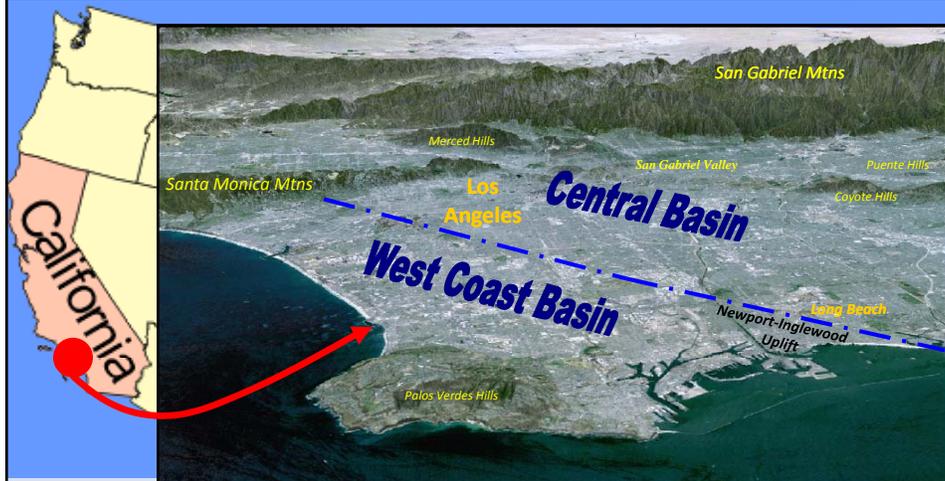


Groundwater Storage and Replenishment in the WRD Service Area: LA County



By: Ted Johnson, P.G., C.H.G., Chief Hydrogeologist
Water Replenishment District of Southern California

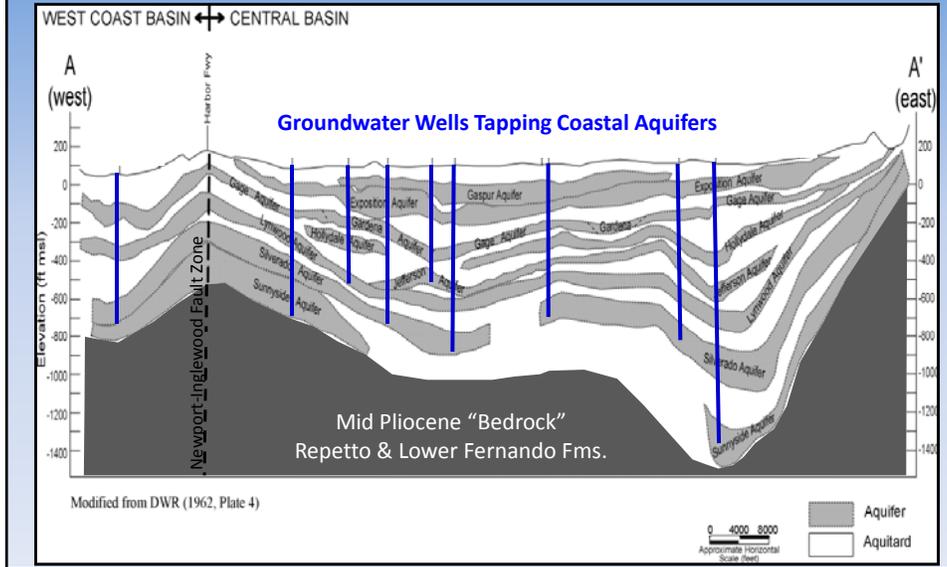


Water Replenishment District of Southern California

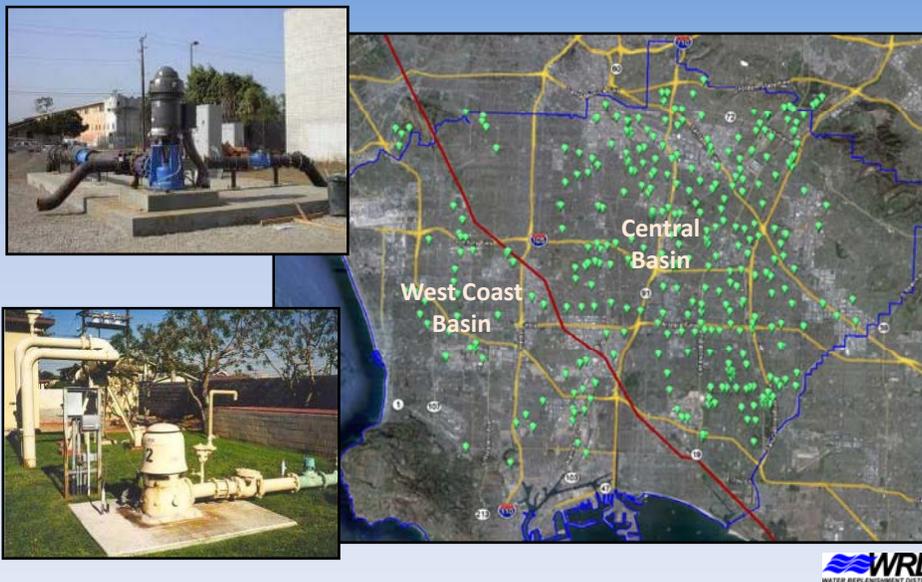
- Formed in 1959 under the Water Replenishment District Act of 1955 (AB 2908 signed into law by Governor Goodwin Knight).
- Operate under Division 18 of the California Water Code.
- Replenish over-drafted groundwater basins and protect groundwater quality.
- Publicly elected Board of Directors (5 members). General Manager (P.E.) and 31 Staff - half with eng./science degrees.
- Serve 43 cities, 4 million people, 420 square miles, >10% of State's Population. Water use 60% imported /40% groundwater.



