City of Santa Fe STEWaRDS Model

Public Hybrid Meeting
December 12, 2024

Introduction and Summary

We are presenting a model of our water system, called STEWaRDS

- **Systems Tool for Evaluating Water Resource Decisions and Strategies**
- **This presentation is about the model (a tool) only, not about results (coming in 2025 & 2026)**

Our water supply is currently safe and reliable due to past and ongoing efforts

- **Community-driven water conservation**
- **Past planning**
  - *Diverse water supply "portfolio": renewable surface water when available, and groundwater for when surface water is less available*
  - *San Juan-Chama Return Flow Project*

Goals of Water 2100

- **A safe, reliable, and resilient water supply in an uncertain future**
- **Integrate community values with science-based water resources planning**

The model: STEWaRDS

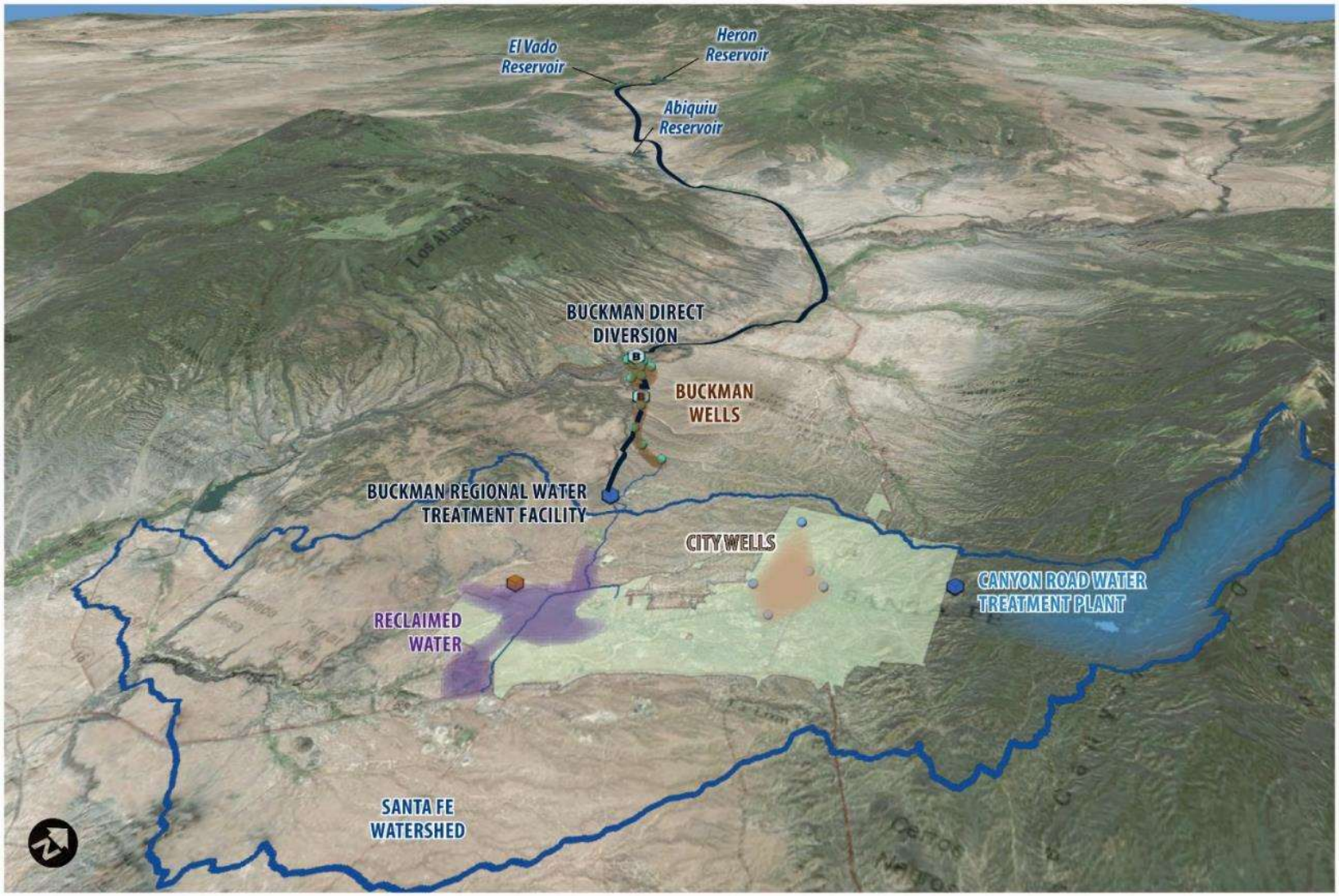
- **Uses the latest technology and best available science to run simulations across 1,000's of future scenarios**
- **Allows us to evaluate strategies to prepare for and adapt to whatever may happen in the future**


WHERE WE'VE BEEN
save water SANTA FE
Thanks to community-driven water conservation,
we have one of the lowest GPCDs* in the country.
EYE ON WATER
AMI
DATA DASHBOARDS
WATER RESOURCES INDICATOR
STEWARDS MODEL of WATER SYSTEM
NEW SCIENCE & TECH-BASED WATER CONSERVATION TOOLS
WHERE WE'RE GOING
These tools plus science-based planning will help us continue to provide a safe, reliable, and resilient water supply to Santa Fe next year, next decade, and next century.
CITY OF SANTA FE WATER
SANTA FE WATER 2100
LEARN MORE: savewatersantafe.com

Background

The System

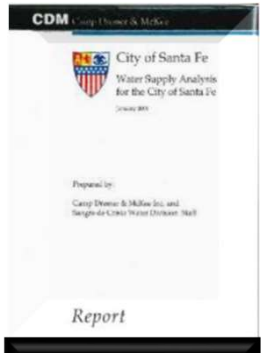
- Santa Fe River watershed
- 4 Potable Sources
  - SF River
  - City Wells
  - Buckman Wells
  - BDD
- City diverts Colorado River water at BDD



