



***WATER REPLENISHMENT DISTRICT
OF SOUTHERN CALIFORNIA***

New Data Provider for the NGWMN

Benny Chong & Evan Lue

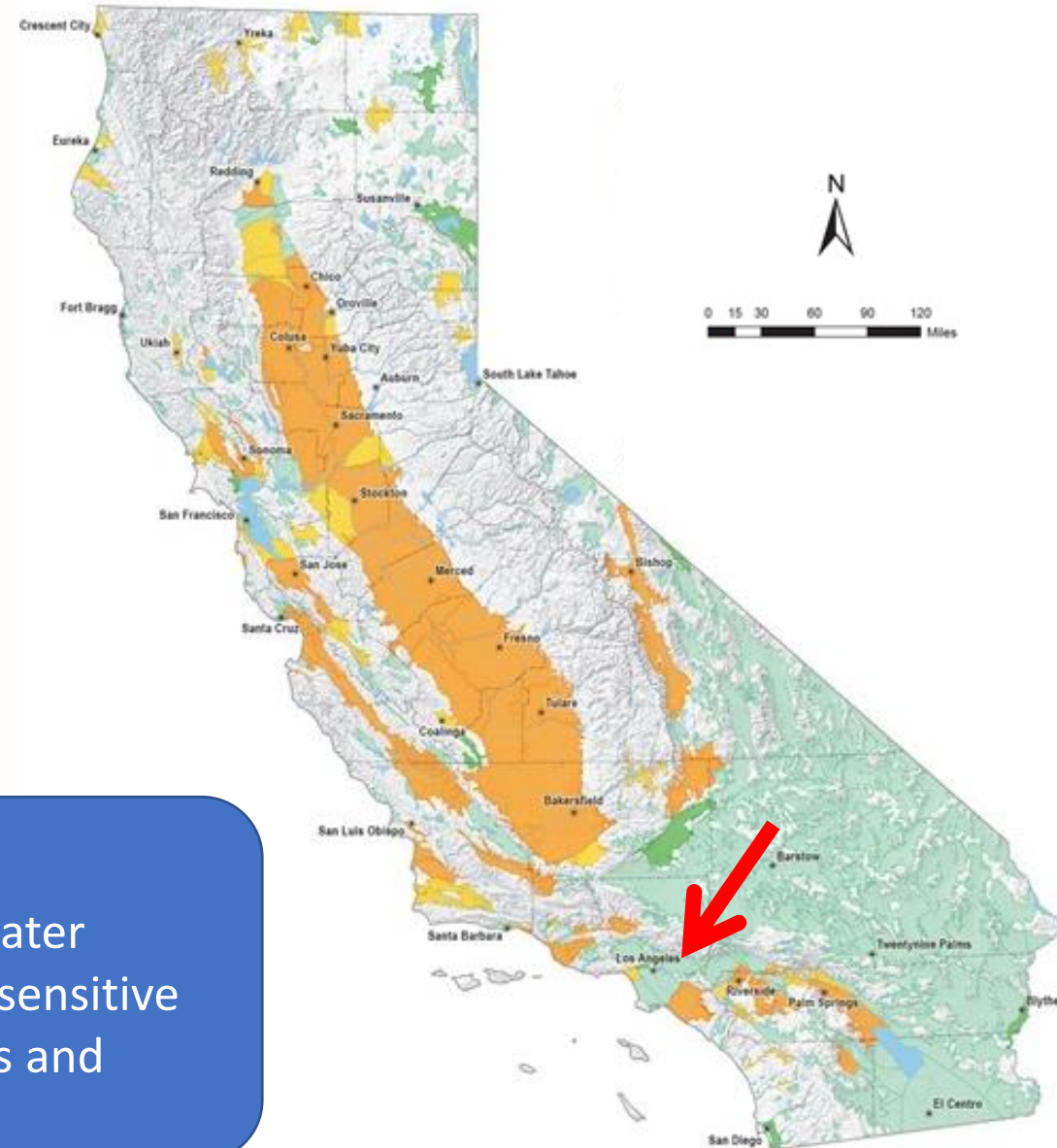
SECURING OUR WATER FUTURE TODAY

Who is the Water Replenishment District?

- Largest groundwater agency (by population) in California. Located in Southern Los Angeles County (see **RED ARROW**).
- Manage two groundwater basins; Central Basin and West Coast Basin (CBWCB).
- Formed by a vote of the people in 1959.

OUR MISSION

"To provide, protect and preserve high-quality groundwater through innovative, cost-effective and environmentally sensitive basin management practices for the benefit of residents and businesses of the Central and West Coast Basins."



Our Service Area



**SERVICE AREA =
420 SQUARE MILES**



43 CITIES



**POPULATION
> 4 MILLION**



**550,000 ACRE FEET
USED PER YEAR**



**50% GROUNDWATER
FROM LOCAL WATER
WELLS**



50% IMPORTED WATER



**WRD SUPPLEMENTS
NATURAL GROUNDWATER
RECHARGE**



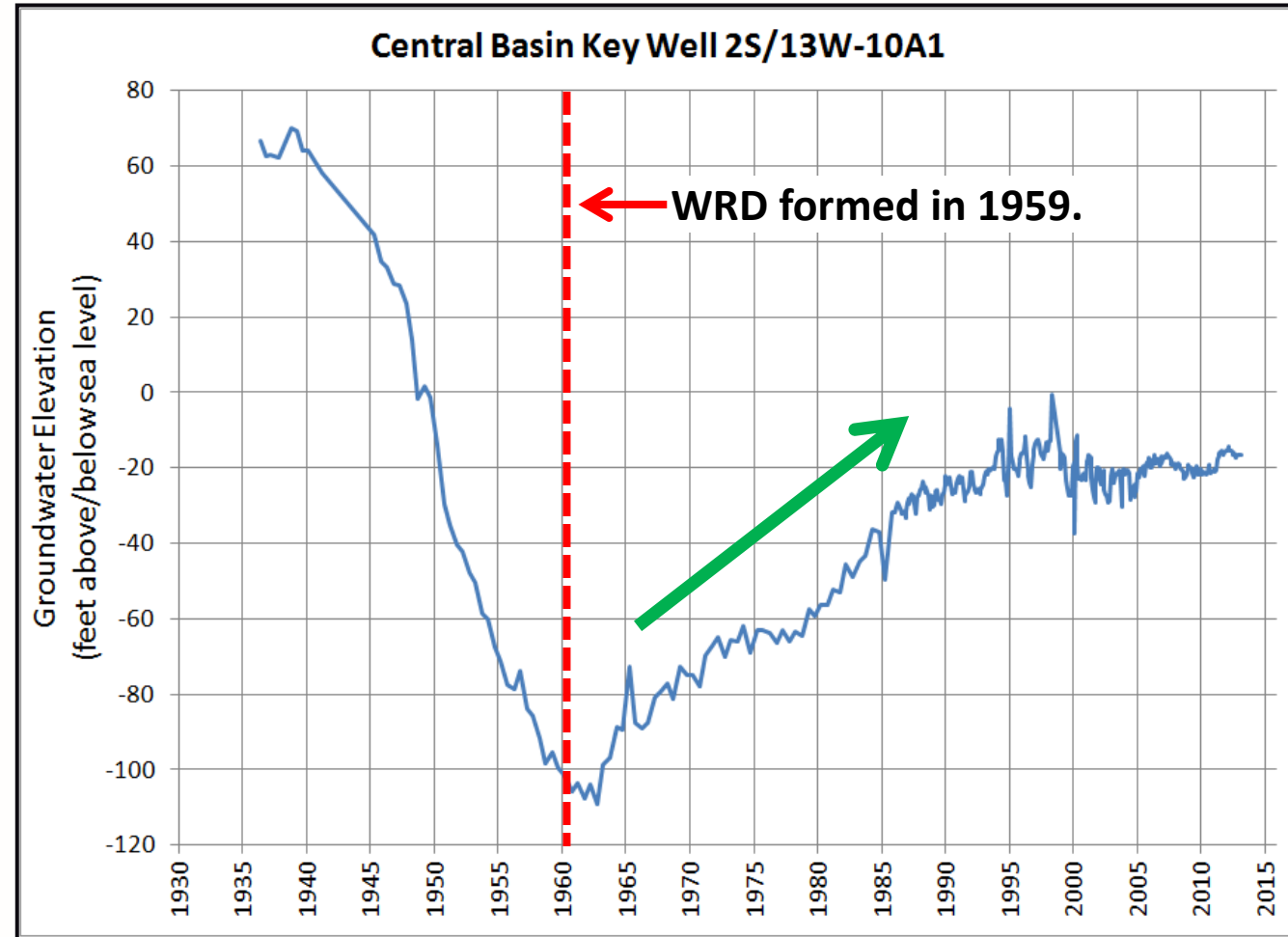
Basin History

Severe Overdraft before 1960

- Plunging Water Levels.
- Seawater Intrusion.
- Wells Went Dry.
- Resources being Depleted.

Recovery Due to...

- Adjudication of Basins.
- Seawater Barrier Wells.
- Formation of WRD.
- Use Imported and Recycled Water for Managed Aquifer Recharge.

