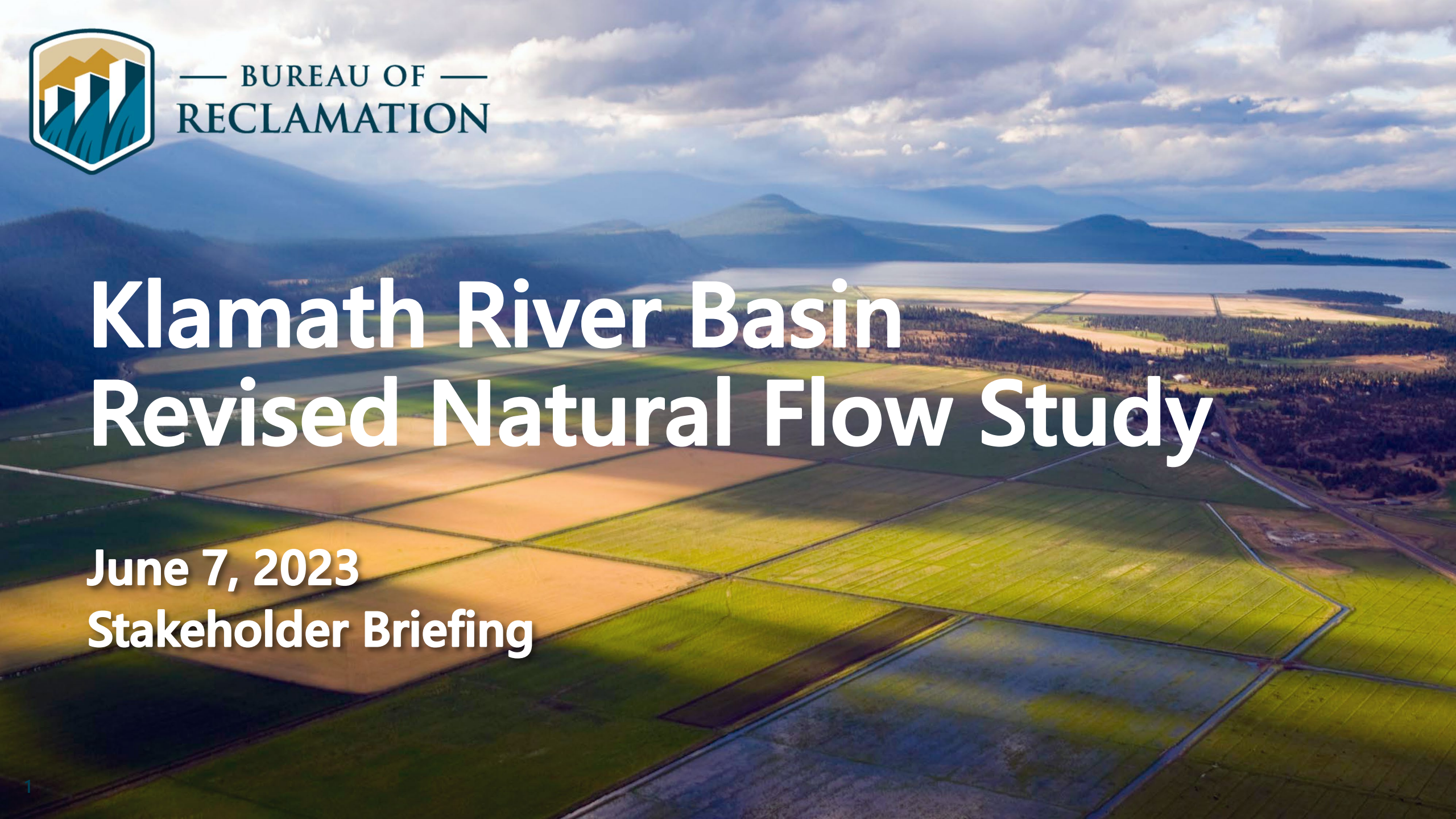


Klamath River Basin Revised Natural Flow Study

June 7, 2023
Stakeholder Briefing

Update Outline

- Study Overview
- Analysis Approach
- Revisit the Nov 2022 Workshop
- Action Items from Workshop
- Next Steps

Study Motivation – Update the 2005 Study

- Contribute to Klamath Basin Science Initiative
- Provide rigorous scientific information to support habitat studies, drought planning, and water supply/allocation planning
- Address 2005 NFS deficiencies (simplistic, coarse timescale, lack of transparency)

NEWS RELEASE ARCHIVE

Reclamation invests in new science updates for Klamath Project

Media Contact: Mary Lee Knecht, 916-978-5100, mknecht@usbr.gov

For Release: July 29, 2020

The sun rising over upper Klamath Lake near Klamath Falls, Oregon.

KLAMATH FALLS, Ore. – In response to Secretary of the Interior David Bernhardt and Reclamation Commissioner Brenda Burman's recent visit with Klamath Basin ranchers, farmers, tribes and community officials, Reclamation is launching a new science initiative to inform Klamath Project operations. The project supplies water to more than 230,000 acres of irrigated farmland along the border between Oregon and California. Updated science will improve water supply forecasting, operations planning and modeling.

"We heard firsthand from the community on the best path forward to address longstanding water challenges," **said Commissioner Burman.** "Reclamation is launching a fresh approach with an initial $1.2 million investment in applied science projects. These projects will improve our understanding of natural stream flows and the relationship between project operations and aquatic ecosystems in the Klamath Basin."

Study Application

- Tools to support the scientific understanding of the basin conditions
- Toolbox to address problems and provide solutions within the basin
- Baseline data and tools for a variety of separate studies and purposes, including upcoming ESA consultations

How do we define Natural Flow?

General Definition

"The water that would exist in a watercourse absent of human intervention."

2005 Natural Flow Study

Streamflow that would exist in a water course by removing "the effects of agricultural development on natural flows."

Current Natural Flow Study

"Naturalized streamflow is defined as the streamflow that would have occurred in the absence of agricultural and other development (roads, railroads, municipalities, etc.) during the 1981-2020 water years."

Scope of Work

2005 Natural Flow Study

- Monthly flow timeseries for water years 1949-2000

- National Research Council (NRC) Recommendations (2008)
  - Quantitative groundwater assessment
  - Daily time step
  - Improve ET estimates
  - Incorporate land cover changes

