

RECLAMATION

Managing Water in the West

SWRCB WRO 90-05 Reclamation Process for Upper Sacramento River Water Temperature Control



U.S. Department of the Interior
Bureau of Reclamation

WRO 90-5 Significant Changes

- Permanently changed Reclamation's water rights to address water temperature habitat protection in the Upper Sac. River as part of basic operations.
- Began the planning process for construction of a Shasta TCD in earnest. (completed 1997)
- Mandated a temperature monitoring network and reporting requirements

WRO 90-5 basic framework

- Designates Red Bluff as potentially the farthest downstream compliance pt for 56F.
- Acknowledges that reasonable control of water temperature for fishery purposes may require the compliance pt to be farther upstream.
- Reasonable control is discussed in terms of conservation of coldwater resources and allowing a higher temperature when necessary for winter-run Chinook Salmon needs.
- Requires consultation with agencies in order to move compliance pt upstream of Red Bluff. (Task Group)

WRO 90-5 basic framework cont.

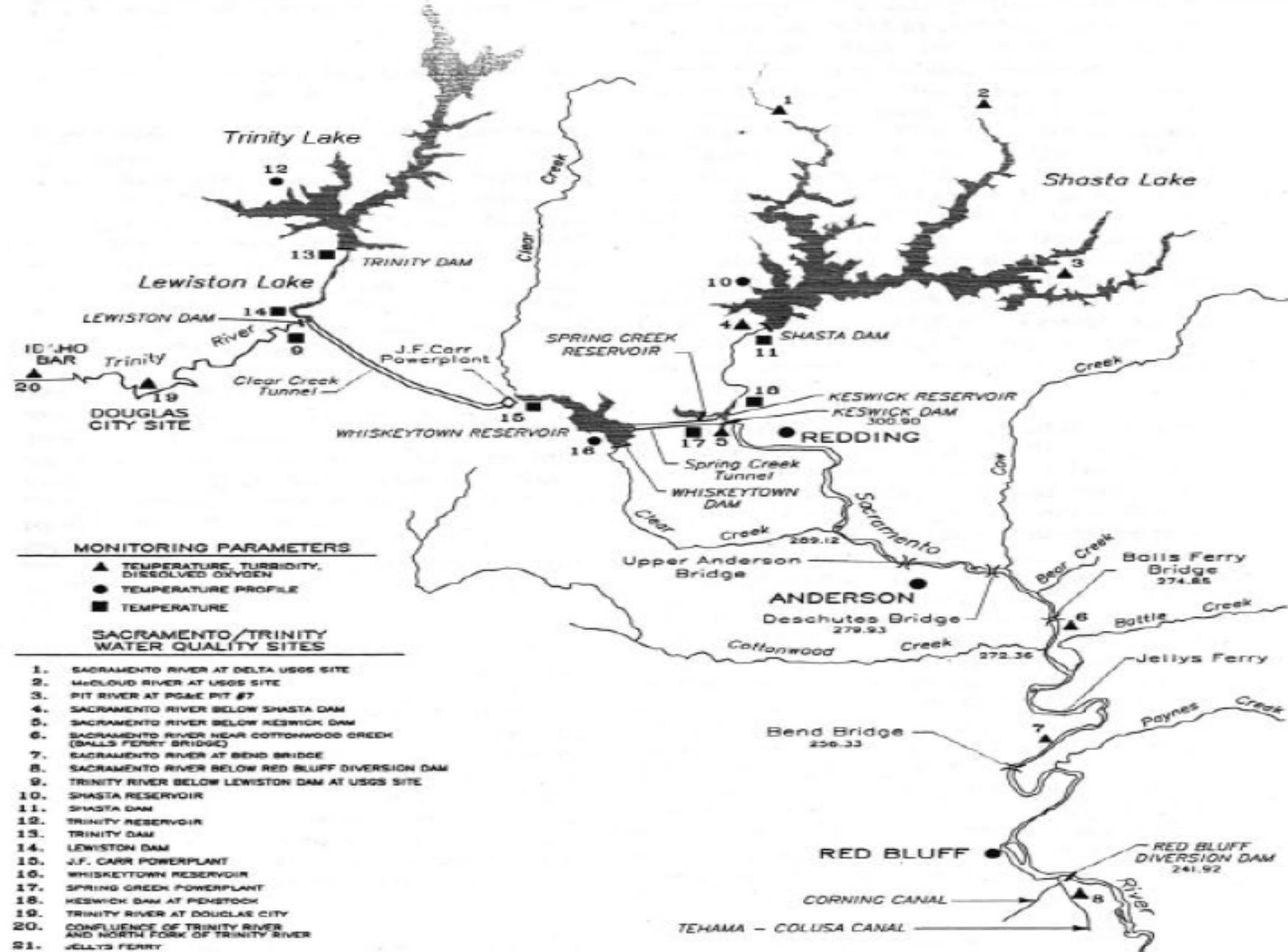
- Requires an operation plan be submitted to SWRCB for compliance points upstream of Red Bluff.
- Requires water temperature compliance reporting to SWRCB. (monthly and annually)

