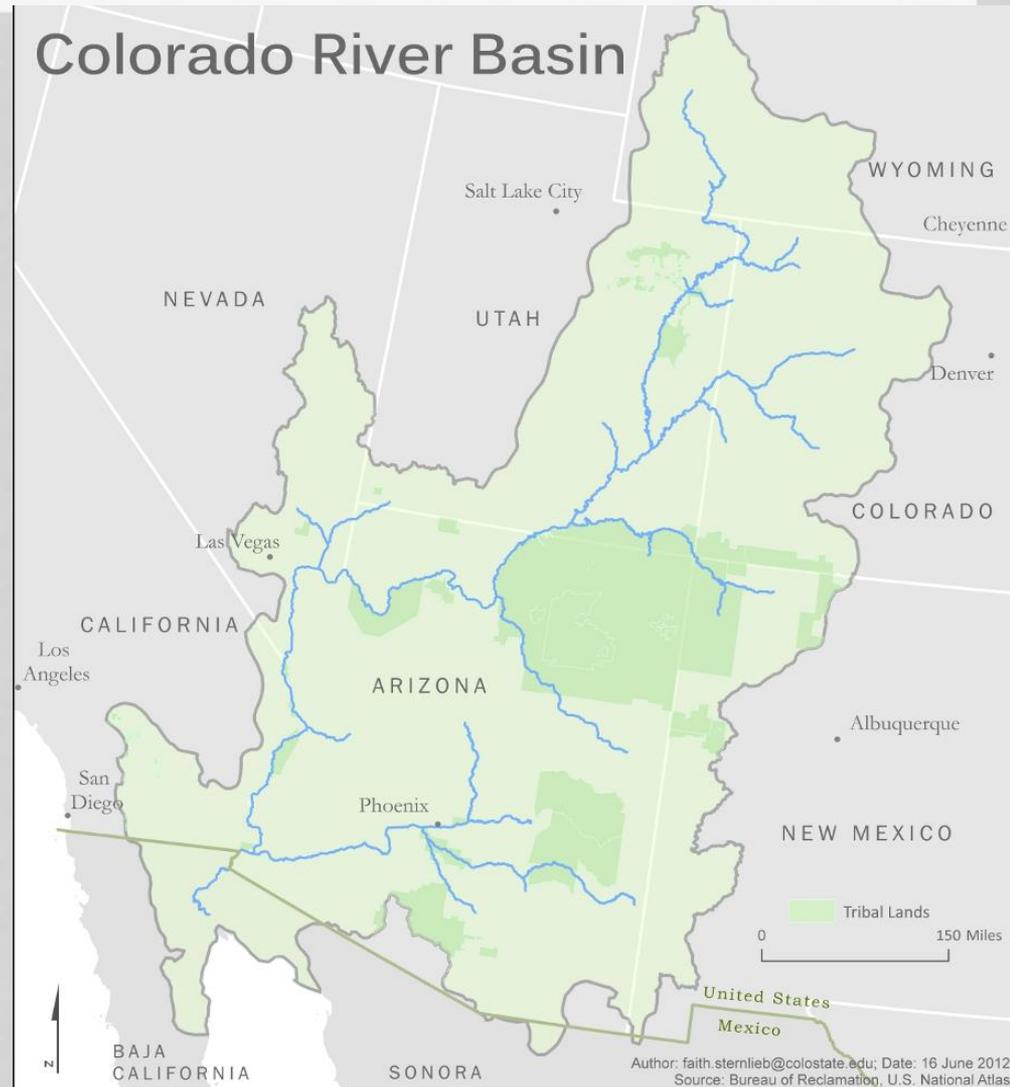


CASE STUDIES

FOR THOSE CONSIDERING AGRICULTURAL WATER CONSERVATION IN THE COLORADO RIVER BASIN

- [Arizona](#)
- [California](#)
- [Colorado](#)
- [Nevada](#)
- [New Mexico](#)
- [Utah](#)
- [Wyoming](#)
- [Multi-state Projects within the Colorado River Basin](#)
- [Projects outside the Colorado River Basin](#)



INTRODUCTION

- Moving Forward on Agricultural Water Conservation in the Colorado River Basin is a USDA-NIFA funded project of the Colorado Water Institute at Colorado State University
- These case studies have been compiled to demonstrate where and how water has been developed in the Colorado River Basin to meet agricultural needs, what changes have been made (or proposed) in those uses to meet different challenges, and how obstacles were addressed.
- To help those considering such changes visualize what can be done, some case studies from outside the Colorado River Basin are included.

INTRODUCTION

- Through a comprehensive literature review, we have produced 78 case studies across the western United States, as well as one international case study, that shed light on various ways water has been diverted for agricultural use and how that water has been managed and its use changed over time to meet both agricultural and other objectives.
- We have categorized the case studies into three general types:
 - **Original water resources development projects:** The original projects that made it possible to use river water for agriculture through such means as diversion and storage.
 - **Programs and regulations:** The local, regional, statewide, and basin-wide processes and programs that have been instituted to better manage the water for purposes such as improving agricultural productivity, meeting endangered species and water quality goals, and conjunctively using groundwater and surface water.
 - **Operation enhancements and water use change:** Cases where practices such as system enhancements, conservation, efficiency enhancement, and in general changes made in agriculture, either management or efficiency, has increased agricultural security or made water available for municipal and environmental water use, or groundwater recharge.

INTRODUCTION

- Through this report, we have identified the projects, irrigation districts, ditch companies, and partnerships that have successfully implemented conservation programs, and have also evaluated various approaches for optimizing use of agricultural water through improving on-farm and delivery system infrastructure and changing management at all levels.
- The case studies can be used in university curricula and as a showcase for decision makers at all levels and scales, from the farm scale to the USDA.
 - These case studies illustrate the sociological, economic, and legal challenges that had to be overcome in order to conserve agricultural water.
- Our intention here has been to provide only basic information about these case studies and provide a foundation for the reader to start their research.
 - We tried to concisely address the main points about each case study that can be cited and provide the corresponding links in the reference section.

ARIZONA

Original Water Resources Development Projects

- [Hohokam Irrigation Canals](#)
- [Swilling Ditch: The First Modern Diversion of the Salt River](#)
- [The Yuma Project and Yuma Auxiliary Project](#)
- [The Gila Project](#)
- [Central Arizona Project](#)
- [Maricopa-Stanfield Irrigation and Drainage District](#)

Programs and Regulations

- [Water Conservation Efforts in Wellton-Mohawk Irrigation & Drainage District](#)
- [Gila River Indian Irrigation District's Water Right Settlement](#)
- [Arizona Best Management Practices Program](#)
- [Arizona Groundwater Management Code](#)
- [Arizona Assured & Adequate Water Supply Programs](#)
- [Arizona Water Banking Authority](#)
- [Arizona Groundwater Banking](#)

Operations Enhancement/Water Use Change

- [YMIDD/CAGRDR Pilot Fallowing and Forbearance Agreement \(Pilot Agreement\)](#)
- [Diamond S Ditch: Automated Gates for Verde River Increased Flows](#)
- [Arizona Land and Water Trust](#)
- [Public Private Partnership for the San Pedro River's Flow Augmentation](#)

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CALIFORNIA

Programs and Regulations

- [PVID/MWD Forbearance and Fallowing Program](#)
- [IID/MWD Water Conservation Program](#)
- [Colorado River Quantification Settlement Agreements](#)
- [Coachella Valley Water Management Plan](#)

Operations Enhancement/Water Use Change

- [All American Canal Lining Project](#)
- [Coachella Canal Lining Project](#)

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COLORADO

Original Water Resources Development Projects

- [Grand Valley Project](#)
- [The Dolores Project](#)
- [Colorado-Big Thompson Project](#)
- [Uncompahgre Project](#)
- [Colorado River Storage Project Act](#)

Programs and Regulations

- [Yampa/White/ Green Basin](#)
- [Colorado Water Bank \(West Slope Water Bank\)](#)
- [Lower Gunnison Salinity Control Project](#)
- [North Fork River Improvement Association](#)

Operations Enhancement/Water Use Change

- [Grand Valley Water Management Plan](#)
- [Orchard Mesa Irrigation District Canal System Improvement Project](#)
- [Montezuma Valley Irrigation Company Water Leasing Proposal](#)
- [Relief Ditch Diversion Modification](#)

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NEVADA

Programs and Regulations

- [Lower Colorado River Basin Intentionally Created Surplus Forbearance Agreement](#)
- [Great Basin Land and Water](#)
- [The SNWA Water Resources Portfolio](#)

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NEW MEXICO

Programs and Regulations

- [San Juan River Settlement Agreement](#)

Operations Enhancement/Water Use Change

- [Sunset Canal Improvement Project](#)

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UTAH

Original Water Resources Development Projects

- [Lake Powell Pipeline Proposal, Utah](#)
- [Central Utah Project](#)
- [San Juan County Utah Multiple Use Project](#)

Programs and Regulations

- [Uinta Basin Salinity Control Project](#)
- [Ferron Salinity Project](#)

Operations Enhancement/Water Use Change

- [The Confluence Nature Park Project](#)

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WYOMING

Original Water Resources Development Projects

- [High Savery Dam and Reservoir: Improving Agriculture and the Environment](#)

Programs and Regulations

- [Wyoming Watershed Management and Rehabilitation Plan](#)

Operations Enhancement/Water Use Change

- [Proposal to Use Coalbed Methane Produced Water](#)

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MULTI-STATE PROJECTS WITHIN THE COLORADO RIVER BASIN

Original Water Resources Development Projects

- [Animas – La Plata Project](#)

Programs and Regulations

- [The San Juan River Basin Recovery Implementation Program](#)
- [Colorado River System Conservation Program](#)
- [Upper Colorado River Endangered Fish Recovery Program](#)
- [Colorado River Basin Salinity Control Project](#)

Operations Enhancement/Water Use Change

- [Ute Mountain Ute Tribe Improved Irrigation Water Technology and Management](#)

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PROJECTS OUTSIDE THE COLORADO RIVER BASIN

Programs and Regulations

- [Freshwater Trust](#)
- [Lower Yuba River Accord](#)
- [Arkansas Basin Roundtable's Template for Ag to Urban Water Transfer](#)
- [Super Ditch](#)
- [The Cap, Murray Darling Basin - Australia](#)
- [Yakima River Basin Integrated Water Resources Management Plan](#)
- [Yakima Basin Water Transfers Working Group](#)
- [Elephant Butte Irrigation District / Audubon](#)
- [Cache County's Water Future](#)

Operations Enhancement/Water Use Change

- [West Side Irrigation District Urban to Ag Transfer](#)
- [South San Joaquin Irrigation District's Pilot Pressure Irrigation Project](#)
- [Umatilla Groundwater Relief](#)
- [Central Oregon Irrigation District Piping Project](#)
- [Three Sisters Irrigation District piping project](#)
- [Manastash Creek Implementation Plan](#)
- [North Fork Blackfoot River, Montana](#)
- [Barker Ranch, Lower Yakima River](#)
- [Columbia Basin Project Irrigation Districts](#)
- [Sunnyside Canal Improvement Project](#)
- [SCADA & Water Measurement Project - Lower Yellowstone](#)
- [Aurora Water: Alternative Transfer Methods in the Arkansas Basin](#)

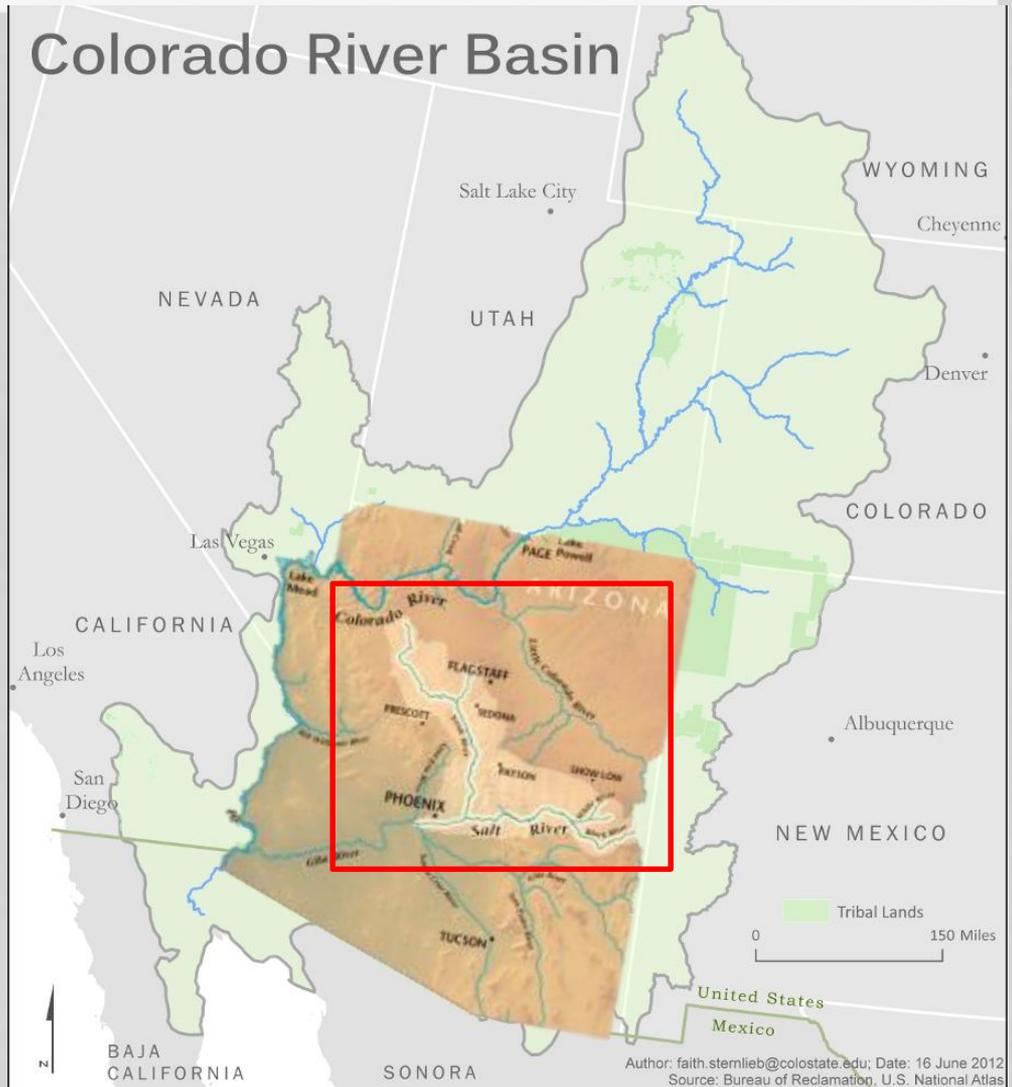
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ARIZONA

HOHOKAM IRRIGATION CANALS

- Located in the Salt River Valley, AZ
- Hohokam people are most noted for constructing irrigation ditches with stone hoes.
- The oldest known water diversion system in the US.
- Sometime between A.D. 600 and 700, Hohokam irrigation engineers designed the first large canals.



HOHOKAM IRRIGATION CANALS

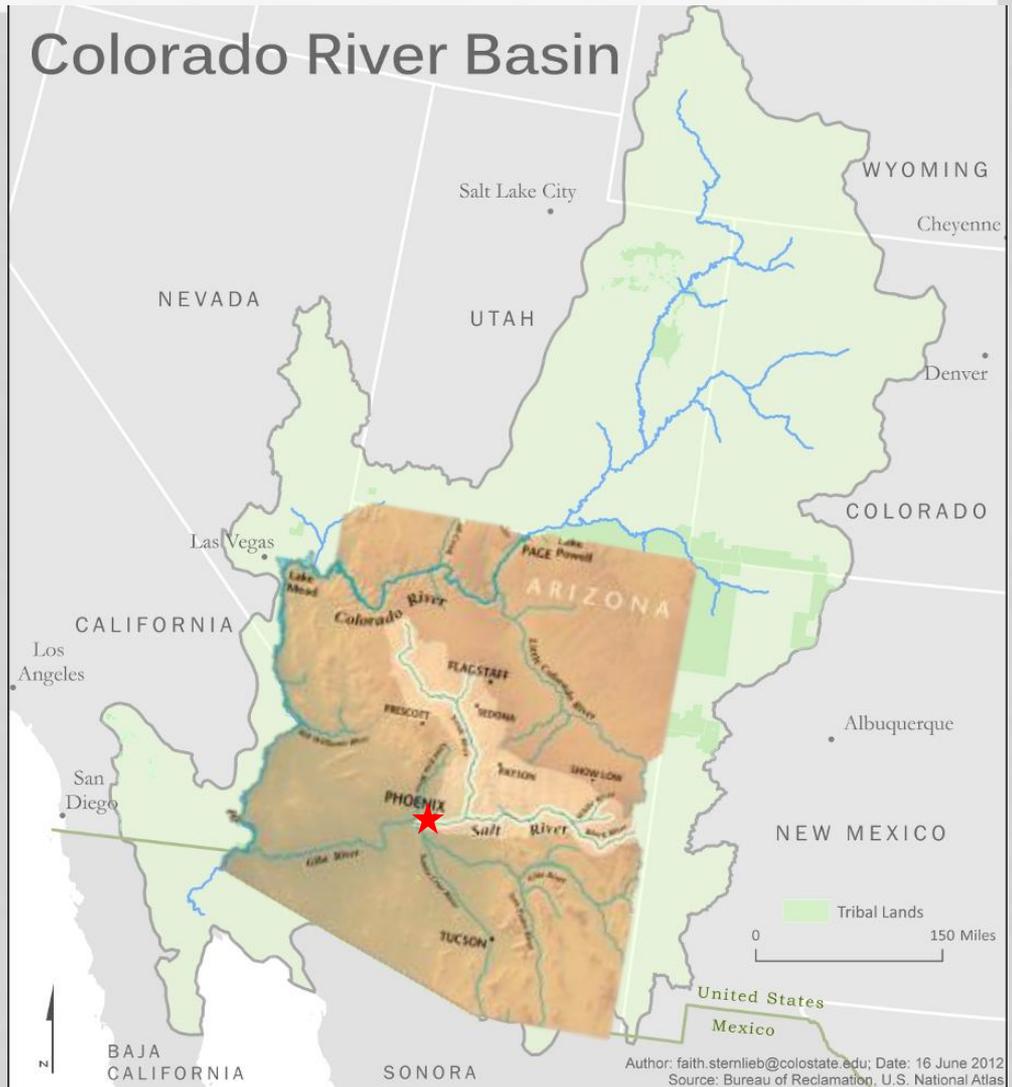
- The Hohokam canal system traversed nearly 500 miles and may have served as many as 50,000 people at a time.
- Many of the canals were over 12 miles in length. The largest recorded Hohokam canal extends for 20 miles. The canals measure 26 and 18 meters in width and approximately 6.1 meters in depth.
- It is likely that the Hohokam canal systems were united into "irrigation communities," sociopolitical units characterized by a hierarchy with distinct leadership roles.
- Each irrigation community would have its own leadership to organize labor for main canal construction, maintenance of the canals, headgates and weirs, the establishment of water allocations and scheduling, and to resolve local conflicts.

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SWILLING DITCH

- This case is about the first modern diversion of the Salt River.
- When Swilling noticed the remnants of canals constructed by the ancient Hohokam people, he realized the irrigation potential of the Salt River Valley.
- In December 1867, he formed the Swilling Irrigation and Canal Company.



SWILLING DITCH

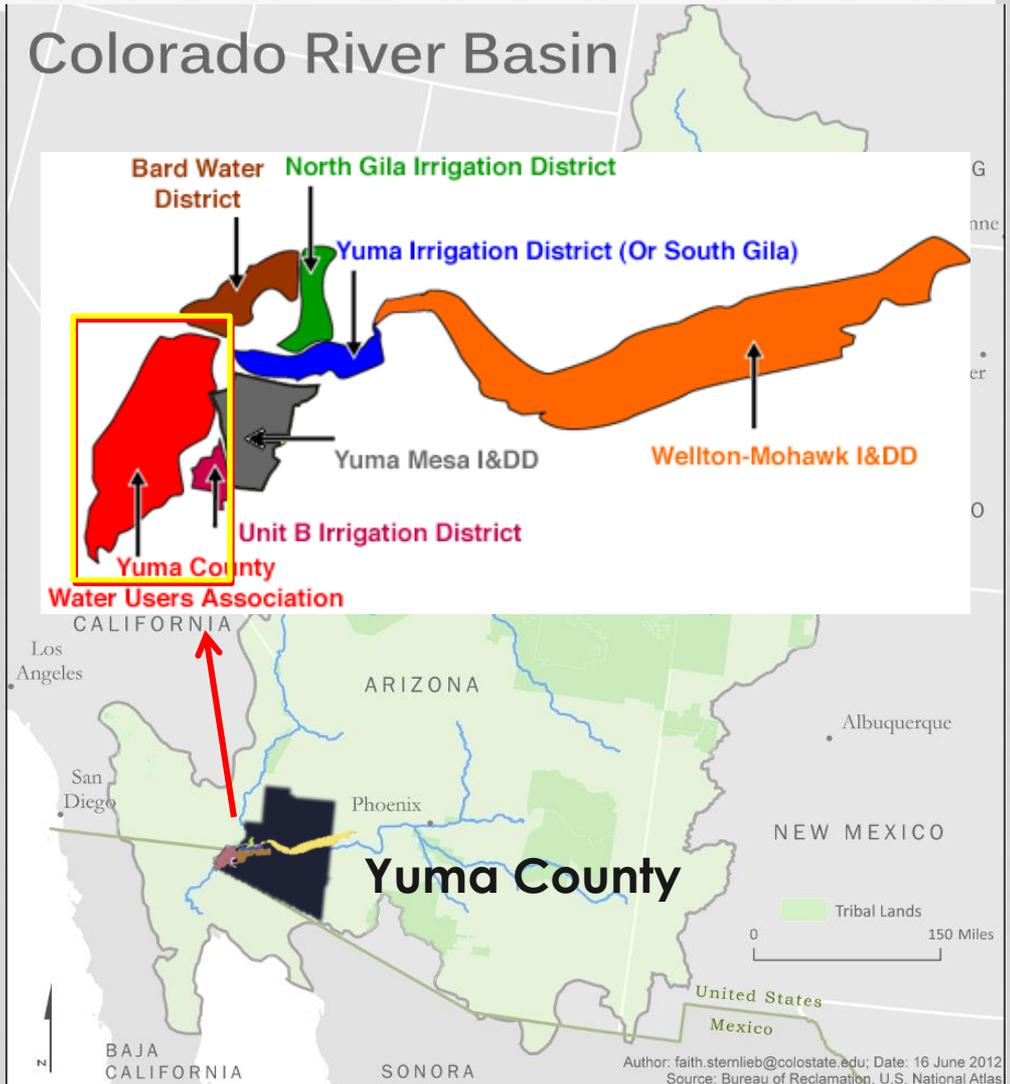
- In 1867, with 16 other stakeholders, Swilling intended to take water from the Salt River via a canal so he could grow crops to sell to miners at Wickenburg and the U.S. Cavalry stationed at Ft. McDowell.
- “Swilling’s Ditch,” first known as “The Salt River Valley Canal,” was completed in 1868.
- Swilling apparently was involved in the development of or had a financial interest in at least five canals in addition to the original Swilling Ditch in the Valley.
- These subsequent series of projects eventually became part of the Salt River Project, which, today, supplies water and power to many of the over four million people in the Phoenix region.

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THE YUMA PROJECT AND YUMA AUXILIARY PROJECT

- Located in Yuma County, Southwest Arizona
- The U.S. Bureau of Reclamation initiated the Yuma Project in 1905 and authorized the Yuma Auxiliary Project in 1917.
- Goals:
 - Yuma Project: to exploit water from the Colorado River and supply it to fertile lands of the Yuma Valley in Arizona
 - Yuma Auxiliary Project: to reduce water loss through conservation practices



THE YUMA PROJECT AND YUMA AUXILIARY PROJECT

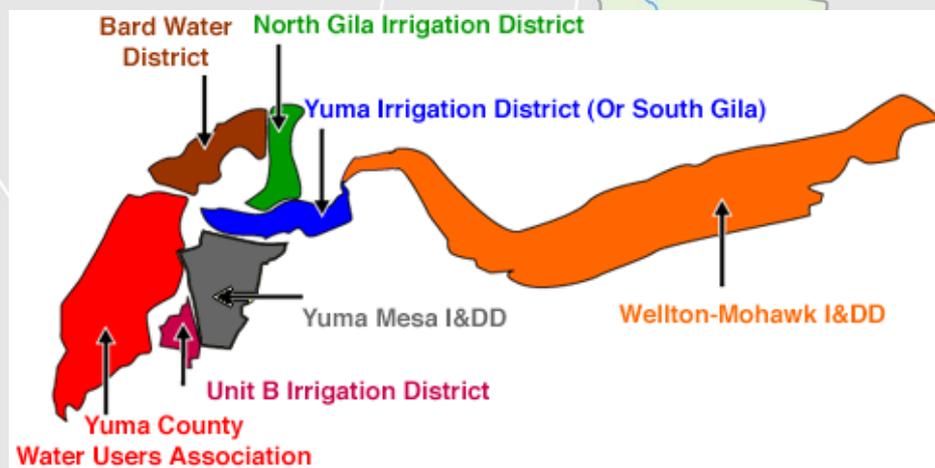
- The Yuma Project is divided into the Reservation Division, which includes 14,676 acres in California, and the Valley Division, which covers 53,415 acres in Arizona.
 - The project uses a system of infrastructures including Laguna Dam, the Boundary Pumping Plant, an unnamed power plant, and a system of canals, laterals, and drains.
- The Yuma Auxiliary Project is often referred to as Yuma Mesa, the Mesa Division, or Unit "B."
 - It was initially planned to have four divisions (A, B, C, and D) to irrigate 45,000 acres of farm land on Yuma Mesa
 - Except Unit "B," the three other units were never developed and the Yuma Auxiliary Project was reduced to 3,305 acres in size by an act on June 13, 1949.



THE GILA PROJECT

- The Gila Project is divided into two divisions:
 - The Yuma Mesa Division, subdivided into three units:
 - The Mesa Unit
 - The North Gila Valley
 - South Gila Valley Units
 - The Wellton-Mohawk Division
- Goal: to divert Colorado River water to satisfy beneficial consumptive use of 300,000 acre-feet of water in each division.

Colorado River Basin



THE GILA PROJECT

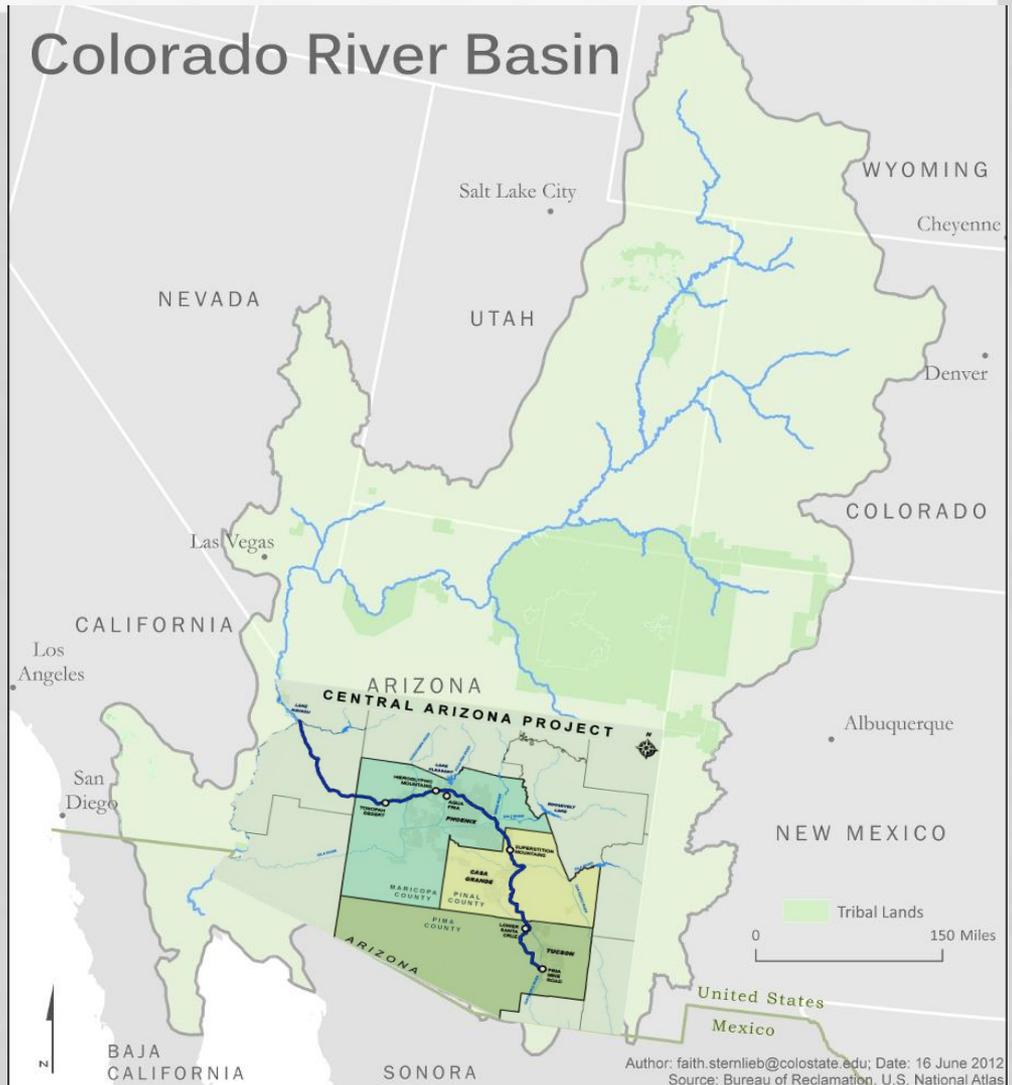
- The project currently provides irrigation service to about 98,000 acres of land.
- Upon full development, the project could provide irrigation service to 65,000 acres in the Wellton-Mohawk Division (reduced from 75,000 acres by the Colorado River Basin Salinity Control Act of 1974) and 42,131 acres in the Yuma Mesa Division.
- The project benefits domestic, municipal and industrial water users as well.
- Project features include: the Gila desilting works at Imperial Dam, the Gila Gravity Main Canal, the Mesa Unit Canals and distribution system, the lateral system in the North Gila Valley, the canal and pipeline distribution in the South Gila Valley, the Wellton-Mohawk Canal distribution and drainage systems

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CENTRAL ARIZONA PROJECT

- Constructed by U.S. Bureau of Reclamation
- Operated by Central Arizona Water Conservation District (CAWCD)
- To deliver the full allocation of Colorado River water to central Arizona and to conserve groundwater supplies by importing surface water from the Colorado River



CENTRAL ARIZONA PROJECT

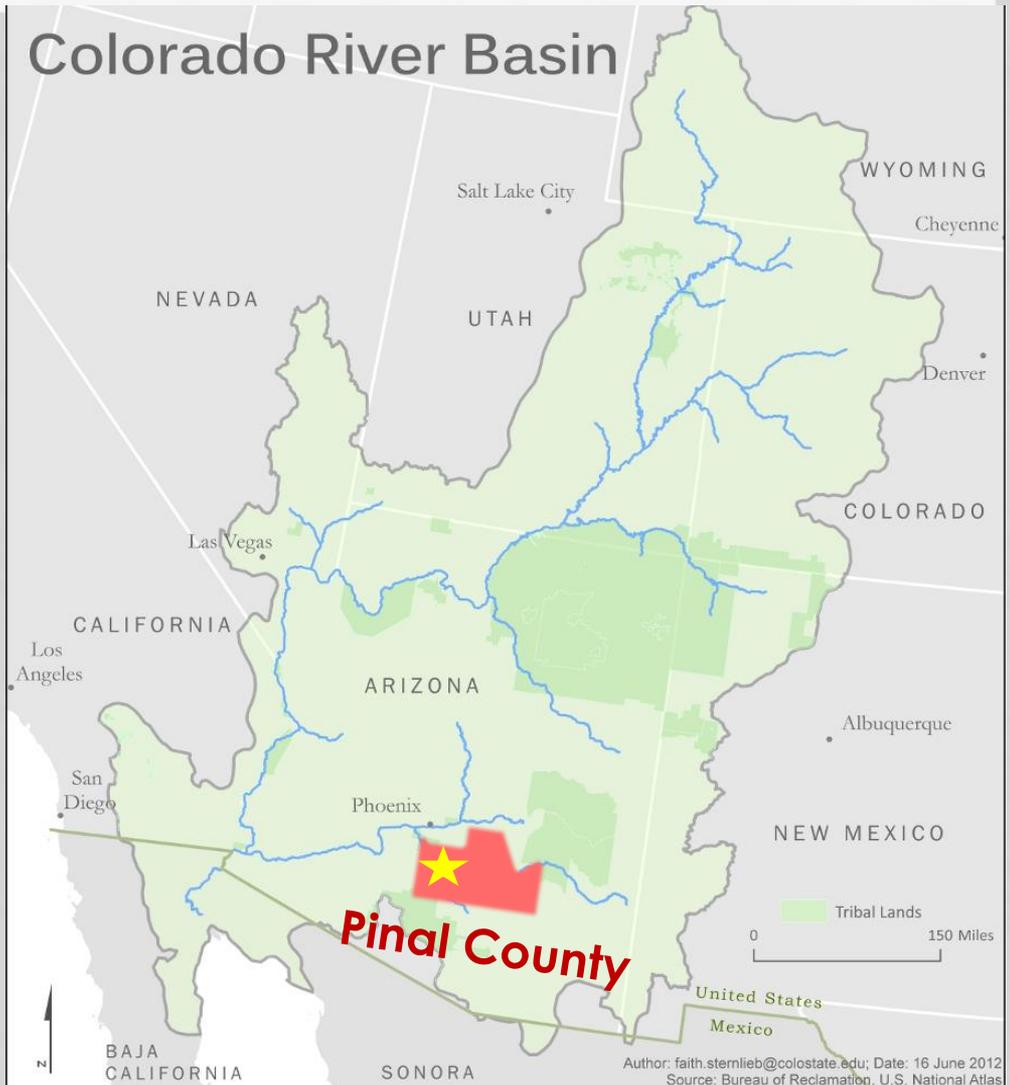
- In 1973, canal construction began at Lake Havasu. Twenty years later the canal was complete.
- A 336-mile canal carrying 1.5 million acre-feet water with the maximum capacity of 2.2 million acre-feet was built to carry water from Lake Havasu to users in Pima, Pinal and Maricopa counties.
- The project will ultimately provide Colorado River water to nearly 700,000 acres of non-Indian agricultural lands and up to 136,900 acres of Tribal lands.
- CAP's delivery of Colorado River water from 1986 through 2010 generated more than \$1 trillion of Arizona's gross state product. In recent years, CAP water deliveries have generated about \$100 billion per year in economic benefit

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MARICOPA-STANFIELD IRRIGATION AND DRAINAGE DISTRICT

- Formed in 1962 to provide irrigation water for agricultural use.
- The district received its CAP water through one aqueduct turnout and operates 75 miles of main conveyance canals, 136 miles of lateral canals and pipelines, 186 farm turnouts and 396 irrigation wells.