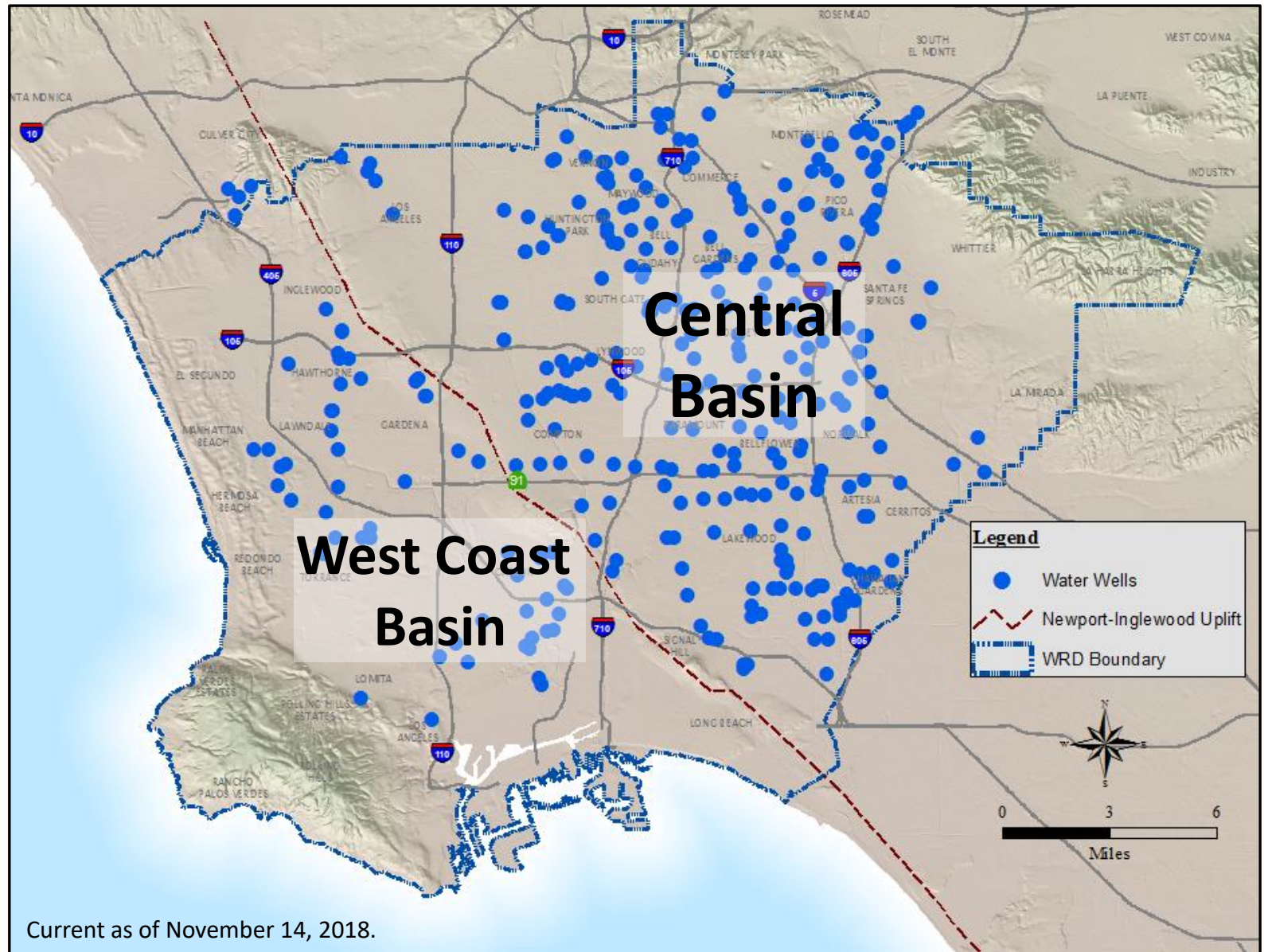


Groundwater Production Wells

Active Wells = 360

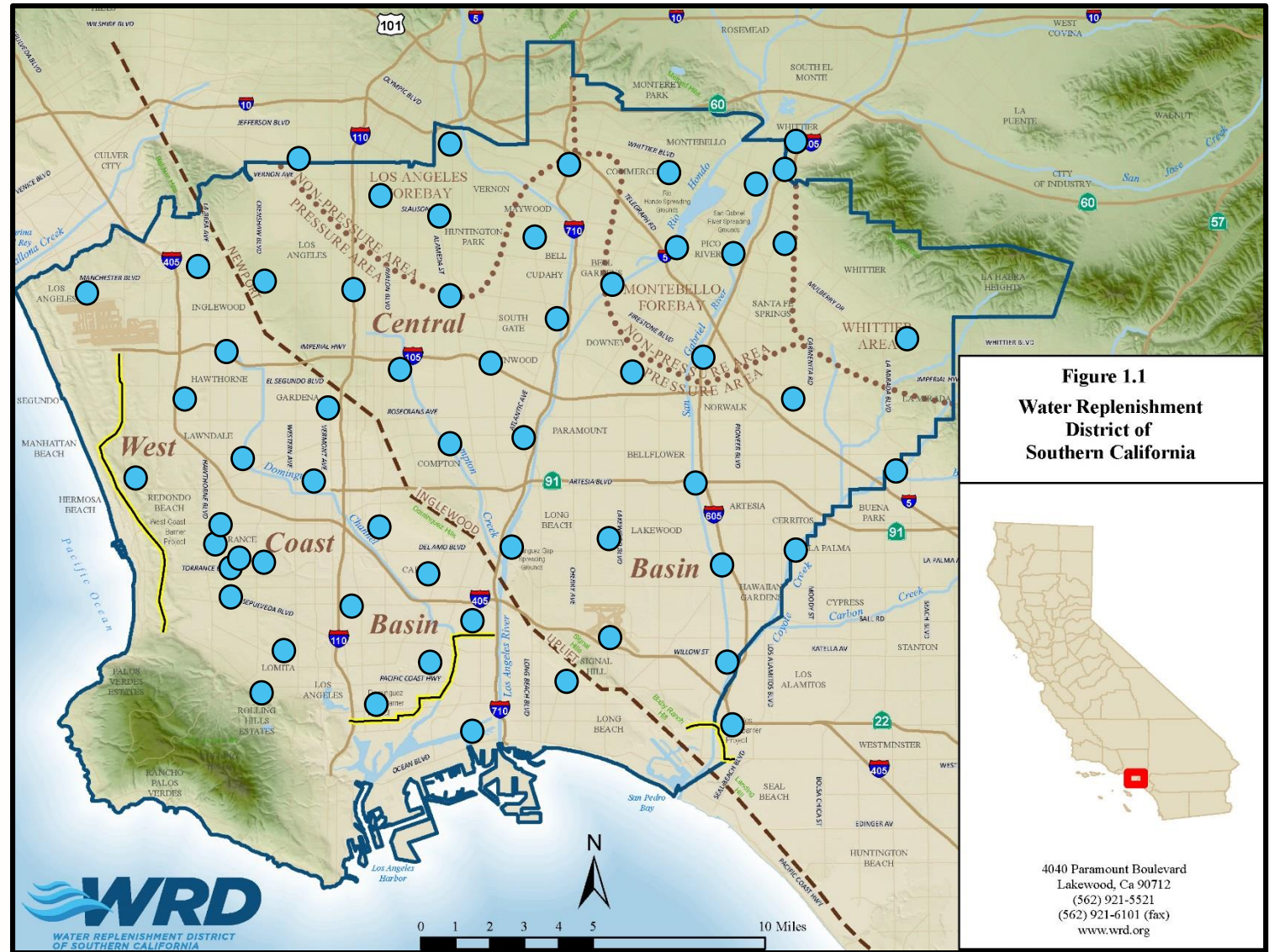
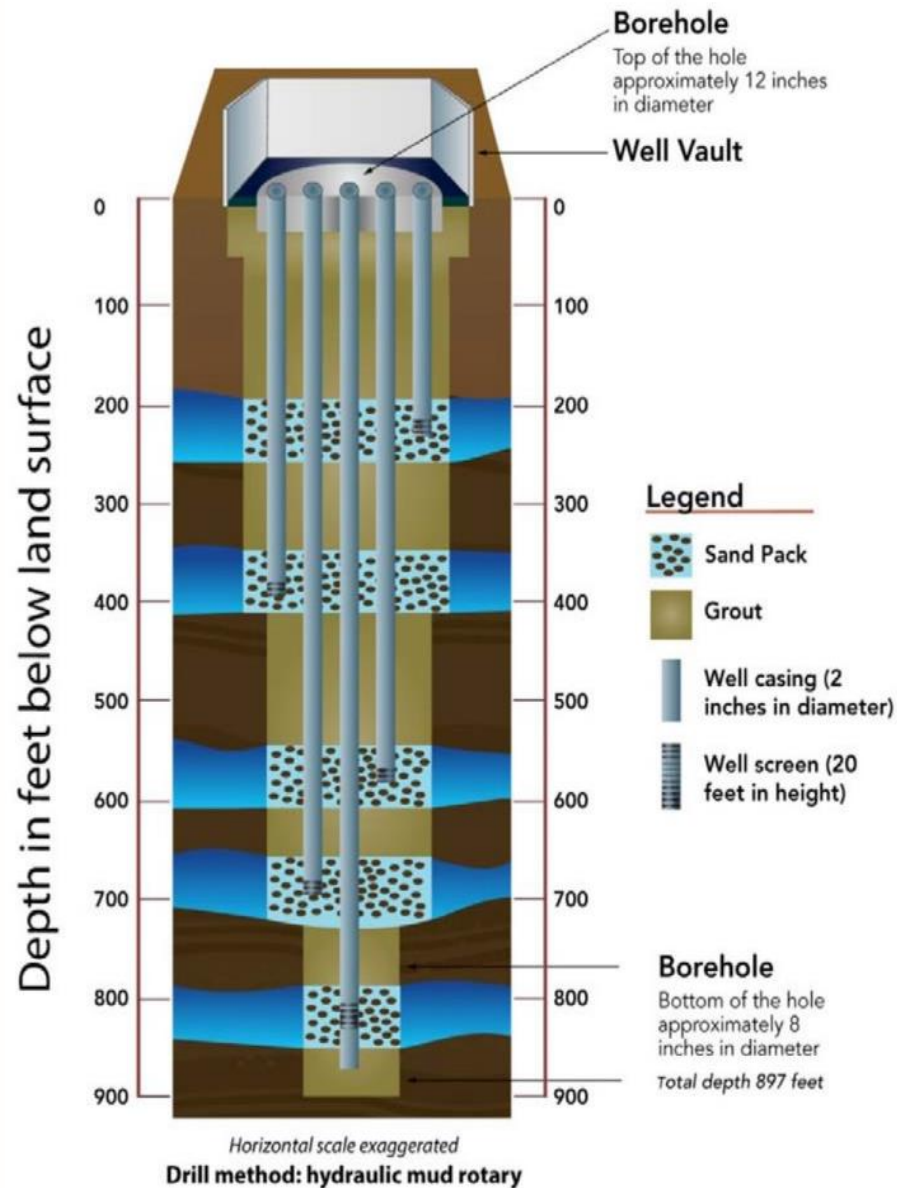
Active Pumpers = 101

Pumping ~250,000 AFY



Current as of November 14, 2018.

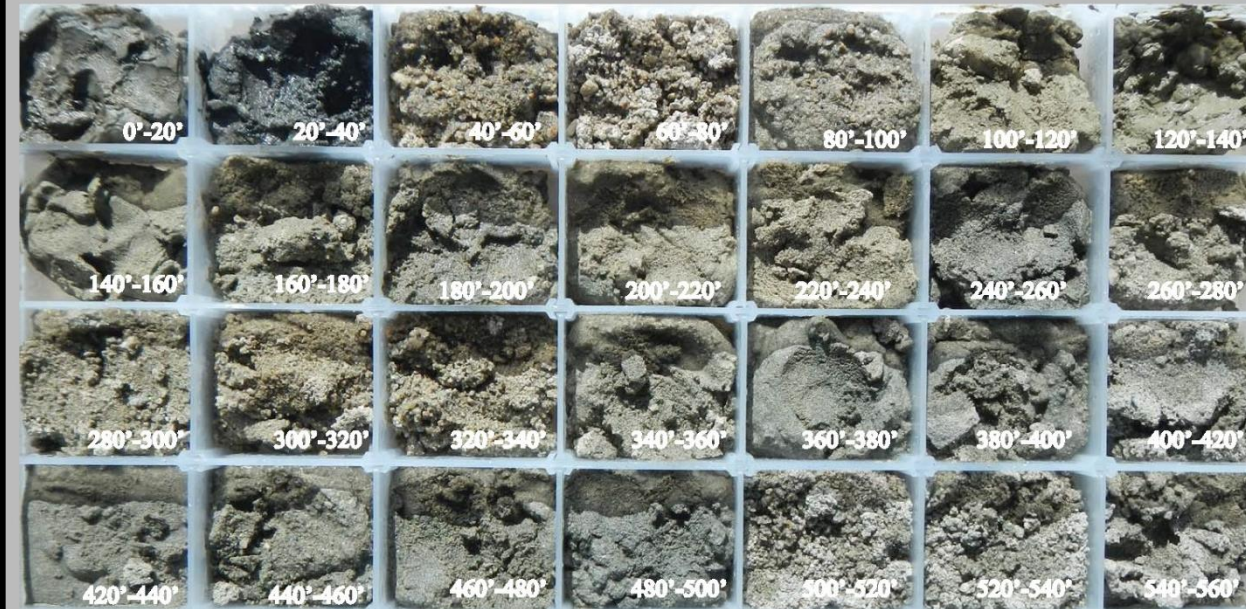
Regional Groundwater Monitoring Network



Regional Groundwater Monitoring Network

Cuttings logged by USGS

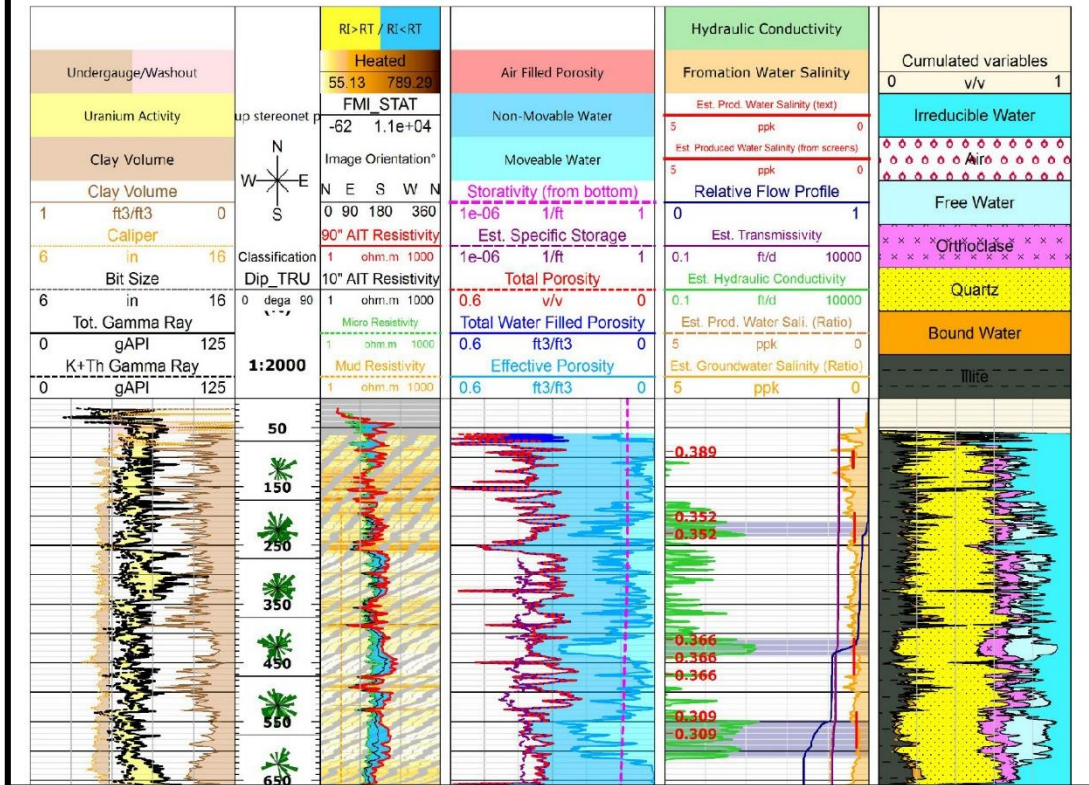
LOS5 - Los Angeles-5
SIEVE DRILL CUTTINGS
Box 1 of 4



