From: Spranza, John [John.Spranza@hdrinc.com]
Sent: 9/6/2022 10:28:06 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]
CC: Edwards, Dawn [Dawn.Edwards@hdrinc.com]
Subject: Bio and Cult Surveys Requested for Options Agreement
Attachments: Needed Bio and Cultural Survey Activities_2022-0705.docx

Both Priority 1 and 2 would be needed to release for construction. Mitigation would likely be needed for grasslands and whatever else we find from the surveys

From: Gregory Klund [Gregory.Klund@Tepa.com]
Sent: 9/6/2022 11:19:32 AM
To: Marcia Kivett [MKivett@sitesproject.org]
Subject: Sites Project - Initial Discussion Followup

Good morning Marcia,

It has been a few months since our initial discussion regarding the Sites Reservoir project and my team just keeps getting more excited as time goes by. We have an amazing team coming together for both planning and construction.

One part of our initial discussion was having a collective tribal collaboration for the design and theme elements of the project. If this is correctly comprehended from that meeting, I would like to arrange a follow up meeting to discuss further. Unlike standard AE project timelines and deadlines, the tribal process is much slower and comprehensive in the collective approval process. When involving more than one tribe, this becomes exponentially more difficult in time management.

It would be great to expand some of our initial ideas collectively with additional members of our planning team this time around. Please let me know if this meeting would be possible and what dates would be suitable to your schedules. We would be open to in person or Zoom events, whatever works best for your team.

Looking forward to hearing back from you.

Best regards,

Gregory Klund • *Business Development Manager*
Nomlaki Technologies, LLC • 2945 Ramco St. Ste. 145• West Sacramento, CA 95691
d 279-348-7093
gregory.klund@tepa.com • www.tepa.com

From: Wesley Walker [walker@mbkengineers.com]
Sent: 9/6/2022 12:58:47 PM
To: steve.micko@jacobs.com
CC: Alicia Forsythe [aforsythe@sitesproject.org]; Leaf, Rob [Rob.Leaf@jacobs.com]
Subject: RE: Sites Project - 2070 Climate CALSIM Run

Thanks, Steve.

It may be worthwhile to discuss so I can determine if we need to adjust any of our availability logic. I was originally planning to just plug the CalSim outputs into our post-processor, but it may be a bit more involved. So it would certainly save us some time if you can give me a primer on what has changed.

I'm fairly open the rest of this week and next, with the exception of this Wednesday and Thursday mornings.

From: Micko, Steve <Steve.Micko@jacobs.com>
Sent: Tuesday, September 6, 2022 12:43 PM
To: Wesley Walker <walker@mbkengineers.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>; Leaf, Rob <Rob.Leaf@jacobs.com>
Subject: RE: Sites Project - 2070 Climate CALSIM Run

Hi Wes,

I posted the NAA with 2070 to the same link.

From a big picture perspective, 3A and 3 are identical.
Alternative 3A and Alternative 3 represent the same baseline regulatory conditions, facilities, Sites participation and Sites operations.
That being said, between 3A and 3, there are a few very minor and technical changes to the WRESL code.

Let me know if you'd like to discuss the technical details.

Best,
Steve

From: Wesley Walker <walker@mbkengineers.com>
Sent: Tuesday, September 6, 2022 12:12 PM
To: Micko, Steve <Steve.Micko@jacobs.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>; Leaf, Rob <Rob.Leaf@jacobs.com>
Subject: [EXTERNAL] RE: Sites Project - 2070 Climate CALSIM Run

Hi Steve,

Thanks for providing this run. Would you also mind providing the NAA with 2070, in the event we need it?

Additionally, so we properly characterize this Alternative 3, the alternative we used in the water availability analysis was alternative 3A (dated 04/11/22). Do you have any documentation or can you provide a quick summary of what (if any) differences there are between 3A and 3?

Thanks,
Wes

From: Micko, Steve <Steve.Micko@jacobs.com>
Sent: Tuesday, September 6, 2022 11:39 AM
To: Wesley Walker <walker@mbkengineers.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>; Leaf, Rob <Rob.Leaf@jacobs.com>
Subject: RE: Sites Project - 2070 Climate CALSIM Run

Hi Wes,

I posted Final EIR/EIS Alternative 3 at WSIP 2070 climate conditions here: 20220906_Alt3_WSIP_2070

Please let me know if you have any questions.

Best,
Steve

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Tuesday, September 6, 2022 11:24 AM
To: Micko, Steve <Steve.Micko@jacobs.com>; Wesley Walker <walker@mbkengineers.com>
Cc: Leaf, Rob <Rob.Leaf@jacobs.com>
Subject: [EXTERNAL] RE: Sites Project - 2070 Climate CALSIM Run

Yes please. Thank you!

Wes, please feel free to coordinate with Steve directly on this and any questions.

Thank you both!

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Micko, Steve <Steve.Micko@jacobs.com>
Sent: Tuesday, September 6, 2022 11:18 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Wesley Walker <walker@mbkengineers.com>
Cc: Leaf, Rob <Rob.Leaf@jacobs.com>
Subject: RE: Sites Project - 2070 Climate CALSIM Run

Hi Ali – Yes, we have a completed, sensitivity level CalSim II study for Alt 3 at WSIP 2070 climate conditions. Should I share this with Wes?

Best,
Steve

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Tuesday, September 6, 2022 11:11 AM
To: Micko, Steve <Steve.Micko@jacobs.com>; Wesley Walker <walker@mbkengineers.com>
Subject: [EXTERNAL] Sites Project - 2070 Climate CALSIM Run
Importance: High

Steve – I completely forgot to ask this last week – do we have Alt 3 with the 10,700 cfs Oct to June modelled in CALSIM? I think we were going to do this for the Final EIR/EIS, but cant remember. If so, has this been completed?

We are looking to use this as some supplemental information in our water availability analysis for the State Board if its available.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

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GLENN COUNTY CLERK-RECORDER'S OFFICE
ROUTE SLIP

TO: Sites Project Authority *DATE: 09/02/2022*

Department:

☐ AS REQUESTED
☐ FOR INFORMATION
☐ FOR DISTRIBUTION
☐ FOR RECOMMENDATION
☐ FOR CONVERSATION
☐ PER PHONE CONVERSATION
☐ SIGNATURE
☐ NECESSARY ACTION
☐ FOR REVIEW/COMMENT
☒ POSTED FOR 30 DAYS

FROM: Eileen Niblack, Office Technician II

COMMENTS:

RECEIVED

SEP 06 2022

SITES PROJECT AUTHORITY

RECORDING REQUESTED BY:
Sites Project Authority
WHEN RECORDED MAIL TO:
P.O. Box 517 Maxwell, Ca
95955

2022EIR035

Recorded at the request of:
SITES PROJECT AUTHORITY
08/01/2022 03:36 PM
Fee: $50.00 Pgs: 3
OFFICIAL RECORDS
Sendy Perez, Clerk-Recorder
Glenn County, CA

THIS SPACE FOR RECORDER'S USE ONLY

PRINT SPECIFIC TITLE OR DOCUMENT BELOW LINE

Notice of Determination

AFFIDAVIT OF POSTING NOTICE

I declare under penalty of perjury that I posted for 30 days a true and correct copy of this notice at the Assessor/Clerk-Recorder's Office in Glenn County commencing on 08/01/2022
Executed at Willows, California on 08/01/2022

By: Eileen Niblack
Deputy County Clerk

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION
(Additional recording fee applies)

2022EIR035 1 of 3

Print Form

Notice of Determination

Appendix D

To:

[■] Office of Planning and Research

U.S. Mail: P.O. Box 3044, Sacramento, CA 95812-3044

Street Address: 1400 Tenth St., Rm 113, Sacramento, CA 95814

[■] County Clerk
County of: Colusa
Address: 546 Jay Street, Suite 200
Colusa, CA 95932
County of: Glenn
Address: 516 West Sycamore Street, Willows, CA 95988
County of: Yolo
Address: 625 Court Street, #B01, Woodland, CA 95695

From:

Public Agency: Sites Project Authority
Address: P.O. Box 517
Maxwell, CA 95955
Contact: Alicia Forsythe
Phone: 530-438-2309

Lead Agency (if different from above):

Address:

Contact:
Phone:

SUBJECT: Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code.

State Clearinghouse Number (if submitted to State Clearinghouse): 2022050480

Project Title: 2022-2024 Sites Reservoir Geologic, Geophysical, and Geotechnical Investigations

Project Applicant: Sites Project Authority

Project Location (include county): Colusa, Glenn, Yolo

Project Description:

The Sites Project Authority is proposing to conduct geologic, geophysical, and geotechnical investigations in Colusa, Glenn, and Yolo Counties. These investigations are intended to provide technical information to assist in the ongoing efforts to formulate and refine the engineering design and to assist in the preparation of permit applications for the proposed Sites Reservoir and its associated facilities in western Sacramento Valley.

This is to advise that the Sites Project Authority has approved the above
([■] Lead Agency or [ ] Responsible Agency)

described project on __July 27, 2022_ (date) and has made the following determinations regarding the above described project.

1. The project [[ ] will [■] will not] have a significant effect on the environment.
2. [ ] An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.
   [■] A Negative Declaration was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures [[■] were [ ] were not] made a condition of the approval of the project.
4. A mitigation reporting or monitoring plan [[■] was [ ] was not] adopted for this project.
5. A statement of Overriding Considerations [[ ] was [■] was not] adopted for this project.
6. Findings [[■] were [ ] were not] made pursuant to the provisions of CEQA.

This is to certify that the final EIR with comments and responses and record of project approval, or the negative Declaration, is available to the General Public at:
122 Old Highway 99 West, Maxwell, CA, 95955

Signature (Public Agency): [signature] Title: Executive Director

Date: July 28, 2022 Date Received for filing at OPR:

Authority cited: Sections 21083, Public Resources Code.
Reference Section 21000-21174, Public Resources Code.

Revised 2011

2022EIR035 2 of 3

Yolo County County
Jesse Salinas, Clerk/Recorder
625 Court Street - Room B01
P.O. Box 1130
Woodland, CA 95776-1130
530-666-8130

Receipt: 22-16001

Product	Name		Extended
FISH	FISH AND WILDLIFE FILING		$2,598.00
	# Pages		2
	Document #		57-CE01202 2-001
	Document Info	SITES PROJECT AUTHORITY	
	Filing Type		ND
	State Fee Prev Charged		false
	No Charge Clerk Fee		false
MISC	MISCELLANEOUS		$50.00
	Amount		$50.00
Total			$2,648.00
Tender (Check)			$2,598.00
Check Number	1025		
Paid By	FORSYTHE GROUP LLC		
Tender (Cash)			$50.00
Paid By	HDR INC		

Thank you

8/1/22 11:05 AM jramirez

2022EIR035 3 of 3

From: Whittington, Chad [Chad.Whittington@jacobs.com]
Sent: 9/6/2022 2:24:35 PM
To: Briard, Monique [Monique.Briard@icf.com]; Williams, Nicole [Nicole.Williams@icf.com]; Huber, Anne [Anne.Huber@icf.com]; Hendrick, Mike [mike.hendrick@icf.com]; Black, Lyna [Lyna.Black@jacobs.com]
CC: Alicia Forsythe [aforsythe@sitesproject.org]; Angela Bezzone [bezzone@mbkengineers.com]; Laurie Warner Herson [laurie.warner.herson@phenixenv.com]; steve.micko@jacobs.com; Leaf, Rob [Rob.Leaf@jacobs.com]; Nudurupati, Sai [Sai.Nudurupati@jacobs.com]; Thayer, Reed [Reed.Thayer@jacobs.com]; Saadat, Samaneh [Samaneh.Saadat@jacobs.com]
Subject: Sites Suitable Habitat Area Analysis - Final EIR/EIS
Attachments: Sites_ModelResultsPackage_SuitableFloodplainHabitat_September6_2022.pdf; Sites_Habitat_Area_Analysis_FEIRS2022_rev02.zip

Hi all,

A package of suitable floodplain habitat area analysis that has been updated with Alternative 2 results is posted to the Sites Project SharePoint: Sites Habitat Area Analysis FEIRS2022 rev02

The package and corresponding transmittal memo are attached.

