

Enabling Groundwater Monitoring with Online Submission System

The California Statewide Groundwater Elevation Monitoring (CASGEM) Program enabled collaboration between local monitoring parties and the Department of Water Resources as they collected groundwater elevation information and made that information available to the public. The data will be made available to the public via the Internet with a GIS interface. As a result, local, State, Federal, and all interested parties can use the data to evaluate and monitor groundwater conditions in California.

Overview

In 2009 the State Legislature amended the Water Code to mandate a statewide groundwater elevation monitoring program. Its purpose was to track seasonal and long-term trends in groundwater elevations in California's groundwater basins. Achieving that goal required collaboration between local monitoring entities and Department of Water Resources (DWR). To enable these entities to collect and share groundwater elevation data DWR developed the California Statewide Groundwater Elevation Monitoring (CASGEM) program. The CASGEM program establishes a permanent, locally-managed program of regular and systematic monitoring in all of California's alluvial groundwater basins.

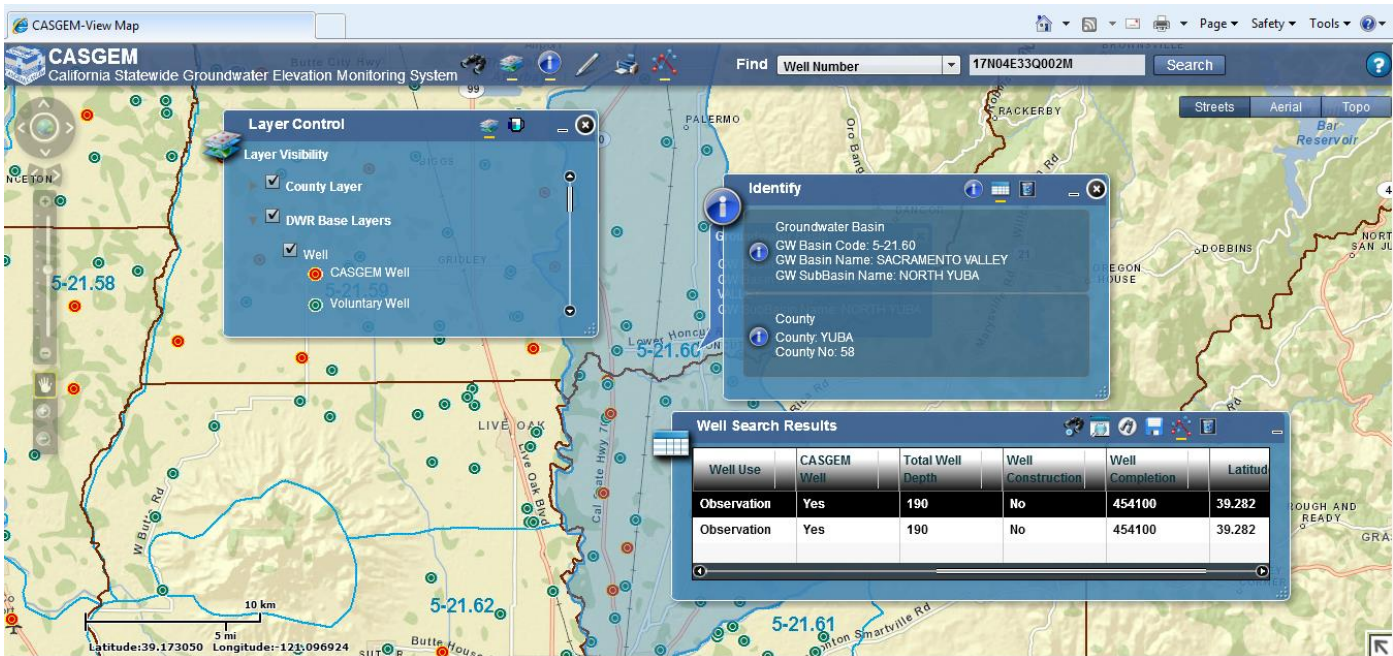
Key Benefits to the Client

- **Functional and Localized System** – The system functionality of the first phase allows DWR to accept notifications submitted by prospective ground water monitoring entities for specific basins or sub basins.
 - **Increased Efficiency with Online Submissions** – The new system enables Monitoring Entities to submit groundwater monitoring plans electronically and to enter construction and location information associated with wells that are included in the monitoring plan.
