



**FREESE
AND
NICHOLS**

Square Pegs

ADAPTING EXISTING RIVER BASIN SIMULATION MODELS FOR PLANNING PURPOSES

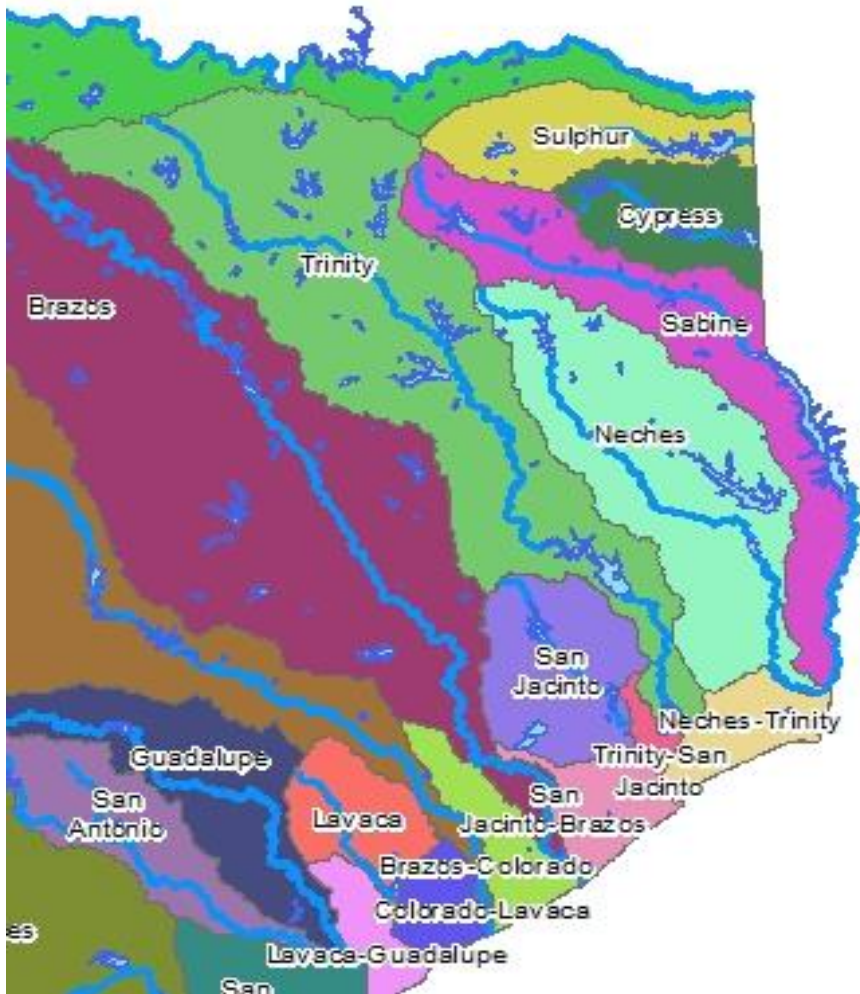
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August 23, 2016



- Case study: repurposing existing models for other purposes for the Sulphur River Basin Feasibility Study
- Comparison of
 - Texas Commission on Environmental Quality's Water Availability Model
 - USACE RiverWare model
- Things to think about
- Disclaimers
 - NOT WRAP vs RiverWare
 - My perspective on a complex subject

Why the Sulphur Basin?



- 3,580 square miles in Texas
- Average flow 932,700 ac-ft/yr
- Average precipitation 47 in/yr
- Four major reservoirs
 - Lake Wright Patman
 - Lake Jim Chapman (aka Cooper)
 - Lake Sulphur Springs
 - Lake Ralph Hall (proposed)
- 57 existing water rights
- Complex environmental, institutional, economic, and social issues

