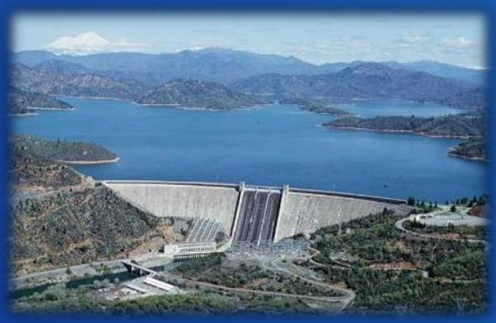
RECLAMATION

Managing Water in the West

Reclamation/NMFS Stakeholder Workshop #4

Shasta RPA Draft Proposed Amendment

February 12, 2017



U.S. Department of the Interior
Bureau of Reclamation

Introductions

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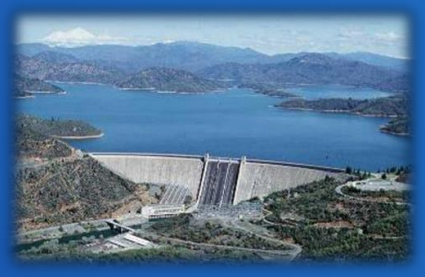
Workshop Agenda



- Introductions
- Workshop Objectives
- Draft Proposed Amendment vs. Current RPA
- 2017 Real-Time Temperature Management
- Updated Sensitivity Analyses
- Next Steps
- Temperature Model Development Update
- Draft Science Work Plan
- Discussion Q&A

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Proposed Ground Rules

- Participate!
- Be respectful
- Help us stay on track
- Speak into microphone
- Take comments in batches – in room then on phone
- Cell phones off/silent in room – Mute if on phone

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Workshop Objectives

Provide status updates, discuss, and receive input on:

1. 2017 Real-time Temperature Management
2. Model Results: Sensitivity Analyses
3. Next Steps in Amendment Process
4. Draft Science Work Plan

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Overview of the Shasta RPA Amendment vs. Current RPA

Background

- 2011 amended RPA provides for adaptive management
- NMFS perspective on why an adjustment/adaptive management is needed:
  - Recent multiple years of drought conditions
  - New science and modeling
  - Data demonstrating low population levels of winter-run and spring-run
  - Potential for increased flexibility & predictability

Background (cont'd)

- Purposes as defined by NMFS:
  - Sets interim operational changes that are necessary at this time
  - Phased approach, provides a bridge between current RPA and completion of the reinitiation of consultation (estimated at 3-5 years)

Framing the Temperature Management Season

- Seasonal planning in the current RPA:
  - February forecast
  - Summer temperature management
  - Fall storage/conservation

Draft Proposed Shasta RPA Amendment

Feature	2011 RPA Amendment	Draft Proposed RPA Amendment	WY 2017 Operation Study
RPA Action I.2.1	Performance Measures:	Objective-Based Management:	*N/A*
	N/A	Australian Model	*N/A*
	N/A	Temp-dependent mortality objectives	*N/A*
	N/A	Peak spring storage targets	*N/A*
	10-year avg % met	End of September storage targets	*N/A*
	10-year avg temperature compliance point (TCP) % met	N/A	*N/A*

Draft Proposed Shasta RPA Amendment

Feature	2011 RPA Amendment	Draft Proposed RPA Amendment	WY 2017 Operation Study
RPA Action I.2.3: Initial forecast	"…sufficient water for temperature management…"	Peak spring storage targets based on water year type	N/A
Adult winter-run migration and holding	56°F DAT btn Balls Ferry and Bend Bridge 4/15-5/15	61°F 7-day average daily maximum temperature (7DADM) at Jellys Ferry 3/1-5/15	N/A
RPA Action I.2.3.A: temp and storage met	Initial allocation	Initial allocation	N/A
RPA Action I.2.3.B: temp and storage not achievable	Coordinate and consult	Monthly Keswick release schedule by water year type	N/A
RPA Action I.2.3.C: drought exception procedure	Temp/TCP and EOS not achievable	Temp/TCP and EOS not achievable	N/A

Draft Proposed Shasta RPA Amendment

Feature	2011 RPA Amendment	Draft Proposed RPA Amendment	WY 2017 Operation Study
RPA Action I.2.4:			
Temperature Compliance Location	Between Balls Ferry and Bend Bridge	Clear Creek CDEC gage (CCR)	Clear Creek CDEC gage (CCR)
Temperature metric	Daily average temperature (DAT)	7DADM or DAT surrogate	DAT surrogate
Temperature criterion	≤56°F DAT	≤53.0°F to ≤56.0°F DAT, depending on yeartype	≤53.0°F DAT (Wet year target)
RPA Action I.2.4.1: Post season winter-run egg-to-fry survival evaluation	N/A	% based on water year type	

Australian Model Framework

Examples of environmental watering objectives under different planning scenarios

SOURCE: Victorian Environmental Water Holder, 2015. Seasonal Watering Plan 2015-16: Introduction.

NOTE: The Seasonal Watering Plan sets objectives based on the amount of precipitation and the amount in storage. This allows for changing priorities that match changes in conditions.

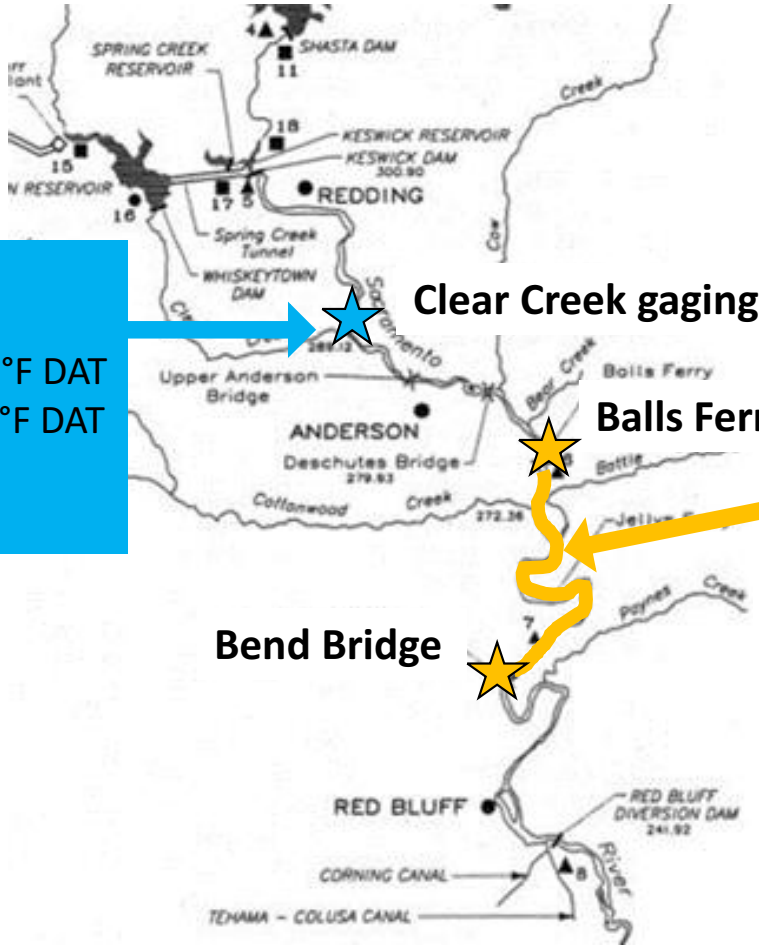
From Mount et al. 2016: Managing Water for the Environment During Drought

Australian Model Framework

	CRITICAL	DRY	BELOW NORMAL	ABOVE NORMAL & WET
Objective	PROTECT	MAINTAIN	RECOVER	ENHANCE
Temperature-dependent mortality objective	<30%	<8%	<3%	<3%
Associated temperature criterion (at Clear Greek gage)	≤56°F DAT	≤54.0°F DAT	≤53.0°F DAT	≤53.0°F DAT

Map of Current and Proposed Temperature Compliance Point

<u>Proposed:</u>
Wet: ≤53.0°F DAT
Above Normal: ≤53.0°F DAT
Below Normal: ≤53.0°F DAT
Dry: ≤54.0°F DAT
Critical: ≤56.0°F DAT



Draft Proposed Shasta RPA Amendment Process

- January 2017: NMFS issued the draft
- March 2017: Reclamation issued formal response
  - Concerns on:
    - Feasibility
    - More restrictive operations
    - Science of new objectives
    - Applicability under adaptive management process as opposed to reconsultation
    - Other elements
- Agency interactions provided for plan to allow for analysis of draft proposal while also conducting an operational study given suitable hydrologic conditions in 2017

Draft Proposed Shasta RPA Amendment Process

- Structured stakeholder engagement process:
  - Workshop #1: seek input on the initial science and modeling workplan
  - Workshop #2: seek input on draft temperature pilot plan components and modeling
  - Workshop #3: review final 2017 temperature management pilot plan and status report on system-wide modeling
  - Workshop #3.5: update on science workplan and system-wide modeling
  - Workshop #4: seek input on science workplan, system-wide modeling results

LOBO Review 2017

- Questions to the IRP associated with:
  - Temperature-dependent egg mortality model and critical temperature threshold
  - Application of the Australian model (Mount et al. 2016)
  - 7 DADM vs. DAT
- December 4-7, 2017, meeting
- January 25, 2018, letter from the Delta Science Program transmitting recommendations

2017 Real-Time Temperature Management

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2017 Operational Study

- **Temperature Targets:**
  - **53°F DAT at Sacramento River above Clear Creek confluence**
    - **Acts a surrogate to 55°F 7DADM at same location**
  - **56°F DAT at Balls Ferry**

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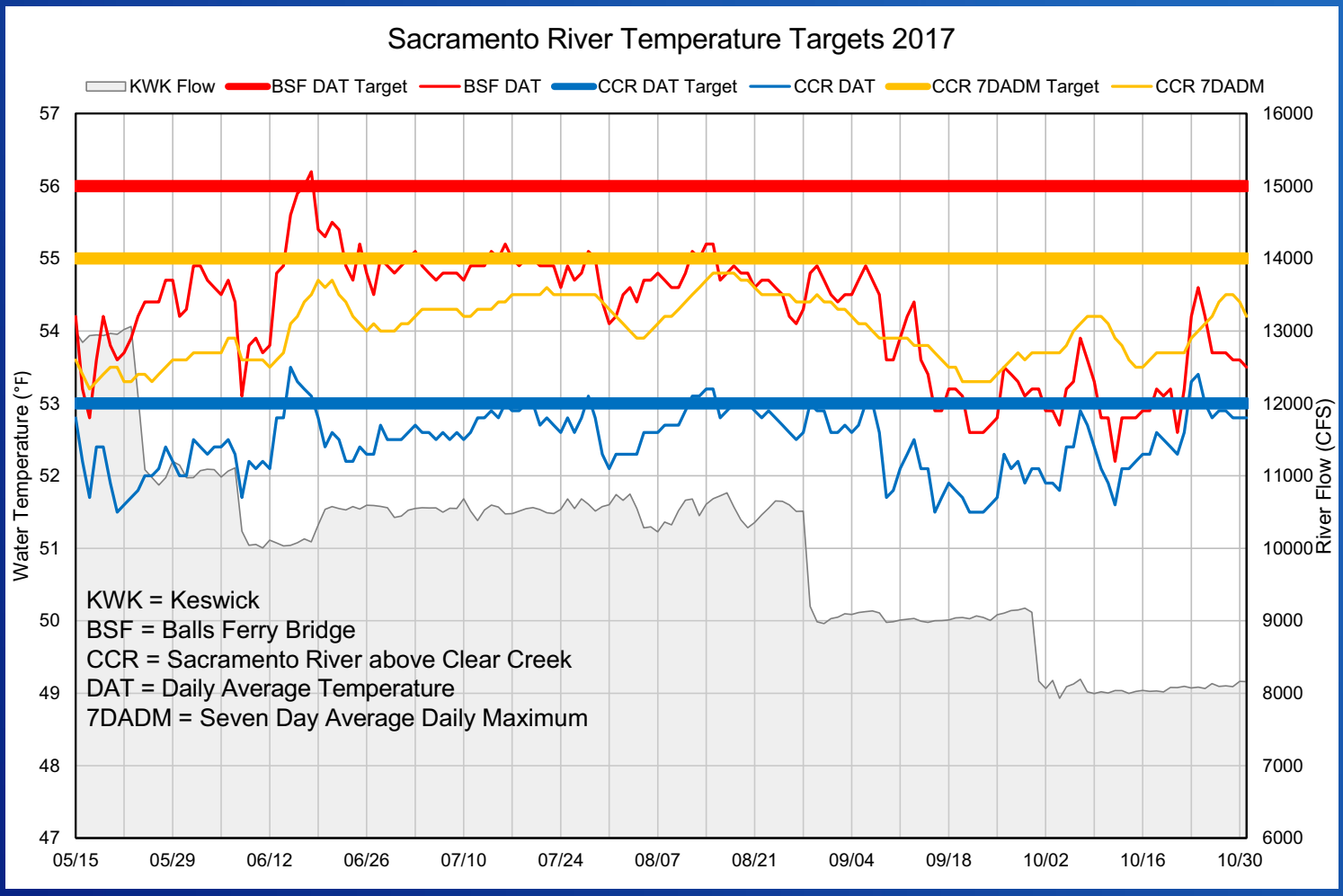

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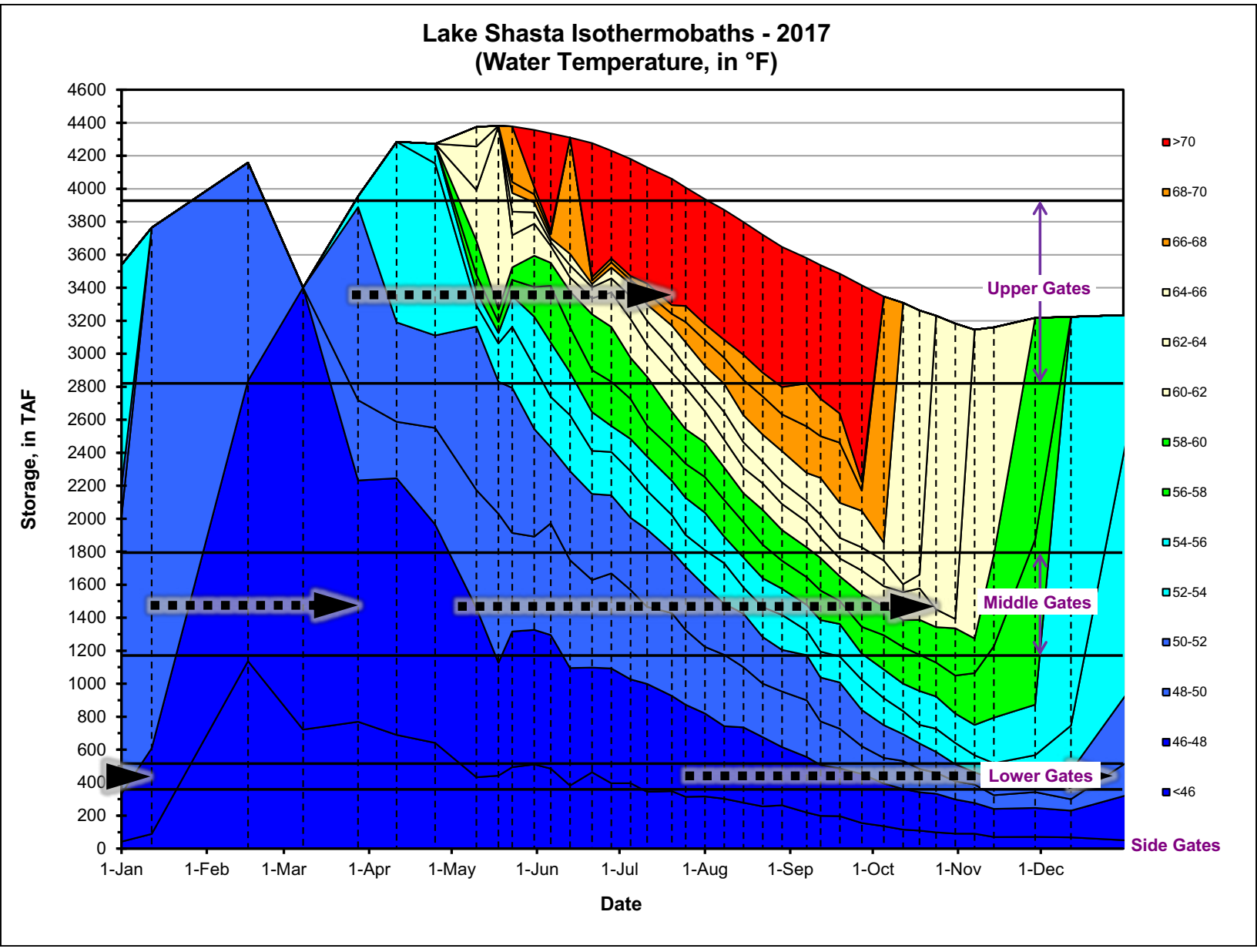
Lake Shasta Isothermobaths - 2017
(Water Temperature, in °F)
Storage, in TAF
4600
4400
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Date
>70
68-70
66-68
64-66
62-64
60-62
58-60
56-58
54-56
52-54
50-52
48-50
46-48
<46
Upper Gates
Middle Gates
Lower Gates
Side Gates

