Recent Enhancements to the Sacramento Valley Finite Element Groundwater Flow Model ($SACFEM_{2013}$)

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Introduction

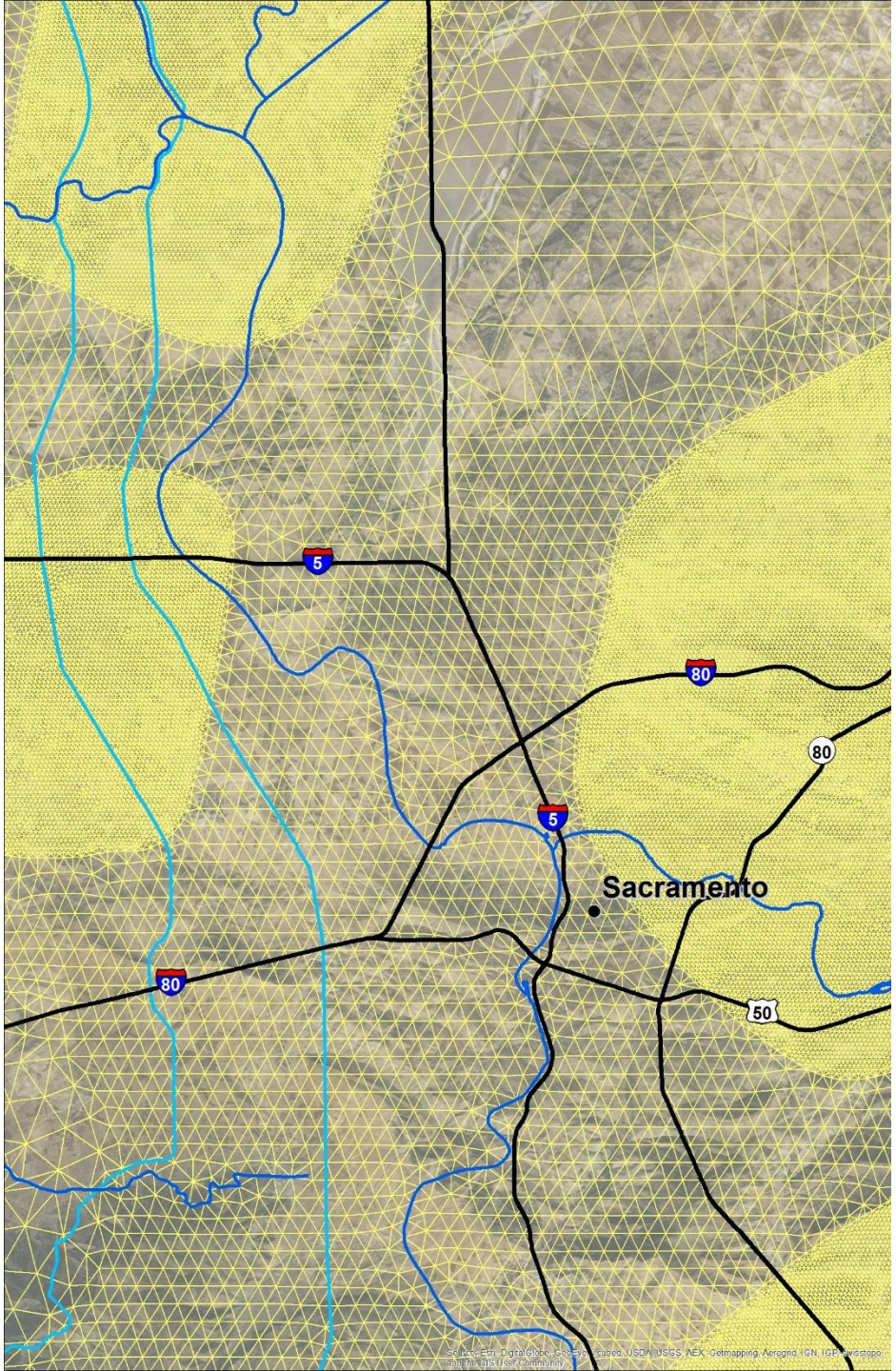
- Background
- Model Construction
  - Areal Characteristics
  - Vertical Characteristics
  - Boundary Conditions
  - Agricultural Water Budget
  - Transient Streams and Flood Bypasses
- Model Calibration

Background

- SACFEM is a regional-scale groundwater (GW) flow model of the Sacramento Valley
- Model objectives include impacts assessment associated with GW production projects (changes in GW/SW interaction and impacts to third party wells)
- SACFEM construction began in mid-2000's undergoing several stages of refinement/recalibration and independent peer review
- Most Recent Updates ($SACFEM_{2013}$)
  - Extension of calibration period through Water Year 2010
  - Expansion of calibration target dataset (multi-level well clusters)
  - Incorporation of transient stream stages
  - Addition of transient flood bypass inundation areas

