NMFS, USFWS, CDFW/Sites Project Technical Assistance Meeting

Sites Reservoir Project

Date: *October 30, 2019*

Location: *ICF Office: 980 9th St., Suite 1200*
12th floor Appalachian Conference Room

Time: 1:00 pm – 4:00 pm

Purpose: Continue discussions regarding Interagency Consultation of the Sites Reservoir Project

Invitees:

Ali Forsythe, Sites Authority ☐
Rob Thomson, Sites Authority ☐
Mike Dietl, Reclamation ☐
Dan Cordova, Reclamation ☐
John Spranza, HDR ☐
Jelica Arsenijevic, HDR ☐
Monique Briard, ICF ☐
Jim Lecky, ICF ☐
Marin Greenwood, ICF ☐
Jason Hasrick, ICF ☐
Lenny Grimaldo ☐
Chris Fitzer, ESA Associates ☐
Rob Leaf, Jacobs ☐
Rob Tull, Jacobs ☐
Cathy Marcinkevage, NMFS ☐
Evan Sawyer, NMFS ☐
???????????, FWS ☐
Krystal Davis-Fadtke, CDFW ☐
Ken Kundargi, CDFW ☐

Agenda:

	Discussion Topic	**Topic Leader**	**Est Time**
1	Introductions	Ali Forsythe	5 min
2	Overview of effects analysis ○ Construction effects ○ Operations effects ▪ Sacramento River - near field ▪ Sacramento River - far field ▪ Feather River ▪ American River ▪ Delta ▪ Life cycle models ○ Cross-walk NMFS-provided model matrix and methods used to date	Marin Greenwood / Jason Hassrick	60 min
3	Overview of daily model and examples of its use ○ What it is? ○ How it has been used? ○ What's its role in environmental review?	Rob Tull	60 min
4	CDFW 60-day process outcomes	Ali Forsythe and Kristal Davis-Fadtke	20 min

5	Additional Modeling o Calsim II o NMFS life cycle model ○ Others?	Group	30 min
5	Next Steps	Group	10 min

Meeting Minutes:

FISH EFFECTS ANALYSIS

Methods Overview, 10/30/2019

Sites

Agenda items

- Overview of effects analysis
  - Construction effects
  - Operations effects
    - Sacramento River - near field
    - Sacramento River - far field
    - Feather River
    - American River
    - Delta
    - Life cycle models
  - Cross-walk NMFS-provided model matrix and methods used to date

Construction Effects

- (Geotechnical Explorations)
- Turbidity and suspended sediment
- Release and exposure of contaminants
- Underwater noise
  - NMFS spreadsheet model
- Fish stranding
- Direct physical injury
- Loss and alteration of habitat

Near-Field Effects (Sacramento River) - Salmonids

- Spatial distribution (screen exposure)
  - Horizontal/vertical: literature review, with specific info. for water surface elevations of screens, etc., % flow split at GCID
- Entrainment through screens
  - Consideration of size distribution (RBDD) vs. mesh size
- Impingement, screen contact, and screen passage
  - Literature review & Swanson et al. equations
- Predation
  - Literature review, including Vogel GCID studies
- Stranding behind screens during high flow
  - High flow, based on water surface elevation
- Attraction to screens during reservoir discharge

Near-Field Effects (Sacramento River) – Green Sturgeon

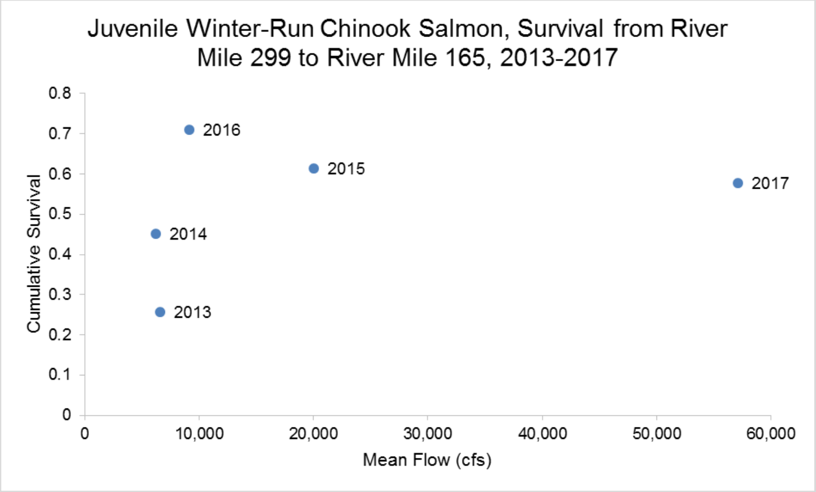
- Review of protective velocity criteria
  - Verhille et al. (2014)
- Entrainment through screens
  - Size distribution

Far-Field Effects (Sacramento River) - Salmonids

- Temperature effects
  - HEC-5Q/USRWQM, incl. 7DADM, etc.; Anderson/Martin models (Winter-Run)
- Redd scour/entombment
  - USRDOM, >40,000 cfs
- Redd dewatering
  - USRDOM, USFWS relationships
- Habitat capacity
  - Spawning WUA w/ CalSim
  - Rearing WUA w/ CalSim
- Juvenile stranding
  - USRDOM, USFWS relationships
- SALMOD
- Floodplain inundation and access
  - Yolo Bypass: daily downscaled CalSim; habitat inundation area (DWR 2016); mean number of days flooded (considering Takata et al. 2017)

Far-Field Effects (Sacramento River) - Salmonids

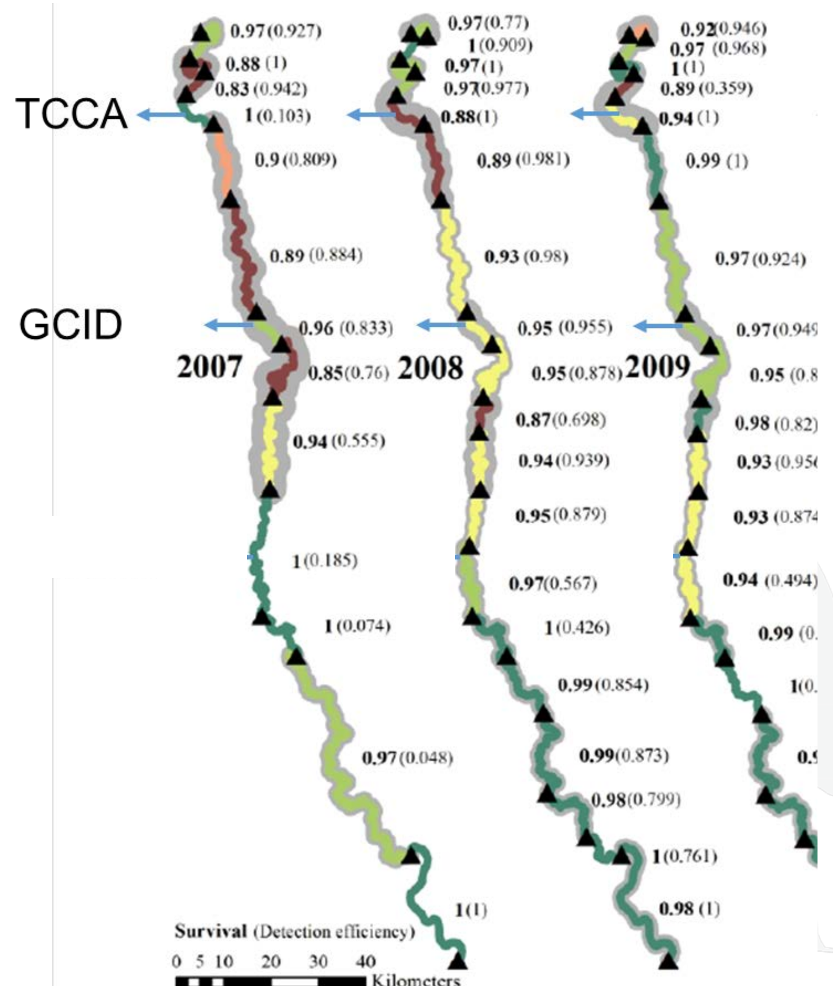
- Migration flow-survival
  - Quantitative analysis based on Henderson et al. (2018) – see next slides
  - Qualitative discussion considering Michel (2018) and Hassrick et al. in prep.



- Sites reservoir releases effects
  - Temperature
  - Water quality (mercury, salinity, false attraction)

Far-Field Flow-Survival Analysis

- Henderson et al. (2018) paper for quantitative analysis
  - Multiple reaches from above Red Bluff down to Knights Landing
  - Focus on Sites withdrawal period (winter/spring), daily timescale
  - Incorporates flow and temperature effects
  - Also includes other (non-operations) covariates
  - Results will allow adjustment of other models, e.g., OBAN



NRC Research Press

ARTICLE

Estimating spatial–temporal differences in Chinook salmon outmigration survival with habitat- and predation-related covariates

Mark J. Henderson, Ilysa S. Iglesias, Cyril J. Michel, Arnold J. Ammann, and David D. Huff

Far-Field Flow-Survival Analysis

Table 1: A description of the covariates included in the mark recapture model.

Category	Covariate	Range	Definition	Hypothesized relationship with survival
Individual	Fish Length[1]	135 - 204 mm	Fork length	Larger fish may exceed gape width of predators
	Fish Condition[1]	0.59 - 1.32	Fulton's K	Increased condition improves predator escape capability
	Transit speed[2]	0.02 - 8.25 km h^{-1}	Reach specific transit speed	Faster moving fish have less exposure to predators
Release group	Batch release[2]	Binary	Tagged fish released concurrently with large hatchery releases.	Predator swamping
	Release reach[1]	Binary	Difference in survival between newly released fish and those released upstream.	Newly released hatchery fish are naïve and susceptible to predation
	Annual flow[3]	179 - 499 cms	Mean flow measured at Bend Bridge throughout outmigration (December-March).	Increased flows produce more habitat and predator refugia throughout the river
Reach specific	Sinuosity[4]	1.04 - 2.74	River distance divided by Euclidean distance.	More natural habitats have more predator refugia
	Diversion density[5]	0 - 1.05 num km^{-1}	Number of diversions per reach length.	Increased predator densities near diversions
	Adjacent cover density[6]	0.2 - 0.76 %	Percent of non-armored river bank with adjacent natural woody vegetation.	Increased cover produces more predator refugia
	Off-channel habitat density[6]	0 - 1.62 %	Off-channel habitat within 50 m of river expressed as percentage of river area	Increased off-channel habitat produces more predator refugia
Time varying	Temperature[7]	6.2 - 12.9 °C	Mean water temperature per reach	Increased temperatures results in increased predation due to higher metabolic demands of predators
	Inter-annual Reach flow[7]	215 – 447 cms	Mean water flow per reach	Higher flows within a reach will produce more habitat and predator refugia within that reach
	Intra-annual Reach flow[7]	129 – 902 cms	Mean water flow per reach and year	Higher intra-annual flows (e.g., precipitation or dam releases) decreases predation due to increased turbidity and increased predator refugia.

[1]Measured during tagging and release; [2]Observed travel times and mixed effects model estimates; [3]California Water Data Library; [4]National Hydrography Dataset; [5]Passage Assessment Database - verified by field survey; [6]Department of Water Resources; [7]River Assessment for Forecasting Temperature (RAFT) model

Far-field effects: Henderson et al.

Category	Covariate	Range	Definition	Hypothesized relationship with survival	Notes/source	Source/assumption for analysis of proposed action
Individual	Transit speed	0.02–8.25 km/h	Reach-specific transit speed	Faster fish have less exposure to predators	Observed travel times and mixed effects model estimates	Assumed mean value from Henderson et al.
Release group	Batch release	Binary	Tagged fish released concurrently with large hatchery releases	Predator swamping	Observed travel times and mixed effects model estimates	Assumed fish not released with large hatchery releases
	Annual flow	179–499 cumecs (6,321–17,622 cfs)	Mean flow measured at Bend Bridge throughout outmigration (December–March)	Increased flows produce more habitat and predator refugia throughout the river	California Water Data Library	USRDOM
Reach-specific	Sinuosity	1.04–2.74	River distance divided by Euclidean distance	More natural habitats have more predator refugia	National Hydrography Dataset	Assumed same values as Henderson et al.
	Diversion density	0–1.05 diversions/km	No. of diversions per reach length	Increased predator densities near diversions	Passage Assessment Database—verified by field survey	Added one to reach 13 to account for Delevan intake; otherwise assumed same values as Henderson et al.
Time-varying	Temperature	6.2–12.9°C (42–55°F)	Mean water temperature per reach	Increased temperatures results in increased predation due to higher metabolic demands of predators	River Assessment for Forecasting Temperature (RAFT) model	USRWQM
	Intra-annual reach flow	129–902 cumecs (4,556–31,853 cfs)	Mean water flow per reach and year	Higher intra-annual flows (e.g., precipitation or dam releases) decrease predation due to increased turbidity and increased predator refugia	RAFT model	USRDOM

Far-field effects: Henderson et al.

- Focused on Dec-Mar
  - Bend Bridge mean flow covariate period
- Scenario 1
  - Equal numbers of fish beginning migrating on each day, Dec-Mar
  - All fish begin migration at Jellys Ferry (upstream of Red Bluff and all project intakes)

Far-field effects: Henderson et al.

- Scenario 2
  - Equal numbers of fish beginning migrating on each day, Dec-Mar
  - Equal numbers of fish beginning migration at the upstream end of each Henderson et al. reach
- Scenario 3
  - Equal numbers of fish beginning migration at the upstream end of each Henderson et al. reach
  - Fish moving in proportion to daily proportion of flow

Far-Field Effects (Feather River) - Salmonids

- Temperature effects
  - Reclamation temperature model
- Redd scour/entombment
- Redd dewatering
- Habitat capacity
  - Spawning WUA
  - Rearing WUA

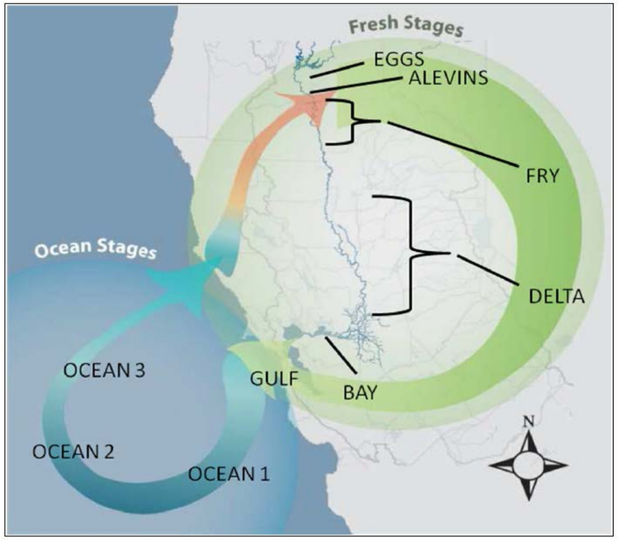
Far-Field Effects (American River) - Salmonids

- Temperature effects
  - HEC-5Q, e.g., for 7DADM
- Redd scour
  - CalSim
- Redd dewatering
  - CalSim/Bratovich et al. (2017)
- Habitat capacity
  - Spawning WUA (USFWS)
  - Rearing WUA (USFWS)

Delta - Salmonids

- South Delta Entrainment
  - Qualitative consideration of CalSim OMR, etc.
- Juvenile through-Delta survival
  - DSM2-HYDRO Velocity Summary
  - Analysis based on Perry et al. (2018) - STARS
  - Delta Passage Model

Life Cycle Modeling: OBAN



General Details:

- Winter-Run Chinook Salmon
- Egg/alevin temperature effects
- Fry rearing flow effects
- Juvenile Yolo flow effects
- Juvenile south Delta export effects
- Juvenile DCC effects
- Ocean conditions not affected by project but included in model (productivity and harvest)
- Incorporate flow-survival adjustment based on Henderson et al. (2018) model

Life cycle modeling: IOS

Application of a Life Cycle Simulation Model to Evaluate Impacts of Water Management and Conservation Actions on an Endangered Population of Chinook Salmon

(1) spawning, models the number and temporal distribution of eggs deposited in the gravel at the spawning grounds

(2) Early development, models the impact of temperature on maturation timing and mortality of eggs at the spawning grounds

(3) fry rearing, models the relationship between temperature and mortality of salmon fry during the river rearing period

(4) river migration, estimates mortality of migrating salmon smolts in the Sacramento River between the spawning and rearing grounds and the Delta

(5) Delta passage, models the impact of flow, route selection, and water exports on the survival of salmon smolts migrating through the Delta to San Francisco Bay

(6) ocean survival, that estimates the impact of natural mortality and ocean harvest to predict survival and spawning returns (escapement) by age

Zeug et al. Environ Model Assess (2012) 17:455–467

Sites

Critical Habitat

Salmonids:

- Adult migration corridors
- Spawning habitat
- Adequate river flows
- Water temperatures
- Habitat and adequate prey free of contaminants
- Riparian and floodplain habitat
- Juvenile emigration corridors
- Estuarine areas

Green Sturgeon

- Sacramento and Feather River far-field effects
  - Temperature effects (Sac-USRWQM, Feather-Reclamation temp. model)
    - Spawning and egg incubation
    - Non-spawning adult presence
    - Pre- and post-spawn adult holding, immigration, and post-spawn emigration
    - Larval and juvenile rearing and emigration
  - Flow effects (CalSim)
- Flow effects Delta
  - South Delta entrainment – salvage-density method (CalSim)
  - Delta outflow – White Sturgeon year-class strength regression (CalSim)
- Critical Habitat
  - Food resources
  - Substrate type / size
  - Water flow and quality
  - Migration corridor
  - Water depth
  - Sediment quality

Delta Smelt

- North Delta food subsidy from Colusa Basin Drain
  - Qualitative discussion based on pilot study years
- South Delta entrainment
  - Adults & Larvae/early juveniles – consideration of OMR flows
- Flow effects
  - Spring – *Eurytemora affinis* – X2 regression
  - Summer – *Pseudodiaptomus forbesi* subsidy to LSZ (QWEST)
  - Fall – consideration of Delta outflow/X2 in relation to habitat attributes
- Upstream sediment entrainment
  - Modeling of sediment concentration in river flow in relation to diversions
- Critical habitat
  - Physical habitat, water, river flow, salinity

Longfin Smelt Outflow-Abundance

Transactions of the American Fisheries Society 145:44–58, 2016

ISSN: 0002-8487 print / 1548-8659 online
DOI: 10.1080/00028487.2015.1100136

ARTICLE

Population Dynamics of an Estuarine Forage Fish: Disaggregating Forces Driving Long-Term Decline of Longfin Smelt in California's San Francisco Estuary

Matthew L. Nobriga*
U.S. Fish and Wildlife Service, Bay Delta Fish and Wildlife Office, 650 Capitol Mall, Suite 8-300, Sacramento, California 95831, USA

Jonathan A. Rosenfield
The Bay Institute, Pier 39, Box Number 200, San Francisco, California 94133, USA

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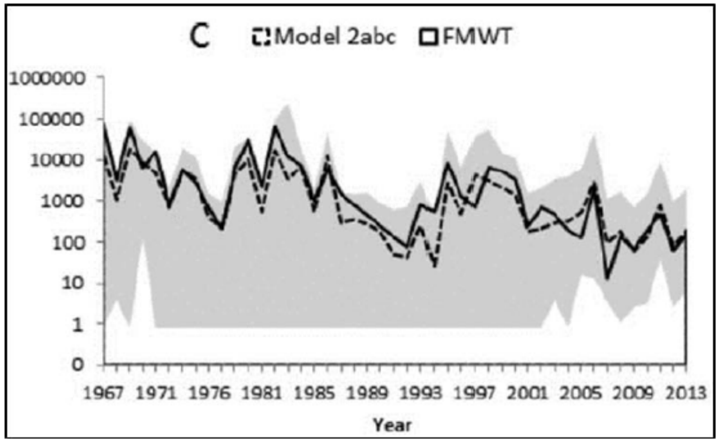

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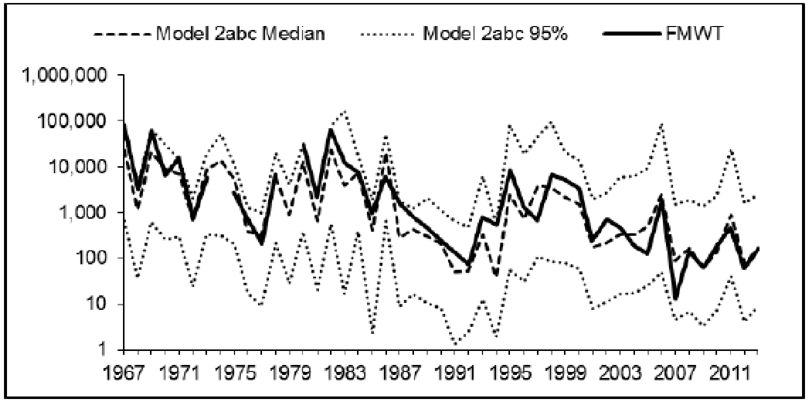


ICF

Exhibit DWR-1352

Technical Memorandum

To: California Department of Water Resources (DWR)

From: Marin Greenwood, Ph.D. (Aquatic Ecologist, ICF) and Corey Phillis, Ph.D. (Resource Specialist, Metropolitan Water District of Southern California)

Date: 7/2/2018

Re: Comparison of Predicted Longfin Smelt Fall Midwater Trawl Index for Existing Conditions, No Action Alternative, and California WaterFix CWF H3+ Operational Scenarios Using the Nobriga and Rosenfield (2016) Population Dynamics Model

Federal and State Agency Aquatics Workshop #1 Agenda Revised

Sites Reservoir Project

Date: October 26, 2020

Time: 10:00 am – 12:00 pm

Location: WebEx
https://meethdr.webex.com/meethdr/j.php?MTID=m2b7a36e811f242a705e7aa8f971cd34b

Audio Call in: 1-408-418-9388,146-951-7592

Purpose: Overview and discussion of Sites Reservoir Project modeling adjustments/diversion criteria.

Invitees:

Kristal Davis-Fadtke, CDFW
Ken Kundargi, CDFW
Jonathan Williams, CDFW
Mike Hendrick, ICF
Jerry Brown, Sites Authority
Ryan Davis, Reclamation
Melissa Dekar, Reclamation
Dan Cordova, Reclamation
Russell Perry, USGS
Doug Jackson, QEDA
Cyril Michel, NMFS
Felipe LaLuz, CDFW
Zachary Kearns, CDFW
Chris Fitzer, ESA
Jason Hassrick, ICF
Noble Hendrix, QEDA
Marin Greenwood, ICF
Evan Sawyer, NMFS
John Spranza, Sites Integration
David Vogel, Natural Resource Scientists, Inc
Jim Lecky, ICF
Erin Heydinger, Sites Integration
Steve Micko, Jacobs
Rob Leaf, Jacobs
Monique Briard, ICF
Rick Wilder, ICF
Ali Forsythe, Sites Authority
Cathy Marcinkevage, NMFS
Steven Schoenberg, USFWS

Agenda:

Discussion Topic	Topic Leader	Est Time
1. Overview and Introductions	John Spranza	5 min
2. Objective of the workshop (Jim L) a. Review purpose of meeting (Jim L, Rob L) b. Analytical Tools (Rick W, Marin G) c. ICF's initial review of modeling output (Rick W) d. OBAN Model Update (Noble H, Doug J)	Jim Lecky	15 min
3. Science Review a. Russell Perry (Reverse flows) b. Cyril Michel (Wilkins Slough/Pulse Flows)	Jason Hassrick	45 min
4. Discussion of model adjustments for new iteration	All	45 min
5. Action Items and Next Steps – Workshop #2	Mike Hendrick	10 min

SITES PROJECT JOINT AQUATICS WORKSHOP

OCTOBER 26, 2020

Sites

Agenda

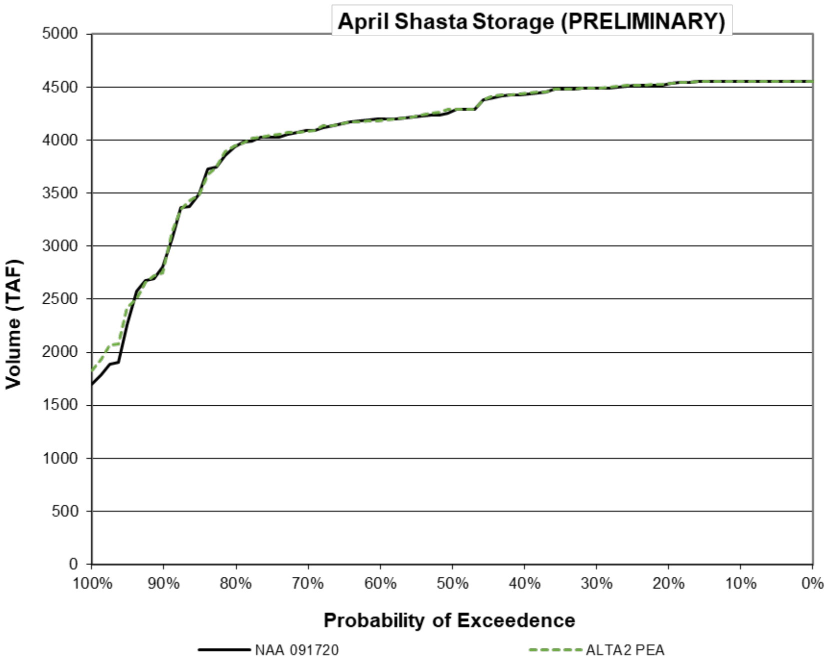
1. Overview and Introductions
2. Objective of the workshop (Jim L)
   a. Review purpose of meeting (Jim L, Rob L)
   b. Analytical Tools (Rick W, Marin G)
   c. ICF's initial review of modeling output (Rick W)
   d. OBAN Model Update (Noble H, Doug J)
3. Science Review
   a. Russell Perry (Reverse flows)
   b. Cyril Michel (Wilkins Slough/Pulse Flows)
4. Discussion of model adjustments for new iteration
5. Action Items and Next Steps – Workshop #2

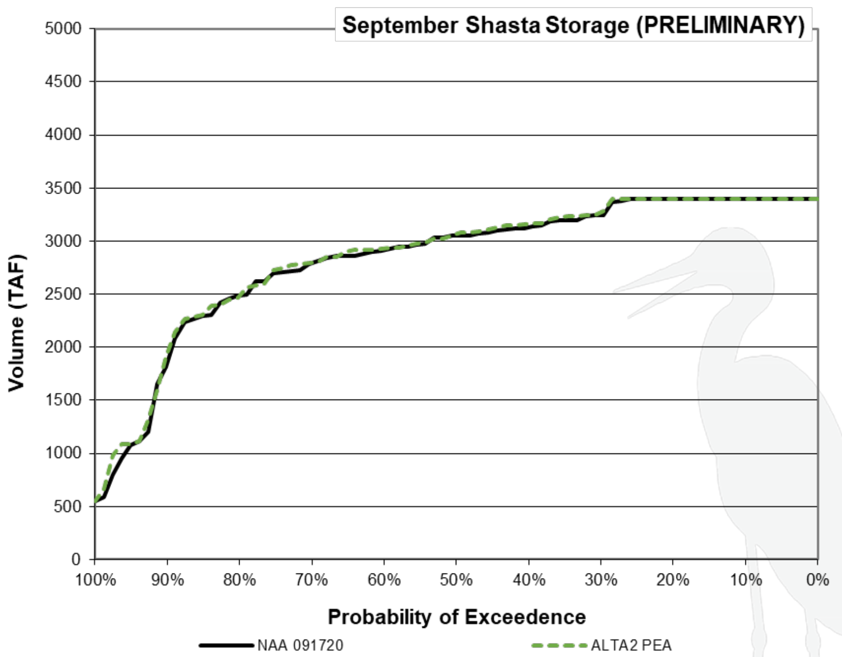
CalSim Results

Preliminary Effects Analysis

Sites

Shasta Lake storage





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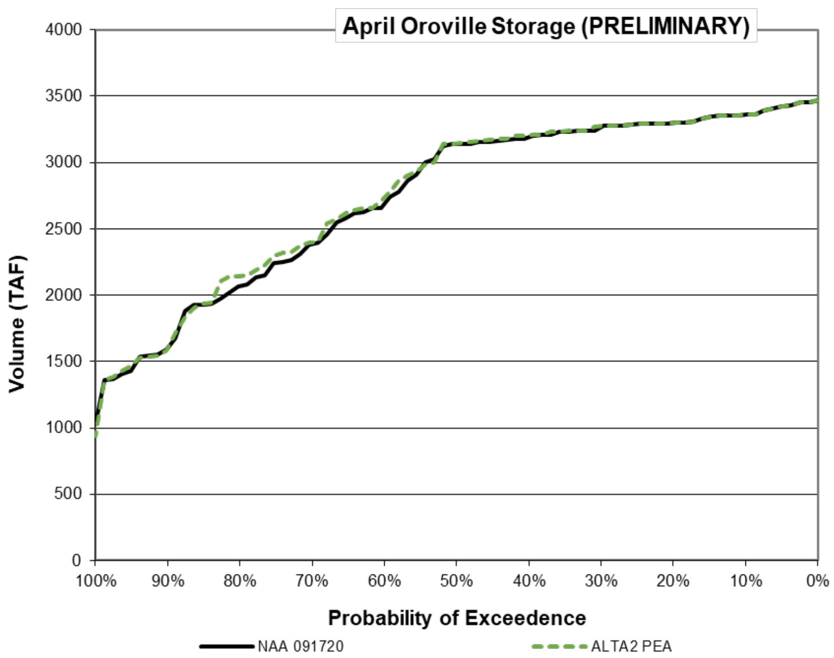
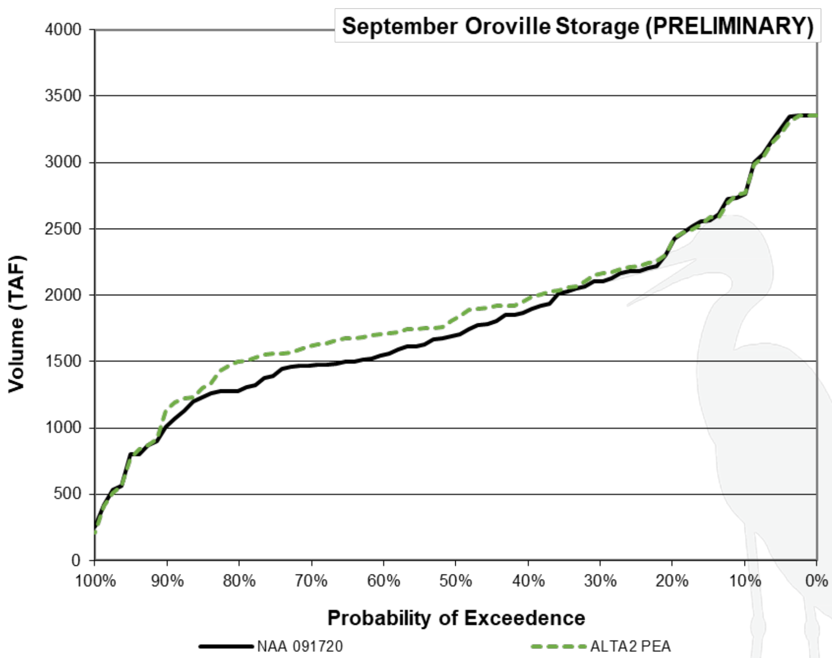
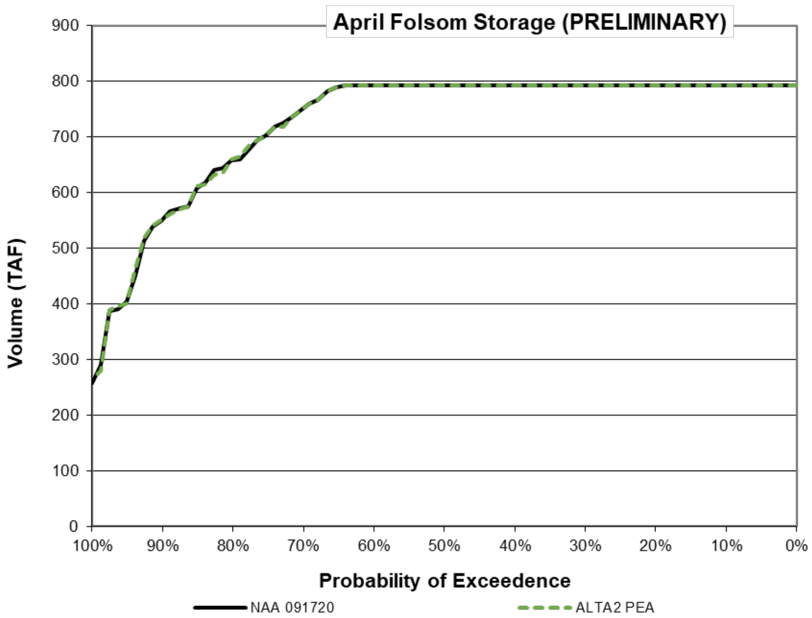
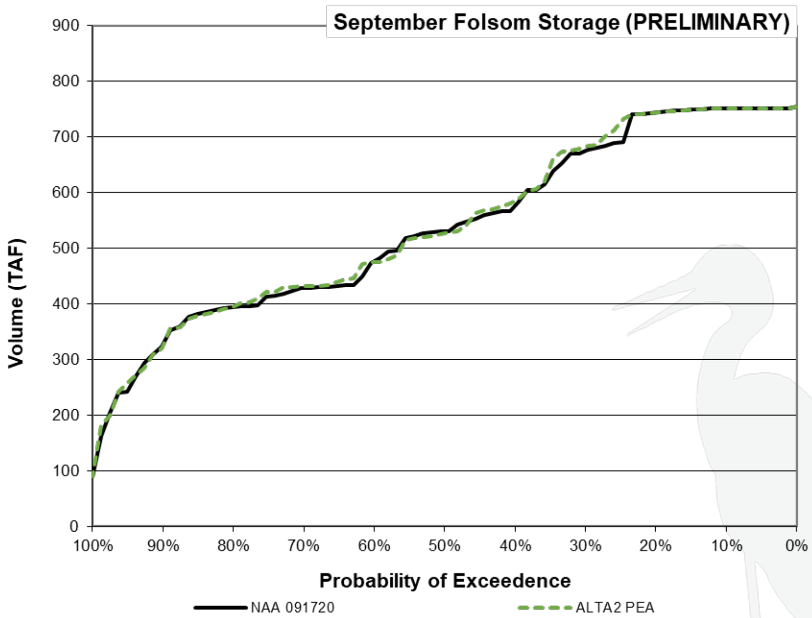
Lake Oroville storage





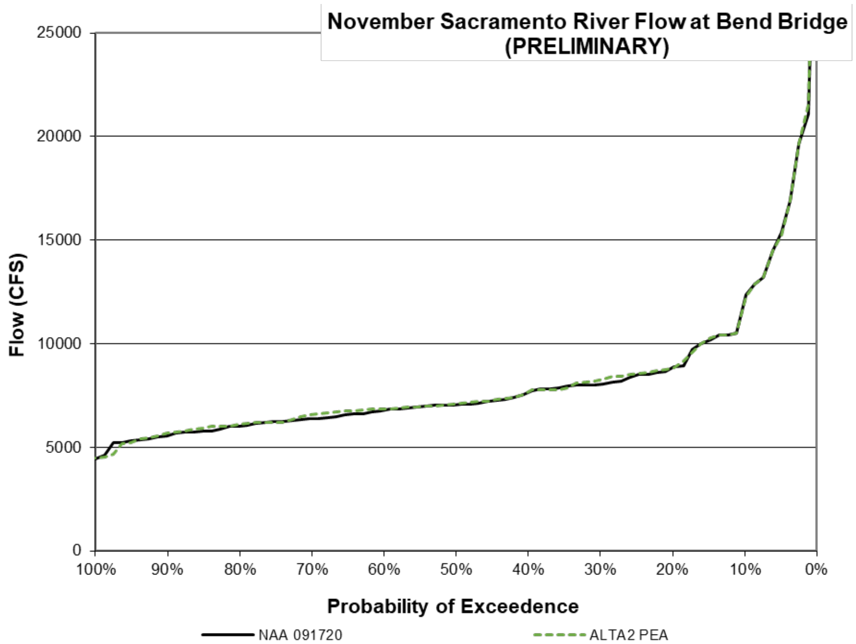
Folsom Lake storage

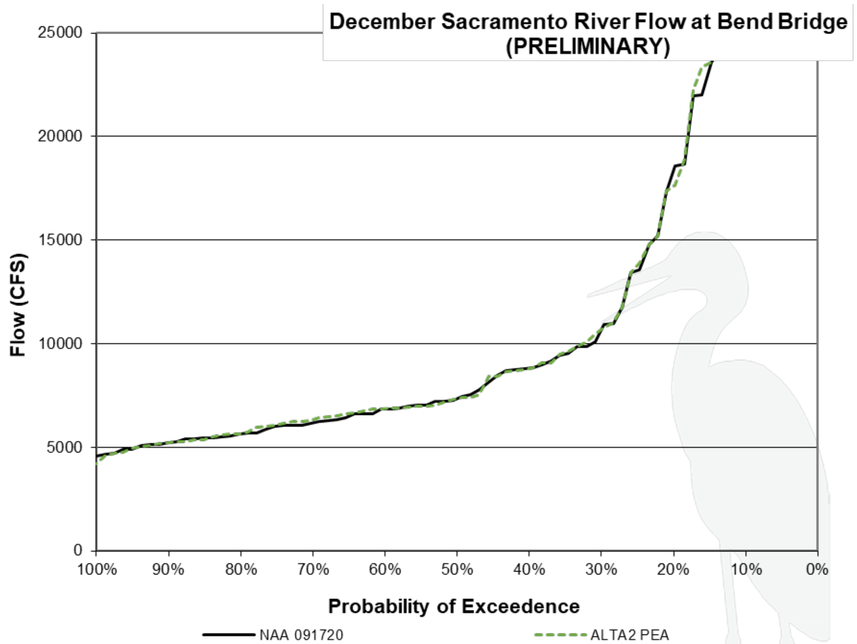




Sites

Bend Bridge flow





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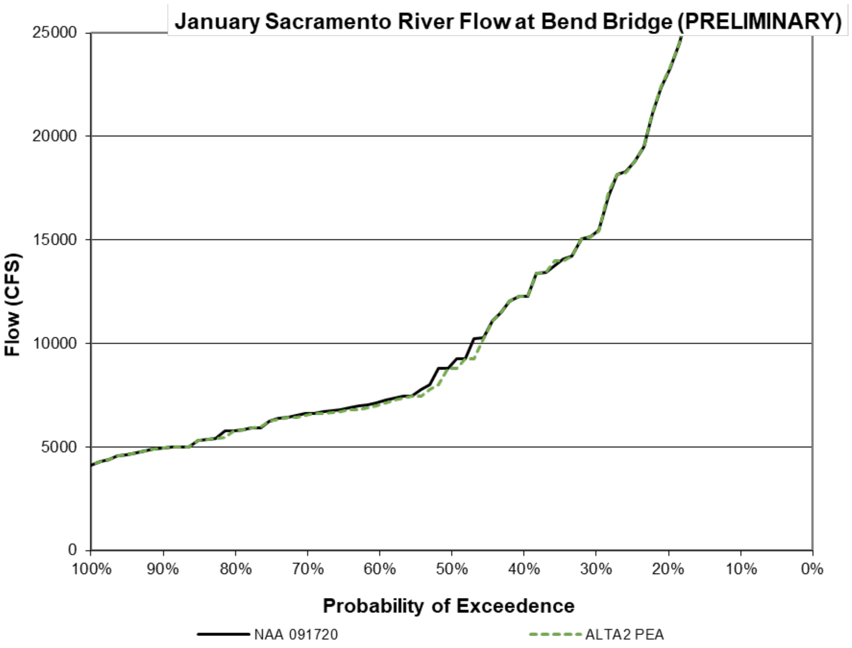

