Sustainable Groundwater Management Act and Groundwater Sustainability Plan for the Napa Valley Subbasin

Hydrologic Model Updates

Nick Newcomb

September 14, 2023

Luhdorff & Scalmanini
Consulting Engineers

Outline

Model Background

Surface Water Updates

- Upper Watershed Model Updates
- Channel Geometry Updates

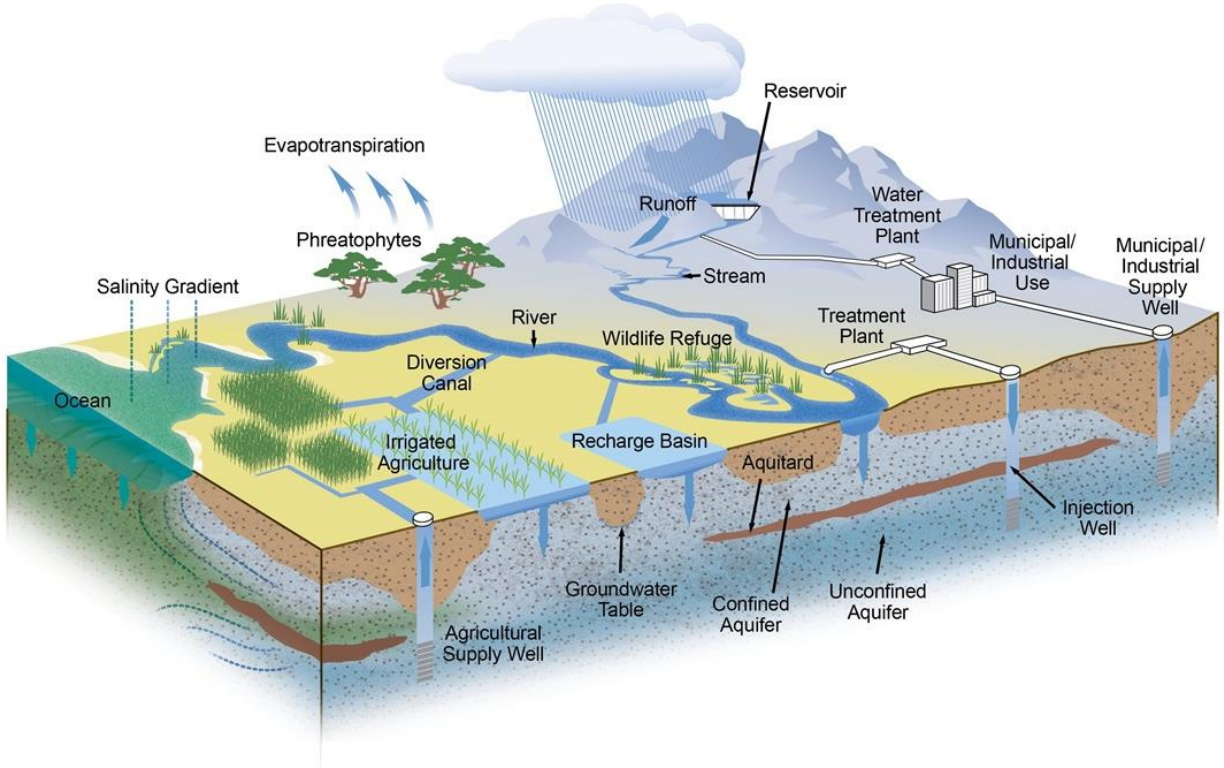
Water Use Estimates

- Background
- Soil Moisture Updates
- Data Gaps

Additional Updates

- Climate Change
- Geology
- Observations

Integrated Model Framework



Model Background

Napa Valley Integrated Hydrologic Model

- Simulates landscape processes, surface water processes and groundwater and how they interrelate

Integration of Various Data Types

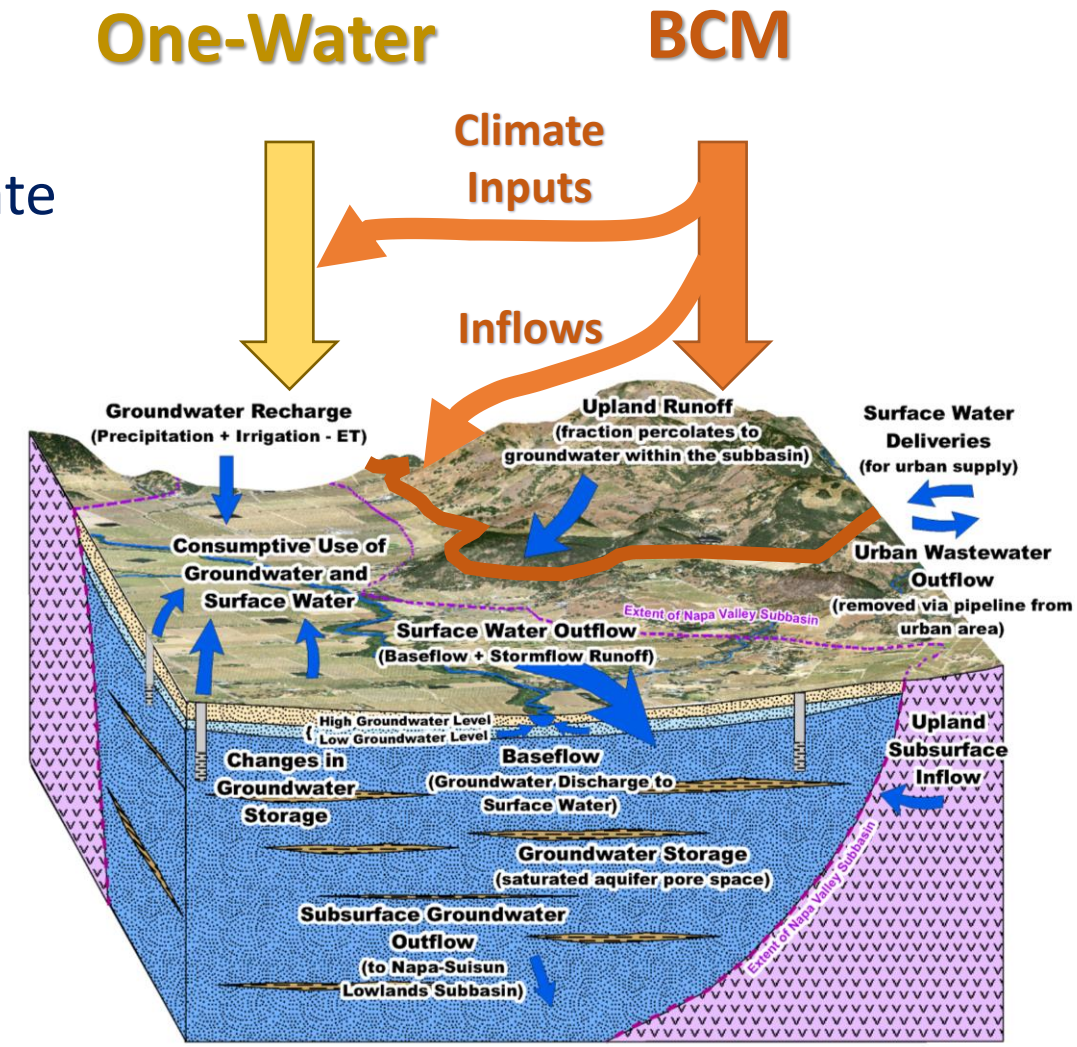
- Many different data types
- Data are spatially and temporally variable

