BEST BEST & KRIEGER LLP

ATTORNEYS AT LAW

Identifying Aquifers For Successful Management

XVI World Water Congress

International Water Resources Association

Cancun, Mexico 29 May – 2 June, 2017

PRESENTED BY

Eric L. Garner

Partner

Initial Assumptions

- Groundwater management is rarely done well where there is insufficient water to meet demand
- We know the elements of good management but it is hard to find examples of it
- Where is it occurring?

The California Groundwater Experience

- California has plenty of examples of poor aquifer management
- Why?
  - Pumping is not regulated – pump until a judge tells you not to
  - Population growth has been dramatic – 400% increase in last 60 years
  - Surface water supplies are highly variable
  - Climate is relatively dry but excellent for agriculture (Mediterranean)
  - Imported water is expensive

The California Groundwater Experience

"Overextraction was the logical outcome"

- Elinor Ostrom, Nobel Prize-Winning Economist, citing the compound uncertainties in California water law and California water conditions in Governing the Commons (1990)

The California Groundwater Experience

Central Valley Aquifer System

- 5.2 million hectares (12.8 million acres), including:
    - One of the world's most productive agricultural regions ($17 billion per year)
    - 6.5 million people (and growing)
- Users:
    - 87% agriculture
    - 13% urban
- Annual production
    - Typical Year: 10.7 billion m3 per year (8.7 million AFY)
    - Dry Year: 15.5 billion m3 per year (12.6 million AFY)
    - Wet Year: 7.6 billion m3 per year (6.2 million AFY)
- Land subsidence
- Groundwater level declines


1988
2004
2008
2013
USGS
SAN JOAQUIN VALLEY
CALIFORNIA
BM H 1235 R
SUBSIDENCE 4.8FT
1988-2013

The California Groundwater Experience

- Yet, a number of aquifers in Southern California are being successfully managed

The California Groundwater Experience

Central Basin

- 72,000 hectares (177,000 acres) of urban Los Angeles County (more than 1 million people)
- 17 billion m3 (1.8 million acre-feet (AF)) of storage capacity
- Users:
  - cities
  - private water companies
  - individuals, school districts, religious institutions, businesses, golf courses, etc.
  - small group of heavy users responsible for ~75% of production
- Annual production:
  - 1950s: 370 million m3 (MCM) per year (300,000 acre-feet per year (AFY))
  - Judgment: 268.1 MCM per year (217,367 AFY)
  - Safe Yield: ~169.3 MCM per year (137,300 AFY)
- Saltwater intrusion
- 1965 Judgment (amended in 1991 and 2013)

The California Groundwater Experience

West Coast Basin (hydrologically connected to Central Basin)

- 37,000 hectares (91,300 acres) of urban Los Angeles County (>1 million people)
- 8 billion m3 (6.5 million AF) of storage capacity
- Users:
  - cities
  - private water utilities
  - local industry (oil companies)
  - landowners with private wells
  - small group (<20) responsible for 85-95% of production
- Annual production:
  - 1959: 116 MCM per year (94,100 AFY)
  - Judgment: 79.5 MCM per year (64,468 AFY)
  - Safe Yield: 37 MCM per year (~30,000 AFY)
- Saltwater intrusion
- 1961/1966 Judgments (amended in 1989 and 2014)

The California Groundwater Experience

Antelope Valley

- 409,000 hectares (1 million acres) in the western Mojave Desert, 50 miles NE of Los Angeles
- ~86 billion m3 (70 million AF) of storage capacity
- Users:
  - water districts
  - U.S. Air Force Base
  - state agencies
  - 3,000+ overlying landowners (fewer than 100 account for majority of overlying production)
- Annual production:
  - 1951: 493 MCM per year (400,000 AFY)
  - Native Yield: 101.5 MCM per year (82,300 AFY)
  - Augmented Safe Yield: 136 MCM per year (110,000 AFY)
- Subsidence of more than 0.3 meter (1 foot) in areas of the valley
- 2015 Judgment