LOS5 Rig Lithology

Beginning Depth (feet)	Ending Depth (feet)	Thickness (ft)	Lithology
548	580	32	Silty sand (vf-m) w/ trace sand (m-vc) and gravels (gran.-sm. peb.); <i>almost all cones</i>
580	600	20	Silty sand (vf-m) w/ trace shell fragments (1-2 mm); <i>all cones</i>
600	620	20	Silty sand (vf-m) w/ trace clay, gravels (gran.-sm. peb.), shell fragments (1-2 mm) and wood fragments (1-3 mm); minor clay and moderate shells 618'-620'; <i>mostly cones</i>
620	640	20	Sandy (vf-m) clayey silt w/ shell fragments (1-4mm), wood fragments (1-2 mm) and trace gravels (gran.-sm. peb.); increasing shells 620'-625' and clay 635'-640, decreasing shells 635'-640'

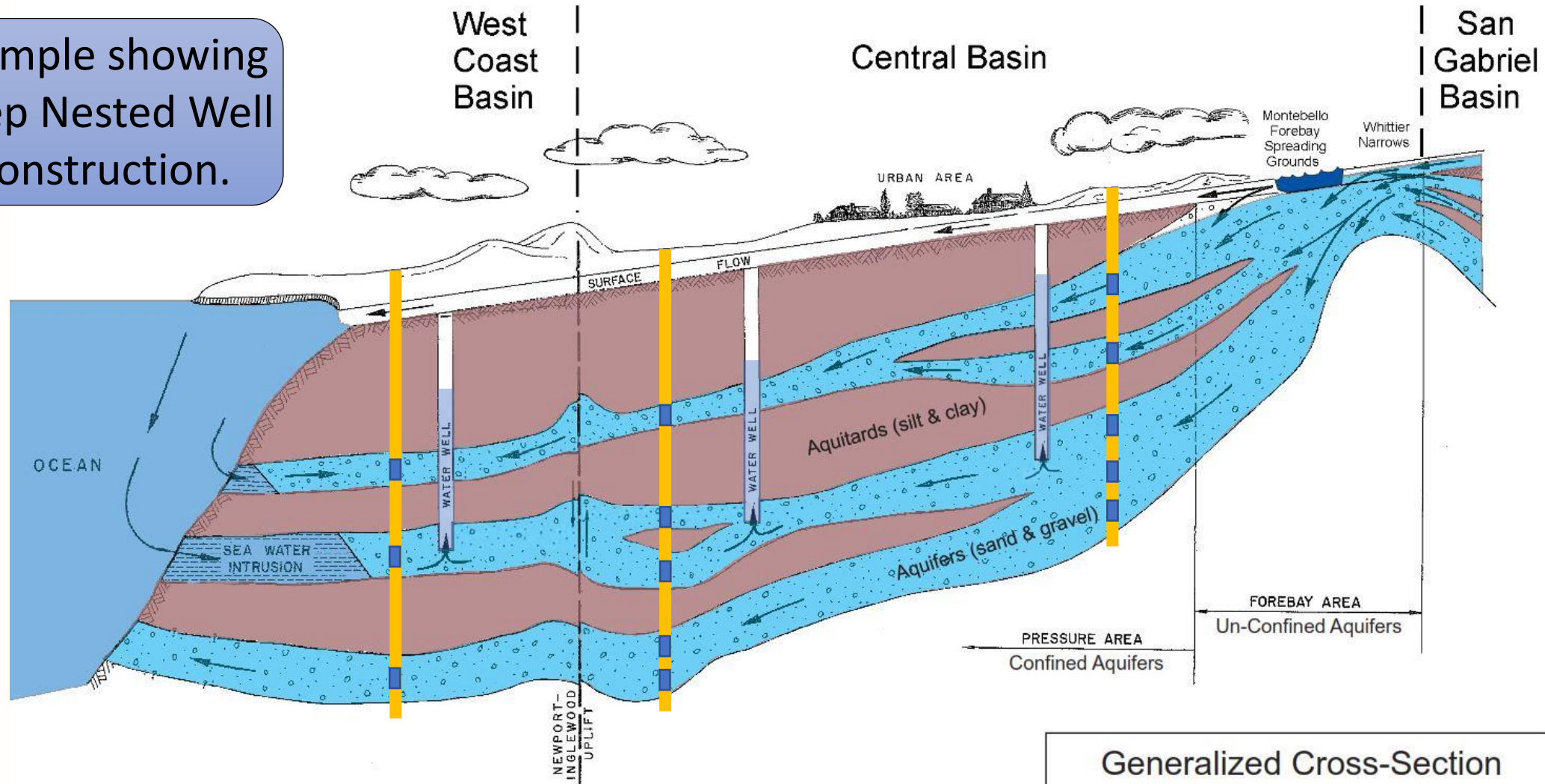
We also use Advanced Geophysics



- Combinable Magnetic Resonance Tool (CMR*)
- Array Induction Tool (AIT*)
- Micro-Cylindrically Focused Log (MCFL*)
- Hostile Natural Gamma Spectroscopy (HNGS*) and gamma ray (SGT*)
- Fullbore Formation Micro-Imager (FMI*)
- Sonic Scanner (MSIP*)

Regional Groundwater Monitoring Network

Example showing
Deep Nested Well
Construction.



Generalized Cross-Section
Central and West Coast Basins

Base Graphic from California Dept. Water Resources, 1959.
Color and other features added by WRD.
Not to Scale

Regional Groundwater Monitoring Network

Water levels monitored using pressure transducers (mainly In-Situ)



Regional Groundwater Monitoring Network

Wells are sampled semiannually by our Hydrogeology Group



Regional Groundwater Monitoring Network

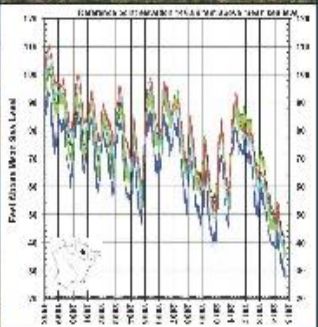


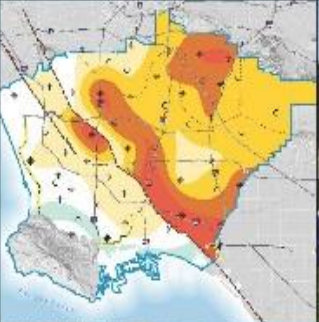
Over 100 chemicals tested from each sample with over 60,000 results per year

Major Minerals	General Physical Properties	Volatile Organic Compounds		
Total Dissolved Solid (TDS)	Apparent Color	Trichloroethylene (TCE)	sec-Butylbenzene	Bromomethane (Methyl Bromide)
Cation Sum	Lab pH	Tetrachloroethylene (PCE)	1,1,1,2-Tetrachloroethane	Chlorobenzene
Anion Sum	Odor	1,1-Dichloroethylene	1,1,1-Trichloroethane	Chlorodibromomethane
Iron, Total, ICAP	pH of CaCO ₃ saturation(25C)	cis-1,2-Dichloroethylene	1,1,2,2-Tetrachloroethane	Chloroethane
Manganese, Total, ICAP/MS	pH of CaCO ₃ saturation(60C)	trans-1,2-Dichloroethylene	1,1,2-Trichloroethane	Chloromethane(Methyl Chloride)
Turbidity	Radon	Chloroform (Trichloromethane)	1,1-Dichloropropene	cis-1,3-Dichloropropene
Alkalinity	Specific Conductance	Carbon Tetrachloride	1,2,3-Trichlorobenzene	Dibromomethane
Boron		1,1-Dichloroethane	1,2,3-Trichloropropane	Hexachlorobutadiene
Bicarbonate as HCO ₃ ,calculated	Metals	1,2-Dichloroethane	1,2,4-Trichlorobenzene	Naphthalene
Calcium, Total, ICAP	Aluminum, Total, ICAP/MS	Fluorotrichloromethane-Freon11	1,2,4-Trimethylbenzene	n-Butylbenzene
Carbonate as CO ₃ , Calculated	Antimony, Total, ICAP/MS	Freon 113	1,2-Dichloropropane	o-Chlorotoluene
Hardness (Total, as CaCO ₃)	Arsenic, Total, ICAP/MS	Isopropylbenzene	1,3,5-Trimethylbenzene	o-Dichlorobenzene (1,2-DCB)
Chloride	Barium, Total, ICAP/MS	n-Propylbenzene	1,3-Dichlorobenzene	o-Xylene
Fluoride	Beryllium, Total, ICAP/MS	m,p-Xylenes	1,3-Dichloropropane	p-Chlorotoluene
Hydroxide as OH, Calculated	Chromium, Total, ICAP/MS	Methylene Chloride	2,2-Dichloropropane	p-Dichlorobenzene
Langelier Index - 25 degree	Hexavalent Chromium (Cr VI)	Toluene	2-Butanone (MEK)	p-Isopropyltoluene
Magnesium, Total, ICAP	Cadmium, Total, ICAP/MS	Dichlorodifluoromethane	4-Methyl-2-Pentanone (MIBK)	Styrene
Mercury	Copper, Total, ICAP/MS	Benzene	Bromobenzene	tert-Butylbenzene
Nitrate-N by IC	Lead, Total, ICAP/MS	Ethyl benzene	Bromochloromethane	trans-1,3-Dichloropropene
Nitrite, Nitrogen by IC	Nickel, Total, ICAP/MS	MTBE	Bromodichloromethane	Vinyl chloride (VC)
Potassium, Total, ICAP	Selenium, Total, ICAP/MS	Perchlorate	Bromoform	
Sodium, Total, ICAP	Silver, Total, ICAP/MS			
Sulfate	Thallium, Total, ICAP/MS			
Surfactants	Zinc, Total, ICAP/MS			
Total Nitrate, Nitrite-N, CALC				
Total Organic Carbon				
Carbon Dioxide				

Regional Groundwater Monitoring Network

Reports are available to the public via <https://www.wrd.org>


Water Replenishment District
of Southern California



REGIONAL GROUNDWATER MONITORING REPORT
WATER YEAR 2013-2014

Central and West Coast Basins
Los Angeles County, California

February 2015



 **WRD**
WATER REPLENISHMENT DISTRICT
OF SOUTHERN CALIFORNIA

Technical Bulletin
Volume 15 ~ Spring 2008

Groundwater Quality in the Central and West Coast Basins

By: Ted Johnson, Chief Hydrogeologist (tjohnson@wrd.org)

Primary MCL (PMCL) Exceedances:

Groundwater producers regularly operate and sample nearly 400 production wells and WRD monitors and samples over 250 observation wells to measure the quality of the groundwater in the Central and West Coast Basins (CWCB). The good news is that the vast majority of groundwater is of high quality and requires little to no treatment before being pumped out of wells and served to the public. The slow movement of groundwater through the underlying gravel, sand, silt, and clay formations improves groundwater quality through a process known as geopurification. Occasionally, though, there are a few compounds that exceed their regulatory Maximum Contaminant Levels (MCLs) from natural causes or human activities. As a result, the impacted groundwater requires treatment before being served to the public or requires the wells to be shut off. The purpose of this Technical Bulletin is to answer the question "What are the most prevalent compounds that exceed their MCLs in the CWCB?"



WRD Hydrogeologist Tony Kirk Collects a Groundwater Sample

To answer this question, WRD queried its water quality database of nearly 750,000 records of groundwater test results for monitoring and production wells. The query identified wells that had samples exceeding either their Primary MCL (PMCL) or Secondary MCL (SMCL), and totaled the number to determine the prevalence of the compounds in the basins. PMCLs are regulatory limits established for compounds that pose a health risk to consumers and SMCLs are established for compounds that are not a health risk but are an aesthetic nuisance such as taste, odor, or discoloration of the water or plumbing fixtures. Both PMCLs and SMCLs are established by the United States Environmental Protection Agency (USEPA) and the California Department of Public Health (CDPH) after a considerable amount of research is performed on the compound.