SWRCB WRO continued jurisdiction

“This term we adopt in this Order will require the Bureau to maintain the temperature in the reach of the Sacramento River between Keswick Dam and the Red Bluff Diversion Dam at 56F when (1) higher temperatures will be detrimental to the fishery and (2) maintenance of 56F in that reach is within the Bureau’s reasonable control.

SWRCB continued jurisdiction

Whether a particular factor is within the Bureau's reasonable control depends on the specific facts and is a matter for the Chief of the Division of Water Rights or the Board to decide, when the Bureau proposes changes in the location where it will meet the temperature requirement. Parties who believe that it is within the Bureau's reasonable control to meet the temperature requirement at a location different from the location the Bureau proposes, may so advise the Chief of the Division of Water Rights."



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Annual WRO 90-5 Information and Process factors

- **Coldwater Availability**
- **Spawning and Habitat Information**
- **Preference of coldwater availability for ESA species vs. other species.**
- **Seasonal TCD flexibility**
- **Integrated operation of CVP facilities towards meeting CVP objectives, including ESA considerations on other CVP controlled streams.**

Annual WRO 90-5 Information and Process factors Cont.

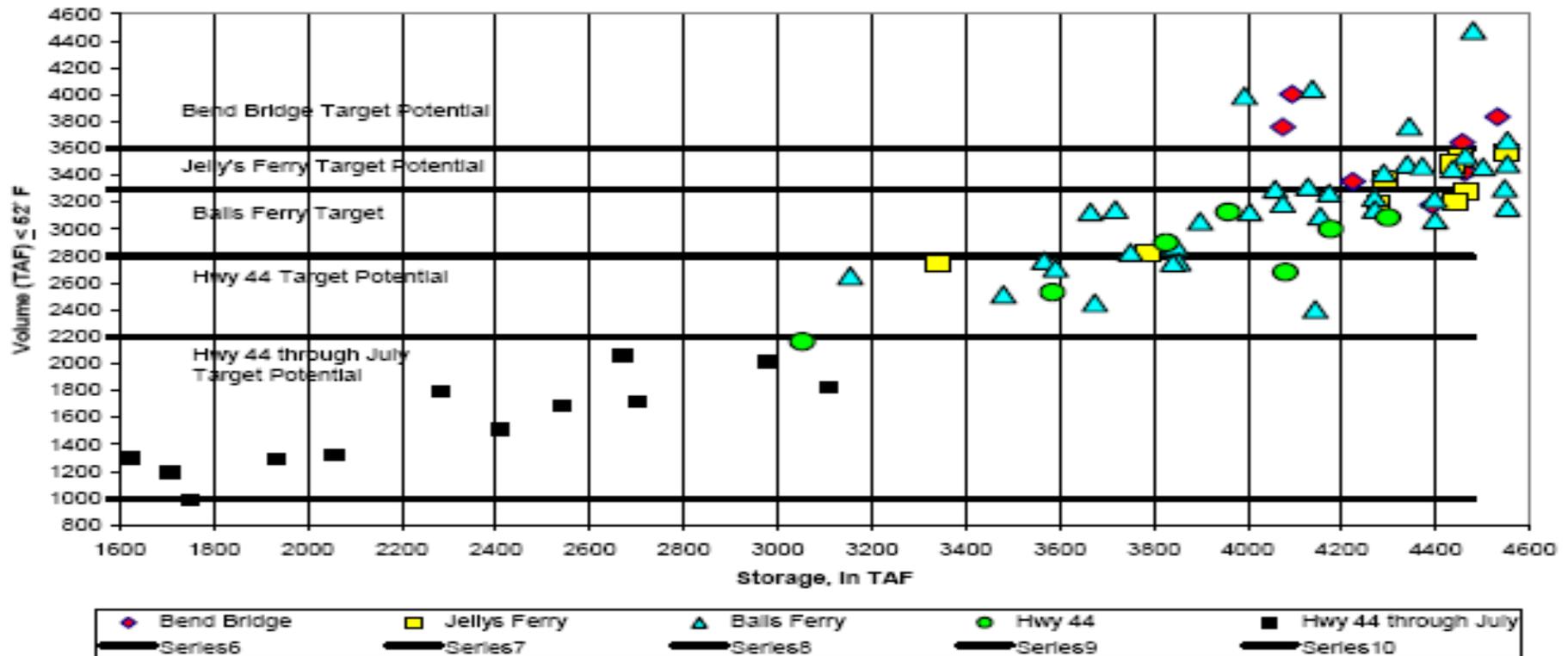
- Each factor potentially affects the other
- Each factor has changed significantly since the original 1993 BO.
- Each changed condition is a basis for ESA review and/or re-consultation.
- Each factor is part of the Task Group water temperature risk assessment.

