BUREAU OF RECLAMATION

CVP Water Temperature Modeling Platform

Modeling Technical Committee (MTC) Output Subgroup Meeting

June 1, 2023; 2:00 p.m. – 4:00 p.m.

Welcome!!

- We are looking forward to a productive meeting.
- Virtual meetings can be challenging and frustrating, especially with a large groups - please be patient and flexible. If you are having technical difficulties, please chat with Sarah Hamilton, or Sarah.Hamilton@stantec.com
- Chat Panel will be used for participants to provide comments and queue up questions. Use Raise Hand functions in Q&A session.
- Feedbacks on meeting logistic and suggestions: Yung-Hsin Sun, PhD, PE; sun.yunghsin@sunziconsulting.com

MTC Output Subgroup: Objectives

- Build common understanding and receive feedback on WTMP planned features for output.
- Explore options for future enhancements.

MTC Output Subgroup: Agenda

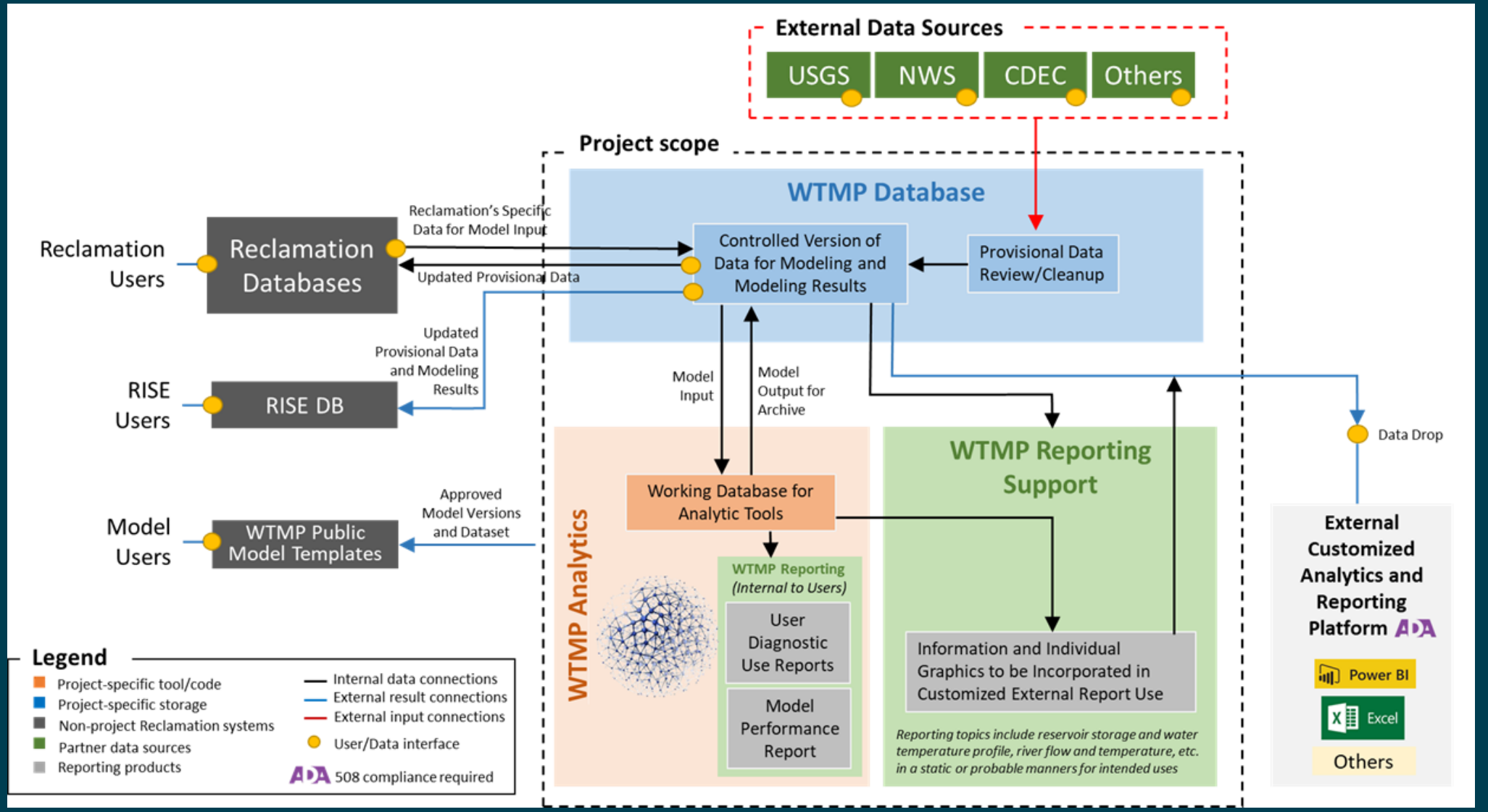
2:00 p.m.	Welcome and Meeting Logistics
2:05 p.m.	Subgroup Orientation Objectives Recap Output Mechanism in WTMP and Options of Information
2:15 p.m.	Introduction: Applications in WTMP that Generate Output (as planned)
2:30 p.m.	Discussion: Useful Output per Application – What Do They Look Like? Model Calibration/Validation Seasonal Temperature Plan and Implementation Long-term Planning Studies
3:20 p.m.	Discussion: Output Concepts for Future Expanded Use of WTMP Concepts for Implemented WTMP Applications Concepts for Potential Future Implemented WTMP Applications
3:50 p.m.	Next Steps
4:00 p.m.	Adjourn