MARICOPA-STANFIELD IRRIGATION AND DRAINAGE DISTRICT

- MSIDD contains an area of about 148,000 acres.
- The Districts Central Arizona Project allocation is 110 thousand acre-feet per year, supplemented with groundwater.
- Annual water use:
 - 2006 was 274 TAF
 - In 2007 rose to 314 TAF
 - Approximately 330 TAF was predicted for 2008

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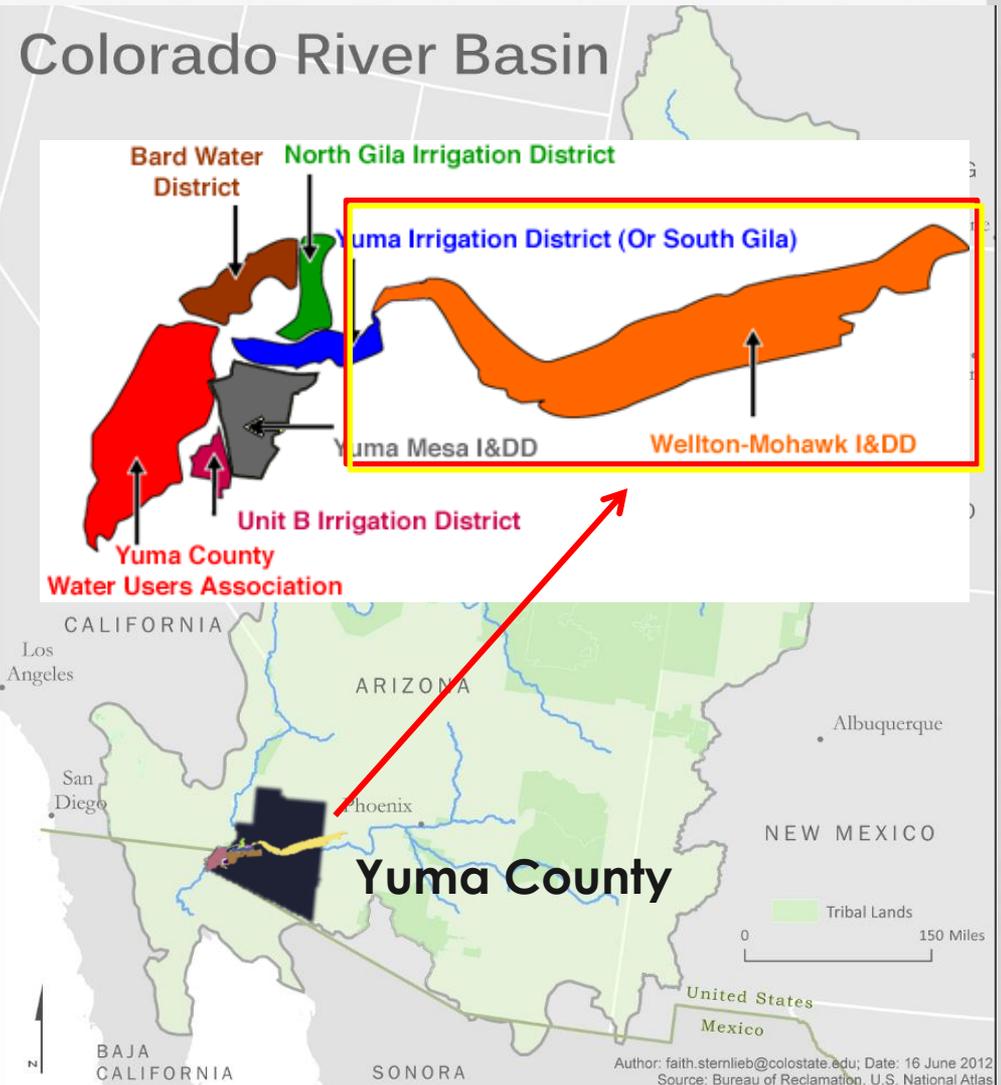
WATER CONSERVATION EFFORTS IN WELLTON-MOHAWK IRRIGATION & DRAINAGE DISTRICT

Projects:

- Wellton-Mohawk Salinity Control Project
- Drainage Reduction Program
- The Settlement Act

Goals:

- To decrease salt concentrations in Mexico's water allocations
- To save water for the Salt River-Pima-Maricopa Indian Community Water Rights



WATER CONSERVATION EFFORTS IN WELLTON-MOHAWK IRRIGATION & DRAINAGE DISTRICT

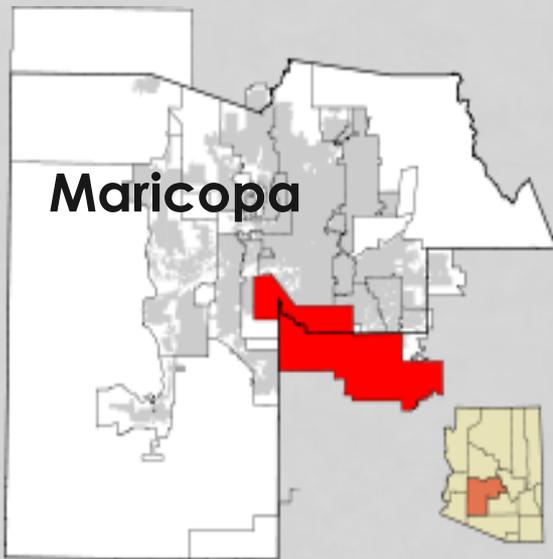
Prompted by:

- Increased salt levels in Mexico's water allocations
- Litigation over the water rights of the Pima-Maricopa Community (for the Settlement Act)
- About 22,000 acre-feet per year reduction in consumptive use
- Actions include: Acreage Reduction, Irrigation Scheduling, Precision Land-Leveling, Improved Farm Ditches and Turnouts, Soil Swapping
- On-farm improvements funded by the USDA Soil Conservation Service

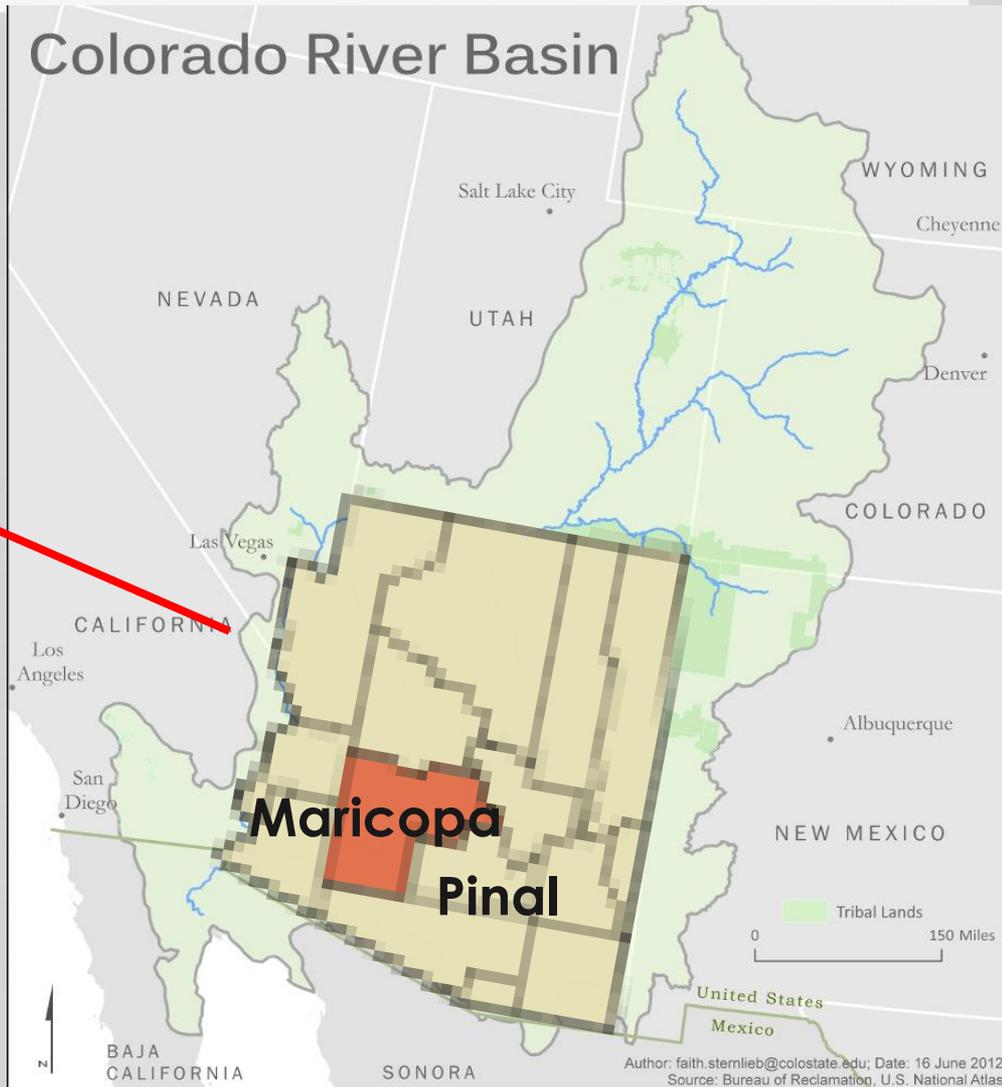
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GILA RIVER INDIAN IRRIGATION DISTRICT'S WATER RIGHT SETTLEMENT



In 2004, tribal leaders received the rights to more than 600,000 AFY in the largest Indian water settlement in U.S. history.



GILA RIVER INDIAN IRRIGATION DISTRICT'S WATER RIGHT SETTLEMENT

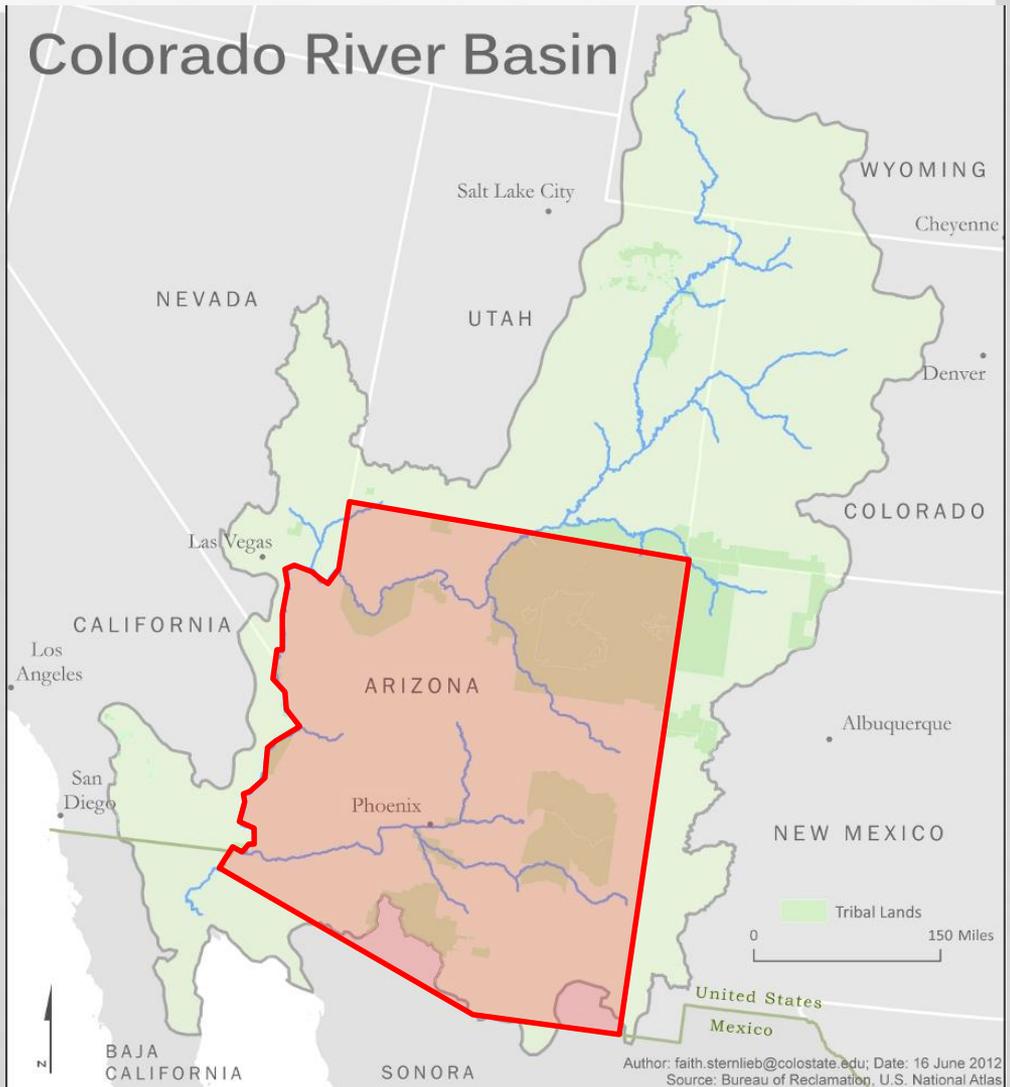
- 311,800 acre-feet will be delivered through the Central Arizona Project Canal.
- The Gila River community would use almost all of its water for agriculture instead of leasing it to off-reservation cities. They will sell one-time water credits each year to cities or other big water users that need an immediate supply.
- Not all Arizonans wanted to set aside so much water for tribal claims from the CAP, which is Arizona's potential to grow and prosper.
- By 2029, the Gila River community plans to build or refurbish at least 1,700 miles of canals to create a system that will irrigate more than 100,000 acres.

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ARIZONA BEST MANAGEMENT PRACTICES PROGRAM

- Authorized by the Arizona State Legislature in 2002.
- To keep the farming industry on a sustainable path.
- The program was developed with grant assistance from the Natural Resources Conservation Service.
- Partners include:
 - University of Arizona
 - USDA-Agricultural Research Service



ARIZONA BEST MANAGEMENT PRACTICES PROGRAM

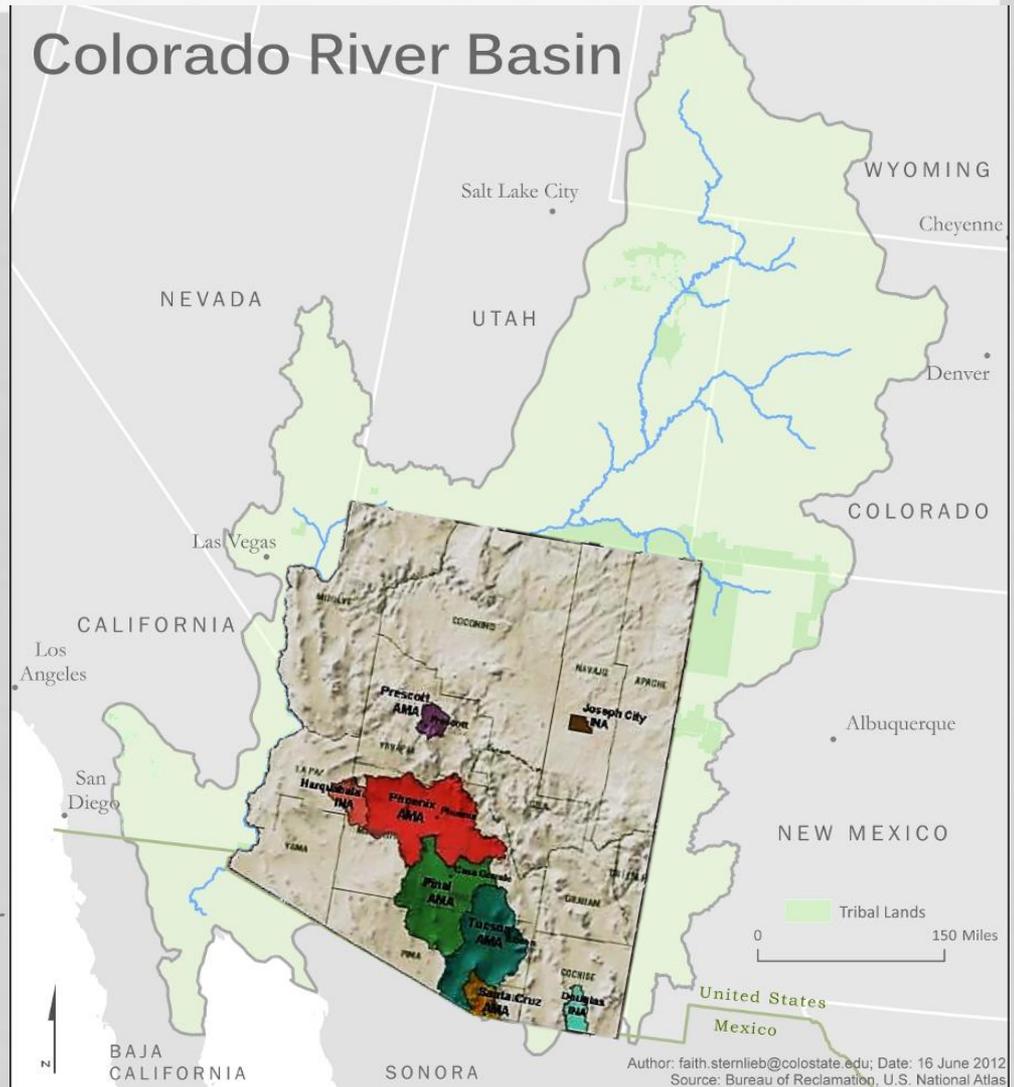
- This program provides incentives to farmers to follow suggestions from the Arizona Department of Water Resources.
- The goal is to ensure that 80% of the water applied to crops is absorbed and not wasted.
- Approved BMPs are separated into four distinct categories:
 1. Water Conveyance System Improvements
 2. Farm Irrigation Systems
 3. Irrigation Water Management
 4. Agronomic Management
- Each BMP has a point value based on its potential contribution for water conservation. A BMP program applicant should score at least 10 points, but they can only score a maximum of three points in each category.

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ARIZONA GROUNDWATER MANAGEMENT CODE

- Due to concerns about groundwater overdraft in Arizona, the Arizona Legislature created the Groundwater Management Code in 1980.
- Three primary goals:
 1. Control severe overdraft occurring in many parts of the state.
 2. Provide a means to allocate the state's limited groundwater resources
 3. Augment Arizona's groundwater through water supply development



ARIZONA GROUNDWATER MANAGEMENT CODE

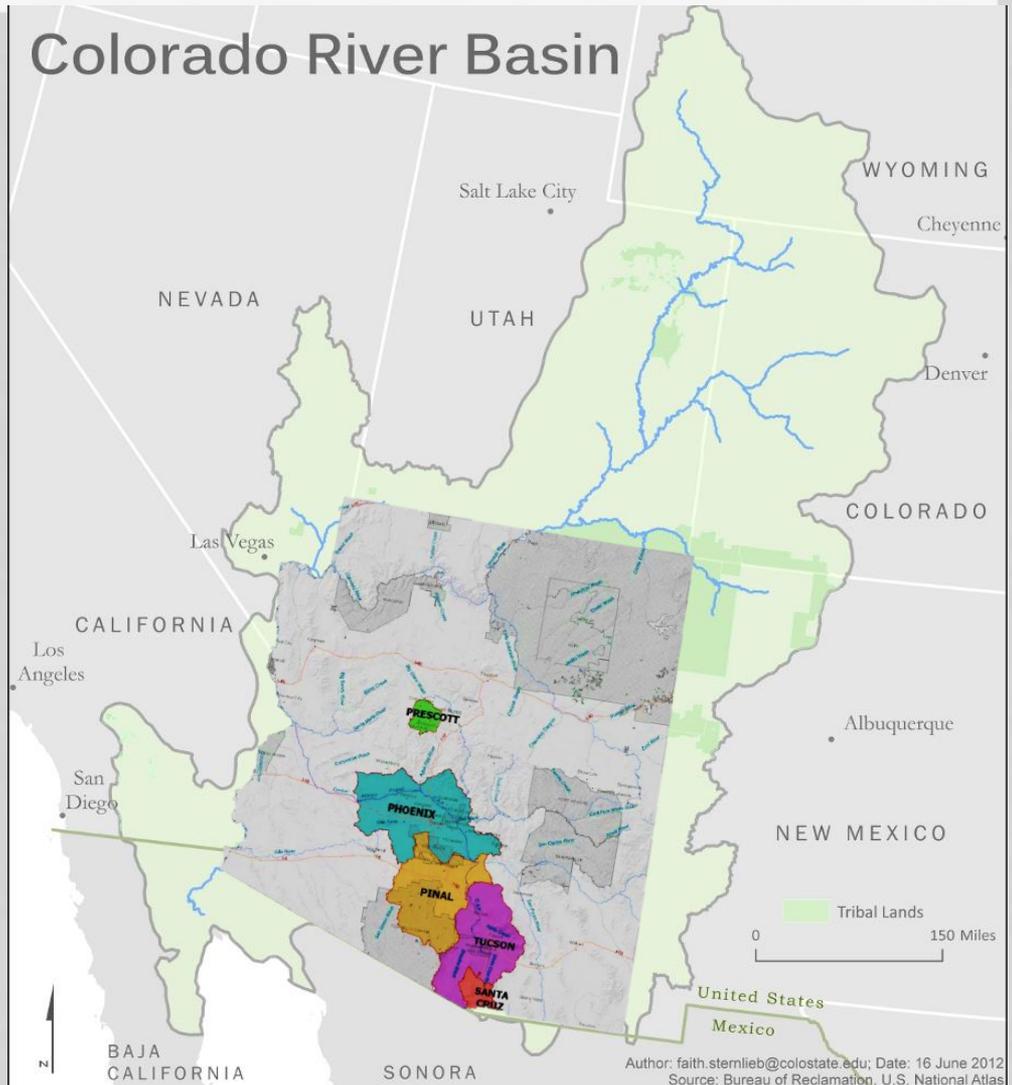
- The six key provisions of the code include:
 1. Create a program of groundwater rights and permits
 2. Prohibit irrigation of new agricultural lands within AMAs
 3. Prepare a series of water management plans for each AMA for conservation targets
 4. Require developers to demonstrate a 100-year assured water supply for new growth
 5. Meter or measure water pumped from all large wells
 6. Report water withdrawal and use annually
- The Code established three levels of water management to respond to different groundwater conditions:
 - General provisions that apply statewide (lowest management level)
 - Provisions that apply to Irrigation Non-Expansion Areas–INAs
 - Provisions that apply to Active Management Areas–AMAs, where groundwater overdraft is most severe (highest level)

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ARIZONA ASSURED & ADEQUATE WATER SUPPLY PROGRAMS

- Arizona Department of Water Resources adopted two programs:
 - Assured Water Supply Program
 - Adequate Water Supply Program
- To address the problem of limited groundwater supplies in Arizona, and protect and preserve limited groundwater supplies within Arizona's five Active Management Areas (AMAs), areas with heavy reliance on mined groundwater.



ARIZONA ASSURED & ADEQUATE WATER SUPPLY PROGRAMS

Assured Water Supply Program:

- Created in 1980 as a part of the Groundwater Code and is practiced within AMAs.
- Applies when a subdivision, six or more parcels with at least one parcel having an area less than 36 acres, is being developed.
- Based on this program, developers must demonstrate all of the following criteria before recording plats or selling parcels:
 - Physical, legal, and continuous water supply availability for the next 100 years
 - The financial capability to construct any necessary water storage, treatment, and delivery systems
 - Proof of sufficient quality of water for the proposed use
 - Consistency of the proposed water use with the management goal of the AMA
 - Consistency of the proposed water use with the current management plan of the AMA.

ARIZONA ASSURED & ADEQUATE WATER SUPPLY PROGRAMS

Adequate Water Supply Program:

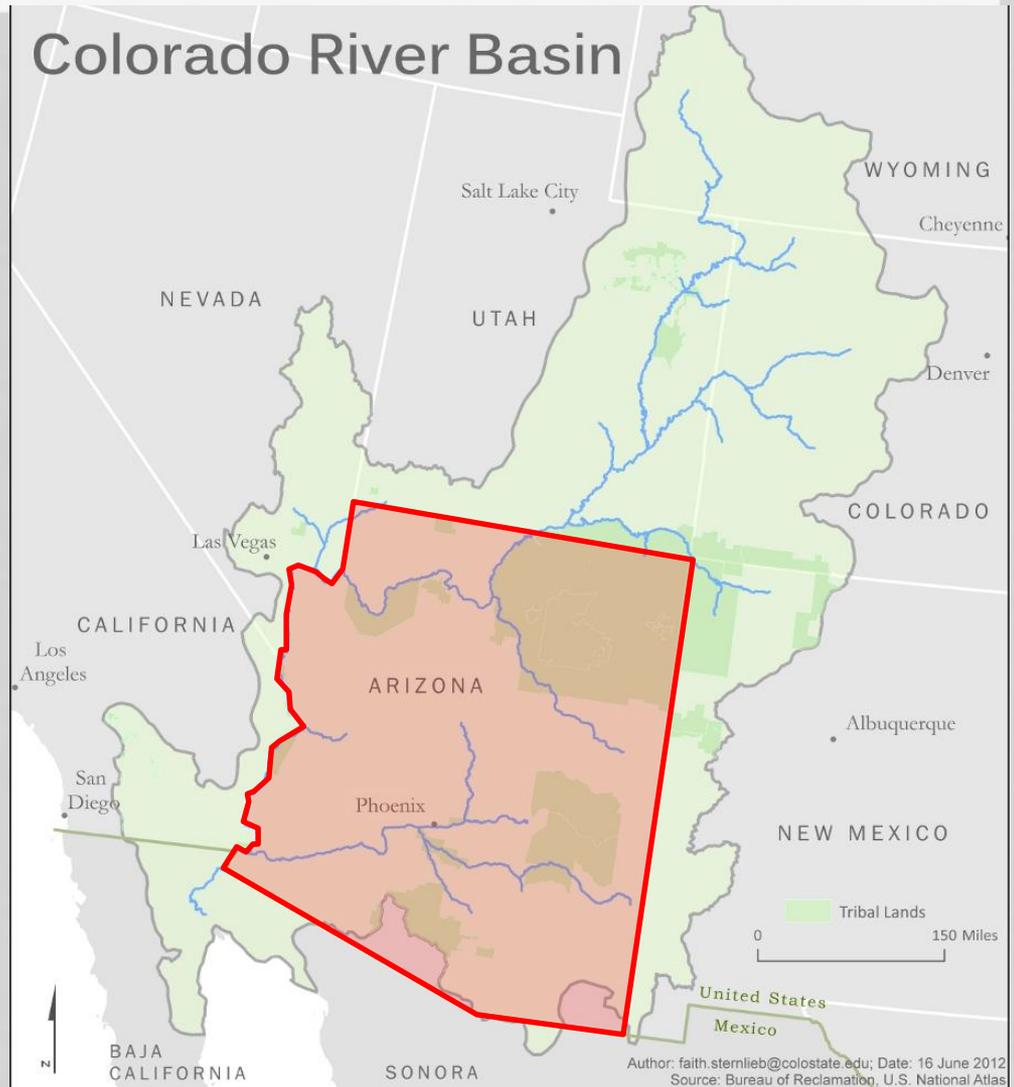
- Created in 1973 in response to the marketing of lots without available water supplies.
- The purpose of this program is to assure that real estate buyers are informed about any water supply limitations.
- It is practiced outside the AMAs as a consumer advisory program and is not as protective as the Assured Water Supply Program.
- Only the first five criteria of the Assured Water Supply Program must be demonstrated to obtain a Designation of Adequate Water Supply from ADWR.

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ARIZONA WATER BANKING AUTHORITY

- Arizona once underutilized its full 2.8 million acre-foot share of water from the Colorado River.
- In order to enable full utilization of the state's Colorado River entitlement and develop long-term storage credits for the unused portion of the entitlement, the Arizona Water Banking Authority was established in 1996.



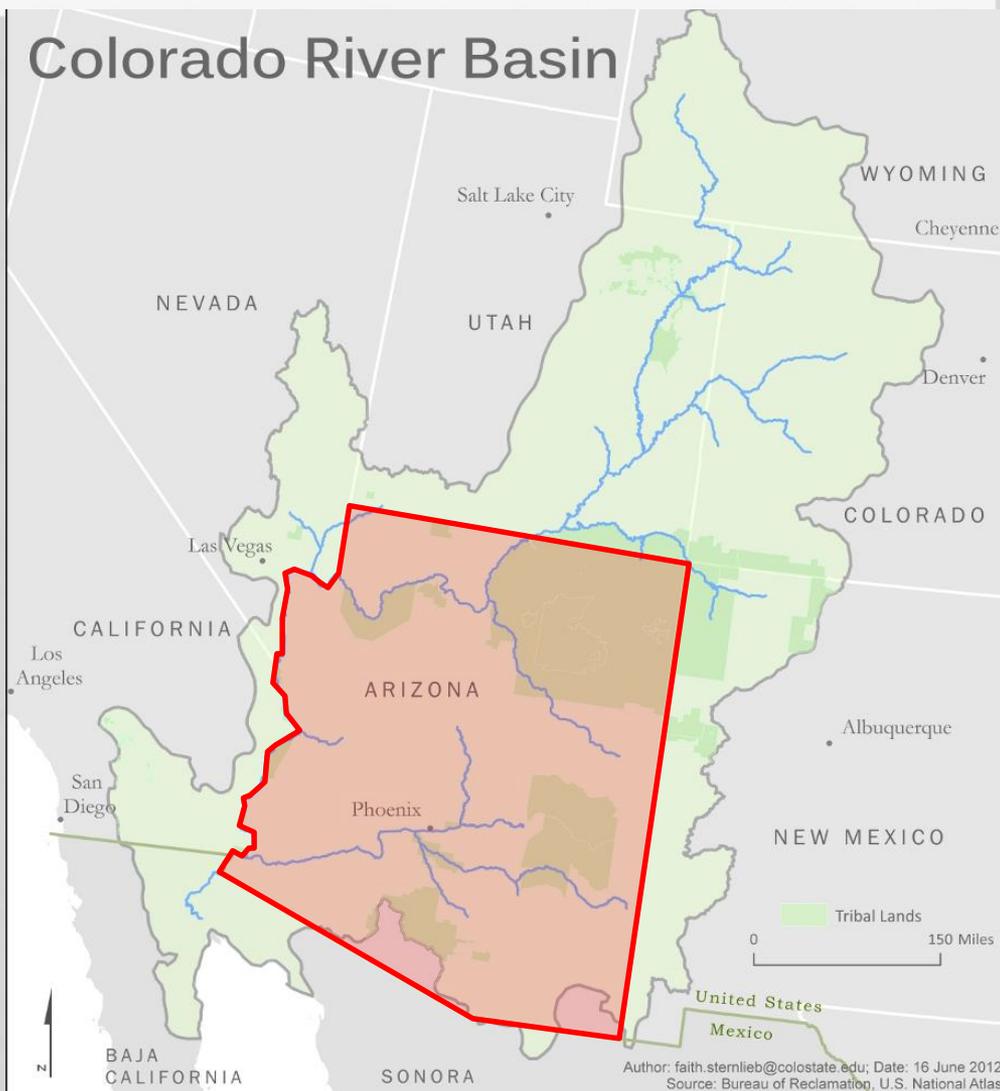
ARIZONA WATER BANKING AUTHORITY

- The stored water in the bank will be used to:
 - Supply municipal and industrial demands and serve communities along the Colorado River at the time of shortage
 - Fulfill the state's water management objectives
 - Comply with water rights settlement agreements among Indian communities
 - Assist Nevada and California through interstate water banking
- Since its establishment through 2013, the Bank has delivered about 4.1 million acre-feet for storage.
- The Arizona Water Bank stores water at two types of facilities:
 - Underground Storage Facility (USFs): Facilities that physically store water in the aquifer through direct recharge.
 - Groundwater Savings Facility (GSFs): Indirect recharge facilities that replace pumped groundwater with surface water instead .



ARIZONA GROUNDWATER BANKING

- At the beginning, the Central Arizona Project (CAP) water was more expensive than pumped groundwater
 - Discouraging farmer participation and encouraging them to continue pumping groundwater.
- On the other hand, cities used to leave their excess allotments in the Colorado River that would flow downstream.



