WHITNEY LAKE REALLOCATION STUDY

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US Army Corps of Engineers

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U.S. ARMY CORPS OF ENGINEERS PACESETTER SOUTHWESTERN DIVISION

EVALUATING WATER MANAGEMENT STRATEGIES: OPPORTUNITIES AND CHALLENGES IN THE WHITNEY LAKE REALLOCATION

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BRAZOS RIVER BASIN

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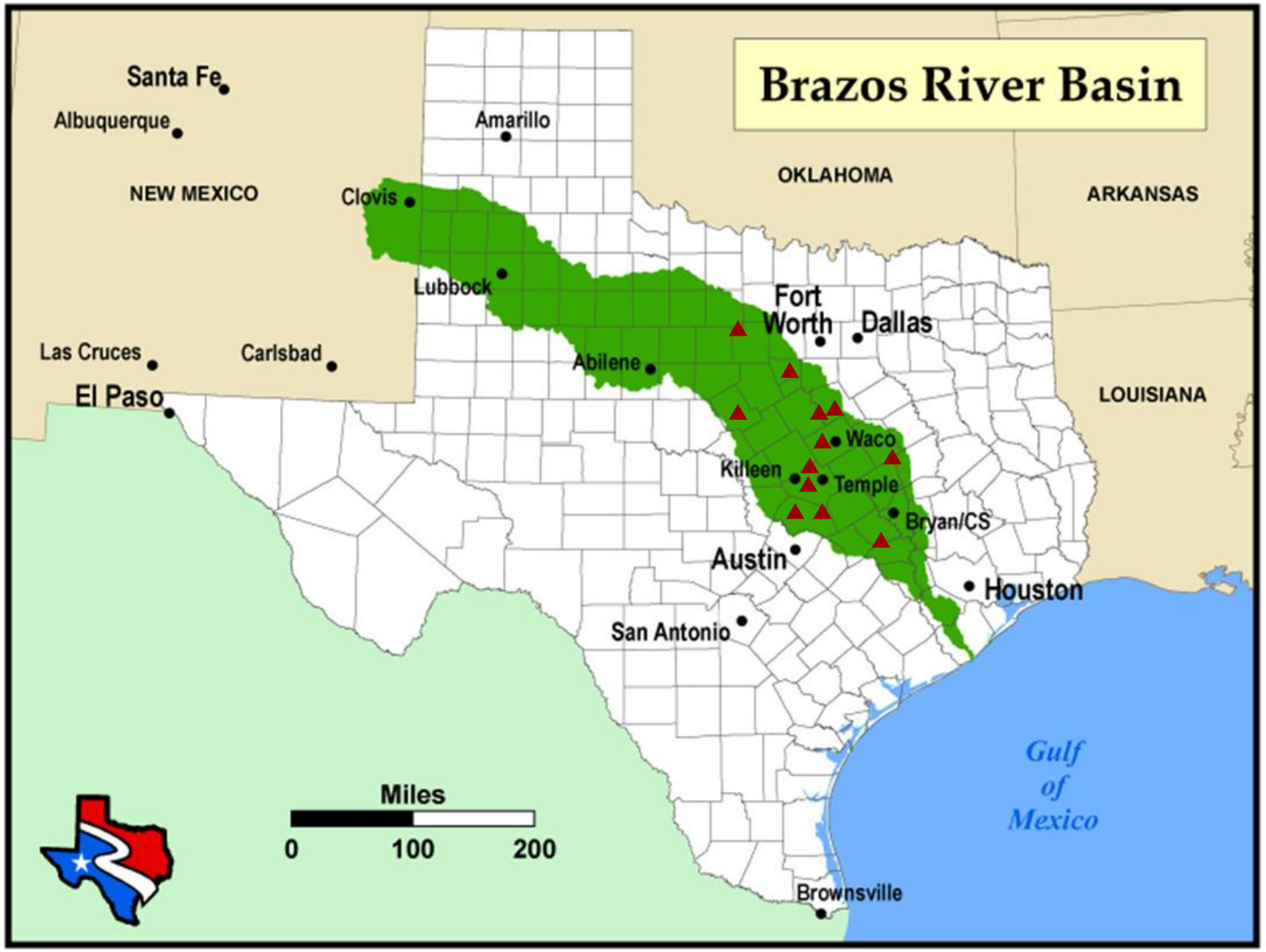
- 38 Planned / 9 constructed
  - 1st - Whitney (1951)
  - 9th - Aquilla (1983)
- Conservation | Flood storage
  - 1.3 M ac-ft | 3.9 M ac-ft
- Cost
  - Construction- $1.5 billion
  - Benefits- $3.6 billion
  - B/C ratio- 2.4

Brazos River Authority (BRA)

- 3 Reservoirs
  - 1st – Possum Kingdom (1941)
  - 3rd – Limestone (1978)
- Conservation Storage
  - 882,000 acre-ft



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BRAZOS RIVER BASIN SYSTEM DIAGRAM

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LEGEND:

FLOOD POOL: FLOOD STORAGE

CONSERVATION POOL: WATER SUPPLY STORAGE

CONTROL POINT: MAXIMUM REGULATED CHANNEL CAPACITY CUBIC FEET PER SECOND (CFS)