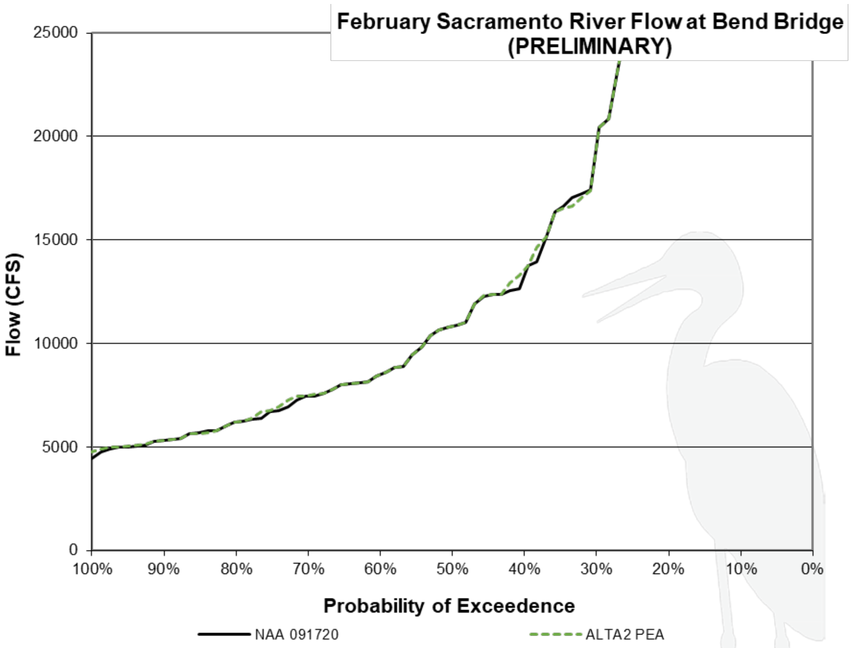

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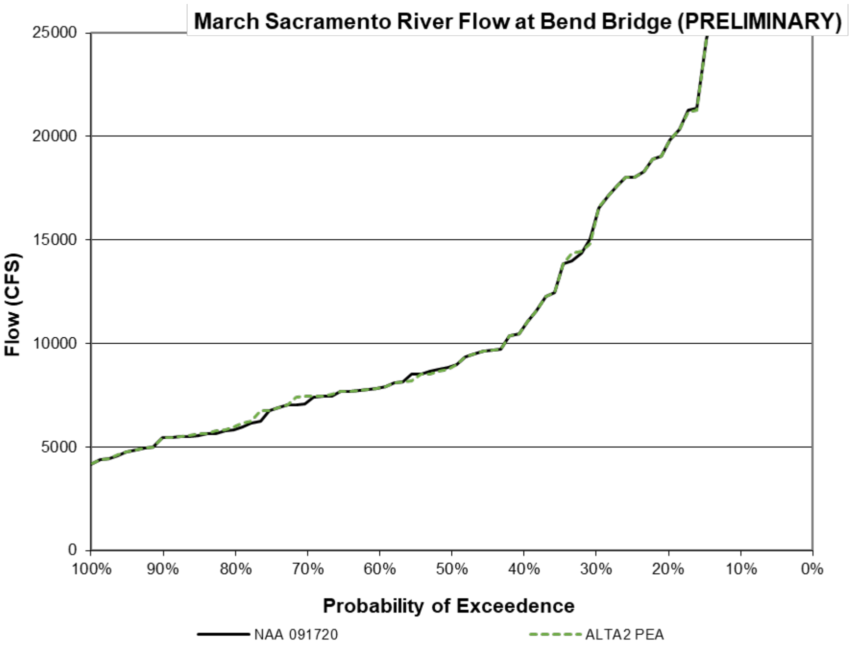

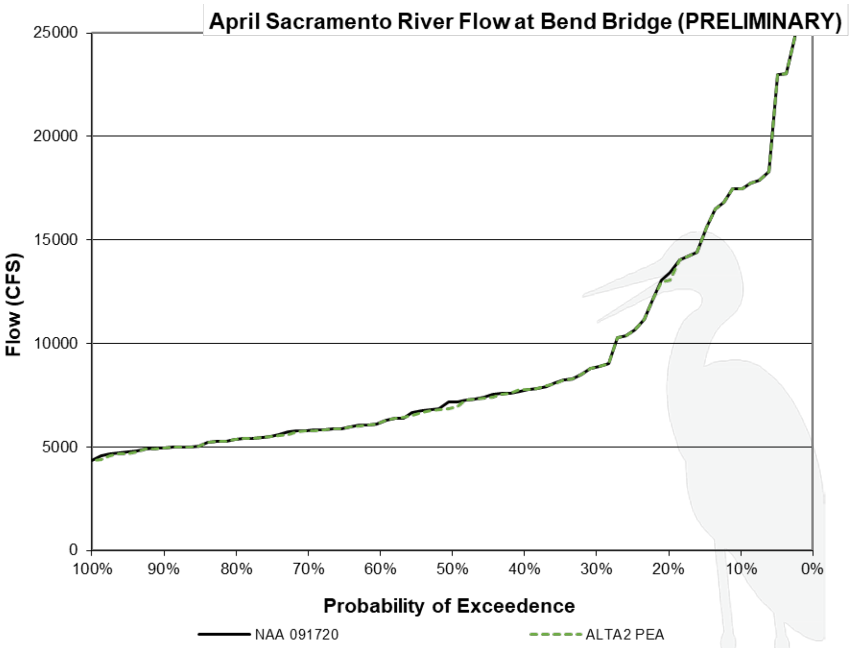

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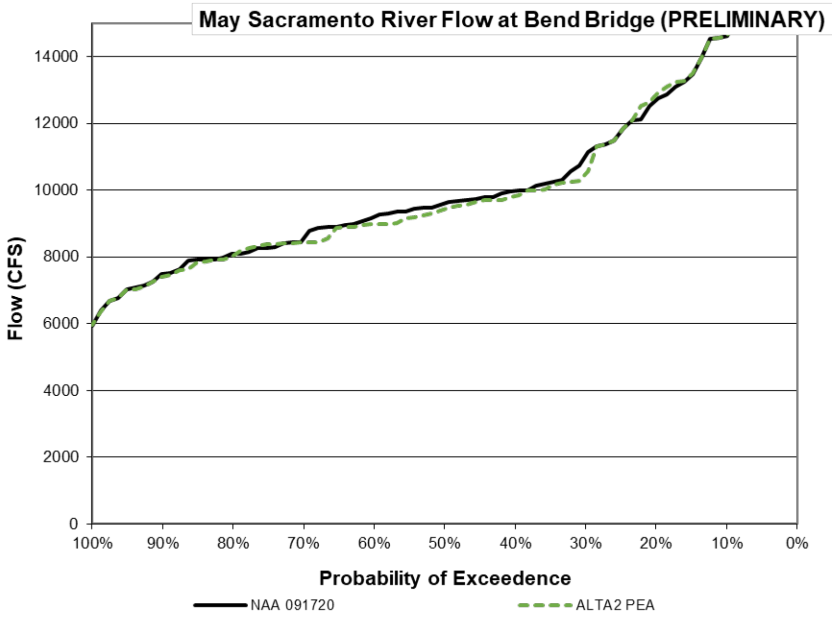

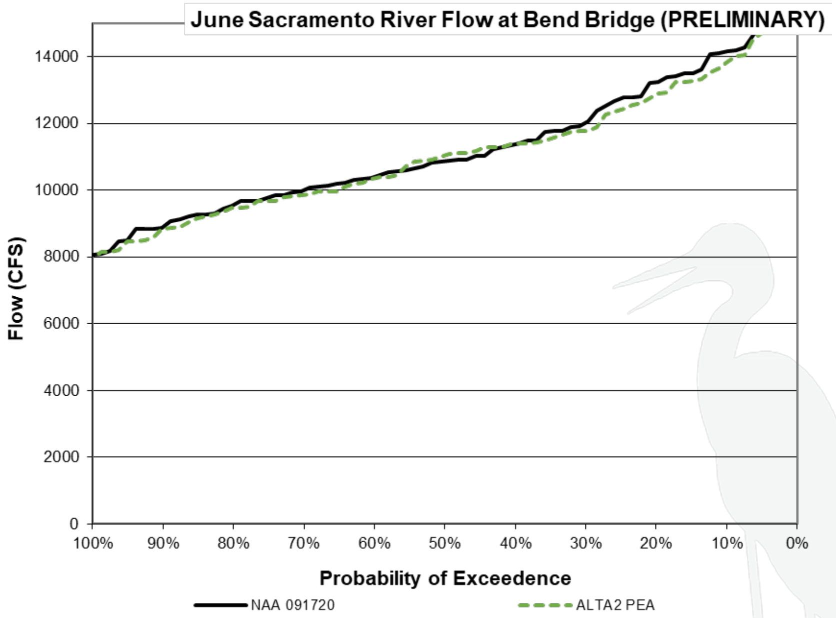

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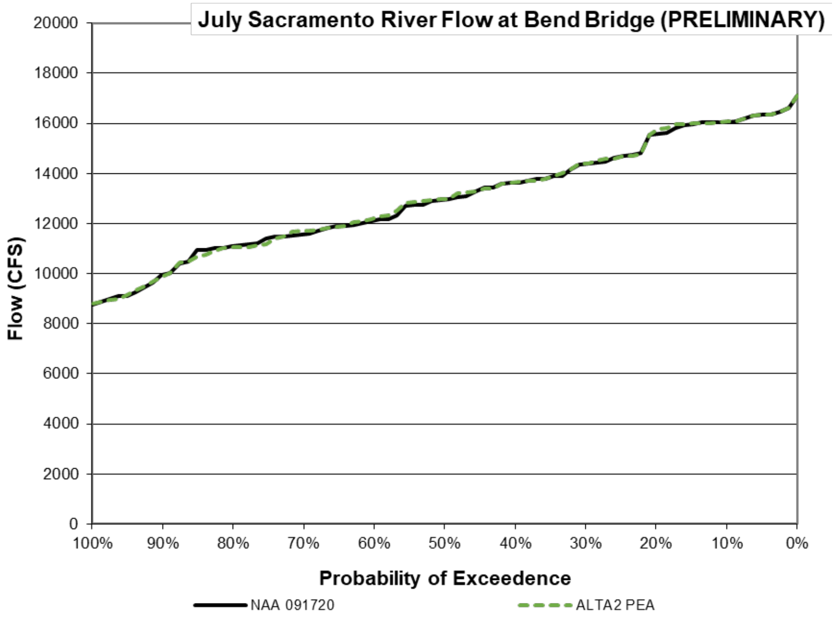

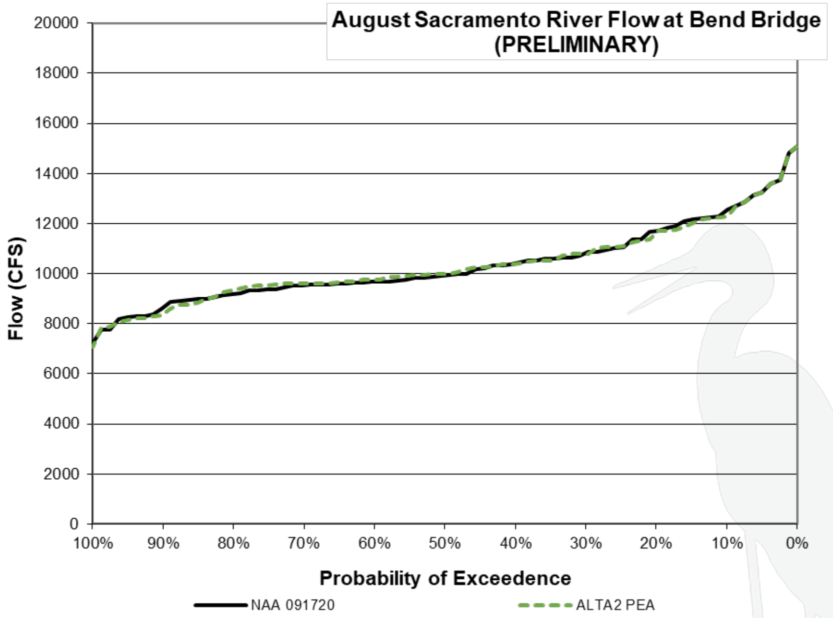

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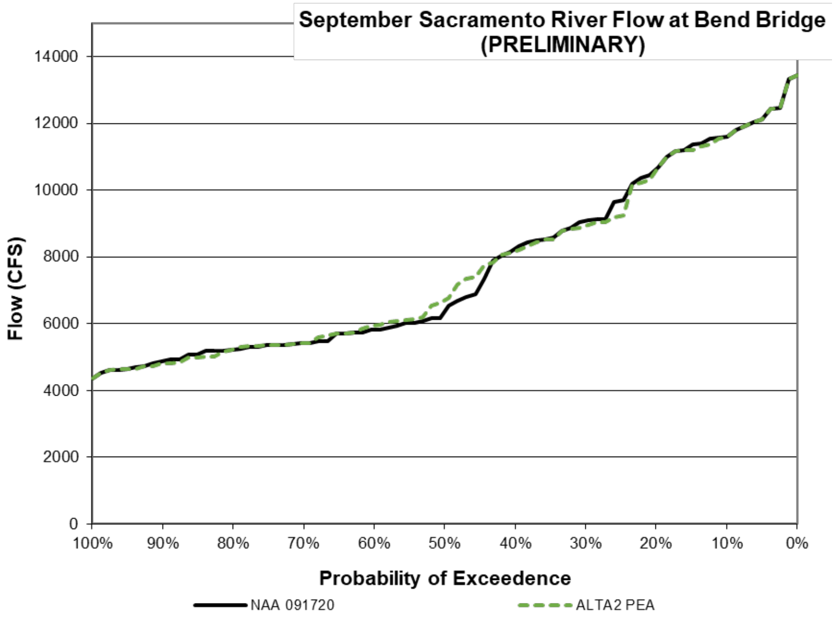

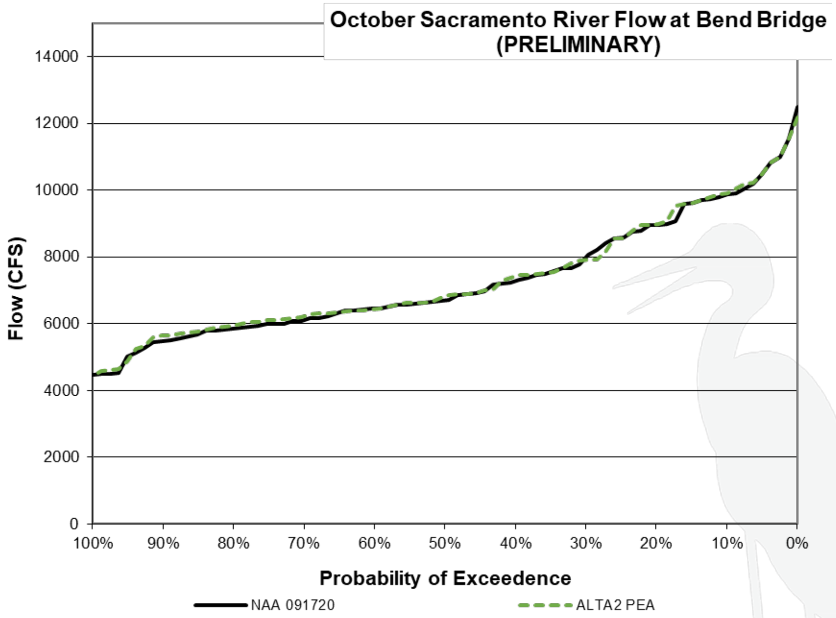

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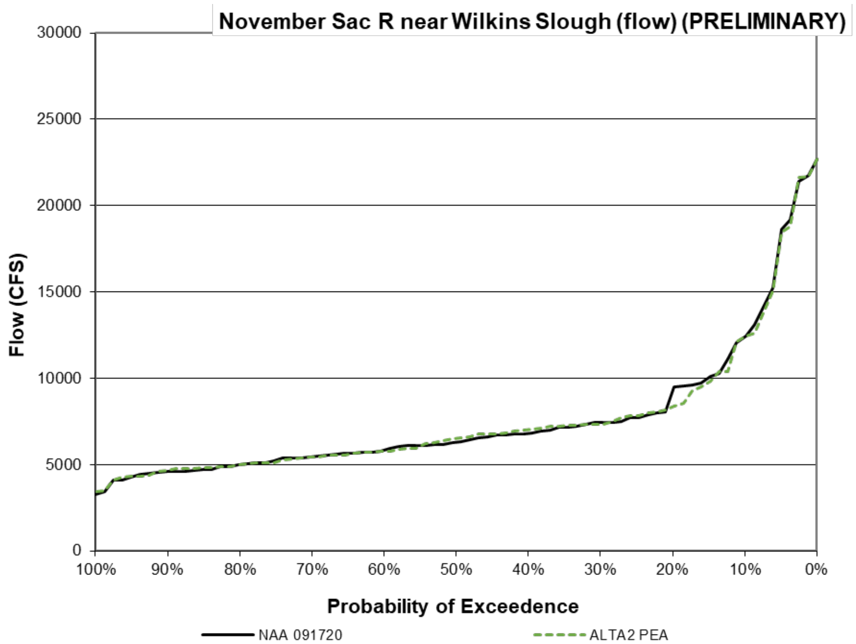
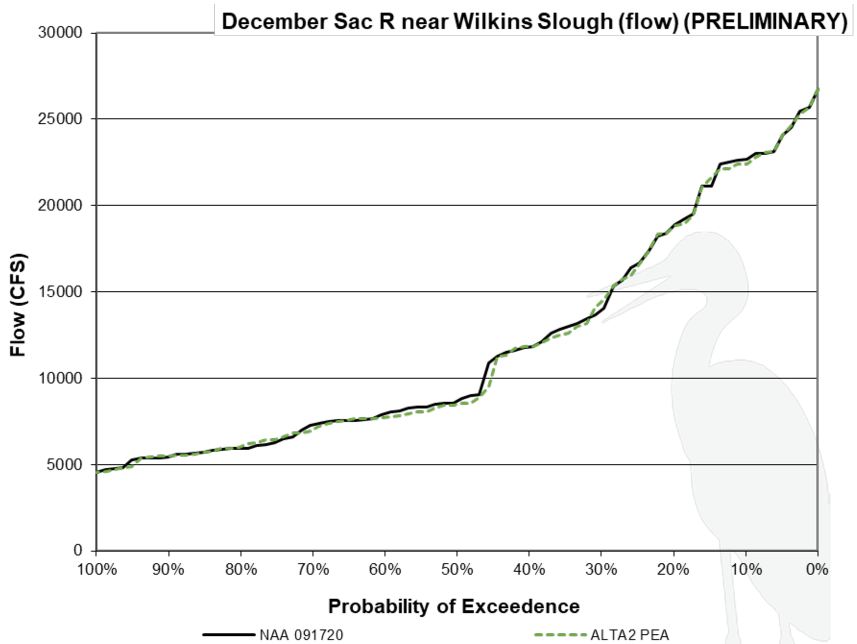
Wilkins Slough flow





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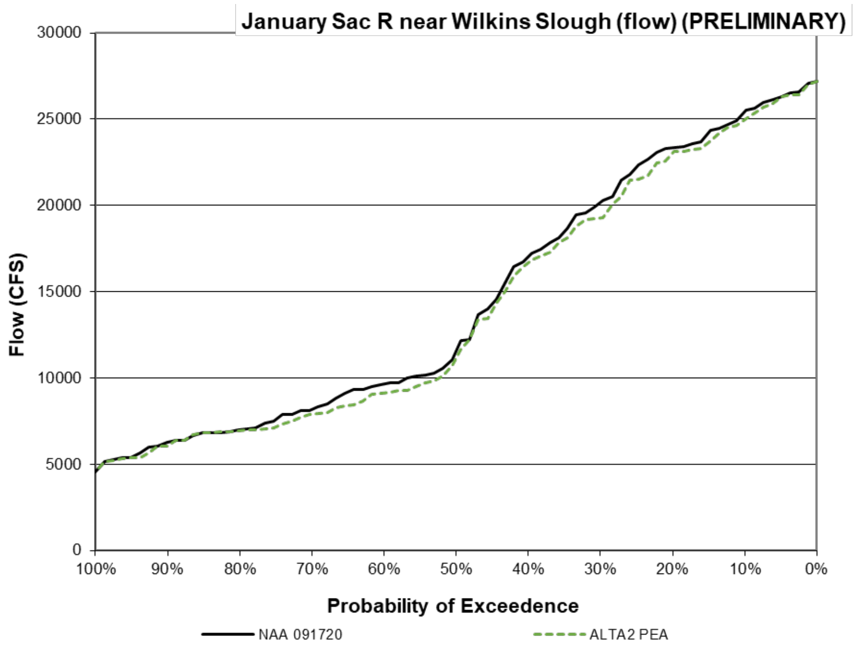

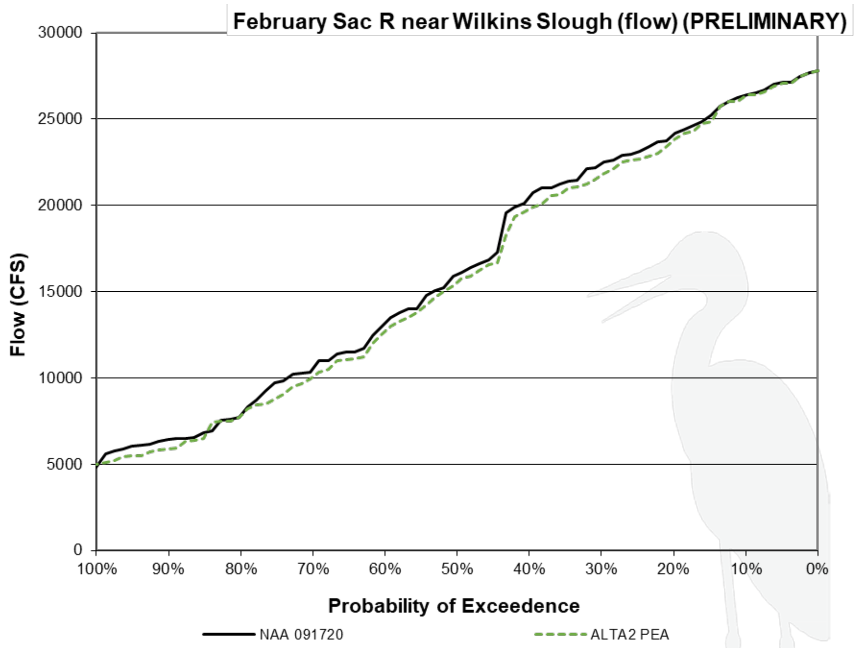

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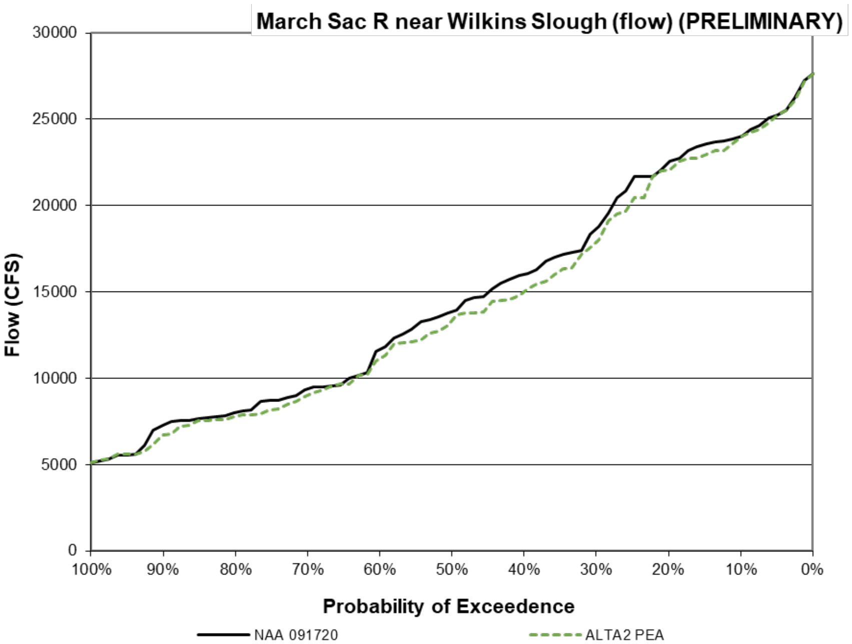

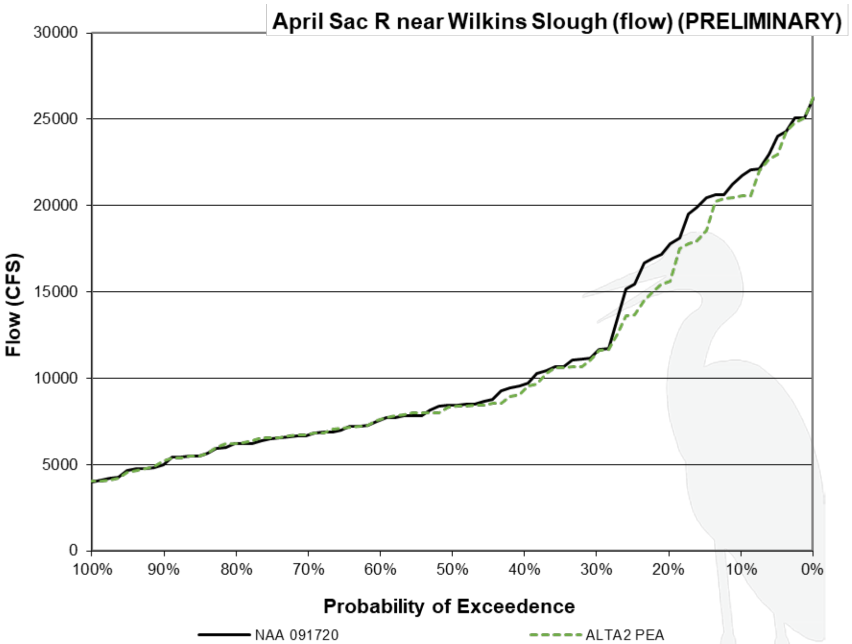

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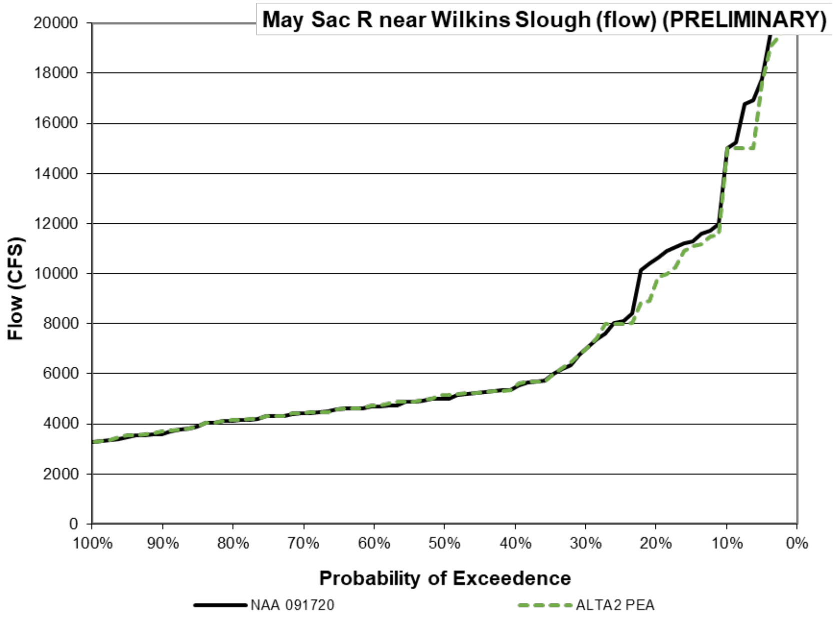
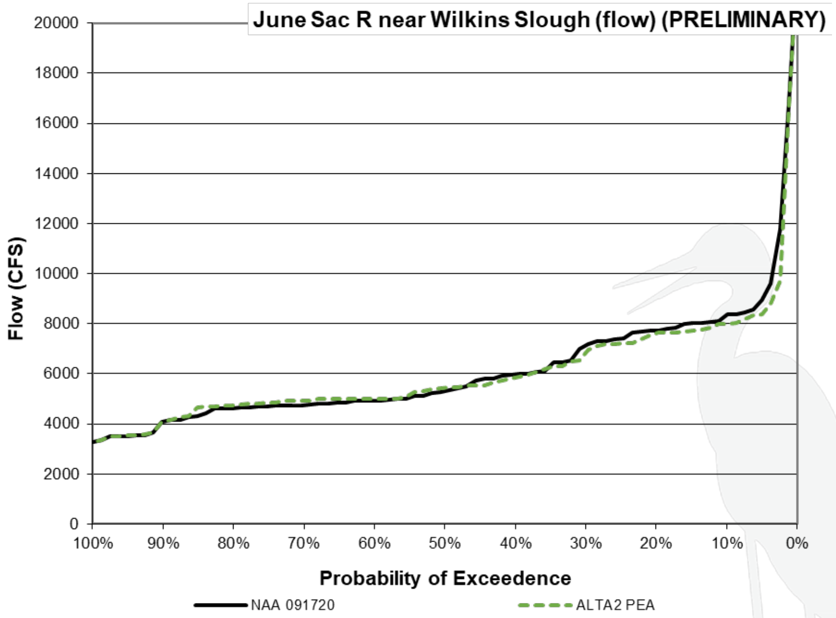
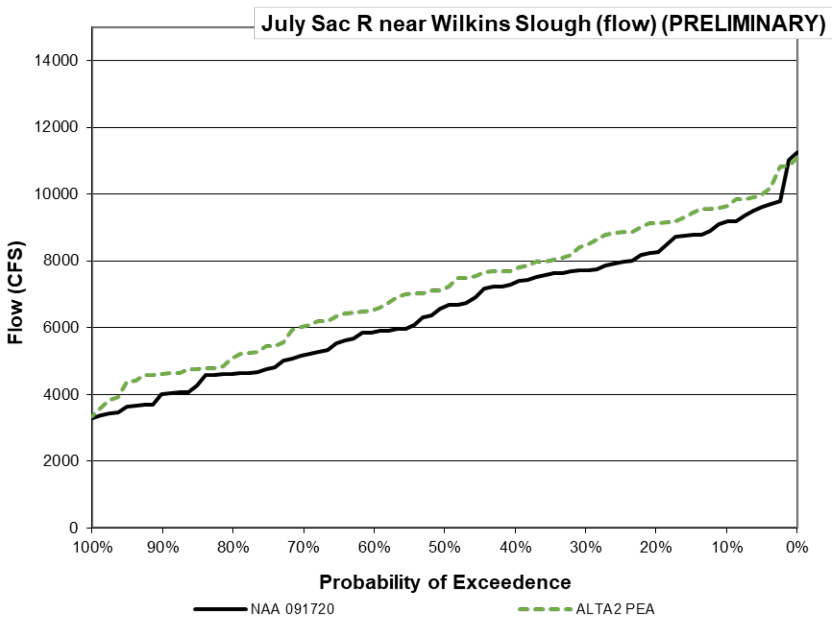
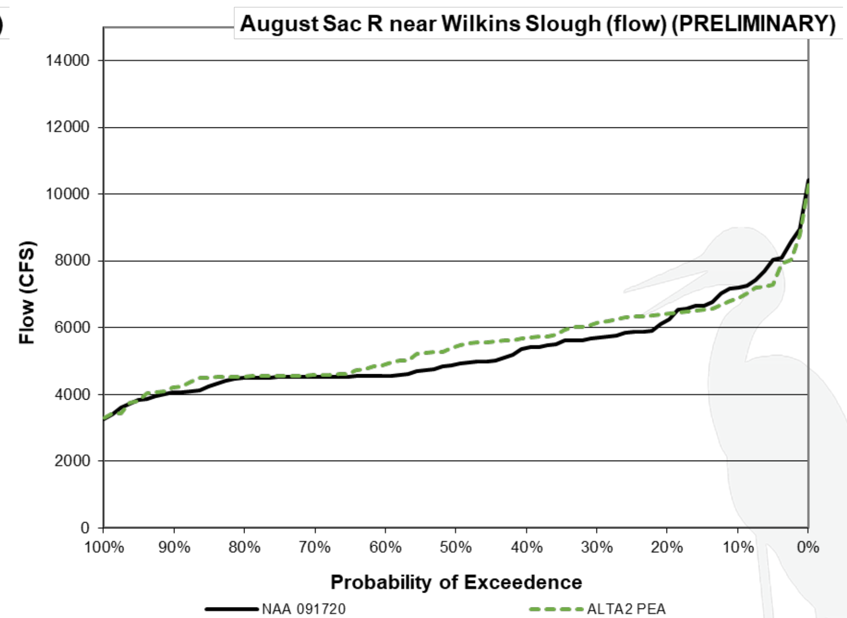