ARIZONA GROUNDWATER BANKING

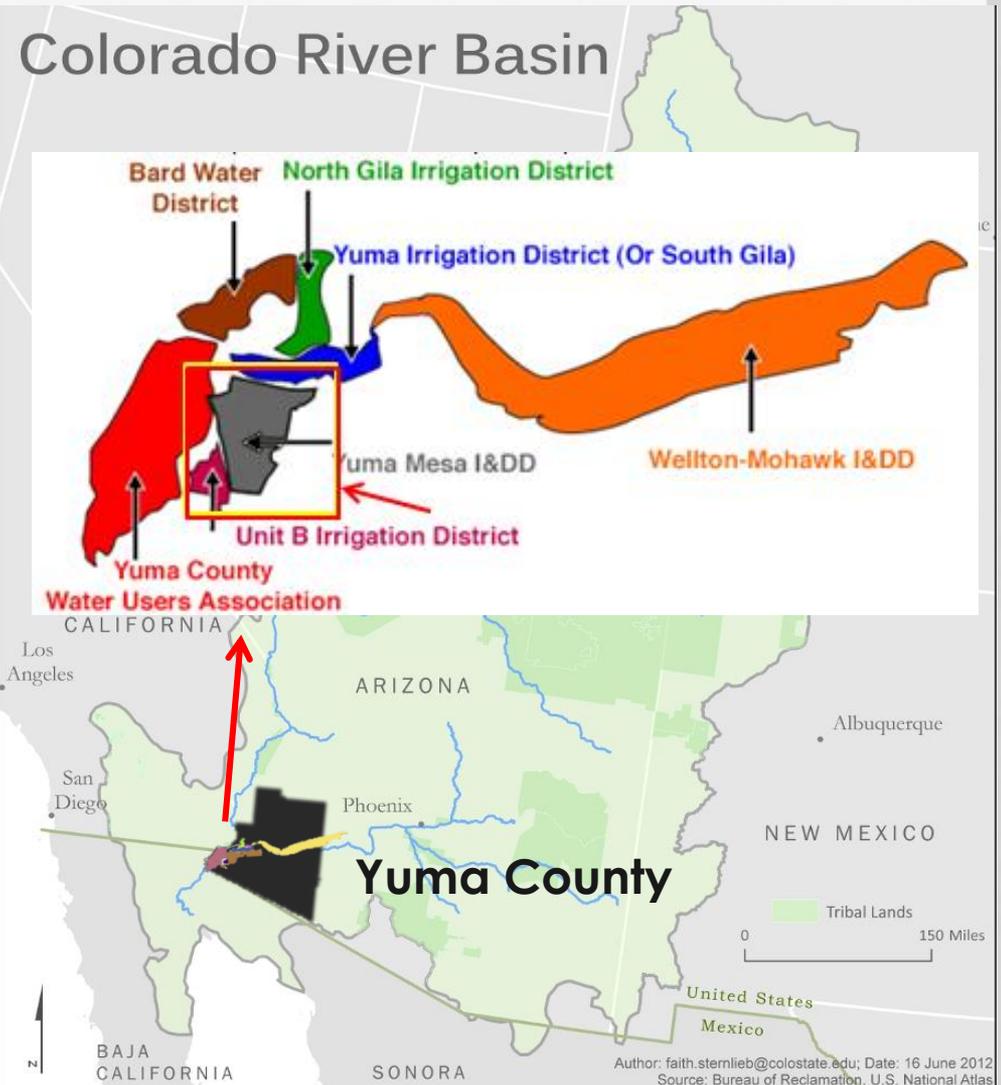
- To reduce groundwater pumping and overdraft, while avoiding losing water downstream to other users, Arizona passed legislation in 1990 to make available to farmers the cities' unused allotments on the Colorado River
 - i.e. CAP surface water supplies, available to farmers at an incentivized rate to be substituted for groundwater withdrawal.
- Cities would receive storage credits which enable them to use the stored CAP water in the future for drought mitigation or to supply increased urban demands .

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YMIDD/CAGRD PILOT FOLLOWING AND FORBEARANCE AGREEMENT (PILOT AGREEMENT)

- The Yuma Mesa Irrigation and Drainage District and the Central Arizona Groundwater Replenishment District initiated a Pilot Following and Forbearance Agreement in January 2014.
- volunteer farmers will be paid to fallow their lands in order to reduce diversion from the Colorado River.



YMIDD/CAGR D PILOT FALLOWING AND FORBEARANCE AGREEMENT (PILOT AGREEMENT)

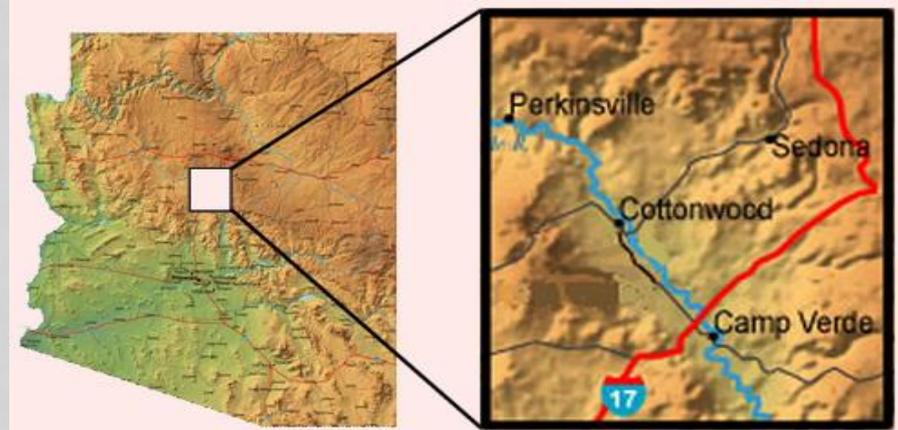
- The agreement was prompted due to concerns about reduced water levels in Lake Mead and the main purpose of this pilot agreement is to conserve water in the Colorado River system to be maintained in Lake Mead.
- The agreement contains two three-year enrolment cycles through Dec. 31, 2019.
 - If either or both parties terminate the pilot agreement, the second cycle will not be practiced and it shall terminate on Dec. 31, 2016.
- A maximum of 1,500 acres of land per year in the YMIDD (less than 10% of the district's total irrigated land) will be fallowed.
 - Each participating landowner can fallow a maximum of 18% of their land and they are obligated to control weeds and dust on their fallowed land and maintain the ditch structures to avoid injury to downstream users.
- Farmers will be paid a base rate of \$750 per acre of fallowed land by CAGR D, and YMIDD will receive an annual adjustment rate of minimum 2% and maximum 6%.

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DIAMOND S DITCH: AUTOMATED GATES FOR VERDE RIVER INCREASED FLOWS

- Collaboration between Diamond S Ditch and The Nature Conservancy (TNC)
- To restore flows to the desert river with no sacrifice to crop production or the local economy
- Two automated ditch gates were installed to keep a constant flow of water in the ditch (\$10,000 each)
- Implemented in 2013
- It increases the river flow by 5 cubic feet per second



DIAMOND S DITCH: AUTOMATED GATES FOR VERDE RIVER INCREASED FLOWS

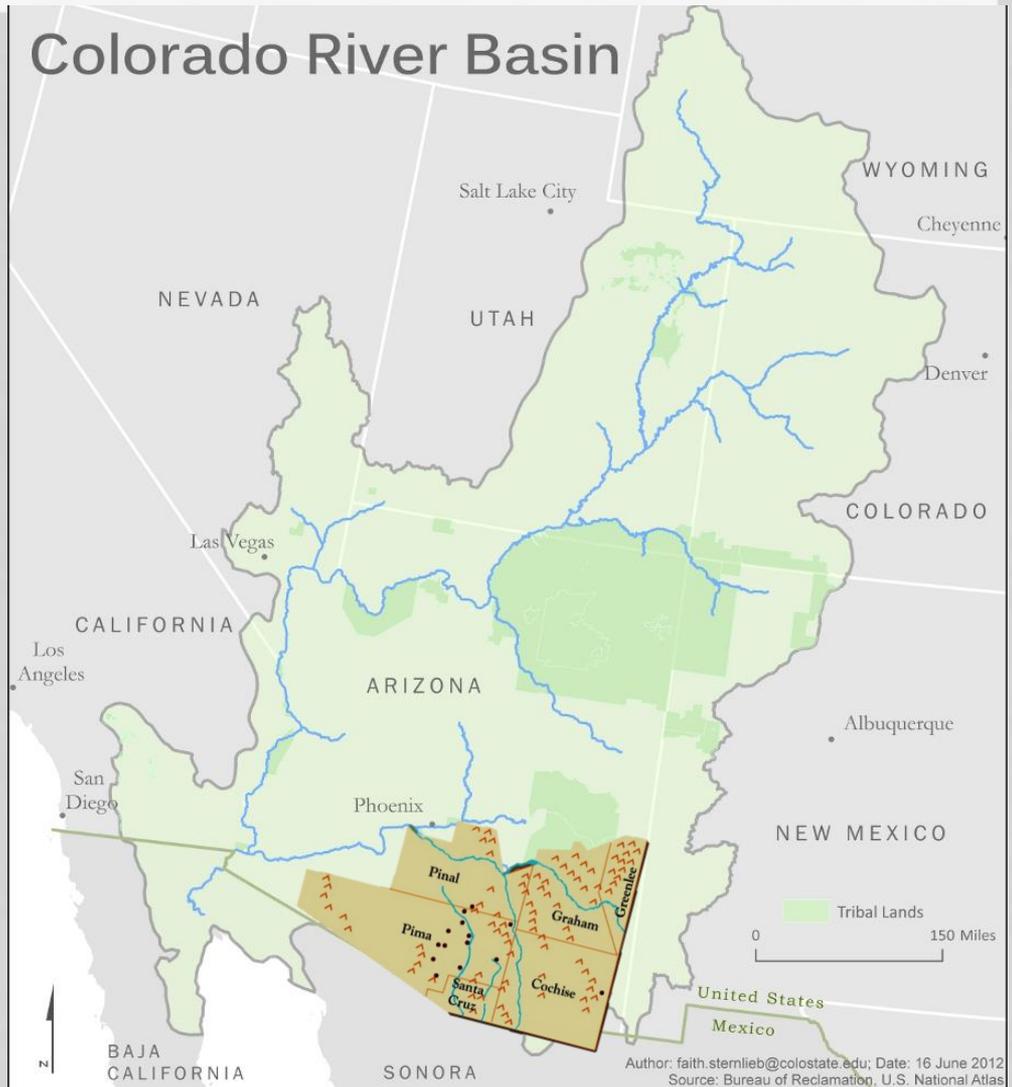
- Diamond S District gets paid up to \$10 per acre-foot of unused irrigation water.
- Project total cost: \$25,000
- The target is to add 30 cfs flow to the river. The strategy is to gradually move up the river valley, motivating the ditch companies upstream of the Diamond S to follow the incentive plan of upgrading their irrigation systems and leaving more flow in the Verde.

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ARIZONA LAND AND WATER TRUST

- The Arizona Land and Water Trust (originally Arizona Open Land Trust) has been seeking ways to address both land and water conservation through water agreements.
- It cohosted a series of “Ranching into the Future” workshops in 2007 for information sharing with farmers, ranchers and other landowners and to engage landowners directly to learn about their concerns and needs.



ARIZONA LAND AND WATER TRUST

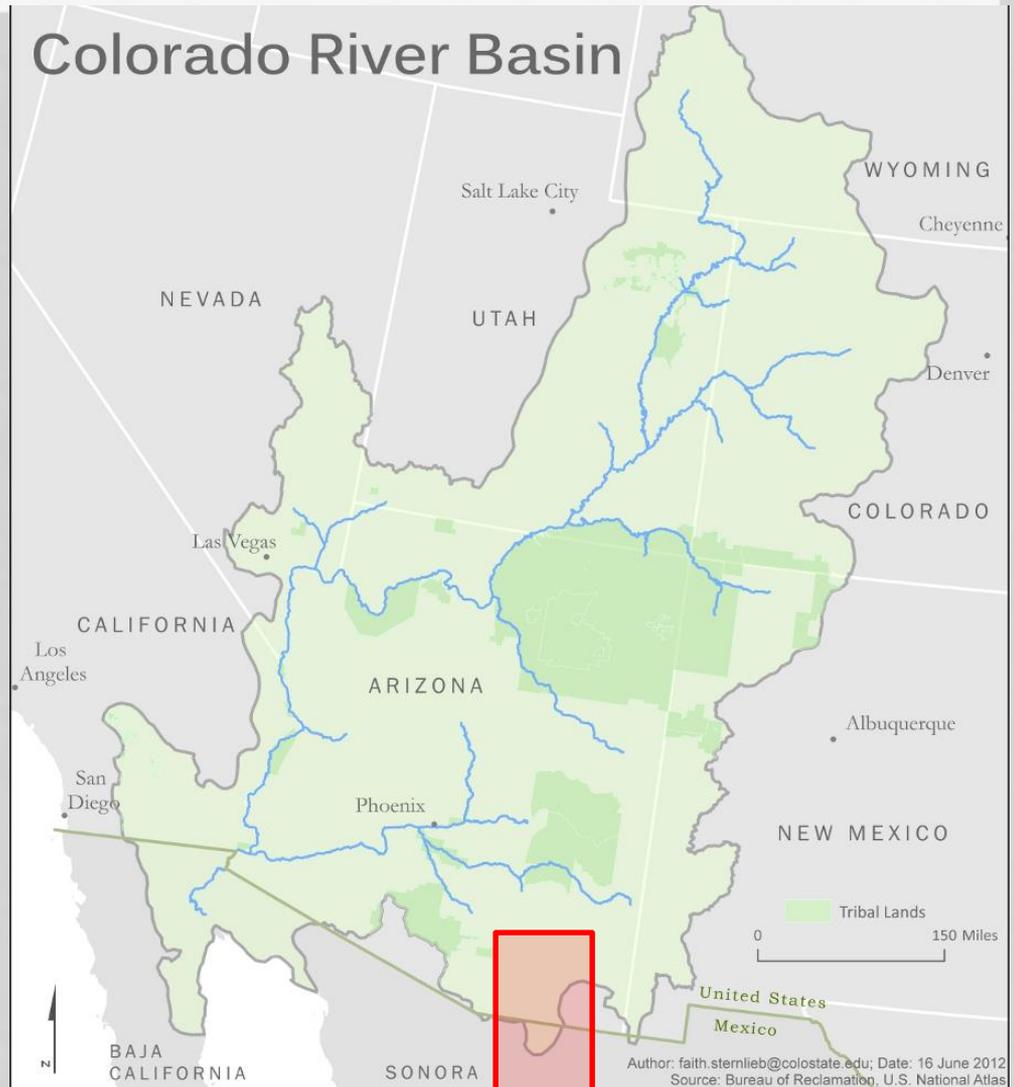
- At one workshop, they convinced a rancher on the Upper Gila River to temporarily shut off a well and fallow a 100-acre alfalfa field.
 - The farmer and ALWT signed a three-year water rights lease agreement in 2012.
 - The farmer avoids pumping about 600 acre-feet of water per year in order to boost flows in the Upper Gila River for environmental purposes. ALWT pays the farmer for this water saving practice.
- Since there is no change in the use of the water right in the temporary agreement, this transaction did not require approval by state officials.
- ALWT key strategies include:
 - Exploring options for rewarding conservation that don't require formal state review
 - Building trust through partnership with the extension service
 - Offering resources to help landowners benefit from conservation

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PUBLIC PRIVATE PARTNERSHIP FOR THE SAN PEDRO RIVER'S FLOW AUGMENTATION

- The San Pedro River, which starts in Mexico and flows into Arizona, provides critical riparian habitat for millions of migratory birds, an endangered aquatic plant, and many vulnerable animal species.
- Streamflow reduction in the river has adversely affected wildlife and fish, while also threatening the long-term reliability of water supplies for human water demands.



PUBLIC PRIVATE PARTNERSHIP FOR THE SAN PEDRO RIVER'S FLOW AUGMENTATION

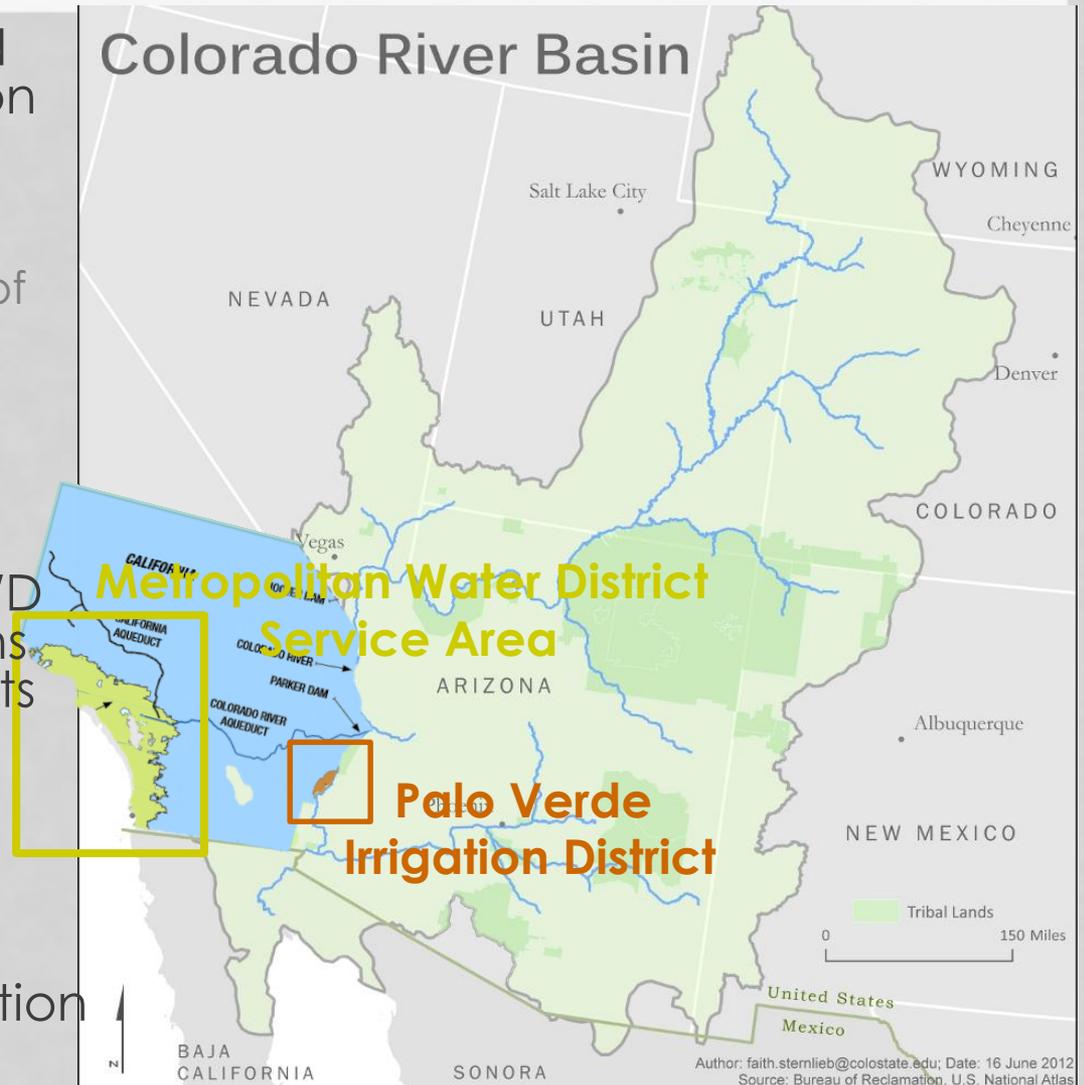
- Every June, TNC works with more than 100 community members in the United States and Mexico to map more than 270 miles of the river and its tributaries to define the extent of surface water.
- They created a groundwater simulation model with local, state and federal partners to better understand aquifer flows that augment the river flow.
 - Using this information, TNC identified best locations for groundwater recharge projects that enhance the San Pedro River flows.
 - They partnered with the Department of Defense to acquire key agricultural lands and are now designing aquifer recharge projects.
- Their partners include: Cochise County, local developers, private foundations and Natural Resource Conservation Service districts



CALIFORNIA

PVID/MWD FORBEARANCE AND FALLOWING PROGRAM

- A 35-year Forbearance and Fallowing Program began on January 1, 2005
 - To transfer water from Palo Verde Irrigation District to Metropolitan Water District of Southern California.
- Supporting the \$800 billion economy of Southern California due to the future water shortages forced MWD to pursue applicable options to improve the reliability of its water resources.
- On the other hand, PVID sought ways to stabilize the farm economy and found agricultural water conservation as an efficient way.



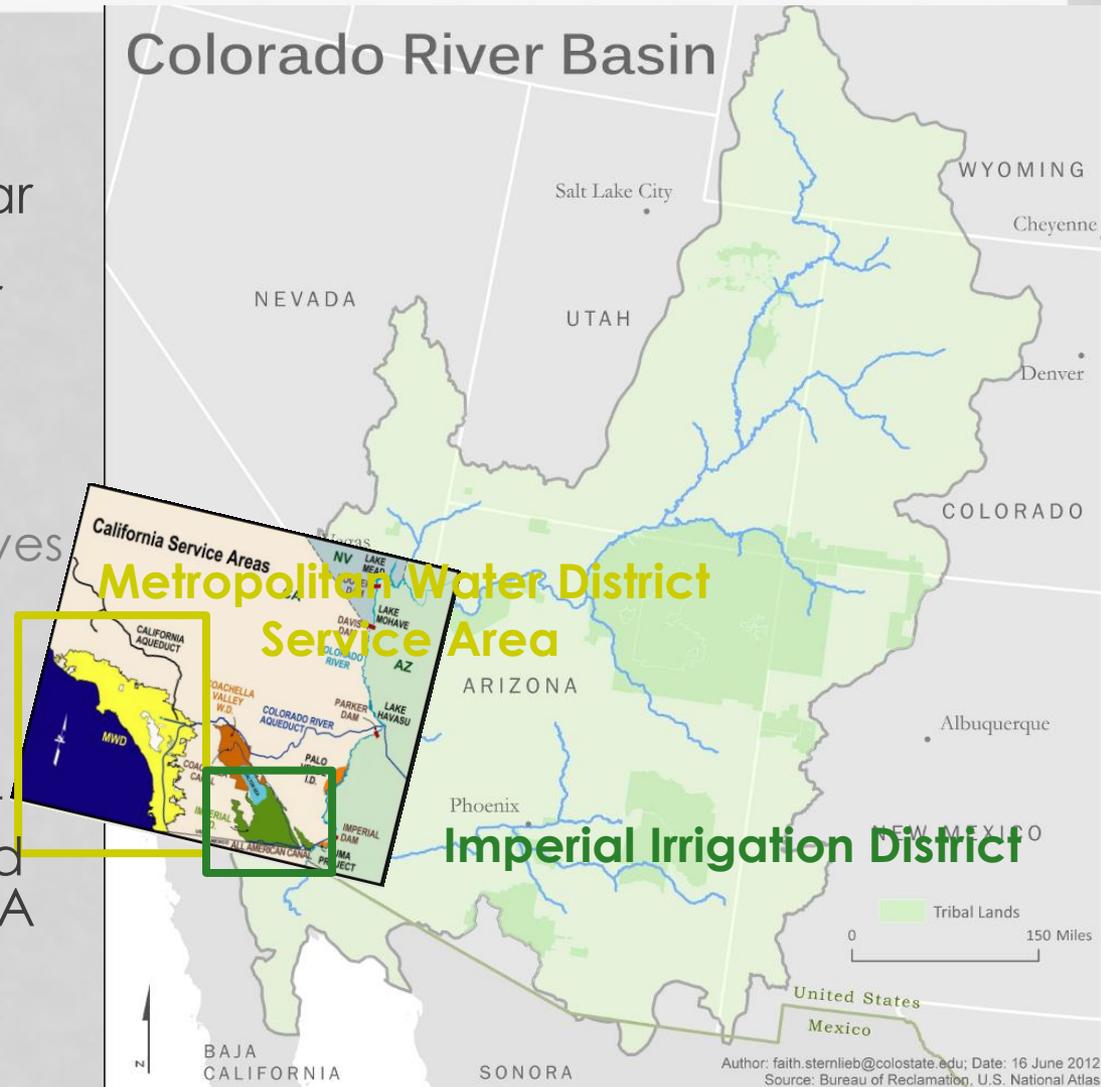
PVID/MWD FORBEARANCE AND FALLOWING PROGRAM

- Between 25,000 to 118,000 acre-feet per year will be transferred to MWD, totaling an estimated 1.8 to 3.9 million acre-feet over the lifespan of the agreement.
- Based on this program, between 7% to 28% of farmlands, or 6,487 to 25,947 acres, are allowed to be taken out of production for fallowing each year.
 - The portion of the land that is left fallowed should be maintained to meet approved soil and water management plans and should be rotated every one to five years
- Participating farmers receive a one-time payment of \$3170 per acre and an annual payment of \$602 for the first year, with an agreed upon price escalation for the following years.
- MWD allocated \$6 million for local community improvement programs and mitigate third party impacts such as loss of employment of farm workers and reduced sales for agricultural input products.



IID/MWD WATER CONSERVATION PROGRAM

- In 1988, Imperial Irrigation District and Metropolitan Water District of Southern California signed a 35-year cost-based water conservation and transfer agreement.
 - Based on this agreement, MWD pays the costs of water conservation measures in IID and receives the conserved water.
- The Agreement was amended in the 2003 Quantification Settlement Agreement and extended to 2041 or through the QSA term, whichever is later.



IID/MWD WATER CONSERVATION PROGRAM

- Fifteen new projects were identified in the 1988 Agreement and in the December 1989 Approval Agreement among IID, MWD, Palo Verde Irrigation District and the Coachella Valley Water District.
 - lateral interceptors, reservoirs, concrete lining of main and lateral canals, non-leak gates, system automation, and a change from 24 to a 12-hour delivery schedule.
- The on-farm improvements consist of tail water return systems, irrigation evaluations, pilot linear move, and drip irrigation systems.
- Between 1998 and 2013, an annual average of 105,009 acre-feet per year has been saved.
 - Ranging between 101,940 and 109,460 acre-feet per year
- Through 2013, a total of 1,841,242 acre-feet have been used by MWD and 159,381 acre-feet have been stored in Lake Mead for MWD.
 - 137,156 AF have also been used by Coachella Valley Water District.

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COLORADO RIVER QUANTIFICATION SETTLEMENT AGREEMENTS

- In October 2003, after about 10 years of negotiations, San Diego County Water Authority and Imperial Irrigation District along with Coachella Valley Water District, Metropolitan Water District of Southern California, the state of California, and the U.S. Department of the Interior signed approximately three dozen agreements to conserve and transfer Colorado River water within California.
 - The complete set of agreements is known as the Colorado River Quantification Settlement Agreement (QSA).
- These agreements were the results of the fact that SDCWA had recognized and well predicted that California will ultimately be limited to its annual Colorado River apportionment of 4.4 million acre-feet, which happened the same year as QSA's initiation.
 - Seeking additional and independent supplies of water, SDCWA had found IID as a logical partner to obtain water from, due to their geographic proximity to MWD's Colorado River Aqueduct and IID's water entitlement of more than 3 million acre-feet per year.

COLORADO RIVER QUANTIFICATION SETTLEMENT AGREEMENTS

- The initial term of this agreement is 45 years, which can be renewed for an additional 30 years if both parties agree.
- Based on the QSA, IID will develop delivery system and on-farm efficiency conservation projects for the water transfer. During the construction period, a ramp-up schedule was agreed to for delivery to SDCWA.
 - To meet the early water transfer demands of the schedule, flowback was allowed during the initial 15 years. After the first 15 years, water should be saved through enhanced on-farm efficiency only.
- Based on the QSA, IID will conserve and transfer 200,000 acre-feet to SDCWA and 103,000 acre-feet per year to CVWD, on a ramp-up basis.
- Under the QSA, the state of California may also purchase water from the IID for sale to the MWD, generating funds for the Salton Sea restoration program.

COLORADO RIVER QUANTIFICATION SETTLEMENT AGREEMENTS

Major features of the QSA include:

- Quantifying IID's Colorado River annual entitlement at 3.1 million acre-feet
 - Quantifying CVWD's Colorado River annual entitlement at 330,000 acre-feet
 - Providing for lining portions of the All American and Coachella canals
 - Settling conflicts among the 4 agencies and the 7 Colorado River Basin states
 - IID developing a Market-Based efficiency conservation program for 310,000 acre-feet annually
 - Providing for large-scale water transfers
-
- The ramp-up schedule was initiated with conserving 10,000 acre-feet water per year in 2003 and delivery quantity should increase to 303,000 acre-feet per year through 2021.
 - MWD delivers the conserved water via the Colorado River Aqueduct to the SDCWA and CVWD receives conserved water via the All-American Canal.

COLORADO RIVER QUANTIFICATION SETTLEMENT AGREEMENTS

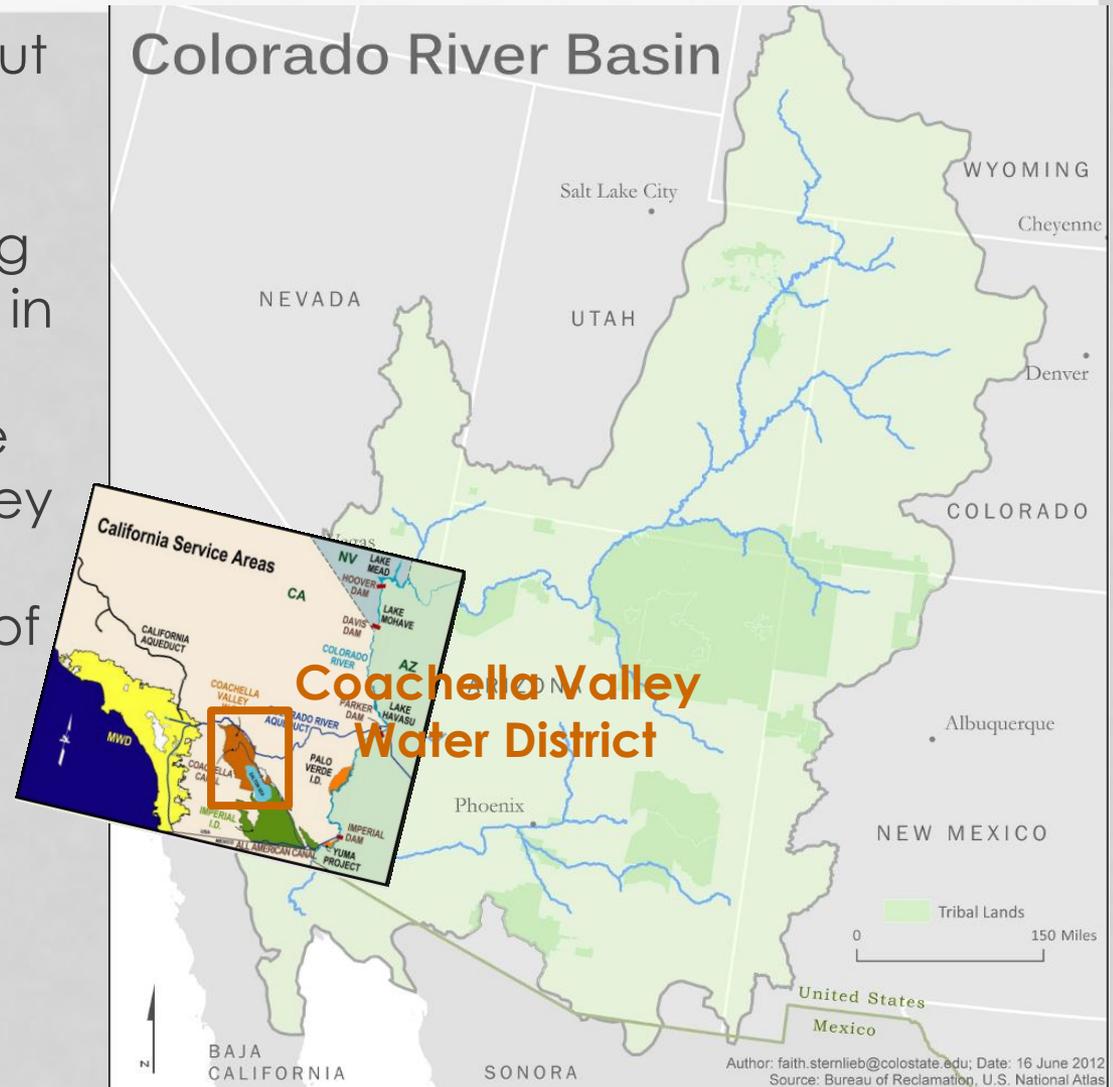
- A plan was developed to determine how the 303,000 acre feet of water would be conserved by efficiency conservation. The Definite Plan optimized efficiency efforts while minimizing costs.
- The final recommendation was 103,000 acre feet would be conserved by delivery system improvements and 200,000 acre feet would be conserved by on-farm efficiency improvements.
 - On-farm efficiency efforts by the farmers include: lining farm head ditches, installing tile drains, leveling farmland, and implementing a number of water management and efficiency conservation measures.
 - The delivery system efficiency projects include: lined canals, built regulating reservoirs, implemented canal seepage recovery programs, built interceptor canals, and used some non-structural measures to enhance the efficiencies of the conveyance and distribution system.
- The QSA included mitigation of all environmental impacts of water conservation efforts within Imperial County, the Salton Sea, as well as MWD and CVWD conserved water service areas.
 - IID will deliver “mitigation” water from the following program to the Sea in order to make up reduced inflows due to the water transfers.

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COACHELLA VALLEY WATER MANAGEMENT PLAN

- To address concerns about groundwater overdraft, Coachella Valley Water District initiated a planning process in the early 1990s in its Lower Valley. This plan was expanded to include the entire Coachella Valley in 1995 and ultimately resulted in development of the Management Plan in 2002.
- An updated draft of the plan was released in December 2010.



COACHELLA VALLEY WATER MANAGEMENT PLAN

- The 2002 Water Management Plan has set four objectives:
 1. Eliminate groundwater overdraft and its corresponding adverse impacts
 2. Maximize opportunities for conjunctive use
 3. Minimize adverse economic impacts to the water users in Coachella Valley
 4. Minimize environmental impacts
- The district has focused on three areas: agriculture, urban and golf.
 - Reduce agricultural water use by 14% by 2015
 - To decrease urban water use by 20% through conservation by 2020
 - Reduce golf course water use at existing courses by 10%, and for new courses to be 25% more efficient than established courses of similar size
- The 2010 Water Management Plan Update has the following objectives:
 - Current and future demands must be met with a 10% supply buffer
 - Long-term groundwater overdraft should be eliminated
 - Water quality should be managed and projected
 - State and federal laws and regulations must be complied with
 - Future costs should be managed
 - Adverse environmental impacts should be minimized

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ALL AMERICAN CANAL LINING PROJECT

- The All American Canal, located adjacent to the U.S.-Mexico border, conveys about 3.1 million acre-feet of water per year.
- One of the key agreements in the 2003 Colorado River Quantification Settlement Agreement was to concrete line the All American Canal.
- Main partners of the project included the San Diego County Water Authority, the Imperial Irrigation District, the Bureau of Reclamation, and the California Department of Water Resources.

ALL AMERICAN CANAL LINING PROJECT

- The project replaced 23 miles of an earthen canal in Imperial County with a concrete-lined canal to save the water lost to seepage.
 - Funded by the state of California and the Water Authority
 - Began in 2007 and completed in early 2010
- Annually, 67,700 acre-feet of water is conserved by this project, which is transferred to San Diego to meet the potable water supply needs of about 500,000 people.
 - This allocation of water to the Water Authority is valid for a period of 110 years.
- Indian tribes in northern San Diego County, San Luis Rey Settlement Parties, will also receive a portion of the conserved water to resolve long-standing disputes.

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COACHELLA CANAL LINING PROJECT

- The Coachella Canal, a branch of the All-American Canal in southeastern California, transfers Colorado River water 123 miles from the All-American Canal to more than 85,000 acres of highly productive agricultural land northwest in the Coachella Valley.
- A 36.5-mile section of the canal was unlined resulting in about 32,350 acre-feet per year water loss through seepage.
- The canal lining project, completed in December 2006, was developed to conserve water and comply with provisions contained in the 2003 Quantification Settlement Agreement.
- Under this project, 35 miles of concrete-lined canal were constructed in parallel with the existing Coachella Canal, resulting in an annual savings of 26,000 acre-feet of water.