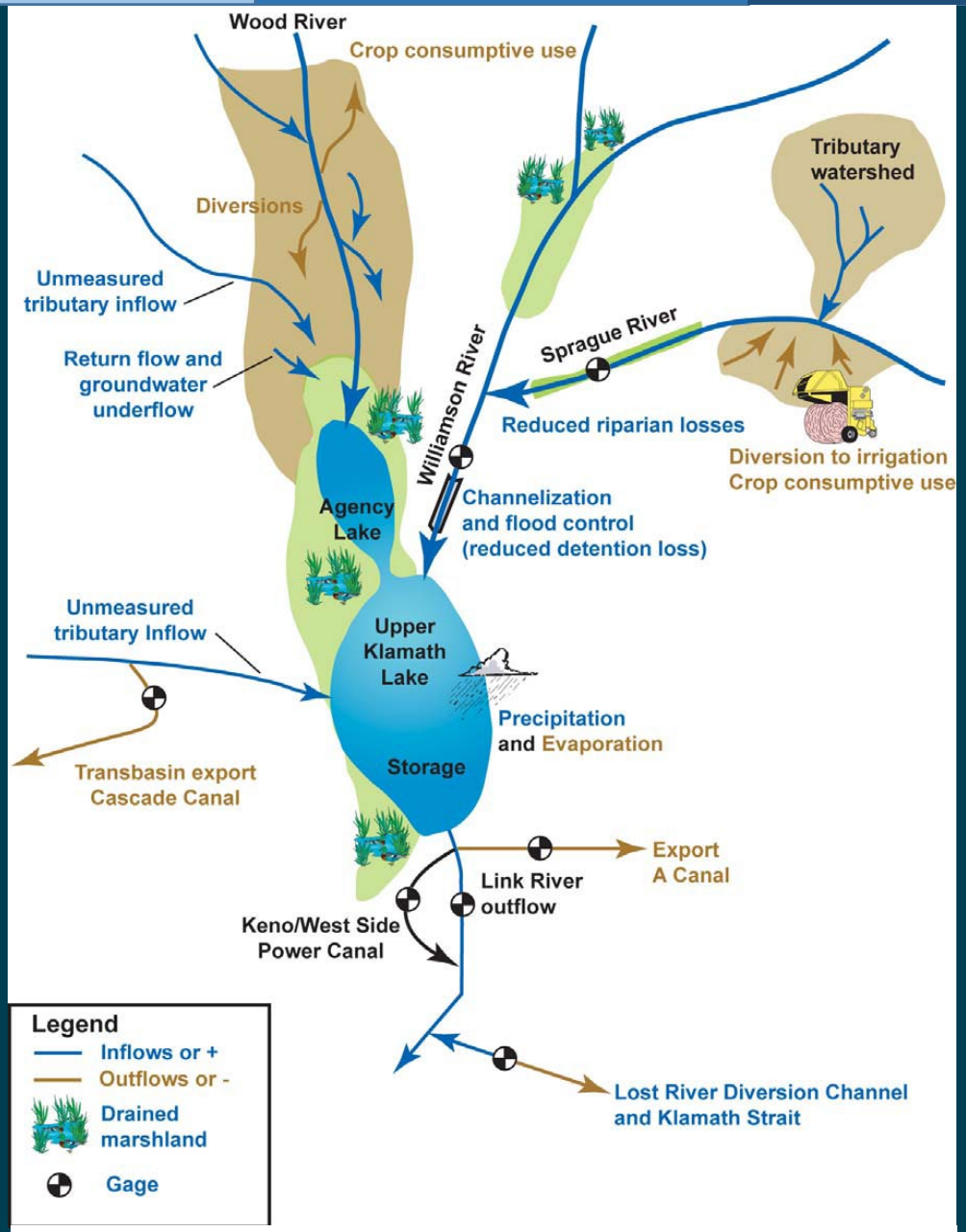
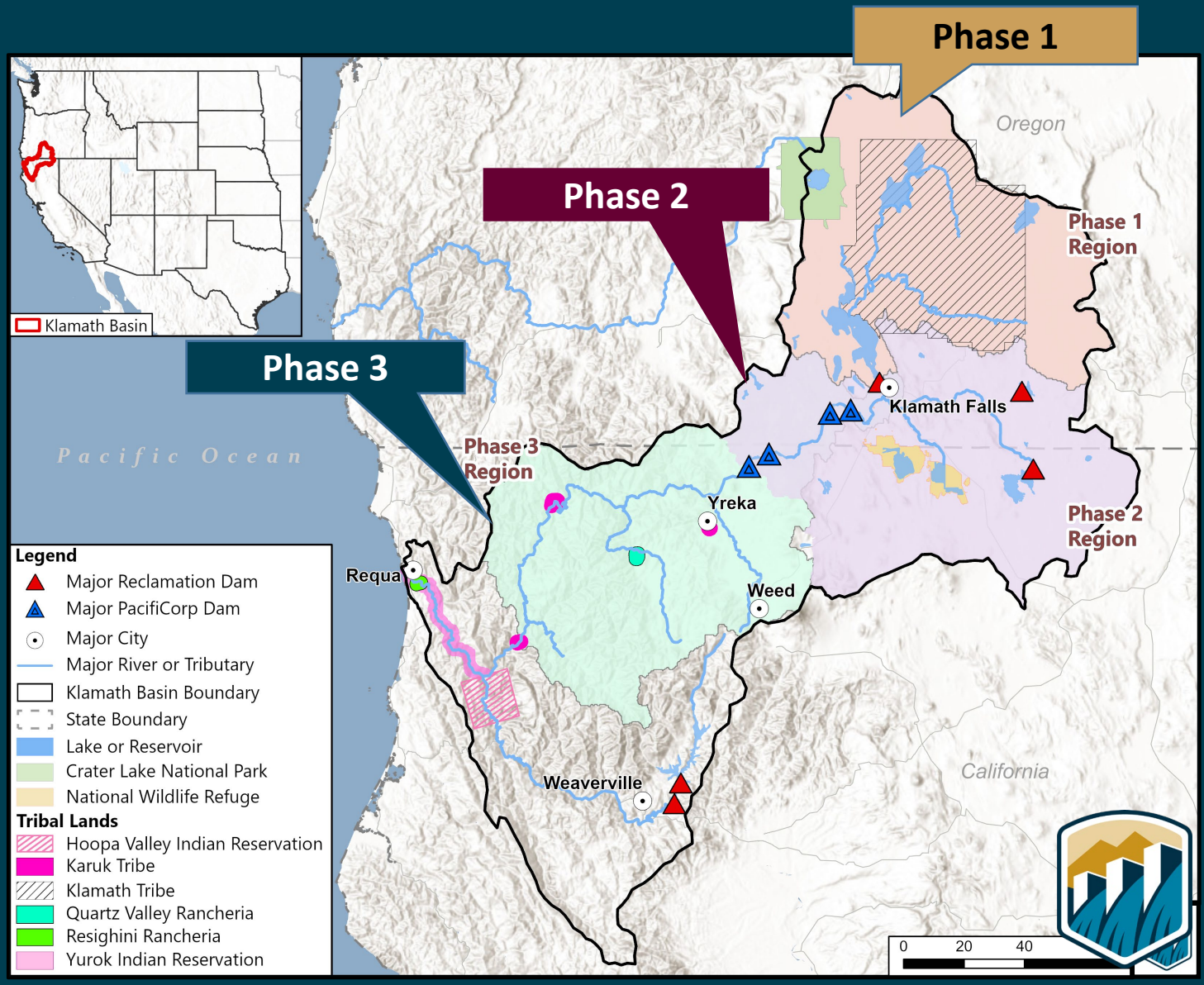


Figure 3. Sketch of the current conditions and types of changes that are addressed in this study.