Photo credit: John Hannon, Reclamation

Recap: Output Mechanism in WTMP and Options

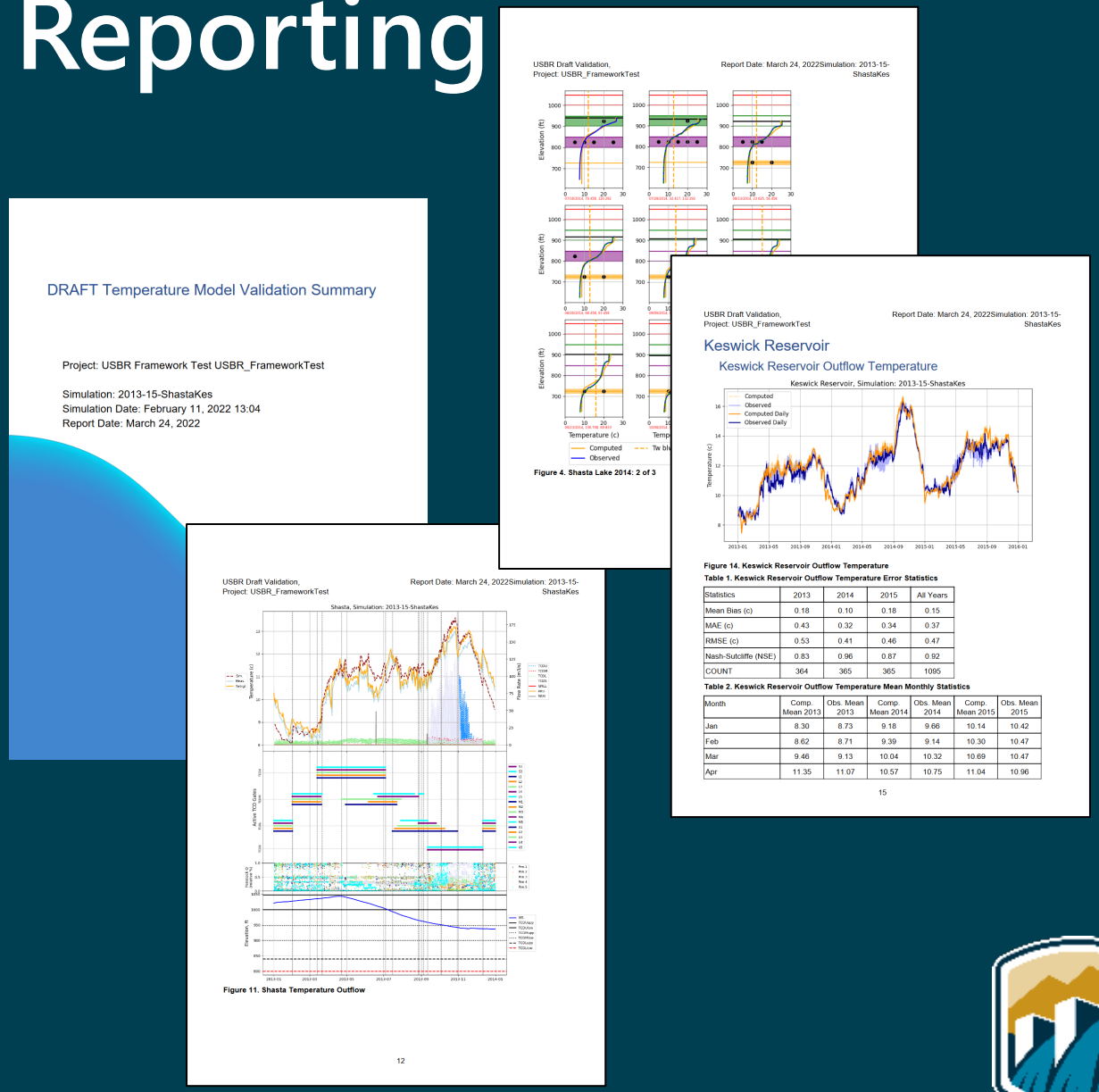
John DeGeorge, PhD, PE; RMA

Water Temperature Modeling Platform (WTMP)



Purpose of Automatic Reporting

- Rapid creation of key output tables and graphics to facilitate results review by modelers
- Creation of tables and graphics that could be incorporated in other reporting and presentation products



DRAFT Temperature Model Validation Summary

Project: USBR Framework Test USBR_FrameworkTest

Simulation: 2013-15-ShastaKes
Simulation Date: February 11, 2022 13:04
Report Date: March 24, 2022

USBR Draft Validation, Project: USBR_FrameworkTest — Report Date: March 24, 2022 Simulation: 2013-15-ShastaKes

Figure 4. Shasta Lake 2014: 2 of 3

USBR Draft Validation, Project: USBR_FrameworkTest — Report Date: March 24, 2022 Simulation: 2013-15-ShastaKes

Keswick Reservoir

Keswick Reservoir Outflow Temperature

Keswick Reservoir, Simulation: 2013-15-ShastaKes

Figure 14. Keswick Reservoir Outflow Temperature

Table 1. Keswick Reservoir Outflow Temperature Error Statistics

Statistics	2013	2014	2015	All Years
Mean Bias (c)	0.18	0.10	0.18	0.15
MAE (c)	0.43	0.32	0.34	0.37
RMSE (c)	0.53	0.41	0.46	0.47
Nash-Sutcliffe (NSE)	0.83	0.96	0.87	0.92
COUNT	364	365	365	1095

Table 2. Keswick Reservoir Outflow Temperature Mean Monthly Statistics

Month	Comp. Mean 2013	Obs. Mean 2013	Comp. Mean 2014	Obs. Mean 2014	Comp. Mean 2015	Obs. Mean 2015
Jan	8.30	8.73	9.18	9.66	10.14	10.42
Feb	8.62	8.71	9.39	9.14	10.30	10.47
Mar	9.46	9.13	10.04	10.32	10.69	10.47
Apr	11.35	11.07	10.57	10.75	11.04	10.96

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USBR Draft Validation, Project: USBR_FrameworkTest — Report Date: March 24, 2022 Simulation: 2013-15-ShastaKes

Shasta, Simulation: 2013-15-ShastaKes

Figure 11. Shasta Temperature Outflow

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Design Requirements

- Simple report creation action for WTMP users (“one-click”)
- Report configuration files editable by advanced users
- Configuration files should be modular and re-usable (“mix and match”)
- Visual presentation of tables and plots should be easily controlled
- Support similar result presentation from different models

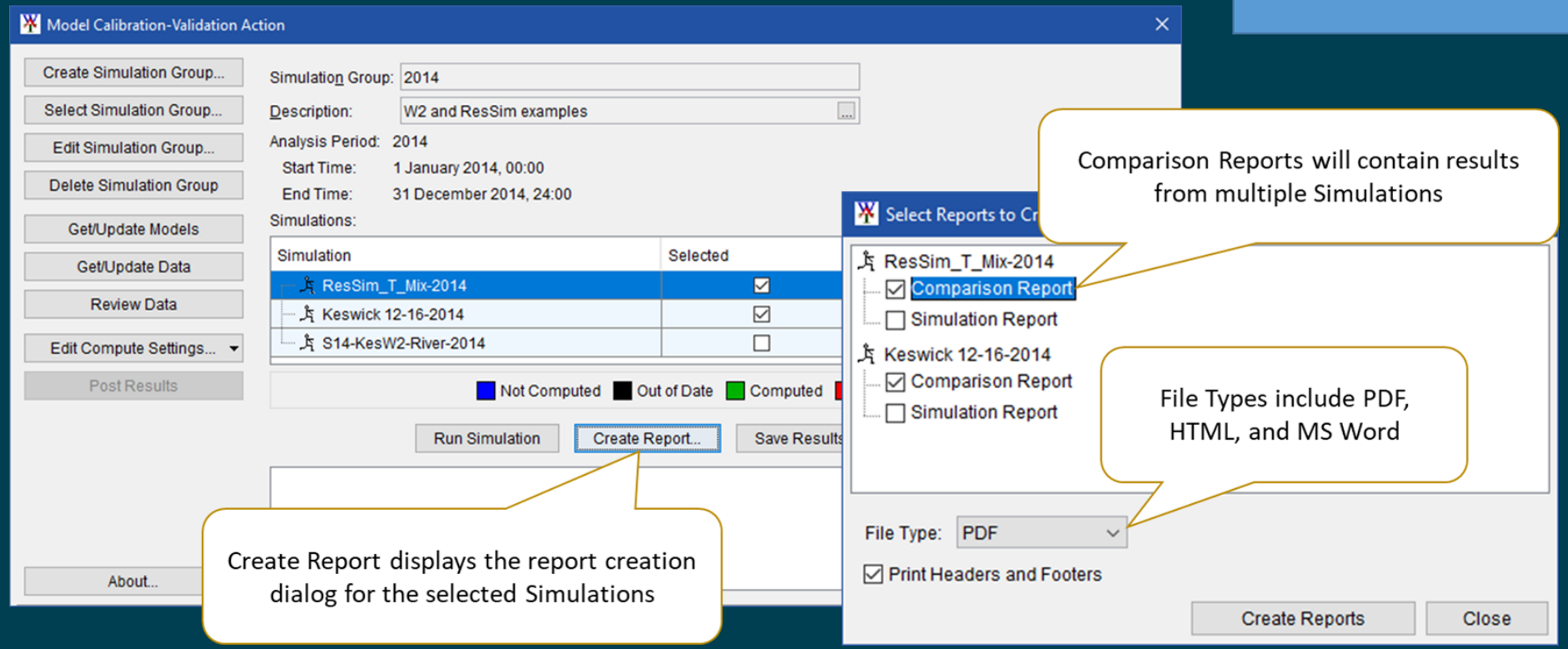
Automatic Reporting Implementation

- Every defined report is scripted and accessible through WTMP user interface.

comparison report (CSV)

Model type, Model Alternative, Chapter Template

```
ResSim, WQ_dsTrib3, Shasta_ResSim.XML
ResSim, WQ_dsTrib3, Keswick_ResSim.XML
ResSim, WQ_dsTrib3, UpperSac_ResSim.XML
```

