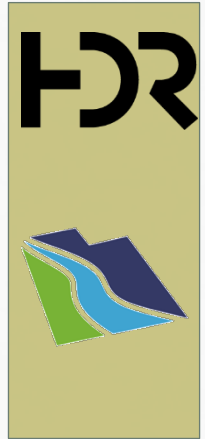


EVALUATION OF CENTRAL UTAH PROJECT WATER SUPPLY VARIABILITY AND FORECASTING OF FUTURE CONDITIONS

STEVE THURIN, SENIOR WATER RESOURCES ENGINEERING
HDR ENGINEERING

TED SHANNON, WATER RESOURCES ENGINEER
HDR ENGINEERING

CORT LAMBSON, PROJECT MANAGER
CENTRAL UTAH WATER CONSERVANCY DISTRICT

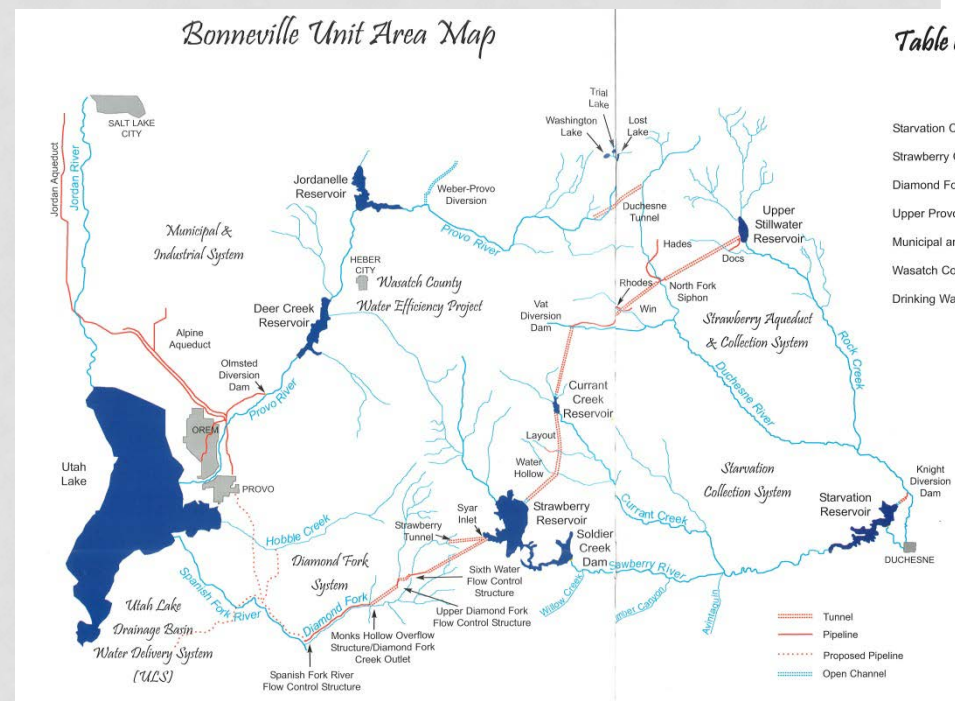


PROJECT BACKGROUND

- Project Goals:
 - Evaluate stressful meteorological and operational conditions
 - Understanding the sensitivity and vulnerability of the system
 - Develop operational criteria and plans to aid in operating under adverse conditions.

