

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.



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.



CASGEM Search			0		Streets Aer
9 s	earch for Overlapped Ba	sin Notifications		CI C	1 Sa
Search Criteria				Methord	TO
DWR Region Office		Well IDNumber			
Hydrologic Region		Basin/Sub Basin			AST PLAN
Monitoring Entity Name		States		it The	1 L
Cooperating Agency Nam	ie i	Submit/Last		Redding	1 5 2-
		Update Date		1 1 1 1 1	1233149
				Chico	1 Costes
	Subr	nit Clear		1:44 -02	NEVADA
				City	on a start
Overlapped Basin N	otification Search Resul	its 🔗 🖬 🖉 🗮 🥂		acramento 3	5
					a som
Basin Name Basin	DWR Region	Hydrologic Region		Francistro	-78
Basin Name Basin Sutter 5-21.6	DWR Region North Central Re	Hydrologic Region Sacramento River	ar	Francistro Oakla	21
Basin Name Basin Sutter 5-21.6 San Pasqual Vai 9-10	2 North Central Re Southern Region	Hydrologic Region Sacramento River South Coast	e ar	Francisto	21
Basin Name Basin Sutter 5-21.6 San Pasqual Val 9-10 Big Valloy 5-15	2 North Central Re Southern Region Northern Region	Hydrologic Region Sacramento River South Coast Sacramento River	- Sar	n Francisco Oakla Sattose	TO ALL ALL ALL ALL ALL ALL ALL ALL ALL AL
Basin Name Basin Sutter 5-21.6 San Pasqual Val 9-10 Big Valley 5-15 Los Osos Valley 3-8	2 North Central Re Southern Region Northern Region South Central Re	Hydrologic Region Sacramento River South Coast Sacramento River Central Coast	- Car	n Francisto esto Sattose	
Basin Name Basin Sutter 5-21.6 San Pasqual Val 9-10 Big Valley 5-15 Los Osos Valley 3-8 Borrego Valley 7-24	DWR Region 2 North Central Re Southern Region Northern Region South Central Re Southern Region	Indirelogic Region Secramento River South Coast Secramento River Central Coast Colorado River	Sar	n Francisco Cakta Santosa	no A Dataere
Basin Name Basin Sutter 5-21.6 San Pasqual Val 9-10 Big Valley 5-15 Los Osos Valley 3-8 Borrego Valley 7-24	DWR Region 2 North Central Re Southern Regior Northern Region South Central Re Southern Region Southern Region	Itydrologic Region South Coast South Coast Caetral Coast Colorado River Colorado River	ar	n Francisco Cakta Sar tosa Sar tosa Sar tosa Sar Las	Dakerst
Basin Name Basin Sutter 5-21.6 San Pasqual Val 9-10 Big Valley 5-15 Los Osos Valley 5-15 Borrego Valley 7-24 Borrego Valley 7-24 North Yuba 5-21.6	DWR Region North Central Re Southern Region Northern Region South Central Ri Southern Region Southern Region North Central Re	Itydrologic Region Secramento River South Coast Colorado River Colorado River Sacramento River	ar ar	n Francisco OMA Statistical Statistics Statistics Statistics	Dates of the second sec
Basin Name Basin Sutter San Pasqual Val 9-10 Big Valley 5-15 Los Osos Valley 3-8 Borrego Valley 7-24 Borrego Valley 7-24 North Yuba 5-21.6 Long Valley 5-15	DWR Region 12 North Central Re Southern Region South Central Ri Southern Region Southern Region Southern Region 10 North Central Re Southern Region	Itydrologic Region Searamento River South Coast Central Coast Colorado River Colorado River South Lahontan	ar	Francisco Status Satus Satus Otepo	Dater and
Basin Name Basin Sutter 5.21,6 San Pasqual Val 9.10 Big Valley 5.15 Los Osos Valley 3.8 Borrego Valley 7.24 Borrego Valley 7.24 North Yuba 5.21,6 Long Valley 6.11 Colusa 5.21,6	DWR Region 12 North Central Re Southern Region South Central Ri Southern Region Southern Region Southern Region North Central Re Southern Region 10 North Central Re	Itytrologic Region South Coast South Coast Central Coast Colorado River Colorado River Sacramento River South Lahontan Sacramento River	ar	n Francisto Contra Sector	Dater of the second sec