2017 Hydrologic Conditions

- Wet Water Year type
- Plentiful Shasta Cold Water Pool
- High Keswick releases in spring

- 2017 conditions mask operational impacts

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Update: System-Wide Sensitivity Evaluations

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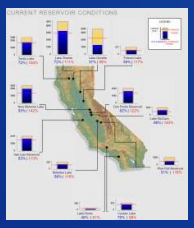
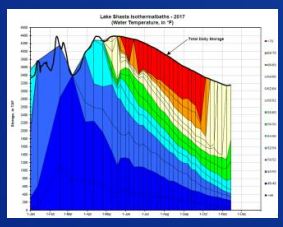
Modeling Process



System Operation: CalSim-II

Simulate water delivery from reservoirs to meet assumed downstream demands/constraints



Temperature: HEC-5Q

Given system conditions (CalSim), simulate changes the Shasta TCD to meet downstream temperatures

Salmon Mortality: Martin Model

Given flow (CalSim) and temperature (HEC-5Q), project upper reach mortality of redd lifecycle

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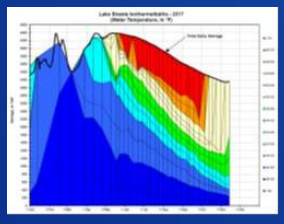
Comparative Sensitivity Analysis: Water Operations

System Operation: CalSim-II

Temperature: HEC-5Q



Salmon Mortality: Martin Model

Current Water Operations*	Proposed NMFS Amendment
Represents recent operational practice	**Shasta Storage and Keswick Release Constraints**
Temperature Target 53°F DAT at CCR*	Same
Base	Same

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Comparative Sensitivity Analysis: Water Operations

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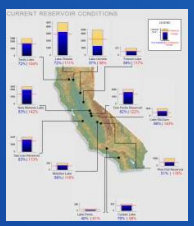
Define the Operational Base Model

CalSim-II
"Existing Model Framework"

CalSim-II
New Base: "Current Operations"



Existing Model Framework	Current Operations (CO)
2008/9 BiOp RPAs	2008/9 BiOp RPAs
Early Long-Term Climate (Q5)	Early Long-Term Climate (Q5)
	Mimic 2013-2015 Drought Relaxations & Curtailments

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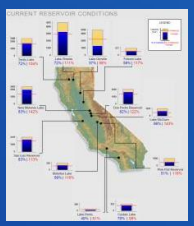
System Operation Assumptions

CalSim-II
"Current Operations"

CalSim-II
"NMFS"



Current Operations (CO)	NMFS Alternative (NMFS)
2008/9 BiOp RPAs	Same
Mimic 2013-2015 Drought Relaxations & Curtailments	Same
Early Long-Term Climate (Q5)	Same
No Storage carryover or release targets	**Proposed Amendments: Shasta Storage and Keswick Release Constraints**

Analyses – Two Scenarios

1. “Current Ops”
   - Attempts to replicate shortage allocation approaches taken during recent drought sequence
- Delta X2 Relaxations
- Reduction of Rio Vista Flow requirement
- Reduction of Emmaton and Jersey Point Water Quality requirements

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Analyses – Two Scenarios

2. "NMFS Amendment"
   - No specific logic that guarantees Shasta storage levels
   - Allows for Project and Non-Project shortage allocation necessary in attempt to meet proposed operational objectives
- Not a policy or realistic strategy, but used to test ability to reach targets under essentially any supply condition

Comparative Sensitivity Analysis

- **Answers:**
  - **What is the magnitude of the potential incremental benefits/impacts by attempting to apply the Proposed Shasta Storage Carryover and Keswick Release constraints on the CVP/SWP system?**
- **CalSim Analysis:**
  - **Feasibility of targets/restrictions**
  - **Impacts/changes to other parts of the CVP/SWP system required to meet targets/restrictions**

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Analyses – Fall Storage Targets

- **Draft Proposed September Storage Targets**
  - **Critically dry: 1.9 MAF**
  - **Dry: 2.2 MAF**
  - **Below Normal: 2.8 MAF**
  - **Above Normal: 3.2 MAF**
  - **Wet: 3.2 MAF**

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Analyses – Fall Storage Targets

- **Evaluate:**
  - **Compliance under "Current Ops"**
  - **Compliance using modified CVP delivery allocation**
    - **Allocations consider fall storage target in computing CVP delivery capability**

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Simulation Results: Shasta September Carryover

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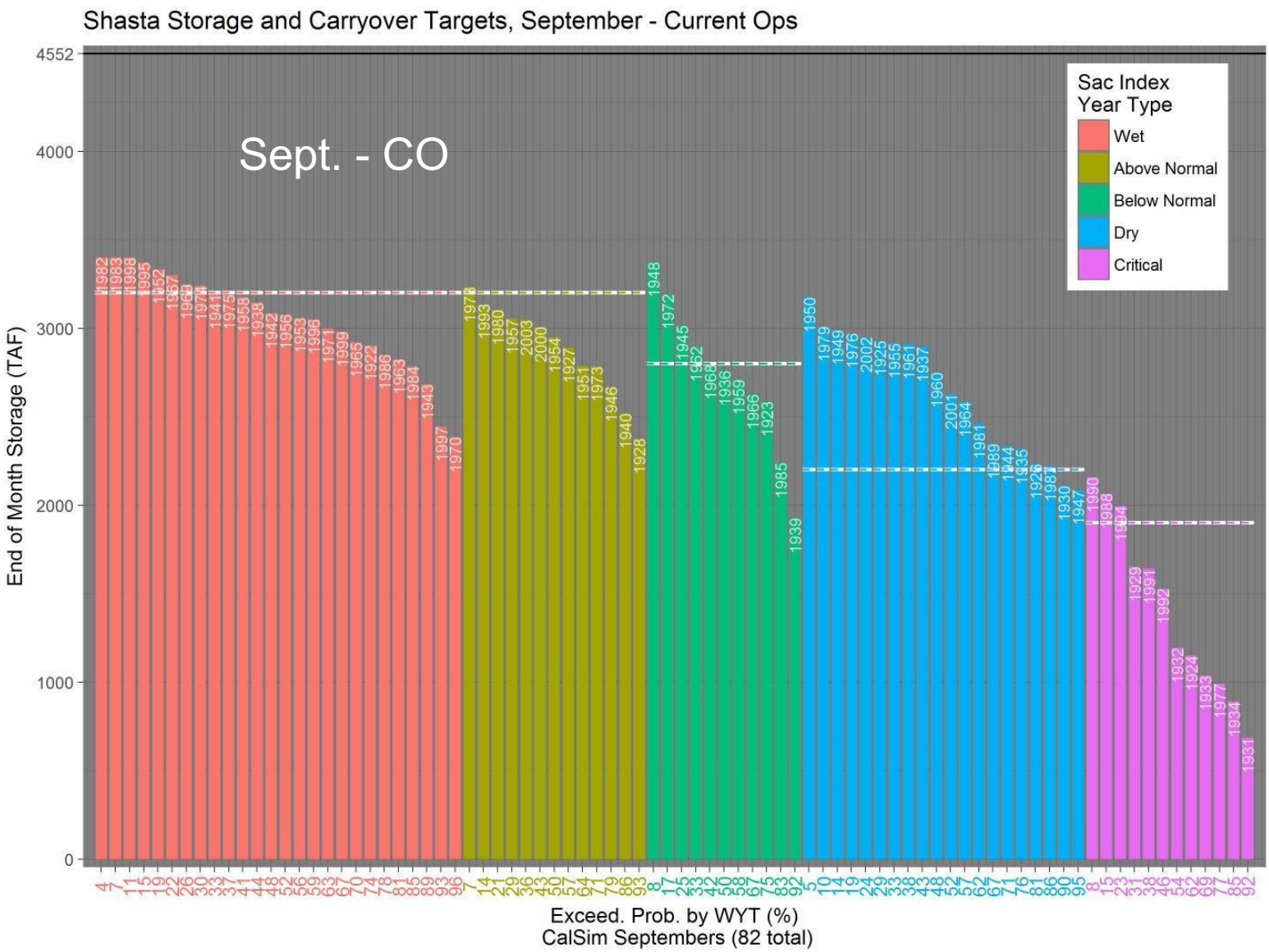
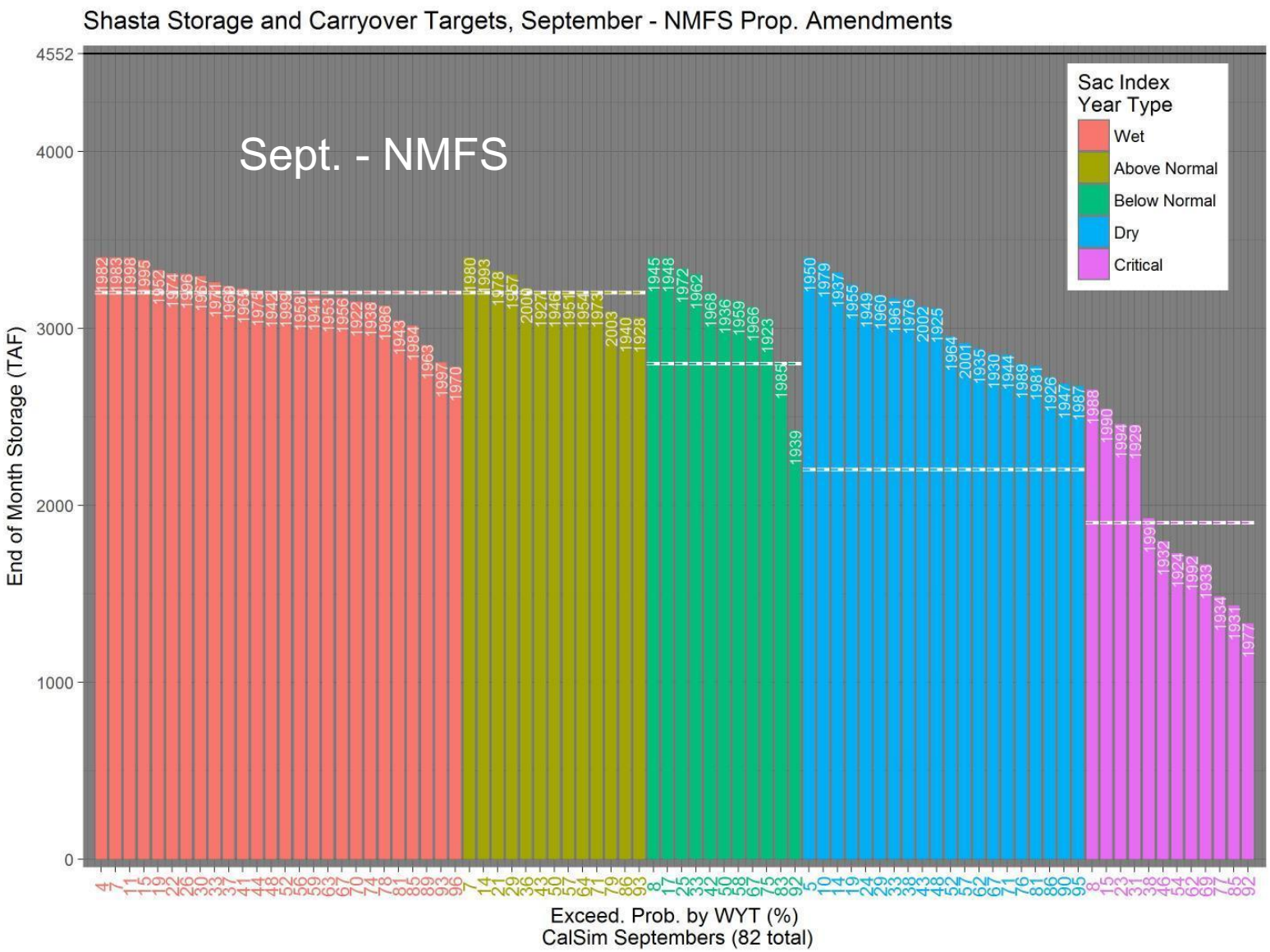

Shasta Storage and Carryover Targets, September - Current Ops
Sept. - CO
Sac Index Year Type
Wet
Above Normal
Below Normal
Dry
Critical
End of Month Storage (TAF)
4552
4000
3000
2000
1000
0
Exceed. Prob. by WYT (%)
CalSim Septembers (82 total)


Shasta Storage and Carryover Targets, September - NMFS Prop. Amendments
Sept. - NMFS
Sac Index Year Type
Wet
Above Normal
Below Normal
Dry
Critical
End of Month Storage (TAF)
4552
4000
3000
2000
1000
0
Exceed. Prob. by WYT (%)
CalSim Septembers (82 total)

Analyses – Spring Storage Targets

- **Draft Proposed Spring Storage Targets**
  - **Critically dry: 3.5 MAF**
  - **Dry: 3.9 MAF**
  - **Below Normal: 4.2 MAF**
  - **Above Normal: 4.2 MAF**
  - **Wet: 4.2 MAF**

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Analyses – Spring Storage Targets

- **Evaluate:**
  - **Compliance under "Current Ops"**
  - **Compliance using modified CVP delivery allocation**
    - **No specific effort to modify October-March operations**
    - **Demonstrates ability to fill given September target**