The package is organized in the following manner:

- 1_Habitat_Area_by_Month_and_WYT
  - Includes comparison tables of mean inundation area by month and water year type. The inundation areas were calculated using the 8-day running averages of flow throughout the entire 82-year period, excluding the first 7 days.
    - HabitatAcreageByMonthWYT_AllRegions__FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
- 2_Frequency_and_Duration
  - Includes frequency and duration comparison tables for events of varying magnitudes lasting 8-17 days, 18-24 days, and greater than 24 days. The Sutter Bypass and Yolo Bypass include additional files showing inundation events of varying acreages lasting within or greater than 10 days, 20 days, 30 days, and 45 days.
    - InChannel_AllReaches_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
    - InChannel_Reach1_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
    - InChannel_Reach2_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
    - InChannel_Reach3_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
    - Sutter_Bypass_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
    - SutterBypass_InundationComparison_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
- Inundation events of varying acreages lasting within or greater than 10 days, 20 days, 30 days, and 45 days
    - Yolo_Bypass_Inundation_Area_Duration-Frequency_FEIRS2022_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
    - YoloBypass_InundationComparison_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
- Inundation events of varying acreages lasting within or greater than 10 days, 20 days, 30 days, and 45 days
- 3_Yolo_Bypass_Daily_Flow_and_Habitat_Area_Timeseries
  - Includes daily flow and inundation area (habitat acreage) timeseries for the Yolo Bypass. The inundation areas were calculated using the 8-day running averages of flow throughout the entire 82-year period, excluding the first 7 days.
    - Daily_Flow_and_Habitat_Area_Timeseries_YoloBypass_FEIRS2022_HistClim_NAA_ALT1A_ALT1B_ALT2_ALT3.xls
- Package contents document (describing the files included in the zip folder)
  - Package_Contents.docx

Please let me know if you have any questions.

Best,

Chad Whittington, PE (he/him) | Jacobs | Water Resources Engineer
925.788.1087 | Chad.Whittington@jacobs.com
2485 Natomas Park Drive Suite 600 | Sacramento, CA 95833 | USA

JACOBS

Memorandum

2485 Natomas Park Drive, Suite 600
Sacramento, California 95833-2937
United States
T +1.916.920.0300
F +1.916.920.8463
www.jacobs.com

Project Name	Sites Reservoir Project	
Subject	Model Results to Support the 2022 Final EIR/EIS: No Action Alternative, Alternative 1A, Alternative 1B, Alternative 2 and Alternative 3 – Suitable Floodplain Habitat	
Attention	Ali Forsythe/Sites Project Authority	Monique Briard/ICF
	Angela Bezzone/MBK	Mike Hendrick /ICF
	Laurie Warner Herson/Phenix	Nicole Williams/ICF
	Anne Huber/ICF	Lyna Black/JACOBS
From	Robert Leaf/JACOBS	Steve Micko/JACOBS
	Chad Whittington/JACOBS	Sai Nudurupati/JACOBS
	Reed Thayer/JACOBS	Samaneh Saadat/JACOBS
Date	September 6, 2022	

1. Introduction

The Sites Reservoir Project team has developed model simulations to support quantitative analysis of Sites long-term operations as part of developing a Final EIR/EIS, for completion in 2022.

The results of these model simulations are provided for informational and review purposes. If there are any questions regarding the results of these simulations, please contact the modeling team.

2. Modeled Scenarios

Model results are provided for the alternatives tabulated below.

Model Name	Label Name (as seen in results)	Description
No Action Alternative 051422	NAA 051422	Baseline simulation (Reclamation 2021 Benchmark)
Alternative 1A 051722	ALT 1A 051722	1.5 MAF Reservoir
Alternative 1B 051722	ALT 1B 051722	1.5 MAF Reservoir with 101 TAF of Reclamation Investment
Alternative 2 051722	ALT 2 051722	1.27 MAF Reservoir

Model Name	Label Name (as seen in results)	Description
Alternative 3 051722	ALT 3 051722	1.5 MAF Reservoir with 360 TAF of Reclamation Investment

The Suitable Floodplain Habitat results were developed for the Sites Final EIR/EIS. Please review Appendix 11M of the Sites Reservoir Project RDEIR/SDEIS for details on approach, assumptions, and limitations. These results are useful so long as the results are interpreted consistent with the model limitations.

3. Model Simulations for Modeled Scenarios

3.1 Suitable Floodplain Habitat Area by Month and Water Year Type

The "1_Habitat_Area_by_Month_and_WYT" folder includes comparison tables of mean inundation area by month and water year type. The inundation areas were calculated using the 8-day running averages of flow throughout the entire 82-year period, excluding the first 7 days

The following pdf report is provided:

- HabitatAcreageByMonthWYT_AllRegions__FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf

3.2 Suitable Floodplain Habitat Area Frequency and Duration

The "2_Frequency_Duration" folder includes frequency and duration comparison tables for events of varying magnitudes lasting 8-17 days, 18-24 days, and greater than 24 days. The Sutter Bypass and Yolo Bypass include additional files showing inundation events of varying acreages lasting within or greater than 10 days, 20 days, 30 days, and 45 days.

The following pdf reports are provided:

- InChannel_AllReaches_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
- InChannel_Reach1_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
- InChannel_Reach2_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
- InChannel_Reach3_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
- Sutter_Bypass_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT3.pdf
- SutterBypass_InundationComparison_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
    - Inundation events of varying acreages lasting within or greater than 10 days, 20 days, 30 days, and 45 days
- Yolo_Bypass_Inundation_Area_Duration-Frequency_FEIRS2022_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf

- YoloBypass_InundationComparison_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
    - Inundation events of varying acreages lasting within or greater than 10 days, 20 days, 30 days, and 45 days

3.3 Suitable Floodplain Habitat Area Daily Timeseries

The "3_Yolo_Bypass_Daily_Flow_and_Habitat_Area_Timeseries" folder includes daily flow and inundation area (habitat acreage) timeseries for the Yolo Bypass. The inundation areas were calculated using the 8-day running averages of flow throughout the entire 82-year period, excluding the first 7 days.

The following excel file is provided:

- Daily_Flow_and_Habitat_Area_Timeseries_YoloBypass_FEIRS2022_HistClim_NAA_ALT1A_ALT1B_ALT2_ALT3.xlsx

Figure 1. Frequency of All In-Channel Reaches Habitat Area Inundation Events.

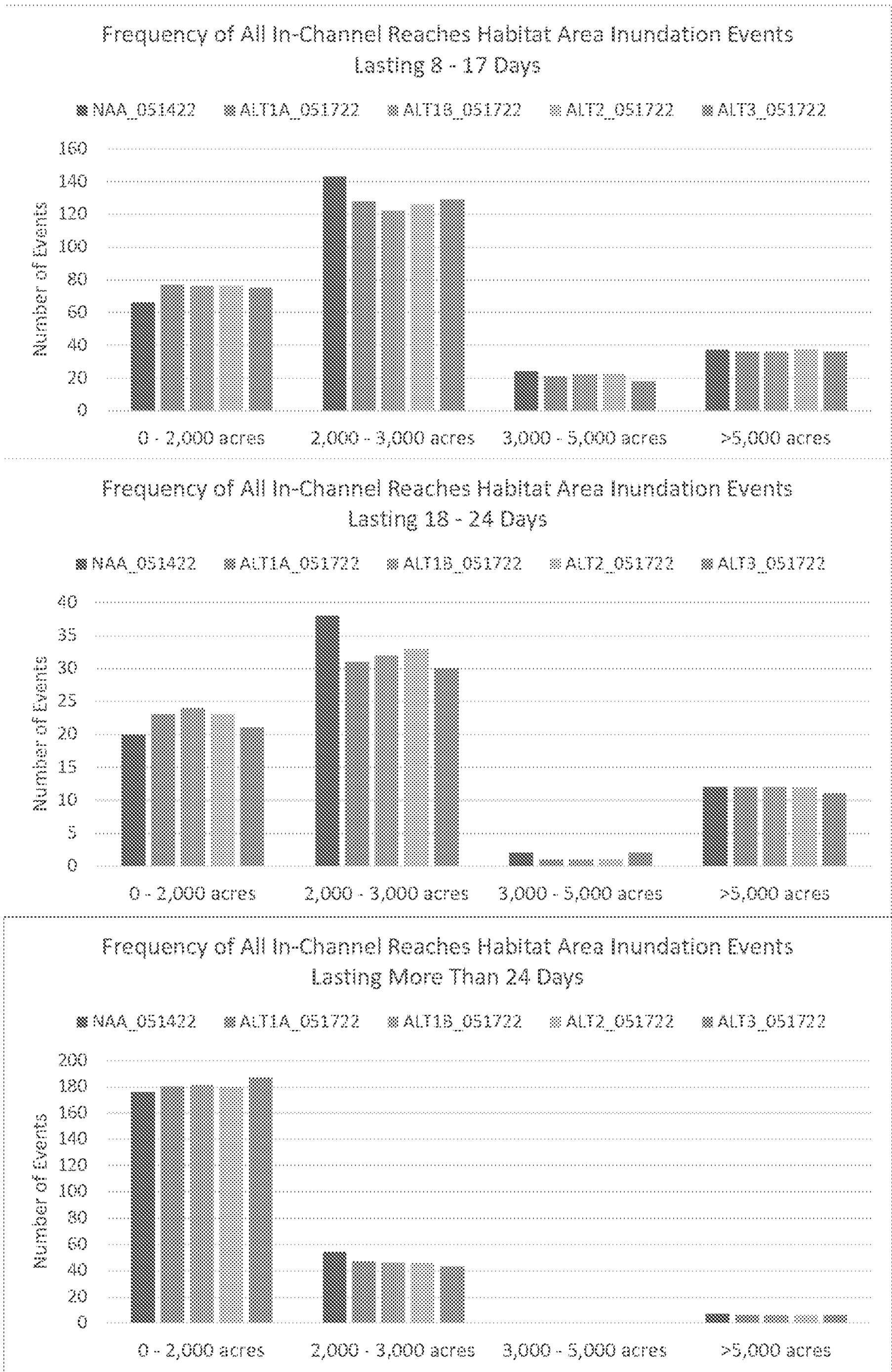


Table 1. Frequency of All In-Channel Reaches Habitat Area Inundation Events.