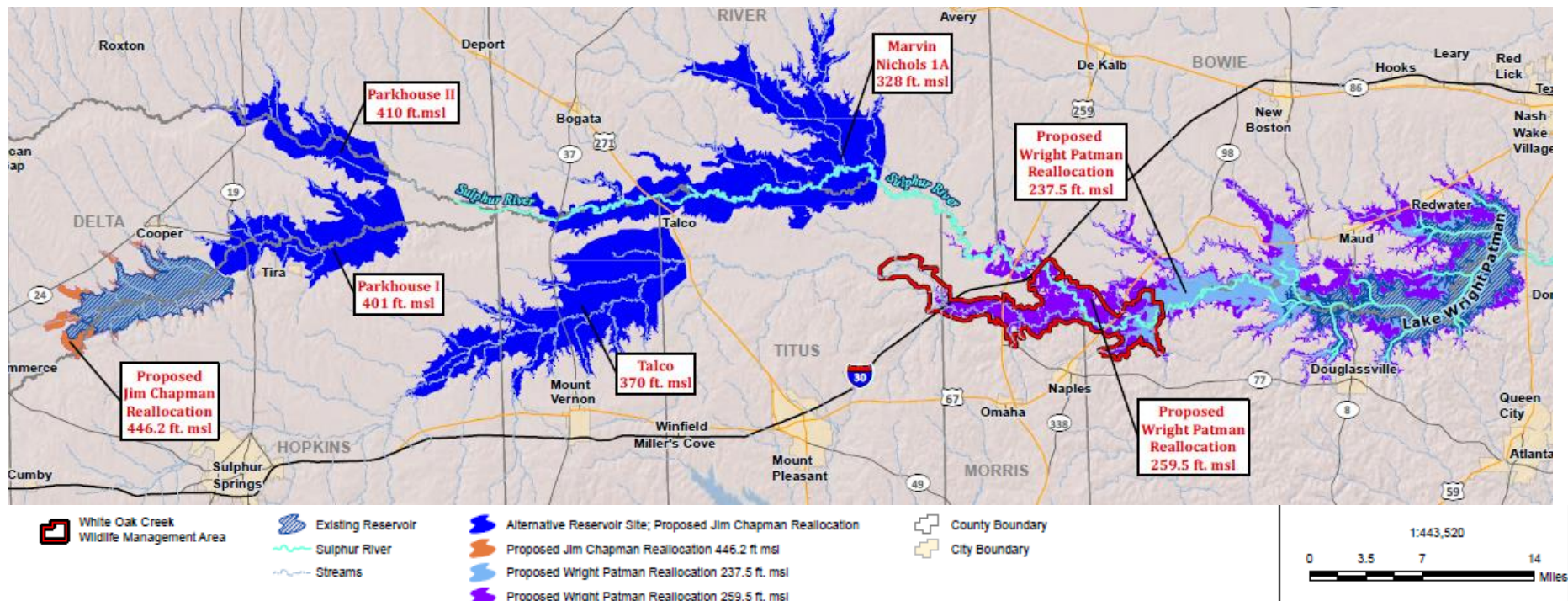


The intent of this study is to develop and evaluate alternative solutions in the Sulphur River Basin for municipal and industrial water supply, and other infrastructure concerns....to determine what project or combination of projects would be expected to optimize the use of existing water resources projects as well as the development of new water infrastructure in order to support quality of life and economic development within and adjacent to the Basin with the least environmental and social impacts.

Alternatives



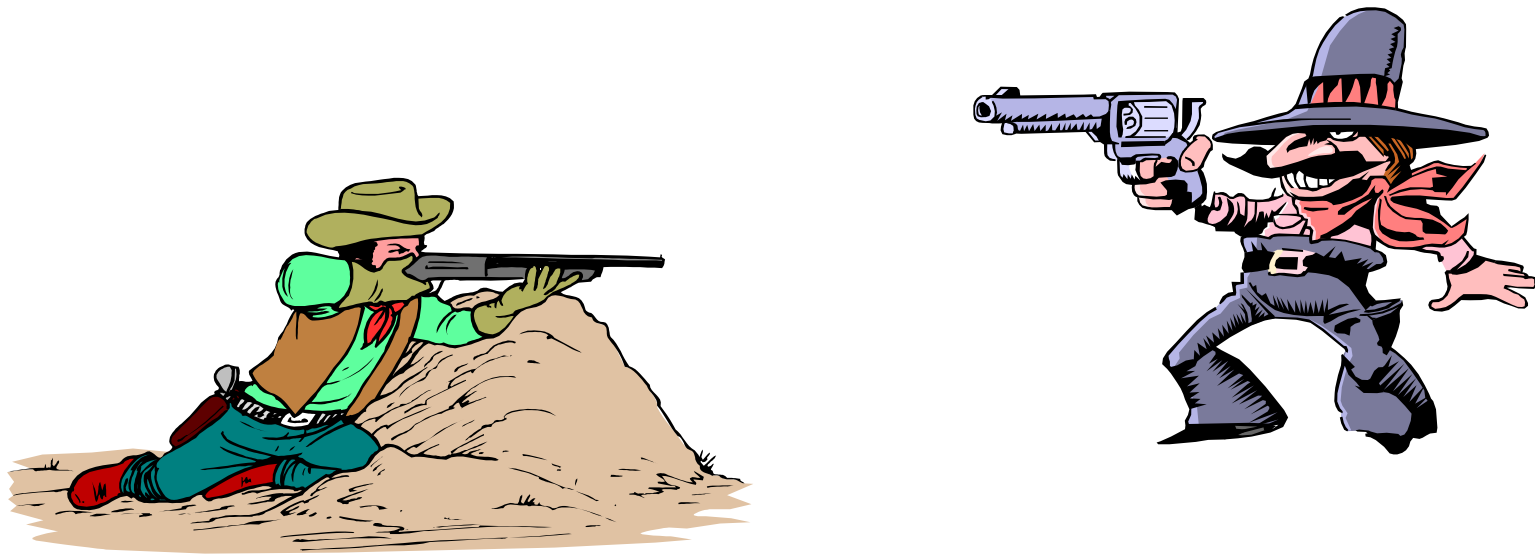
- Four potential reservoir sites
- Reallocation of Lakes Wright Patman or Jim Chapman



Modeling Needs



- Local sponsors wanted WAM modeling to be consistent with state permitting and planning processes
- Federal process wanted hydrologic yields using USACE models
- Limited use of both models had shown some significant difference in results





- Developed for permitting new water rights
- All water rights as permitted
 - Initial storage
 - Full diversion
 - Full authorized consumption (no return flows unless required)
 - Priority allocation “first in time is first in right”
- Modifications for state-sponsored regional water planning
 - Current and future reservoir storage
 - Miscellaneous operational changes

