BUREAU OF RECLAMATION

CWEMF

# Central Valley Project Water Temperature Modeling Platform

California Water and Environmental Modeling Forum

Session 4

April 17, 2023; 10:30 a.m. – 12:15 p.m.

# Session 4: Central Valley Project (CVP) Water Temperature Modeling Platform (WTMP)

| | | |
|---|---|---|
| 10:30 | Introduction | Yung-Hsin Sun (Sunzi Consulting LLC) |
| 10:35 | When We Saw You Last: Recap 2022 session on the CVP WTMP | Randi Field (US Dept of the Interior, Bureau of Reclamation) |
| 10:45 | If You Could See Me Now: Implementation of the CVP WTMP | Tom Evans (Resource Management Associates, Inc.) |
| 11:00 | The Games We Play: Highlights of model calibration and validation | Mike Deas (Watercourse Engineering, Inc.) & Craig Addley (Stantec Consulting Services Inc.) |
| 11:20 | We Are What We Eat: Taming data management | Jeff Schuyler (Eyasco, Inc.) & Mike Deas (Watercourse Engineering, Inc.) |
| 11:35 | Put Things into Perspective: Characterize and communicate uncertainty | Mike Deas (Watercourse Engineering, Inc.) & Yung-Hsin Sun (Sunzi Consulting LLC) |
| 11:55 | Light at the End of the Tunnel: The Endgame | Randi Field (US Dept of the Interior, Bureau of Reclamation) |
| 12:05 | Q&A | Yung-Hsin Sun and Team |
| 12:15 | Adjourn | |

# Session 4: Central Valley Project (CVP) Water Temperature Modeling Platform (WTMP)

| Moderator/ Panelist | Panelist | Panelist | Panelist | Panelist | Panelist |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
| Yung-Hsin Sun, PhD, PE, D.WRE<br>Sunzi Consulting LLC. | Randi Field<br>Central Valley Operations Office, US Department of the Interior, Bureau of Reclamation | Tom Evans, PhD, PE, D.WRE<br>Resource Management Associates, Inc. | Mike Deas, PhD, PE<br>Watercourse Engineering, Inc. | Craig Addley, PhD, PE<br>Stantec Consulting Services Inc. | Jeff Schuyler<br>Eyasco, Inc. |
| | Reclamation Project Lead | | Consultant Team Lead | | |