Simulation Results: Shasta April Carryover

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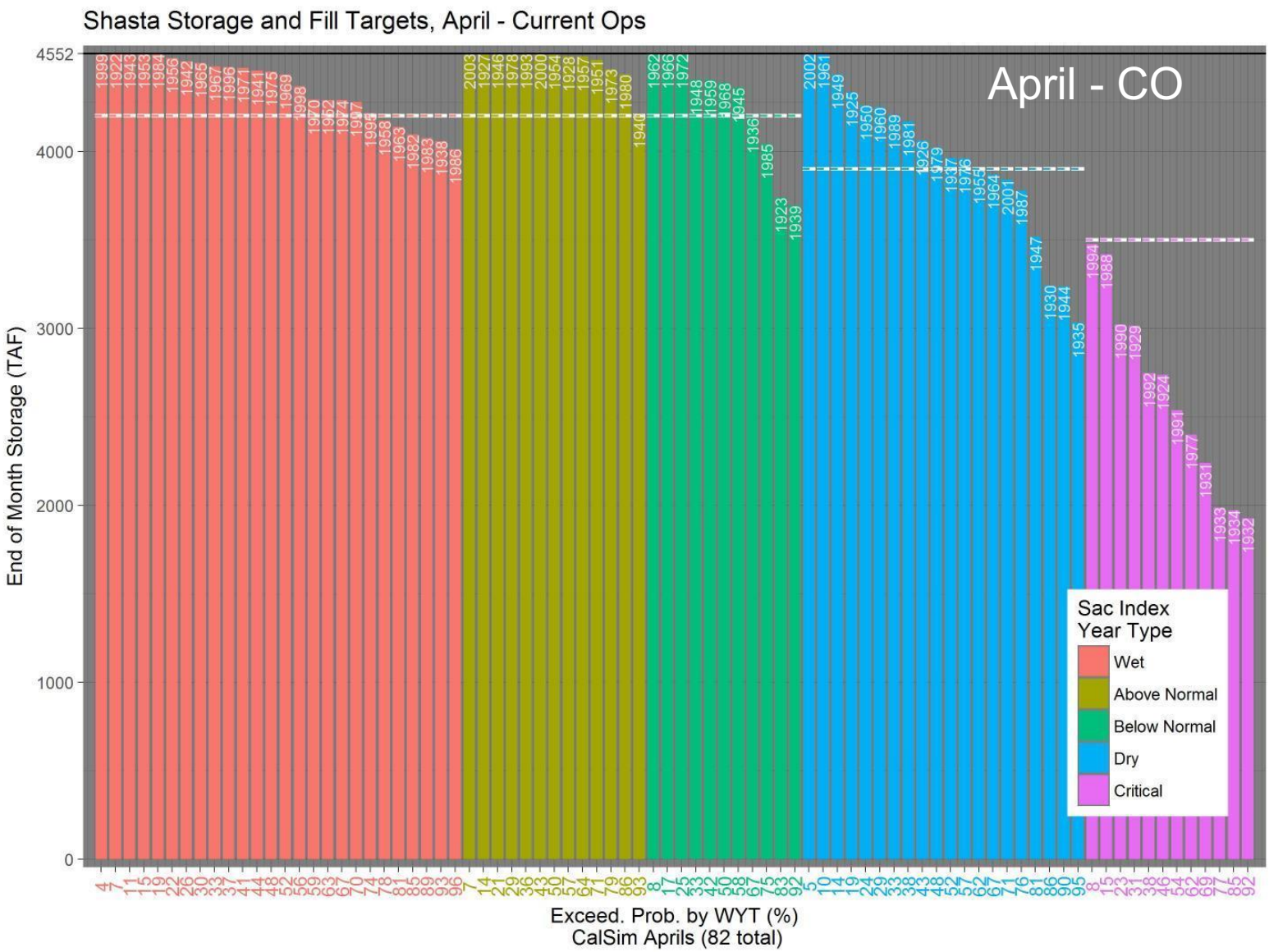
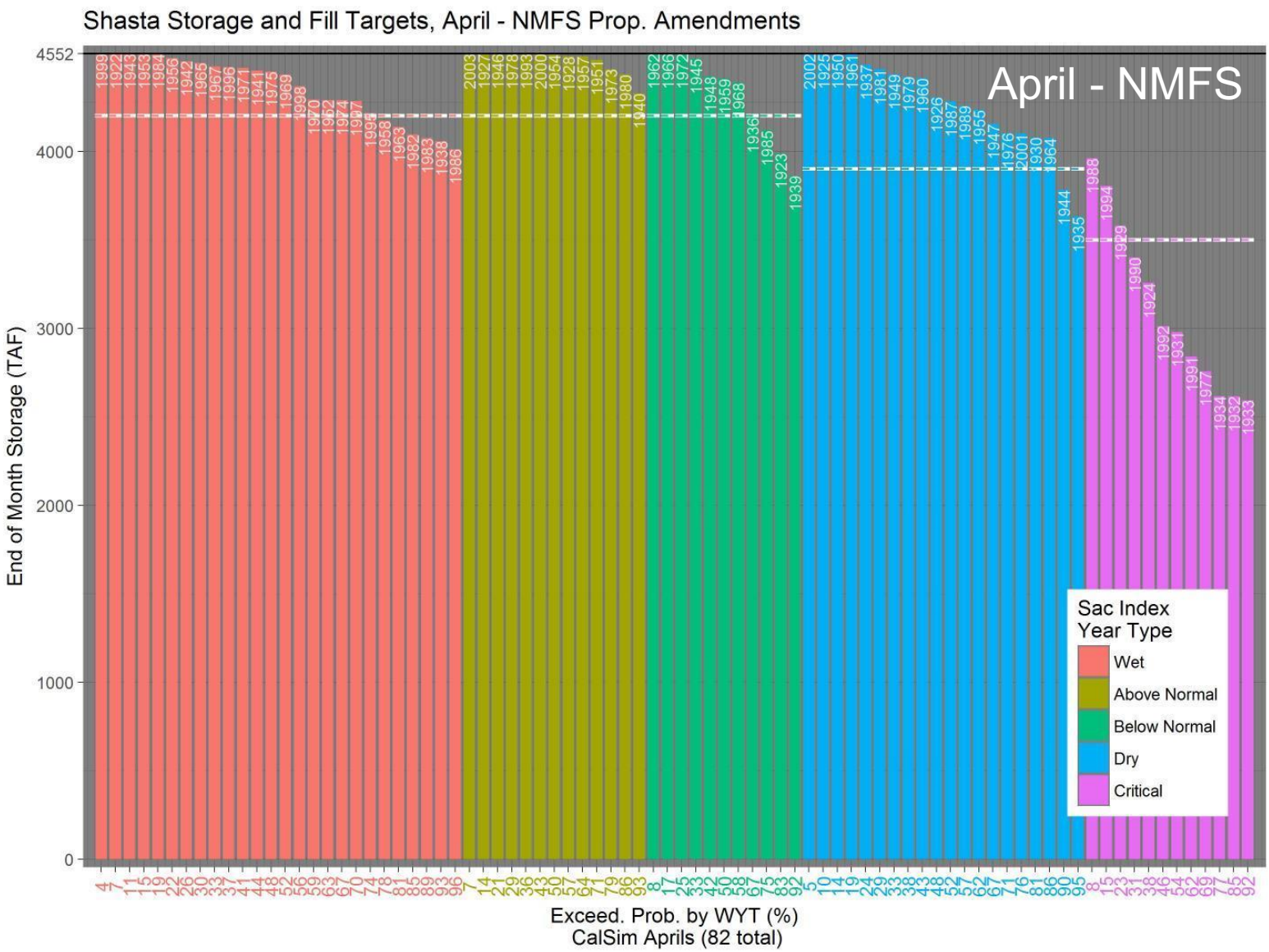
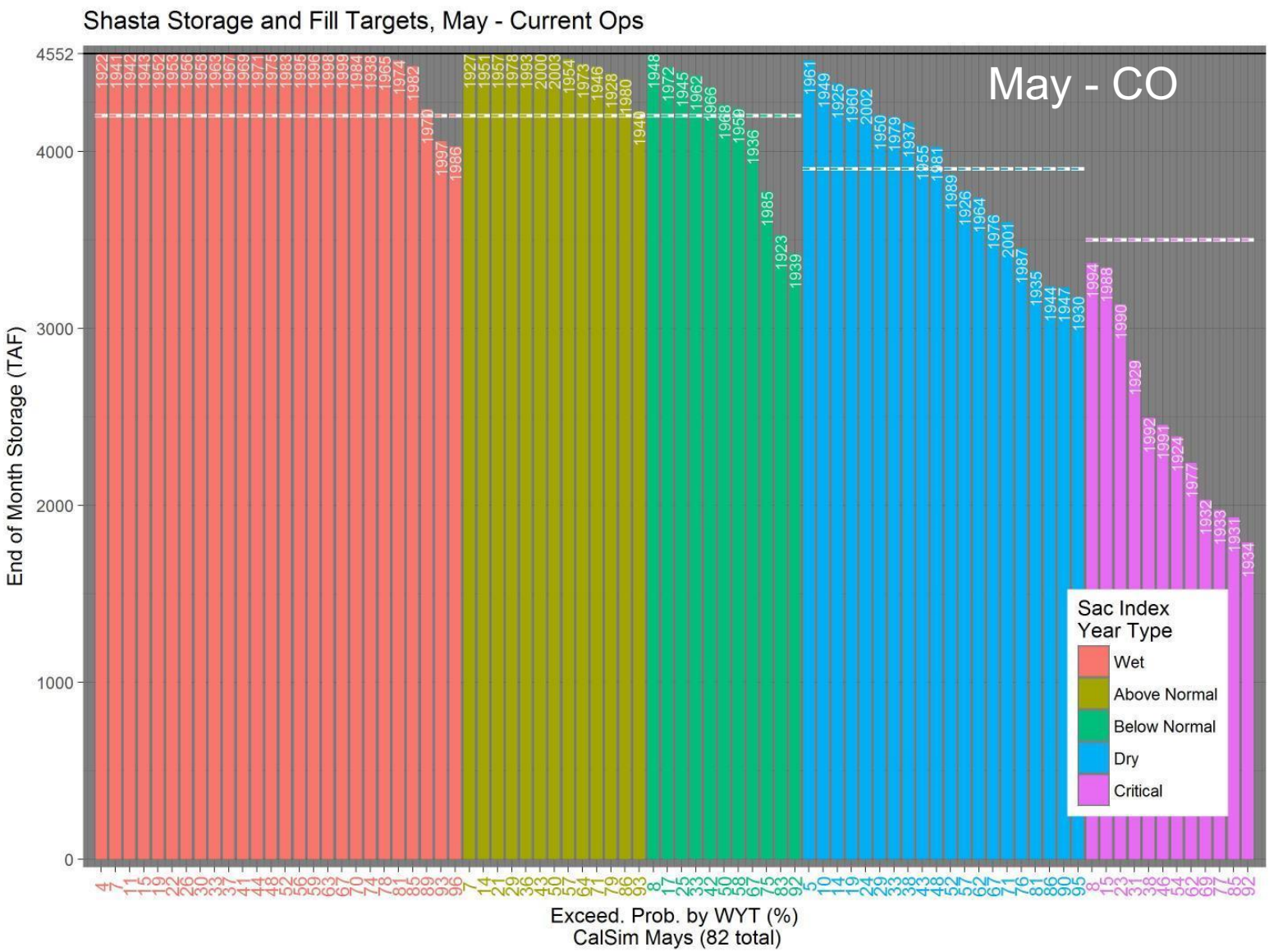
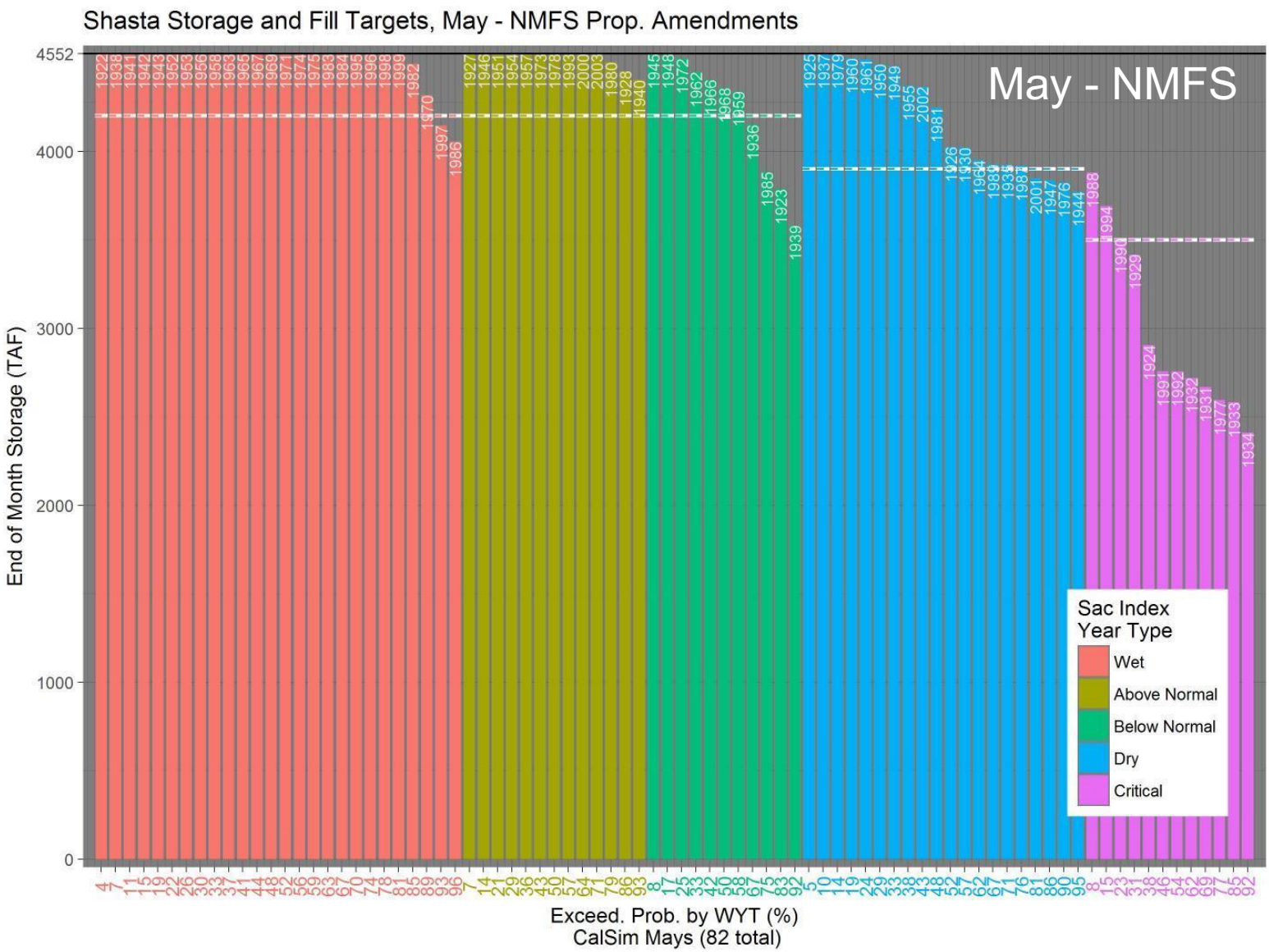

Shasta Storage and Fill Targets, April - Current Ops
April - CO
End of Month Storage (TAF)
4552
4000
3000
2000
1000
0
Exceed. Prob. by WYT (%)
CalSim Aprils (82 total)
Sac Index Year Type
Wet
Above Normal
Below Normal
Dry
Critical


Shasta Storage and Fill Targets, April - NMFS Prop. Amendments
April - NMFS
End of Month Storage (TAF)
4552
4000
3000
2000
1000
0
Exceed. Prob. by WYT (%)
CalSim Aprils (82 total)
Sac Index
Year Type
Wet
Above Normal
Below Normal
Dry
Critical

Simulation Results: Shasta May Carryover

RECLAMATION


Shasta Storage and Fill Targets, May - Current Ops
May - CO
End of Month Storage (TAF)
4552
4000
3000
2000
1000
0
Exceed. Prob. by WYT (%)
CalSim Mays (82 total)
Sac Index Year Type
Wet
Above Normal
Below Normal
Dry
Critical


Shasta Storage and Fill Targets, May - NMFS Prop. Amendments
May - NMFS
End of Month Storage (TAF)
4552
4000
3000
2000
1000
0
Exceed. Prob. by WYT (%)
CalSim Mays (82 total)
Sac Index
Year Type
Wet
Above Normal
Below Normal
Dry
Critical

Why aren't proposed Storage objectives met?

- **Wet Years:**
  - Flood Control requirements evacuate additional water from storage

- **Below Normal, Dry, and Critical years:**
  - Demonstrates improved storage with relaxed requirements and delivery curtailments
  - Not feasible in all years. Poor hydrology in consecutive drier years can not recover storage deficit

Analyses – Spring Release Limits

- **Draft Proposed Spring Release Limits**
  - **April:**
    - **Critically Dry: 4,000 cfs**
    - **Dry: 6,000 cfs**
    - **Below Normal: 6,000 cfs**
    - **Above Normal: 6,500 cfs**
    - **Wet: 8,000 cfs**
  - **May:**
    - **Critically Dry: 7,500 cfs**
    - **Dry: 8,000 cfs**
    - **Below Normal: 9,000 cfs**
    - **Above Normal: 11,000 cfs**
    - **Wet: 12,000 cfs**

Analyses – Spring Release Limits

- **Evaluate:**
  - **Compliance under "Current Ops"**
  - **Compliance using modified CVP delivery allocation**
    - **No specific limits set on releases**
    - **Operation affected solely by allocation and storage conditions**

