

Advancing FIRO using dynamic water demand predictions

Future work sponsored by NOAA NIDIS

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Mathew Rosencrans; NWS Climate Prediction Center

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Challenges to FIRO implementation

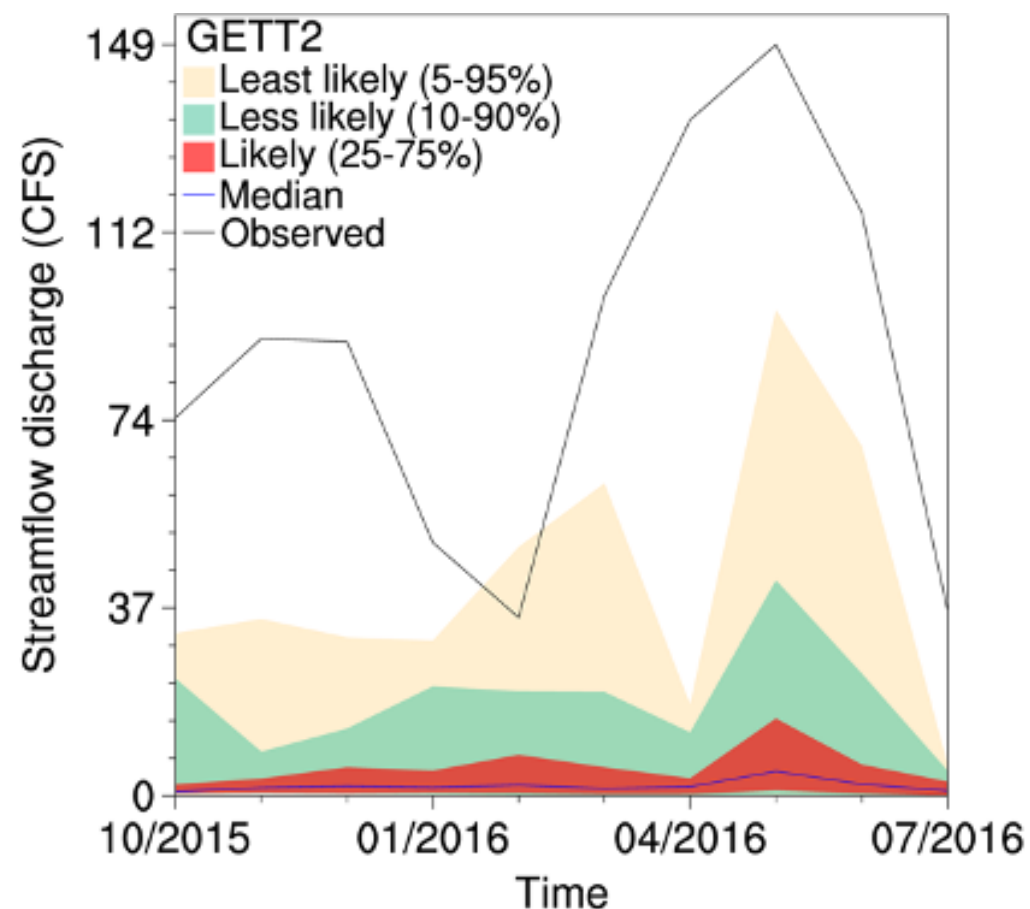
Limitations identified in the Little River System, Texas pilot

- Limited skill for subseasonal-to-seasonal climate forecasts based on current NWS Hydrologic Ensemble Forecast Service (HEFS)
- Large uncertainties in projection of reservoir water budget components, including both natural (e.g., evaporation) and anthropogenic (e.g., withdrawals) processes

