



NSF NRT-InFEWS: Indigenous Food, Energy, and
Water Security and Sovereignty
Presents:



Food, Energy and Water (FEWS) Learning Modules

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THE UNIVERSITY
OF ARIZONA



Introduction to Water Within the FEW Nexus

THE UNIVERSITY OF ARIZONA – INDIGE-FEWSS
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Yá'át'ééh abíní!

**We are presenting here on
Pascua Yaqui & Tohono O'odham
Land**



Yá'át'ééh abíní!

We welcome our guests joining us
from Diné College on Navajo
Nation

PART 1:

Water Quality

Here & Now

LEARNING OBJECTIVES

- Describe the state of water resources within Navajo Nation
- Reflect on water impact on daily life-Describe effect COVID-19 has had on water access

PART 1:

Water Quality Here and Now

AGENDA

- Introduction
- Water Rights on Navajo Nation
- Water Resources & Covid-19 Challenges
- Water Access & Infrastructure
- Water Quality & Classification

Sources of Water on the Navajo Nation

Surface Water

- Colorado River
- Little Colorado River
- San Juan River
- Tributary Washes

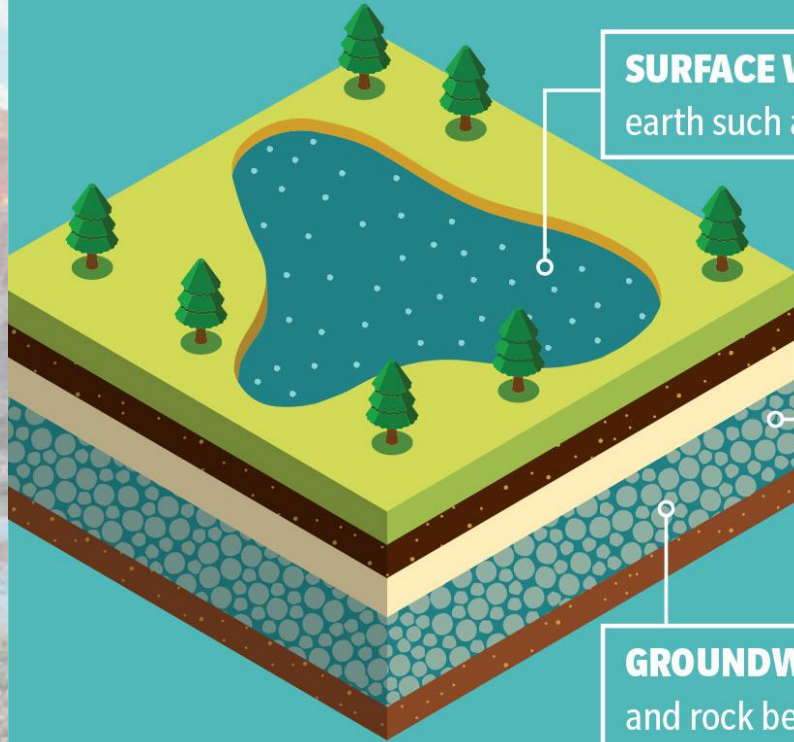
Ground Water

- Coconino Aquifer
- Navajo Aquifer
- Dakota Aquifer

Federal Project Water Allocations

- Animas-La Plata Project
- Navajo Indian Irrigation Project
- Navajo-Gallup Water Supply Project

SURFACE WATER VS GROUND WATER

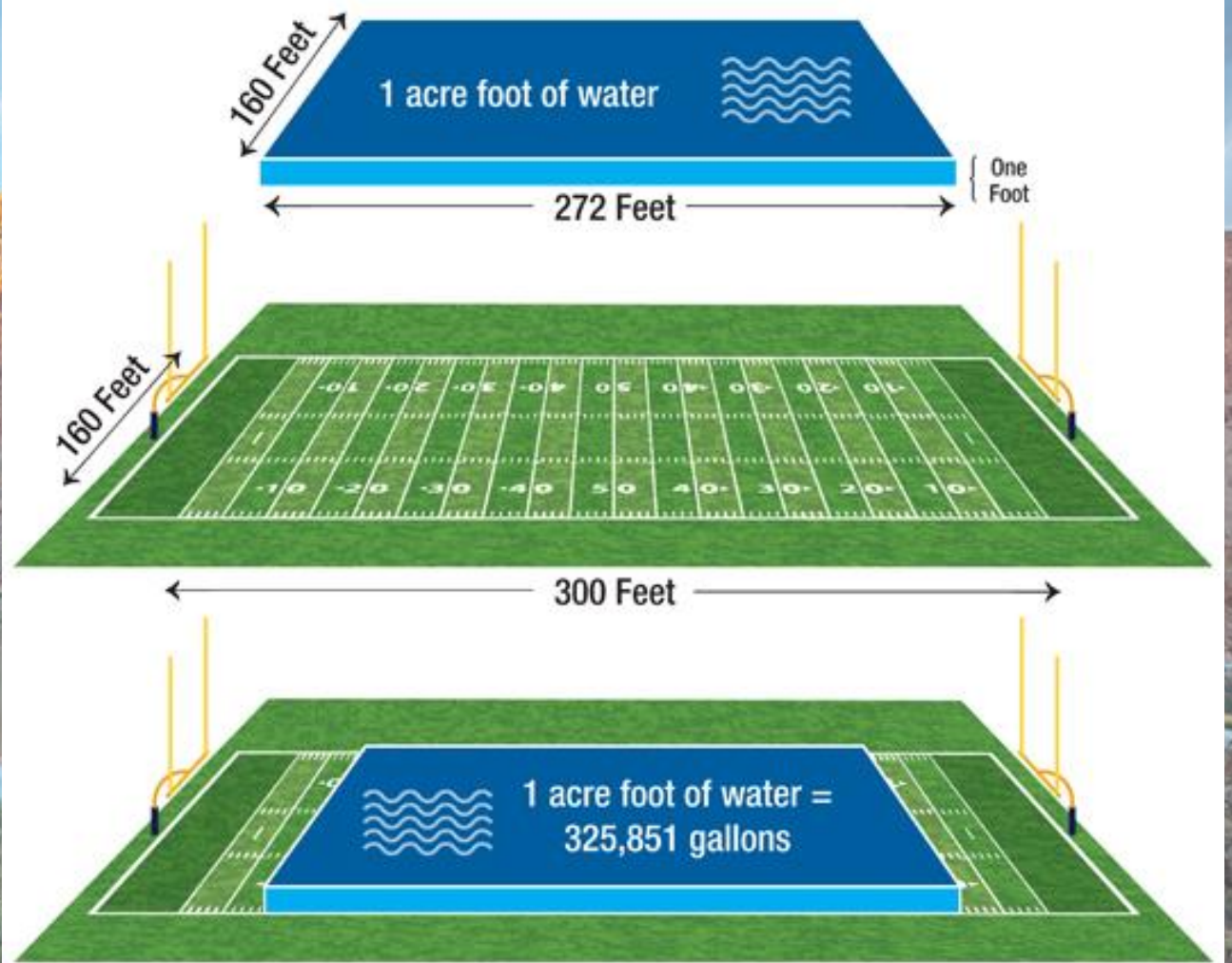


SURFACE WATER: water on the surface of the earth such as streams and lakes

AQUIFER: An underground layer of water-bearing permeable rock.