The results confirmed that the vast majority of groundwater samples do not exceed their MCLs, indicating good water quality. Less than 0.5% of the samples exceeded their PMCLs and only 2% exceeded their SMCLs. Of the compounds that were found to exceed their MCLs, the most commonly detected ones are listed below:

#1. Arsenic was found above its PMCL in more wells than any other constituent. Arsenic is an inorganic compound that occurs naturally in soils, rocks and minerals. It dissolves in the groundwater at low or high concentrations depending on the prevalence of the arsenic-bearing rock and the geochemical conditions of the soil/groundwater interactions. Arsenic can also enter the groundwater through human activities such as agricultural or industrial practices. The PMCL for arsenic was recently lowered by the USEPA from 50 parts per billion (ppb) to 10 ppb. The CDPH has proposed 10 ppb for the State PMCL. The highest concentration found in the database query was 205 ppb. Treatment technologies are varied for Arsenic and include precipitation, adsorption, ion exchange, membranes, and some alternative technologies.

#2. Perchloroethylene (PCE or Tetrachloroethylene) was the second-most detected compound above its PMCL. It is a volatile organic compound (VOC) that is a colorless liquid with a mild chloroform-like odor. PCE is most commonly used in the textile industry (businesses concerned with the design or manufacture of clothing) and also as a component in dry-cleaning products. PCE released to soil will readily evaporate or leach into groundwater where it can travel considerable distances. The PMCL for PCE has been set at 5 ppb by both the USEPA and CDPH. The highest concentration found was 27 ppb. The USEPA has approved Granular Activated Carbon in combination with Packed Tower Aeration as a PCE treatment technology.

#3. Trichloroethylene (TCE) was the third-most detected compound above its PMCL. It is a VOC with its greatest use to remove grease from fabricated metal parts. If released to soil it can leach into groundwater and can travel considerable distances. The PMCL for TCE has been set at 5 ppb by both the USEPA and CDPH. The highest concentration found during the database query was 850 ppb. The USEPA has approved Granular Activated Carbon in combination with Packed Tower Aeration as a treatment technology for TCE.

Water Replenishment District
of Southern California




**Engineering Survey
and Report**

2016

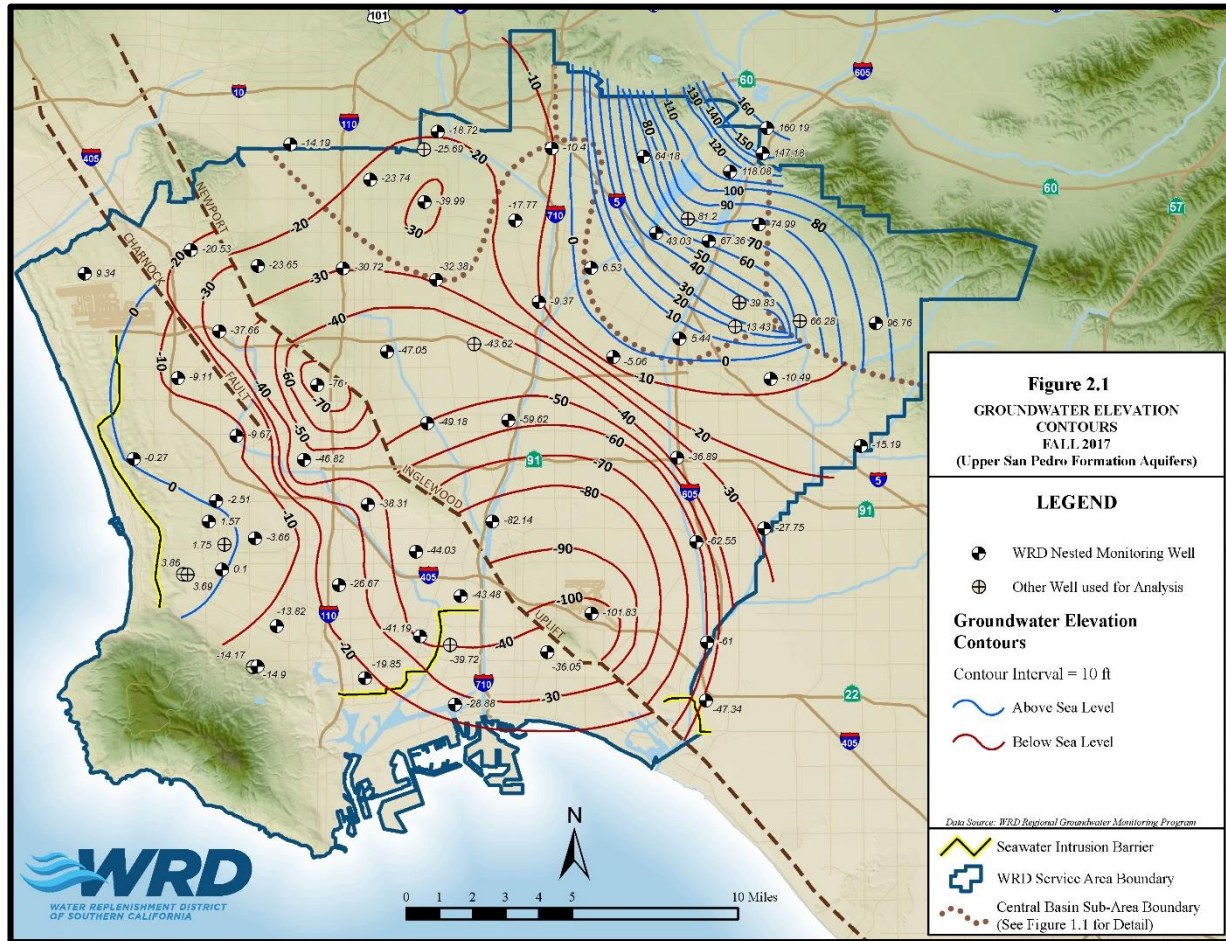
March 3, 2016

Updated:
May 9, 2016

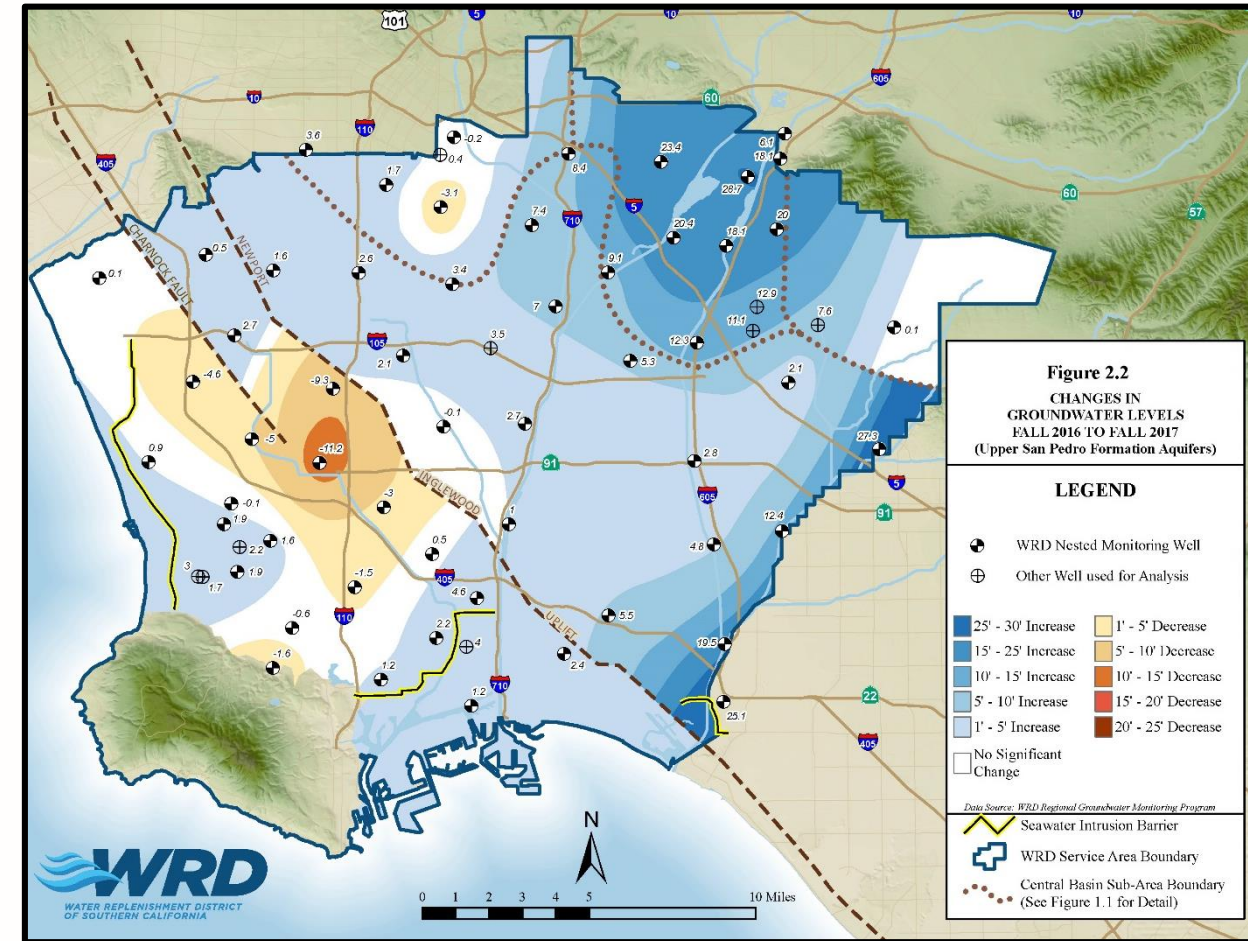


How do we use data from our well network?