Simulation Results: Keswick April Release

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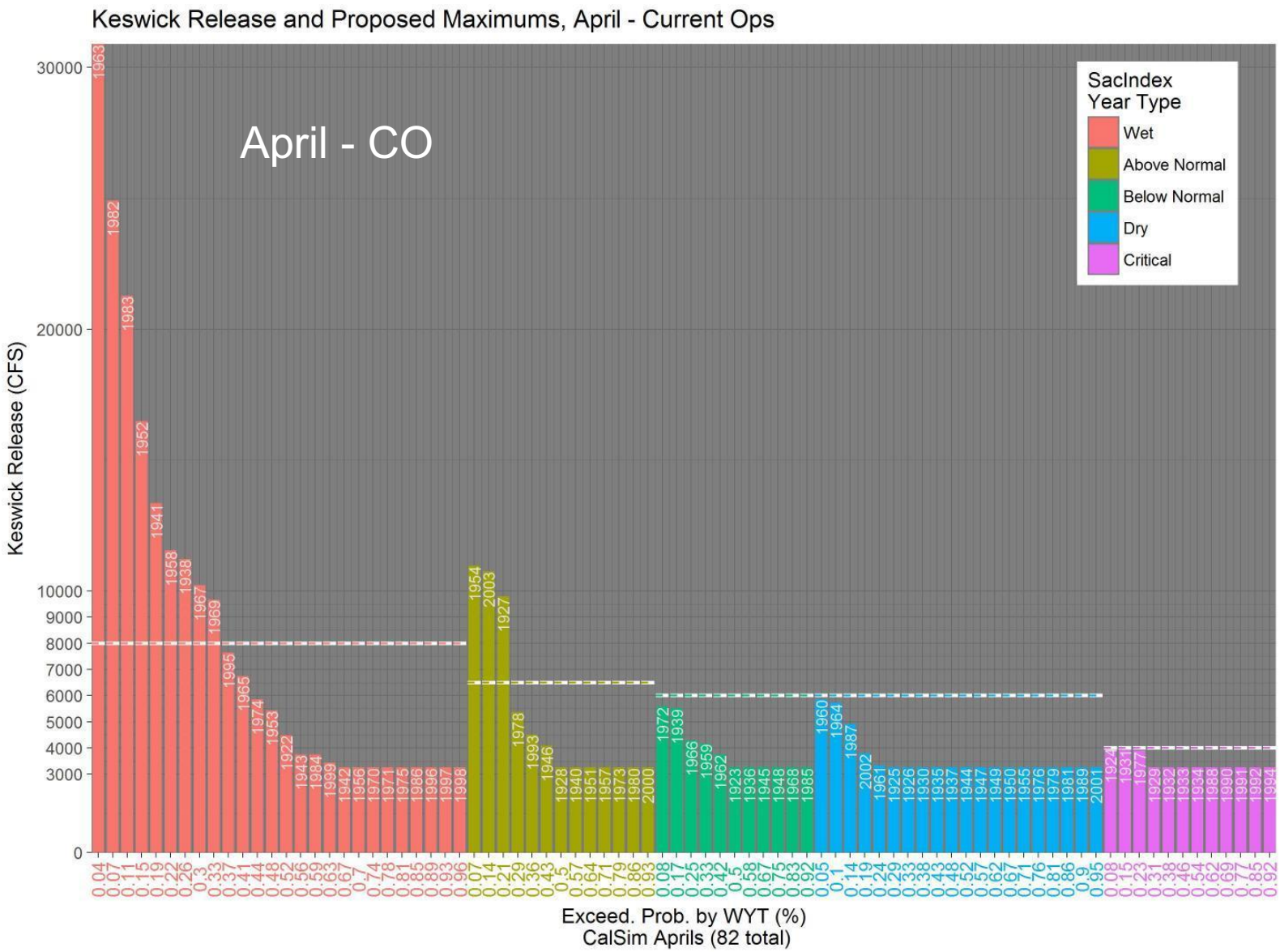
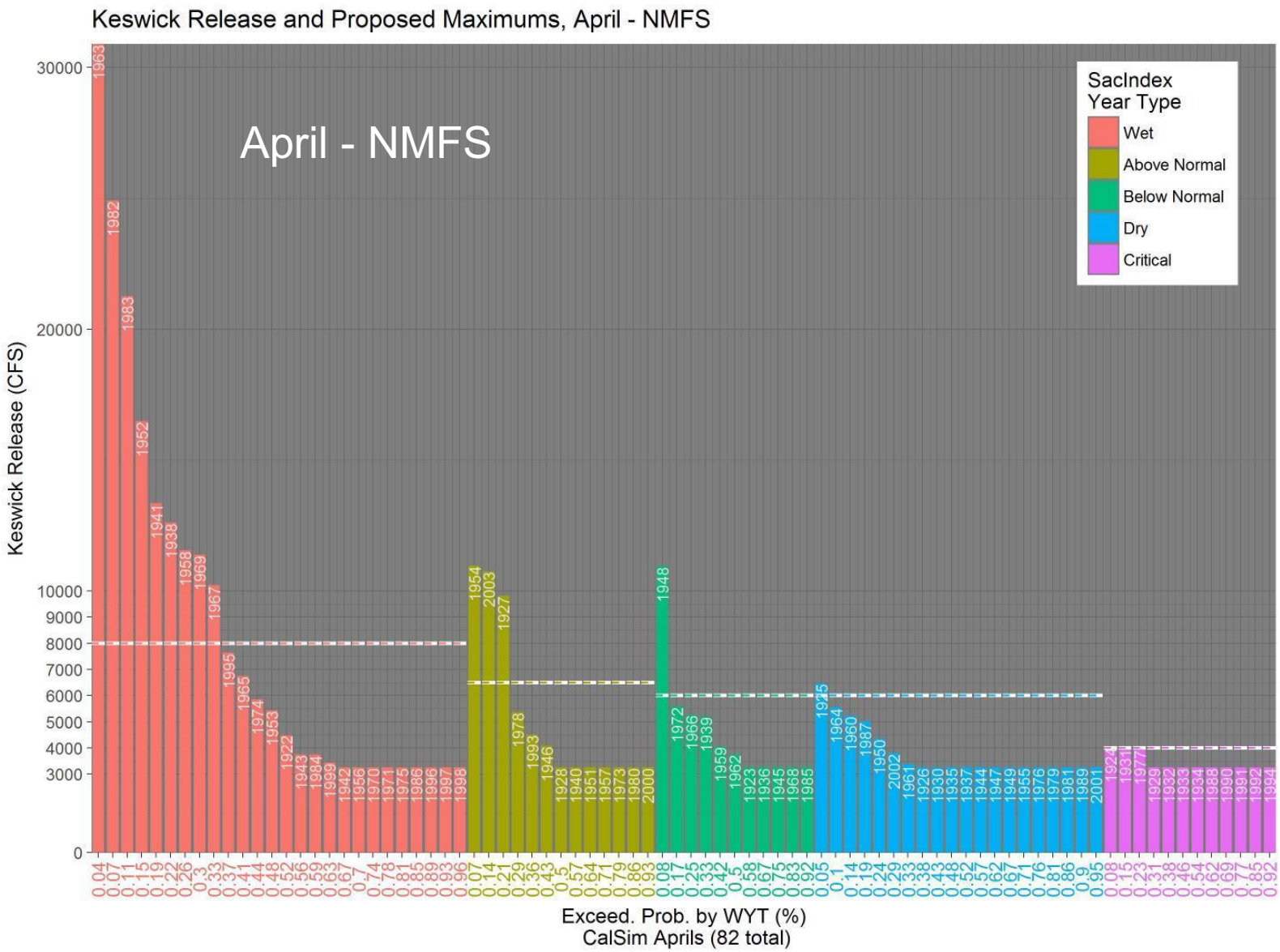

Keswick Release and Proposed Maximums, April - Current Ops
April - CO
SacIndex Year Type
Wet
Above Normal
Below Normal
Dry
Critical
Keswick Release (CFS)
30000
20000
10000
9000
8000
7000
6000
5000
4000
3000
0
Exceed. Prob. by WYT (%)
CalSim Aprils (82 total)


Keswick Release and Proposed Maximums, April - NMFS
April - NMFS
SacIndex Year Type
Wet
Above Normal
Below Normal
Dry
Critical
Keswick Release (CFS)
Exceed. Prob. by WYT (%)
CalSim Aprils (82 total)

Simulation Results: Keswick May Release

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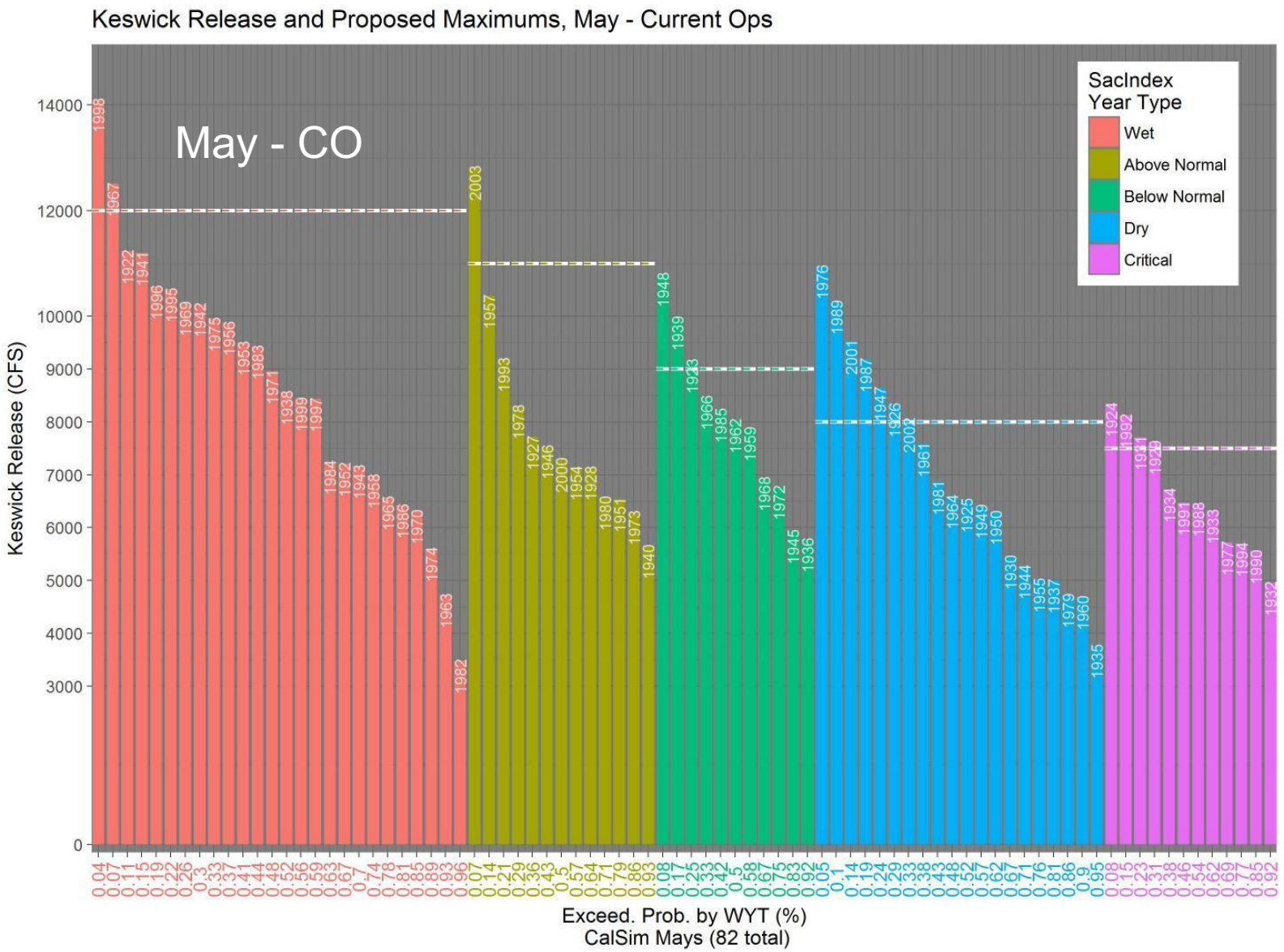
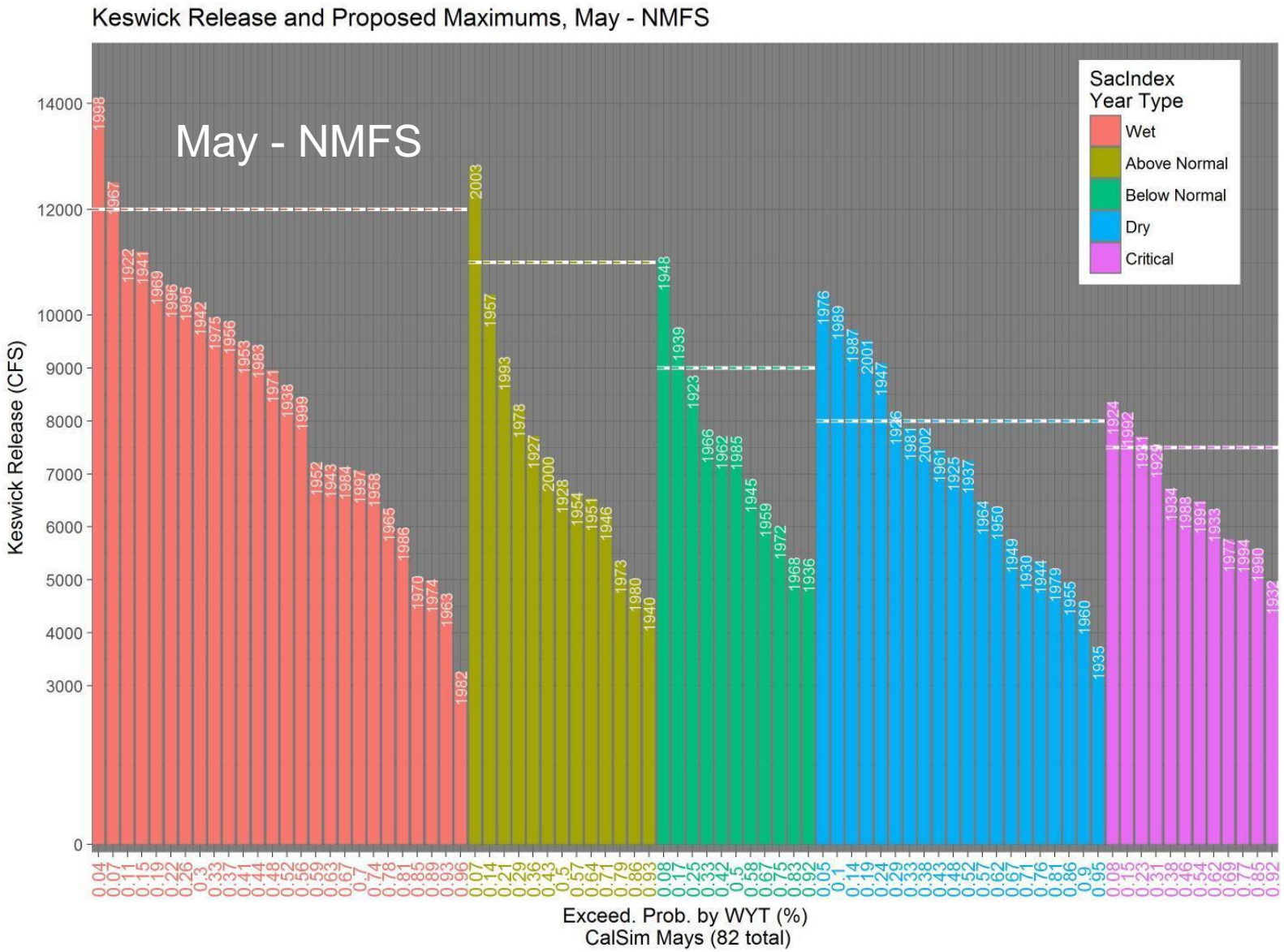

Keswick Release and Proposed Maximums, May - Current Ops
May - CO
SacIndex Year Type
Wet
Above Normal
Below Normal
Dry
Critical
Keswick Release (CFS)
14000
12000
10000
9000
8000
7000
6000
5000
4000
3000
0
Exceed. Prob. by WYT (%)
CalSim Mays (82 total)


Keswick Release and Proposed Maximums, May - NMFS
May - NMFS
SacIndex Year Type
Wet
Above Normal
Below Normal
Dry
Critical
Keswick Release (CFS)
14000
12000
10000
9000
8000
7000
6000
5000
4000
3000
0
Exceed. Prob. by WYT (%)
CalSim Mays (82 total)

Why aren’t proposed Releases objectives met?

- In either scenario, few instances exceed the release objective
- Higher storage conditions increase Flood Control potential which increase releases