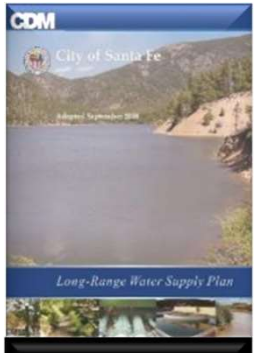
Past Planning Efforts

1988

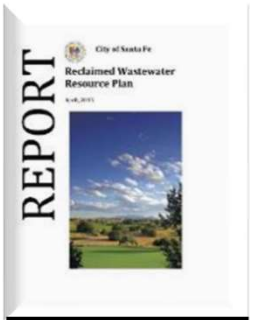
1998



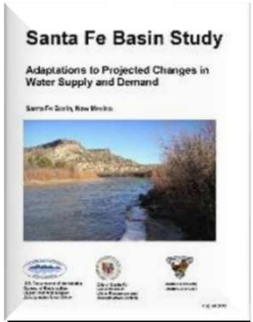
2001



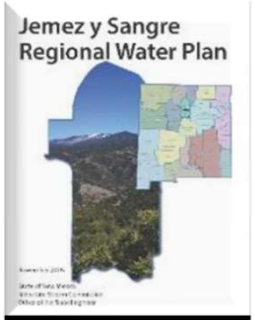
2008



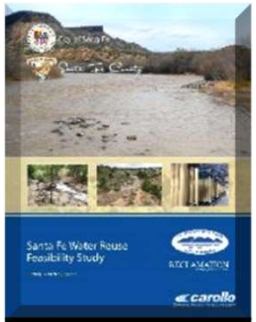
2013



2015

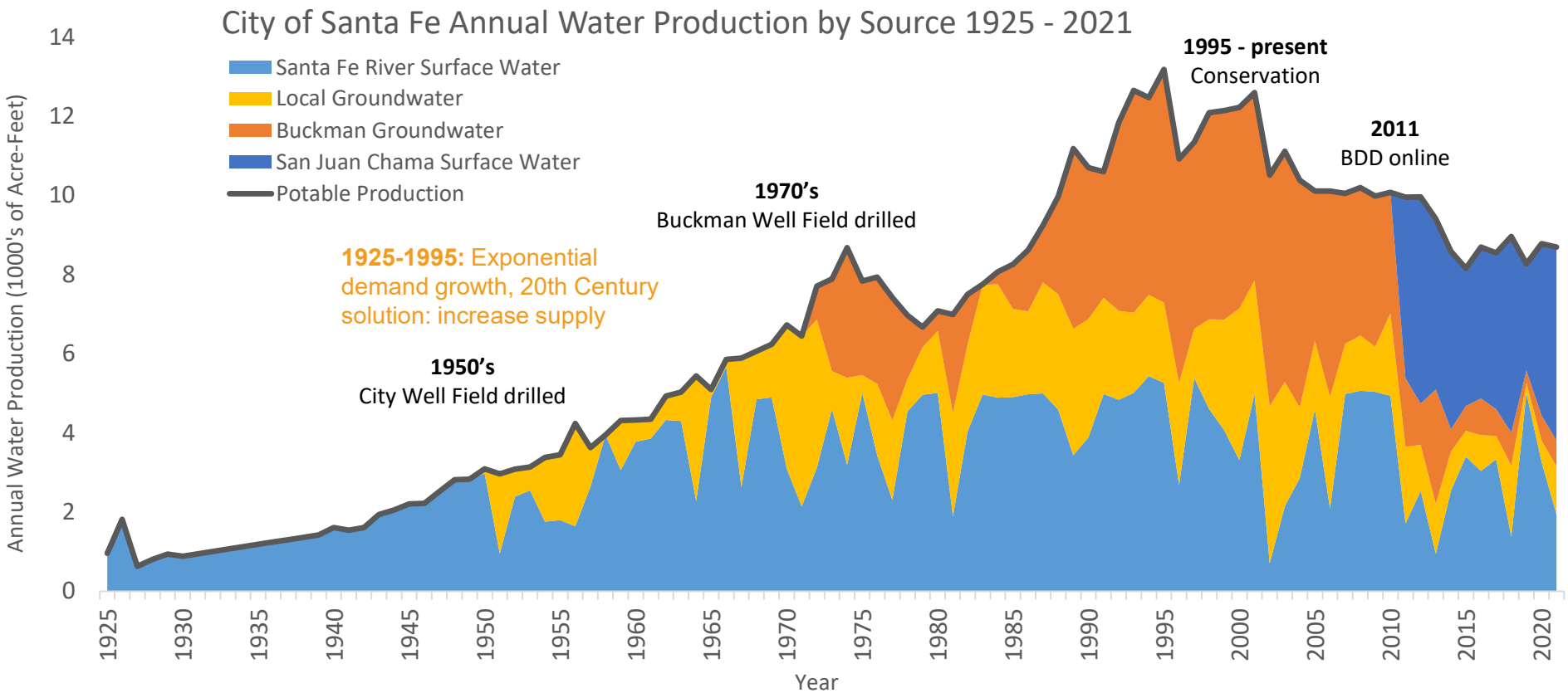


2016

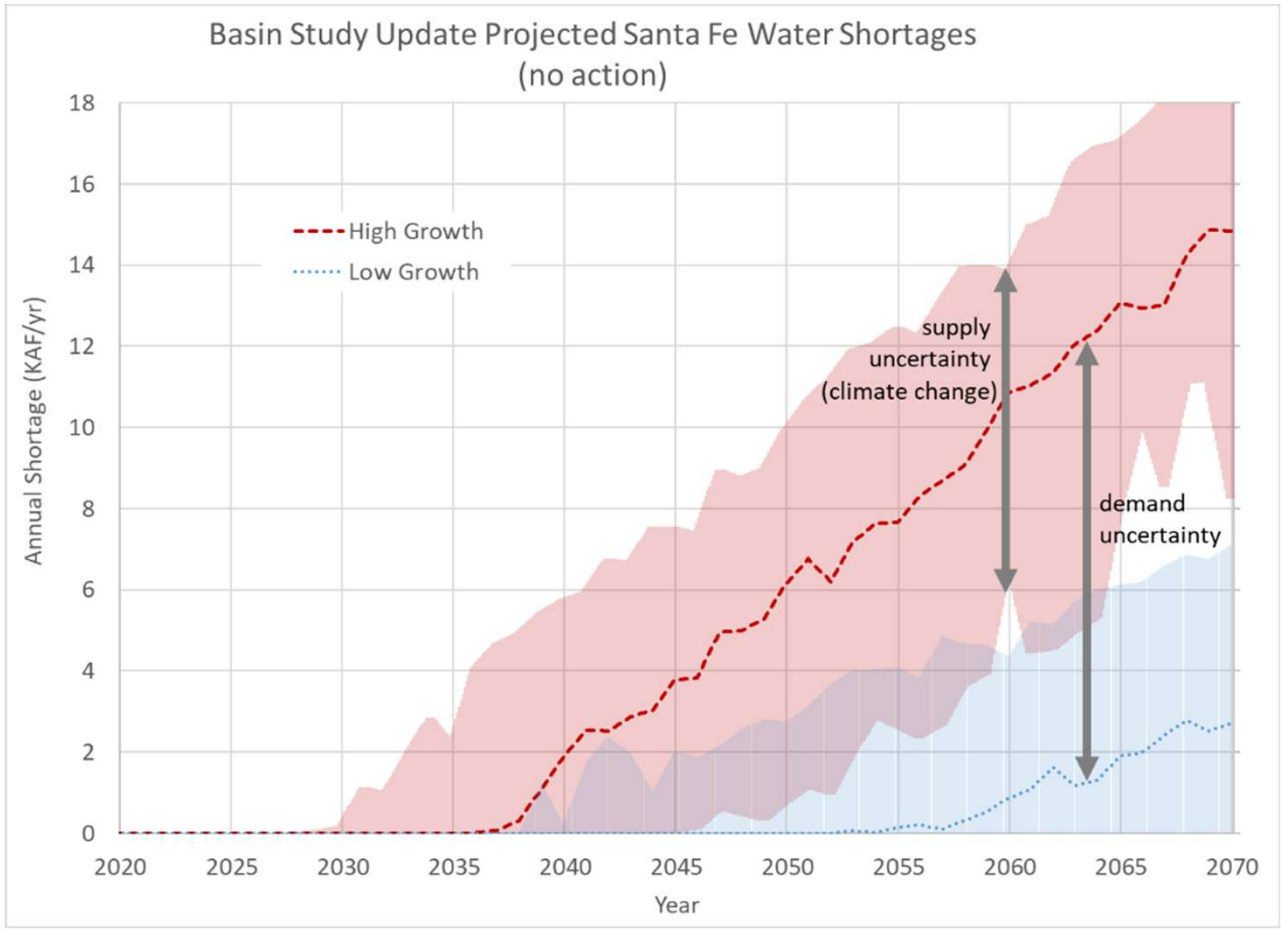


2017

Results of Past Planning



Most Recent Planning (Basin Study Update): Projected Shortages



Response to Basin Study Projected Shortages

Continued conservation

Increase use of treated wastewater

- **Reuse Feasibility Study**
  - *Treated wastewater has long been recognized as an underutilized resource*
  - *Identified return flow credits as the best way to utilize treated wastewater*
- **Design and Construct Return Flow Project**
  - *Resolution 2019-56*
  - *Project has long been "next in line"*
  - *Will stretch our Colorado River water three times further*

ASR

- **Performed high-level feasibility studies**

Status quo: buy water rights

Water 2100
Planning Process

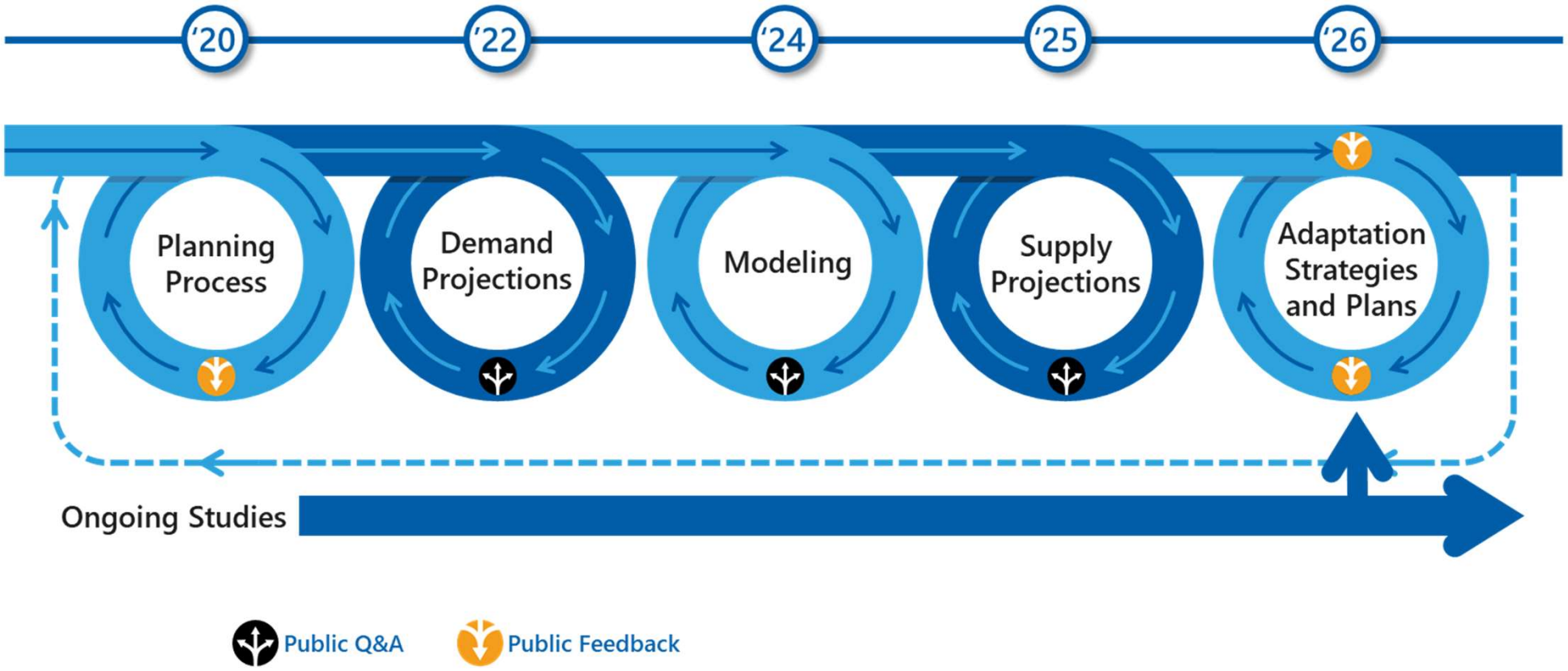
Water 2100 Overview

80-year plan evaluating water demand and supplies

Collaborating with USBR

- **STEWaRDS developed via cost-share grant and MOA via WaterSMART program**
- **USBR providing technical expertise on climate hydrology**
- **Work in parallel with the USBR Rio Grande Basin Study**

Planning Process



Technology Overview

Technological Development

Under Development *In Pilot Phase*

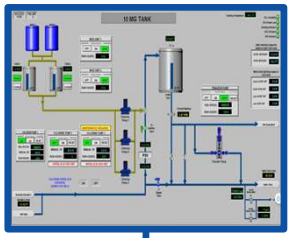
Manual Operation

...Before SCADA

- Field Readings
- Charts / Tables
- Excel

SCADA System

Production Management

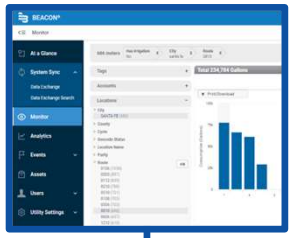


2003

- Realtime Sensor Data
- Programmed Control
- Server Data Storage
- SQL Data Queries

AMI Beacon

Demand Management

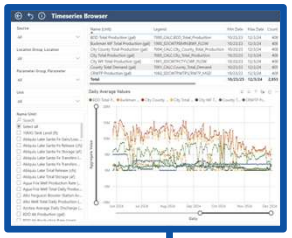


2016

- System Demand Monitoring
- Badger Smart Metering
- Cloud-based Data Storage
- Leak Detection
- EyeOnWater User Interface

PowerBI Dashboards

Data Integration / Analysis



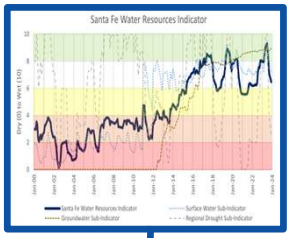
2020

- Integration
- Standardization
- Analysis
- Visualization
- Decision-making
- Realtime Groundwater Monitoring / Aquifer Testing