PERMEABLE ROCK: layers of porous rock and sand capable of holding water

GROUNDWATER: water that saturates soil, sand and rock beds, supplying springs and wells



Arizona's Annual Water Budget

Adapted from Bob Arnold

Water Source	Million Acre-Feet	% of Total
Surface Water		
Colorado River	2.8	35.6 %
<i>CAP</i>	1.6	21%
<i>On-River</i>	1.2	16%
In-State Rivers	1.4	17.8%
<i>Salt-Verde</i>	1.0	13%
<i>Gila & others</i>	0.4	5%
Ground Water	2.9	36.8%
Reclaimed Water	0.77	9.8%
Total	7.87	

Colorado River

- Maximum of 50,000 acre-foot/year (AFY) to Arizona
- The remaining water supply is split up:
 - 51.75% to Colorado
 - 11.25% to New Mexico
 - 23% to Utah
 - 14% to Wyoming



Central Arizona Project (CAP)

- 336-mile system that brings Colorado River water to central and southern Arizona
- Delivers the state's single largest renewable water supply
- Serves 80% of the state's population..
- Largest single power user in the state, using up to 2.8 million megawatt hours per year, roughly the amount used by 250,000 homes.



For more information,
check out the [CAP website!](#)

Central Arizona Project (CAP)

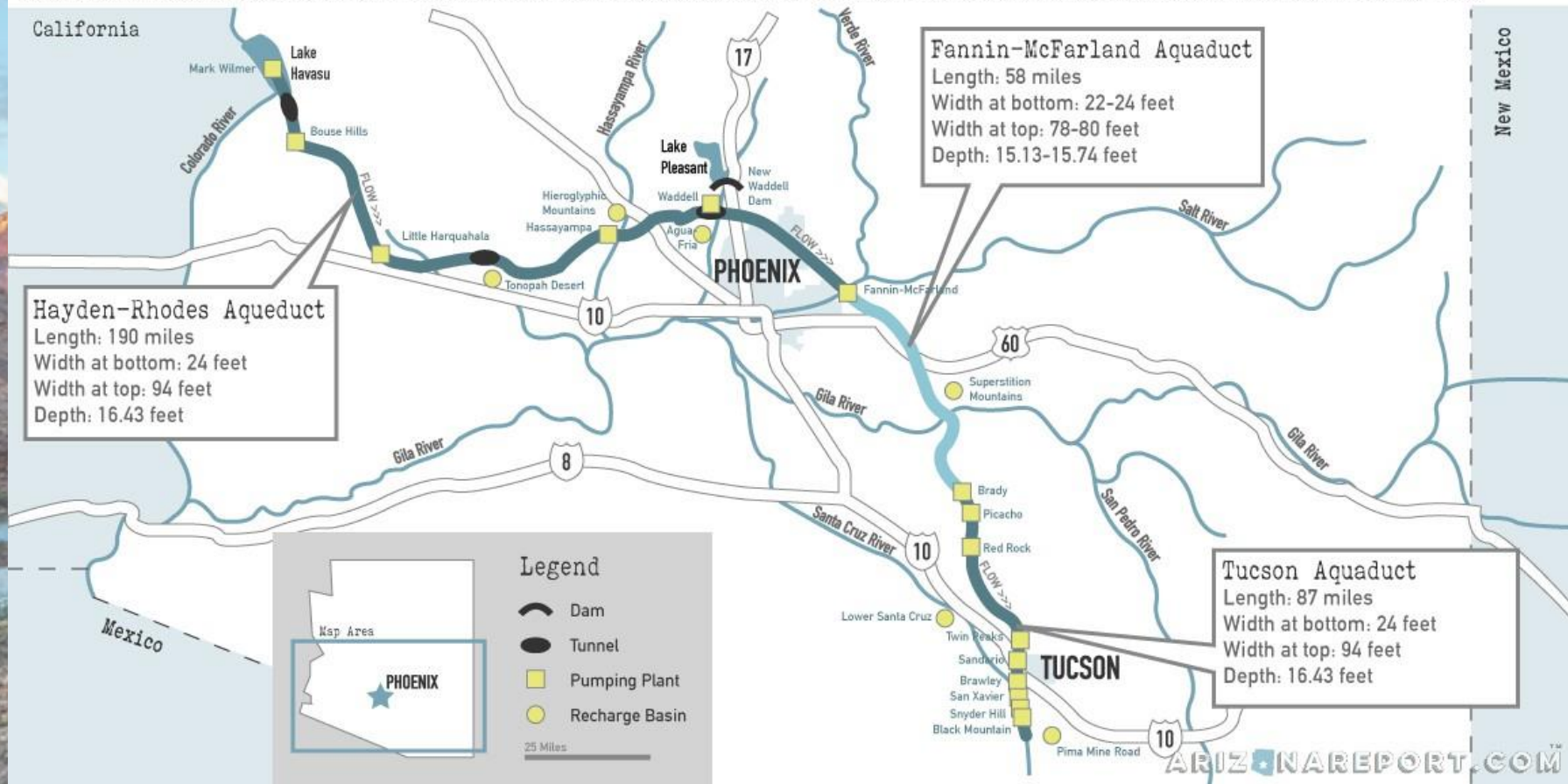
- The canal loses approximately 16,000 acre-feet a year to evaporation, which is about 1% of the annual flow.
- The canal descends approximately 5" per mile.
- Depending on flow, water takes 5-7 days to go from beginning to end of the aqueduct.

