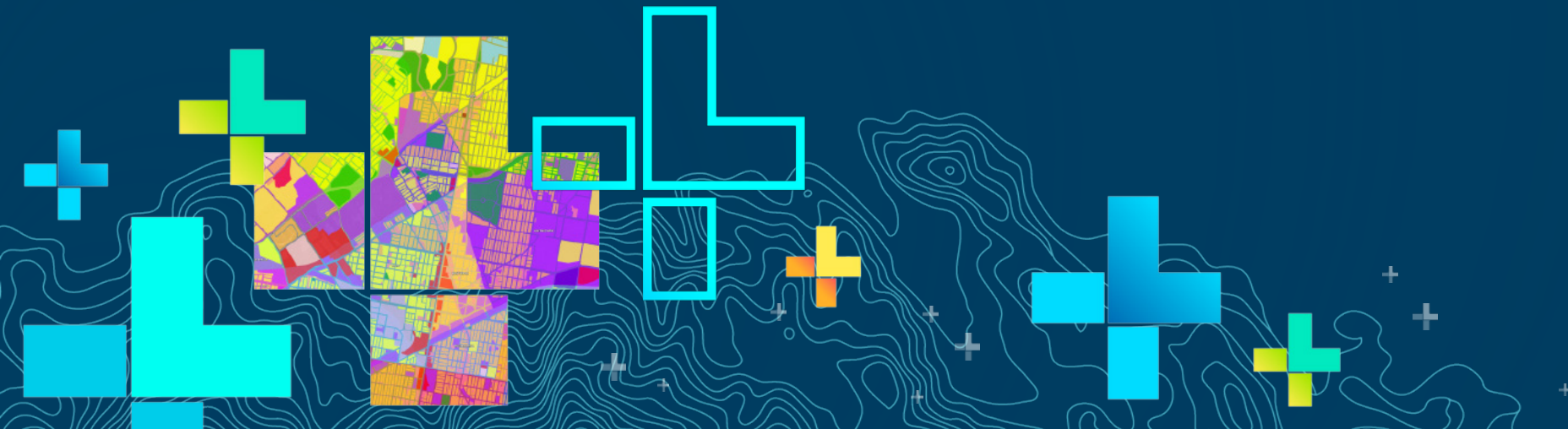


Using Online Tools to Communicate the Quality of California's Groundwater Resource

Dori Bellan, geologist
CA State Water Board GAMA Program



What is the GAMA Program?

- The Groundwater Ambient Monitoring and Assessment (GAMA) Program is California's comprehensive groundwater quality monitoring program
 - Monitors and assesses the untreated groundwater used for drinking water supply, including trends
 - Collaborates with the U.S. Geological Survey as its technical lead, and depends highly upon the cooperation with local water agencies and well owners
- The main goals of the GAMA Program are to:
 - Improve statewide comprehensive groundwater monitoring
 - Increase the availability of groundwater quality information to the public



California's Comprehensive Groundwater Quality Monitoring Program

Increase the availability of groundwater quality information to the public

- Past methods:
 - In-person meetings
 - Online maps created by IT department (delays waiting for development)
 - Hard copy reports and fact sheets
- Today:
 - ESRI online map applications and tools using ArcGIS Online and Portal
 - Allows scientists to create applications (decreasing time of development)
 - Facilitates rapid sharing of findings to a wide audience
 - Gives the user several ways to interact with the information



GAMA Program Data

Groundwater data is collected and centralized by the GAMA Program

- Data Collected

- Legislative Mandate: Priority Basin Project (USGS technical lead): statistically unbiased sampling design to assess ambient groundwater quality of the resource used for drinking water supply, both public and domestic
- Domestic Well Project: response-driven sampling offered to domestic well owners free of charge, county focus areas (Currently in hiatus)
- Special Studies Project (LLNL technical lead): leading sampling and analysis techniques for groundwater age, nitrate source, denitrification

- Data Centralized and Standardized

- Div. of Drinking Water, NWIS, Dept of Water Resources, Pesticide Reg
- Regulated Cleanup Programs and Orders (GeoTracker, ILRP, etc.)
- Other Groundwater Studies



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GAMA Program Data

Type and Processing

- Latitude, Longitude, Well Name, Source, Chemical, Detection
 - Knowledge of source's format and reporting
 - Reporting limits used for substitution to assign more realistic detection
 - Non-detects, detections below the reporting limit, zero values (human errors)
 - Non-parametric methods used when applying geostatistics for predictions

RowLabels	AverageCor	Count	long	lat
S-MS-SV30	0.00276776695	2	-121.22916667000	36.33811111000
3310037-039	0.00337706304	16	-117.57684000000	33.88382000000
3910004-012	0.00347647491	26	-121.29765900000	38.12778100000