The California Groundwater Experience

Mojave River Groundwater Basin

- 880,000 hectares (2.2 million acres)
- Users:
  - farms
  - small municipalities
  - more than 800 well producers with minimal production
- Annual production:
  - 1980s: 322 MCM per year (261,000 AFY)
  - Safe Yield: 166.5 MCM per year (135,000 AFY)
  - 2014-2015: 152 MCM per year (123,000 AFY)
- Lawsuit initiated by users of hydrologically-connected Mojave River
- 1996 Judgment

The California Groundwater Experience

Chino

- 62,000 hectares (154,000 acres)
- 22.5 billion m3 (18.3 million AF) of storage capacity
- Users:
  - municipal (24)
  - agricultural (1,000+)
  - industrial/commercial (20+)
- Annual production:
  - Safe Yield: 172 MCM per year (140,000 AFY)
  - Current Production: ~197 MCM per year (160,000 AFY)
- Lawsuit initiated by users of hydrologically-connected Santa Ana River
- 1978 Judgment

The California Groundwater Experience

Santa Maria

- 75,000 hectares (184,000 acres) in coastal area north in Santa Barbara and San Luis Obispo counties
- 18.5 billion m3 (15 million AF) of storage capacity
- Users:
  - public water suppliers
  - overlying landowners
- Annual production:
  - 188.7 MCM per year (153,000 AFY) (2015)
- Recharge facilities needed costly maintenance
- 2008 Judgment

The California Groundwater Experience

Summary of California Groundwater Management Process:

- A lawsuit is filed, bringing all stakeholders/users together
- Determine safe yield (technical analysis)
- Allocate shares of pumping
- Set fee for pumping above allocation
- Secure supplemental water (funded by fees)
- Create adaptive management structure ("watermaster")
- Usually, some or all of the above by stakeholder agreement
- Court maintains continuing jurisdiction

The California Groundwater Experience

Orange County Groundwater Basin

- 90,000 hectares (224,000 acres) in Orange County coastal plain (2.4 million people)
- 81 billion m3 (66 million AF) of storage capacity
- Users:
  - 19 major producers (cities, water districts, private water companies) account for 97%
  - 200 small-capacity wells produce less than 31,000 m3 per year (25 AFY)
- Annual production:
  - 1950s: 179 MCM per year (145,000 AFY), 87% agriculture
  - Today: 370+ MCM per year (300,000+ AFY), mostly urban
- Seawater intrusion
- Managed by Orange County Water District since 1933 without an adjudication (funded by property taxes, pumping fee and overpumping surcharge)

Other Examples of Aquifer Management

Genevese Aquifer, France and Switzerland

- ~4000 hectares (10,000 acres)
- Use:
  - drinking water (10 Swiss wells, 5 French wells)
- Annual production:
  - 1960-1980: up to 14 MCM per year (11,350 AFY)
  - Native Yield: 7.5 MCM per year (6,000 AFY)
  - Currently: 15-17 MCM per year (12,000-14,000 AFY)
- Mining between 1960 and 1980 reduced aquifer storage by about one-third
- 1978 Agreement

Other Examples of Aquifer Management

Los Sotillos Aquifer, Andalucía, Spain

- < 7,000 hectares (17,000 acres)
- Users:
  - 21 agricultural users
  - Combined 2,450 hectares (6,000 acres) of irrigated land
- Annual production:
  - ~3,000 m3 per hectare (less than 1 AF/acre) per year
- In 1980s, national discourse about water rights raised awareness among aquifer users
- Community of Irrigators formed in 1987 – annually assigns equal allocation per hectare

Other Examples of Aquifer Management

Eastern Snake Plain Aquifer (ESPA), Idaho, United States

- 2.8 million hectares (6.9 million acres)
- 1.2 trillion m3 (1 billion AF) of water stored
- Uses:
  - 95% agriculture
  - 5% residential drinking water
- Annual production:
  - 1.35 billion m3 per year (1.1 million AFY)
  - In addition, 10+ billion m3 per year (8.2 million AFY) discharges from aquifer to Snake River
- When senior surface water right holders are not satisfied by Snake River flows, the State can issue curtailment orders restraining junior groundwater right holders from pumping
- 2008 Comprehensive Aquifer Management Plan adopted by State
- 2015 Agreement between surface water and aquifer users