60,000 cfs

HYDROPOWER PRODUCTION

CITY

* DISTANCES NOT TO SCALE

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TEXAS ANNUAL RAINFALL

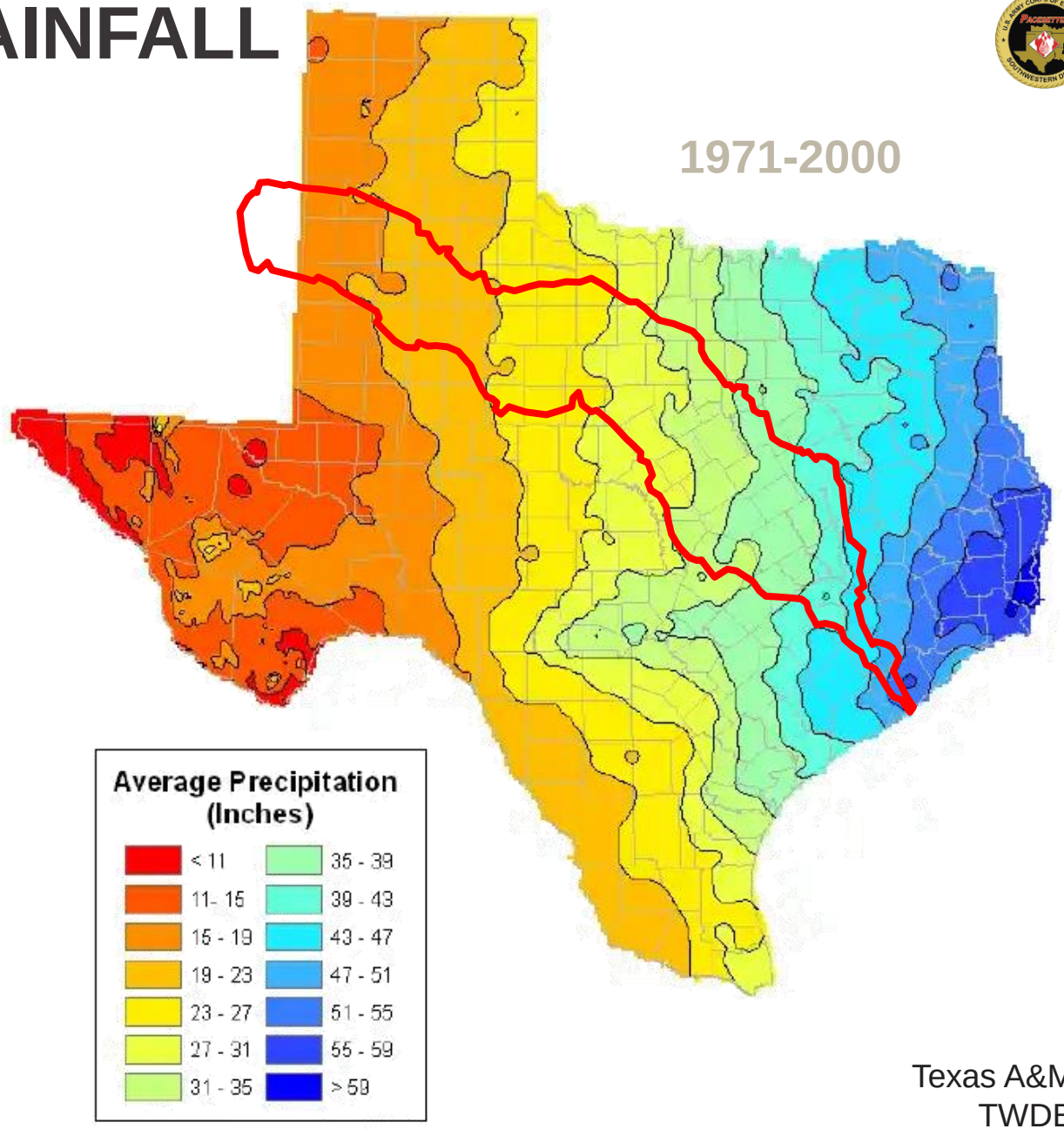
Texas has a great variation in annual rainfall across the state

More than **4ft** swing in annual rainfall from the western counties to the eastern counties

Brazos River Basin experiences this drastic swing

More than **75%** of the Brazos Basin sits on the drier side of the state

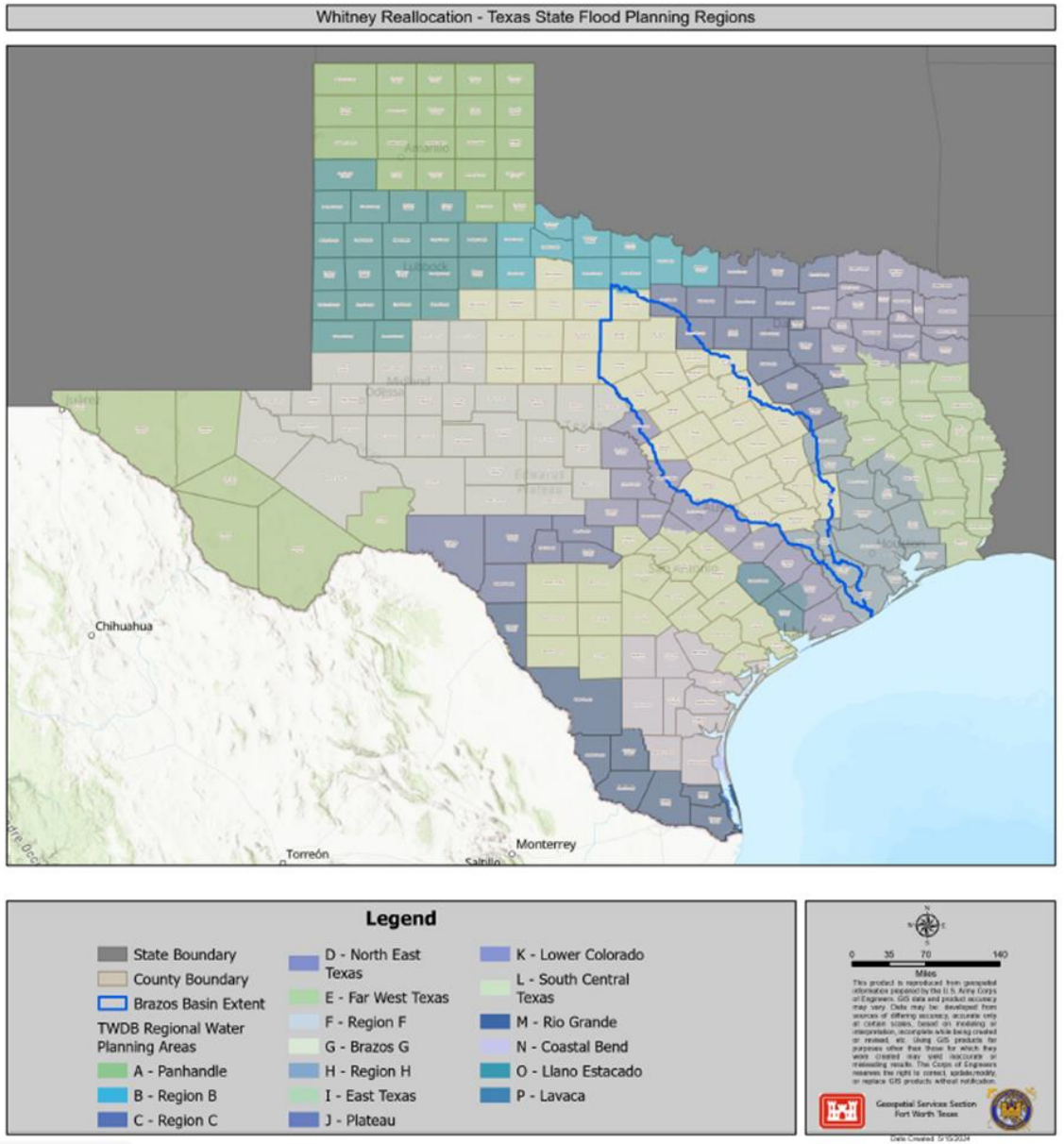
Every drop of water stored in the basin is important to many different entities