In the order of appearance

# When We Saw You Last:

## Recap 2022 Session on the CVP WTMP (and more)

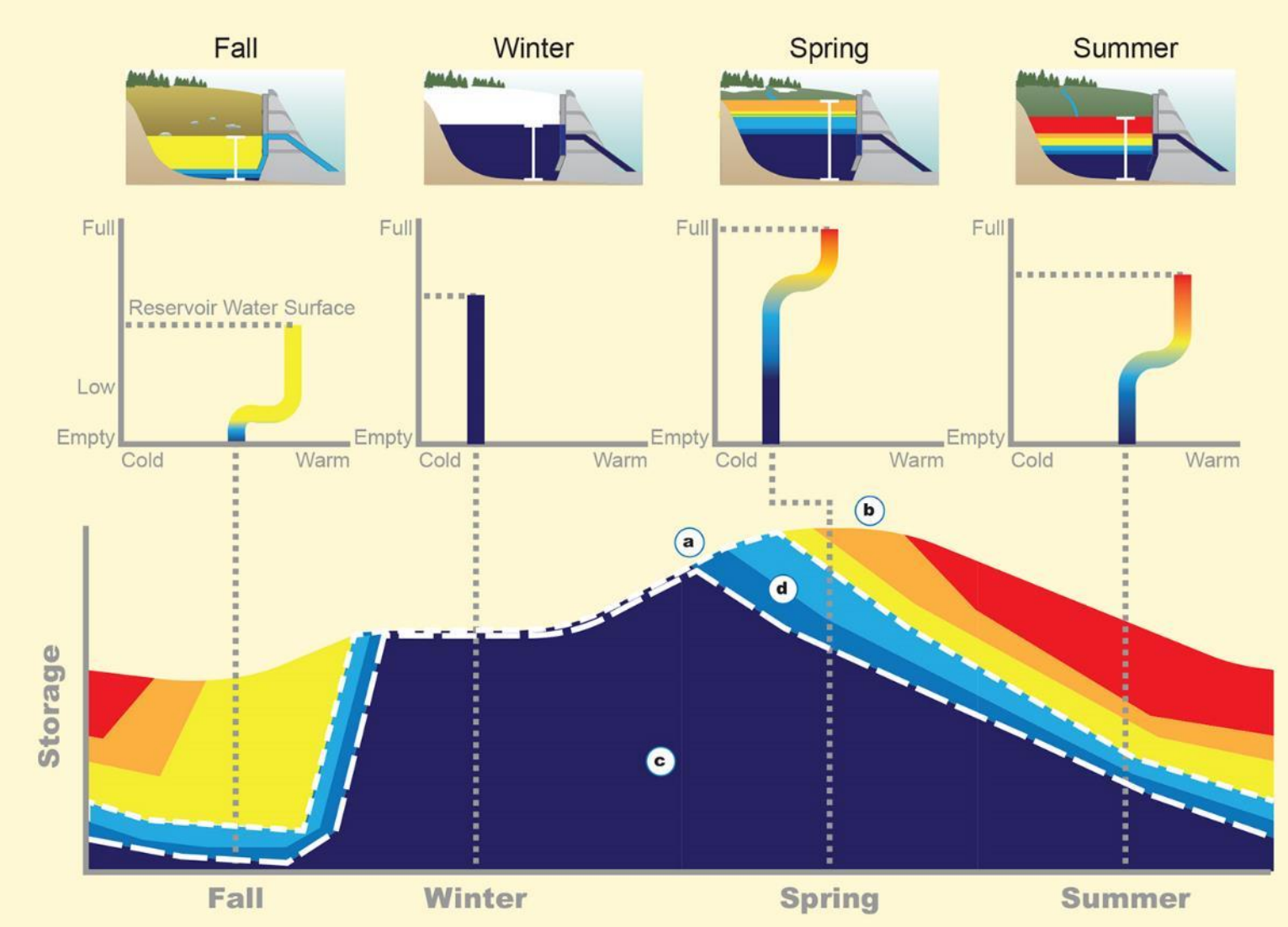
Randi Field, US Department of the Interior, Bureau of Reclamation

# Active Temperature Management Serves Downstream CVP Goals

- **Environmental Goal:** Fishery habitat objectives

- How?
  - Reservoir stratification and cold-water pool resources
  - Facility infrastructure and systemwide operations
  - Computational tools
  - Seasonal, real-time, and long-term planning products

# Water Temperature Management Story



# Elements of Temperature Management

## The Why

1. **Environmental Objectives:** Defining management criteria (e.g., target species' seasonal temperature requirements and their distribution in downstream river reaches).

## The Resources

2. **Total Reservoir Storage:** Defining cold water volume through reservoir storage.

3. **Reservoir Water Temperature Profile:** Defining cold water volume through thermal profile characterization.

## The Means

4. **Selective Withdrawal:** Assessing selective withdrawal facilities and strategies.

5. **Tail Bay Water Temperature Management:** Determining reservoir tail bay temperatures.

## The Factors

6. **Meteorological Conditions:** Determining heat gain from the reservoir to downstream river management locations to inform decision-making processes.

