



CALIFORNIA
WATER FIX
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DWR - 1028



CALSIM MODELING



OVERVIEW OF TESTIMONY

- 1. CWF H3+ Proposed Operations criteria**
- 2. Analysis of BA to CWF H3+ changes**
- 3. CWF H3+ Operations Modeling Approach**
- 4. CWF H3+ Operations Modeling Results**
- 5. CWF H3+ Modeling Approach**



OVERVIEW OF TESTIMONY

Opinions:

- 1. Meets the D-1641 fish and wildlife requirements including X2, NDOI, Rio Vista, and export/inflow ratio**
- 2. Meets the 2008/09 BOs requirements including OMR and Fall X2**
- 3. End-of-May and end-of-September storage levels similar to the NAA in major SWP and CVP upstream reservoirs.**
- 4. Water deliveries to CVP and SWP contractors, including Settlement Contractors, Exchange Contractors, Refuge Level 2, and Feather River Service Area Contractors, similar to NAA.**



OVERVIEW OF TESTIMONY

Opinions (cont'd):

- 5. Long-term average deliveries to CVP and SWP north of Delta and south of Delta water service contractors were similar or higher than NAA.**
- 6. The sensitivity analysis shown in “Developments after Publication of the Proposed Final Environmental Impact Report” (Exhibit SWRCB-108) compared the incremental changes under the BA H3+ and the CWF H3+ relative to the NAA. The sensitivity analysis results showed that overall operations including upstream storage, river flows, and water supply deliveries remained similar.**



1. CWF PROPOSED OPERATIONS CRITERIA

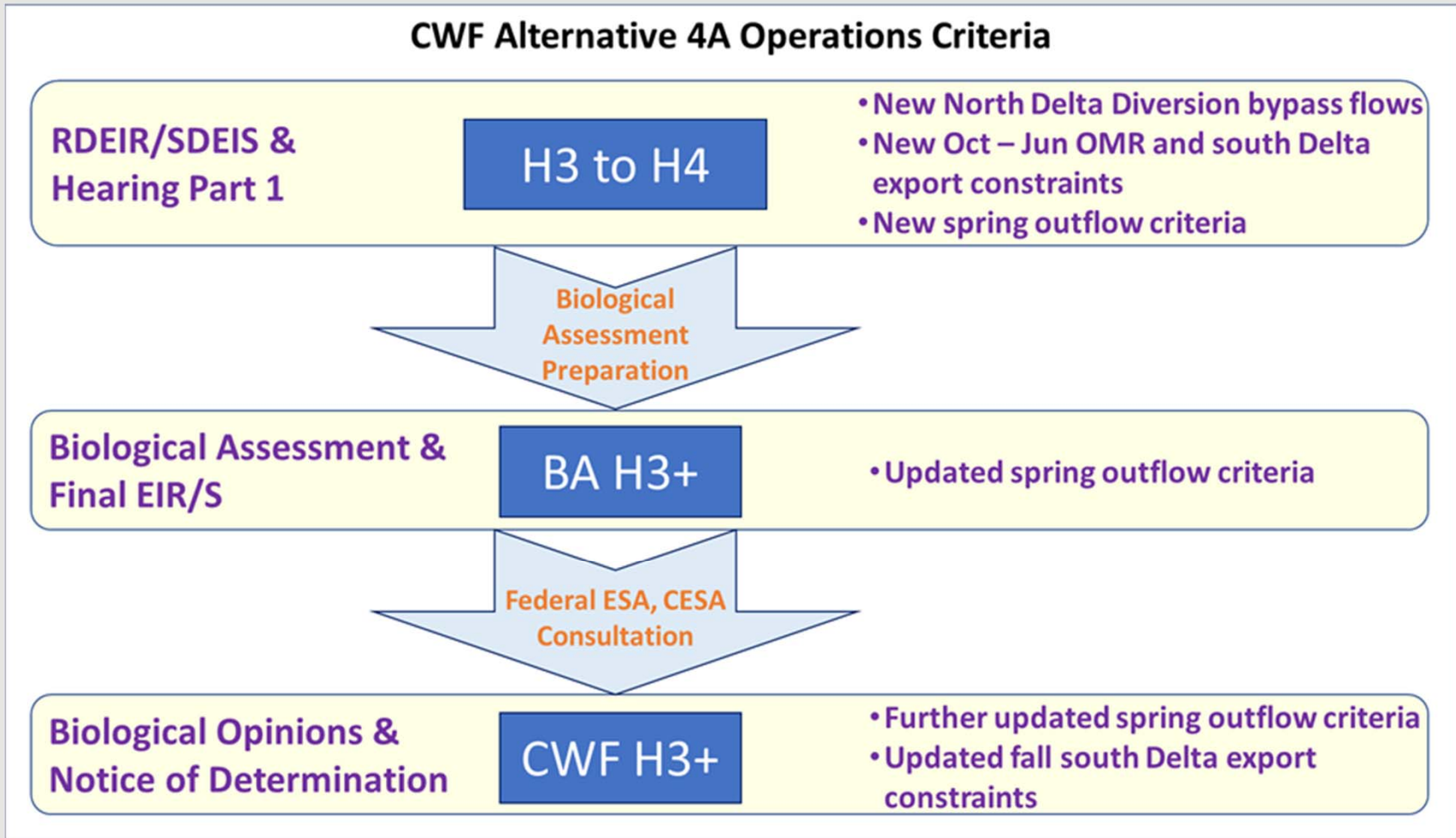


1. CWF PROPOSED OPERATIONS CRITERIA

- **The CWF H3+ represents the proposed initial CWF operational criteria**
 1. As presented in Part 1, the CWF proposed project is Alternative 4A with operations criteria H3 to H4
 2. The August 2016 BA included only one set of operations criteria (H3+)
 3. The July 2017 NOD included slight revisions to H3+



1. CWF PROPOSED OPERATIONS CRITERIA





1. CWF PROPOSED OPERATIONS CRITERIA

- **What has not changed:**
 - All the operational criteria for Alternative 4A H3 to H4 presented in Part 1 (DWR-515 Table 1) remain the same in CWF H3+ except for:
 1. Spring outflow
 2. Fall South Delta OMR and export restrictions



1. CWF PROPOSED OPERATIONS CRITERIA

- **What has changed:**
 1. Changes to spring Delta outflow requirement
 2. Changes to fall south Delta export constraints



1. CWF PROPOSED OPERATIONS CRITERIA

- **What has changed (cont'd):**

- 1. **Changes to spring outflow requirement:**

- A March outflow requirement was added.
 - Dependent upon the forecasted hydrologic conditions in March (eight river index).
 - Total Delta exports are curtailed to no less than 1500 cfs, if needed, to meet requirement.
 - SJR I-E ratio included, but suspended when Delta outflow is greater than 44,500 cfs.



1. CWF PROPOSED OPERATIONS CRITERIA

- **What has changed (cont'd):**

- 2. Changes to fall south Delta export constraints:**

- In the CWF H3+ Scenario, October and November OMR flow requirements and south Delta export restrictions were removed.



1. CWF PROPOSED OPERATIONS CRITERIA

	No Action Alternative (NAA)	H3	H4	BA H3+ and FEIRS Alternative 4A	CWF H3+
Planning horizon ^a	Year 2030	Same as NAA	Same as NAA	Same as NAA	Same as NAA
Inflows/Supplies	Historical with modifications for operations upstream of rim reservoirs and with changed climate at Year 2030	Same as NAA	Same as NAA	Same as NAA	Same as NAA
Facilities					
North Delta Diversion Intakes	Not included	9,000 cfs north Delta diversion intake on the Sacramento River at Hood	Same as H3	Same as H3	Same as H3
Head of Old River Gate	Temporary Head of Old River Barrier installed in the fall months	Permanent Head of Old River Gate	Same as H3	Same as H3	Same as H3
North Delta Diversion Operations Criteria					
North Delta Diversion Bypass Flows	Not included	Sacramento River bypass flow requirements downstream of the proposed intakes as described in Table 2 below. In addition, a constraint on the potential diversion at the north Delta intakes, to account for the fish screen sweeping velocity criteria of 0.4 fps. The constraint was derived based on resulting diversions from the DSM2 modeling.	Same as H3	Same as H3	Same as H3
Minimum flow near Rio Vista	SWRCB D-1641	Same as NAA with additional minimum flow requirement of 3,000 cfs from January to August.	Same as H3	Same as H3	Same as H3



1. CWF PROPOSED OPERATIONS CRITERIA

	No Action Alternative (NAA)	H3	H4	BA H3+ and FEIRS Alternative 4A	CWF H3+
South Delta Export Restrictions					
South Delta exports (Jones PP and Banks PP)	SWRCB D-1641. Vernalis flow-based export limits Apr 1 – May 31 as required by NMFS BiOp (Jun, 2009) Action IV.2.1 (additional 500 cfs allowed for Jul – Sep for reducing impact on SWP)	SWRCB D-1641. Pumping at the south Delta intakes are preferred during the July through September months up to a total pumping of 3,000 cfs to minimize potential water quality degradation in the south Delta channels. No specific intake preference is assumed beyond 3,000 cfs.	Same as H3	Same as H3	Same as H3
Combined Flow in Old and Middle River (OMR)	FWS BiOp (Dec 2008) Actions 1 through 3 and NMFS BiOp (Jun 2009) Action IV.2.3	New OMR criteria in Table 3 below or same as the NAA, whichever results in less negative OMR flows	Same as H3	Same as H3	Oct and Nov: Same as NAA Other months: Same as H3
Head of Old River Barrier/Gate	Head of Old River Barrier (HORB) is only installed in the fall months per FWS Delta Smelt BiOp Action 5; it is assumed to be not installed in April or May.	HOR gate operations assumptions (% OPEN) Oct 50%, Nov 100%, Dec 100%, Jan 50%, Feb - Jun 15th 50%, Jun 16-30 100%, Jul - Sep 100%; HOR gate will be open 100% whenever flows are greater than 10,000 cfs at Vernalis.; Oct-Nov: Before the D-1641 pulse = HOR gate open, During the D-1641 pulse = for 2 weeks HOR gate closed; After D-1641 pulse: HORB open 50% for 2 weeks	Same as H3	Same as H3	Same as H3



1. CWF PROPOSED OPERATIONS CRITERIA

	No Action Alternative (NAA)	H3	H4	BA H3+ and FEIRS Alternative 4A	CWF H3+
Delta Outflow Requirements					
Delta Outflow Index (Flow and Salinity)	SWRCB D-1641 and USFWS BiOp (Dec 2008) Action 4 (Fall X2 Requirement)	Same as NAA	Same as NAA; In addition, enhanced spring Delta outflow required during the Mar-May period. Mar-May average outflow requirement is determined based on 90% forecast of Mar-May Eight River Index (8RI). For modeling purposes, the Mar-May 8RI was forecasted based on a correlation between the Jan-Feb 8RI and Mar-May 8RI at ELT. Each year in March, Delta outflow target for the Mar-May period is determined based on the forecasted Mar-May 8RI value and its exceedance probability, from the Table 5 below, linearly interpolating for values in-between. This additional spring outflow is not considered as an "in-basin use" for CVP-SWP Coordinated Operations. This outflow requirement is met first by curtailing Delta exports at Banks and Jones Pumping Plants by an amount needed to meet the outflow target, such that the minimum exports are at least 1,500 cfs. In wetter years (< 50% exceedance), if the outflow target is not achieved by export curtailments, then the additional flow needed to meet the outflow target is released from the Oroville reservoir as long as its projected end-of-May storage is at or above 2 MAF.	<p>March, April, May: maintain the March–May average Delta outflow that would occur with existing facilities under the operational criteria described in the 2008 USFWS BiOp and 2009 NMFS BiOp.</p> <p>The 2009 NMFS BiOp Action IV.2.1 (San Joaquin River i-e ratio) will be used to constrain Apr–May total Delta exports under CWF to meet March–May Delta outflow requirement per current operational practices.</p>	<p>March, April, May: Maintain spring (March–May) outflow that would occur with existing facilities under the operational criteria described in the 2008 USFWS BiOp and 2009 NMFS BiOp, including current climate conditions.</p> <p>March: Eight River Index based outflow targets shown in Table 6 to be achieved to the extent possible through total Delta export curtailments such that exports do not fall below 1,500 cfs;</p> <p>April and May: same as FEIRS/BA H3+ criteria, except restriction apply only up to a maximum outflow target of 44,500 cfs.</p>



2. ANALYSIS OF BA TO NOD CHANGES



2. ANALYSIS OF BA TO NOD CHANGES

- **DWR Epilogue**

- Sensitivity analysis performed to assess operational effects of the changes between BA and NOD.
- **The implications to water supply, surface water, water quality and fisheries resources were found to remain similar to the FEIRS Alternative 4A.**



3. CWF OPERATIONS MODELING APPROACH



3. CWF OPERATIONS MODELING APPROACH

- **A 2015 version of the CalSim II model was used to simulate NAA and CWF operations in this petition and the BA**
- **A 2010 version of the CalSim II model was used for the FEIRS Alternatives**



4. CWF OPERATIONS MODELING RESULTS

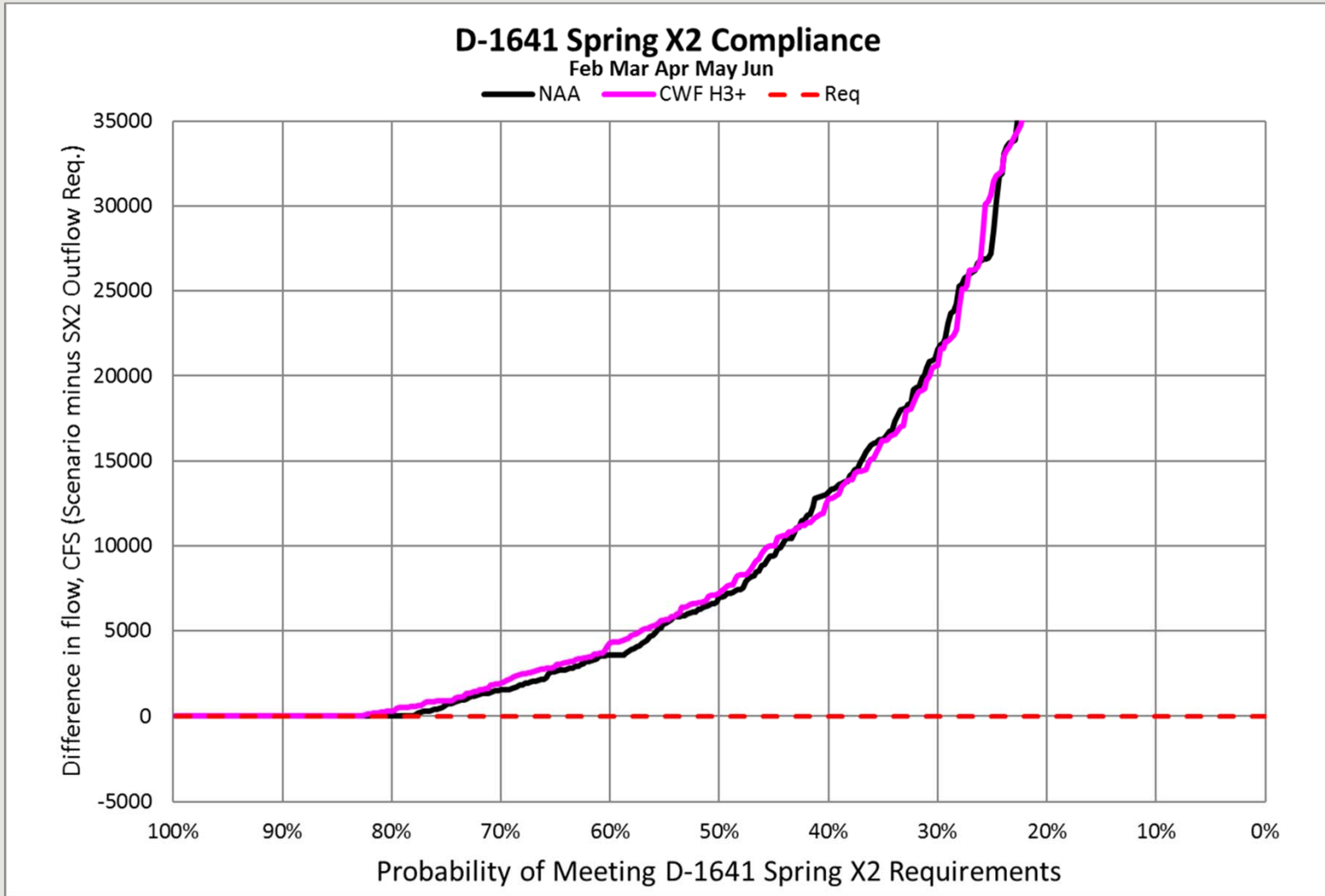


4. CWF OPERATIONS MODELING RESULTS

- **CWF H3+ scenario meets the D-1641 fish and wildlife requirements including X2, NDOI, Rio Vista, and export/inflow ratio**