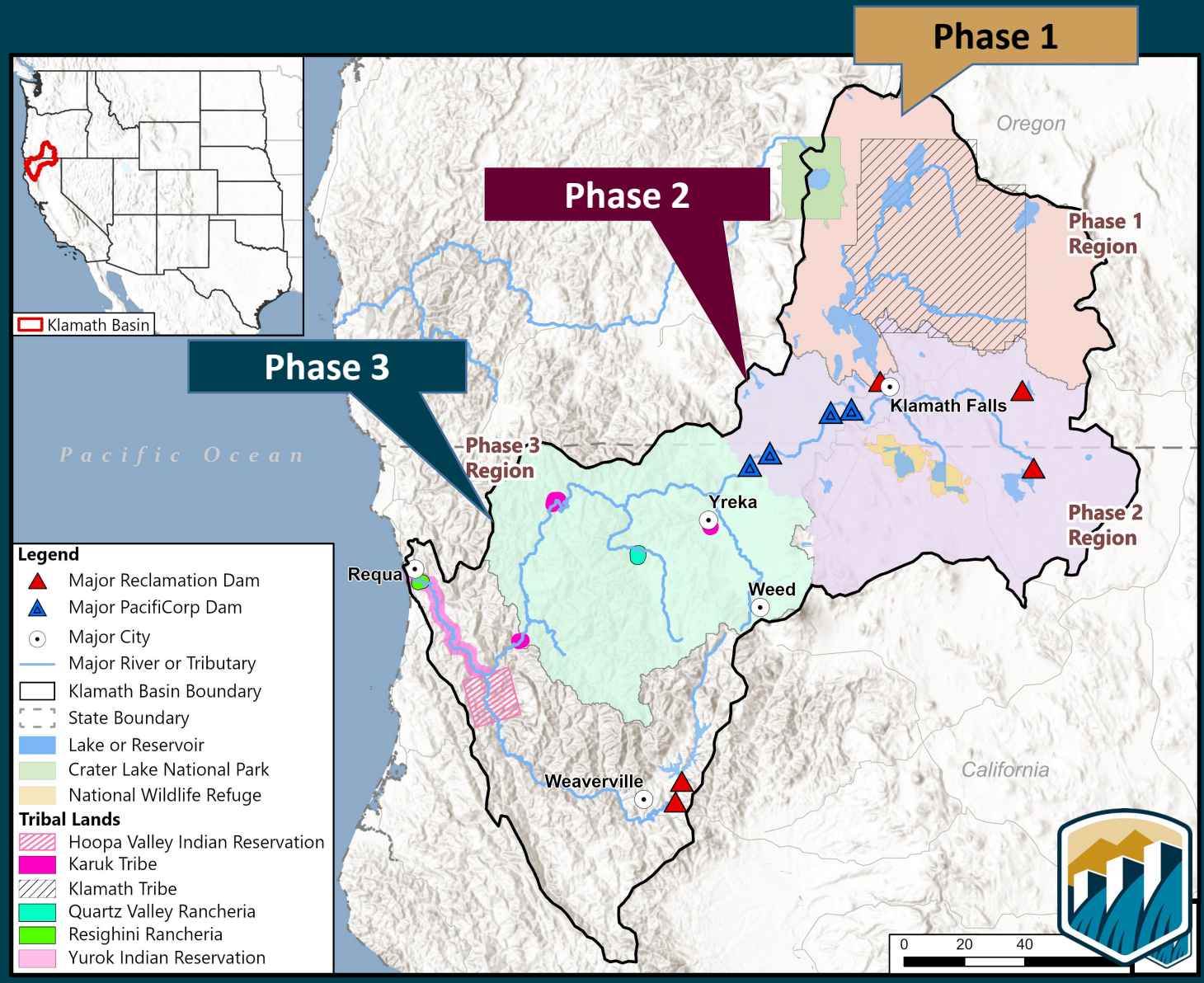
2025 Natural Flow Study

- Supply the most scientifically thorough estimates of daily natural flows
- Use current data, novel scientific technologies and methods
- Highly Influential Scientific Assessment (HISA)
  - Internal Peer Review
  - External Peer Review
  - Collaboration with local subject matter experts



Project Extent

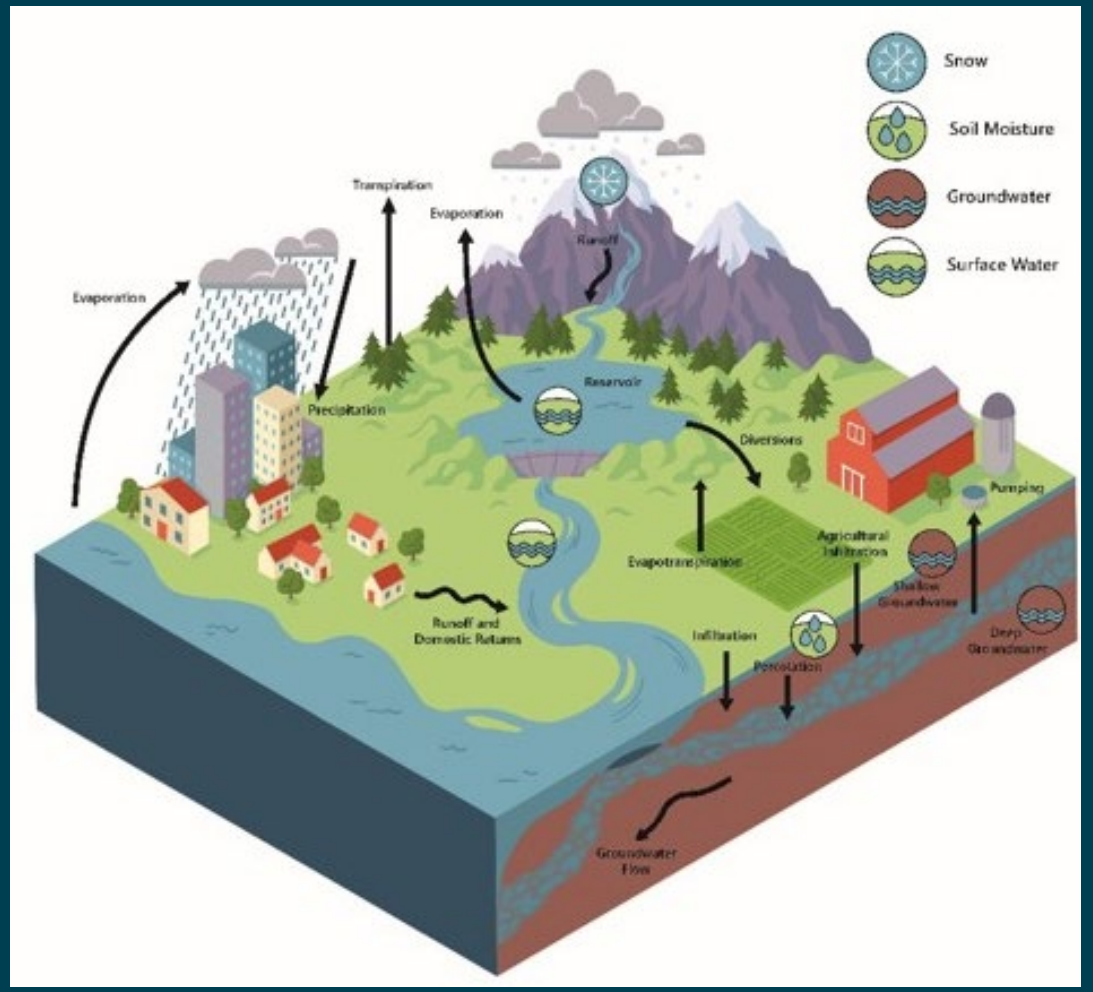
- Phase 1 – Above Link River Dam (UKL inflows)
- Phase 2 – Link River Dam to Irongate Dam
- Phase 3 – Irongate Dam to the confluence with the Trinity River