COACHELLA CANAL LINING PROJECT

- The project also included a variety of check structures, canal crossings, flow measurement structures, and environmental mitigation measures.
- The total water conservation from this project along with the All American Canal Lining Project is about 93,700 acre-feet per year.
- San Diego County Water Authority receives 77,700 acre-feet of conserved water per year for 110 years. The remaining 16,000 acre-feet of water per year belong to San Luis Rey settlement parties, which contain several bands of Mission Indians in northern San Diego County
- The California Department of Water Resources funded 70% and the SDCWA funded the remaining capital costs.

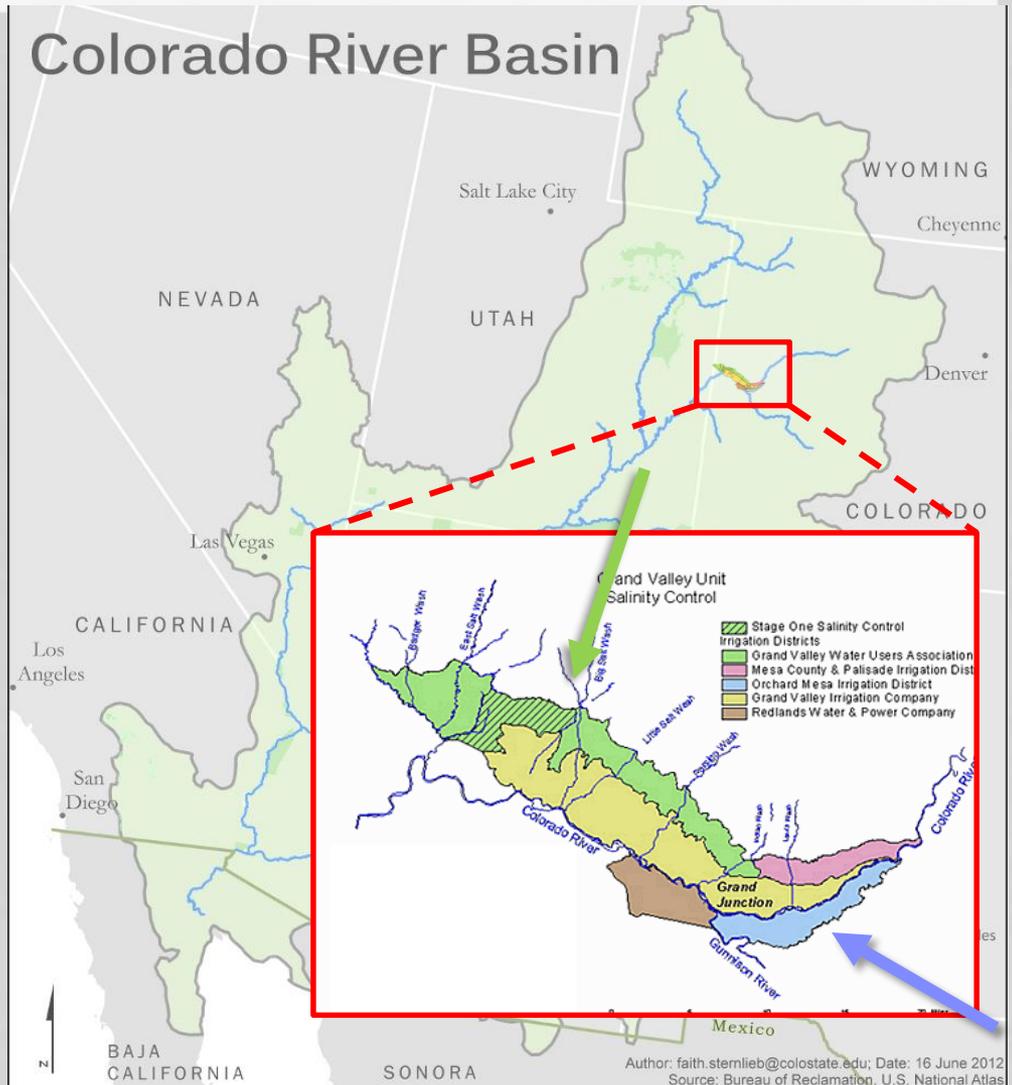
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COLORADO

GRAND VALLEY PROJECT

- To reliably supply irrigation water demands of thousands of acres of farmlands and orchards in Grand Valley, the Secretary of the Interior approved the plan for the construction of the Grand Valley Project by the Bureau of Reclamation in 1907.
- On January 5, 1911, the project was approved by the President and was allocated \$1,500,000 for its construction.
- The construction was delayed until September 23, 1912, when the Secretary of Interior authorized the Reclamation Service to begin construction.



GRAND VALLEY PROJECT

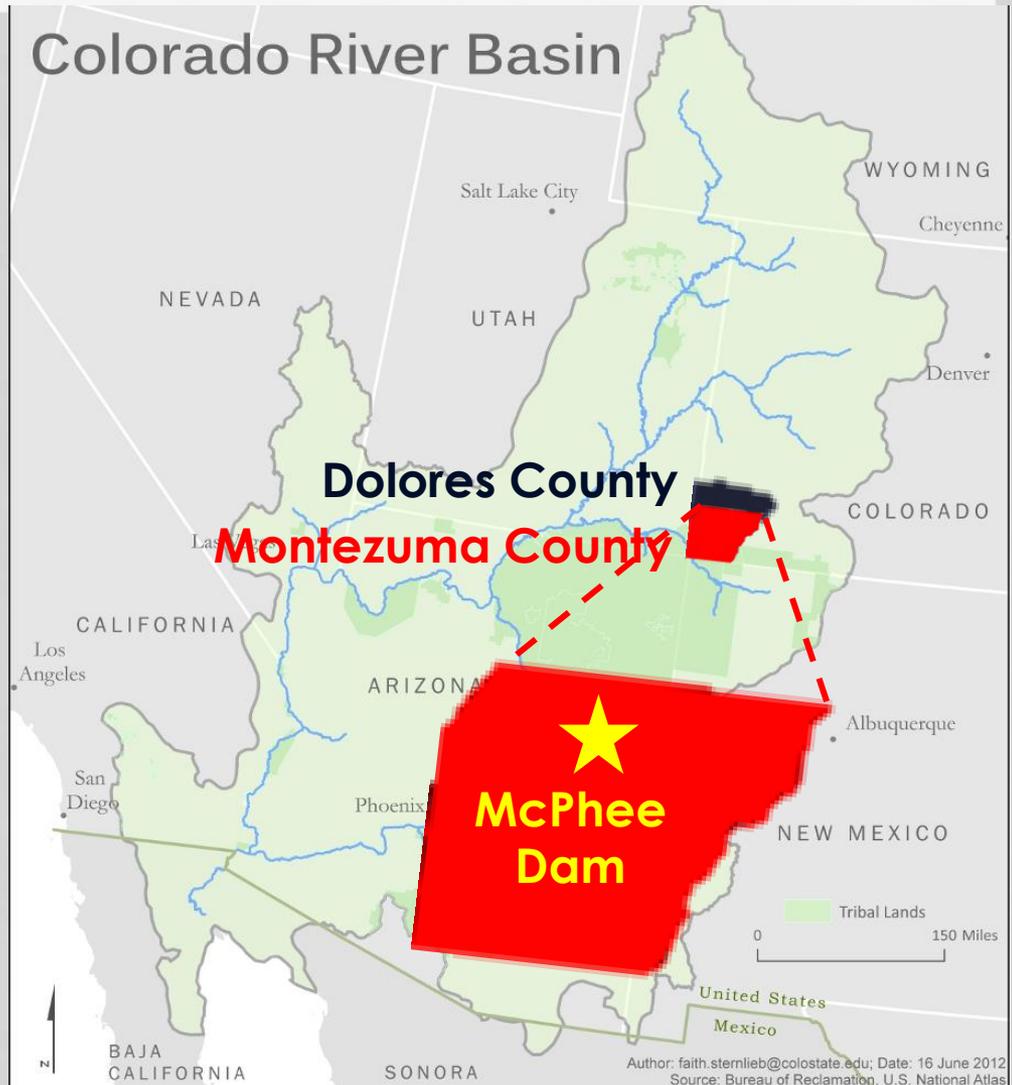
- The project is operated on the north side of the Colorado River in Grand Valley by Grand Valley Water User`s Association and on the south side of the Colorado River and east of the Gunnison River by Orchard Mesa Irrigation District.
- The first irrigation water supplied by the project was in 1915, when the project was 60% complete.
- This project fully supplies water demands of 33,368 acres of land and provides supplemental water to nearly 8,600 acres of fertile land in west-central Colorado.
- Infrastructure includes: a diversion dam, a power plant, two pumping plants, two canal systems totaling 90.1 miles, 166 miles of laterals, and 113 miles of drains.
- The Grand Valley Power Plant's capacity is 3.0 megawatts.

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THE DOLORES PROJECT

- The Dolores Water Conservancy District was formed in 1961 to operate the Dolores Project to provide benefits to wide range of water needs and collect funds to repay the Federal Government.
- McPhee Dam and Reservoir is the principle storage feature of the Dolores Project which includes a system of canals, tunnels, and laterals to deliver water to over 61,000 acres of land



THE DOLORES PROJECT

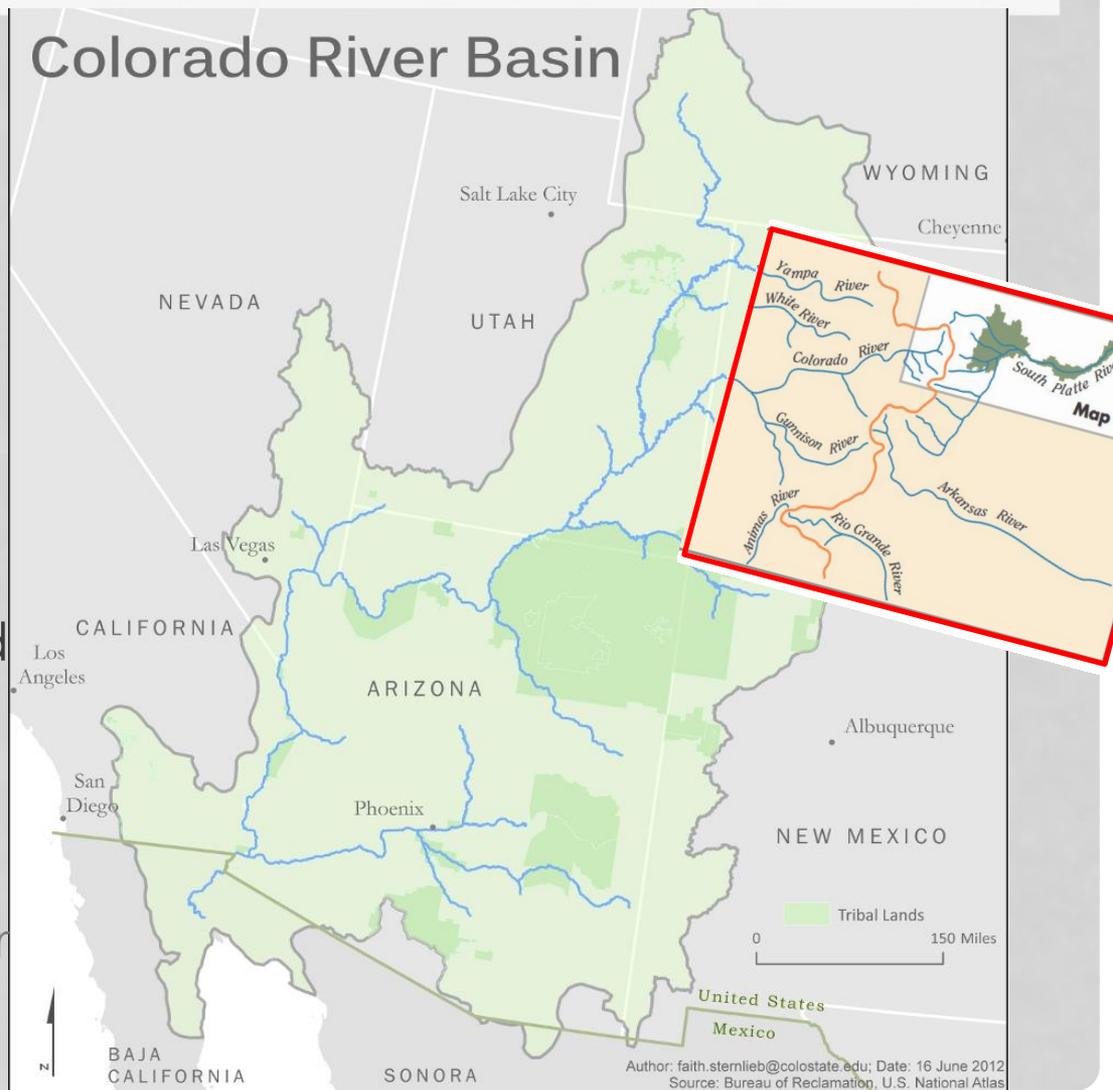
- The Dolores Project provides water to meet multiple water needs in Montezuma and Dolores Counties:
 - Irrigation of 28,000 acres of full service land
 - 7,600 acres of full service land on the Ute Mountain Ute Tribe
 - Municipal water
 - Water for fisheries
 - Wetlands and wildlife habitat
 - Supplemental irrigation water to the Montezuma Valley Irrigation Company
 - Recreation on McPhee Reservoir and white water boating opportunities below the dam
- New irrigated lands are entitled to 2AF/acre via a water bank under which users not using all their water can make it available to others.

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COLORADO-BIG THOMPSON PROJECT

- The Northern Colorado Water Users Association, formed in 1935, pushed the idea of transferring Colorado River water to the East slope of the Rocky Mountains, initiated in 1880s.
- The construction of the Colorado-Big Thompson Project began in 1938 and the was completed in 1957.
 - The Project consists of 12 reservoirs, 35 miles of tunnels, 95 miles of canals, seven hydroelectric power plants, and 700 miles of transmission lines.



COLORADO-BIG THOMPSON PROJECT

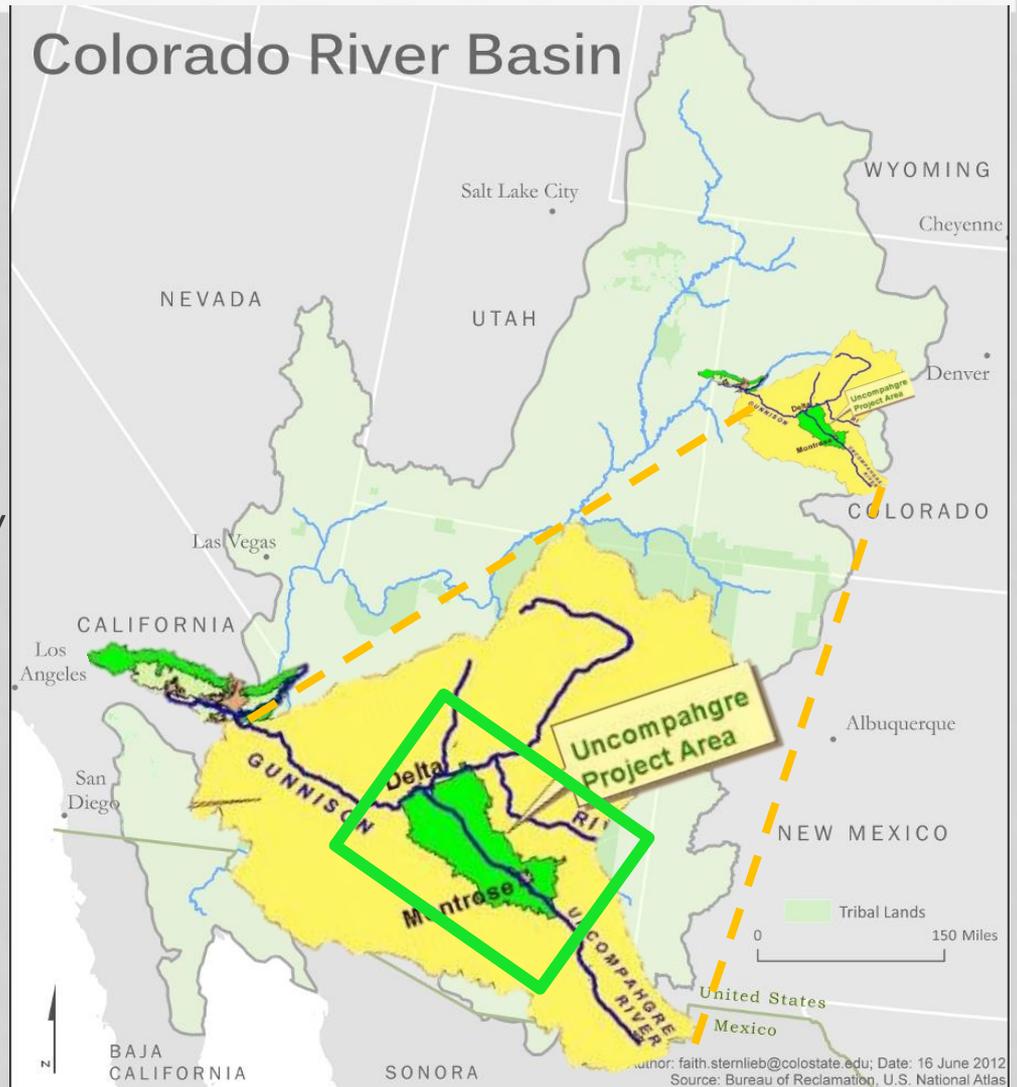
- C-BT stores, regulates, and diverts Colorado River water from the western slope of the Rocky Mountains to the eastern slope 3,800 feet beneath the Continental Divide through the 13.1-mile Alva B. Adams Tunnel.
- Each year, the project collects on average more than 200,000 acre feet of snowmelt on the west slope and delivers it to more than 640,000 acres of irrigated farm and ranch land and 860,000 people in portions of eight counties within Northern Water boundaries in the east slope.
- Upon its full completion, 85% of the C-BT allottees, those who own units of project water, represented irrigated agriculture. Today, only about one-third of C-BT units are owned by the agricultural sector.
 - Meanwhile, municipal holdings increased from 18% of the total to 41% and industry holdings increased from less than 1% to 4% from 1962 to 1992.
 - Although farmers currently make up less than a third of the total number of allottees, they still use the majority of the C-BT water. This has been made possible because of C-BT's great operational and institutional flexibility and transferable water allotment system.

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UNCOMPAGHGRE PROJECT

- Constructed by the Bureau of Reclamation and operated by the Uncompahgre Valley Waters Users Association.
- Authorized by the Secretary of the Interior on March 14, 1903 in response to the 1902 Reclamation Act.
 - The act had selected the Uncompahgre Valley for immediate development.



UNCOMPAGHGRE PROJECT

- Originally called the Gunnison Project, the Uncompahgre Project currently supplies full irrigation water to about 76,300 acres of land in west-central Colorado.
- Project features include:
 - Taylor Park Dam and Reservoir
 - Gunnison Tunnel
 - Seven diversion dams
 - 128 miles of main canals
 - 438 miles of laterals
 - 216 miles of drains.

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COLORADO RIVER STORAGE PROJECT ACT

- The Colorado River Storage Project act was authorized in 1956 to allow comprehensive development of the water resources of the Upper Basin states.
- The main purpose of the act was to provide long-term regulatory storage of water in the Upper Basin to develop its apportionments of the Colorado River while meeting Lower Basin's entitlements.
 - Other purposes identified in the 1956 act include: providing for reclamation of arid and semi-arid lands, providing flood control, and generating hydropower.
 - The project also provides for recreation and enhances fish and wildlife habitat
- This project includes four initial storage units: the Wayne N. Aspinall Unit in Colorado, Flaming Gorge Unit in Utah, Navajo Unit in New Mexico, and Glen Canyon Unit in Arizona.

COLORADO RIVER STORAGE PROJECT ACT

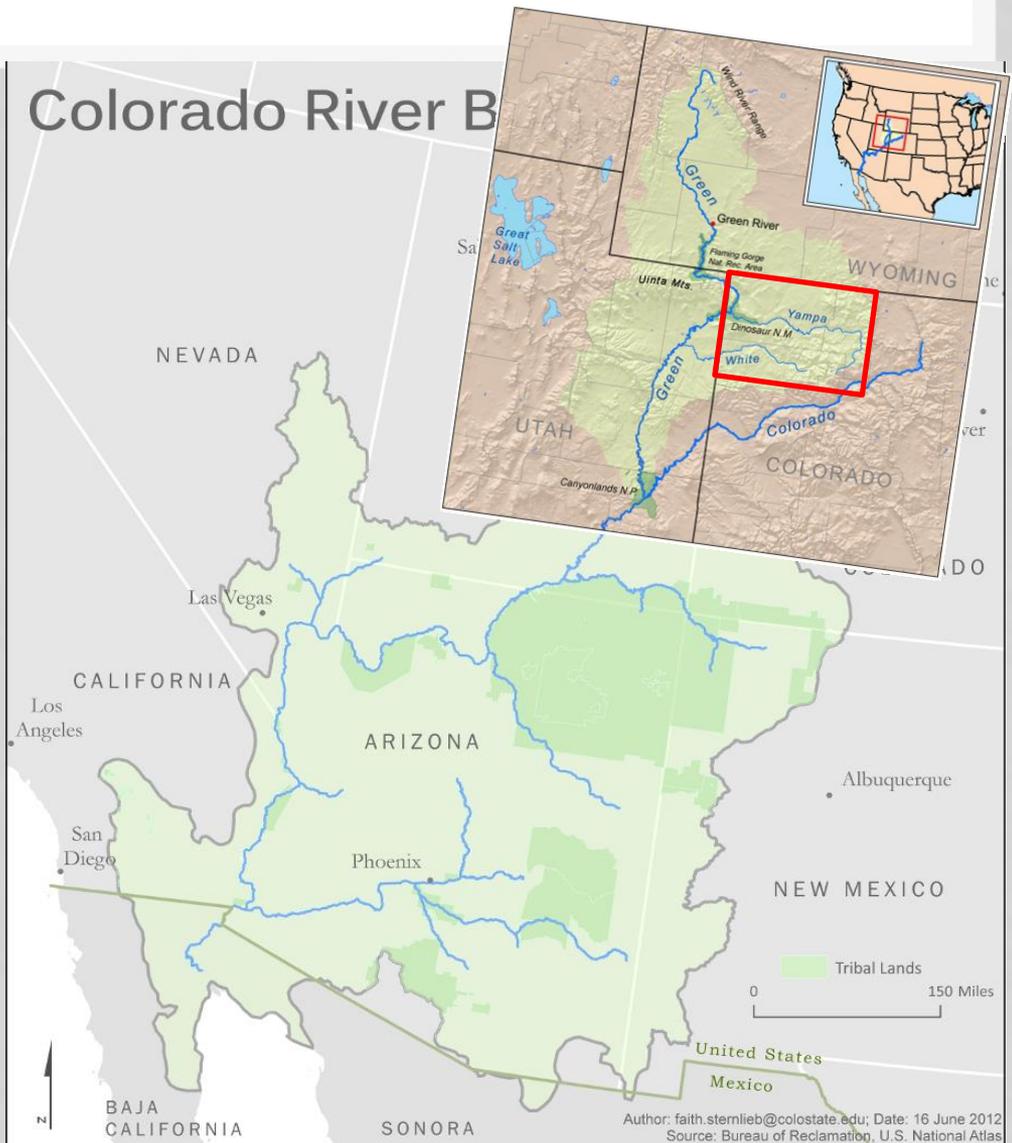
- The Aspinall Unit is comprised of three dams: Blue Mesa, Crystal, and Morrow Point
- Glen Canyon Dam, which is the key unit for controlling water releases to the Lower Basin, is the largest facility.
- The combined live storage capacity of the CRSP main storage unit dams is about 30.6 million acre-feet. These dams' power generation capacity exceeds five billion kilowatt-hours of energy annually.
- 22 participating projects (originally 11) develop water in the Upper Colorado River system for irrigation, municipal and industrial uses.
 - More than 554,000 acre-feet of water is supplied by the participating projects for irrigation.

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YAMPA/WHITE/ GREEN BASIN

- The Yampa/White/Green Basin Roundtable, concerned about poor physical and legal reliability of its water resources, is trying to find ways to guarantee current and future water supply for both consumptive and non-consumptive uses.
- The Roundtable is one of the basin groups established by the Colorado legislature to assist the state in its water planning.



YAMPA/WHITE/ GREEN BASIN

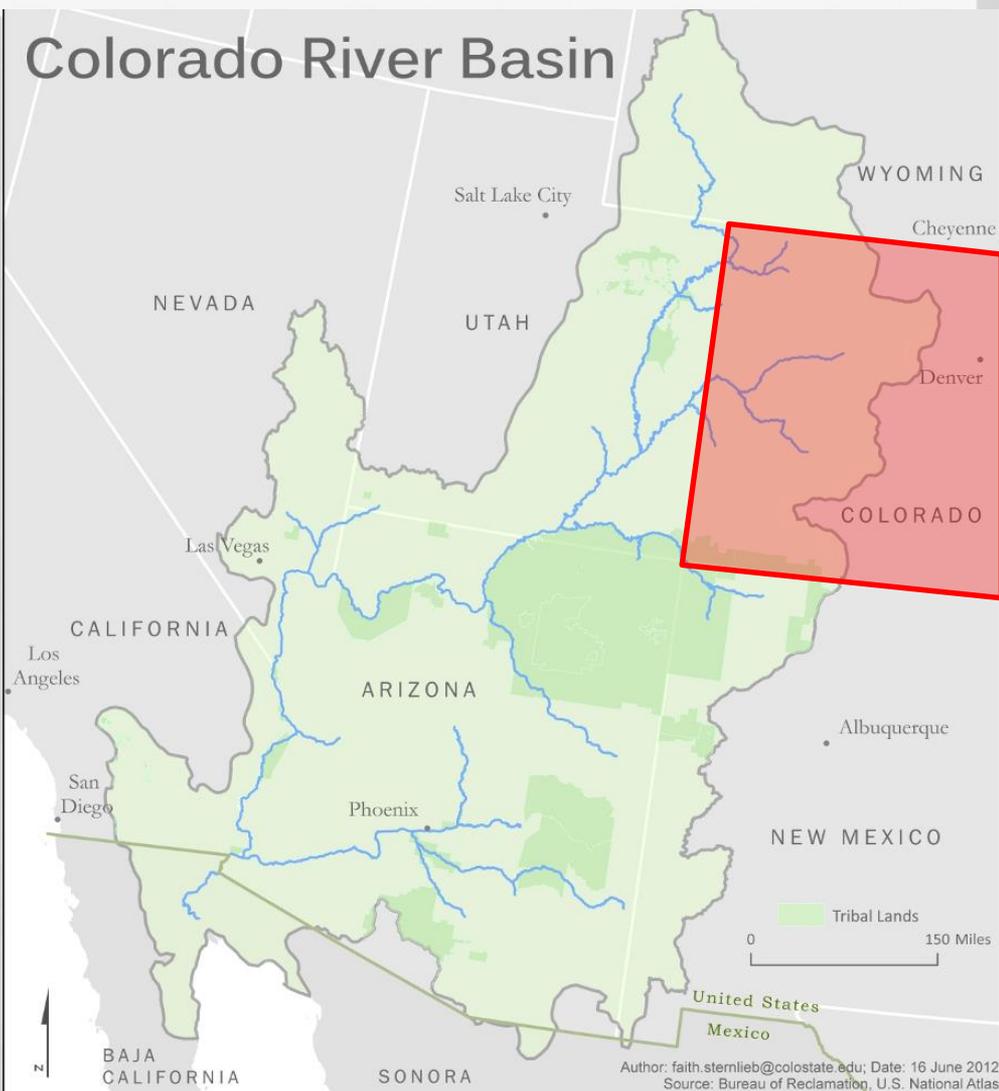
- These three basins are relatively underdeveloped, with limited storage, and are independent for local water planning as there are no diversions between them.
 - On the other hand, population growth imposes additional municipal needs, additional irrigated agricultural areas have been identified in Statewide Water Supply Initiative studies, and the energy sector will potentially have the greatest growth in consumptive water demand.
- The Roundtable believes that these demands should be supplied in a way that the non-consumptive needs are not sacrificed. These goals can be achieved by appropriately planning storage, delivery, and administrative structure.
 - For example, interstate delivery compliance might be timed to meet endangered fish recovery program flow targets, or in planning for additional storage in the system, the balance between high spring flow for both recreational and ecological demands should be considered.
- The Roundtable also believes that it is critical to develop a framework protecting an apportioned supply within each drainage basin in its Basin Implementation Plan.

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COLORADO WATER BANK (WEST SLOPE WATER BANK)

- Based on the 1922 Colorado River Compact, Upper Basin states (CO, NM, UT, and WY) should deliver water at a rate of 7.5 MAF/yr on a 10-year rolling average to Lower Basin states (AZ, NV, CA).
 - If the 10-year rolling average falls below 7.5 MAF, the Lower Basin states may institute a forced reduction in Upper Basin water consumption (compact curtailment).
- The Colorado Water Bank would increase the security of the Upper Colorado River Basin water supplies and reduce the potential negative impacts of persisting drought conditions.



COLORADO WATER BANK (WEST SLOPE WATER BANK)

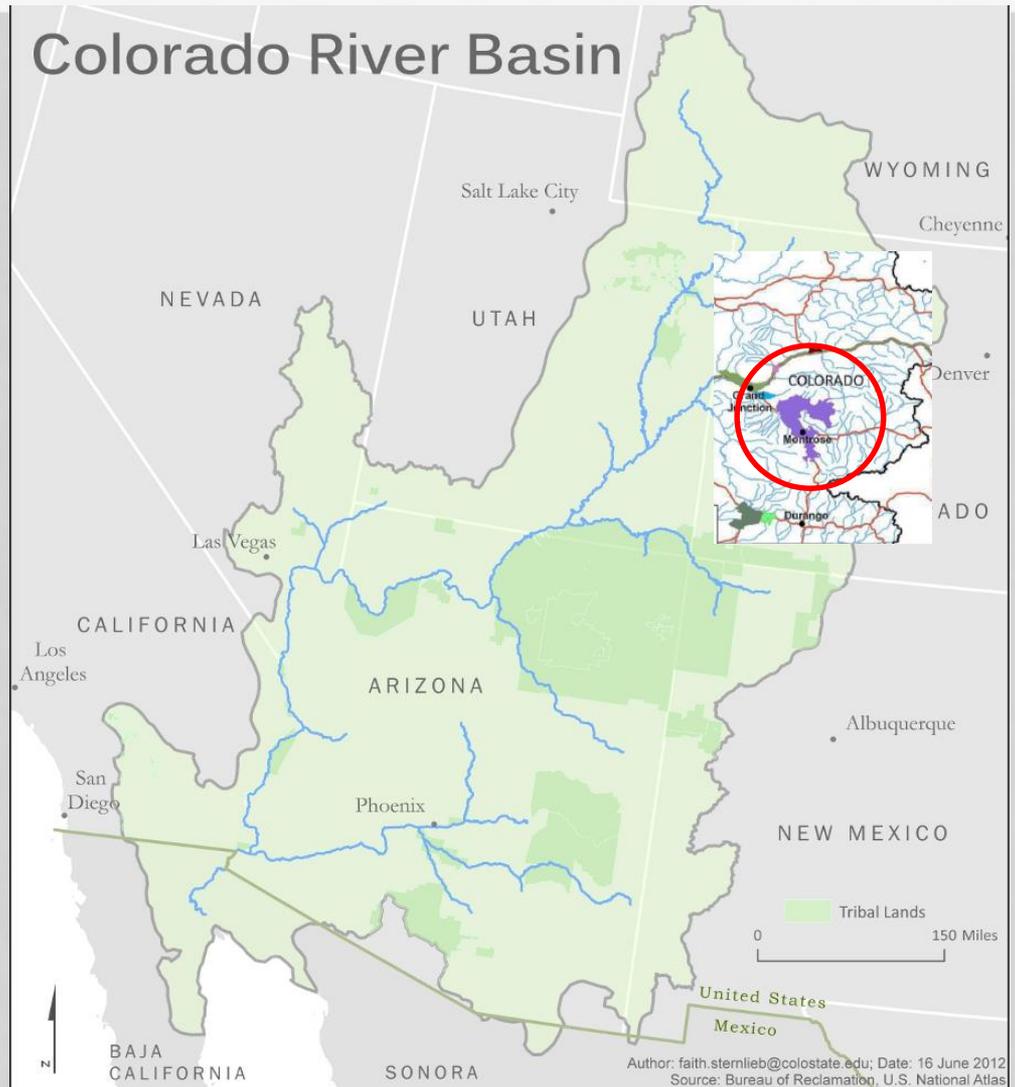
- The Colorado River Water Conservation District devised a model for water banking and is working with ranchers and conservation organizations to make water a profitable crop through a market-based approach.
- The Colorado River Water Bank would provide municipalities on the east slopes of Colorado's Rocky Mountains a mechanism to buy water consumption rights from agricultural water right holders on the west slope.
 - Still in the development stage.
- About 200,000 acre-feet water is estimated to be saved by the water bank
 - Requiring deficit irrigation or fallowing on 130,000 to 260,000 acres on the West Slope.
- The Water Bank operation would be as follows:
 - Agricultural water users who volunteer to participate in the program would be compensated to temporarily fallow, split season irrigate, or deficit irrigate lands with pre-compact water rights.
 - The saved water would be stored in the Water Bank and post-Compact water users would subscribe to the bank for access to pre-Compact water.

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LOWER GUNNISON BASIN SALINITY CONTROL PROJECT

- In 1974, the Colorado River Basin Salinity Control Act authorized the Secretary of Interior to plan and construct salinity-control projects in the Colorado River Basin to control the salinity of water delivered to users in the United States and Mexico.
- The Lower Gunnison Salinity Control Project, begun in 1986, was one of the first projects to mitigate salinity in the Lower Gunnison and Uncompahgre River Basins.