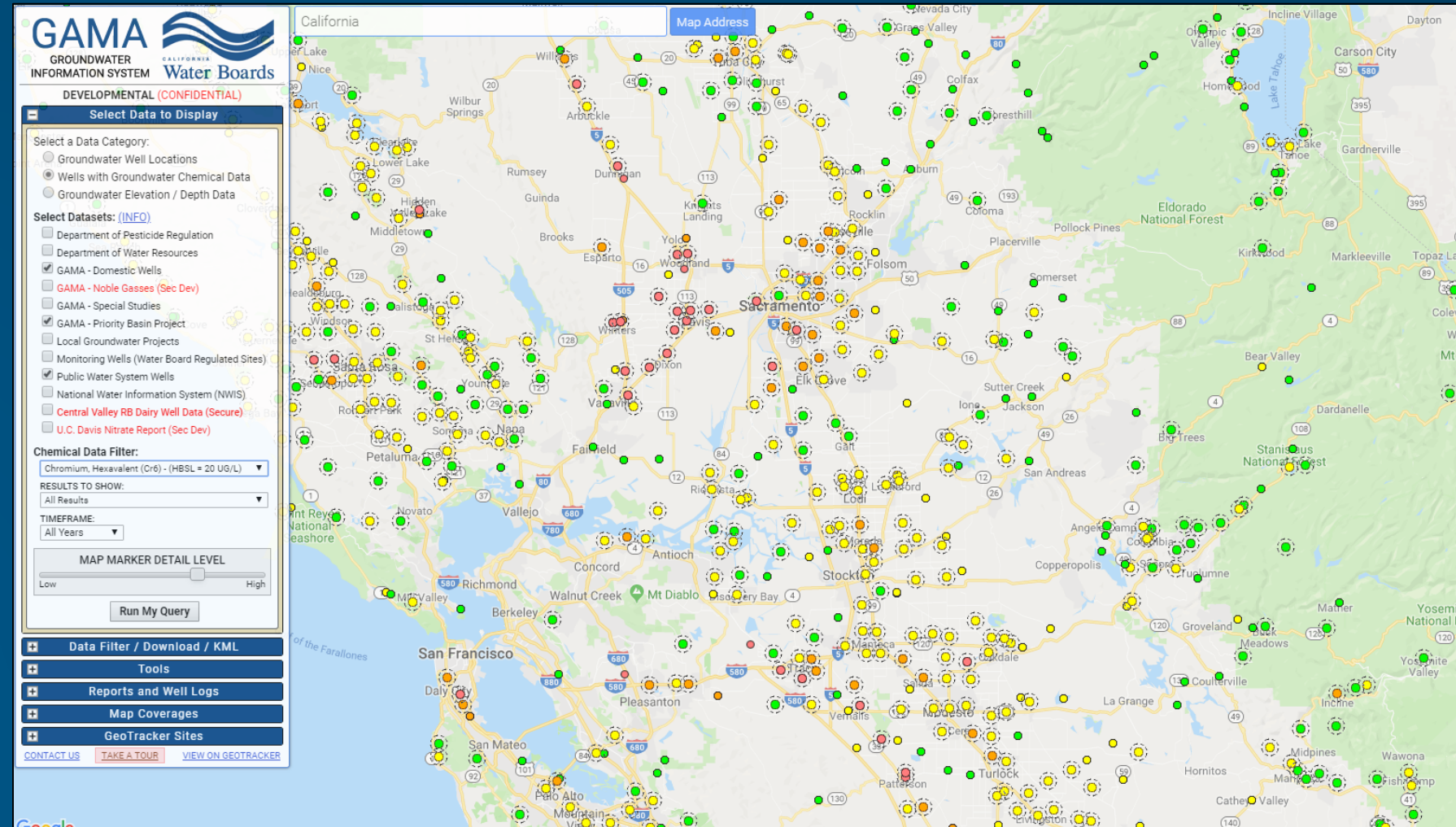
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GAMA Program Groundwater Information System