Groundwater Elevation Contours

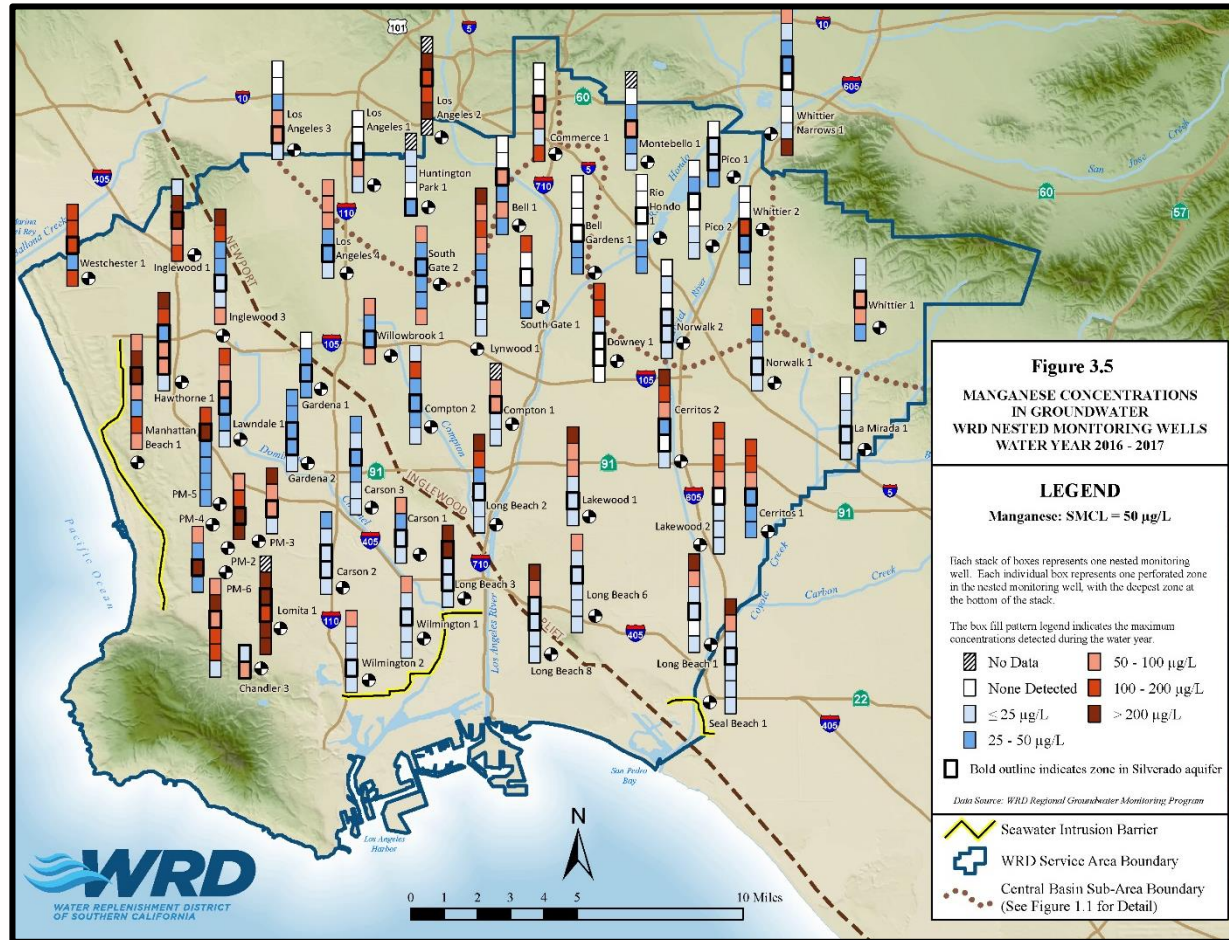


Changes in Groundwater Levels

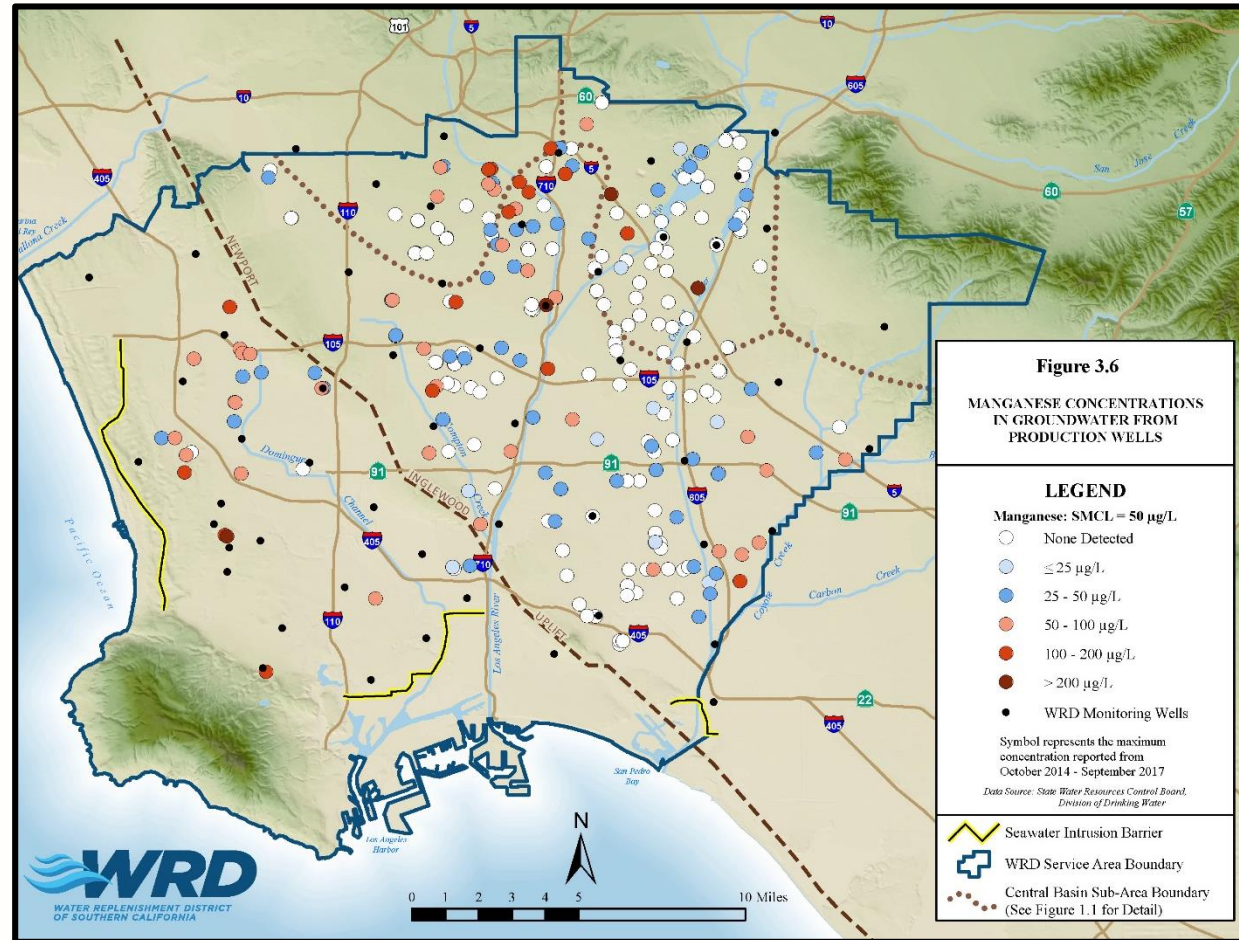


How do we use data from our well network?

Manganese in Monitoring Wells

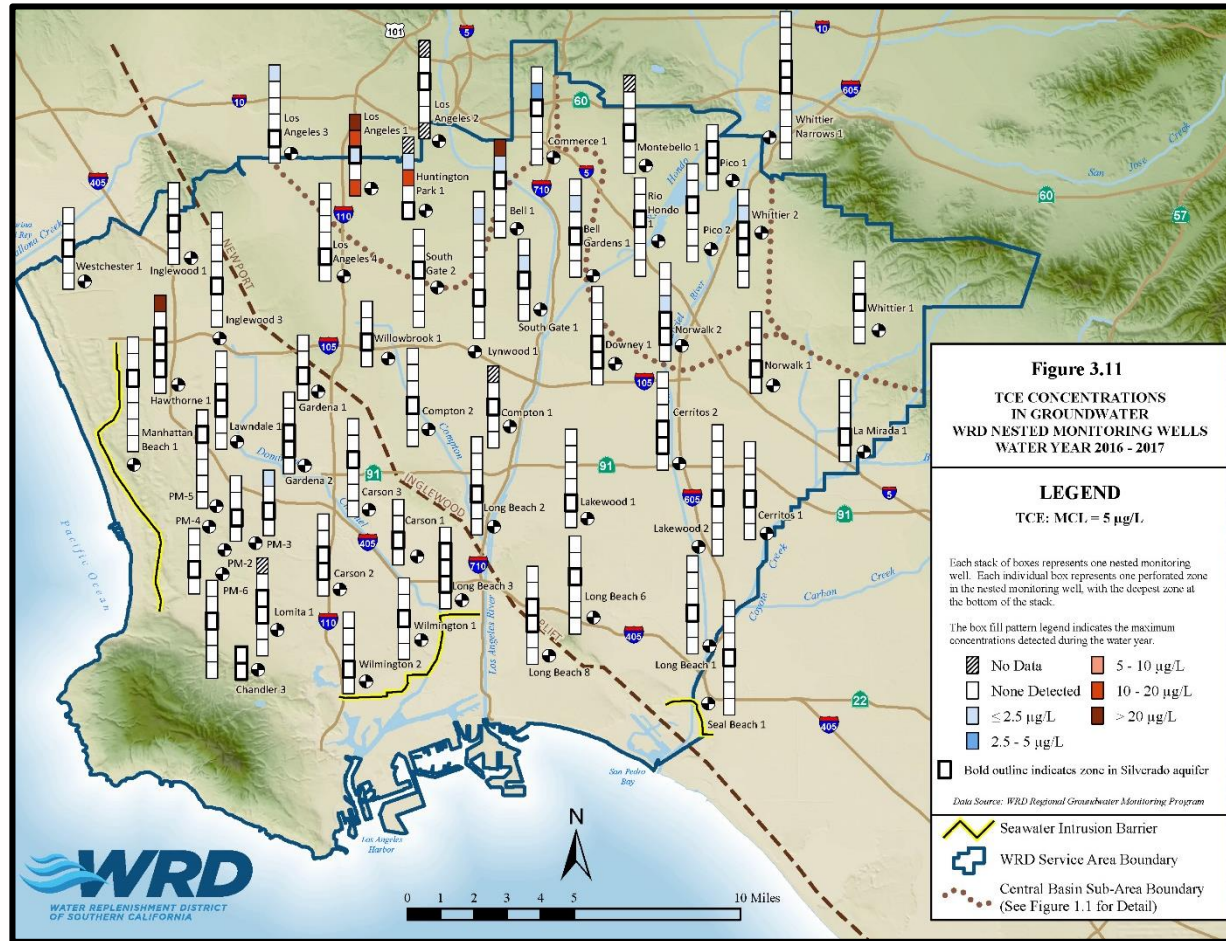


Manganese in Production Wells

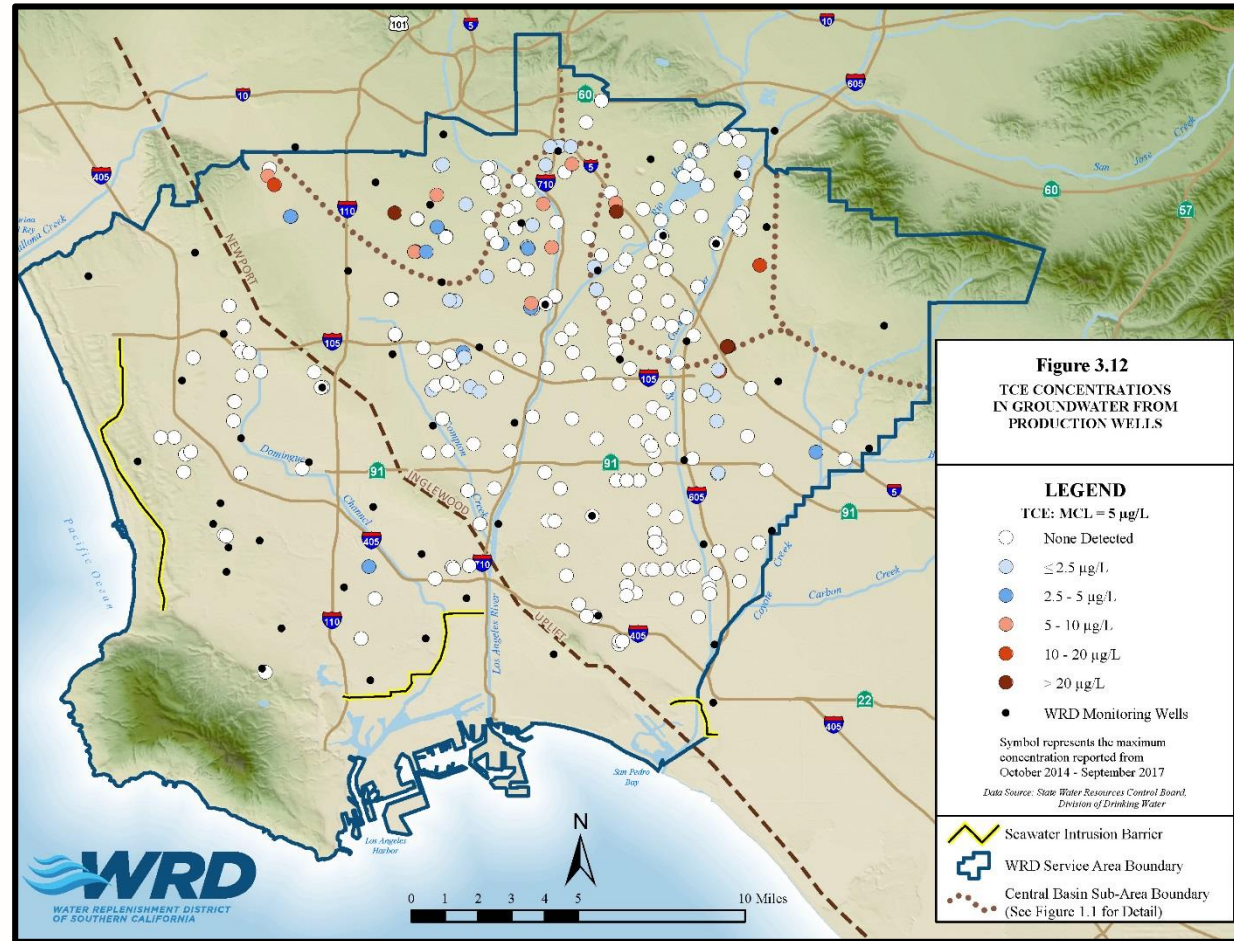


How do we use data from our well network?

