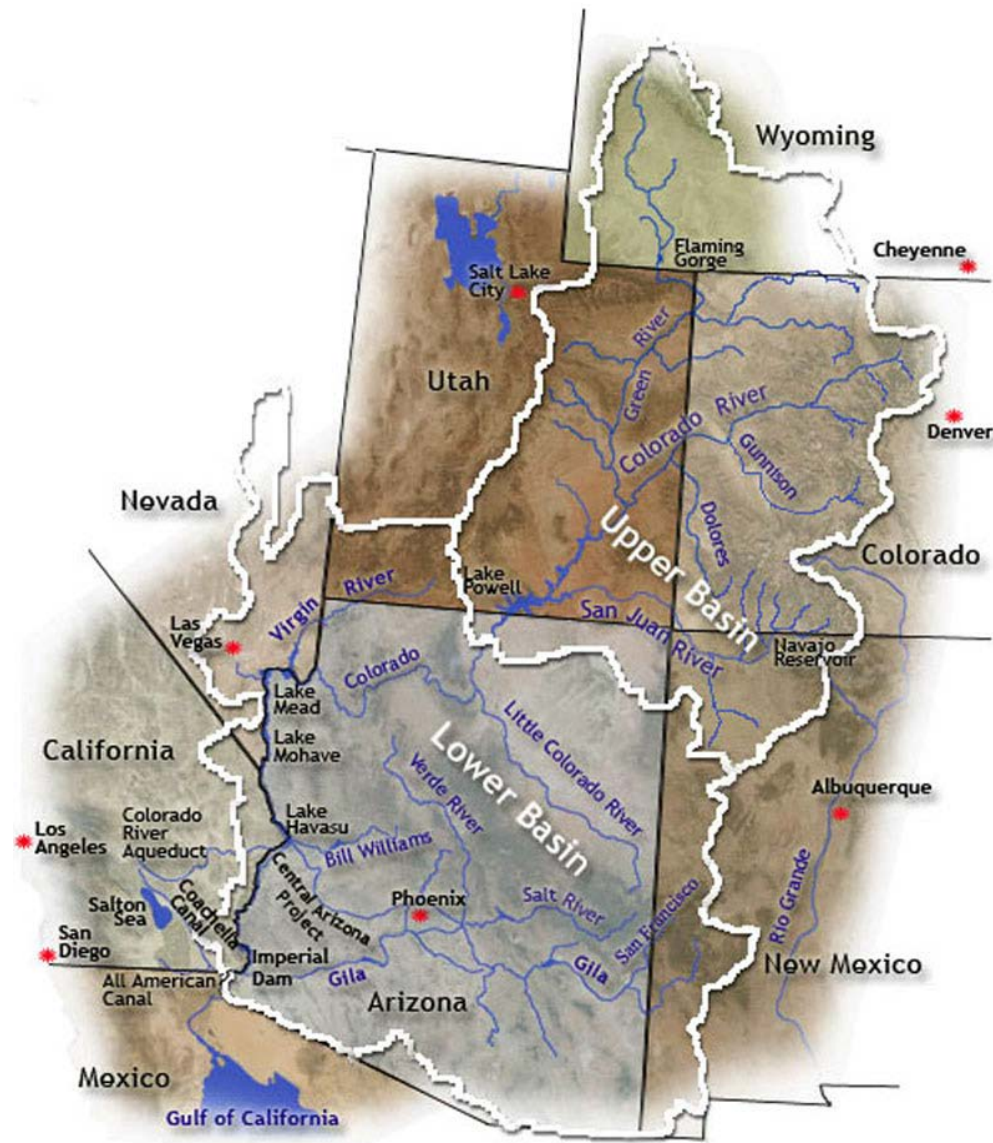


A Case Study in Efficiency – Agriculture and Water Use in the Yuma Area

Presentation by
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October 8, 2015