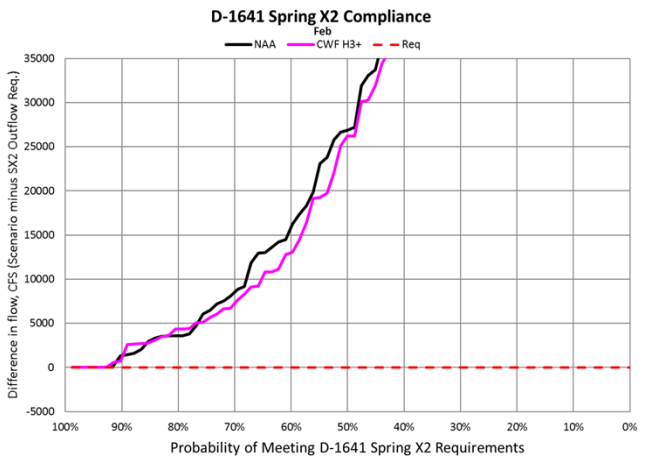
4. CWF OPERATIONS MODELING RESULTS



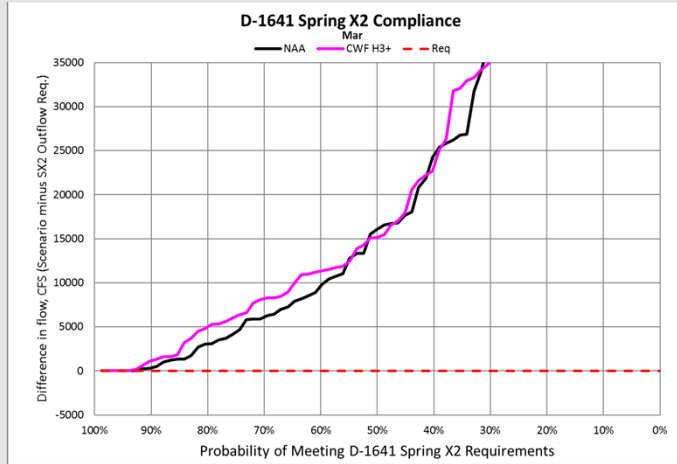


4. CWF OPERATIONS MODELING RESULTS

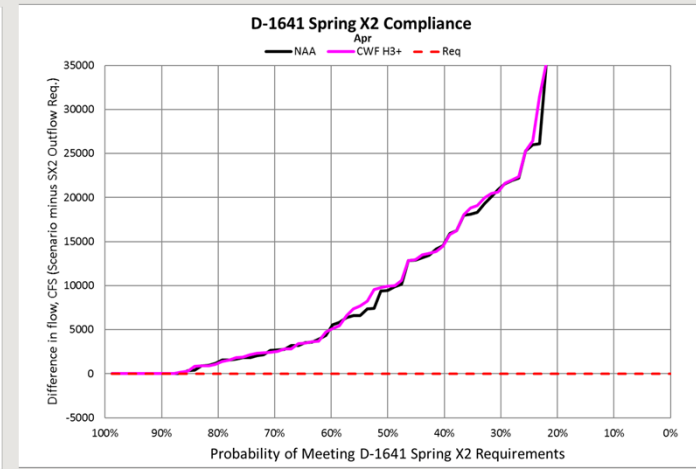
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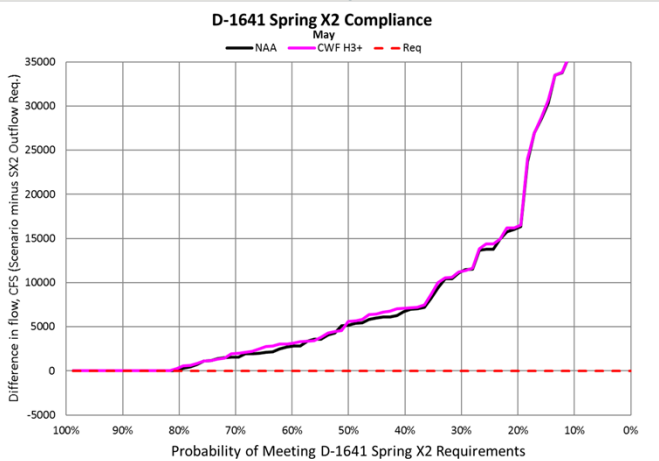
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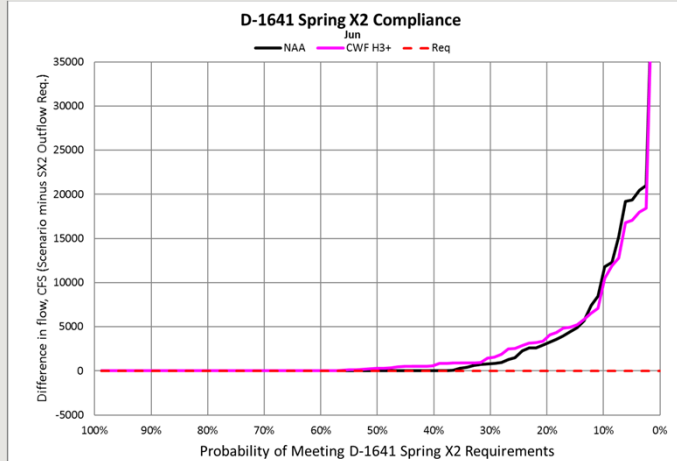
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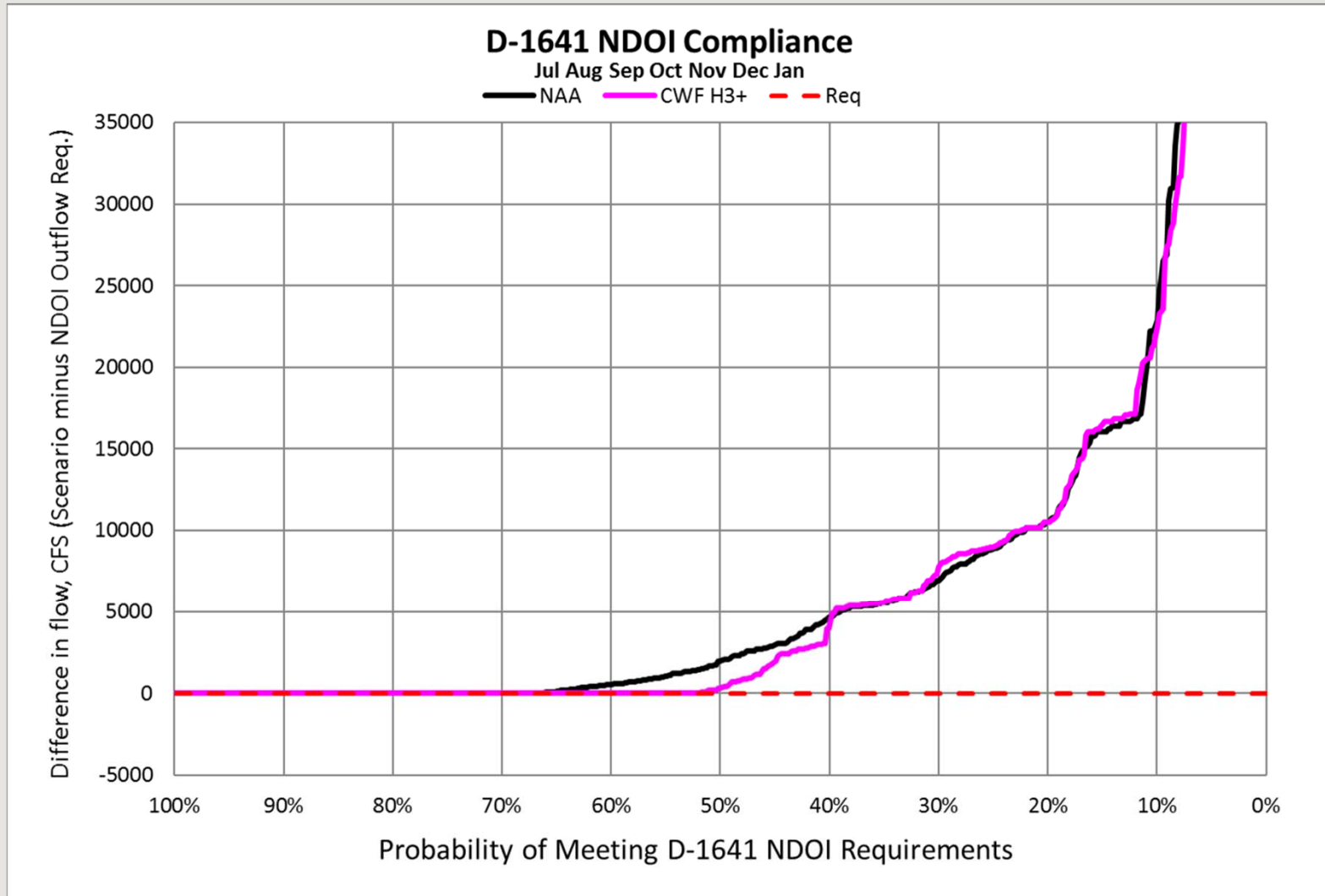


June





4. CWF OPERATIONS MODELING RESULTS





4. CWF OPERATIONS MODELING RESULTS

July

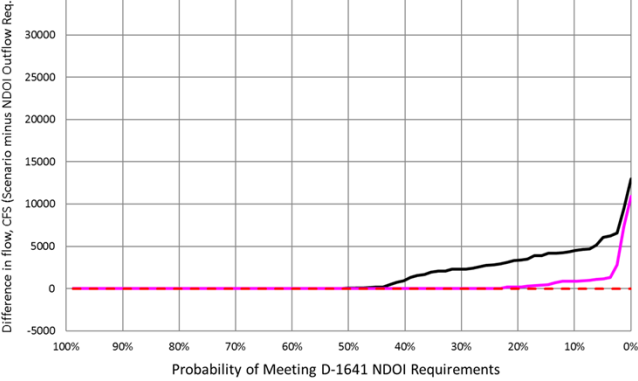
August

September

D-1641 NDOI Compliance

Jul

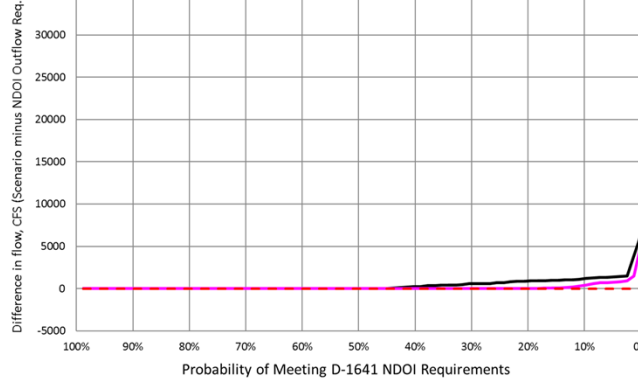
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D-1641 NDOI Compliance

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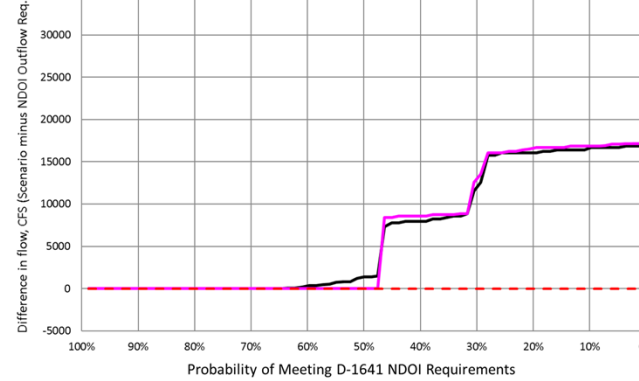
— NAA — CWF H3+ - - Req



D-1641 NDOI Compliance

Sep

— NAA — CWF H3+ - - Req



October

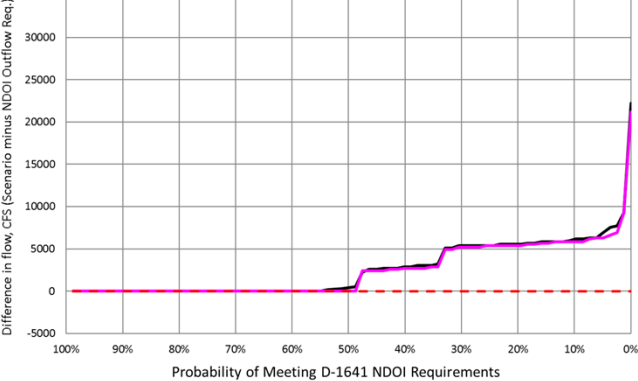
November

December

D-1641 NDOI Compliance

Oct

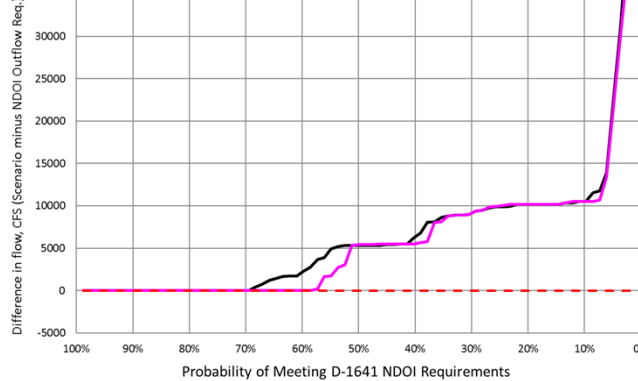
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D-1641 NDOI Compliance

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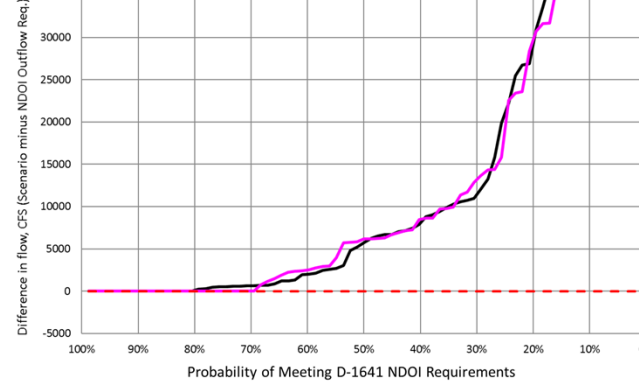
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D-1641 NDOI Compliance

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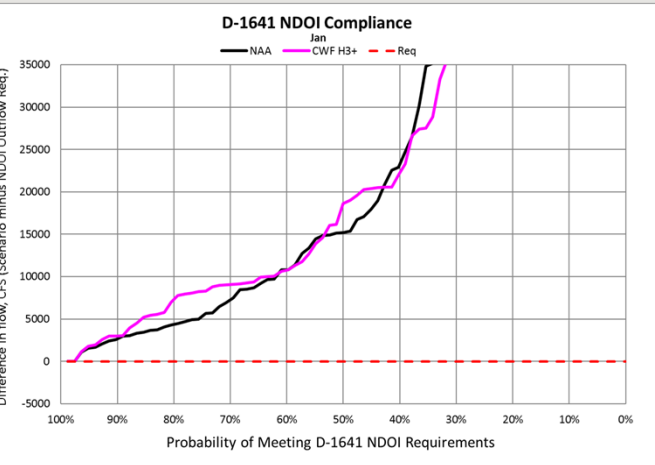
— NAA — CWF H3+ - - Req





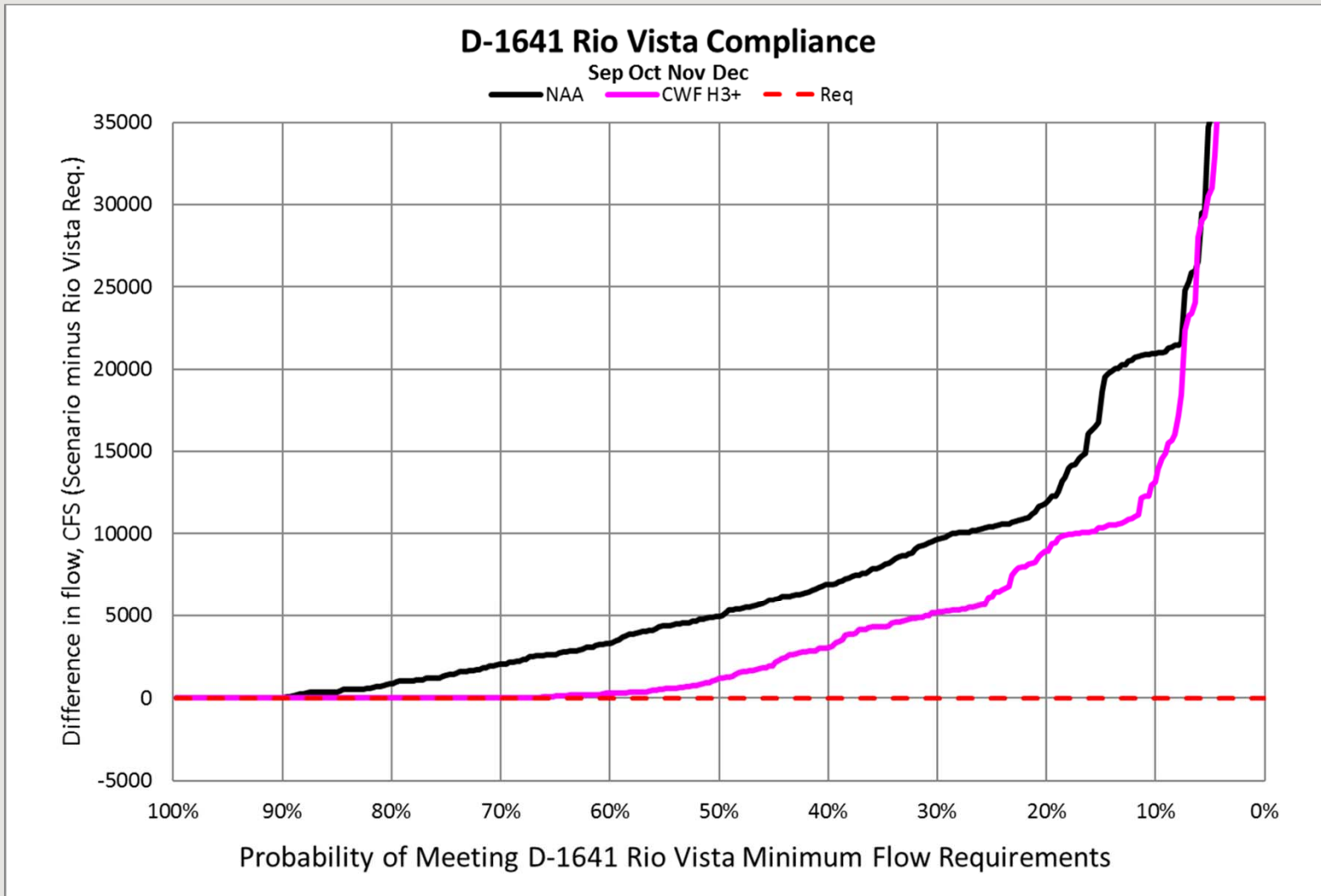
4. CWF OPERATIONS MODELING RESULTS

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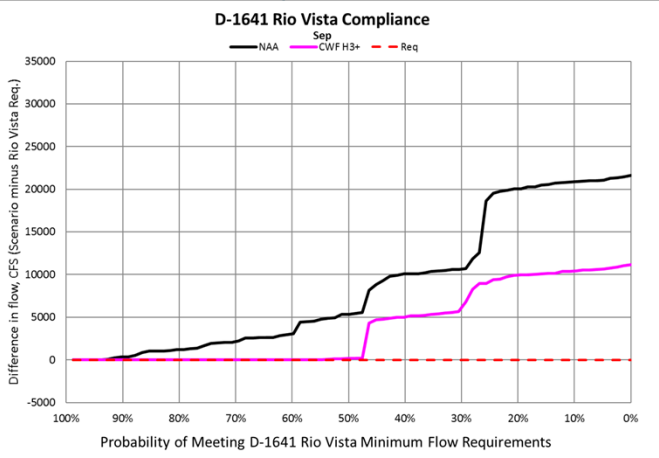
4. CWF OPERATIONS MODELING RESULTS