TCEQ Water Availability Models

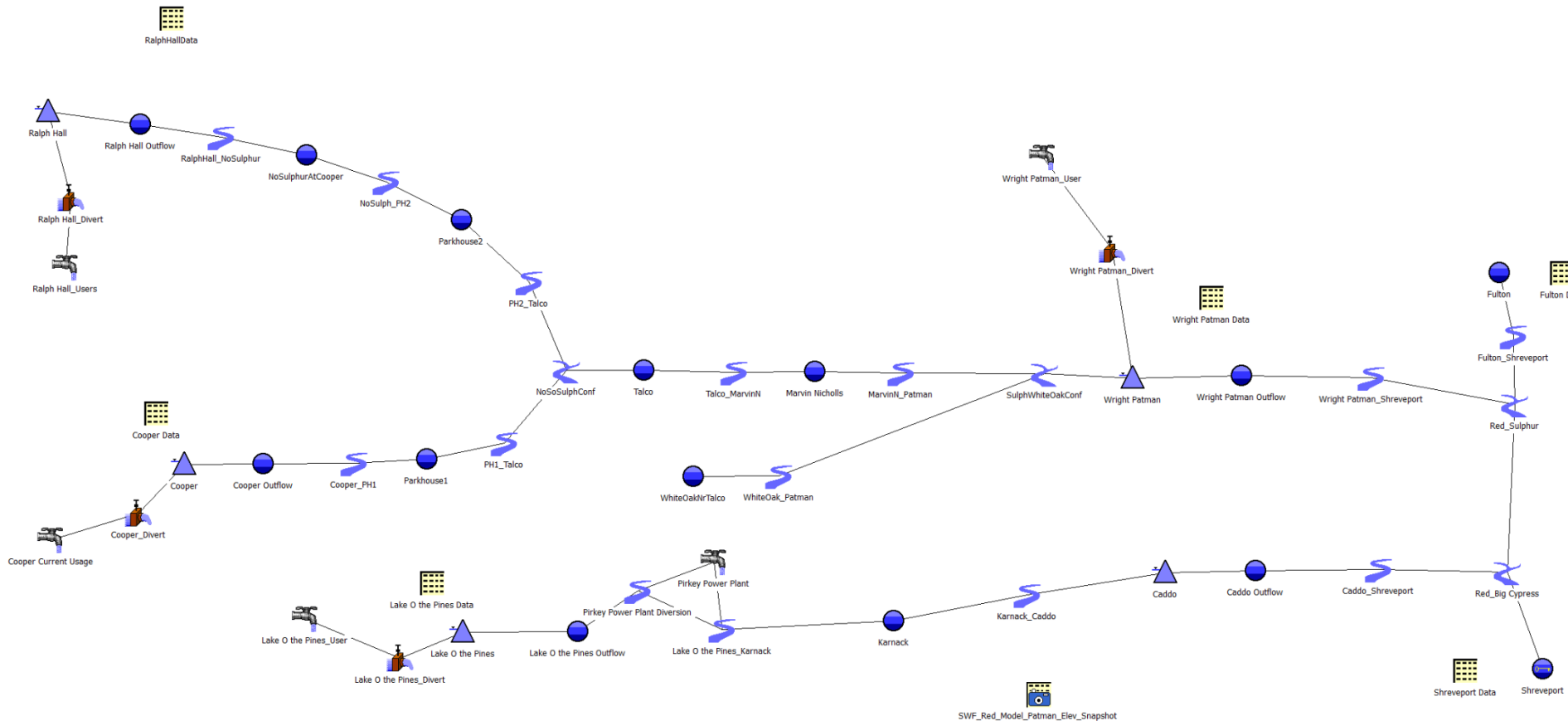


- Parent model Water Rights Analysis Package (WRAP)
- Sulphur Basin in Texas only
- Naturalized hydrology from 1940 to 1996
- Monthly time step

USACE RiverWare Model



- USACE regulation model
- Subset of larger USACE Red River Basin Model



USACE RiverWare Model



- Models Federal reservoirs plus Lake Ralph Hall
- FNI added proposed projects and performed yields
- Other reservoirs/water rights represented by historical operation
- Hydrology from 1938 to 2006 (subsequently extended through 2014)
- Daily time step
- USACE modeling protocols

WAM vs USACE Model



- Compare RW hydrologic yields to WAM hydrologic yields
- Develop understanding of differences
- Recommendations for path forward



Model Leveling (WAM vs RW)



Things made the same

- Reservoir volumetrics
- Low-flow releases
- Diversions (major reservoirs)
- Upstream to downstream allocation

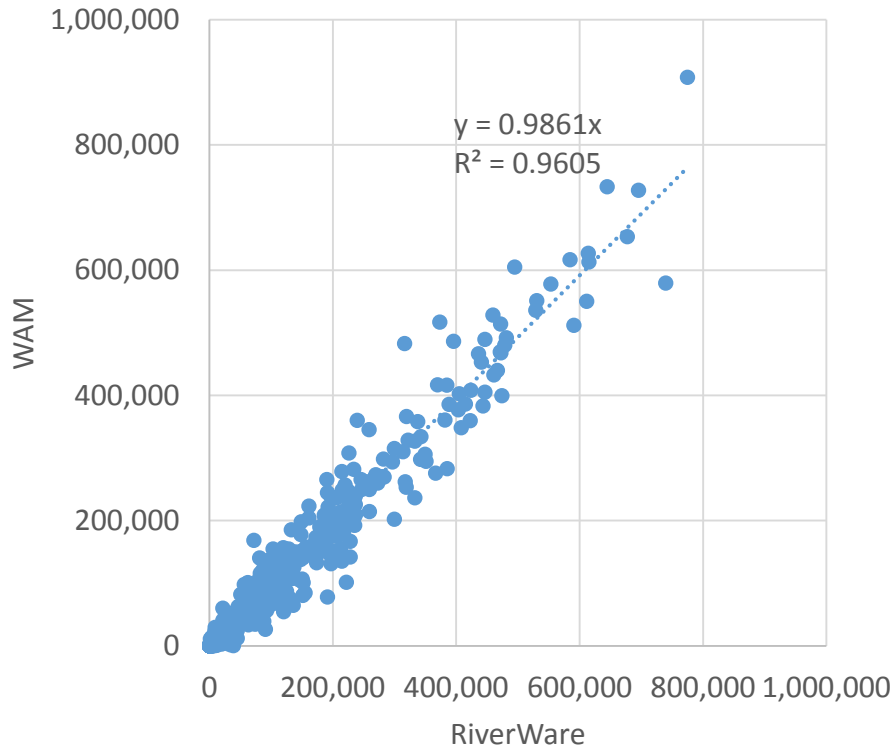
Things left unchanged

- Flow data
- Evaporation and precipitation (existing projects)
- Handling of minor water rights