WRI

Water Resources Indicator

Seasonal Monitoring



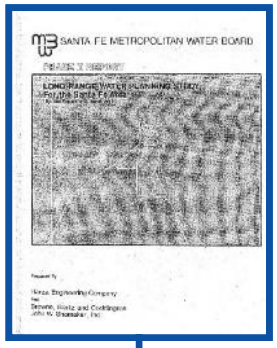
2021

- Drought Monitoring
- Seasonal Assessment
- Decision-making

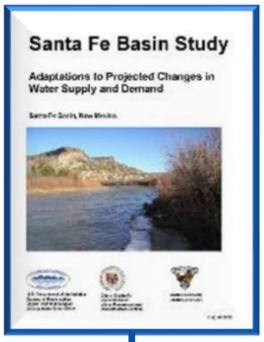
Planning & Model Development

* STEWaRDS = *Systems Tool for Evaluating Water Resources Decisions and Strategies*

1988 Water Plan



2015 Basin Study



2017 Basin Study Update

Water 2100

SANTA FE WATER 2100

Future Planning…

1988 — 2015 — 2017 — 2020 — *Future Updates…*

Excel Models (Singular Runs)

WaterMAPS Model (104 Runs)

isee systems

STEWaRDS Model (1000's of Runs)

GoldSim

Understanding Our *Current* System

Demand Data

Manual, Beacon AMI

Commercial	Indoor
Residential	Outdoor
Reuse	Non-Revenue

4 Sources of Supply

Manual, SCADA, Beacon

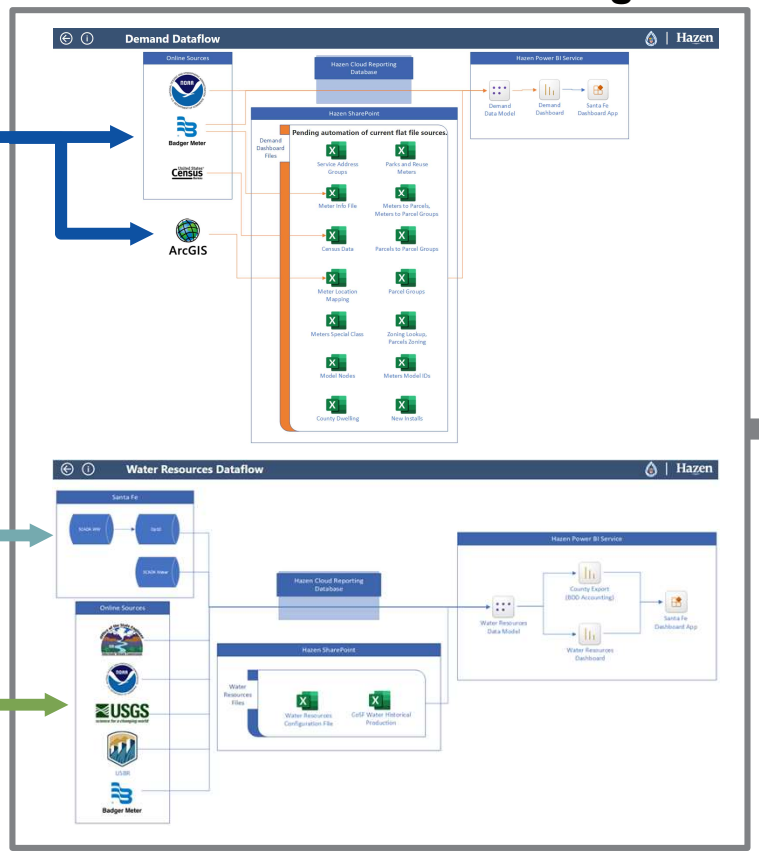
Surface	*Groundwater*
1. CRWTP	3. City Wells
2. BDD	4. BWF

External Agencies

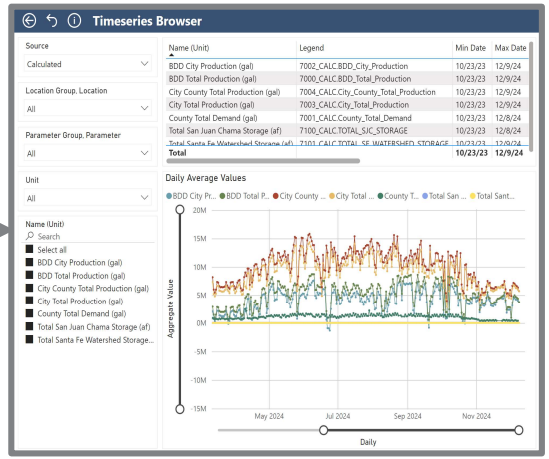
API's & Spreadsheets

Healy Foundation · Bureau of Reclamation · Internet of Water · Thornburg Foundation

PowerBI Dashboard Data Integration



Informed Decision Making



Understanding Our *Future* System

Climate Traces

CMIP3
USBR Projections
Climate Expert Review

System Integration

Regional Hydrology
Supply & Demand
Constraints

Vulnerabilities

System Disruptions
"What If's"…

1000's of Simulations with PowerBI Analysis

GoldSim

Model Results

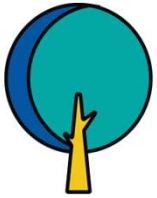
Analysis
Evaluation
Responsive Strategies

Model Overview

Questions We Want the Model to Answer

Reliability
Do we have enough water to meet increasing demand?

Sustainability
Surface water use (more renewable) vs groundwater use?



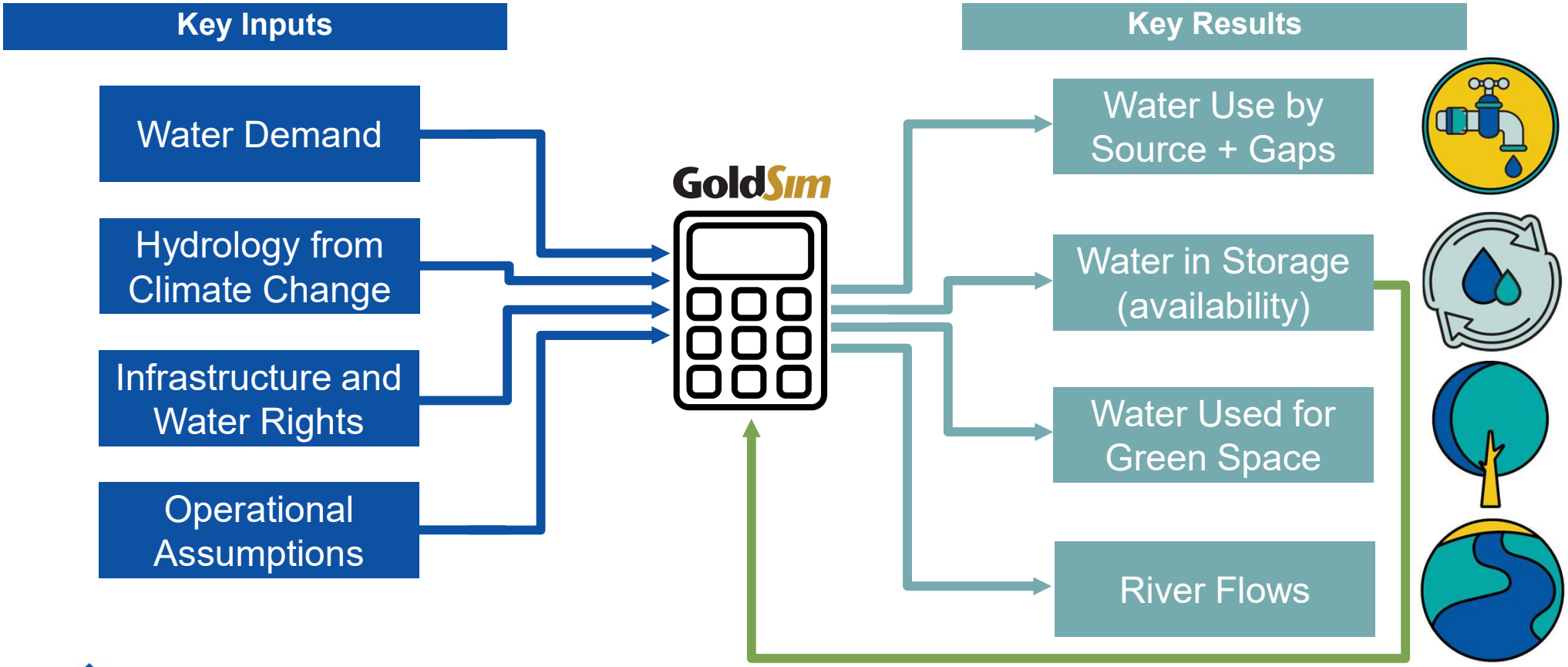
Social (Green)
How green is the City (water used for green space)?

Environmental (Blue)
How much water is there in the Santa Fe River?

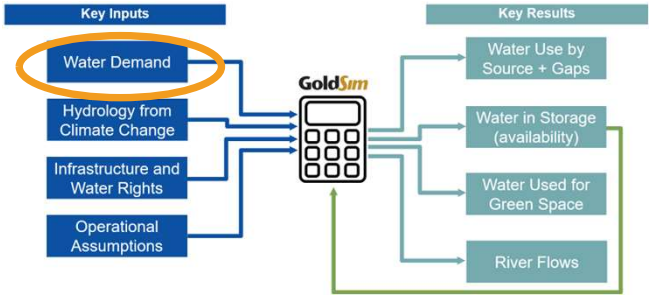
- How does our future system perform according to these criteria?
- What potential system vulnerabilities affect these criteria?
- How effectively do our adaptive strategies improve these criteria?