COLORADO RIVER BASIN

The Law of the River

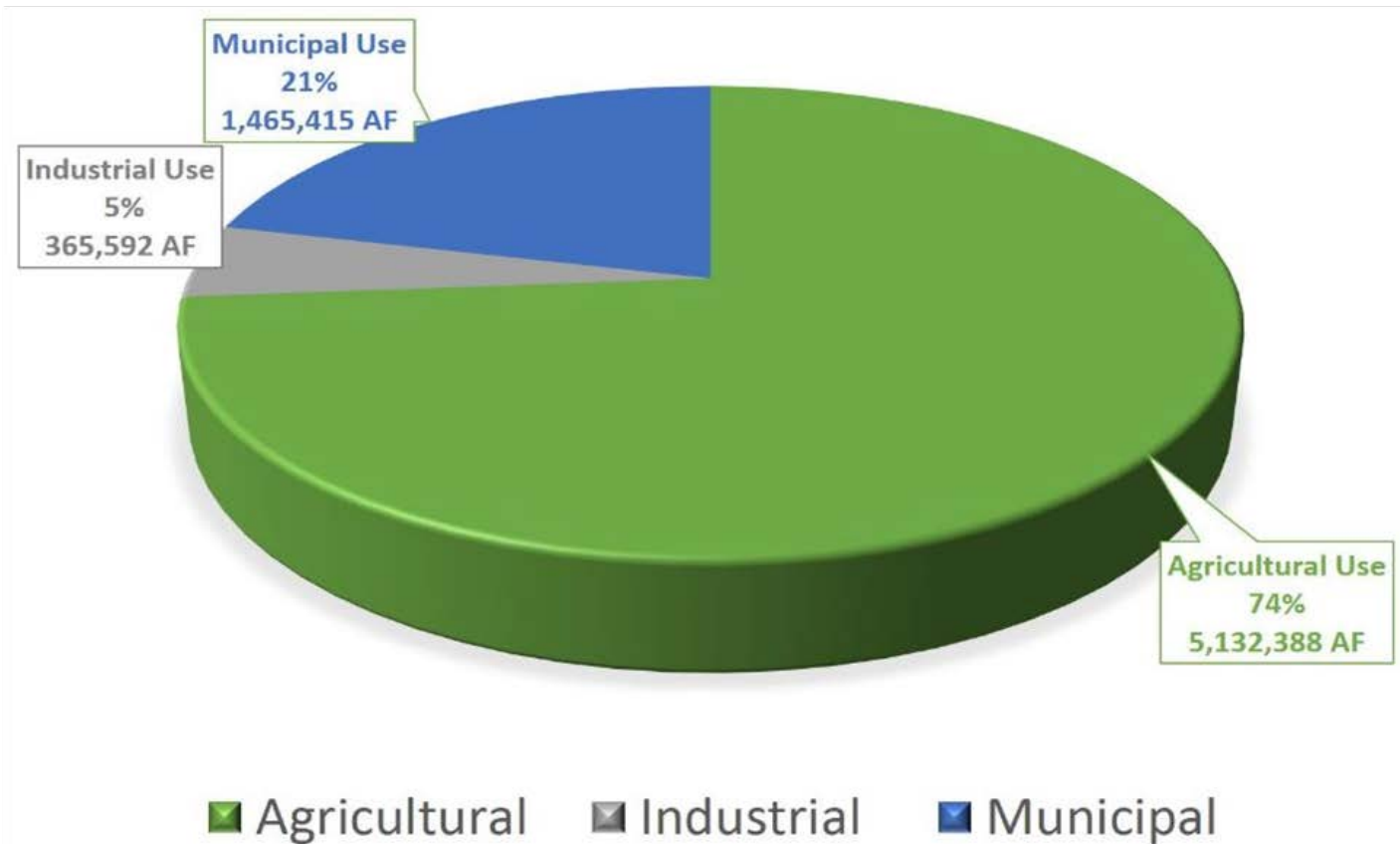
The Law of the River is a term used to describe the many laws, court decisions and decrees, policies, contracts and treaties that govern the operation of the Colorado River system from its headwaters in Rocky Mountain National Park, Colorado south to the international border with Mexico. It is complex and interwoven.