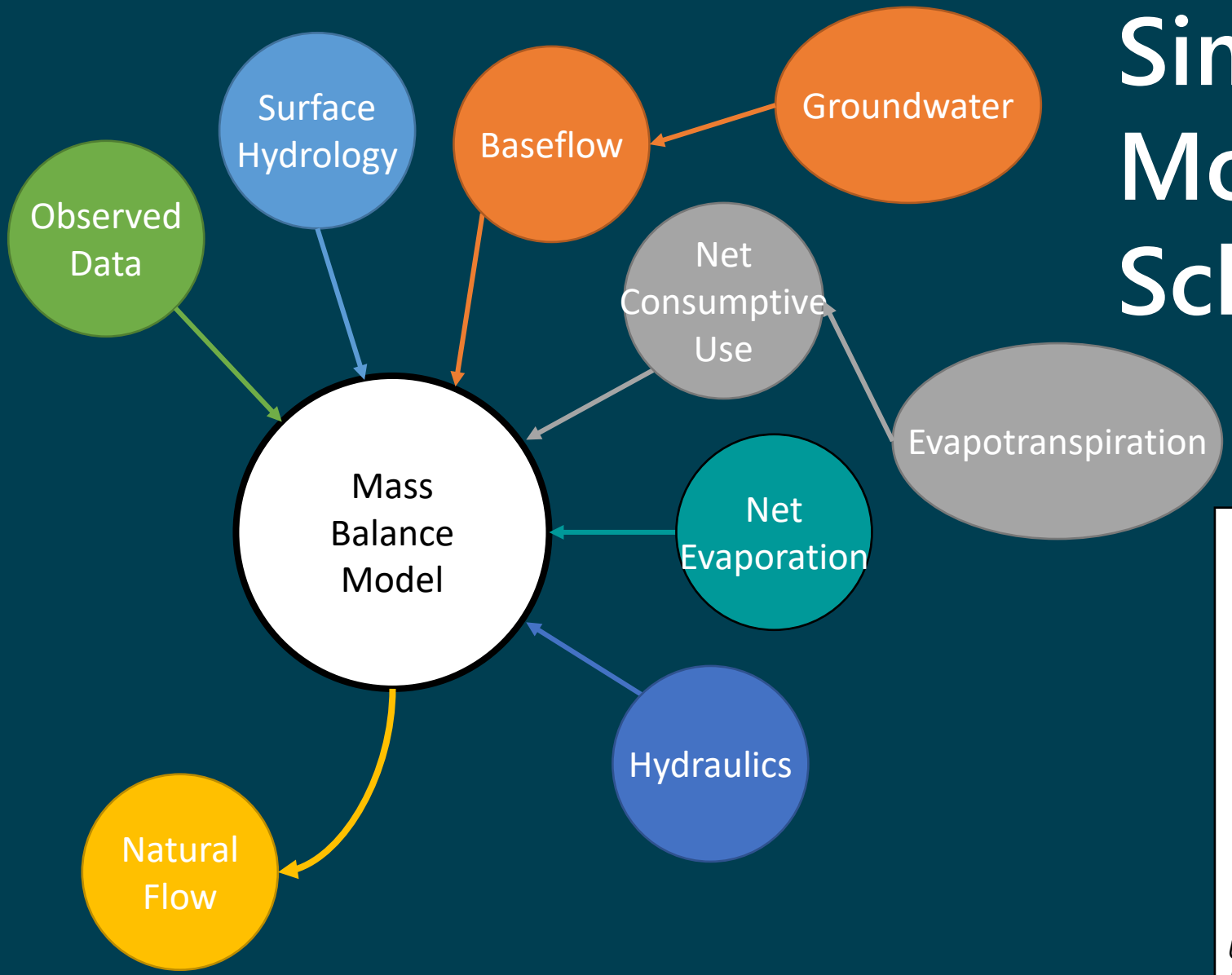
Basic Water Balance Methodology

Natural flow = gaged flow ± depletion ± water management

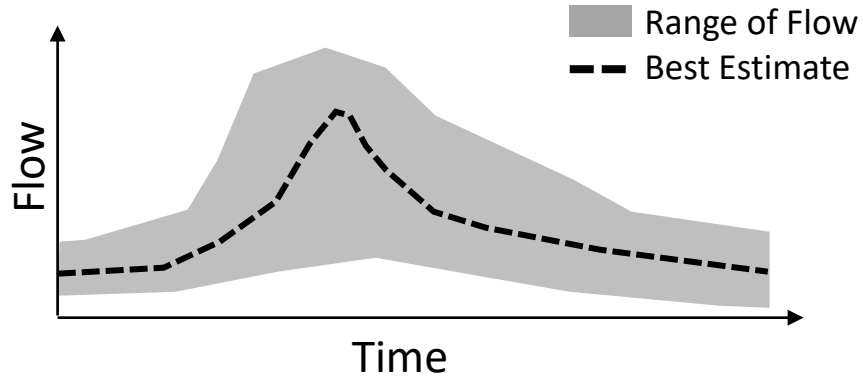
- Calibrate to **current** conditions
- Analyze models for **pre-development** conditions



Simplified NFS Modeling Schematic



Natural Flow Estimates



Use both methods and multiple parametrizations of RiverWare Mass Balance Model to generate range and best estimate of Natural Flow.

November 2022 Workshop Summary

Purpose: clarify goals and methods of the planned study and solicit recommendations for applicable data sets and references.

- 2 days & 7 presentations
- ~20+ stakeholders

Outcomes

- ~50+ action items to enhance the study
- ~10+ post-workshop reference sharing
- 2 Recorded Desktop Tours

Workshop Action Items

No.	Subject	Comment	Added By	Relevance?	Level of Effort	Owner
1	General	Connect with KBMP		Medium	Low	Marketa
2	General	Provide USGS a summary of potential opportunities		high	low	Caroline
3	General	Summarize opportunities to collaborate with USGS		High	low	Caroline
4	General	Build a working bibliography		High	High	Caroline
5	General	Desktop tours		High	Low	Caroline
6	General	Better figure showing how the models interact		High	Medium	Marketa
7	General	How do we account for fire suppression in the natural flow estimate?		Medium	low	Marketa
8	General	Develop a clear list of what is and isn't included in this study		High	Medium	Marketa
9	General	clearly state purpose of study and potential uses.		High	Low	Caroline
10	General	unify terms to describe natural flow (pre-development)		High	low	Caroline
11	General	Respond to OWRD's letter		Medium	medium	Caroline / Marke
		Update ET estimates w/ DRIs input -- this cannot be done in PRMS. However,				

