EAA Modeling Program Update

A presentation to the

HCP Joint Committee Meeting

By

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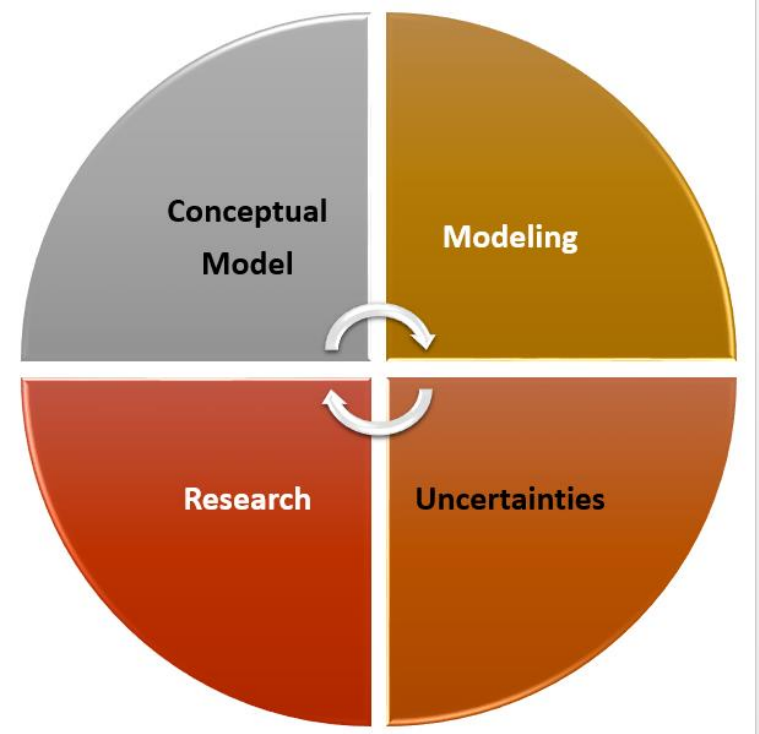
Topics

- Modeling Five-Year Plan
- MODFLOW Drought-Of Record Simulations
- Recharge Estimation Methods
- Groundwater Model Uncertainty Analysis

Groundwater Modeling

- Modeling is an iterative process
- Represents a compilation of knowledge
- Can identify key uncertainties and the potential effects of those uncertainties on model predictions
- Feedback to research program so data collection can focus on areas most likely to improve predictive ability
- Uncertainty cannot be eliminated but its magnitude and potential effects can be better understood
- EAA is at the beginning of a process of evaluating model uncertainties



Groundwater Model 5-Year Plan

- 2015
  - Begin process of uncertainty analyses with MODFLOW model using an ensemble approach, as recommended by NRC review committee
  - Complete documentation for updated MODFLOW model
  - Evaluate potential uses of new FEFLOW groundwater model