WATER SUPPLY IN ARIZONA

Water Source	Million Acre-Feet (MAF)		% of Total
SURFACE WATER			
Colorado River		2.8	40 %
<i>CAP</i>	<i>1.6</i>		<i>23%</i>
<i>On-River</i>	<i>1.2</i>		<i>17%</i>
In-State Rivers		1.2	17%
<i>Salt-Verde</i>	<i>.7</i>		
<i>Gila & others</i>	<i>.5</i>		
GROUNDWATER		2.7	40%
RECLAIMED WATER		0.2	3%
Total		7 MAF	

WATER USE IN ARIZONA

Arizona's Water Use by Sector (2013)



COLORADO RIVER PROBABILITIES OF SHORTAGE

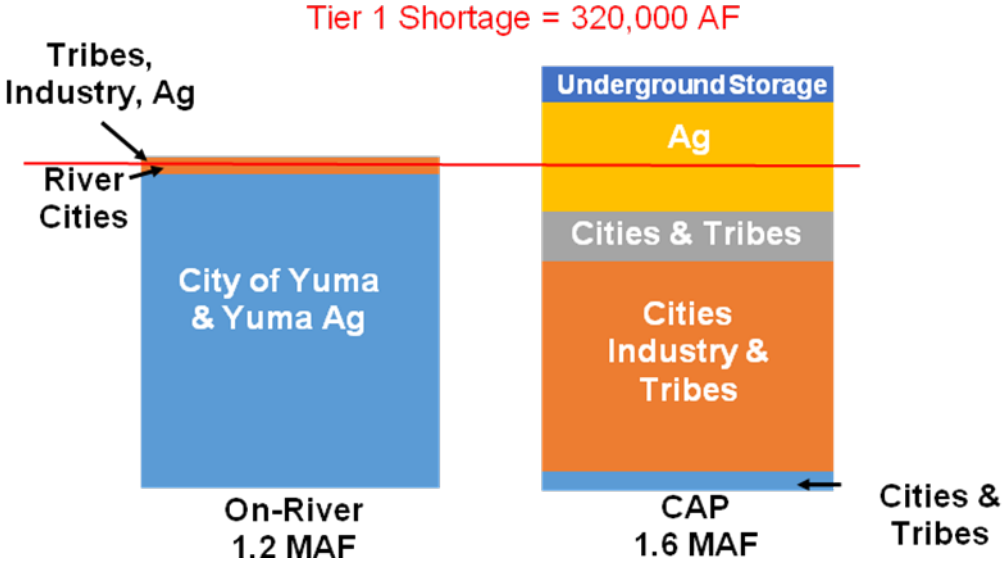
	2016	2017	2018	2019	2020
Probability of any level of shortage (Mead \leq 1,075 ft.)	N	47	65	66	63
1 st level shortage (Mead \leq 1,075 and \geq 1,050 ft)	0	47	46	40	34
2 nd level shortage (Mead $<$ 1,050 and \geq 1,025 ft)	0	0	19	21	20
3 rd level shortage (Mead $<$ 1,025)	0	0	0	5	9

Source: US Bureau of Reclamation CRSS Model Run – June 2015

EFFECTS OF TIER 1 SHORTAGE

Arizona Shortage in the Near Term

Arizona's Allocation - 2.8 MAF



COLORADO RIVER BASIN WATER SUPPLY AND DEMAND STUDY

- Started in January 2010
- Completed in December 2012
- USBR and the 7 basin states
- Defined Current and Future Water Supply and Demand Imbalances
- Developed and Analyzed Strategies
- For next 50 years
- Significant shortfalls
- 3.2 maf/yr

A Case Study in Efficiency –Agriculture and Water Use in the Yuma Area

Case Study Committee

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Myth: “Water is too valuable to use on farms.”