Future Hydrologic Response

- Reasonably bound future hydrologic conditions
- Evaluate future changes to climate, land use, etc.

Support Management and Policy Decisions

- Inform stakeholders and managers
- Inform monitoring and future data collection



Surface Water (Background)

Tributary Inflows

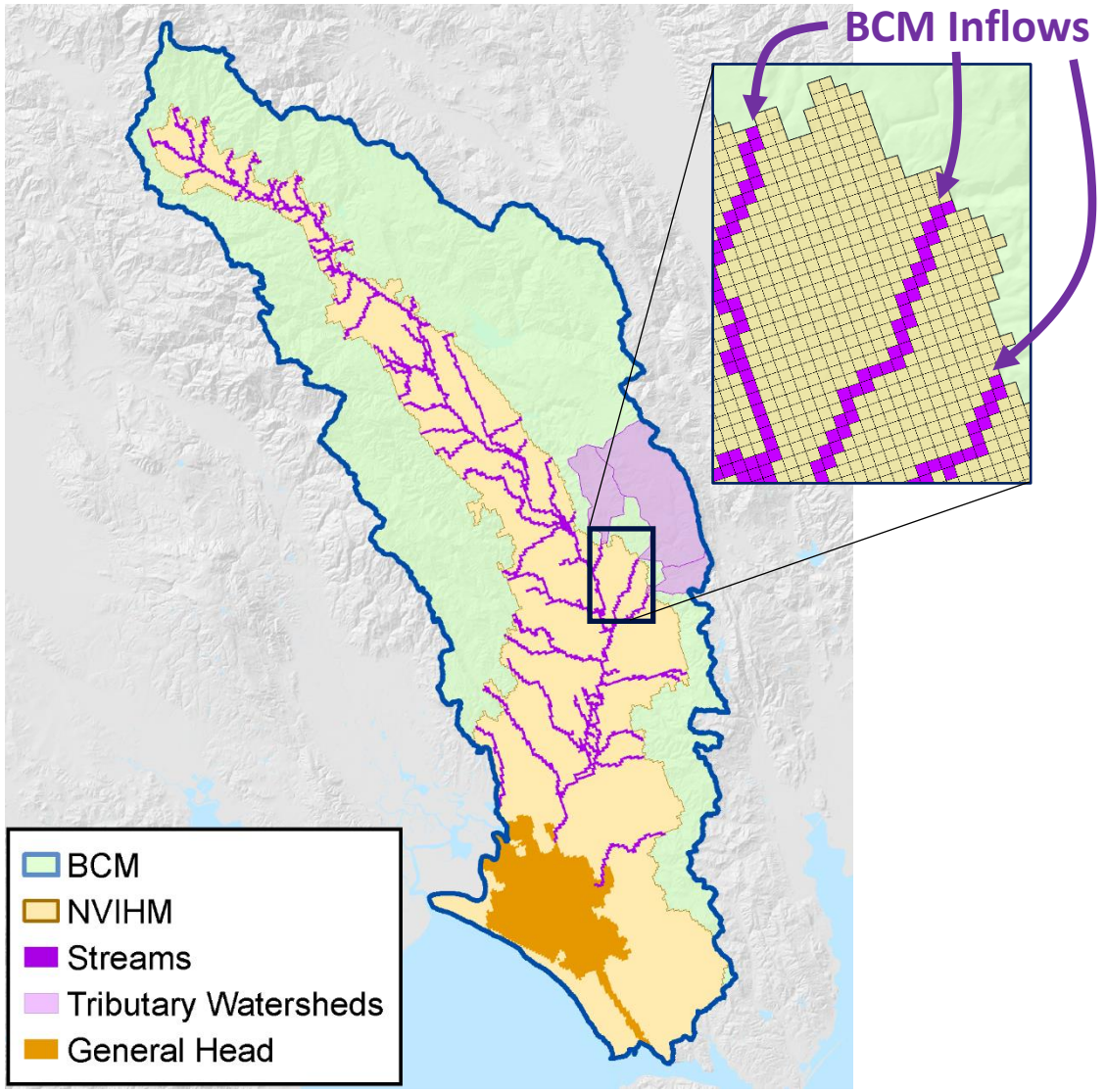
- Upper watershed response using the statewide Basin Characterization Model (BCM)
- BCM post-processed to provide tributary recharge & runoff

Flow

- Calculated internally from Manning's Equation
- Diversions and runoff & returns from landscape