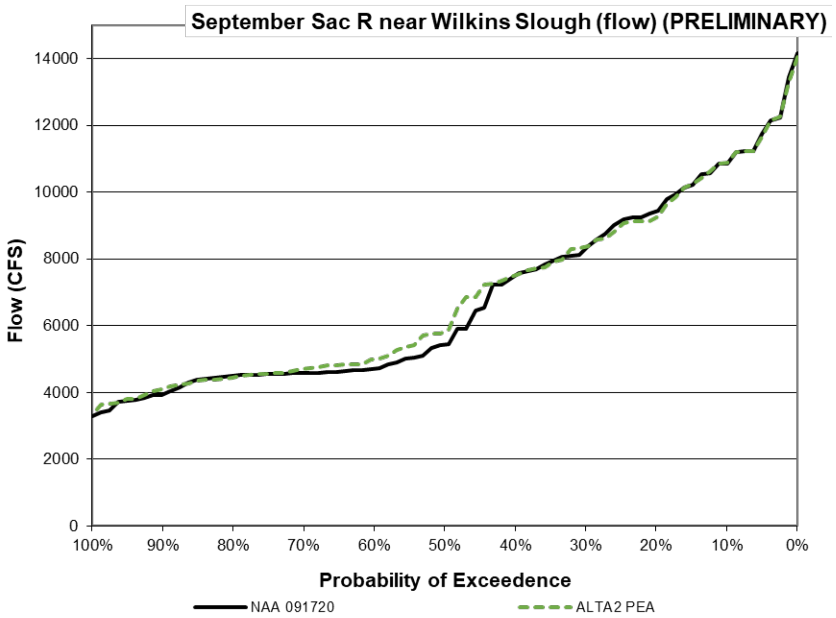


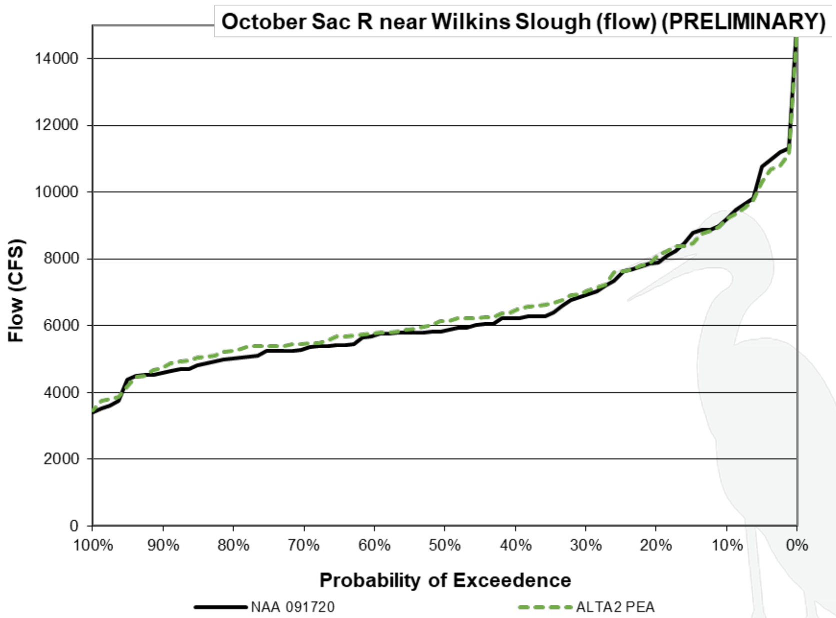
Wilkins Slough flow





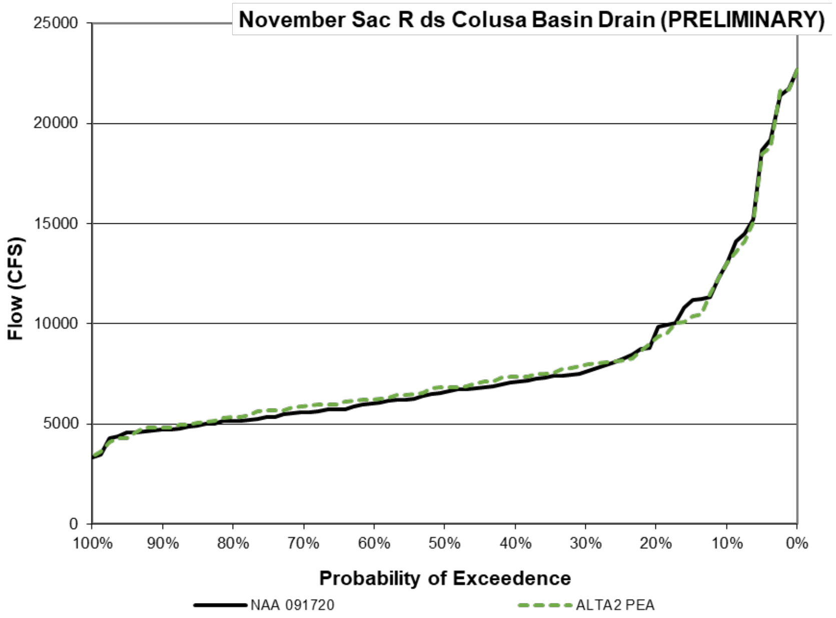
Wilkins Slough flow

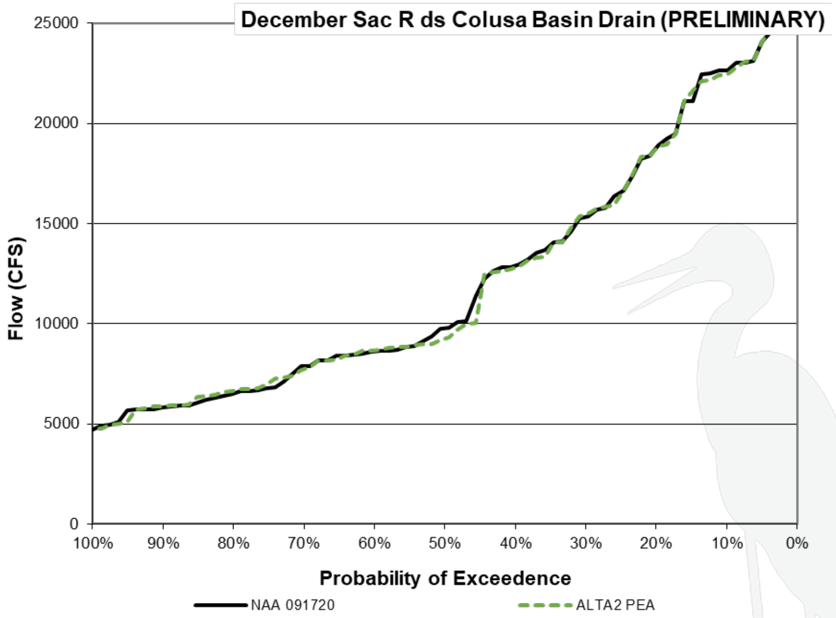




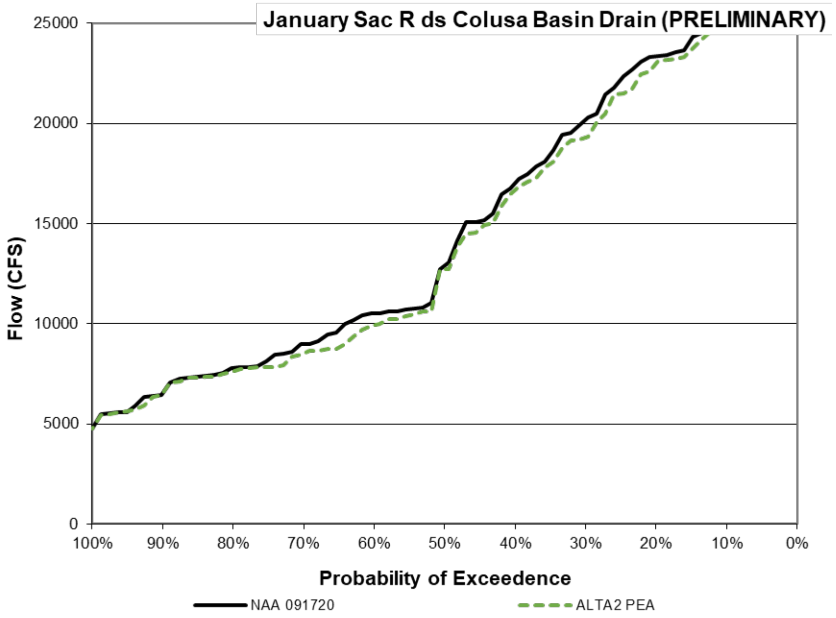
Sites

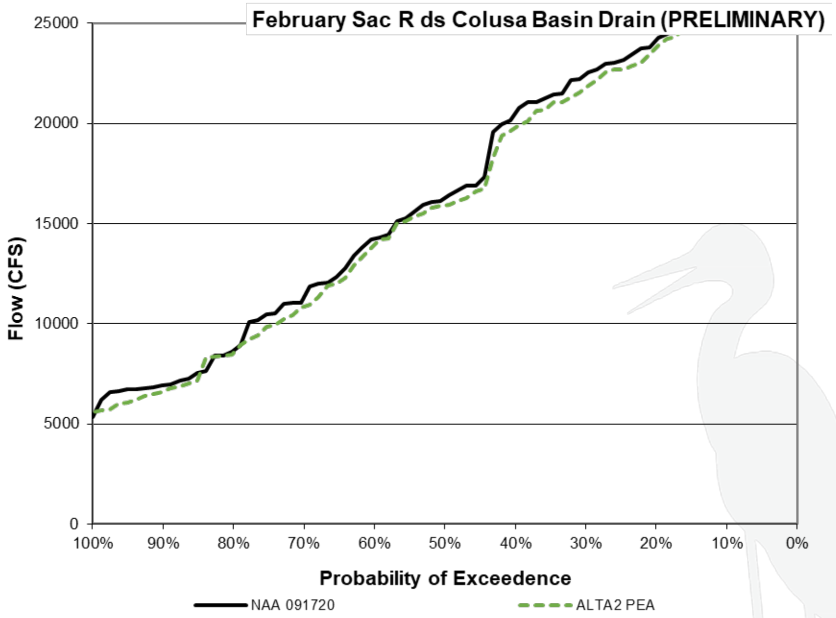
Sacramento River downstream of Colusa Basin Drain





Sacramento River downstream of Colusa Basin Drain





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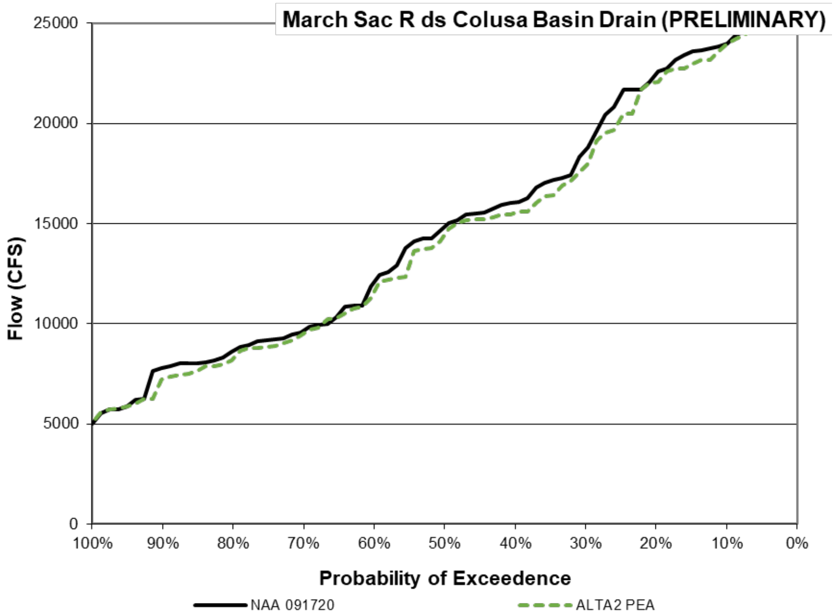
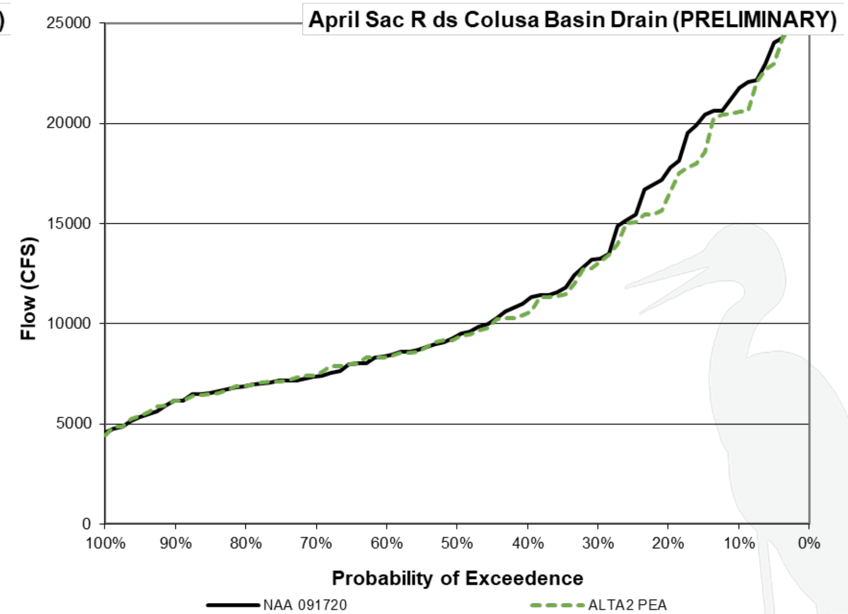
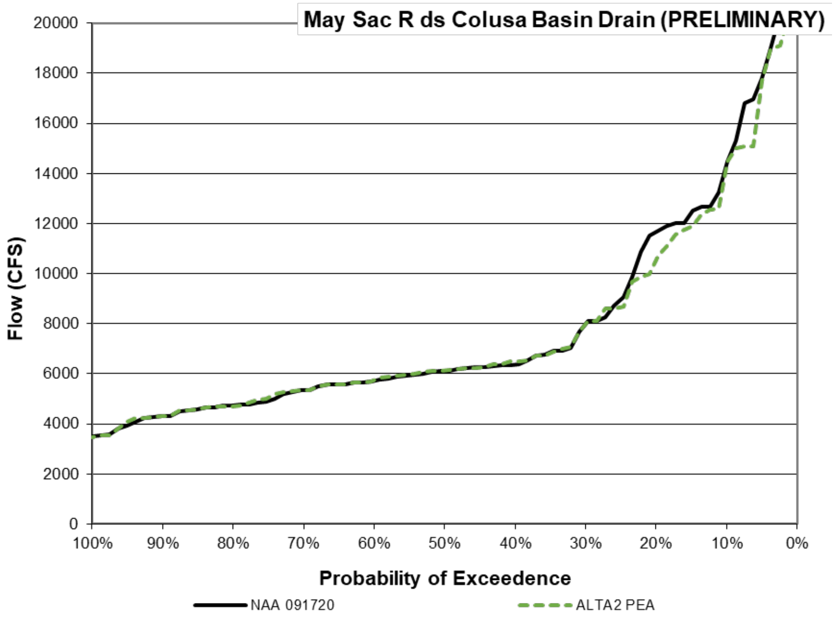
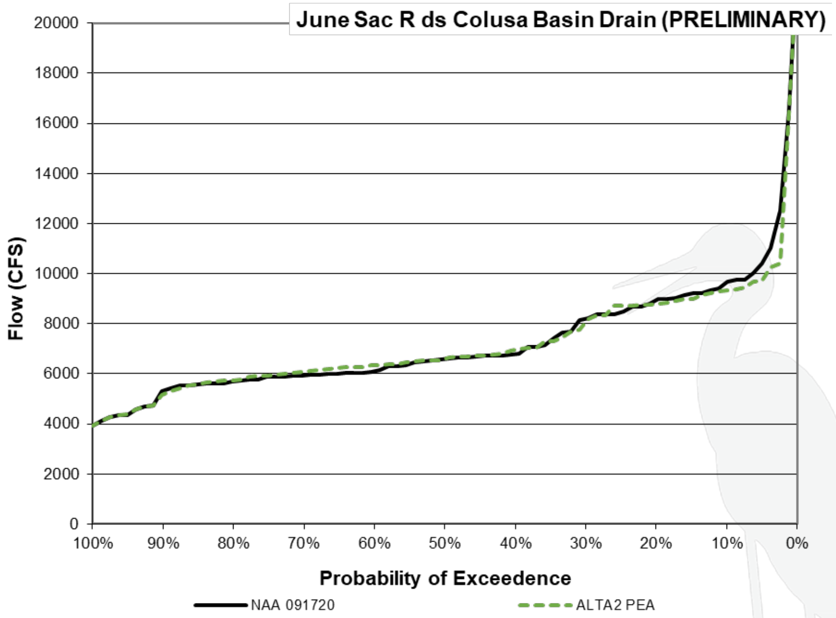
Sacramento River downstream of Colusa Basin Drain



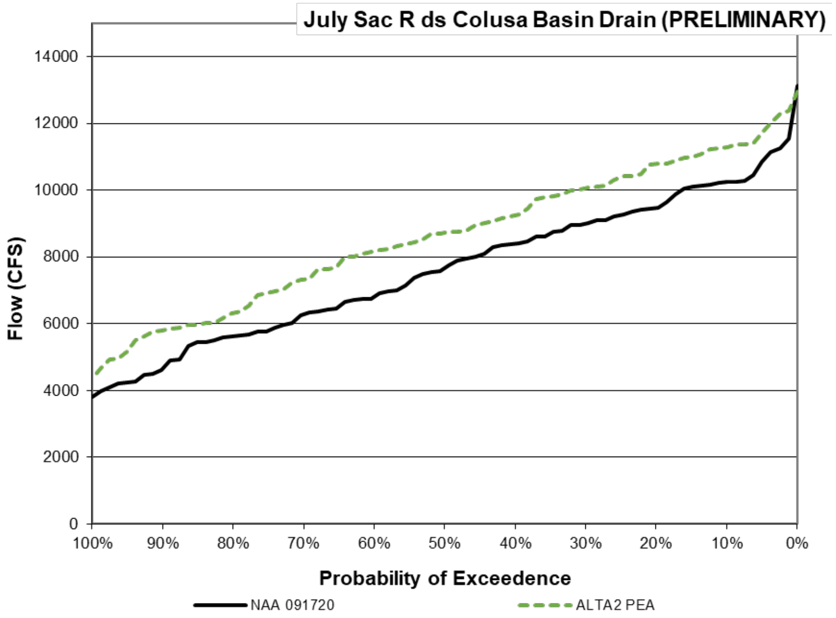


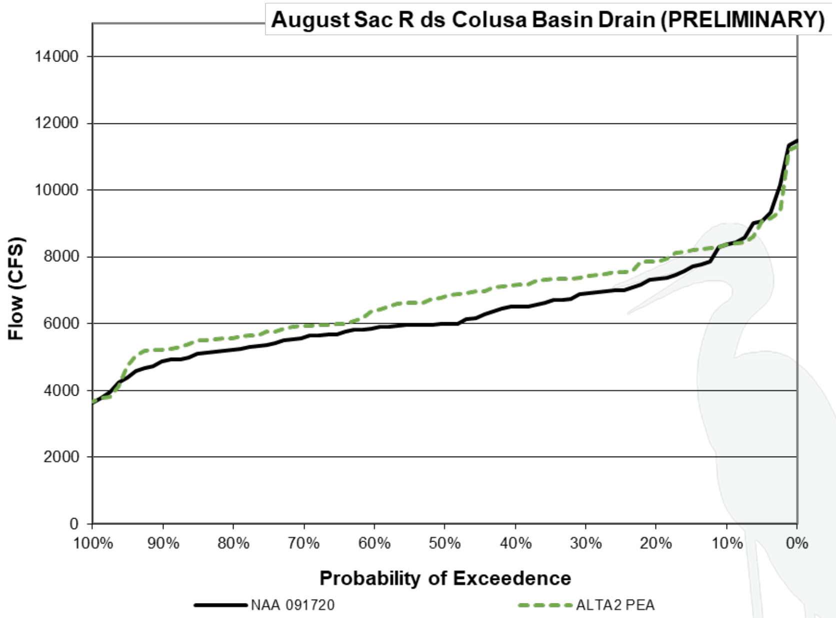
Sacramento River downstream of Colusa Basin Drain



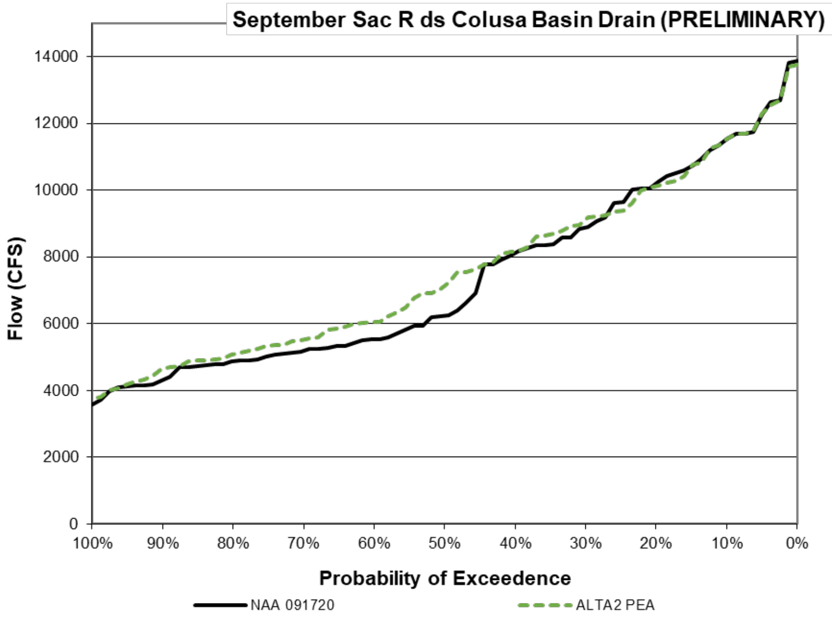


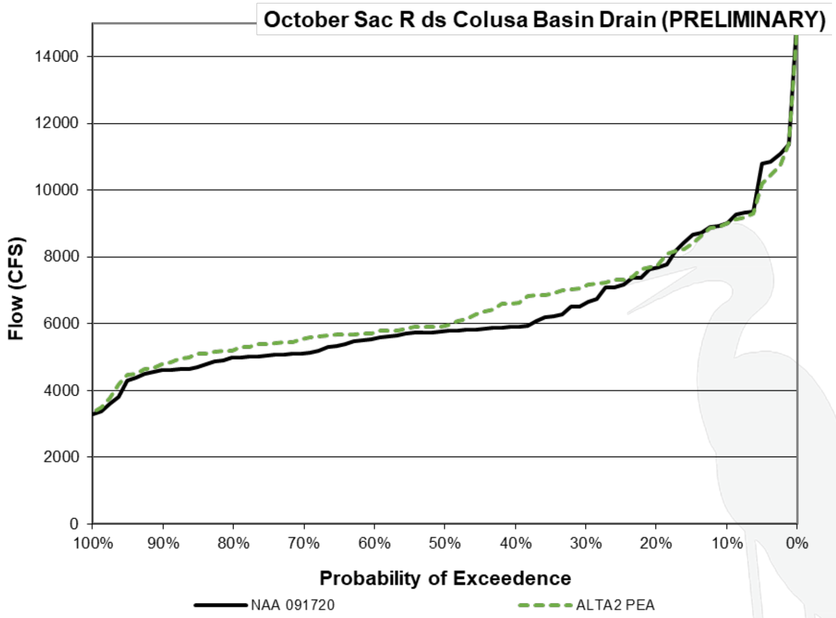
Sacramento River downstream of Colusa Basin Drain



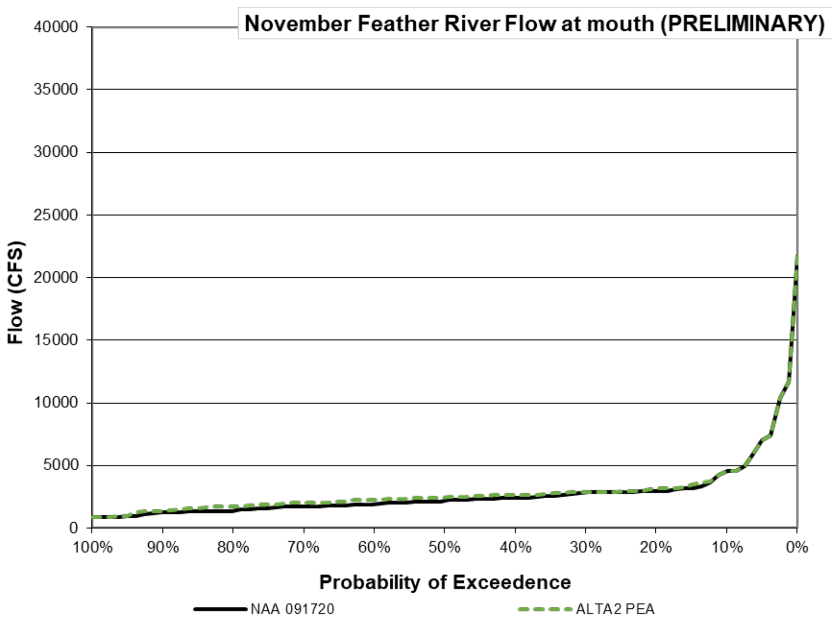


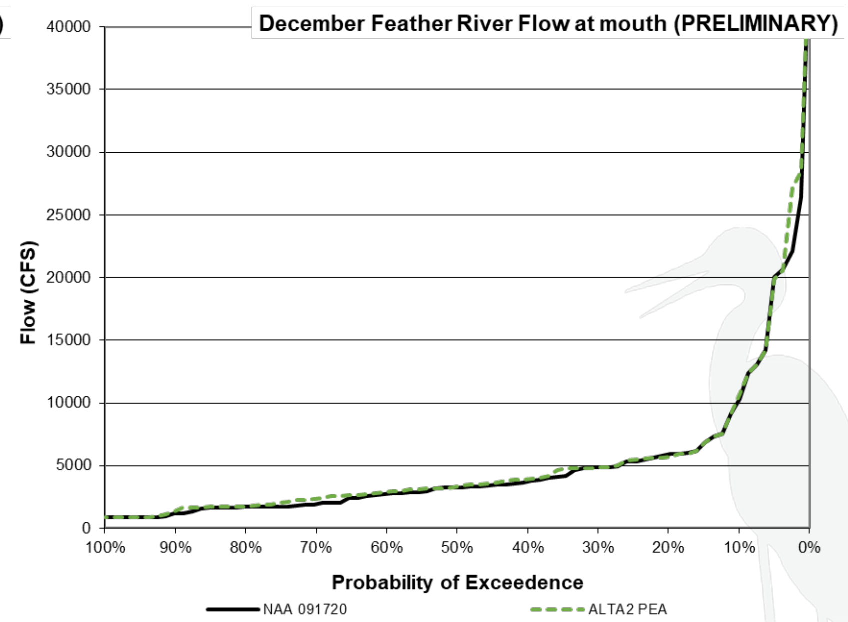
Sacramento River downstream of Colusa Basin Drain