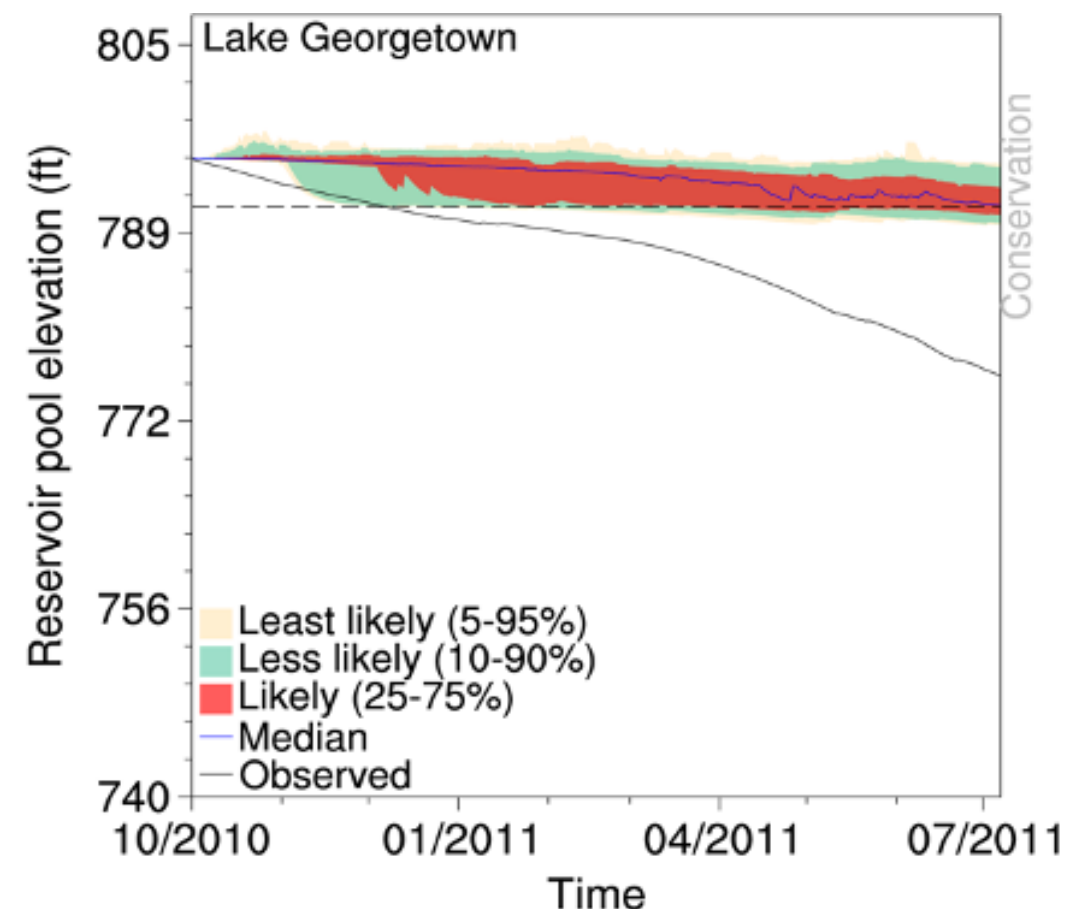
Challenges to FIRO implementation

Limited forecast skill at Lake Georgetown, Brazos River Basin

Reservoir inflows



Reservoir levels

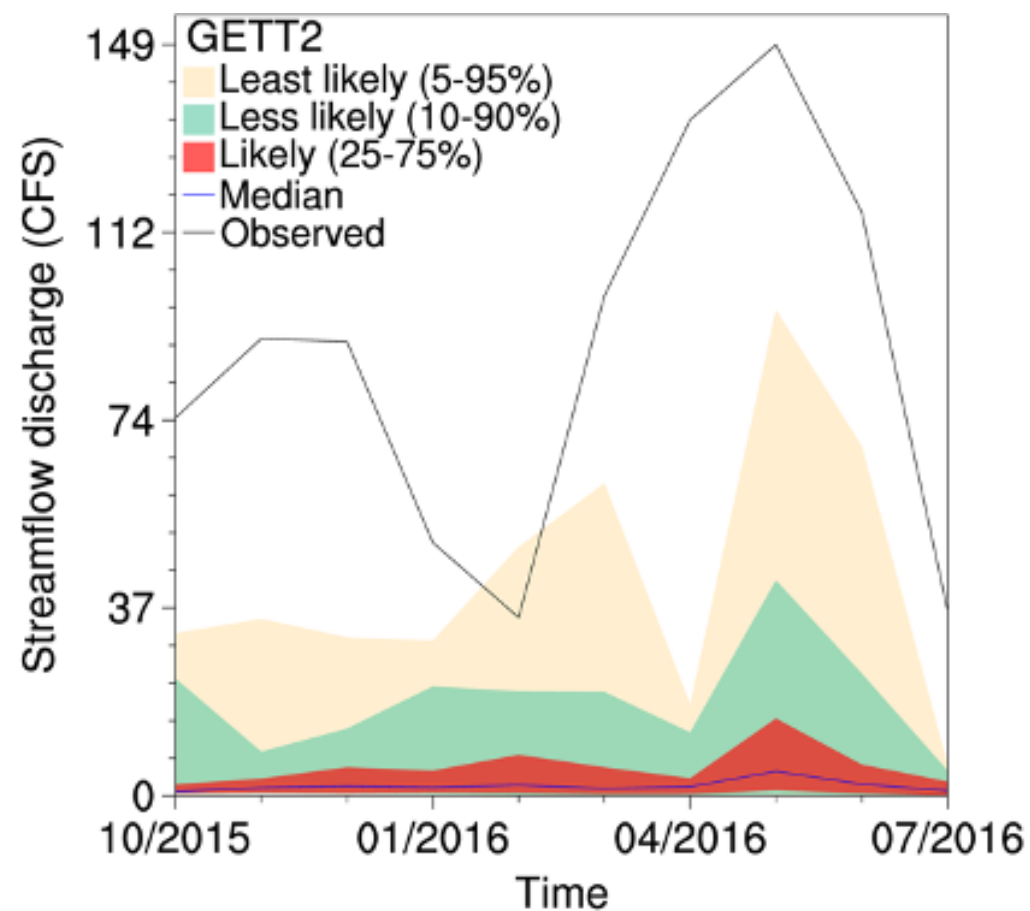


- Narrow ensemble range for streamflow forecasts do not capture observed inflows
- Discrepancies in observed reservoir levels and forecasted levels is driven by departures in actual reservoir demands and simulated demands

Challenges to FIRO implementation

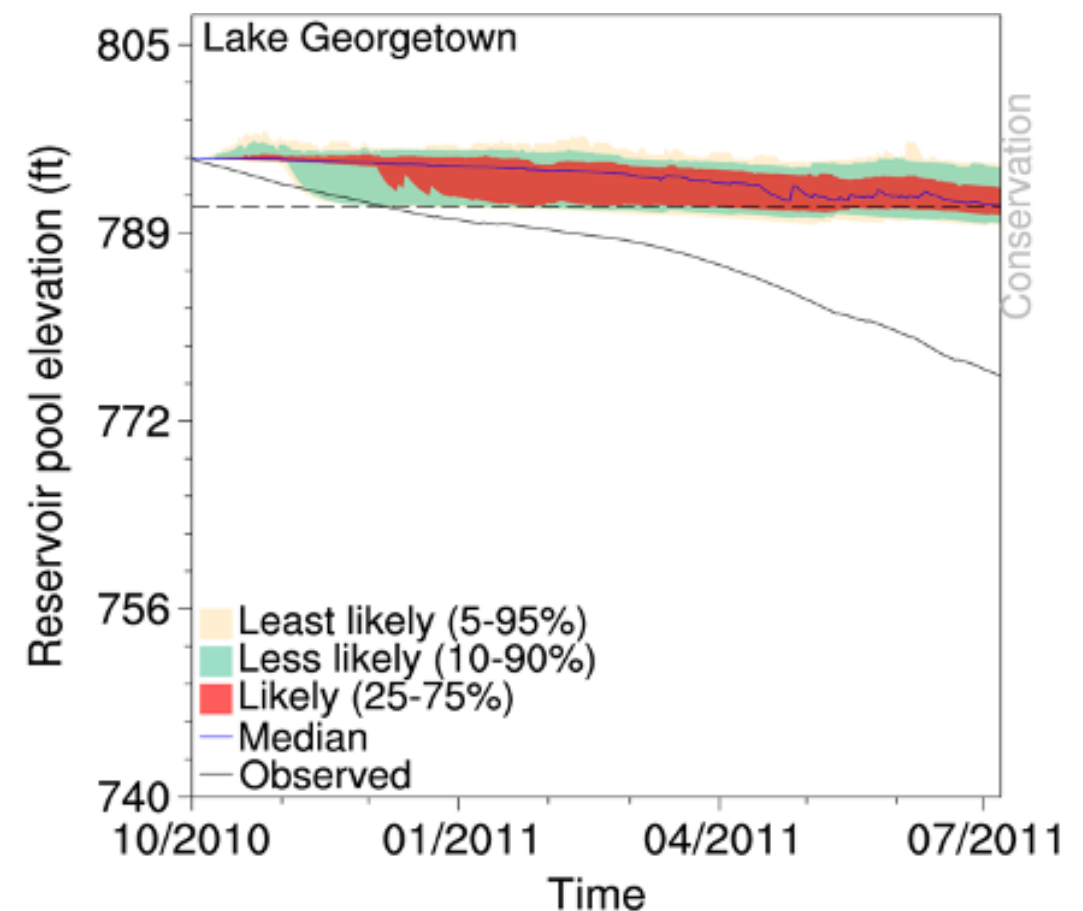
Limited forecast skill at Lake Georgetown, Brazos River Basin