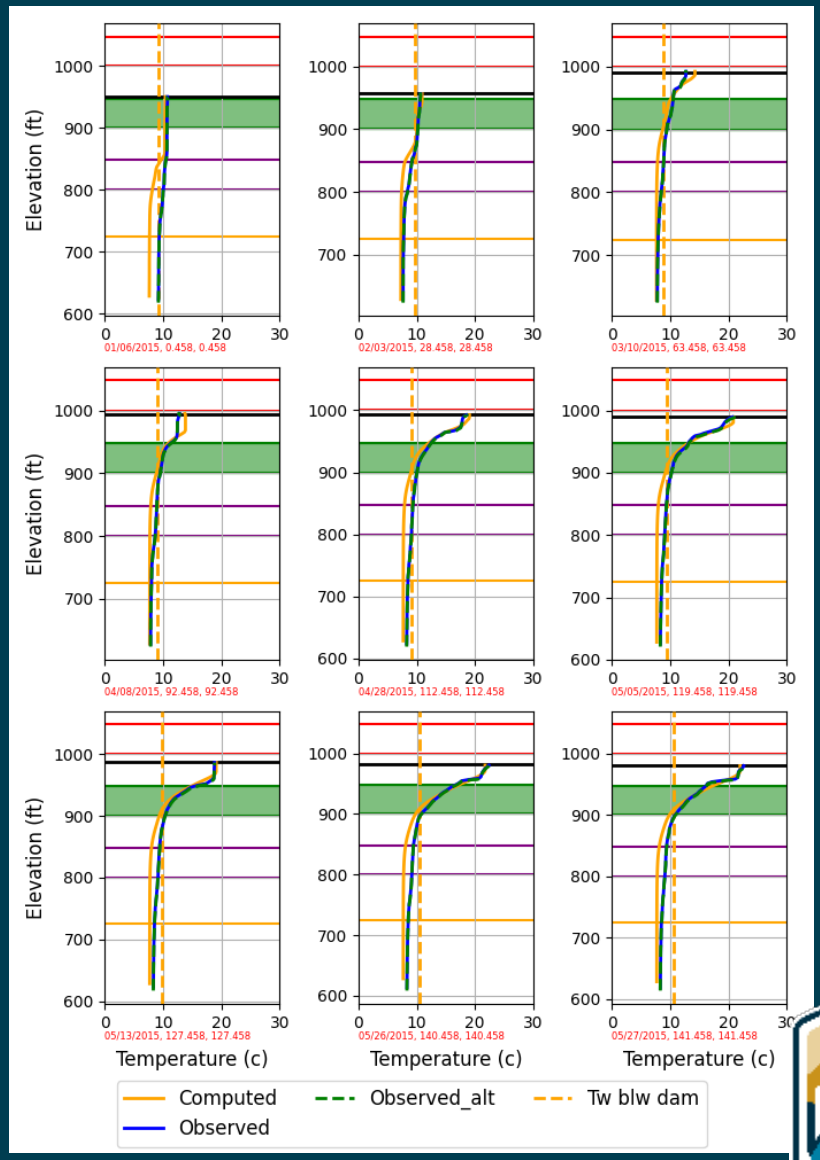


Automatic Reporting Implementation (Cont.)

- Configuration files (XML format) (i.e., the script)
  - Separated by sections – Report table of contents will show headings for chapters and sections
  - Sections contain one or more report objects
  - Syntax references implemented models and observed data
- Currently available report objects
  - Text Blocks with String substitution; Profile Plots; Time Series Plots; Error Statistics Table; Monthly Statistics Table; Single Statistics Table; Profile Statistics Table; Contour Plots; Reservoir Contour Plots; Buzz Plots (American River Basin only); and Shasta Outlet Operations Plot

Profile Plot Object, subset of documentation

Name	Description	Example
Description	Name of the figure in the Table of Figures and figure name	<Description>Shasta Lake w tribs %%year%%</Description>
Xlabel	Label for X axis of plots at the bottom of a given page of plots	<XLabel>Temperature (C)</XLabel>
Ylabel	Label for Y axis of plots at the left side of a given page of plots	<YLabel>Elevation (ft)</YLabel>
SplitbyYear	Boolean value. If True, separates plots by year. Each year will have its own counter (ex 1 of 3) and be denoted in the table of figures. When a new year starts in the plots, a new plot page will be added, instead of continuing the current plot page in a new panel, even if the max amount of panels per page isn't reached. Default: True	<SplitByYear>False</SplitByYear>
Parameter	Specifies the parameter of data for the plot series. Used to set units flags and grab correct data from model results.	<Parameter>Temperature</Parameter>
ProfilesPerRow	Determines the number of plot panels per row per page Default: 3	<ProfilesPerRow>3</ProfilesPerRow>
RowsPerPage	Determines the number of rows of plots per page Default: 3	<RowsPerPage>3</RowsPerPage>
Gridlines	Boolean to set gridlines on all Profile Plots. Default: True	<Gridlines>True</Gridlines>
UseDepth	Boolean field to determine if profile plots use depths or elevations. Depths start at 0 and increase positively further down the plot. Elevations use the water surface elevation Default: False	<UseDepth>False</UseDepth> <UseDepth>True</UseDepth>
DatesSource	Determines the dates of the Profile Plots. Can either be set to a defined lines <Flag> value (See Line Flags) or a list of calendar dates or Julian dates. If the defined line flag is used, each available date in the dataset (currently only works for Observed data). If a list of dates is to be used, datessource must include a set of subitems of <date>. If left blank, a regular interval of dates is selected using the start and end times of the model run. Default: Observed	<DatesSource>Observed</DatesSource>