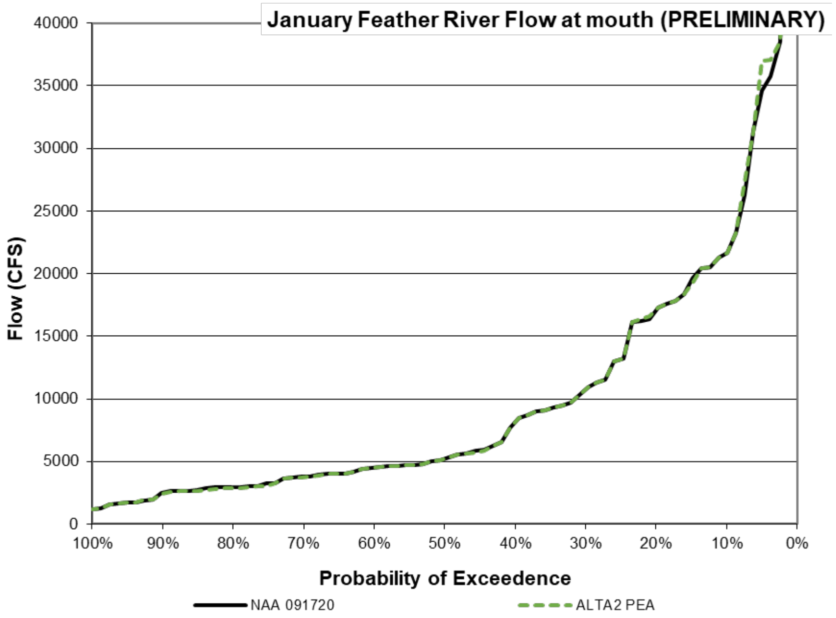


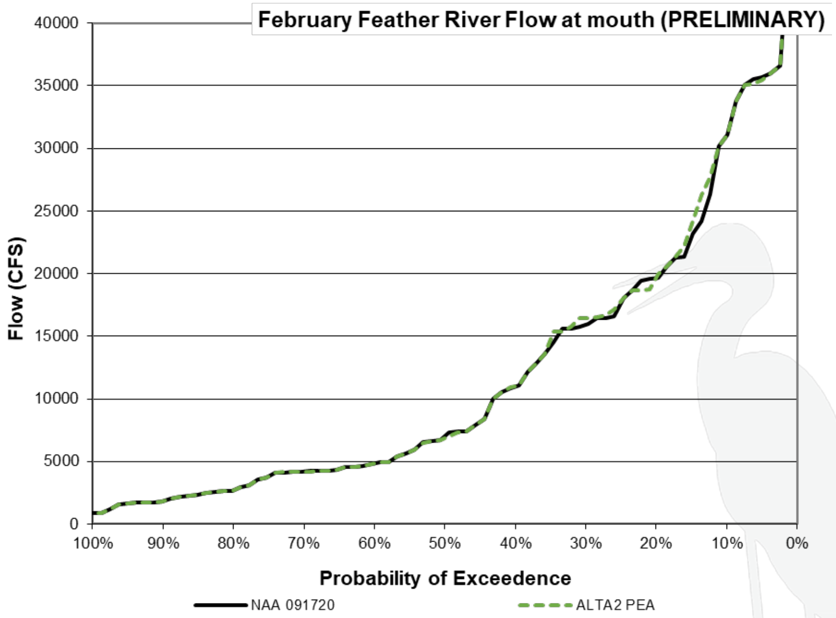
Feather River at Mouth flow



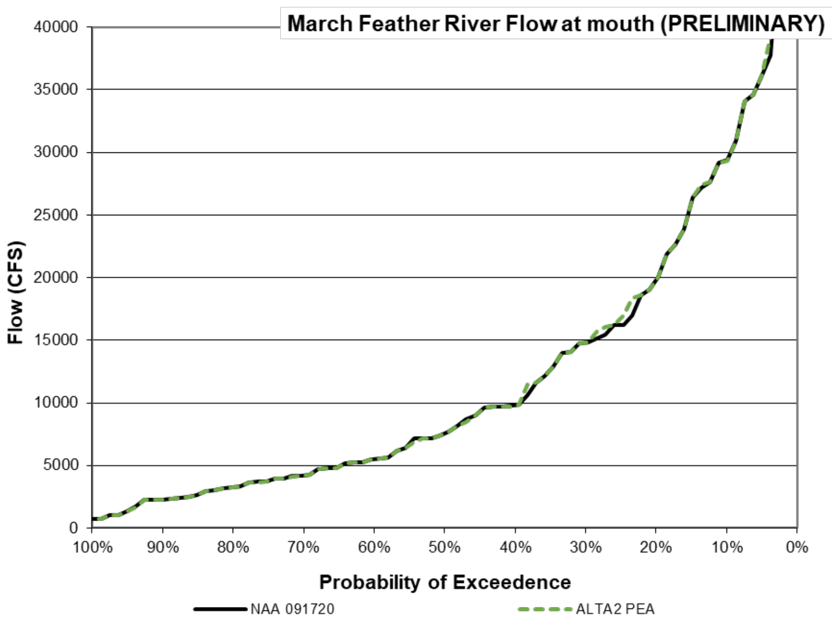


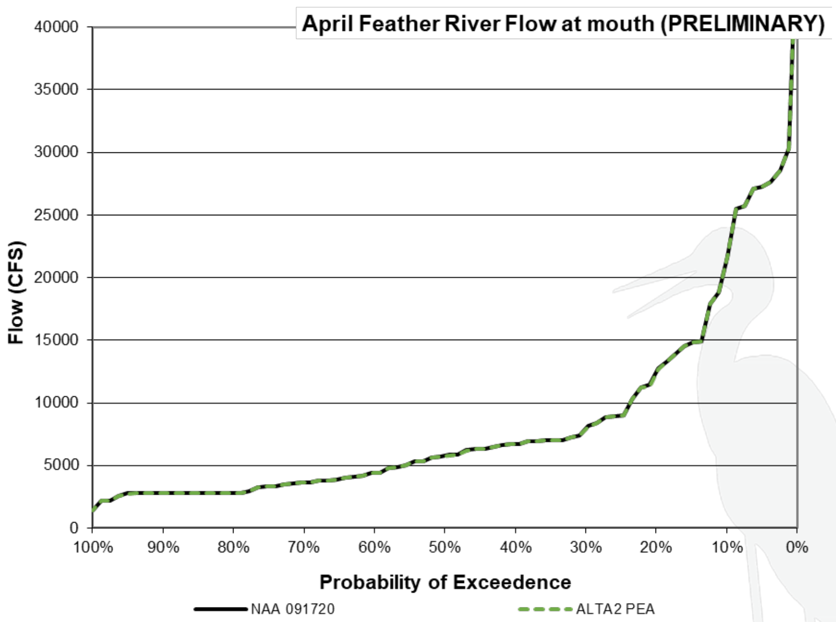
Feather River at Mouth flow



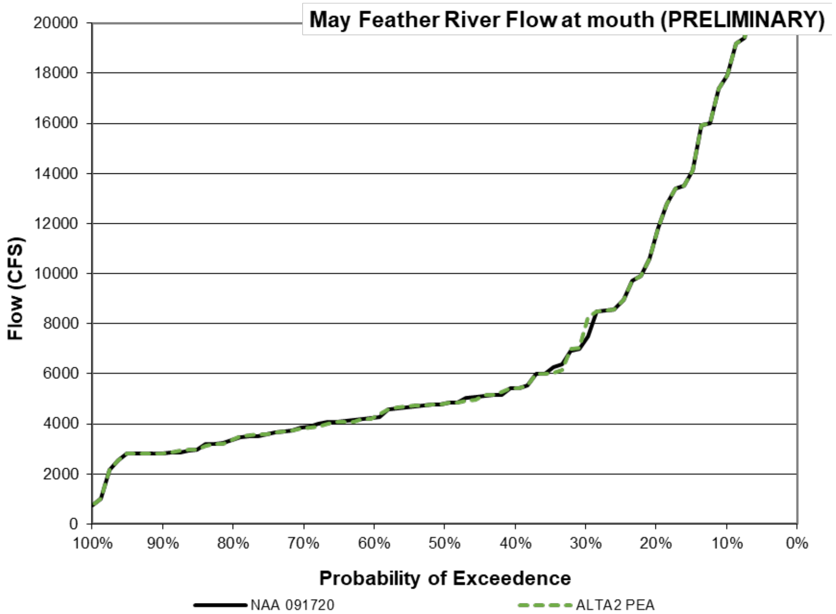


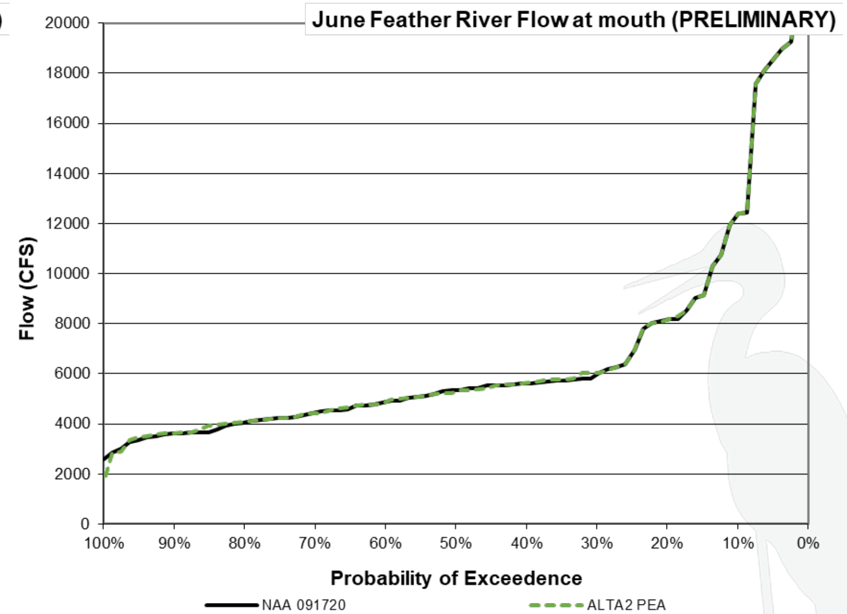
Feather River at Mouth flow



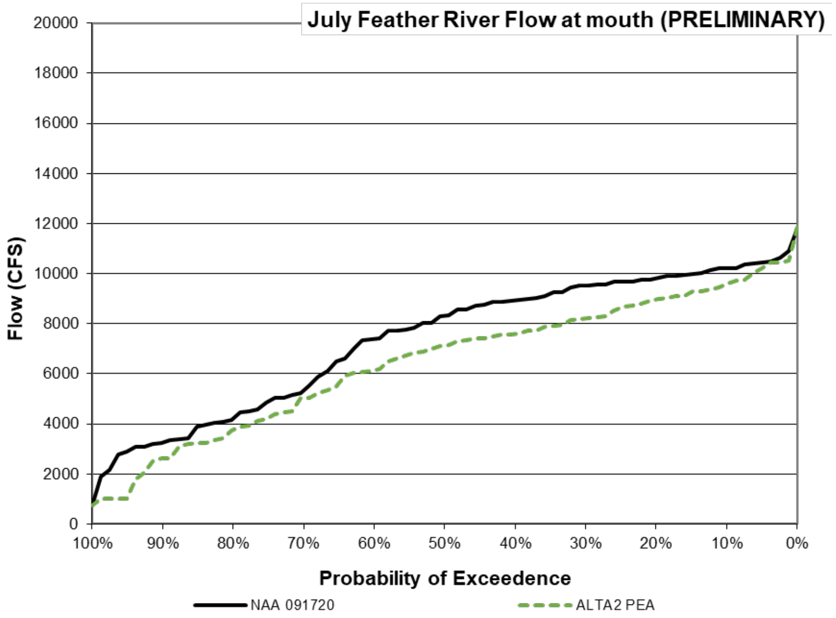


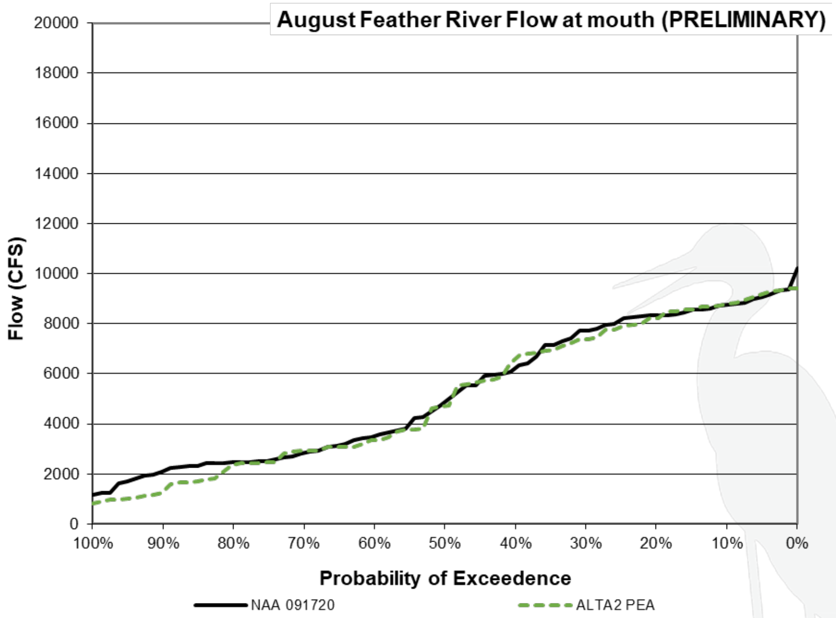
Feather River at Mouth flow



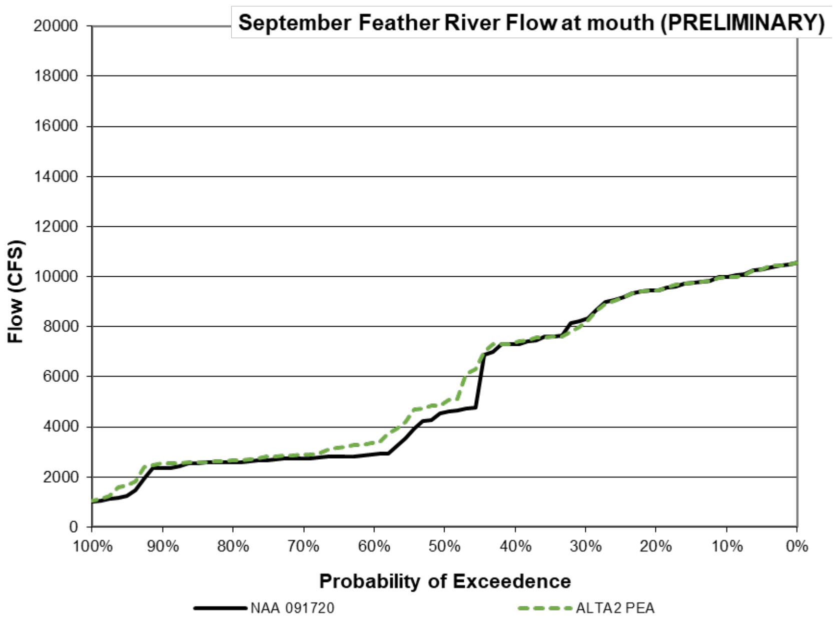


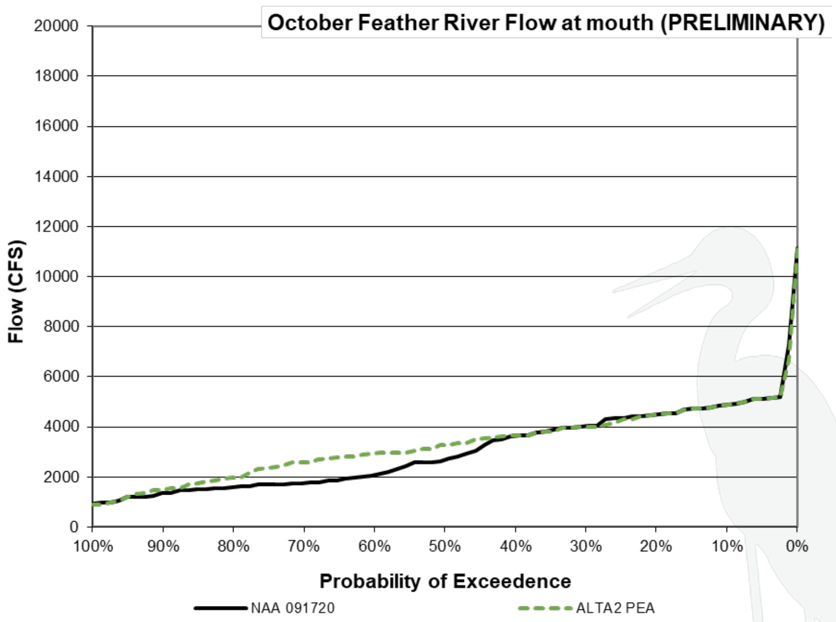
Feather River at Mouth flow



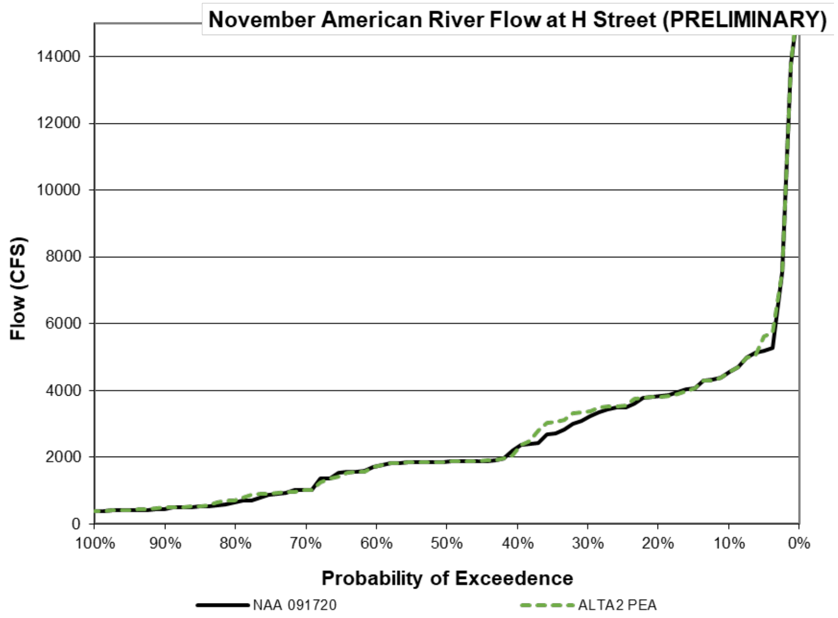


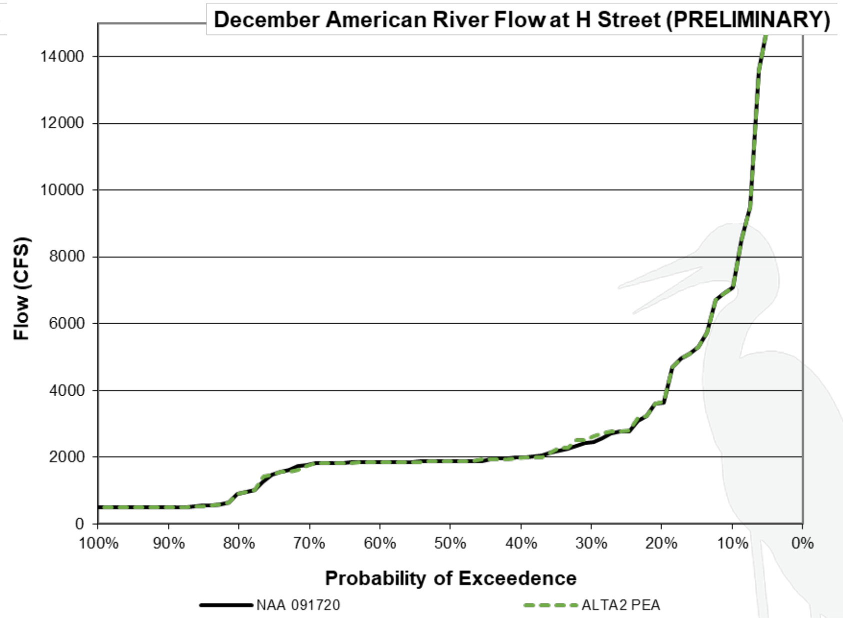
Feather River at Mouth flow



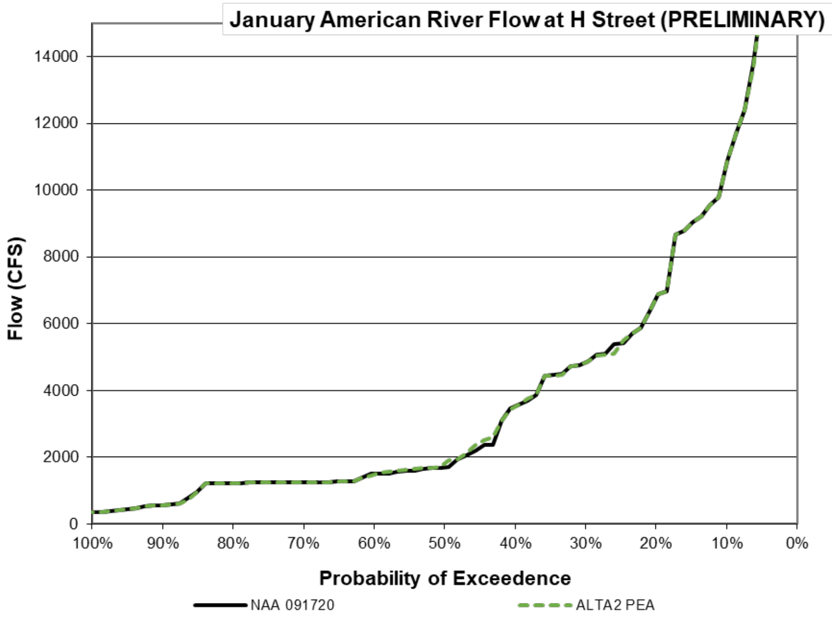


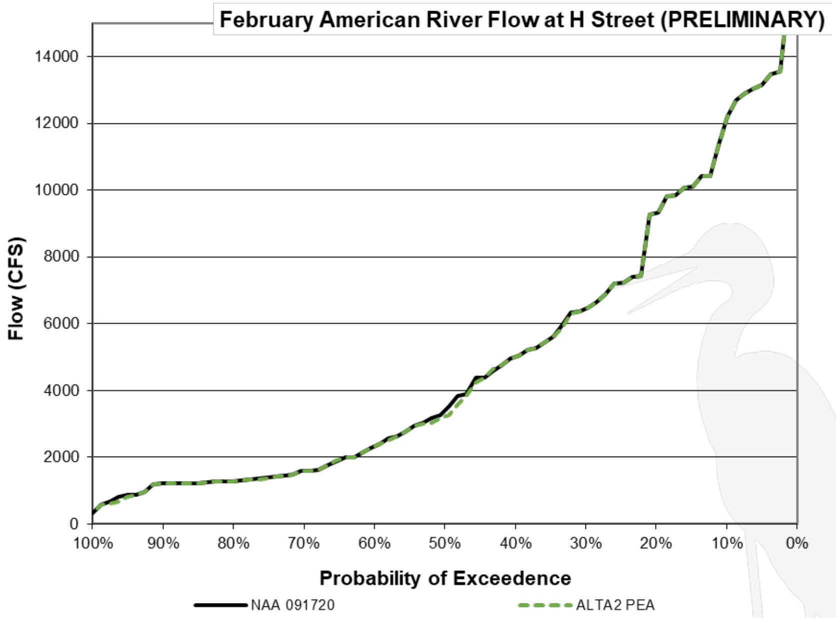
American River at H Street flow





American River at H Street flow





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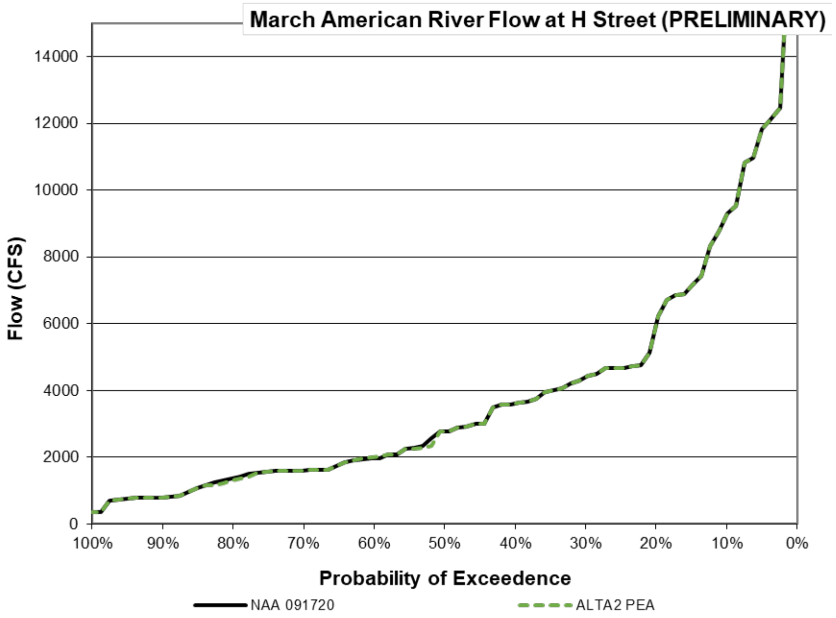

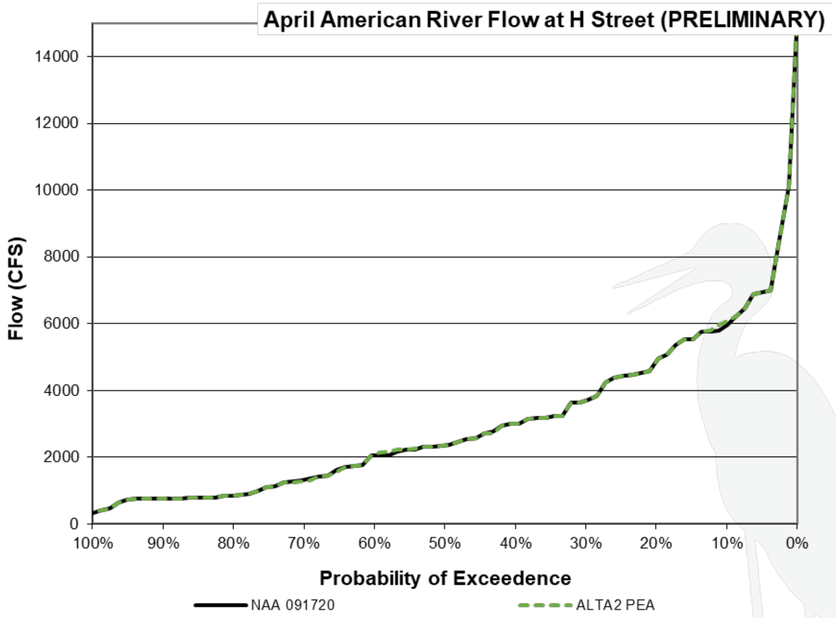

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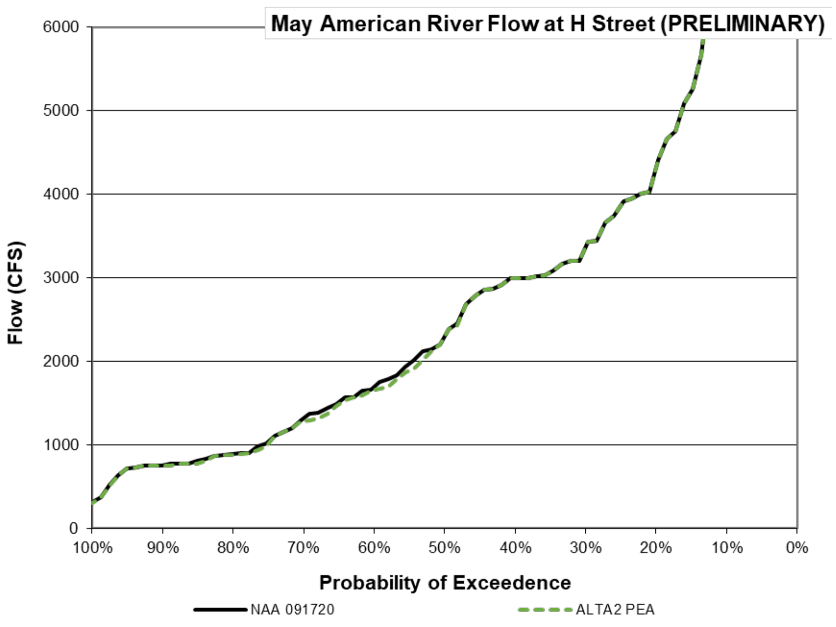
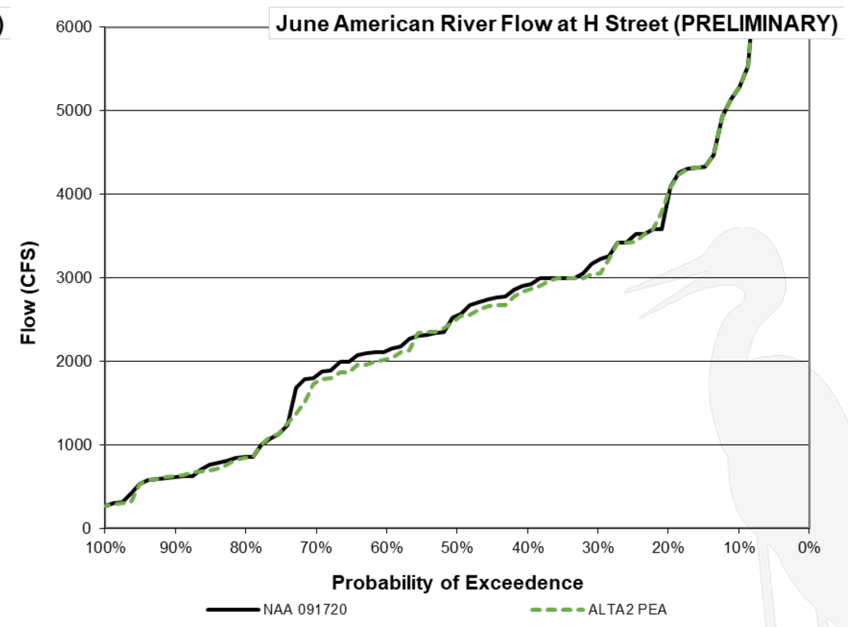
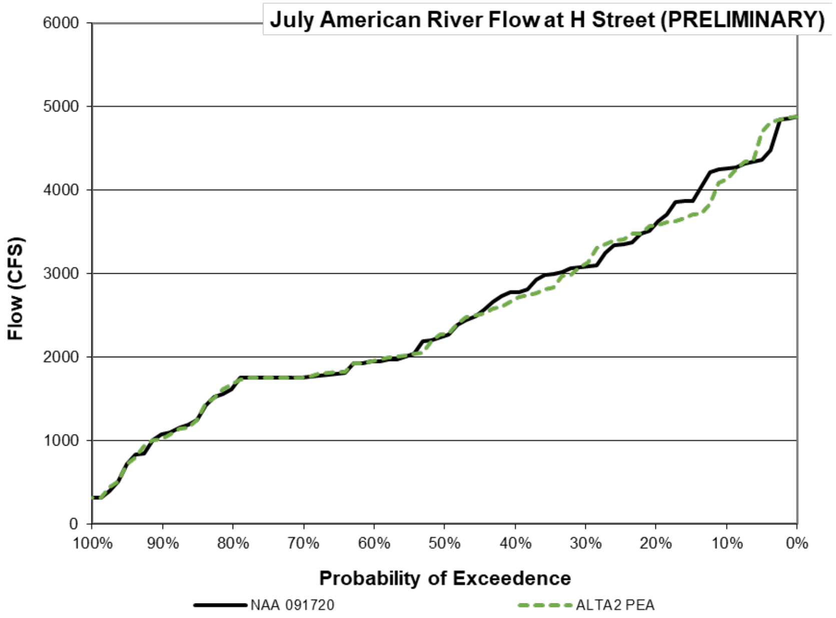
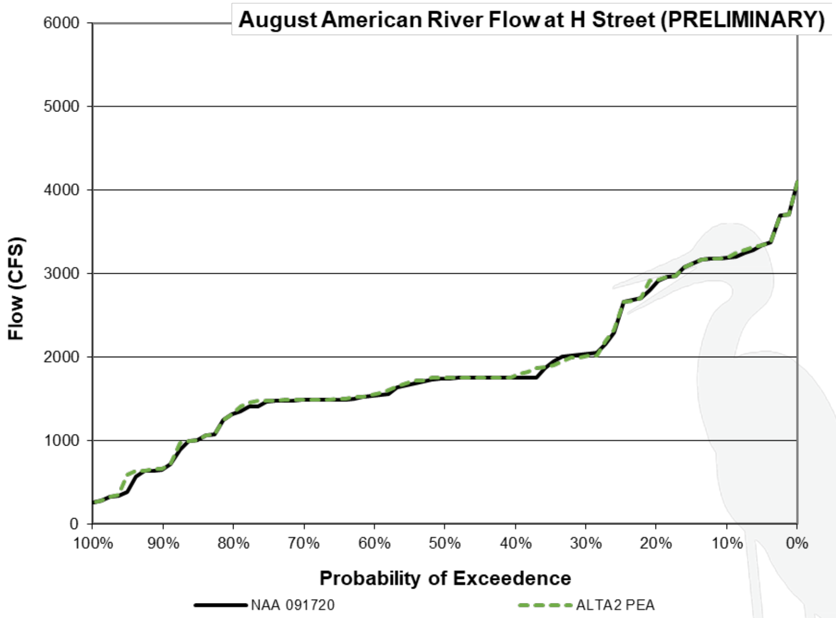
American River at H Street flow





American River at H Street flow





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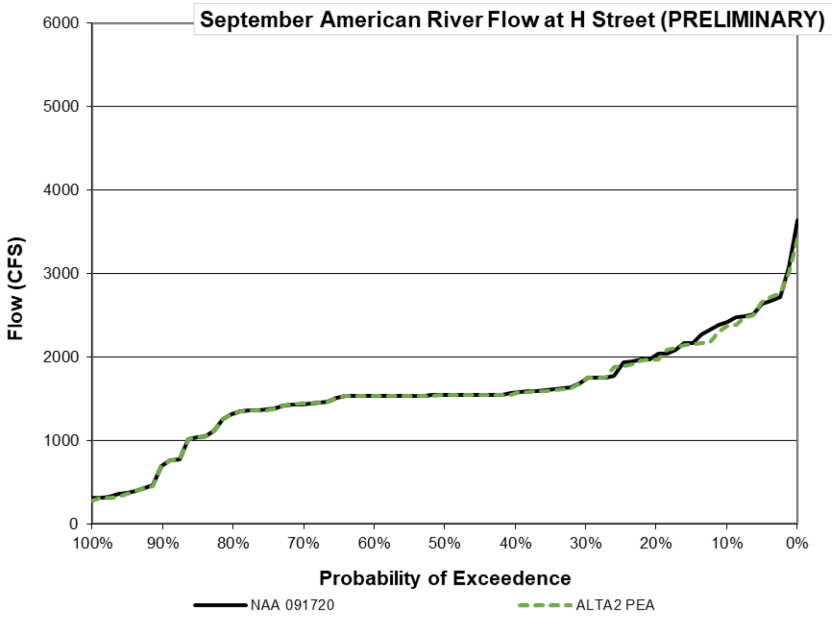
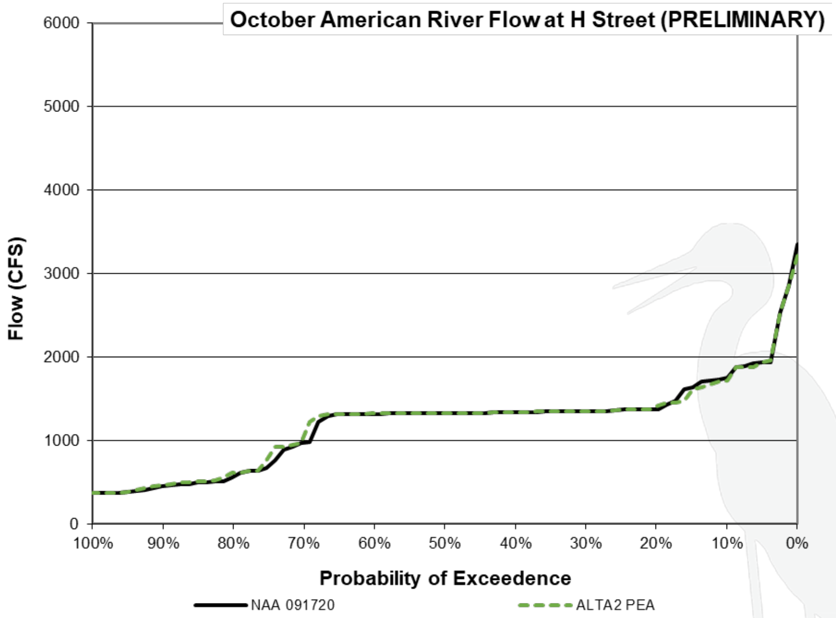
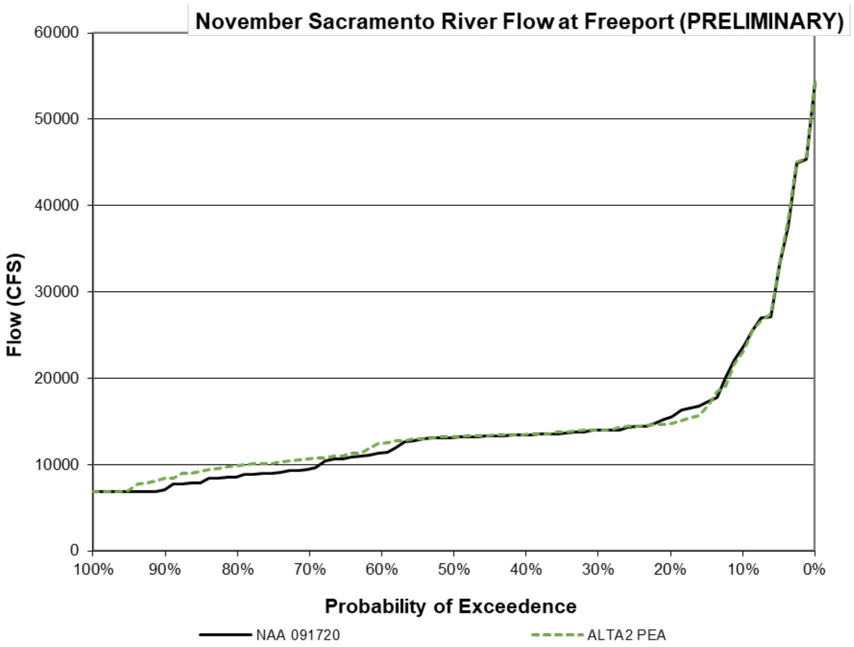
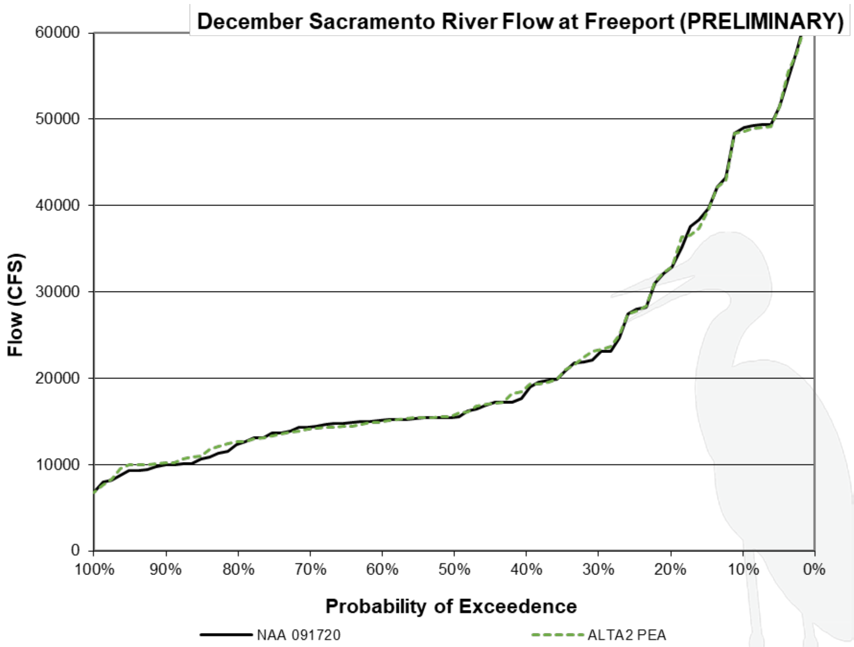
American River at H Street flow





Freeport flow





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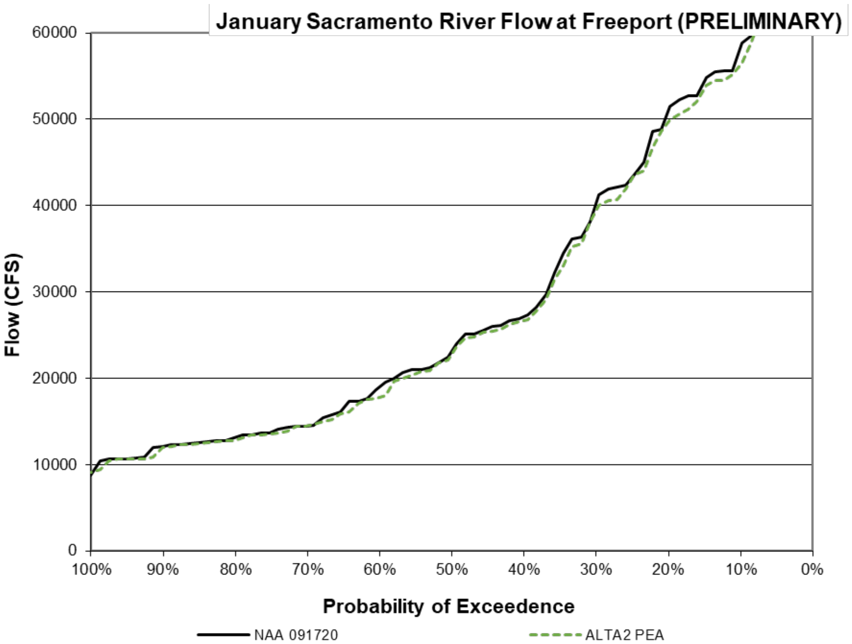

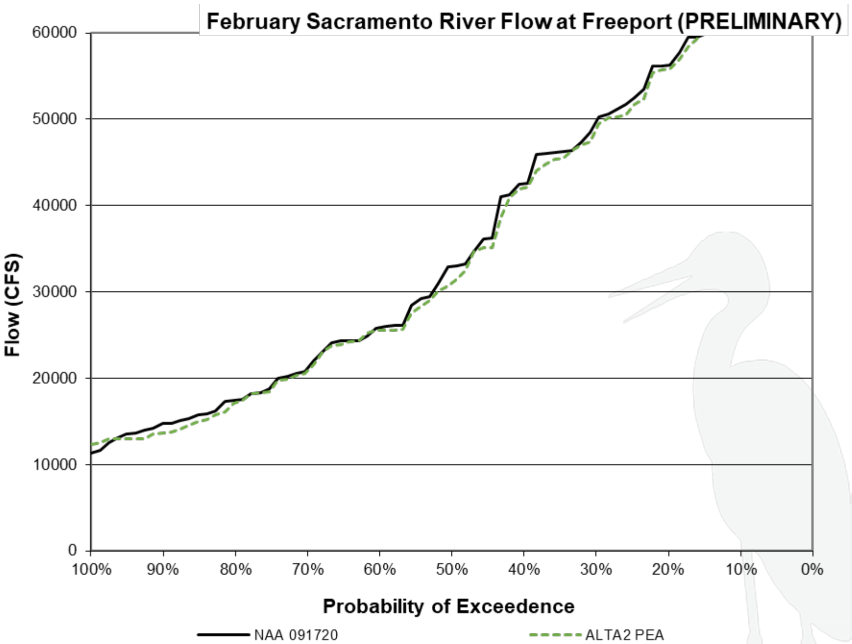

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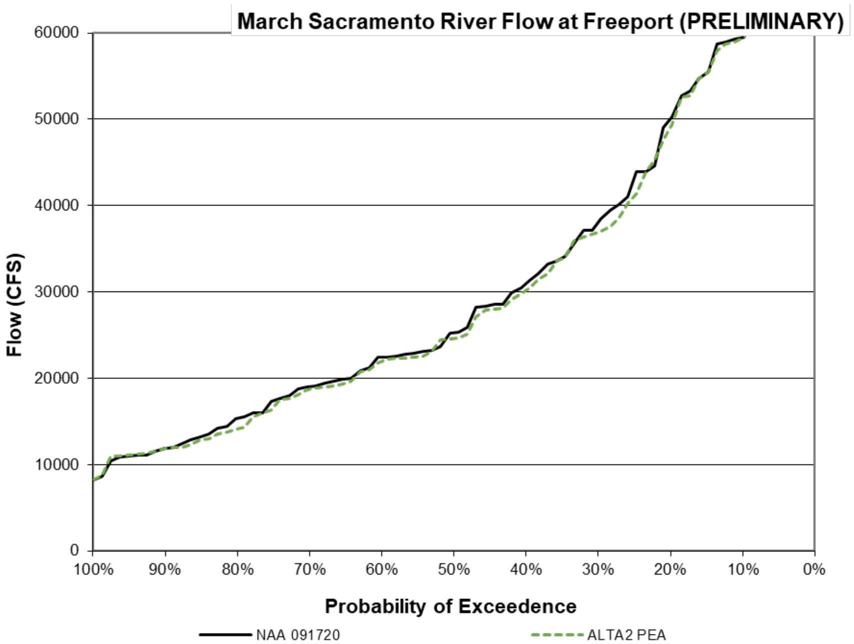

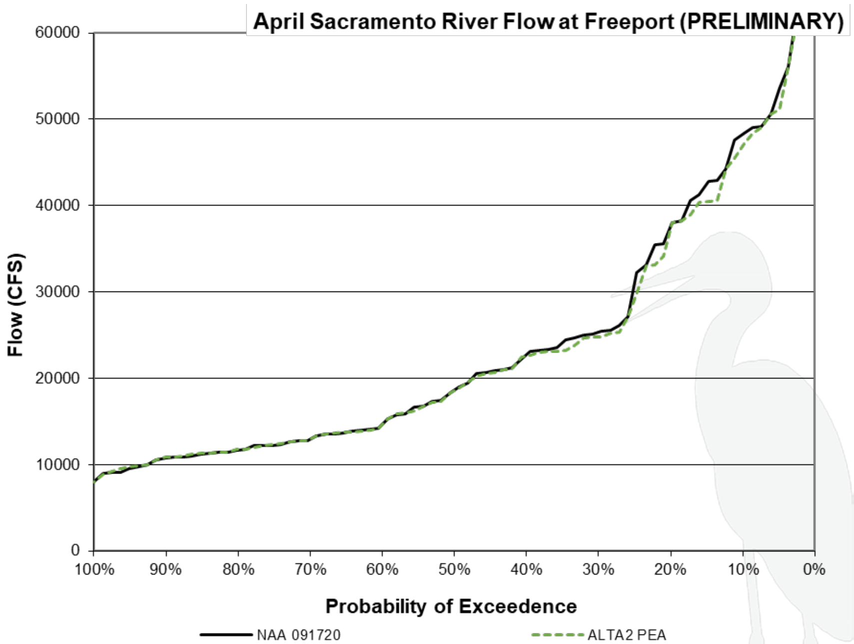

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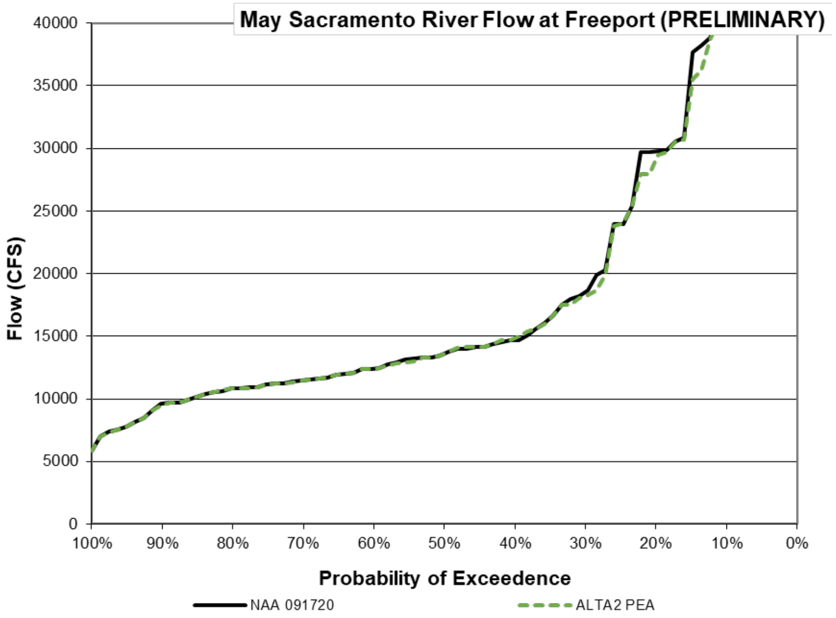

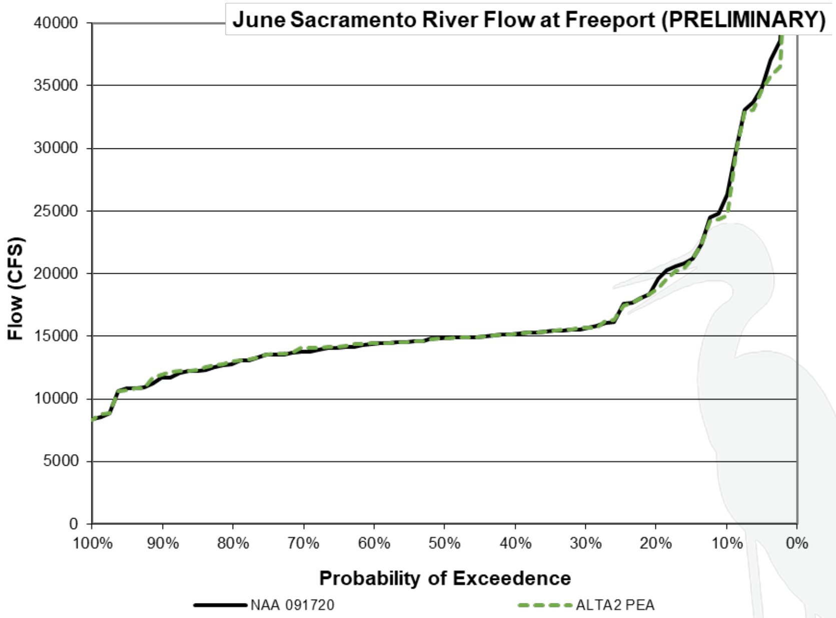

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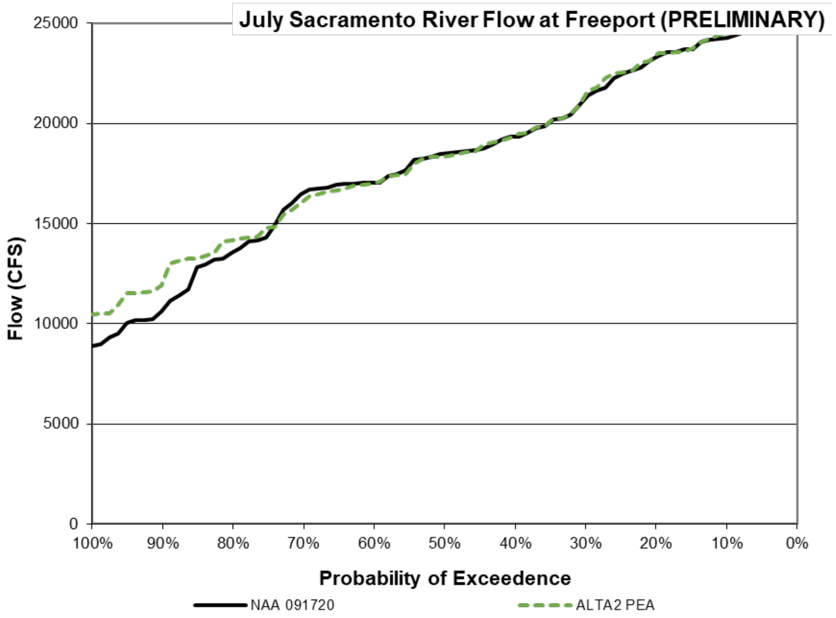