Reservoir inflows



Non-stationarity on supply side

Reservoir levels

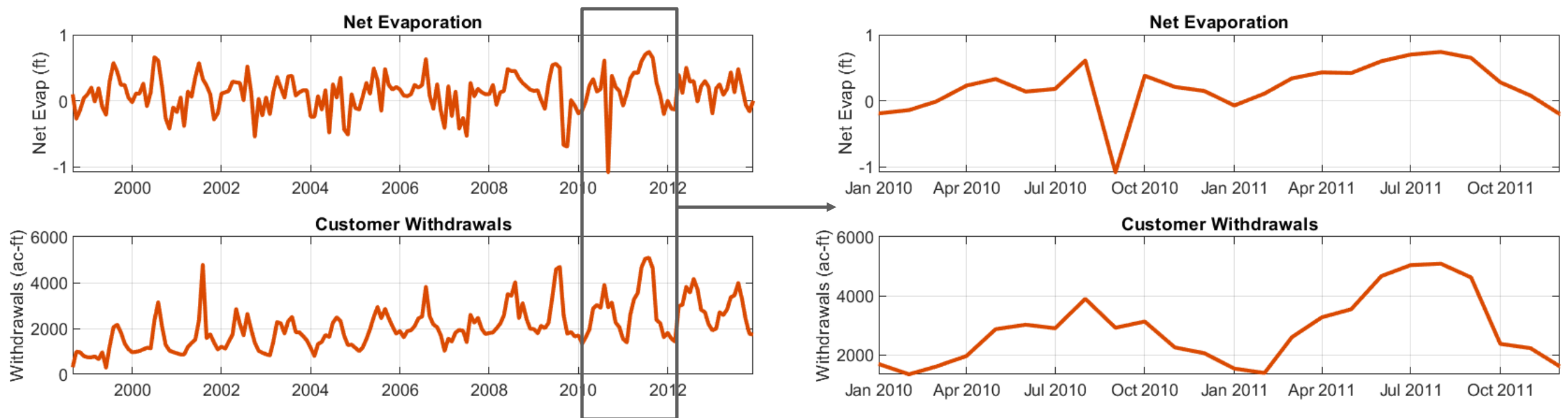


Non-stationarity on demand side

Challenges to FIRO implementation

Default reservoir model simulations use static, monthly withdrawals

Departures from norms during 2011 drought for Lake Georgetown

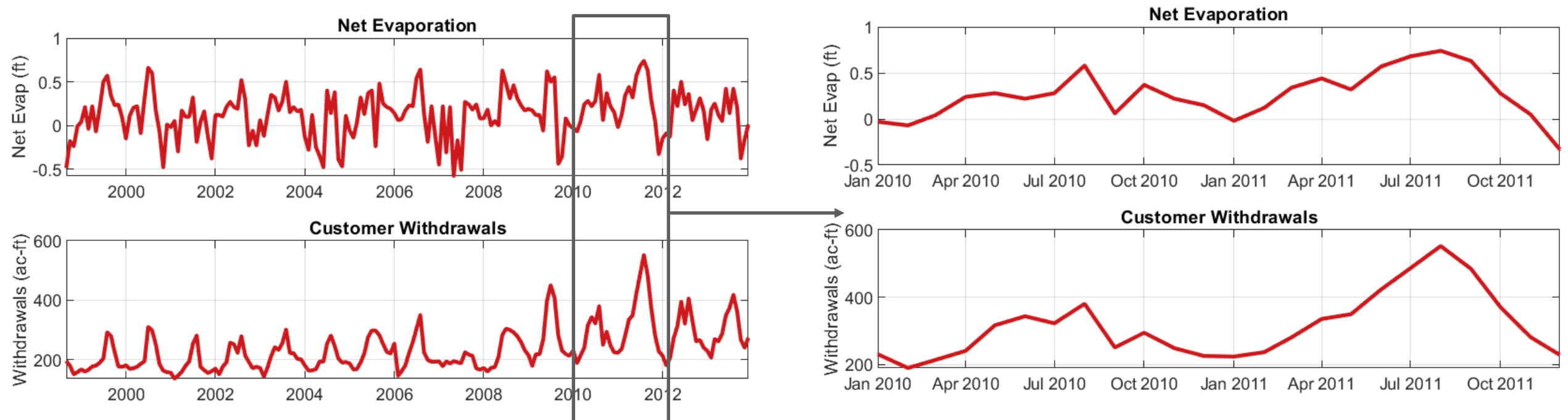


Static demand modeling approaches do not capture departures in historic conditions, particularly those observed during drought periods

Challenges to FIRO implementation

Default reservoir model simulations use static, monthly withdrawals

Departures from norms during 2011 drought for Lake Granger



Static demand modeling approaches do not capture departures in historic conditions, particularly those observed during drought periods