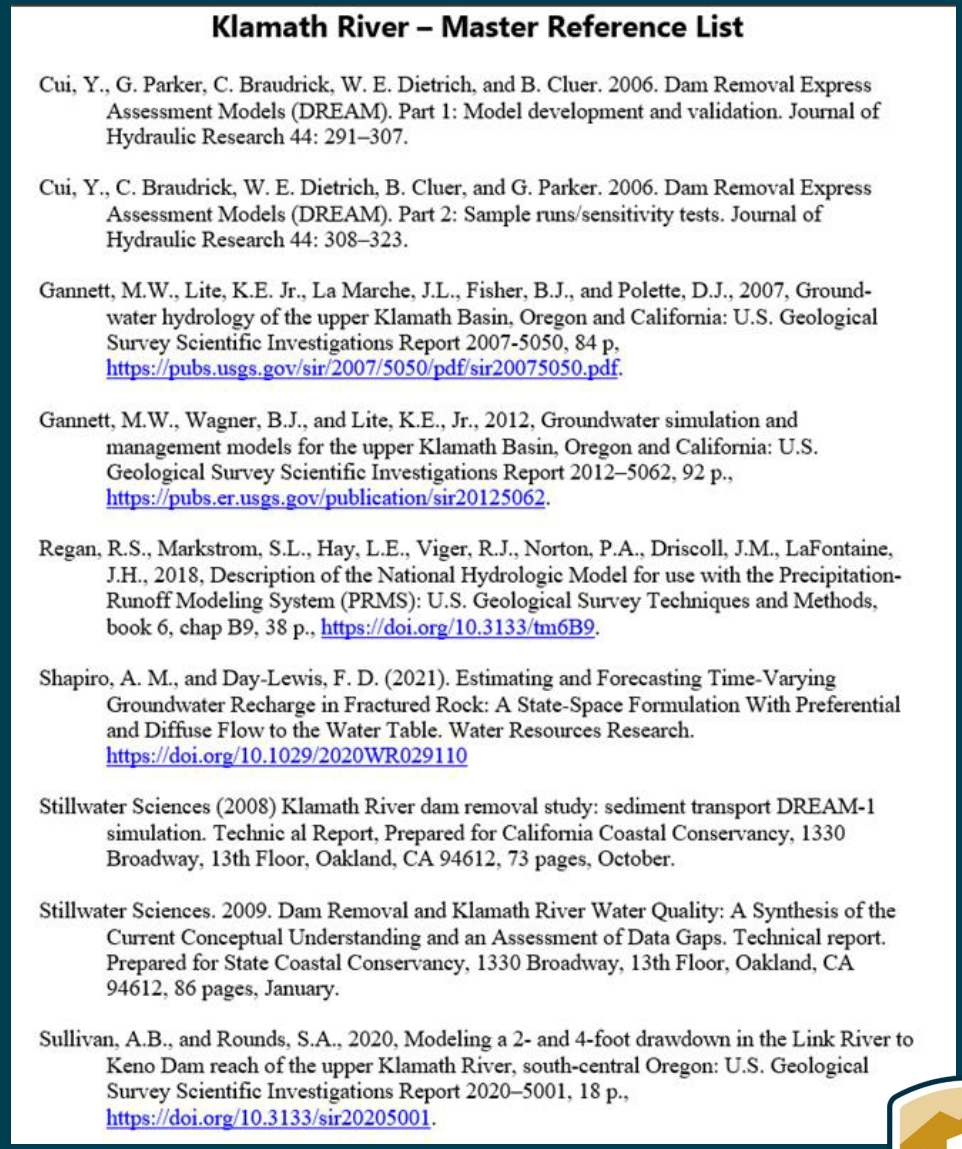
- ❑ Dynamic Reference List
- ✓ Concerns about monthly estimates of Open Water Evaporation
- ✓ Add Fourmile Reservoir and natural lakes to open water evaporation
- ❑ Partition crop consumptive use estimates according to source (SW and GW)
- ✓ Develop supplemental pumping estimates as input to GW model
- ✓ Investigate the hydraulic connection between LKL and KR
- ✓ Apply calculated ET estimates for surface water hydrology model
- ✓ 3 Desktop tours
- ✓ Assess the existing Shasta & Scott River GW models
- ✓ Hydraulic roughness uncertainty analysis

Gold items will be discussed in more detail

GW = groundwater; KR = Klamath River; LKL = Lower Klamath Lake; SW = surface water; UKL = Upper Klamath Lake

Dynamic Reference List

- 900+ files organized and documented
- Draft complete
- Focusing on:
  - Journal articles
  - Other reports
  - Legal agreements
  - Historical maps
- Updated periodically (quarterly/semi-annually)



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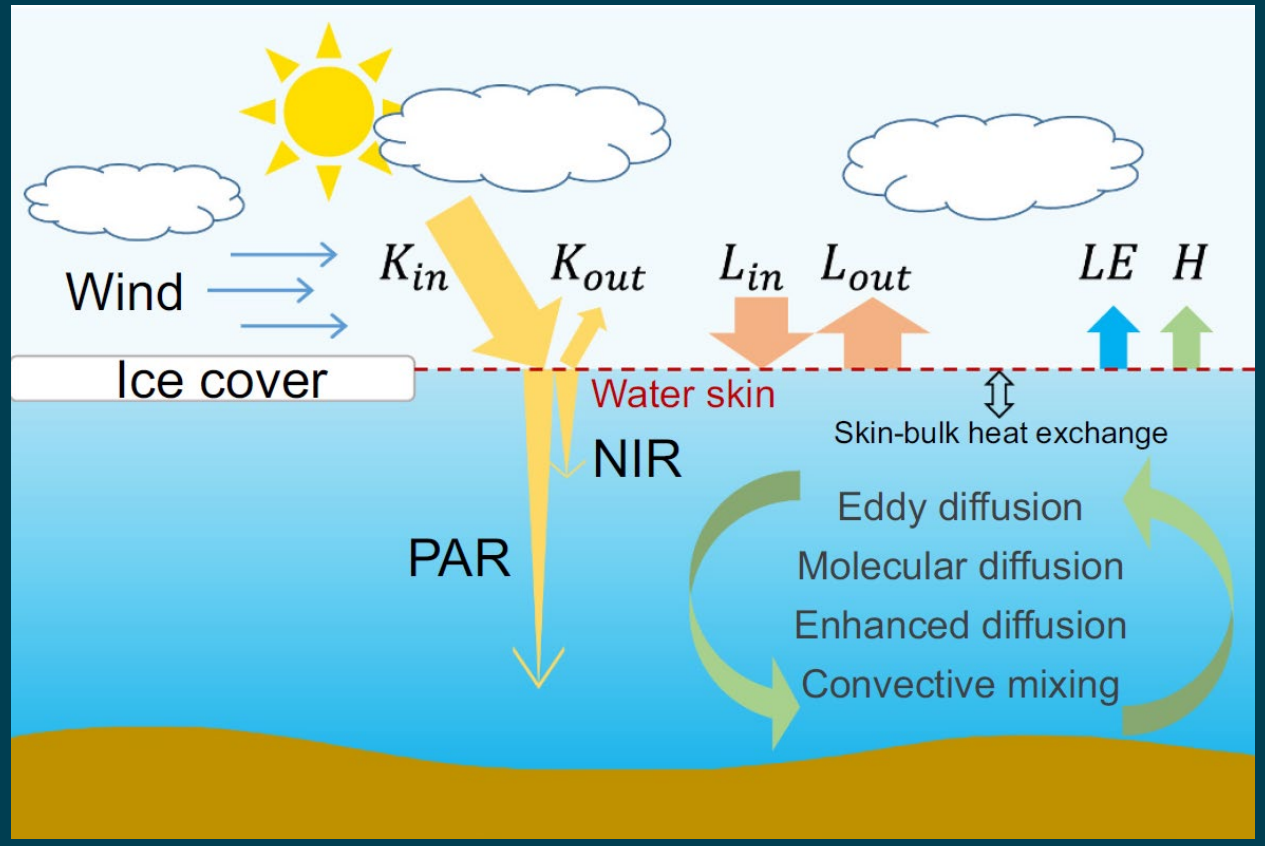
Stillwater Sciences. 2009. Dam Removal and Klamath River Water Quality: A Synthesis of the Current Conceptual Understanding and an Assessment of Data Gaps. Technical report. Prepared for State Coastal Conservancy, 1330 Broadway, 13th Floor, Oakland, CA 94612, 86 pages, January.