Groundwater in Sandy Aquifers – Folded and Faulted, 2000 ft Deep in Areas

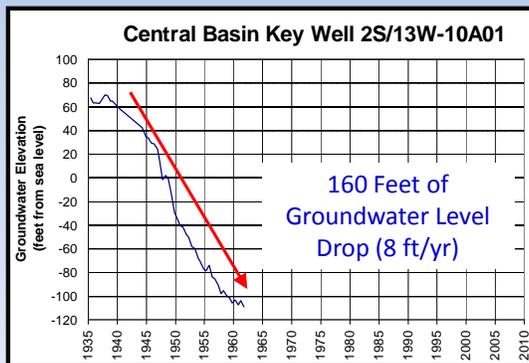


**Over 400 Wells Pumping 240,000 acre feet per year
(78 billion gallons/year) by Cities and Private Co.**



Excessive Pumping Caused GW Overdraft

- Plunging groundwater levels fell below sea level.
- Artesian wells stopped flowing. Wells went dry.
- Allowed seawater to intrude and contaminate fresh aquifers.



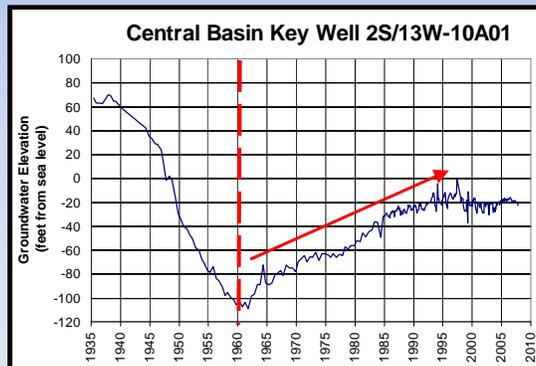
Groundwater Management Solutions

- SEAWATER BARRIER WELLS: LA County installed injection wells along coast to halt seawater intrusion starting in 1950s.
- NEW REPLENISHMENT WATER: WRD formed in 1959 to perform managed aquifer recharge through artificial replenishment and groundwater storage.
- CONTROL EXTRACTIONS: West Coast Basin adjudicated 1961; Central Basin adjudicated 1965. Capped pumping at 281,835 acre feet per year. Still greater than natural safe yield, relying on WRD for replenishment and storage to maintain balance.



Results of Groundwater Management

- Since 1959, nearly 7 million acre feet of imported/recycled water replenished / stored in the groundwater basins.
- Groundwater levels rose to healthy and sustainable levels.
- Seawater intrusion halted.



Ways to Replenish / Store Water Underground

- Spreading Grounds
- Injection Wells (Seawater Barrier Wells – Aquifer Storage and Recovery Wells – ASR)
- In-Lieu (pay pumpers not to pump groundwater)



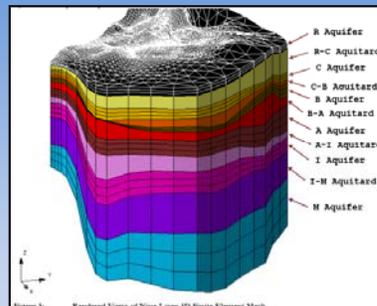
Science of Groundwater Storage

- Understand the hydrogeology of the groundwater basins:
 - Aquifers, aquitards, merged zones, basin boundaries, faults.
 - Water levels, water quality, vertical gradients, short term and long term groundwater trends.
 - Recharge areas, water budget, well locations, pumping.
 - Aquifer properties: hydraulic conductivity, storativity, transmissivity, porosity.
 - Location of potential contaminating activities.
 - Potential geochemical reactions between storage water and native groundwater.

- Some Useful Tools:
 - Monitoring wells, monitoring program, aquifer tests, conceptual models, computer models, geochemical models, tracer tests, well profiling, geophysical logs, Geographic Information System (GIS) mapping and analysis ability, GeoTracker, CASGEM.



WRD Monitoring and Modeling Programs



Groundwater Storage Future

- 450,000 acre feet of available storage identified in the Central and West Coast Basins.
- Use of this storage space would ensure drought-proof and long term supply of groundwater to the region.
- Use local water (recycled and storm water) to the maximum extent possible to reduce / eliminate imported water and help alleviate demands on the bay delta (WRD's W.I.N. Program). Will create a locally sustainable groundwater supply.



Groundwater Storage Challenges

- Technical Challenges:
 - Urban / Rural open space for new storage projects.
 - Adequate hydrogeology and water quality to receive storage water without causing harm. Potential for contamination of stored water.
 - Availability of storage water with climate change and imported water supplies dwindling.
- Other Challenges:
 - Adjudications were silent on storage. No "Rule Book".
 - Power struggle between multiple water agencies over available storage space. Who has rights to store water?
 - Legal disputes go on and on. Appeal after appeal. Delays storage projects from going forward. The public loses.
 - Legislation can help settle matters (SB 1386, Lowenthal).



Conclusions

- Groundwater Replenishment and Storage programs are proven methods for reliable water supplies.
- Increased use of recycled water and storm water for recharge are great alternatives to ease off bay delta imported water.
- Proper science is needed to understand and manage groundwater basins to optimize storage opportunities.
- Numerous challenges exist to implement storage programs that can be overcome through good science, communication, cooperation, and education. Expedited implementation of storage programs is desired for the benefit of the public.



THANK YOU!



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