Standardizes/Federalizes
all groundwater data to
allow queries across
datasets

Tools to disseminate and
summarize data

Downloads available in
tabular form

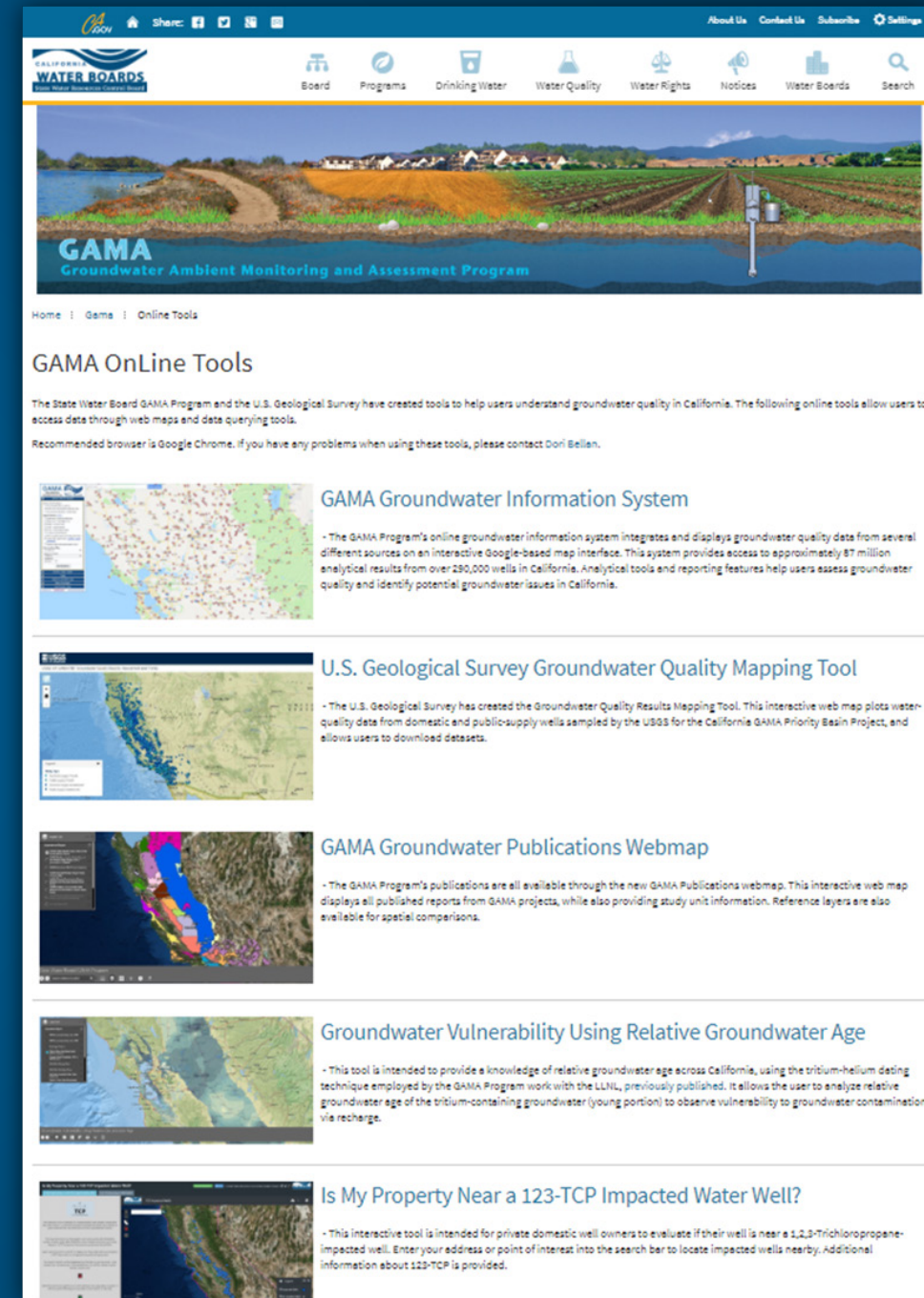


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GAMA Program Online Tools

waterboards.ca.gov/gama/online_tools

Includes a list of ever increasing GIS web applications to disseminate and communicate groundwater data



GAMA OnLine Tools

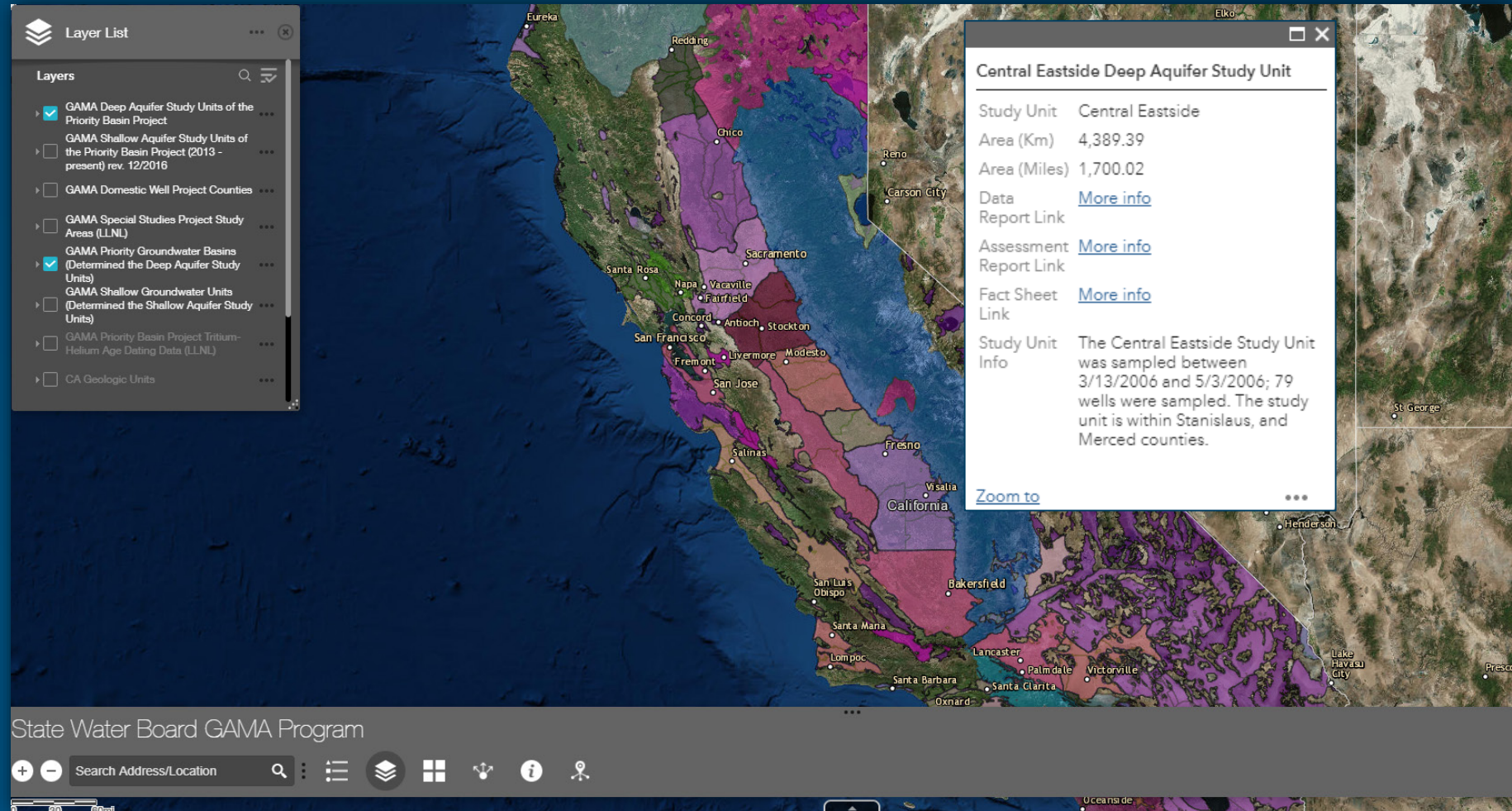
The State Water Board GAMA Program and the U.S. Geological Survey have created tools to help users understand groundwater quality in California. The following online tools allow users to access data through web maps and data querying tools.

Recommended browser is Google Chrome. If you have any problems when using these tools, please contact Dori Bellan.

- GAMA Groundwater Information System**
 - The GAMA Program's online groundwater information system integrates and displays groundwater quality data from several different sources on an interactive Google-based map interface. This system provides access to approximately 87 million analytical results from over 290,000 wells in California. Analytical tools and reporting features help users assess groundwater quality and identify potential groundwater issues in California.
- U.S. Geological Survey Groundwater Quality Mapping Tool**
 - The U.S. Geological Survey has created the Groundwater Quality Results Mapping Tool. This interactive web map plots water-quality data from domestic and public-supply wells sampled by the USGS for the California GAMA Priority Basin Project, and allows users to download datasets.
- GAMA Groundwater Publications Webmap**
 - The GAMA Program's publications are all available through the new GAMA Publications webmap. This interactive web map displays all published reports from GAMA projects, while also providing study unit information. Reference layers are also available for spatial comparisons.
- Groundwater Vulnerability Using Relative Groundwater Age**
 - This tool is intended to provide a knowledge of relative groundwater age across California, using the tritium-helium dating technique employed by the GAMA Program work with the LLNL, previously published. It allows the user to analyze relative groundwater age of the tritium-containing groundwater (young portion) to observe vulnerability to groundwater contamination via recharge.
- Is My Property Near a 123-TCP Impacted Water Well?**
 - This interactive tool is intended for private domestic well owners to evaluate if their well is near a 1,2,3-Trichloropropane-impacted well. Enter your address or point of interest into the search bar to locate impacted wells nearby. Additional information about 123-TCP is provided.