Sullivan, A.B., and Rounds, S.A., 2020, Modeling a 2- and 4-foot drawdown in the Link River to Keno Dam reach of the upper Klamath River, south-central Oregon: U.S. Geological Survey Scientific Investigations Report 2020–5001, 18 p., https://doi.org/10.3133/sir20205001.

Concerns about monthly estimates of Open Water Evaporation

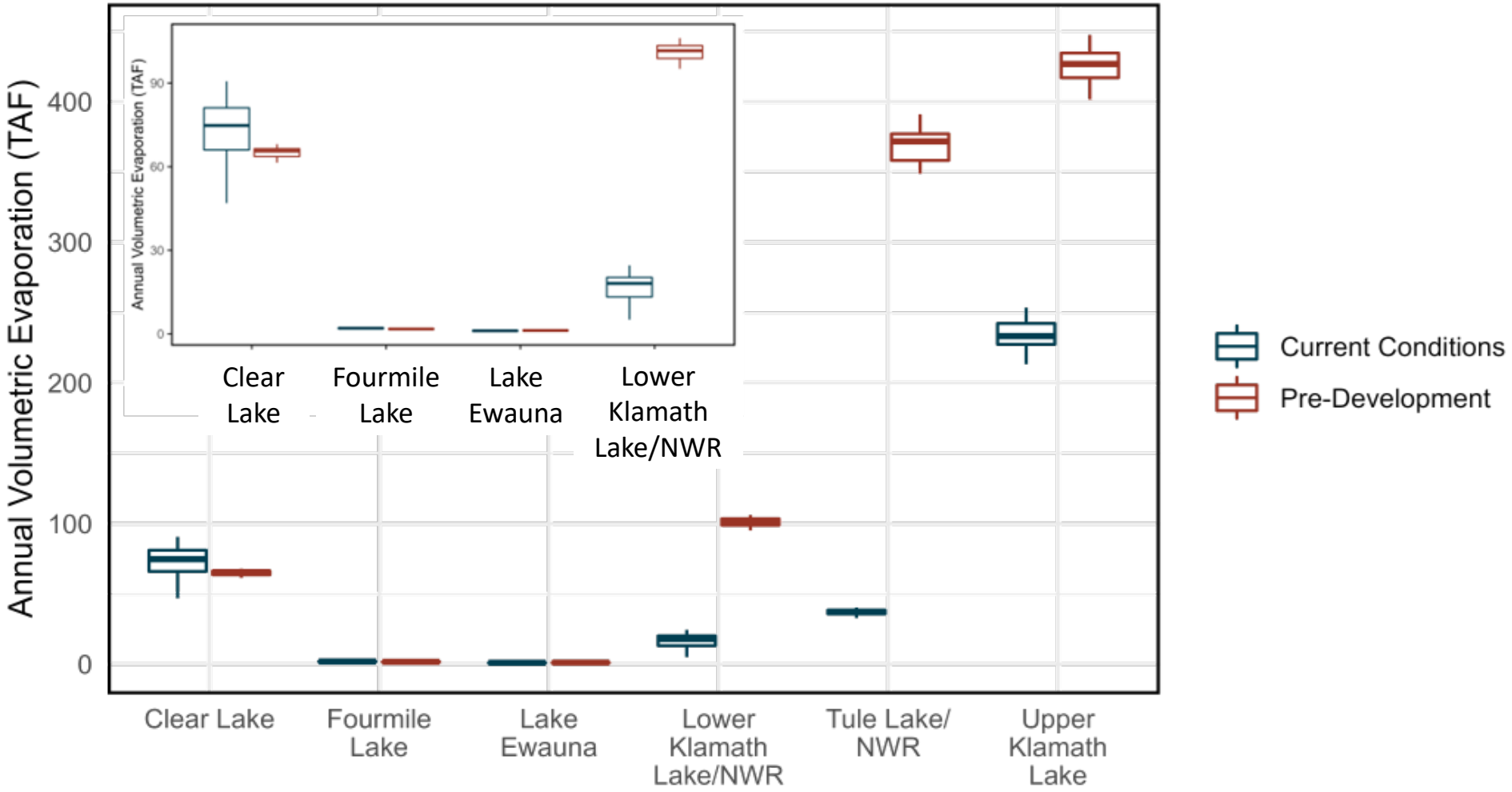
Switch to Daily Lake Evaporation Model for Open Water Evaporation

- Calculations at a daily time step
- Eliminates disaggregation errors
- More comprehensive algorithm
  - Wind speed/direction
  - Fetch
  - Parameterized heat storage



Schematic of Lake temperature and evaporation model
Zhao et al., 2020

Add Fourmile Reservoir & Natural Lakes to Open Water Evaporation



Preliminary Information – Subject to Revision. Not for Citation or Distribution.