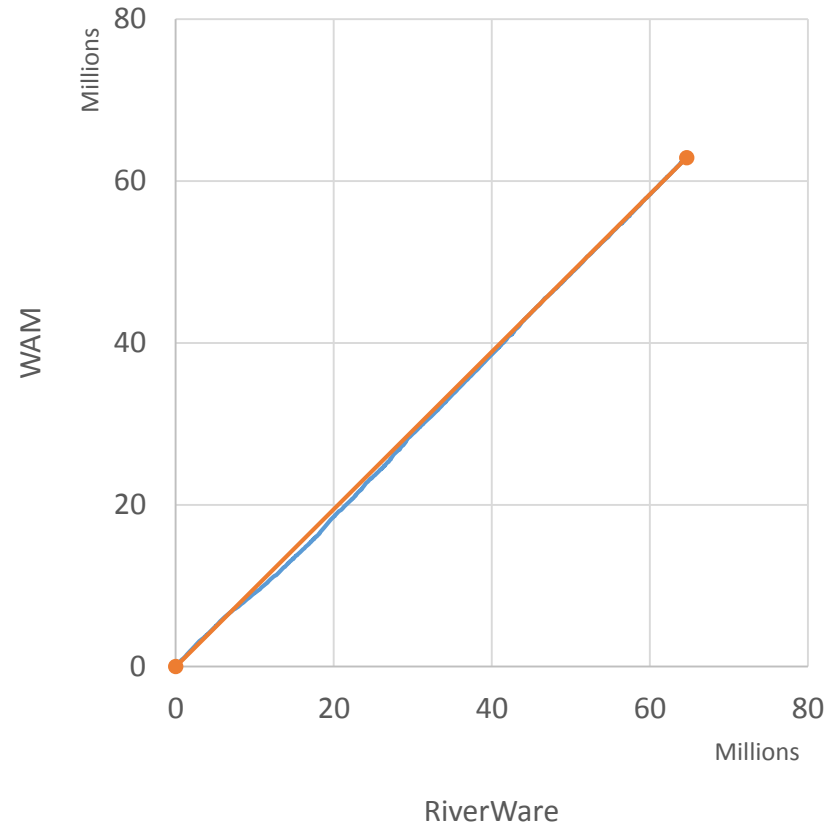
Comparison of Hydrology



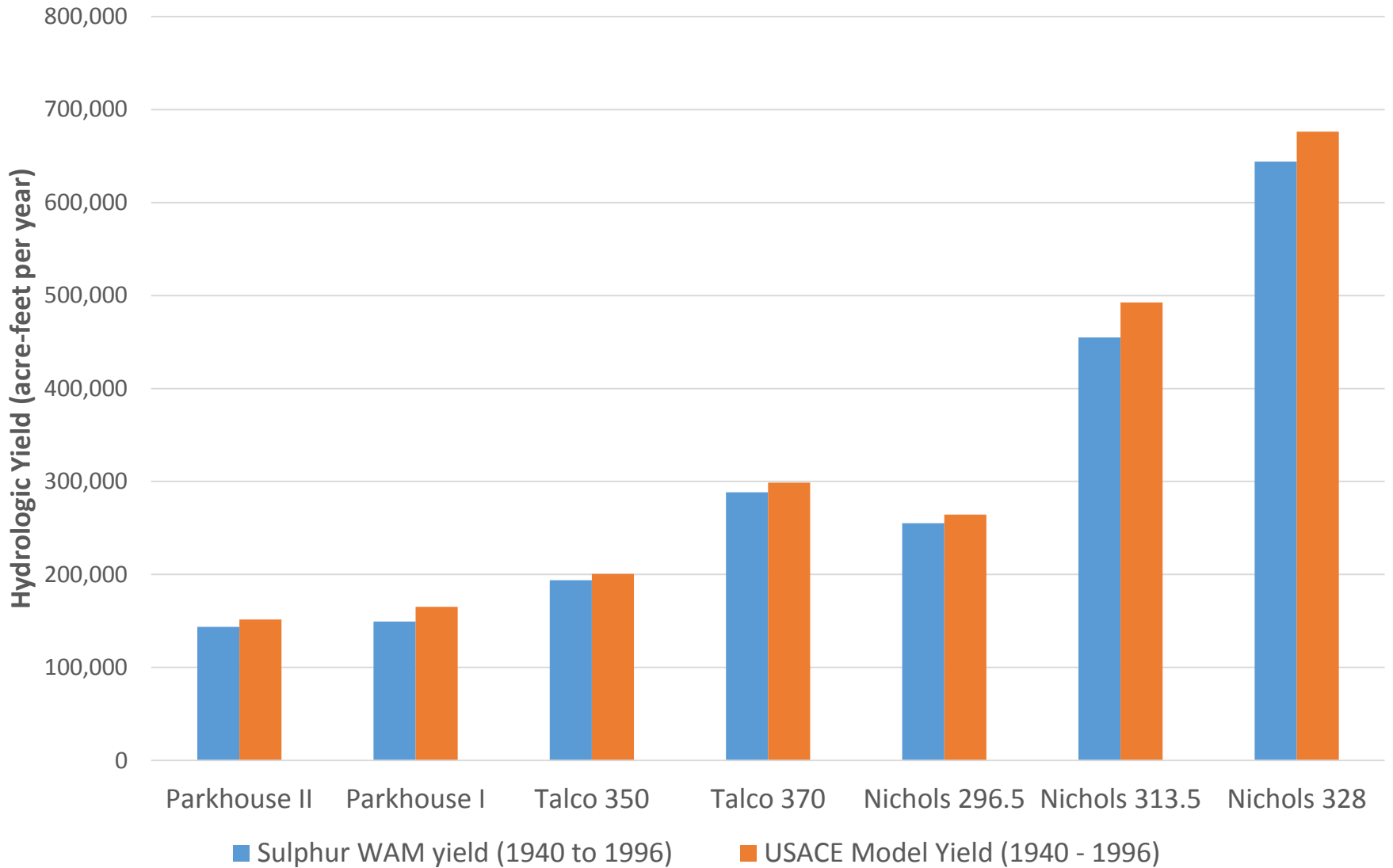
Comparison of WAM and RiverWare Monthly Flows (1940 to 1996)