GAMA Program Study Areas Web Map

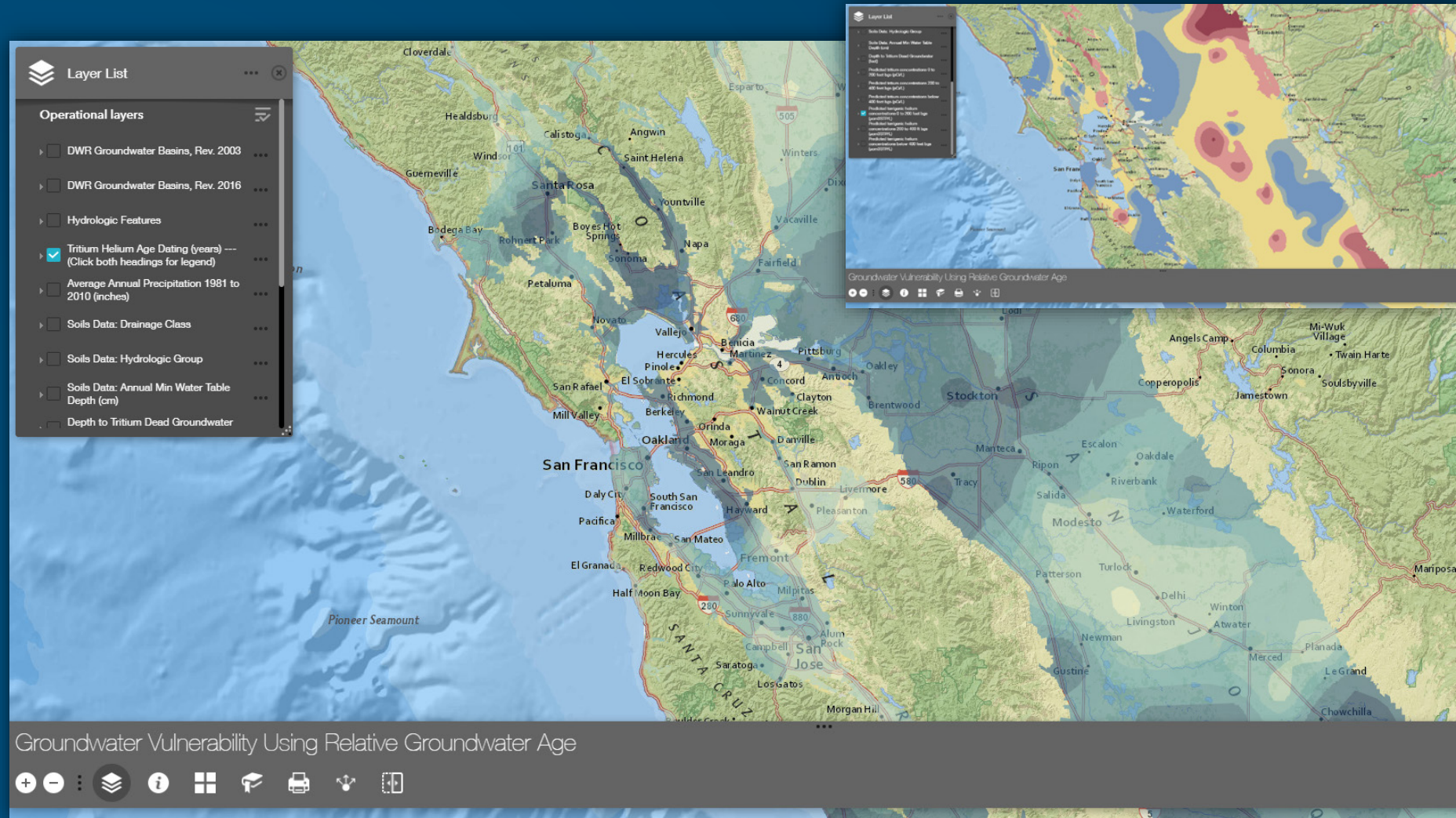
Provides spatial information, links to publications, reference data



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Groundwater Vulnerability Using Relative Groundwater Age