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days											
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	66	77	11	17%	76	10	13%	76	10	13%	75	9	14%
2,000 - 3,000 acres	143	128	-15	-10%	122	-21	-15%	126	-17	-12%	129	-14	-10%
3,000 - 5,000 acres	24	21	-3	-13%	22	-2	-8%	22	-2	-8%	18	-6	-25%
>5,000 acres	37	36	-1	-3%	36	-1	-3%	37	0	0%	36	-1	-3%
	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	20	23	3	15%	24	4	20%	23	3	15%	21	1	5%
2,000 - 3,000 acres	38	31	-7	-18%	32	-6	-16%	33	-5	-13%	30	-8	-21%
3,000 - 5,000 acres	2	1	-1	-50%	1	-1	-50%	1	-1	-50%	2	0	0%
>5,000 acres	12	12	0	0%	12	0	0%	12	0	0%	11	-1	-8%
	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	176	180	4	2%	181	5	3%	180	4	2%	187	11	6%
2,000 - 3,000 acres	54	47	-7	-13%	46	-8	-15%	46	-8	-15%	43	-11	-20%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	7	6	-1	-14%	6	-1	-14%	6	-1	-14%	6	-1	-14%

*Based on total number of events in 82 year simulation period.

Table 2. Monthly Summary of Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days in October											
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
2,000 - 3,000 acres	1	2	1	100%	2	1	100%	2	1	100%	2	1	100%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days in November												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	7	8	1	14%	8	1	14%	8	1	14%	6	-1	-14%
2,000 - 3,000 acres	4	5	1	25%	4	0	0%	5	1	25%	6	2	50%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days in December												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	10	12	2	20%	11	1	10%	12	2	20%	13	3	30%
2,000 - 3,000 acres	24	15	-9	-38%	15	-9	-38%	15	-9	-38%	14	-10	-42%
3,000 - 5,000 acres	3	3	0	0%	3	0	0%	4	1	33%	3	0	0%
>5,000 acres	6	6	0	0%	6	0	0%	6	0	0%	6	0	0%

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days in January												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	14	14	0	0%	13	-1	-7%	14	0	0%	13	-1	-7%
2,000 - 3,000 acres	23	20	-3	-13%	19	-4	-17%	20	-3	-13%	22	-1	-4%
3,000 - 5,000 acres	4	2	-2	-50%	2	-2	-50%	2	-2	-50%	2	-2	-50%
>5,000 acres	6	7	1	17%	7	1	17%	7	1	17%	7	1	17%

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days in February												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	11	15	4	36%	16	5	45%	14	3	27%	15	4	36%
2,000 - 3,000 acres	22	21	-1	-5%	21	-1	-5%	20	-2	-9%	19	-3	-14%
3,000 - 5,000 acres	7	6	-1	-14%	7	0	0%	5	-2	-29%	3	-4	-57%
>5,000 acres	13	11	-2	-15%	11	-2	-15%	12	-1	-8%	11	-2	-15%

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days in March												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	10	14	4	40%	14	4	40%	14	4	40%	13	3	30%
2,000 - 3,000 acres	28	27	-1	-4%	27	-1	-4%	27	-1	-4%	28	0	0%
3,000 - 5,000 acres	5	5	0	0%	5	0	0%	6	1	20%	5	0	0%
>5,000 acres	7	7	0	0%	7	0	0%	7	0	0%	7	0	0%

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days in April												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	7	7	0	0%	7	0	0%	7	0	0%	7	0	0%
2,000 - 3,000 acres	15	11	-4	-27%	11	-4	-27%	11	-4	-27%	12	-3	-20%
3,000 - 5,000 acres	5	4	-1	-20%	4	-1	-20%	4	-1	-20%	4	-1	-20%
>5,000 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days in May												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%
2,000 - 3,000 acres	12	11	-1	-8%	11	-1	-8%	11	-1	-8%	11	-1	-8%
3,000 - 5,000 acres	0	1	1	-	1	1	-	1	1	-	1	1	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days in June												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	2	3	1	50%	3	1	50%	3	1	50%	3	1	50%
2,000 - 3,000 acres	4	4	0	0%	3	-1	-25%	4	0	0%	4	0	0%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days in July												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	1	0	-1	-100%	0	-1	-100%	0	-1	-100%	1	0	0%
2,000 - 3,000 acres	7	8	1	14%	6	-1	-14%	8	1	14%	8	1	14%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days in August												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 3,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days in September												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 3,000 acres	3	4	1	33%	3	0	0%	3	0	0%	3	0	0%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Table 3. Monthly Summary of Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days

Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days in October

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 3,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days in November

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	3	1	-2	-67%	1	-2	-67%	1	-2	-67%	1	-2	-67%
2,000 - 3,000 acres	1	0	-1	-100%	0	-1	-100%	0	-1	-100%	0	-1	-100%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days in December

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	4	4	0	0%	5	1	25%	4	0	0%	3	-1	-25%
2,000 - 3,000 acres	3	1	-2	-67%	2	-1	-33%	1	-2	-67%	2	-1	-33%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	1	1	-

Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days in January

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	4	5	1	25%	5	1	25%	5	1	25%	5	1	25%
2,000 - 3,000 acres	5	3	-2	-40%	2	-3	-60%	3	-2	-40%	2	-3	-60%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	5	5	0	0%	5	0	0%	5	0	0%	4	-1	-20%

Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days in February

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	1	2	1	100%	2	1	100%	2	1	100%	1	0	0%
2,000 - 3,000 acres	7	3	-4	-57%	3	-4	-57%	3	-4	-57%	3	-4	-57%
3,000 - 5,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
>5,000 acres	2	2	0	0%	2	0	0%	2	0	0%	1	-1	-50%

Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days in March

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	4	6	2	50%	6	2	50%	6	2	50%	7	3	75%
2,000 - 3,000 acres	11	8	-3	-27%	9	-2	-18%	8	-3	-27%	7	-4	-36%
3,000 - 5,000 acres	1	0	-1	-100%	0	-1	-100%	0	-1	-100%	1	0	0%
>5,000 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%

Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days in April

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 3,000 acres	5	7	2	40%	7	2	40%	7	2	40%	6	1	20%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%

Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days in May

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%
2,000 - 3,000 acres	2	3	1	50%	3	1	50%	3	1	50%	3	1	50%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days in June

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	0	1	1	-	0	0	-	1	1	-	0	0	-
2,000 - 3,000 acres	0	1	1	-	1	1	-	1	1	-	2	2	-
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days in July

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 3,000 acres	2	3	1	50%	3	1	50%	4	2	100%	3	1	50%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days in August

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	1	1	0	0%	2	1	100%	1	0	0%	1	0	0%
2,000 - 3,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days in September

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 3,000 acres	2	2	0	0%	2	0	0%	3	1	50%	2	0	0%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Table 4. Monthly Summary of Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days in October											
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	13	16	3	23%	17	4	31%	16	3	23%	17	4	31%
2,000 - 3,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days in November												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	13	13	0	0%	13	0	0%	13	0	0%	14	1	8%
2,000 - 3,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days in December												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	12	12	0	0%	12	0	0%	12	0	0%	12	0	0%
2,000 - 3,000 acres	0	1	1	-	1	1	-	1	1	-	1	1	-
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days in January												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	13	13	0	0%	14	1	8%	13	0	0%	15	2	15%
2,000 - 3,000 acres	3	3	0	0%	3	0	0%	3	0	0%	2	-1	-33%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	2	1	-1	-50%	1	-1	-50%	1	-1	-50%	1	-1	-50%

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days in February												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	8	9	1	13%	10	2	25%	9	1	13%	11	3	38%
2,000 - 3,000 acres	2	1	-1	-50%	1	-1	-50%	1	-1	-50%	1	-1	-50%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days in March												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	11	13	2	18%	13	2	18%	13	2	18%	13	2	18%
2,000 - 3,000 acres	6	2	-4	-67%	1	-5	-83%	2	-4	-67%	1	-5	-83%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days in April												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	12	10	-2	-17%	10	-2	-17%	10	-2	-17%	9	-3	-25%
2,000 - 3,000 acres	3	2	-1	-33%	2	-1	-33%	2	-1	-33%	2	-1	-33%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days in May												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	18	20	2	11%	20	2	11%	20	2	11%	23	5	28%
2,000 - 3,000 acres	9	8	-1	-11%	8	-1	-11%	8	-1	-11%	8	-1	-11%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days in June												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	11	10	-1	-9%	10	-1	-9%	10	-1	-9%	11	0	0%
2,000 - 3,000 acres	4	2	-2	-50%	2	-2	-50%	2	-2	-50%	1	-3	-75%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days in July												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	21	22	1	5%	23	2	10%	22	1	5%	22	1	5%
2,000 - 3,000 acres	17	19	2	12%	19	2	12%	18	1	6%	19	2	12%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days in August												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	15	14	-1	-7%	12	-3	-20%	14	-1	-7%	10	-5	-33%
2,000 - 3,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

	Frequency of All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days in September												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	29	28	-1	-3%	27	-2	-7%	28	-1	-3%	30	1	3%
2,000 - 3,000 acres	7	6	-1	-14%	6	-1	-14%	6	-1	-14%	5	-2	-29%
3,000 - 5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>5,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Figure 2. Average Annual All In-Channel Reaches Habitat Area Inundation Events.