 - **Empowered Users have More Options** – Users can submit groundwater elevation data and extract elevation data for reporting purposes. Additionally, monitoring entities can access the groundwater elevation data in both a graphical and tabular format through the CASGEM website.
 - **Multi-faceted User Interface** – the solution provides customized public views of the information submitted by monitoring entities under the CASGEM program.
 - **Ensures that data accurate and necessary** – the program eliminates the chance of multiple entites performing the same work – which would result in duplicates. Also, it allows entities to track: progress, montoring areas, findings.
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Trinity Technology Group worked with DWR to create CASGEM. By automating a number of processes and allowing users across the state to share data, CASGEM removes the necessity of performing a number of manual processes and improves the program’s efficiency.

Helpful features that improve efficiency:

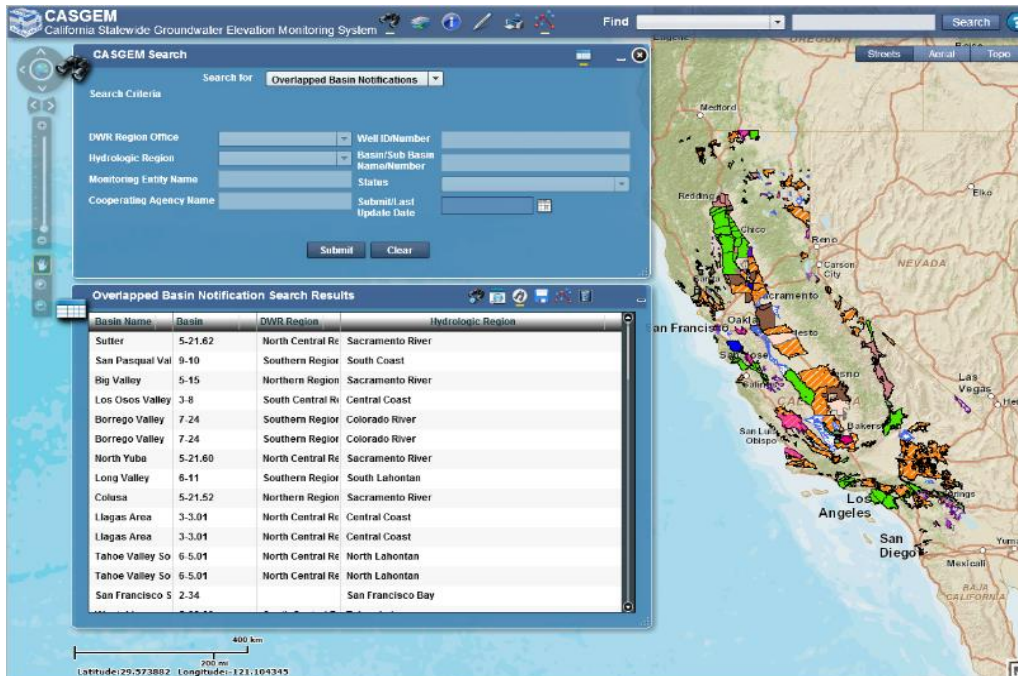
- Rich GIS interface through the CASGEM map viewer, which displays the spatial entities on a California base map.
- Users have extensive search capabilities. Advanced users can perform quick searches on the system to quickly search for a groundwater basin or a well based on basin/sub-basin number and well number, respectively.
- Ability to save search results in a convenient format such as PDF, Excel or CSV to allow ad-hoc reporting for spatial data entities.
- Users can draw and measure polygons and lines on the map to determine the distance between wells and calculate areas and perimeters drawn by them on the map. Map viewer allows users to do trend analysis on groundwater elevation data using hydrographs, wherein they can select multiple wells for studying seasonal and long term trends of groundwater elevation in a given groundwater basin.