Coldwater Availability “Rule of Thumb”

- The volume of coldwater below 52F available in Shasta storage in late April is a good indicator of thermal management potential.
- Task Group assess how to potentially manage and distribute this thermal potential through the temperature control season.

Coldwater Availability “Rule of Thumb”

Figure 3
Shasta End of April Storage
Future (2030) b(2) w/SDIP - Based on Compliance Pt



Appendix B, from the Jun 30, 04 BA

Spawning Distribution Change for WR

Winter-run Chinook spawning distribution 1982 – 2006 showing shift upstream above Balls Ferry

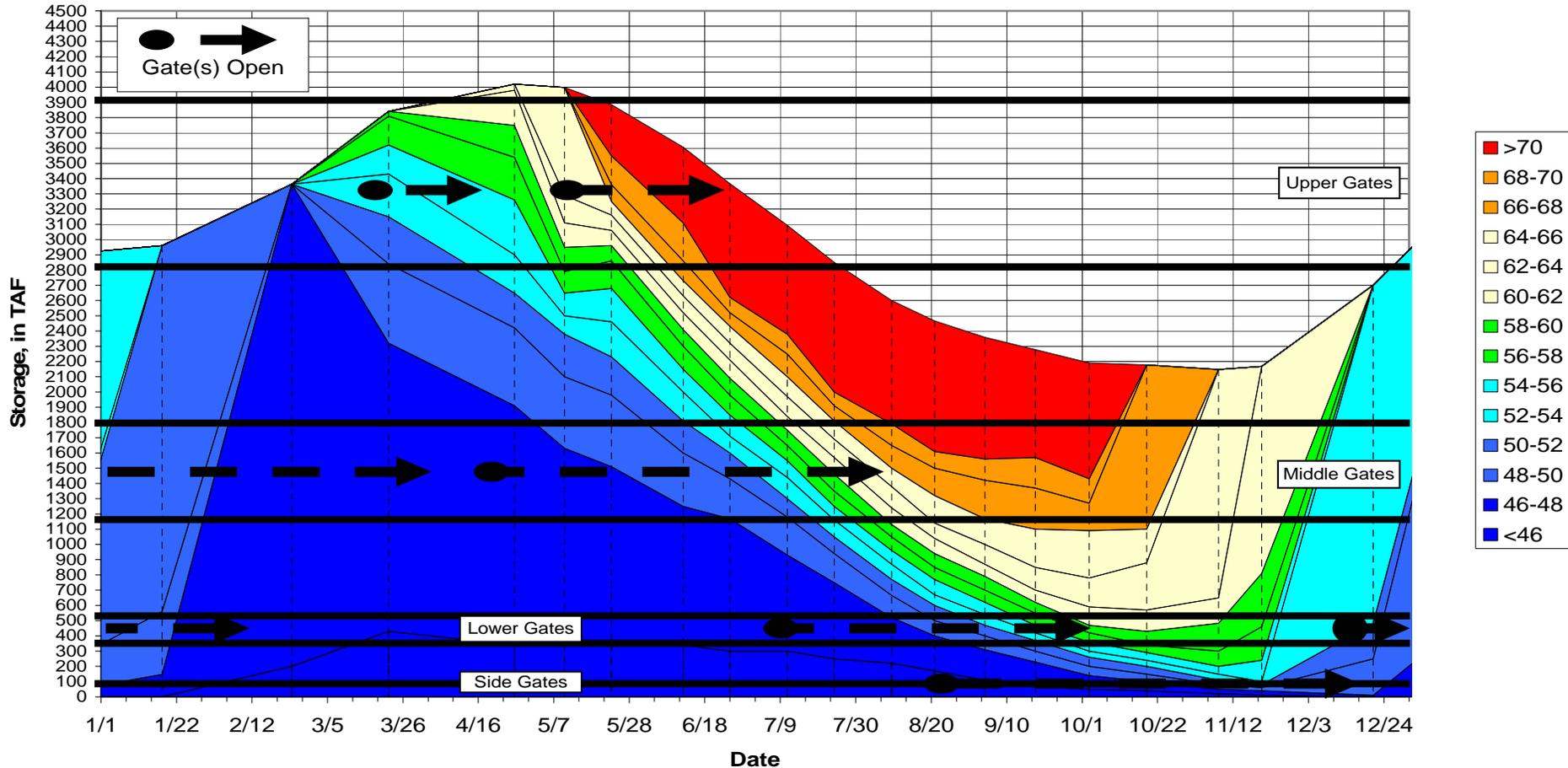
River Section	YEAR																				
	82	85	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Keswick to A.C.I.D. Dam	0%	6%	0%	1%	6%	0%	0%	2%	5%	0%	7%	3%	0%	3%	0%	6%	36%	40%	66%	16%	52%
A.C.I.D. Dam to Highway 44 Bridge	56%	13%	15%	23%	30%	36%	70%	20%	61%	26%	83%	71%	83%	77%	31%	27%	15%	22%	17%	36%	36%
Highway 44 Br. to Airport Rd. Br.	36%	26%	17%	30%	47%	51%	20%	46%	25%	24%	9%	26%	17%	16%	66%	47%	45%	28%	16%	49%	12%
Airport Rd. Br. to Balls Ferry Br.	3%	14%	18%	7%	2%	6%	10%	15%	2%	41%	0%	0%	0%	1%	1%	5%	4%	1%	0%	0%	0%
Balls Ferry Br. to Battle Creek	0%	0%	9%	2%	0%	1%	0%	5%	0%	6%	0%	0%	0%	1%	2%	6%	0%	0%	0%	0%	0%
Battle Creek to Jellys Ferry Br.	0%	1%	21%	2%	0%	1%	0%	0%	2%	0%	1%	0%	0%	0%	0%	2%	0%	0%	0%	0%	0%
Jellys Ferry Br. to Bend Bridge	0%	4%	14%	8%	13%	0%	0%	5%	2%	0%	0%	0%	0%	0%	0%	8%	1%	0%	0%	0%	0%