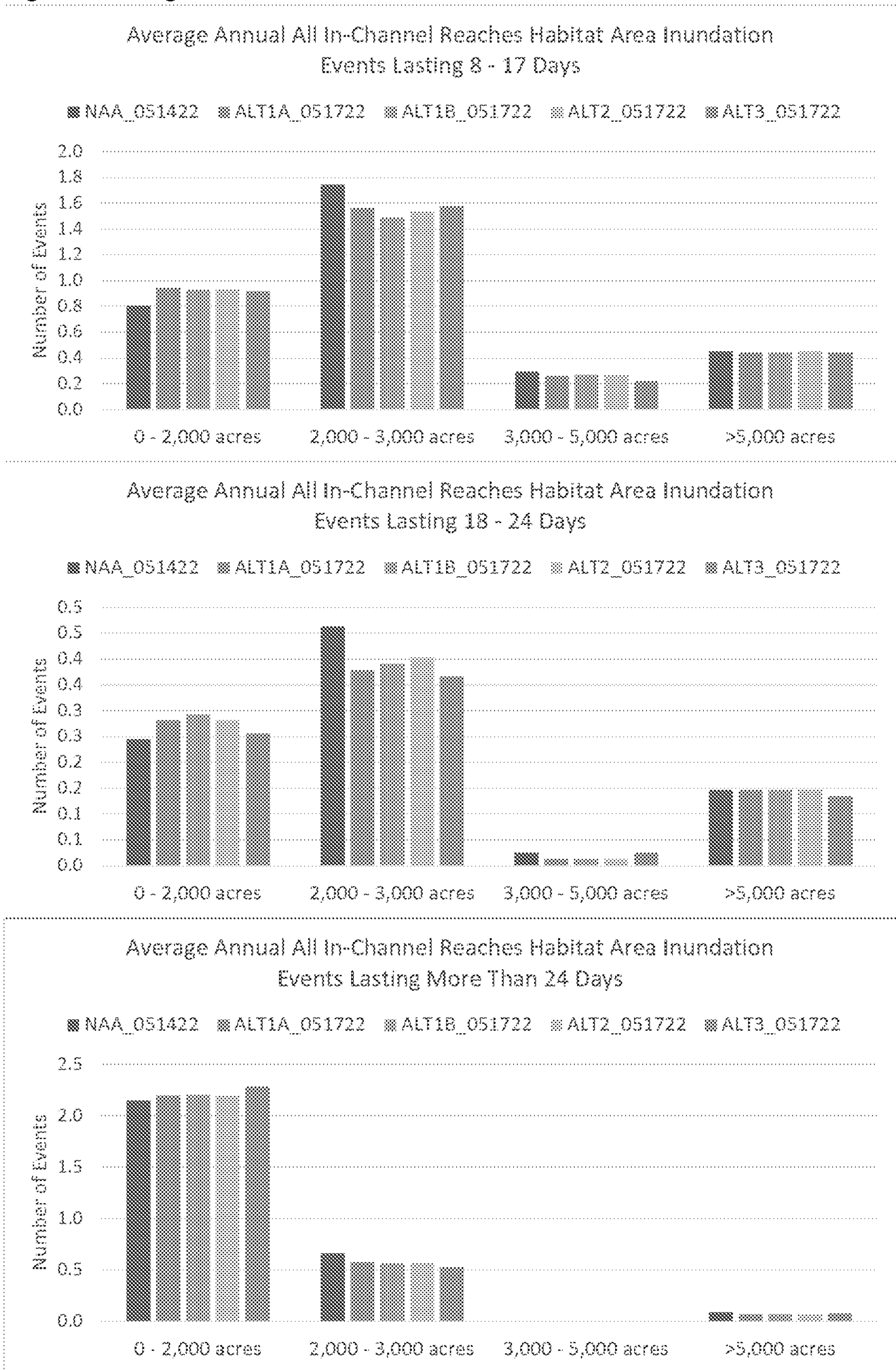


Table 5. Average Annual All In-Channel Reaches Habitat Area Inundation Events.

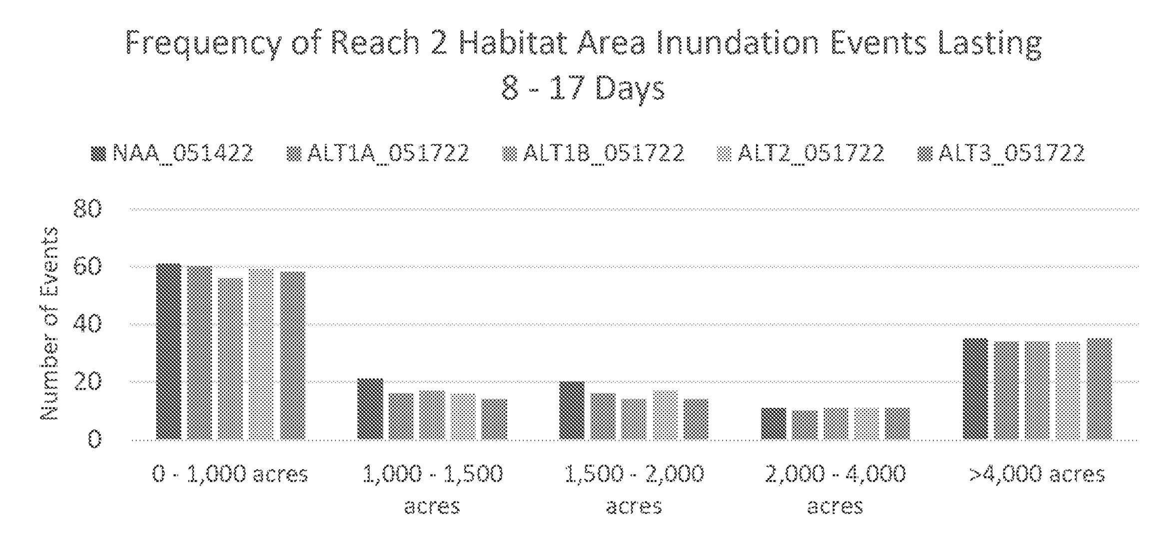
	Average Annual All In-Channel Reaches Habitat Area Inundation Events Lasting 8 - 17 Days											
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	0.80	0.94	0.13	17%	0.93	0.12	15%	0.93	0.12	15%	0.91	0.11	14%
2,000 - 3,000 acres	1.74	1.56	-0.18	-10%	1.49	-0.26	-15%	1.54	-0.21	-12%	1.57	-0.17	-10%
3,000 - 5,000 acres	0.29	0.26	-0.04	-13%	0.27	-0.02	-8%	0.27	-0.02	-8%	0.22	-0.07	-25%
>5,000 acres	0.45	0.44	-0.01	-3%	0.44	-0.01	-3%	0.45	0.00	0%	0.44	-0.01	-3%

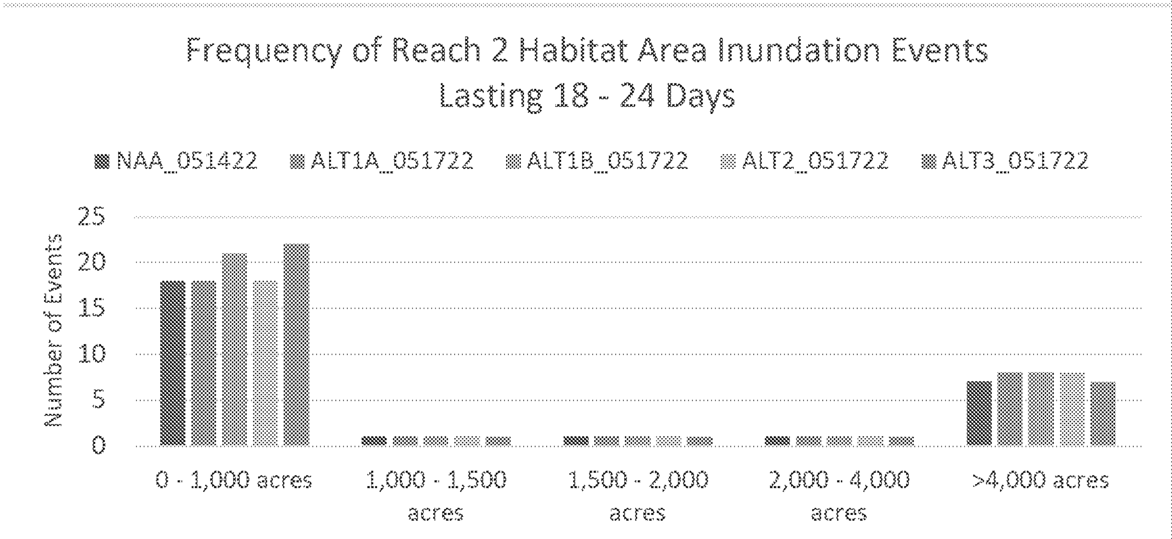
	Average Annual All In-Channel Reaches Habitat Area Inundation Events Lasting 18 - 24 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	0.24	0.28	0.04	15%	0.29	0.05	20%	0.28	0.04	15%	0.26	0.01	5%
2,000 - 3,000 acres	0.46	0.38	-0.09	-18%	0.39	-0.07	-16%	0.40	-0.06	-13%	0.37	-0.10	-21%
3,000 - 5,000 acres	0.02	0.01	-0.01	-50%	0.01	-0.01	-50%	0.01	-0.01	-50%	0.02	0.00	0%
>5,000 acres	0.15	0.15	0.00	0%	0.15	0.00	0%	0.15	0.00	0%	0.13	-0.01	-8%

	Average Annual All In-Channel Reaches Habitat Area Inundation Events Lasting More Than 24 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,000 acres	2.15	2.20	0.05	2%	2.21	0.06	3%	2.20	0.05	2%	2.28	0.13	6%
2,000 - 3,000 acres	0.66	0.57	-0.09	-13%	0.56	-0.10	-15%	0.56	-0.10	-15%	0.52	-0.13	-20%
3,000 - 5,000 acres	0.00	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-
>5,000 acres	0.09	0.07	-0.01	-14%	0.07	-0.01	-14%	0.07	-0.01	-14%	0.07	-0.01	-14%

*Based on total events in 82 year simulation period.

Figure 1. Frequency of Reach 2 Habitat Area Inundation Events.





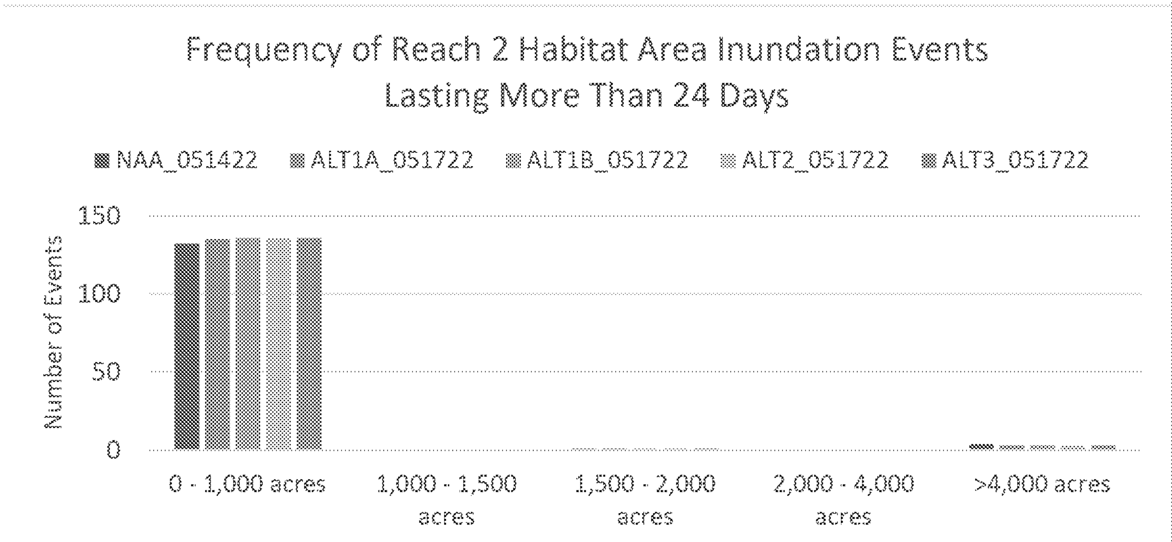


Table 1. Frequency of Sacramento River Reach 2 Habitat Area Inundation Events.

	Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days											
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	61	60	-1	-2%	56	-5	-8%	59	-2	-3%	58	-3	-5%
1,000 - 1,500 acres	21	16	-5	-24%	17	-4	-19%	16	-5	-24%	14	-7	-33%
1,500 - 2,000 acres	20	16	-4	-20%	14	-6	-30%	17	-3	-15%	14	-6	-30%
2,000 - 4,000 acres	11	10	-1	-9%	11	0	0%	11	0	0%	11	0	0%
>4,000 acres	35	34	-1	0	34	-1	0	34	-1	0	35	0	0
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	18	18	0	0%	21	3	17%	18	0	0%	22	4	22%
1,000 - 1,500 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
1,500 - 2,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
2,000 - 4,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
>4,000 acres	7	8	1	0	8	1	0	8	1	0	7	0	0
	Frequency of Reach 2 Habitat Area Inundation Events Lasting More Than 24 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	132	135	3	2%	136	4	3%	136	4	3%	136	4	3%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	4	3	-1	0	3	-1	0	3	-1	0	3	-1	0

*Based on total number of events in 82 year simulation period.

Table 2. Monthly Summary of Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days

Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days in October

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days in November

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	6	5	-1	-17%	4	-2	-33%	5	-1	-17%	5	-1	-17%
1,000 - 1,500 acres	0	1	1	-	2	2	-	1	1	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	1	1	-
2,000 - 4,000 acres	0	1	1	-	1	1	-	1	1	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	1	1	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days in December

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	10	11	1	10%	9	-1	-10%	11	1	10%	11	1	10%
1,000 - 1,500 acres	2	2	0	0%	1	-1	-50%	2	0	0%	1	-1	-50%
1,500 - 2,000 acres	5	5	0	0%	5	0	0%	5	0	0%	3	-2	-40%
2,000 - 4,000 acres	3	2	-1	-33%	2	-1	-33%	2	-1	-33%	4	1	33%
>4,000 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%

Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days in January

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	14	13	-1	-7%	14	0	0%	13	-1	-7%	13	-1	-7%
1,000 - 1,500 acres	1	3	2	200%	3	2	200%	3	2	200%	3	2	200%
1,500 - 2,000 acres	1	0	-1	-100%	0	-1	-100%	0	-1	-100%	0	-1	-100%
2,000 - 4,000 acres	2	0	-2	-100%	0	-2	-100%	1	-1	-50%	0	-2	-100%
>4,000 acres	7	6	-1	-14%	7	0	0%	6	-1	-14%	8	1	14%

Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days in February

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	10	10	0	0%	10	0	0%	10	0	0%	10	0	0%
1,000 - 1,500 acres	3	0	-3	-100%	0	-3	-100%	0	-3	-100%	0	-3	-100%
1,500 - 2,000 acres	6	3	-3	-50%	1	-5	-83%	4	-2	-33%	2	-4	-67%
2,000 - 4,000 acres	2	3	1	50%	4	2	100%	3	1	50%	3	1	50%
>4,000 acres	10	9	-1	-10%	8	-2	-20%	9	-1	-10%	8	-2	-20%

Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days in March

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	12	11	-1	-8%	9	-3	-25%	10	-2	-17%	9	-3	-25%
1,000 - 1,500 acres	4	1	-3	-75%	2	-2	-50%	2	-2	-50%	1	-3	-75%
1,500 - 2,000 acres	1	2	1	100%	2	1	100%	2	1	100%	2	1	100%
2,000 - 4,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
>4,000 acres	8	9	1	13%	9	1	13%	9	1	13%	8	0	0%

Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days in April

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	5	6	1	20%	6	1	20%	6	1	20%	6	1	20%
1,000 - 1,500 acres	4	3	-1	-25%	3	-1	-25%	3	-1	-25%	3	-1	-25%
1,500 - 2,000 acres	5	4	-1	-20%	4	-1	-20%	4	-1	-20%	4	-1	-20%
2,000 - 4,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
>4,000 acres	6	6	0	0%	6	0	0%	6	0	0%	6	0	0%

Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days in May

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
1,000 - 1,500 acres	5	4	-1	-20%	4	-1	-20%	4	-1	-20%	4	-1	-20%
1,500 - 2,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
2,000 - 4,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days in June

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,000 - 1,500 acres	1	1	0	0%	1	0	0%	0	-1	-100%	1	0	0%
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days in July

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,000 - 1,500 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days in August

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days in September

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Table 3. Monthly Summary of Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in October												
0 - 1,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in November												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in December												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in January												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	4	3	-1	-25%	5	1	25%	3	-1	-25%	5	1	25%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	4	4	0	0%	4	0	0%	4	0	0%	3	-1	-25%
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in February												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	5	4	-1	-20%	4	-1	-20%	4	-1	-20%	4	-1	-20%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
>4,000 acres	1	2	1	100%	2	1	100%	2	1	100%	2	1	100%
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in March												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	3	6	3	100%	7	4	133%	6	3	100%	7	4	133%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in April												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in May												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	1	0	-1	-100%	0	-1	-100%	0	-1	-100%	1	0	0%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in June												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,000 - 1,500 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
1,500 - 2,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in July												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in August												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
	Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in September												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Table 4. Monthly Summary of Frequency of Reach 2 Habitat Area Inundation Events Lasting More Than 24 Days

Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in October

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	5	5	0	0%	5	0	0%	5	0	0%	5	0	0%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in November

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in December

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	5	6	1	20%	7	2	40%	6	1	20%	5	0	0%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in January

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	15	16	1	7%	16	1	7%	16	1	7%	18	3	20%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in February

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	8	9	1	13%	9	1	13%	9	1	13%	11	3	38%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%

Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in March

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	16	17	1	6%	17	1	6%	17	1	6%	15	-1	-6%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	2	1	-1	-50%	1	-1	-50%	1	-1	-50%	1	-1	-50%

Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in April

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	10	9	-1	-10%	9	-1	-10%	9	-1	-10%	9	-1	-10%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in May

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	3	3	0	0%	3	0	0%	4	1	33%	3	0	0%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in June

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in July

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	27	27	0	0%	26	-1	-4%	27	0	0%	26	-1	-4%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in August

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	18	18	0	0%	19	1	6%	18	0	0%	20	2	11%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days in September

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	17	17	0	0%	17	0	0%	17	0	0%	16	-1	-6%
1,000 - 1,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
1,500 - 2,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,000 - 4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>4,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Figure 2. Average Annual Reach 2 Habitat Area Inundation Events.

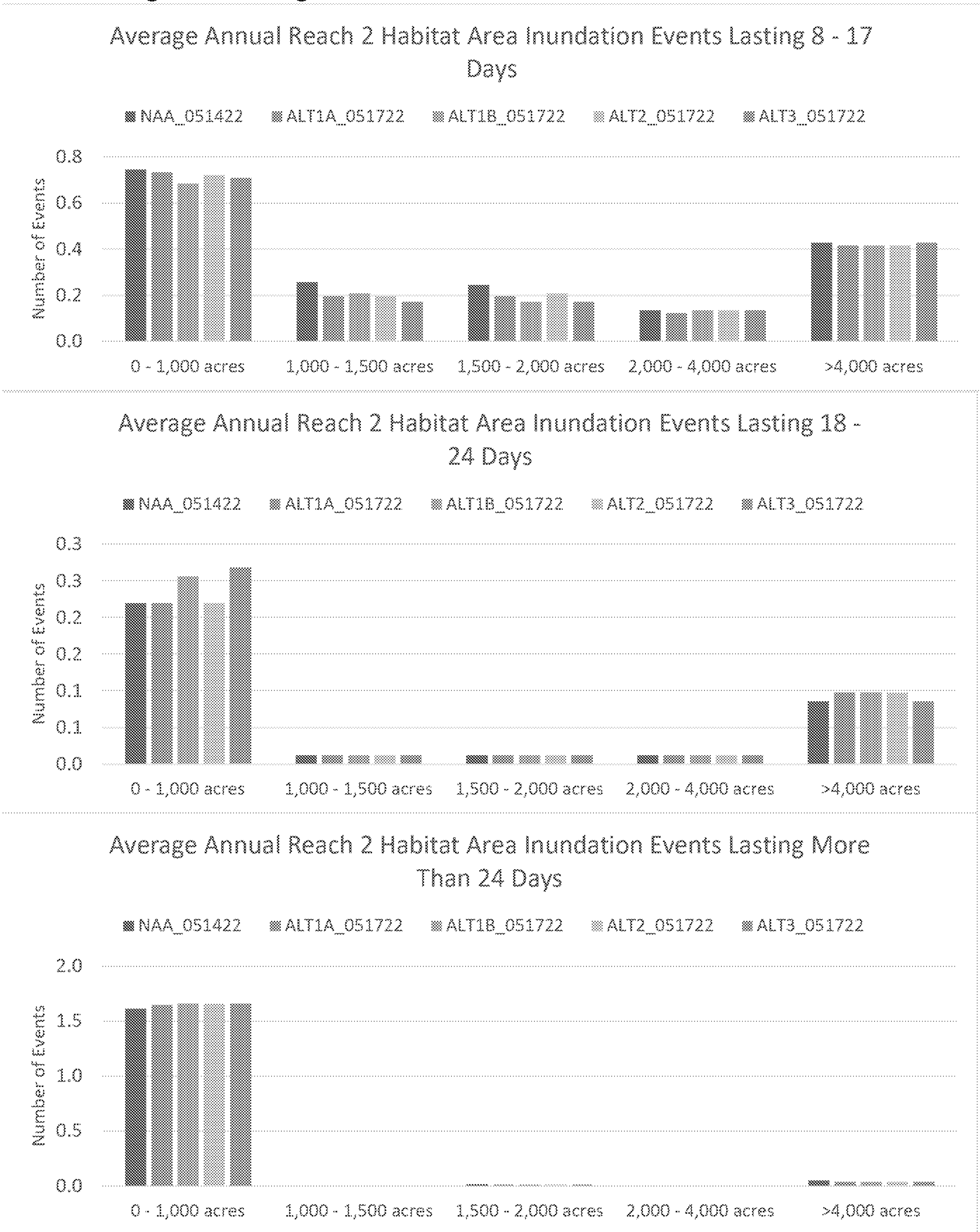


Table 4. Average Annual Reach 2 Habitat Area Inundation Events.