Stream Properties

- Channel geometry is fixed
- Channel elevation (LIDAR)
- Channel width estimated using areal lidar & imagery



Surface Water (Upper Watershed Updates)

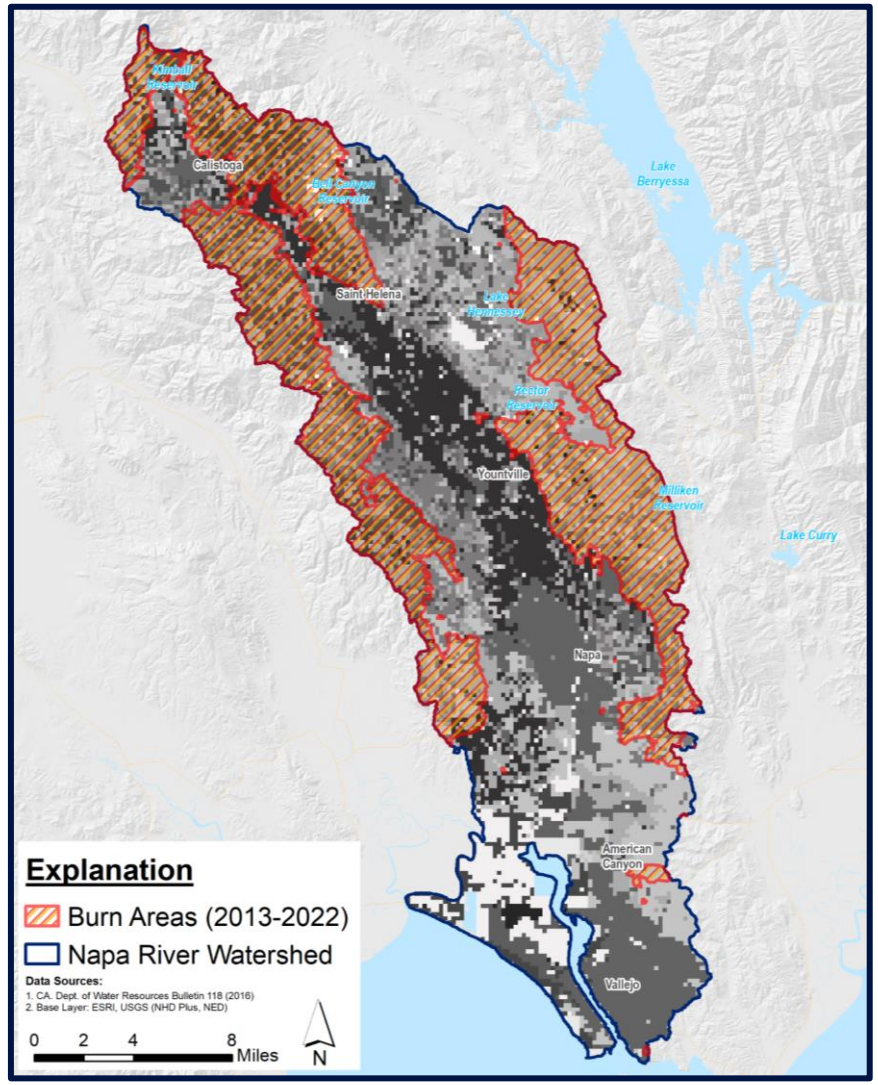
Rationale

- Statewide datasets may not reflect local conditions (land use, geology, climate, other characteristics)
- Land use is fixed over time (e.g., fires)
- Reliant on USGS for updated input and output
- Climate change models outdated

Updates

- In-house model (local inputs and refined scale)
- Time-variant land use
- Update climate change models

Napa Watershed Burned Areas (2013-2022)



Surface Water (Channel Geometry Refinements)

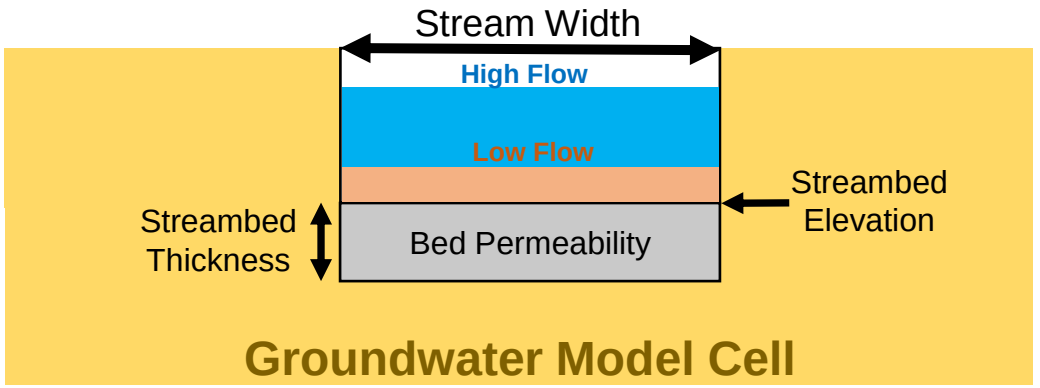
Rationale

- Channel geometry affects stream discharge, stage, width and interaction between groundwater and surface water
- Channel geometry is not fixed in time