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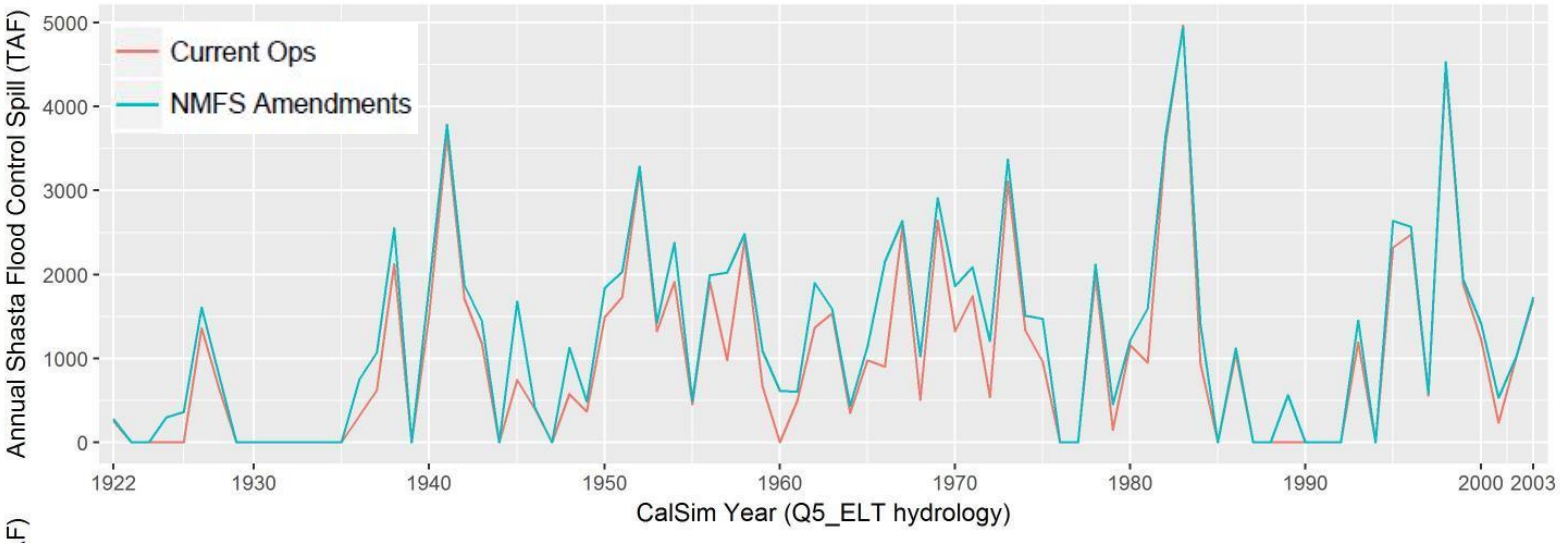
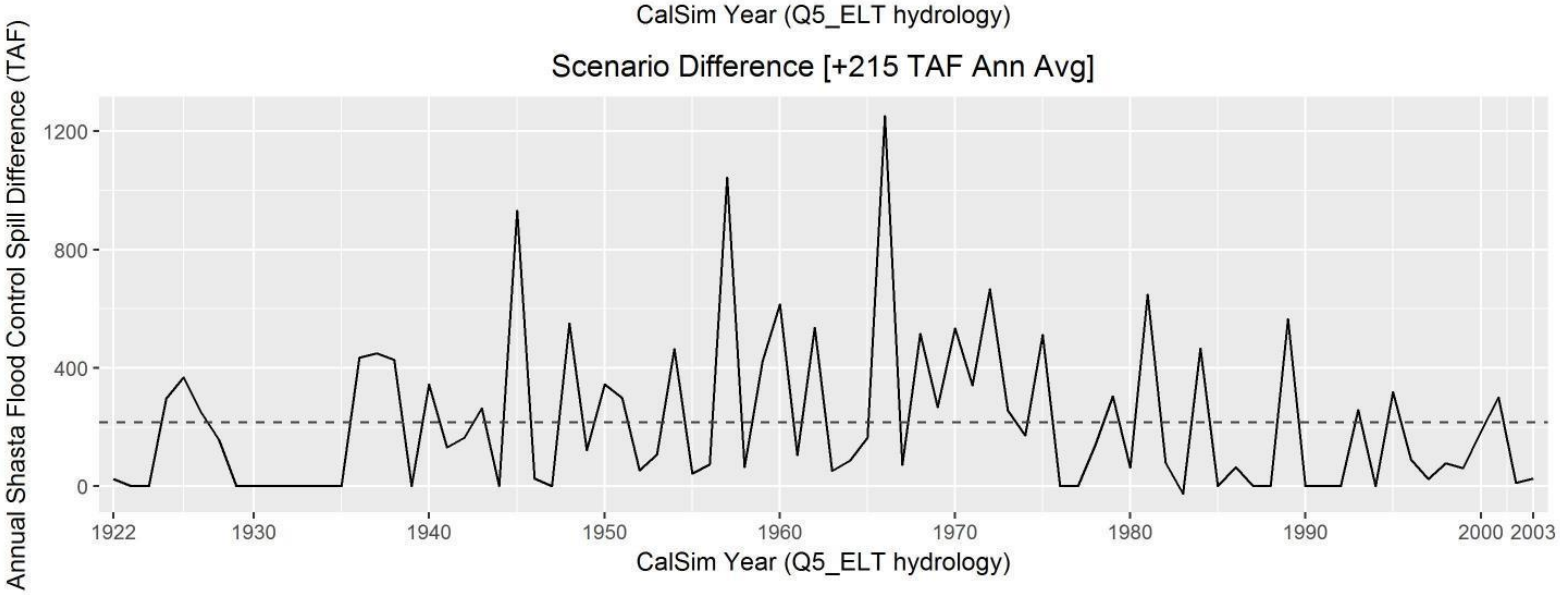
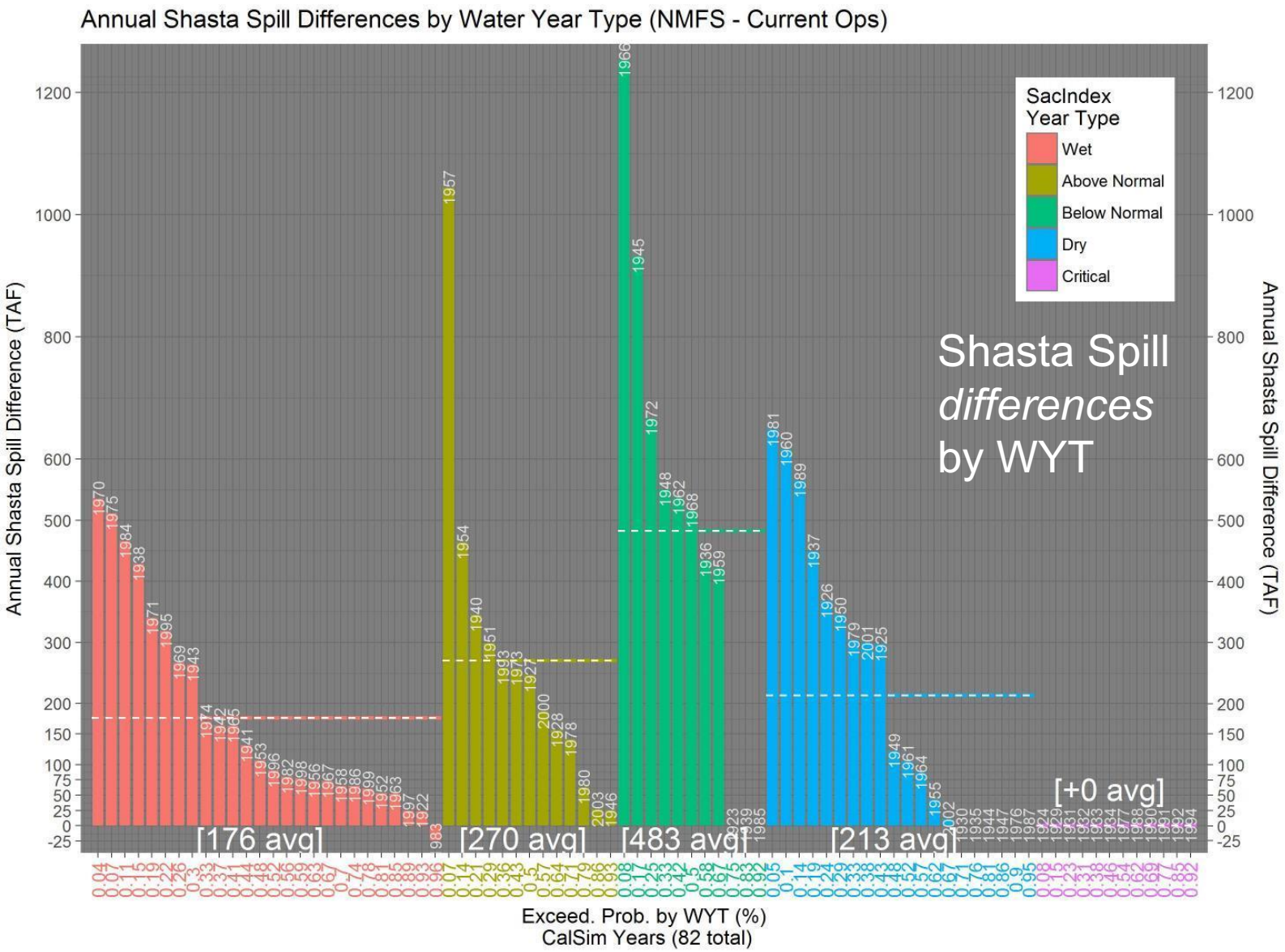
Annual Shasta Flood Control Spill - Increases by 215 TAF under NMFS' proposed amendment






Annual Shasta Spill Differences by Water Year Type (NMFS - Current Ops)
Annual Shasta Spill Difference (TAF)
Annual Shasta Spill Difference (TAF)
SacIndex Year Type
Wet
Above Normal
Below Normal
Dry
Critical
Shasta Spill differences by WYT
[176 avg]
[270 avg]
[483 avg]
[213 avg]
[+0 avg]
Exceed. Prob. by WYT (%)
CalSim Years (82 total)

Simulation Results: Deliveries

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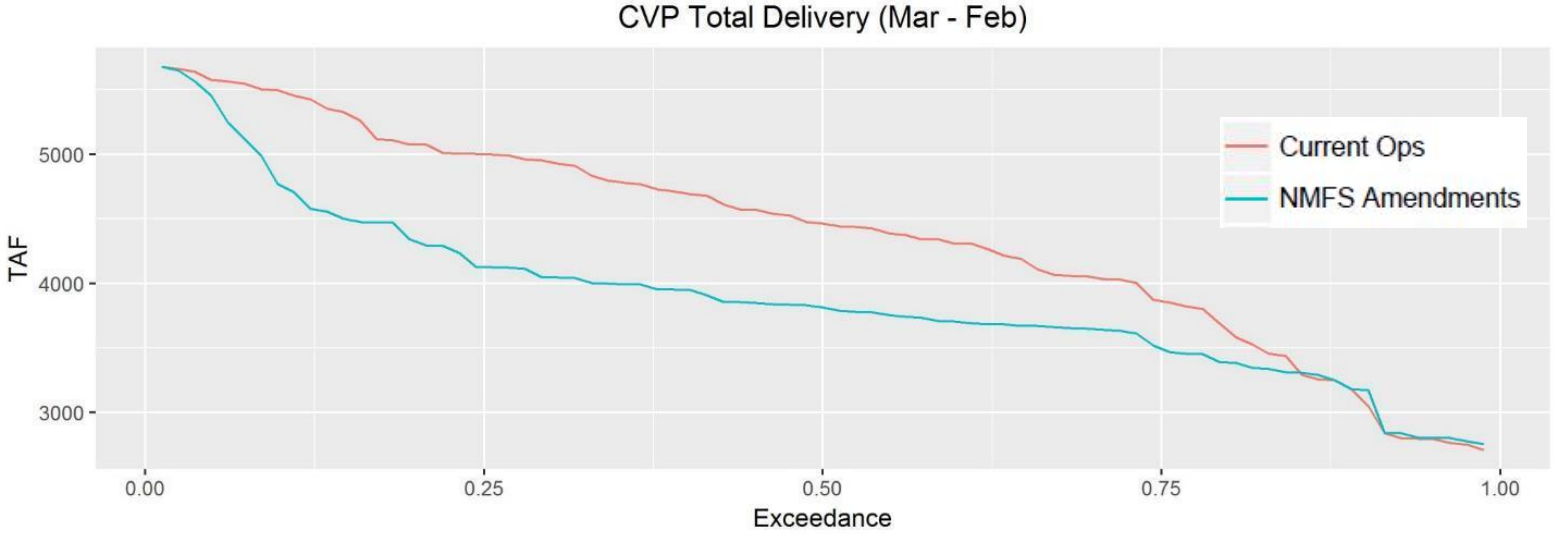
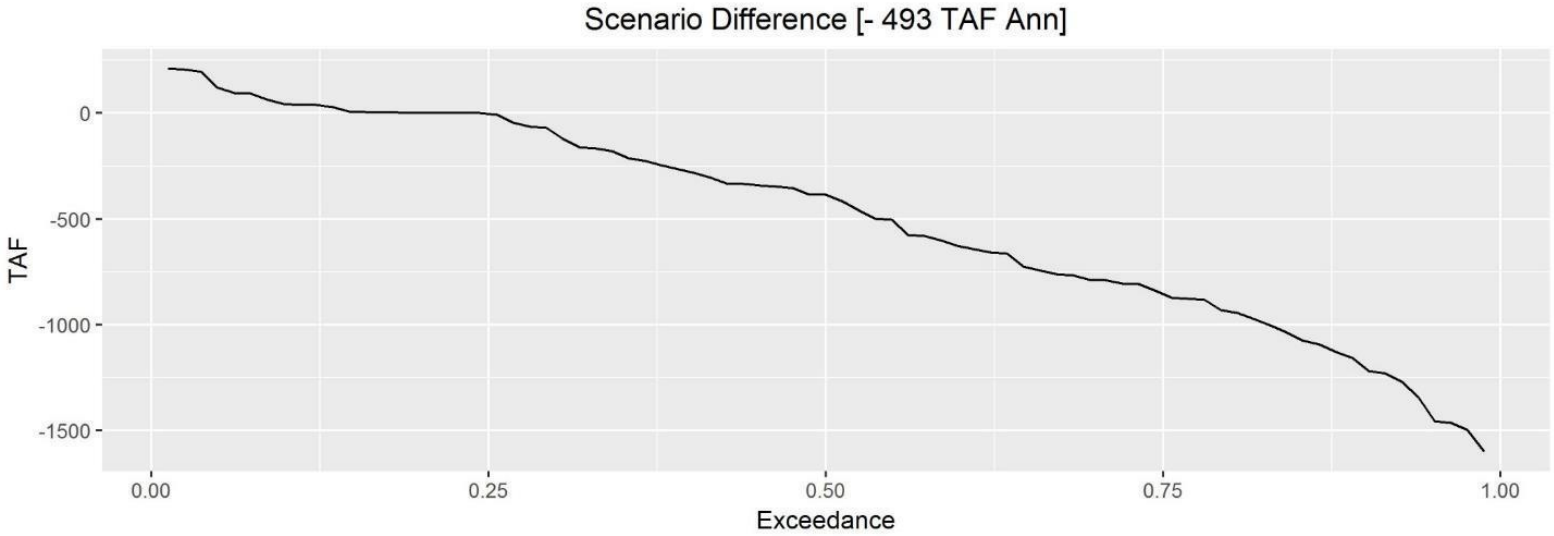
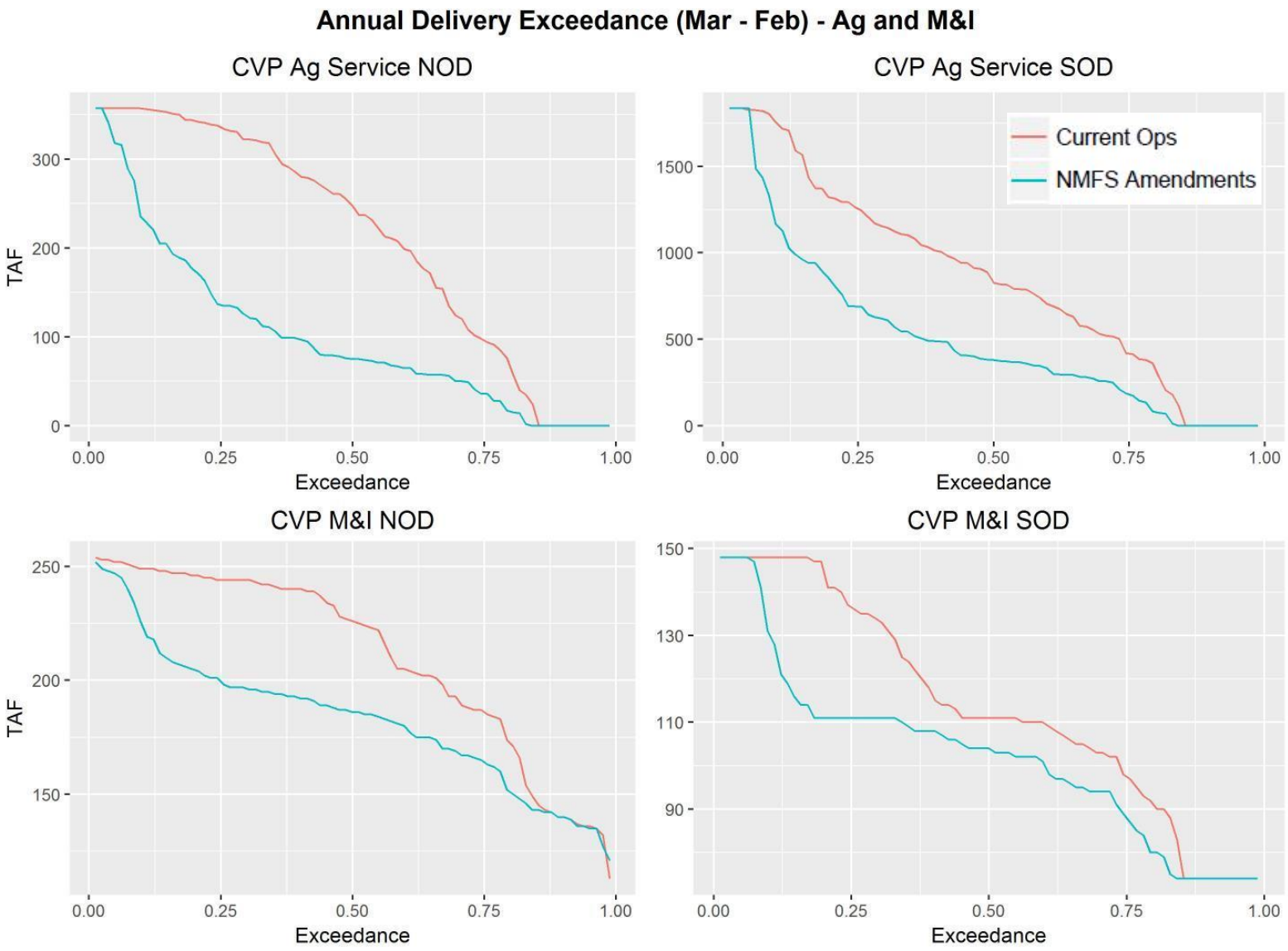
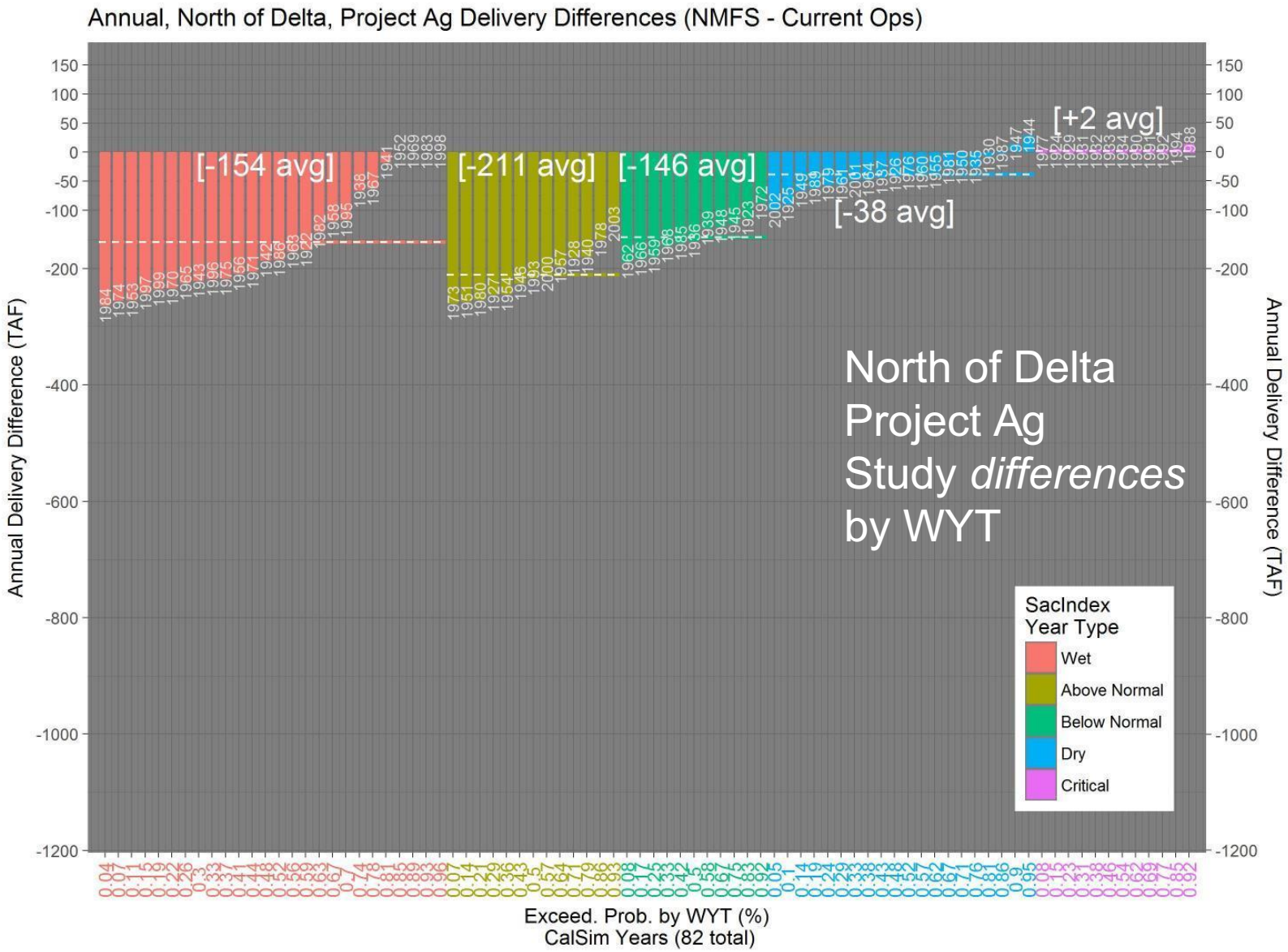
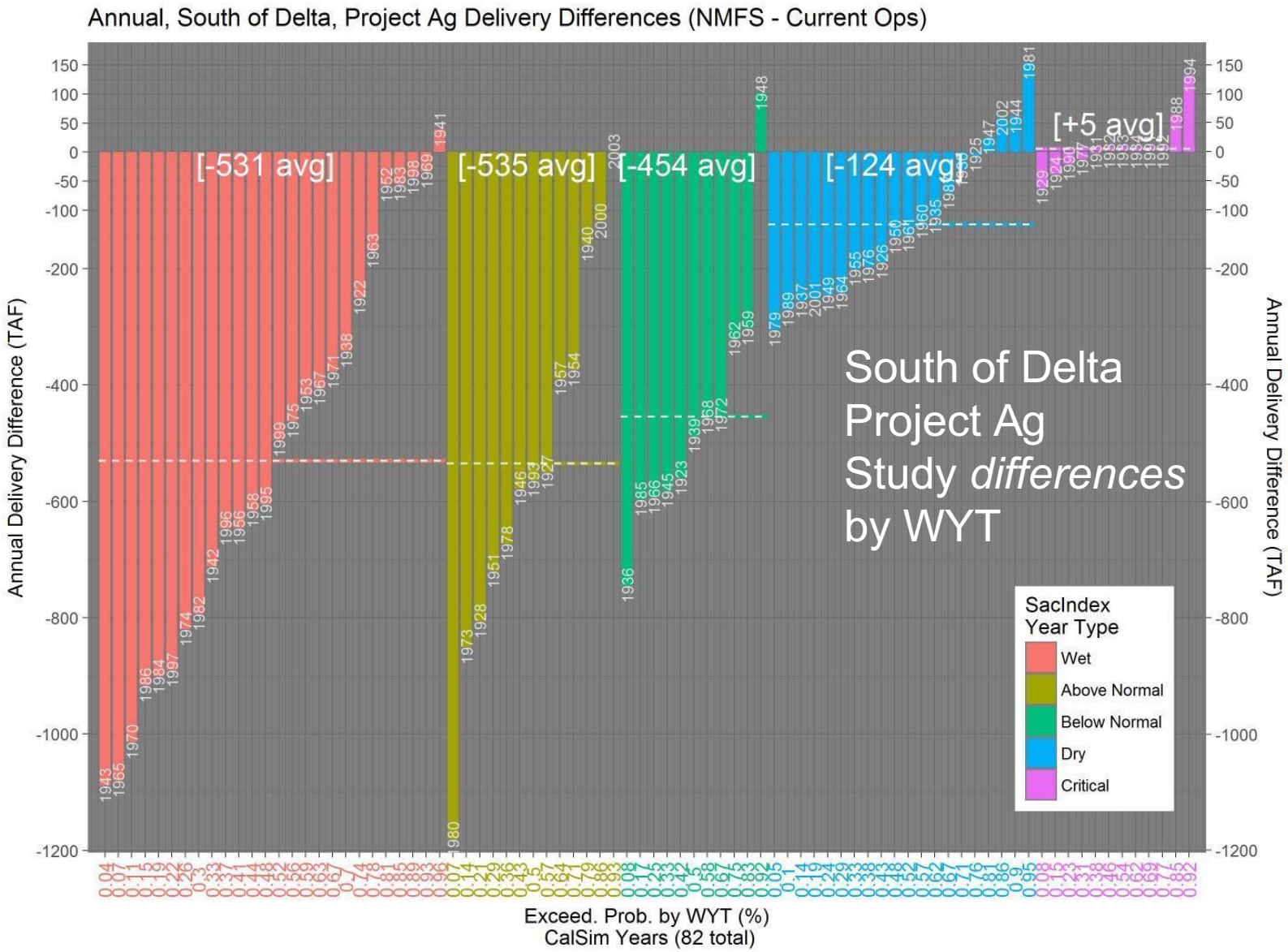
Overall change in CVP Delivery