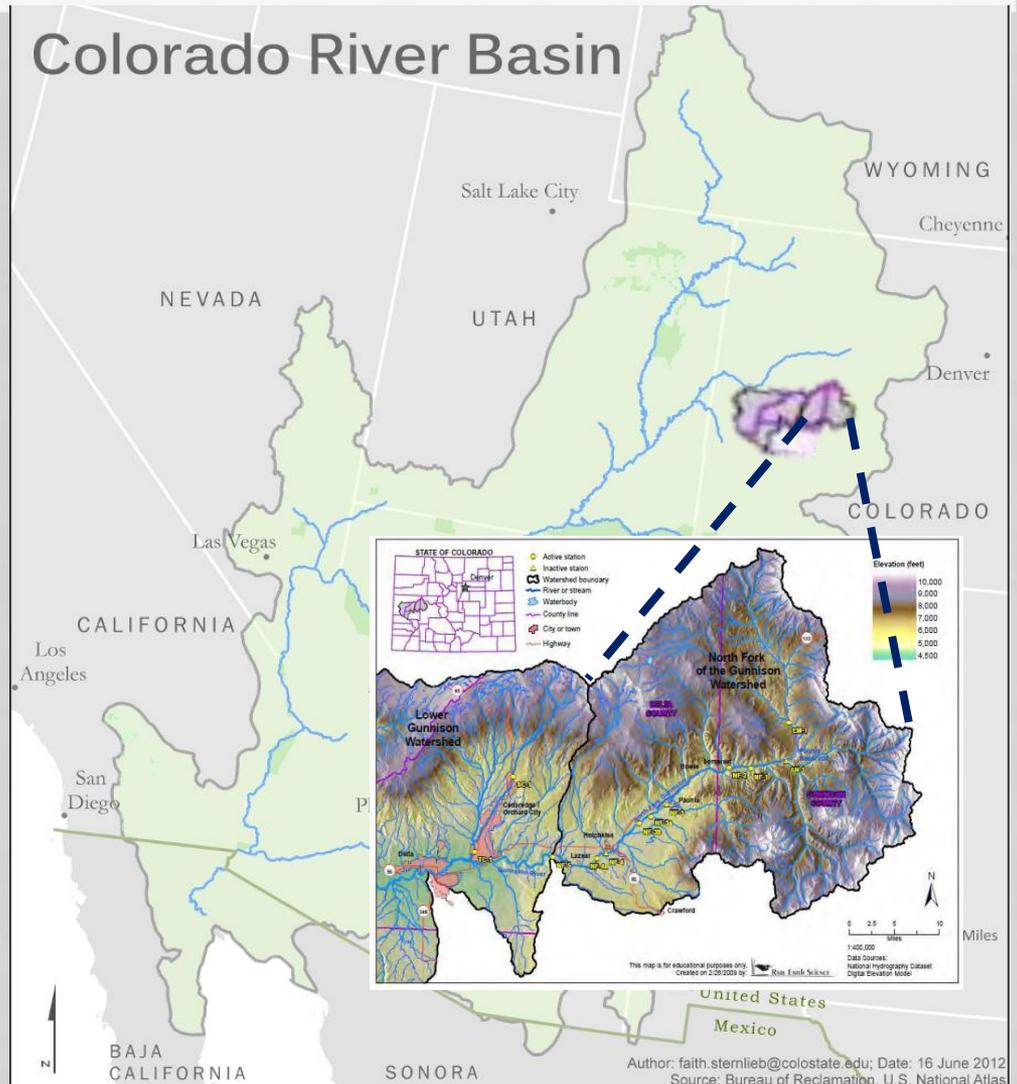
LOWER GUNNISON BASIN SALINITY CONTROL PROJECT

- Salinity load of the Lower Gunnison Basin is estimated to be 1,440,000 tons/yr of which 840,000 tons is attributed to agricultural practices:
 - On-farm practices contribute 440,000 ton/yr
 - Off-farm practices contribute 400,000 tons/yr
- The Lower Gunnison Basin's salt loading have now reduced ~227,100 tons/year by both on-farm and off-farm measures.
- On-farm practices include:
 - Improved irrigation efficiency
 - Improved irrigation technology such as periodic move systems, continuous move systems, and other high tech systems.
- Off-farm conservation is mostly practiced through lined canals and laterals.



NORTH FORK RIVER IMPROVEMENT ASSOCIATION

- North Fork River Improvement Association, a “solution-focused” non-profit organization, was formed in 1996 to improve stream stability, riparian habitat, and ecosystem function along the North Fork of the Gunnison River.
- The organization is a coalition of landowners, farmers, ranchers, environmentalists, irrigation companies, outdoor enthusiasts, in-stream gravel mining companies, and individual members.



NORTH FORK RIVER IMPROVEMENT ASSOCIATION

- NFRIA was developed due to the problem of high bank erosion along the river and aimed to research new and innovative solutions.
- It promotes community improvement and sustainable agricultural practices and strives to support the restoration of the North Fork into a healthy, usable, and sustainable river.
- NFRIA pursues its goals with grants from over 60 local, state, and national organizations and individual donations from their members.
- As one of its first achievements, NFRIA obtained funding to specify the river's problems, quantify these problems, and develop recommendations for its restoration.
 - This Community Based Assistance Grant was awarded by the EPA in 1996.



SPLIT SEASON APPROACH TO WATER USE IN THE LITTLE CIMARRON RIVER, THE GUNNISON RIVER BASIN

- The split season use of water was agreed upon through a collaboration between the Colorado Water Conservation Board (CWCB) and the Colorado Water Trust in 2015.
- This approach acknowledges and preserves the values of both irrigated agriculture and restoring flow to a local river.
- This agreement will help restore late summer flows to a 5-mile reach of the Little Cimarron River in the Gunnison River Basin.
 - It will leave 5.8 cubic feet per second of water in the river in late summer.
 - This reach has historically had low to no flows as the result of water diversions.



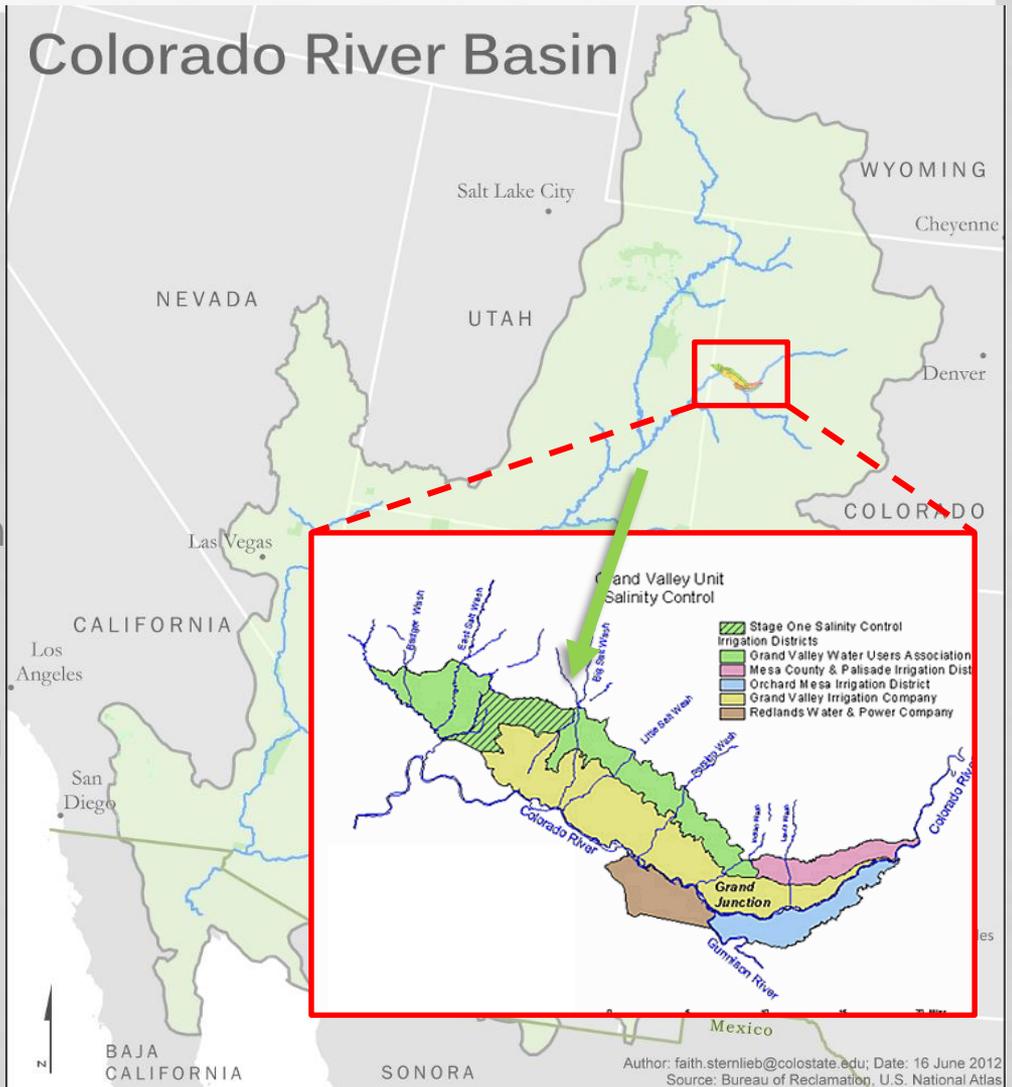
SPLIT SEASON APPROACH TO WATER USE IN THE LITTLE CIMARRON RIVER, THE GUNNISON RIVER BASIN

- Based on this agreement, a ranch irrigated from the McKinley Irrigation Ditch will stop diverting water from the Cimarron River in mid-summer and leave the water in the river for instream flow use by the CWCB.
- Until mid-summer, the ranch will continue diverting water for irrigation.
 - This will allow the agricultural water rights holders to continue their agricultural activities in early summer and then choose to be compensated for leaving the water in the river in late summer and early fall.
- This concept can be practiced under current state law with no need for change in the state law and has statewide application.
 - The main challenge would be to find a water right in proximity of a reach that needs water, which is available in the market



GRAND VALLEY WATER MANAGEMENT PLAN

- The Bureau of Reclamation and the Grand Valley Water Users Association developed the Grand Valley Water Management Plan.
 - In response to the U.S. Fish and Wildlife Service call for more water for the fish in the 15-mile reach of the Colorado River and as part of the Upper Colorado River Endangered Fish Recovery Program.
- The initial goal was to save ~28,500 acre-feet per year and leave it in the river.
- On average, it has conserved 36,463 acre-feet per year from 2002-2010.



GRAND VALLEY WATER MANAGEMENT PLAN

- In spite of these water savings, the farming community still receives their entire titled allocation, while being reimbursed for operating the new infrastructure.

The plan includes:

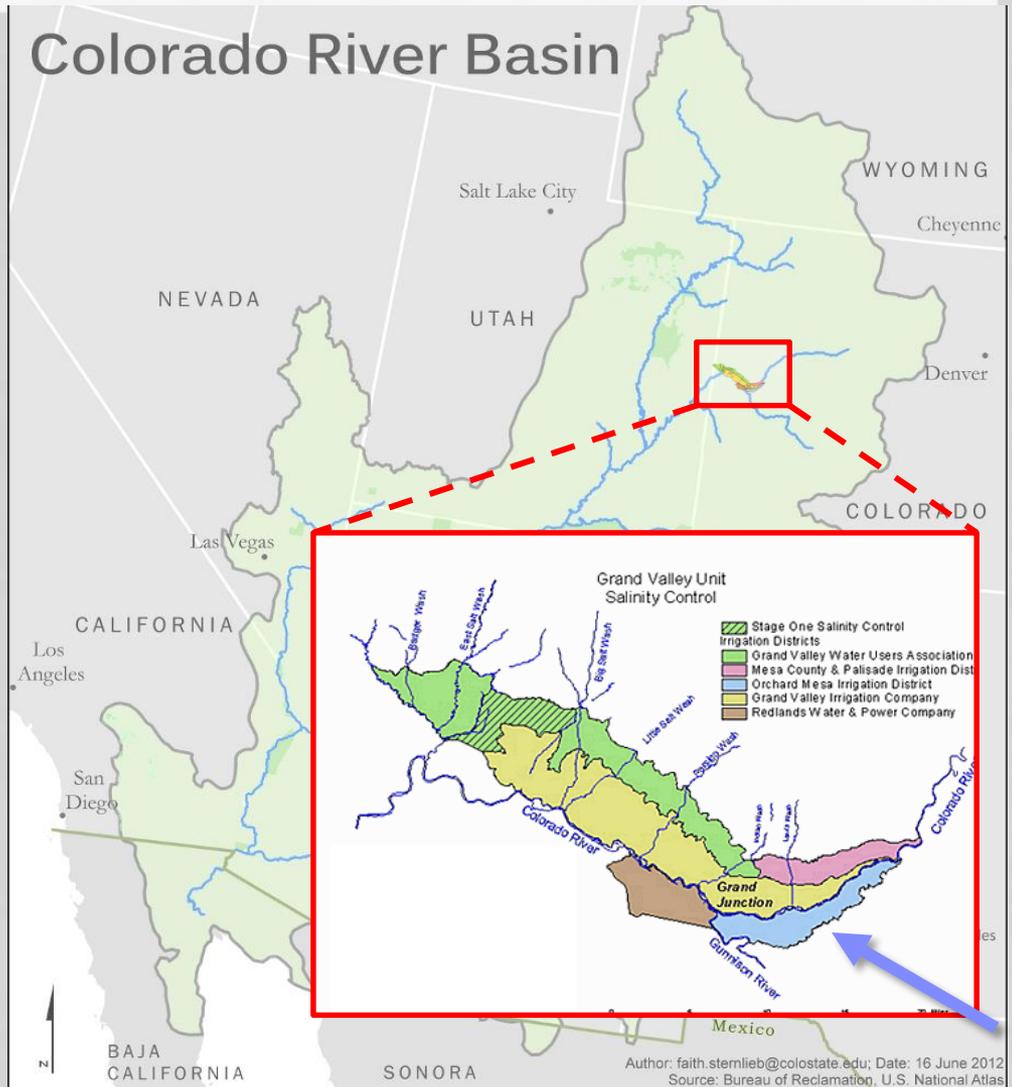
- Seven new canal check structures and a bypass pipeline (all constructed in 2000–2001)
 - A pumping station at Highline Lake
 - An integrated SCADA system
 - Rehabilitation of eight existing canal check structures in the Government Highline Canal
 - The Palisade return flow pipeline
- The main concern about this plan is that Colorado water law does not support protecting conserved water for instream flow purposes
 - However, since there is no other diversion in that reach, others may not be able to use that water.

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ORCHARD MESA IRRIGATION DISTRICT CANAL SYSTEM IMPROVEMENTS PROJECT

- In 2013, the Bureau of Reclamation proposed to construct system improvements in Orchard Mesa Irrigation District on behalf of the Upper Colorado River Basin Endangered Fish Recovery Program.
 - To increase the reliability of water supply in the OMID Division of the Grand Valley Project.
 - In response to the U.S. Fish and Wildlife Service identification of the need for additional flows within the 15-Mile Reach and the Recovery Program identification of the proposed project as a source to contribute additional flows



ORCHARD MESA IRRIGATION DISTRICT CANAL SYSTEM IMPROVEMENTS PROJECT

- The 15-mile reach starts from the Grand Valley Irrigation Company Diversion Dam near Palisade to the Colorado River confluence with the Gunnison River.
- The project is expected to be fully operational in 2016 and it is estimated that it will result in 17,000 acre-feet saving in irrigation water.
- The project also reduces pumping by 28,000 acre-feet annually, which would reduce energy demand for pumping.
- After flow augmentation in the 15-mile reach, the water will be redirected to the Grand Valley Power Plant to increase hydropower generation.

ORCHARD MESA IRRIGATION DISTRICT CANAL SYSTEM IMPROVEMENTS PROJECT

- The system improvement will also reduce agricultural, municipal, and industrial water shortages.

Proposed Improvements include:

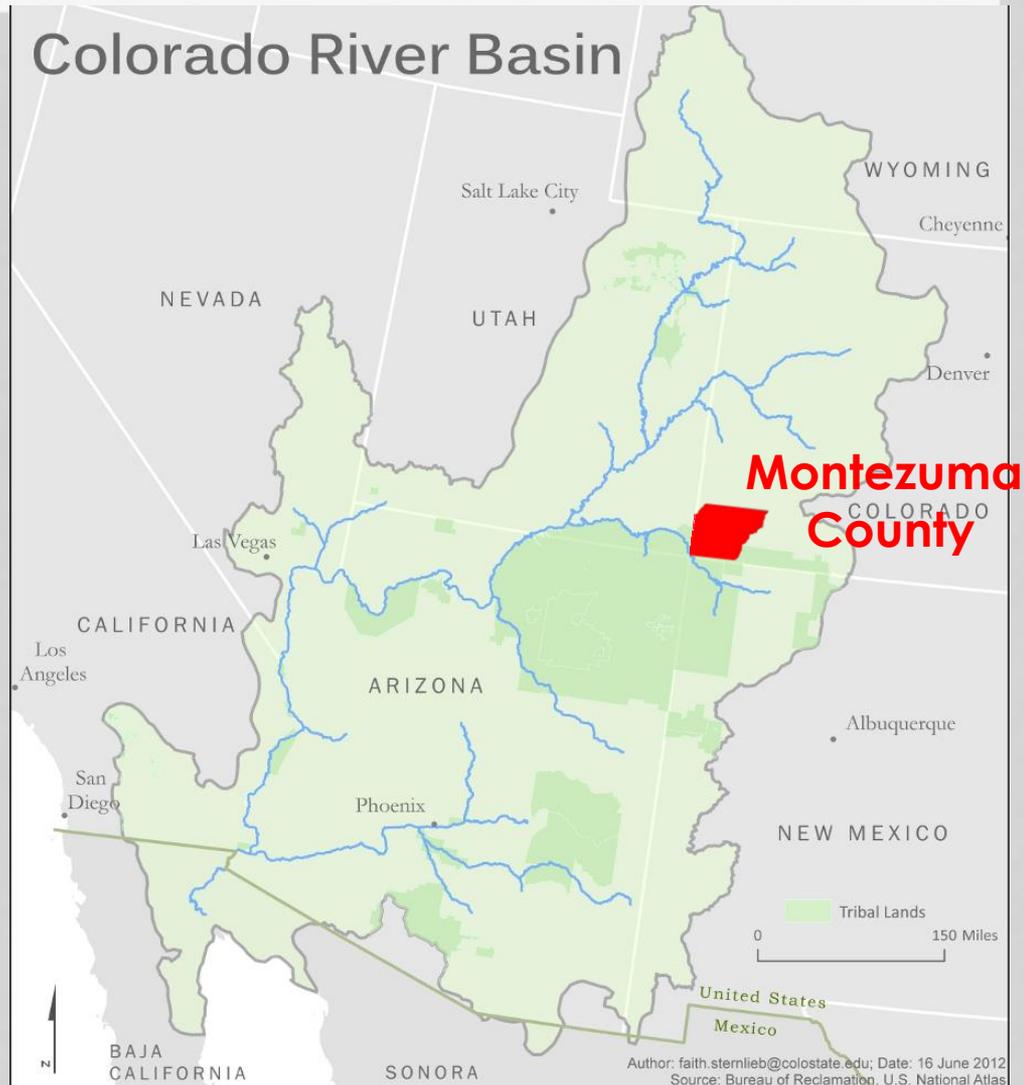
- Construction of a new 80-100 acre-foot regulating reservoir
- Improve water level control in Orchard Mesa Canals No. 1 & 2
- Installation of a SCADA System
- Increased pump capacity
- Construction of interties between the Canals No. 1 and No. 2 to help balance flows in the irrigation system and upgrades to canal end spills
- Reduced canal and lateral seepage (Lining and Piping)
- Improved operational procedures (Improved Operations)

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MONTEZUMA VALLEY IRRIGATION COMPANY WATER LEASING PROPOSAL

- In 2011, the board of directors of Montezuma Valley Irrigation Company proposed to its shareholders the concept of leasing water on a short-term, trial basis, to the Colorado Water Conservation Board to augment flows downstream of McPhee Dam.
- Private interests, conservation organizations and other nongovernmental sources were to provide the funds for the lease.



MONTEZUMA VALLEY IRRIGATION COMPANY WATER LEASING PROPOSAL

- Based on this proposal, up to 6,000 acre-feet of water would be supplied in three out of 10 years, to be released from McPhee.
 - The water conservation board could use the water for a maximum of 120 days during the irrigation season
- The MVIC board of directors saw their proposal as a proactive step toward securing their water rights
 - The region is a habitat to some sensitive fish species. If these species get listed as threatened or endangered, the region's water managers would potentially lose control of the river.
- This was conceptualized as a win-win situation as the flow would enhance downstream fish habitat, while the lease proceeds could be used by the irrigation company to fund enhancement of the irrigation system to mitigate water shortage problems.

MONTEZUMA VALLEY IRRIGATION COMPANY WATER LEASING PROPOSAL

After many meetings, the board's proposal was voted down by its shareholders in 2012.

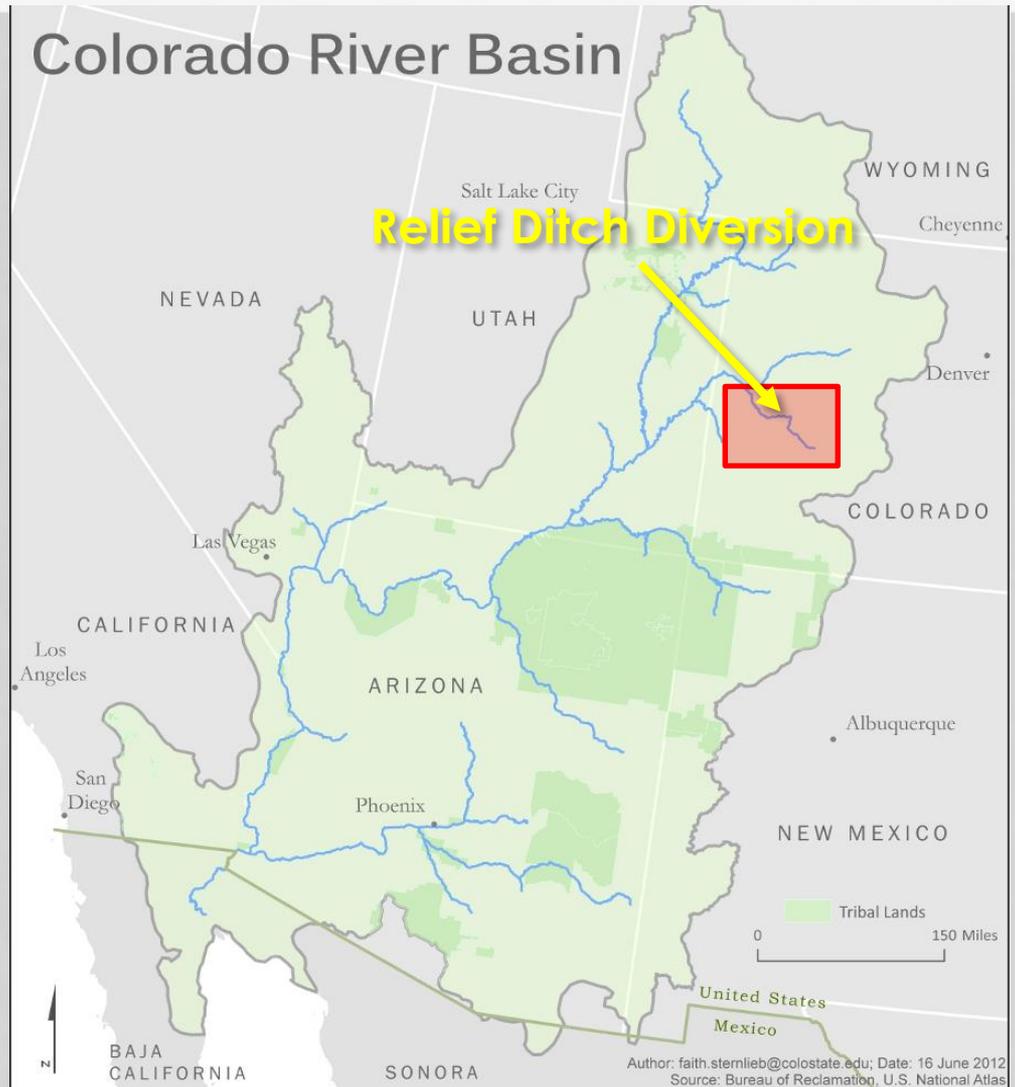
- It was not clear to shareholders who currently are not getting as much water as they desire how leasing water could in the long run provide them that water by improving the delivery system.
- Many shareholders believed that leasing water for environmental purposes might lead later to environmental groups demanding that water without compensation, if it could be shown the farmers did not need it.

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RELIEF DITCH

- Trout Unlimited approached irrigators who divert water within the Gunnison Gorge National Conservation Area to build trust and explore ways to:
 - Develop a sustainable diversion structure that provides a better management of irrigation water to the Relief Ditch, enhances the riparian environment while reducing erosion, reduces fish entrainment, removes a barrier to fish movement, and creates safe boater passage and fishing access.



RELIEF DITCH

- The modifications seem necessary due to concerns about erosion and riparian degradation, native fish populations, fish entrainment, poor water control, fish passage barrier, and boater hazard.
- The Relief Ditch Diversion Modification Project
 - Replaces a pushup dam on the Gunnison River with a permanent diversion
 - Installs a modern head gate on the ditch
 - Rehabilitates the eroded riverbanks at the diversion point
 - Moves the diversion point upstream by 250 feet
 - Removes railroad rails that were driven into the river bed



NEVADA

LOWER COLORADO RIVER BASIN INTENTIONALLY CREATED SURPLUS FORBEARANCE AGREEMENT

- Intentionally Created Surplus Forbearance Agreement was initiated in 2007.
- It is an agreement among Southern Nevada Water Authority, the Secretary of the Interior, and some lower basin water users who agreed to allow the SNWA to convey its formerly called "in-state water" to the Colorado River and receive credits.
 - The lower basin entities that signed the agreement include: Arizona Department of Water Resources, Palo Verde Irrigation District, Imperial Irrigation District, City of Needles, Coachella Valley Water District, The Metropolitan Water District of Southern California, and the Colorado River Commission of Nevada.
- If the created water is not used in the same year, it is converted to extraordinary conservation ICS credits.

LOWER COLORADO RIVER BASIN INTENTIONALLY CREATED SURPLUS FORBEARANCE AGREEMENT

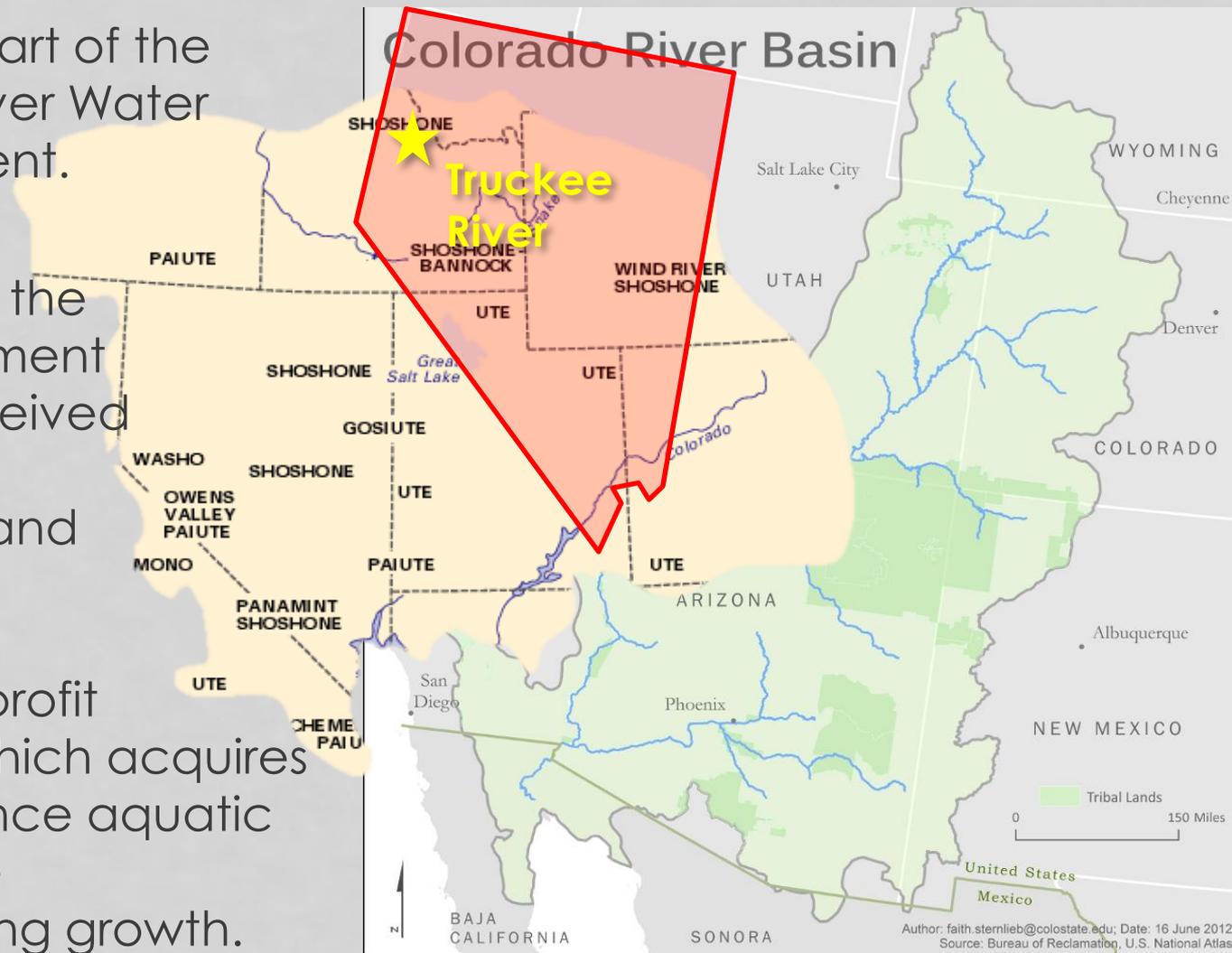
- SNWA can create up to 300,000 acre feet of credits in Lake Mead for future use, like a bank account.
- SNWA has three types of ICS projects:
 - Tributary conservation: SNWA conveys water from the Muddy and Virgin Rivers to Lake Mead and receives over 30,000 acre-feet per year of consumptive use rights.
 - Groundwater imported: The water authority has purchased the permits to use up to 15,000 acre-feet per year of the Coyote Spring Valley water to develop groundwater imported ICS.
 - System efficiency: Warren H. Brock Reservoir (formerly Drop 2 Reservoir) captures Nevada's unused Colorado River water before it flows downstream and to Mexico. Through system efficiency ICS, SNWA will receive at least 400,000 acre-feet at a maximum rate of 40,000 acre-feet per year beginning in 2011.
- In addition, Extraordinary Conservation allows water users to implement a water conservation project, such as land fallowing or canal lining and save it in Lake Mead.

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GREAT BASIN LAND AND WATER

- Established as part of the 1996 Truckee River Water Quality Settlement.
- Launched with the litigation settlement funds, then received congressional appropriation and federal grants.
- GBLW is a nonprofit organization which acquires water to enhance aquatic resources while accommodating growth.



GREAT BASIN LAND AND WATER

- This organization buys water rights and converts the acquired water rights to instream flow rights, which are held by members of the partnership.
 - The water rights are occasionally purchased along with the associated lands.
- GBLW's water right acquisition process is relatively fast as the acquisition is not practiced through conventional land or water trusts, which require time consuming negotiation and conservation easement processes.
- Over the past 15 years, GBLW has completed more than 100 voluntary, market-based water rights transactions in the Great Basin.

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THE SNWA WATER RESOURCES PORTFOLIO

- In its 2009 Water Resource Plan, the Southern Nevada Water Authority has employed a portfolio approach to evaluate its overall resource options and make appropriate decisions about its water supplies.
- The Plan's current & future resources portfolio includes conservation, Colorado River water, groundwater resources and augmentation.
- These resources are prioritized considering their reliability, availability, accessibility, cost and need.
- In developing this diversified portfolio, the SNWA has considered the fact that under the Law of the River, Lower Basin States are allowed to use the unused apportionment of another state.
 - If Arizona does not use all of its basic apportionment, the Secretary of the Interior may authorize Nevada and California to use the unused portion.
 - The SNWA also has a right to Nevada's unused Colorado River water.

THE SNWA WATER RESOURCES PORTFOLIO

- In addition to Nevada basic apportionment, return-flow credits, and unused apportionment, SNWA has the following mechanisms to supply their demand:
 - Flood Control Surplus
 - Domestic Surplus
 - Intentionally Created Surplus (ICS)
 - Banked Resources
- SNWA purchases or leases water from individual shareholders of irrigation companies and pays for the irrigation companies' assessment studies, which contributes to the companies' long-term stability.
- They believe partnerships with agricultural users can be beneficial without impacts to food production, and can prevent future conflicts.