Example Time Series Plot Objects

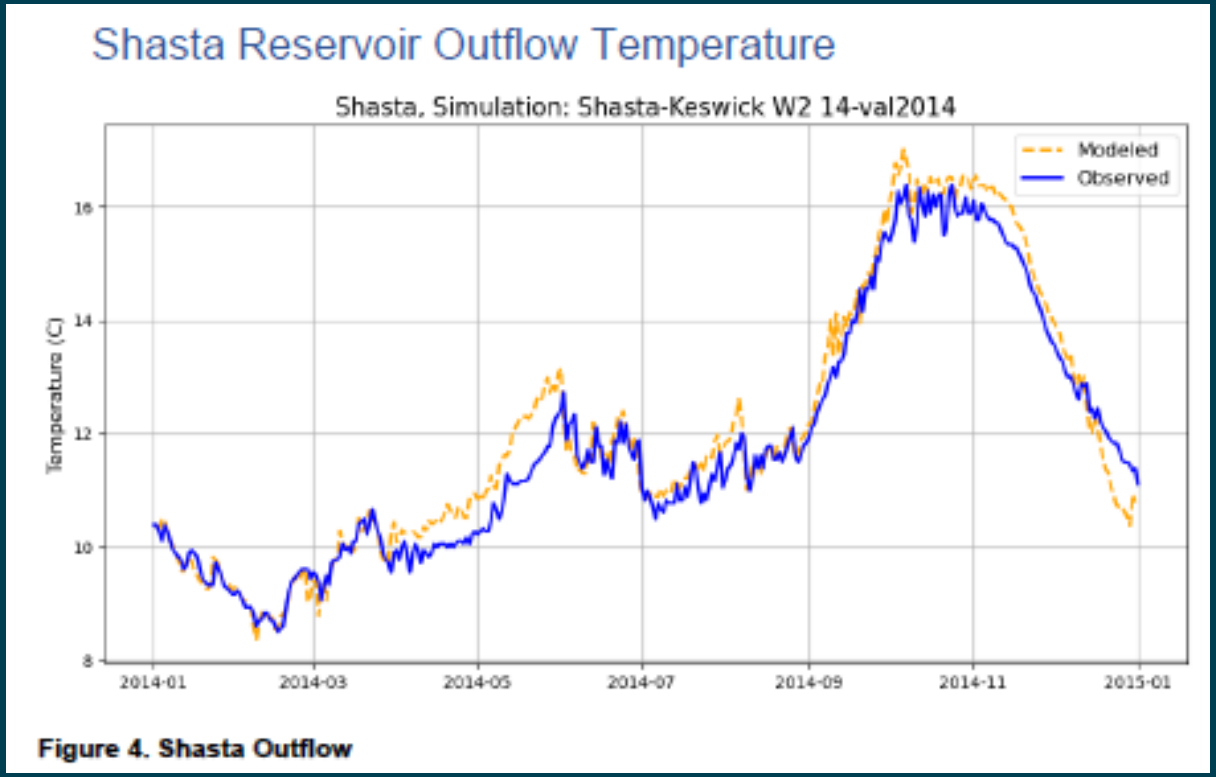
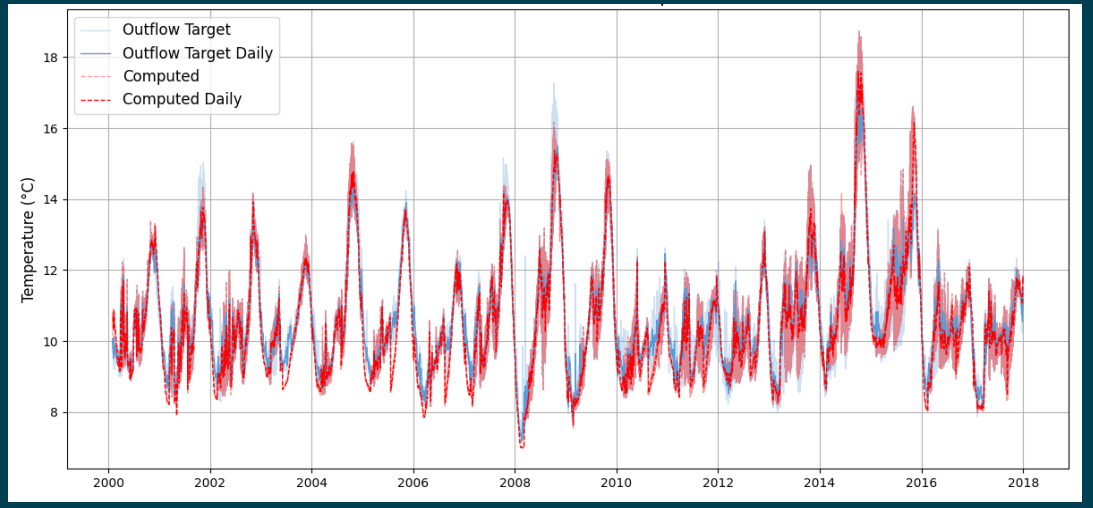
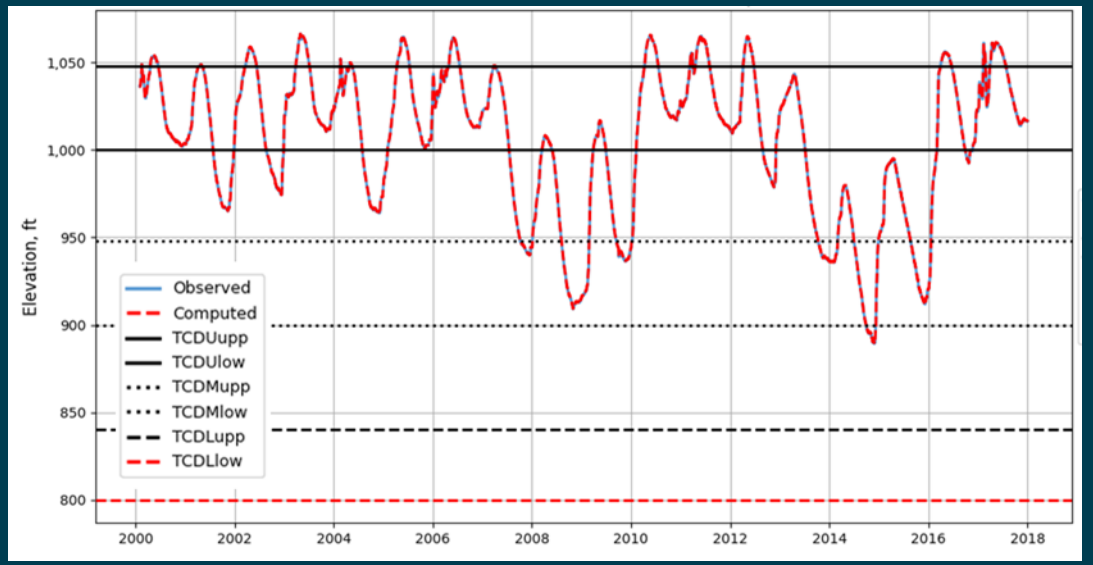