TCE in Monitoring Wells

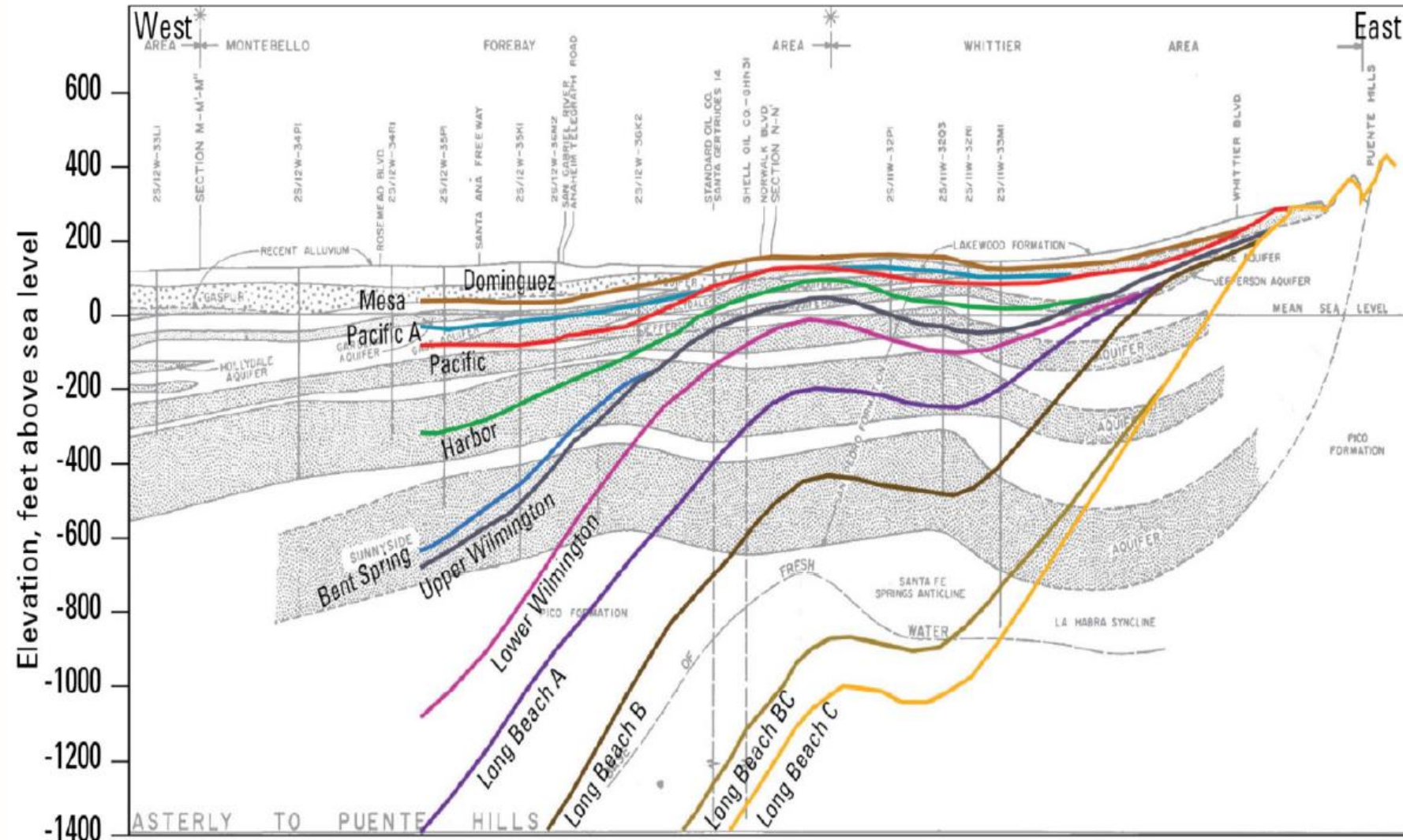


TCE in Production Wells

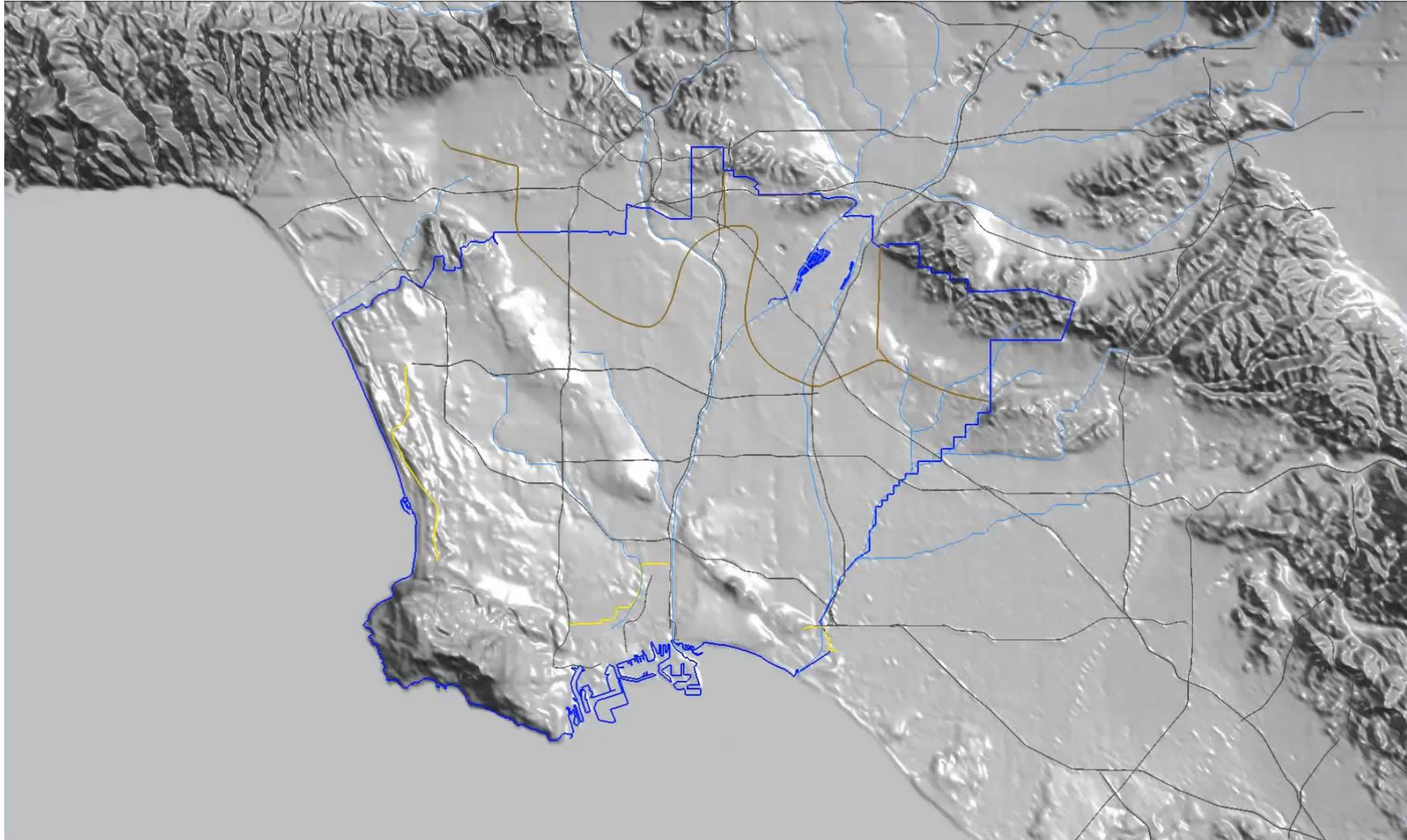


How do we use data from our well network?

Working on a new sequence stratigraphy model with USGS



How do we use data from our well network?



Trans-Boundary Flow Directions and Groundwater Budget

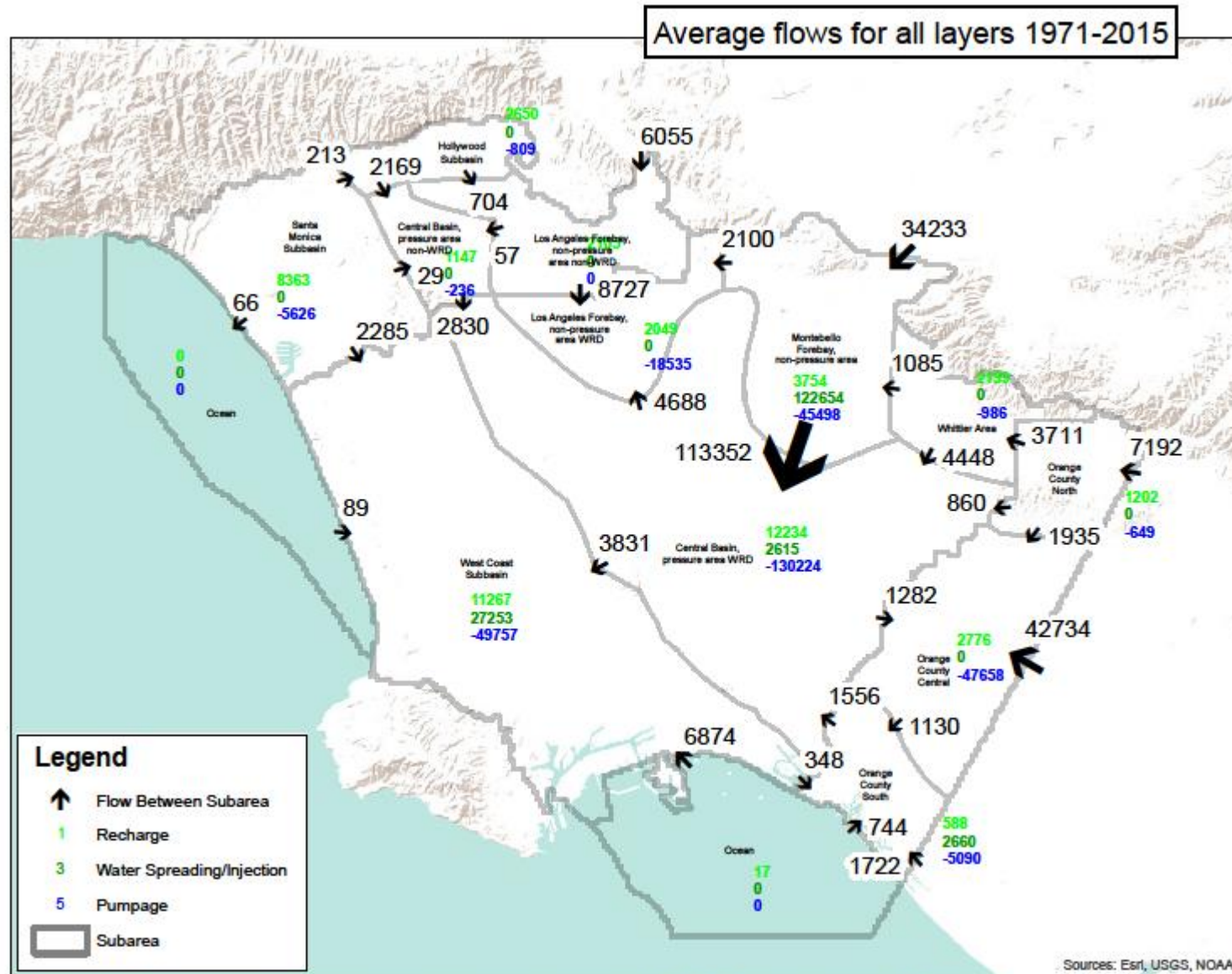


Figure D14. Average groundwater flow between subareas in Los Angeles Coastal Plain, 1971-2015, Los Angeles County, California.