Model Construction Areal Characteristics

- Sacramento River Hydrologic Region
- Model domain encompasses the Sacramento Valley Groundwater Basin
- Finite element model (MicroFEM)
  - 150,000+ nodes (300,000+ elements)
  - Nodal spacing ranges from 410 ft (125 m) to 3,300 ft (1,000 m)
  - Spacing along streams and bypasses = 1,640 ft (500 m)
  - Grid/mesh can be reconfigured to meet project needs



Model Construction
Vertical Discretization

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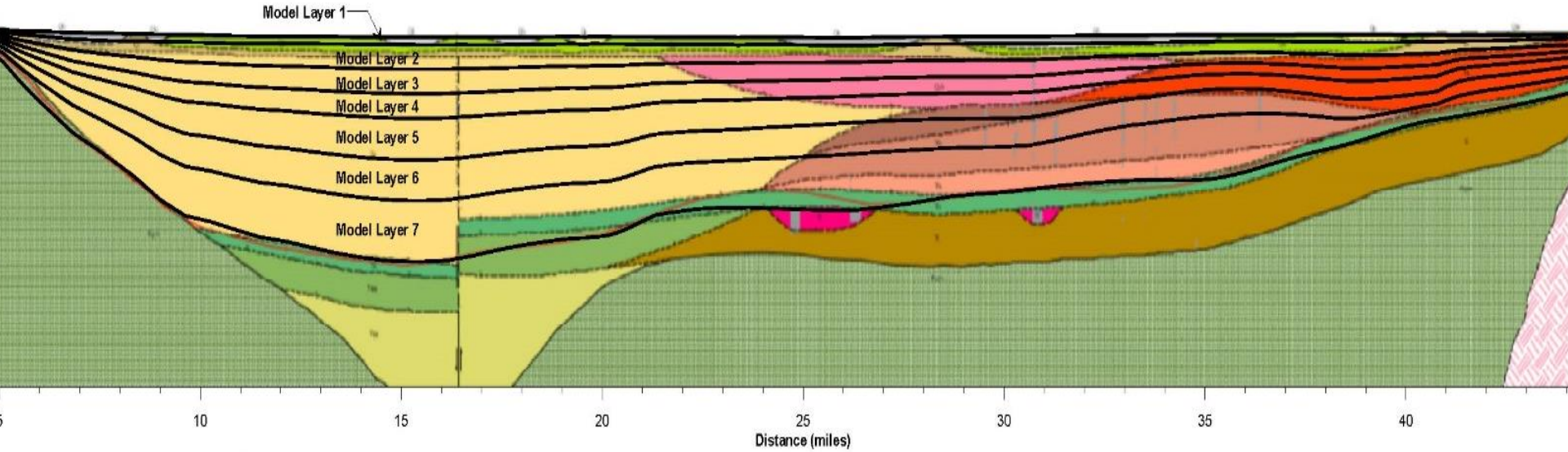
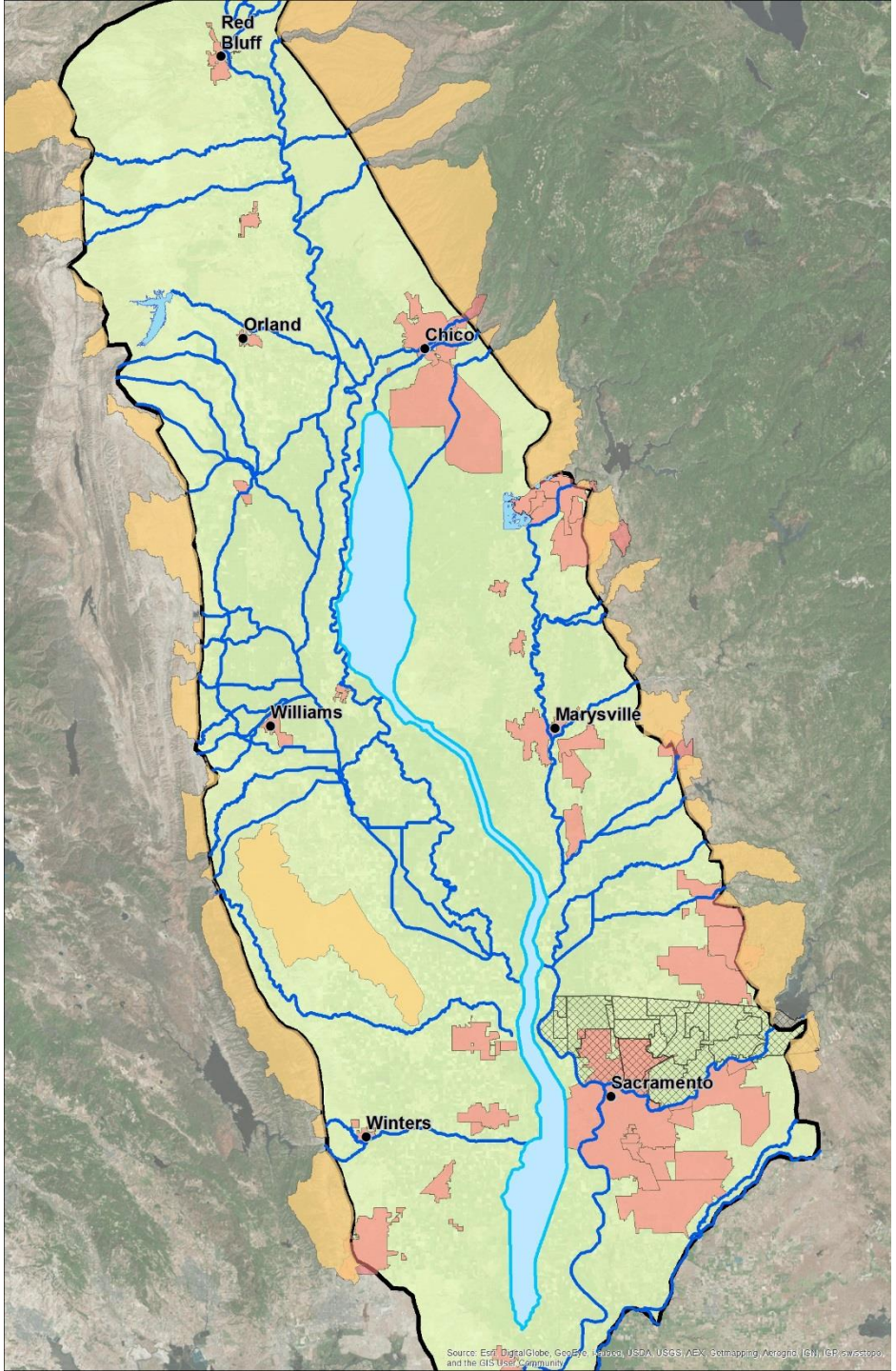