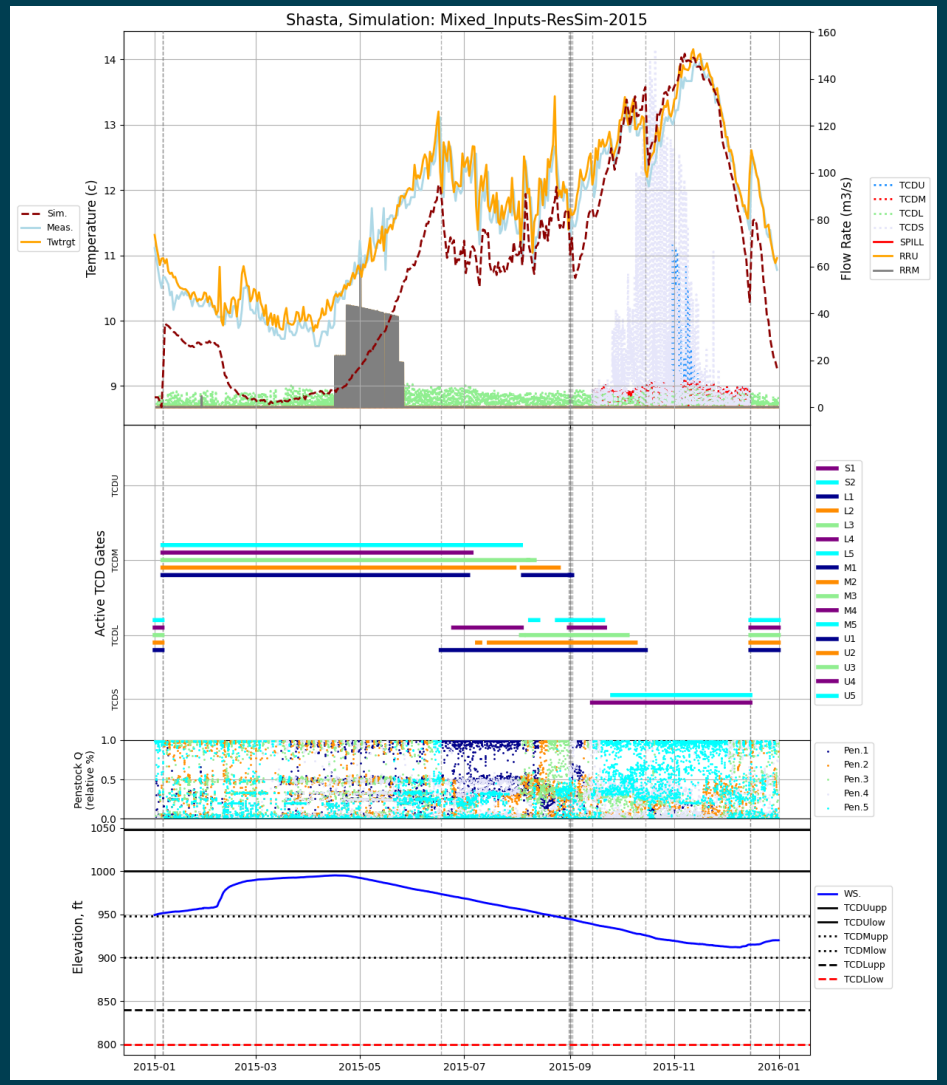
Figure 4. Shasta Outflow

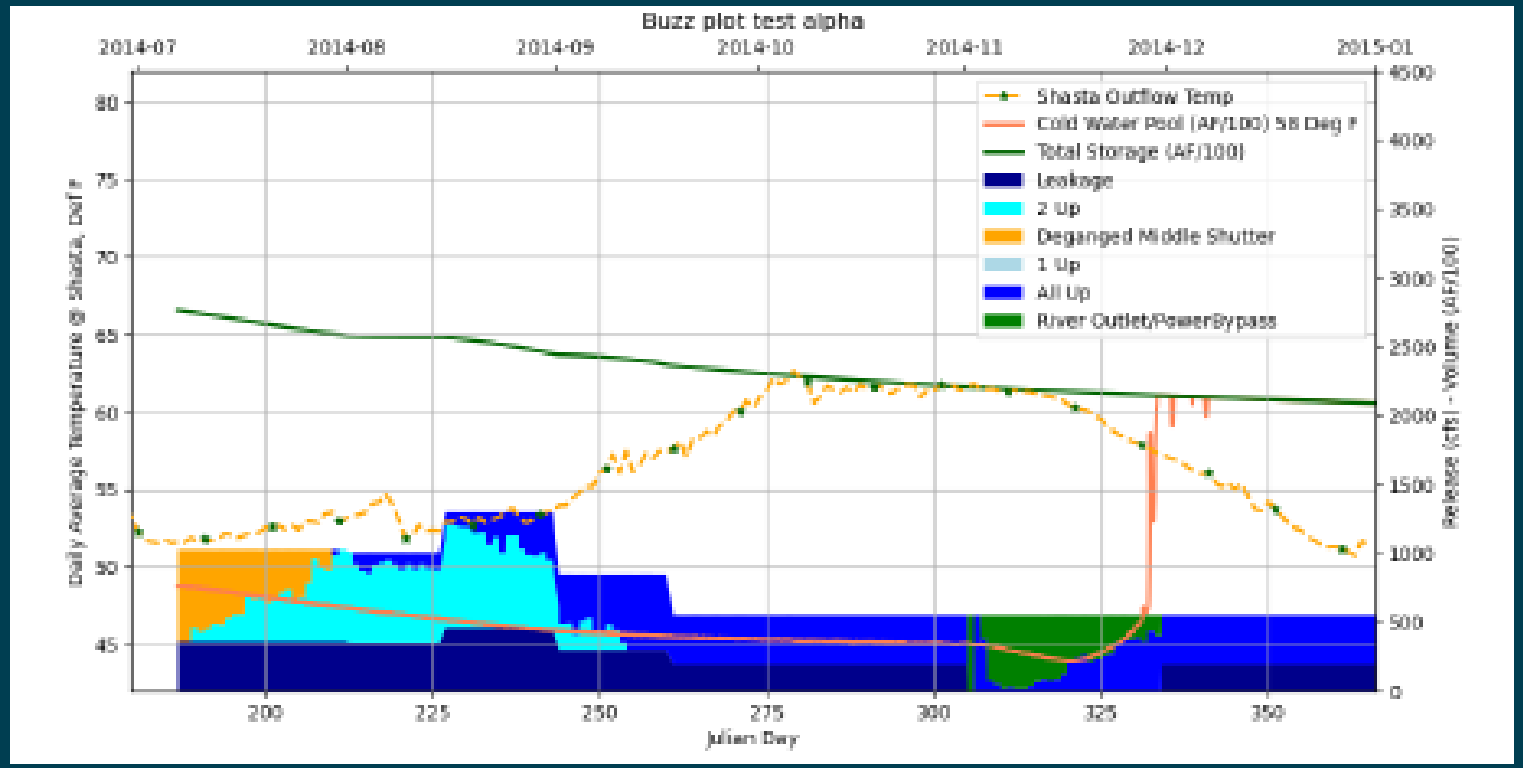




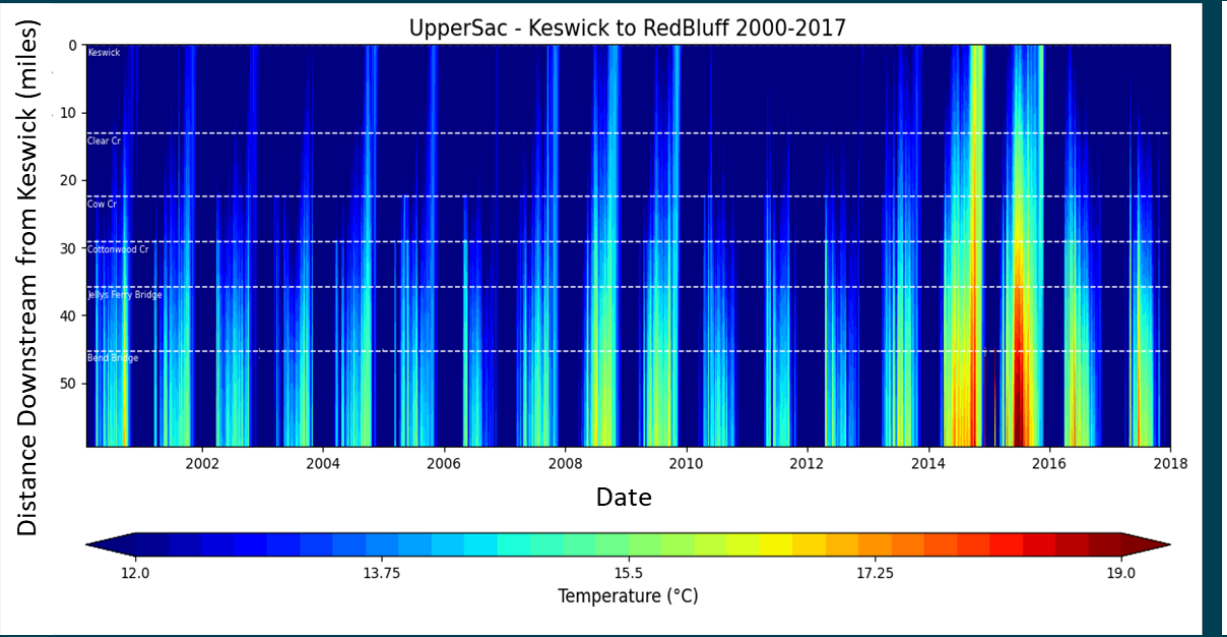
Example Complex Plot Objects

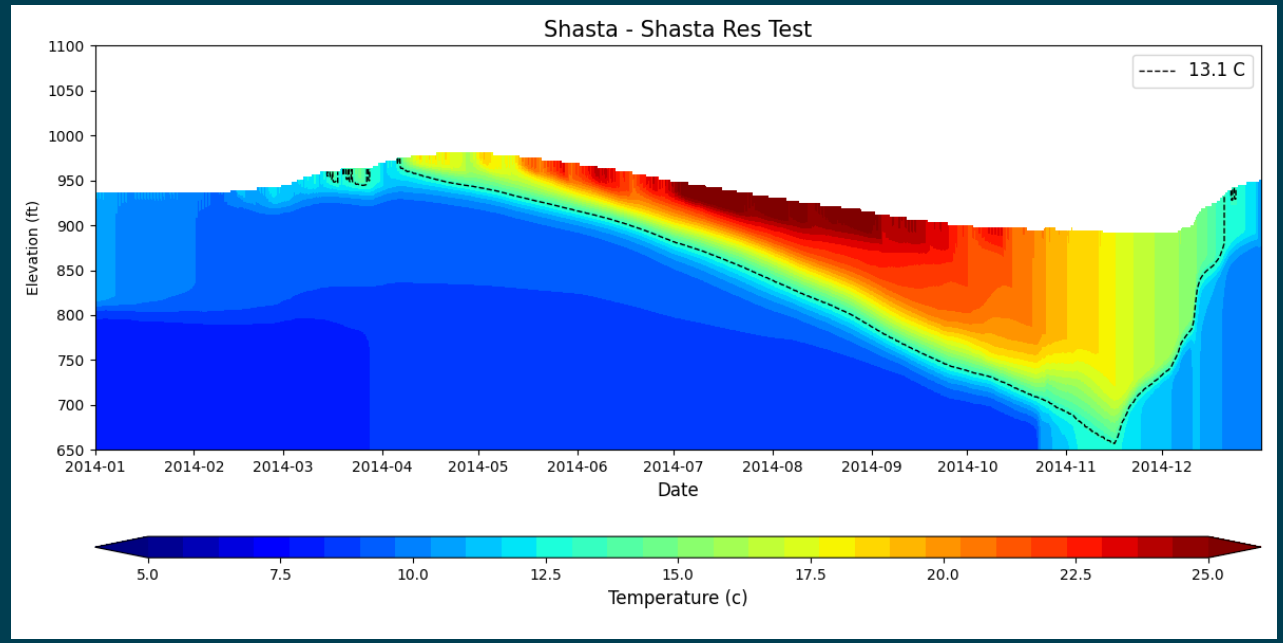
- Shasta Operations Plot





Example Contour Plot Objects





Example Table Objects

- Shasta Outflow Error Statistics Table

Statistics	2014	All Years
Mean Bias (deg C)	0.23	0.23
MEA (deg C)	0.37	0.37
RMSE (deg C)	0.47	0.47
Nash-Sutcliffe (NSE)	0.95	0.95
COUNT	365	365