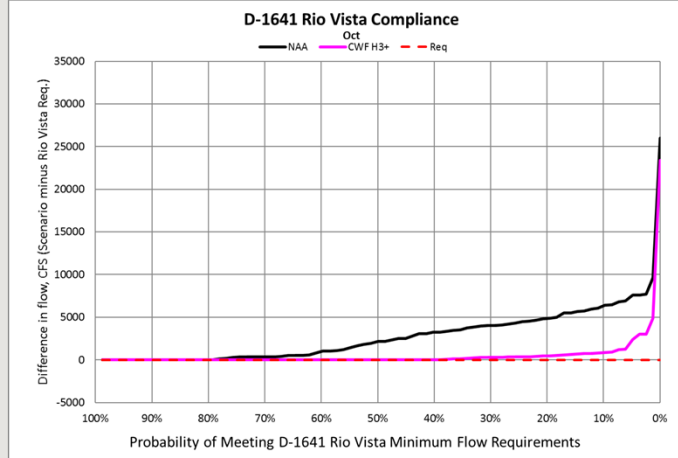


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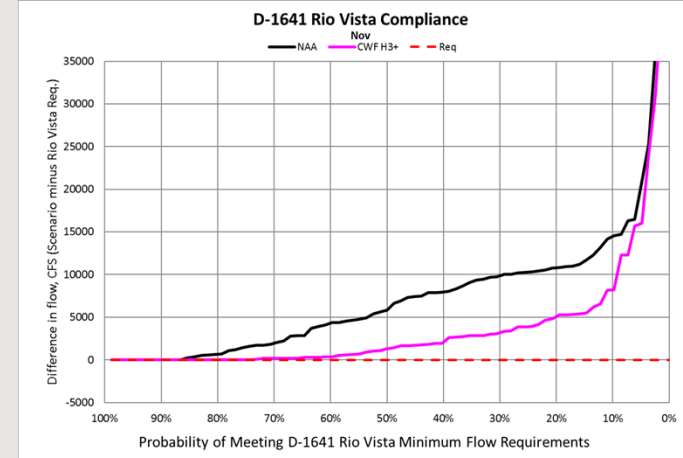
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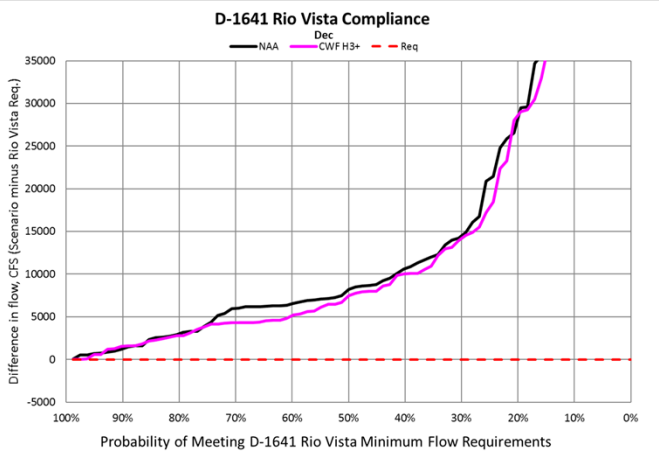
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November

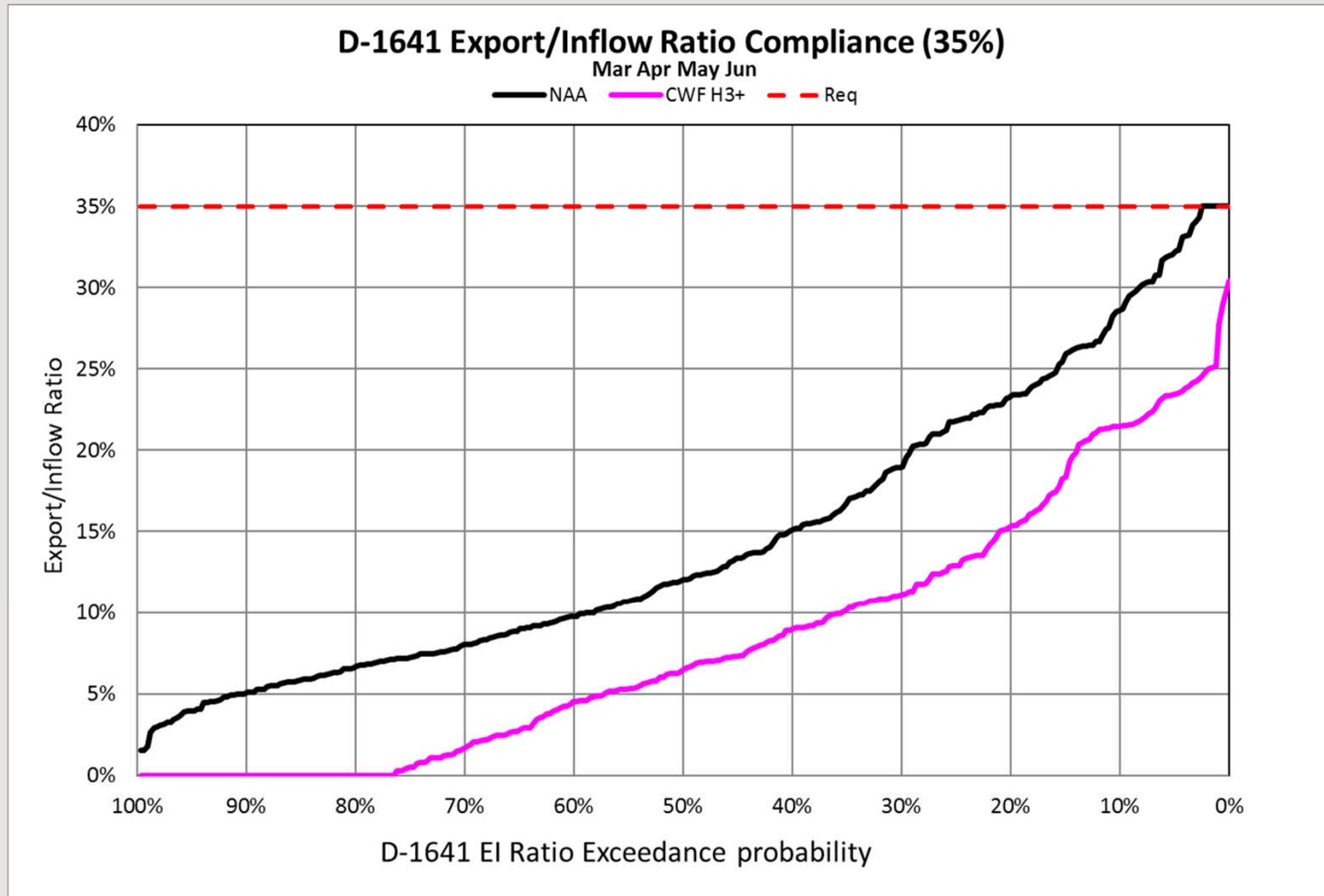


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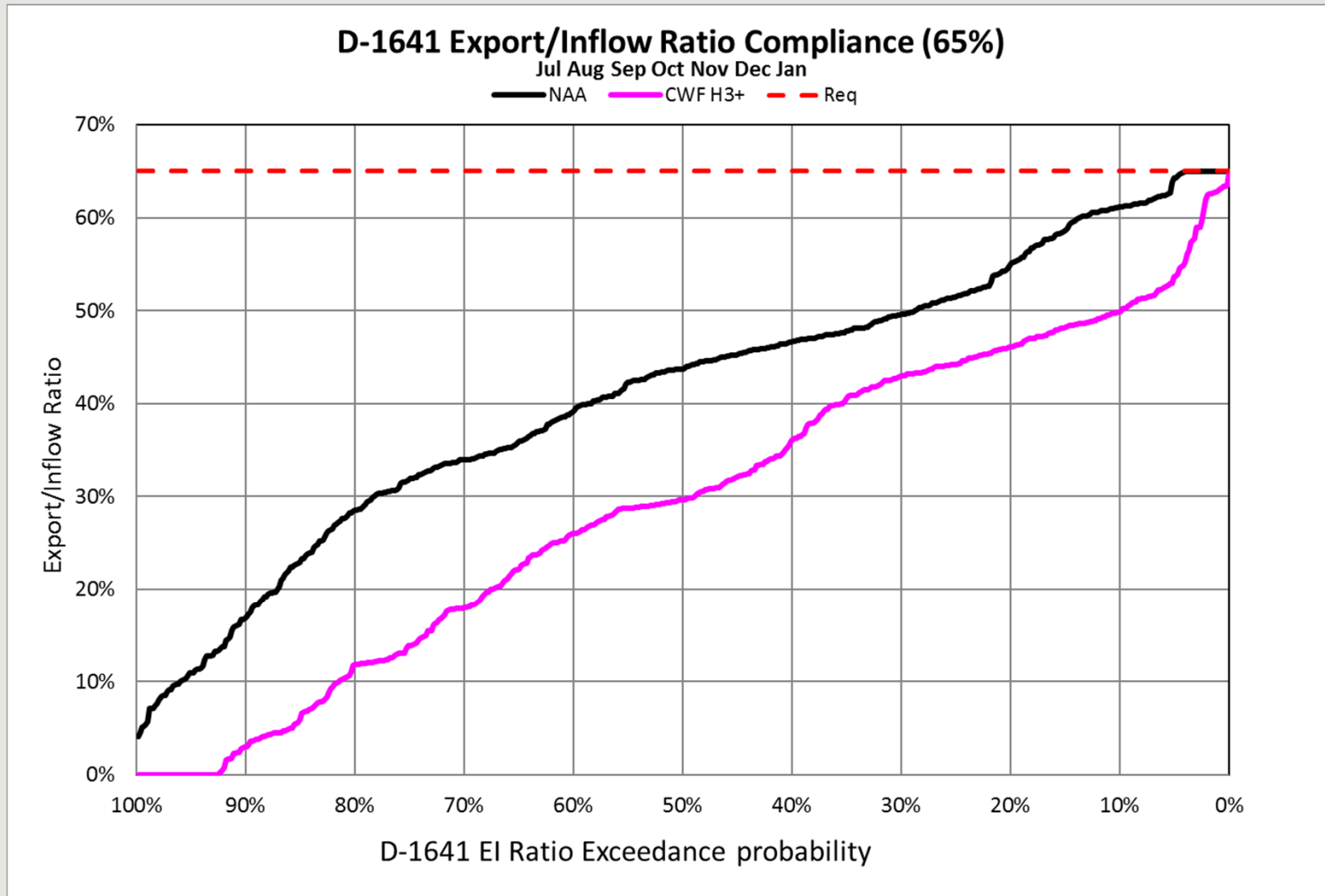


4. CWF OPERATIONS MODELING RESULTS



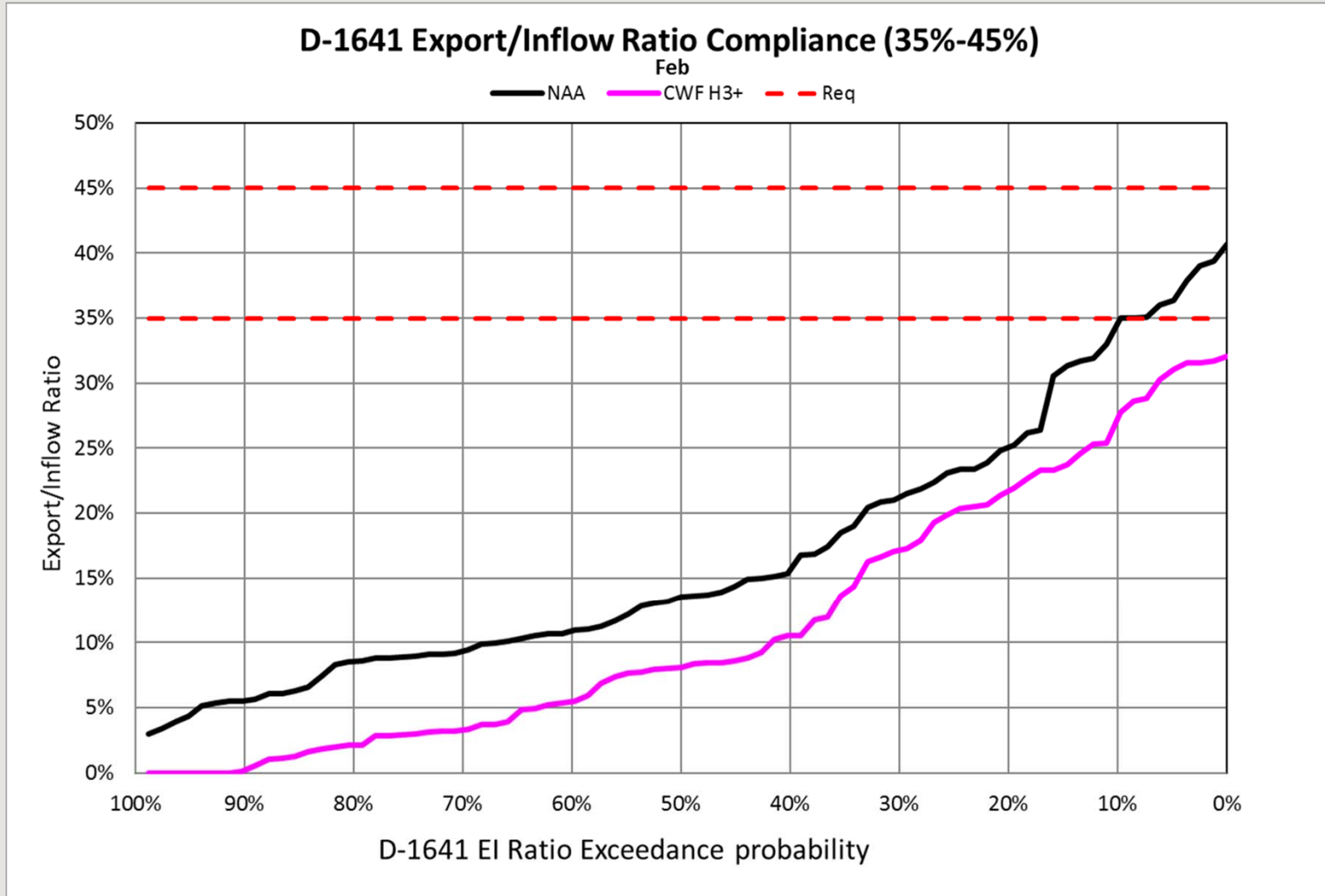


4. CWF OPERATIONS MODELING RESULTS





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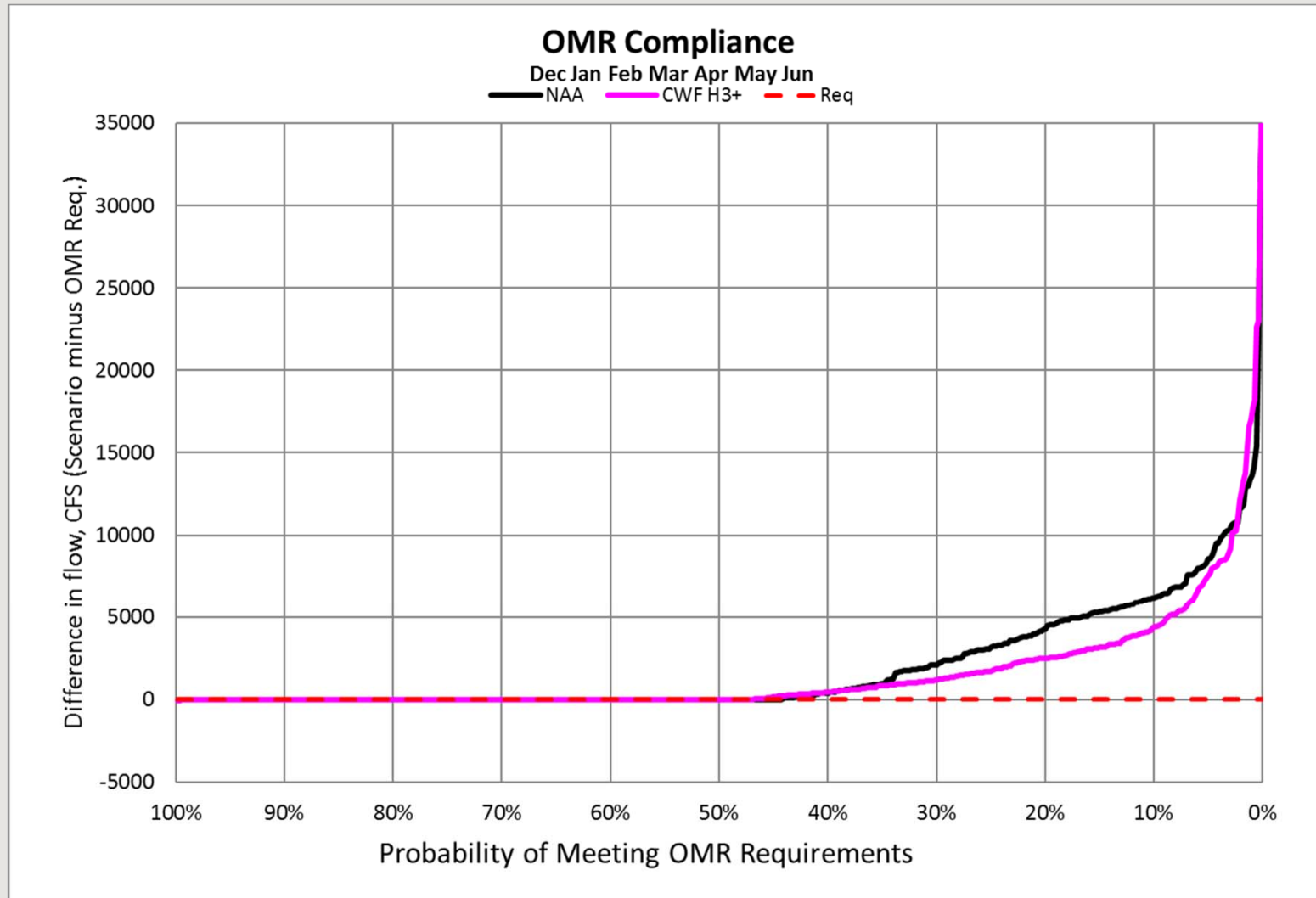