“Although about 80 percent of Colorado River water goes to agriculture, we would be unwise to assume that we can address shortages solely by removing irrigation water from farms. Retiring too much farmland will harm our economy in the Southwest, our food security and our quality of life. Further improving efficiency, judicious switching to less-thirsty crops, and using science to grow more with less water will be essential, but we must be careful not to destabilize rural economies that are the foundation of the basin.”

Anne Castle, former Assistant Secretary for Water and Science, U.S. Dept. of the Interior from “Busting myths about water shortage” at <http://www.utsandiego.com/news/2013/sep/26/busting-myths-about-water-shortage/>

STUDY OUTLINE

- Water Supply
- Infrastructure
- Irrigation Management
- Economics
- Environmental Considerations

WATER SUPPLY

Agricultural water use efficiency has improved over time. The Yuma and Gila Projects were authorized to provide irrigation diversion and water delivery systems.

Competition for water resources within the Colorado River Basin resulted in the Colorado River Compact of 1922 (Compact), and the many laws, court decrees and decisions, policies, contracts and treaties that govern the operation of the Colorado River, collectively known as the Law of the River.

Agricultural water rights in the Yuma area are, in general, among the oldest and best water rights on the Lower Colorado River.

Water management in the Lower Colorado River Basin is unique due to the USBR acting under the authority of the Secretary of the Interior (Secretary) as watermaster. All water releases from Glen Canyon Dam and Hoover Dam and Lower Basin water uses are under the purview of the USBR.

Due to the operational structure of the Lower Colorado River Basin, there is an emphasis in the Yuma area on accuracy when placing water orders because water ordered but not used can result in deliveries to Mexico above their water orders and shortages at Imperial Dam result in irrigators receiving less water than they had ordered.

EARLY WATER USE

- 1800s
- Yuma Project
- Basin-wide competition
- Led to Compact
- Boulder Canyon Project Act
 - Project Authorizations
 - Allocations in Lower Basin
 - Watermaster
- Arizona v. California
- Confirmed Allocations

THE ARIZONA PRIORITY SYSTEM

- Arizona applies a priority system to its apportionment of Colorado River water.
- PPRs as described in the Decree have **first** priority as the most senior rights. Established prior to 1929
- Federal Reservations and Perfected Rights established before September 30, 1968 are **second** priority.
- **Third** priority water rights are held by water users that executed contracts with the United States on or before September 30, 1968. Second and third priority rights are coequal.
- **Fourth** priority rights are held by water users with contracts, Secretarial reservations or other rights established after September 30, 1968. This priority includes the Central Arizona Water Conservation District (CAWCD) contract, and all subcontracts for Central Arizona Project (CAP) water. All fourth priority entitlements are coequal.
- **Fifth** priority water users have contracts for unused Arizona entitlement
- **Sixth** priority water users have contracts for surplus Colorado River water.