Texas A&M
TWDB

EXISTING CONDITIONS

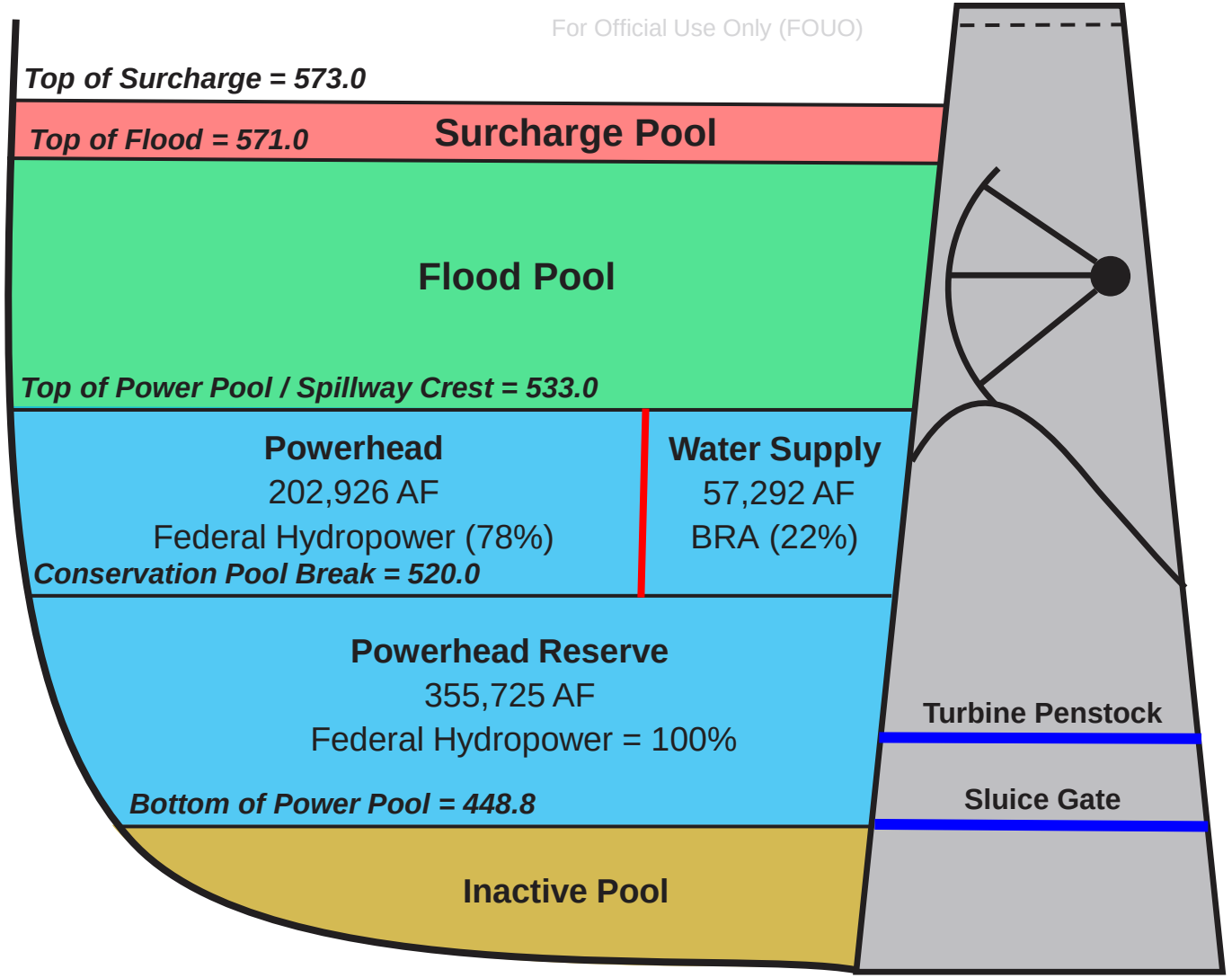
- BRA has contracted up to approximately **750,000 acre-feet per year of water.**
- The most recent BRA customer survey showed a need of **~250,000 ac-ft** across BRA's current customers.
- According to Texas State Flood Planning, **Region G** demand is expected to increase from **502,000 ac-ft/yr** to just over **1 M ac-ft/yr,** an increase of 103% over the next **50 years**.