Model Overview

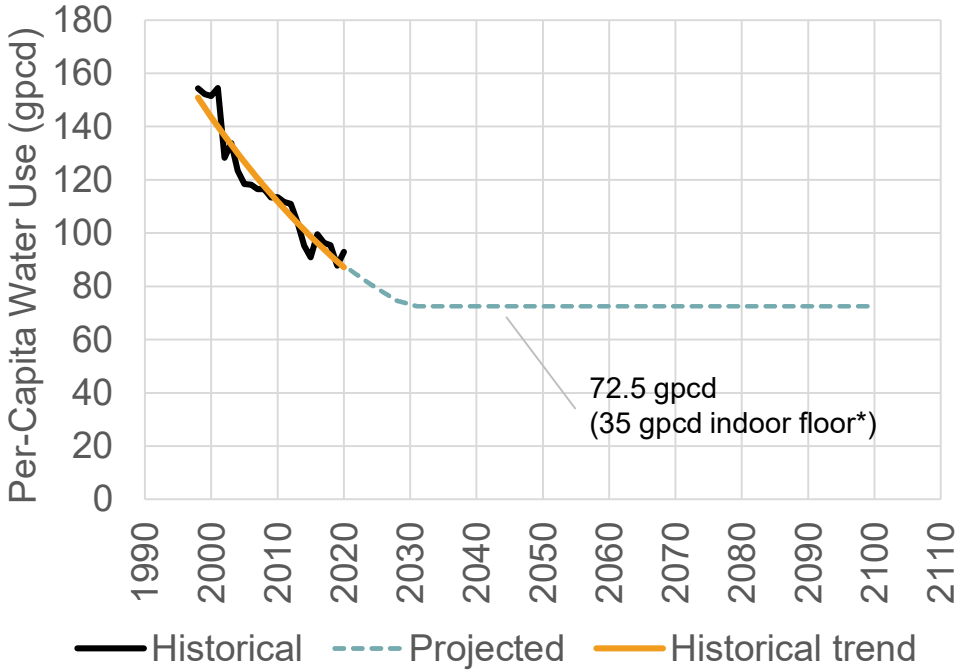
* Monthly time steps, to year 2100

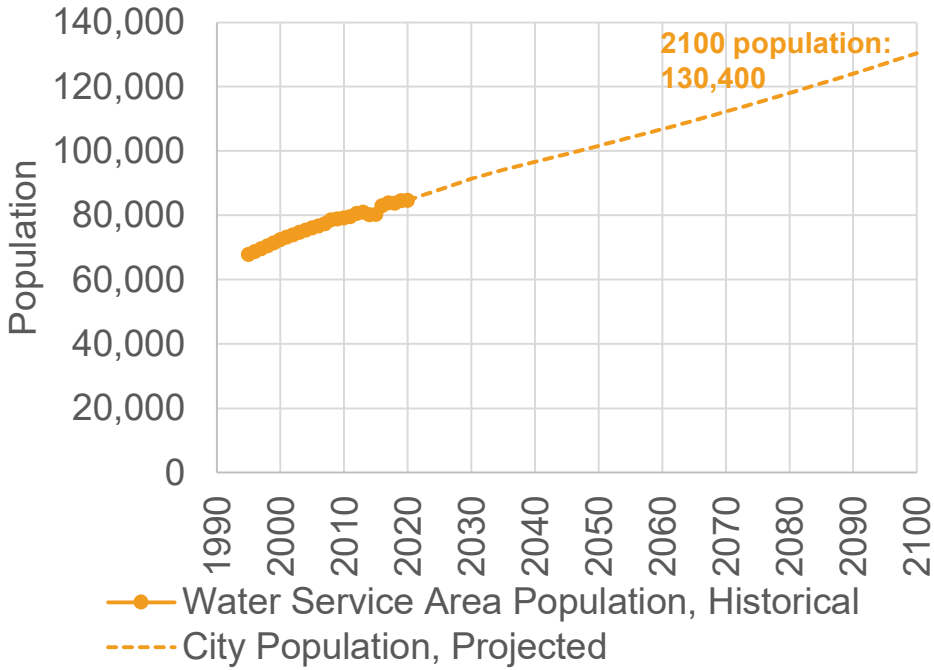


Demand Projections



- GPCD and population simulated separately
- Allows for independent "what-ifs," e.g. conservation (gpcd) and/or rapid growth (population)





Supply Projections

Current (Placeholders)

- 104 CMIP 3 *"traces"* as input

In Progress

- USBR and UMass (Rio Grande Basin Study)
- Temperature and precipitation as inputs

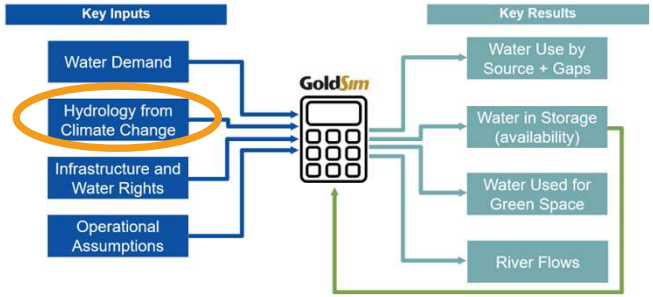
  91 choices: 7 temperature x 13 precipitation
- 10 different hydrology time-series for each temp / precip

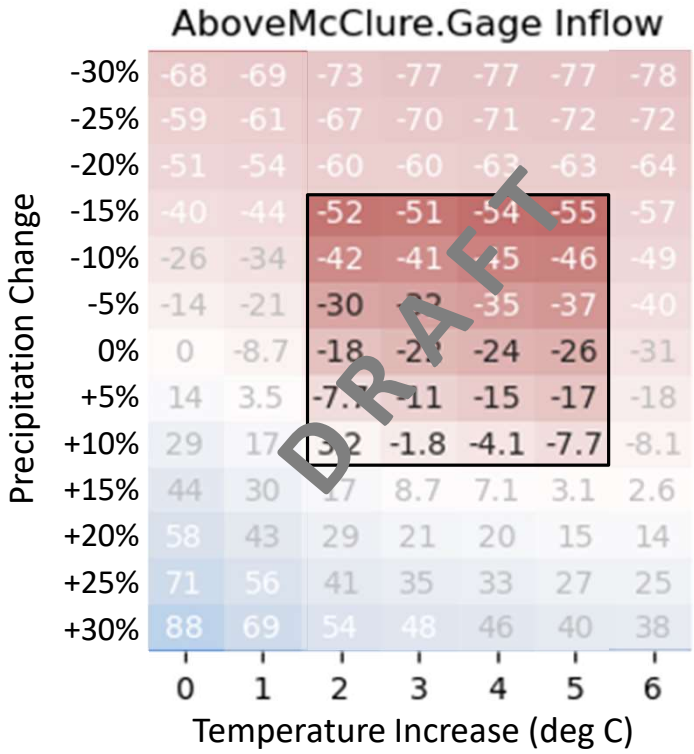
  Up to 910 simulations
- We will use a subset based on best available science

Example:
Percent Change in Flow at End of Century
(Relative to 1980-2020 Average)

STEWaRDS Approach

- Click a single button for all runs
- Roll results up in Power BI to make sense of them

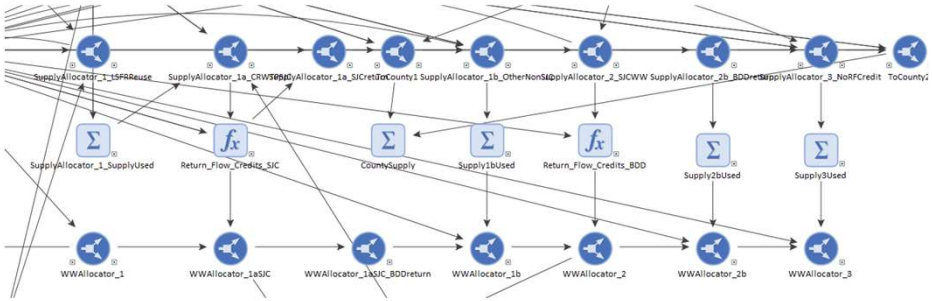




How the model selects supplies to use

Supply limits

- **Capacity (wells and treatment plants)**
- **Water availability**
- **Water rights**

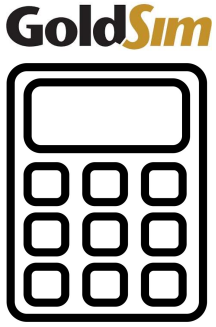


Priority-based supply selections

- **Minimal amount of groundwater (exercise wells)**
- **Then prioritize surface water over groundwater**
  - *Use all water available from Santa Fe watershed*
  - *Then use San Juan-Chama water*

Consider wastewater availability with each source

- **Only SJC water can be used for return flow**
- **Prioritize non-SJC for reuse and lower Santa Fe River flows**
- **This is a big change from previous plan and model**



Surface Water Storage

Model tracks water available based on hydrology and past usage

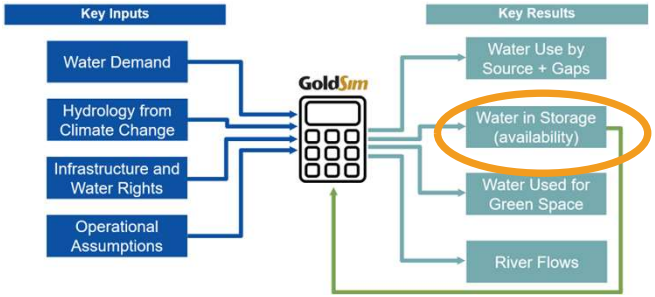
- **Water storage output for month 1 becomes water storage input for month 2**

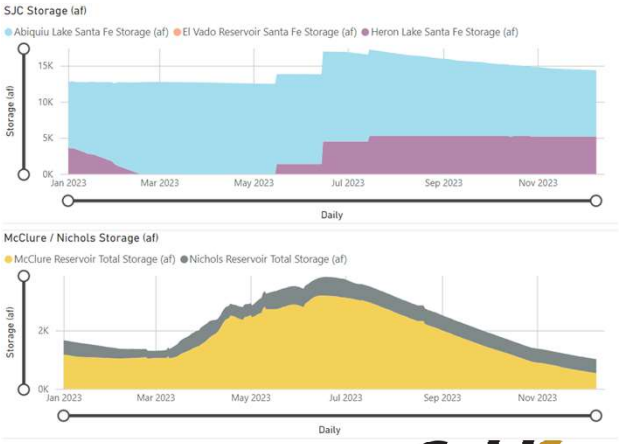
Santa Fe Watershed Reservoirs

- **Inflows**
  - *Runoff from watershed, based on supply projections*
- **Outflows**
  - *Acequias*
  - *Living River release (volume based on ordinance)*
  - *Diversion to water supply (Canyon Road Water Treatment Plant)*

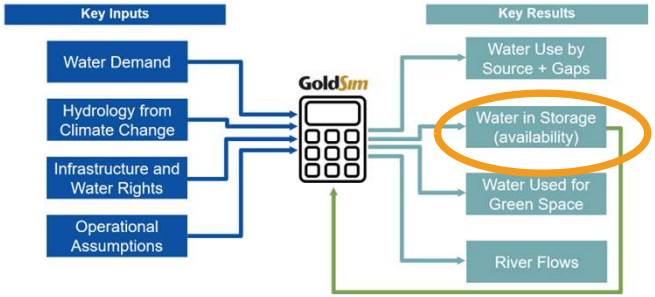
San Juan-Chama Reservoirs

- **Inflows**
  - *SJC allocations, based on supply projections*
  - *Adaptation strategies, e.g. lease water*
- **Outflows**
  - *Release for water supply diversion at BDD*
  - *Evaporation*
  - *Storage fee*