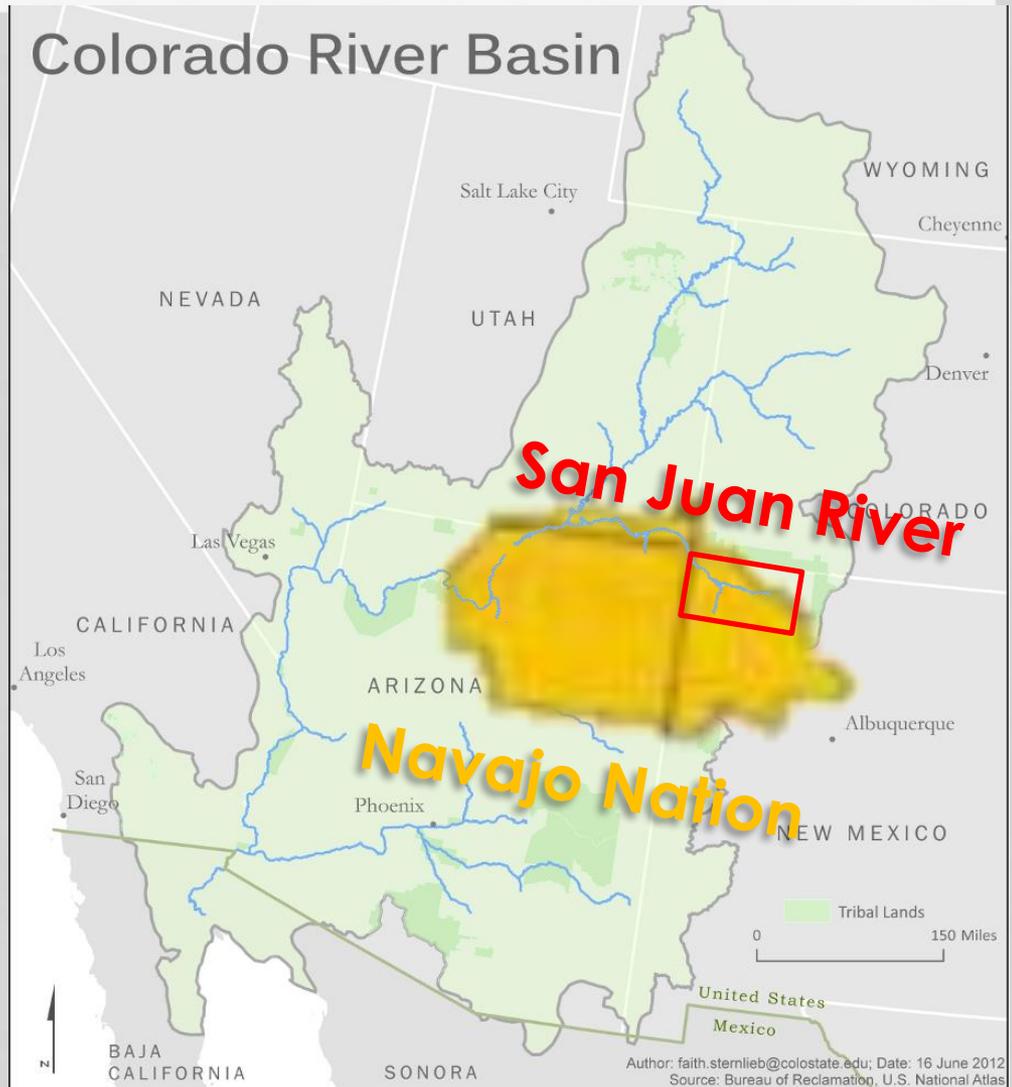
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NEW MEXICO

SAN JUAN RIVER SETTLEMENT AGREEMENT

- After over 20 years of efforts to adjudicate the Navajo Nation's water rights, on April 19, 2005, the State of New Mexico and the Navajo Nation signed a settlement agreement to
 - Adjudicate these rights
 - Provide necessary water development projects for the Navajo Nation in exchange for a release of enough water to avoid displacement of non-Navajo water users in the basin



SAN JUAN RIVER SETTLEMENT AGREEMENT

- Settlement Agreement was executed on December 17, 2010, and final decrees were entered on November 1, 2013.
- New Mexico's apportionment of the Colorado River is 669,400 AF of consumptive use.
 - Of which, 58,000 AF is the share of reservoir evaporation storage projects.
 - Of the remaining, 56% is the Navajo Nation's share for irrigation and domestic use.
- In addition to the water rights, the Navajo Nation:
 - May divert supplemental carriage water, if needed
 - May develop additional ground water on Navajo lands
 - Would have a small amount of rights it has acquired under state law
 - Would have additional rights to de minimus residential domestic and stock uses
 - Would have a contractual right to storage in Ridges Basin Reservoir
 - May re-use tail water or waste water so long as the re-use does not cause the Nation's diversion and depletion rights to be exceeded

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SUNSET CANAL IMPROVEMENT PROJECT

- Sunset Canal Company proposed the Sunset Canal Improvement Project to enhance approximately 11 miles of the New Mexico section of the Sunset Canal.
- The Sunset Canal diverts the Gila River water to irrigated croplands within the Virden Valley north of the river.
 - It serves 2,236 acres in New Mexico and another 316 acres in Arizona.



SUNSET CANAL IMPROVEMENT PROJECT

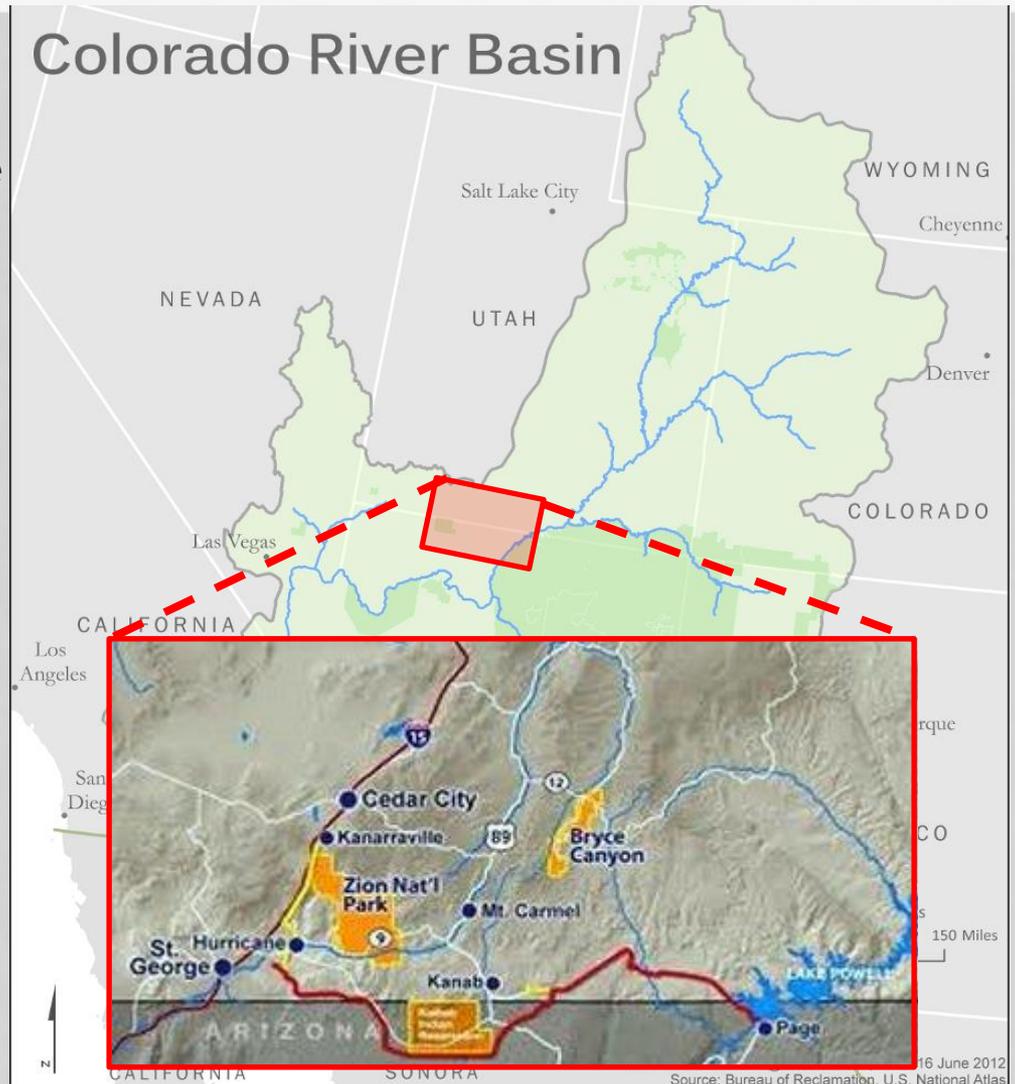
- The canal improvement proposal has been developed due to long-term concerns about the maintenance, slopes stability, sediment capture below steep slopes, and water loss through infiltration, evaporation, and plant uptake in the open unlined canal in current condition.
 - It has been estimated that the water loss through canal seepage is about 20%.
- Sunset Canal Company is planning to install a water transmission pipeline within the existing canal and place sealed valves and water meters for individual users.
 - The canal improvement project is expected to conserve the water loss.



UTAH

LAKE POWELL PIPELINE PROPOSAL, UTAH

- Washington County Water Conservancy District, which supplies water to St. George City in southwest Utah, proposed building a pipeline to bring Colorado River water from Lake Powell to Washington and Kane counties.
- The Lake Powell Pipeline Development Act, passed by the Utah State Legislature in 2006, authorized the Board of Water Resources to build the Lake Powell Pipeline.



LAKE POWELL PIPELINE PROPOSAL, UTAH

- Washington County, with the current population of approximately 150,000, is forecasted to grow to nearly 200,000 by year 2020, and up to 580,000 in the next 50 years.
 - Despite the high population growth rate, Washington County's St. George City, located in the driest county in the second driest state in the country, has the highest per capita water consumption rate for desert cities in the U.S.
- In the absence of the pipeline, this Utah share of Colorado River water is currently flowing down to the Lower Colorado River Basin states.
- Through this pipeline system, water will be pumped underground about 138 miles from Lake Powell to Sand Hollow Reservoir in Hurricane.
- At full development, the pipeline will deliver up to 82,000 acre-feet per year to Washington County Water Conservancy District and 4,000 acre-feet per year to Kane County Water Conservancy District.

LAKE POWELL PIPELINE PROPOSAL, UTAH

Critics to the proposal:

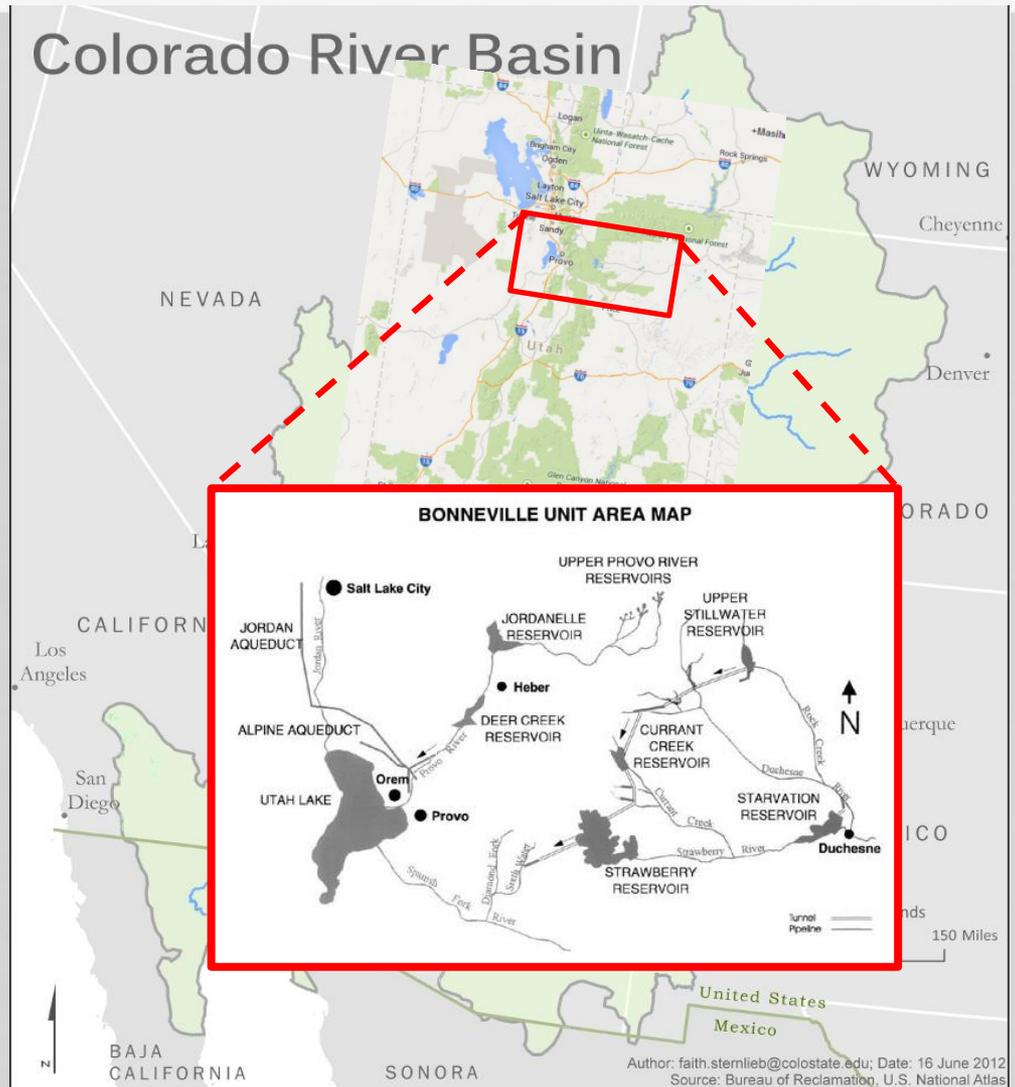
- The study incorporated an excessive rate of growth, outdated water use numbers, and unreasonably low water conservation expectations to justify the need for the Pipeline.
- Effects of the long-term drought and rising temperature levels in the West have not been considered.
- Project costs, initially estimated at \$250 million and now exceeding \$2 billion, will be imposed on the region's small communities.
- It has not been clarified how the Water District will pay the multimillion dollar annual bond payments.
- Utah economists' new studies show that water revenue would need to increase 370%, which might require a drastic, ten-fold increase in impact fees

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CENTRAL UTAH PROJECT

- The Bureau of Reclamation was authorized to plan and construct the Central Utah Project on April 11, 1956.
 - Under the Colorado River Storage Act.
 - The largest water resources development program in Utah.
- Construction began in 1966 and continued until October 30, 1992.
- The project diverts a portion of Utah's allotted share of the Colorado River water to 10 counties (originally 12).



CENTRAL UTAH PROJECT

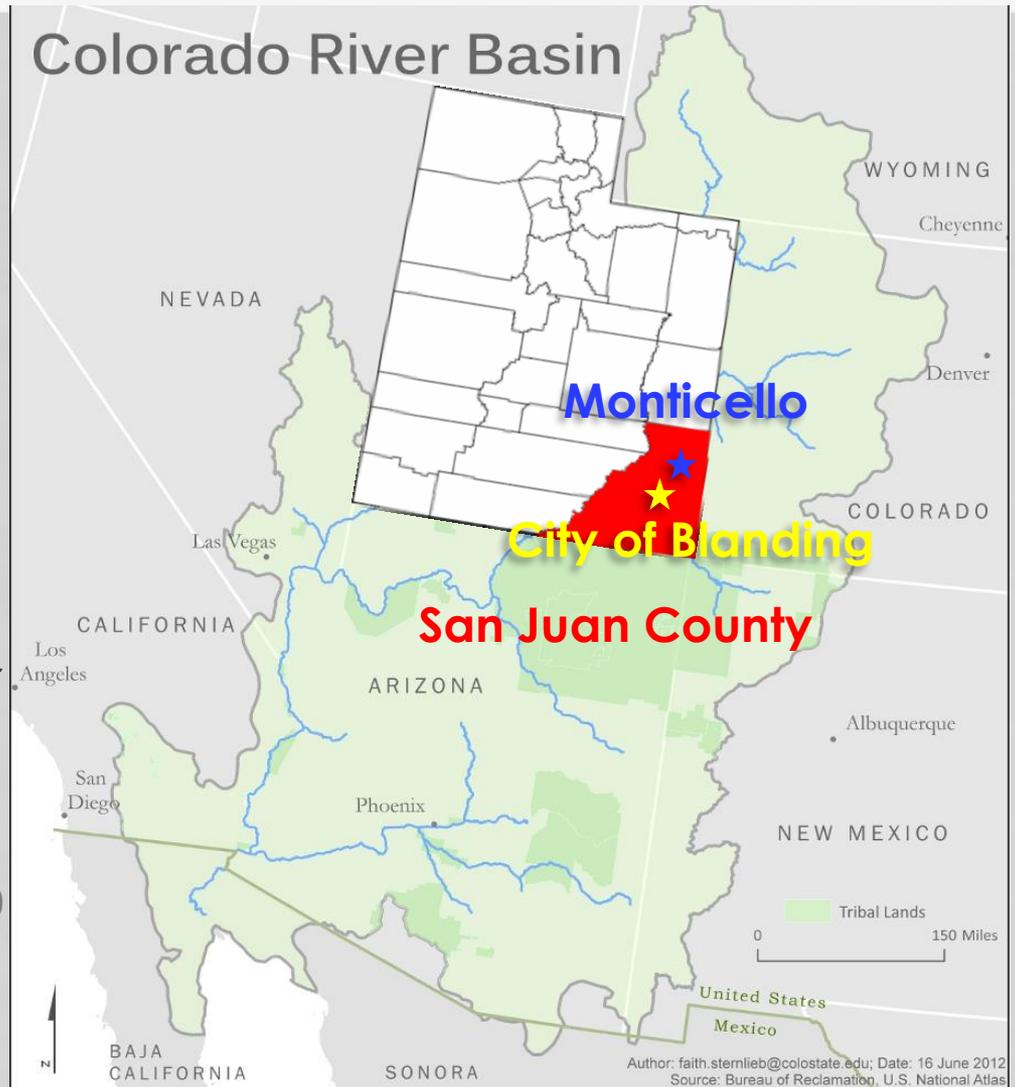
- The project is divided into six separate units, Vernal, Bonneville, Jensen, Upalco, Uintah and Ute Indian Units de-authorized in the Reclamation Projects Authorization and Adjustment Act.
 - The largest unit is the Bonneville Unit, located on both sides of the Wasatch Mountains in central and northeastern Utah.
 - This unit expands in both Uinta and Bonneville Basins
 - All other units are located in the Uinta Basin
- The project supplies 62,000 acre feet of water per year for irrigation to over 30,000 acres agricultural lands and 94,750 acre feet per year for municipal and industrial purposes
 - Meeting water demands of about 400,000 people.
 - The municipal share includes diversion of 20,000 acre-feet per year to the Metropolitan Water District of Salt Lake City, began in 2005 in 4,000 acre-foot increments over a 5-year period.

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SAN JUAN COUNTY UTAH MULTIPLE USE PROJECT

- One of the biggest Utahans challenges is to keep their water.
 - They have to show that they can put their water right to beneficial use.
- San Juan County Water Conservancy District worked with the City of Blanding and Blue Mountain Irrigation Company to build a reservoir above Monticello in San Juan County, southeast Utah.
 - This reservoir has made 25,000 acre-feet of Colorado River water available to the district through the law of the river.



SAN JUAN COUNTY UTAH MULTIPLE USE PROJECT

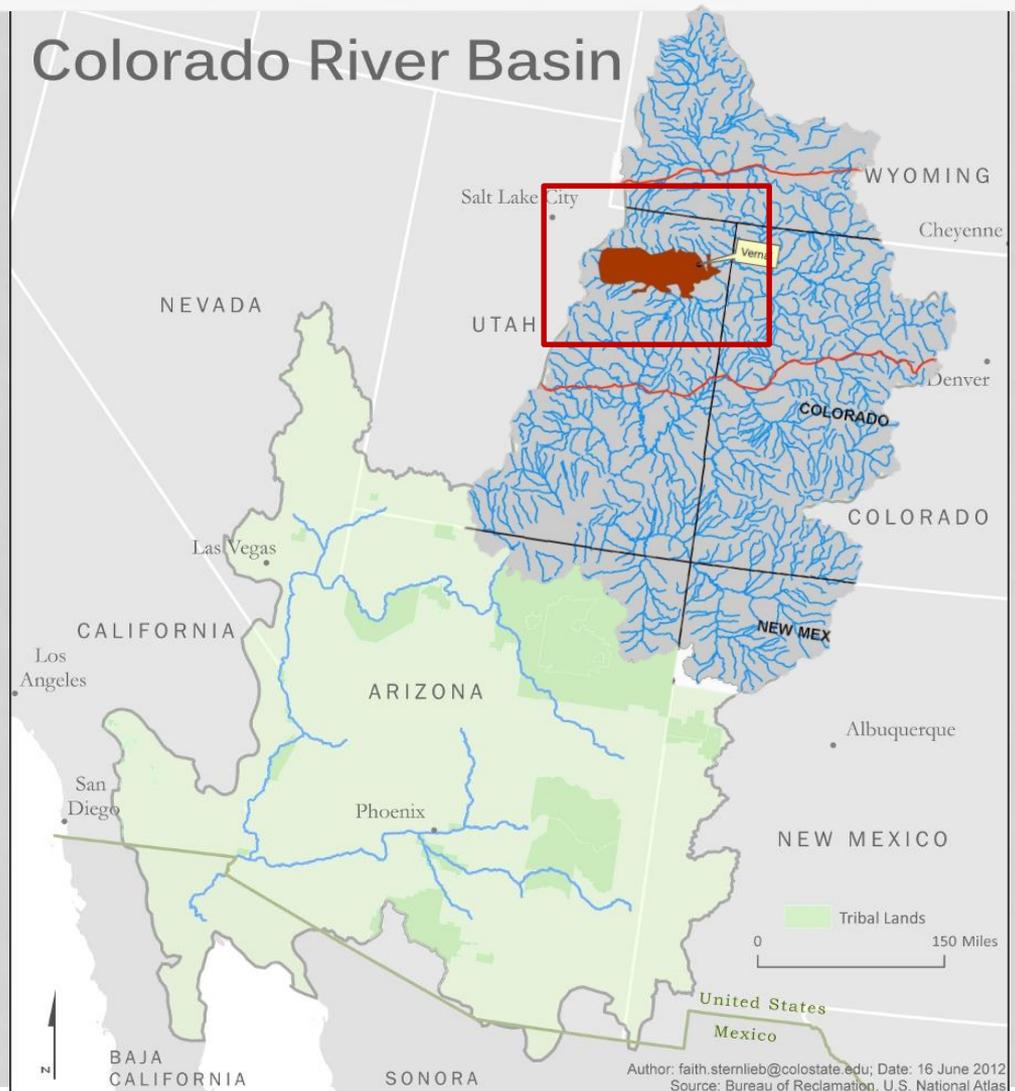
- Farmers who used to irrigate their lands by snow pack and ditches changed their water right into a storage right so they could use it for sprinkler irrigation, which is much more efficient
 - 65% compared to 30% with flood
- They also have more flexibility on the timing of irrigation.
- If the irrigators wanted to use ground water, they would have to pump it from 2000-foot deep wells, which would have been too expensive.
- If the project was to only supply agriculture, it could not have been approved.
 - Participation of municipal partners helped it happen.
- They also involved Fish and Wildlife for recreation and 500 acre-feet should be saved for a conservation pool for fishing.

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UINTA BASIN SALINITY CONTROL PROJECT

- The Uinta Basin's estimated salinity load transferred to the Colorado River is approximately 500,000 tons per year
 - Including 328,120 tons from agricultural practices.
- The salt load from agricultural practices comes from both on-farm practices, 208,120 tons per year, and off-farm practices, 120,000 per year.



UINTA BASIN SALINITY CONTROL PROJECT

- The Bureau of Reclamation began implementing salinity control projects in the Uinta Basin in 1986.
- Natural Resources Conservation Service had also started on-farm improvements in 1981 under its Agriculture Conservation Program.
- Key accomplishments of the Uinta Basin Salinity Control Program include:
 - Treatment of nearly 653 miles of canal and laterals out of 1,761 miles
 - Enhanced irrigation methods on about 126,600 acres out of 211,600 total irrigable acres
- Through NRCS on-farm efficiency improvements, the average irrigation efficiency in the Uinta Basin has improved by 30%
- Local farmers have also benefited from funds for irrigation equipment and technical assistance.



FERRON SALINITY PROJECT

- For nearly 100 years farmers and ranchers in the Ferron area have been flood irrigating, resulting in continual salt loading to Ferron Creek and salt damages to once productive agricultural soils.
- The Ferron Salinity Project was completed in 2006, as a result of collaboration among USDA-Natural Resources Conservation Service, the Bureau of Reclamation, Ferron Canal and Reservoir Company, as well as national, state and local partners.



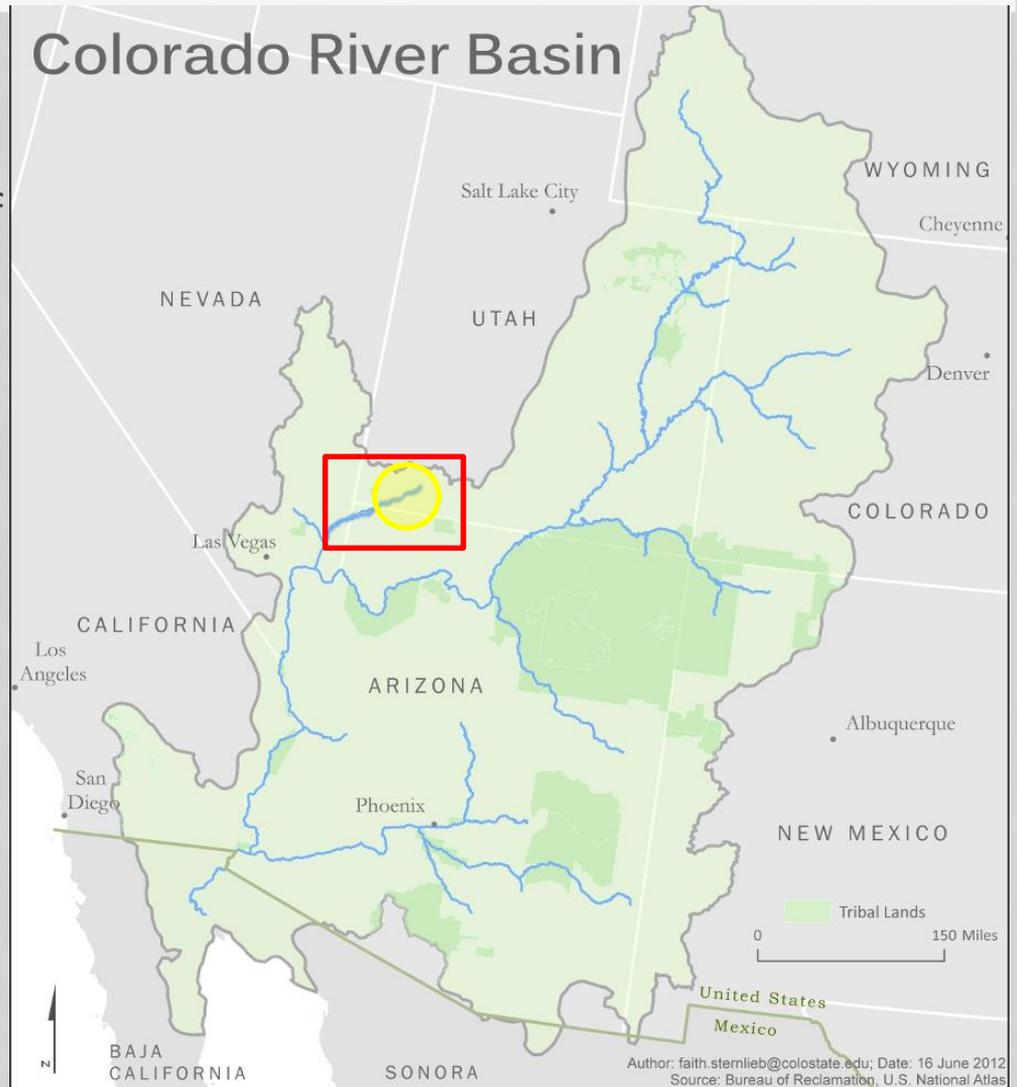
FERRON SALINITY PROJECT

- The Salinity Irrigation Environmental Quality Improvement Project (EQIP) saves an estimated annual 47,000 tons of salt from entering the Colorado River.
- Salt accumulation has been decreased by reducing deep percolation, eliminating canal and ditch seepage, and installation of pressurized sprinkler systems.
- The project includes 175 miles of pipe fed by two laterals from Millsite Reservoir and three regulating ponds.
- Approximately 10,000 acres of alfalfa, row crops and pastureland have been equipped with pressurized sprinkler irrigation systems.
 - This has increased the overall irrigation efficiency from about 30% to 67%.
- The more efficient conveyance and irrigation systems have also extended the irrigation season into the fall and increased productivity.



THE CONFLUENCE NATURE PARK PROJECT

- The Virgin River Land Preservation Association in partnership with a variety of entities, including the Washington County Water Conservancy District and the state of Utah, converted agricultural lands in the Virgin River Valley of southwest Utah that was targeted for development, into a 350-acre county park and nature reserve.



THE CONFLUENCE NATURE PARK PROJECT

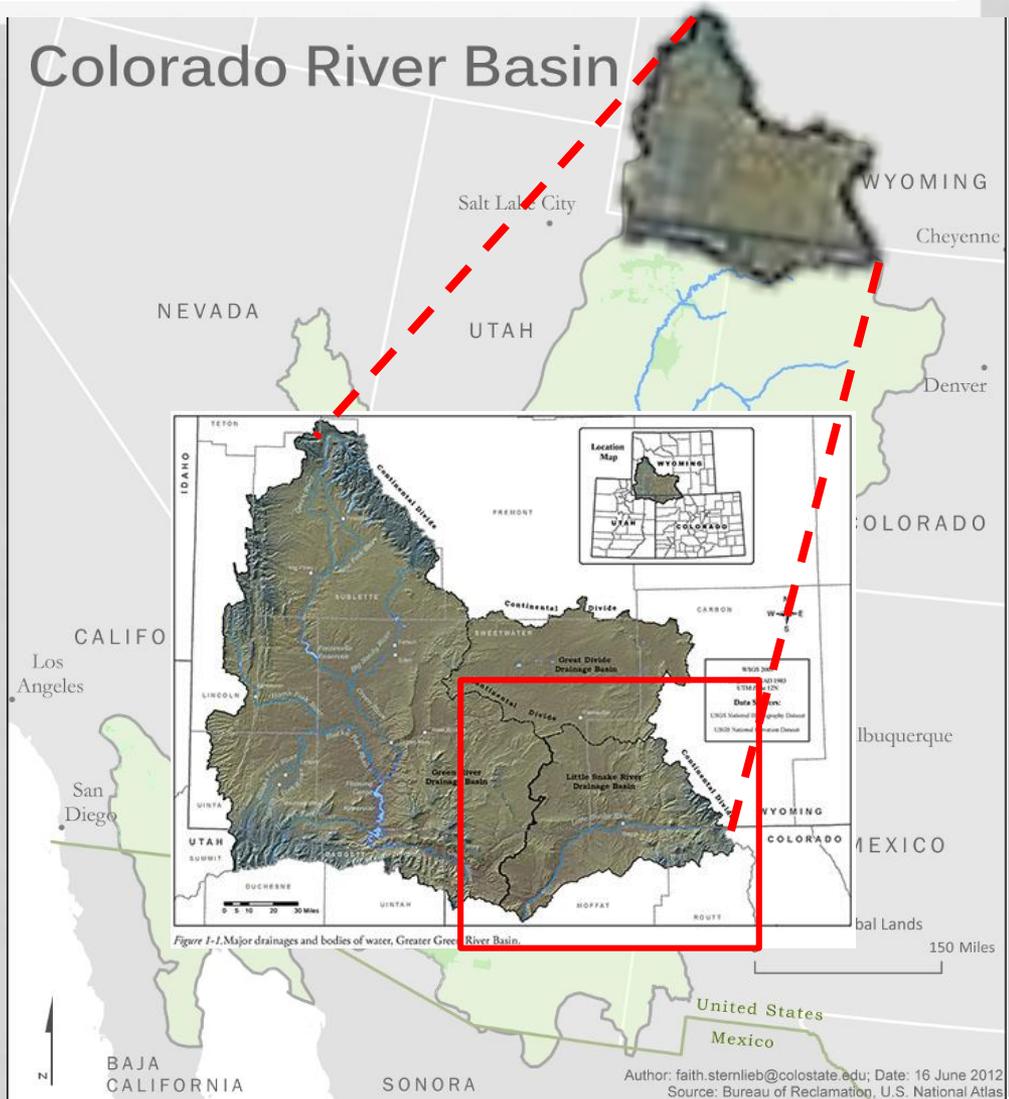
- The Confluence Nature Park helps restore streamflow, while diluting and cooling the Virgin River to improve the chances of survival for several at-risk fish species.
- The region has recently experienced rapid urban growth mostly onto farmlands.
- The project was created on three properties, retaining irrigated fields, ponds and water rights.
- The \$5 million of this project was provided by a variety of sources, including the state, private donors, the federal government, the Washington County Water Conservancy District and the Conservation Fund.



WYOMING

HIGH SAVERY DAM AND RESERVOIR: IMPROVING AGRICULTURE AND THE ENVIRONMENT

- High Savery Dam and Reservoir's construction was authorized by Wyoming Legislature in 1984.
 - In order to mitigate the impacts of Wyoming's only large transbasin diversion
 - The diversion removed 21,000 acre-feet from the basin.
- The reservoir, with a capacity of 23,000 acre-feet, was built on the Savery Creek, a tributary to the Little Snake River in the Green River drainage in south central Wyoming and northwest Colorado.



HIGH SAVERY DAM AND RESERVOIR: IMPROVING AGRICULTURE AND THE ENVIRONMENT

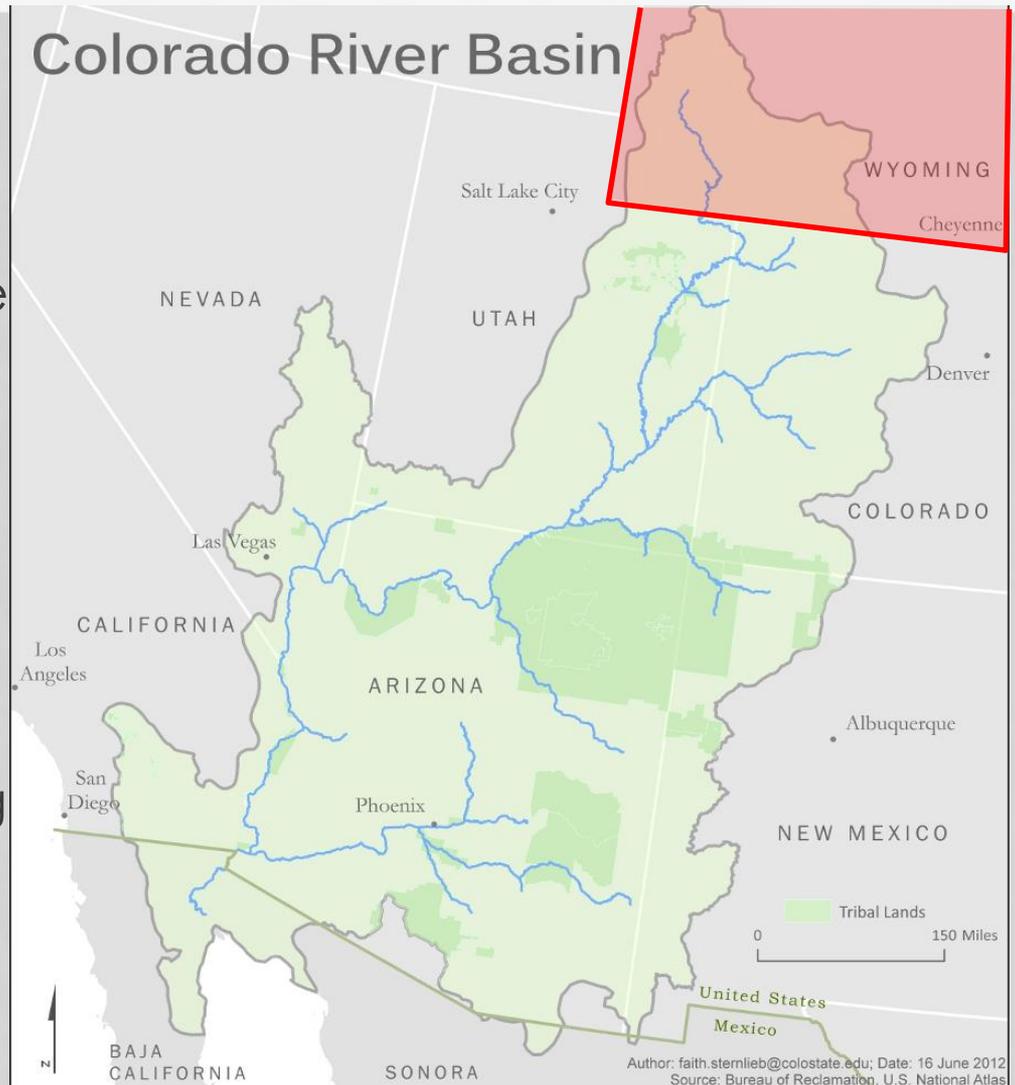
- The success of this project was due to a broad coalition among the agricultural community, wildlife and conservation organizations, and government entities at local, state, and federal levels.
 - The mitigation took over 20 years to permit and build.
- The reservoir has a multiple level outlet system designed to maintain downstream temperature for fisheries.
- Barriers have also been constructed against non-native fish moving upstream.
- In order to get the project permit, they had to mitigate wetland and stream channel impacts and enhanced environmental attributes along the river corridor to maximize the benefits of the stored water.
- The reservoir also provides late season irrigation water for ranchers, while creating a fishery and recreation.