Objectives of future work

Addressing limitations identified in Texas pilot study

Thrust 1

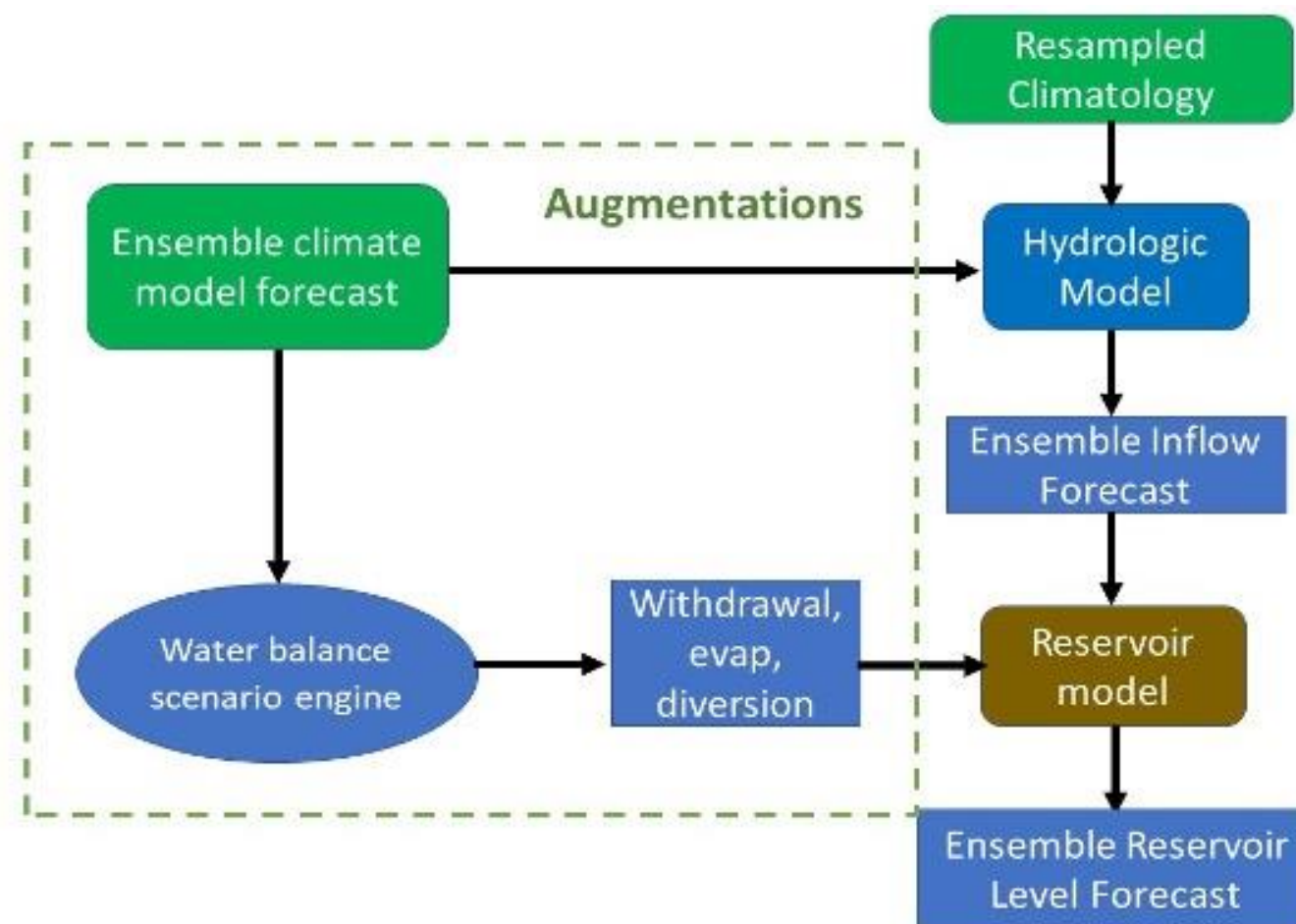
Introduce ensemble forecasts from dynamic climate models to complement and expand current climatology-based ensemble forecasts

Thrust 2

Develop forecasts for water withdrawals, diversions, and lake evaporation to better represent weather/climate varying water demand

Objectives of future work

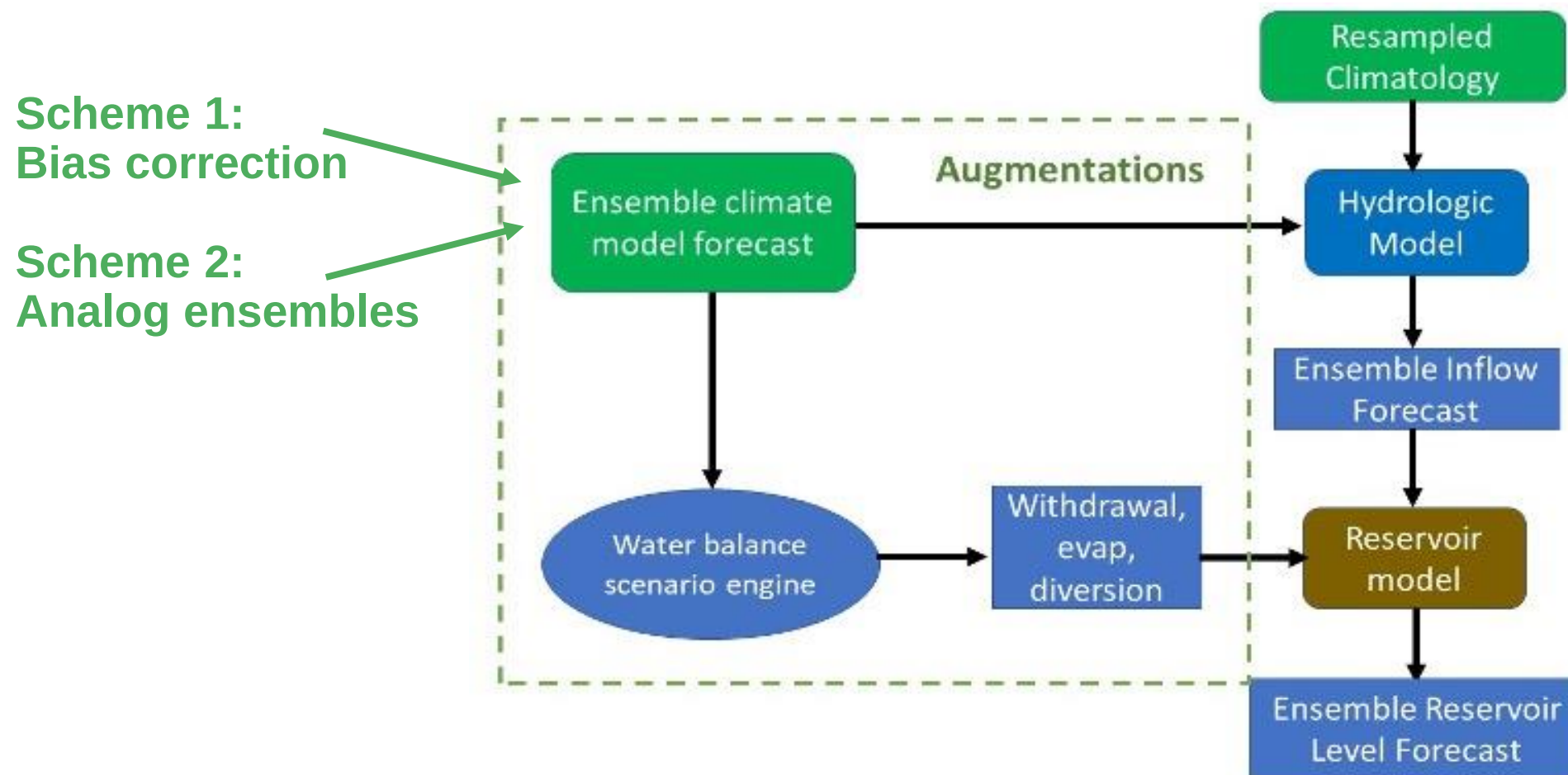
Addressing limitations identified in Texas pilot study