Partitioning crop consumptive use estimates according to source

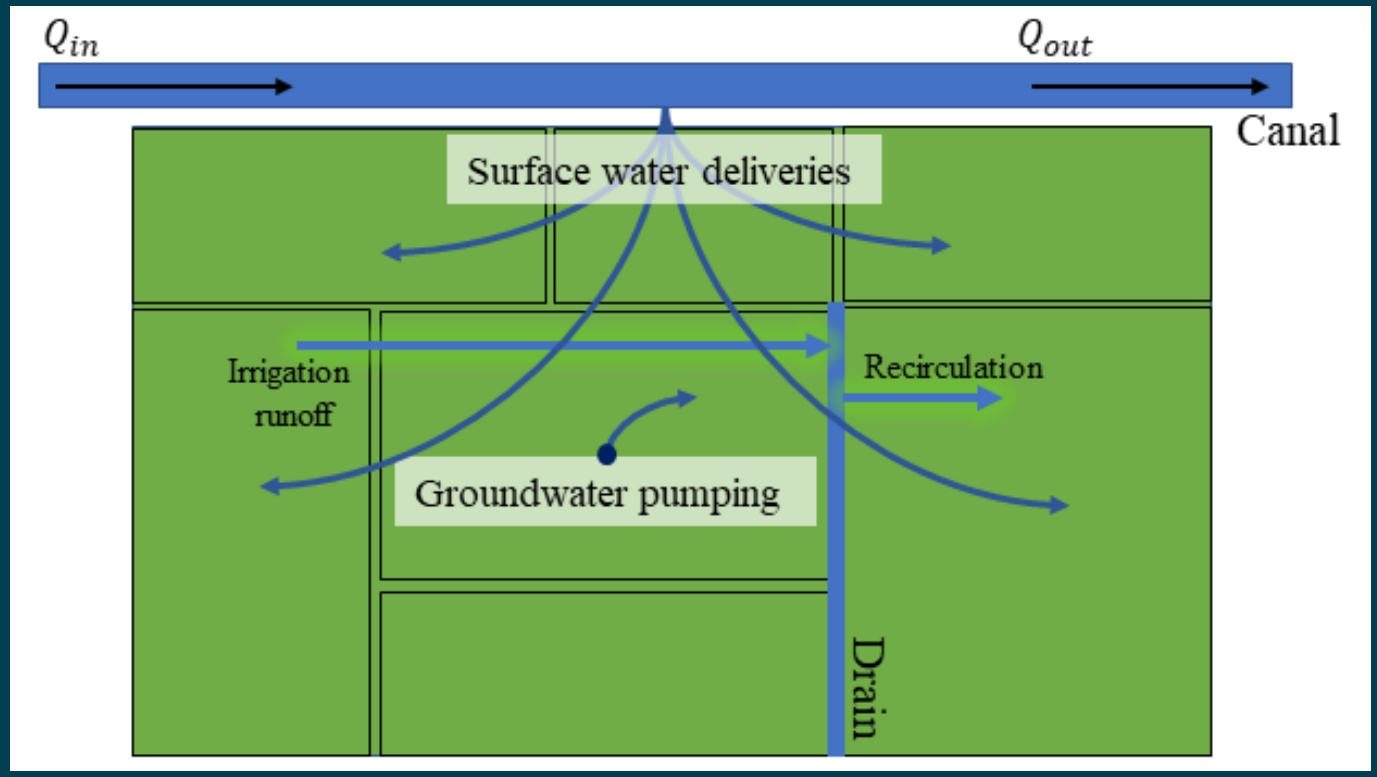
- Approximate partitioning of crop consumptive use (influence of groundwater on agricultural ET)
  - DRI working with USBR and Confluence Resource Consulting to identify locations of irrigated agriculture with access to shallow groundwater
  - Selection of sites where irrigation ceased and evidence of consumptive use remained
  - Use of mapping field elevations relative to major rivers/streams to distinguish between surface water and groundwater influence

Thank you to OWRD, DRI & Larry Dunsmoor for support.

Develop supplemental pumping estimates as input to groundwater model

Analyses include:

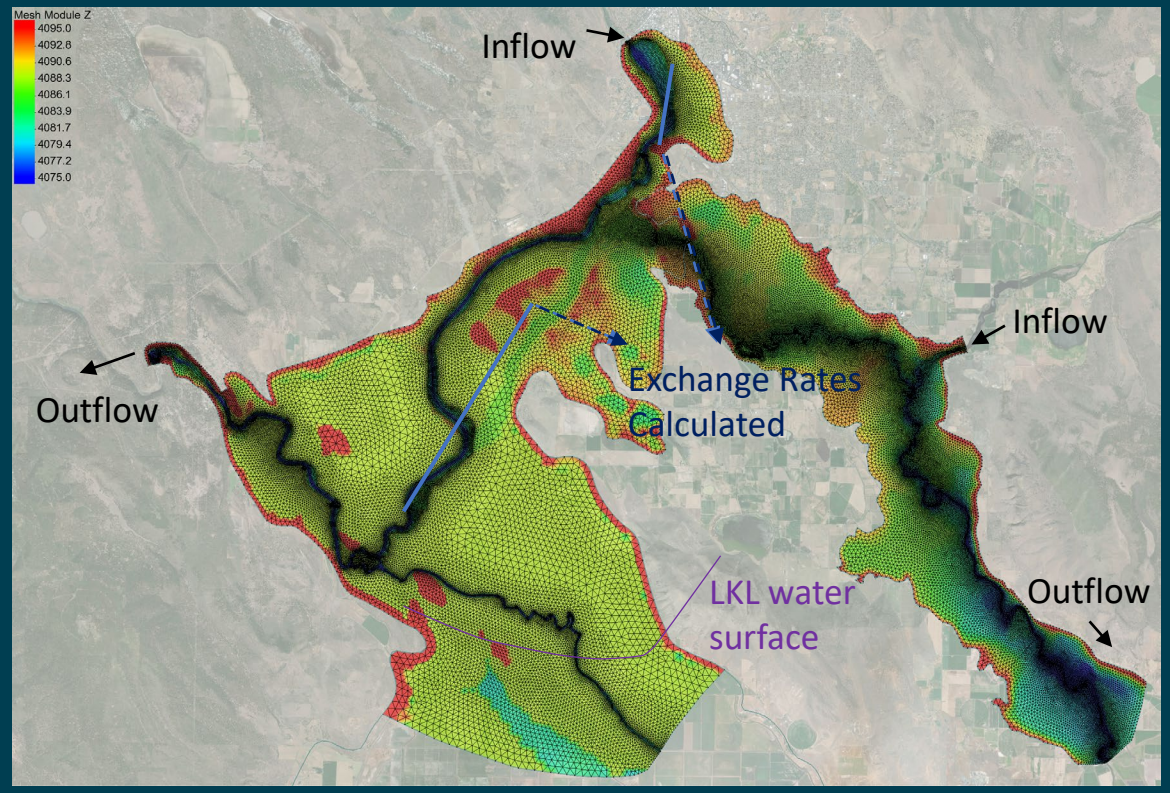
- Recharge from canal seepage
- Deep percolation from irrigation recharge
- Groundwater pumping for irrigation
- Groundwater pumping for domestic, community, municipal and industrial uses
- Calculated baseflow from stream gage observations



Thank you to Jacob Kann from Aquatic Ecosystem Sciences LLC & Jeffrey Walker from Walker Environmental Research LLC for providing additional data.