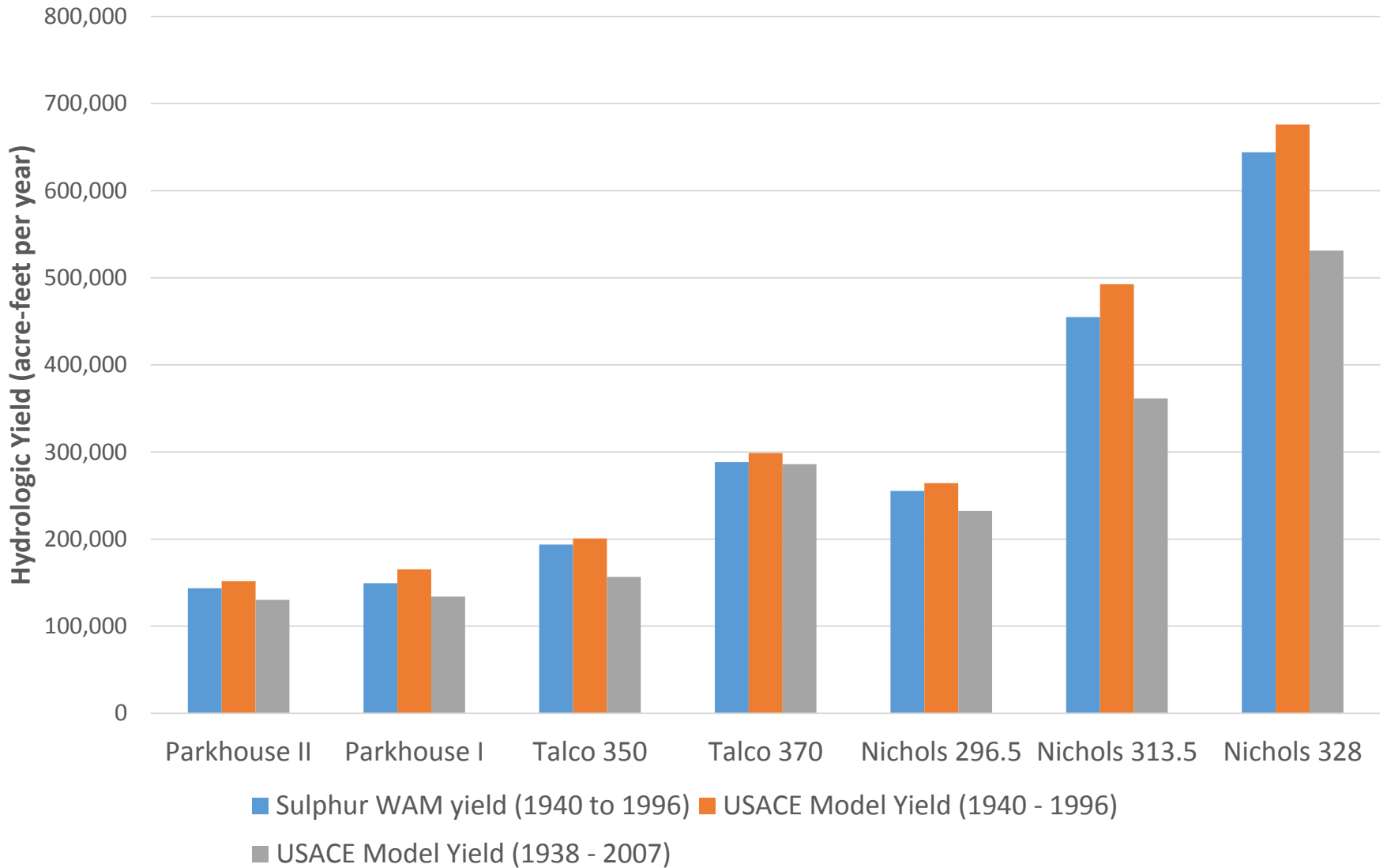
Double Mass Comparison of WAM and RiverWare Monthly Flows (1940 to 1996)