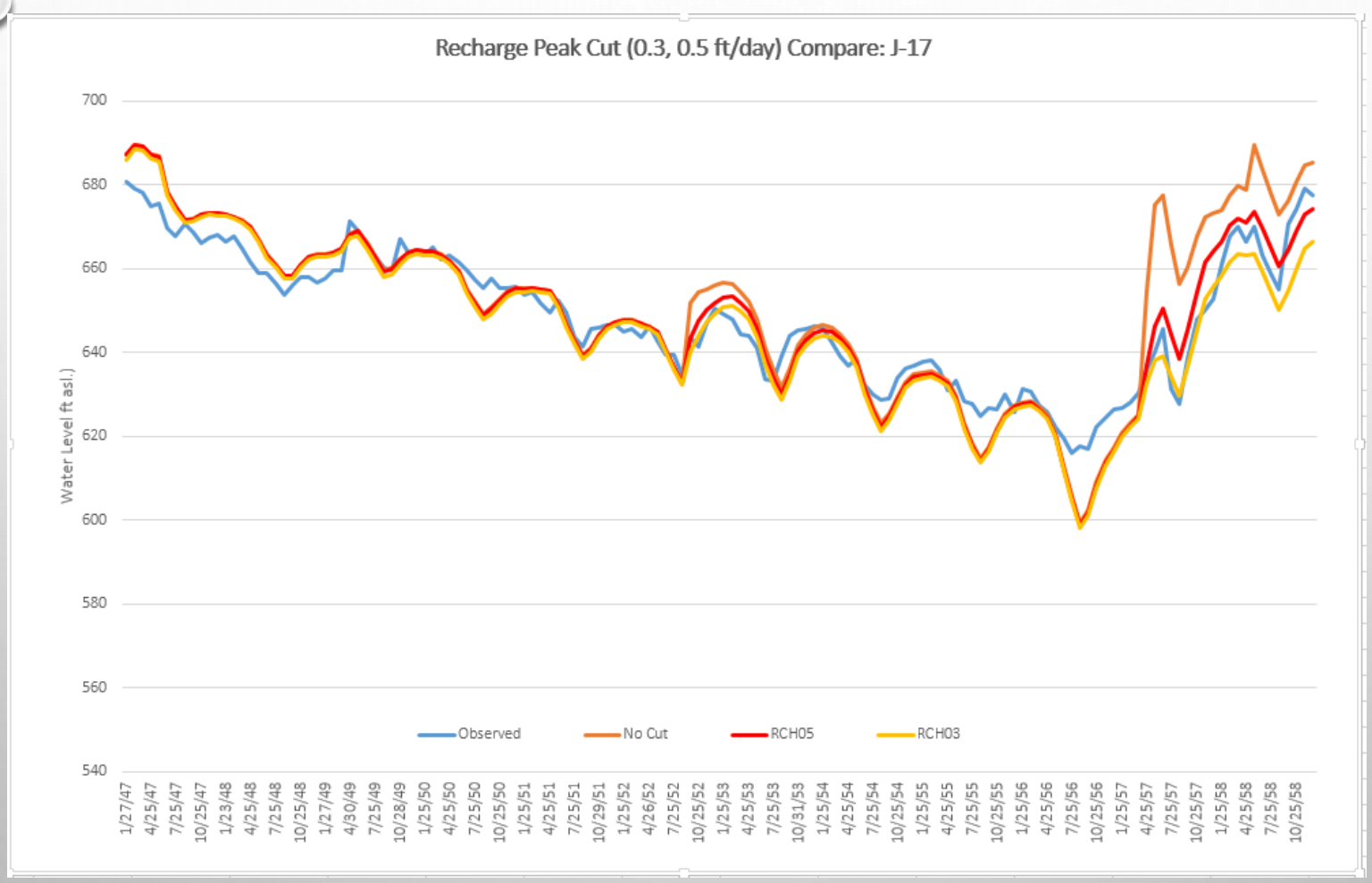
- 2016
  - Initiate uncertainty and sensitivity analyses on the updated MODFLOW model using the ensemble approach recommended by NRC
  - A primary goal will be to quantify uncertainty in the "bottom up" analysis used to establish conservation measures associated with the EA HCP