- Shasta Outflow Temperature NSE, invalid under .65 Statistics Table

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	0.97	0.27	0.13	0.57	0.86	-	-	0.98	0.98	0.97	0.89	0.80
2014	0.92	0.49	0.56	0.72	0.91	0.96	0.98	0.97	0.96	0.92	0.53	0.28
2015	-0.02	-0.30	0.48	0.83	0.95	0.96	0.98	0.97	0.96	0.86	0.33	0.54
All	0.86	0.22	0.50	0.79	0.93	0.96	0.98	0.97	0.97	0.91	0.67	0.66

- Shasta Outflow Mean Monthly Statistics Table

Month	Comp. Mean 2014	Obs. Mean 2014
Jan	9.71	9.77
Feb	9.00	9.03
Mar	9.92	9.91
Apr	10.46	9.99
May	11.98	11.13

- Shasta Lake with Tributaries in 2013 Profile Statistics Table

Statistics	08Jan2013	05Feb2013	12Mar2013	03Apr2013	08May2013	20May2013
Mean Bias (deg C)	0.56	0.59	0.76	0.80	0.89	0.82
MEA (deg C)	0.76	1.08	0.97	0.87	1.01	0.94
RMSE (deg C)	0.92	1.21	1.10	1.04	1.16	1.14
Nash-Sutcliffe (NSE)	0.22	-0.26	0.29	0.67	0.85	0.92

Photo credit: John Hannon, Reclamation

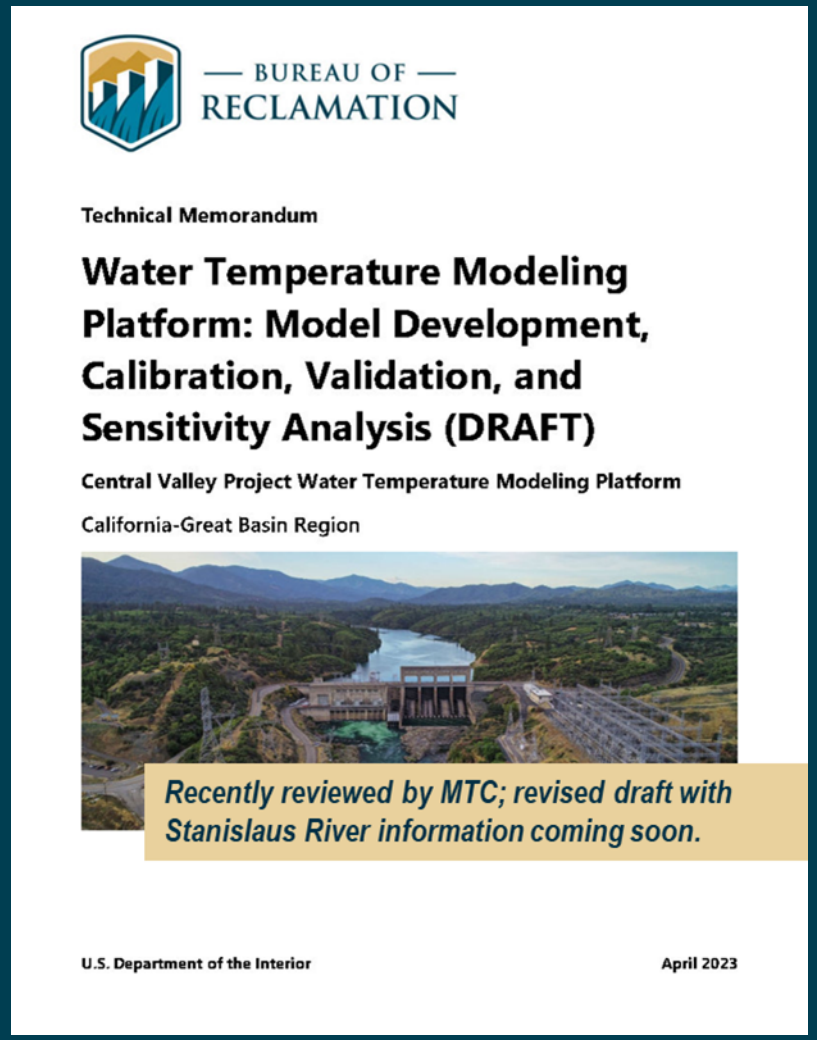
Introduction: Applications in WTMP that Generate Output (as planned)

Yung-Hsin Sun, PhD, PE; Sunzi Consulting LLC

John DeGeorge, PhD, PE; RMA

Calibration/Validation

- A significant amount of output figures and tables were incorporated in appendices for the draft Model Development TM
- Design focusing on modeler's needs for review and documentation