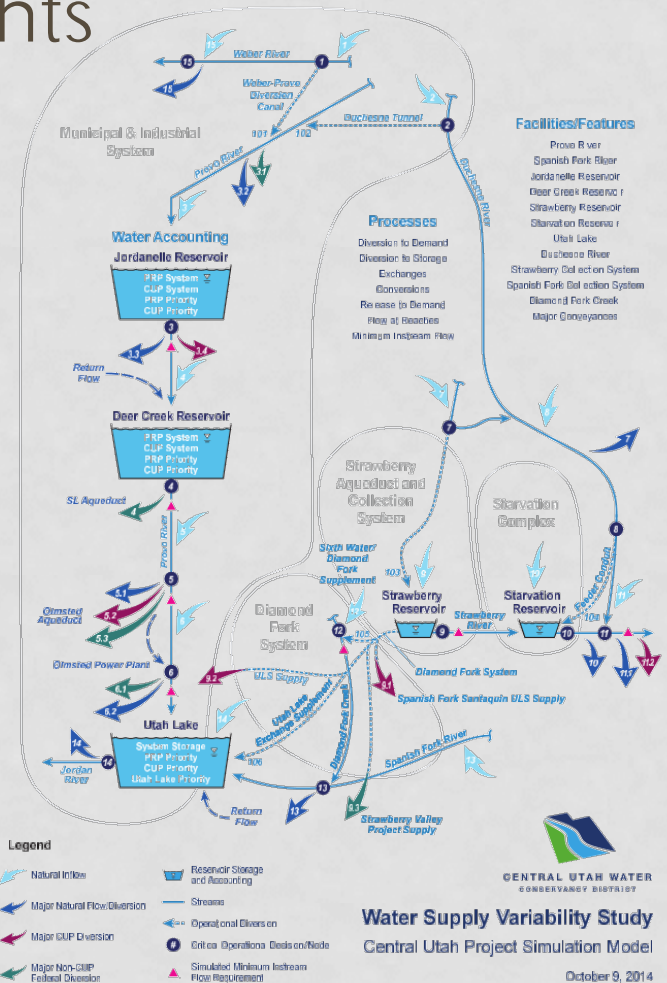
CENTRAL UTAH WATER CONSERVANCY DISTRICT (CUWCD)

- Organized in 1964 as a repayment entity for the Central Utah Project (CUP)
- Assumed management of CUP under the Central Utah Project Completion Act (1992)
- Wholesale supplier of:
 - 354,141 acre-feet total
 - 150,000 acre-feet M&I water supply
- 3 reservoirs
- 134 miles of pipelines
- 3 WTP