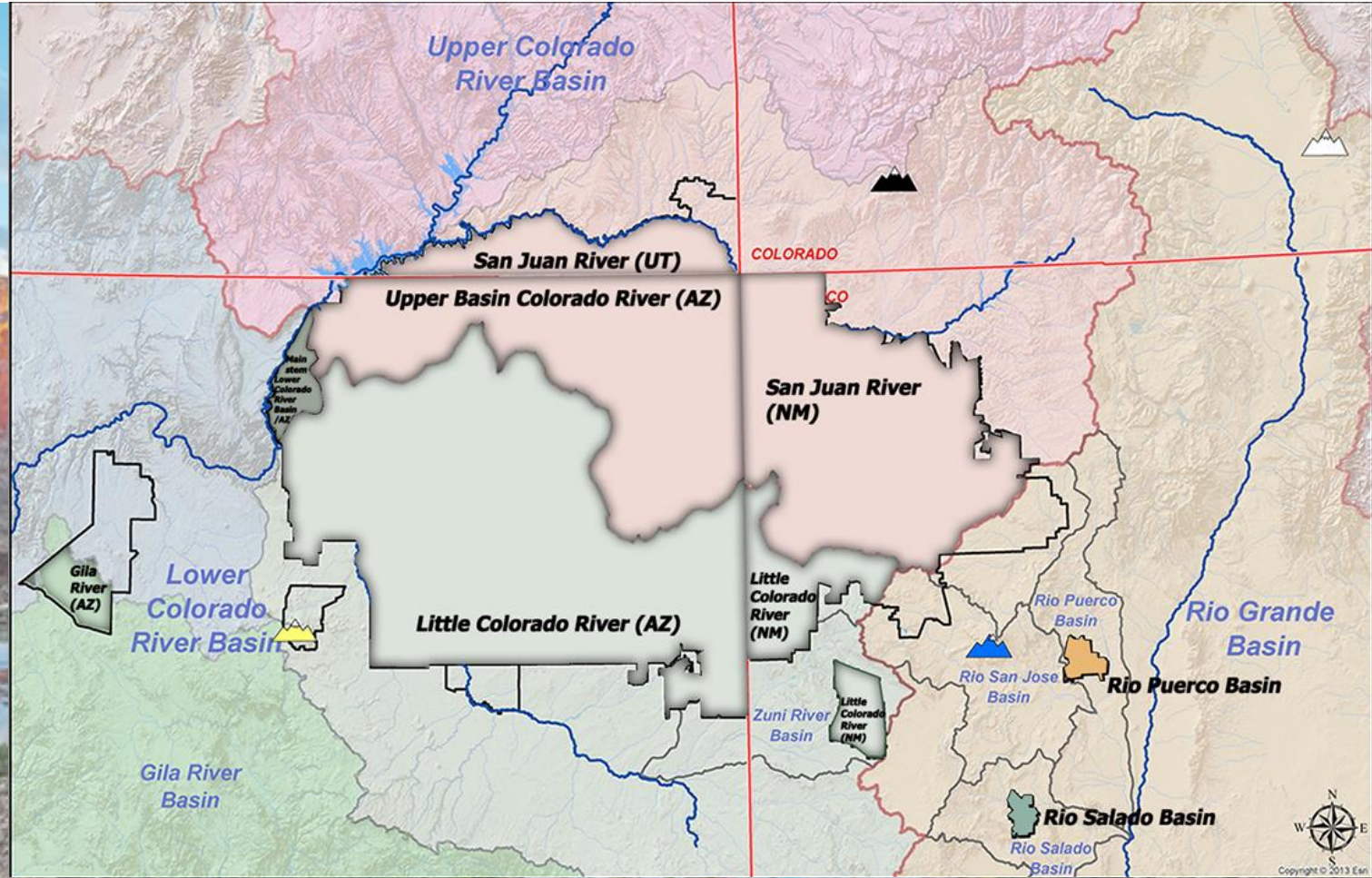


For more information,
check out the [CAP website!](#)

Central Arizona Project (CAP) Canal Map

Construction began on the CAP canal in 1973 and took 20 years to reach substantial completion. The canal diverts Colorado River water and extends 336 miles through the Sonoran Desert from Lake Havasu to Tucson. Water travels uphill from Lake Havasu (elev. 447') to Phoenix (elev. 1500') and Tucson (elev. 2389') through a network of pumping stations, tunnels and storage basins.





Navajo Nation Water Rights
Commision

Native American Tribal Water Rights

Winters v. US (1908)

- Role of the federal government as trustee to Native American Tribes
- Winters Doctrine: reserved water rights

San Juan River Basin Utah (2021)

- 81,500 acre-feet/year
- Meets the needs of 166,000 typical American households
- \$220 M for water infrastructure

Navajo Nation San Juan Basin New Mexico Water Rights Settlement (2010)

- 604,660 acre-feet/year (depletion of 323,670 acre-feet/year)
- Supply line projects will be built by Bureau of Reclamation

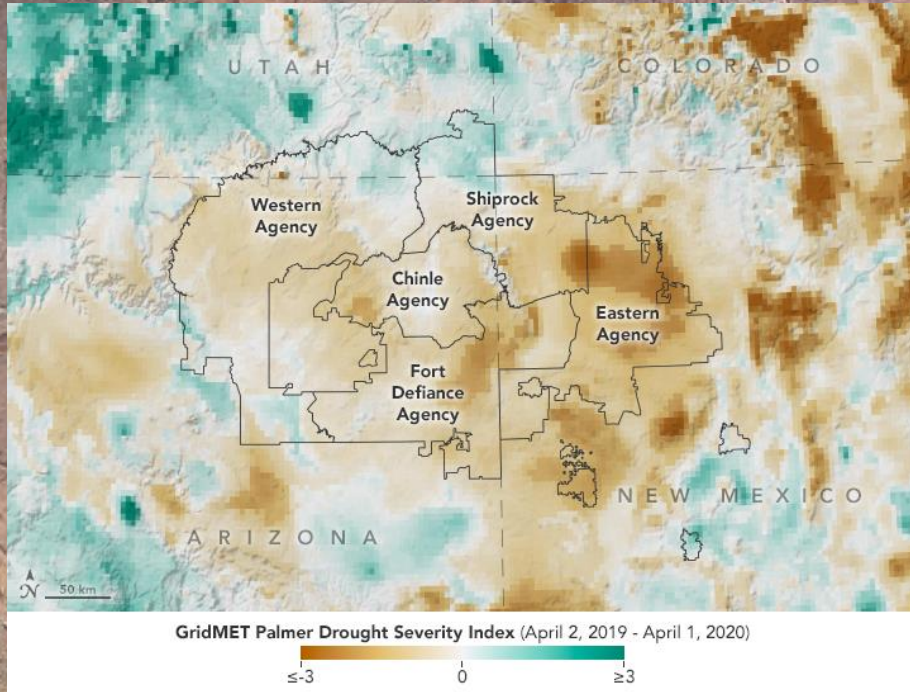
Water Reparations to Date

Water Allocation	AFY
<i>Surface Water</i>	
Colorado River	162,900
San Juan River	1,620,000
<i>Ground Water</i>	
San Juan Colorado River Basin, Utah	81,500
San Juan River Basin, New Mexico	633,000 Diversion
	327,000 Depletion
Total	2,824,400

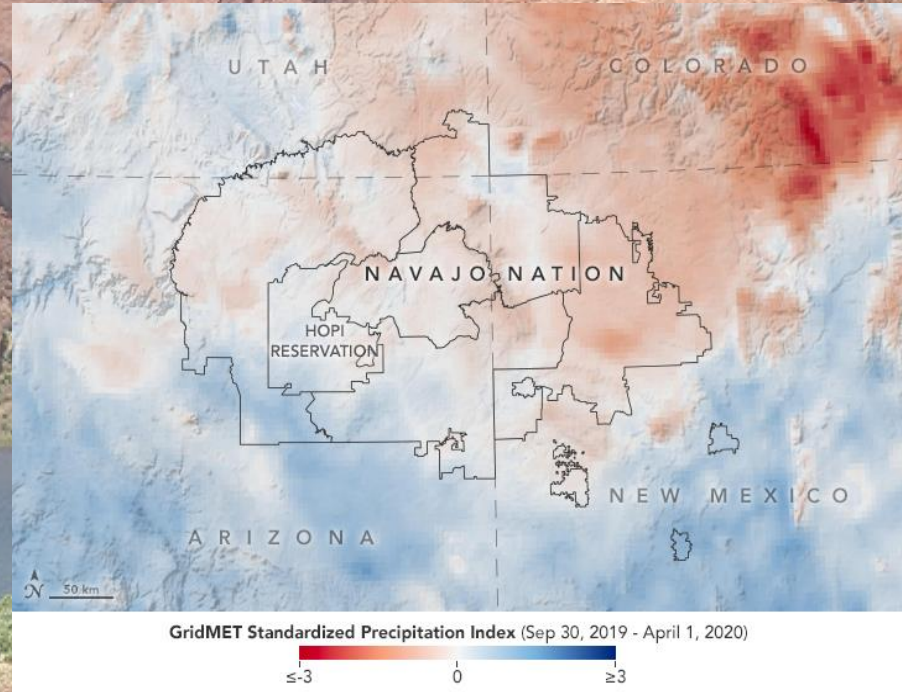
Climate Challenges and Water Supplies

Resource: [NASA's Drought Severity Assessment Tool \(DSET\)](#)