WHITNEY LAKE POOL ELEVATIONS

*All elevations in NGVD29

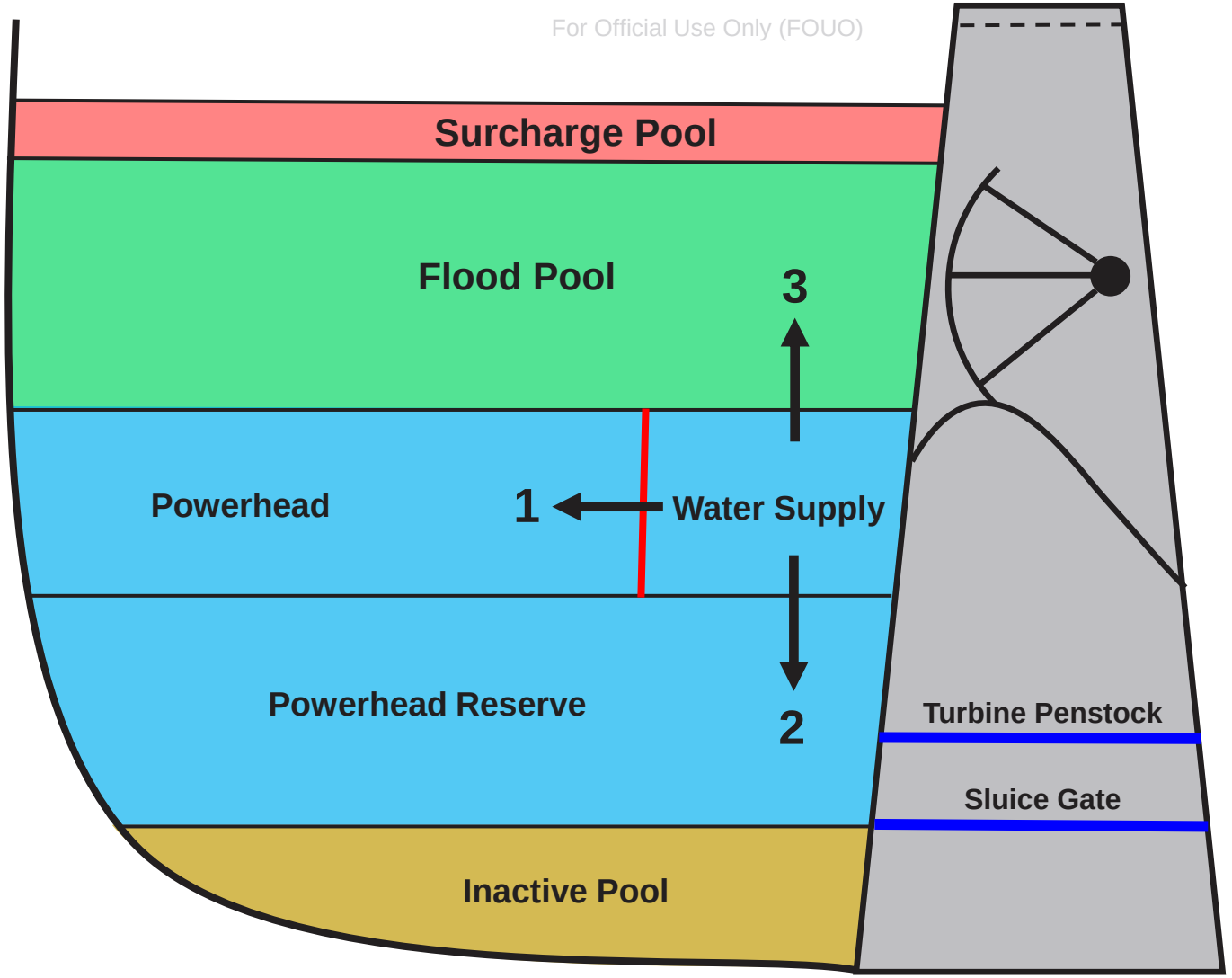
- Whitney conservation pool is broken into **3 parts**.
- Powerhead storage is designated for **SWPA** and hydropower generation.
- Water Supply pool is designated for **BRA**.
- Powerhead reserve is reserve storage to increase head on turbines.
  - Storage can be used in emergencies
  - Increase risk to damage generators