California Department of Water Resources. 2005. *Butte County Groundwater Inventory Analysis*. Prepared by the Division of Planning and Local Assistance, Northern District. February.

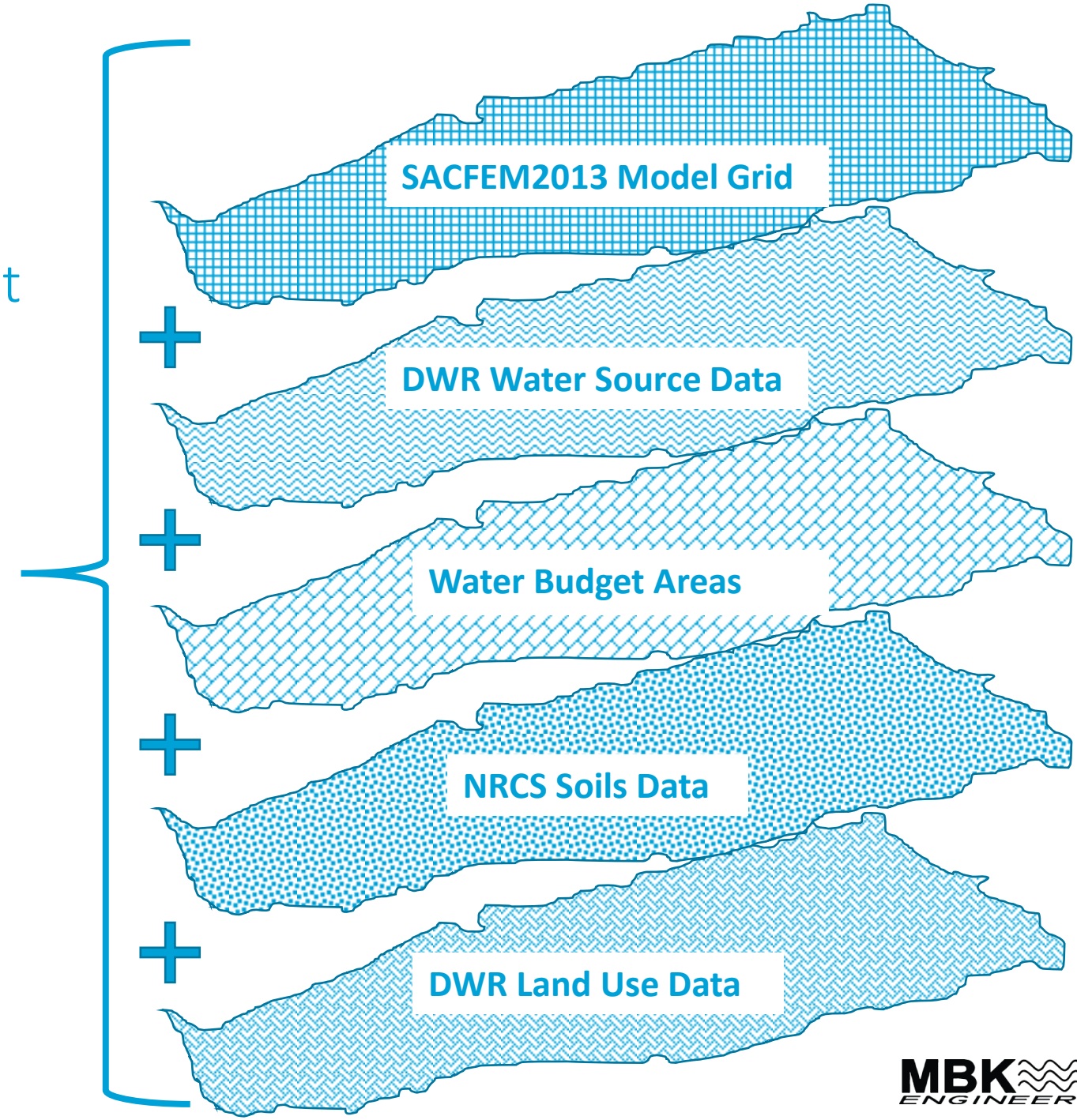
Model Construction Boundary Conditions

- Head-Dependent
  - Streams and lakes
  - Groundwater discharge to land surface
  - Flood bypasses
- Specified-flux Boundaries