NASA Earth Observatory

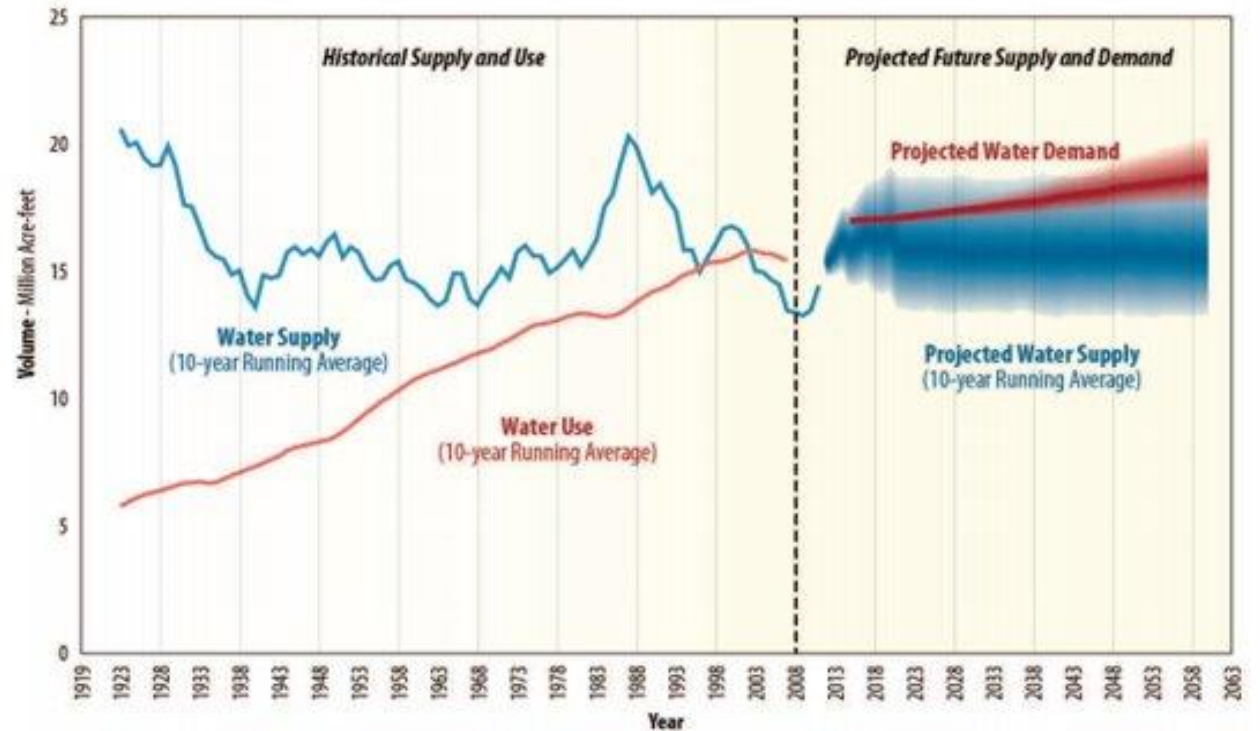


NPR



Colorado River Supply Decreasing While Demand Increases

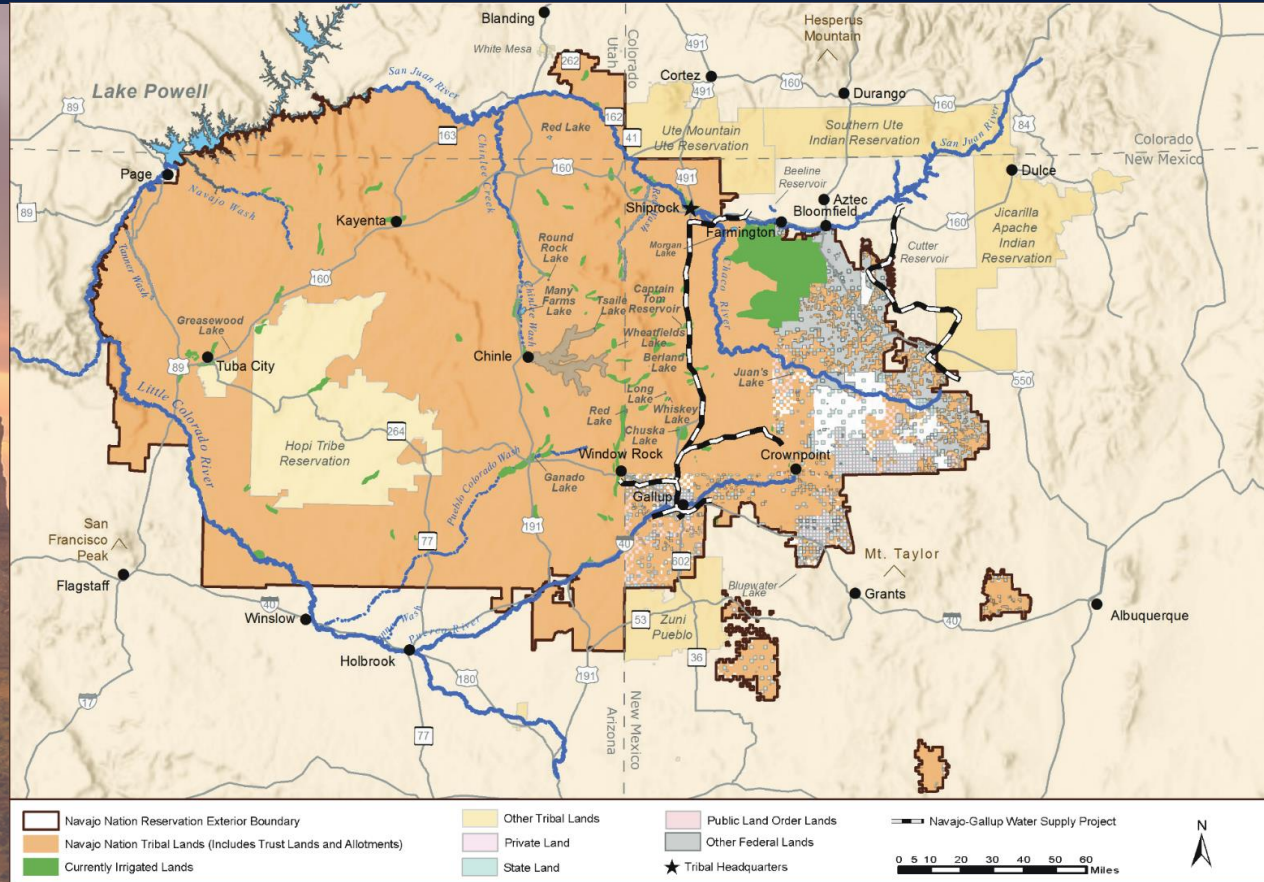
Projected supply and demand on the Colorado River—
2.6 MAFY shortfall,
2060—USBR, 2012