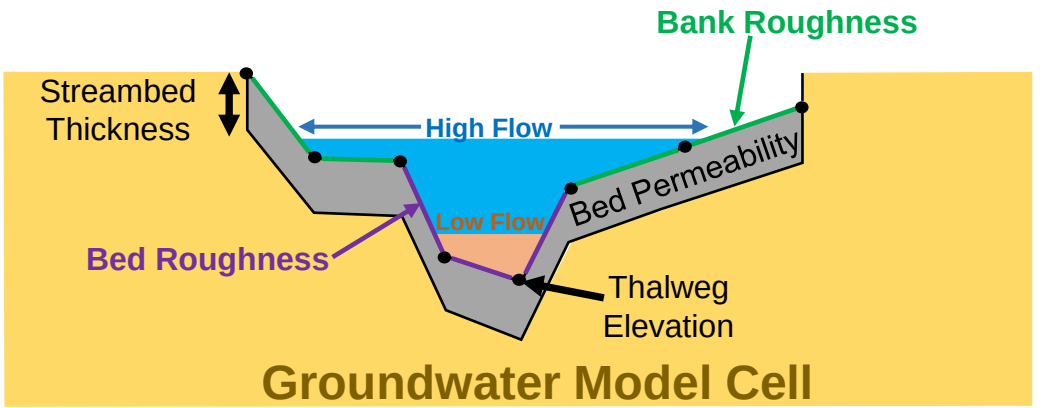
Updates

- Update channel methodology to better represent geometry
  - Lidar (2003, 2018)
  - Channel cross sections from pre- and post-restoration
- Utilize datasets to vary channel geometry over time
- Include time-variant land use in BCM

Rectangular Channel



Modified Channel Geometry

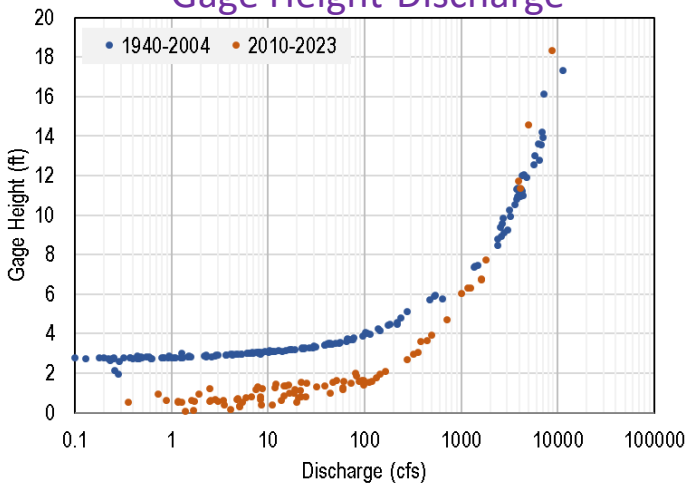


Surface Water (Verification & Utility)

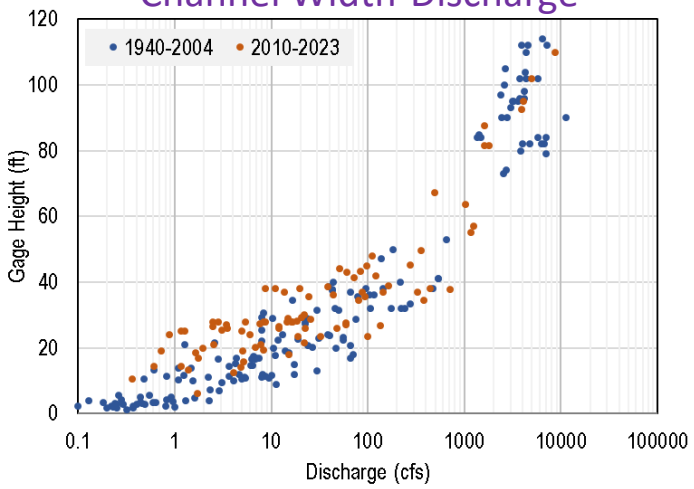
Napa River at St Helena (1145600)

Stream Mechanics

Gage Height-Discharge



Channel Width-Discharge



Verification

- Comparison of modeled relationships to USGS field measurements at different flows

Calibration

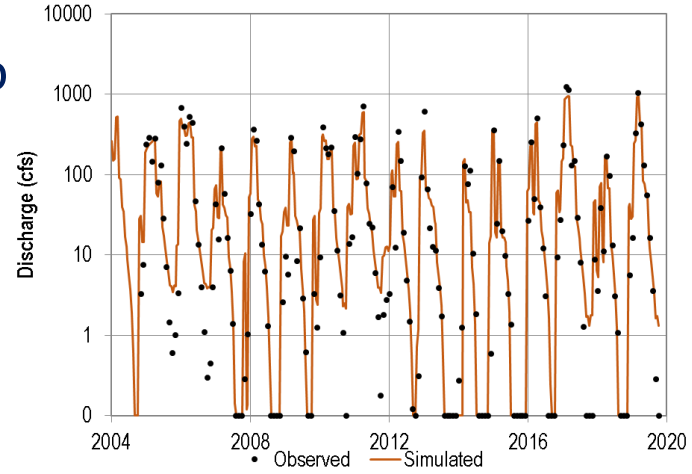
- Compare simulated to measured flow at USGS and RCD gages
- Leverage Stream Watch (flow vs. no flow)

Re-evaluate

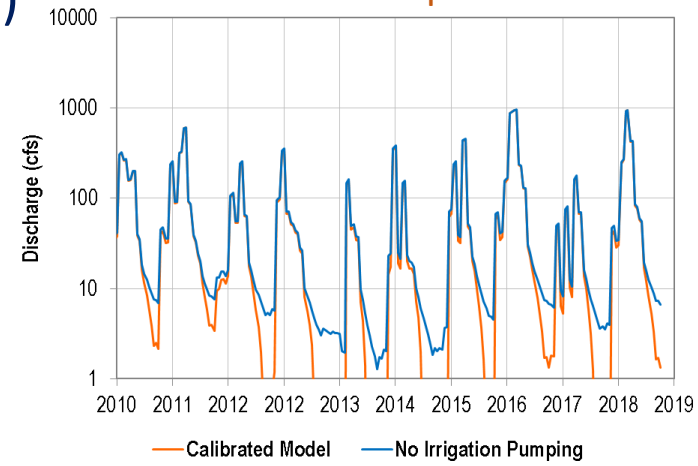
- Stream conditions (flow duration, groundwater-surface water interaction)
- Stream depletion