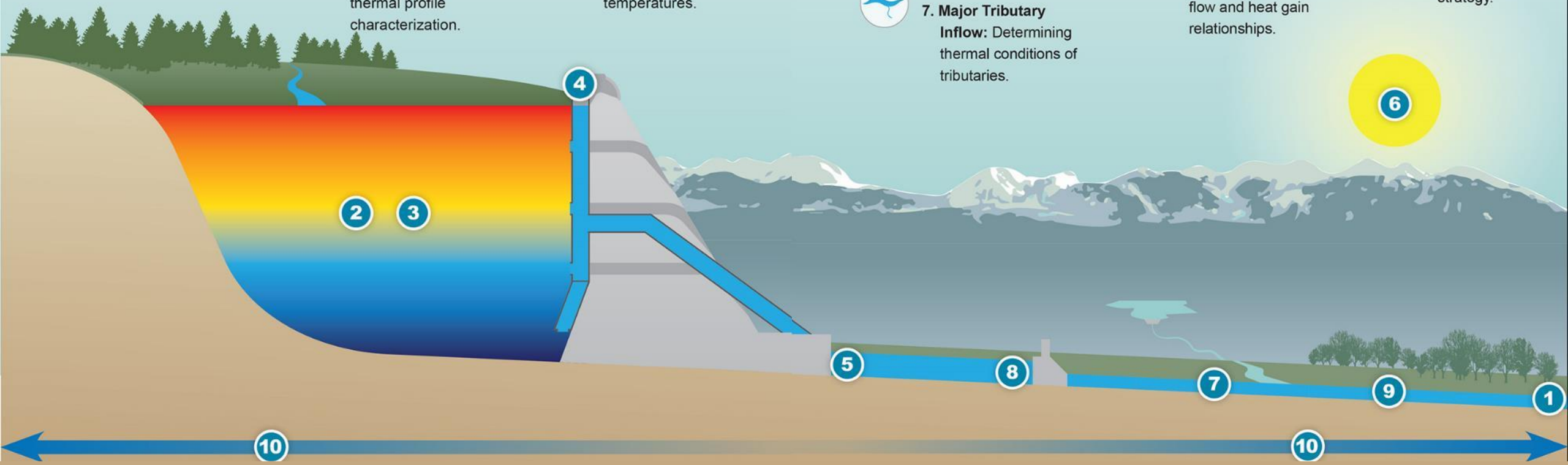
7. **Major Tributary Inflow:** Determining thermal conditions of tributaries.

8. **Regulating Reservoirs:** Characterizing re-regulating reservoir conditions and river release temperatures.

9. **River Flow Heat Gain Relationship:** Employing river flow and heat gain relationships.

## The Methods

10. **Monitoring:** Using system-wide monitoring network information to assess conditions and adapt the selective withdrawal strategy.




Reference: Reclamation, 2017. Water Temperature Management in Reservoir-River Systems through Selective Withdrawal, Reference Technical Memorandum for Central Valley Project Operation, California. September.

# Vision for WTMP Project

## Goal: Deliver quality products to support Reclamation's mission – predict water temperature to support CVP operations

- Modernize CVP systemwide water temperature modeling and analytics
- Develop to current professional standards
- Consistency: Real-time, seasonal, and long-term planning
- Design for flexibility
- Address uncertainty
- Leverage technological advancements
- Build expertise