Map of Surface Waters on the Navajo Nation

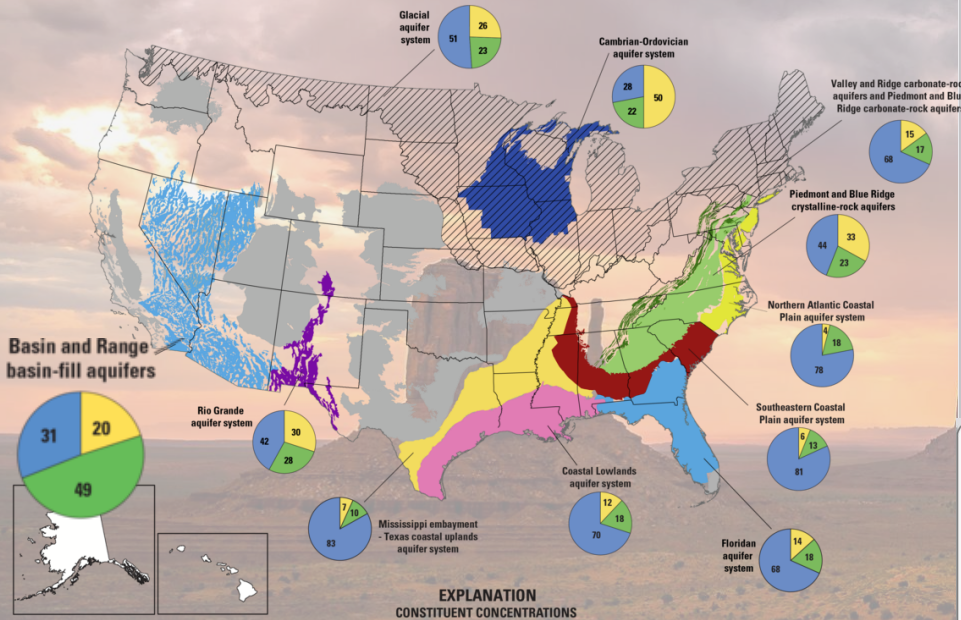
San Juan River and Little Colorado River border or flow through Navajo Nation

Assessment of Current Tribal Water Use and Projected Future Water Development



Ground Water on the Navajo Nation

OVERVIEW OF WATER QUALITY IN PRINCIPAL AQUIFERS Exceedances of human-health benchmarks by one or more inorganic contaminants

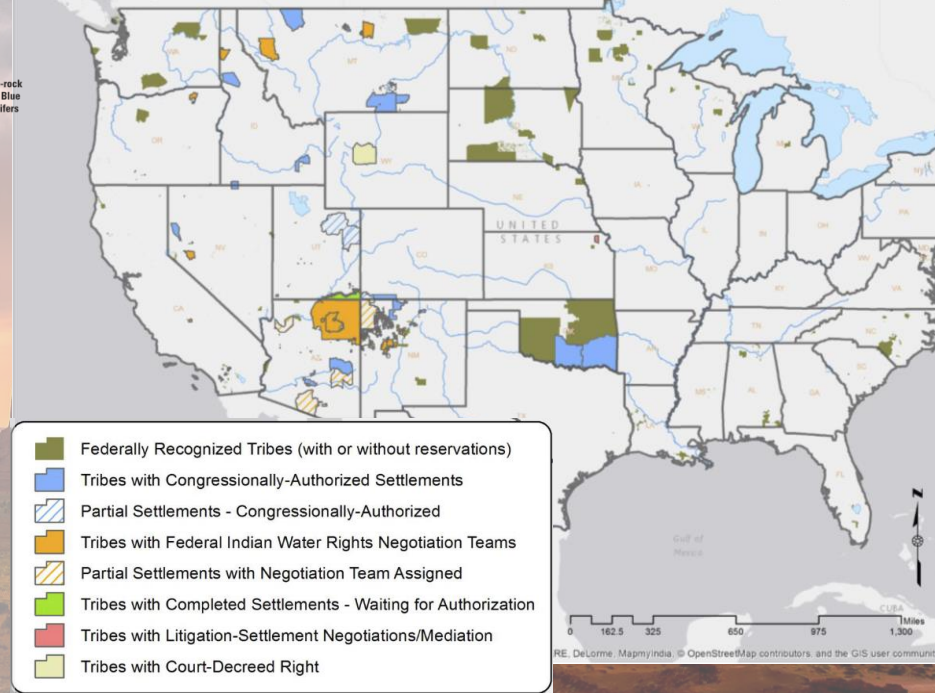


Values represent the proportion of the study area with groundwater that falls into one of three defined categories for inorganic constituents. Percentages might not sum to 100 because of rounding.

- High: Concentration of at least one inorganic contaminant exceeds a human-health benchmark.
- Moderate: Concentration of at least one inorganic contaminant is greater than one-half a human-health benchmark.
- Low: Concentrations of all inorganic contaminants are less than half of a human-health benchmark for inorganic constituents or are not detected.

Concentrations of organic constituents (not shown) did not exceed human-health benchmarks in samples from any of the Principal Aquifers shown.

Water Rights Claims Status for Federally Recognized Tribes (Draft)