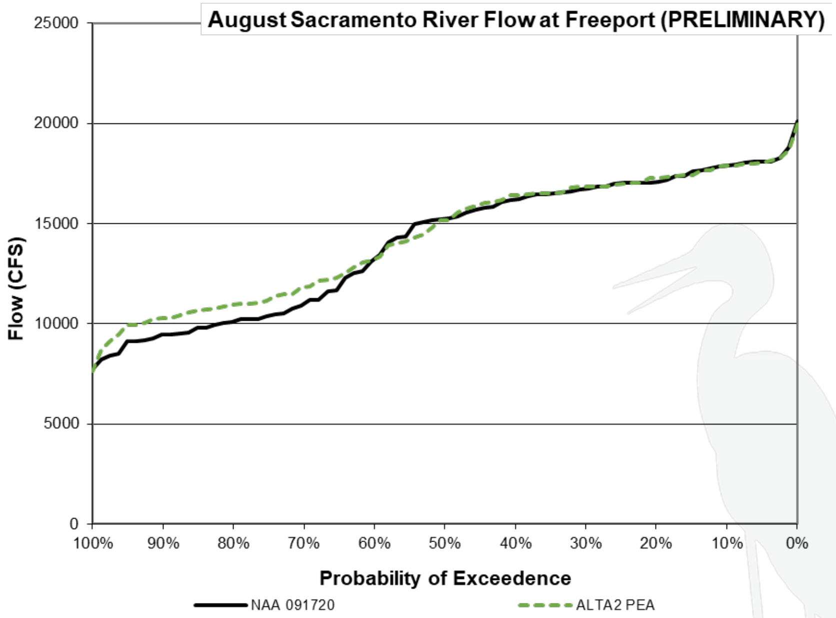

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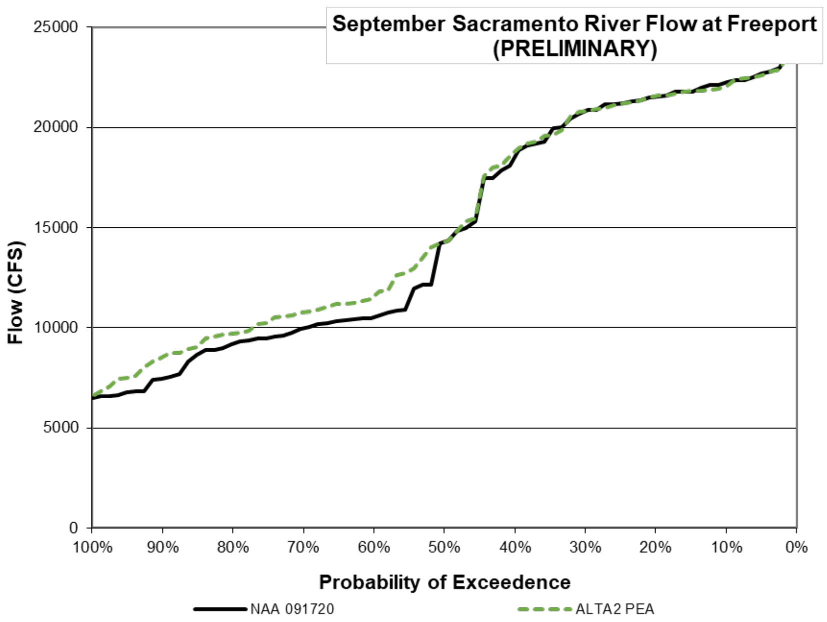
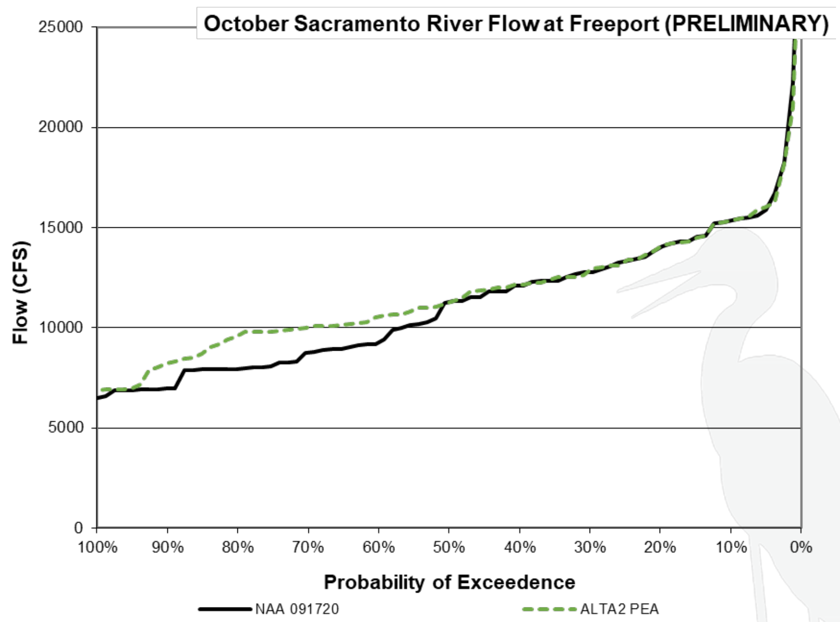
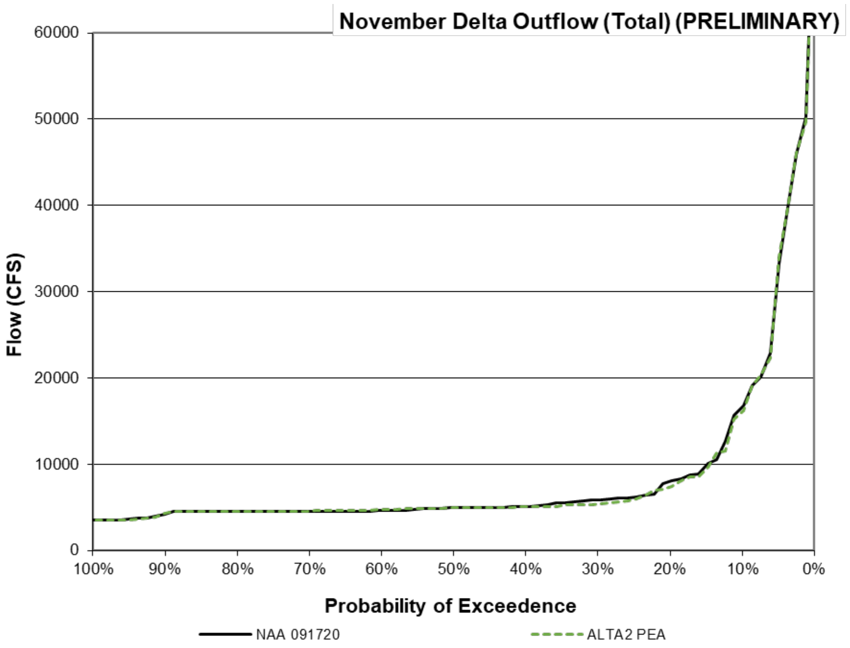
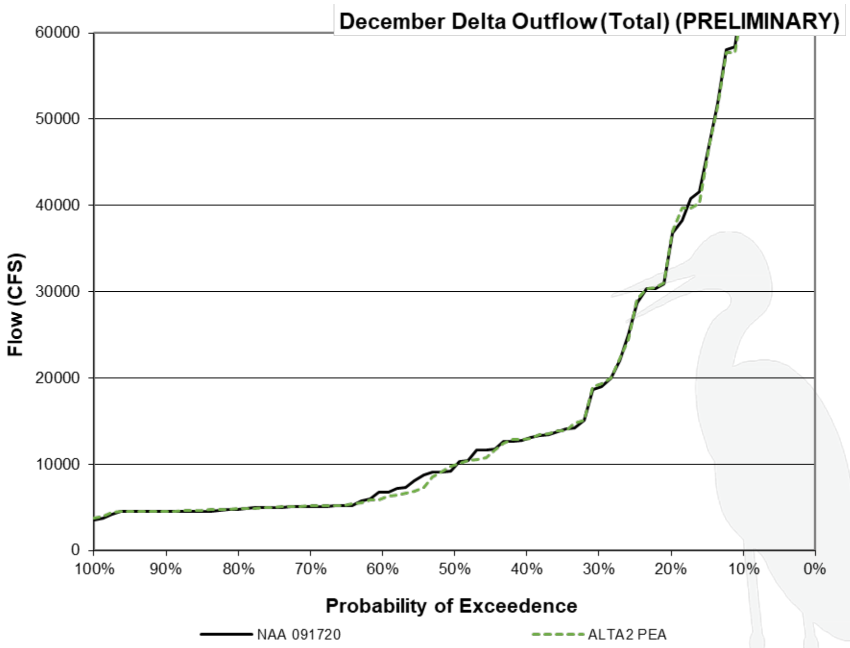




Delta Outflow





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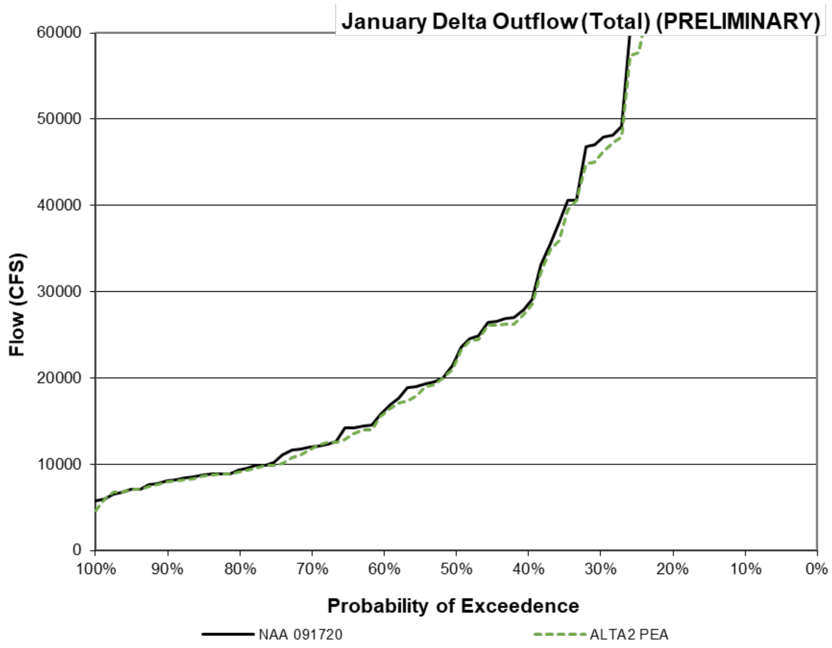

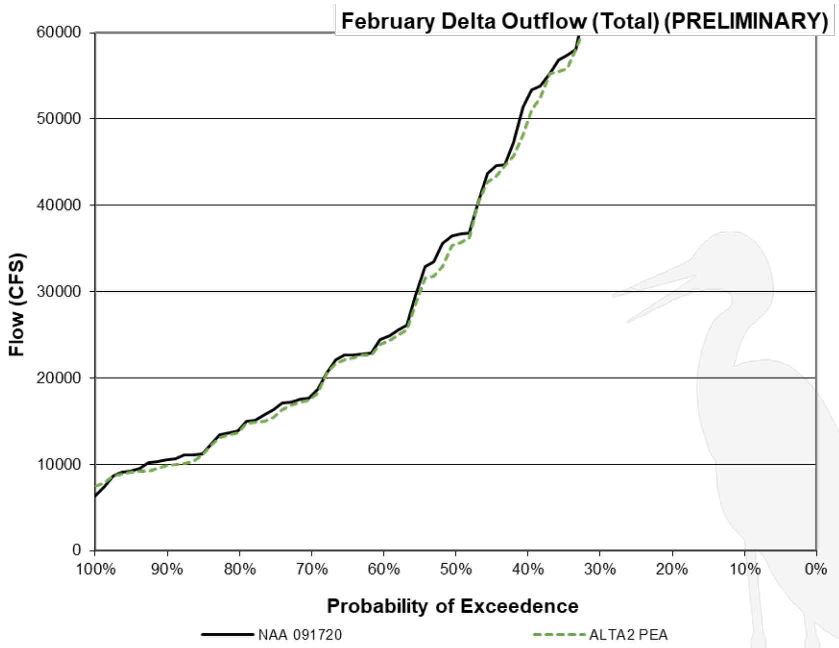

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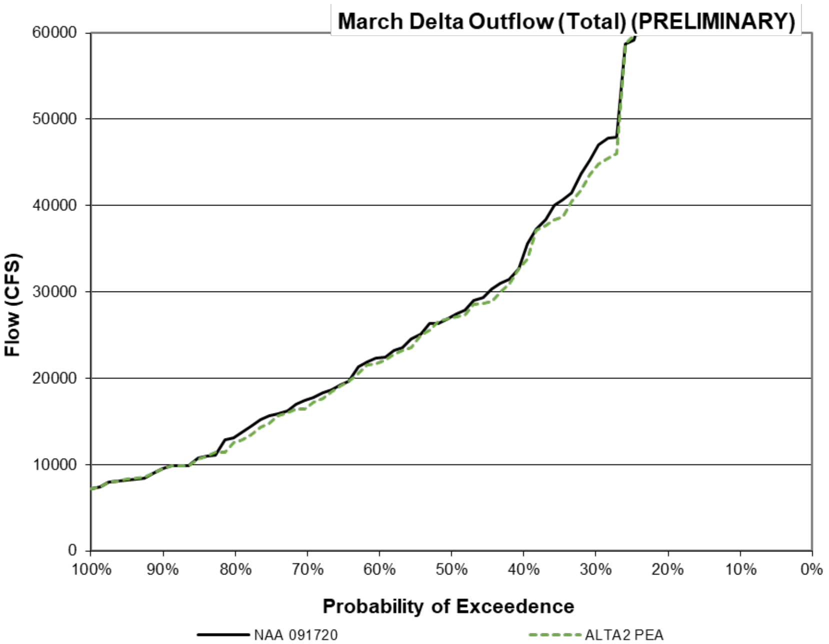
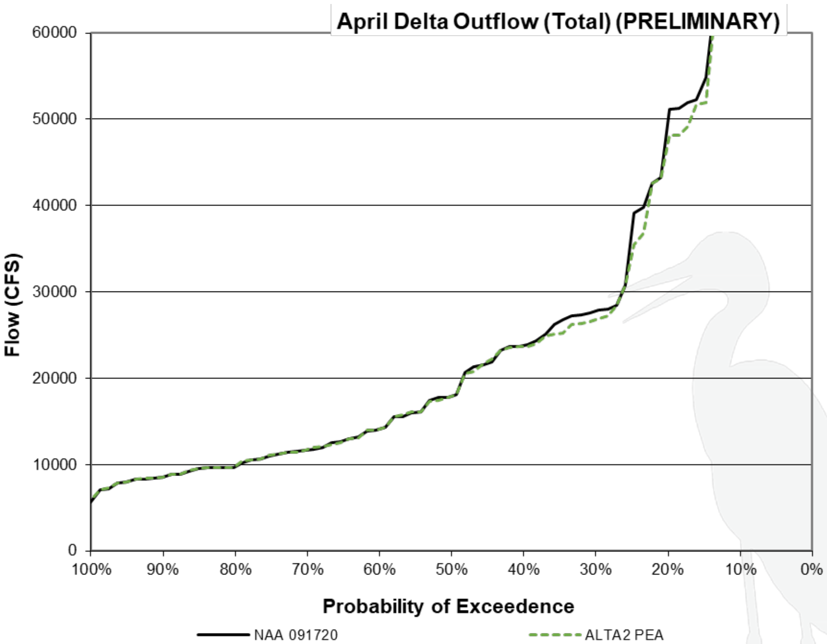
Delta Outflow





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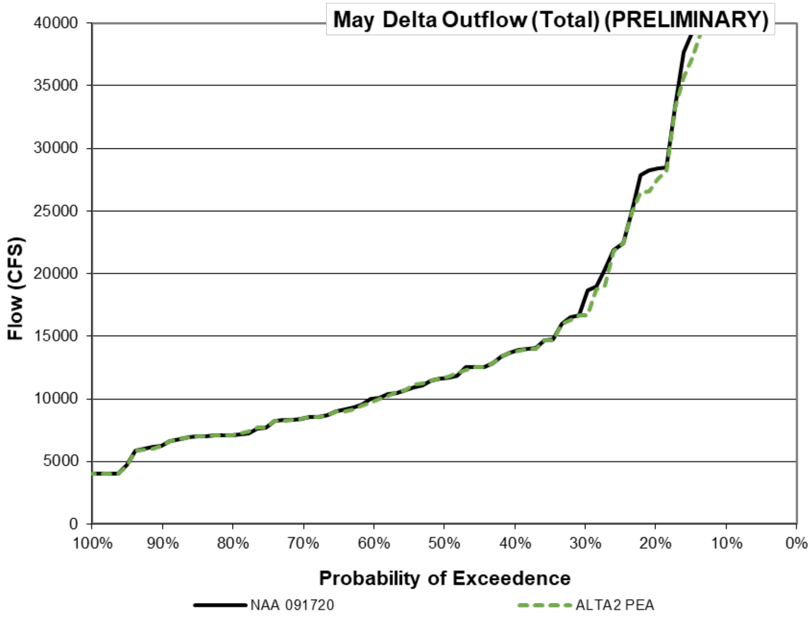

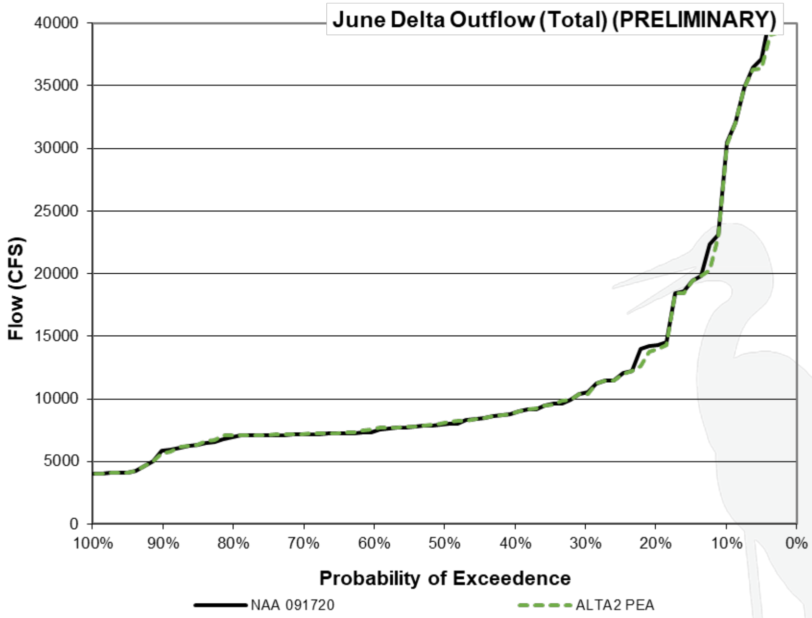

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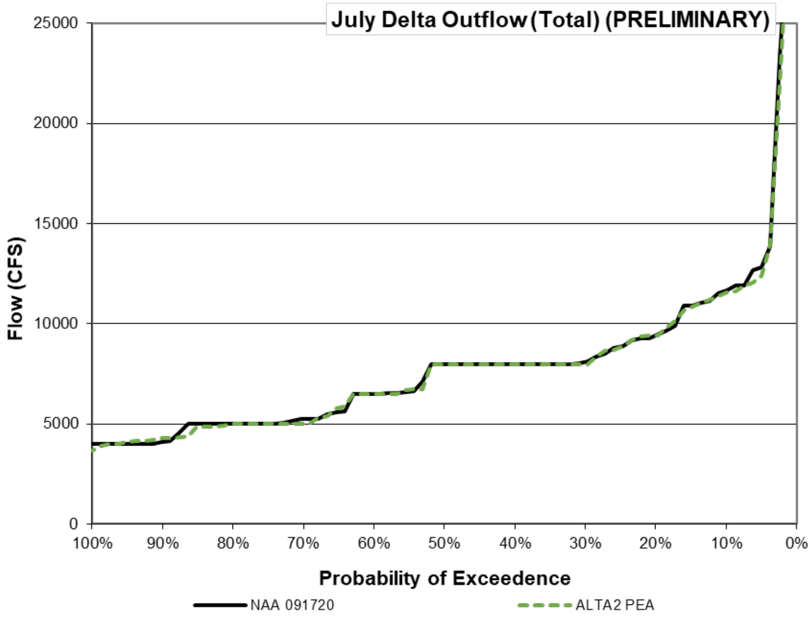

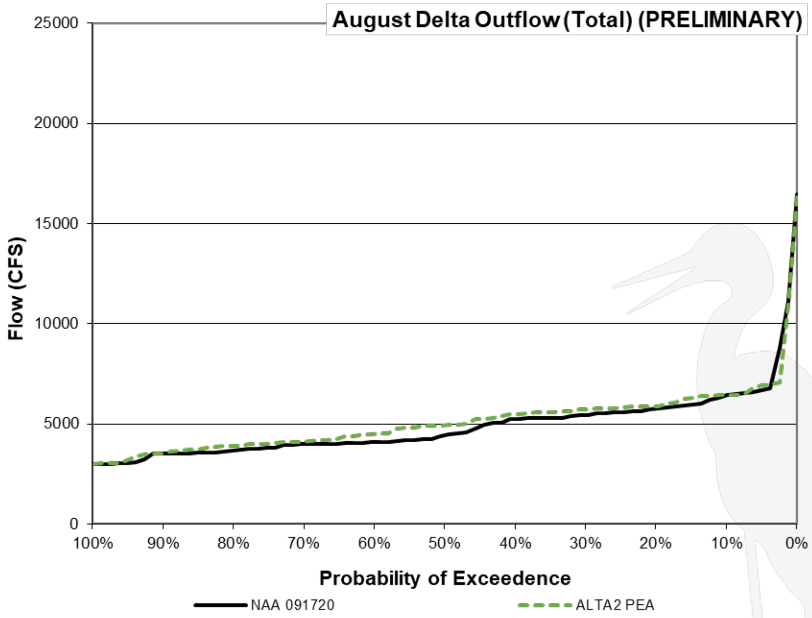

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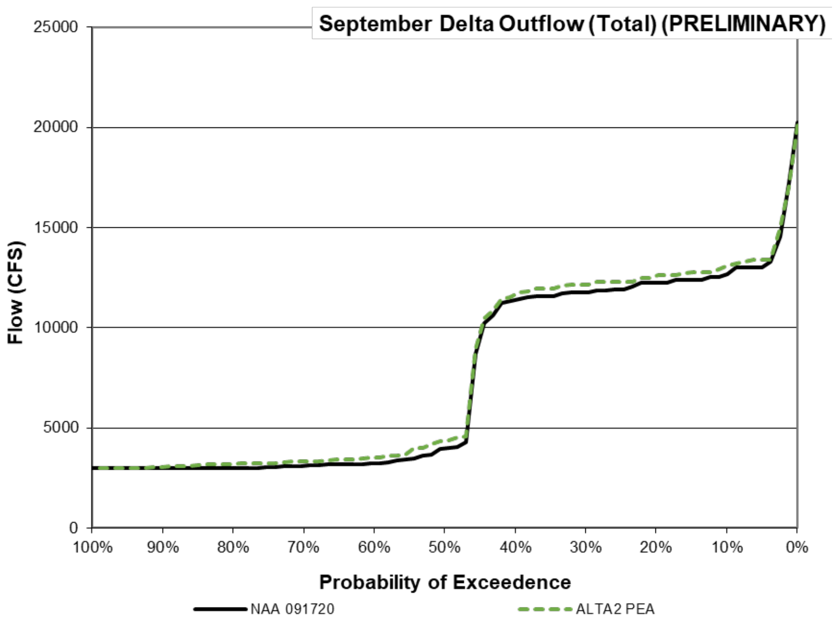
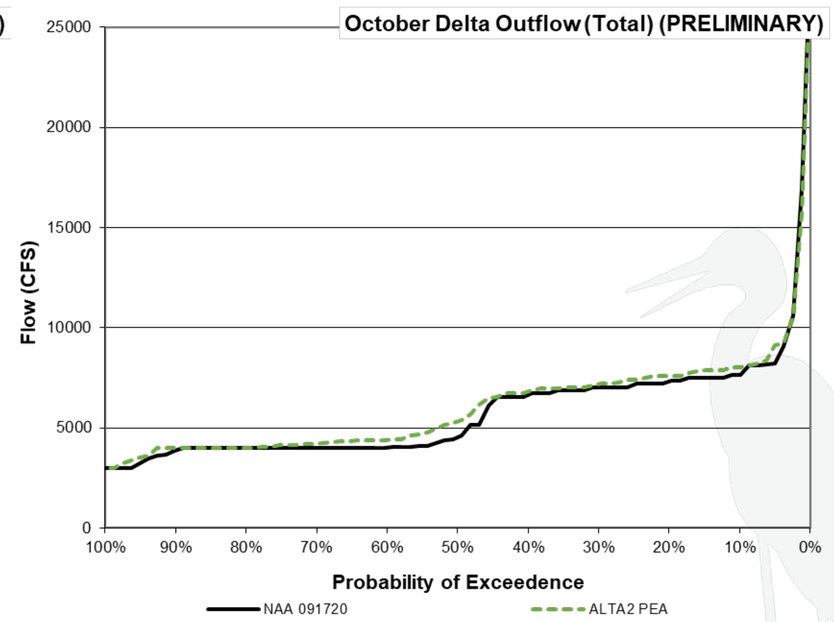
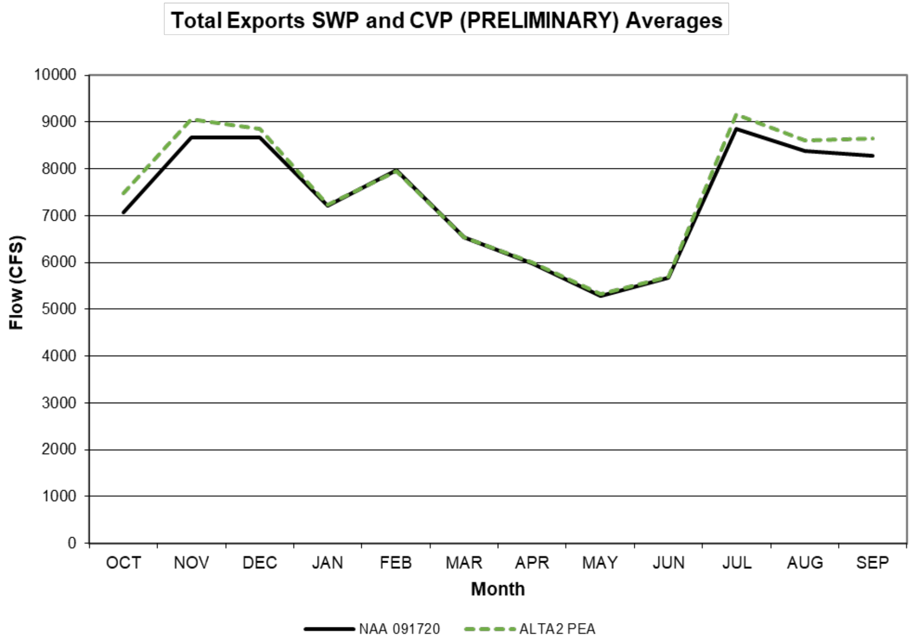
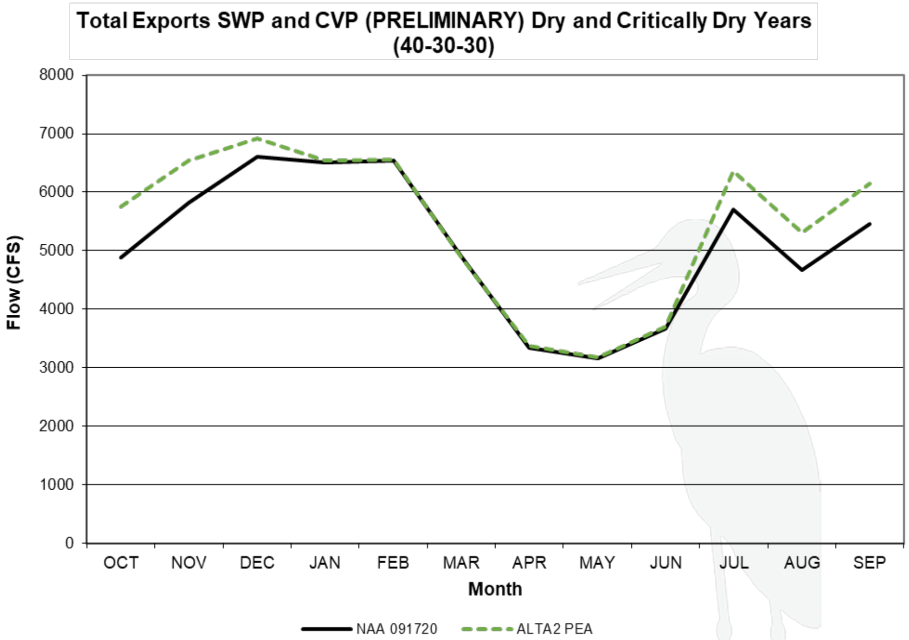




Delta Exports

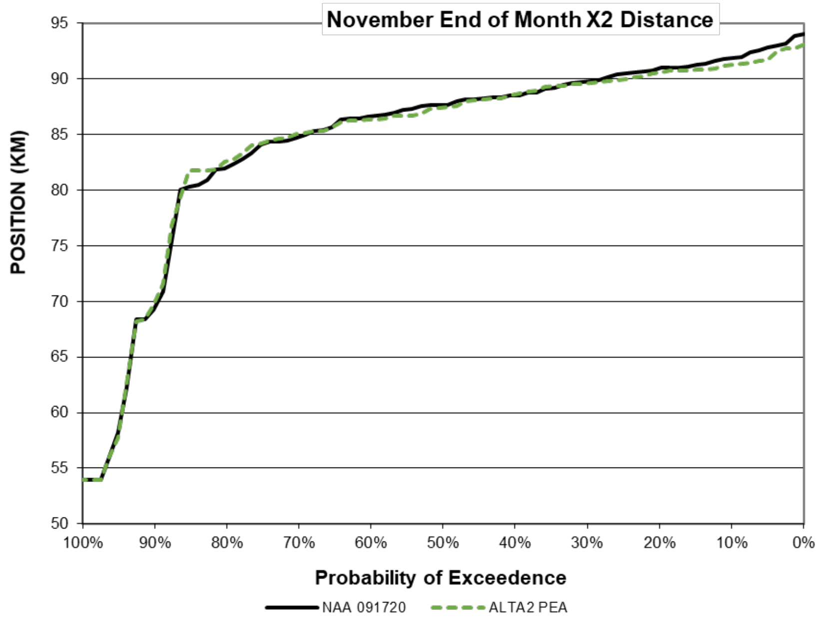




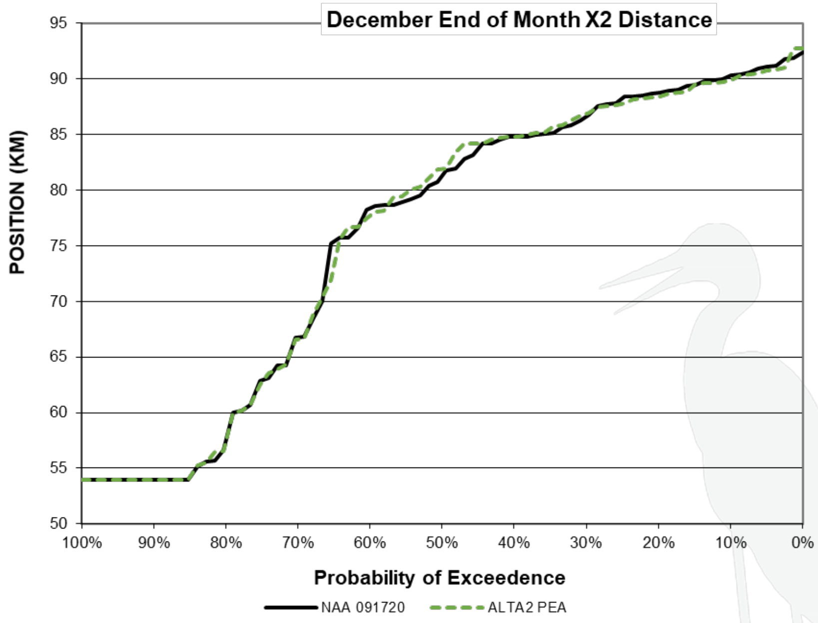
X2 Results

Preliminary Effects Analysis

X2



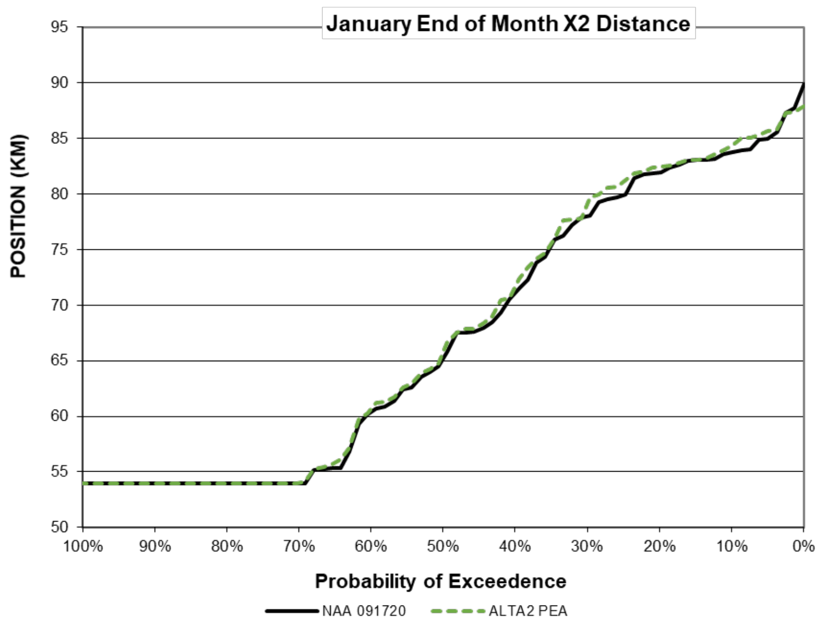
November End of Month X2 Distance
POSITION (KM)
95
90
85
80
75
70
65
60
55
50
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Probability of Exceedence
NAA 091720
ALTA2 PEA



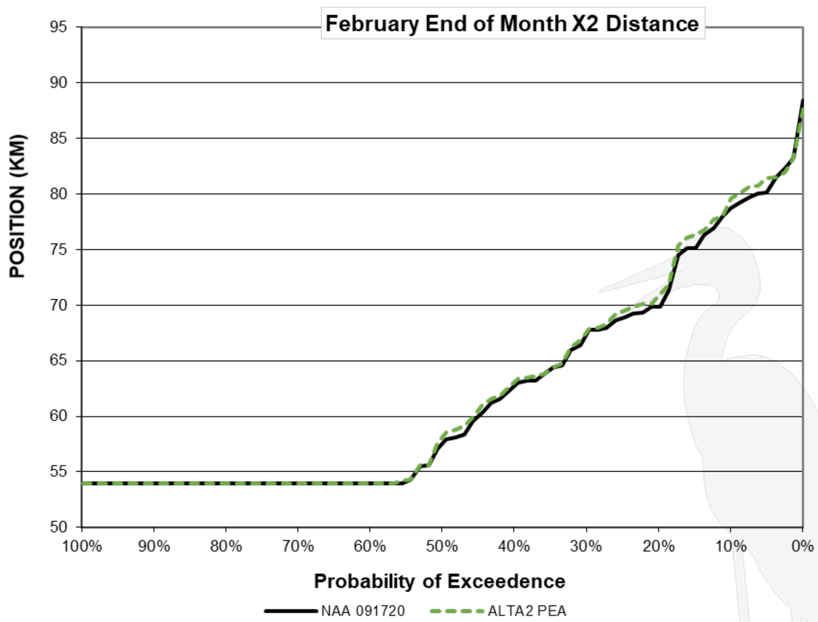
December End of Month X2 Distance
POSITION (KM)
95
90
85
80
75
70
65
60
55
50
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Probability of Exceedence
NAA 091720
ALTA2 PEA