Regional Groundwater Monitoring Network

WRD is also the groundwater monitoring entity for the CBWCB

WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA MONITORING PLAN

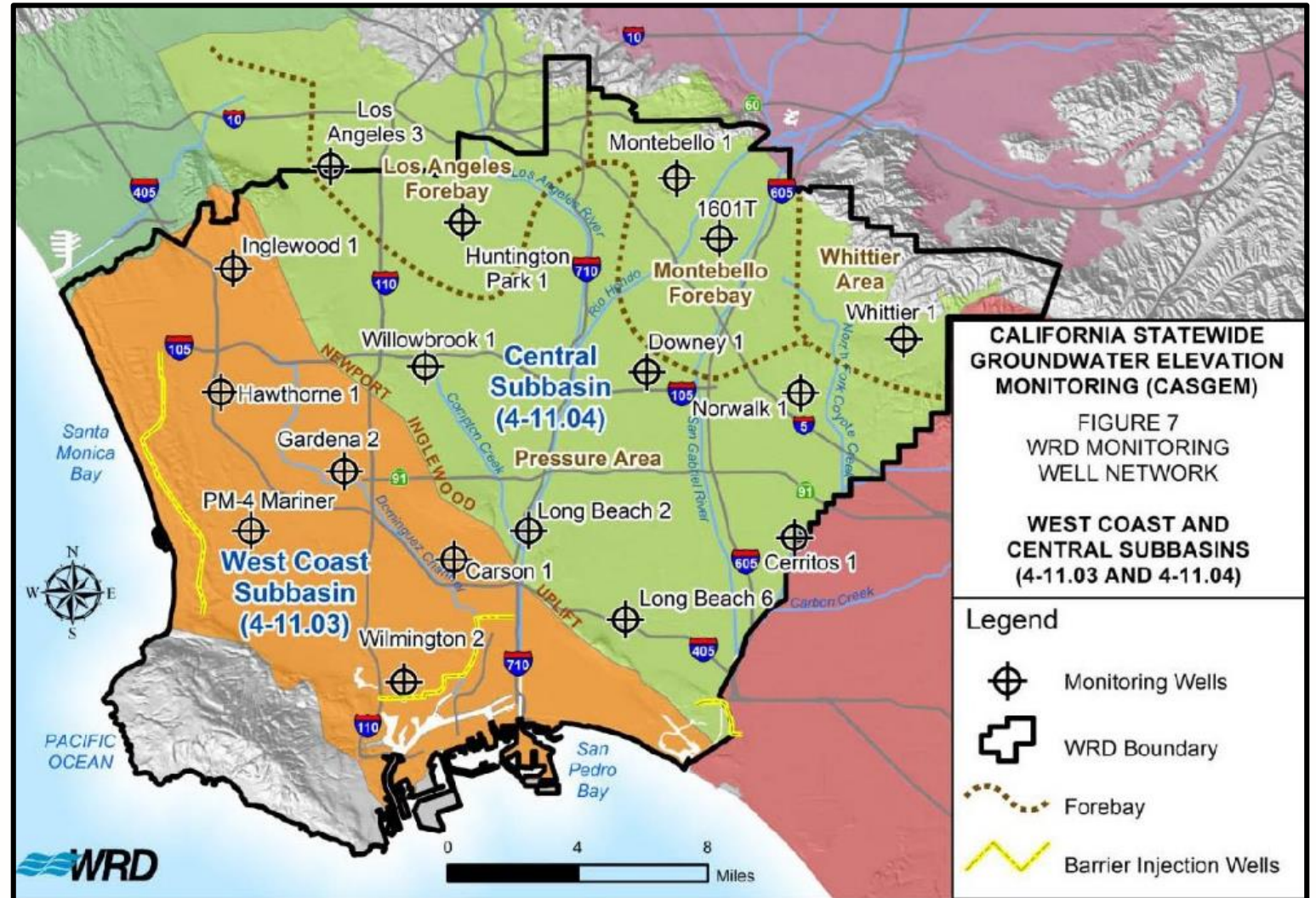
FOR

CALIFORNIA STATEWIDE GROUNDWATER ELEVATION MONITORING (CASGEM) PROGRAM

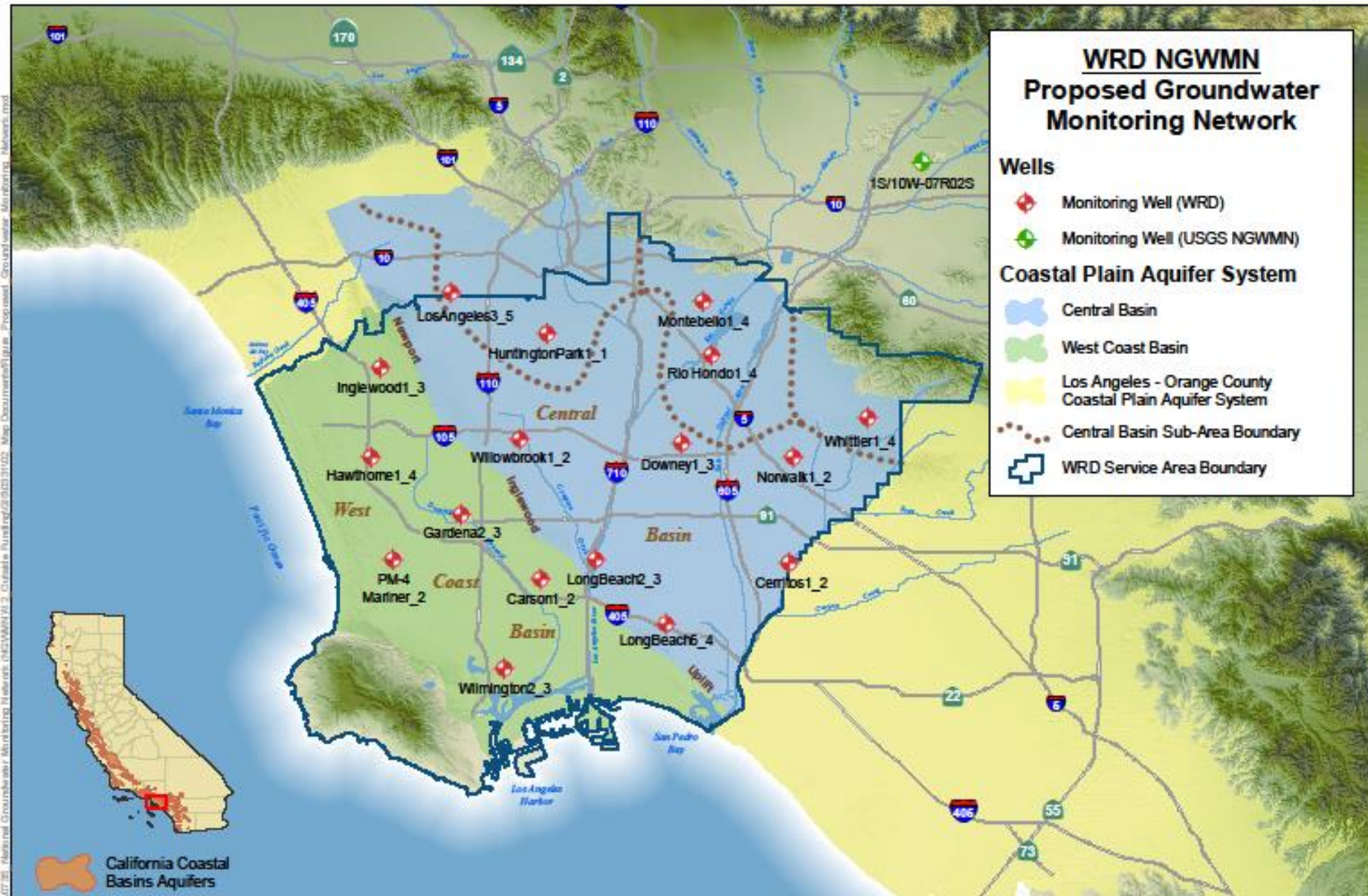
South Coast Hydrologic Region
Basin 4-11 Coastal Plain of Los Angeles County
Subbasin 4-11.03 West Coast
Subbasin 4-11.04 Central



Final plan submitted October 25, 2011



NGWMN Proposed Network



NGWMN Well Selection and Classification

#	Subbasin	State Well Number	Well Name	Well Depth (ft)	Top of Screen (ft)	Bottom of Screen (ft)	Aquifer Screened
1	4-11.03 West Coast	04S13W09H010S	Carson1_2	760	740	760	Silverado
2	4-11.03 West Coast	03S14W25K009S	Gardena2_3	630	610	630	Silverado
3	4-11.03 West Coast	03S14W17G006S	Hawthorne1_4	420	400	420	Silverado
4	4-11.03 West Coast	02S14W28M005S	Inglewood1_3	450	430	450	Silverado
5	4-11.03 West Coast	04S14W04Q002S	PM-4 Mariner_2	550	500	540	Silverado
6	4-11.03 West Coast	04S13W32F003S	Wilmington2_3	560	540	560	Silverado
7	4-11.04 Central	04S11W05P010S	Cerritos1_2	1020	1000	1020	Silverado
8	4-11.04 Central	03S12W09J003S	Downey1_3	600	580	600	Silverado
9	4-11.04 Central	02S13W22C001S	HuntingtonPark1_1	910	890	910	Silverado
10	4-11.04 Central	04S13W01N005S	Long Beach2_3	470	450	470	Silverado
11	4-11.04 Central	04S12W21M011S	Long Beach6_4	500	480	500	Silverado
12	4-11.04 Central	02S14W12E005S	LosAngeles3_5	350	330	350	Silverado
13	4-11.04 Central	02S12W10Q008S	Montebello1_4	390	370	390	Silverado
14	4-11.04 Central	03S11W17F002S	Norwalk1_2	1010	990	1010	Silverado
15	4-11.04 Central	02S12W26D012S	RioHondo1_4	450	430	450	Silverado
16	4-11.04 Central	03S11W02K006S	Whittier1_4	470	450	470	Silverado
17	4-11.04 Central	03S13W08J002S	Willowbrook1_2	520	500	520	Silverado

- Good spatial distribution of wells in WRD service area
- 17 dedicated monitoring wells
- Wells have an average of 18 years of continuous data
- Wells are screened only in the deeper and principal aquifer (Silverado)

Do we collect data differently than the NGWMN?

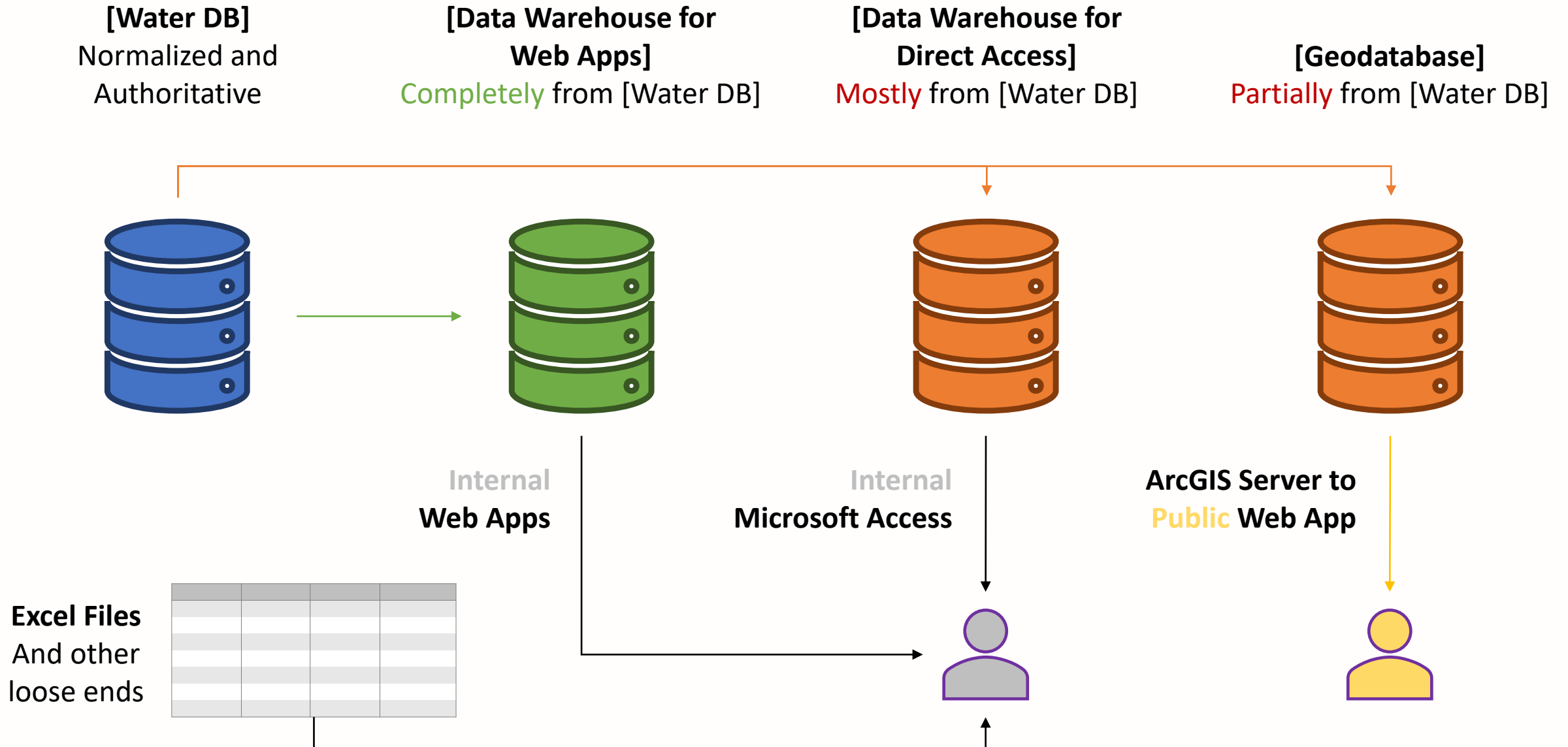


- Collect quarterly manual water level data via electric sounder and daily pressure transducer data.
- Collect seminannual water quality through grab samples via Grundfos 2" Rediflo and Bennett pumps.