WATER USER ALTERNATIVES

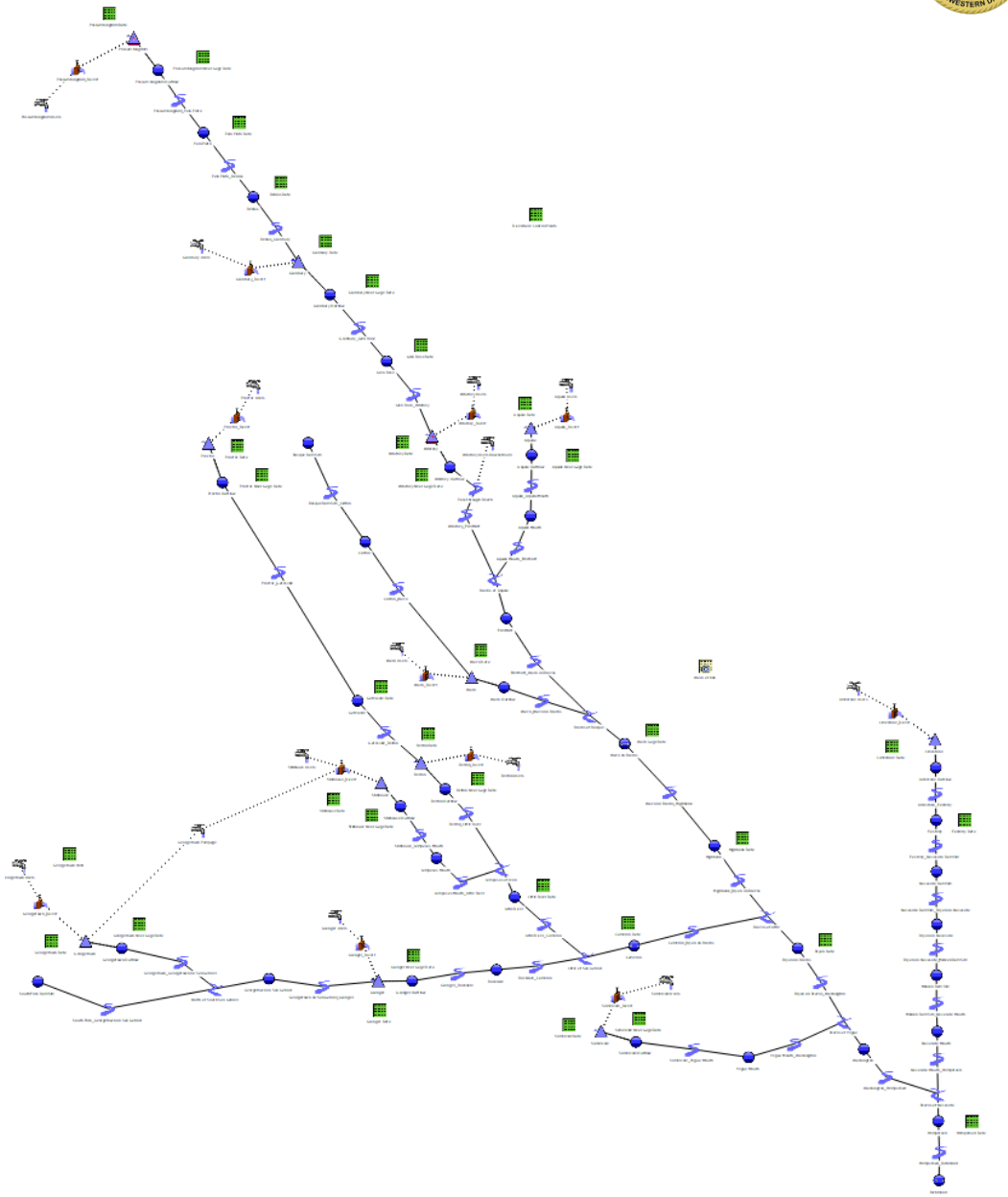
*All elevations in NGVD29

What opportunities does Lake Whitney have to **increase** water supply storage, while **limiting** consequences to other functions?



RESERVOIR ALTERNATIVE MODELING

- Flood Operations *(Completed Jan 2014)*
- Environmental and Seepage Flows *(Completed Dec 2023)*
- Updated Hydrology, Evaporation, Storage Tables, Outflow Tables *(Completed Jan 2024)*
- Water Supply Diversions *(Completed Feb 2024)*
- Hydropower Operations *(Completed Mar 2024)*
- Firm Yield Model *(Completed Mar 2024)*
- Water Accounting Model *(Completed Mar 2024)*
- Surcharge Operations *(Completed Jun 2024)*
- Dependable Capacity Model *(Completed Nov 2024)*



RIVERWARE MODEL

22-minute run time

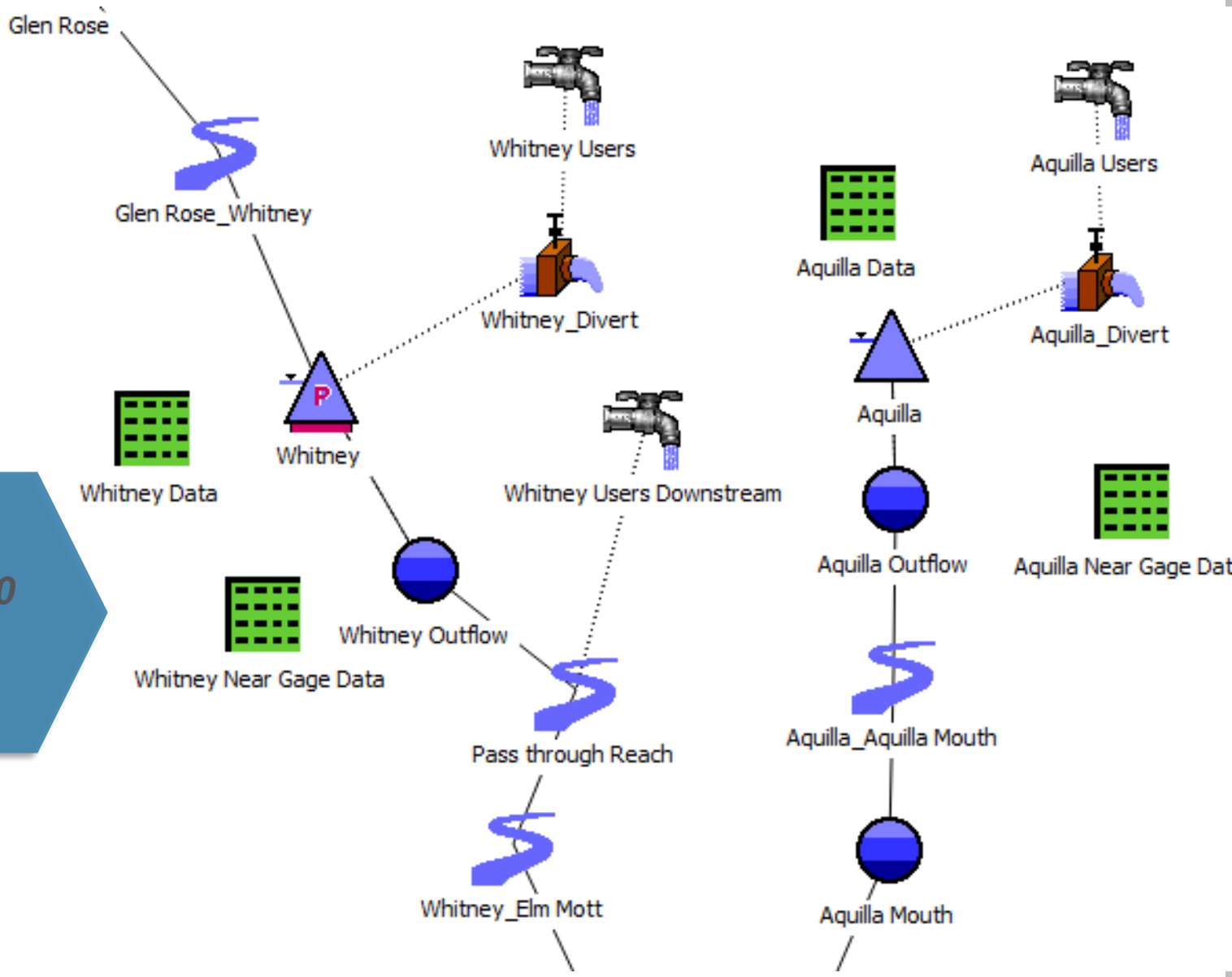
1/1/1938-9/30/2022 (**83.75yrs**)