  - Deep percolation of precipitation and applied irrigation water
  - Agricultural groundwater pumping
  - Mountain front recharge
  - Urban pumping
  - No-flow



Model Construction Agricultural Water Budget

GIS Data Set



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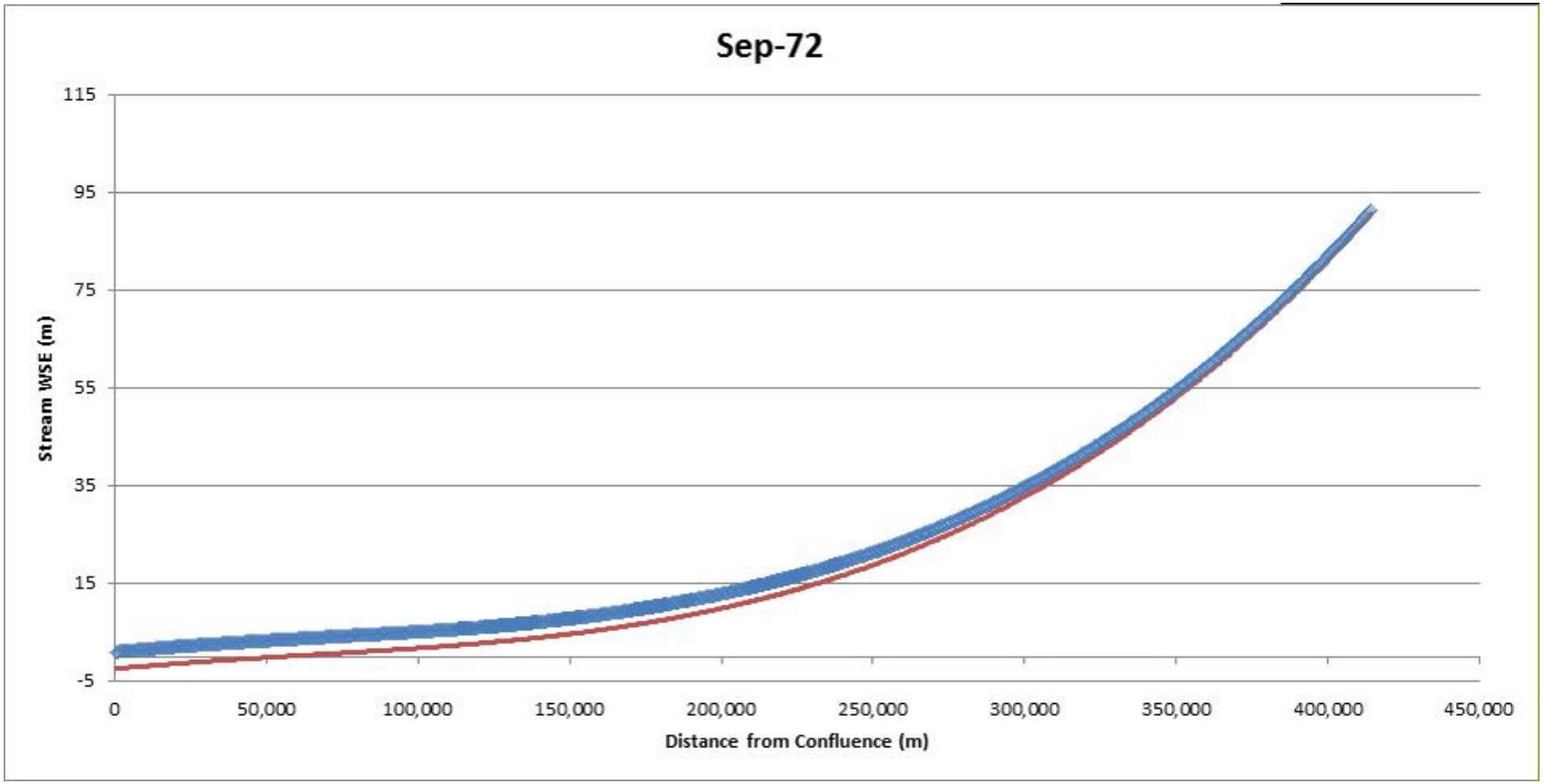
Model Construction
Transient Stream Stage