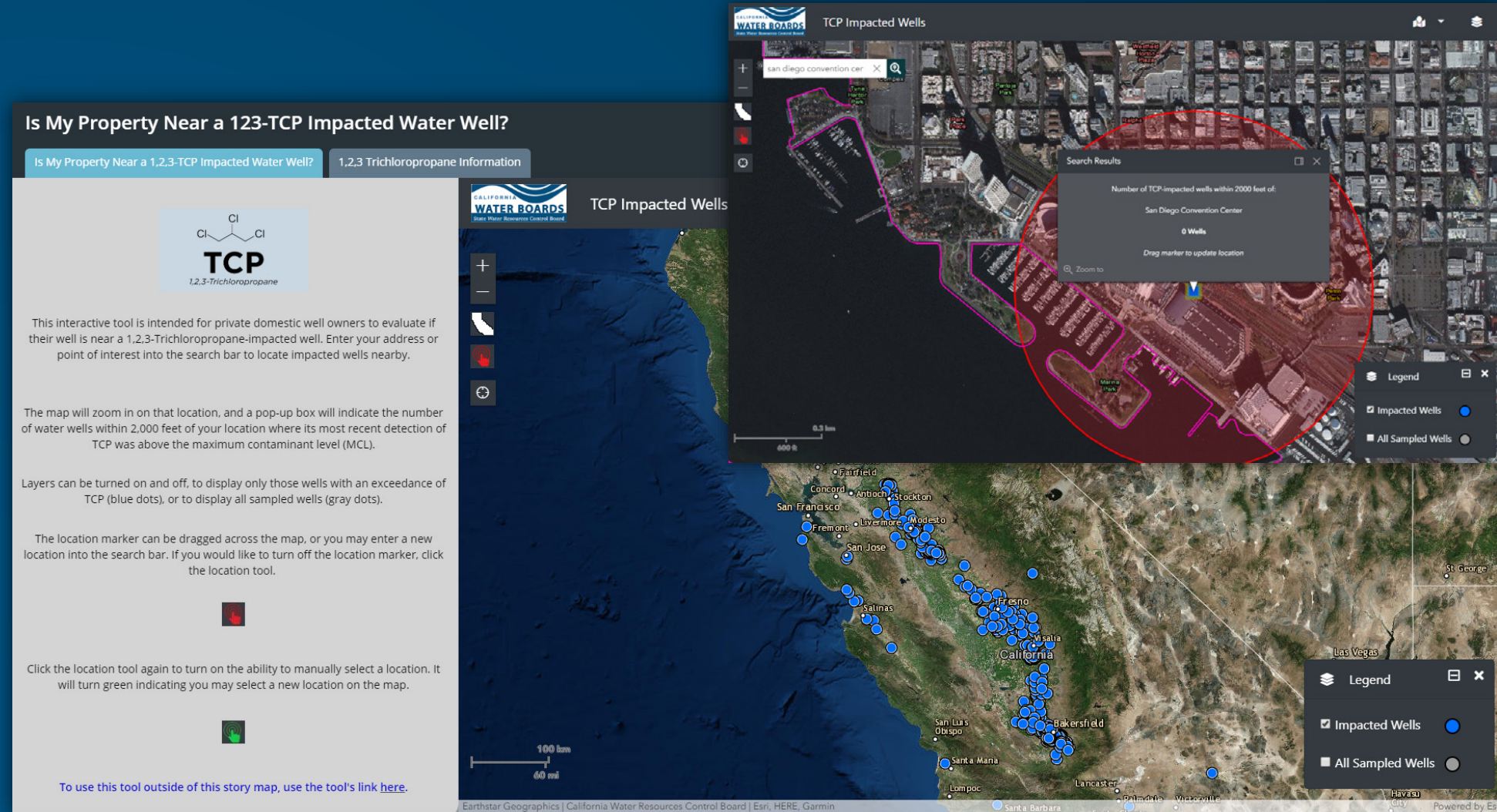
Displays areas containing tritium in groundwater, predicted tritium and helium detections, and soils data to determine where recharge occurs



Is My Property Near a 123-TCP Impacted Water Well?

Story Map design to educate public of the contaminant, including occurrence information, and tool directions

Integrates address lookup to determine proximity to known contaminated water wells