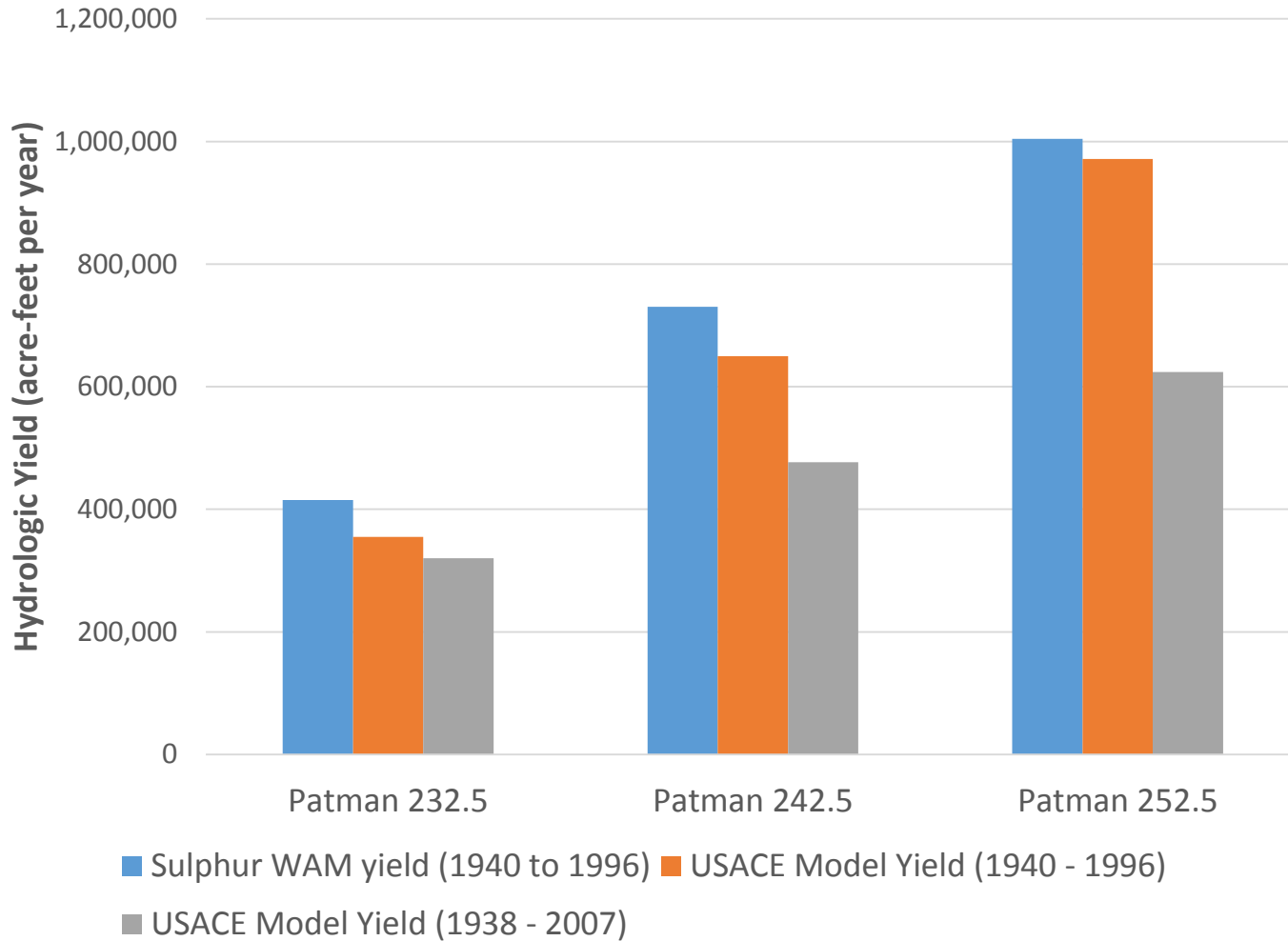
Yields of New Reservoirs



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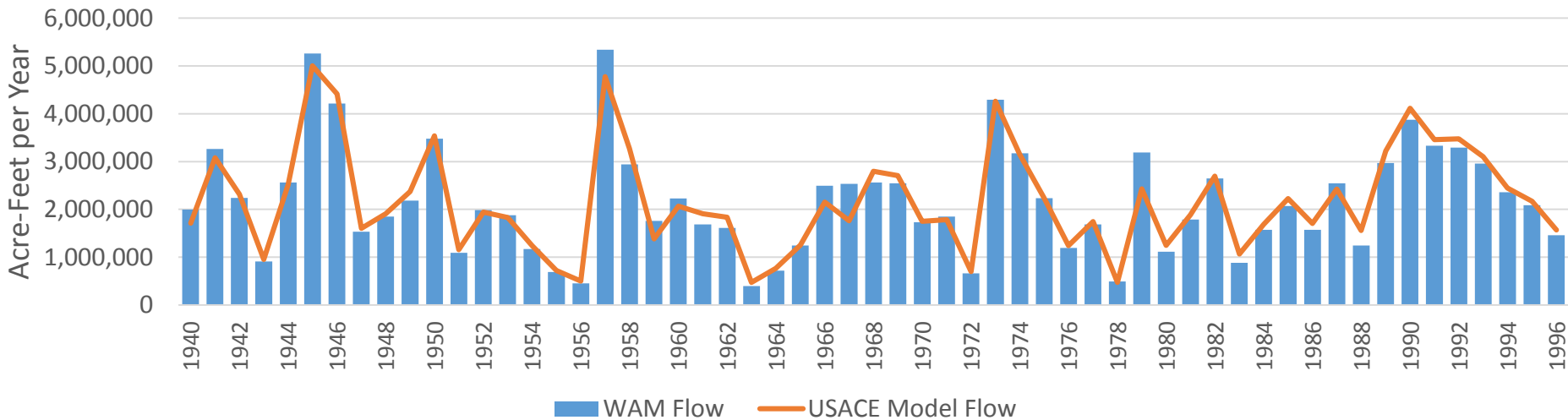