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WYOMING WATERSHED MANAGEMENT AND REHABILITATION PLAN

- Wyoming Water Development Commission funds irrigation improvements for ditch companies with severance tax dollars.
- Before such funds are granted, watershed planning must be in place.
- In order to promote this watershed-based planning WWDC has developed a Watershed Management and Rehabilitation Plan for the state.



WYOMING WATERSHED MANAGEMENT AND REHABILITATION PLAN

Based on their plan, watershed description and inventory studies shall include:

1. Land uses and management activities
2. Surface and subsurface geology
3. Estimations of hydrology of the watershed
4. Evaluation of channel structure, morphology, and stability of stream systems
5. Description of irrigation systems within the watershed
6. Description of water and air quality within the watershed
7. Evaluation of water storage and flood control demands
8. Evaluation of stream gauge coverage and period of record

In general, the plan shall

- Identify required land and management methods
- Address irrigation supply systems and recommend upgrades, modifications, operational improvements and efficiency management techniques
- Identify upland water development opportunities
- Specify the interrelationships between water management, irrigation rehabilitation opportunities, and overall health of the watershed

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PROPOSAL TO USE COALBED METHANE PRODUCED WATER

- A proposal has been made in south-central Wyoming to treat produced water from coal bed methane mines in the region and discharge it into the streams or make it available for irrigation.
- If approved, this practice is estimated to provide an additional 3,500 acre-feet of water per year.

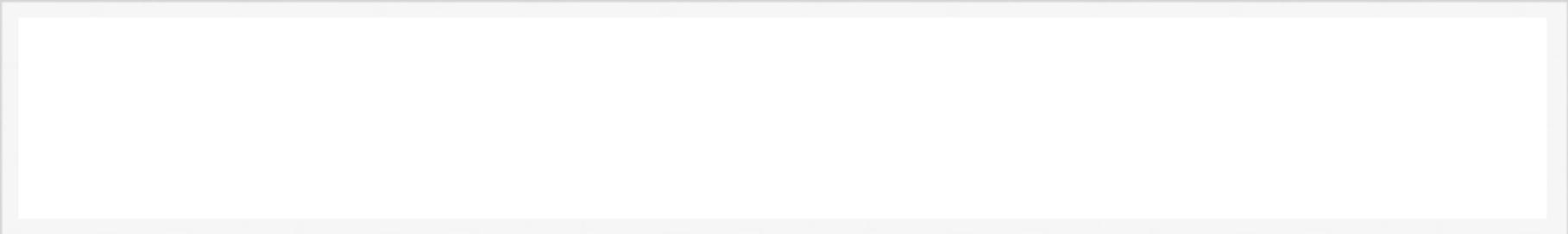


PROPOSAL TO USE COALBED METHANE PRODUCED WATER

- This produced water, which is a byproduct of the process of developing, extracting, or disposing energy-related products, is currently re-injected back into the ground.
- Treating and using produced water for other purposes not only may reduce energy companies' costs associated with re-injecting it into the ground (as the benefit from selling that water covers treatment costs), it also diminishes environmental concerns, augments streamflow, and secure agricultural water supply.
- Although it appears to be a win-win situation, proponents believe that energy companies have been hesitant to make any change in their current activities due to concerns about the Bureau of Land Management's bureaucratic system.

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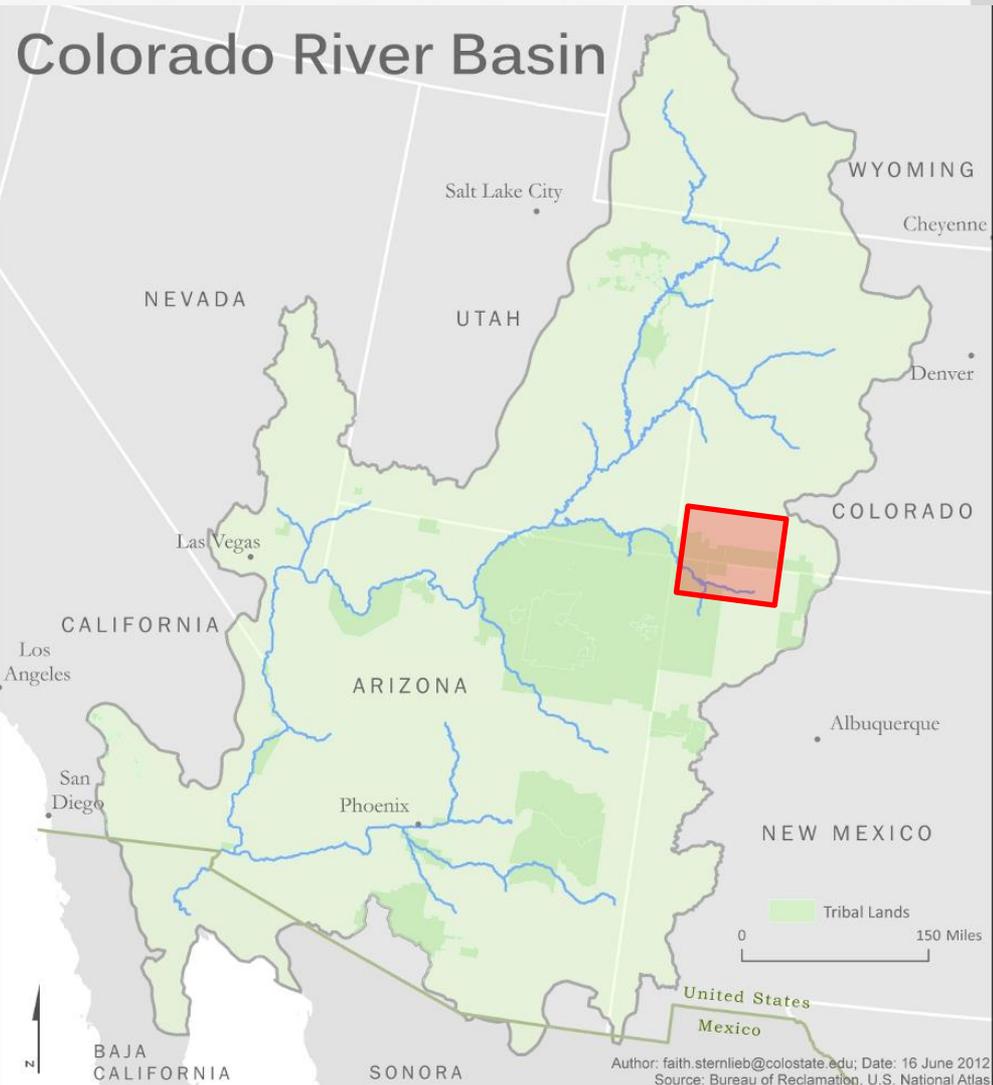




**MULTI-STATE PROJECTS
WITHIN THE COLORADO
RIVER BASIN**

ANIMAS - LA PLATA PROJECT

- Located in La Plata and Montezuma Counties in S.W. Colorado and in San Juan County in N.W. New Mexico.
- The Project was authorized by the Colorado River Basin Project Act of September 30, 1968.
- The original primary purpose of the project: to provide irrigation water
 - Later changed to municipal and industrial water supply.
 - The original A-LP project consisted of three reservoirs and 48 miles of canals and tunnels to deliver water from the Animas Basin to the La Plata Basin.



ANIMAS - LA PLATA PROJECT

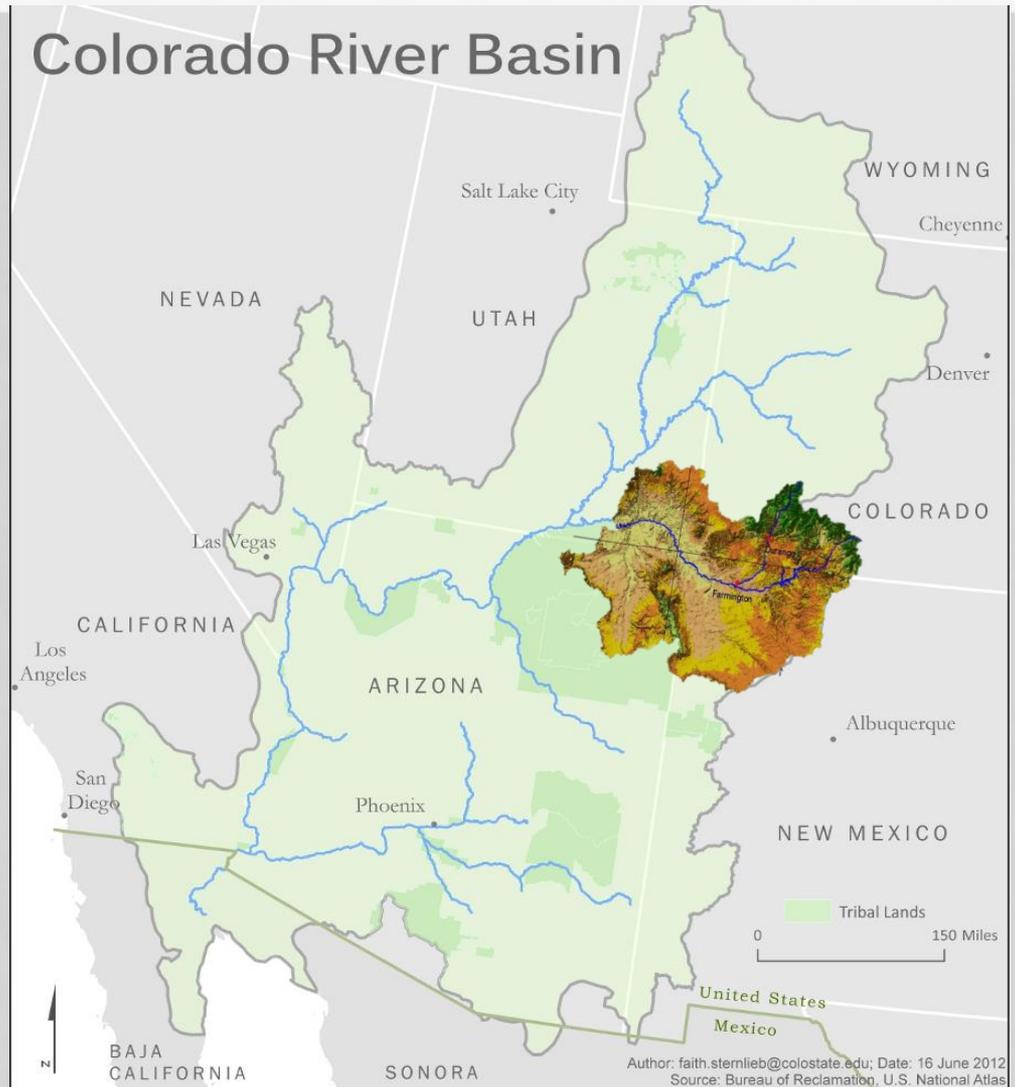
- The A-LP Project created Lake Nighthorse near Durango, Colorado, with an annual storage capacity of 120,000 acre-feet.
- In December 1986, two Indian tribes, the Ute Mountain Ute and Southern Ute tribes, became a part of A-LP by signing the Colorado Ute Indian Water Rights Final Settlement Agreement.
 - Based on this agreement, the Utes gave up their claims in the San Juan River Basin in exchange for water in A-LP and \$60 million in development funds.
 - This agreement modified the A-LP Project from an irrigation project of 191,200 acre-feet per year of depletion to an exclusively municipal and industrial water supply project of 57,100 acre-feet per year of depletion.
- Entities involved in the 1986 Agreement include: United States, the State of Colorado, the Ute Mountain Tribe, the Southern Ute Indian Tribe, the Colorado Water Resources and Power Development Authority, the Animas-La Plata Water Conservancy District, the New Mexico Interstate Stream Commission, the San Juan Water Commission, and Montezuma County, Colorado.

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THE SAN JUAN RIVER BASIN RECOVERY IMPLEMENTATION PROGRAM

- The San Juan River Basin Recovery Implementation Program was initiated in November 1992 and will be implemented through 2023.
- The signing of this agreement followed the discovery of two endangered fishes in the San Juan River:
 - Colorado pikeminnow
 - Razorback sucker
- The original 1992 document was modified by the Coordination Committee in 2006, 2010, and 2012



THE SAN JUAN RIVER BASIN RECOVERY IMPLEMENTATION PROGRAM

- This program is a partnership among the Secretary of the Interior, the governors of the states of Colorado and New Mexico, the Navajo Nation, Jicarilla Apache Nation, Southern Ute Indian Tribe and Ute Mountain Ute Indian Tribe.
- The main goals of the program are to conserve populations of the two endangered fishes, while proceeding with water development in the basin.
- Program elements include:
 - Managing and augmenting populations and protecting genetic integrity
 - Protecting, managing, and augmenting habitat
 - Managing nonnative species; monitoring and evaluating fish and habitat in support of recovery actions
 - Coordinating and assessing program's progress toward recovery information and education



COLORADO RIVER SYSTEM CONSERVATION PROGRAM

- The four largest cities that get a portion of their drinking water from the Colorado River agreed to pilot a conservation fund for two years, as of 2014, to pay volunteer farmers, industries and municipalities to reduce their use of Colorado River water:
 - Denver
 - Phoenix
 - Las Vegas
 - Los Angeles
- As the four cities get a portion of their water supply from the Colorado River, a water shortage in the river would threaten the reliability and security of their water supply.
- Each city will contribute \$2 million and the Bureau of Reclamation will fund \$3 million, totaling \$11 million.
- The water can be saved through practices such as fallowing, installing more efficient irrigation systems, recycling industrial supplies.

COLORADO RIVER SYSTEM CONSERVATION PROGRAM

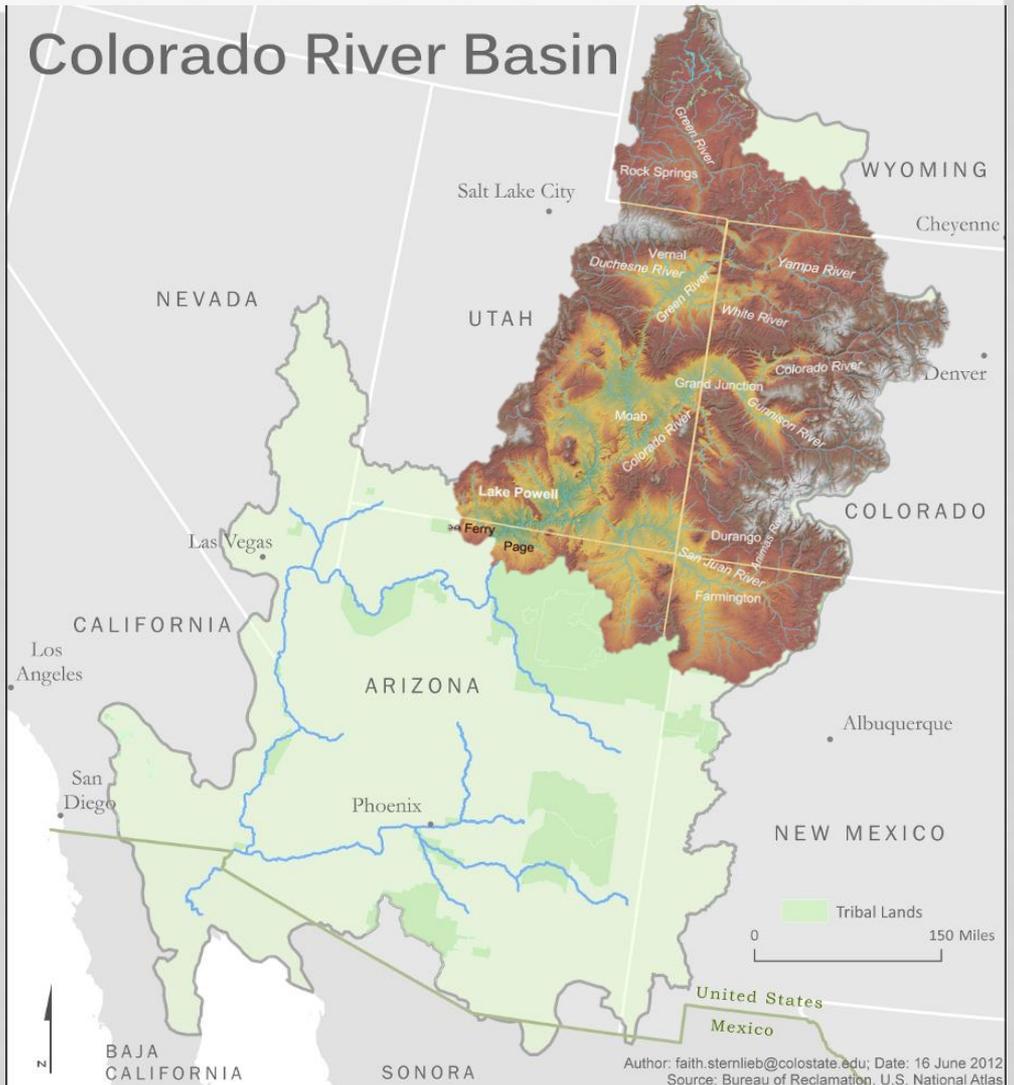
- The program's main goal is to maintain the levels of Lake Mead and Lake Powell high enough to delay or avoid the declaration of a water shortage and call on the river.
- Upon termination of the two year pilot program, if its success is proven, the four cities will expand the funding and invest in more water-saving projects.
- This program has been set up for emergency short-term drought mitigation and would be terminated if Colorado River flows increase to levels that can sustain Lake Powell.
- Critics of the program believe:
 - It does not account for some current issues such as climate change and shifts in water demand from agriculture to municipal use.
 - Current law does not give farmers the flexibility to save water without losing their water rights.
 - Lack of incentives prevents farmers from water saving

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UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

- The Upper Colorado River Endangered Fish Recovery Program was initiated in 1988 to revive four species of endangered fish:
 - Humpback chub
 - Bonytail
 - Colorado pikeminnow
 - Razorback sucker
- The endangered species are revived while water use and development proceeds to meet human demands in compliance with interstate compacts and federal and state laws.



UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

- The program was started following the signing of a cooperative agreement among the Governors of Colorado, Utah, and Wyoming; the Secretary of the Interior; and the Administrator of Western Area Power Administration.
- It has seven elements:
 1. Instream flow identification and protection
 2. Habitat restoration
 3. Nonnative fish management
 4. Propagation and stocking
 5. Research and monitoring
 6. Information and education
 7. Program management
- The program has been characterized by its cost-effectiveness and collaborative on-the-ground achievements toward overcoming the challenges of water development and management, while recovering endangered fish species.

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COLORADO RIVER BASIN SALINITY CONTROL PROJECT

- The construction, operation, and maintenance of projects to control the salt load delivered to Mexico, via the Colorado River, were authorized the Colorado River Basin Salinity Control Act, passed in 1974.
- In 1994, Public Law 98-569 amended the 1974 Salinity Control Act and authorized the Secretary of Interior to develop a comprehensive program for minimizing salt loads from lands administered by the Bureau of Land Management through improved vegetation cover, better use of onsite precipitation, and stronger plant root systems.
- The Act and its amendments also authorized the Secretary of Agriculture to enhance and protect the quality of the Colorado River water for use in the United States and the Republic of Mexico.

COLORADO RIVER BASIN SALINITY CONTROL PROJECT

- Prior to this program, the Colorado River carried an annual average salt load of about 9 million tons at Hoover Dam.
 - It imposed between \$500 million and \$750 million per year to the United States and over \$100 million per year to the Republic of Mexico.
 - The costs to the United States could exceed \$1.5 billion per year in the future in the absence of salinity control projects.
- Title I of the Colorado River Basin Salinity Control Act provided the means to comply with the U.S. obligations to Mexico, addressed in the 1973 agreement between the two governments.
 - The United States shall ensure the annual water delivery of 1.36 million acre-feet to Mexico upstream of Morelos Dam with an average salinity of no more than 115 +30 parts per million above the annual average salinity of Colorado River water arriving at Imperial Dam (average annual differential of salinity above and below Imperial Dam).
- Title II authorized specific salinity control units upstream of Imperial Dam to meet the requirements of the Clean Water Act.

COLORADO RIVER BASIN SALINITY CONTROL PROJECT

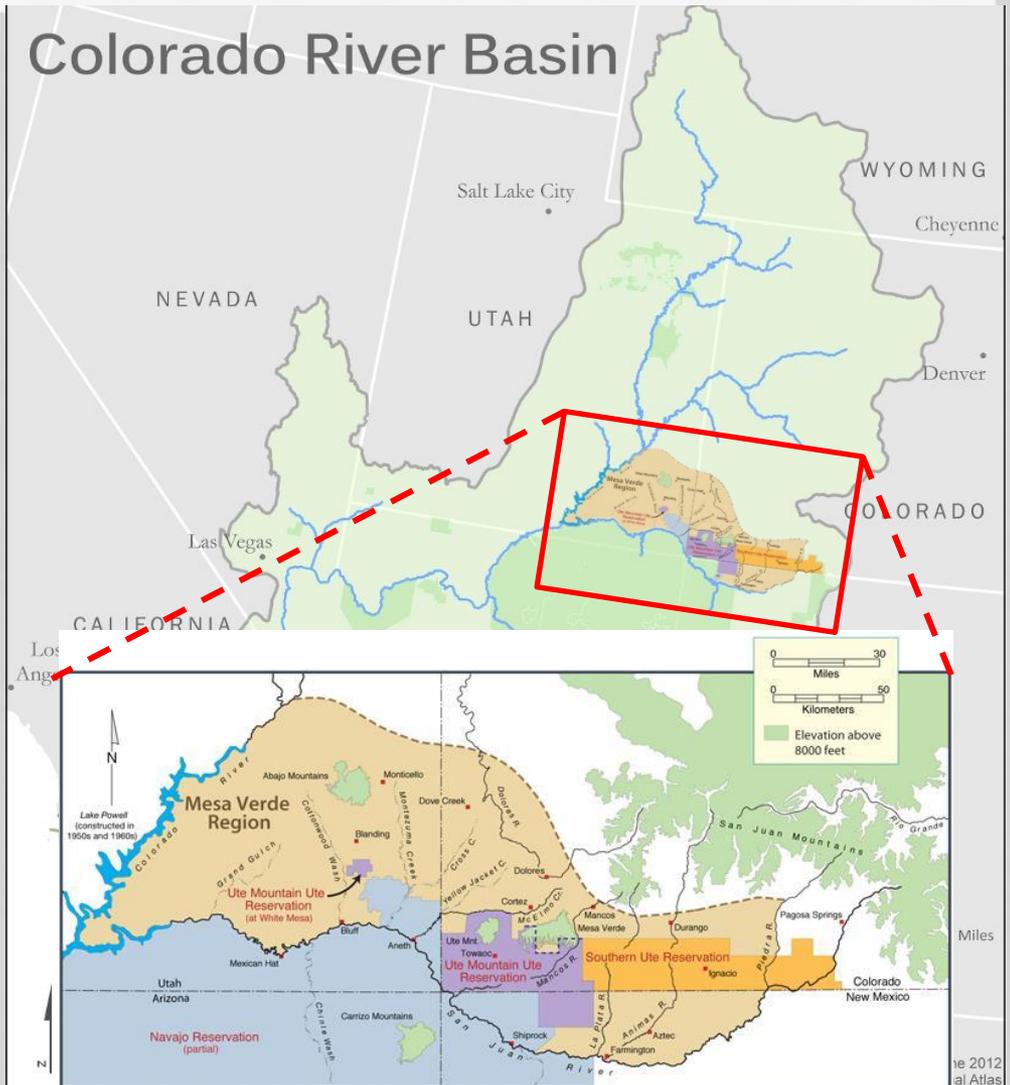
- Reclamation and NRCS are mainly targeting to control the salinity at Imperial Dam, where irrigation induced salt loading is estimated to be about 37% of the salinity at Imperial Dam.
- Reclamation, BLM, and NRCS plan to cost-effectively reduce salinity with a combined control target of 1.85 million tons per year by 2030.
 - To date, they have been able to reduce Colorado River system's salt load by an estimated 1.295 million tons per year.
- The benefit of salinity control has been estimated to be \$340 per ton in 1994 dollar values, as opposed to \$20 to \$100 per ton cost of salinity control.

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UTE MOUNTAIN UTE TRIBE FARM & RANCH ENTERPRISES

- Located in the Ute Mountain Ute Tribe Land, southwest Colorado.
- The Ute Mountain Ute Tribe Farm & Ranch Enterprises proposed a project to the Bureau of Reclamation to conserve water using Supervisory Control and Data Acquisition (SCADA) technology and improved irrigation water management.
- The project was awarded in September 2010.



UTE MOUNTAIN UTE TRIBE FARM & RANCH ENTERPRISES

- Since completion, this project has saved approximately 1,327 acre-feet of water per year.
- The project contains 109 center pivot sprinklers
 - These sprinklers are supplied with water from the McPhee Reservoir via 40 miles of open canal and siphon pipe.
- Conserved water is saved in the McPhee Reservoir for other uses.
- In order to facilitate making precise decisions about the amount and timing of irrigation water, they have also installed automated irrigation management systems and soil moisture monitoring stations, integrated into a SCADA system.

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**PROJECTS OUTSIDE THE
COLORADO RIVER
BASIN**

FRESHWATER TRUST

- The Freshwater Trust works with landowners and irrigation districts in the Pacific Northwest to buy and lease water for instream flows.
- Purpose: To keep farmers on the land, and more water in the streams.
- They have about \$600,000 to \$1M per year paid out by the Bonneville Power Administration as part of mitigation for their storage projects in the Columbia River Basin.



FRESHWATER TRUST

- In one example, they got a farmer's agreement to shorten his irrigation season to end hay production in the middle of July instead of September. Although he loses his 3rd cutting of hay, he gets to keep the first two most productive cuttings, and the fish get water when they need it in the middle of July.
- In another case, the Trust was looking to get more water in the stream in the upper Lostine River, but was faced with 5 irrigation ditch companies and over 100 landowners.
 - Rather than individual contracts, they contracted specifically with the ditch companies to leave a certain amount of water in the river at certain times without changing their water rights.
 - Since the water rights weren't modified, state regulation wasn't necessary, and the process became much simpler. The Freshwater



LOWER YUBA RIVER ACCORD

- YCWA built New Bullards Bar (NBB) Dam and Reservoir to deliver surface water to local farmers and reduce flood risk.
- North division of the county used to rely on surface water diversions from the Yuba River. The South unsustainably drawn groundwater.
- NBB provided new surface water deliveries to the southern part of the county, the groundwater aquifer was restored to historic levels.
- Later, Farmers voluntarily agreed to forgo their surface water and the water was transferred to cities.
 - Irrigators were paid for the transfer, then pumped groundwater to irrigate their crops.



LOWER YUBA RIVER ACCORD

- The Lower Yuba River Accord (Yuba Accord) is a model settlement agreement, providing benefits for fish and wildlife purposes and water supply reliability for irrigation, hydropower generation and recreation.
- It has three main agreements:
 - Establishing significantly higher instream flows for wild salmon and steelhead on the Lower Yuba River
 - Assuring annual water transfers to California's Natural Resources Agency for fish and wildlife, and to cities and farms who receive their water supplies from the State Water Project and Central Valley Project.
 - Establishing a series of conjunctive use agreements with 7 local irrigation districts to enable them better steward their water rights and supplies.

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ARKANSAS BASIN ROUNDTABLE'S TEMPLATE FOR AG TO URBAN WATER TRANSFER

- The Arkansas Basin has lost some 15 percent of its irrigated agriculture to urban water transfers since 1950.
- Projections are for the basin to lose that much more by 2030.
- The roundtable created a Water Transfer Guidelines Committee to determine, “If water is going to be transferred from agriculture, how can it be done without harming rural communities and other third parties to the transactions?”



ARKANSAS BASIN ROUNDTABLE'S TEMPLATE FOR AG TO URBAN WATER TRANSFER

- It took two years of intense facilitated meetings to provide the template guidelines.
- The template is structured around three focus areas:
 - What are the considerations to be addressed when contemplating a transfer?
 - What questions should be asked specific to each of those considerations?
 - What mitigation might be needed?
- Considerations range from effects on water quality, to the size of a transfer relative to an affected area.



SUPER DITCH

- While most conservancy districts were formed to develop water resources, the Lower Arkansas Valley Water Conservancy District was formed in 2002 to protect water resources.
- In 2006, LAVWCD hired an engineering firm and an economist to conduct a feasibility study for cooperative leasing as an alternative to permanent dry-up of agricultural land from sales of water to municipalities.



- The study identified seven lower Arkansas ditch companies. Representatives from these companies took a demonstrative field trip to PVID to learn about their lease contract with MWD.

SUPER DITCH

- LAVWCD conceptualized that farmers will have greater bargaining power if they work together in a rotational fallowing scheme and provide water.
- In 2007-2008, the steering committee was formed to determine feasibility of establishing a “Super Ditch,” a company that would lease water, conserved by fallowing land, to municipalities instead of selling it outright.
- In May 2008, two-dozen shareholders from six of the seven ditches signed on as incorporators and the secretary of State certified the incorporation of the Lower Arkansas Valley Super Ditch Company and the first Board of Directors.
- In 2012, the Super Ditch submitted a lease-fallowing pilot project with Fountain and Security, which was denied due to insufficiency of water to move.
- In mid-July 2014, the company filed another pilot program to transfer water from several farms on the Catlin Canal to the town of Fowler for 10 years.
 - It was approved in September 2014.
 - Seven participating farms with 1,128 acres will be fallowed on a rotational basis for up to three out of the next years 10 and supply 500 acre-feet water per year to Fowler.

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THE CAP, MURRAY DARLING BASIN - AUSTRALIA

- The Cap, which reduces water rights by about one-third, was institutionalized for the Murray-Darling Basin in a comprehensive Basin Plan, adopted in 2012.
- This cap on water rights will support ecology and leave on average 60% of the water in the rivers.
- The Murray-Darling Basin is Australia's food basket, providing nearly 40% of the country's agricultural production.
- The devastating millennium drought from 1997 to 2009 reduced river flows in the basin to 40-60% of average, leaving many farmers with no water allocations for three years.



THE CAP, MURRAY DARLING BASIN - AUSTRALIA

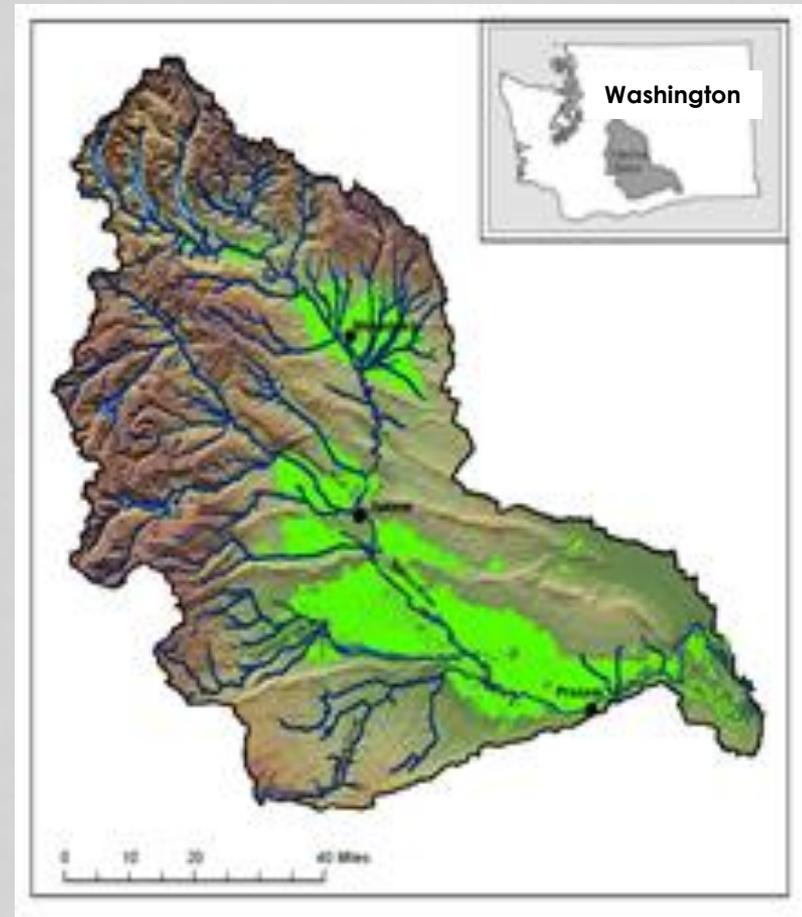
- To achieve the goal of reducing water use by a third, the government employed two mechanisms:
 - Buying water rights;
 - Increasing the efficiency of irrigation distribution systems through the Sustainable Rural Water Use and Infrastructure Program, which provides eligible applicants up to \$350,000 to modernize their system.
- At the beginning, the government mostly focused on buying water rights, and about one-third of the government funds have been directed towards buying water rights from willing sellers.
 - This highly affected the rural community and now the government has largely shifted to increase efficiency.
- In comparison with buying water rights, improving efficiency requires two to seven times greater investments.
- Since 2002, the Australian Commonwealth government has allocated equal to U.S. \$14 billion to achieve their water saving goals.
 - To date, they have achieved 70% of the targeted reductions in water use.