4. CWF OPERATIONS MODELING RESULTS

- **CWF H3+ scenario meets the 2008/09 BO requirements including OMR and Fall X2**



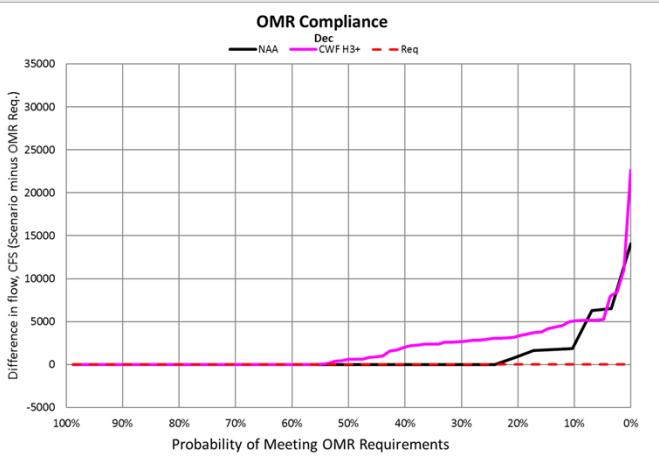
4. CWF OPERATIONS MODELING RESULTS



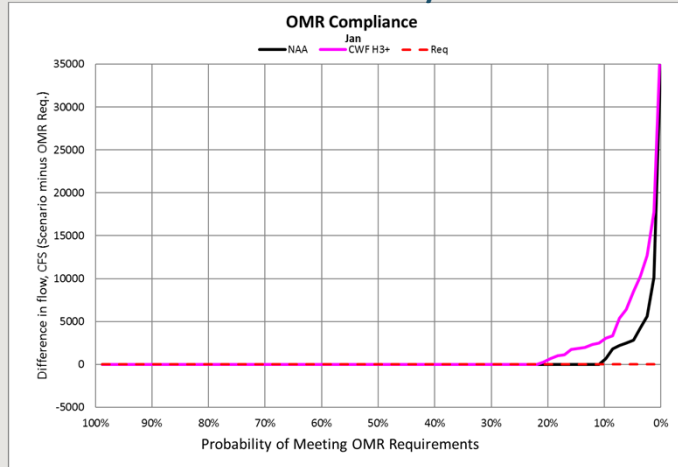


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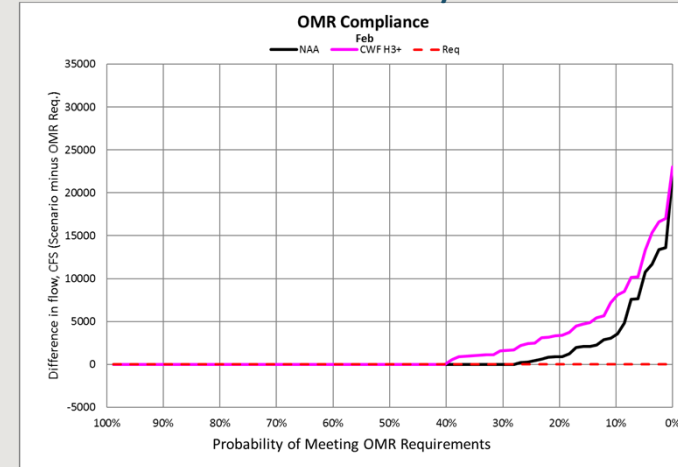
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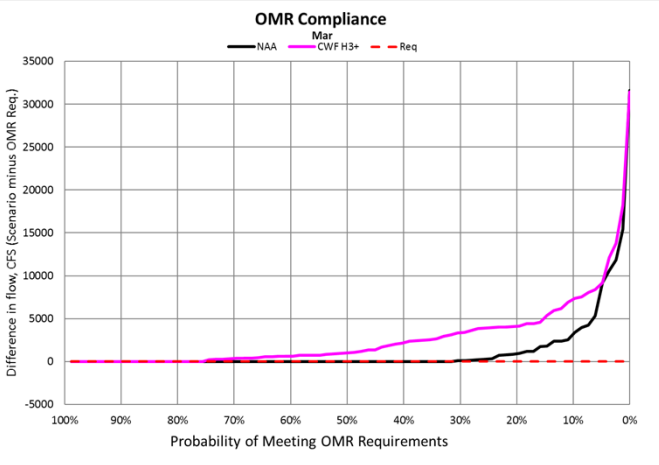
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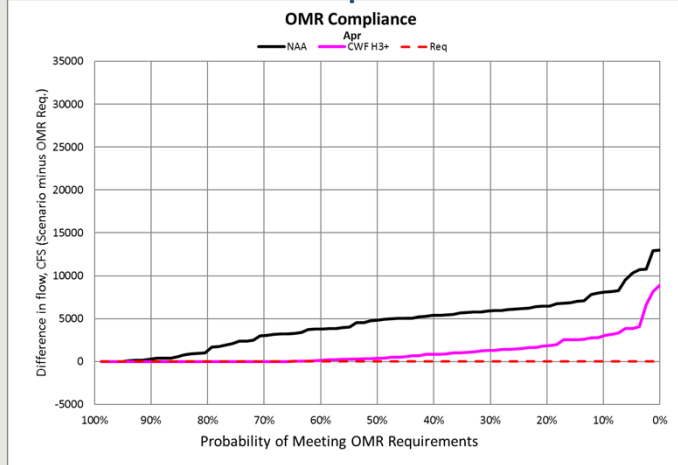
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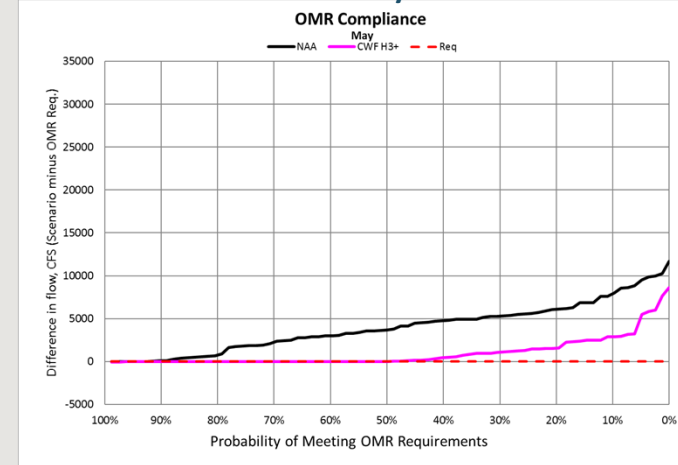
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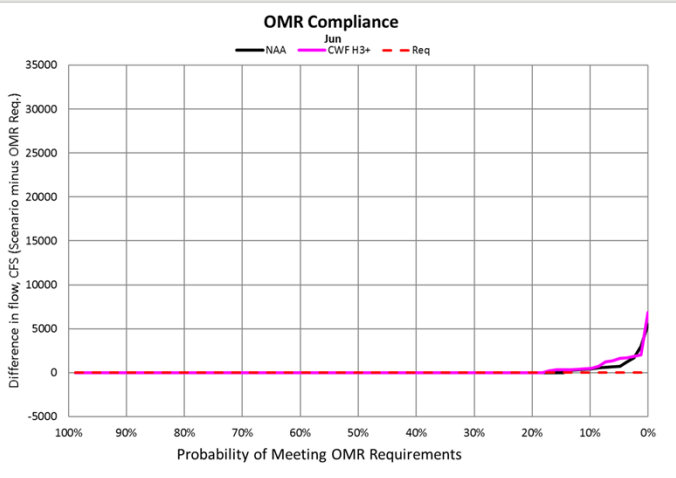
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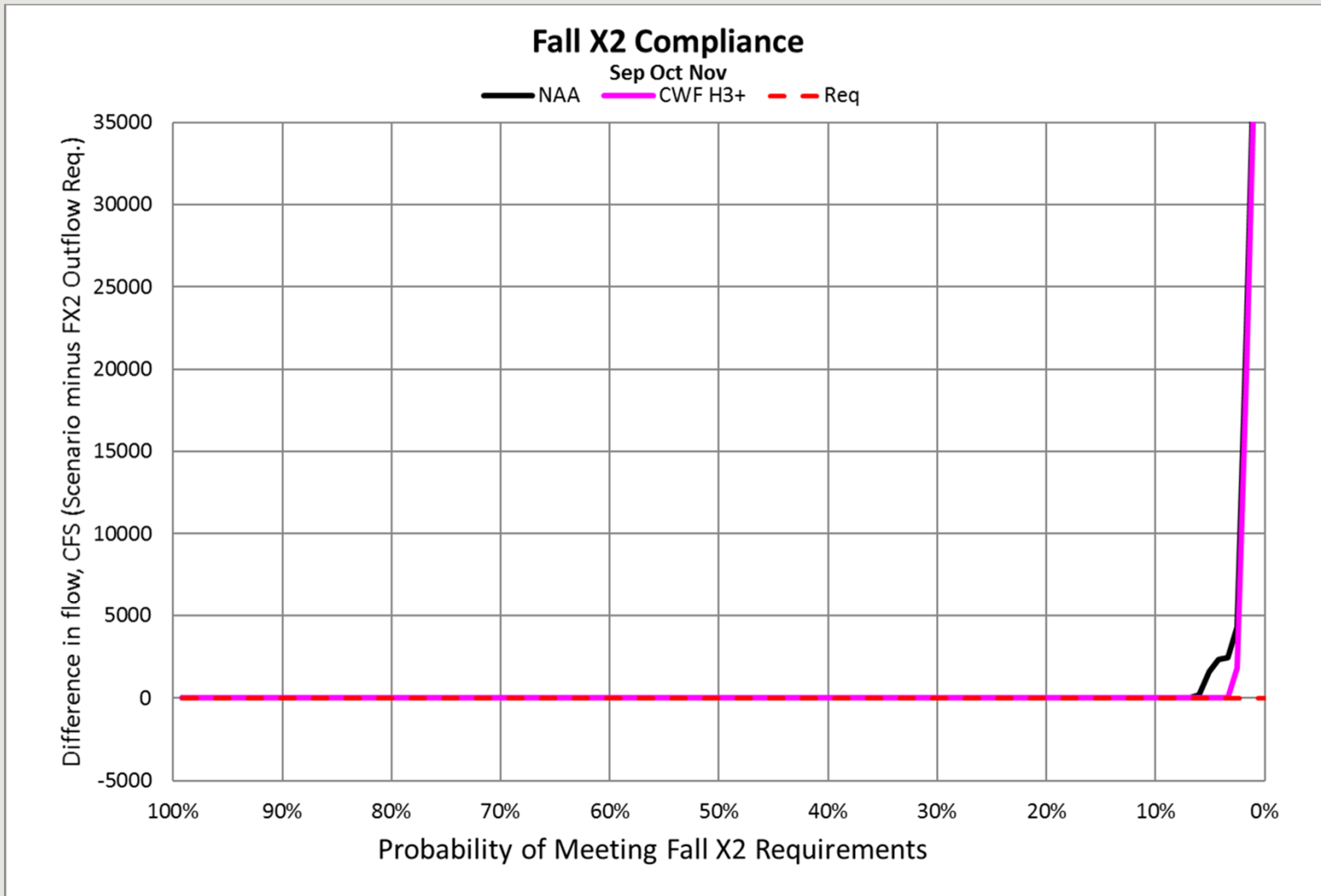
4. CWF OPERATIONS MODELING RESULTS

June





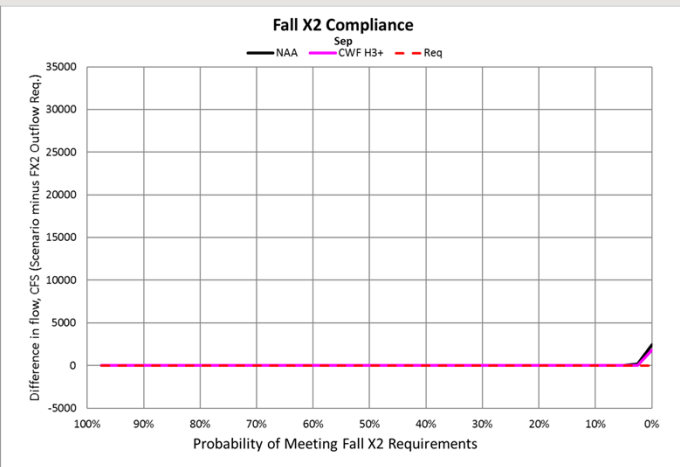
4. CWF OPERATIONS MODELING RESULTS



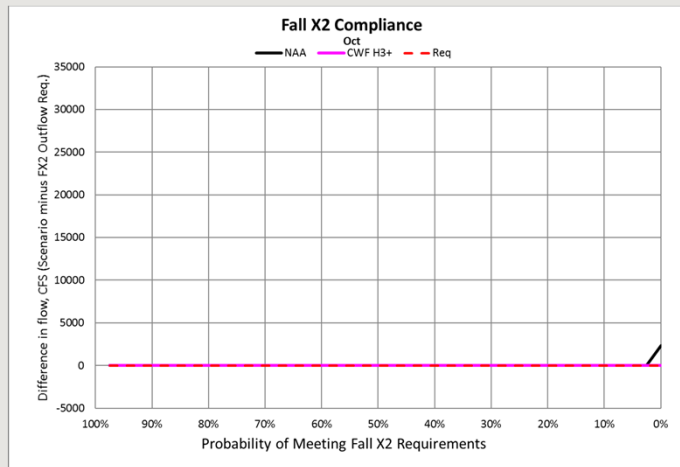


4. CWF OPERATIONS MODELING RESULTS

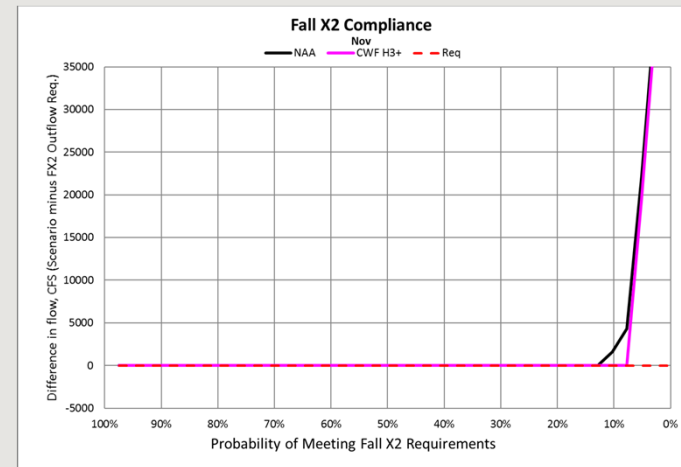
September



October



November



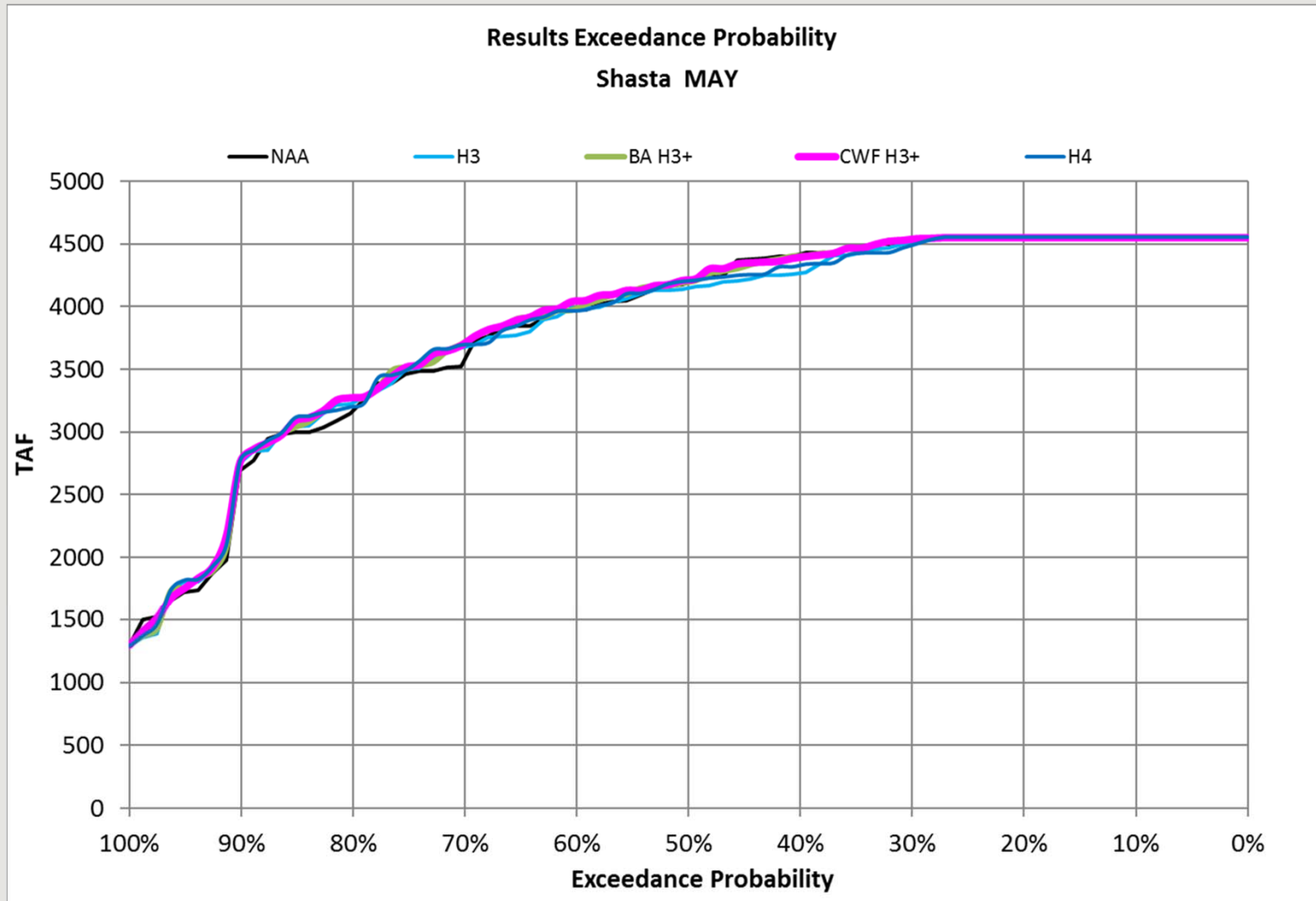


4. CWF OPERATIONS MODELING RESULTS

- **Similar end-of-May and end-of-September storage levels compared to the NAA in major SWP and CVP upstream reservoirs**