Groundwater Capacity and Availability



STEWaRDS calculates groundwater levels

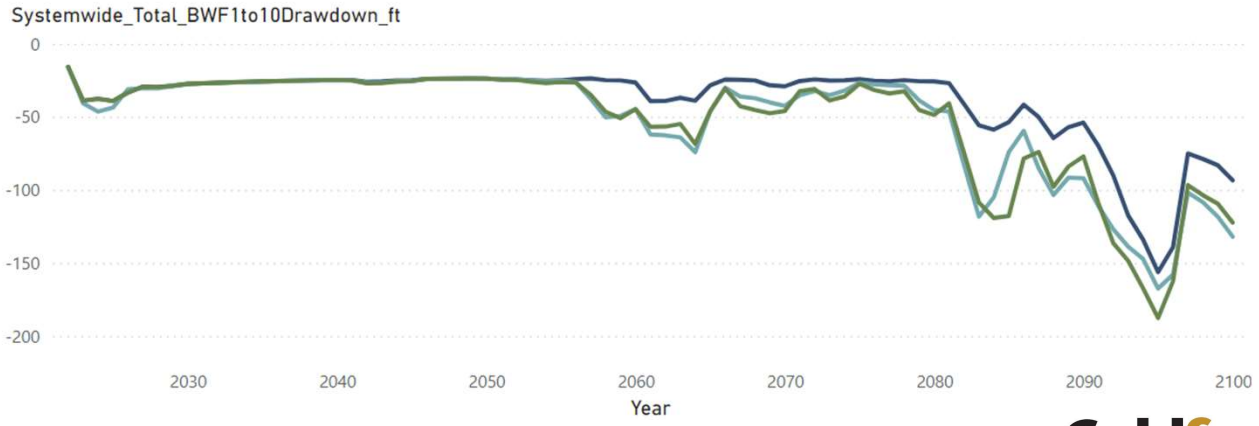
- **Based on a numerical groundwater model**

Water level variations based on

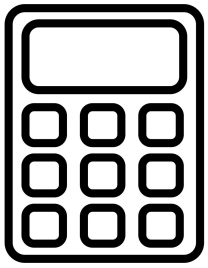
- **Past pumping**
- **Climate change (reduced recharge)**

Water levels used for:

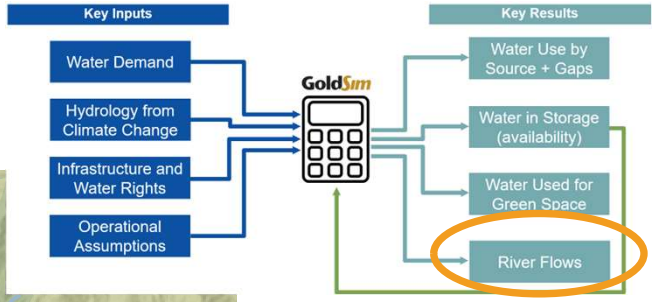
- **Well production rates**
- **Water availability**