Possum Kingdom Reservoir to ***Gulf of Mexico***

~20,000 *sq. mi*

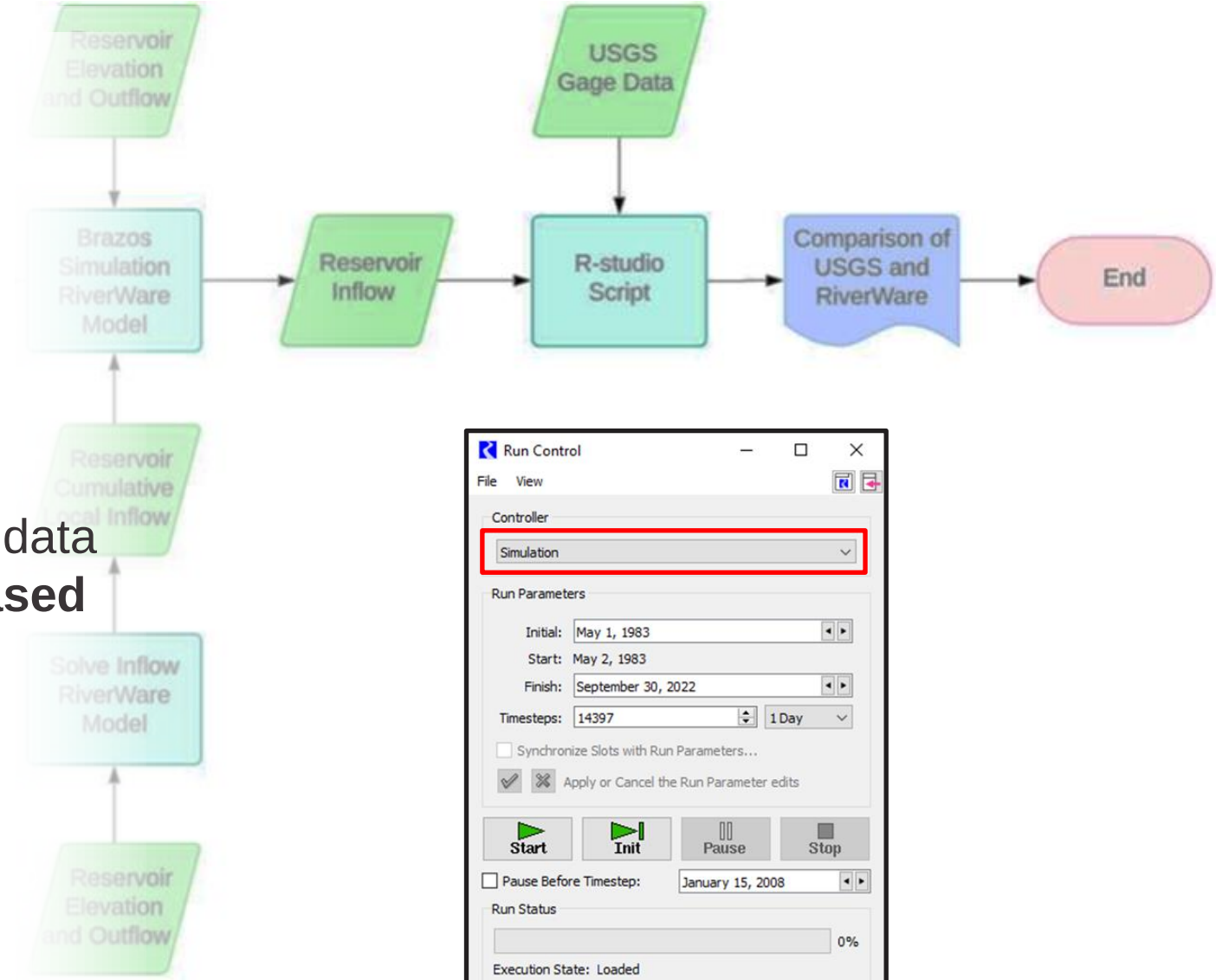
12 Total Reservoirs (9 USACE) (3 BRA)