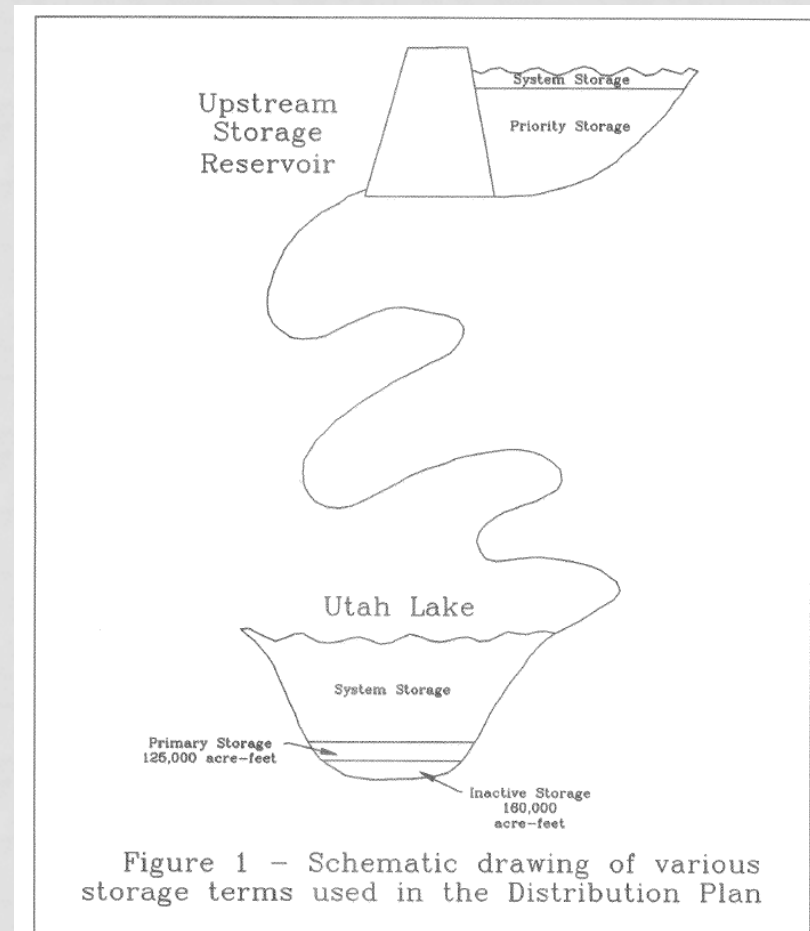
WATER RIGHTS

- Natural Flow, Utah Lake rights
- Provo water users
- Bonneville-unit CUP
- Operational Constraints:
 - minimum instream flows
 - Weber and Duchesne rights
 - Utah Lake Compromise elevation



EXCHANGE AND CONVERSIONS

- Flow/Storage Accounts
 - Provo River runoff
 - Imported Water
 - System Storage
 - Priority Storage
- Accounting
 - Conversion:
 - System Storage to Priority
 - Exchanges: between reservoirs



CLIMATE CHANGE SCENARIOS

- Climate Scenarios
 - Historic natural flows (WY 1950 to 2009)
 - Downscaled GCM Projected Trends and Variability
 - Paleo Record Trends and Variability
 - Observed Record Trends and Variability