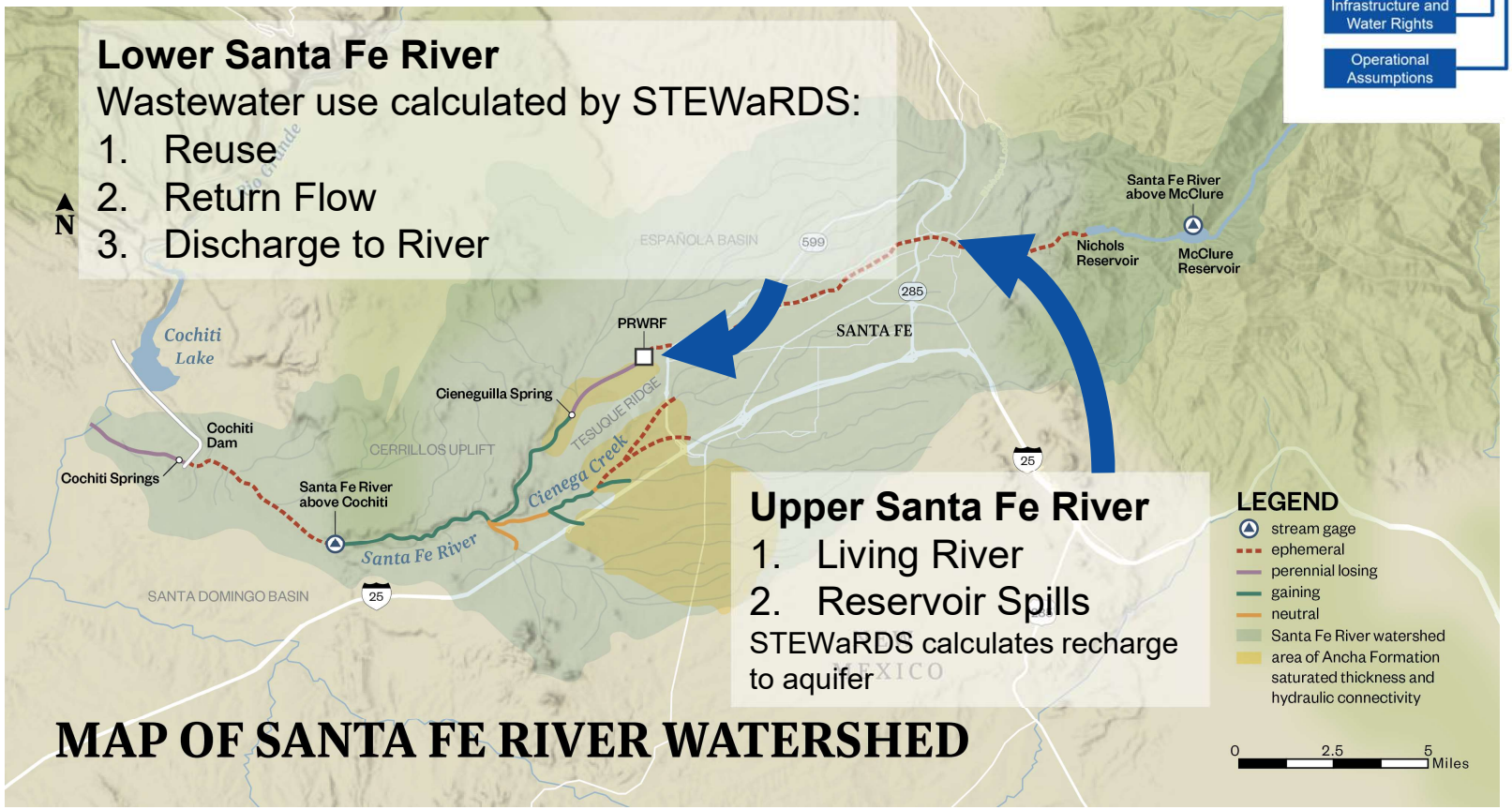


GoldSim



Modeling River Flows

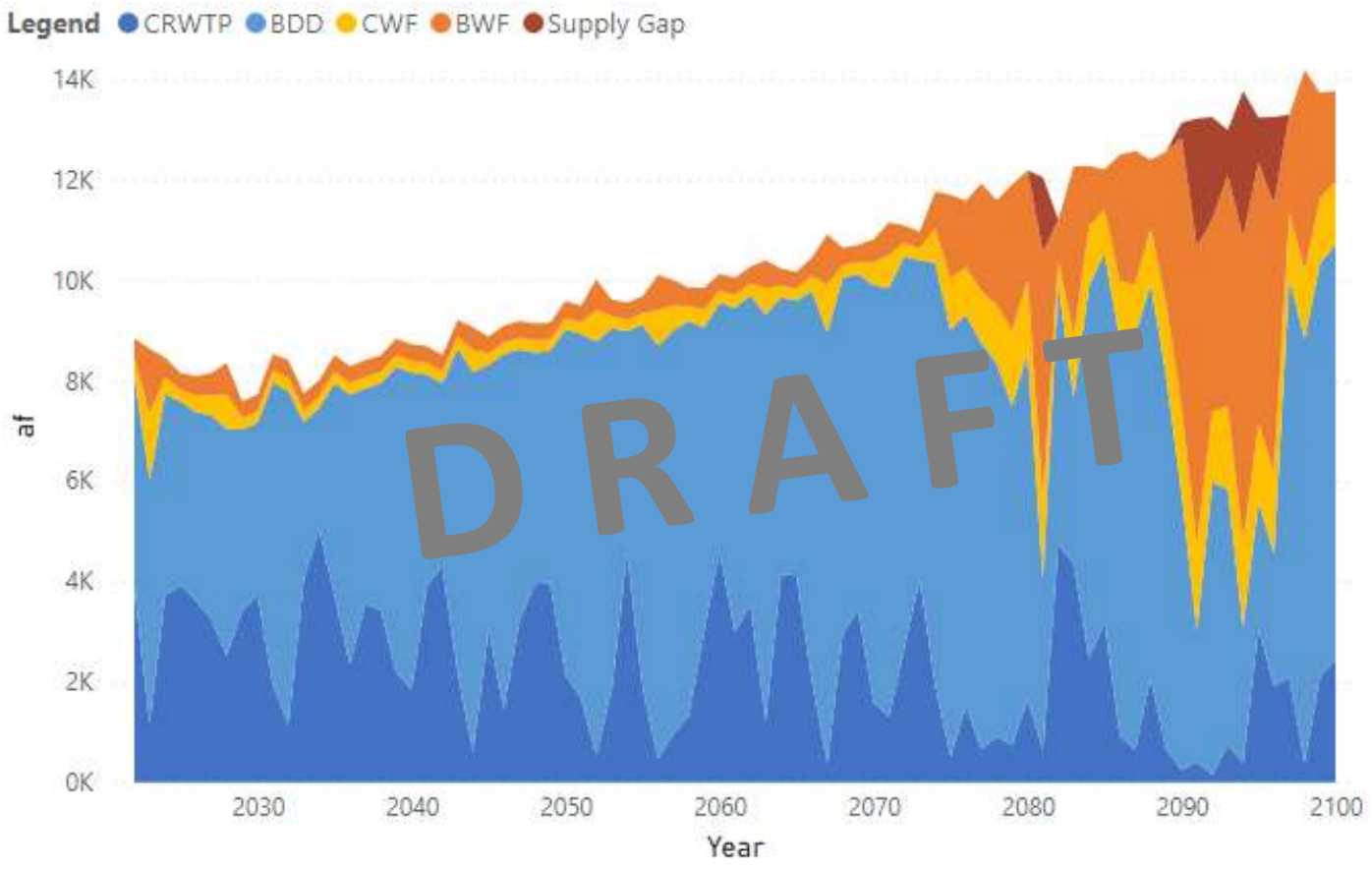




Building Resiliency: Simulating Vulnerabilities

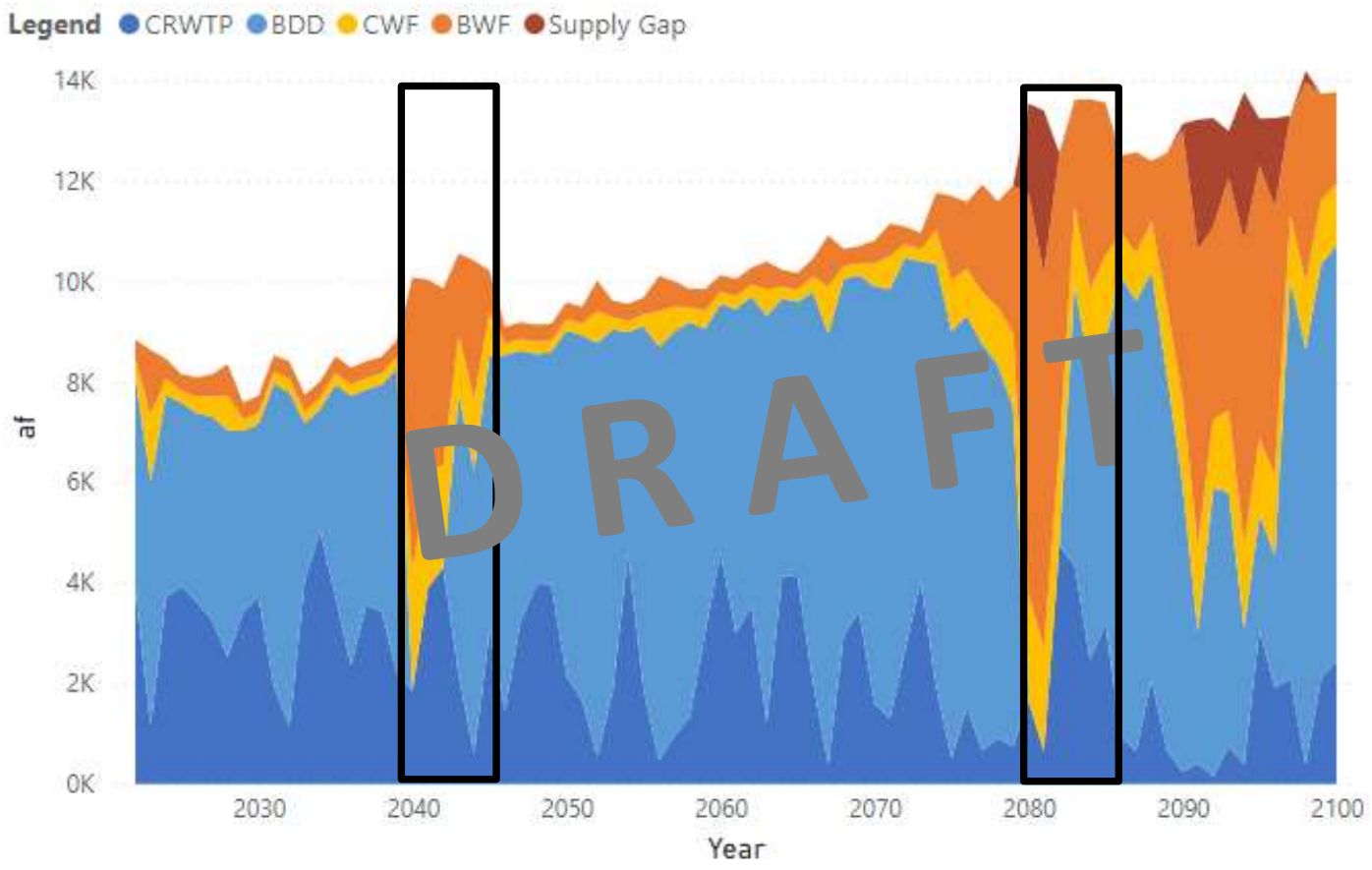
Baseline

Climate change, no additional vulnerabilities



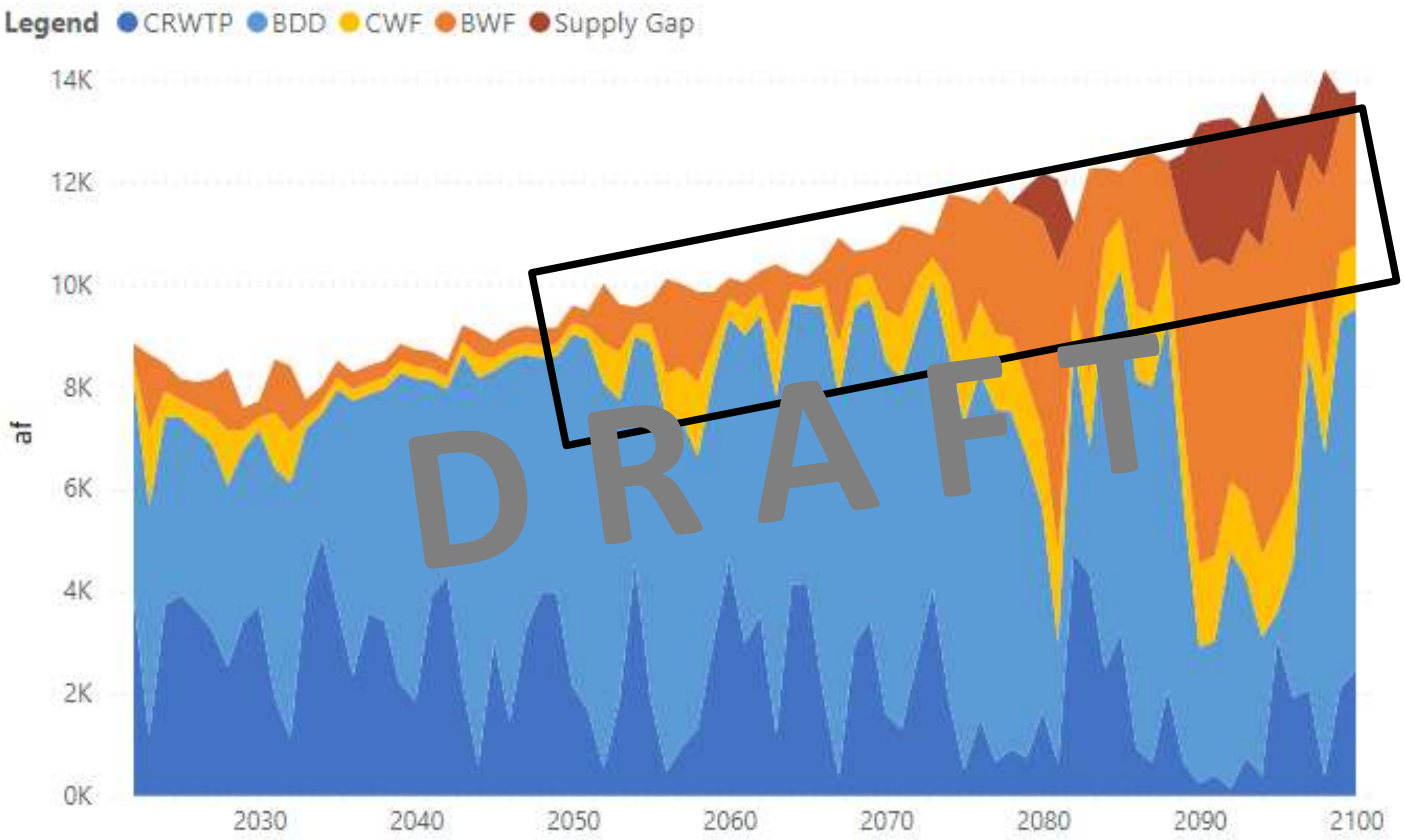
Example Vulnerability:
BDD Down

Various possible causes, e.g., sediment, post-fire ash, water quality contamination



Example Vulnerability:
Additional* 25% reduction in SJC Allocations

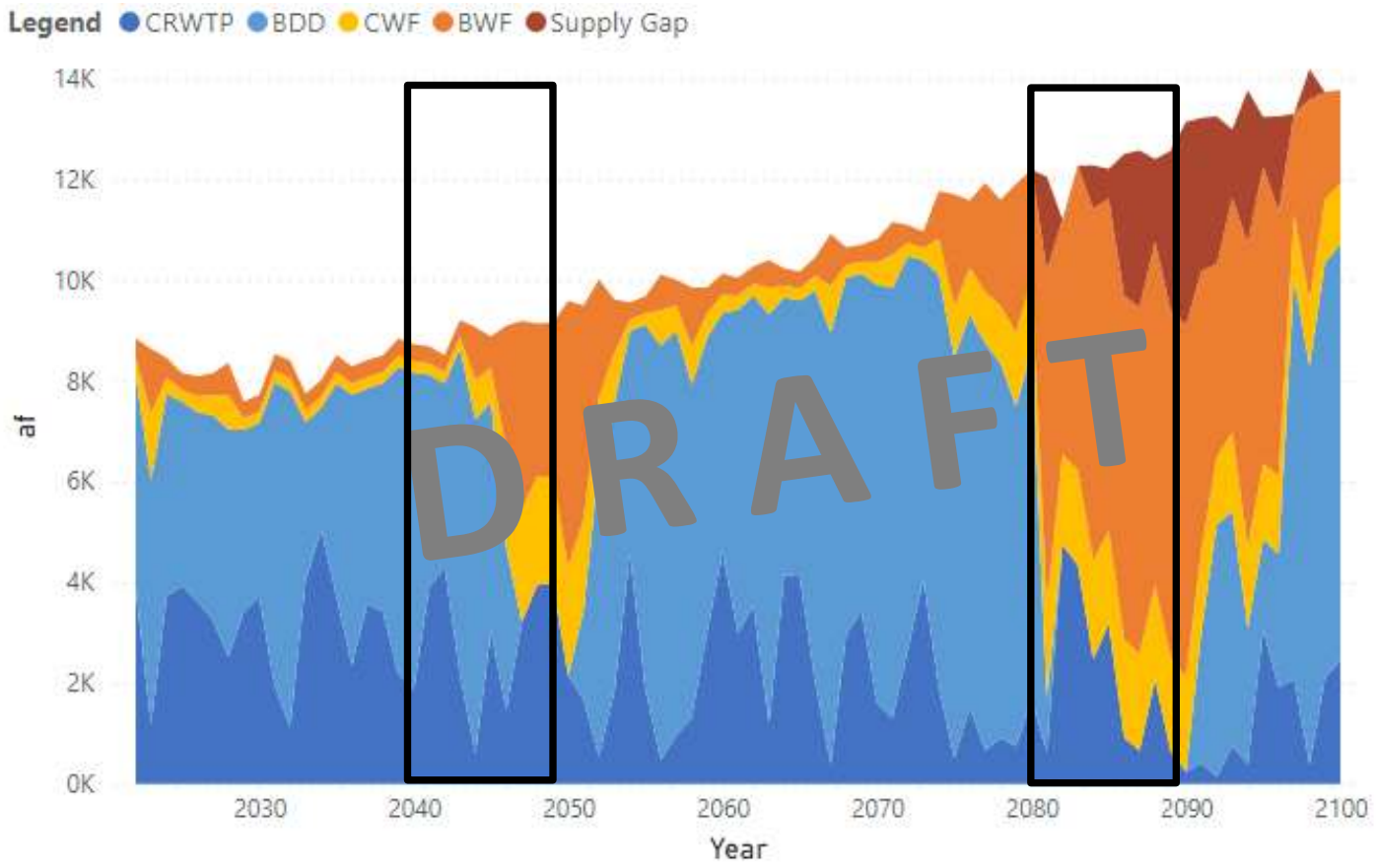
Possible cause: Colorado River "compact calls"