Wright Patman Reallocation

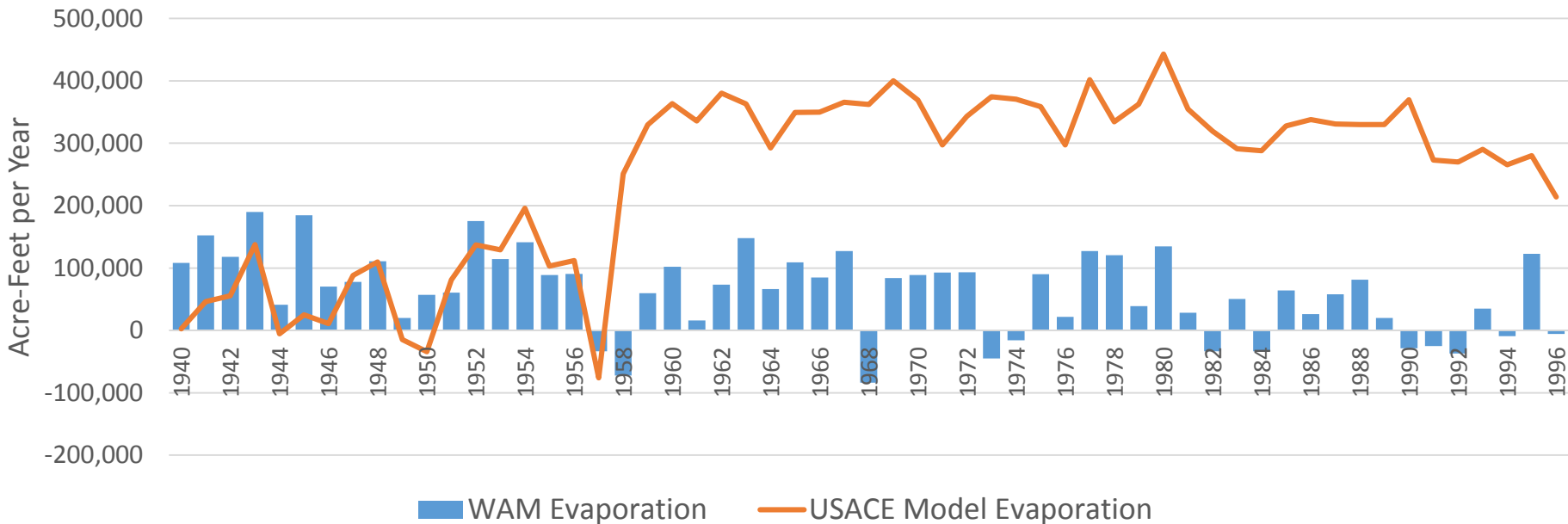


Patman Conservation at 252.5 ft

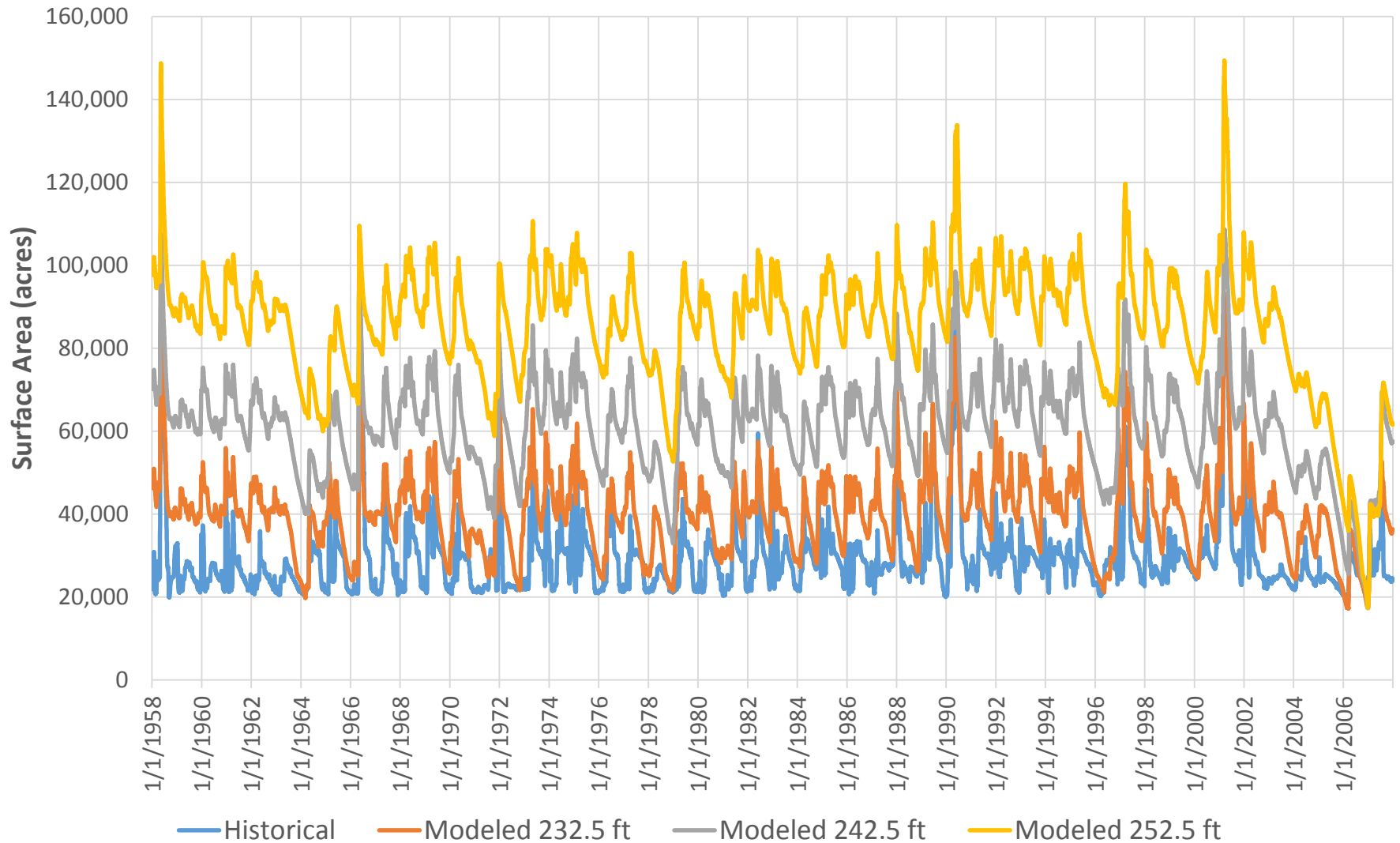
Inflows



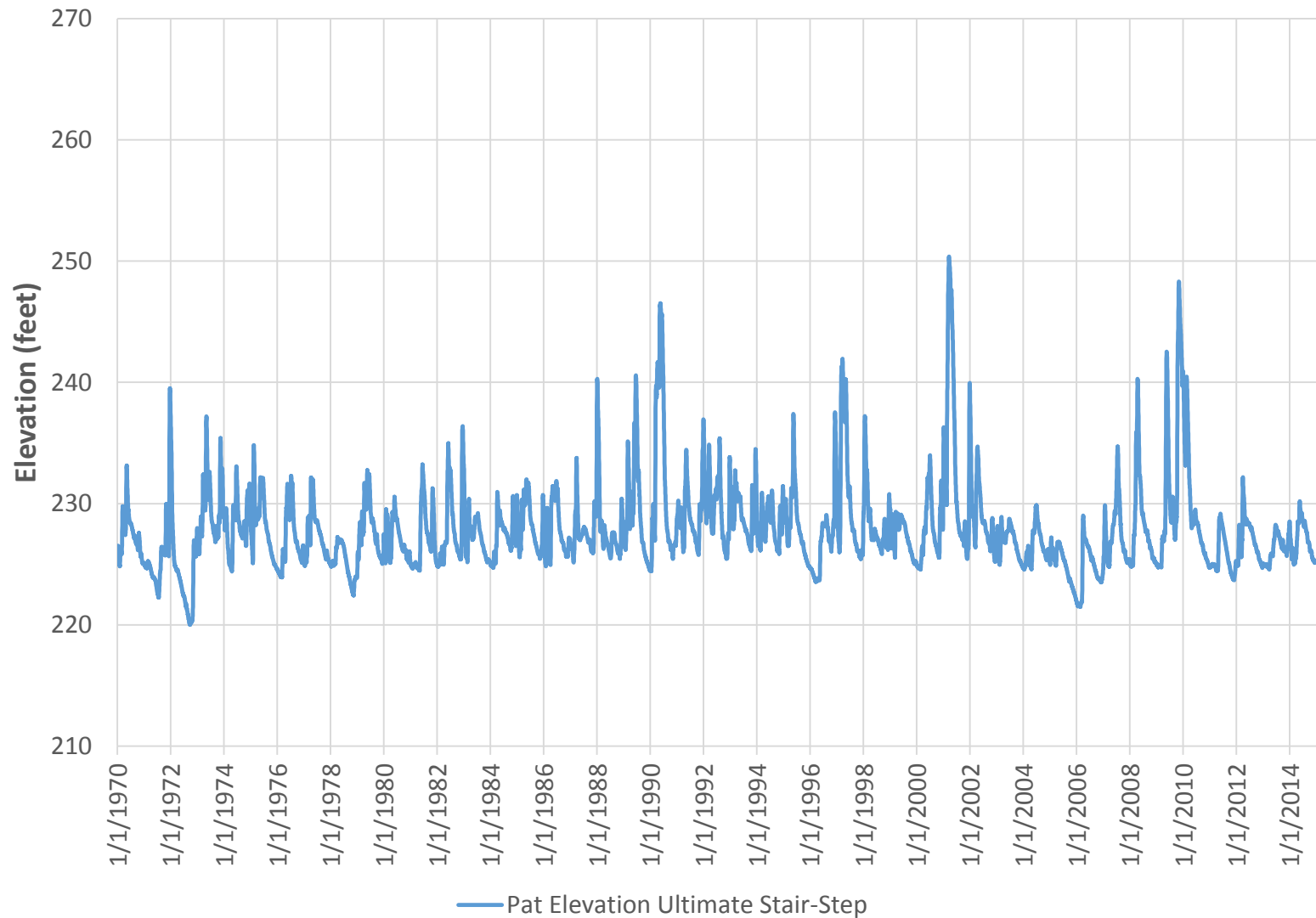
Net Evaporation



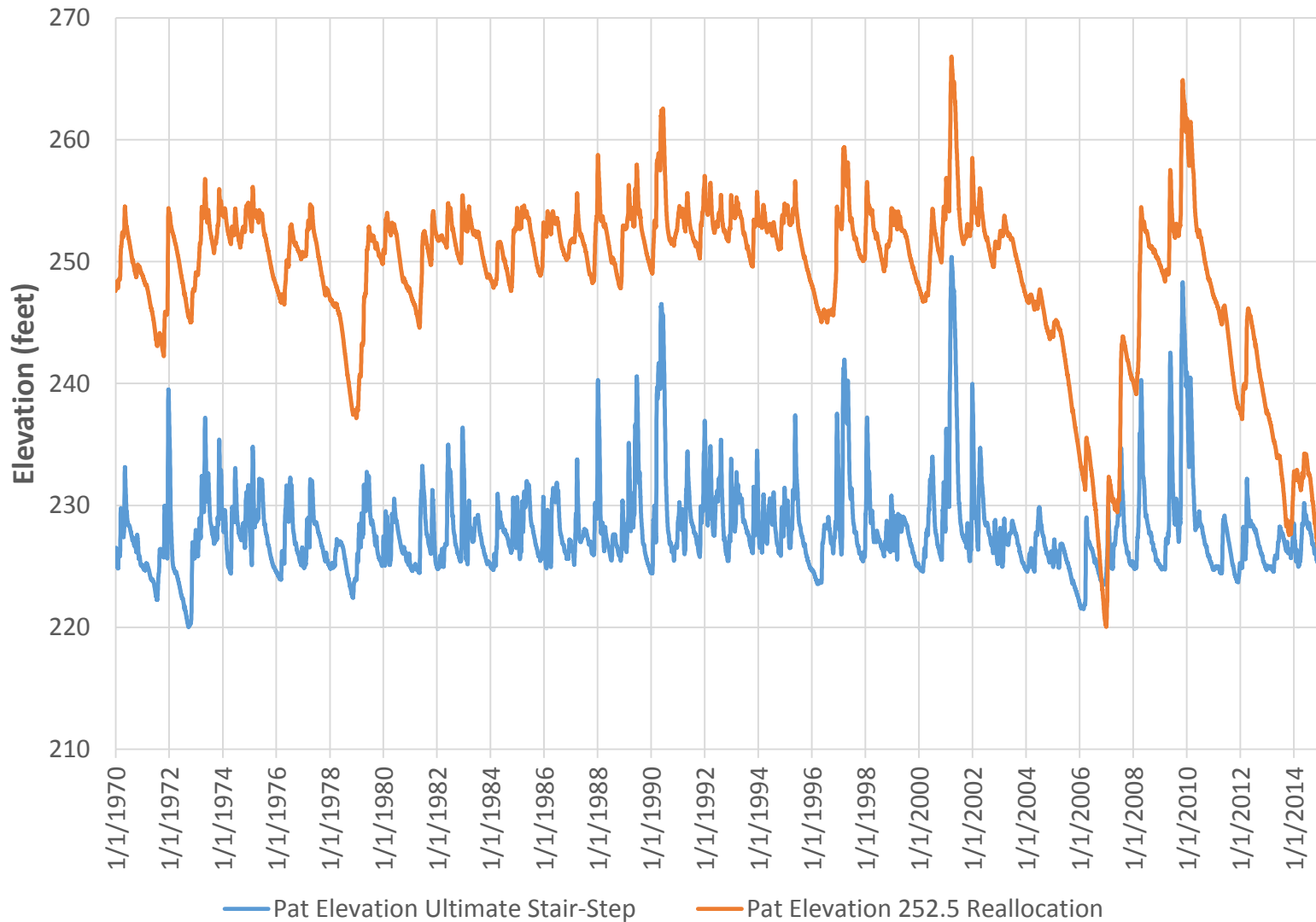
Impact Precipitation on Reservoir



Let's Talk About Timesteps



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Things to Think About



- Have an understanding of
 - The purpose for which your model was developed and how that might affect your answer
 - The input data – not all hydrology is the same
 - The new processes for which the model will be applied
- Just because two models give different results does not mean one is wrong



Thank you for your time! Any questions?

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