# Reclamation's Perspective on Model Development Standards

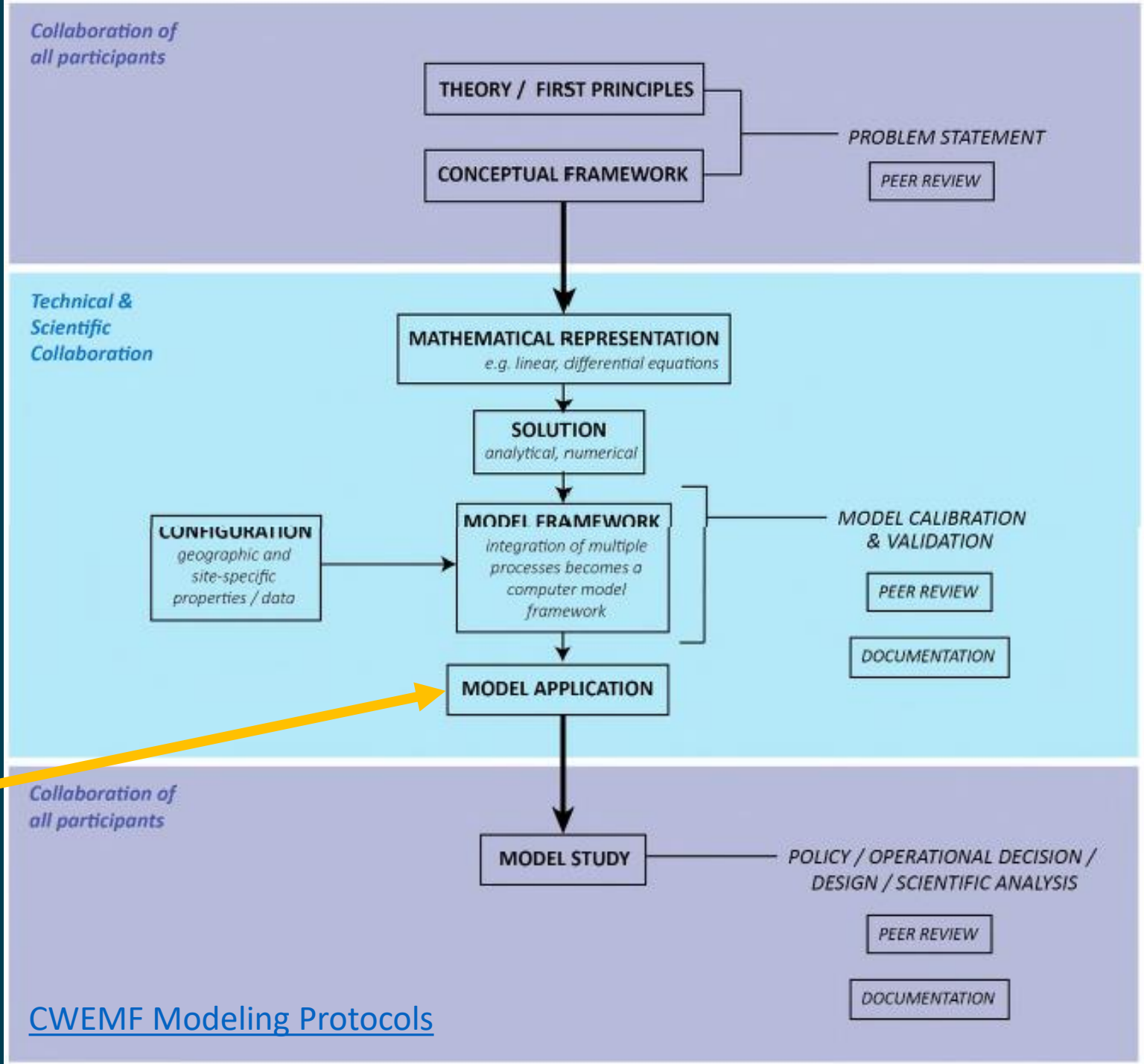
- A new paradigm to promote best science practices:
  - Support and encourage a structured model development approach
  - Foster a participatory and collaborative forum to engage all community members
  - Advocate for transparency of documentation, logic, and data
  - Evaluate performance, encourage accountability, and subject to independent peer review
  - Design with a long-term vision of use and support

# Structured Model Development Approach

- CWEMF Modeling Protocols benefits:
  - Improved performance and reliability
  - Better documentation
  - Better access
  - Improve understanding and reproduction
  - Increased confidence and credibility