*Additional beyond effects of hydrology / climate change

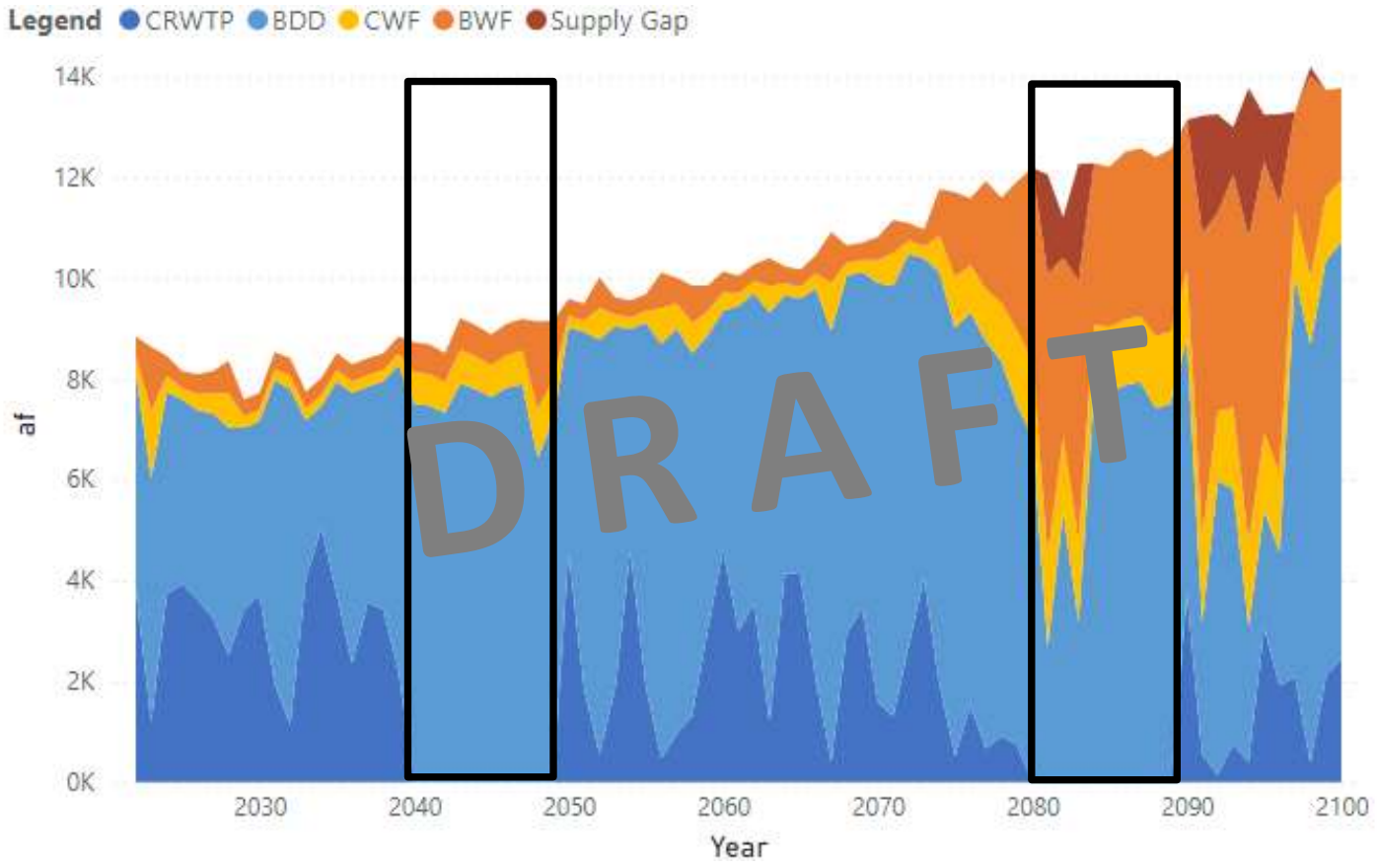
Example Vulnerability:
No SJC Inflow/Allocations for 10 years

Possible cause: catastrophic wildfire in SJC headwaters



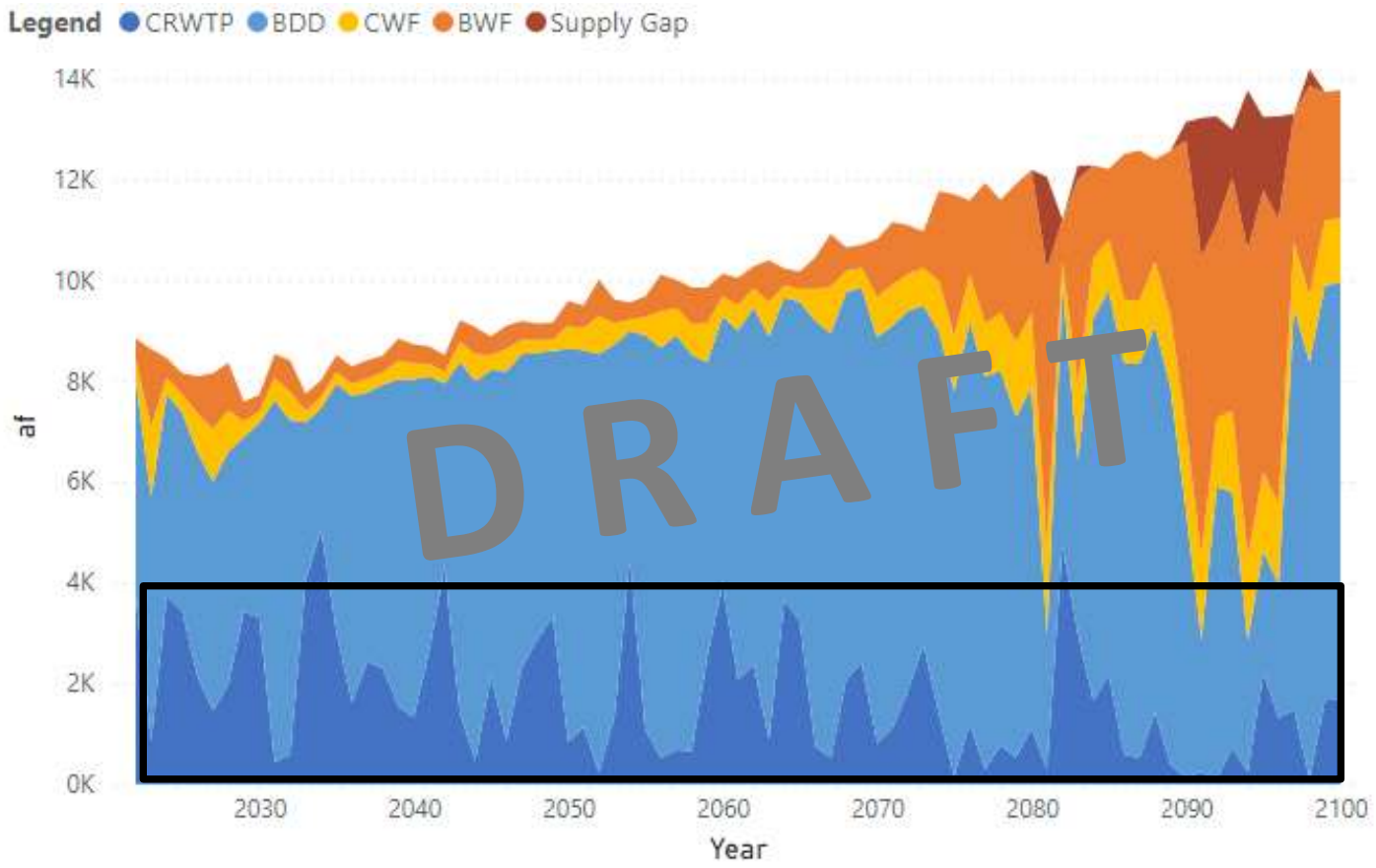
Example Vulnerability:
Canyon Road Water Unavailable for 10 years

Possible cause: catastrophic wildfire in the watershed and ensuing ash/debris flows