Bend Bridge to RBDD	0%	6%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RBDD to Tehama Br.	3%	28%	4%	16%	0%	5%	0%	4%	2%	0%	1%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Tehama Br. To Woodson Bridge	n/s	0%	0%	8%	2%	2%	0%	0%	0%	0%	n/s	n/s	0%	0%	0%	0%	0%	0%	0%	0%	0%
Woodson Bridge to Hamilton City Br.	n/s	0%	n/s	0%	0%	n/s	0%	n/s	n/s	n/s	n/s	n/s	n/s	n/s							
Hamilton City Bridge to Ord Ferry Br.	n/s	n/s	n/s	n/s	0%	n/s	0%	n/s	n/s	n/s	n/s	n/s	n/s	n/s							
Ord Ferry Br. To Princeton Ferry	n/s	n/s	n/s	n/s	n/s	n/s	0%	n/s	n/s	n/s	n/s	n/s	n/s	n/s							
Total New Redds Counted	33	103	313	1,285	47	104	10	55	44	17	175	70	30	121	1,144	588	1,386	610	878	621	1,968



Source: DFG, SRSSAP Tech. Report No. 06-2, 2006

Seasonal TCD Flexibility

Lake Shasta Isothermobaths - 2001
(Water Temperature, in ° F)



Integrated Operation of CVP

- Other water sources (Trinity, American) may at times help support Upper Sac. Temperature achievement, but over time this capability has diminished.
- Use of 90% Exceedence Hydrology forecast for CVP allocation purpose is designed to minimize potential conflict of water conservation necessary for coldwater pool development and spring export of water.
- If available water supply is a limiting allocation factor, Keswick release patterns are designed first on a seasonal pattern conducive to temperature management. Delta exports then follow that water release pattern when the water enters the Delta.