Model Performance

Streamflow



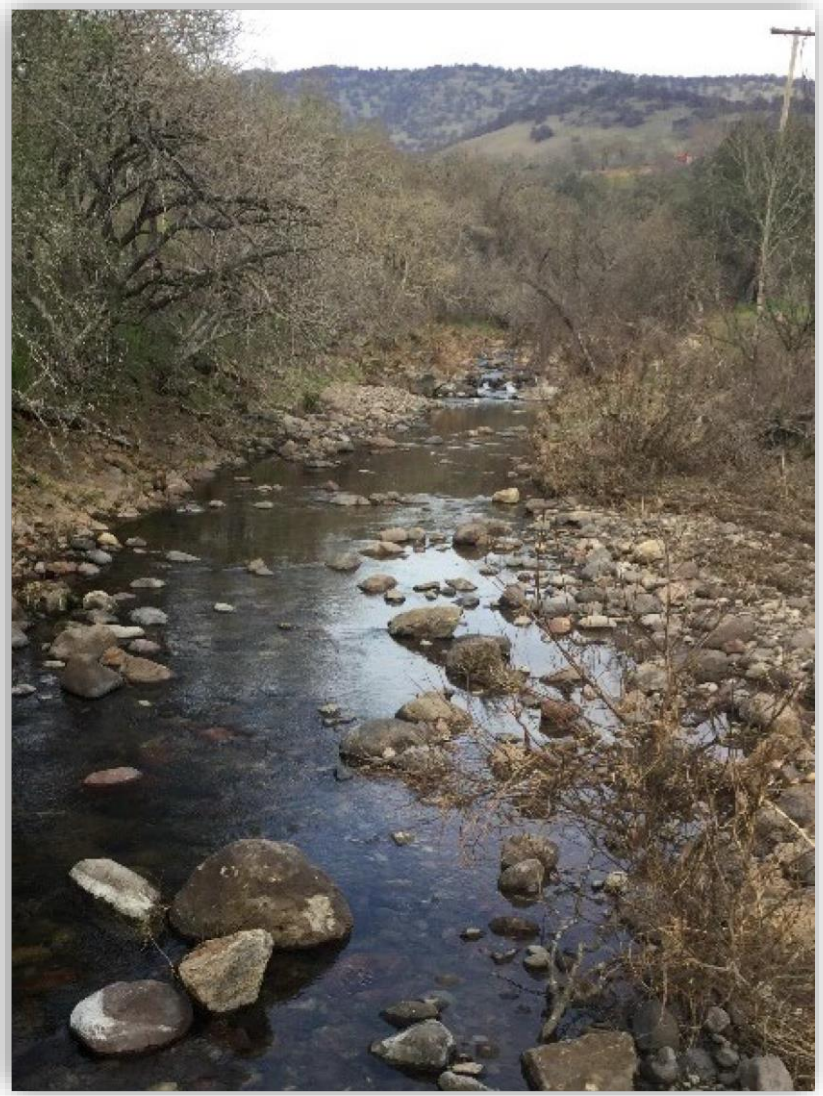
Stream Depletion



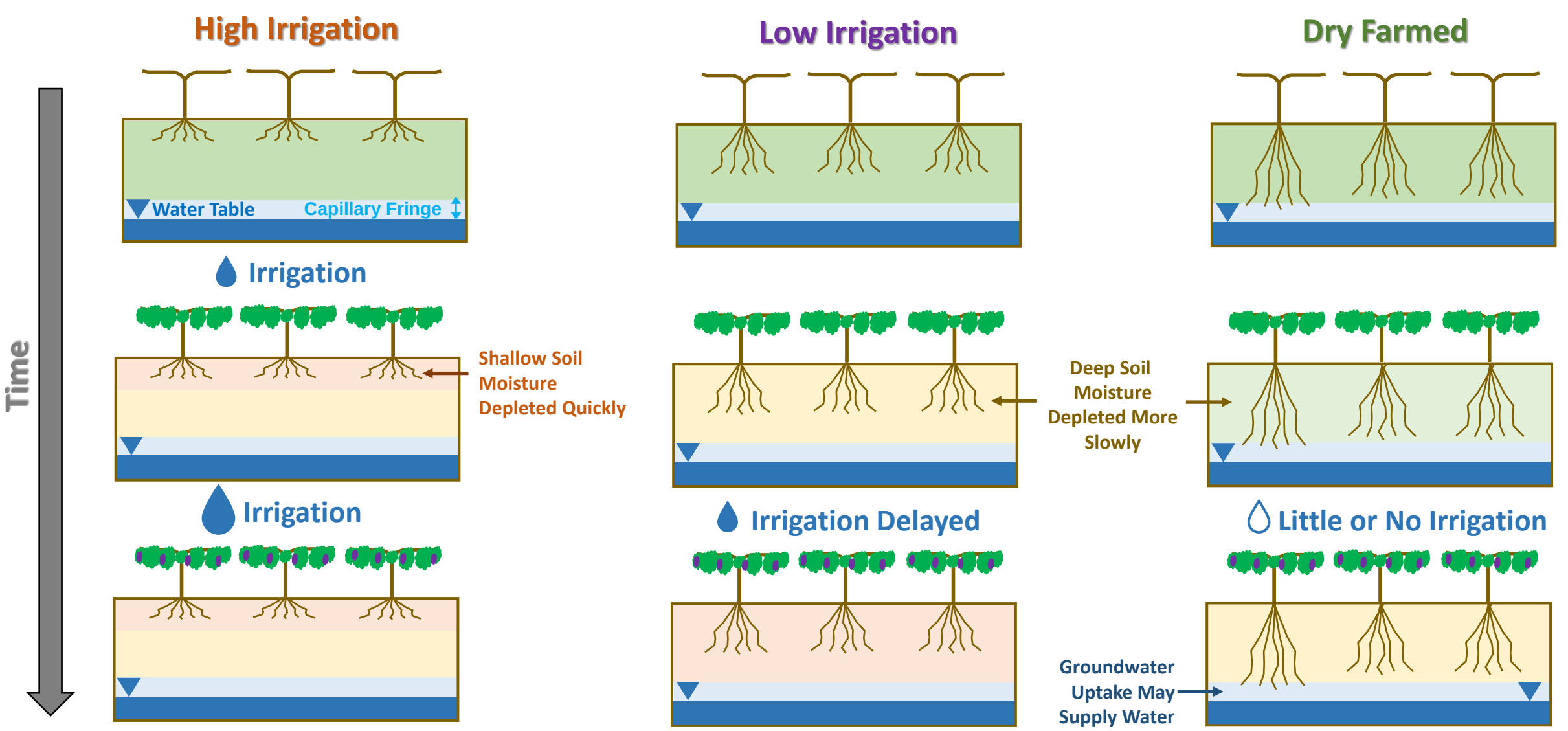
Discussion Topics

What other watershed characteristics could be important to refine or update?