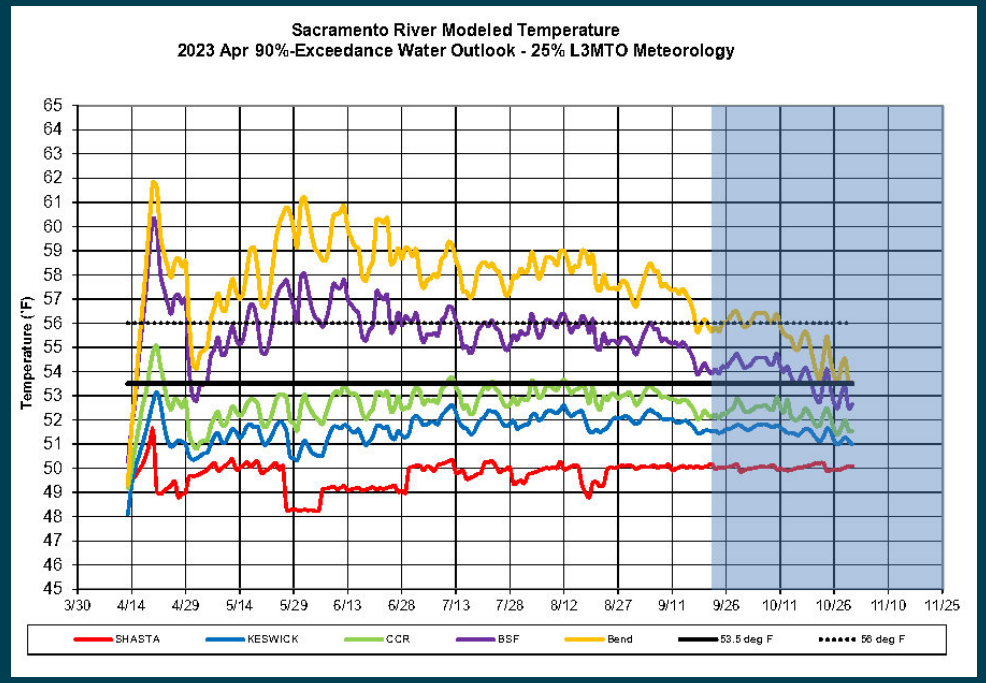


Seasonal Water Temperature Planning

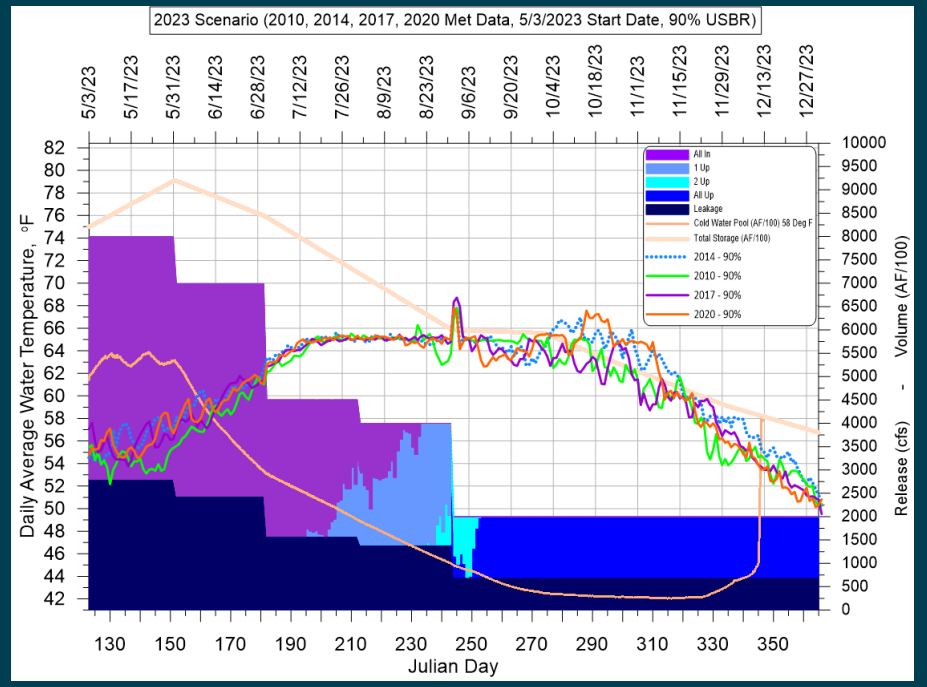
- Focus on relevant information typically included in the meeting package
  - Repeatable template that can be used throughout the season, showing records in the past and forecast in the future.
    - Realized conditions in the past of the current season provide useful context for future actions, including decisions and events of significant effects on water temperature management in the remaining season.
    - The process is a progressive planning process with forecast and correction, and a sequential decision process where the future decisions are subject to the constraints of previous ones.
  - Incorporate forecast uncertainty
    - Selective year scenarios (as in ARG package)
    - Quantifiable uncertainty (work in progress)
  - Necessary tables as identified

Seasonal Water Temperature Planning, Examples

- Example from the SRTTG Package



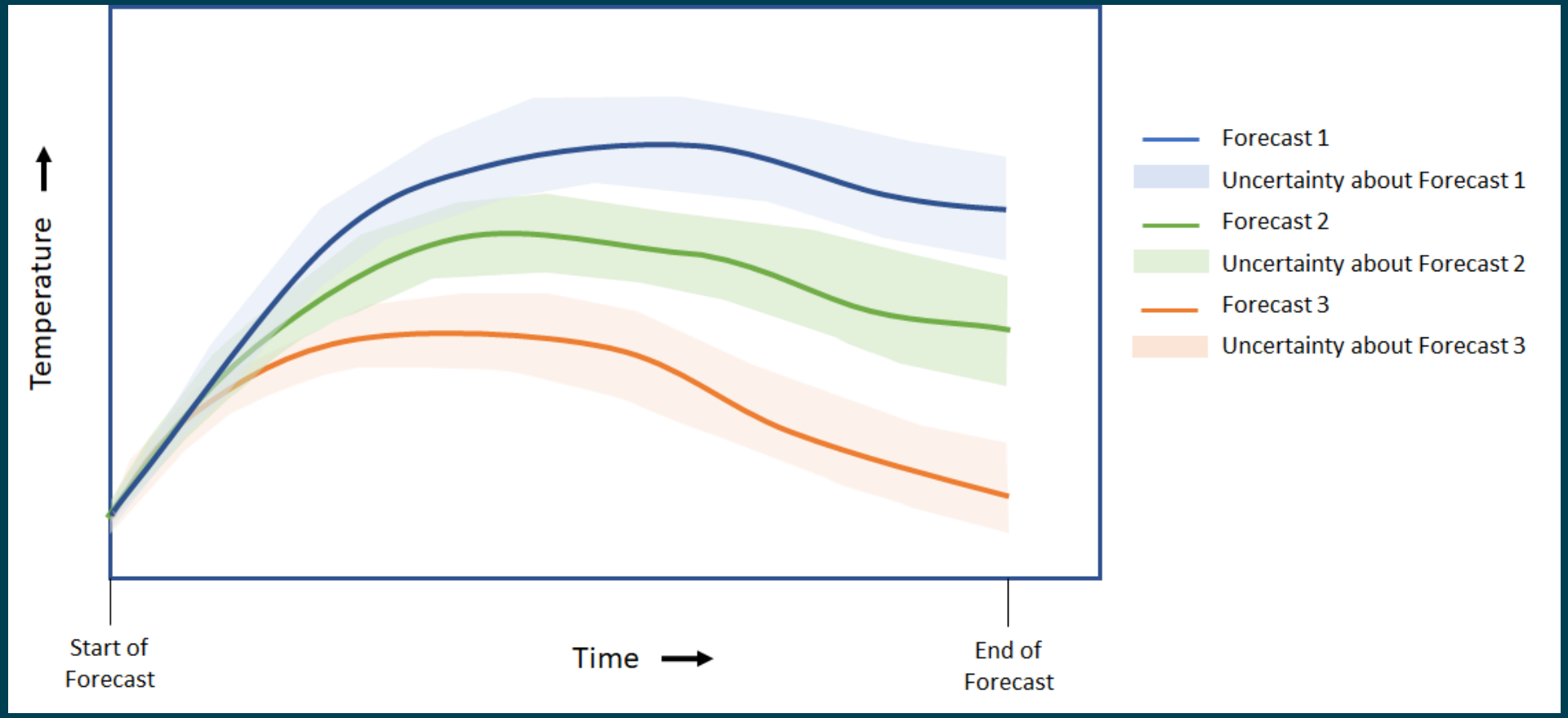
- Example from the ARG Package



- Is consistent information from different systems important?

Seasonal Water Temperature Planning, Forecasting Example

- Conceptual Error Band Chart (something we are working on)



Seasonal Water Temperature Planning, Hindcast

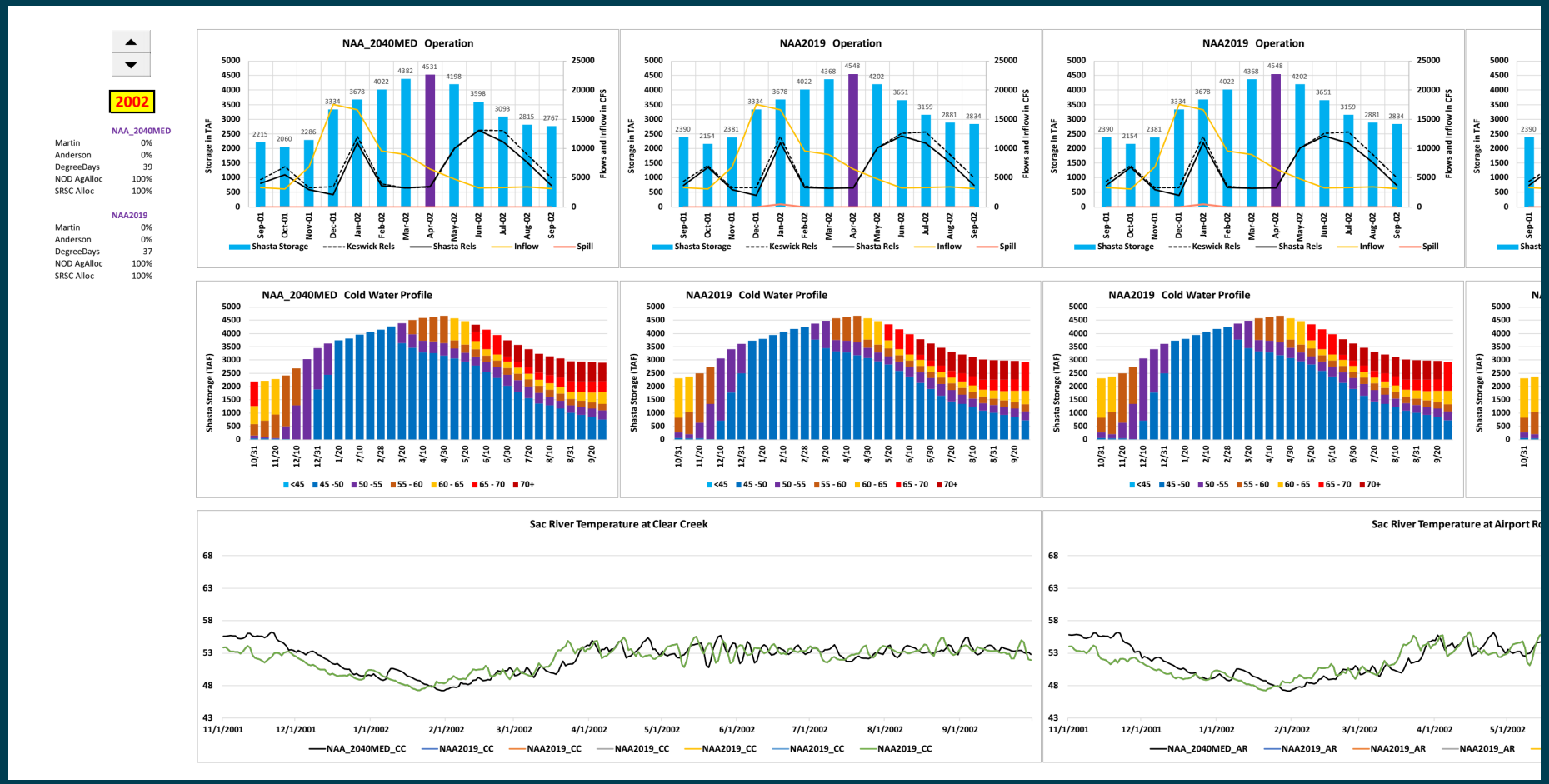
- End-of-Season Hindcast
  - The hindcast exercise is to inspire lessons learned for improved management.
  - Context is required to be useful.
  - Will the report be different than what we have planned?