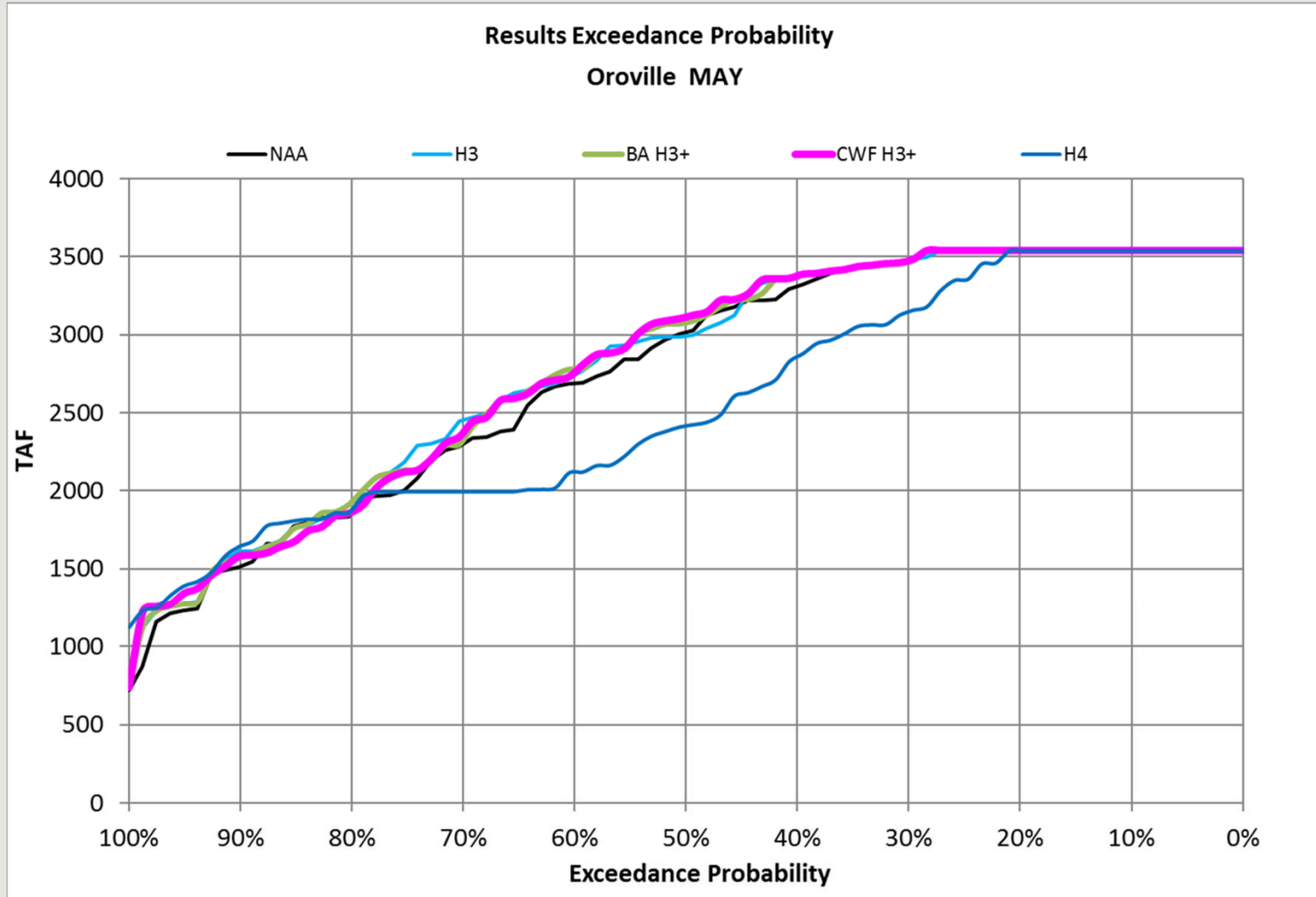


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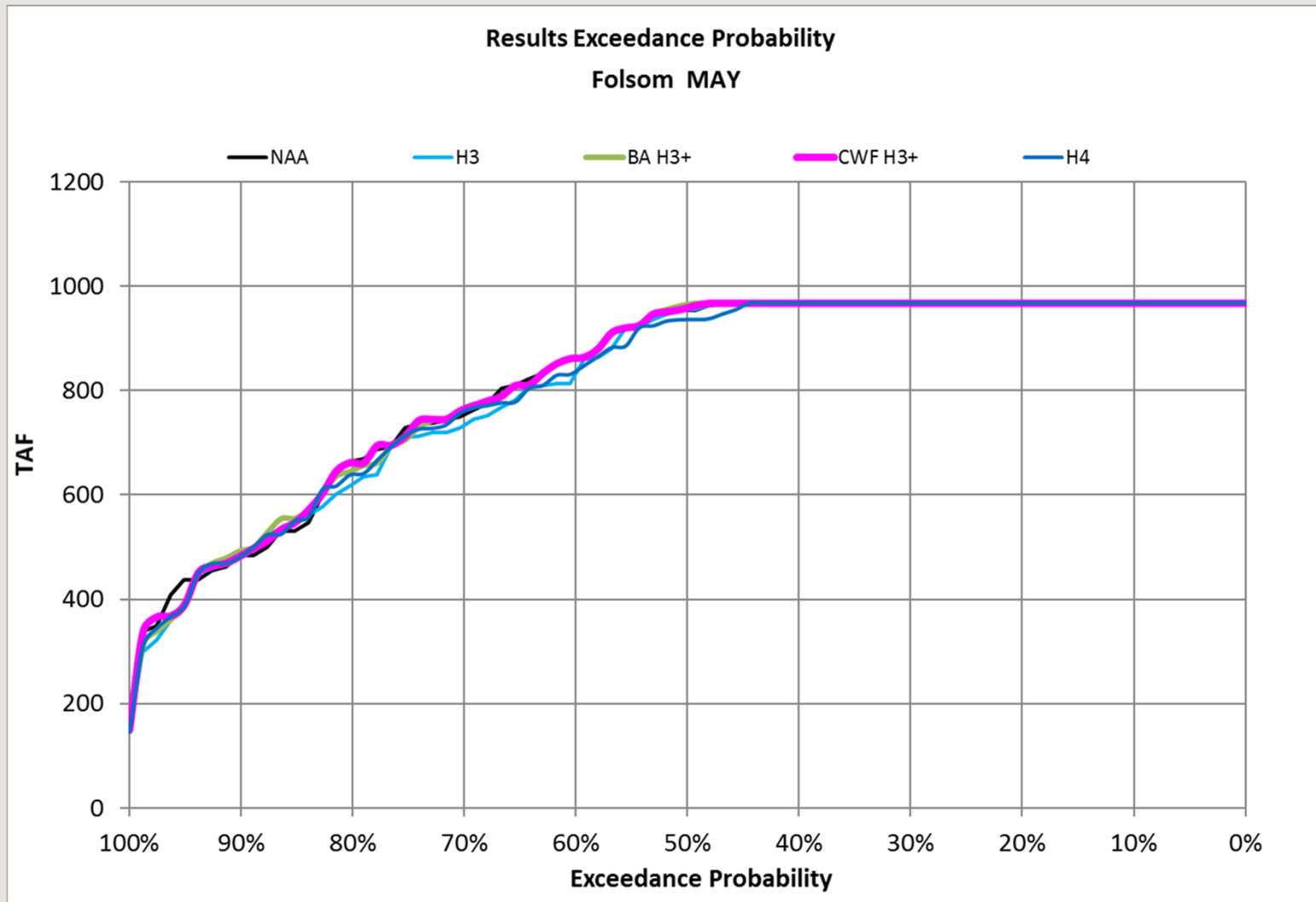


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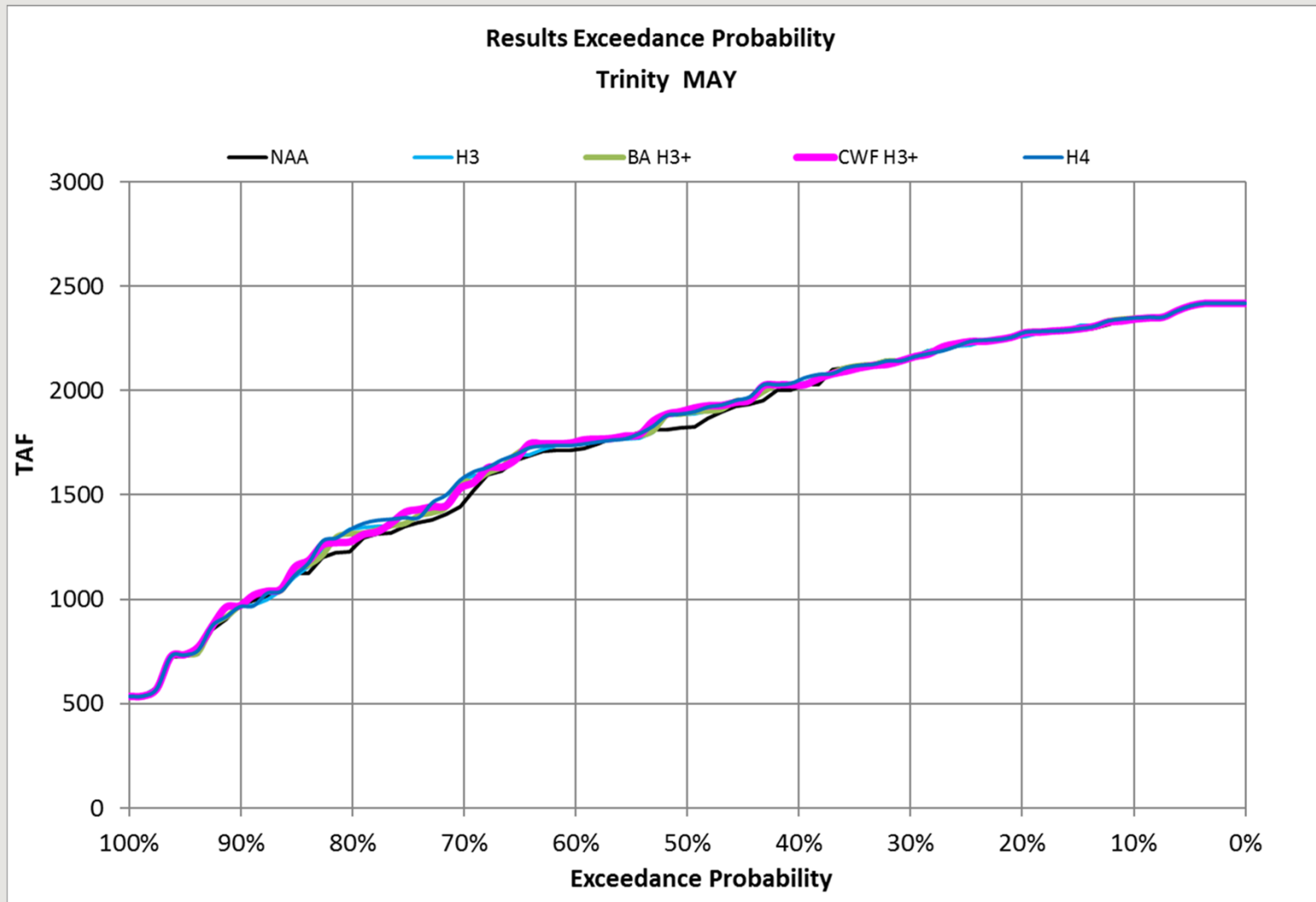


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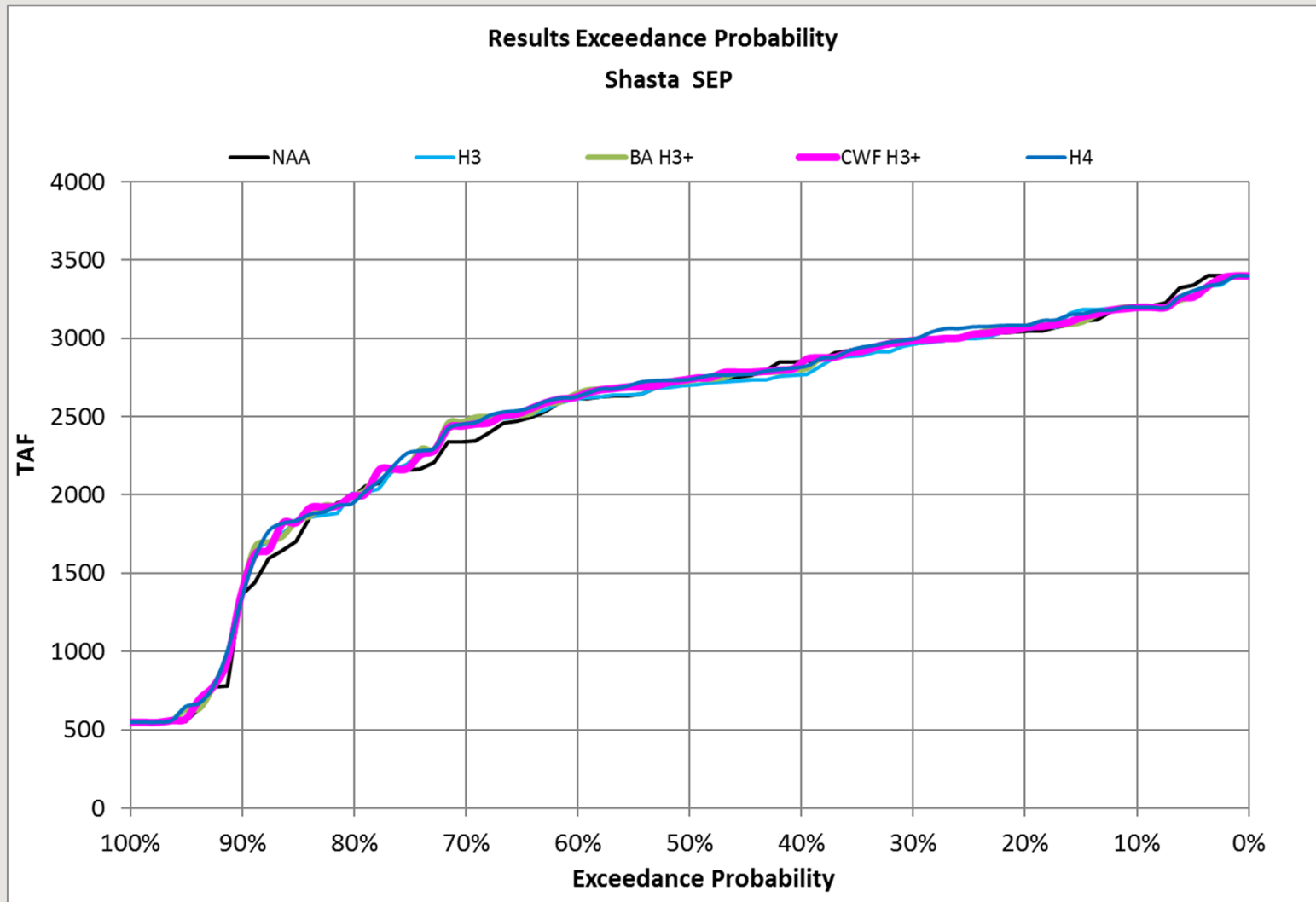


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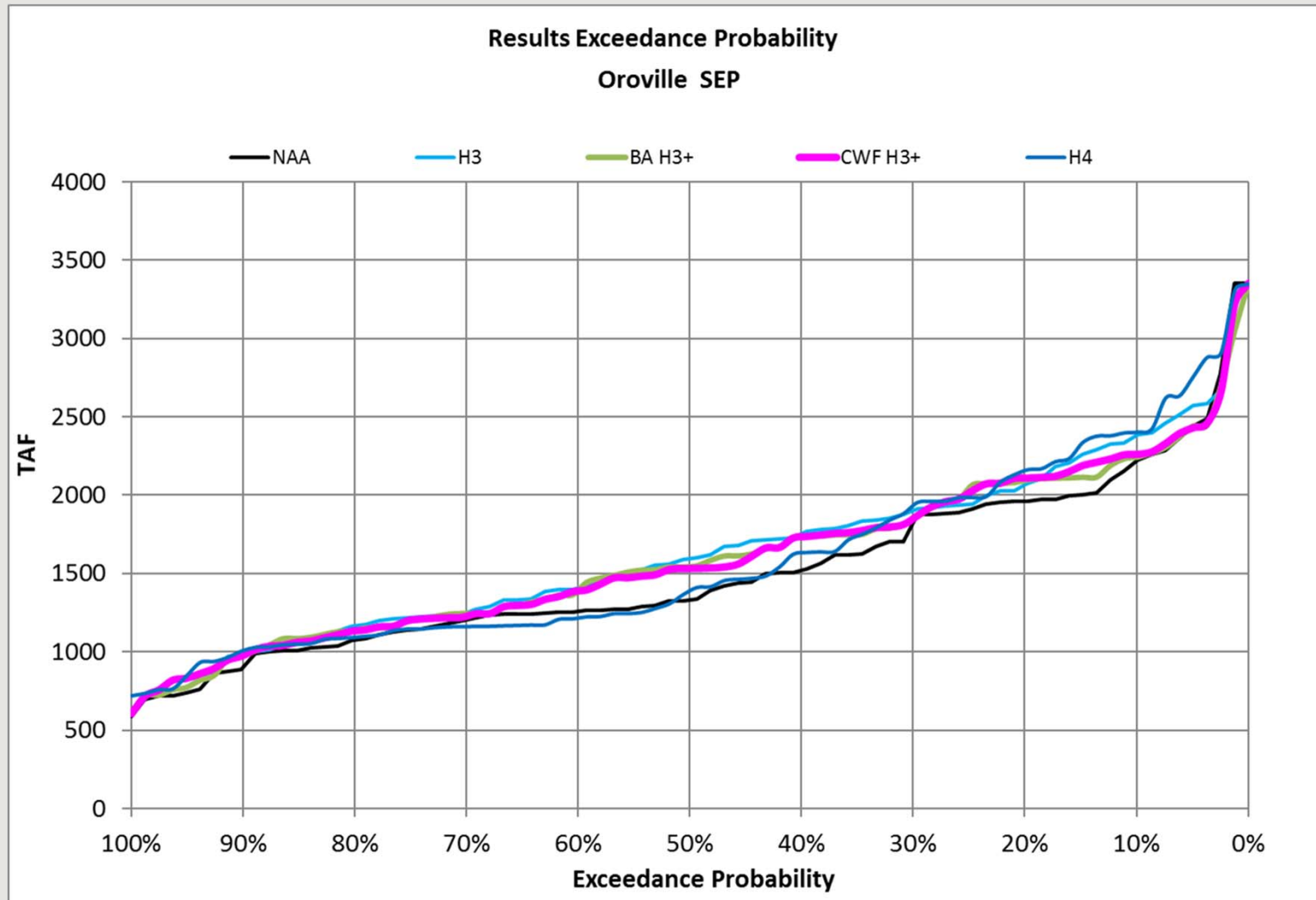