Are there any other data that could be leveraged to better represent surface water processes?

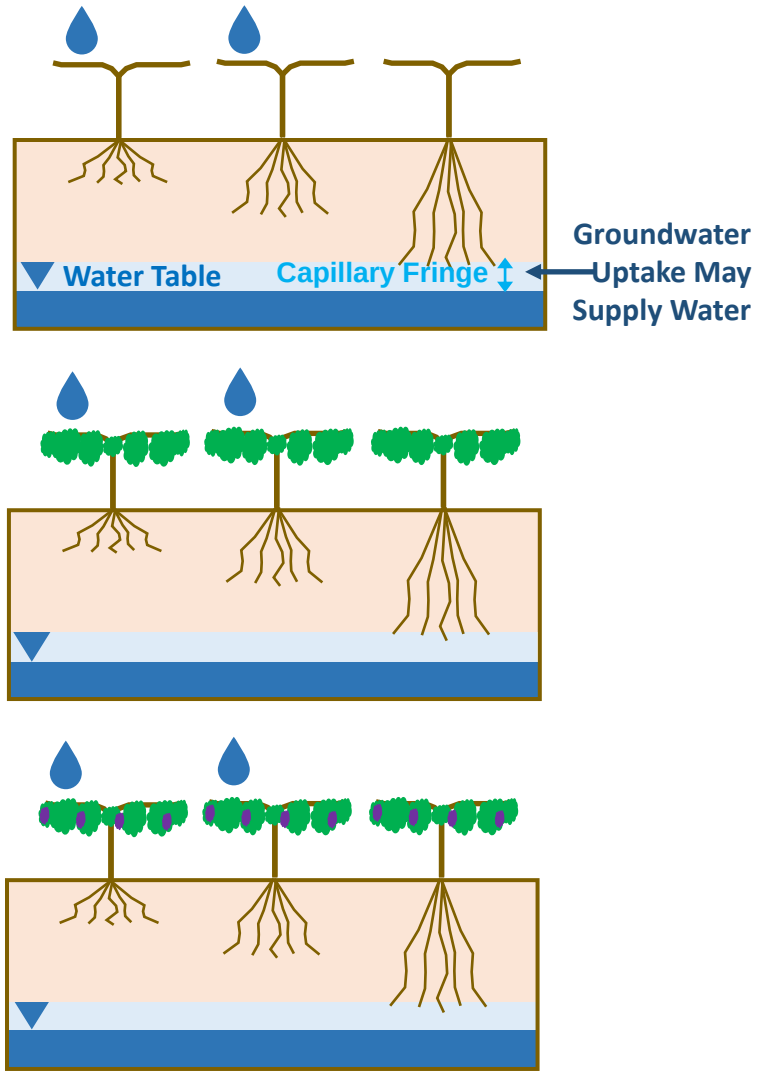


Water Use (Soil Moisture Storage Background)



Water Use (Soil Moisture Storage Updates)

Current Model Framework



Existing Framework

- Soil moisture storage is reduced on the scale of days to weeks
- Irrigation is required when precipitation or groundwater uptake cannot satisfy crop water demand
- Irrigation begins earlier in season
- Native vegetation can be easily water stressed

Update

- Coordination with USGS platform developers
  - Updates to model platform to incorporate longer-term soil moisture storage
  - Directly incorporate on-farm water storage in model platform and examine storage of runoff

Water Use (Evapotranspiration Updates)

Evapotranspiration

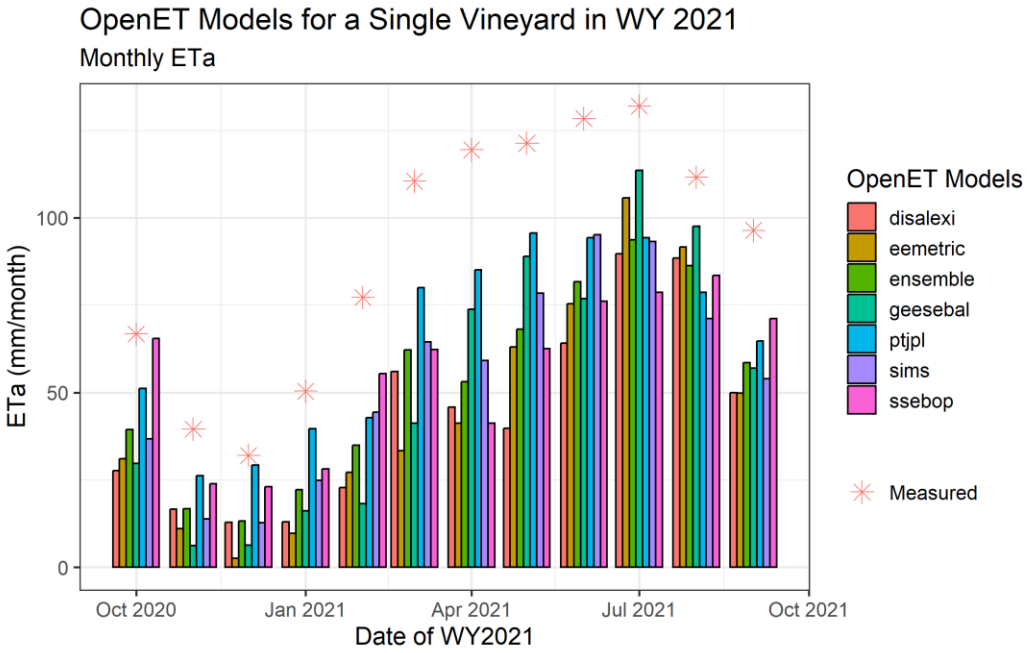
- Discrepancies between measured (Tule) and remotely sensed ET (OpenET)
- Issues with local CIMIS station