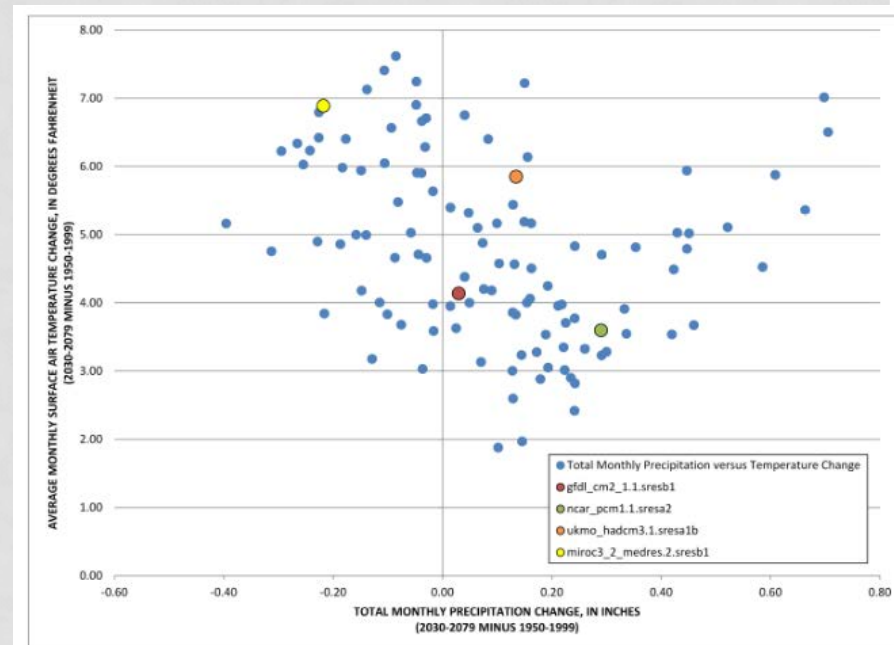


Figure 7. Total Monthly Precipitation Versus Temperature Change

CLIMATE VARIABILITY SCENARIO

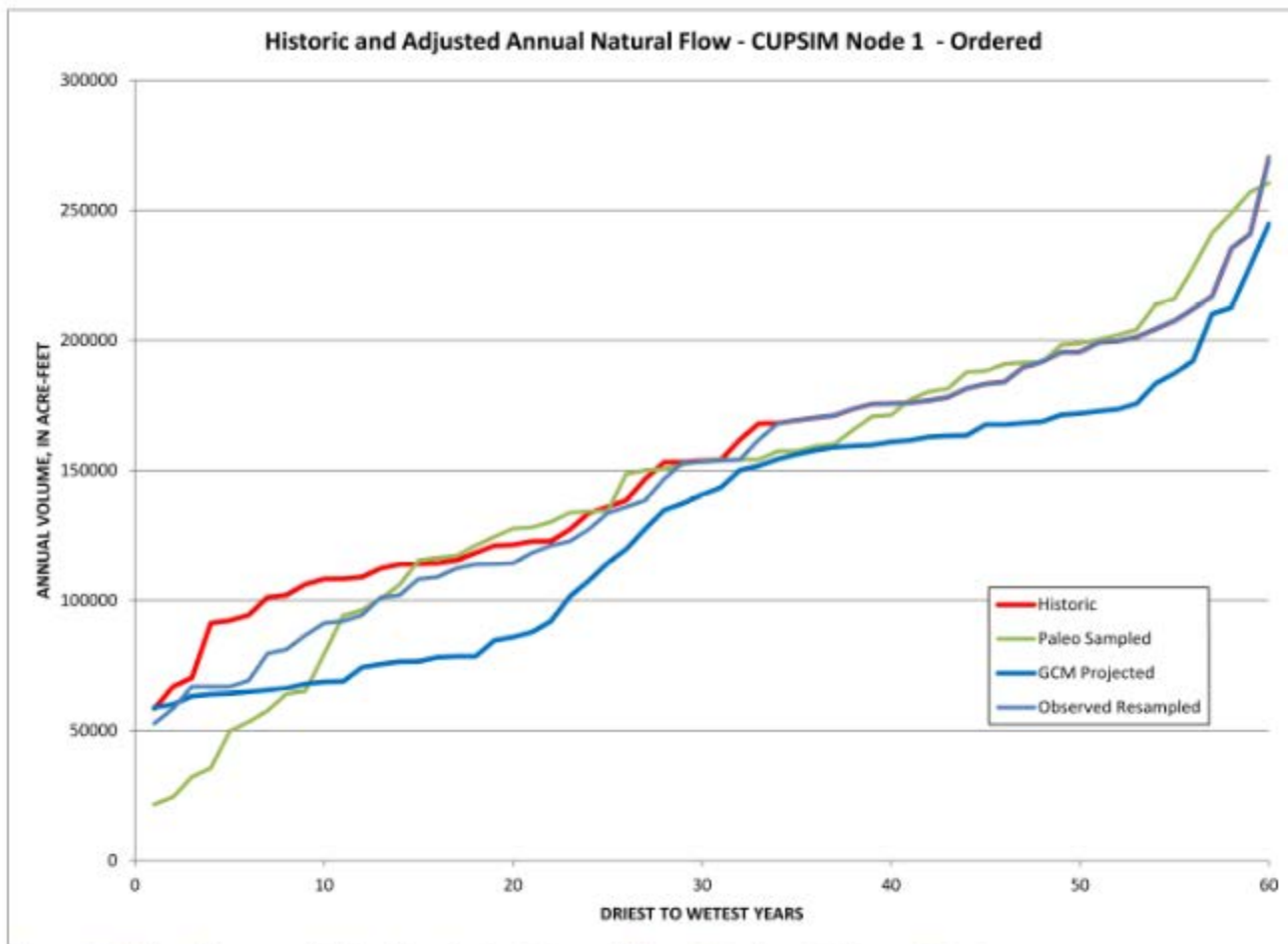
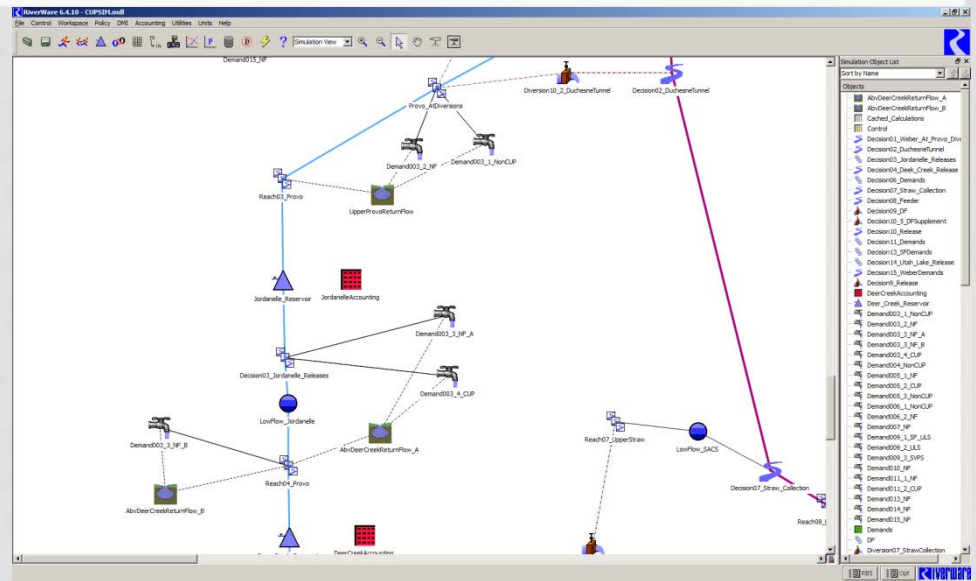