Annual Delivery Exceedance (Mar - Feb) - Ag and M&I
CVP Ag Service NOD
CVP Ag Service SOD
CVP M&I NOD
CVP M&I SOD
TAF
Exceedance
Current Ops
NMFS Amendments
0
100
200
300
500
1000
1500
90
110
130
150
250
0.00
0.25
0.50
0.75
1.00


Annual, North of Delta, Project Ag Delivery Differences (NMFS - Current Ops)
[-154 avg]
[-211 avg]
[-146 avg]
[-38 avg]
[+2 avg]
North of Delta
Project Ag
Study *differences*
by WYT
SacIndex
Year Type
Wet
Above Normal
Below Normal
Dry
Critical
Annual Delivery Difference (TAF)
Annual Delivery Difference (TAF)
Exceed. Prob. by WYT (%)
CalSim Years (82 total)


Annual, South of Delta, Project Ag Delivery Differences (NMFS - Current Ops)
Annual Delivery Difference (TAF)
Annual Delivery Difference (TAF)
[-531 avg]
[-535 avg]
[-454 avg]
[-124 avg]
[+5 avg]
South of Delta Project Ag Study differences by WYT
SacIndex Year Type
Wet
Above Normal
Below Normal
Dry
Critical
Exceed. Prob. by WYT (%)
CalSim Years (82 total)

CalSim-II Summary

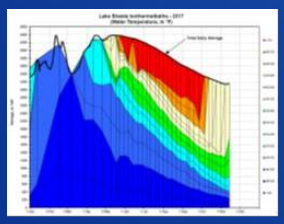
- Shasta carryover storage is increased most in Dry and Critical year types
- Not all years can meet Shasta storage targets
- Flood control spills are increased
- Release targets are largely met already
- CVP delivery curtailments indicate estimated volume of water to increase Shasta storage
  - Underestimated for full storage performance
  - Model designed to isolate impacts to CVP delivery to focus on magnitude of required water (sensitivity analysis), remaining performances are largely the same

Temperature Management Analyses

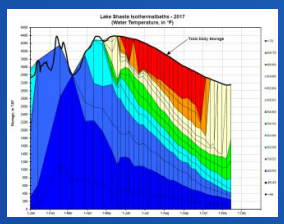
RECLAMATION

Temperature Assumptions

HEC-5Q
"Current Operations"



HEC-5Q
"NMFS"



Current Operations (CO)	NMFS Alternative (NMFS)
Uses CalSim CO Monthly Results	**Uses CalSim NMFS Monthly Results**
6-hr time-step	Same
May 15- Oct 31	Same
Max 6 gate changes per month	Same
Iterates gate operations to conserve cold water pool	Same
Target 53°F temperature at CCR	Same

Comparative Analysis

- **Answers:**
  - **What are the incremental benefits/impacts of the proposed temperature target by attempting to apply the proposed Shasta storage carryover and release criteria?**

Temperature Results

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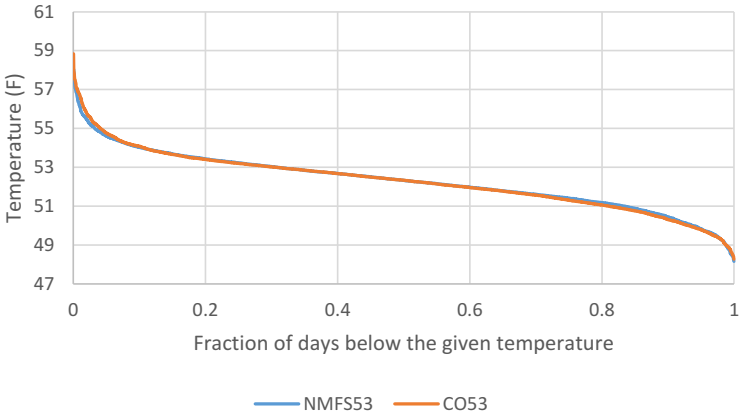
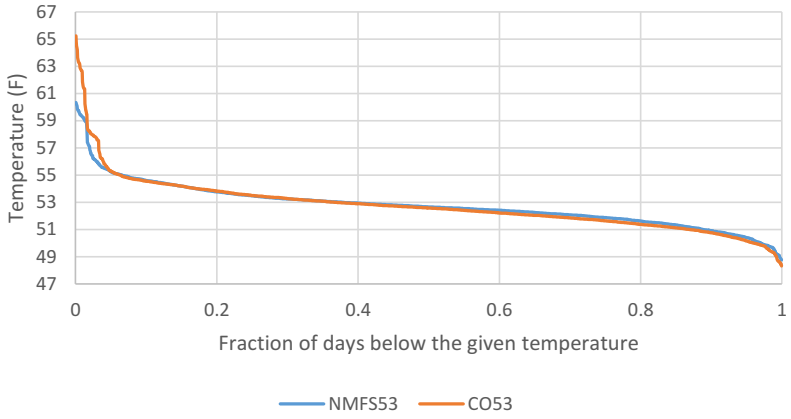
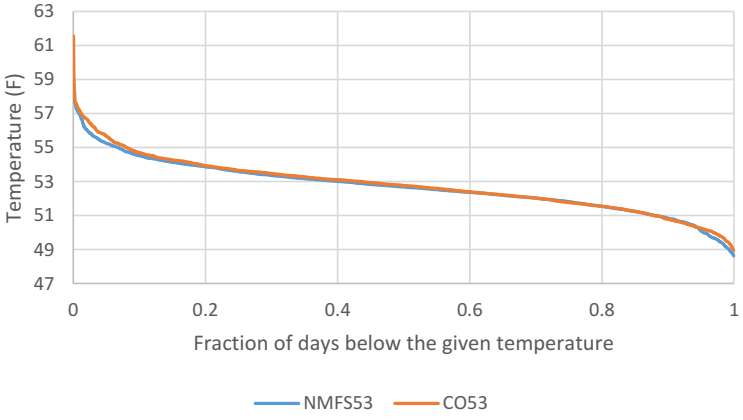
Sac R. Below Clear Creek Temperature: May - Oct, Wet Water Year Type



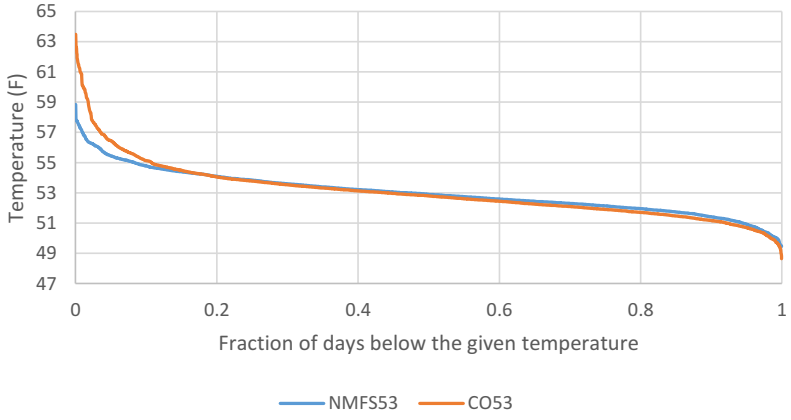
Sac R. Below Clear Creek Temperature: May - Oct, Above Normal Water Year Type