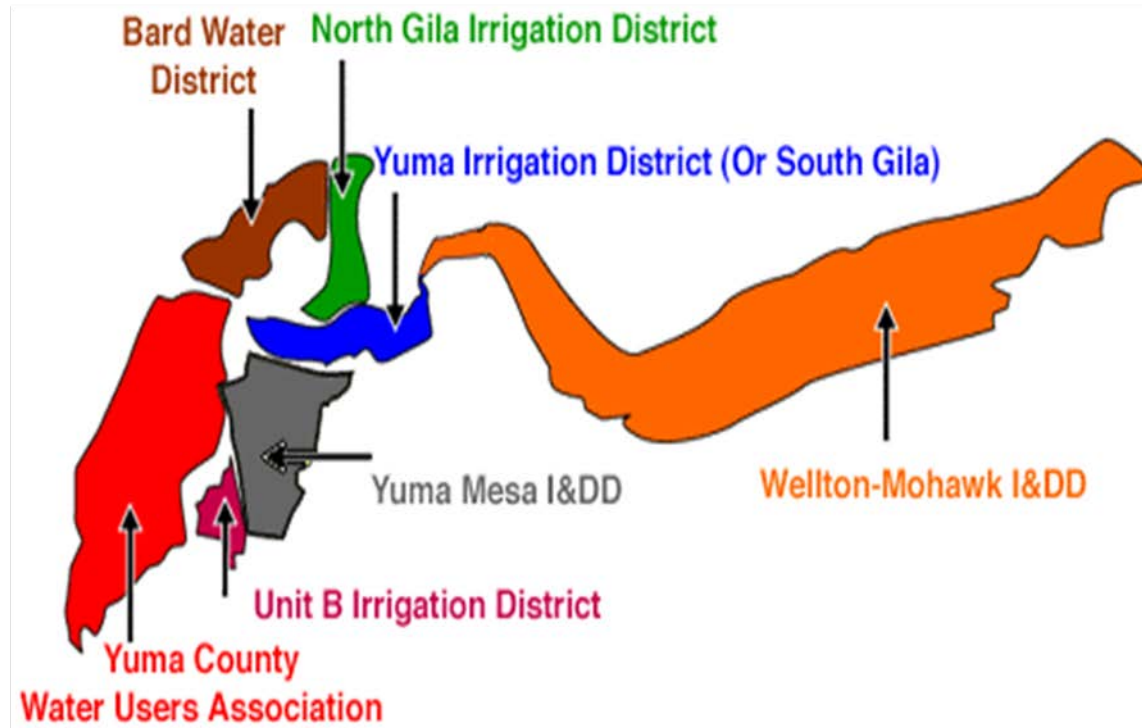
Water Rights for Agriculture in the Yuma Area

- Long Standing, Complex, and Unique
- Water rights vary among the water users in the Yuma area with a combination of PPRs and contractual rights.
- PPRs are the oldest and best water rights on the lower Colorado River.

Yuma Area Irrigation Districts



Yuma Area Irrigation Districts (cont)



Yuma Area Mainstem Agricultural Contractors and their Entitlements and Priorities

Entity	Contract Entitlements	Quantity (in AF)	Priority
WMIDD	Consumptive use	278,000	3rd
YCWUA	Beneficial Use-Diversion Right	254,200	1st
YMIDD ²	Consumptive use	YMD Apportionment	3rd
YID ²	Consumptive use	YMD Apportionment	3rd
NGVIDD ²	Beneficial Use-Diversion Right Consumptive use	YMD Apportionment	1st 3rd
Unit B	Beneficial Use-Diversion Right	6,800	1st

Management of the Colorado River in the Lower Basin

- Unique due to the USBR acting under the authority of the Secretary as watermaster.
- All water releases from Glen Canyon Dam and Hoover Dam and water uses within the lower basin are pursuant to the Law of the River
- Releases from Hoover Dam provide water for the following purposes, in priority order: (1) river regulation and improvement of navigation and flood control; (2) irrigation and domestic uses; and (3) power.
- The USBR schedules water releases only on advance water orders for downstream users.

Management of the Colorado River in the Lower Basin (cont)

Parker Dam is the last facility on the lower Colorado River used by USBR to control downstream releases. Water users are required to carefully assess their water needs to minimize extra releases or shortages at Imperial Dam near Yuma, Arizona. Extra water at the dam can result in additional Colorado River water being delivered to Mexico above their water order. Shortages at Imperial Dam results in each water user taking delivery from the dam being required to take a pro rata reduction in their deliveries to accommodate the shortage. The USBR prepared an analysis in 1961 to evaluate the incidence of over-delivery to Mexico and the incidence of shortages. As a result of the study, Senator Dam Wash and Reservoir were constructed for regulatory purposes. The William H. Brock Reservoir, another regulating reservoir, was constructed in 2010 to conserve water ordered and released but not taken by water users in the United States.