Sites

X2



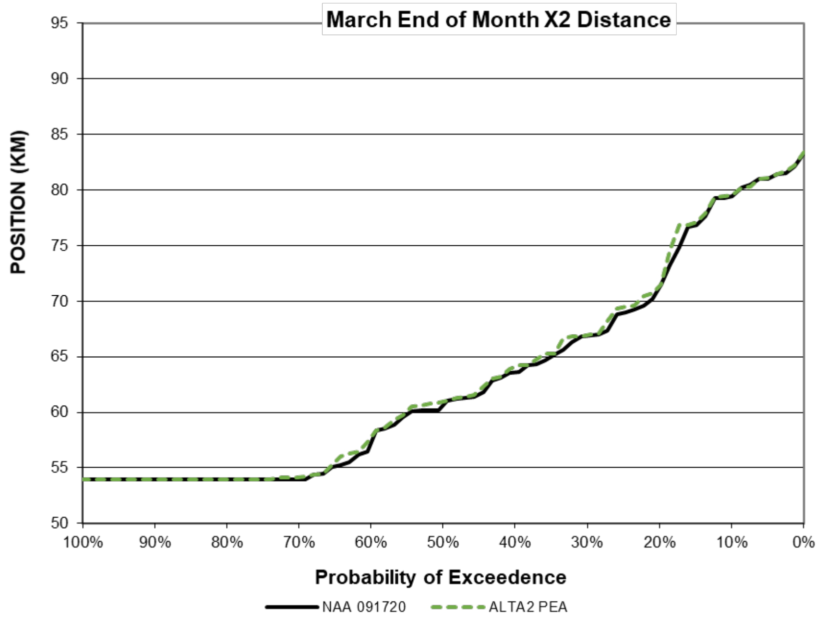
January End of Month X2 Distance
POSITION (KM)
95
90
85
80
75
70
65
60
55
50
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Probability of Exceedence
NAA 091720
ALTA2 PEA



February End of Month X2 Distance
POSITION (KM)
95
90
85
80
75
70
65
60
55
50
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Probability of Exceedence
NAA 091720
ALTA2 PEA

Sites

X2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Probability of Exceedence
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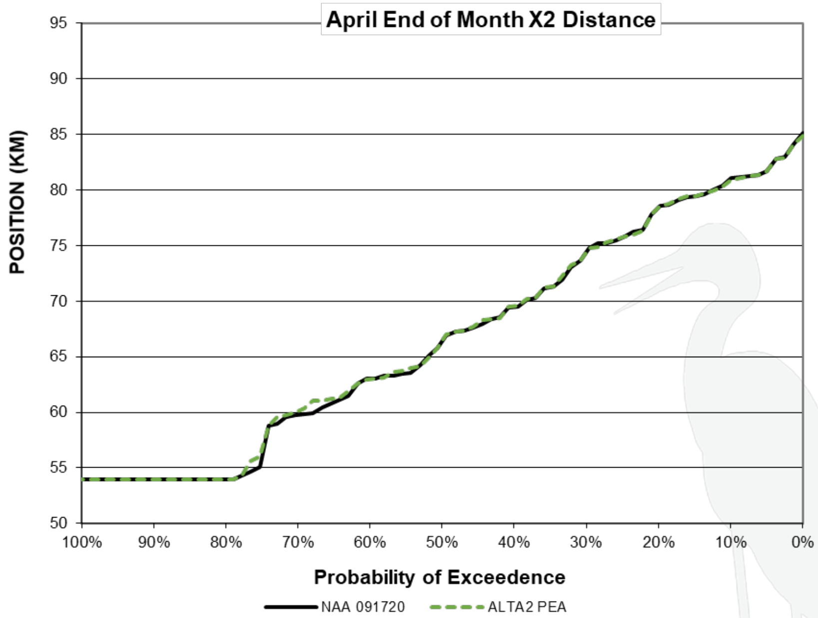
ALTA2 PEA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Probability of Exceedence
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ALTA2 PEA

Sites

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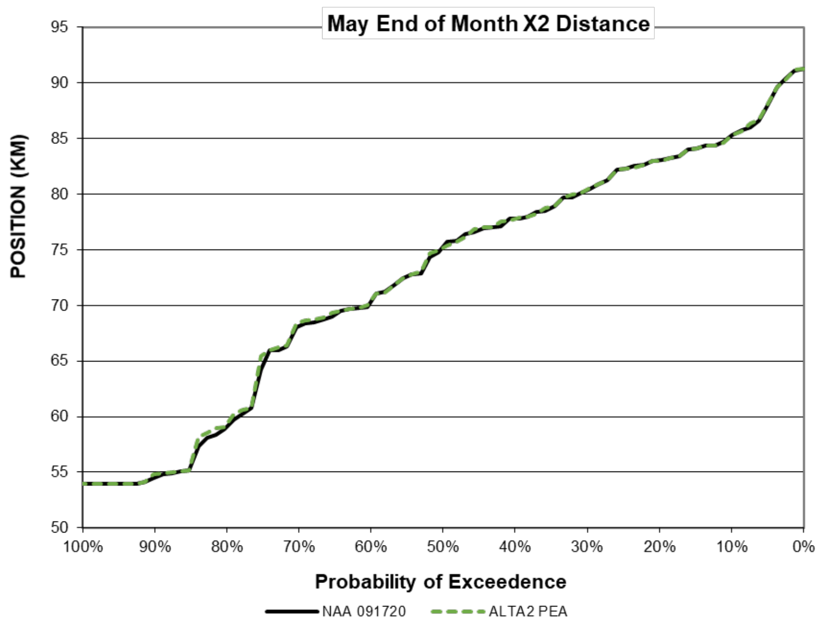
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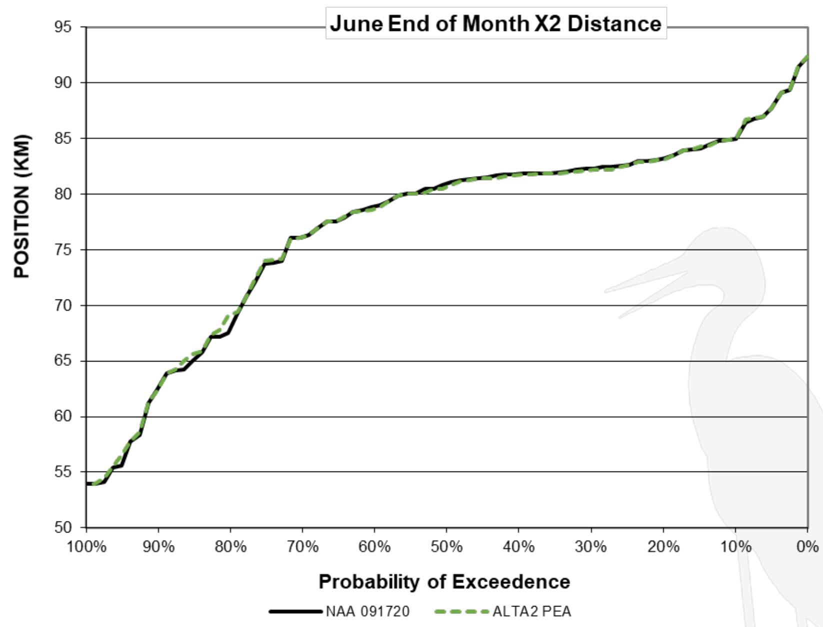
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Probability of Exceedence
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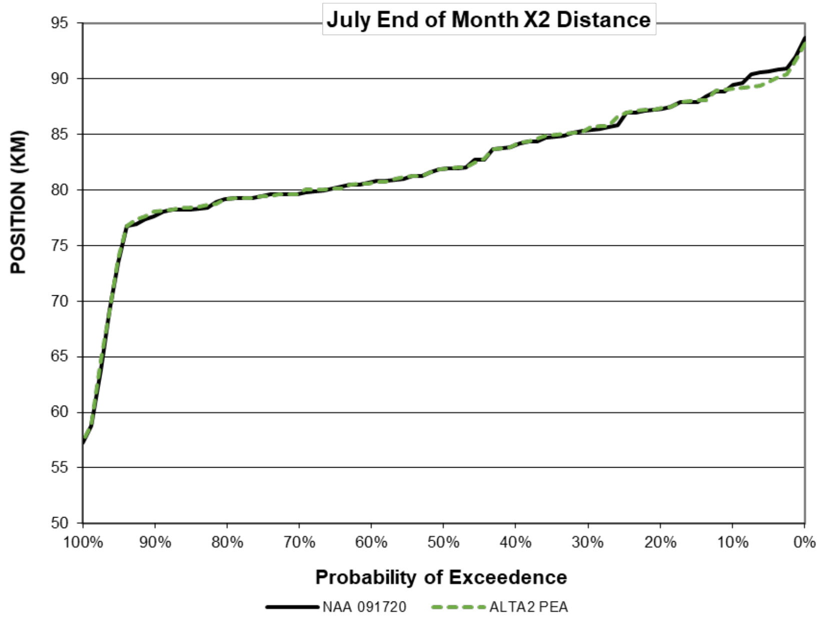
ALTA2 PEA

X2



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Probability of Exceedence
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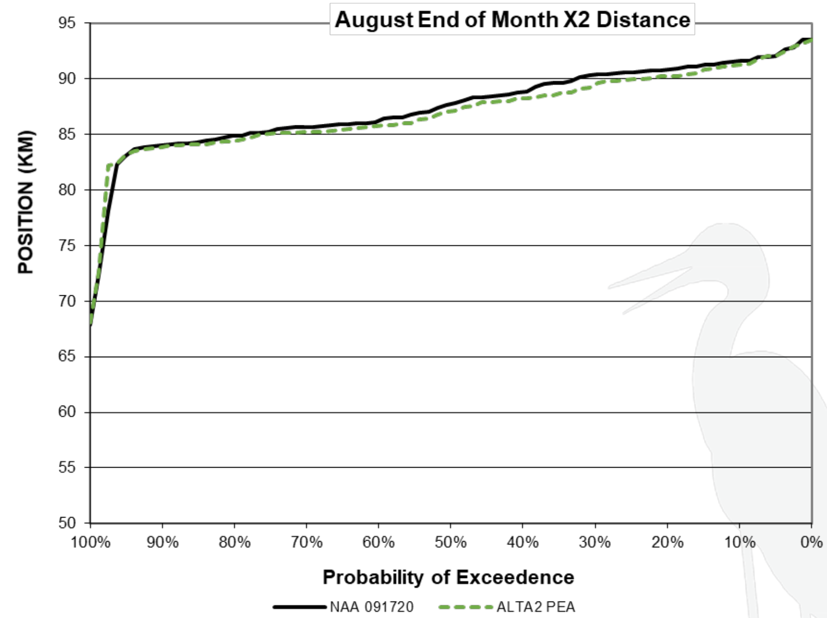
ALTA2 PEA



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Probability of Exceedence
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ALTA2 PEA

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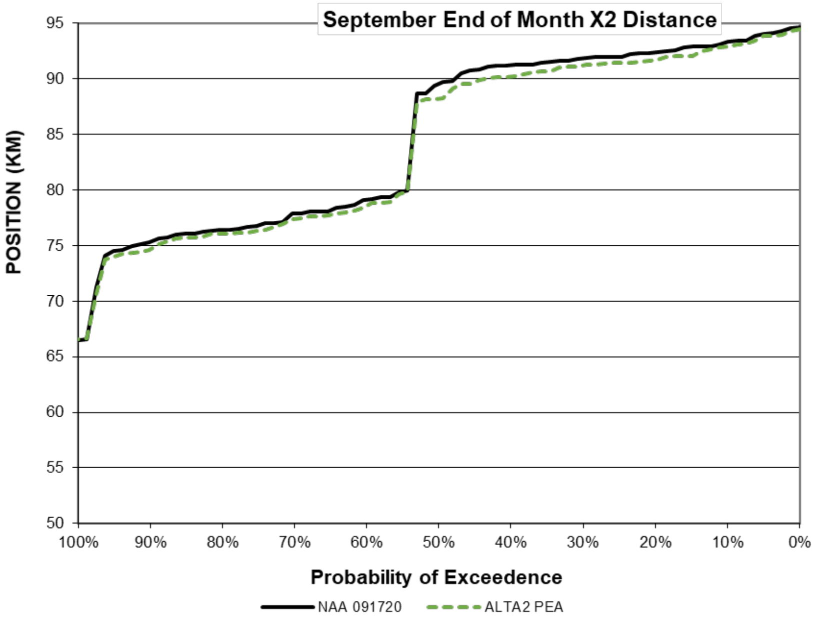
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Probability of Exceedence
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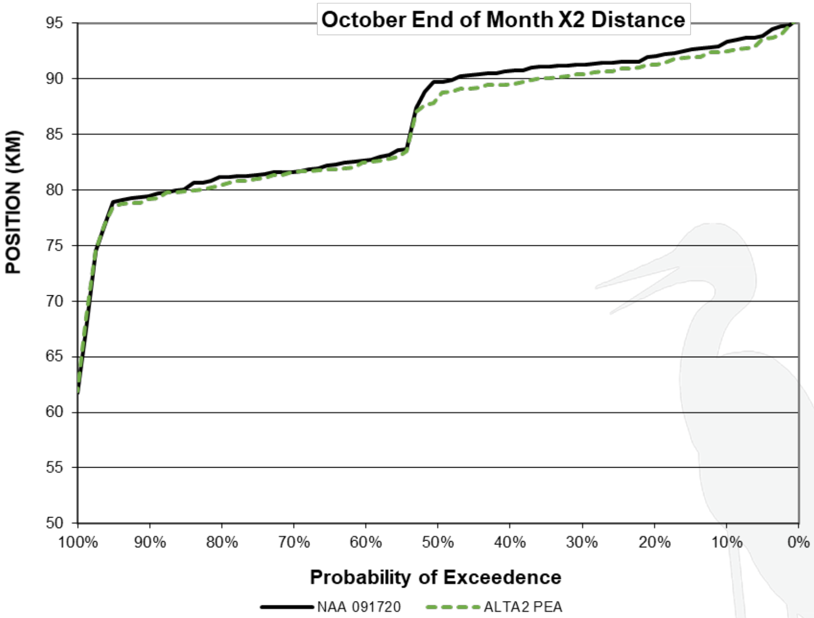
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POSITION (KM)
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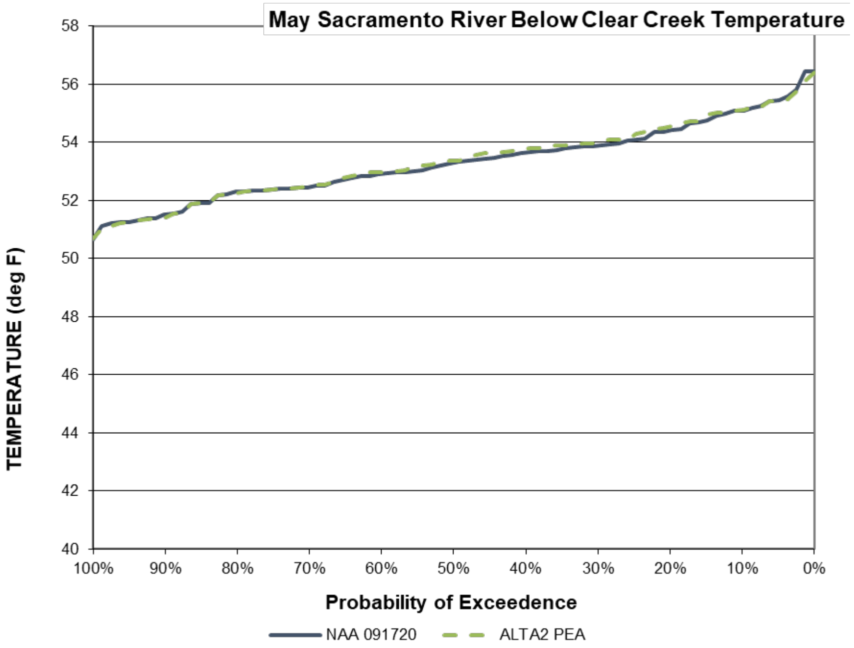
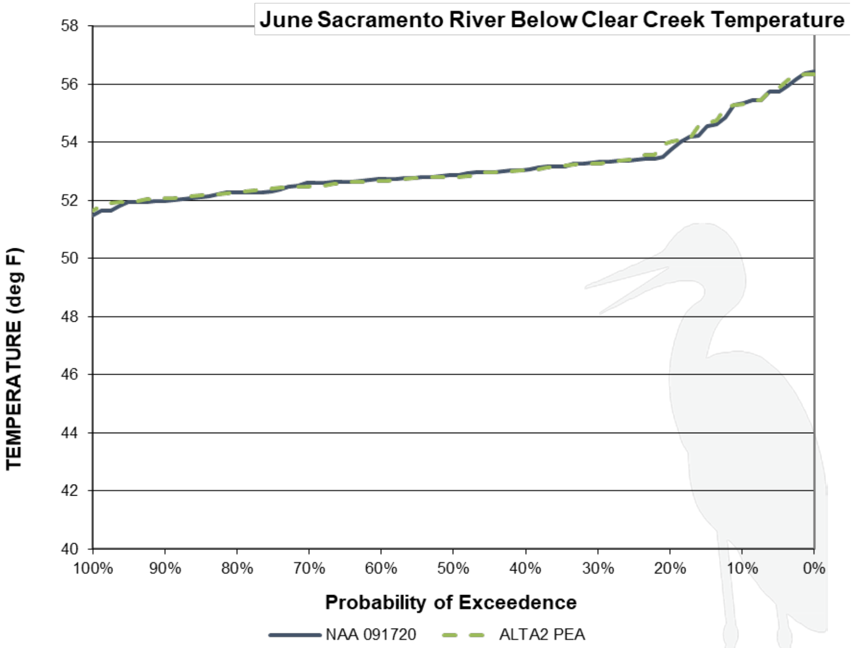
Probability of Exceedence
NAA 091720
ALTA2 PEA

Temperature Results

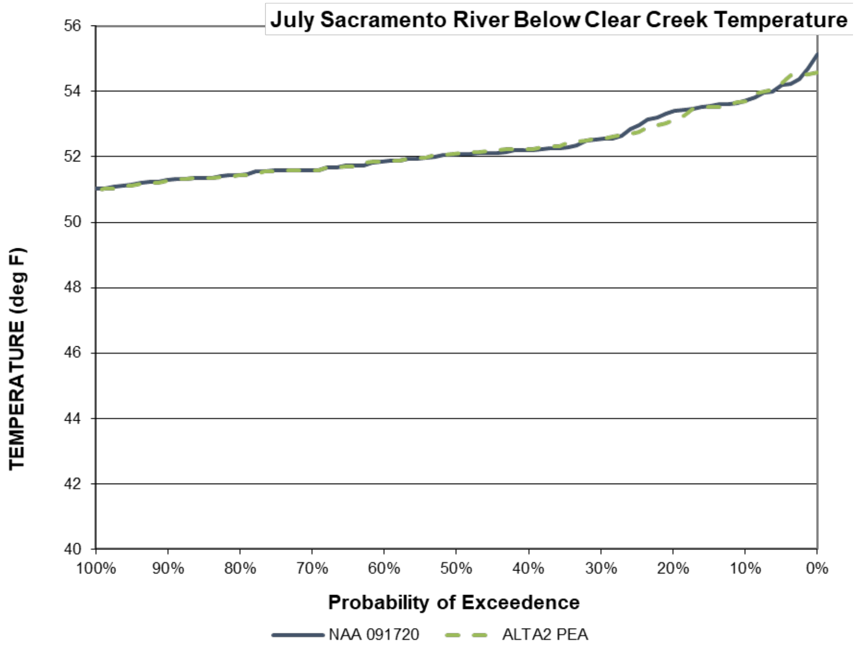
Preliminary Effects Analysis

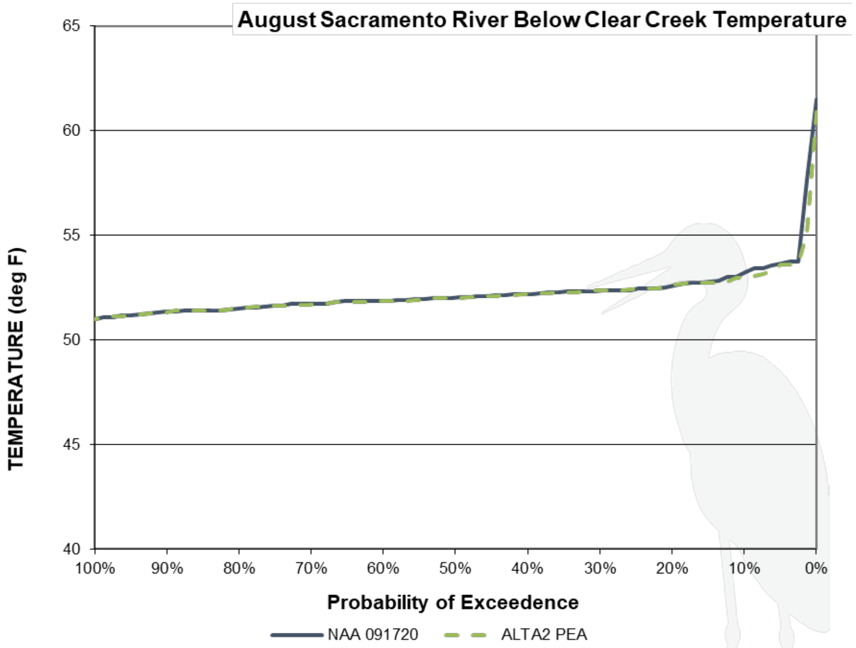
Sacramento River below Clear Creek Temperature



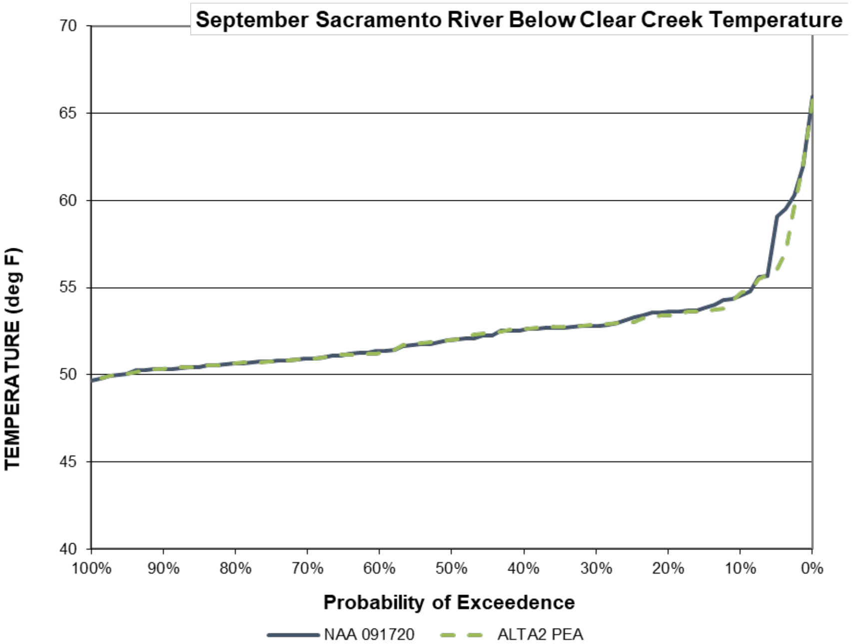


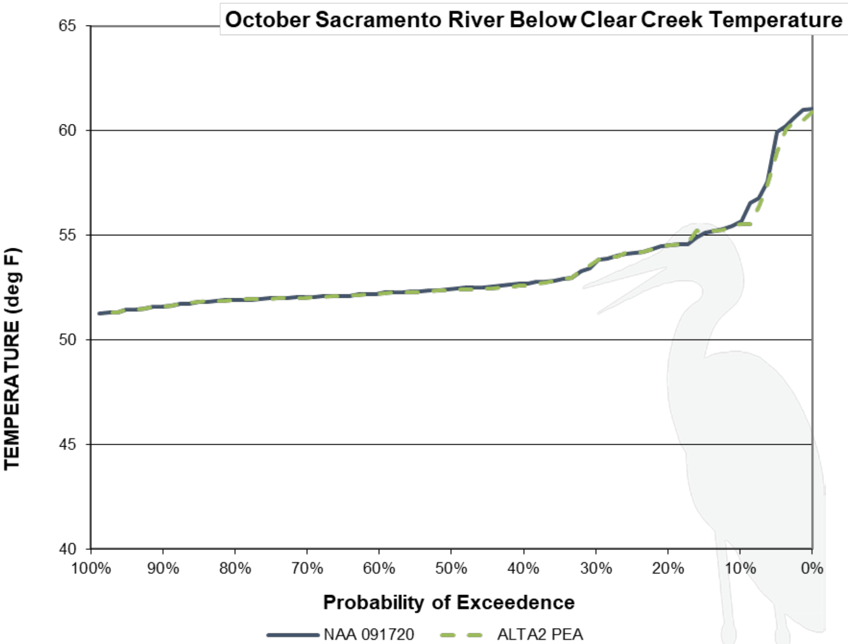
Sacramento River below Clear Creek Temperature





Sacramento River below Clear Creek Temperature

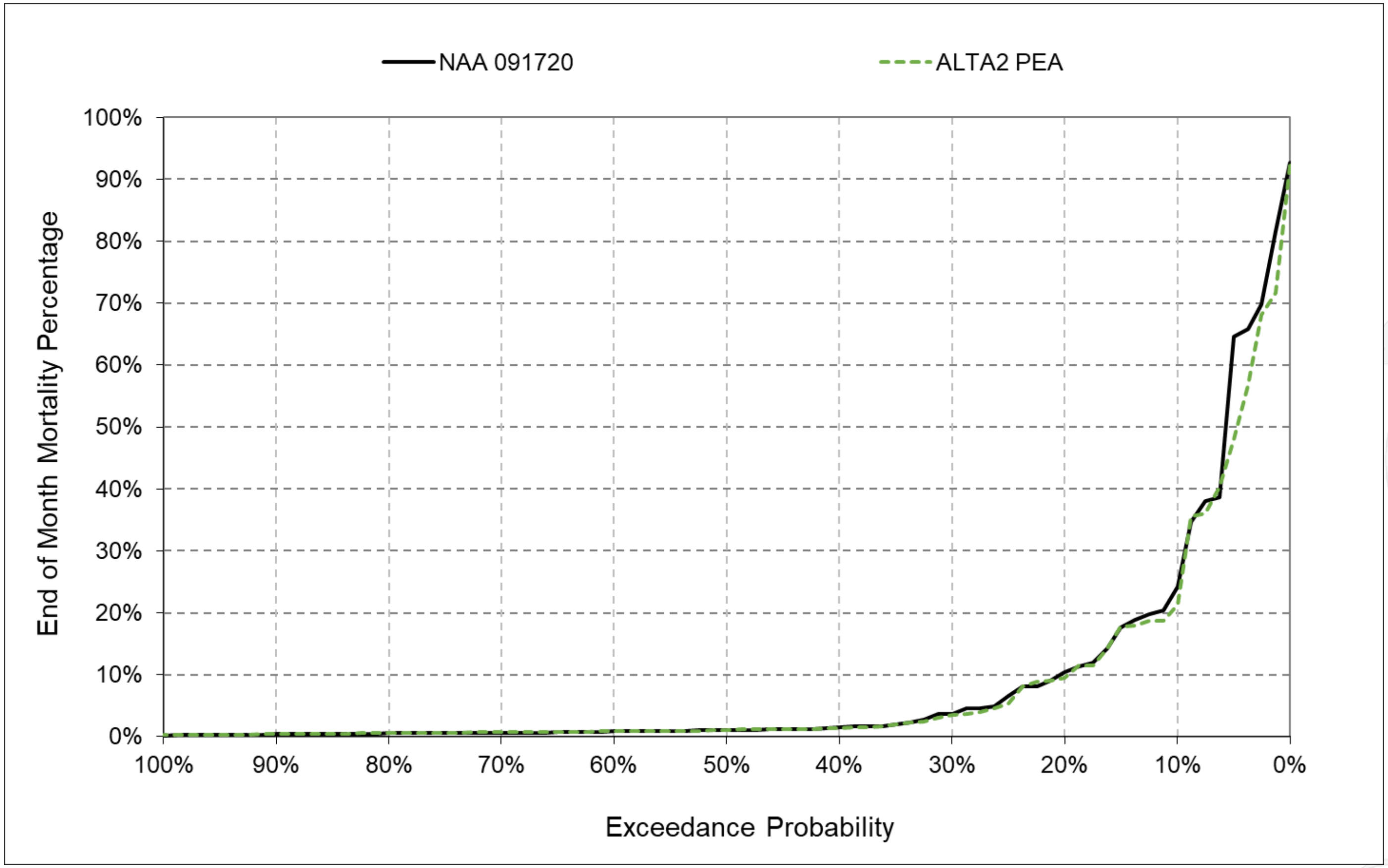




Temperature-Based Early Life Stage Mortality Results

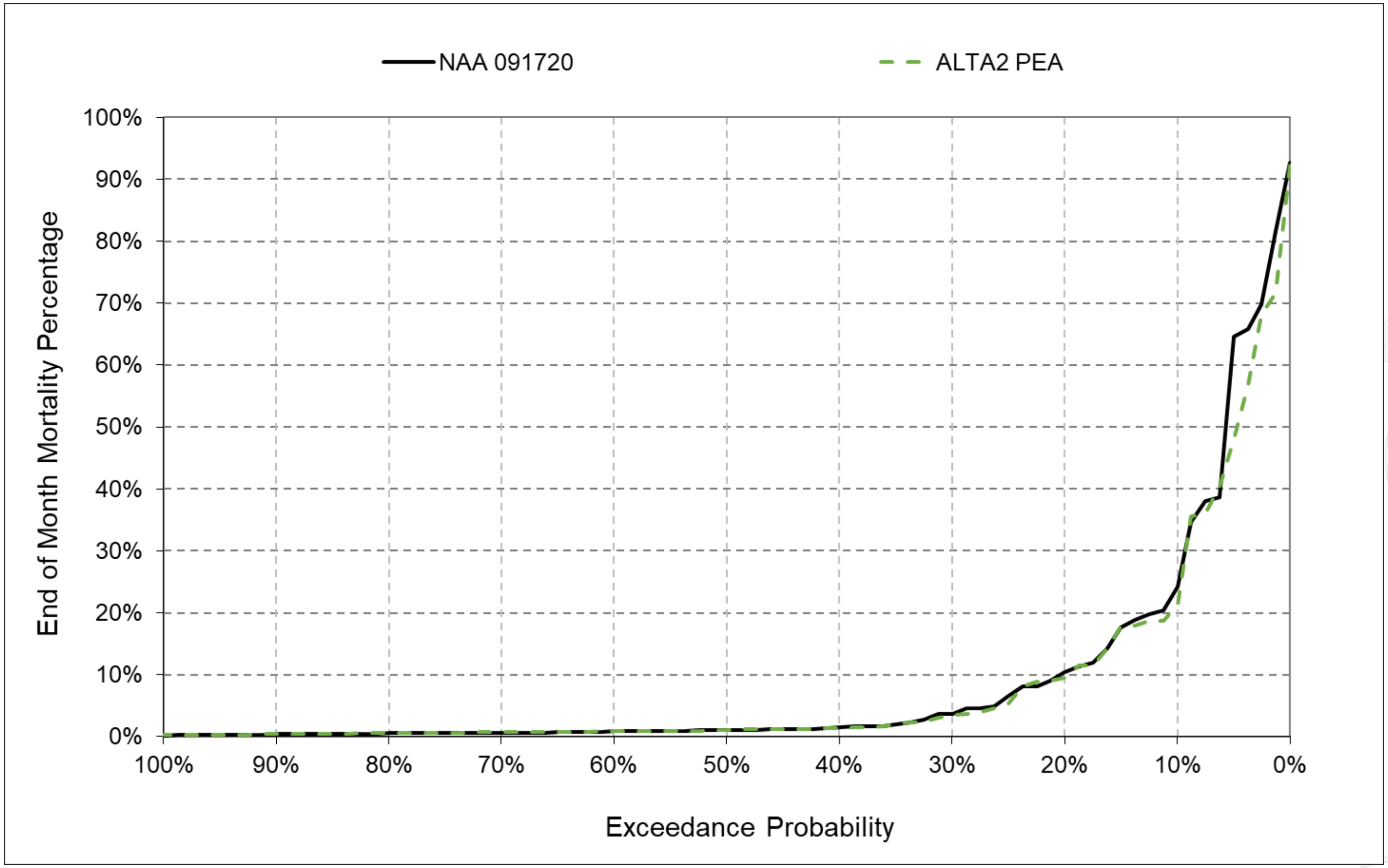
Preliminary Effects Analysis

Anderson Model Mortality



Sites

Martin Model Mortality



Questions?