Proposed augmentations to existing workflow in producing ensemble streamflow and reservoir pool forecasts and seasonal ranges

Objectives of future work

Addressing limitations identified in Texas pilot study

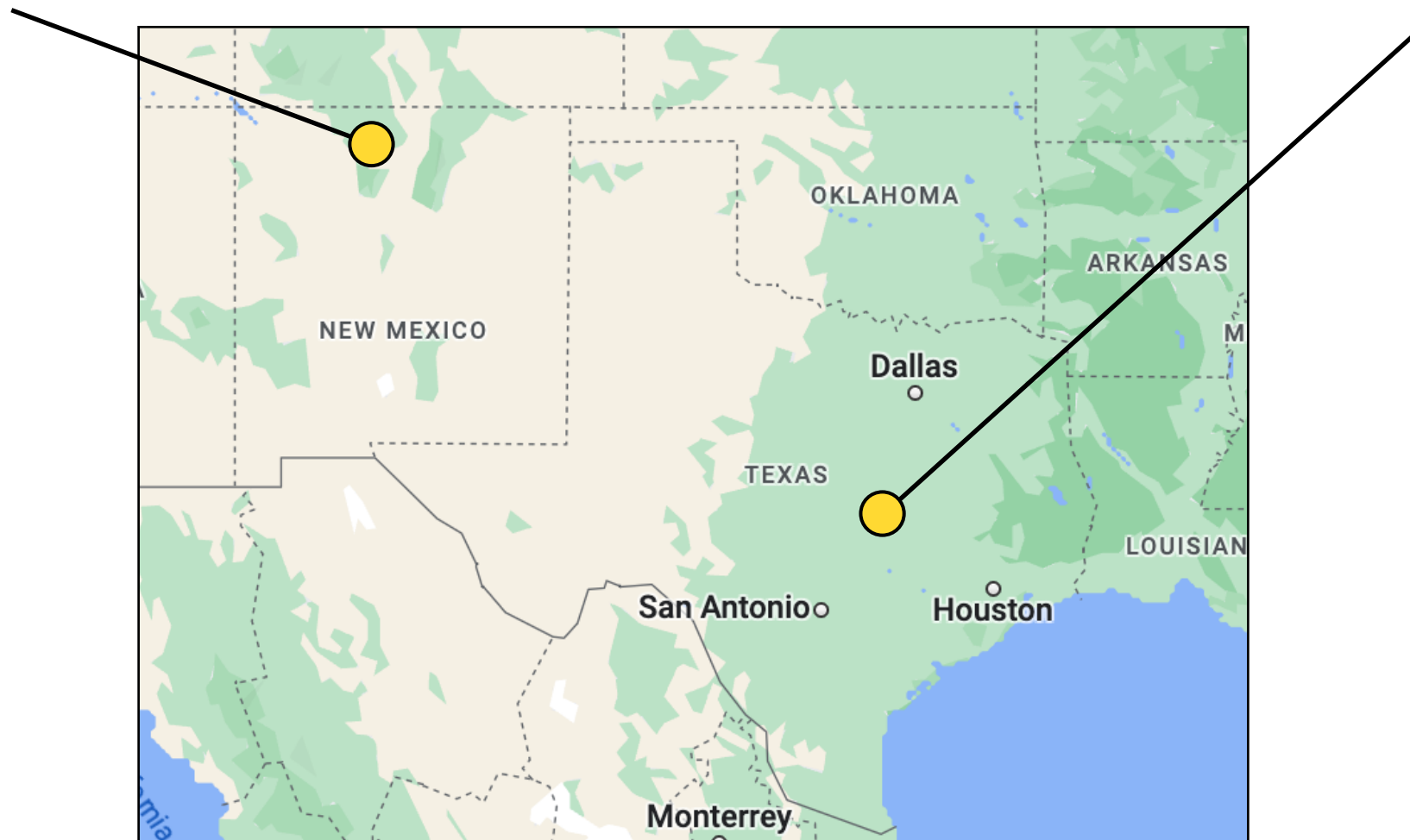


Proposed augmentations to existing workflow in producing ensemble streamflow and reservoir pool forecasts and seasonal ranges