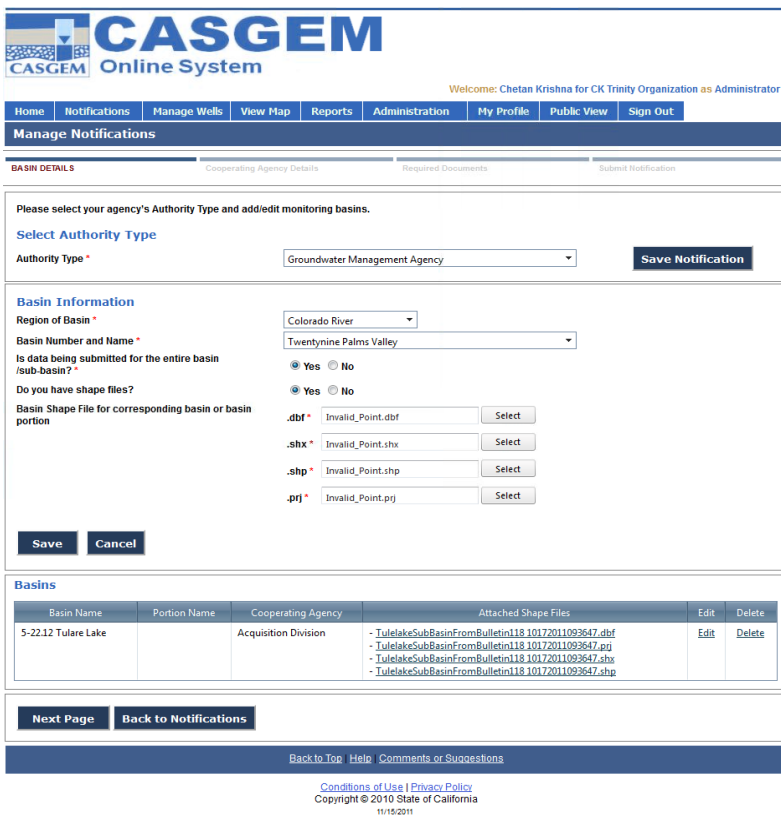
The CASGEM application allows the users to submit shapefiles, a popular geospatial vector data format for geographic information systems. When uploaded, the shapefiles are validated for the following criteria:

- They must have a coordinate system (can be projected or geographic).
- They must fall between the California Map Extent (an extent is the limit of the geographic area shown on a map, usually defined by a rectangle).
- The type of geometry exposed by the shapefile must be polygon.

The shapefile validation ensures that clean data is submitted for the CASGEM program, and that these shapefiles are available on the map in real time once they are submitted. They can be viewed on the map using the CASGEM map viewer module.



Groundwater Elevation Data entered into CASGEM shows up on the state map and uses color to differentiate areas surveyed and elevations reported.



CASGEM Online System

Welcome: Chetan Krishna for CK Trinity Organization as Administrator

Home | Notifications | Manage Wells | View Map | Reports | Administration | My Profile | Public View | Sign Out

Manage Notifications

Basin Details | Cooperating Agency Details | Required Documents | Submit Notification

Please select your agency's Authority Type and add/edit monitoring basins.

Select Authority Type

Authority Type *

Basin Information

Region of Basin *

Basin Number and Name *

Is data being submitted for the entire basin /sub-basin? * Yes No

Do you have shape files? Yes No

Basin Shape File for corresponding basin or basin portion

.dbf *

.shx *

.shp *

.prj *

Basin Name	Portion Name	Cooperating Agency	Attached Shape Files	Edit	Delete
5-2212 Tulare Lake		Acquisition Division	- TulareLakeSubBasinFromBulletin118.10172011093647.dbf - TulareLakeSubBasinFromBulletin118.10172011093647.prj - TulareLakeSubBasinFromBulletin118.10172011093647.shx - TulareLakeSubBasinFromBulletin118.10172011093647.shp	Edit	Delete

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Basin overlaps and gaps:

- The CASGEM map viewer interface determines if more than one shapefile was submitted for a groundwater basin by two different monitoring entities.
- It identifies unmonitored basins by creating a GIS layer; it computes the difference between the groundwater basins and the monitoring entity polygons layers.
- The monitoring entity polygon layer also identifies if an application submitted by a monitoring entity spans multiple groundwater basins.

This information is displayed using the flex application CASGEM map viewer. The CASGEM map viewer is embedded in the CASGEM website.

User Account Management:

- The CASGEM application can authenticate users against a variety of sources. The internal DWR users or employees are authenticated against the windows active directory using their email address.
- The application allows users to assume different roles, such as administrator (capability to assign roles to other users of your organization among other things), contributor, or read-only.
- External monitoring entities can maintain their own list of designated users for the application, invite users to register with the CASGEM system and assign roles and delegate work to them based on these roles.
- The application has customized web services pertaining to the account management module. CASGEM web services interface with these services for authentication and also provide implementation of authorization rules based on the application specific roles.