Basin Name Basin Sutter 5-21.6 San Pasqual Val 9-10 Big Valley 5-15 Los Osos Valley 7-24 Borrego Valley 7-24 North Yuba 5-21.6 Long Valley 6-11 Colusa 5-21.6 Lagas Area 3-301	2000 Region 22 North Central Re Southern Region Southern Region Southern Region Southern Region 30 North Central Re Southern Region 32 Northern Region 14 North Central Re	Interedoptic Region Secramento River South Coast Sacramento River Colorado River Colorado River Sacramento River Sacramento River Contral Coast Contral Coast	ear	Francisto OAR	Los eles
Basin Name Basin Sutter 5-21.6 San Parsparal Val 9-10 Big Valley 5-15 Los Closo Valley 5-15 Borrego Valley 7-24 Borrego Valley 7-24 Borrego Valley 7-24 Long Valley 5-21.6 Long Valley 6-11 Columa 5-21.6 Llagas Area 3-3.01 Llagas Area 3-3.01	2008 Region 22 Morth Central Re Southern Region Southern Region Southern Region 30 Morth Central Re Southern Region 12 Morthern Region 14 Morth Central Re North Central Re	Interediopic Region Interest River South Coast South Coast Colorado River Colorado River South Lubontan Sacramento River Contral Coast Contral Coast Contral Coast Contral Coast	Car	n Francisco OM Station	no Bakerona Lodo eles San
Basih Name Basih Sutter 5-21.6 San Pasqual Val 9-10 Big Valley 5-15. Los Osos Valley 3.8 Borrego Valley 7-24 Borrego Valley 7-24 Long Valley 6-11 Colusa 5-21.5 Lagas Area 3-301 Lagas Area 3-301 Tahoe Valley So 6-501	UMR Region 22 North Central Re South Central Re South Central Re South Central Re Southern Region 00 North Central Re Southern Region 12 North Central Re 1 North Central Re	Iterrologic Region Secramento River Secramento River Central Coast Colorado River Colorado River Sacramento River Sacramento River Central Coast Central Coast Central Coast	Car	n Francisto Onto Service San Las Otsport	Basersona Los eles San Diego
Basin Name Basin Sutter 5-21.6 San Pasqual Val 6-10 Big Valley 5-15 Los Osos Valley 7.4 Borrego Valley 7.24 Borrego Valley 7.24 North Yuba 5-21.5 Los Qualey 6.11 Coluss 3-3.04 Llagas Area 3.3.04 Tahoe Valley So 5.6.01	DMR Region 22 Morth Central Re Southern Region Southern Region Southern Region Southern Region 00 North Central Re North Central Re 10 North Central Re 10 North Central Re 10 North Central Re	Interfolique Region Secramento River South Coast Sacramento River Colorado River Colorado River Sacramento River South Lahontan Sacramento River Central Coast Central Coast North Lahontan	Car	n Francisto OAR	Biskere Los Los eles San Diego
Basin Name Basin Sutter 5-21.6 San Passpall Val 9-10 Big Valley 5-15 Los Cosos Valley 7.24 Borrego Valley 7.24 Borrego Valley 7.24 North Yuba 5-21.6 Log Valley 6-11 Colusa 5-21.6 Llagas Area 3-3.01 Tahoe Valley So 6-5.01 San Francisco 5 2.3	UMR Region 22 Morth Central Re Southern Region Southern Region Southern Region Southern Region 80 North Central Re Southern Region North Central Re North Central Re North Central Re	Interiologic Region Sucramento River South Coast Sacramento River Colorado River Colorado River Sacramento River Sacramento River Contral Coast Central Coast Central Coast North Labontan North Labontan San Francisco Bay	e car	n Francisto Statuto Statuto Statuto Statuto Statuto Ang	Daterore Loca eles San Diego