Next Steps

SITES PROJECT AND MODELING UPDATE AND DISCUSSION- AQUATICS FOCUSED

OCTOBER 26, 2020

Objectives of Meeting

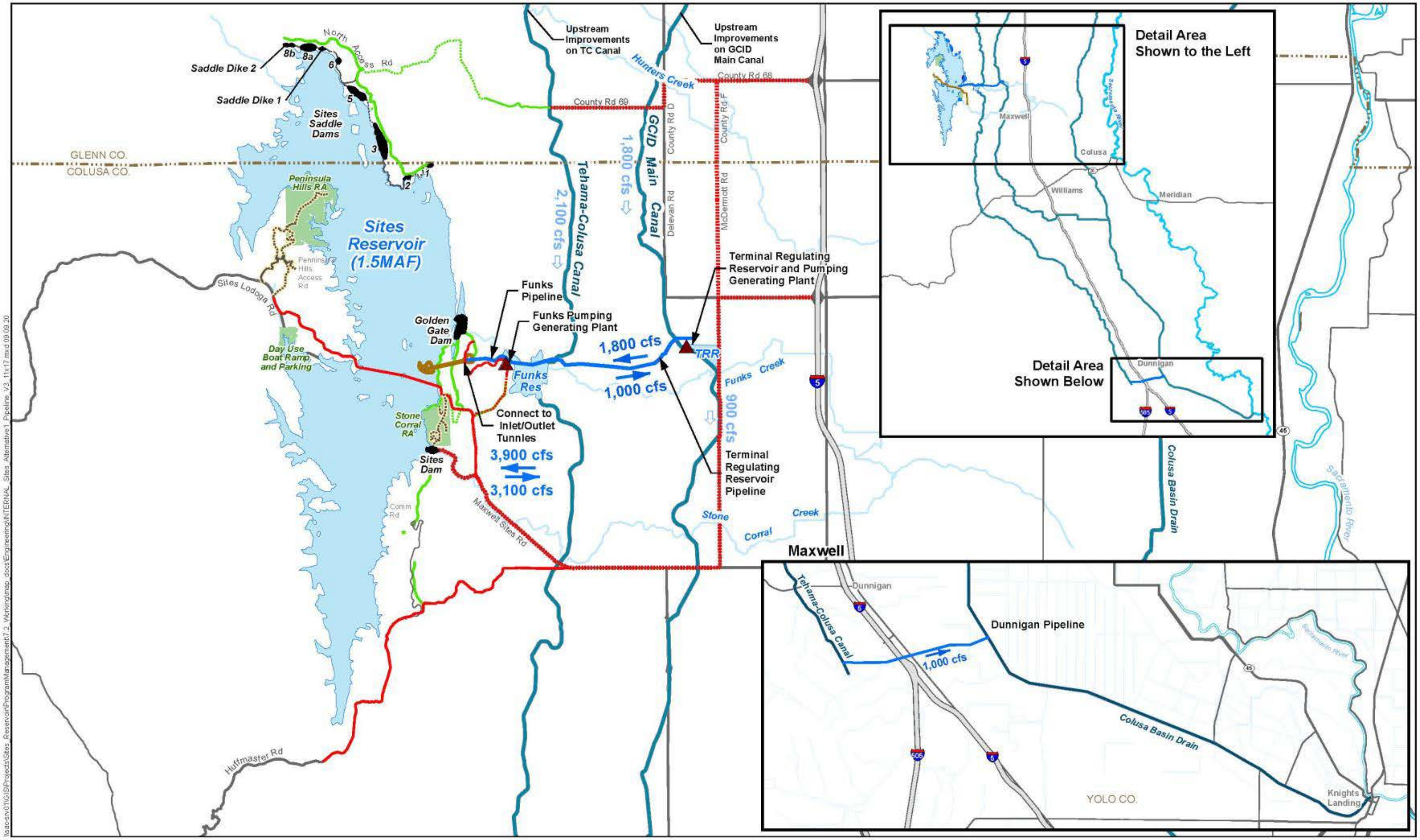
1. Provide general update on:
   - Revised project description
   - 2020 model update
2. Discuss next steps and timing

Revised Project Description

Major Revisions to Project

- Reservoir size reduced from 1.8 to 1.5 MAF
- No Delevan diversion, pipeline or outfall
  - Utilize existing at Red Bluff and Hamilton City pumping plants
  - Releases to T-C Canal to the CBD
  - New 1,000 cfs near Dunnigan
  - Alternative 2: a new 1,000 CFS outfall near Tyndall Landing
- Releases reduced from 1,500 to 1,000 cfs

Revised Project: Alternative 1



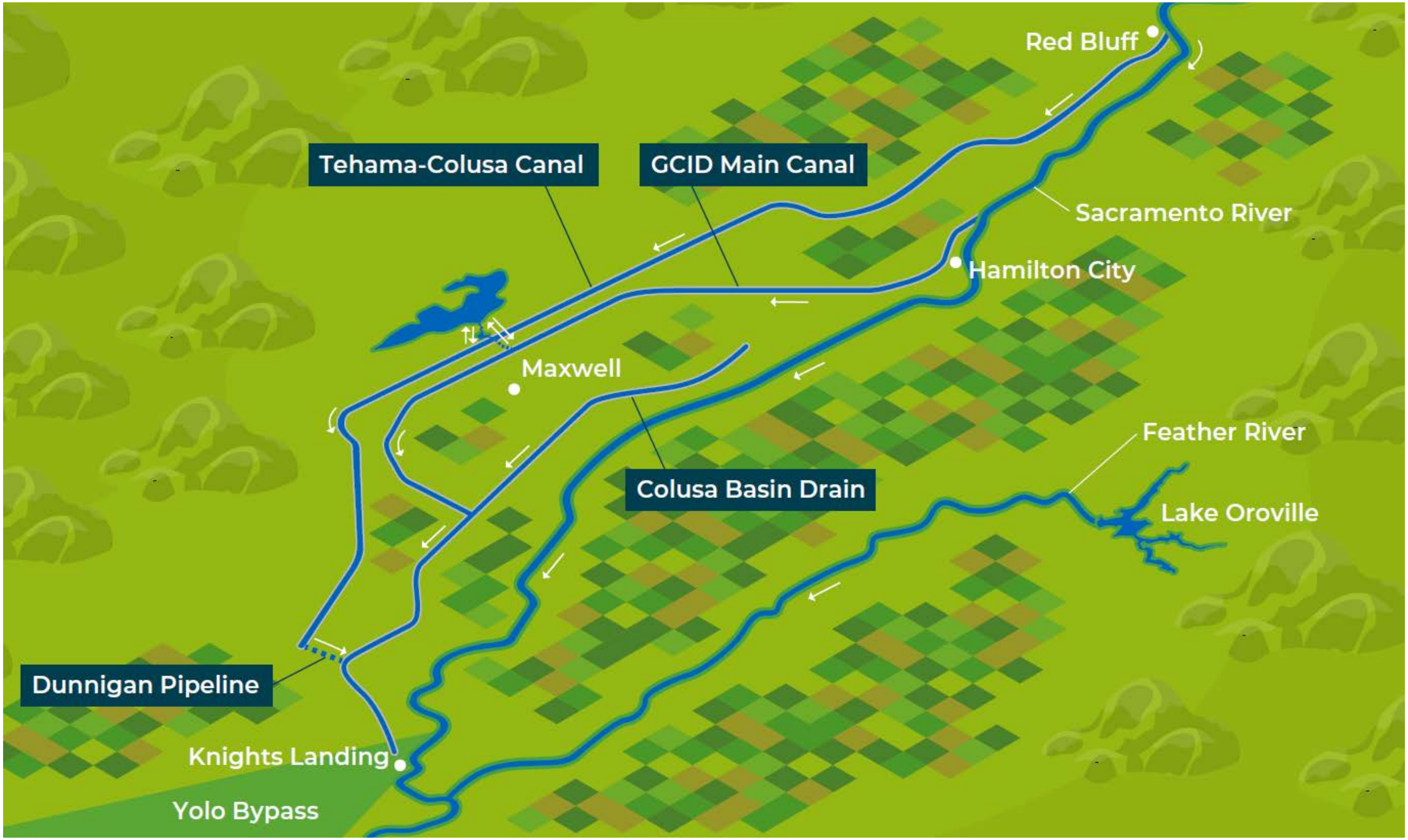
Legend

- Canal
- Pipeline
- Maintenance Access Road
- Construction/Maintenance Route
- New/Realigned Permanent Road
- Construction Route (Existing Road)
- Existing Roads
- Waterways

0 N 2
Scale in Miles

ALTERNATIVE 1

Revised Project: Alternative 1



Sites Project Model Updates

Agenda

- Updates to Sites Project sizing and facilities
- Updates to CalSim II model
- Preliminary Effects Analysis (PEA)
- Assumptions
- Results

Sites Facilities

- 1.5 MAF Reservoir
- 2 intakes
- Dunnigan Pipeline
  - Outlet: Connects Tehama-Colusa Canal to Colusa Basin Drain
  - Capacity: 1,000 cfs

Updates to CalSim II model

- Baseline model
  - 2019 BiOps at current climate
  - Updates, incorporating 2020 SWP ITP action are forthcoming
- Hydrology improvements
  - Bypass and weir flow modeling improved
- Federal participation
  - Coordination with Reclamation on-going
  - Evaluating options with Reclamation as a funding partner and/or Reclamation as an exchange partner at Shasta
- State Water Project participation
  - Coordination with DWR on-going
  - Assessing integration of project with Oroville

Sites

Preliminary Effects Analysis (PEA)

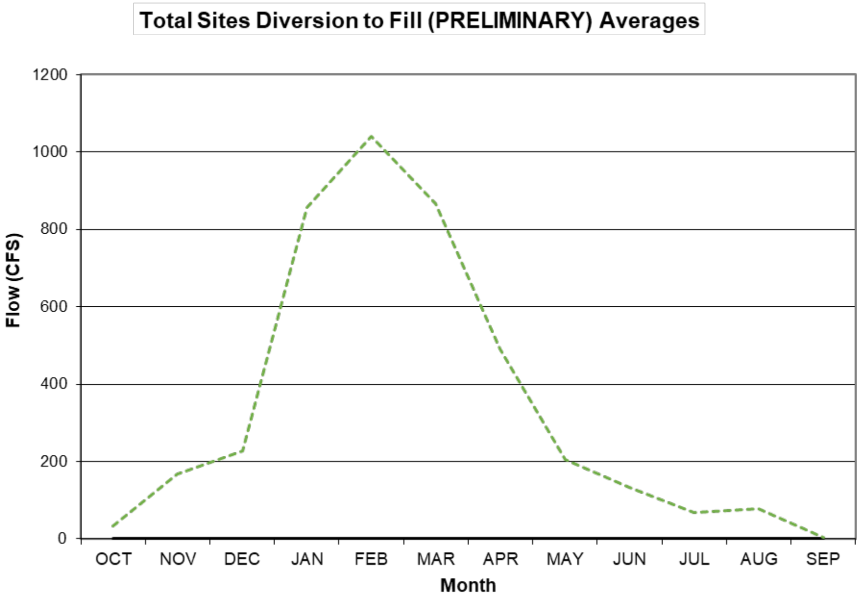
- Goal: Identify and resolve areas of concern for aquatic resources
- Approach: Assess effects of Sites with assumptions (below) that would identify potential impacts to aquatic resources
  - Larger reservoir size: 1.5 MAF
  - Federal investment: 91 TAF of CVP storage
  - State investment: 244 TAF of Prop 1
  - Modified WSIP diversion criteria (bypass criteria for Red Bluff, Hamilton City, Wilkins Slough; protection of pulse flows)
- Next steps: Review model results and refine operating criteria

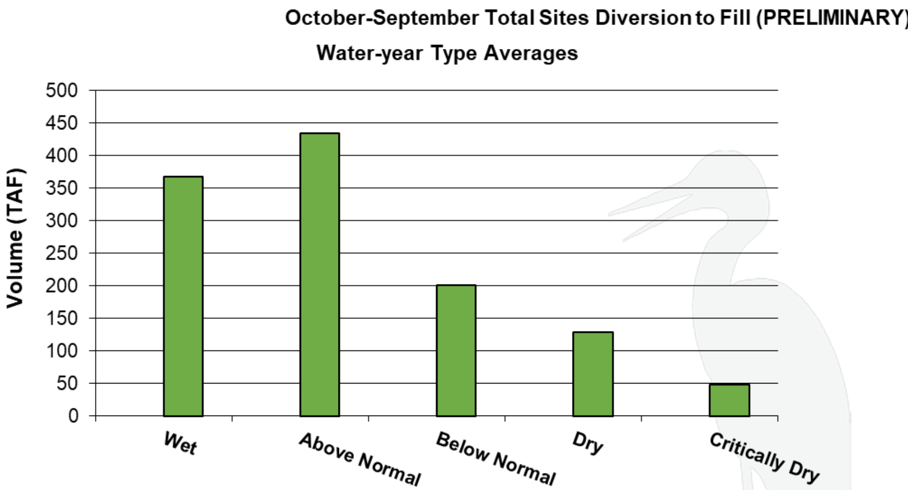
Sites Project Model Results

Results Summary

- Sites Diversions
- Sites Releases
- Sacramento River at Bend Bridge
- Sacramento River at Wilkins Slough
- Sacramento River downstream of Colusa Basin Drain
- Feather River at Mouth
- American River at H Street
- Sacramento River at Freeport
- Delta Outflow

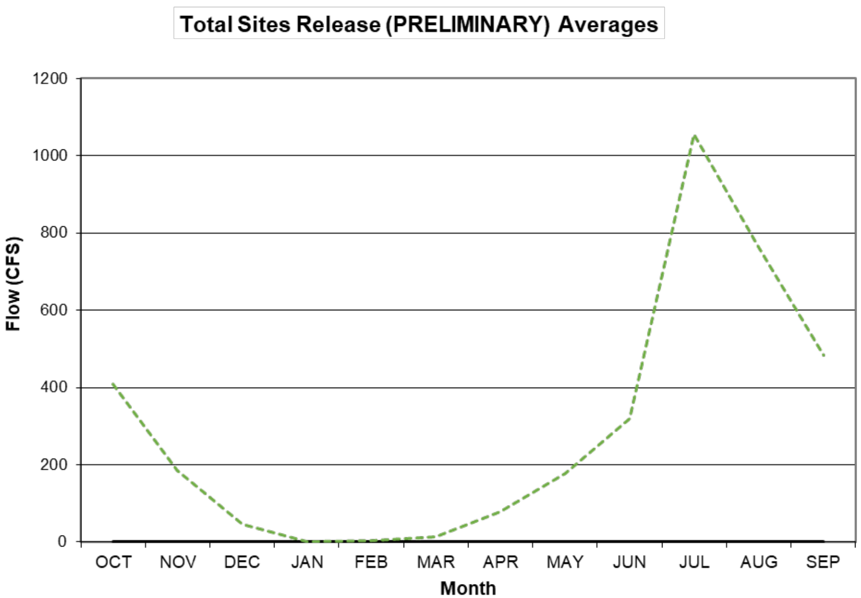
Sites Diversions

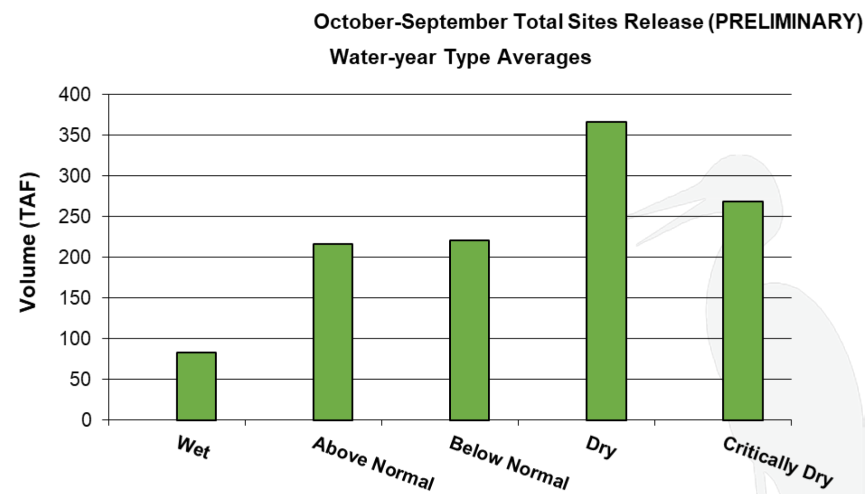




Output Parameter	Long-term Average (TAF)	Dry and Critical Average (TAF)
Diversions	244	97

Sites Releases

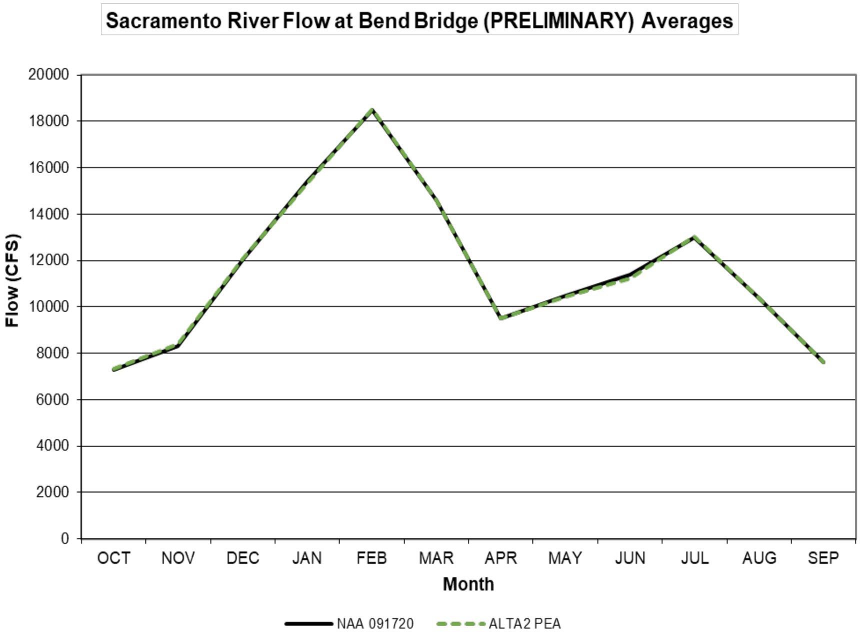


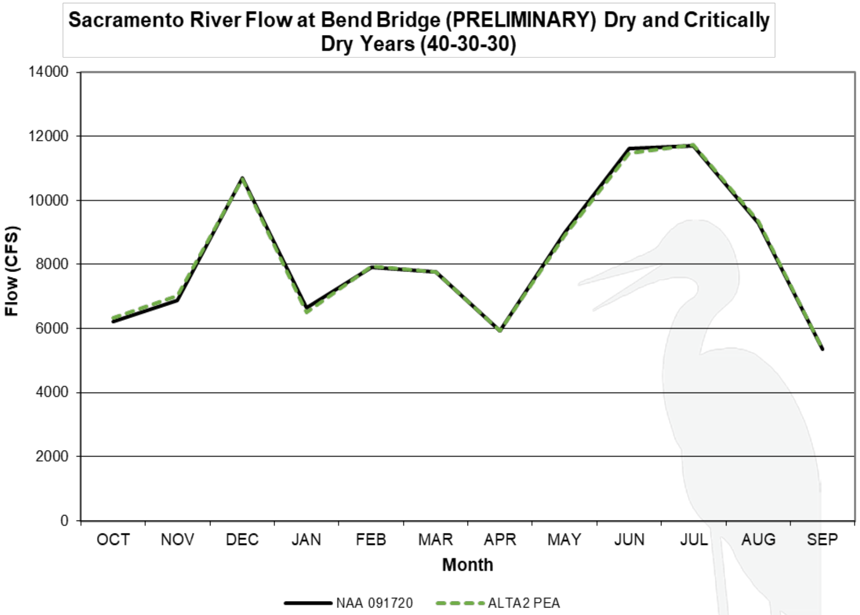


Output Parameter	Long-term Average (TAF)	Dry and Critical Average (TAF)[1]
Releases	216	337

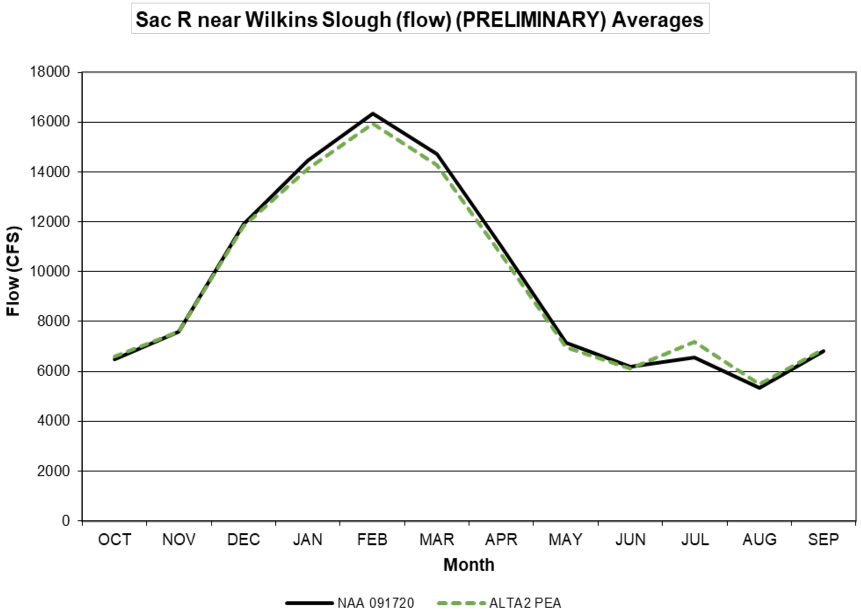
[1]Dry and Critically Dry releases are preliminary and subject to increase

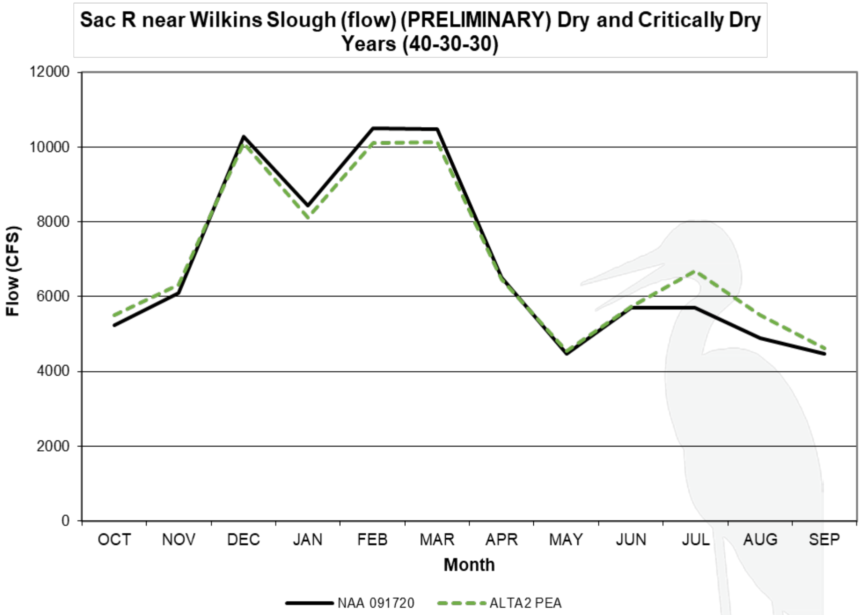
Sacramento River at Bend Bridge





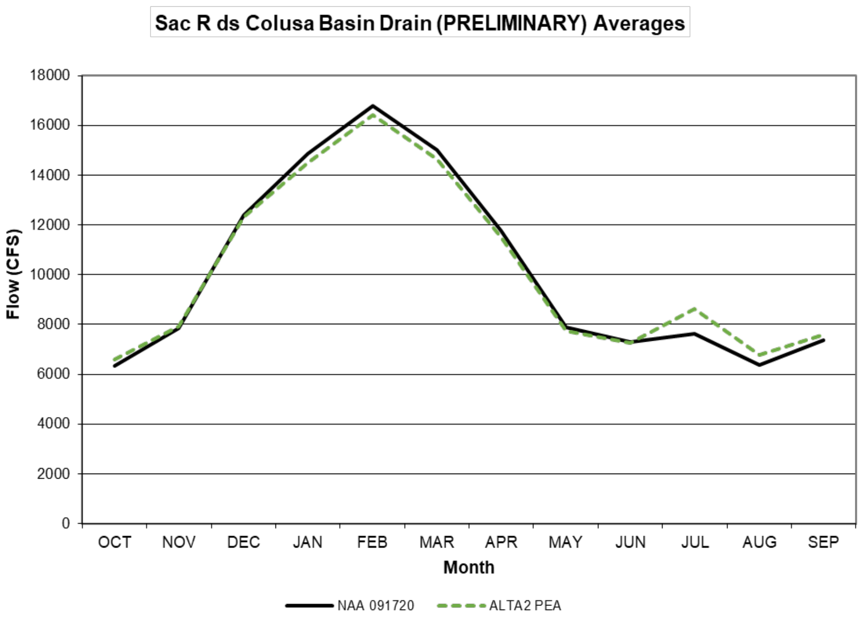
Sacramento River at Wilkins Slough

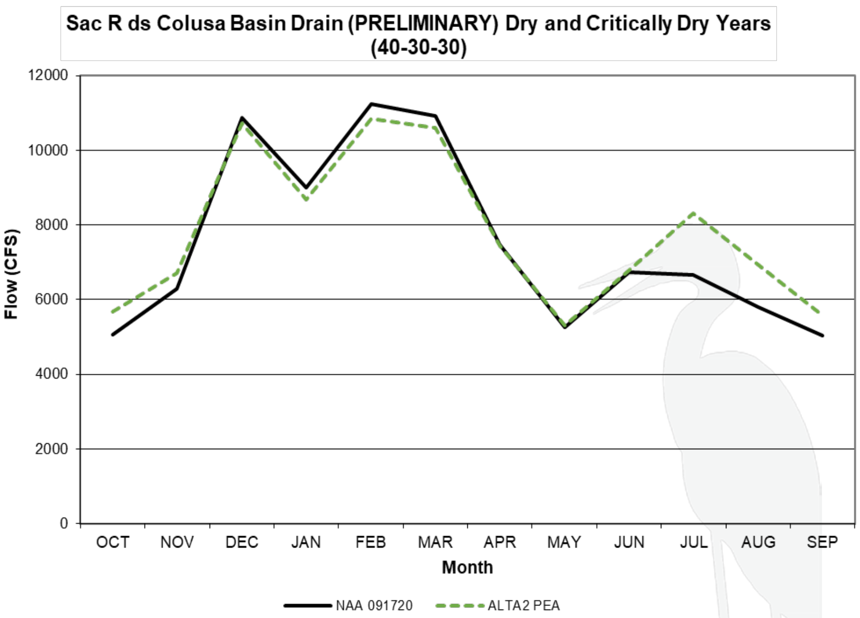




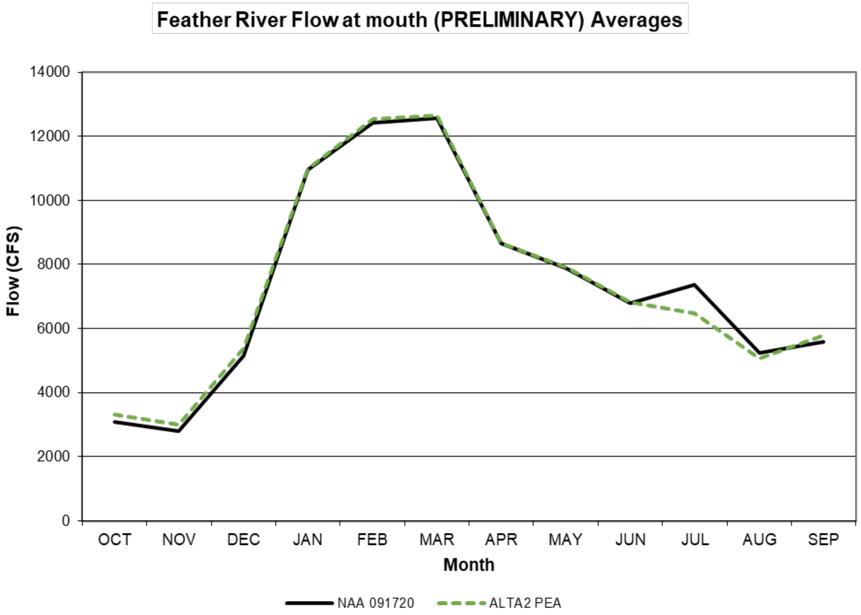
Sites

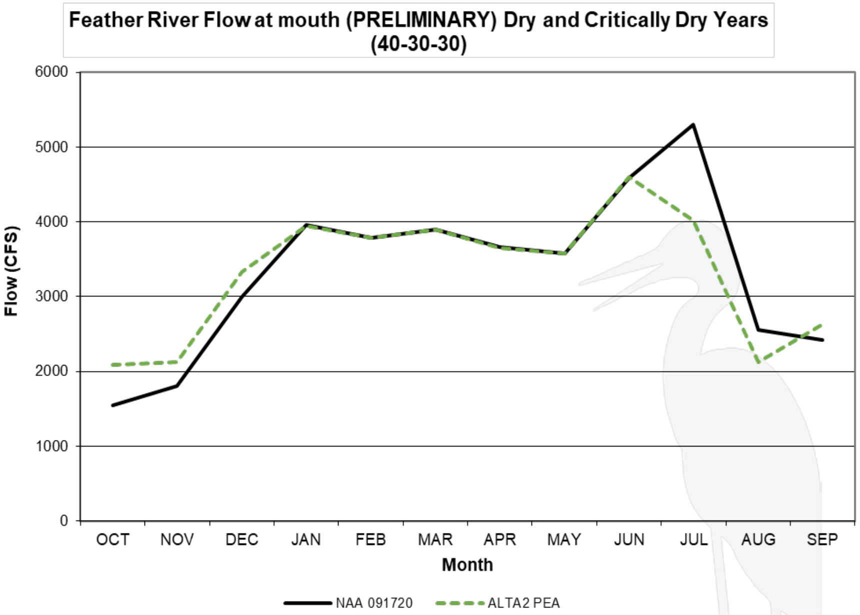
Sacramento River downstream of Colusa Basin Drain



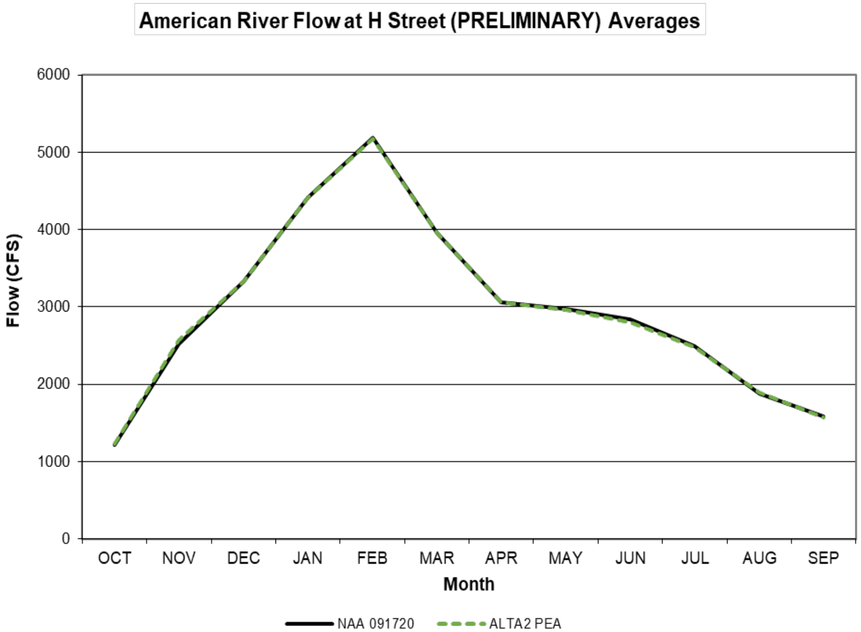


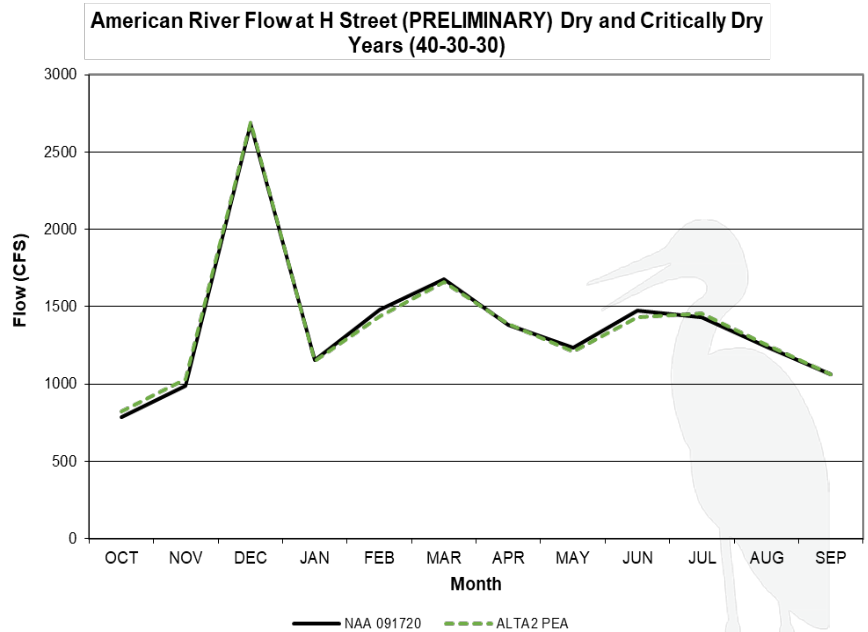
Feather River at Mouth



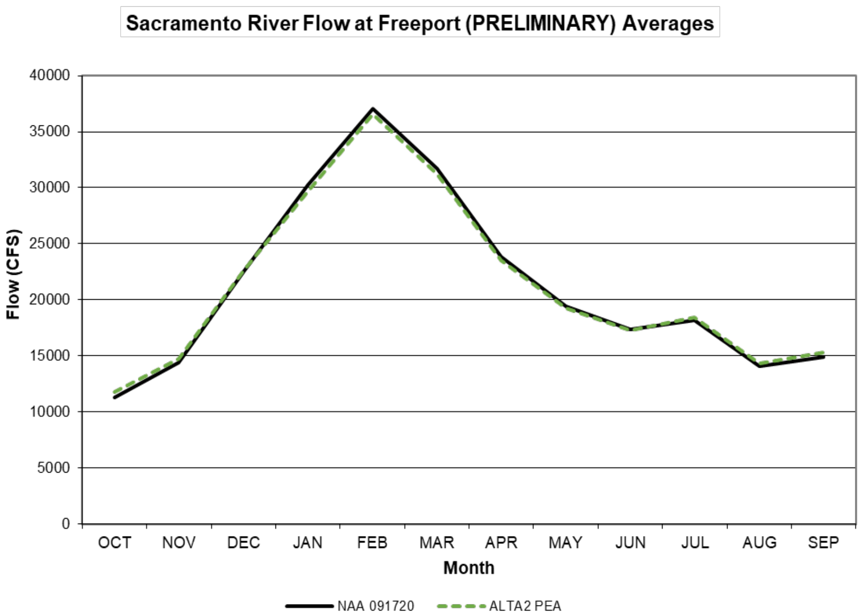


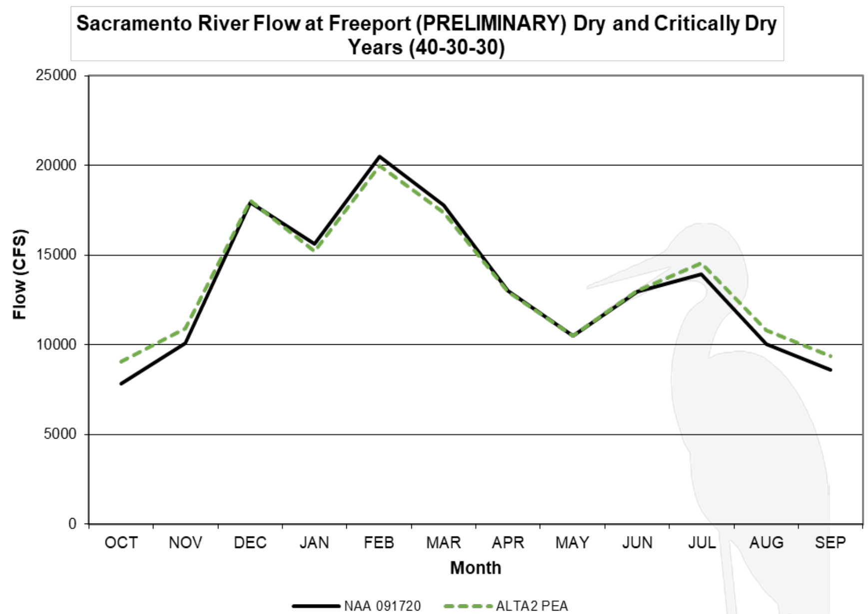
American River at H Street





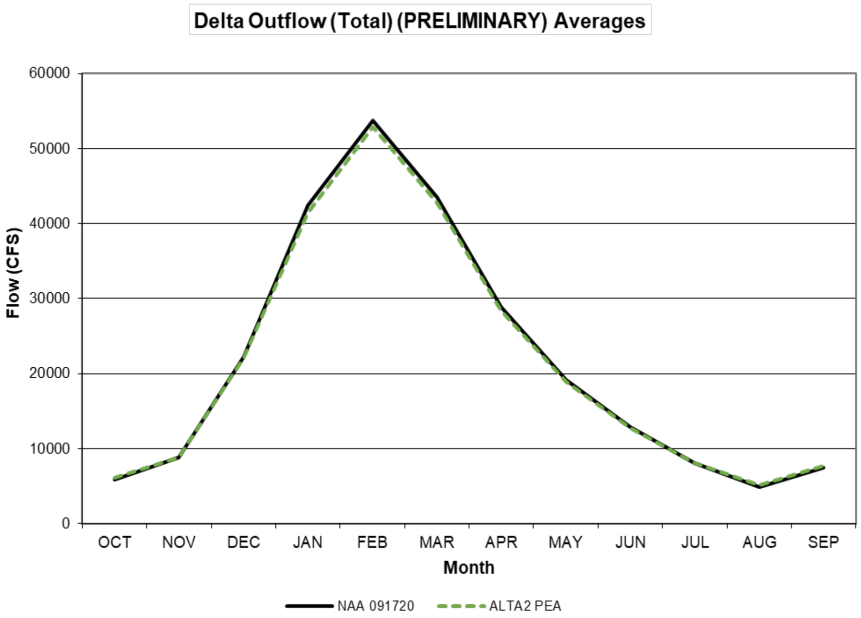
Sacramento River at Freeport

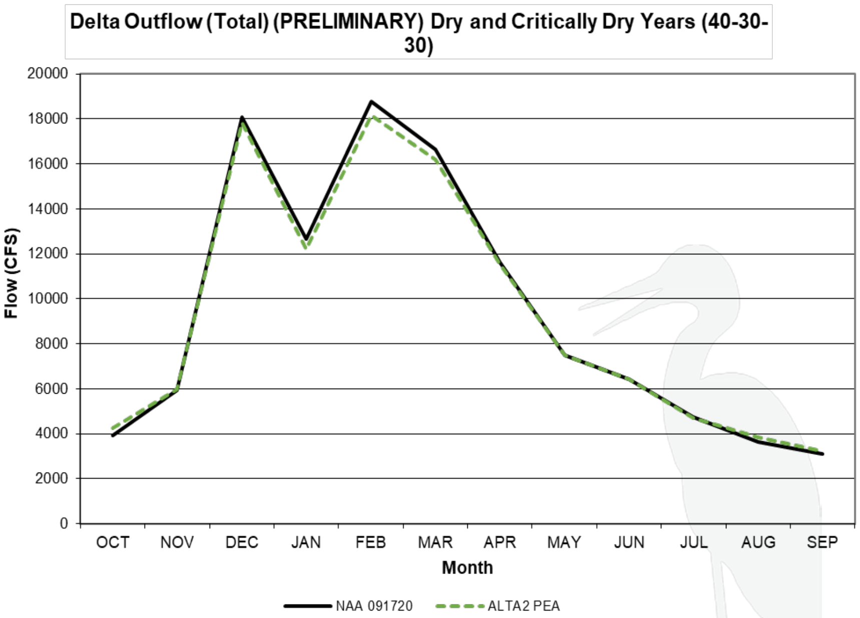




Sites

Delta Outflow





Questions?

END OF UPDATE MEETING

Sites

Aquatics Agency Workshop #3 Agenda

Sites
Affordable Water, Sustainably Managed

Our Core Values – Safety, Trust and Integrity, Respect for Local Communities, Environmental Stewardship, Shared Responsibility and Shared Benefits, Accountability and Transparency, Proactive Innovation, Diversity and Inclusivity
Our Commitment – To live up to these values in everything we do

Meeting Information:

Date:	May 14, 2021	**Location:**	Microsoft Teams use link in invite Or call in (audio only) (833) 255-2803,,855752524#
Start Time:	9:00 a.m.	**Finish Time:**	10:30 a.m.
Purpose:	Review agency questions and begin group discussion of prioritized comments		

Meeting Invitees:

Kristal Davis-Fadtke, CDFW	Felipe La Luz, CDFW	Jim Lecky, ICF
Ken Kundargi, CDFW	Zachary Kearns, CDFW	Erin Heydinger, Sites Integration
Jonathan Williams, CDFW	Chris Fitzer, ESA	Steve Micko, Jacobs
Mike Hendrick, ICF	Jason Hassrick, ICF	Rob Leaf, Jacobs
Jerry Brown, Sites Authority	Marin Greenwood, ICF	Monique Briard, ICF
Ryan Davis, USBR	Evan Sawyer, NMFS	Rick Wilder, ICF
Melissa Dekar, USBR	John Spranza, Sites Integration	Ali Forsythe, Sites Authority
Dan Cordova, USBR	Jonathan Williams, CDFW	Cathy Marcinkevage, NMFS
Russell Perry, USGS	Jonathan Nelson, CDFW	Steven Schoenberg, USFWS
Doug Jackson, QEDA	Erica Meyers CDFW	Nick Bauer, CDFW
Cyril Michel, NMFS	Elissa Buttermore, USBR	Andrew Huneycutt, CDFW
Annmarie Ore, SWRCB	Suzanne Manugian. USBR	Matt Johnson, CDFW
Ryon Kurth, CDFW	Michale Beakes, USBR	Robert Sherrick, CDFW
Stephanie Gordon, EPA		

Agenda:

Discussion Topic	**Topic Leader**	**Time Allotted**
1. Introductions and Objectives a. Agency Prioritized Questions Received b. Objectives and Approach for Today	John Spranza	10 min
2. Biological Rational Discussion a. Bypass Flows for RBPP, Hamilton City Pump Station, and Wilkins Slough, Bend Bridge Pulse Flow Protection	Jim Lecky	25 min

3.	Exchanges and Sacramento River and Yolo Temperatures	Steve Micko	20 min
4.	Fremont Weir Protections a. Scope of Discussion b. Development of Modeling Criteria c. Discuss initial Findings	Jim/Steve/Marin	20 min
5.	Next Steps and Adjourn	John Spranza	5 min

Meeting Notes:

1.