	Average Annual Reach 2 Habitat Area Inundation Events Lasting 8 - 17 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	0.74	0.73	-0.01	-2%	0.68	-0.06	-8%	0.72	-0.02	-3%	0.71	-0.04	-5%
1,000 - 1,500 acres	0.26	0.20	-0.06	-24%	0.21	-0.05	-19%	0.20	-0.06	-24%	0.17	-0.09	-33%
1,500 - 2,000 acres	0.24	0.20	-0.05	-20%	0.17	-0.07	-30%	0.21	-0.04	-15%	0.17	-0.07	-30%
2,000 - 4,000 acres	0.13	0.12	-0.01	-9%	0.13	0.00	0%	0.13	0.00	0%	0.13	0.00	0%
>4,000 acres	0.43	0.41	-0.01	0	0.41	-0.01	0	0.41	-0.01	0	0.43	0.00	0
	Average Annual Reach 2 Habitat Area Inundation Events Lasting 18 - 24 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	0.22	0.22	0.00	0%	0.26	0.04	17%	0.22	0.00	0%	0.27	0.05	22%
1,000 - 1,500 acres	0.01	0.01	0.00	0%	0.01	0.00	0%	0.01	0.00	0%	0.01	0.00	0%
1,500 - 2,000 acres	0.01	0.01	0.00	0%	0.01	0.00	0%	0.01	0.00	0%	0.01	0.00	0%
2,000 - 4,000 acres	0.01	0.01	0.00	0%	0.01	0.00	0%	0.01	0.00	0%	0.01	0.00	0%
>4,000 acres	0.09	0.10	0.01	0	0.10	0.01	0	0.10	0.01	0	0.09	0.00	0
	Average Annual Reach 2 Habitat Area Inundation Events Lasting Greater than 24 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 1,000 acres	1.61	1.65	0.04	2%	1.66	0.05	3%	1.66	0.05	3%	1.66	0.05	3%
1,000 - 1,500 acres	0.00	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-
1,500 - 2,000 acres	0.01	0.01	0.00	0%	0.01	0.00	0%	0.01	0.00	0%	0.01	0.00	0%
2,000 - 4,000 acres	0.00	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-
>4,000 acres	0.05	0.04	-0.01	0	0.04	-0.01	0	0.04	-0.01	0	0.04	-0.01	0

*Based on total events in 82 year simulation period.

Table 1a. Count of Years That Exceed Flow Magnitude and Duration Thresholds Between 1922 and 2003
Ord Ferry, Moulton Weir, and Colusa Weir Spill Results - ALT1A_051722 Compared to NAA_051422

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference	
> 0 cfs	67	66	-1	-1.5%	45	44	-1	-2.2%	30	28	-2	-6.7%	22	19	-3	-13.6%	8	8	0	0.0%
> 1,000 cfs	65	63	-2	-3.1%	44	44	0	0.0%	29	27	-2	-6.9%	19	16	-3	-15.8%	8	8	0	0.0%
> 2,000 cfs	62	60	-2	-3.2%	44	44	0	0.0%	28	26	-2	-7.1%	18	16	-2	-11.1%	7	7	0	0.0%
> 3,000 cfs	61	60	-1	-1.6%	43	40	-3	-7.0%	26	23	-3	-11.5%	16	14	-2	-12.5%	6	4	-2	-33.3%
> 4,000 cfs	60	59	-1	-1.7%	41	38	-3	-7.3%	24	21	-3	-12.5%	15	13	-2	-13.3%	5	4	-1	-20.0%
> 6,000 cfs	55	54	-1	-1.8%	38	37	-1	-2.6%	21	20	-1	-4.8%	12	11	-1	-8.3%	4	3	-1	-25.0%
> 8,000 cfs	52	51	-1	-1.9%	36	32	-4	-11.1%	19	19	0	0.0%	10	10	0	0.0%	3	3	0	0.0%
> 10,000 cfs	49	50	1	2.0%	32	31	-1	-3.1%	17	17	0	0.0%	10	9	-1	-10.0%	3	3	0	0.0%

Table 1b. Count of Years That Exceed Flow Magnitude and Duration Thresholds Between 1922 and 2003
Total Weir Spill Results - ALT1A_051722 Compared to NAA_051422

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference	
> 0 cfs	71	71	0	0.0%	50	49	-1	-2.0%	38	35	-3	-7.9%	26	25	-1	-3.8%	14	13	-1	-7.1%
> 1,000 cfs	70	69	-1	-1.4%	49	47	-2	-4.1%	35	34	-1	-2.9%	25	24	-1	-4.0%	13	13	0	0.0%
> 2,000 cfs	69	69	0	0.0%	48	45	-3	-6.3%	35	33	-2	-5.7%	23	22	-1	-4.3%	13	12	-1	-7.7%
> 3,000 cfs	68	68	0	0.0%	47	44	-3	-6.4%	32	31	-1	-3.1%	22	22	0	0.0%	13	11	-2	-15.4%
> 4,000 cfs	67	64	-3	-4.5%	45	44	-1	-2.2%	31	27	-4	-12.9%	22	21	-1	-4.5%	10	9	-1	-10.0%
> 6,000 cfs	63	62	-1	-1.6%	44	42	-2	-4.5%	28	26	-2	-7.1%	20	17	-3	-15.0%	8	7	-1	-12.5%
> 8,000 cfs	60	59	-1	-1.7%	42	41	-1	-2.4%	25	24	-1	-4.0%	17	15	-2	-11.8%	6	5	-1	-16.7%
> 10,000 cfs	58	58	0	0.0%	41	39	-2	-4.9%	24	21	-3	-12.5%	15	13	-2	-13.3%	4	4	0	0.0%

*Total Weir Spill Results include spills from Ord Ferry, Moulton Weir, Colusa Weir, and Tisdale Weir.

Table 1c. Count of Years That Exceed Flow Magnitude and Duration Thresholds Between 1922 and 2003
Total Sutter Bypass Flow Results - ALT1A_051722 Compared to NAA_051422

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference	
> 0 cfs	82	82	0	0.0%	82	82	0	0.0%	82	82	0	0.0%	82	82	0	0.0%	82	82	0	0.0%
> 1,000 cfs	81	81	0	0.0%	76	76	0	0.0%	69	69	0	0.0%	60	60	0	0.0%	47	47	0	0.0%
> 2,000 cfs	81	81	0	0.0%	67	67	0	0.0%	52	52	0	0.0%	41	41	0	0.0%	33	33	0	0.0%
> 3,000 cfs	81	81	0	0.0%	63	61	-2	-3.2%	49	47	-2	-4.1%	38	36	-2	-5.3%	24	23	-1	-4.2%
> 4,000 cfs	80	80	0	0.0%	58	58	0	0.0%	46	46	0	0.0%	32	31	-1	-3.1%	19	19	0	0.0%
> 6,000 cfs	76	76	0	0.0%	55	53	-2	-3.6%	39	36	-3	-7.7%	26	26	0	0.0%	13	13	0	0.0%
> 8,000 cfs	73	73	0	0.0%	48	47	-1	-2.1%	35	33	-2	-5.7%	23	22	-1	-4.3%	11	10	-1	-9.1%
> 10,000 cfs	68	68	0	0.0%	46	45	-1	-2.2%	33	29	-4	-12.1%	22	22	0	0.0%	9	8	-1	-11.1%

Table 2a. Count of Years That Exceed Flow Magnitude and Duration Thresholds Between 1922 and 2003
Ord Ferry, Moulton Weir, and Colusa Weir Spill Results - ALT1B_051722 Compared to NAA_051422

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference	
> 0 cfs	67	65	-2	-3.0%	45	44	-1	-2.2%	30	28	-2	-6.7%	22	19	-3	-13.6%	8	8	0	0.0%
> 1,000 cfs	65	63	-2	-3.1%	44	44	0	0.0%	29	27	-2	-6.9%	19	16	-3	-15.8%	8	8	0	0.0%
> 2,000 cfs	62	60	-2	-3.2%	44	44	0	0.0%	28	26	-2	-7.1%	18	16	-2	-11.1%	7	6	-1	-14.3%
> 3,000 cfs	61	59	-2	-3.3%	43	40	-3	-7.0%	26	23	-3	-11.5%	16	14	-2	-12.5%	6	5	-1	-16.7%
> 4,000 cfs	60	59	-1	-1.7%	41	38	-3	-7.3%	24	20	-4	-16.7%	15	13	-2	-13.3%	5	4	-1	-20.0%
> 6,000 cfs	55	55	0	0.0%	38	37	-1	-2.6%	21	20	-1	-4.8%	12	11	-1	-8.3%	4	3	-1	-25.0%
> 8,000 cfs	52	52	0	0.0%	36	32	-4	-11.1%	19	19	0	0.0%	10	10	0	0.0%	3	3	0	0.0%
> 10,000 cfs	49	50	1	2.0%	32	31	-1	-3.1%	17	17	0	0.0%	10	9	-1	-10.0%	3	3	0	0.0%

Table 2b. Count of Years That Exceed Flow Magnitude and Duration Thresholds Between 1922 and 2003
Total Weir Spill Results - ALT1B_051722 Compared to NAA_051422

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference	
> 0 cfs	71	72	1	1.4%	50	49	-1	-2.0%	38	36	-2	-5.3%	26	25	-1	-3.8%	14	13	-1	-7.1%
> 1,000 cfs	70	70	0	0.0%	49	47	-2	-4.1%	35	34	-1	-2.9%	25	24	-1	-4.0%	13	13	0	0.0%
> 2,000 cfs	69	69	0	0.0%	48	45	-3	-6.3%	35	33	-2	-5.7%	23	22	-1	-4.3%	13	12	-1	-7.7%
> 3,000 cfs	68	68	0	0.0%	47	44	-3	-6.4%	32	31	-1	-3.1%	22	22	0	0.0%	13	10	-3	-23.1%
> 4,000 cfs	67	64	-3	-4.5%	45	44	-1	-2.2%	31	27	-4	-12.9%	22	21	-1	-4.5%	10	8	-2	-20.0%
> 6,000 cfs	63	62	-1	-1.6%	44	42	-2	-4.5%	28	26	-2	-7.1%	20	17	-3	-15.0%	8	7	-1	-12.5%
> 8,000 cfs	60	59	-1	-1.7%	42	40	-2	-4.8%	25	23	-2	-8.0%	17	15	-2	-11.8%	6	5	-1	-16.7%
> 10,000 cfs	58	58	0	0.0%	41	39	-2	-4.9%	24	20	-4	-16.7%	15	13	-2	-13.3%	4	4	0	0.0%

*Total Weir Spill Results include spills from Ord Ferry, Moulton Weir, Colusa Weir, and Tisdale Weir.