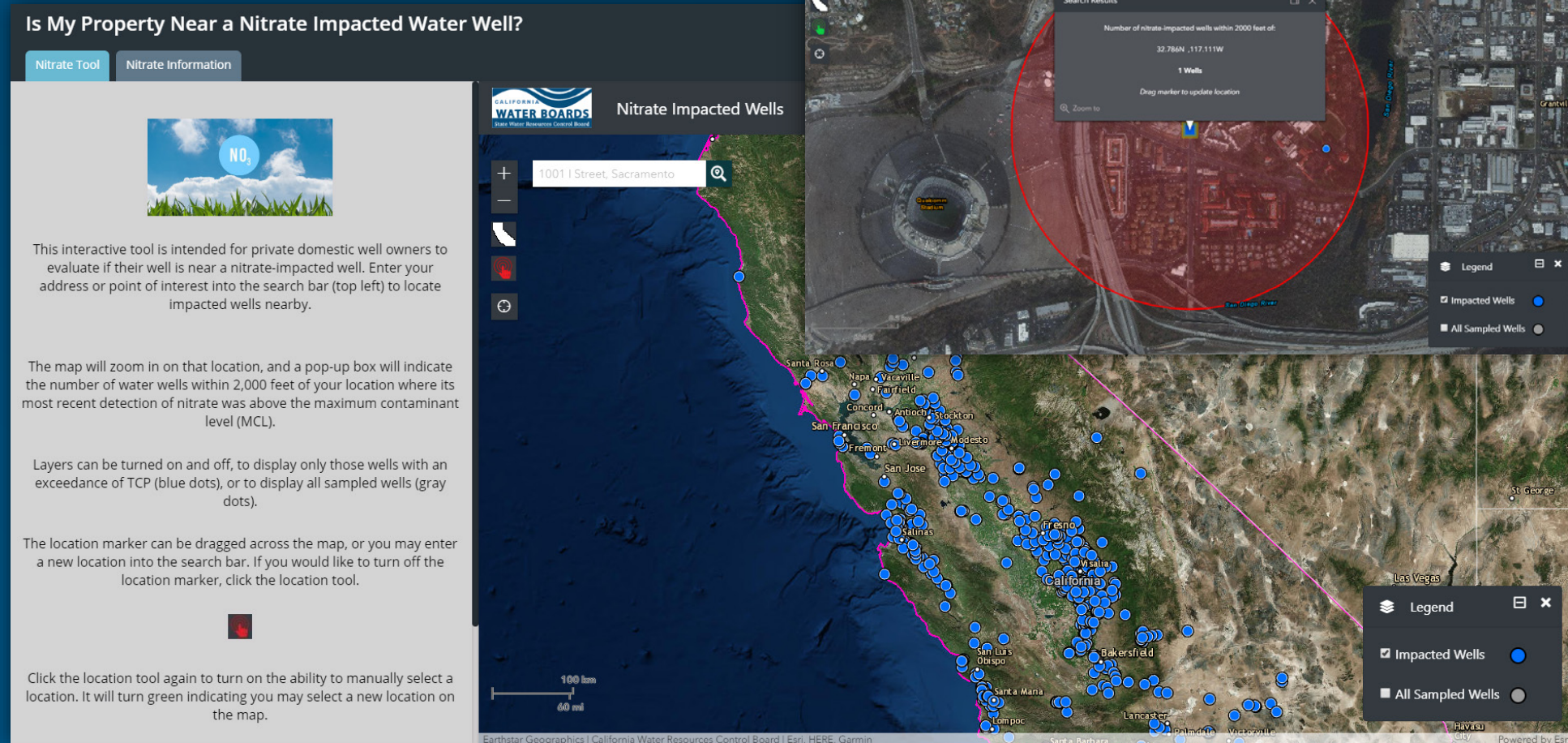


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Is My Property Near a Nitrate Impacted Water Well?

Story Map design to provide education of contaminant, occurrence information, and tool directions

Integrates address lookup to determine proximity to known contaminated water wells

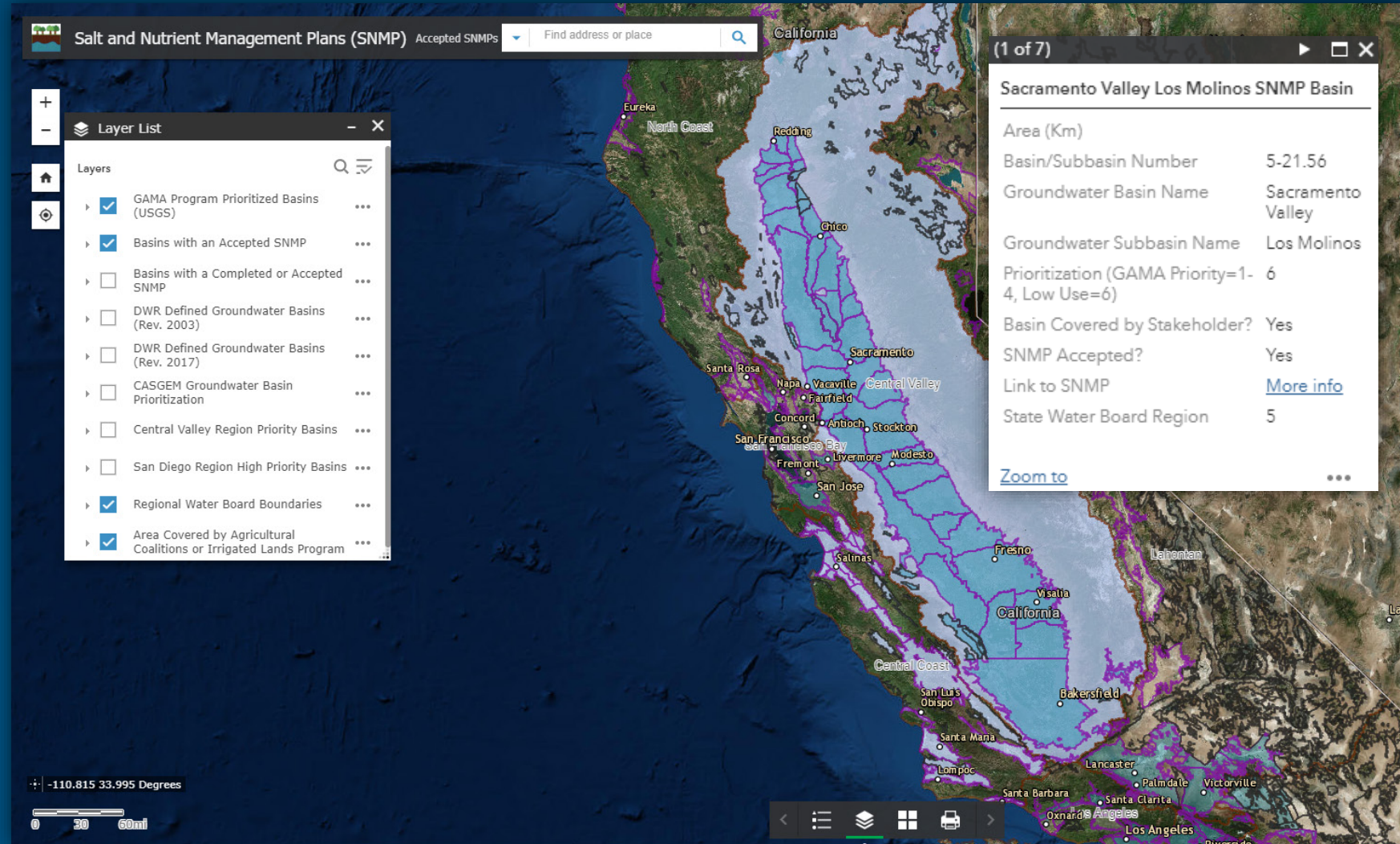


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CA Salt and Nutrient Management Plan (SNMP) Status

Provides status of water quality objectives and protection of beneficial uses in groundwater basins throughout CA

Provides local Regional Board and basin information, local contact, and link to plan