Study sites

San Juan-Chama Project (USBR)
New Mexico

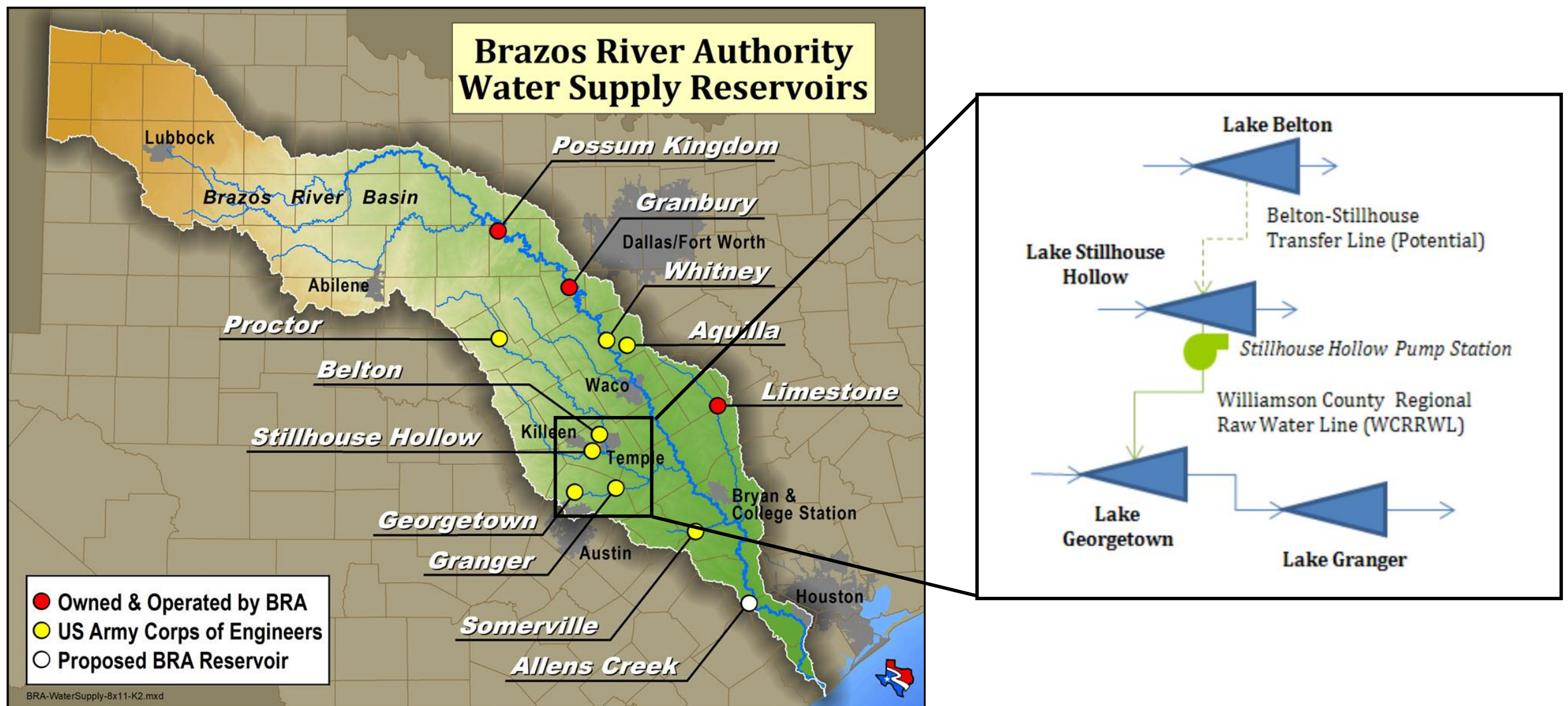
Little River System (USACE)
Texas



Two reservoir systems with different hydrological settings and research needs

Little River System, Texas

Thrust 2: Incorporating water demand predictions

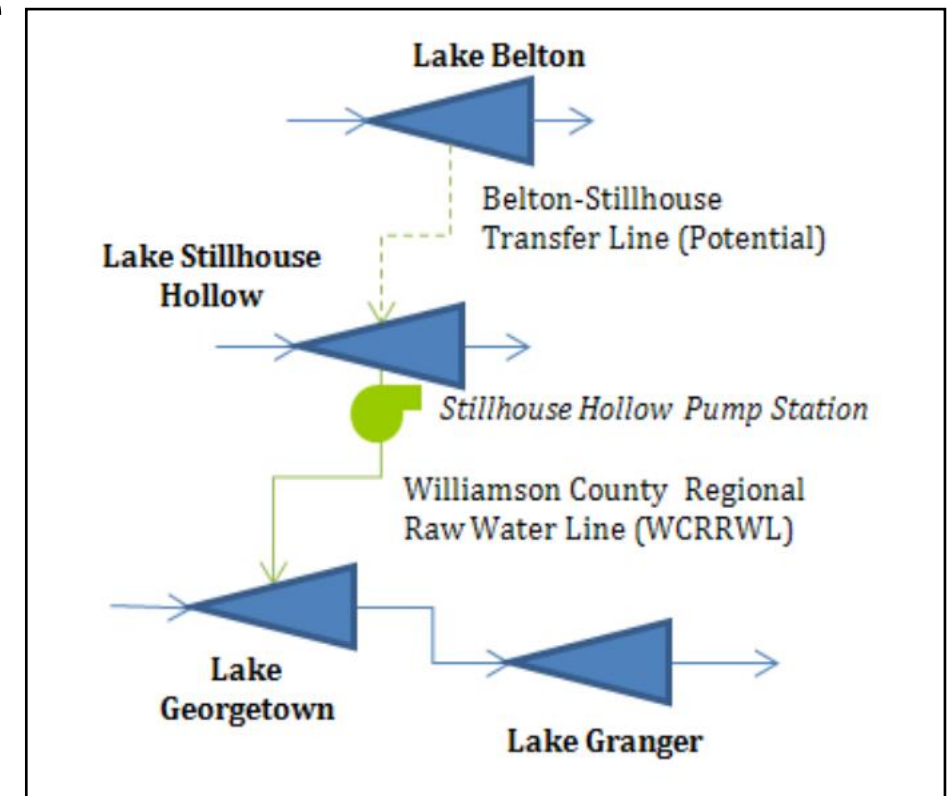


Source: BRA

Little River System, Texas

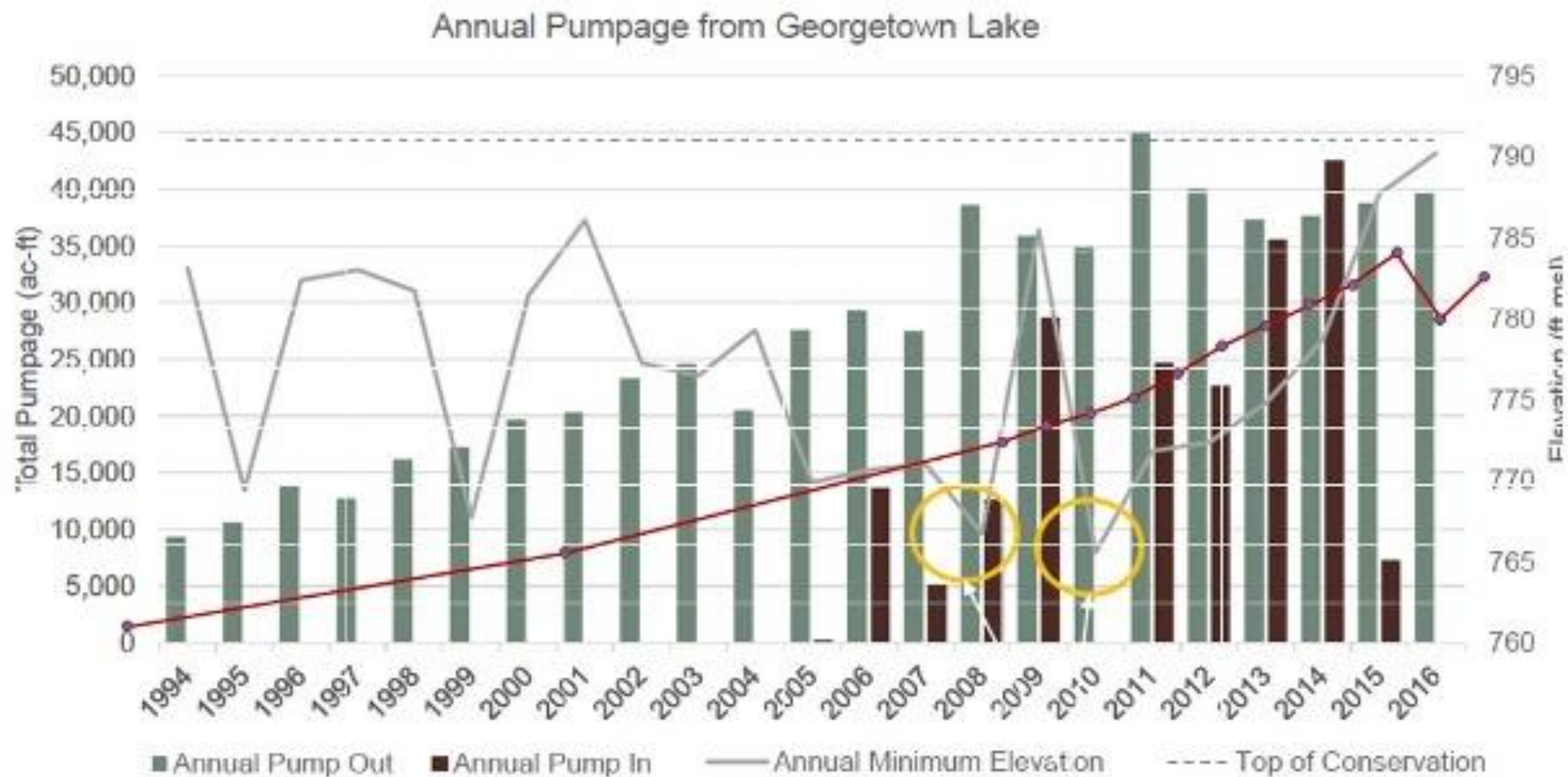
Thrusts 1 & 2: Incorporating water demand predictions