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YAKIMA RIVER BASIN INTEGRATED WATER RESOURCES MANAGEMENT PLAN

- In 2009, Washington's Department of Ecology convened a diverse work group to develop a proposal for management of the Yakima River Basin.
- The consensus-based Yakima River Basin Integrated Water Resources Management Plan was completed in 2011.
 - This is the first basin-wide plan in the nation to address management issues of a water-short basin.



YAKIMA RIVER BASIN INTEGRATED WATER RESOURCES MANAGEMENT PLAN

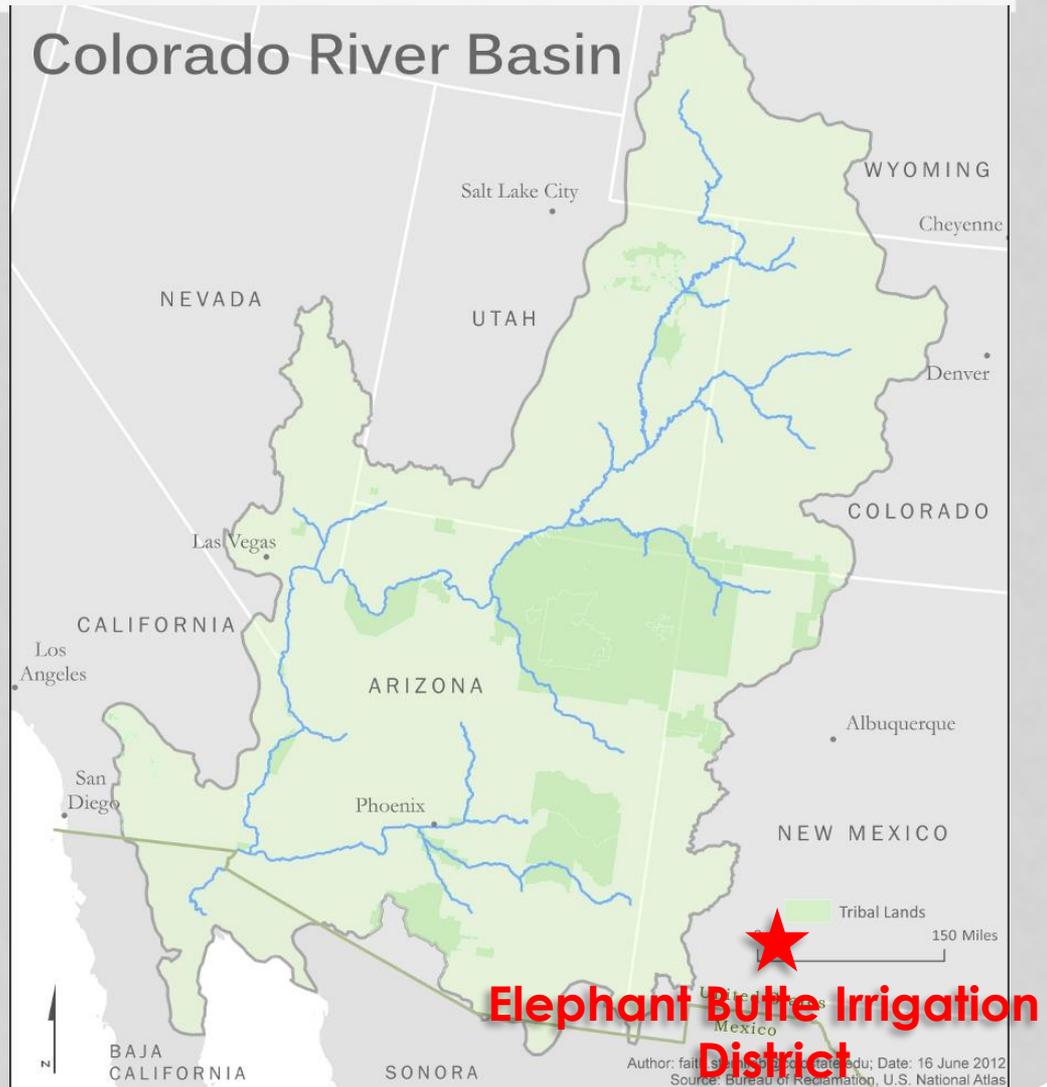
- The plan was prompted due to scientists' prediction that the Yakima Basin, the nation's second-largest agricultural production region, will probably experience 20 significant droughts in the next 100 years,
 - Resulting in a total of \$3 billion loss only to the farmers, neglecting losses to related industries, which may add another \$3 billion.
- The Integrated Plan includes seven major elements, including:
 1. Construction of fish passages at six reservoirs
 2. Conservation of up to 170,000 acre-feet water
 3. Structural/Operational changes to raise Cle Elum Lake by three feet and to construct a pipeline between two other lakes
 4. Habitat/Watershed improvement to protect 70,000 acres of forest and shrub steppe
 5. Increase surface water storage by approximately 550,000 acre-feet
 6. Implement pilot projects to evaluate aquifer recharge and increase groundwater storage
 7. Use mechanisms such as water market and/or water bank, and facilitate water transfers between districts

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ELEPHANT BUTTE IRRIGATION DISTRICT / AUDUBON

- The Elephant Butte Irrigation District and environmental groups, such as New Mexico Audubon reported in 2010 that they are developing an environmental water transaction program where Audubon can buy water rights from EBID's willing sellers.
- Water rights that Audubon acquires may provide habitat for some species susceptible to being listed as threatened or endangered.



ELEPHANT BUTTE IRRIGATION DISTRICT / AUDUBON

- This program was being developed due to concerns about the National Environmental Policy Act's preferred alternatives.
 - Which would reduce depletions from agriculture without acquiring agricultural water rights on one hand and was not far reaching enough for environmental purposes on the other hand.
- The two entities collaborated and came up with a better solution to conceptually consider irrigating for habitat, similar to irrigating for a crop.
 - Audubon offered to become an EBID constituent, like a farmer and EBID agreed.
 - Surface water transfers from one farmer to another within EBID do not need permits from the State Engineers Office.
- Based on their consensus, EBID has the authority to approve or deny the transfers and the shareholders will not lose any water-rights.

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CACHE COUNTY'S WATER FUTURE

- The Bear River Development Act authorized the Utah Division of Water Resources to develop water storage facilities to store the Bear River's excess water in Cache County, and avail it to other areas in the state.
 - The act was passed in 1991.



CACHE COUNTY'S WATER FUTURE

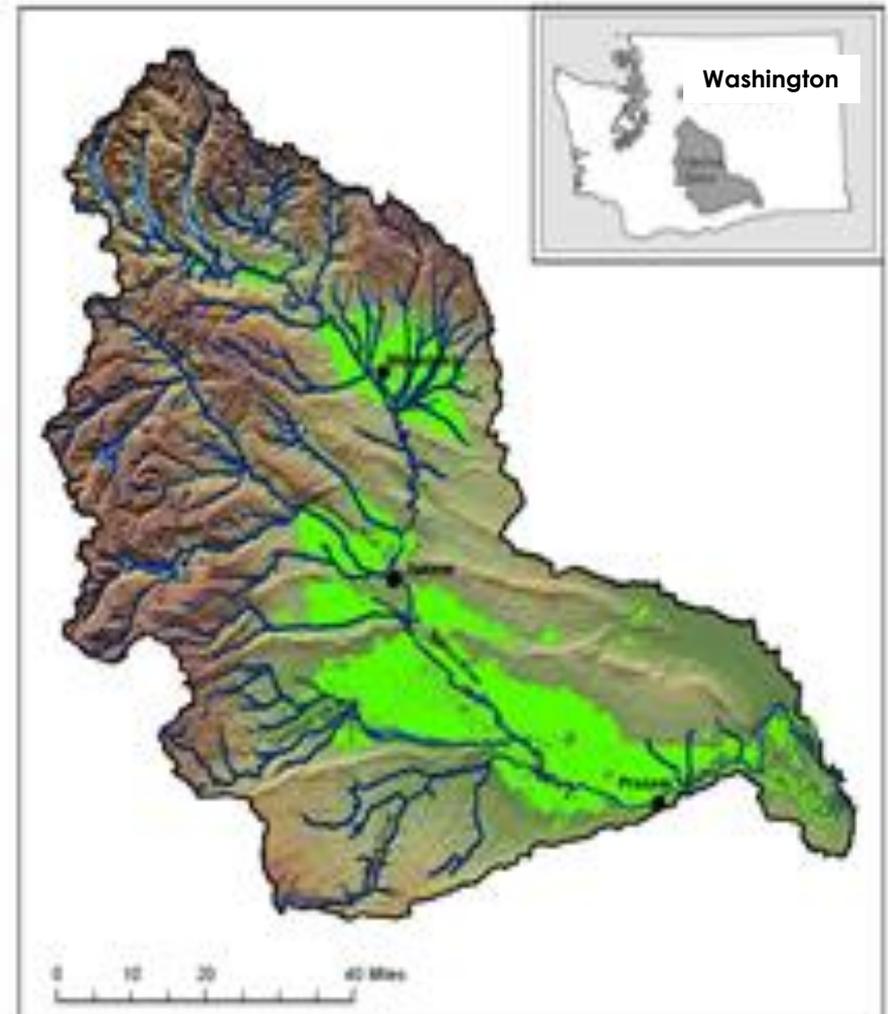
- Utah's population has doubled in the last 30 years and it is projected that the population will increase from about 3 million people to 5.5 million by 2050.
 - It is important to store winter flows to be used during summers.
- Another controversial option for managing the state's water is to convert agricultural water use, which will partly happen as agricultural land is sold and developed.
 - Agriculture currently uses 82% of Utah's water.
- Utah has also begun to conserve water through efforts such as the Slow the Flow campaign
 - These efforts have resulted in 18% reduction in the per capita water use from 2000 to 2010.

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YAKIMA BASIN WATER TRANSFERS WORKING GROUP

- The Yakima Basin Water Transfers Working Group was established in 2001.
- The goal is to facilitate the voluntary transfer of water in order to provide water for current and future demands, while preserving existing water rights.



YAKIMA BASIN WATER TRANSFERS WORKING GROUP

- It is a group of professional water managers, engineers, hydrogeologists, fisheries biologists, irrigation districts, law firms.
- These individuals volunteer to review water transfer proposals and provide recommendations to the Department of Ecology and the Bureau of Reclamation
 - Both of these entities provide recommendations to the Superior Court for temporary transfers.
- This process was used to transfer 40,000 acre-feet water during a four-month period in 2001 and 50,000 acre-feet in two months in 2005.
- It is seen as enabling fast and flexible water marketing to respond to rapidly changing needs.

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WEST SIDE IRRIGATION DISTRICT URBAN TO AG TRANSFER

- This is a case where given significant drought conditions in 2014, the City of Tracy, California, decided to transfer their treated wastewater to agricultural water users.
- Fallowed farmland in several Tracy area irrigation districts were being impacted by state-imposed water restrictions due to severe drought.
- Districts with pre-1914 and riparian water rights were unharmed but others, such as West Side Irrigation District, were being hit hard.



WEST SIDE IRRIGATION DISTRICT URBAN TO AG TRANSFER

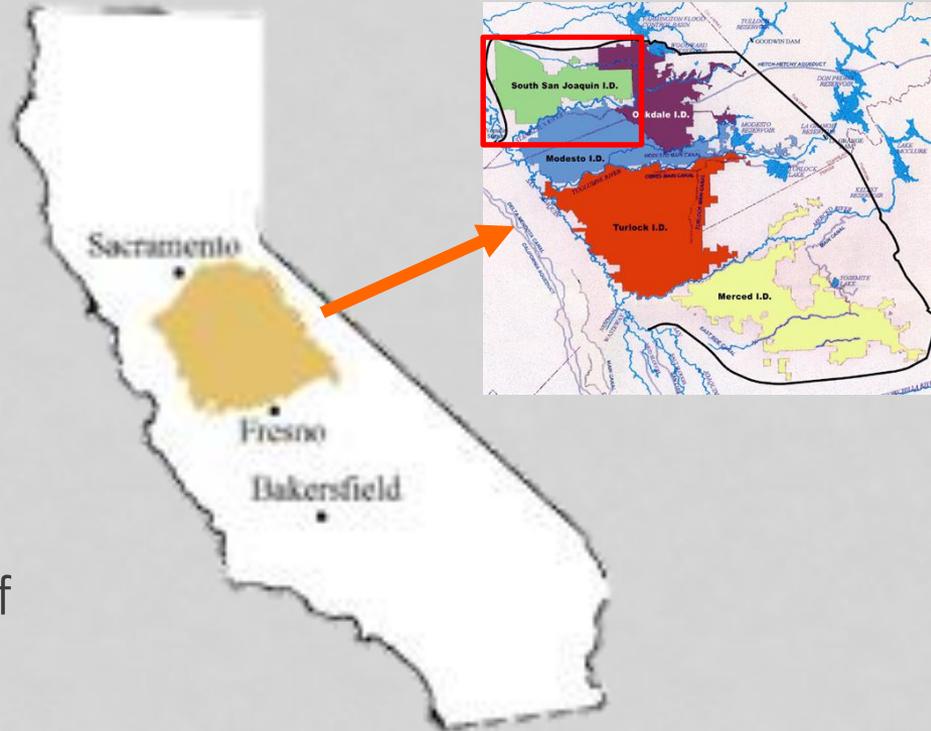
- The State Water Resources Control Board had ordered the district to stop pumping irrigation water from the Old River.
 - Only 30% of normal was being delivered to growers in the old Plain View area.
- That had forced WSID to leave 25% of its irrigable lands fallowed and to abandon another 35%.
- To help WSID mitigate drought effects, the City of Tracy agreed to transfer a daily average of 27 acre-feet of its treated wastewater to the irrigation district.

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SOUTH SAN JOAQUIN IRRIGATION DISTRICT'S PILOT PRESSURE IRRIGATION PROJECT

- California's South San Joaquin Irrigation District board in partnership with Stantec Consulting developed a pilot pressure irrigation project and irrigation program to improve delivery efficiency and service.
- The SSJID service area consists of 3,800 acres of Central Valley.
- The farmers used to pay a flat rate of \$24/acre for irrigation water. The Water Conservation Act had recently mandated the SSJID to bill water deliveries volumetrically.
 - This encouraged the irrigation district to increase the efficiency of their irrigation system.



SOUTH SAN JOAQUIN IRRIGATION DISTRICT'S PILOT PRESSURE IRRIGATION PROJECT

- Stantec Consulting developed a web-based interface entitled “The Division 9 Irrigation Information Center.” It contains tools such as:
 - National weather service alerts for the area
 - Weather forecasts
 - Doppler radar imaging
 - Customizable and exportable/printable charts on past weather (rainfall, wind, temperature, humidity, evapotranspiration rates)
 - Water deliveries (time start, time end, total hours irrigated, average flow rate and total water delivered)
 - Moisture sensor information
- Each farmer has been assigned a unique platform and they use this system to schedule the date and number of hours of irrigation desired.

SOUTH SAN JOAQUIN IRRIGATION DISTRICT'S PILOT PRESSURE IRRIGATION PROJECT

- The project also consists of:
 - A 19-mile network of pipelines with flexible pressurization
 - A 56-acre-foot water storage basin
 - A 1,225-hp pumping station containing seven vertical turbine pumps capable of pumping a total of 52.4 cfs
 - A total of 55 solar-powered Field Telemetry Units controlling 77 customer connections
- The Division 9 system has reduced:
 - Water needs by up to 30%
 - Spills to the drains by 5,000 acre-feet (or 1.96 feet of water per acre) in the 2012 irrigation year
 - The acreage pumping from aquifers by 50%, decreasing the cost of running pumps and reducing diesel emissions
- The system has also improved crop yields by up to 30% due to the high quality surface water supply.

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UMATILLA GROUNDWATER RELIEF

- Northeast Oregon Water Association was formed in August 2013 and proposed the Umatilla Groundwater Relief.

- Purpose:
 - To divert water from Colombia River to agricultural lands in the Umatilla Basin, East Oregon
 - To recharge aquifers in the basin.
 - The project would provide additional water for irrigators while upstream projects would benefit fisheries and wildlife.



- The project would provide additional water for irrigators while upstream projects would benefit fisheries and wildlife.

UMATILLA GROUNDWATER RELIEF

- The project would also reduce reliance on groundwater resources.
- Working with the Oregon Water Resources Department and the Governor's office, NOWA is securing three new water rights to divert an additional 500 cubic feet per second from the Columbia River.
 - It could supply water demands of up to 200,000 acres of farmland for full production.
- For this diversion, NOWA is designing a pipeline, using existing river infrastructure. This pipeline would pump water into three critical groundwater areas during peak irrigation season in summer.
- They are also considering constructing a new storage reservoir.
- NOWA would administer the water rights, and supply the water to critical groundwater areas.



CENTRAL OREGON IRRIGATION DISTRICT PIPING PROJECT

- The Central Oregon Irrigation District piped 2.5 miles of open ditch.
 - COID is an agricultural, industrial, and municipal water supplier.
- This project helped reduce diversions by 19.6 cfs in the Deschutes River Basin.
- The saved water augments instream flow.



CENTRAL OREGON IRRIGATION DISTRICT PIPING PROJECT

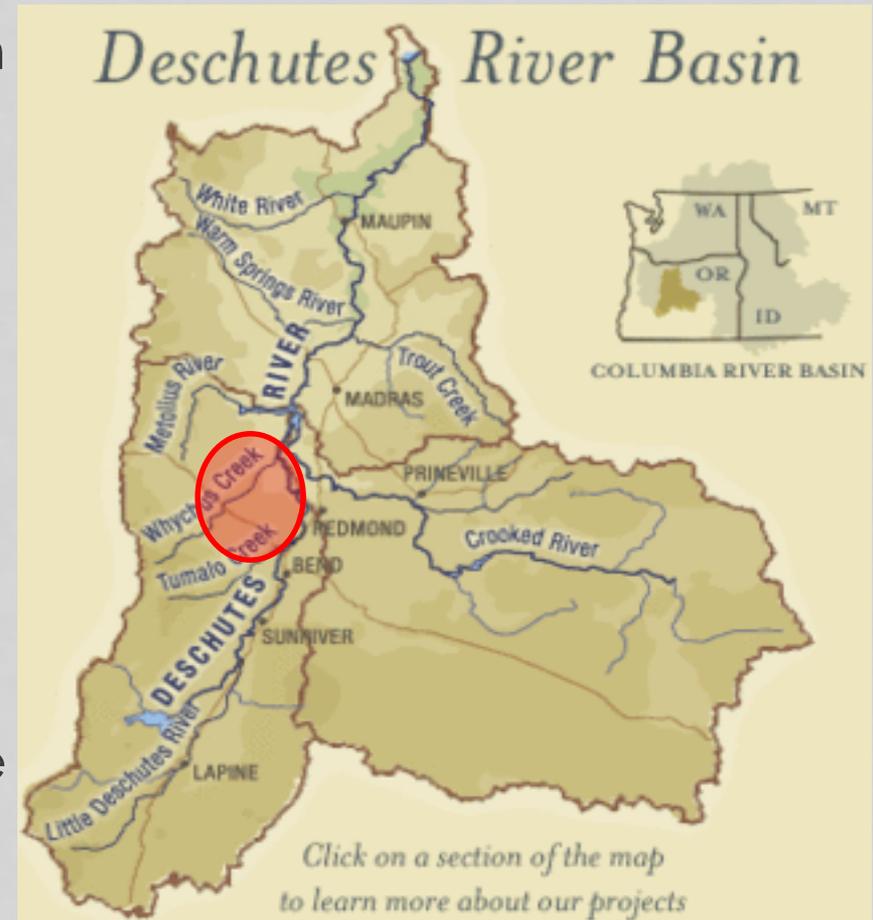
- This project was a response to Oregon's Conserved Water Program.
 - This program, in addition to promoting water conservation, maximizes beneficial use of water, and also requires that a minimum of 25% of conserved water should be used for instream augmentation.
- The pipe also includes a hydroelectric generator with the capacity of 5 megawatt.
- Several sources funded the \$24 million cost of the project, including:
 - Deschutes River Conservancy
 - US Bureau of Reclamation
 - Oregon Water Enhancement Board
 - Oregon Department of Environmental Quality
 - Oregon Department of Energy

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THREE SISTERS IRRIGATION DISTRICT PIPING PROJECT

- Through a partnership among USDA-NRCS, Three Sisters Irrigation District, Oregon Watershed Enhancement Board, Confederated Tribes and several other natural resource entities, a project was funded, designed and provided with operational support.
- The Three Sisters Irrigation District diversion is the largest and oldest diversion in the Whychus Creek watershed, historically responsible for diverting up to 90% of summer flow and significant fish entrapment.



THREE SISTERS IRRIGATION DISTRICT PIPING PROJECT

This project

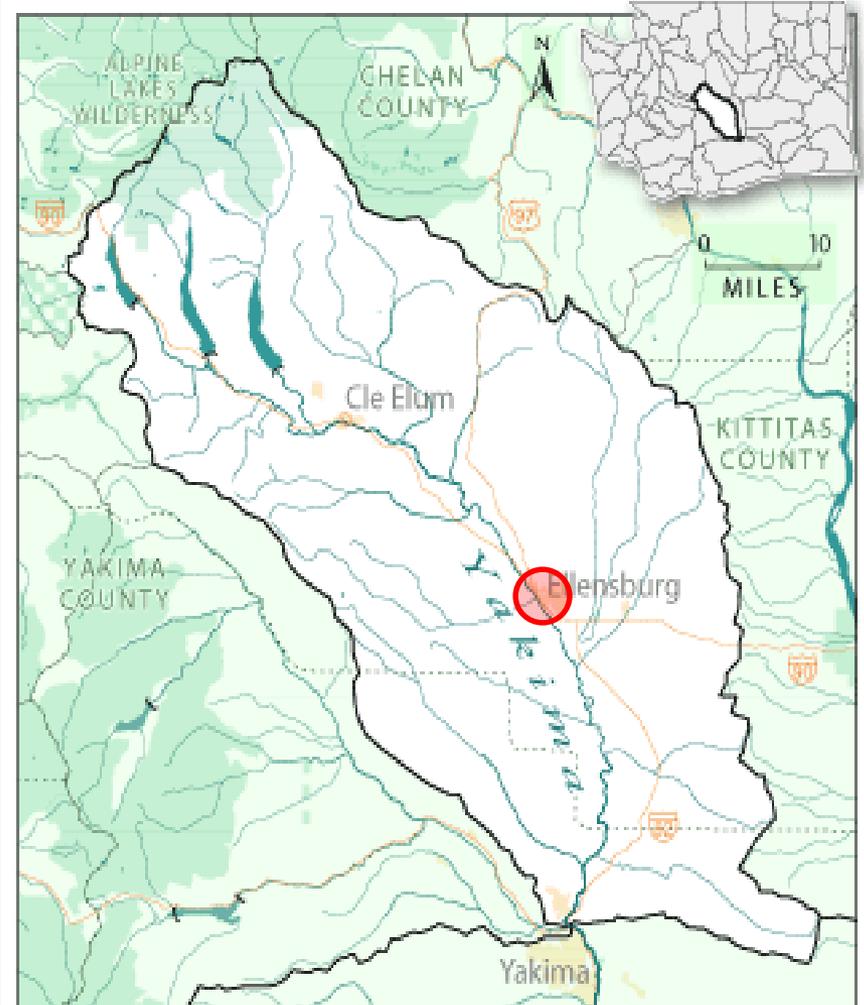
- Converted 10.3 miles of unlined main canal to buried pipeline
 - The previously open canal lost 40-75% of its water to seepage and evaporation.
- Installed four new automated fish screen weir gates
- Setup a Supervisory Control and Data Acquisition system
- It is expected that these enhancements save 2,550 acre-feet of water per year in the upper Deschutes.
 - The saved water is purchased by the Deschutes River Conservancy for a protected instream right to restore habitat in Whychus Creek for endangered steelhead and threatened bull trout and other fish species.
- There is a 400-foot elevation difference between the reservoir and the lowest ranch, which creates natural pressure and eliminates demands to pump water.
- TSID is also trying to switch from rill and wheel line sprinklers to center pivot sprinkler systems on 30 of its member farms.

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MANASTASH CREEK IMPLEMENTATION PLAN

- The Manastash Creek Steering Committee was formed in 2001 with assistance from the Kittitas County Conservation District.
 - It implements The restoration projects in Manastash Creek in the Yakima River Basin, central Washington.
- In 2007, an implementation plan was created for a project to restore 3.25 miles in lower reaches of Manastash Creek.



MANASTASH CREEK IMPLEMENTATION PLAN

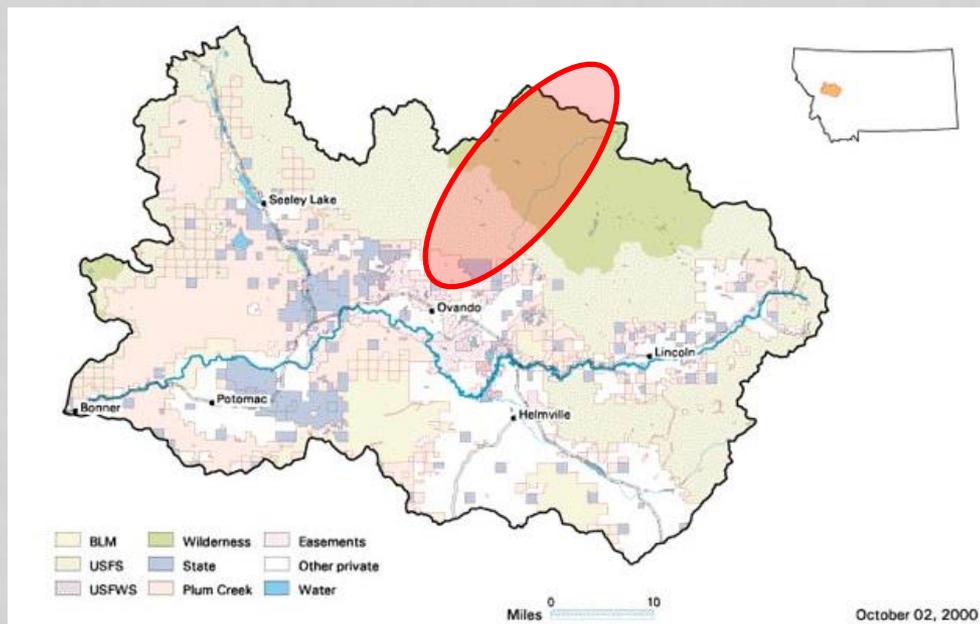
- The restoration was planned due to the concerns regarding to the threat of an Endangered Species Act lawsuit.
 - Before the implementation of this project, lower Manastash Creek dried out in late-spring, just after the beginning of irrigation season.
- The ultimate goal is to conserve 6 cfs.
 - Flow restoration which would allow the river to flow year-round would provide habitat for more than 50 spawning pairs of steelhead per year and up to 1,000 Coho salmon.
- The project includes:
 - Converting open ditches to pipes
 - Consolidating diversions
 - Improved on-farm efficiency
 - Purchasing instream flow rights on a willing seller basis

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NORTH FORK BLACKFOOT RIVER

- Trout Unlimited funded a project to conserve 18.5 cfs water for instream flow enhancement through a 30-year lease and a change of purpose of use.
 - The saved water augments streamflow in an important bull trout creek that once suffered from habitat problems in late summer and early fall.



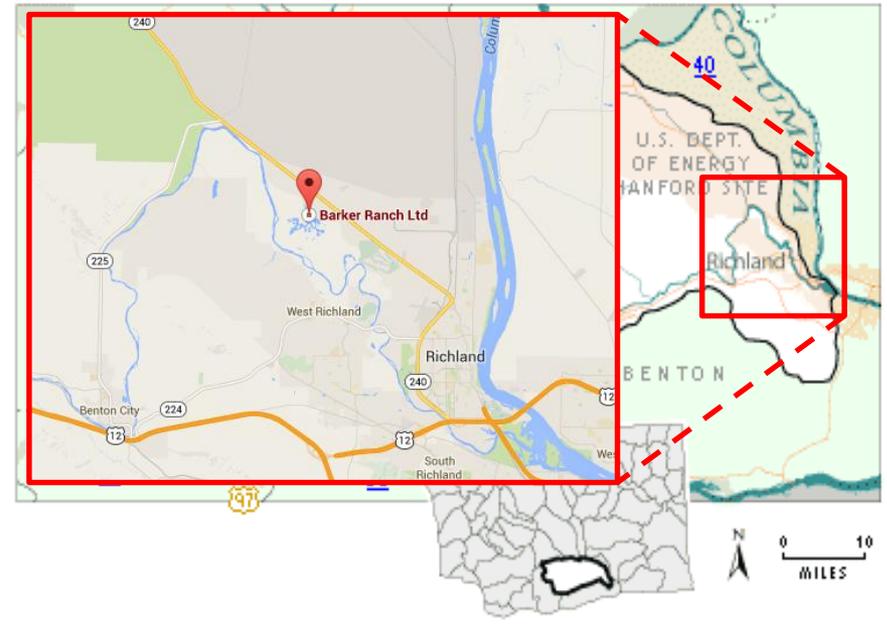
- To conserve this water, a farmer replaced a leaky irrigation canal with pumps and pipes and installed center pivot irrigation system and a solar-powered stock watering well.

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BARKER RANCH, LOWER YAKIMA RIVER

- Washington's Columbia River Water Management Program funded a canal piping project in the water-short lower Yakima River, Washington.
 - In order to restore a wetland refuge that depends on irrigation water.



- The wetlands on Barker Ranch are habitats to at least 175 different species of birds and other terrestrial wildlife, such as coyotes, badgers, and deer.
- Depending on the month, the project conserves between 3.5-10 cfs, totaling 6,436 acre-feet per year.

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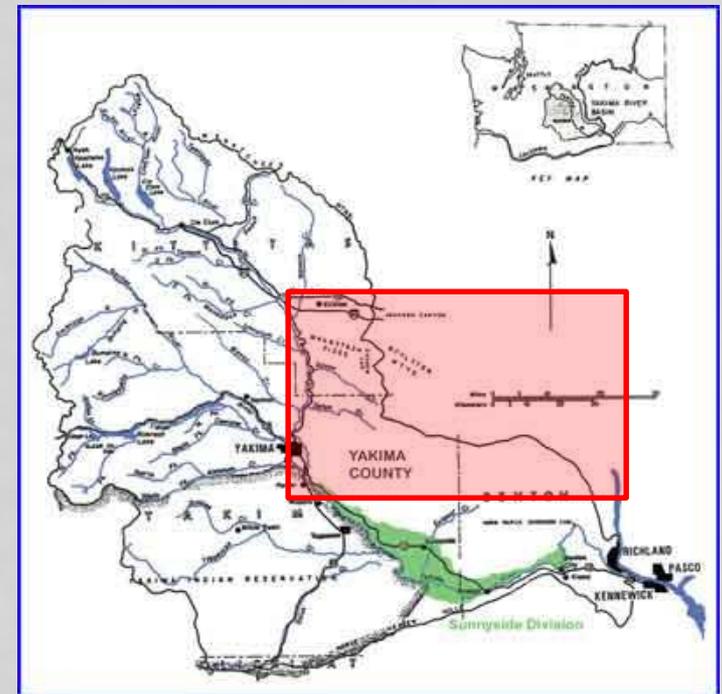
COLUMBIA BASIN PROJECT IRRIGATION DISTRICTS

- Through piping and lining of open ditches, 5,450 acre-feet of Columbia River water is saved.
 - The conserved water will not increase instream flows. Instead, it is used for agriculture to reduce dependency on groundwater.
- The saved water is spread to a groundwater-dependent area in East, South, and Quincy districts of the Columbia River in Oregon and Washington.
 - This area was running out of groundwater resources and had to rely on higher water diversions from the Columbia River, and it would otherwise need to convert to dryland farming.



SUNNYSIDE CANAL IMPROVEMENT PROJECT

- Through a settlement agreement in the Yakima Basin Water Rights Adjudication, Sunnyside Valley Irrigation District will make canal improvements in order to reduce its annual diversion.
- The agreement is among the Bureau of Reclamation, the Washington Department of Ecology, the Yakama Nation, and the Sunnyside Division Board of Control.
 - Sunnyside Valley Irrigation District is the operating entity for SDBOC.



SUNNYSIDE CANAL IMPROVEMENT PROJECT

- Two thirds of this water savings, 19,450 acre-feet per year, will benefit instream flows.
- The remaining water savings, 9,712 acre-feet per year, will be used for irrigation purposes.
- Some of the major components of this project include:
 - Replacement of 30 existing check drop structures with automated gates to maintain a consistent water elevation in the canal
 - Installment of a Supervisory Control and Data Acquisition system
 - Construction of three re-regulation reservoirs

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SCADA & WATER MEASUREMENT PROJECT - LOWER YELLOWSTONE

- The Lower Yellowstone Irrigation Project Board of Control in Montana will create SCADA communications with 17 key sites along the Lower Yellowstone Irrigation Project's 330-mile distribution system.
- This is accomplished by installing or enhancing water control structures, such as:
 - Spillway structures
 - Pumping stations
 - Monitoring stations



SCADA & WATER MEASUREMENT PROJECT - LOWER YELLOWSTONE

- They will also install a new diversion structure equipped with fish screens.
- These improvements are expected to reduce the diversions from the Yellowstone River by 40,000 acre-feet per year
- The saved water will remain in the river.
- Bureau of Reclamation has funded 50% of the project's total costs



AURORA WATER'S ROCKY FORD TRANSFERS

Located in the Otero County, Lower Arkansas River Basin, Colorado

Rocky Ford I

- Aurora Water purchased approximately 58% of water shares of the Rocky Ford Ditch Company in 1987
 - To secure additional municipal water supplies
 - All agricultural lands involved in this purchase were dried up and put back into native vegetation

Rocky Ford II

- Initiated in 1999 to add an additional 36% of shares
- Rocky Ford II was approved by the Colorado Water Court and its decree was issued on January 28, 2004
- The amount of transferrable water was determined based on historic consumptive use analysis, using 30 years of historical data.
 - This amount was estimated to be 1.76 acre feet per acre

AURORA WATER'S ROCKY FORD TRANSFERS

- Rocky Ford II requires lands to either be re-vegetated, enrolled in the continued farming program, or be classified as “non-agricultural development.”
 - Approximately 31% of the Rocky Ford Ditch II are enrolled in Continued Farming for which Aurora supported implementation of high-efficiency irrigation technology and provides 0.50 acre-feet per acre annually to the farms.
- The transferable water is diverted to the City of Aurora or stored in Pueblo Reservoir.
- The remaining portions of the water will either be diverted as surface return flow into the Rocky Ford Ditch flume or stored at Pueblo Reservoir and released later to mimic delayed return flows so that there is no injury to downstream water users.

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