Changes to CVP Ops since 93 BO affect coldwater management potential (+ or – effect on Upper Sac. Temp)

- **Trinity River Decision (-)**
- **SWRCB D-1641 higher winter and spring outflow requirements (-)**
- **CVPIA in-stream flow actions in fall/winter (-)**
- **General California increases in water demand for all purposes (-)**
- **Installation of TCD (+)**
- **CVPIA Improved fish passage at Red Bluff and ACID dams (+)**

Issues faced annually for WRO 90-05 Temp Ops Plan

- **Balancing water temp needs of species/life stages over entire temperature control season**
- **Conserving coldwater for most efficient distribution over temperature control season**
- **Maximizing water temperature habitat for Winter Run in spring months vs. coldwater conservation for later time periods.**

Natural variables faced annually

- **Hydrology (Overall water supply and Shasta coldwater availability)**
- **Size of thermal loading from creeks (Cow, Cottonwood and Battle creeks) below Keswick during spring.**
- **Redding Air Temperatures**
 - **Seasonal departures from normal**
 - **Short-term fluctuations and Predictability**

Temperature Models used by Reclamation to manage to WRO 90-5

- Differentiated by purpose of use
 - Seasonal/Real-time models are used for forecasting and tracking purposes. These models are used to make **ABSOLUTE** water temperature projections.
 - Long-term Planning Temperature models are used to **INCREMENTALLY** compare alternative simulation - not used for absolute water temperature projections nor compliance strategies

WRO 90-05 Model tools

- A specifically adapted version of the long-term Sacramento R. Water Quality Model (SRWQM) is used by Reclamation to produce seasonal temperature target projections, and to seasonally update those projections.
- Adapted to utilize most current Shasta profile information set.
- For this model the Shasta Tail bay temp targets are flexible inputs in order to characterize the seasonal management progression of TCD operations and coldwater availability relationships

WRO 90-05 Model tools

- Information produced from several alternative model runs for compliance strategy is shared with the Task Group through the consultation process.
- Inherent uncertainty exists for forecasted projections of Redding air temps and local creek water temperature thermal loading influences
- Risk/Adaptive management discussion in the Task Group invariably is a discussion about summer water temps for winter run protection vs. late summer/fall water temps and protection of multiple species.

Real-time Models for day to day temperature management

- Real-time (Day to Day) management of Upper Sac temps and TCD management uses a simplistic incremental approach of characterizing current flow magnitudes, TCD/Shasta Tail bay water temps and projected Redding Air temperatures.
- Most difficult operations occur in spring and fall when flow response times from Shasta Lake are long and ambient air temperatures are most variable.

Real-time feedback considerations

- The seasonal and real-time models have feedback considerations.
- The seasonal model is updated to use the most recent Shasta temperature profile.
- In real-time management, the seasonal progression in time through different TCD levels is a good indicator of how the current year compares to previous years.

Long-term Planning Models

- **Shasta Tail bay temperature targets are inflexible and set to a rigid seasonal strategies.**
- **TCD operations and Shasta Tail bay targets are not reflective of 90-05 process.**
- **Does not have Task Group Risk/Adaptive Management process inherent**
- **Good for Incrementally comparison, not absolute temps**

Commonality of the Model Approaches

- Both seasonal and long-term modeling approaches are limited or constrained for their water temperature management capabilities to spring coldwater availability.
- The availability of coldwater can be characterized by either approach.
- Spring coldwater availability is the key resource that the Task Group must assess how to designate a seasonal coldwater management strategy.
- People (Task Group), not models, make the inherent risk/adaptive management assessment tradeoffs.

WRO 90-05 as an adaptive management process

- **Historical record shows that the WRO 90-05 process works to adaptively manage the coldwater resource efficiently.**
- **Models bring information and projections for the Task Group to weigh and consider for the whole temperature season.**
- **People make the difficult tradeoffs and then adapt.**
- **Process has worked well, Reclamation emulates process for water temperatures in the American River using the ARG forum.**