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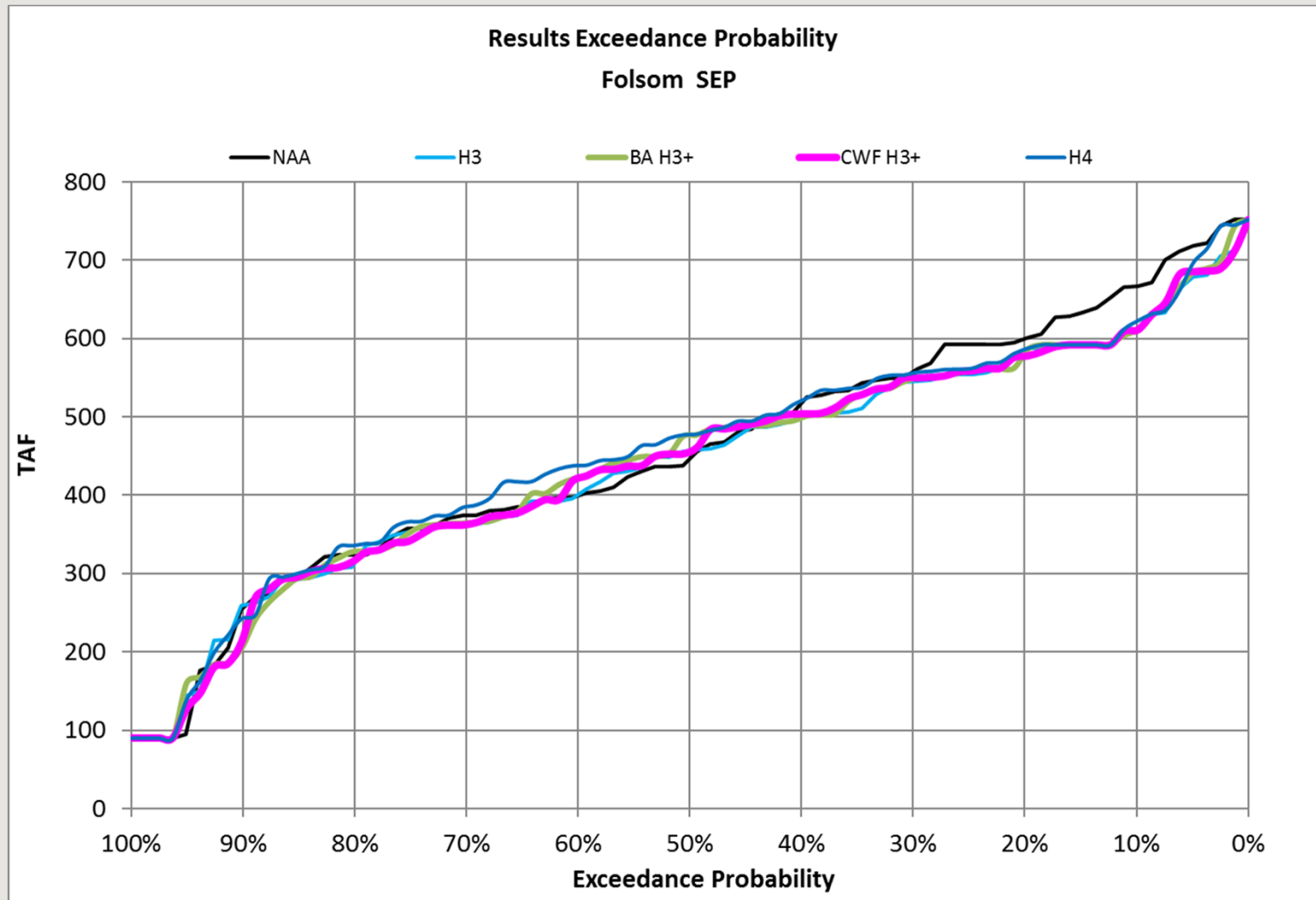


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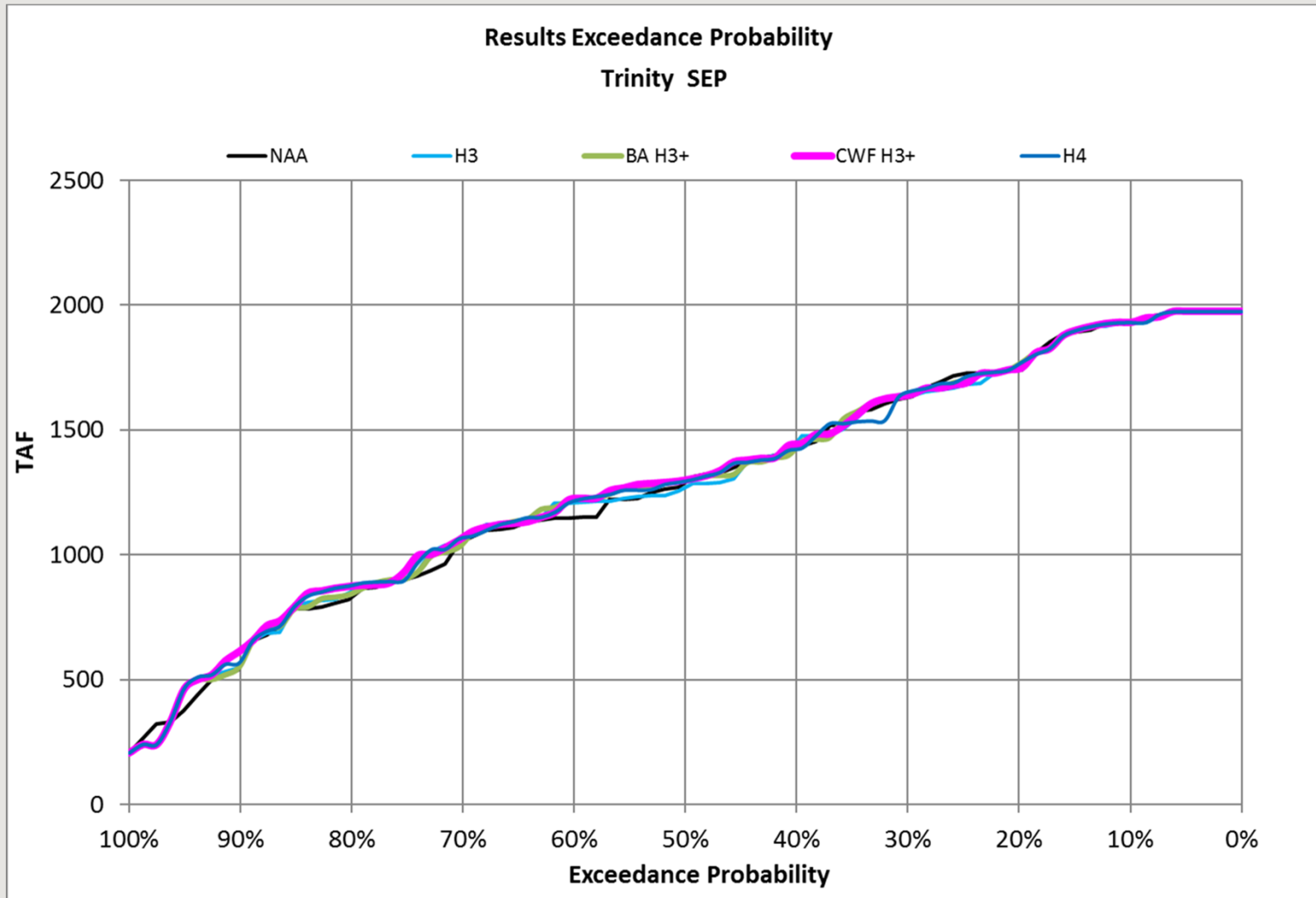


4. CWF OPERATIONS MODELING RESULTS





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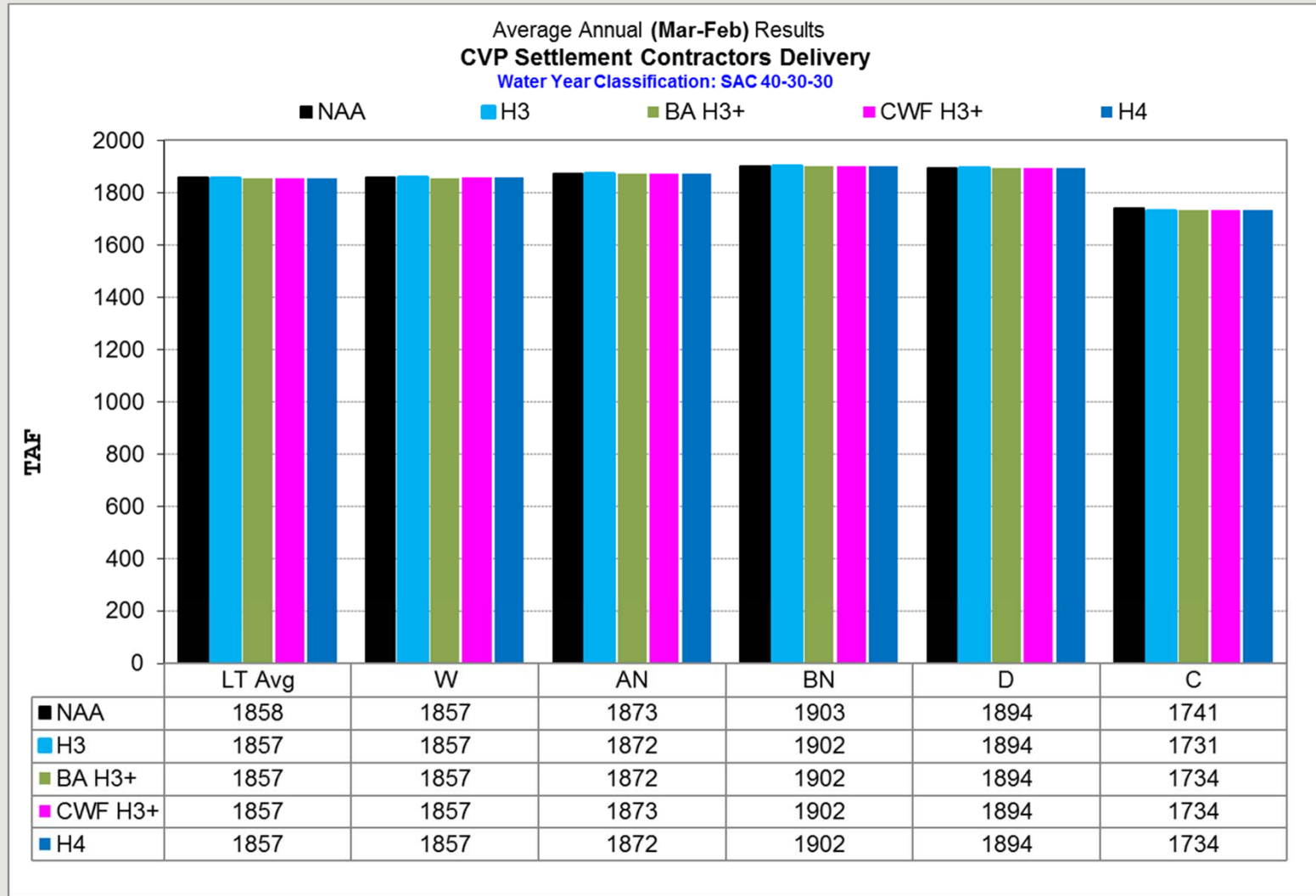


4. CWF OPERATIONS MODELING RESULTS

- **Similar water deliveries to CVP and SWP contractors, including Settlement Contractors, Exchange Contractors, Refuge Level 2, and Feather River Service Area Contractors, compared to NAA**

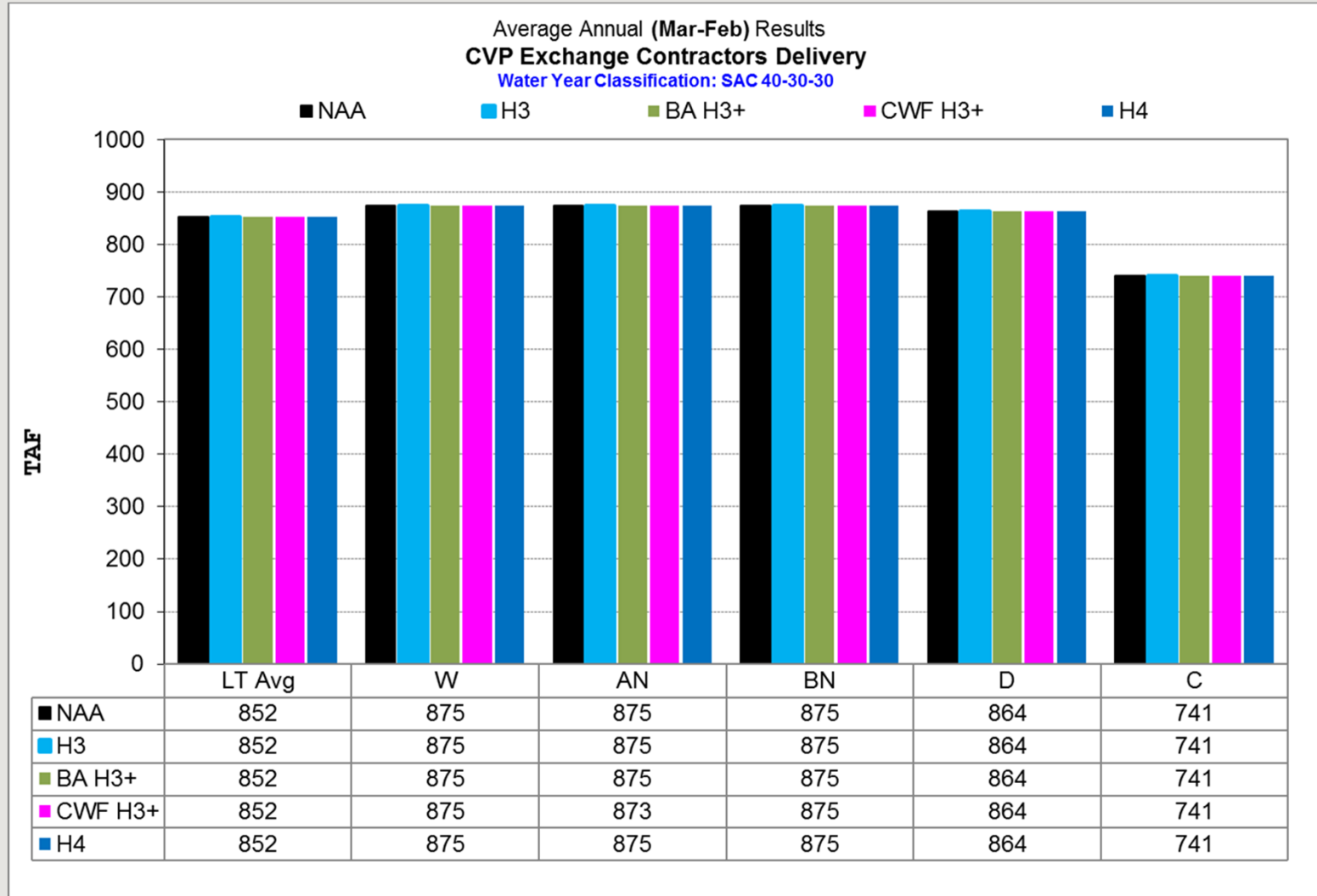


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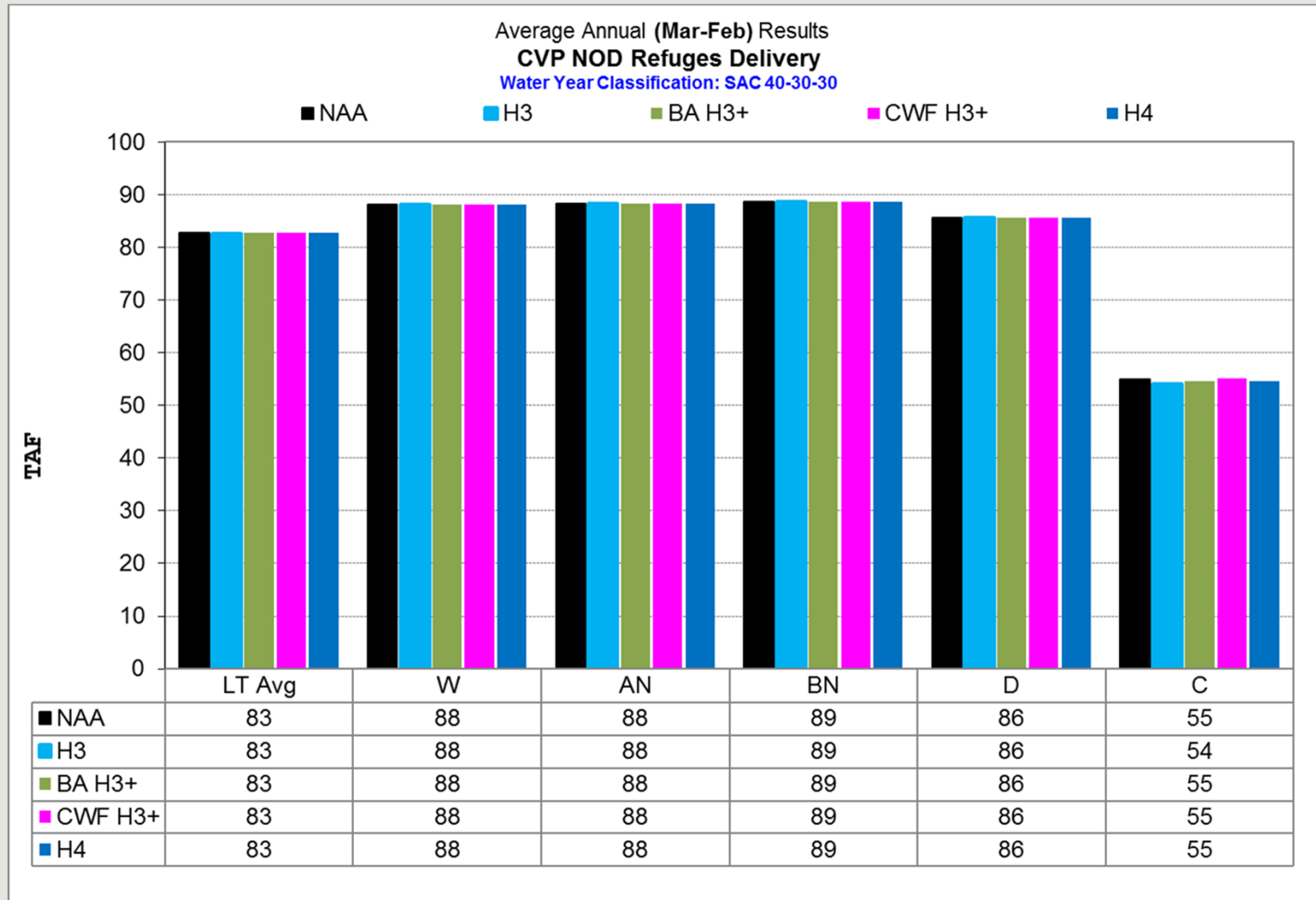