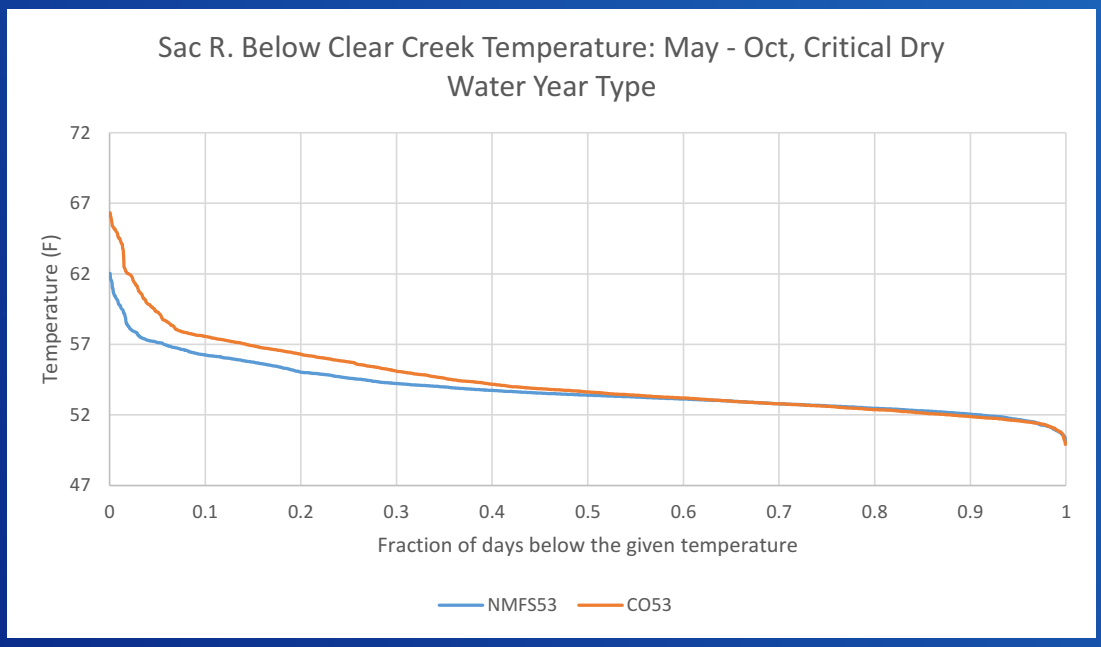


Sac R. Below Clear Creek Temperature: May - Oct, Below Normal Water Year Type



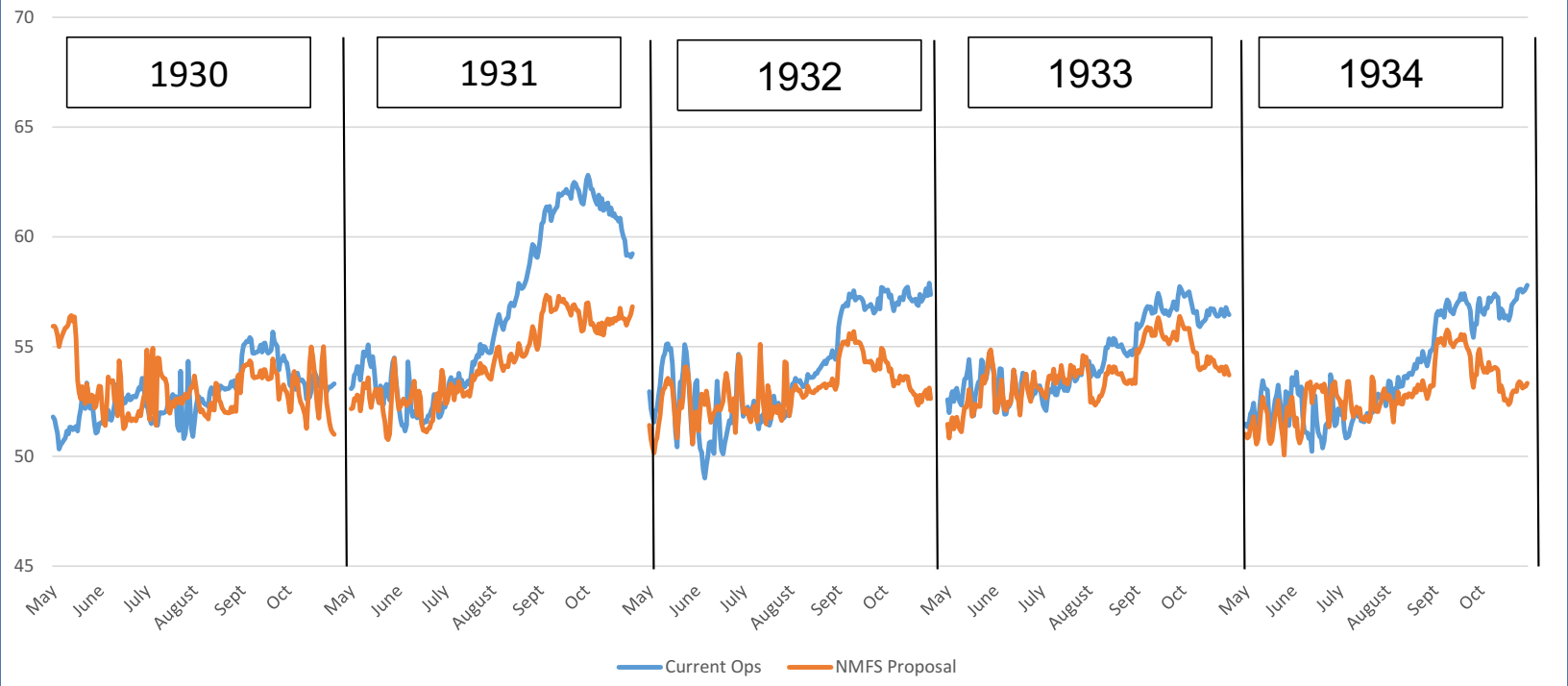
Sac R. Below Clear Creek Temperature: May - Oct, Dry Water Year Type





RECLAMATION

May through October Sacramento River Temperature at CCR



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Temperature Summary

- **Wet and Above Normal water year types indicate weak benefits**
  - **Result of abundance of cold water pool, where both scenarios perform similarly**
- **Below Normal and Dry water year types indicate moderate benefits**
  - **Improved downstream temperature is realized by avoiding early-season cold water pool use and extending temperature control in the late season**
  - **CO late-season performance is poorer as a result of mining early-season cold water pool, however, early-season temperature in NMFS scenario are warmer**

RECLAMATION

Temperature Summary

- Critical Water year types yield most significant benefits
  - Higher storage conditions offer enhanced gate use and flexibility
  - Benefits are limited and can not sustain downstream temperature goals during persistent drought periods

RECLAMATION

Salmon Mortality Analyses

RECLAMATION

Salmon Mortality Assumptions

Martin Model
"Current Operations"

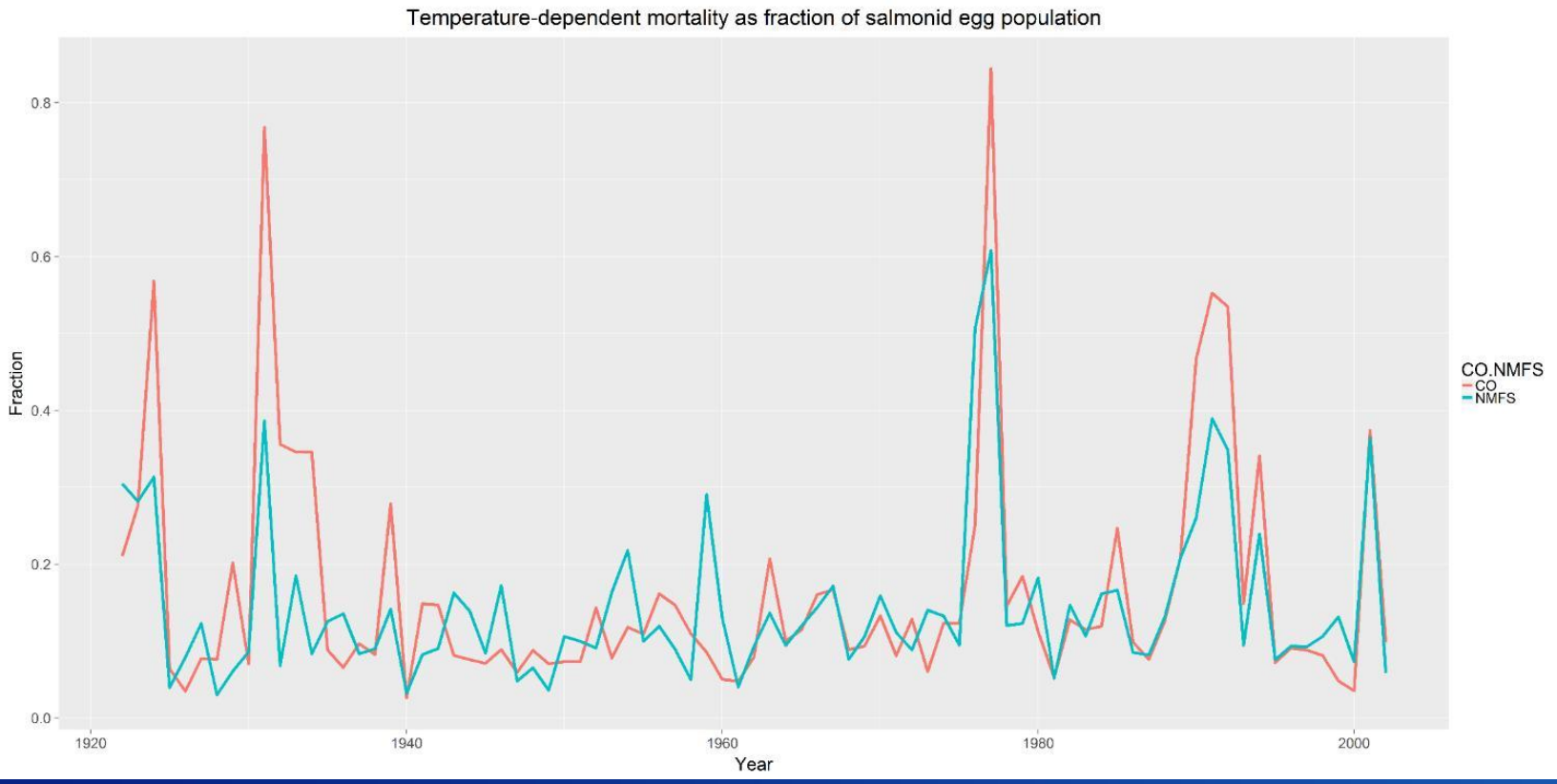
Martin Model
"NMFS"

Current Operations (CO)	NMFS Alternative (NMFS)
Uses Daily HEC-5Q CO data	**Uses Daily HEC-5Q NMFS data**
Keswick to Tehama Bridge	Same
Martin equation applied across redds lifetime	Same
Assumed spatial-temporal representative redd distribution	Same
Each date-river mile combination multiplied by % of total redd population and combined for an estimate of yearly total mortality %	Same

Salmon Mortality Results

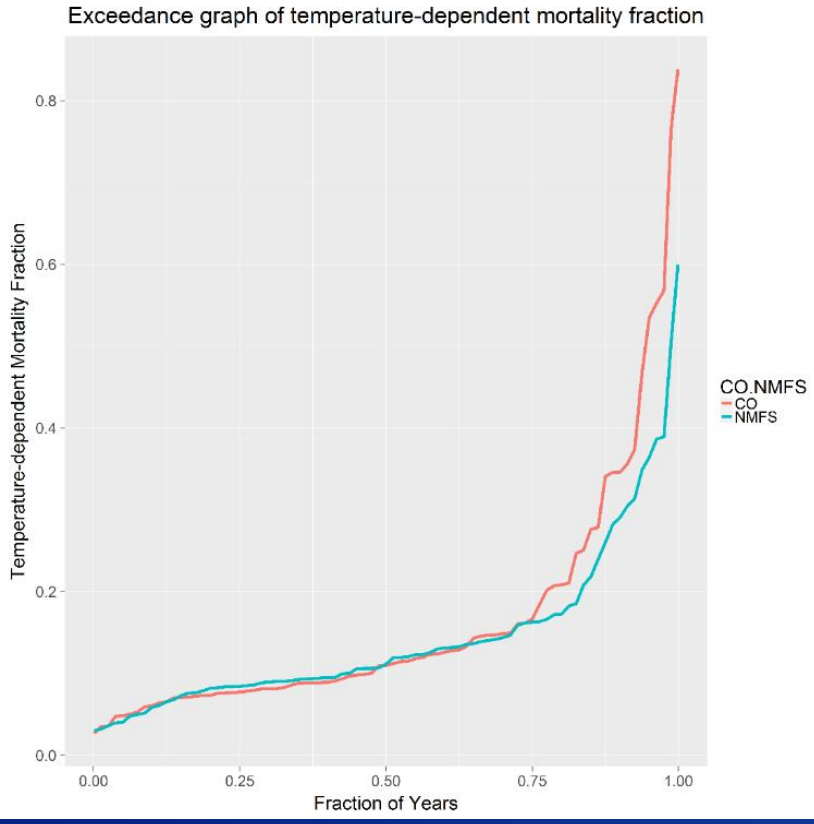
RECLAMATION

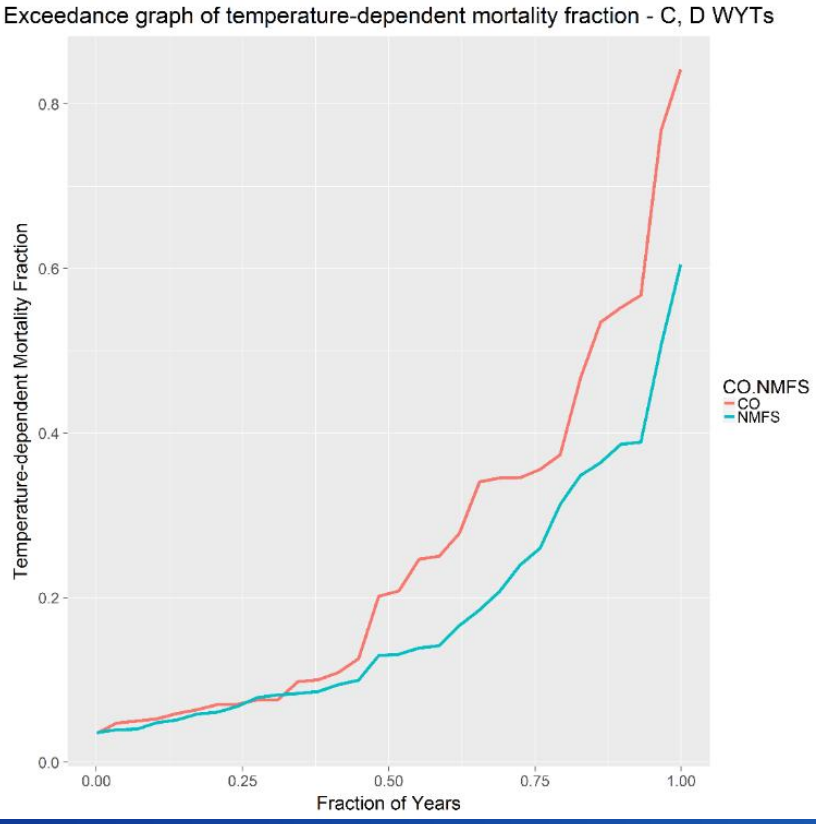
Mortality results: Time series, 1922-2002



RECLAMATION

Mortality results: Exceedance graphs





Salmon Mortality Summary

- Demonstrates an example application; makes assumptions about redd distribution and timing

RECLAMATION

Next Steps

RECLAMATION

Road Map

#1
- Stakeholder Workshop #1
- Science and Modeling Work Plans

#2
- Stakeholder Workshop #2
- Introduction to Analyses
- 2017 Temperature Operation

#3
- Stakeholder Workshop #3
- Preliminary Operations Results
- Science Work Plan Introduction

RECLAMATION

Road Map (continued)

#4

- Stakeholder Workshop #4
- 2017 Real-Time Operations Review
- Sensitivity Results Update
- Draft Science Work Plan

Re-consultation

- Establish Shasta Focus Group under ROC on LTO
- Products and Milestones TBD

Operations / Temperature

- Further Develop Temperature Target Location/Metric/Value Concepts and Studies

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2018 Operations Concepts

RECLAMATION

2018 Operations Concepts

- **Currently Under Discussion**
  - **Location, Value, Metric**

RECLAMATION

Shasta Lake and Keswick Reservoir Flow and Temperature Modeling

RECLAMATION

Goals

- Enhance existing temperature modeling capabilities
- Develop temperature management framework in a collaborative environment

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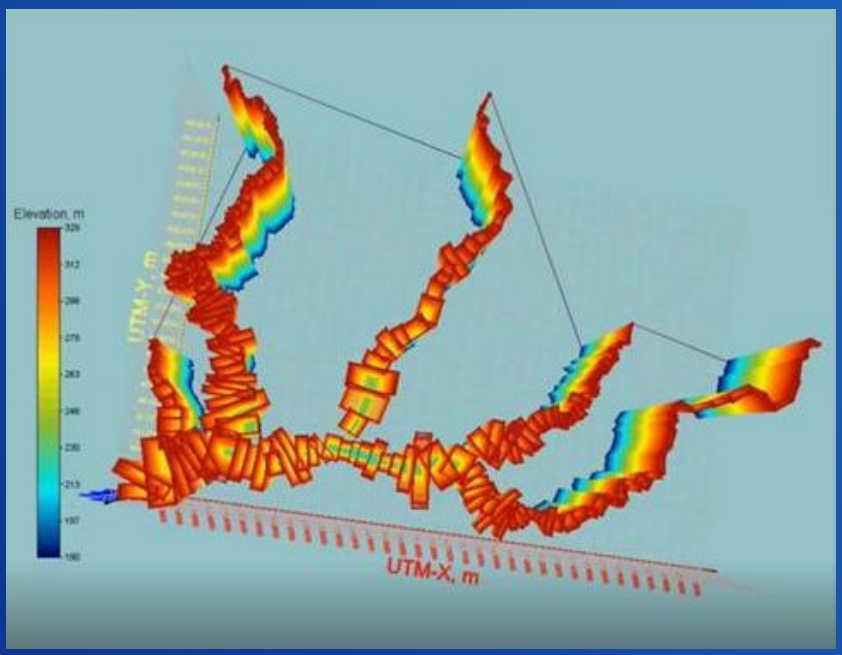
Progress Update

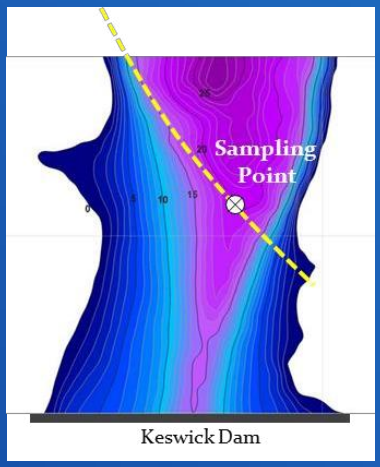
- Model Selection: CE-QUAL-W2
- Bathymetry development
  - Shasta Lake
  - Keswick Reservoir
- Model geometry

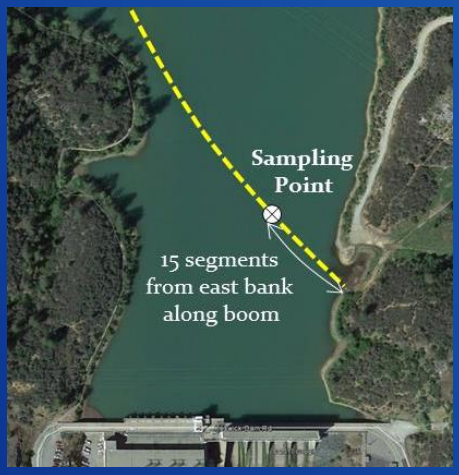


RECLAMATION

Modeling Development

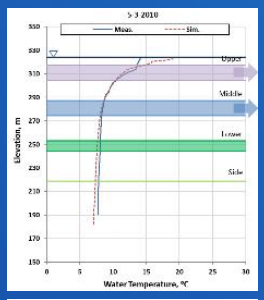
- Complete Data Needs
- Data Period
  - 2010-2016
  - Data needs
    - Keswick profile