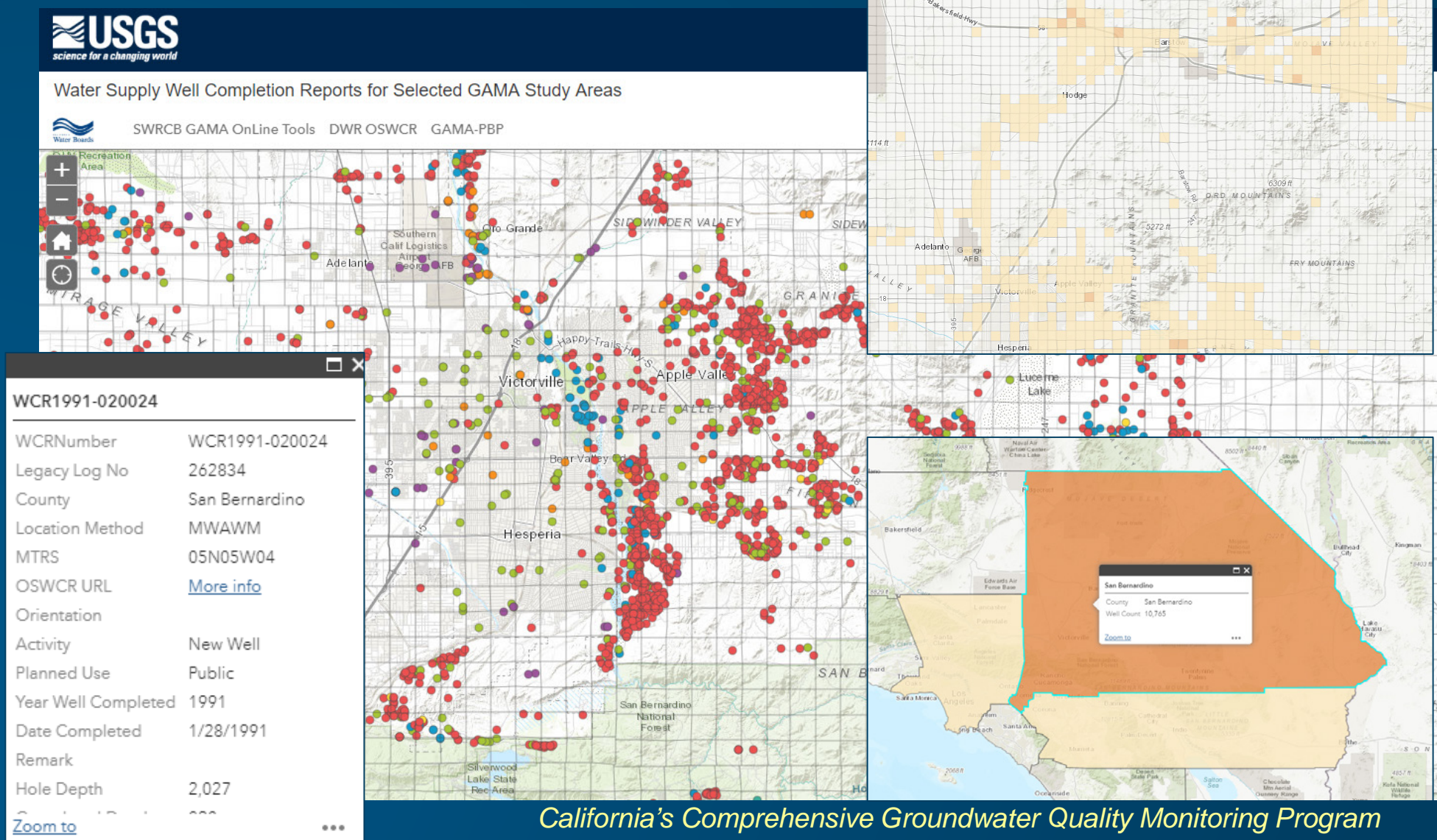
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Well Completion Report Attribution for Water Supply Wells

GAMA Program
Project- attribute well
completion reports
from PDF, statewide

Provides digital
information from
reports, accurate
location, other well
names, and link to
PDF report

Spatial extents display
varying info: well point,
section heat map,
county well count as
attributed.