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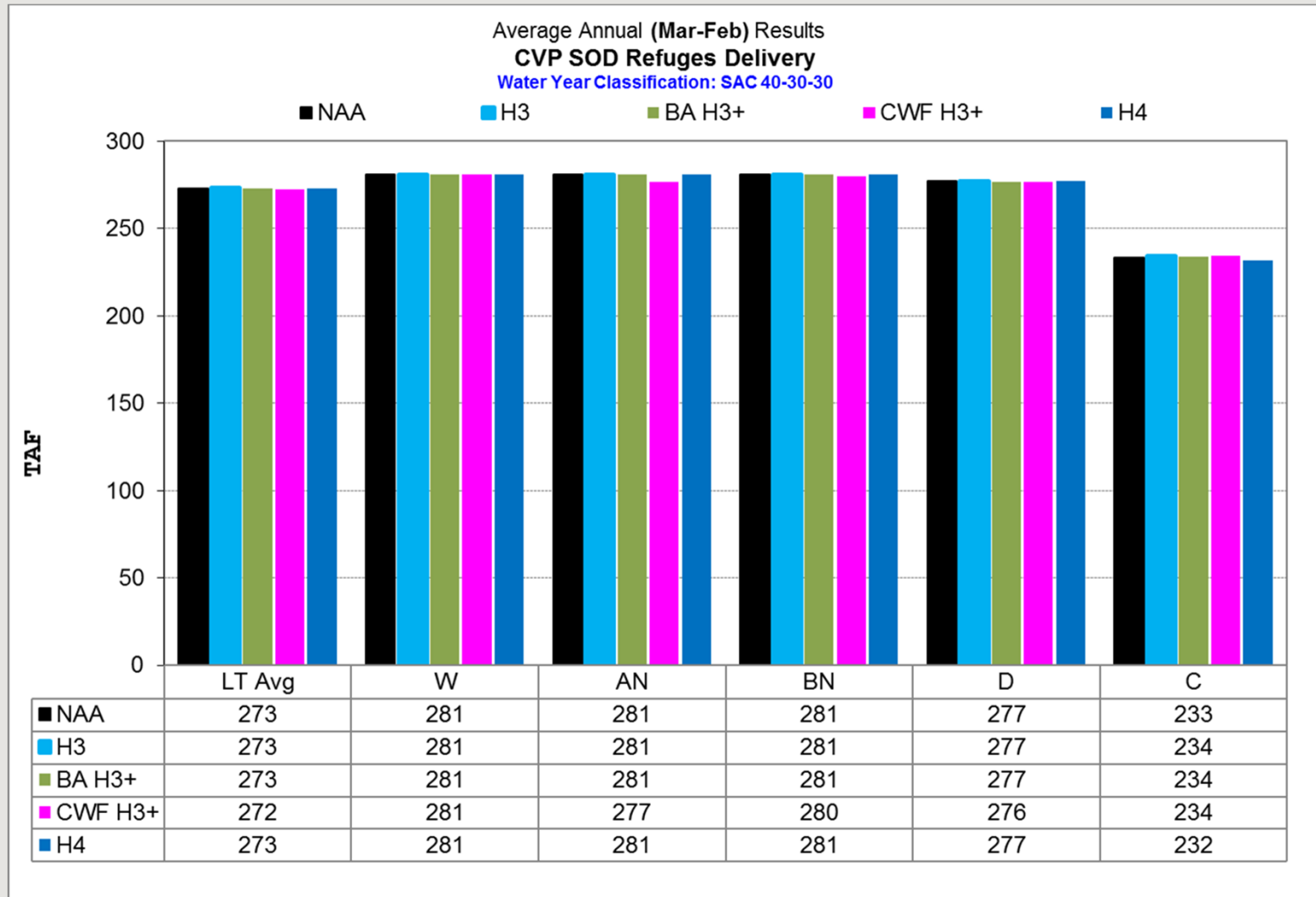


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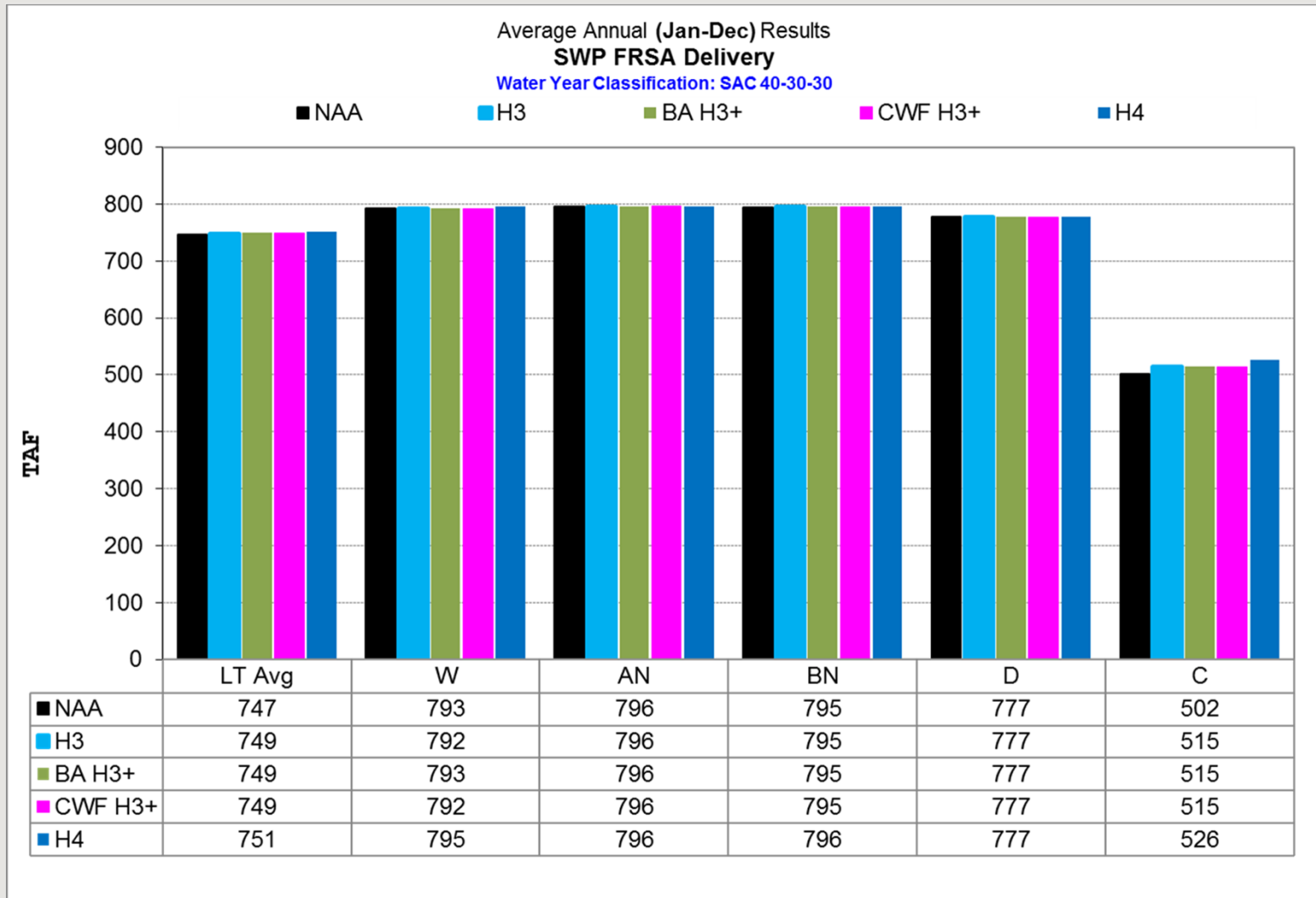


4. CWF OPERATIONS MODELING RESULTS





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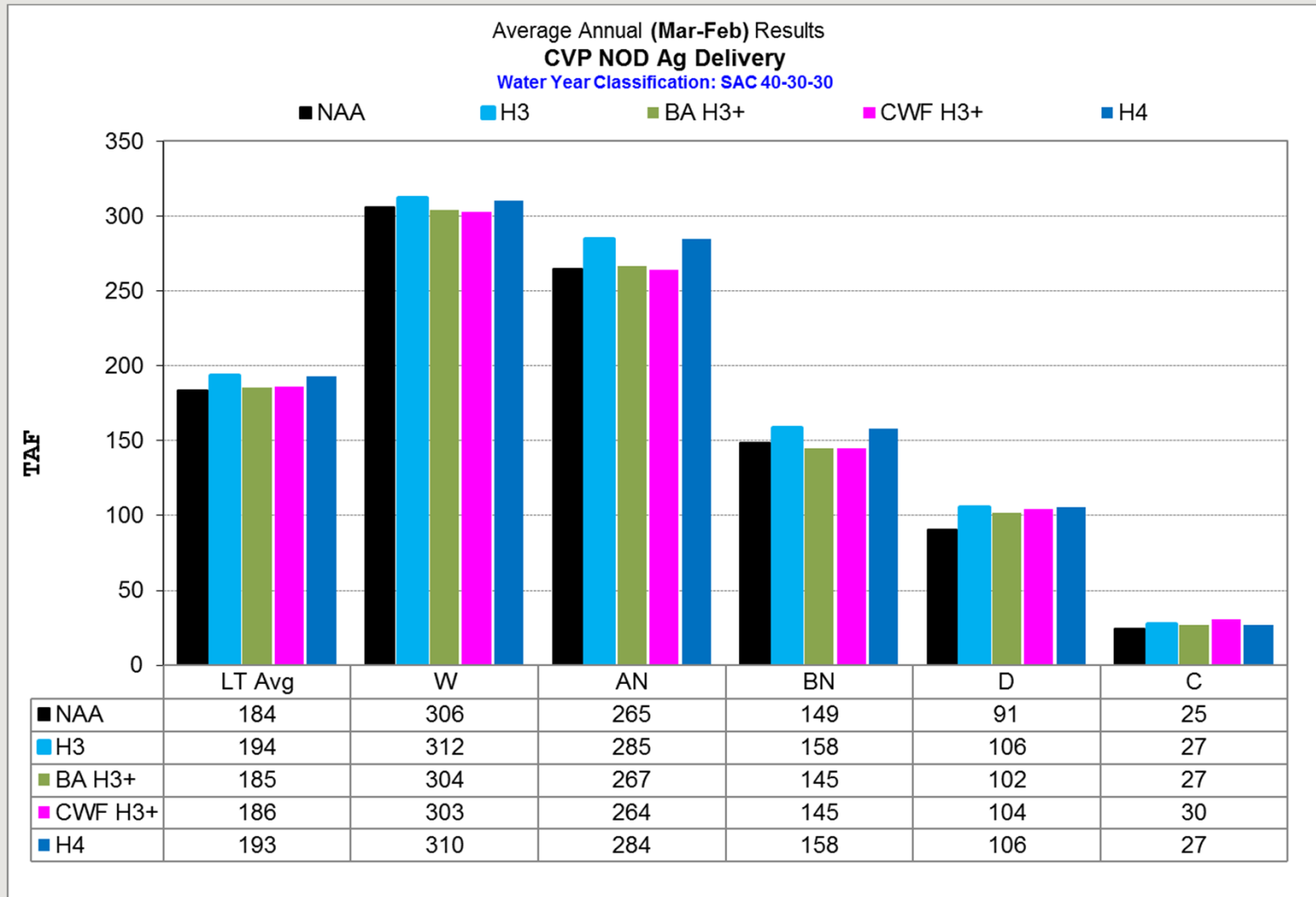


4. CWF OPERATIONS MODELING RESULTS

- **Similar or higher deliveries to CVP and SWP north of Delta and south of Delta water service contractors, compared to NAA.**