Groundwater Modeling

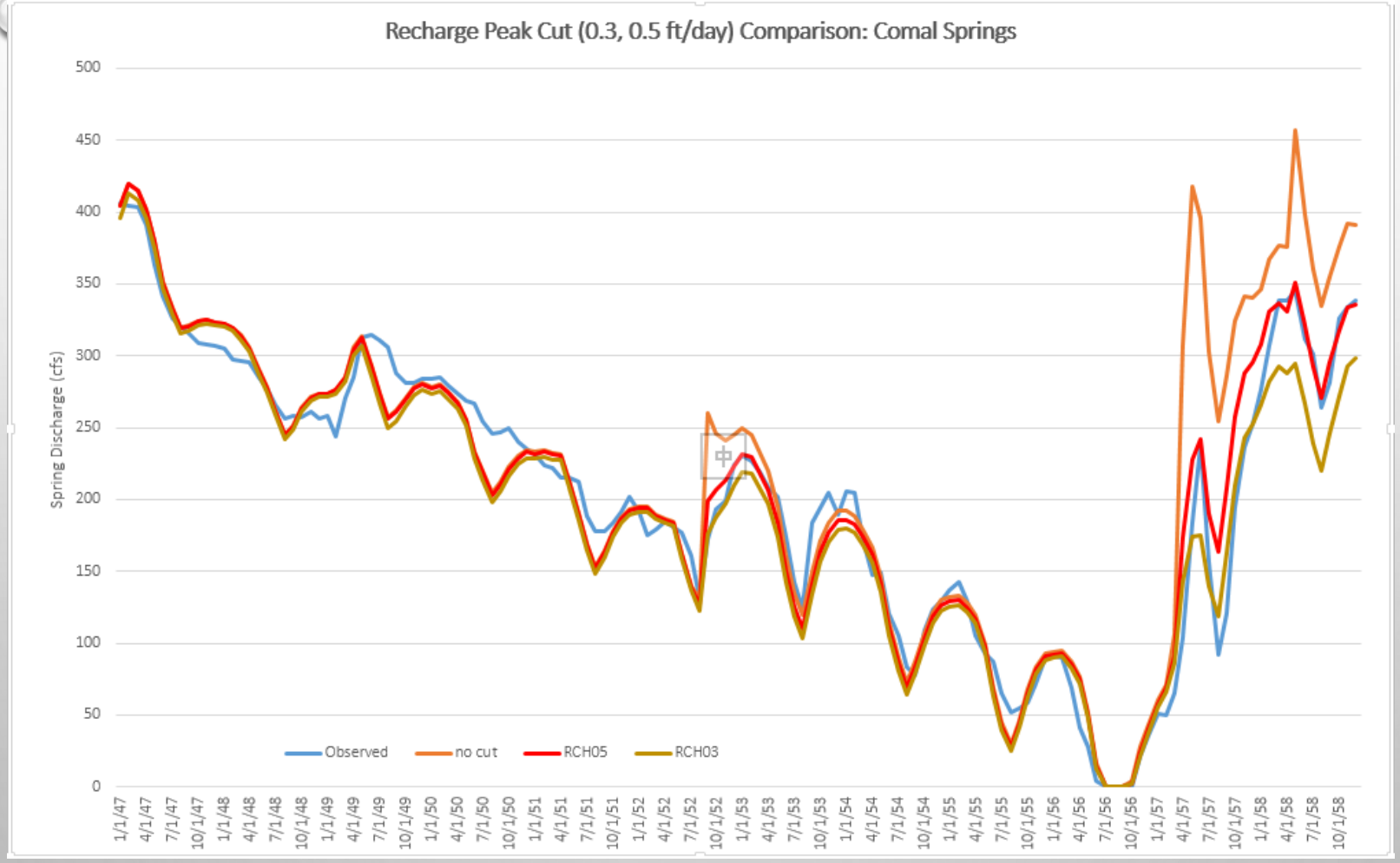
- 2017
  - Begin planning stages for next major model update
  - Assess conceptual model in light of new data
  - Assess current best practices and modeling software
- 2018
  - Document proposed conceptual changes and modeling approach in a model update plan
  - Obtain expert/peer review of update plan, revise and finalize
  - Begin Procurement process for outside consulting/expertise, if needed
- 2019
  - Begin model updates: 1 to 3 year process depending on scope of changes

