions
- Make data and results relevant to public and policy needs
Drought impacted water supply estimation (Gailey, 2020)

Bulletin 118 Groundwater Basins

Groundwater quality estimation (Pace et al., 2019)

Domestic well communities (Pace et al., 2019)

Disadvantaged communities (2017 ACS Census data)

Groundwater Sustainability Agencies (State agencies)
Domestic Well Communities

1. 2010 Census Block Groups
2. Community Water System Boundaries
3. OSWCR Well Locations
4. Residential Parcels

• Pace et al., 2019
Integrating data to locate domestic well communities

1. Started with populated census blocks (2010 Census)
2. Subtracted CWS boundaries (Tracking CA water system service areas)
3. Added locations of domestic wells (OSWCR)
4. Incorporated the location of residential parcels (LandVision)

“likely DWA”
- PLSS sections containing wells, people, and residential parcels

Unpopulated areas
Unknown water source (0.5 million people)
Likely served by a domestic well (1.6 million people)
Served by CWS (35.1 million people)

Water Source Type in California
Water quality estimates by water source type in CA

(DWA = domestic well area, MCL = maximum contamination level Small CWS ≤200 connections, medium CWS = 200-9,999 connections, large CWS = 10,000+ connections)
Example regional results: water quality estimates among domestic well communities in the San Joaquin Valley

<table>
<thead>
<tr>
<th></th>
<th>As (µg/L)</th>
<th>N (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median (IQR)</td>
<td>2.7 (5.4)</td>
<td>3.4 (3.9)</td>
</tr>
<tr>
<td>95th percentile</td>
<td>18.6</td>
<td>12.2</td>
</tr>
<tr>
<td>Pop &gt; MCL</td>
<td>46,657</td>
<td>33,279</td>
</tr>
<tr>
<td>Pop% &gt; MCL</td>
<td>9.6</td>
<td>6.8</td>
</tr>
</tbody>
</table>

MCL
Drinking Water Tool

Use the tools below to learn more about groundwater issues in your area and throughout California. Visit [Getting Involved](#) to learn how to use this information to take action in your community. To provide feedback, [contact the Community Water Center](#).

- **Your Water Data**
  - Discover where your water comes from based on your address. Learn about water quality and water supply in your area and how to get involved with local water issues.

- **California Water Data**
  - Use our web mapping tool for a deeper dive into California's many water data layers. Features include the ability to overlay data layers like Drought Scenarios and print reports.
Strengths

- Example of community driven research translation
- First statewide publically available tool to identify domestic well communities
- Use of parcel data to define locations of domestic well populations
- Basis for future research to protect vulnerable households

Limitations

- Lack of information about state smalls (5-14 service connections)
- Uncertainty about exact location of domestic wells
- Assumption of evenly distributed populations across large census blocks in rural areas
- Under estimated reliance on domestic wells (i.e. excluded wells within CWS boundaries)
Next steps

• Environmental justice analysis of drinking water quality by source type (paper in prep)

• Improve population estimates of domestic well community layer

• Fold in improved drinking water quality estimates

• Inform implementation of Human Right to Water Act, Sustainable Groundwater Management Act, and development of Aquifer Risk Map
Poll question

What is the most important factor relating domestic well use to aquifer risk?

a) Number of domestic well drawing from an aquifer
b) Estimated population reliant on wells drawing from an aquifer
c) Both are equally important
Links

Feb. 12, 2020 Drinking Water Tool Webinar Download and watch at home (.mp4;160MB)

Drinking Water Tool drinkingwatertool.communitywatercenter.org

WESS White paper Pace et al. 2019

Pace, C., Balazs, C., Cushing, L., Morello-Frosch, R. (2019). UC Berkeley Water Equity Science Shop. Domestic Well Community Boundaries Version 1.0.

Contact: Clare Pace, Ph.D., MPH, cpace@berkeley.edu, UC Berkeley, Environmental Science Policy and Management, Water Equity Science Shop
Needs Assessment - Methodology to Estimate Domestic Well Water Quality

Emily Houlihan, GAMA
April 17th, 2020
SAFER Workshop
Existing Water Quality Resources – Limitations for Domestic Well Analysis

- Domestic well water quality results: Limited in time and space
- Shallow aquifer modeling/estimation: Data may not represent water quality accessed by domestic wells
## Existing Domestic Well Water Quality Resources
*(for reference)*