Wastewater and Alternative Water Access



Water Hauling



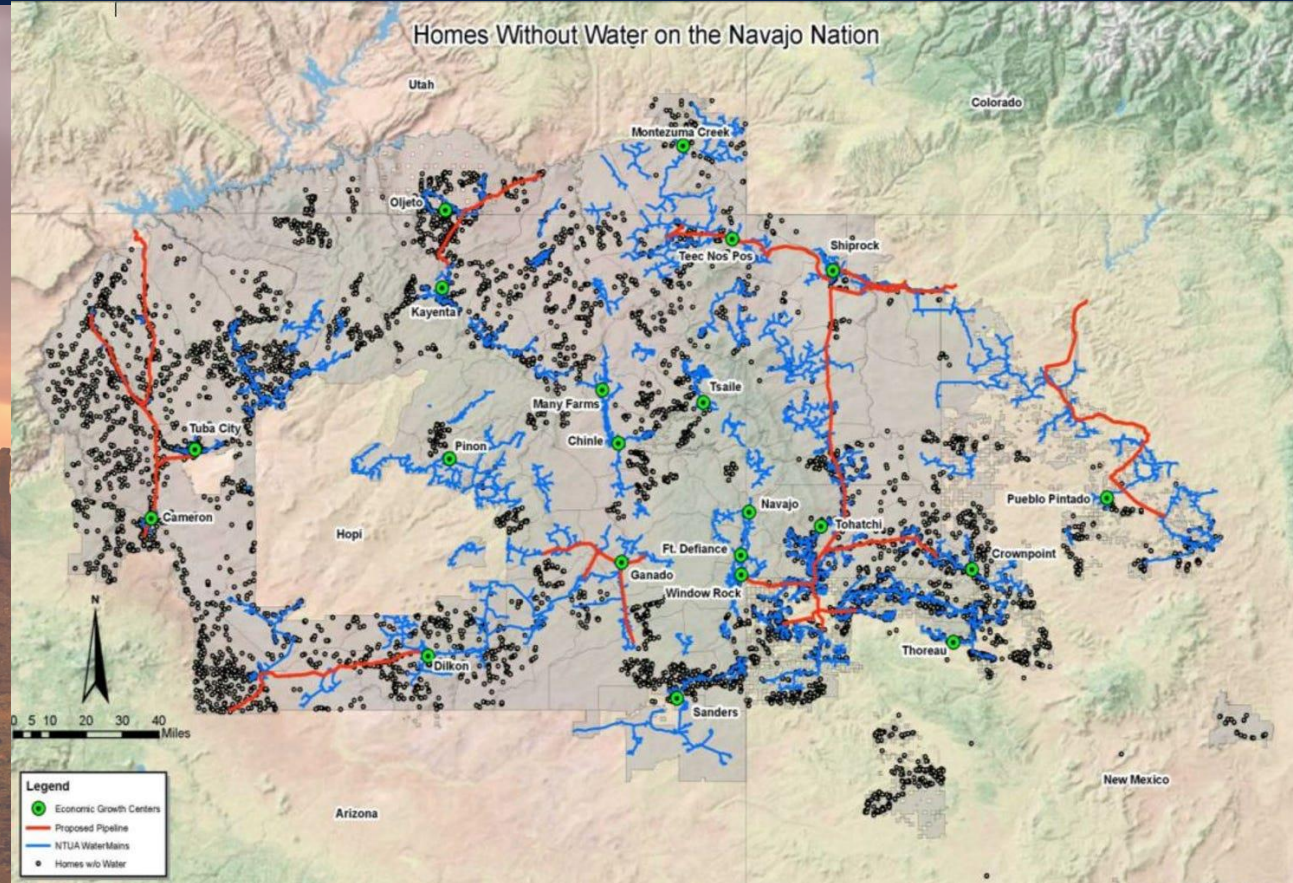
NTUA Wastewater Treatment Facility



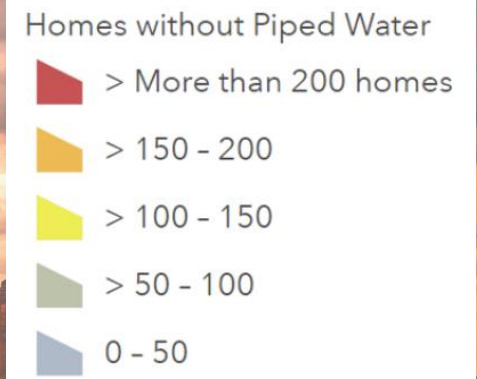
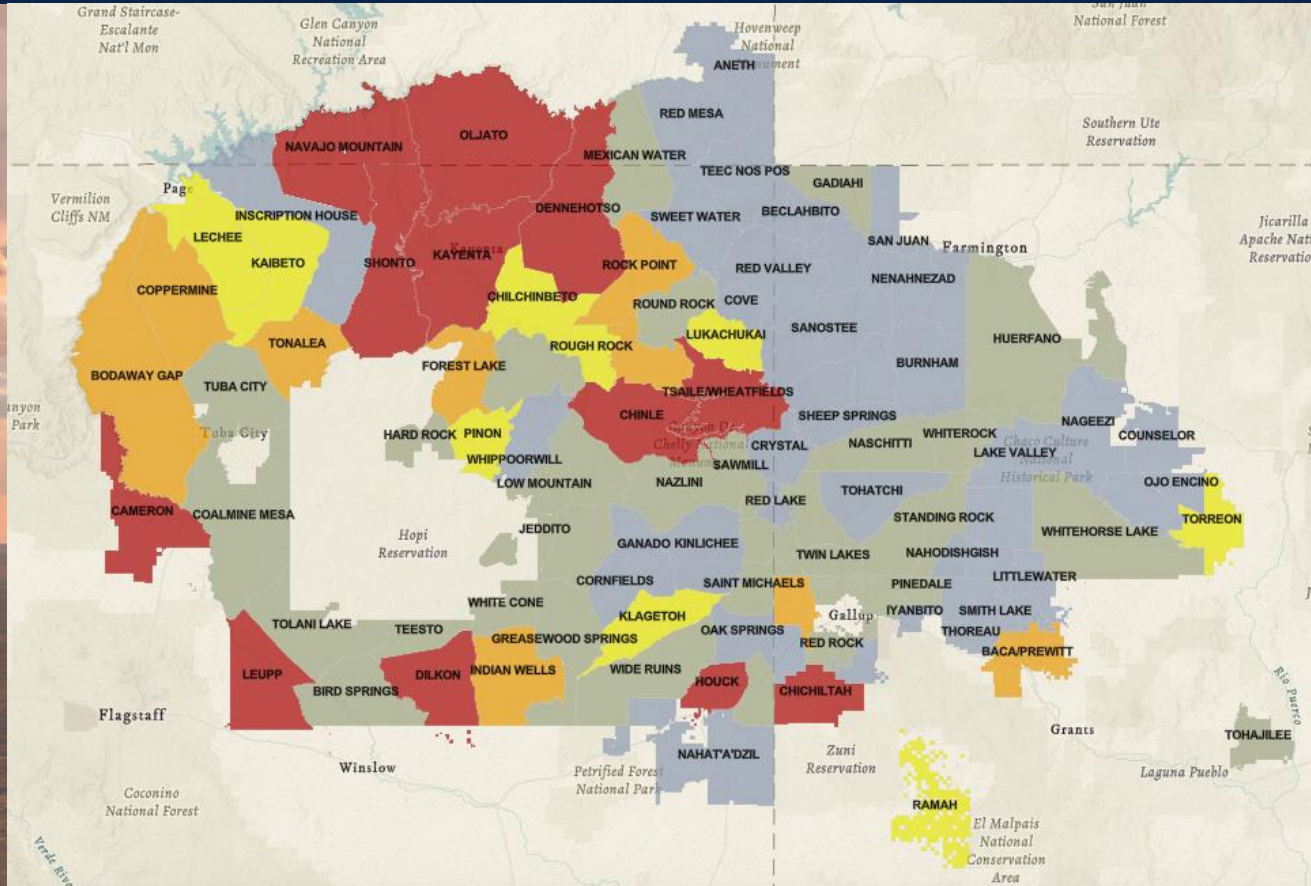
Wastewater Treatment

Map of Current Water Grid

Limited compared to the size of the Navajo Nation – many home sites are still without water.