Preliminary Drought-of-Record Simulations with Updated MODFLOW Models

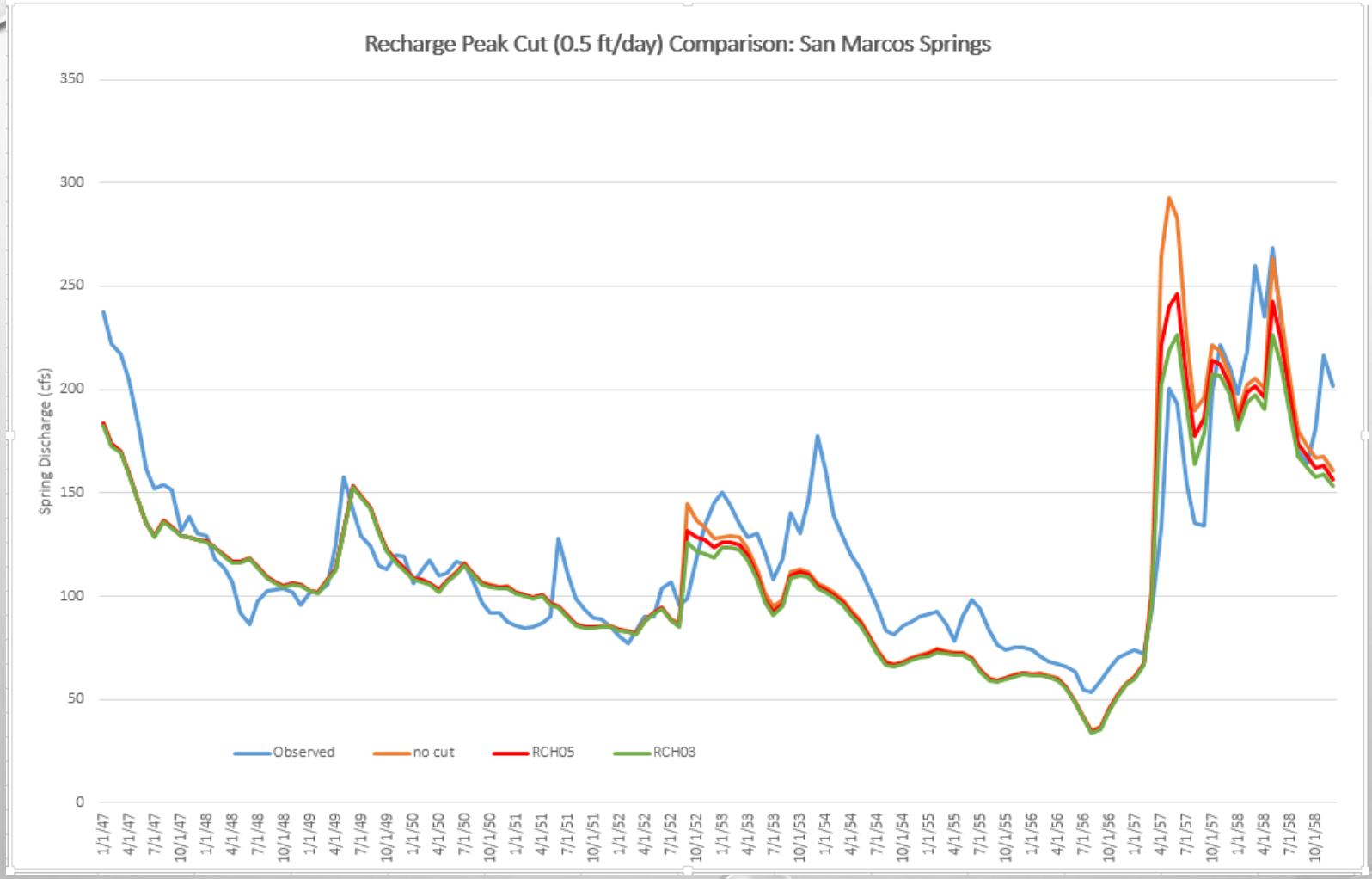
MODFLOW Drought-of-Record Scenario: sensitivity to limiting peak recharge rate