159 total RiverWare Objects



SIMULATION MODEL

- **Elevation** and **outflow** were set *input*
- **Reservoir inflow** was desired *output*
- **Local cumulative inflow hydrology** was updated for all reservoirs
- Results were **validated** against observed data
- Results were used as *inputs* to the **rulebased period of record (POR) model**

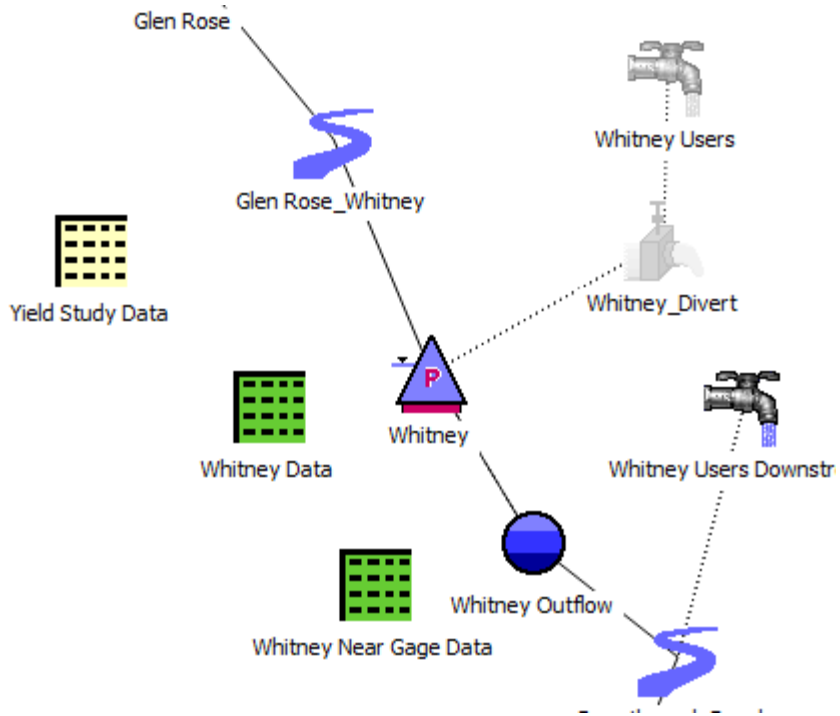


YIELD MODEL

- Utilized RiverWare's user guide to build yield model.

  USACE-SWD Modeling Techniques : Computing Reservoir Yield

- Calculates **maximum** water use of the power pool during the drought of record.