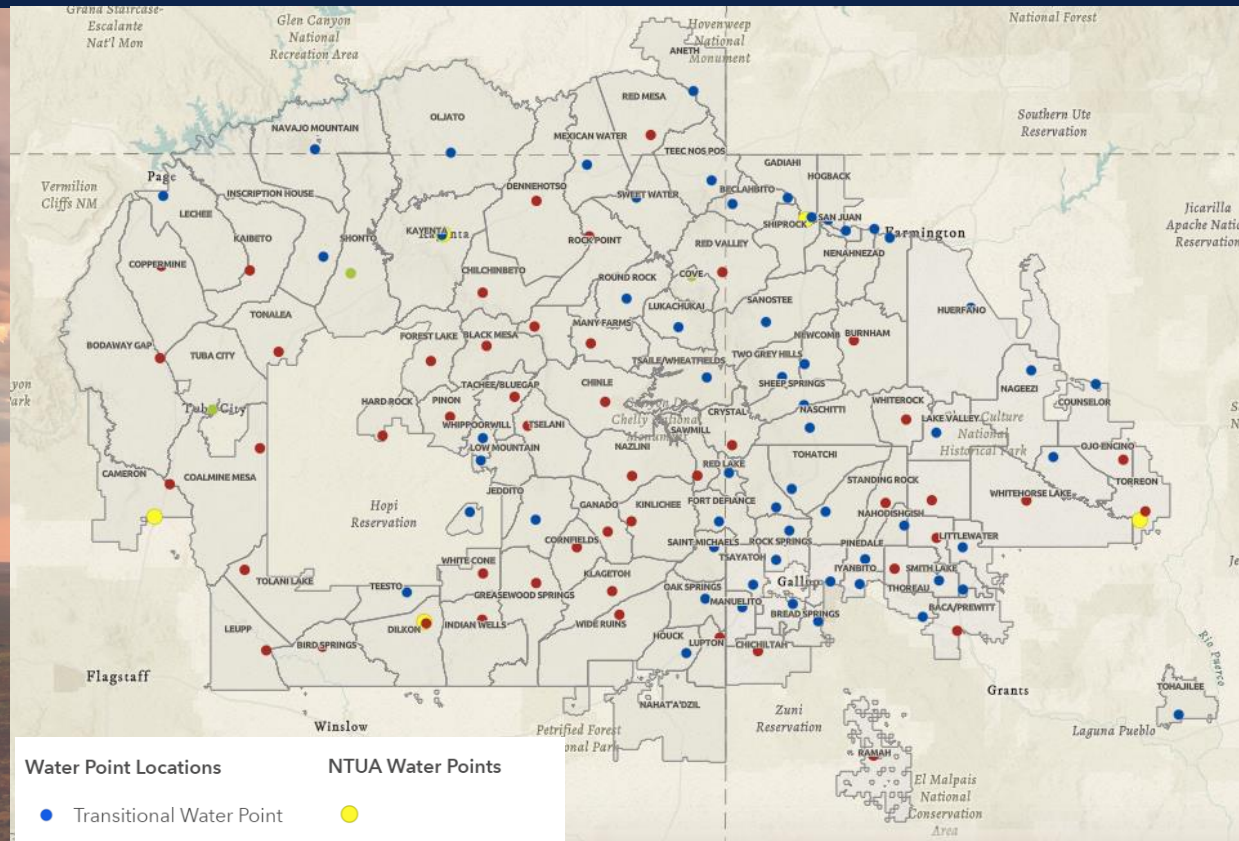


Navajo Nation Water Insecurity



<http://navajosafewater.org/>

Water Points on Navajo Nation



Water Point Locations	NTUA Water Points
● Transitional Water Point	●
● Existing Permanent Water Point	
● Not Participating	
	 Navajo Nation Chapters

Transitional Water Point: A water point installed utilizing IHS CARES Act Funds after COVID-19 managed by the Chapter where water will be provided free of charge and water storage containers with water disinfection tablets as needed will be distributed to residents of homes with no piped water.

Existing Permanent Water Point: A water point that existed prior to COVID-19 managed by the Chapter or Navajo Tribal Utility Authority (NTUA) where utilizing IHS CARES Act Funds water will be provided free of charge and water storage containers with water disinfection tablets as needed will be distributed to residents of homes with no piped water. Click the point for more information about fees.

NTUA Water Point: A water point operated by the NTUA that may require payment.

Not Participating: Chapters not participating in the Navajo Safe Water Program.



Disparities in Drinking Water Quality Communication

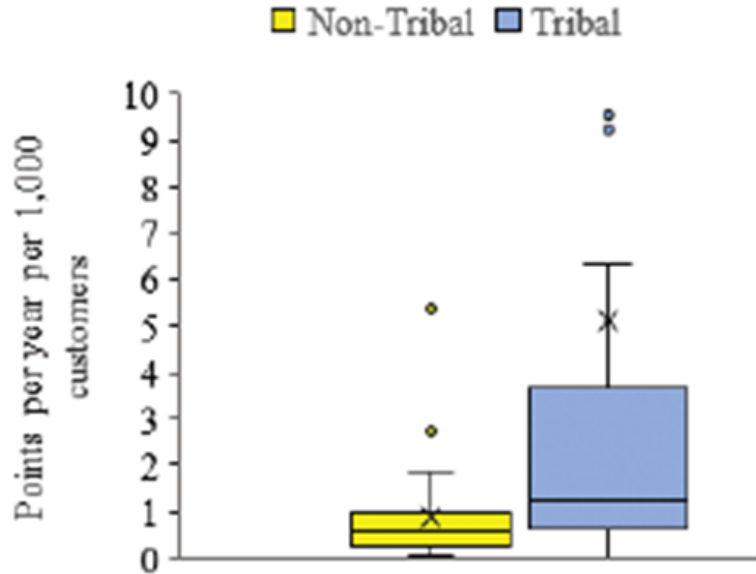


Figure 5. Drinking water violation points of non-tribal and tribal water, state aggregated. The difference is significant at $p < 0.05$.

- Between 2014-2017 more Safe Water Drinking Act violation on Tribal lands
- Also, Tribal members and communities were less likely to hear about violations
- SWDA violations occurring on tribal lands per state violations: Arizona (10%), Idaho (34%), and Wyoming (40%)

Conroy-Ben, Otakuye, & Richard, Rain. (2018). Disparities in Water Quality in Indian Country. *Journal of Contemporary Water Research & Education*, 163(1), 31–44.



North Central Arizona Water Project

The nation's long-term goals include several large regional water supply projects:

- **Navajo-Gallup Water Supply Project** (will convey 37,000 acre-feet of water from Cutter Reservoir and the San Juan River and to 40 Navajo chapters in New Mexico and Arizona, the City of Gallup, and the southern part of the Jicarilla Apache Nation)
 - 2050 finish date
- **Western Navajo Pipeline**, (Lake Powell to the Cameron Chapter)
 - Navajo Nation: 10,900 acre-feet/yr
 - Hopi Tribe: 4,000 acre-feet/yr
- **Ganado Regional Project**
- **Southwest Navajo Regional Project**
- **Utah Project**
- **Farmington to Shiprock Pipeline** (part of the ALP project)



US EPA & Navajo Nation EPA



U.S. E.P.A. granted Navajo Nation “treatment in a similar manner as a state” (TAS) under the federal Clean Water Act on January 20, 2006.