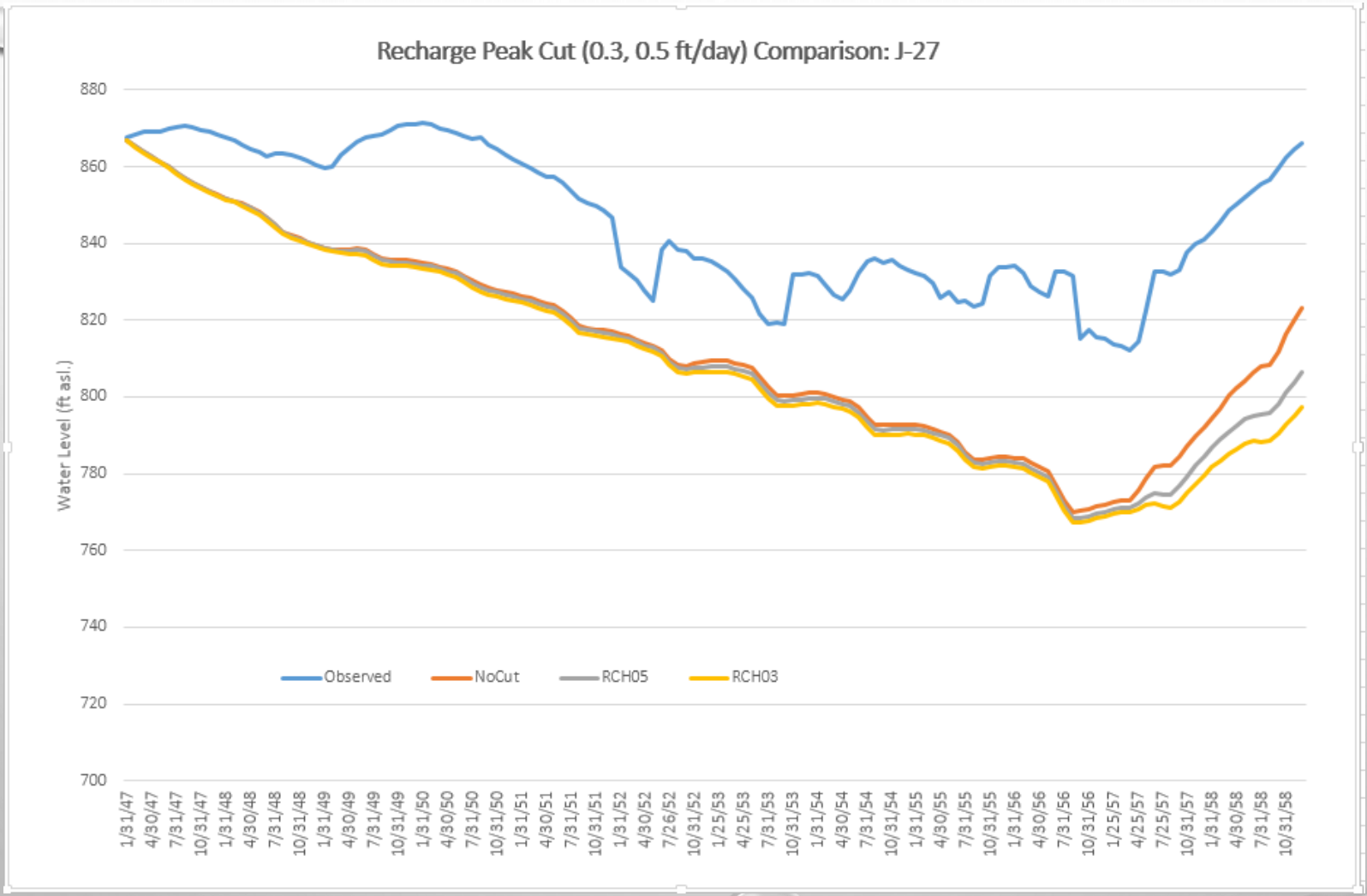


MODFLOW Drought-of-Record Scenario: sensitivity to limiting peak recharge rate



MODFLOW Drought-of-Record Scenario: sensitivity to limiting peak recharge rate




Recharge Peak Cut (0.3, 0.5 ft/day) Comparison: J-27
Water Level (ft asl.)
880
860
840
820
800
780
760
740
720
700
Observed
NoCut
RCH05
RCH03
1/31/47
4/30/47
7/31/47
10/31/47
1/31/48
4/30/48
7/31/48
10/31/48
1/31/49
4/30/49
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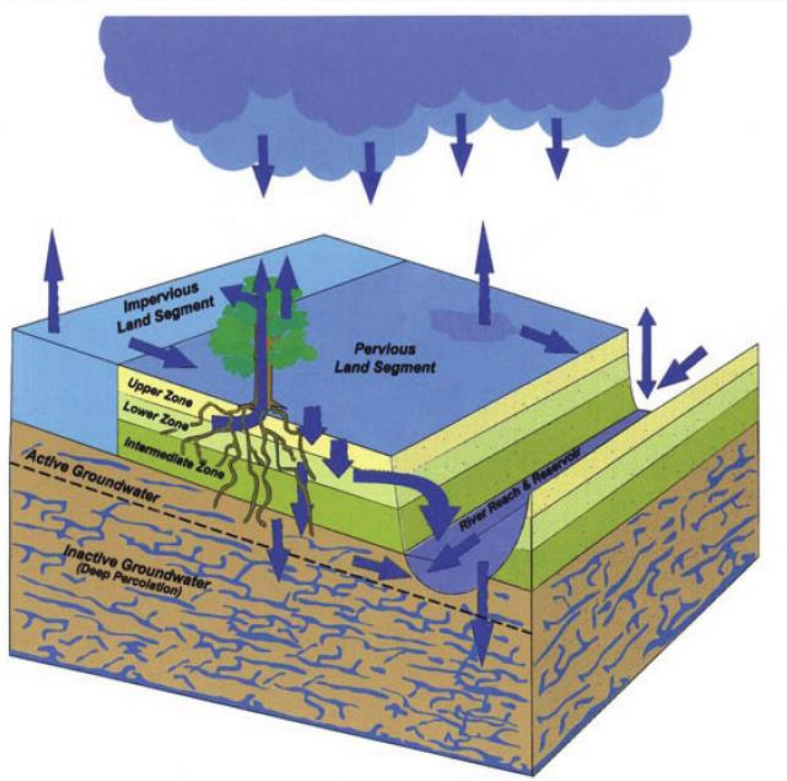
Groundwater Model Uncertainty Analysis

- EAA goal is to understand effects of uncertainty in predicting the effects of conservation measures on sustaining aquifer levels and spring flows
- Currently pursuing "Ensemble Approach" recommended by National Academies' Science Review Panel
- Develop a set of MODFLOW groundwater models that can be reasonably calibrated with different assumptions about amount and distribution of recharge as well as other conceptual and parameter uncertainties
- Use the ensemble set of models to re-run HCP-style analyses to evaluate the effect of conservation measures with modern pumping imposed on drought-of-record scenarios
- Goal is to complete this round of uncertainty analyses by end of 2016