<table>
<thead>
<tr>
<th>Available datasets</th>
<th>Dataset limitations</th>
<th>Water quality estimations (models or other)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Raw water quality data</strong></td>
<td></td>
<td><strong>USGS 2012</strong>&lt;br&gt;Only covers nitrate and arsenic in basins</td>
</tr>
<tr>
<td>Public supply wells</td>
<td>Public supply wells are generally deeper than domestic wells</td>
<td><strong>Ransom et al., 2017</strong>&lt;br&gt;Only covers nitrate in the Central Valley</td>
</tr>
<tr>
<td>Monitoring wells</td>
<td>Monitoring wells may be shallower than domestic wells</td>
<td><strong>Community Water Center Drinking Water Tool</strong>&lt;br&gt;Covers four constituents in most locations statewide</td>
</tr>
<tr>
<td>Domestic wells (USGS GAMA, USGS SAAS, LPAs)</td>
<td>Data is only available for select counties. USGS GAMA and USGS SAAS studies are one-time sampling events.</td>
<td><strong>CV-SALTS</strong>&lt;br&gt;Only covers nitrate in the Central Valley</td>
</tr>
<tr>
<td>State small system wells</td>
<td>Not widely available yet</td>
<td><strong>GAMA Needs Assessment</strong>&lt;br&gt;Covers all constituents with an MCL in most locations statewide (where data is available)</td>
</tr>
</tbody>
</table>
Needs Assessment Approach

Estimate domestic well water quality per square mile
- Use existing water quality data from multiple datasets, filtered and averaged to represent domestic well water depths

Estimate density of domestic wells per square mile
- Rely on well construction record data from the Department of Water Resources
Key Methodology Decisions*

- Apply Depth Filter To Public Supply Data
- Average by PLSS (square mile) sections
- Use Groundwater Units
- Use Water Quality Ranking System

*Detailed methodology presented in White Paper
Depth Filter

Determine where public supply well water quality data can be used as a proxy for domestic well water quality.
Average Data by Square Mile Sections

Groundwater quality estimated for each PLSS section using nearest available data
Groundwater Units

**USGS boundary** that delineates basins and upland portions of the state

Expands water quality estimations to cover 99% of domestic wells.
Water Quality “Grade” System

<table>
<thead>
<tr>
<th>Long-term (20-year) average</th>
<th>Recent results (within 2 years)</th>
<th>“Grade”</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; MCL</td>
<td>&gt; MCL</td>
<td>6</td>
</tr>
<tr>
<td>&gt; MCL</td>
<td>&lt;= MCL</td>
<td>5</td>
</tr>
<tr>
<td>&lt;= MCL</td>
<td>&gt; MCL</td>
<td>4</td>
</tr>
<tr>
<td>Between 80% – 100% of MCL</td>
<td>&lt;= MCL</td>
<td>3</td>
</tr>
<tr>
<td>Between 50% – 80% of MCL</td>
<td>&lt;= MCL</td>
<td>2</td>
</tr>
<tr>
<td>&lt; 50% of MCL</td>
<td>&lt;= MCL</td>
<td>1</td>
</tr>
<tr>
<td>No data</td>
<td>No data</td>
<td>0</td>
</tr>
</tbody>
</table>
GAMA Domestic Well Water Quality Tool
Results

Approximately 25% of domestic wells may have water quality risks for one or more constituents with an MCL.

Four constituents (arsenic, 1,2,3-TCP, nitrate, and gross alpha (radioactive elements)) account for 80% of water quality grades above 4.
Poll Question 1

The most important factor for aquifer water quality risk is:

a. Long-term water quality
b. Recent water quality
c. Magnitude of threshold exceedance
d. Number of chemicals above threshold
e. All are equally important
Aquifer Risk Map Questions

• What constitutes an “aquifer used or likely to be used as a source of drinking water for a state small water system or a domestic well”?

• Should there be different levels of “risk”?

• What metrics should be included in “risk”?

• How to account for data gaps, uncertainty, and variability within aquifers?

• How should this data be displayed and communicated to the public?

Future contact information

SAFER@Waterboards.ca.gov

Questions, comments are welcome.

Emily.Houlihan@Waterboards.ca.gov
Questions or comments

Email SAFER@waterboards.ca.gov
  • Subject: At Risk Webinar
  • Name
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  • Your question or a sentence describing the topic of your comment or question
Thank you!

More information:

SAFER Website
https://www.waterboards.ca.gov/safer

SAFER Q&A Webinar
April 30th, 2-3:30pm
Register here: safer qa-session.eventbrite.com