Example Vulnerability:
Reduced Santa Fe Watershed Inflow

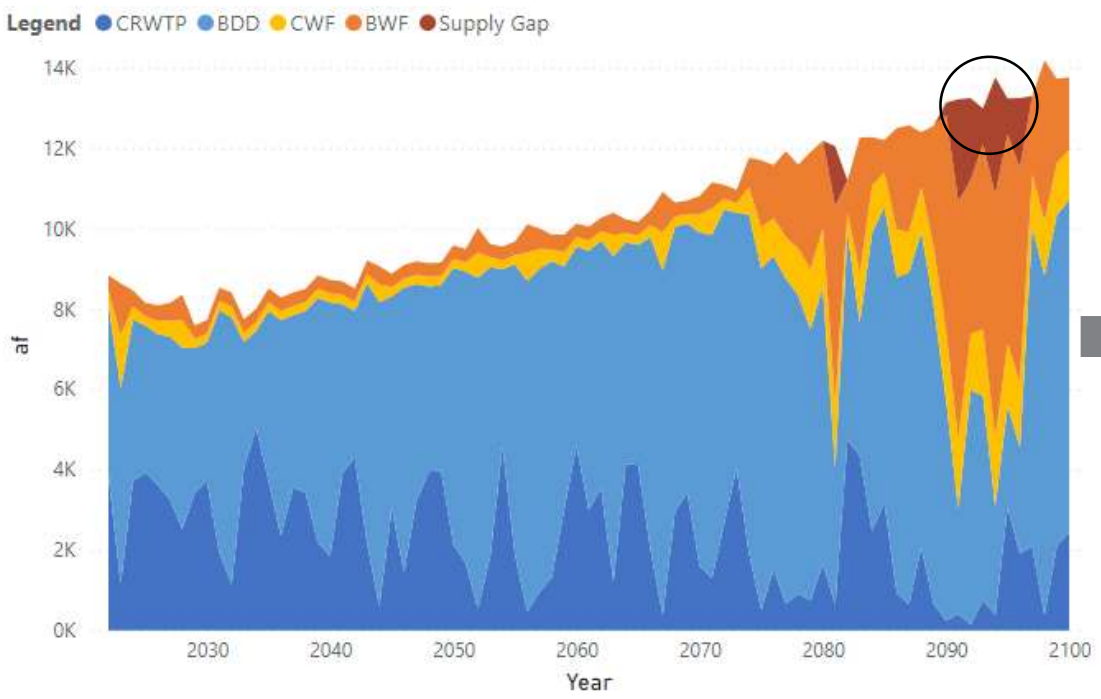
Various possible causes, e.g., post-fire sediment, Rio Grande compact



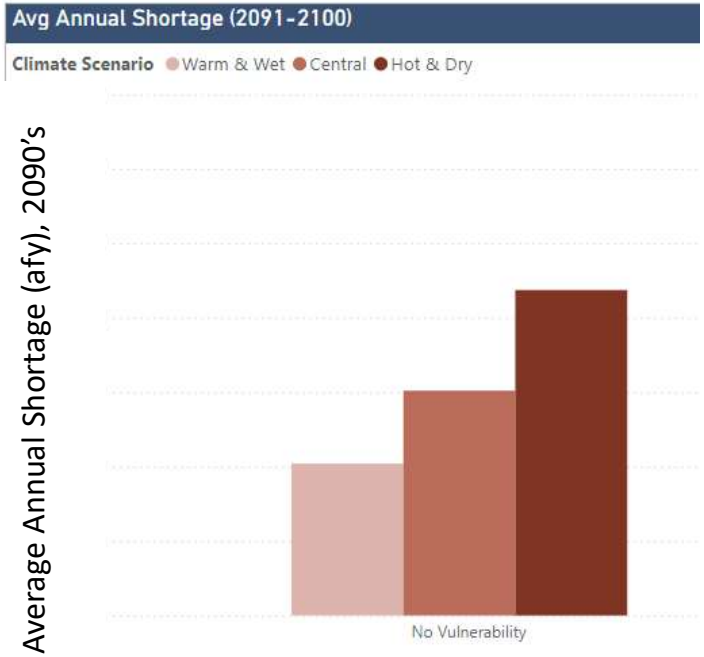
Putting it all Together

Using Power BI to Aggregate Results

1 run

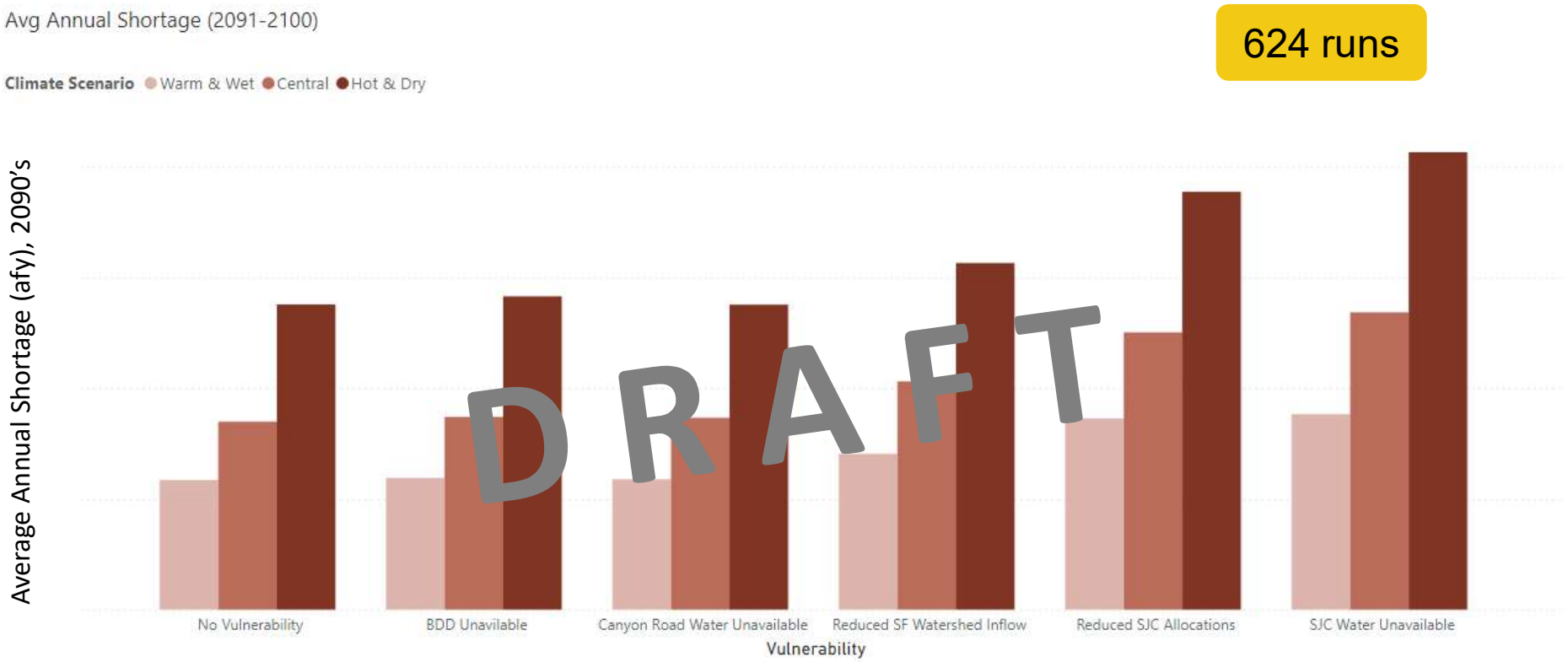


104 runs



Example Result: Reliability

- We can look at all vulnerabilities at once



Summary of Results and Dimensions

Result Metrics	Dimensions
• Reliability	• Climate
• Sustainability	• Vulnerabilities
• Social (Green)	• Population
• Environmental (Blue)	• **Adaptation strategies**

The ability to combine thousands of runs across multiple dimensions and metrics enhances our understanding of the system and its uncertainties.

This insight enables the development and evaluation of robust adaptation strategies, strengthening our resilience.

The overarching goal is to optimize existing resources and live within our means.

Summary

We presented a model of our water system, called STEWaRDS

- **Systems Tool for Evaluating Water Resource Decisions and Strategies**
- **This presentation was about the model (a tool) only, not about results (coming in 2025 & 2026)**

Our water supply is currently safe and reliable due to past and ongoing efforts

- **Community-driven water conservation**
- **Past planning**
  - *Diverse water supply "portfolio": renewable surface water when available, and groundwater for when surface water is less available*
  - *San Juan-Chama Return Flow Project*

Goals of Water 2100

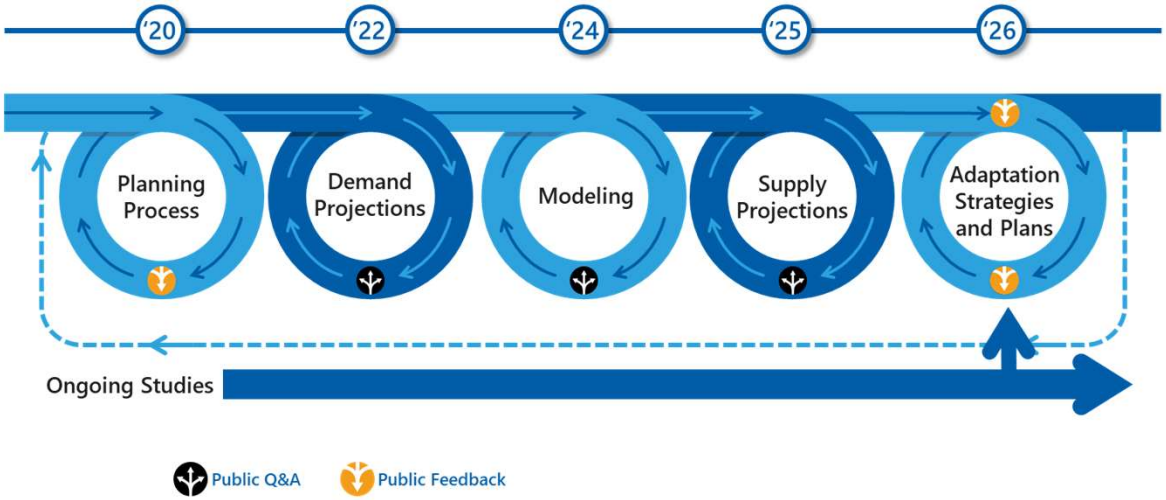
- **A safe, reliable, and resilient water supply in an uncertain future**
- **Integrate community values with science-based water resources planning**

The model: STEWaRDS

- **Uses the latest technology and best available science to run simulations across 1,000's of future scenarios**
- **Allows us to evaluate strategies to prepare for and adapt to whatever may happen in the future**

Next Steps

Next Steps



Supply Projections (USBR / UMass)

- **Public informational / Q&A 2025**

Adaptation Strategies 2026

- **Public input and feedback**
- **City values and relative importance of the criteria:**
  - *Reliability*
  - *Sustainability*
  - *Social*
  - *Environmental*

Integration of County Model

Keep an eye on SaveWaterSantaFe.com for Conservation public input sessions this spring

Questions?