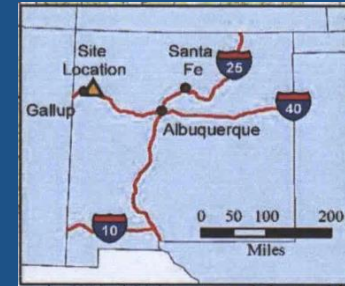
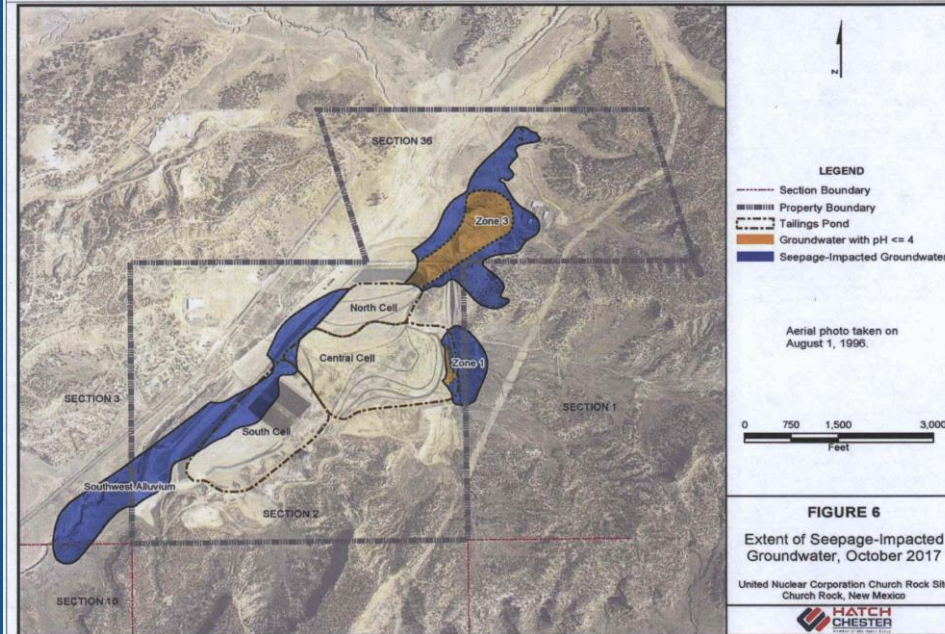
This allowed Navajo Nation EPA (1995) to develop EPA-approved water quality standards and to issue water quality certifications for actions requiring federal permits on their lands in order to protect tribal waters.





Superfund Site: UNITED NUCLEAR CORP. | CHURCH ROCK, NM

Figure 3: Extent of Seepage-Impacted Ground Water, October 2017



<https://semspub.epa.gov/work/06/100011828.pdf>



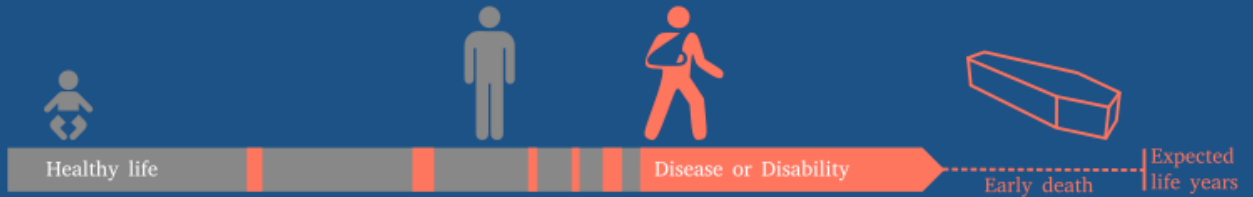
Water Quality Standards in the Making

DALY

Disability Adjusted Life Year is a measure of overall disease burden, expressed as the cumulative number of years lost due to ill-health, disability or early death

$$= \text{YLD} + \text{YLL}$$

Years Lived with Disability + Years of Life Lost



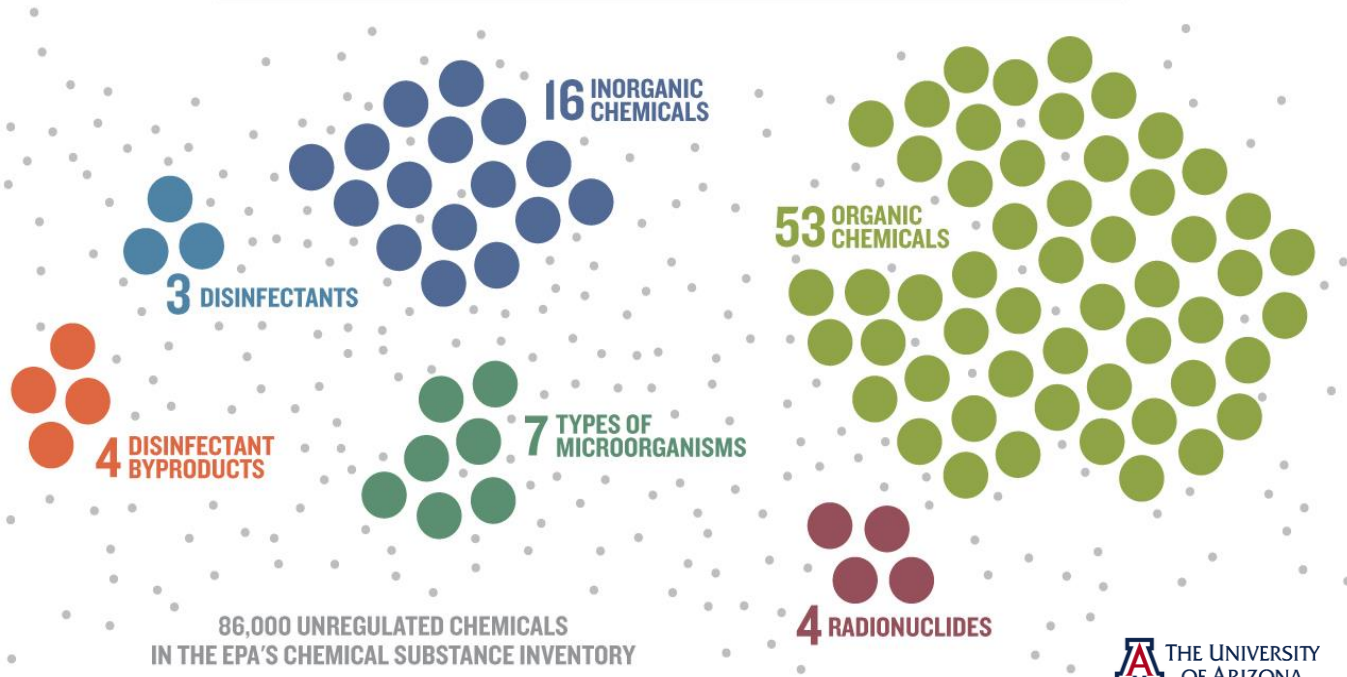
10E-6
10E-4

Chemical Toxins
Microbial Pathogens



Water Quality Standards

EPA REGULATED DRINKING WATER CONTAMINANTS





Water Quality Standards

- **Maximum Contaminant Level Goal (MCLG)** - The level of a contaminant in drinking water below which there is no known or expected risk to health.
- **Maximum Contaminant Level (MCL)** - The highest level of a contaminant that is allowed in drinking water. *MCLs are enforceable standards.*
- **Treatment Technique (TT)** - A required process intended to reduce the level of a contaminant in drinking water.
- **Maximum Residual Disinfectant Level Goal (MRDLG)** - The level of a drinking water disinfectant below which there is no known or expected risk to health.
- **Maximum Residual Disinfectant Level (MRDL)** - The highest level of a disinfectant allowed in drinking water.

* Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million (PPM).



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