NGWMN Status of Year 1

- Classify sites into subnetworks and monitoring categories for water levels and water quality (Nov – Dec 2018).
- Populate NGWMN Well Registry with site and network information (Dec 2018 – Jan 2019).
- Connect WRD databases to NGWMN Portal using web services (Jan-Mar 2019).
- Collect WL and WQ data for NGWMN (Mar – May 2019)
- Document data collection and management protocols, summary report (May – Jun 2019)

Database structure at WRD

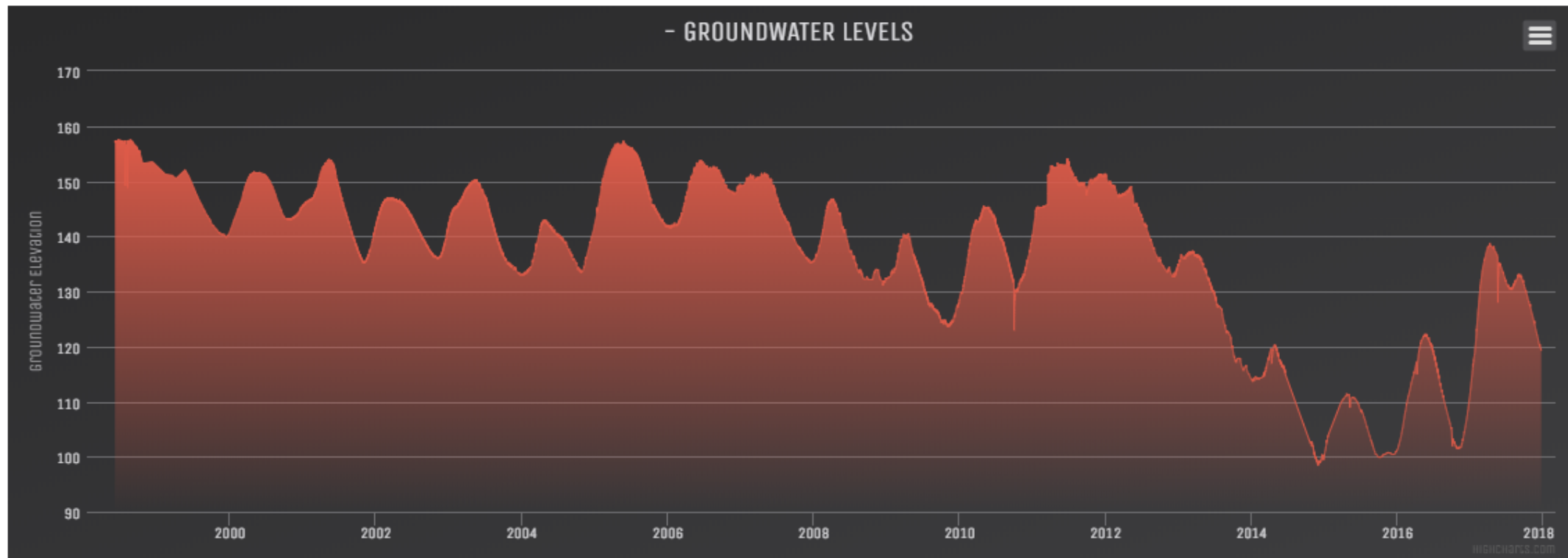


Experience with web applications at WRD

WATER LEVEL DATA FOR WELL

OWNER NUMBER: P1_1

WRD ID: 100001



Experience with web applications at WRD

WRD LAB DATA

Search by Report Number:

Report No.

Search by WRD ID:

WRD ID

SEARCH

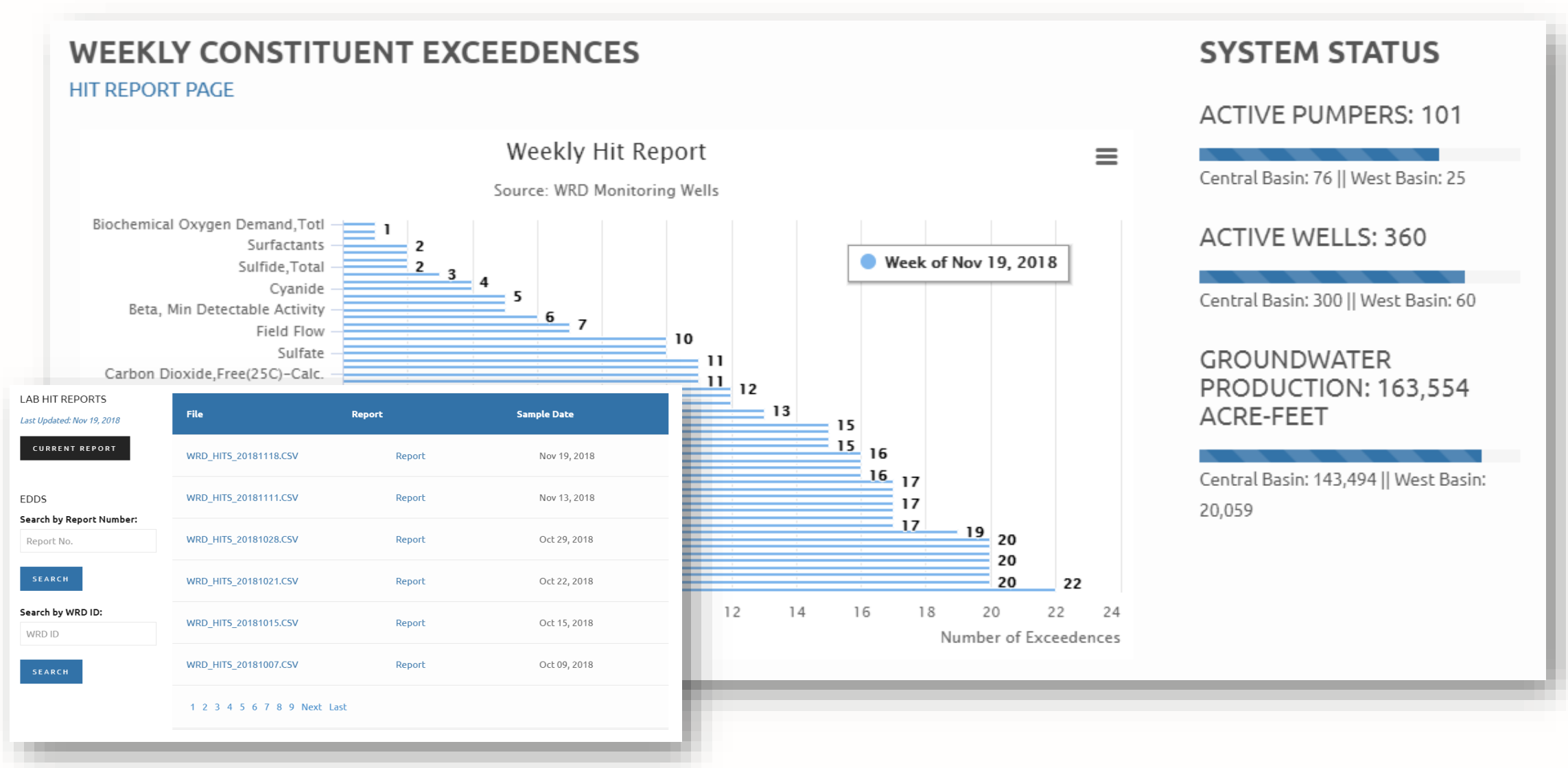
SEARCH

WRD ID	Sample Date	Sample Time	Storet	Constituent	Method	Flag	Value	DL	MDL
100001	2018-05-01	16:30:00	35215	18	SM 2120B		45.000	3.000	3.000
100001	2018-05-01	16:30:00	35216	39	SM 2150B		2.000	1.000	1.000
100001	2018-05-01	16:30:00	35217	41	SM2510B		550.000		
100001	2018-05-01	16:30:00	35221	42	EPA 150.1		8.040		

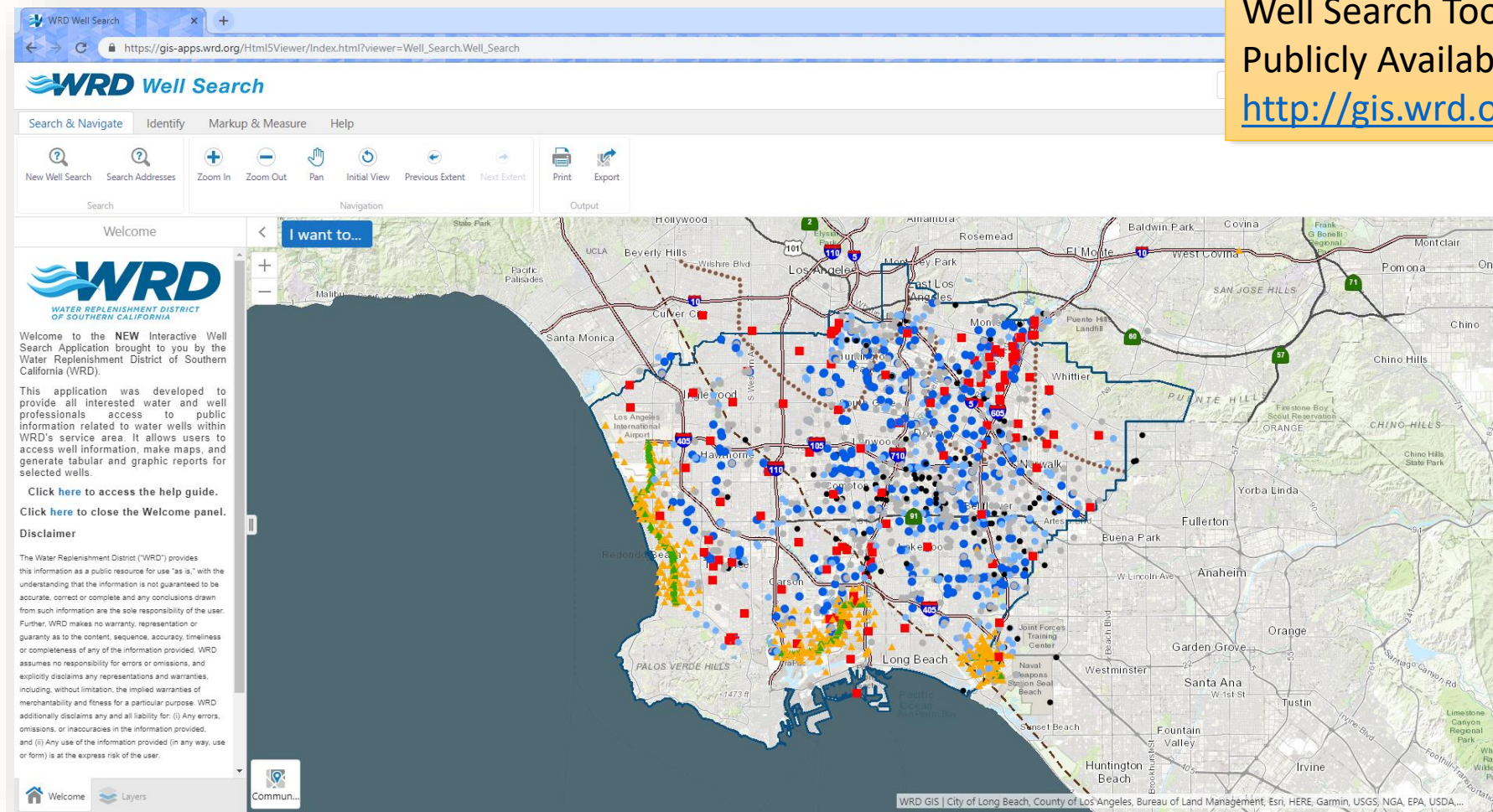
WELL DATA

Construction Date	Destruction Date	Well Depth	Bore Diameter	Bore Depth	Casing Type	Casing Diameter	Drill Method	TOP	BOP
1996		900	9.88	930	PVC80	3	ROT	860	900
NOTES:		Pico Water District Office Yard (562) 692-3756, RPE updated 9/7/16							

Experience with web applications at WRD



Experience with web applications at WRD



Well Search Tool
Publicly Available
<http://gis.wrd.org>

WRD web service plan for the NGWMN

- TBD
- If possible, our preference is to utilize ArcGIS Server to produce web services for the NGWMN





THANK YOU

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