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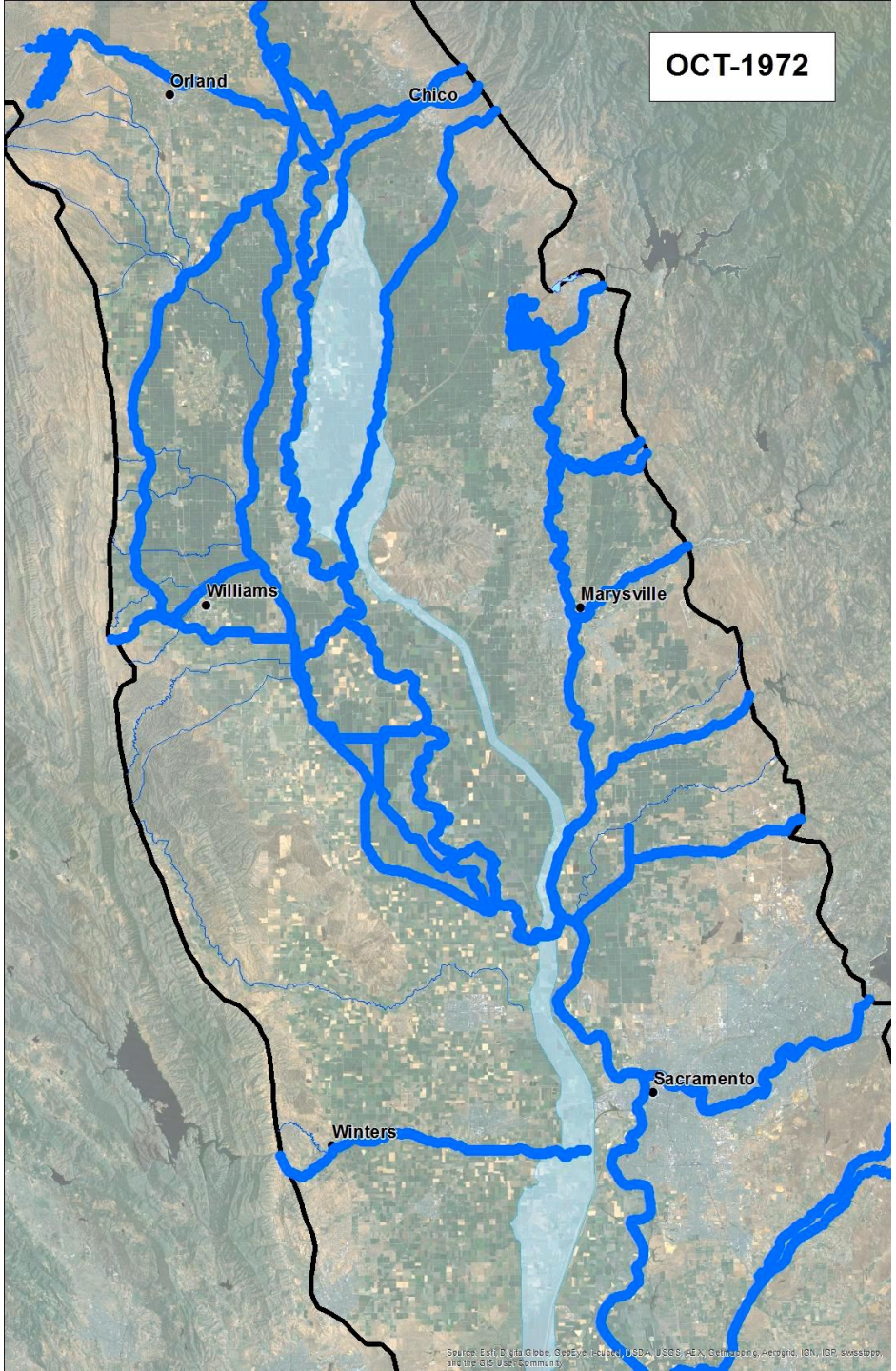
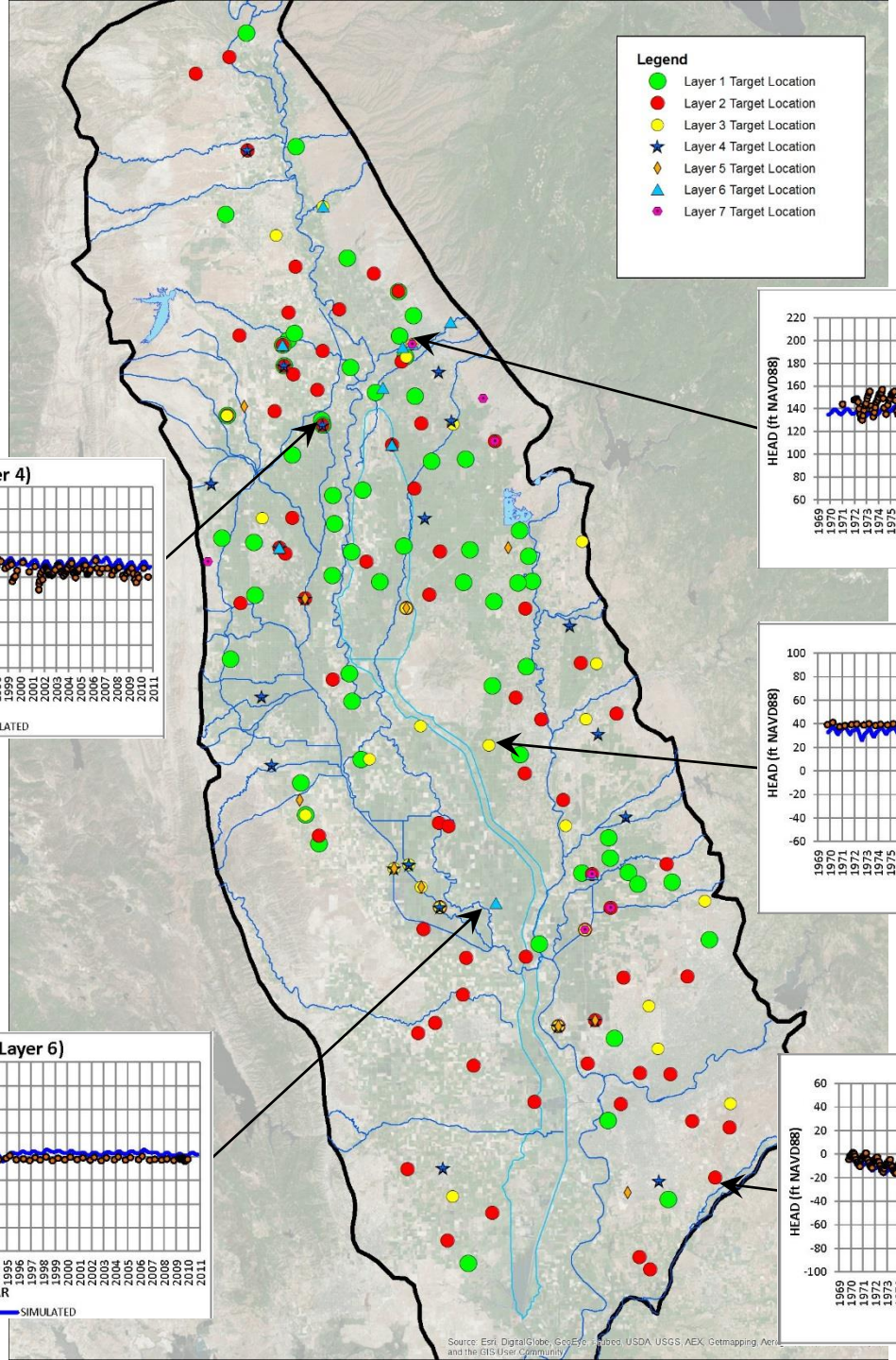
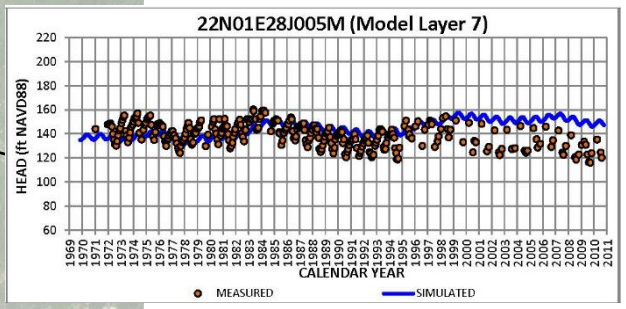
Model Construction Transient Stream and Flood Bypass Inundation Areas