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

ome Notifications Manage Wells V	iew Map Reports	Administration	My Profile	Public View	Sign Out		
anage Notifications							
	0	2			14 M - 177 - 17		
Cooperation Cooperation	ng Agency Details	Required Docu	ments	Subr	nit Notrication		
Please select your agency's Authority Type and a	dd/edit monitoring basin	15.					
Select Authority Type							
Authority Type *	Groundwater Ma	anagement Agency		•	Save No	otificat	ion
Basin Information	Colorado River	•					
asin Number and Name *	Twentuning Bala	ns Valley		•			
s data being submitted for the entire basin	Ves No						
sub-basin?* lo vou have shape files?	© Yes ◎ No						
asin Shape File for corresponding basin or basi	n		Calast				
ortion	.dbt - Invalid_	Point.dbf	select				
	.shx * Invalid_	Point.shx	Select				
	.shp * Invalid_	Point.shp	Select				
	.prj * Invalid_I	Point.prj	Select				
Save Cancel							
asins							
Basin Name Portion Name	Cooperating Agency		Attached Sha	pe Files		Edit	Delete
5-22.12 Tulare Lake A	cquisition Division	- TulelakeSubBasinFre	mBulletin118 10	172011093647.dbf		Edit	Delete
		- TulelakeSubBasinFri	mBulletin118 10	172011093647.shx			
		- TulelakeSubBasinFre	omBulletin118 10	172011093647.shp			
		- TulelakesubbasinFri	ombulietin116 10	172011093047.snp			
Next Page Back to Notifications							
	Dealth Terry U	ala L Commonte er Sug	aaatiana				
	Back to TOD THE	elb i Commenta or aud	uesuons				

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 l	Jser	s									
Current A	1550	ciated U	sers								
									1 🔯		
Dissociate	Use	r Name	_	User E	Email	е Туре		Edit			
Dissociate	Chet	tan Krishna		ckrishr	na@trinitytg.com			Con	Contributor		Edit
Dissociate	Hem	al Mehta		hmehta@trinitytg.com					Administrator		Edit
Dissociate	Moh	ian Kumar		mnara	simhan@trinitytg.com			Non	ne		Edit
Dissociate	Test	User		user@t	ttgtest.com			Read	dOnly		Edit
Invite Us	er										
First Name *		Enter First N	lame			Last Name *	Enter La	st Name			
Email *		Enter Email	Address	7		Role Type *	Admini	strator	-		
017											
Send In	vite										
Invited U	sers	1									
											1 🛐
First Name	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.



N	lanag	e Notifications								
F	Please se	elect a basin from the gr	rid below to view detail	s.						
	Tounca	ntons								
									_ I 🕺	
	Assign	n Basin Portion Name Monitoring Entity Agency Status Reviewer Submit Date RO								
		T	T	T	Ţ	T	T	T	T	
	Borrego Valley District b		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	
	<u>Assign</u>	Owens Valley	Inyo County Portion	Los AngelesDepartment 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 D	ata											
					_	_						
CASGEM ID	Local Well Number	Date	Military Time (PST)	NM	QМ	Reading @RP	Reading @WS	RP to WS	RP Elev	GS Elev	WSE	GS to WS
T	T											
387377N1217295W001	10N02E03R001M	08/23/2011	09:00			12.000	9.342	2.658	15.231	35.567	12.573	22.994
<u>381724N1217450W001</u>	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.



Trinity Technology Group Provides Innovative Solutions

At TrinityTG, we are in the business of solving the problems that arise with shifts in business strategies and operations. No matter what information technology challenges you face, we can use those challenges as opportunities to find solutions that fit your current and future needs. We can help to develop business, technical, and enterprise architectures to improve business processes and transactions. Our Strategic Planning approach focuses on re-use and adaptation vs. re-building from scratch. We perform process analysis with an eye to best leverage your current system. We design process maps to enable effective communication between business and technical users throughout the project life cycle. At every phase, we use new technologies and techniques to maximize your investment in business systems. To establish cohesive and effective interaction through the project life cycle, we produce formal plans for all of the following critical processes for every project: Communication, Risk Management, Change Management, Configuration Management, Implementation Management, and Project Management.

TrinityTG's Success is Measured in the Satisfaction of our Clients

Our clients are among the largest of state agencies across the public sector and the most progressive and advanced in the private sector. Our clients' success drives our business; 95% of our business comes from referrals from current and past clients. **We distinguish ourselves by our approach, working in connection with our clients to ensure their satisfaction every step of the way.**

We Listen. We Produce. And We Deliver Extraordinary Results.

Give us an opportunity to show you what we can do for you.



2015 J Street, Suite 105 Sacramento, CA 95811 916.779.0201 www.trinitytg.com



Our clients include:



CALIFORNIA CORRECTIONAL













California Environmental Protection Agency