Long-term Planning Studies

- A long-term planning study is different than a seasonal planning study is that it uses CalSim data but not forecast data. It also conducts a seasonal planning study for each simulated year (i.e., 100 years in the latest CalSim 3 in preparation).
  - Seasonal planning output can be leveraged for yearly information from a long-term planning studies. However, the aggregated information and statistics of the entire simulation period may be more important.
  - Work-in-progress with the planning team.
    - Output similar to those from CalSim runs?
    - Something more?

Long-term Planning Studies Example

- Example of using XL for matching display of information of a typical CalSim study review format used by modelers (i.e., an online review tool rather than a report)



Long-term Planning Studies

- Example of an old automatic reporting format from DWR's Oroville Facilities Relicensing Program (circa 2006)

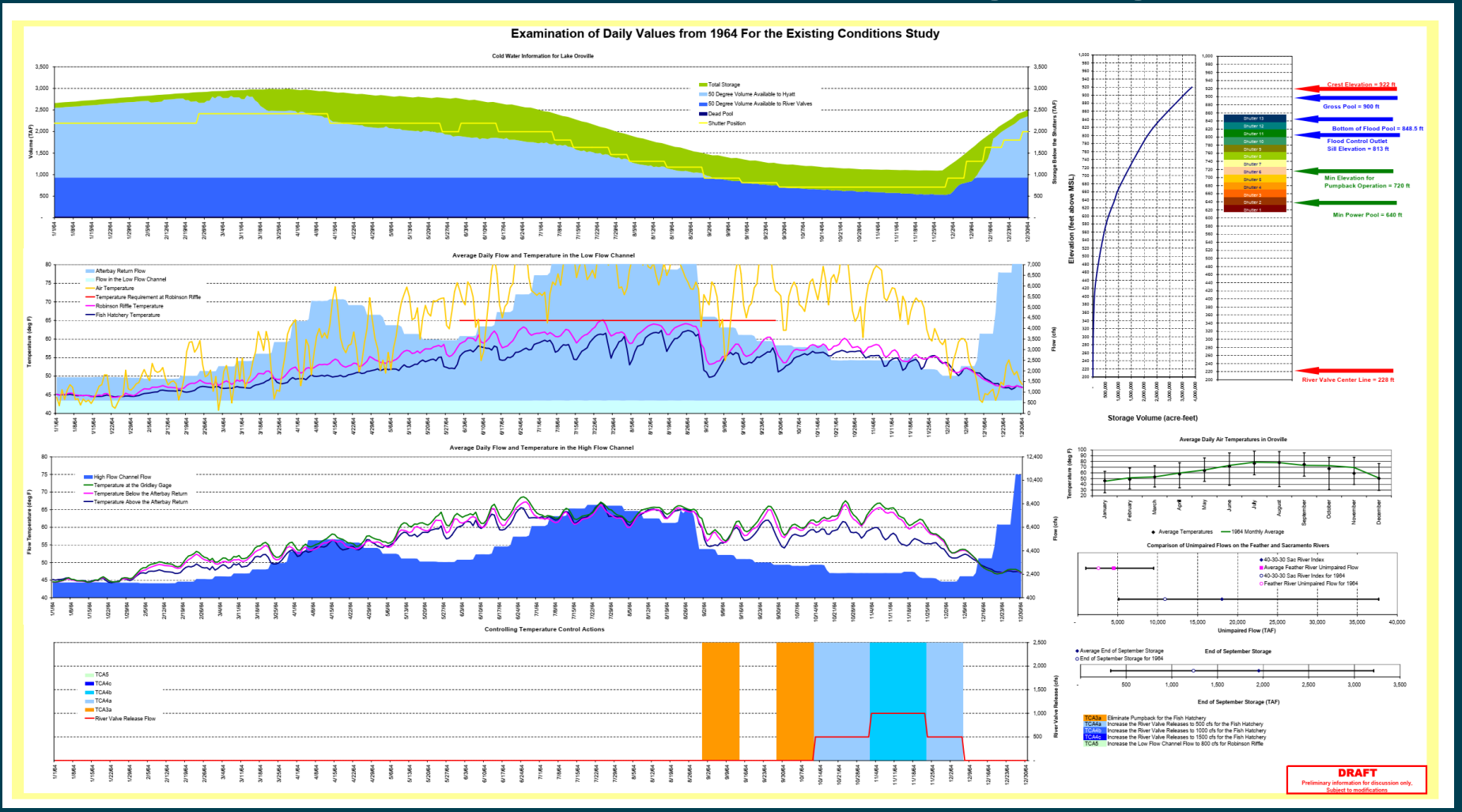


Photo credit: John Hannon, Reclamation

Discussion

Yung-Hsin Sun, PhD, PE; Sunzi Consulting LLC

Discussion: Useful Output per Application – What Do They Look Like?

Discussion: Output Concepts for Future Expanded Use of WTMP

Photo credit: John Hannon, Reclamation

Next Steps

Randi Field, CVO

Yung-Hsin Sun, PhD, PE, Sunzi Consulting LLC

WTMP Next Steps

- Complete the planned implementation for the current project.
- Separately, future development considerations and plan formulation.

Upcoming MTC and Topics

- MTC 09 Meeting: July 6, 2023; 1:00 p.m. – 4:00 p.m.
- Upcoming topics:
  - Model uncertainty
  - WTMP output and visualization
  - Other topics, as needed
- You have the registration link already in the Agenda – do it today.

Information Sharing and Contacts

- Key WTMP team members
  - Randi Field, RField@usbr.gov
  - Mike Deas, Mike.Deas@watercourseinc.com
  - John DeGeorge, jfdegeorge@rmanet.com
  - Craig Addley, Craig.Addley@stantec.com
  - Jeff Schuyler, Eyasco, Inc. jeff@eyasco.com
  - Yung-Hsin Sun, sun.yunghsin@sunziconsulting.com
- Project Information:
  - Contract: mppublicaffairs@usbr.gov
  - Website link - https://www.usbr.gov/mp/bdo/cvp-wtmp.html

NEXT MTC MEETING: July 6, 2023;
1:00 p.m. – 4:00 p.m.
BUREAU OF
RECLAMATION