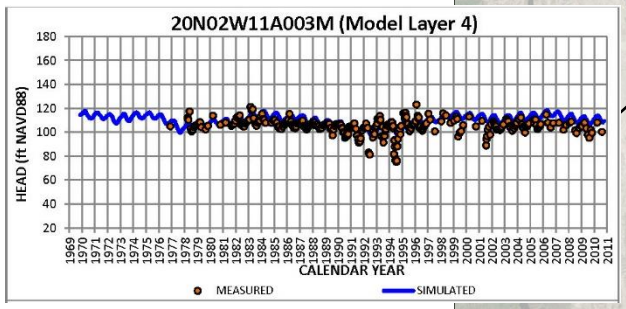
- 50 individual streams
  - Transient stages
  - Distribution of active versus dry streams based on historical gage data
- Two lakes (Thermalito and Black Butte)
  - Constant stage
- Three flood bypasses
  - Butte, Sutter, and Yolo
  - Historical flow data and flow-stage relationships used to estimate bypass inundation

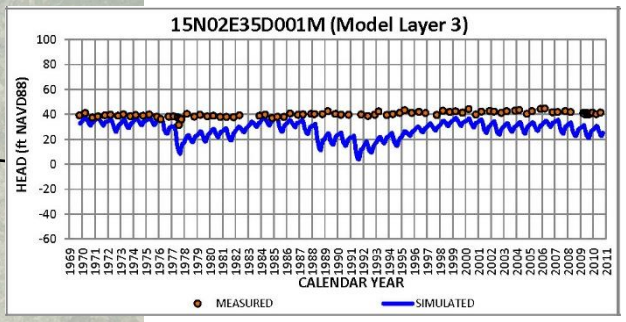


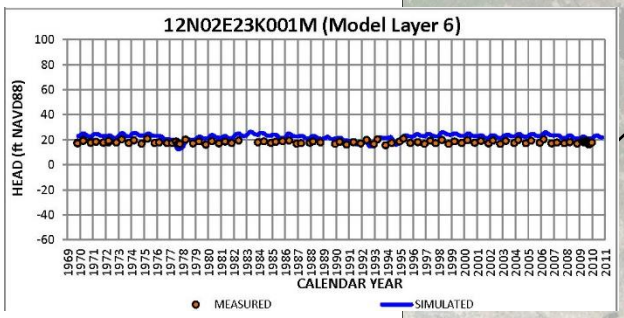
SACFEM$_{2013}$ Calibration

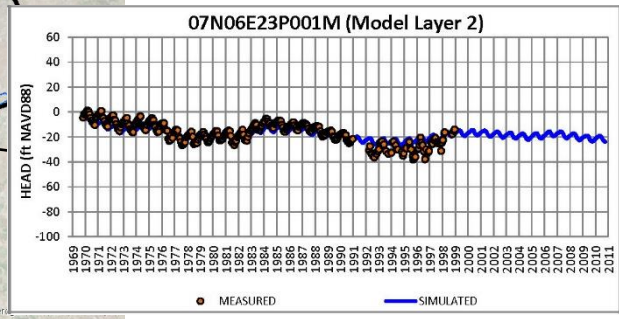




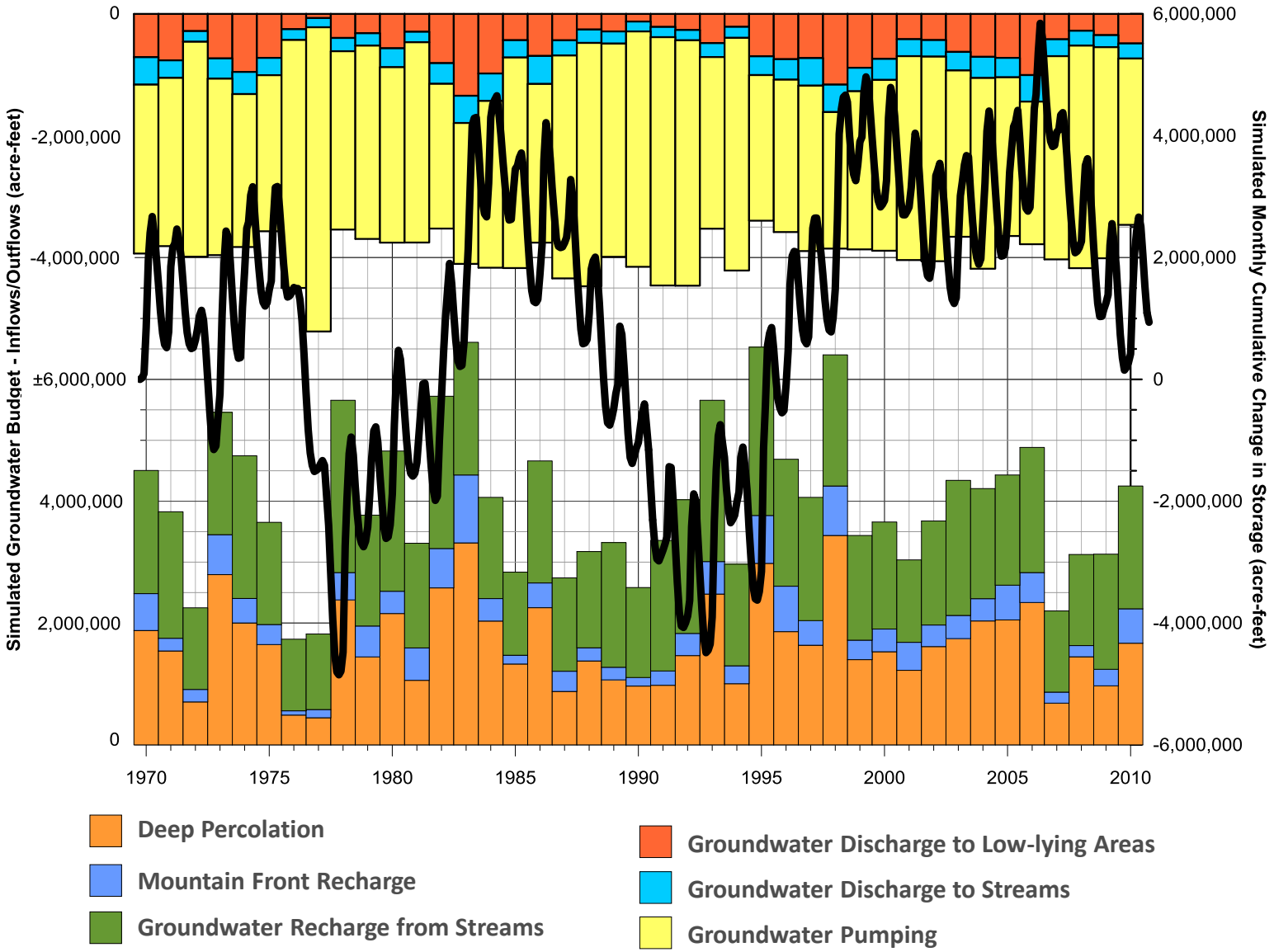








Simulated Water Budget



Summary

- Recent refinements to $SACFEM_{2013}$ include:
  - Enhanced depiction of surface water features
  - Extension of simulation period through Water Year 2010
  - Improvement of the calibration target dataset
- $SACFEM_{2013}$ is available for local/regional scale impacts analysis
- SACFEM has been applied to numerous GW production projects
  - Lower Tuscan Conjunctive Use Study
  - Proposition 50 Groundwater Production Projects (Feather WD, Garden Highway MWC, Meridian Farms MWC, Pelger MWC, RD-108, and River Garden Farms)
  - Long-Term Water Transfer Program
- Documentation and comprehensive user's manual are available (LTWT EIR, Appendix M)
  - http://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=18361
- If your project requires use of public domain model code or dynamic streamflow predictions, $SACFEM_{2013}$ datasets can be utilized to support other platforms