- Need to address narrow variation in ensemble forecasts (underspread)
- Need to better represent variations in water withdrawals, releases, and evaporation without relying solely on historical data
- Develop modeling modules to account for likely water demand scenarios based on forecasted climate conditions to create augmented reservoir level forecasts



Methodology

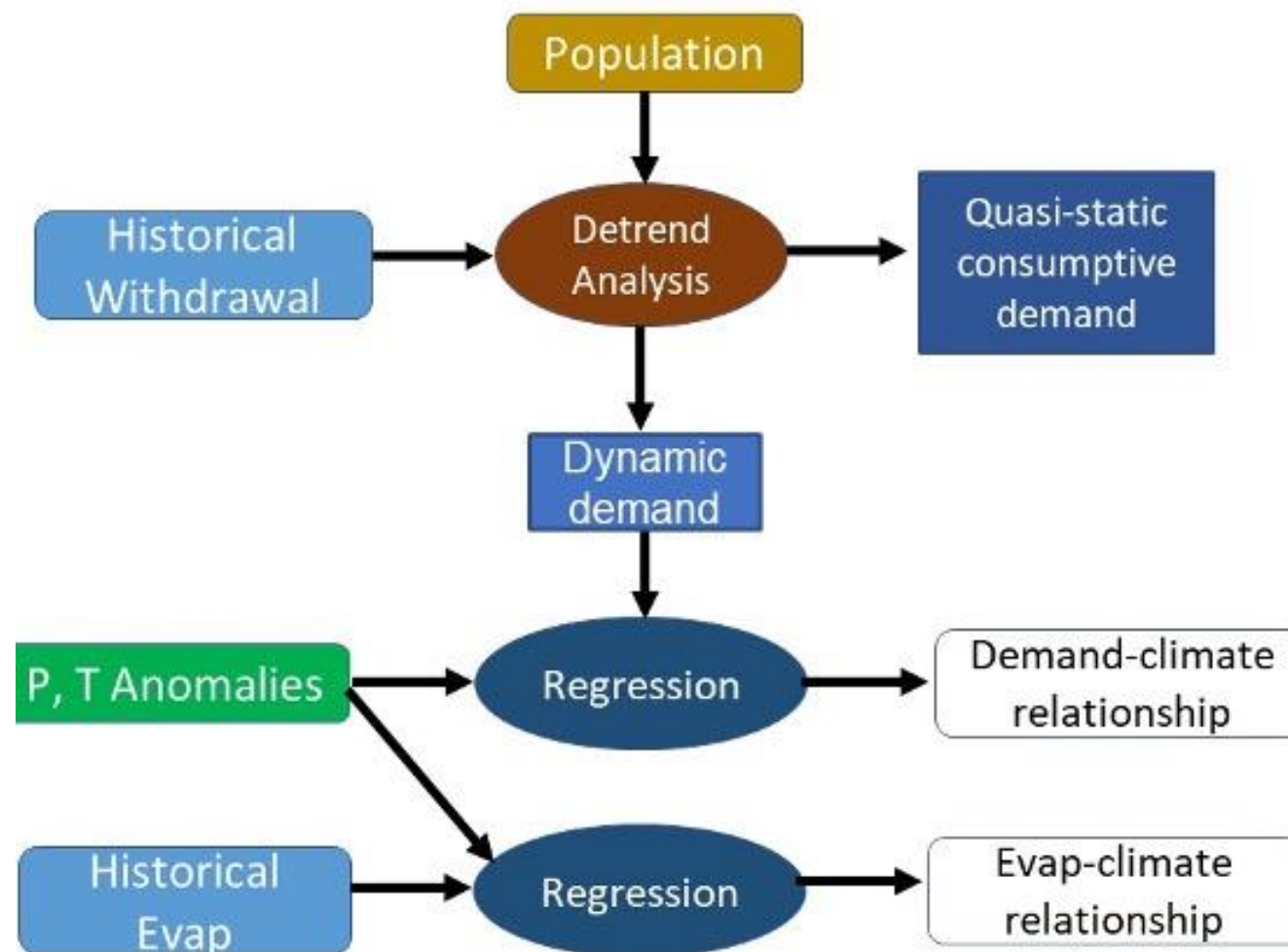
Thrusts 2: Incorporating water demand predictions