Figure 12. Weber River near Oakley Gage Ordered Annual Flows, Historic and Adverse Datasets

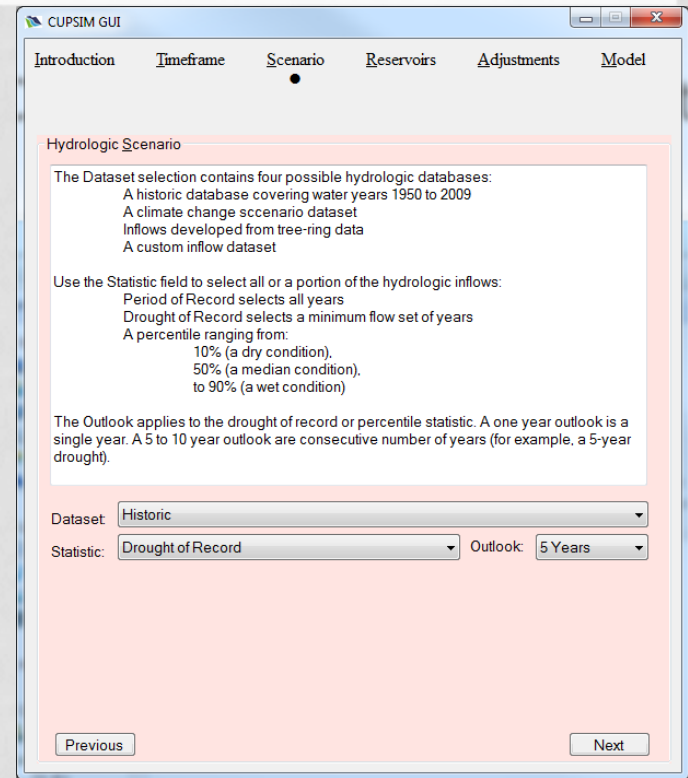
CUPSIM MODEL

- PROSIM : base model
- Goals:
 - Accessibility
 - Simplifications
- Features:
 - Monthly timestep
 - 60 years period of record
 - Accounting
 - Initialization rules : hydrology datasets and scenarios
 - Post-processing rules : scenario statistics