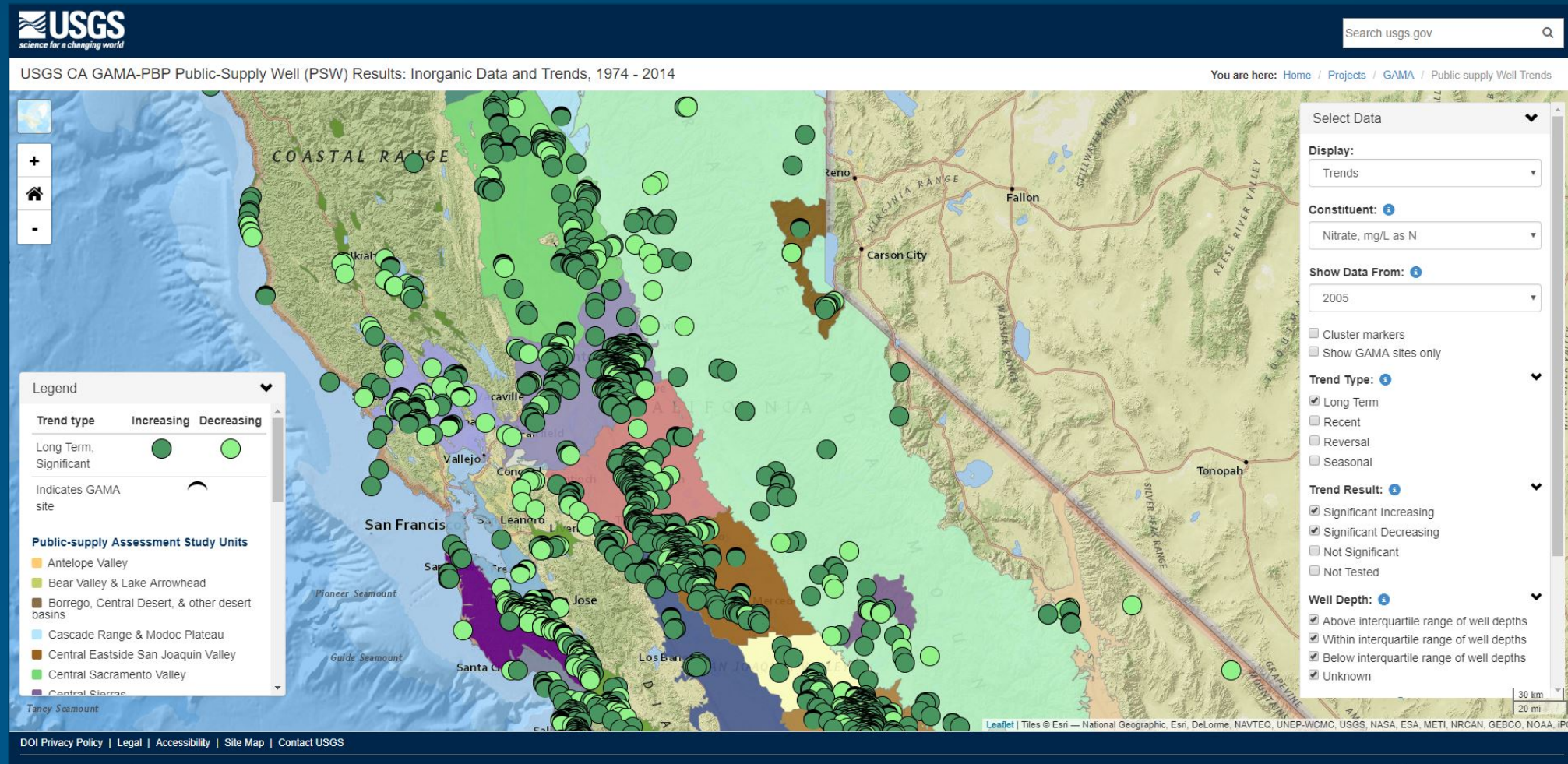
Web Apps In Progress

Fall to Winter 2019



GAMA Program Inorganic Trend-Data

Standardized GAMA Program and Drinking Water Division water quality data to assess trends and statistical significance in inorganic constituents (various time intervals and depths)



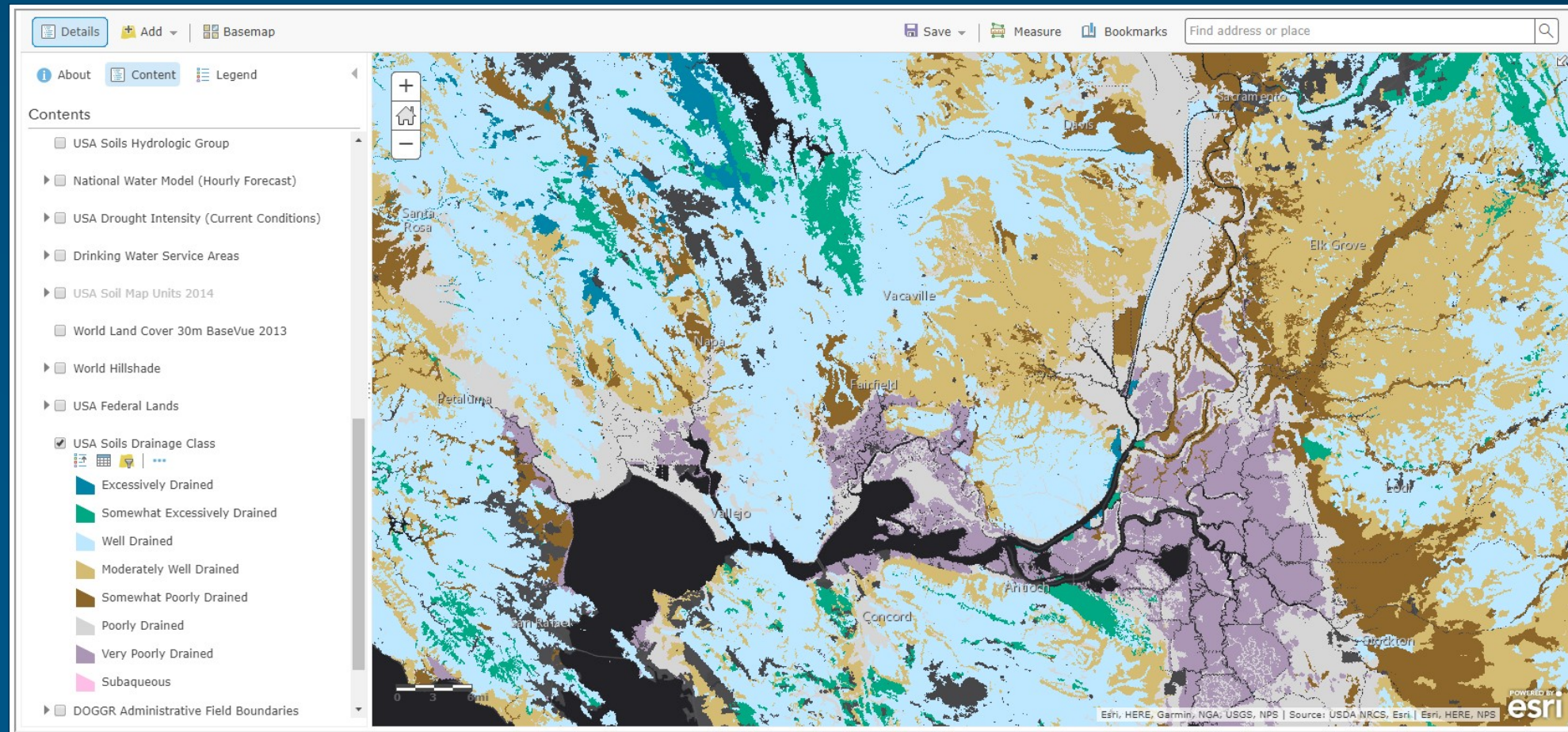
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Source Water Protection Data Hub

Integrates ground and surface water data that affects drinking water sources

One location, downloadable, accessible via GIS Portal

Facilitates coordination amongst different divisions and agencies



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Vital Role

- These tools allow GAMA technical staff to develop web applications. This capability is vital to GAMA accomplishing its mission to make data available to the public:
 - Applications can be developed and made public in a timely manner, without dependency on IT resources
 - GAMA technical staff can control the accuracy of the resulting message from the application
 - Applications are created with an understanding of the data, improving the application
 - Our science, and the communication of drinking water quality to CA citizens, further benefits from the tools and data management provided



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