Infrastructure

- Early on, it was recognized that the Yuma area had some of the most productive farm land in the United States.
- Beginning in the late 1800's and early 1900's, the construction of infrastructure in the Yuma area began and the first water was delivered to Yuma Valley fields in 1910.
- The North Gila received water deliveries shortly thereafter.
- Early agricultural practices were less efficient, at both the district level and on-farm. Generally, districts utilized earth ditches and delivered water to farms that furrow irrigated crudely leveled fields.
- The story began to change in the latter part of the 20th century.
- In the 1960's and 1970's, issues with the salinity of the Colorado River began to influence the infrastructure within the Yuma area.

Infrastructure (cont)

- The largest changes came about as a result of the beginning of consolidation within the food industry.
- Arizona farmers adapted readily to consolidated production processes and there was a shift to the Yuma area as a center for vegetable production.
- As Yuma transitioned into a major national production hub, greater demands in quality, size, uniformity and yield were placed on area growers, prompting a cultural transition to the precision management of Yuma grown crops.
- This prompted a need for greater irrigation consistency and efficiency, both at the district and on-farm levels and the Yuma area farmers responded.

Infrastructure (cont)

- The volume of system losses to evaporation, seepage and phreatophytes in main canals, laterals and ditches are highly dependent on whether structures are lined or unlined or within closed conduits.
- Within the Yuma area, there is a very large number of lined canals, laterals and ditches.
- Although the numbers vary by district, over 70 percent of the main canal miles are lined while nearly 90 percent of the lateral miles are lined and over 80 percent of the on-farm ditches are lined.



Concrete Lined Canal

Infrastructure (cont)

- There have been numerous other changes within the districts to improve water use efficiency.
- Include modifications of conveyance systems and turnouts to allow high volume deliveries
- Implementation of improved scheduling and delivery practices including the use of Supervisory Control and Data Acquisition (SCADA) systems for gate control and the use of electronic metering devices.

On-farm Infrastructure Improvements

- Mechanical land-leveling has resulted in improved water distribution and increased water conservation.
- Precision field leveling using lasers is the most current technology.
- In conjunction with leveled fields, water is also applied using alternate delivery methods, including sprinkler and drip irrigation.
- Growers may irrigate the same crop using more than one irrigation method to insure that the volume of water needed to optimize production is delivered to the plant.

Return Flows – Unique to Yuma Area

- The concept of return flows must be included in any discussion regarding infrastructure improvements and water efficiency in the Yuma area.
- In the Yuma area, the majority of contracts with the USBR are consumptive use contracts meaning that the USBR measures both diversions and return flows to the system. The consumptive use is then determined by subtracting return flows from diversions.
- This system is unique to the Yuma area where return flows are available for consumptive use in the U.S. or in satisfaction of the Mexican treaty obligation. By lining a canal, lateral or ditch, the district actually decreases their return flows to the river. Lining enhances system operations but does not necessarily result in increased water in the Colorado River.

ENVIRONMENTAL WATER USE IN YUMA COUNTY AND THE LOWER COLORADO RIVER

- The Lower Colorado River Basin has been the subject of many actions to mitigate river operations by the USBR from Hoover Dam to the Mexican border.
- The National Wildlife refuges along the river were created for the purpose of conservation of fish and wildlife in association with mitigating effects of operation of the federal water projects.
- The LCR MSCP was implemented in 2005 to mitigate the effects of the discretionary operations of the dams by balancing the use of the Colorado River resources with the conservation of native species and habitats. Both agricultural water users and hydropower users in the Yuma area contribute substantially to Arizona's share of the program costs each year.
- Other environmental efforts in the Yuma area include the Yuma East Wetlands, activities within the Gila River channel and cross border environmental efforts.