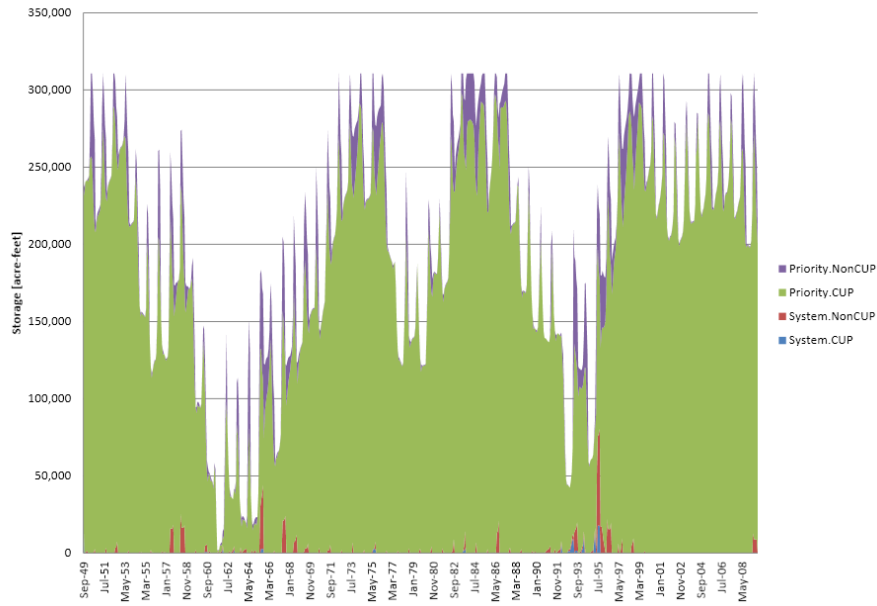
CUPSIM GRAPHICAL USER INTERFACE (GUI)

- GUI provided for convenience
- Input DMI:
 - Scenario types
 - Period of Record
 - Drought of Record
 - Percentile
 - Reservoir and account storage
 - Inflow and demand adjustments
- Output DMI:
 - Annotated post-processing statistics
 - Spreadsheet and RiverWare model file

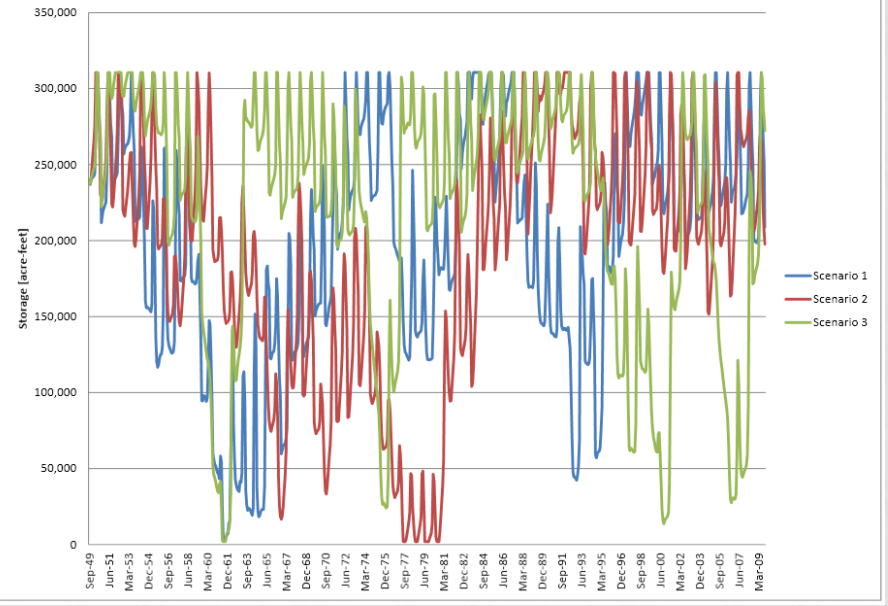


OUTPUT EXAMPLES

Simulated Jordanelle Storage - Historic Hydrology



Simulated Jordanelle Total Storage - Select Climate Variability



SUMMARY

- Proactive evaluation of operations and water rights sensitivity to changes in climate
- On-going work to evaluate climate change scenarios
- Possible future applications:
 - Explore adaptation planning
 - Additional climate change effects
 - Annual Operating Plans