Manage Users

Current Associated Users

	User Name	User Email	Role Type	
Dissociate	Chetan Krishna	ckrishna@trinitytg.com	Contributor	Edit
Dissociate	Hemal Mehta	hmehta@trinitytg.com	Administrator	Edit
Dissociate	Mohan Kumar	mnrasimhan@trinitytg.com	None	Edit
Dissociate	Test User	user@ttgtest.com	ReadOnly	Edit

Invite User

First Name *

Email *

Last Name *

Role Type *

[Send Invite](#)

Invited Users

First Name	Last Name	Email	Registration Complete
UAT	User	uatuser@ttgtest.com	False
test	user	testuser@ttgtest.com	False

User Basin Designation Workflow and Notification:

- DWR administrators or/and supervisors can see a dashboard of all the applications that have been submitted through the CASGEM program. Using this dashboard, they can assign applications to reviewers.
- Reviewers can see all pending applications on their dashboard. When a reviewer begins to process an application, monitoring entities are notified through automated emails.
- When the reviewer is satisfied with the information provided, he recommends the groundwater basin for monitoring entity designation, and the application gets updated on supervisor and reviewer dashboards.
- The supervisor can agree with the recommendation, or they can request additional reviews. If the supervisor is satisfied with the recommendation, he or she passes the designation on to an approver.
- The approver then designates a portion of the groundwater basin to the monitoring entity.
- Once approved, the monitoring entities receive an email detailing the intent of award for the designation of a groundwater basin to them for monitoring.

Integration with Legacy Systems:

- The CASGEM application has been built using N-Tier architecture principles.
- The user interface is supported by a rich set of web services that have been built on the principles of SOA.
- The application database has also been designed to allow portability and interaction with legacy and future systems.

Manage Notifications								
Please select a basin from the grid below to view details.								
Notifications								
Assign	Basin	Portion Name	Monitoring Entity	Agency	Status	Reviewer	Submit Date	RO
	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	Borrego Valley	Borrego Water District boundary	Borrego Water District		Additional Information Requested	mzimmerm	12/13/2011	SRO
	San Juan Valley	Middle and Lower sub basins	San Juan Basin Authority		Additional Information Requested	mzimmerm	1/28/2011	SRO
	Kern County	Kern Delta	Kern River Fan Group		Final Review In Progress	cmckenzi	9/6/2011	SCRO
Assign	Owens Valley	Inyo County Portion	Los Angeles Department of Water and Power		Assigned For Review	egorman	12/14/2011	SRO
	Cuddeback Valley		Mojave Water Agency	United States Geological Survey	Open			SRO

Meeting Legislative Deadlines:

- Monitoring entities can submit groundwater elevation data in a flexible manner through web forms available in the application, or through excel based batch uploads.
- The submission passes validation checks, and then data is displayed to the user in grids on the application.
- The rows in the grids for wells where the monitoring entity is non-compliant are shown in red color to clearly identify the elevation data submittals that have missed a legislative deadline.

Latest Elevation Data												
CASGEM ID	Local Well Number	Date	Military Time (PST)	NM	QM	Reading @RP	Reading @WS	RP to WS	RP Elev	GS Elev	WSE	GS to WS
<input type="text"/>	<input type="text"/>											
387377N1217295W001	10N02E03R001M	08/23/2011	09:00			12.000	9.342	2.658	15.231	35.567	12.573	22.994
381724N1217450W001	04N02E22P001M	02/12/2011	08:00			13.266	9.328	3.938	15.000	34.567	11.062	23.505
382670N1227235W042	CKWell040	12/25/2010	00:00			13.213	14.234	-1.021	60.000	40.000	61.021	-21.021
377796N1211880W001	02S07E10B001M	12/03/2010	00:00			95.000	76.000	19.000	100.000	90.000	81.000	9.000
377417N1211929W001	02S07E22N002M											
370471N1200246W001	10S18E20G001M											

Public Access and Reporting:

- Once registered with CASGEM, a public user has access to the information on the groundwater monitoring basins assigned to them and monitoring entities.
- They have the ability to observe the study long-term and view seasonal trends in groundwater elevation data.
- The user can view spatial data using the map viewer and can generate reports based on smart filters.

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