Crop Coefficients

- Assigned by crop type (e.g. white vs black grapes)
- May not account for spatial variability in ET
- May not account for temporal variability in ET

Updates

- Determine Factors that influence Kc and ET
  - Physical Processes
  - Cultural Practices
- Developing approach to appropriately adjust framework to capture variability



Water Use (Other Considerations)

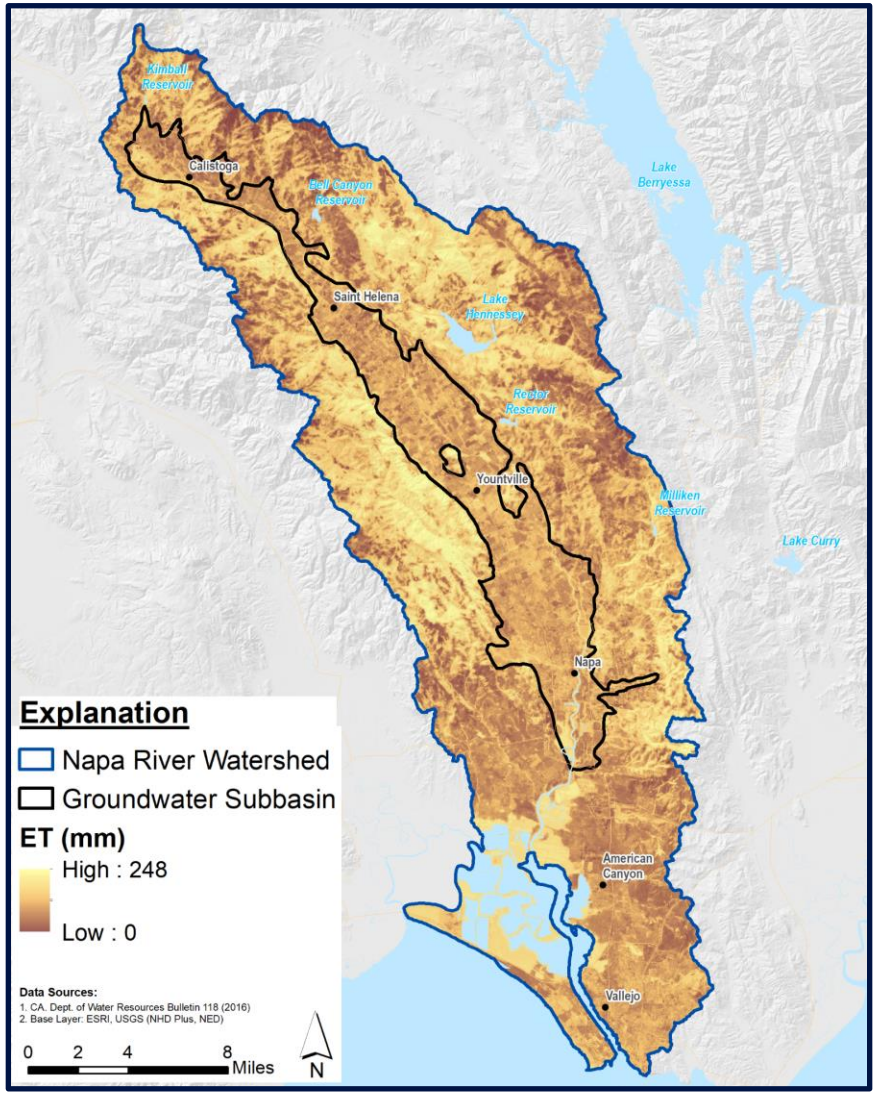
Data Gap (Measurements)

- Irrigation scheduling and amount
- Measured evapotranspiration
- Measured soil moisture

Data Gap (Information)

- Rooting depth
- Root stock
- Variety
- Row spacing
- Cover crop

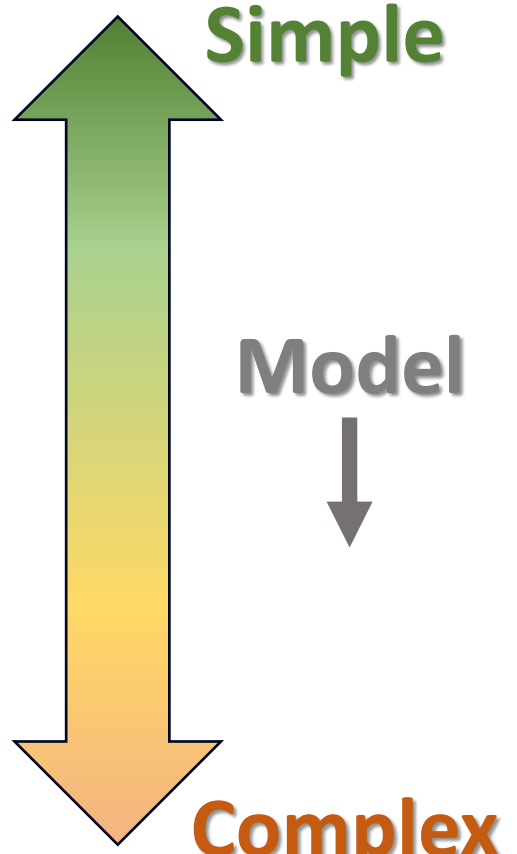
OpenET Evapotranspiration (July 2021)



Discussion Topics

How can we best leverage available data to develop inputs that are representative of land and water use in the Napa Valley?