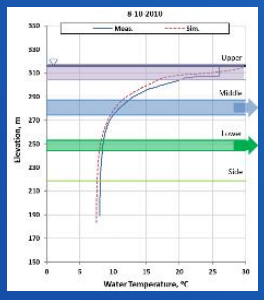


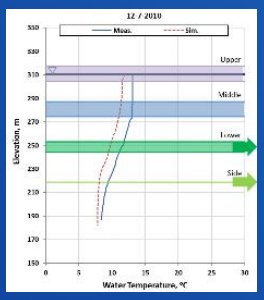


Model Development

- **Model Parameterization**
  - **Hydrodynamic**
  - **Temperature**
- **Model Calibration**
- **Model Documentation (Draft)**

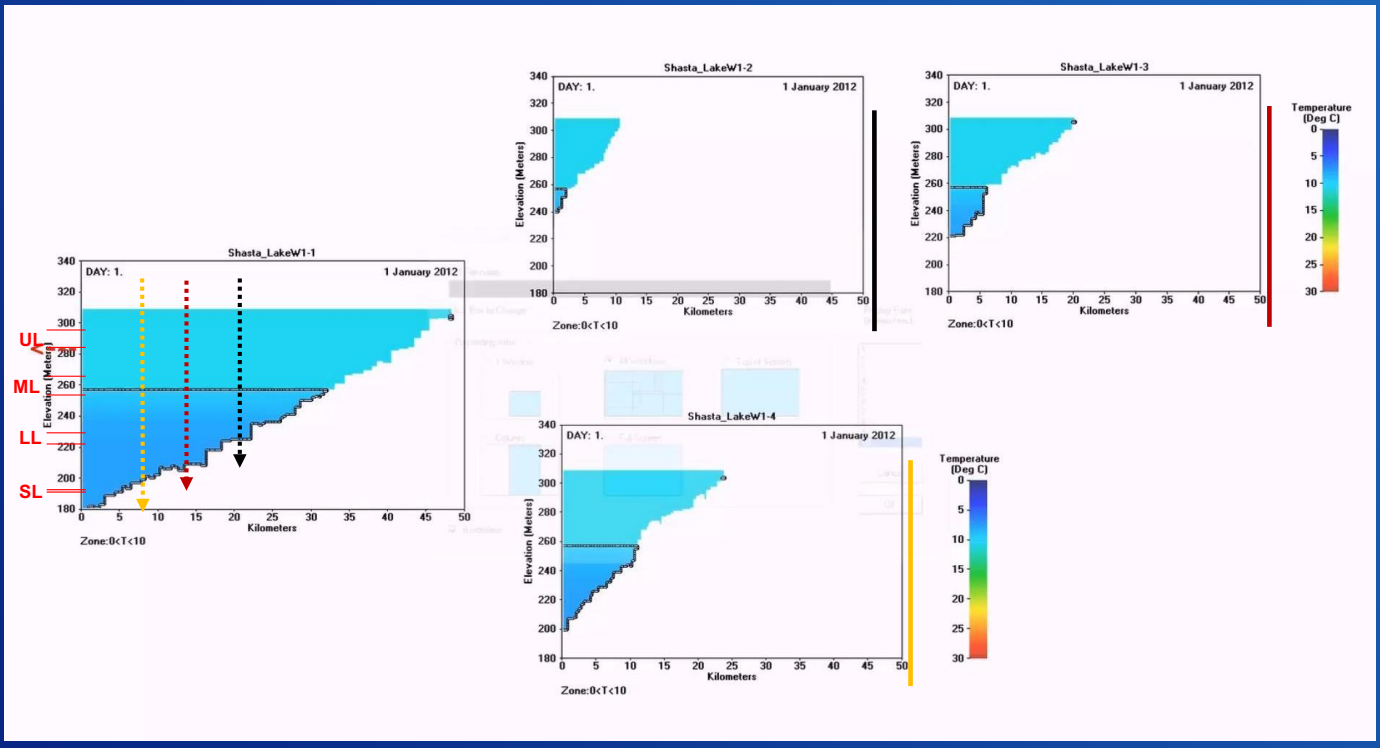






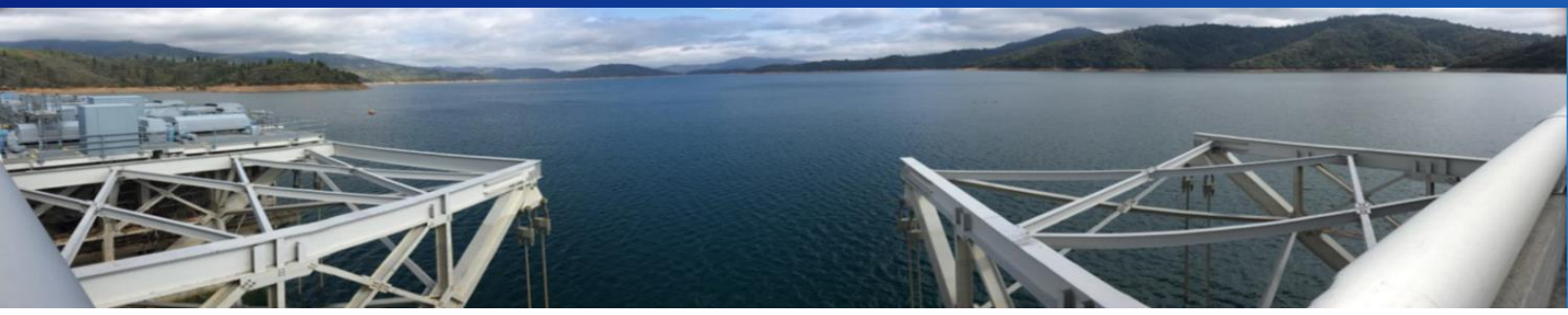
RECLAMATION

Preliminary Results



Next Steps

- Complete Phase I
  - Model Documentation (Final)
- Initiate Phase II
  - Calibration Refinement
  - Data Management
  - Post Processing
  - Testing
  - Forecasting
  - Comparison with existing models



Shasta RPA Amendment:

Science and Monitoring Work Plan

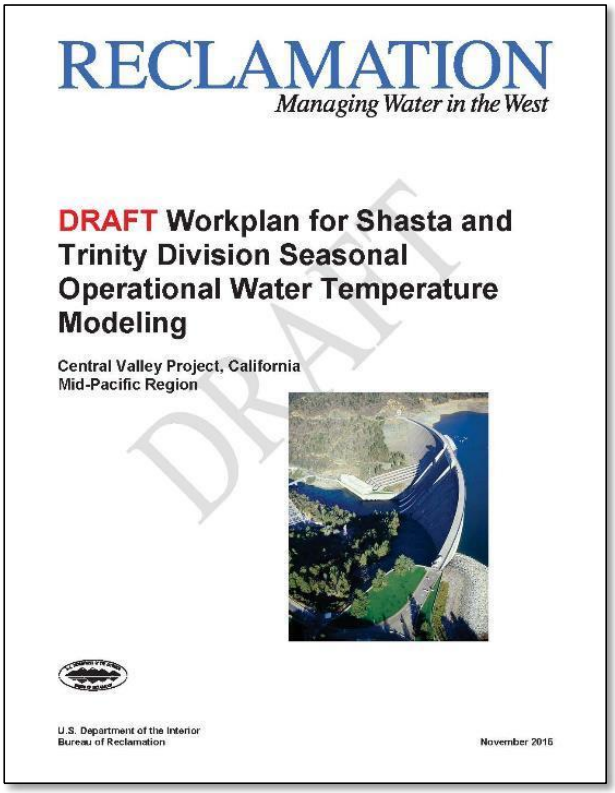
NOAA Fisheries & US Bureau of Reclamation

Status of the Plan

The current document is a Reclamation and NMFS product originally envisioned to be similar to the *CVP and SWP Drought Contingency Biological Monitoring Plan* (Dec. 2014).

Concurrent Effort

The Science Plan is intended to complement Reclamation's *Modeling Workplan* (Nov. 2016), the objective of which is to update and refine modeling capabilities.



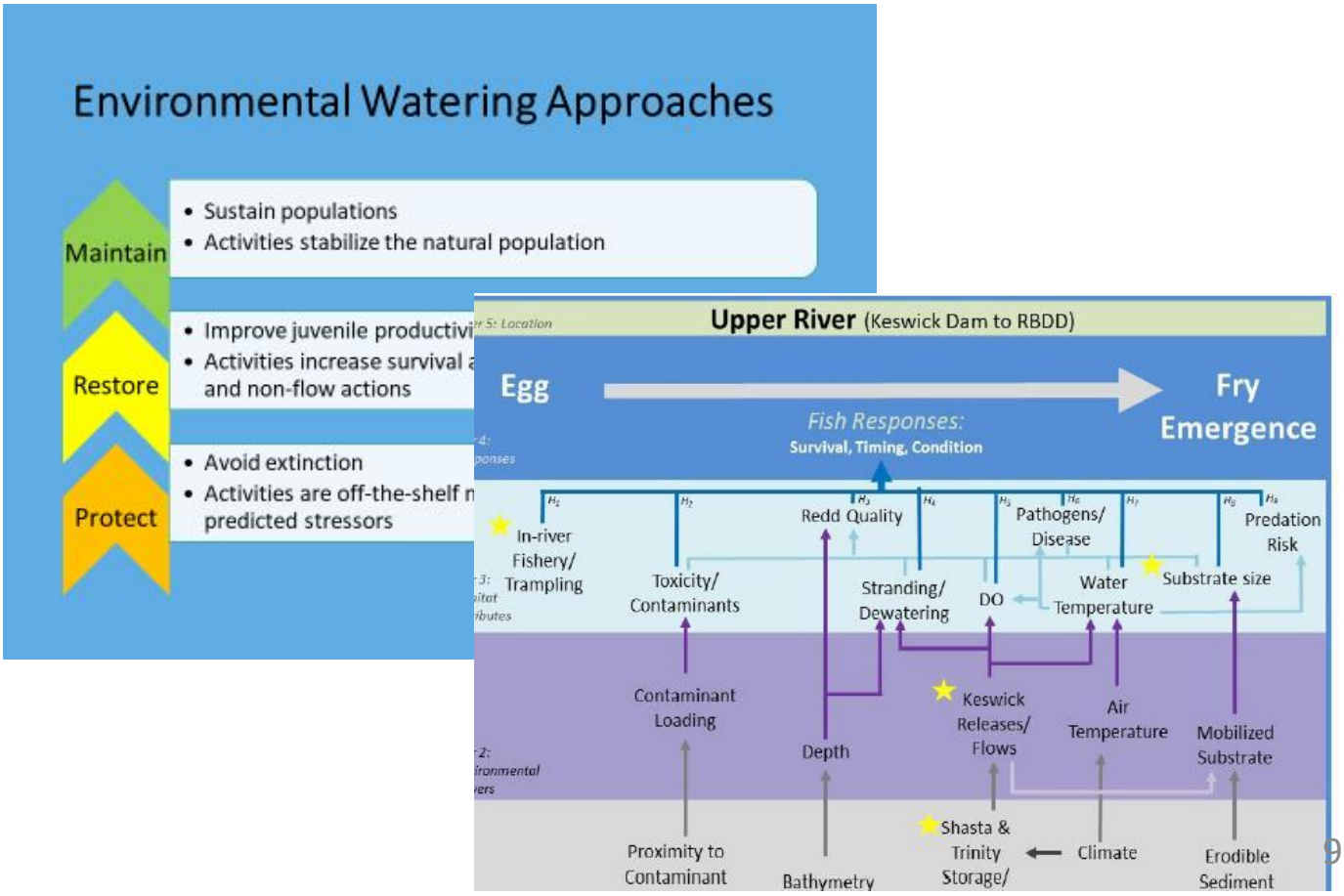
Science Plan Objectives

To be used to help guide the “budget in Federal fiscal year 2018, if possible, and into fiscal year 2019 and beyond.”

Specifically by directing actions that will:

- Reduce uncertainty on the conditions necessary to achieve desired fish and water management goals
- Identify near-term monitoring, biological modeling, and analysis and synthesis needs to improve fish and water management decision-making regarding Action Suite I.2
- Coordinate activities between agencies, stakeholders, and other interested parties.

Fish and Water Management Goals

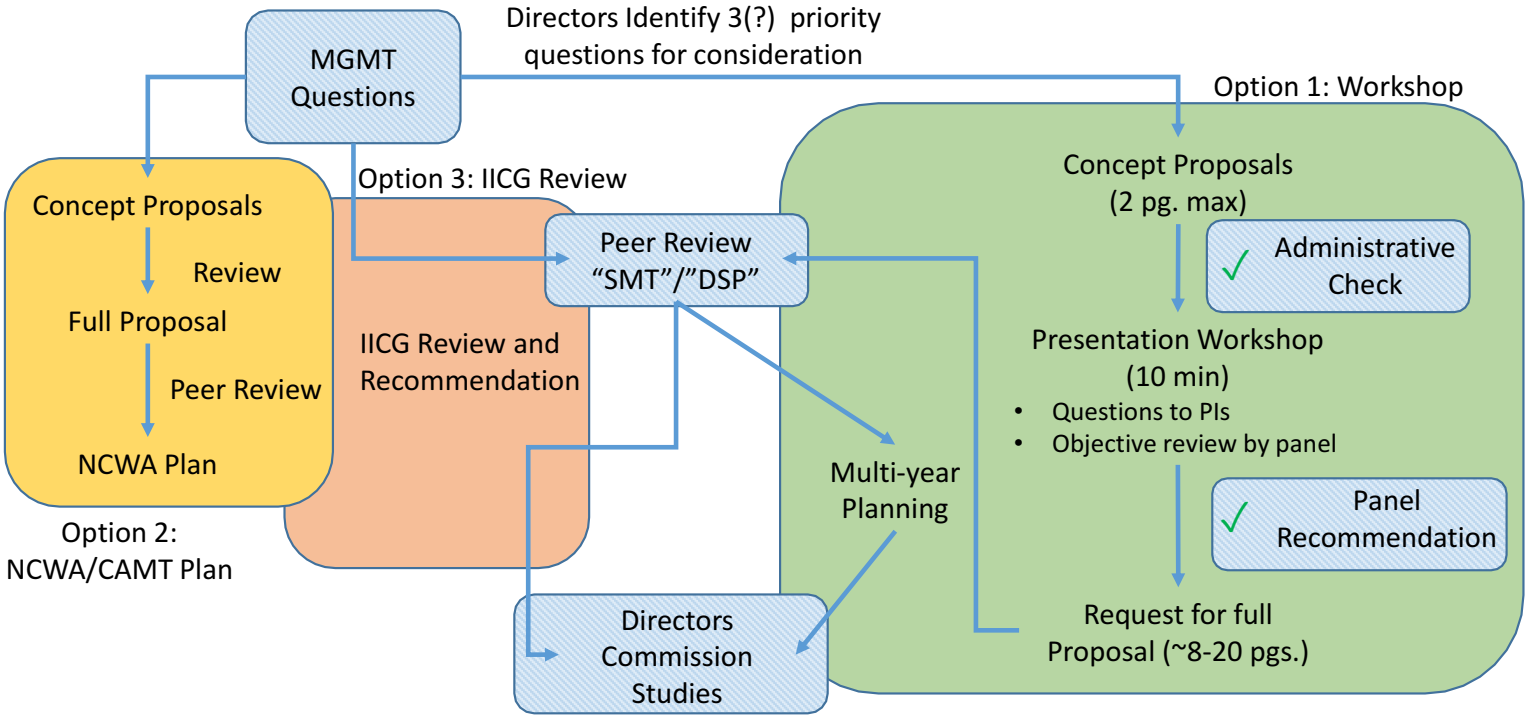


Management Questions

- Forecasting (biological modeling and synthesis)
- Species Viability and Variability (mechanistic studies of observation and experiments)
- Interactions between Stressors (community studies)
- Structural Modification and Facilities (engineering studies)

Implementation

Science Planning: Annual/Bi-annual cycle?



Monitoring

The Science Plan identifies a number of new and ongoing monitoring programs the data of which currently inform, or may be used in the future to inform, Project operations. This monitoring may be further used to answer the proposed management questions.

- Core Monitoring (existing, compliance monitoring)
- Special Studies (Short-term, opportunistic studies)

Time Table and Next Steps

Task	Timeline
Final version of Science Plan	December 2017 – January 2018
Study prioritization and planning	January- June 2018-2020
Study funding and implementation	October 2018- September 2021
Study Status Reporting	Semiannually WY 2019-2021
Monitoring Status Reporting	Open data approach
Biological Review Panel (Independent review of final findings and monitoring)	September 2019, 2021, 2023

Questions and Feedback

Reclamation and NMFS are particularly interested in comments regarding

(1) sufficiency of the Management Questions section,

(2) the collaborative science approaches to planning, prioritization, and implementation described in the Implementation section (slide 7), and

(3) adequacy of the Stakeholder Involvement and Outreach section.

Questions and input can be provided via email to Evan Sawyer, evan.sawyer@NOAA.gov. Please send comments no later than COB March 2, 2018.

Discussion
Q&A

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