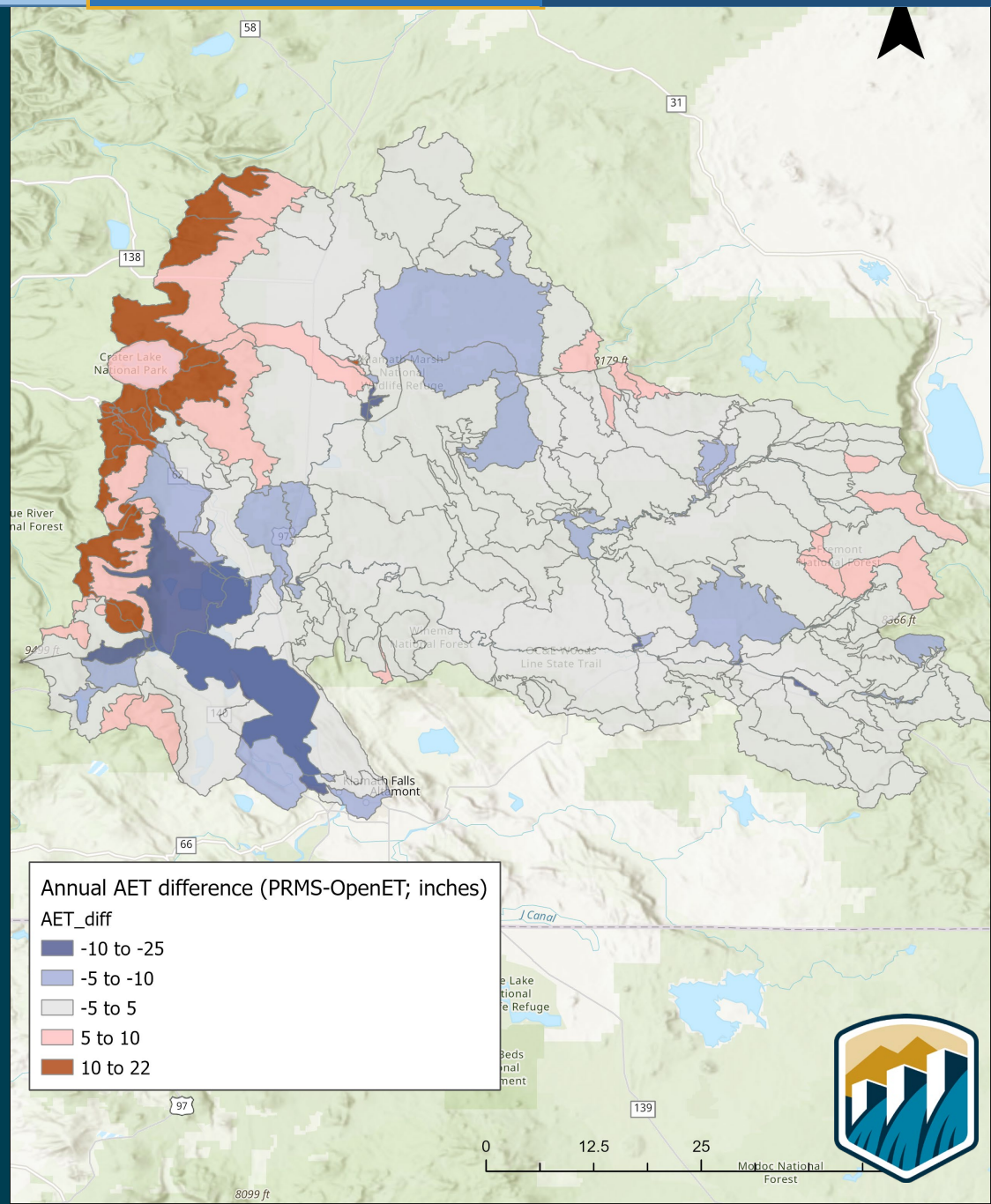
Investigate hydraulic connection between Lower Klamath Lake and Klamath River

- Quantifying water exchange under pre-development conditions between Klamath River and Lost River Slough, and Klamath River and Lower Klamath Lake
- Initial modeling complete
- Sensitivity testing complete. Currently analyzing results



Apply calculated ET estimates for surface water hydrology model

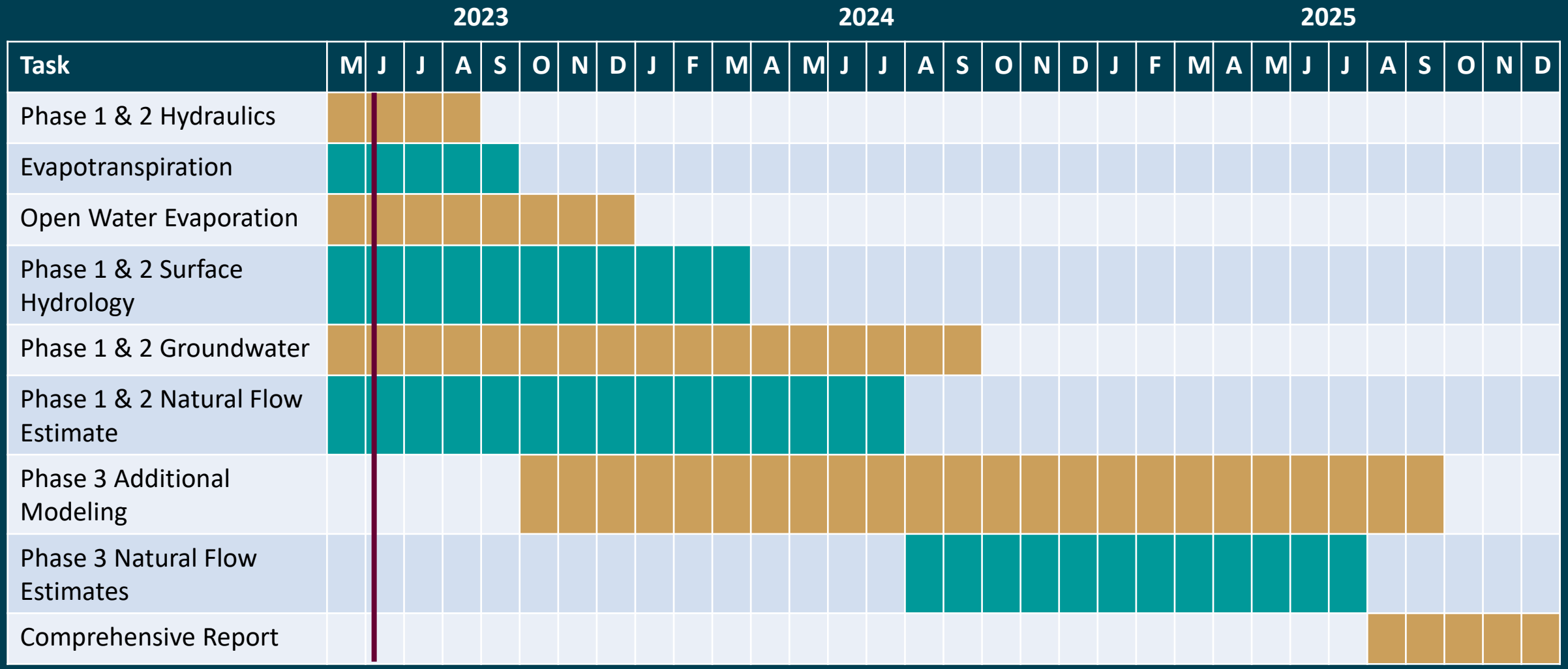
- using eeMetric AET and SNODAS SWE
- Combined Phase 1 and 2 surface water hydrology models
  - Received gridMET-NHM from USGS late January ahead of public release
  - Calibrating to SWE/AET first and then refining with streamflow if possible
  - Applying daily UKL inflow estimates to calibrate Phase 1 region



Next Steps for Project Success

- Continue Phase 1 & 2 Analysis
- Complete Phase 1 & 2 Hydraulics & Evapotranspiration Assessment this fiscal year
- Follow HISA peer review plan
- Next stakeholder update – Fall 2023
- Next workshop – Phase 1 & 2 results (~Fall 2024)
- Scoping effort + site visit for Phase 3 groundwater modeling
- Desktop tour of lower basin, below Iron Gate Dam

Project Timeline




BUREAU OF
RECLAMATION
Questions and Additional Discussion

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