# What does the CWEMF Development Process Look Like?

*WE ARE HERE*



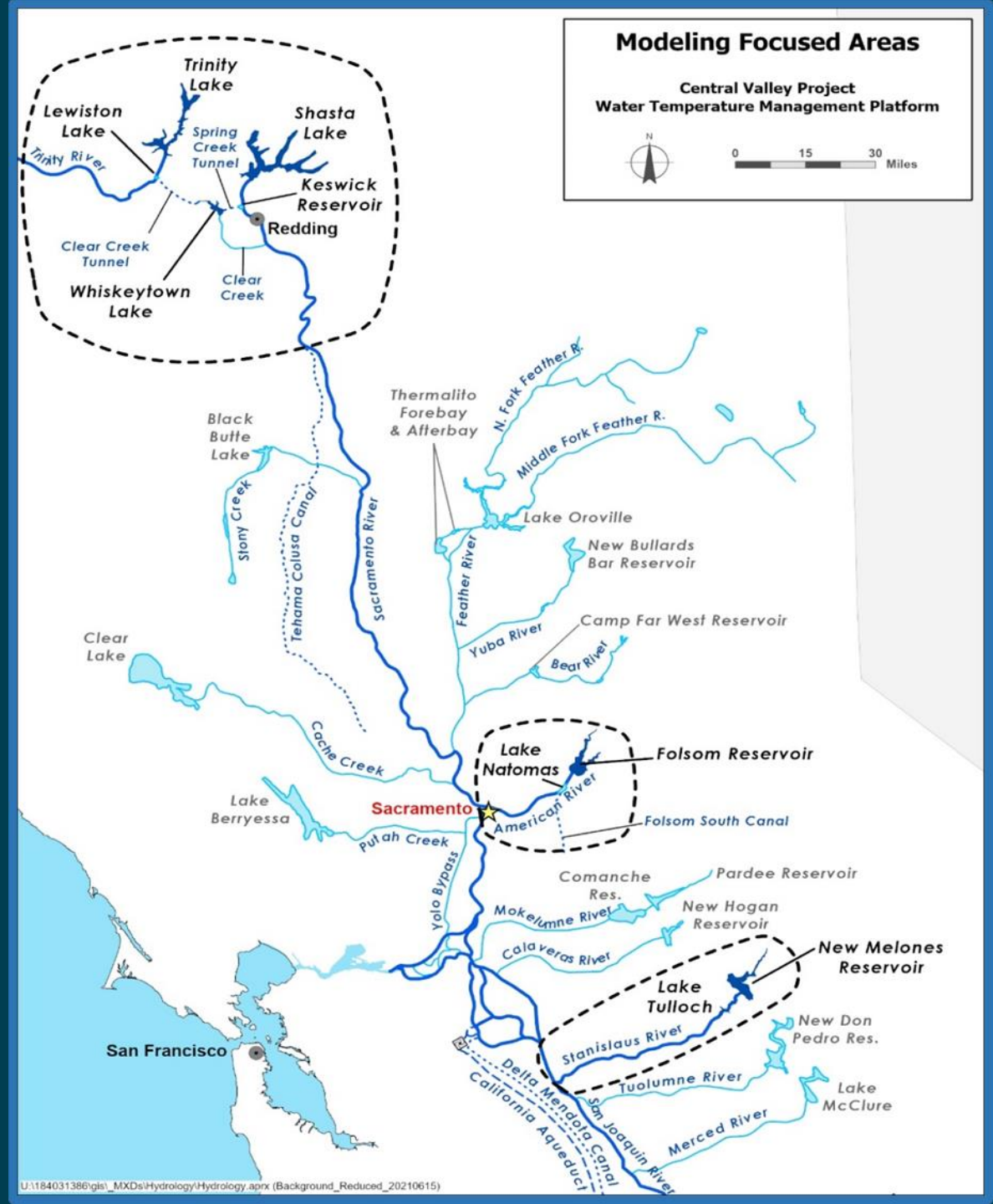
# How does the Approach Compare?

| CWEMF Guidance | WTMP |
| --- | --- |
| Preliminary Analyses | Model and Framework Selections |
| Framing the Modeling Study | Model Configuration, Testing, and Uncertainty |
| Application of the Model | Model Applications (In-Progress) |
| Communicating and Documenting Results | Technical Memoranda |
| Encouraging Collaboration in the Modeling Community | Modeling Technical Committee and Peer Review |