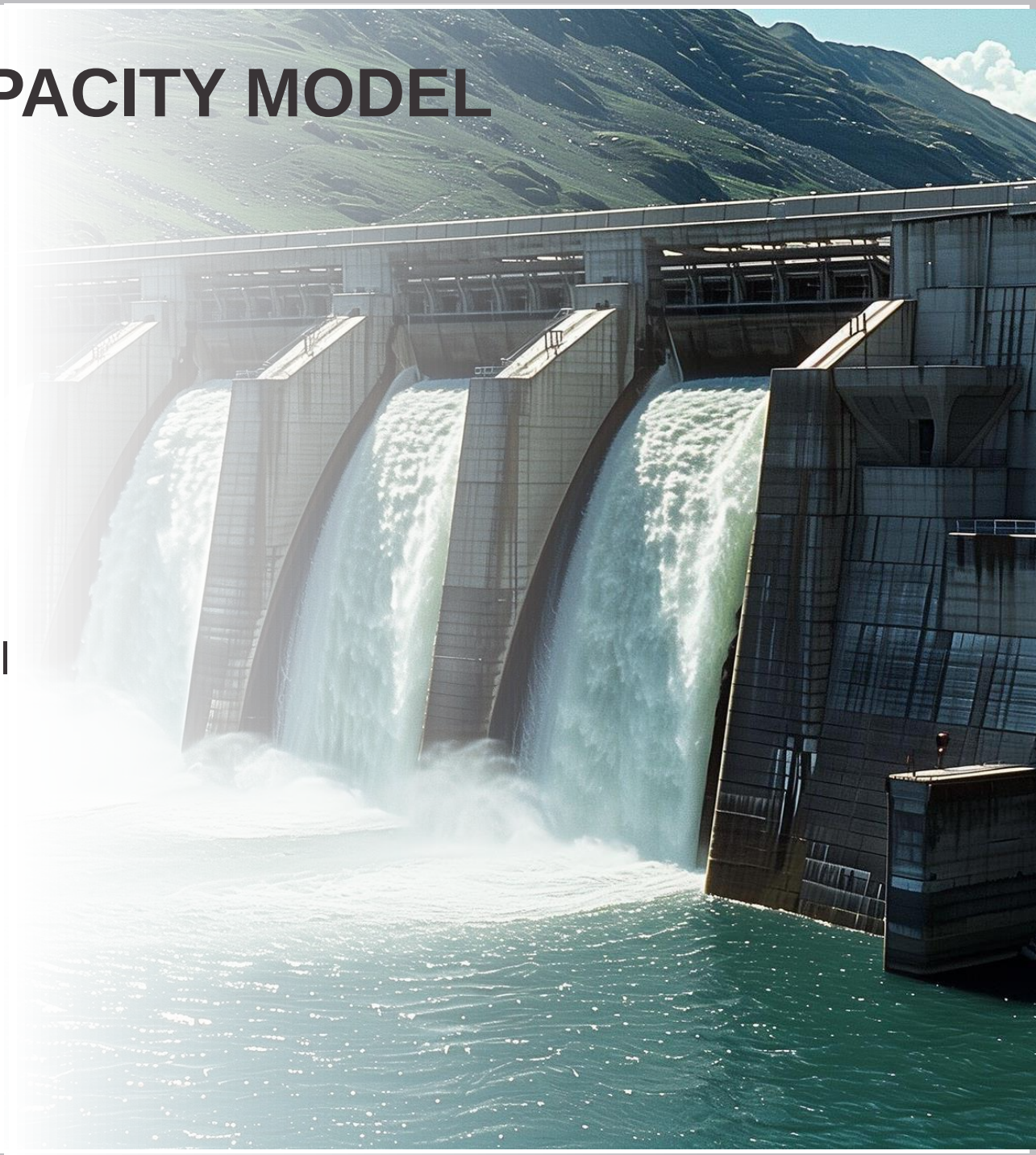


RULEBASED MODEL

- Incorporates the results from the Simulation and Yield model to run the period of record with a new Whitney operation ruleset.
- Does the bulk of the alternative analysis.
- Results from the rulebased model, is provided to Economics and Environmental group to determine the lost in benefits (if any) due to the changes in operations.

DEPENDABLE CAPACITY MODEL

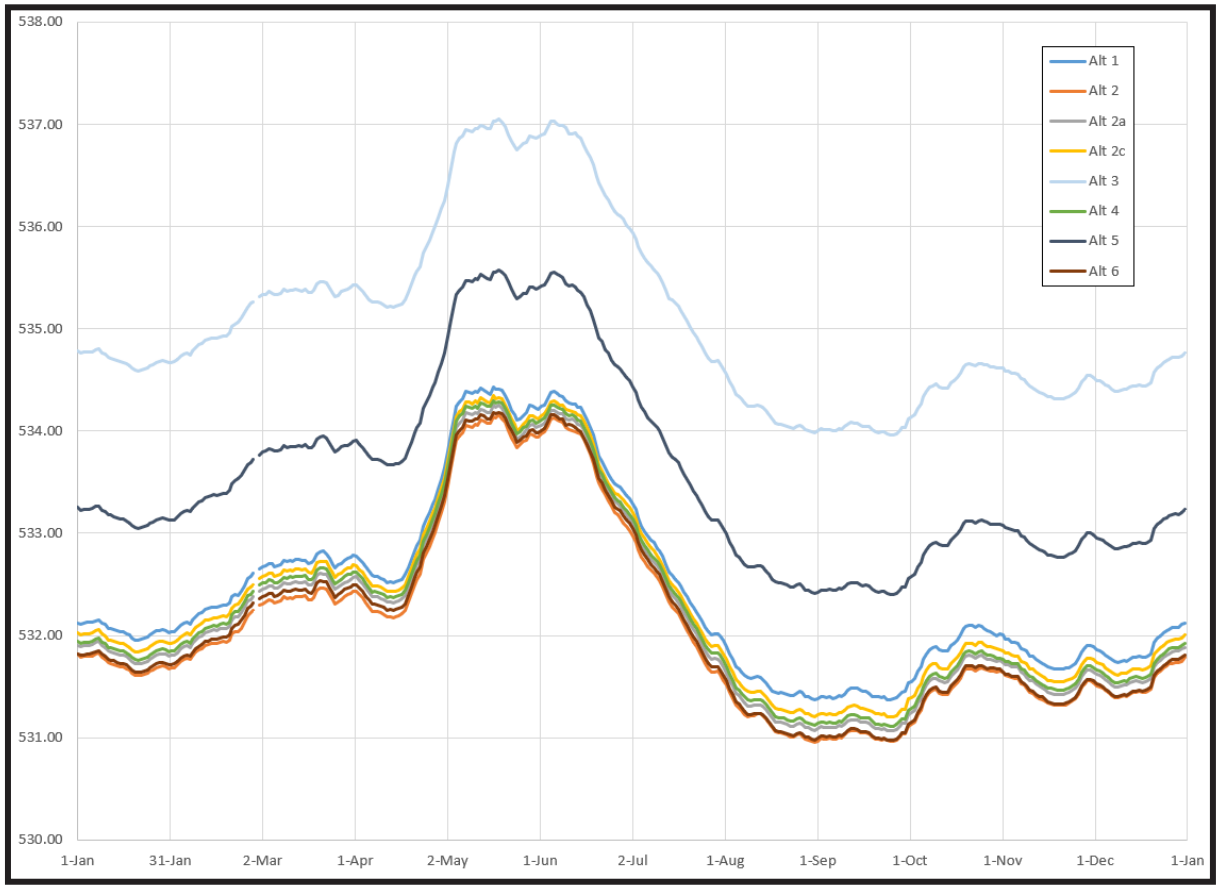
- Dependable capacity is a term used in the hydroelectric market to determine reliable electricity a plant can produce over a specific period of time during unfavorable conditions.
- Multiple Run Manager (MRM) RiverWare model was built to run every August in the period of record separately.
- The maximum available energy was called upon for the entire month.



RIVERWARE RESULTS

.	Lowest	Highest
Minimum Elevation (ft)	521.90 (alt 4)	525.1 (alt 3)
Max Outflow (cfs)	76,700 (multiple)	78,000 (alt 3)
Water Supply Yield (acre-ft/yr)	18,590 (baseline)	56,570 (alt 2)
Daily Water Supply Request (cfs)	25.31 (baseline)	78.10 (alt 2)

Alternative High Low Comparison



Alternative Average Yearly Elevation

CONCLUSION AND NEXT STEPS

- Brazos experiences **extreme changes** in climate year to year.
- Whitney's operations has **many complexities** to address for a reallocation towards water supply
- **Four** RiverWare models were used to model the complexities of Whitney Reservoir.
- **Eight** reallocation alternatives were computed through these models
- Results have been dispersed to different disciplines to determine the **economic** and **environmental** effects of these alternatives.
- Continued coordination between cooperating entities.

QUESTIONS?

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