Where Aquifer Management Is Not Working

Ogallala Aquifer, Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas and Wyoming

- 45 million hectares (112 million acres)
- 3.5 trillion m3 (2.9 billion AF) of water stored
- Uses:
  - almost exclusively agricultural
  - >6.2 million irrigated hectares
- Annual production:
  - ~23.5 billion m3 per year (19 million AFY)
- Long-term mining of about 330 billion m3 (267 million AF) between pre-development and 2013
- Water levels have dropped by as much as 75 meters (250 feet) in areas

Where Aquifer Management Is Not Working

Sana'a Aquifer, Yemen

- 320,000 hectares (790,000 acres) (population of nearly 3 million)
- Uses:
  - irrigation (>80% of use)
  - urban (<20%)
- Annual production:
  - Estimated Use: 220-270 MCM per year (178,000 -220,000 AFY)
  - Safe Yield: 79 MCM per year (64,000 AFY)
- Groundwater declines of 3-4 meters annually
- World Bank-supported, US $33 million water management project – "Moderately Unsatisfactory" outcome

Key Conditions for Groundwater Management

Certain, imminent & broad threat of long-term damage to aquifer

- Declining groundwater levels alone have failed to drive action (e.g., San Joaquin, Ogallala, Sana'a)
- What drives action?
  - Seawater intrusion (e.g., coastal Southern California aquifers)
  - Impact to connected surface water source (e.g., ESPA, Mojave, Chino)
- **Certain** = Evidence/data available and accepted by stakeholders
- **Imminent** = Action needed now to address threat
- **Broad** = All water users threatened

Key Conditions for Groundwater Management

Aquifer includes urban water users

- Long-term interest in sustainable local supply
- Responsible to public and subject to political pressure
- Substantial $ source - pass cost along to rate payers (e.g., Southern California aquifers)

Key Conditions for Groundwater Management

Supplemental water source is available

- Safe yield can be met by combination of lowering production and recharging basin
- Limiting existing uses to safe yield may be too severe for water users (e.g., Ogallala, Central Valley)

Key Conditions for Groundwater Management

Aquifer includes junior water rights holders

- Junior users are more willing to compromise in exchange for certain allocations (e.g., ESPA groundwater users, Southern California public water providers)
- Senior users are more likely to advocate for status quo, confident in their legal rights (e.g., Central Valley overlying agriculture) – but must have some risk

Key Conditions for Groundwater Management

Aquifer is not too large

- In a smaller aquifer, it is easier to:
  - Gather data
  - Have accountability - involve all stakeholders
  - Enforce a management agreement
- It is more likely that stakeholders in a smaller aquifer:
  - Will be impacted by their own pumping
    - In contrast, in the Central Valley and Ogallala aquifers, farmer's extractions draw water from broad areas, causing marginal impacts to farmer's own water levels. Worst impacts are not necessarily felt in area where most pumping occurs (border areas).
  - Share commonality with other stakeholders, such as culture, language, water uses (e.g., Los Sotillos, Genevese)

Key Conditions for Groundwater Management

Bottom-Up & Top-Down

- Locally-derived solutions (e.g., Los Sotillos; contrast Sana'a)
- Local solution is then enforced from above (e.g., Southern California)

Key Conditions for Groundwater Management

Bottom-Up & Top-Down

- "Reliance on top-down regulatory approaches has had little success in modifying water use behavior. The [Government of Yemen] is as yet unable to either govern water use effectively, or to control random drilling which continues to undermine Yemen's vital and scarce water resources."

- "An approach involving greater reliance on community-based governance, backed by technical assistance and an adequate legal framework, may have been more successful than the top-down regulatory one adopted, but was not considered."
  - World Bank's Independent Evaluation Group in its 2012 Implementation Completion Report for the US$33M Sana'a Basin Project

Thank you for attending

Eric L. Garner

Partner

Best Best & Krieger LLP

Los Angeles Office

Phone: (213) 787-2561

Email: eric.garner@bbklaw.com

www.bbklaw.com