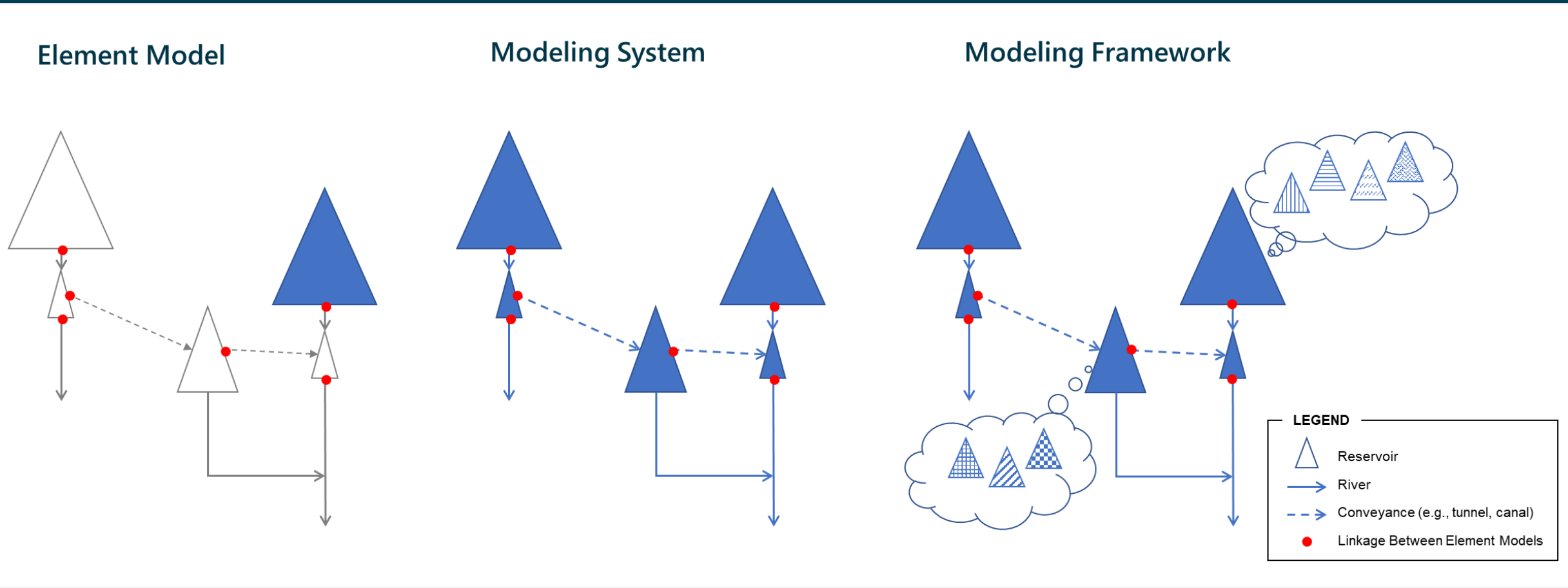
# WTMP Unique Features

| WTMP Items | Highlights of Unique Features |
|---|---|
| Key Code Modifications | Enhanced modeling considerations for unique facility components |
| Model Domain | Consistent with operations which influence downstream water temperature |
| Model Framework | Addresses multi-model simulations/different spatial-temporal scales + uncertainty |
| Data Management System | Improve flexibility for data access and quality of data |
| Communications/Transparency | Quarterly Modeling Technical Committee Meetings/Web access/RISE |

# WTMP Model Domain



# Modeling Flexibility: Element, System, and Framework




CE-QUAL-W2

HEC-ResSim

HEC-WAT

# HEC-WAT Framework Using W2 and ResSim

- Shasta-Keswick-Upper Sacramento River
  - ResSim Only
  - Combined W2 and ResSim