HSPF Watershed Models

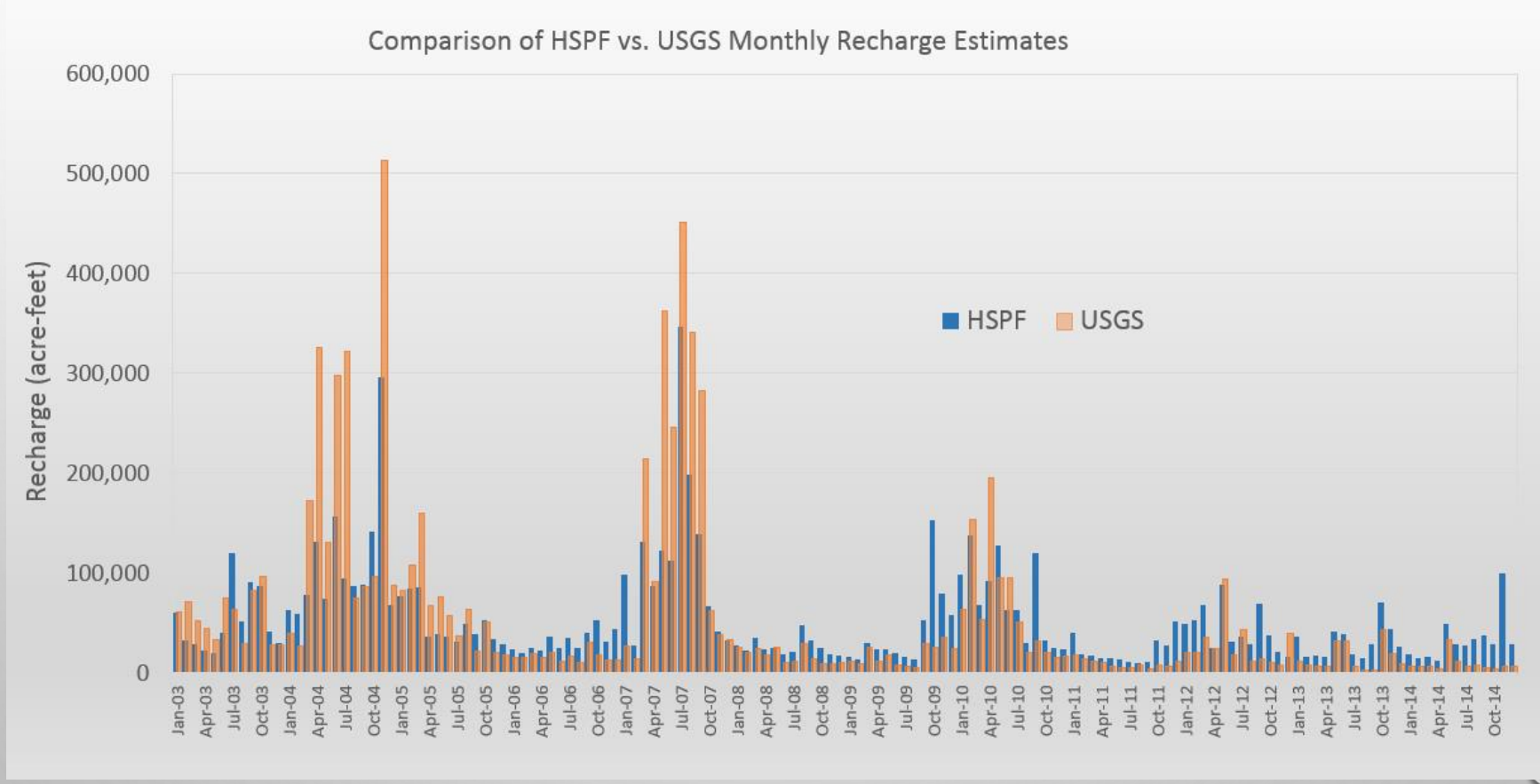
HSPF Watershed Models

- Surface water models compute recharge for all 9 delineated watersheds
- Models use precipitation data as primary input
- Modeled processes include interception storage, surface infiltration, soil storage, evapotranspiration, surface runoff to streams (storm flow), subsurface diversion to streams (baseflow), streamflow, and deep infiltration to groundwater (a.k.a. recharge!)
- All water is accounted for in terms of mass balance