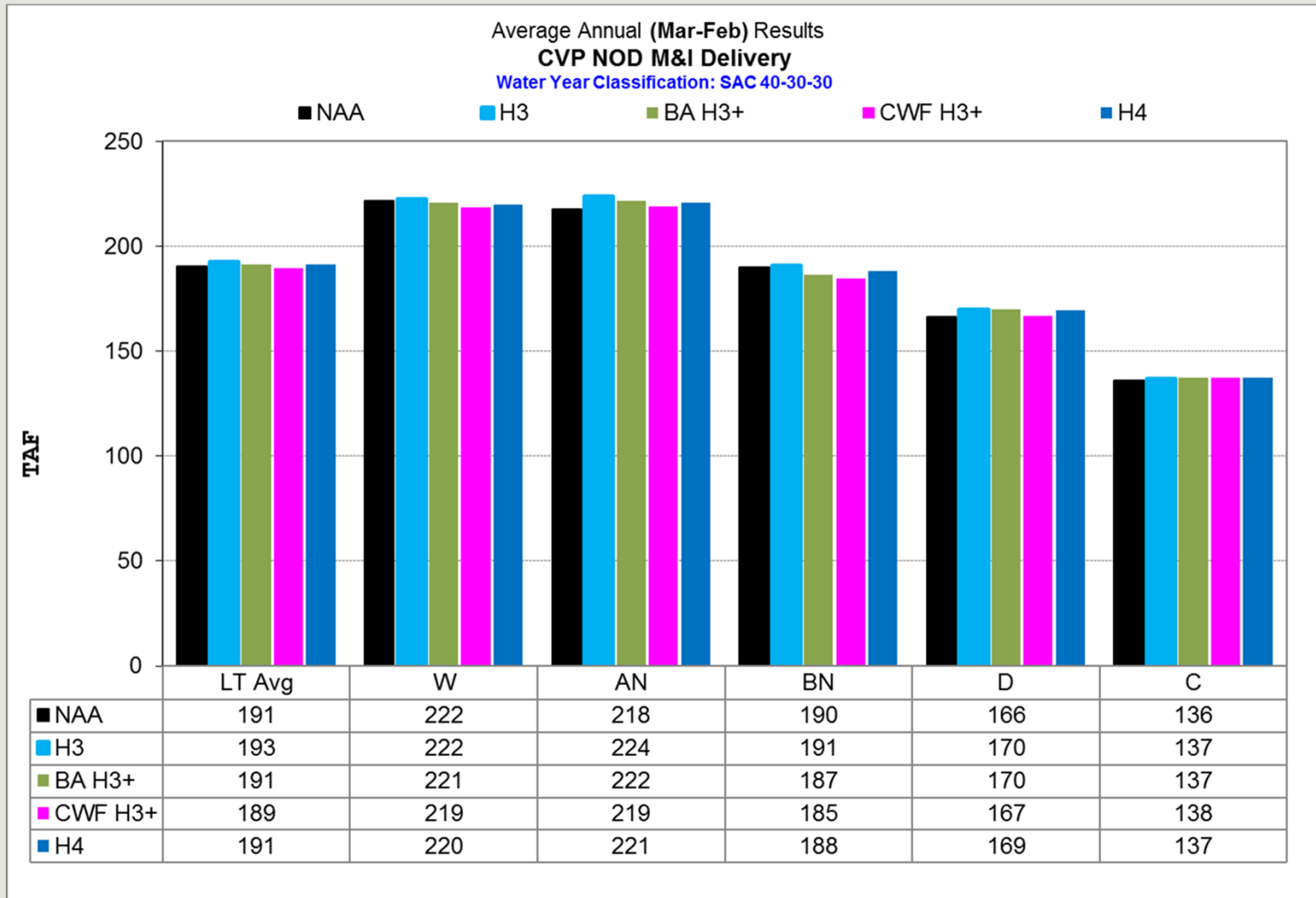


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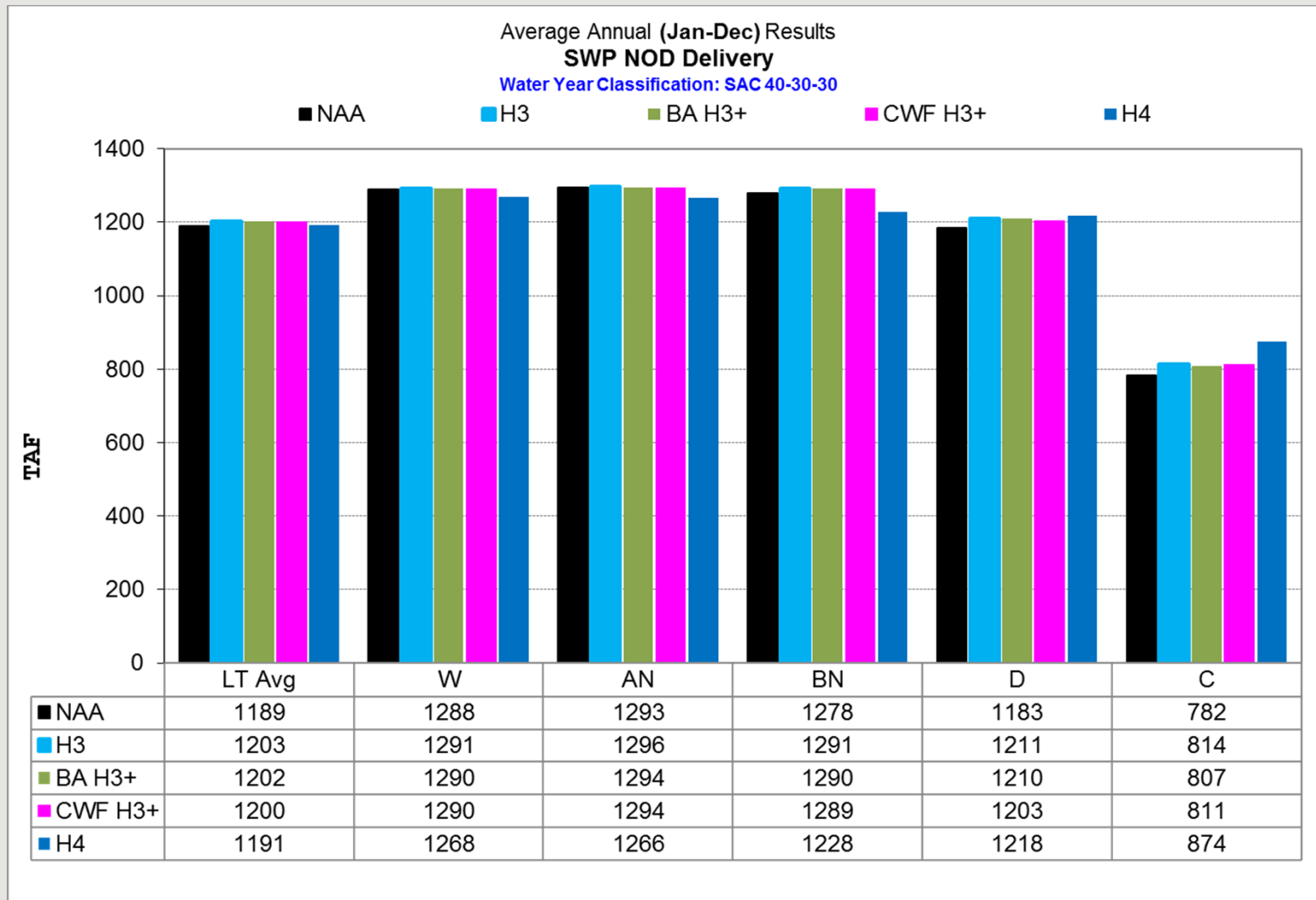


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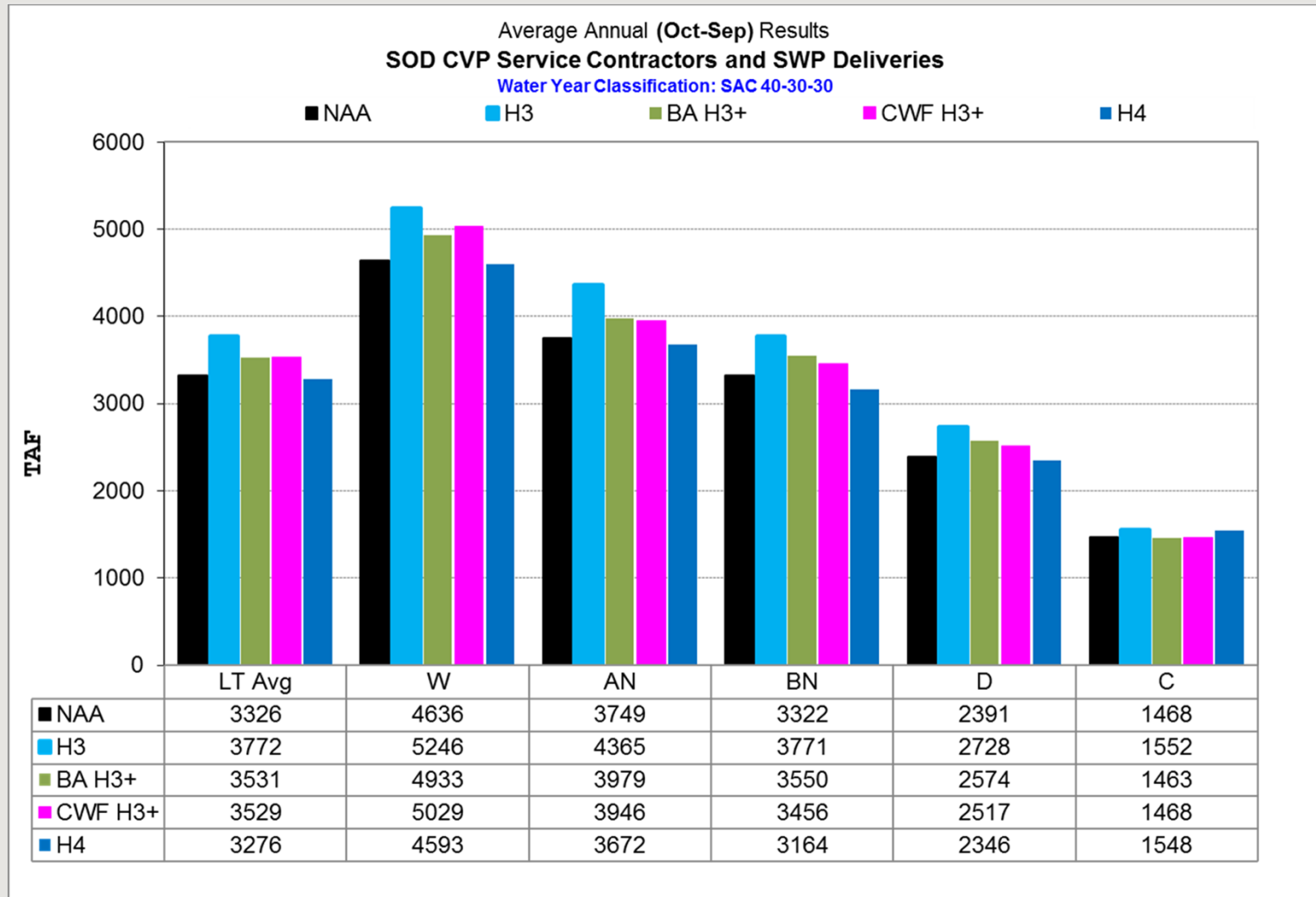


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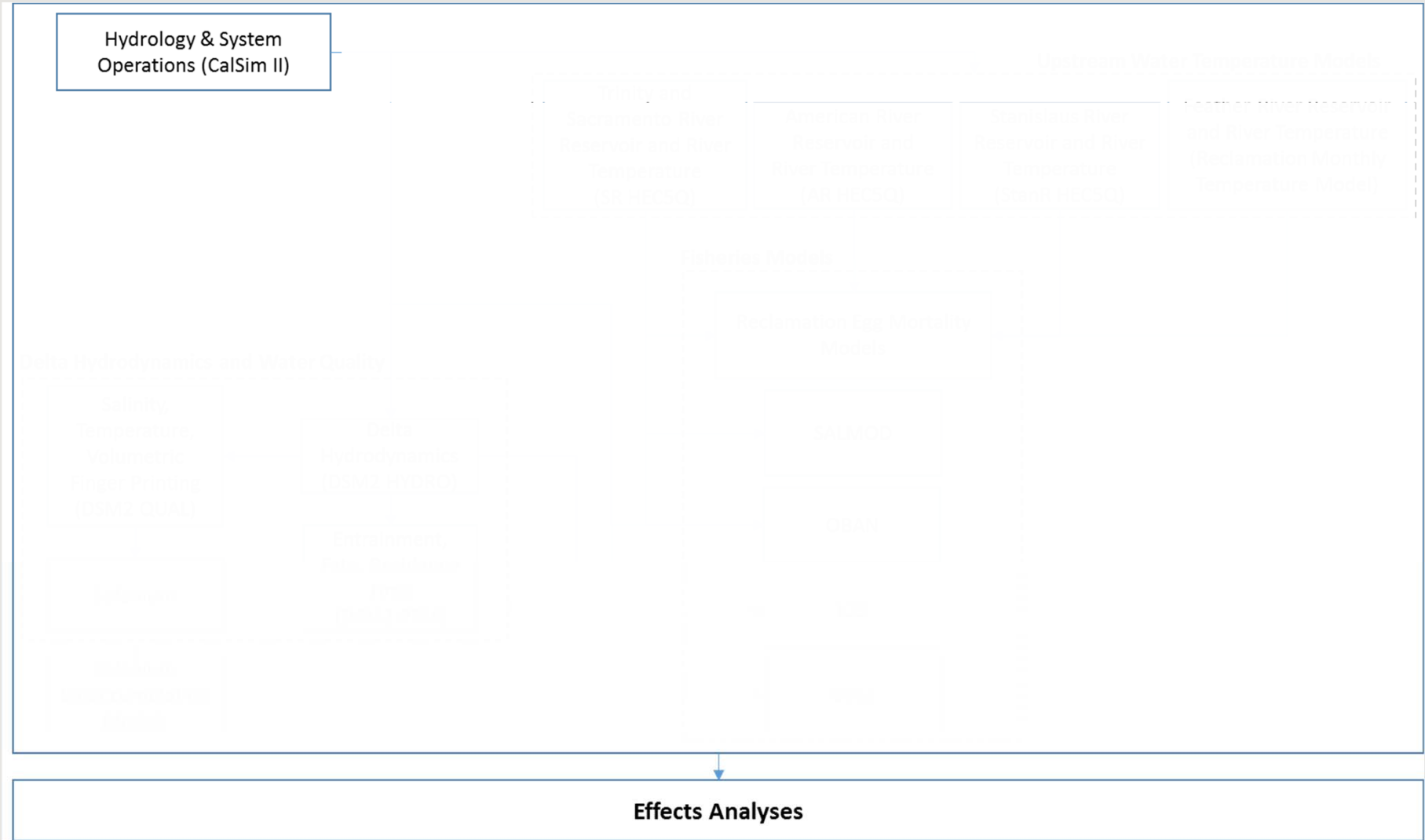




5. CWF MODELING APPROACH

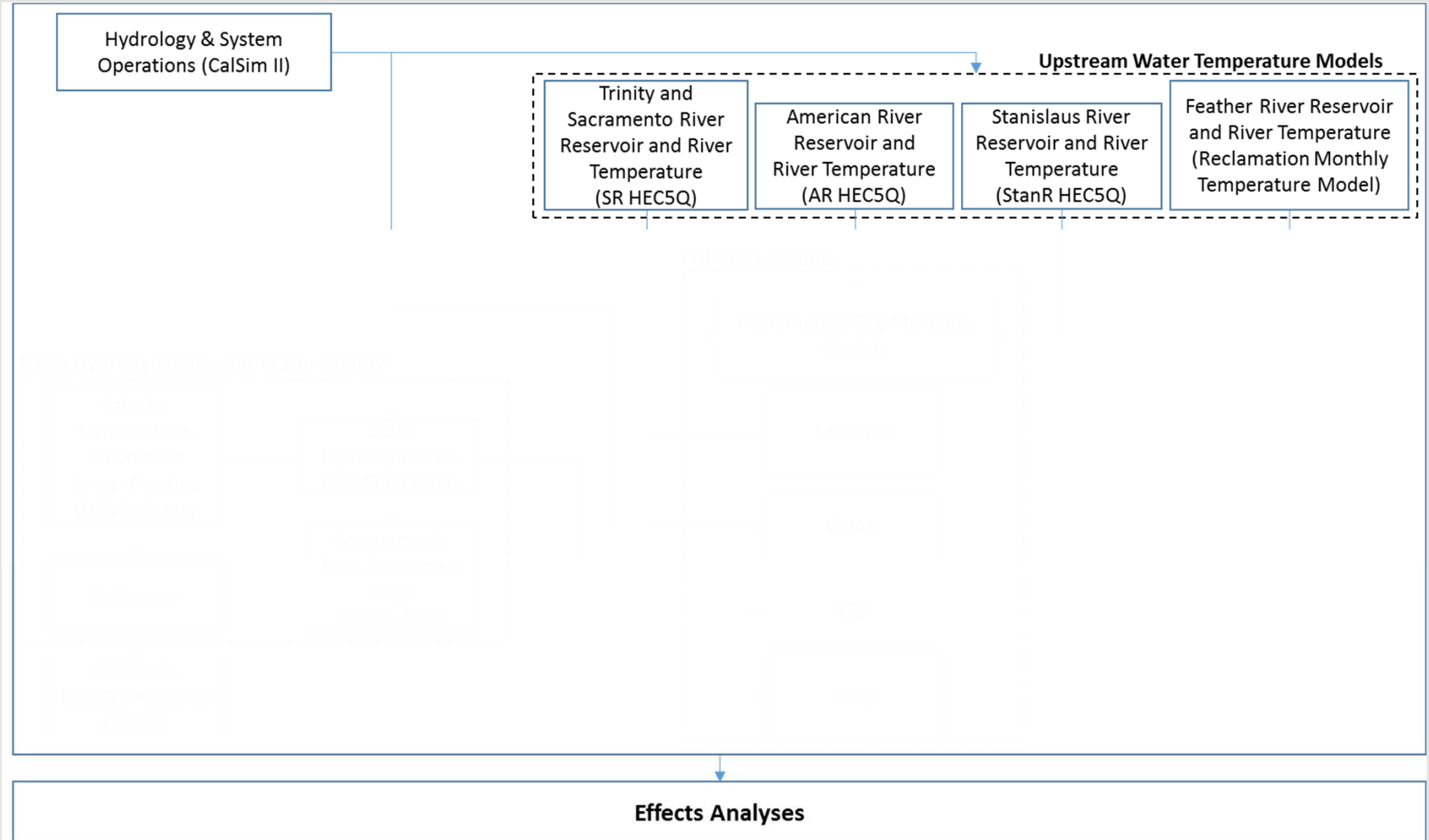


5. CWF MODELING APPROACH



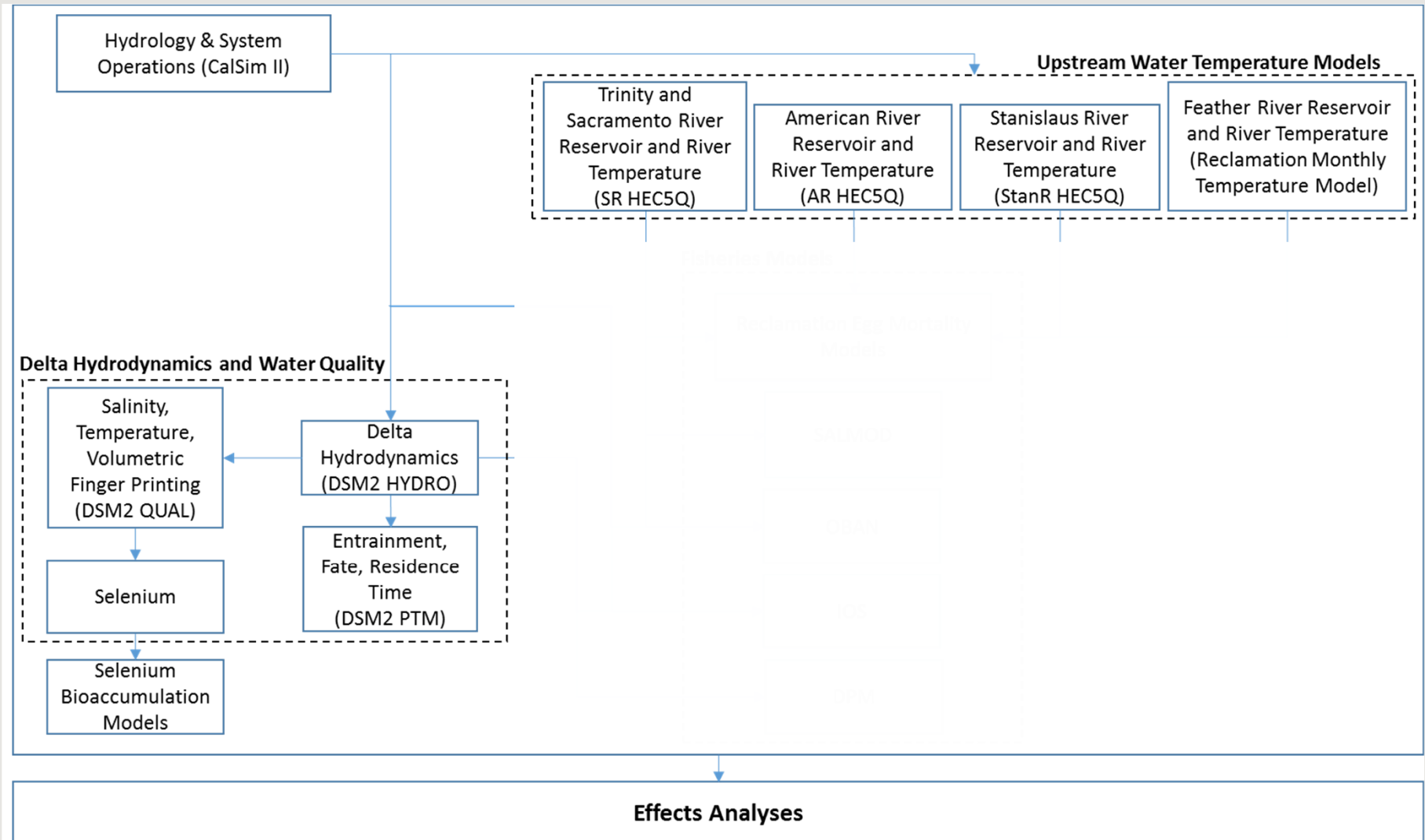


5. CWF MODELING APPROACH





5. CWF MODELING APPROACH





5. CWF MODELING APPROACH