Sites Project Joint Aquatic Workshop

PULSE FLOWS FOR SALMON: SITES RESERVOIR PROJECT DIVERSION CRITERIA

May 14, 2021 Workshop

Agenda

- Introductions and Objectives
  - Objectives and Approach for Today
- Agency Prioritized Questions Received
- Rationale Discussion
- Exchanges and Upper Sacramento River Temps
- Next Steps

Objectives and Approach

- Sites review prioritized comments received
- Diversion rationale
  - Biological and/or otherwise
  - Q&A session on operational components and rearing impact assessment
- Exchanges and temperature of upper Sacramento River
- Water quality questions will have a dedicated workshop

General Comment Areas

- Biological rationale for diversion and operation criteria
- Methodology of water delivery and analysis of water sent through Yolo bypass, south-of-delta and North Bay Aqueduct
- Fish presence monitoring for operations
- Temperature effects to Sacramento River and Yolo Bypass due to deliveries
- Shasta exchanges and biological benefits vs diversion impacts
- Oroville and Folsom exchanges and impact assessment methodology
- Effects of operations to Funks and Stone Corral Creeks

Rationale

Sites

Rationale – Regulatory Framework

- Among all the statutory and permit requirements Environmental review and ESA compliance under the respective state and federal laws is paramount
- The framework for decision making under those statutes is: a comparison of future conditions with and without the project
- To make these workshops meaningful we would like to shift to focus to determination of effects and where appropriate identification of mitigation

Biological Rationale – existing standards

RBDD

GCID

RD 108

Biological Rationale – Bend Bridge Pulse flow

Focus of April 9, 2021 workshop

- Rich body of literature on the value or flood plains, side channels, and tributary streams as rearing habitat
- Recent literature on flow survival relationship for emigrating smolts (Michel et al. 2015, Henderson et al. 2018, Notch et al. 2020)
- Recent literature on the importance of variability in the hydrograph, particularly in drier year, in survival of emigrating smolts (Michel et al. 2021, Hassrick et al. in prep)

Biological Rationale - Bend Bridge Pulse flow

Challenges with existing literature

- There isn't a good metric to relate flow to survival through the rearing phase of the life cycle
- The flow survival relationships presented in the literature (e.g. Michel 2015 and Henderson 2018) are based on a comparison of smolt survival in wet years and dry years.
- Fish survive better in wet years, however, the application of these studies to within year operational decisions is limited
- The literature on variability in the hydrograph (Michel et al. 2021 and Hassrick et al. in prep) appears more relevant to within year operations

Biological Rationale – Operations

- Real-time monitoring will be key, but
- We need input from this group
  - Hydrology
  - Fish presence
- What point do we turn on the pumps?
- How does the project gain access to the existing monitoring program?
- Would Sites project need to augment monitoring for real-time presence absence? If so, how?

Biological Rationale – How to Assess Impacts to Rearing Habitat?

- Literature is sparse with options
  - Relationship between flow and habitat is the current metric
  - Seems like more side channel is beneficial
    - We are modeling change with and without project
    - How does that relate to quantifiable effect?
      - What is the threshold where an effect would be realized?
        - 2,900 cfs max diversion
      - What has been used in the past or in development?

Exchanges and Upper Sacramento Temperatures

Exchanges and Temperatures Upper Sac

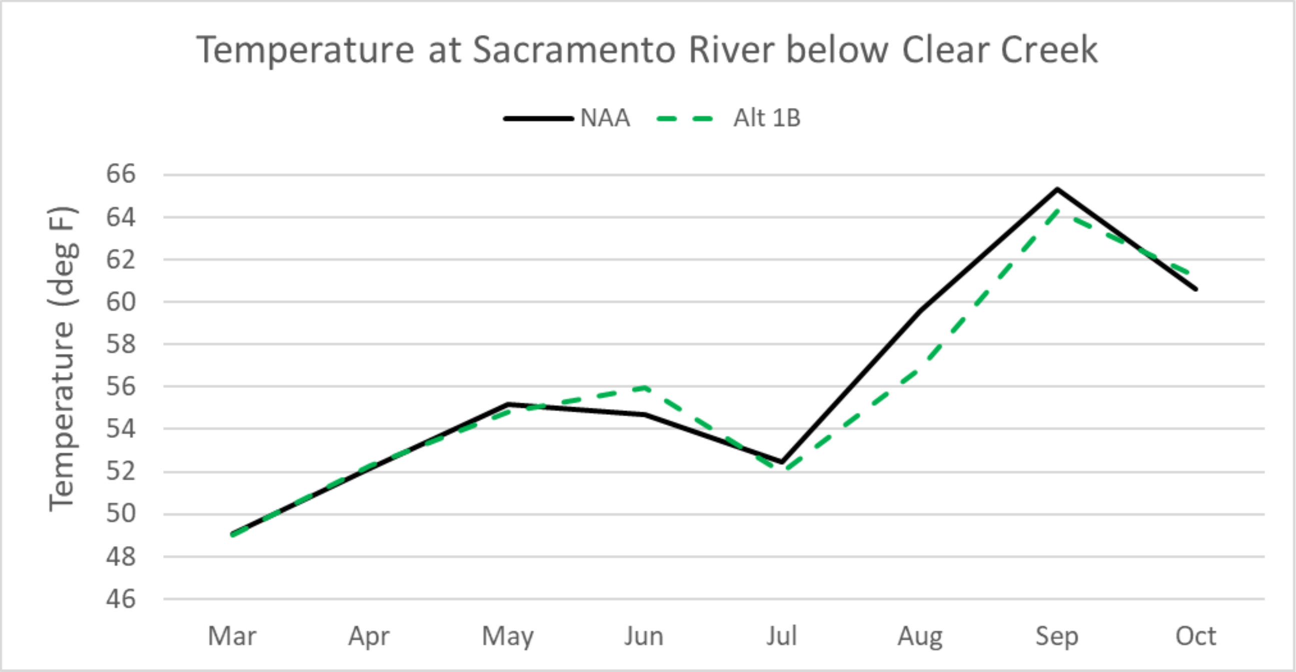
- Modeled exchange criteria:
  - Time Period: April through June
  - Water Year Types: Dry and Critically Dry water years
  - Temperature Management Tiers: 2, 3 and 4
  - Minimum flow requirement at Keswick:
    - 6,000 cfs in April and May
    - 10,000 cfs in June
- Release criteria
  - Time Period: August through November

Exchanges and Benefits

- Frequency of exchange
  - 8 years of 82-year planning simulation period with exchange volume greater than 50 TAF
- Volume of exchange
  - From 50 TAF to 230 TAF
- **Temperature benefits**
  - Decreases of up to 2 deg F in Sac River at Clear Creek
- **Early life stage temperature-based mortality**
  - Martin: Decreases of up to 9% in a given year
  - Anderson: Decreases of up to 17% in a given year

Exchanges and Temperatures

- Year: 1977
- Water Year Type: Critically Dry
- Temperature Tier: 4



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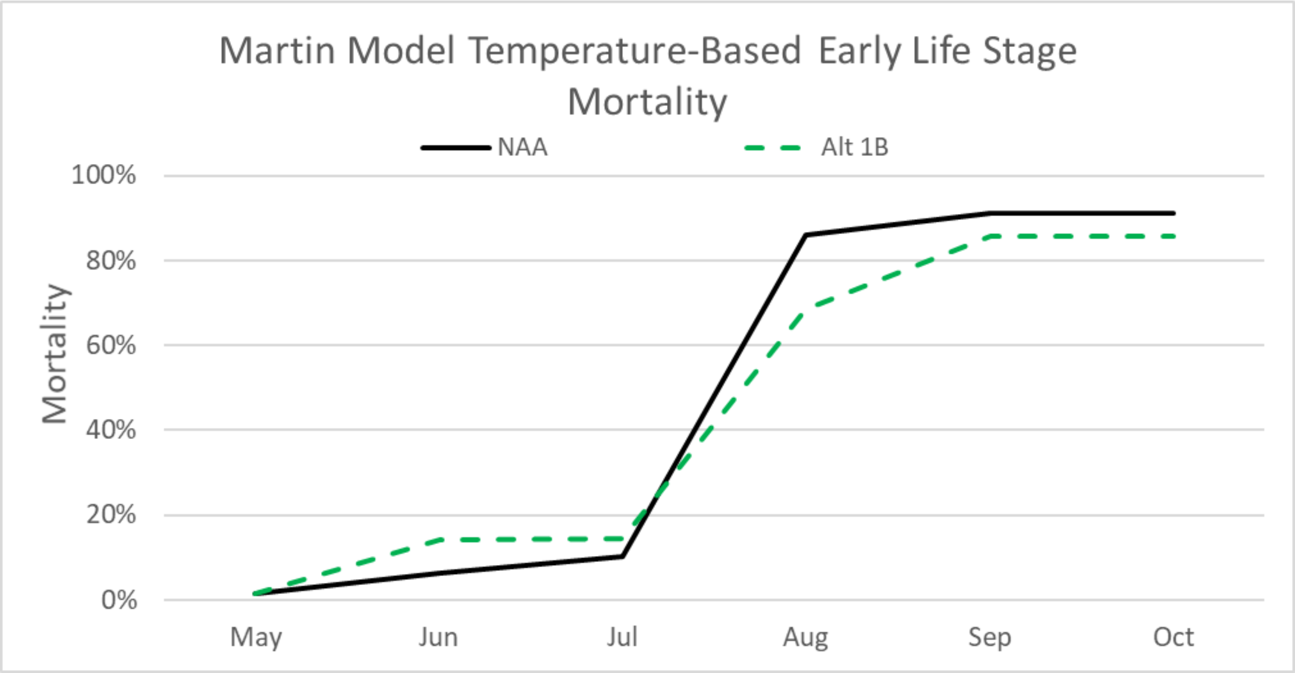

Exchanges and Temperatures

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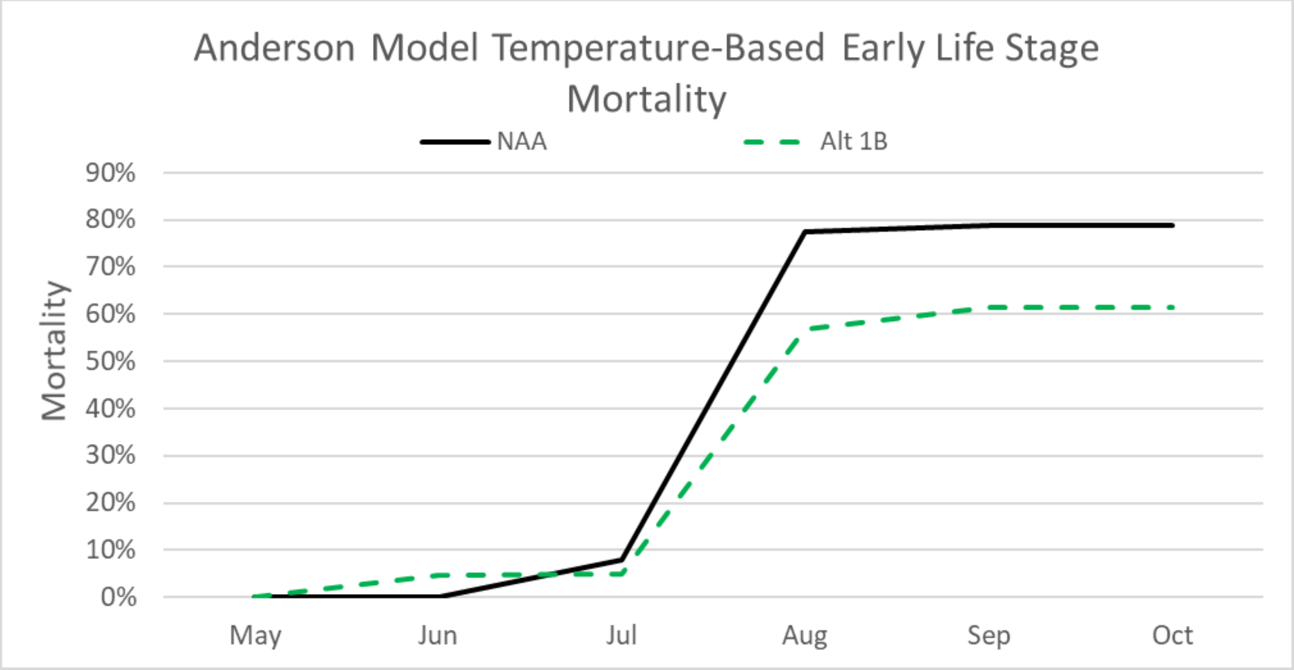


Next Steps

- Topics for next workshop
  - Change in approach for workshop?
    - What would be more effective?
- Schedule for next meeting

Sites

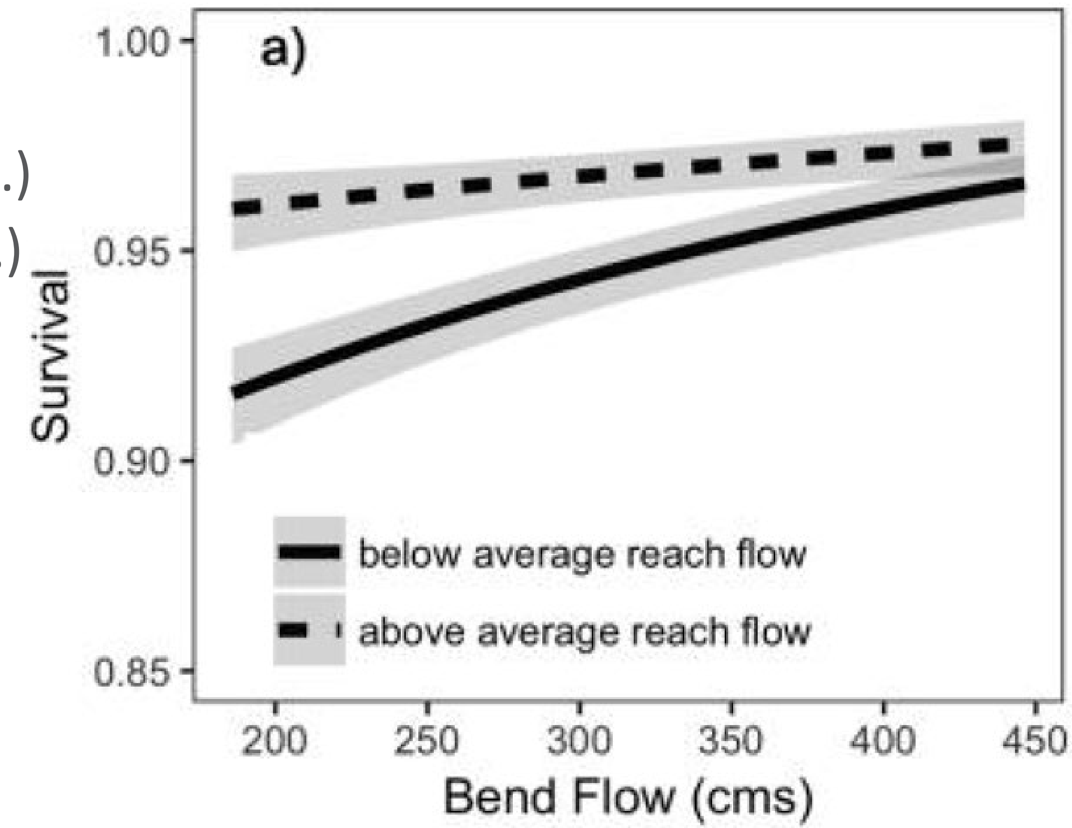
Sites Project Diversion Criteria

Sites Diversion Criteria	
Bend Bridge Pulse Protection Season	October - May
Bend Bridge Pulse Protection Initiation Criteria	3-day average Sacramento River must exceed 8,000 cfs; 3-day average tributary flow must exceed 2,500 cfs
Bend Bridge Pulse Protection Duration	7 days upon initiation
Bend Bridge Pulse Protection Re-setting Criteria	After completion of pulse protection period, resetting criteria must be met for another pulse protection period to commence: 3-day Sacramento River flow must go below 7,500 cfs for 7 consecutive days; 3-day moving average tributary flow must go below 2,500 cfs for 7 consecutive days
Wilkins Slough Bypass Flow	8,000 cfs April - May; all other times, 5,000 cfs
Fremont Weir Notch Criteria	Prioritize the Fremont Weir Notch, Yolo Bypass preferred alternative, flow over weir within 10% when spill range between 600 cfs and 6,000 cfs; First 600 cfs of spill are protected within 1%
Flows into the Sutter Bypass System	None
Freeport Bypass Flow	None
Surplus Delta Outflow	7 days of flow availability in February – March is required before diversions can be made in those months
SWP ITP Delta Outflow	44,500 cfs April - May

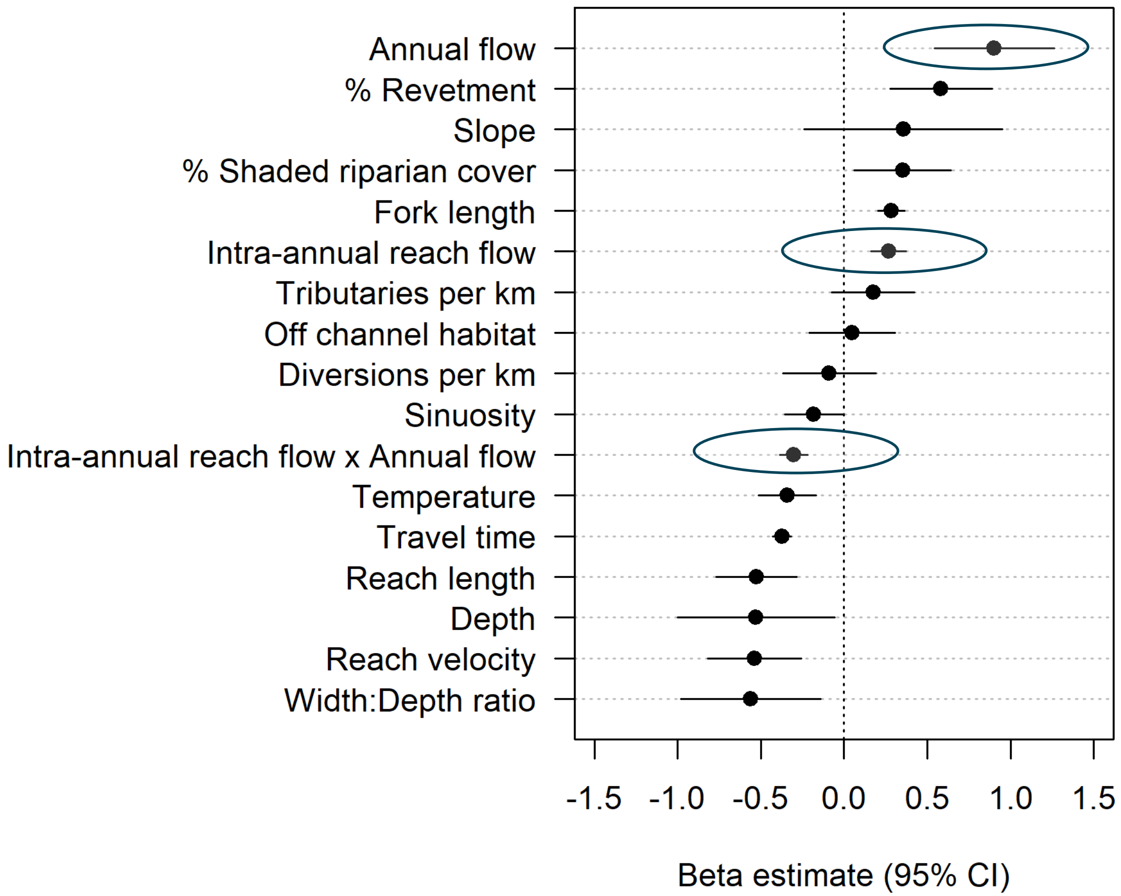
Riverscape Level – Henderson et al. (2018)

Reach x Year flow interaction

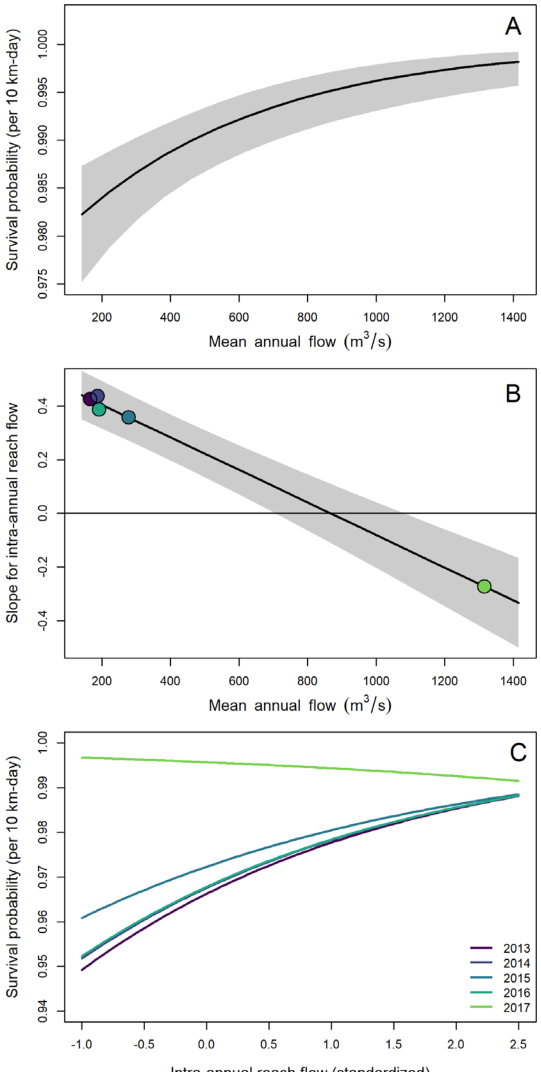
- Covariate response
  - High flow year (above ave.)
  - Low flow year (below ave.)



Factors That Affect Winter Run Survival



Riverscape Level – Hassrick et al. (in prep)



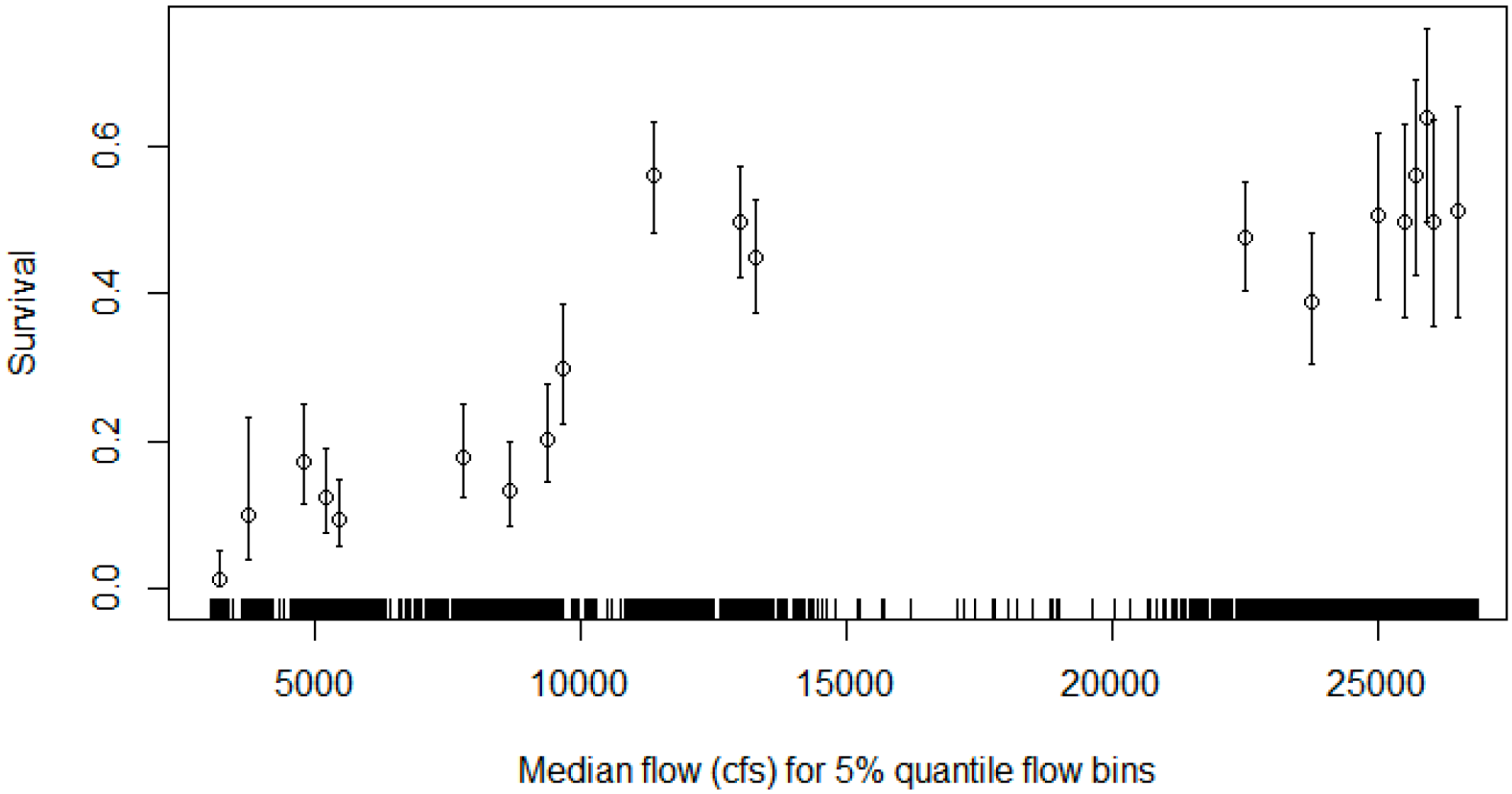
A. Survival as a function of mean annual flow

Shaded regions in panels A and B show 95% confidence intervals

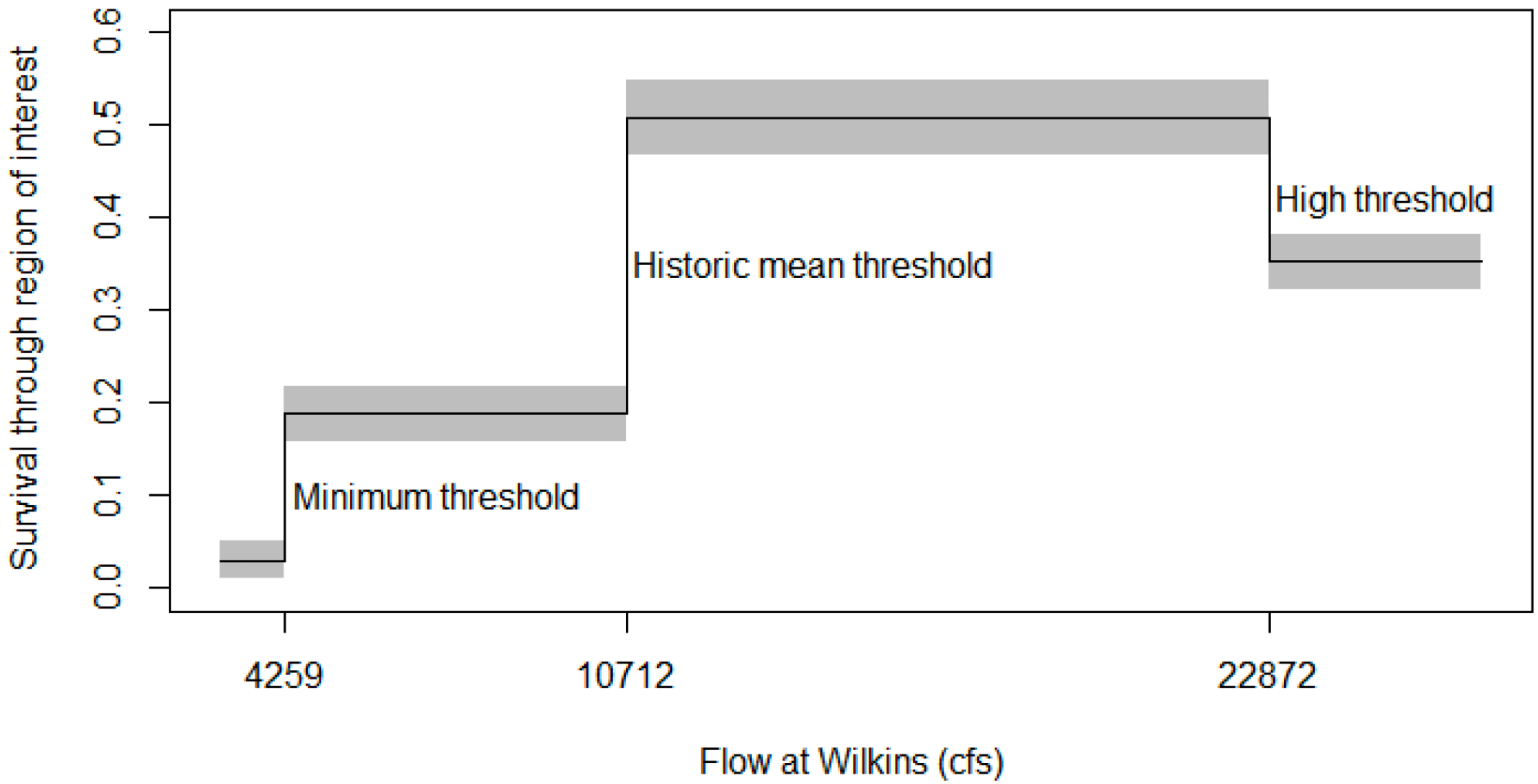
B. Slope coefficient for intra-annual reach flow as a function of mean annual flow.

C. Combined mean annual flow and intra-annual reach flow on predicted survival

Nonlinear Flow-Survival - Michel et al. (2021)

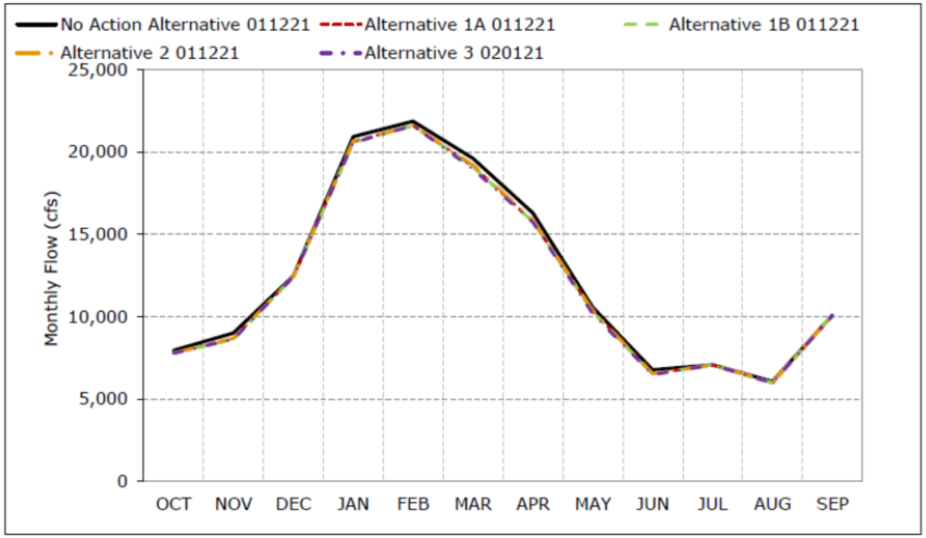


Nonlinear Flow-Survival - Michel et al. (2021)



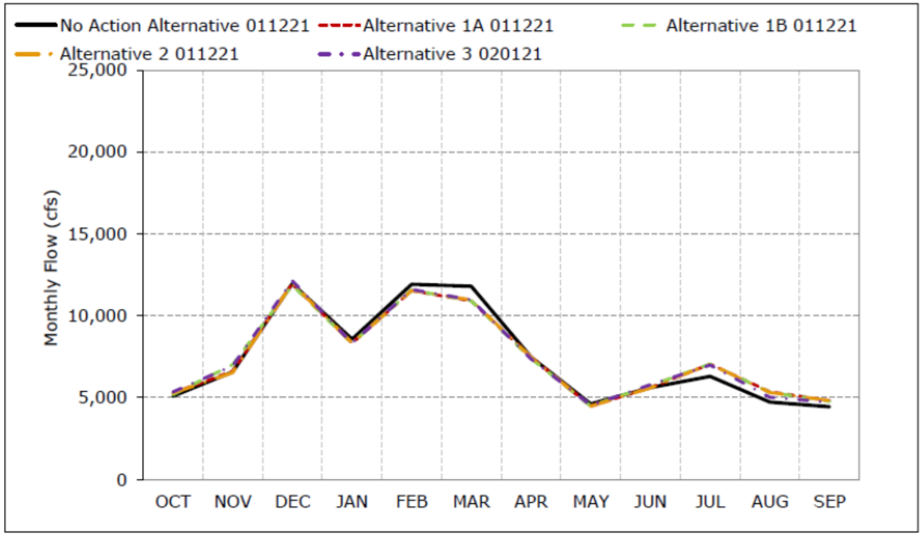
CalSim Average Annual Flow at Wilkins Slough Wet Year v. Dry Year

Figure 5B2-14-2. Sacramento River at Wilkins Slough Flow, Wet Year Average Flow



*As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999).
*These results are displayed with calendar year - year type sorting.

Figure 5B2-14-5. Sacramento River at Wilkins Slough Flow, Dry Year Average Flow



*As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999).
*These results are displayed with calendar year - year type sorting.

Sacramento River Flow at Wilkins Slough December - March

Figure 5B2-14-9. Sacramento River at Wilkins Slough Flow, December

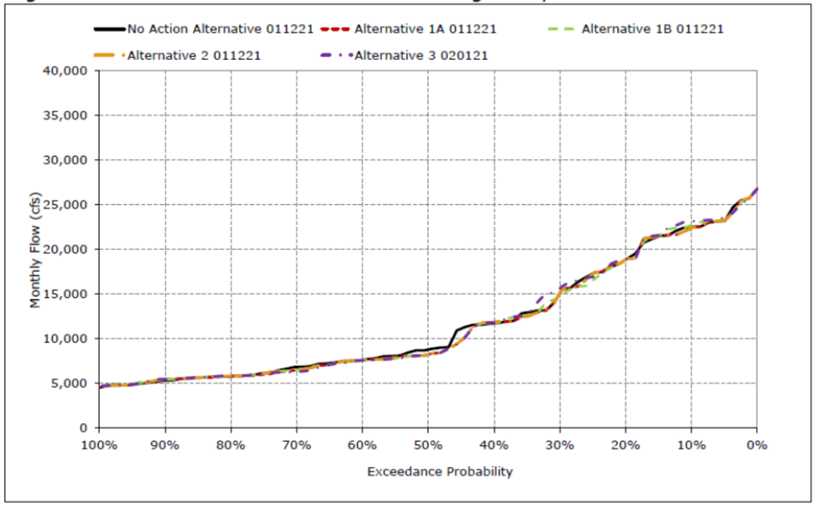


Figure 5B2-14-10. Sacramento River at Wilkins Slough Flow, January

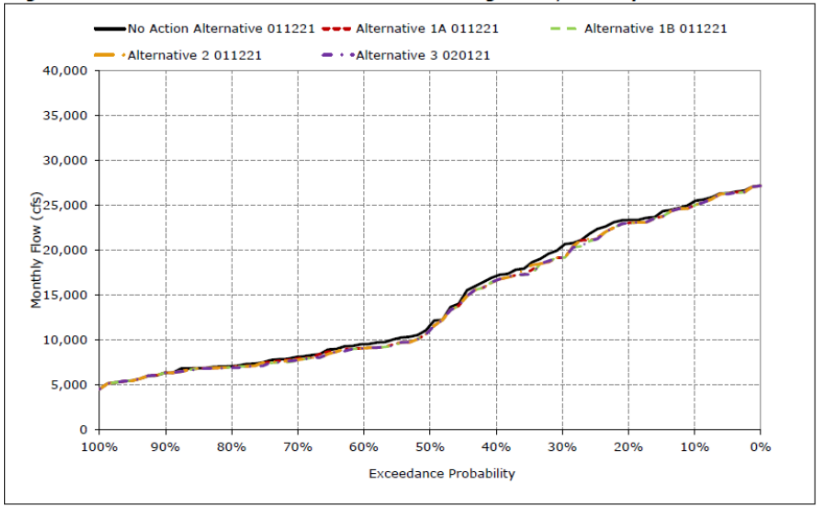


Figure 5B2-14-11. Sacramento River at Wilkins Slough Flow, February

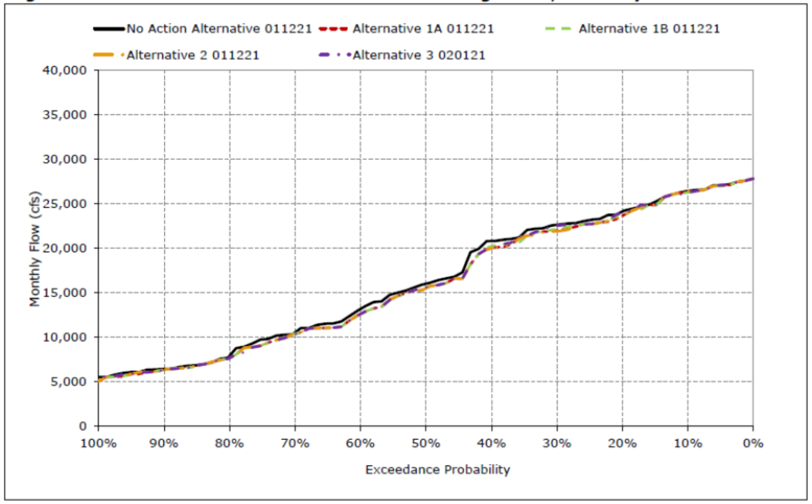


Figure 5B2-14-12. Sacramento River at Wilkins Slough Flow, March