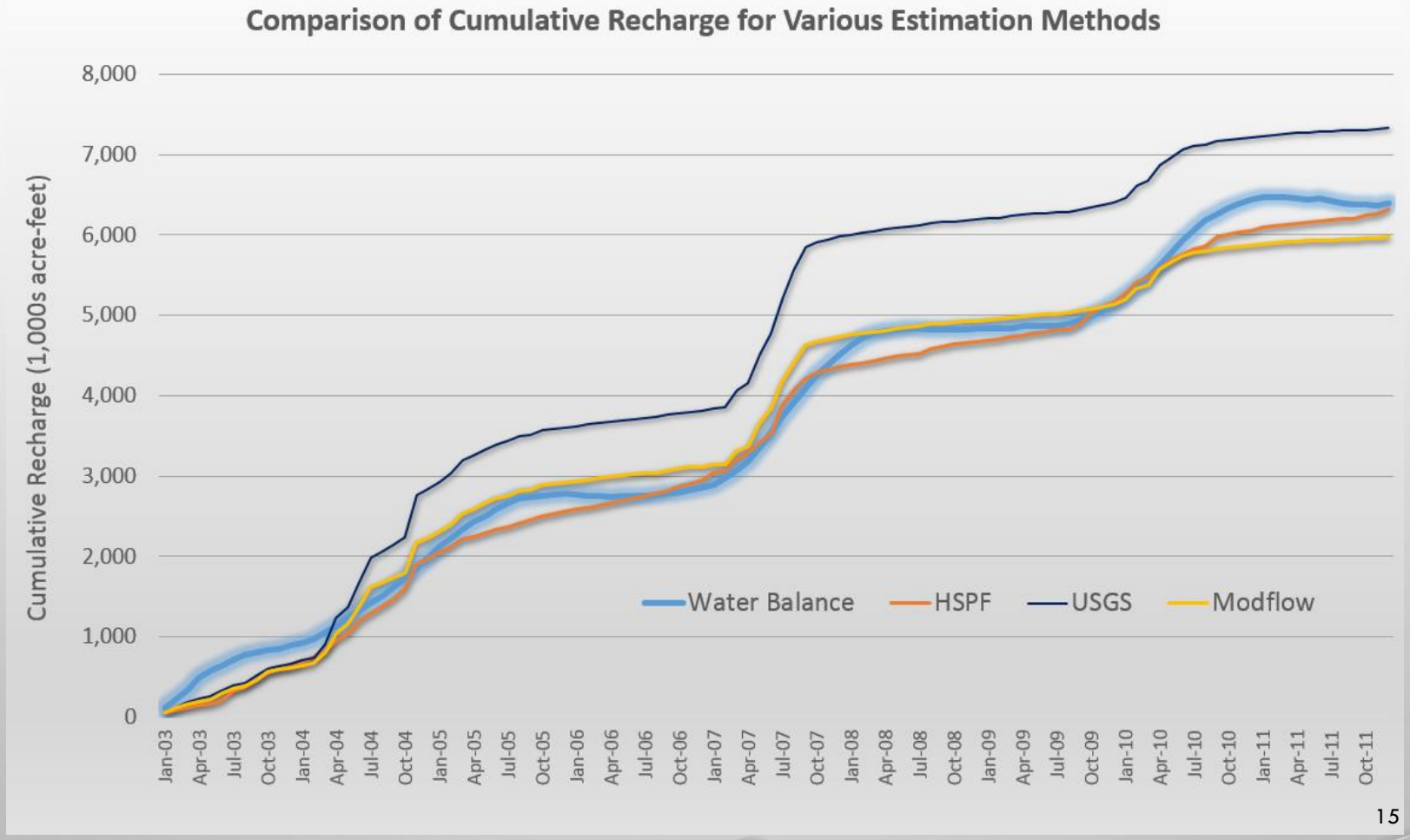


after HDR (2002)

Comparison of HSPF and USGS Recharge Estimates



Comparison to Water Balance Approach



Summary

- Groundwater modeling can help us evaluate and understand the overall importance of conceptual uncertainties and data gaps
- Pulls together the body of knowledge and conceptual understanding gained from past decades of research and data collection
- Informs future research and data collection so focus can be on topics most important to effective aquifer management
- Planned uncertainty analysis will help to either provide confidence in the effectiveness of HCP conservation measures or show what additional measures may be needed in Phase II to protect critical habitat and species