De-trend pumpage attributed to local population growth trends

Methodology

Thrusts 2: Incorporating water demand predictions



Workflow for establishing climate-dependent consumptive demand forecasts

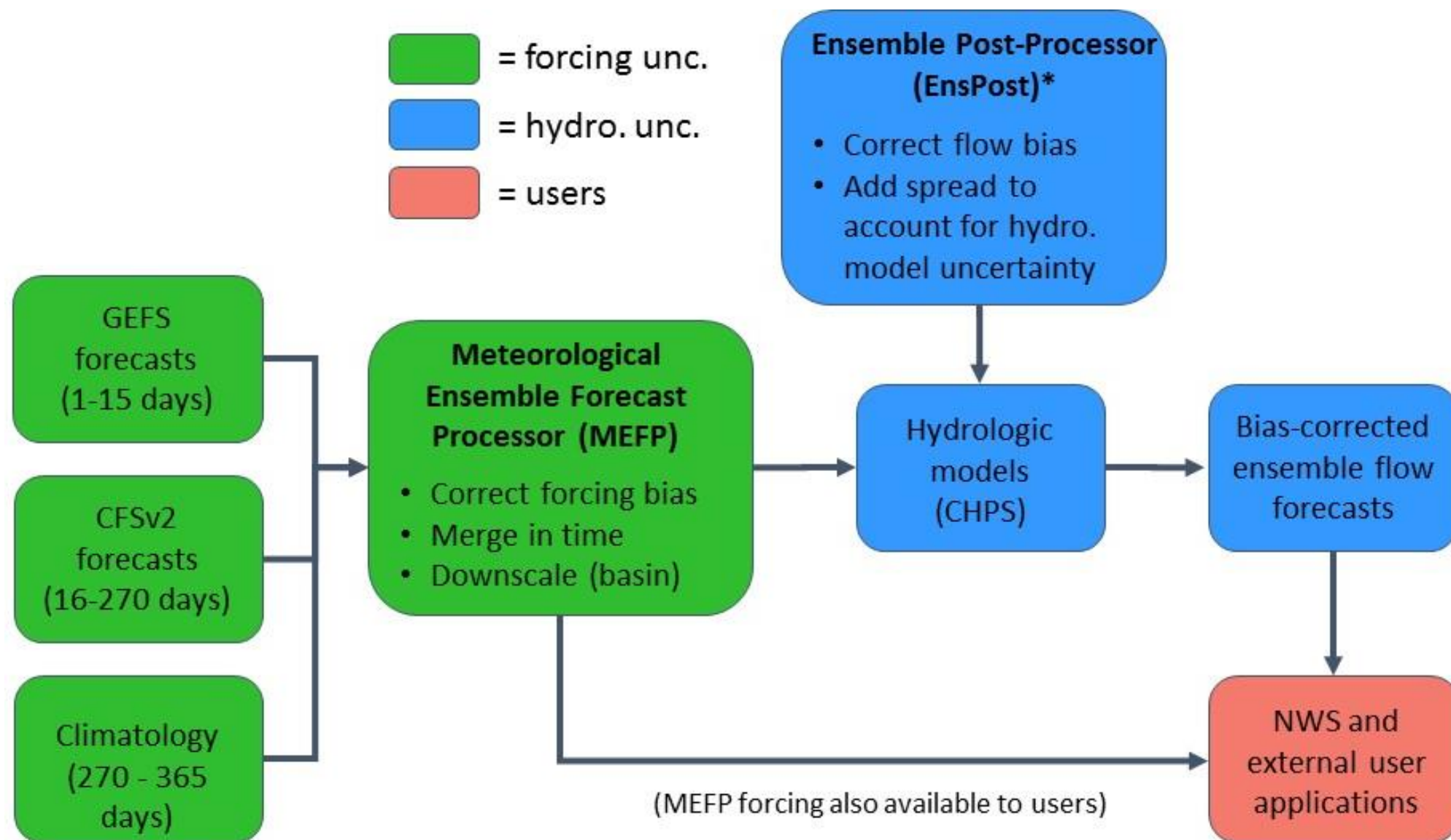
Expected Outputs

- Enhance forecast workflow through development of module for predicting water demand under different climatic conditions
- **Improve predictions of reservoir levels** crossing critical thresholds associated with drought triggers
- Support Texas FIRO efforts by improving forecasts for applications relevant to guiding early storage/release decisions
- Help inform future HEFS implementation and improvements nationwide to facilitate the adoption in reservoir management plans
- Improve lead time and accuracy of forecasts of anomalous reservoir levels will contribute to the NIDIS Drought Early Warning System

Thank you

Questions?

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*EnsPost turned on for Headwater locations in Trinity