What are the questions we should be asking growers and other stakeholders to collect the information we need?



Additional Elements

Climate Change

- Existing climate change models (CMIP5) are outdated and do not reflect local conditions well
- CMIP6 and coordination with DWR regarding best practices (in development)

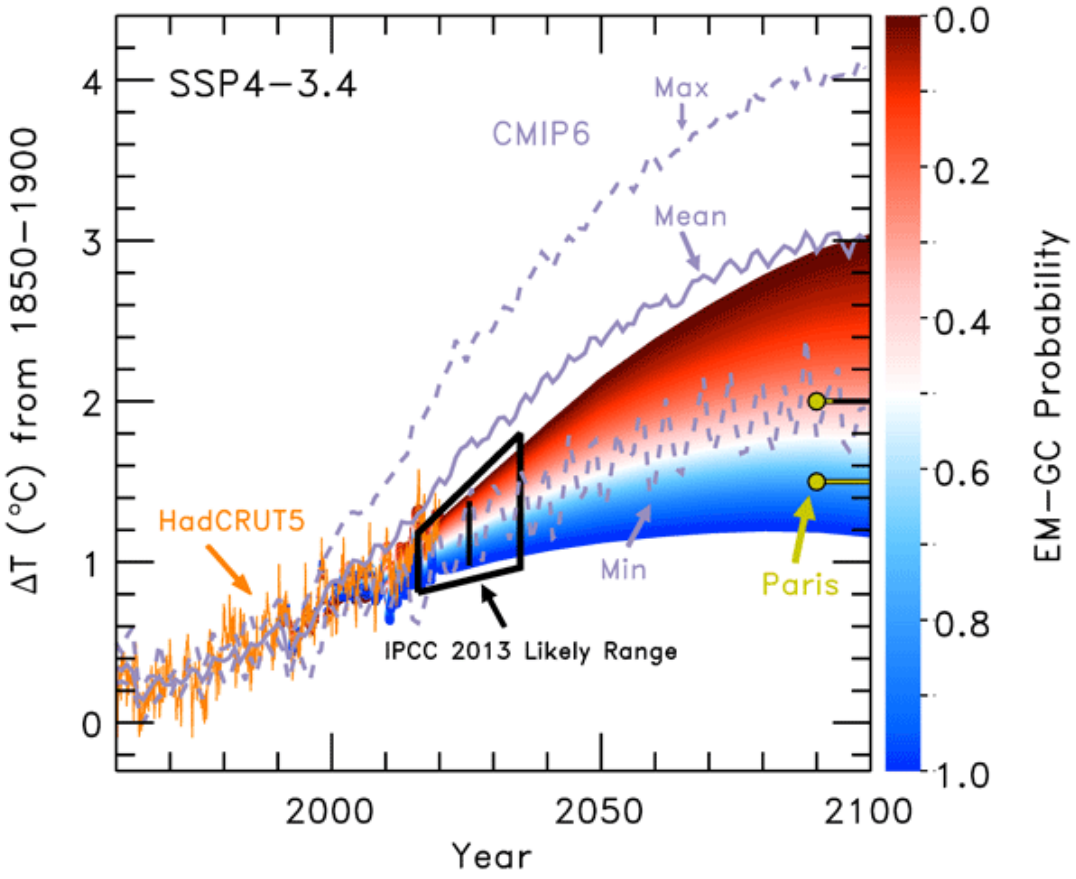
Geologic Refinements

- Continual refinements based on interpretation of new data and information
  - Alluvial thickness and aquifer configuration
  - Well distribution and completion by aquifer based on updated inventory and mapping

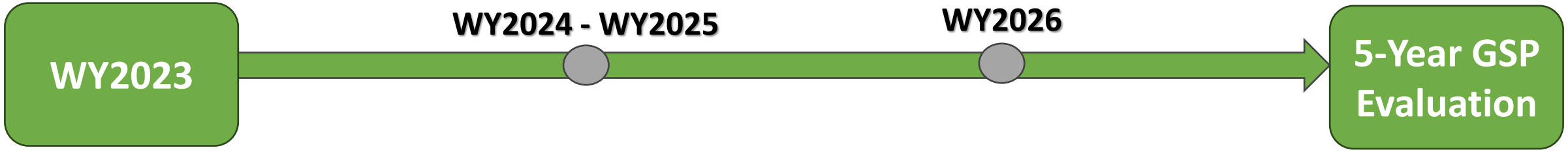
Observations

- Compare simulated and measured ET
- Qualitative data (Stream Watch)
- Vertical gradients from ISW monitoring sites
- Applied water (groundwater pumping)

Coupled Model Intercomparison Project (CMIP) Phase 6



Timeline



- Channel Geometry Update
- BCM Updates
- Aquifer Geometry Update
- Well Distribution Update
- Examine ET & Cultural Practices
- As-needed scenarios

- Aquifer Geometry Update
- Update ET in Model
- Platform Updates
  - Soil Moisture
  - On-Farm Storage
- Evaluate Modeled Water Use
- Update Observations
- Update Calibration
- As-needed scenarios

- Update Model Projections
- Update Climate Change Models
- Update Projected Water Budgets
- Update Scenarios
- Update Model Report

Thank You

Nick Newcomb
Luhdorff & Scalmanini, C. E.
nnewcomb@lsce.com
(530) 661-0109

Luhdorff & Scalmanini
Consulting Engineers

Napa County Groundwater Sustainability Agency

Jamison Crosby, ***Natural Resources Conservation Manager***
Planning, Building, and Environmental Services Department
1195 Third Street
Suite 210
Napa, CA 94559
jamison.crosby@countyofnapa.org

Ryan Alsop, ***County Executive Officer***
Napa County Groundwater Sustainability Agency
1195 Third Street
Napa, CA 94559

Brian Bordona, ***Director***
Planning, Building, and Environmental Services Department
1195 Third Street
Napa, CA 94559