Table 2c. Count of Years That Exceed Flow Magnitude and Duration Thresholds Between 1922 and 2003
Total Sutter Bypass Flow Results - ALT1B_051722 Compared to NAA_051422

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference	
> 0 cfs	82	82	0	0.0%	82	82	0	0.0%	82	82	0	0.0%	82	82	0	0.0%	82	82	0	0.0%
> 1,000 cfs	81	81	0	0.0%	76	76	0	0.0%	69	69	0	0.0%	60	60	0	0.0%	47	47	0	0.0%
> 2,000 cfs	81	81	0	0.0%	67	68	1	1.5%	52	52	0	0.0%	41	41	0	0.0%	33	33	0	0.0%
> 3,000 cfs	81	81	0	0.0%	63	61	-2	-3.2%	49	47	-2	-4.1%	38	36	-2	-5.3%	24	23	-1	-4.2%
> 4,000 cfs	80	80	0	0.0%	58	58	0	0.0%	46	46	0	0.0%	32	31	-1	-3.1%	19	19	0	0.0%
> 6,000 cfs	76	76	0	0.0%	55	53	-2	-3.6%	39	37	-2	-5.1%	26	26	0	0.0%	13	13	0	0.0%
> 8,000 cfs	73	73	0	0.0%	48	47	-1	-2.1%	35	33	-2	-5.7%	23	22	-1	-4.3%	11	10	-1	-9.1%
> 10,000 cfs	68	68	0	0.0%	46	45	-1	-2.2%	33	29	-4	-12.1%	22	22	0	0.0%	9	8	-1	-11.1%

Table 3a. Count of Years That Exceed Flow Magnitude and Duration Thresholds Between 1922 and 2003
Ord Ferry, Moulton Weir, and Colusa Weir Spill Results - ALT2_051722 Compared to NAA_051422

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference	
> 0 cfs	67	66	-1	-1.5%	45	44	-1	-2.2%	30	28	-2	-6.7%	22	19	-3	-13.6%	8	8	0	0.0%
> 1,000 cfs	65	63	-2	-3.1%	44	44	0	0.0%	29	27	-2	-6.9%	19	16	-3	-15.8%	8	8	0	0.0%
> 2,000 cfs	62	60	-2	-3.2%	44	44	0	0.0%	28	26	-2	-7.1%	18	16	-2	-11.1%	7	7	0	0.0%
> 3,000 cfs	61	60	-1	-1.6%	43	41	-2	-4.7%	26	23	-3	-11.5%	16	14	-2	-12.5%	6	4	-2	-33.3%
> 4,000 cfs	60	59	-1	-1.7%	41	38	-3	-7.3%	24	21	-3	-12.5%	15	13	-2	-13.3%	5	4	-1	-20.0%
> 6,000 cfs	55	54	-1	-1.8%	38	37	-1	-2.6%	21	20	-1	-4.8%	12	11	-1	-8.3%	4	3	-1	-25.0%
> 8,000 cfs	52	51	-1	-1.9%	36	32	-4	-11.1%	19	19	0	0.0%	10	10	0	0.0%	3	3	0	0.0%
> 10,000 cfs	49	50	1	2.0%	32	31	-1	-3.1%	17	17	0	0.0%	10	9	-1	-10.0%	3	3	0	0.0%

Table 3b. Count of Years That Exceed Flow Magnitude and Duration Thresholds Between 1922 and 2003
Total Weir Spill Results - ALT2_051722 Compared to NAA_051422

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference	
> 0 cfs	71	71	0	0.0%	50	49	-1	-2.0%	38	35	-3	-7.9%	26	25	-1	-3.8%	14	13	-1	-7.1%
> 1,000 cfs	70	69	-1	-1.4%	49	47	-2	-4.1%	35	34	-1	-2.9%	25	25	0	0.0%	13	13	0	0.0%
> 2,000 cfs	69	69	0	0.0%	48	45	-3	-6.3%	35	33	-2	-5.7%	23	22	-1	-4.3%	13	12	-1	-7.7%
> 3,000 cfs	68	68	0	0.0%	47	44	-3	-6.4%	32	31	-1	-3.1%	22	22	0	0.0%	13	11	-2	-15.4%
> 4,000 cfs	67	64	-3	-4.5%	45	44	-1	-2.2%	31	27	-4	-12.9%	22	21	-1	-4.5%	10	9	-1	-10.0%
> 6,000 cfs	63	62	-1	-1.6%	44	42	-2	-4.5%	28	26	-2	-7.1%	20	17	-3	-15.0%	8	7	-1	-12.5%
> 8,000 cfs	60	59	-1	-1.7%	42	42	0	0.0%	25	24	-1	-4.0%	17	15	-2	-11.8%	6	5	-1	-16.7%
> 10,000 cfs	58	58	0	0.0%	41	39	-2	-4.9%	24	21	-3	-12.5%	15	13	-2	-13.3%	4	4	0	0.0%

*Total Weir Spill Results include spills from Ord Ferry, Moulton Weir, Colusa Weir, and Tisdale Weir.

Table 3c. Count of Years That Exceed Flow Magnitude and Duration Thresholds Between 1922 and 2003
Total Sutter Bypass Flow Results - ALT2_051722 Compared to NAA_051422

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference	
> 0 cfs	82	82	0	0.0%	82	82	0	0.0%	82	82	0	0.0%	82	82	0	0.0%	82	82	0	0.0%
> 1,000 cfs	81	81	0	0.0%	76	76	0	0.0%	69	69	0	0.0%	60	60	0	0.0%	47	47	0	0.0%
> 2,000 cfs	81	81	0	0.0%	67	67	0	0.0%	52	52	0	0.0%	41	41	0	0.0%	33	33	0	0.0%
> 3,000 cfs	81	81	0	0.0%	63	61	-2	-3.2%	49	47	-2	-4.1%	38	36	-2	-5.3%	24	23	-1	-4.2%
> 4,000 cfs	80	80	0	0.0%	58	58	0	0.0%	46	46	0	0.0%	32	31	-1	-3.1%	19	19	0	0.0%
> 6,000 cfs	76	76	0	0.0%	55	53	-2	-3.6%	39	36	-3	-7.7%	26	26	0	0.0%	13	13	0	0.0%
> 8,000 cfs	73	73	0	0.0%	48	47	-1	-2.1%	35	33	-2	-5.7%	23	22	-1	-4.3%	11	10	-1	-9.1%
> 10,000 cfs	68	68	0	0.0%	46	45	-1	-2.2%	33	29	-4	-12.1%	22	22	0	0.0%	9	8	-1	-11.1%

Table 4a. Count of Years That Exceed Flow Magnitude and Duration Thresholds Between 1922 and 2003
Ord Ferry, Moulton Weir, and Colusa Weir Spill Results - ALT3_051722 Compared to NAA_051422

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference	
> 0 cfs	67	66	-1	-1.5%	45	45	0	0.0%	30	28	-2	-6.7%	22	20	-2	-9.1%	8	8	0	0.0%
> 1,000 cfs	65	64	-1	-1.5%	44	43	-1	-2.3%	29	26	-3	-10.3%	19	16	-3	-15.8%	8	8	0	0.0%
> 2,000 cfs	62	61	-1	-1.6%	44	43	-1	-2.3%	28	25	-3	-10.7%	18	16	-2	-11.1%	7	6	-1	-14.3%
> 3,000 cfs	61	59	-2	-3.3%	43	40	-3	-7.0%	26	23	-3	-11.5%	16	14	-2	-12.5%	6	5	-1	-16.7%
> 4,000 cfs	60	59	-1	-1.7%	41	38	-3	-7.3%	24	21	-3	-12.5%	15	13	-2	-13.3%	5	5	0	0.0%
> 6,000 cfs	55	55	0	0.0%	38	36	-2	-5.3%	21	20	-1	-4.8%	12	10	-2	-16.7%	4	3	-1	-25.0%
> 8,000 cfs	52	52	0	0.0%	36	33	-3	-8.3%	19	19	0	0.0%	10	10	0	0.0%	3	3	0	0.0%
> 10,000 cfs	49	50	1	2.0%	32	31	-1	-3.1%	17	17	0	0.0%	10	9	-1	-10.0%	3	3	0	0.0%

Table 4b. Count of Years That Exceed Flow Magnitude and Duration Thresholds Between 1922 and 2003
Total Weir Spill Results - ALT3_051722 Compared to NAA_051422

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference	
> 0 cfs	71	72	1	1.4%	50	49	-1	-2.0%	38	37	-1	-2.6%	26	25	-1	-3.8%	14	13	-1	-7.1%
> 1,000 cfs	70	70	0	0.0%	49	47	-2	-4.1%	35	34	-1	-2.9%	25	24	-1	-4.0%	13	13	0	0.0%
> 2,000 cfs	69	70	1	1.4%	48	46	-2	-4.2%	35	33	-2	-5.7%	23	22	-1	-4.3%	13	11	-2	-15.4%
> 3,000 cfs	68	69	1	1.5%	47	45	-2	-4.3%	32	30	-2	-6.3%	22	22	0	0.0%	13	10	-3	-23.1%
> 4,000 cfs	67	65	-2	-3.0%	45	45	0	0.0%	31	27	-4	-12.9%	22	22	0	0.0%	10	8	-2	-20.0%
> 6,000 cfs	63	63	0	0.0%	44	42	-2	-4.5%	28	25	-3	-10.7%	20	18	-2	-10.0%	8	6	-2	-25.0%
> 8,000 cfs	60	59	-1	-1.7%	42	40	-2	-4.8%	25	24	-1	-4.0%	17	15	-2	-11.8%	6	5	-1	-16.7%
> 10,000 cfs	58	58	0	0.0%	41	39	-2	-4.9%	24	21	-3	-12.5%	15	13	-2	-13.3%	4	4	0	0.0%

*Total Weir Spill Results include spills from Ord Ferry, Moulton Weir, Colusa Weir, and Tisdale Weir.

Table 4c. Count of Years That Exceed Flow Magnitude and Duration Thresholds Between 1922 and 2003
Total Sutter Bypass Flow Results - ALT3_051722 Compared to NAA_051422

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference	
> 0 cfs	82	82	0	0.0%	82	82	0	0.0%	82	82	0	0.0%	82	82	0	0.0%	82	82	0	0.0%
> 1,000 cfs	81	81	0	0.0%	76	76	0	0.0%	69	69	0	0.0%	60	60	0	0.0%	47	47	0	0.0%
> 2,000 cfs	81	81	0	0.0%	67	68	1	1.5%	52	52	0	0.0%	41	41	0	0.0%	33	33	0	0.0%
> 3,000 cfs	81	81	0	0.0%	63	62	-1	-1.6%	49	47	-2	-4.1%	38	36	-2	-5.3%	24	23	-1	-4.2%
> 4,000 cfs	80	80	0	0.0%	58	58	0	0.0%	46	46	0	0.0%	32	32	0	0.0%	19	19	0	0.0%
> 6,000 cfs	76	76	0	0.0%	55	53	-2	-3.6%	39	37	-2	-5.1%	26	26	0	0.0%	13	14	1	7.7%
> 8,000 cfs	73	73	0	0.0%	48	47	-1	-2.1%	35	31	-4	-11.4%	23	22	-1	-4.3%	11	11	0	0.0%
> 10,000 cfs	68	69	1	1.5%	46	45	-1	-2.2%	33	29	-4	-12.1%	22	21	-1	-4.5%	9	8	-1	-11.1%

Table 5. Sutter Bypass Habitat Inundation Duration Frequency Based on Estimated Daily Sutter Bypass Flows
NAA_051422 vs ALT1A_051722 (Historic Climate)

Total Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	191	197	6	3%	453	457	4	1%	473	475	2	0%	547	551	4	1%
t>=11 days	341	340	-1	0%	298	300	2	1%	207	208	1	0%	20	20	0	0%

January Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	25	27	2	8%	47	50	3	6%	85	87	2	2%	91	95	4	4%
t>=11 days	41	42	1	2%	39	39	0	0%	24	25	1	4%	0	0	0	0%

February Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	15	17	2	13%	34	37	3	9%	52	50	-2	-4%	92	88	-4	-4%
t>=11 days	31	30	-1	-3%	36	36	0	0%	31	31	0	0%	0	0	0	0%

March Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	12	12	0	0%	27	28	1	4%	47	48	1	2%	123	123	0	0%
t>=11 days	36	35	-1	-3%	38	38	0	0%	34	34	0	0%	1	1	0	0%

April Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	4	6	2	50%	16	16	0	0%	25	25	0	0%	62	62	0	0%
t>=11 days	31	31	0	0%	42	43	1	2%	38	38	0	0%	9	9	0	0%

May Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	6	6	0	0%	20	20	0	0%	30	30	0	0%	37	37	0	0%
t>=11 days	35	34	-1	-3%	30	29	-1	-3%	38	38	0	0%	10	10	0	0%

June Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	16	16	0	0%	43	43	0	0%	29	29	0	0%	16	16	0	0%
t>=11 days	30	30	0	0%	29	29	0	0%	18	18	0	0%	0	0	0	0%

July Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	9	9	0	0%	35	35	0	0%	18	18	0	0%	0	0	0	0%
t>=11 days	20	20	0	0%	9	9	0	0%	2	2	0	0%	0	0	0	0%

August Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	7	7	0	0%	12	12	0	0%	3	3	0	0%	0	0	0	0%
t>=11 days	16	16	0	0%	7	7	0	0%	0	0	0	0%	0	0	0	0%

September Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	18	18	0	0%	13	13	0	0%	3	3	0	0%	0	0	0	0%
t>=11 days	5	5	0	0%	1	1	0	0%	0	0	0	0%	0	0	0	0%

October Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	22	22	0	0%	45	45	0	0%	15	15	0	0%	4	5	1	25%
t>=11 days	17	17	0	0%	6	6	0	0%	0	0	0	0%	0	0	0	0%

November Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	26	27	1	4%	76	76	0	0%	70	70	0	0%	44	45	1	2%
t>=11 days	37	37	0	0%	26	26	0	0%	8	8	0	0%	0	0	0	0%

December Frequency of Exceedance (WY 1922-2003)

Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff	NAA	ALT1A	Difference	Percent Diff
t<=10 days	31	30	-1	-3%	85	82	-3	-4%	96	97	1	1%	78	80	2	3%
t>=11 days	42	43	1	2%	35	37	2	6%	14	14	0	0%	0	0	0	0%

Table 6. Sutter Bypass Habitat Inundation Duration Frequency Based on Estimated Daily Sutter Bypass Flows
NAA_051422 vs ALT1B_051722 (Historic Climate)

Duration	Total Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	191	196	5	3%	453	455	2	0%	473	477	4	1%	547	551	4	1%
t>=11 days	341	341	0	0%	298	301	3	1%	207	208	1	0%	20	20	0	0%

Duration	January Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	25	27	2	8%	47	48	1	2%	85	87	2	2%	91	96	5	5%
t>=11 days	41	42	1	2%	39	40	1	3%	24	25	1	4%	0	0	0	0%

Duration	February Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	15	17	2	13%	34	37	3	9%	52	50	-2	-4%	92	88	-4	-4%
t>=11 days	31	30	-1	-3%	36	36	0	0%	31	31	0	0%	0	0	0	0%

Duration	March Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	12	12	0	0%	27	28	1	4%	47	49	2	4%	123	123	0	0%
t>=11 days	36	35	-1	-3%	38	38	0	0%	34	34	0	0%	1	1	0	0%

Duration	April Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	4	6	2	50%	16	16	0	0%	25	25	0	0%	62	62	0	0%
t>=11 days	31	32	1	3%	42	43	1	2%	38	38	0	0%	9	9	0	0%

Duration	May Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	6	6	0	0%	20	20	0	0%	30	30	0	0%	37	37	0	0%
t>=11 days	35	33	-2	-6%	30	29	-1	-3%	38	38	0	0%	10	10	0	0%

Duration	June Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	16	16	0	0%	43	43	0	0%	29	29	0	0%	16	16	0	0%
t>=11 days	30	30	0	0%	29	29	0	0%	18	18	0	0%	0	0	0	0%

Duration	July Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	9	9	0	0%	35	35	0	0%	18	18	0	0%	0	0	0	0%
t>=11 days	20	20	0	0%	9	9	0	0%	2	2	0	0%	0	0	0	0%

Duration	August Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	7	7	0	0%	12	12	0	0%	3	3	0	0%	0	0	0	0%
t>=11 days	16	16	0	0%	7	7	0	0%	0	0	0	0%	0	0	0	0%

Duration	September Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	18	18	0	0%	13	13	0	0%	3	3	0	0%	0	0	0	0%
t>=11 days	5	5	0	0%	1	1	0	0%	0	0	0	0%	0	0	0	0%

Duration	October Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	22	22	0	0%	45	45	0	0%	15	15	0	0%	4	5	1	25%
t>=11 days	17	17	0	0%	6	6	0	0%	0	0	0	0%	0	0	0	0%

Duration	November Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	26	27	1	4%	76	76	0	0%	70	70	0	0%	44	45	1	2%
t>=11 days	37	37	0	0%	26	26	0	0%	8	8	0	0%	0	0	0	0%

Duration	December Frequency of Exceedance (WY 1922-2003)															
	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff	NAA	ALT1B	Difference	Percent Diff
t<=10 days	31	29	-2	-6%	85	82	-3	-4%	96	98	2	2%	78	79	1	1%
t>=11 days	42	44	2	5%	35	37	2	6%	14	14	0	0%	0	0	0	0%

Table 7. Sutter Bypass Habitat Inundation Duration Frequency Based on Estimated Daily Sutter Bypass Flows
NAA_051422 vs ALT2_051722 (Historic Climate)

Total Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	191	196	5	3%	453	457	4	1%	473	475	2	0%	547	552	5	1%
t>=11 days	341	340	-1	0%	298	300	2	1%	207	208	1	0%	20	20	0	0%

January Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	25	27	2	8%	47	48	1	2%	85	87	2	2%	91	96	5	5%
t>=11 days	41	42	1	2%	39	40	1	3%	24	25	1	4%	0	0	0	0%

February Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	15	16	1	7%	34	37	3	9%	52	50	-2	-4%	92	88	-4	-4%
t>=11 days	31	30	-1	-3%	36	36	0	0%	31	31	0	0%	0	0	0	0%

March Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	12	12	0	0%	27	28	1	4%	47	48	1	2%	123	123	0	0%
t>=11 days	36	35	-1	-3%	38	38	0	0%	34	34	0	0%	1	1	0	0%

April Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	4	6	2	50%	16	16	0	0%	25	25	0	0%	62	62	0	0%
t>=11 days	31	31	0	0%	42	43	1	2%	38	38	0	0%	9	9	0	0%

May Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	6	6	0	0%	20	20	0	0%	30	30	0	0%	37	37	0	0%
t>=11 days	35	34	-1	-3%	30	29	-1	-3%	38	38	0	0%	10	10	0	0%

June Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	16	16	0	0%	43	43	0	0%	29	29	0	0%	16	16	0	0%
t>=11 days	30	30	0	0%	29	29	0	0%	18	18	0	0%	0	0	0	0%

July Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	9	9	0	0%	35	35	0	0%	18	18	0	0%	0	0	0	0%
t>=11 days	20	20	0	0%	9	9	0	0%	2	2	0	0%	0	0	0	0%

August Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	7	7	0	0%	12	12	0	0%	3	3	0	0%	0	0	0	0%
t>=11 days	16	16	0	0%	7	7	0	0%	0	0	0	0%	0	0	0	0%

September Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	18	18	0	0%	13	13	0	0%	3	3	0	0%	0	0	0	0%
t>=11 days	5	5	0	0%	1	1	0	0%	0	0	0	0%	0	0	0	0%

October Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	22	22	0	0%	45	45	0	0%	15	15	0	0%	4	5	1	25%
t>=11 days	17	17	0	0%	6	6	0	0%	0	0	0	0%	0	0	0	0%

November Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	26	27	1	4%	76	76	0	0%	70	70	0	0%	44	45	1	2%
t>=11 days	37	37	0	0%	26	26	0	0%	8	8	0	0%	0	0	0	0%

December Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff	NAA	ALT2	Difference	Percent Diff
t<=10 days	31	30	-1	-3%	85	84	-1	-1%	96	97	1	1%	78	80	2	3%
t>=11 days	42	43	1	2%	35	36	1	3%	14	14	0	0%	0	0	0	0%

Table 8. Sutter Bypass Habitat Inundation Duration Frequency Based on Estimated Daily Sutter Bypass Flows
NAA_051422 vs ALT3_051722 (Historic Climate)

Total Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	191	195	4	2%	453	453	0	0%	473	474	1	0%	547	556	9	2%
t>=11 days	341	342	1	0%	298	303	5	2%	207	209	2	1%	20	20	0	0%

January Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	25	27	2	8%	47	48	1	2%	85	86	1	1%	91	96	5	5%
t>=11 days	41	42	1	2%	39	40	1	3%	24	25	1	4%	0	0	0	0%

February Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	15	17	2	13%	34	36	2	6%	52	50	-2	-4%	92	89	-3	-3%
t>=11 days	31	30	-1	-3%	36	37	1	3%	31	32	1	3%	0	0	0	0%

March Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	12	12	0	0%	27	28	1	4%	47	48	1	2%	123	125	2	2%
t>=11 days	36	35	-1	-3%	38	37	-1	-3%	34	34	0	0%	1	1	0	0%

April Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	4	5	1	25%	16	15	-1	-6%	25	25	0	0%	62	62	0	0%
t>=11 days	31	31	0	0%	42	44	2	5%	38	38	0	0%	9	9	0	0%

May Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	6	6	0	0%	20	20	0	0%	30	30	0	0%	37	37	0	0%
t>=11 days	35	34	-1	-3%	30	29	-1	-3%	38	38	0	0%	10	10	0	0%

June Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	16	16	0	0%	43	43	0	0%	29	29	0	0%	16	16	0	0%
t>=11 days	30	30	0	0%	29	29	0	0%	18	18	0	0%	0	0	0	0%

July Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	9	9	0	0%	35	35	0	0%	18	18	0	0%	0	0	0	0%
t>=11 days	20	20	0	0%	9	9	0	0%	2	2	0	0%	0	0	0	0%

August Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	7	7	0	0%	12	12	0	0%	3	3	0	0%	0	0	0	0%
t>=11 days	16	16	0	0%	7	7	0	0%	0	0	0	0%	0	0	0	0%

September Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	18	18	0	0%	13	13	0	0%	3	3	0	0%	0	0	0	0%
t>=11 days	5	5	0	0%	1	1	0	0%	0	0	0	0%	0	0	0	0%

October Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	22	22	0	0%	45	45	0	0%	15	15	0	0%	4	5	1	25%
t>=11 days	17	17	0	0%	6	6	0	0%	0	0	0	0%	0	0	0	0%

November Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	26	27	1	4%	76	76	0	0%	70	70	0	0%	44	44	0	0%
t>=11 days	37	38	1	3%	26	26	0	0%	8	8	0	0%	0	0	0	0%

December Frequency of Exceedance (WY 1922-2003)																
Duration	>7,000 Acres				>8,000 Acres				>9,000 Acres				>10,000 Acres			
	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff	NAA	ALT3	Difference	Percent Diff
t<=10 days	31	29	-2	-6%	85	82	-3	-4%	96	97	1	1%	78	82	4	5%
t>=11 days	42	44	2	5%	35	38	3	9%	14	14	0	0%	0	0	0	0%

Figure 1. Frequency of Sutter Bypass Habitat Area Inundation Events.

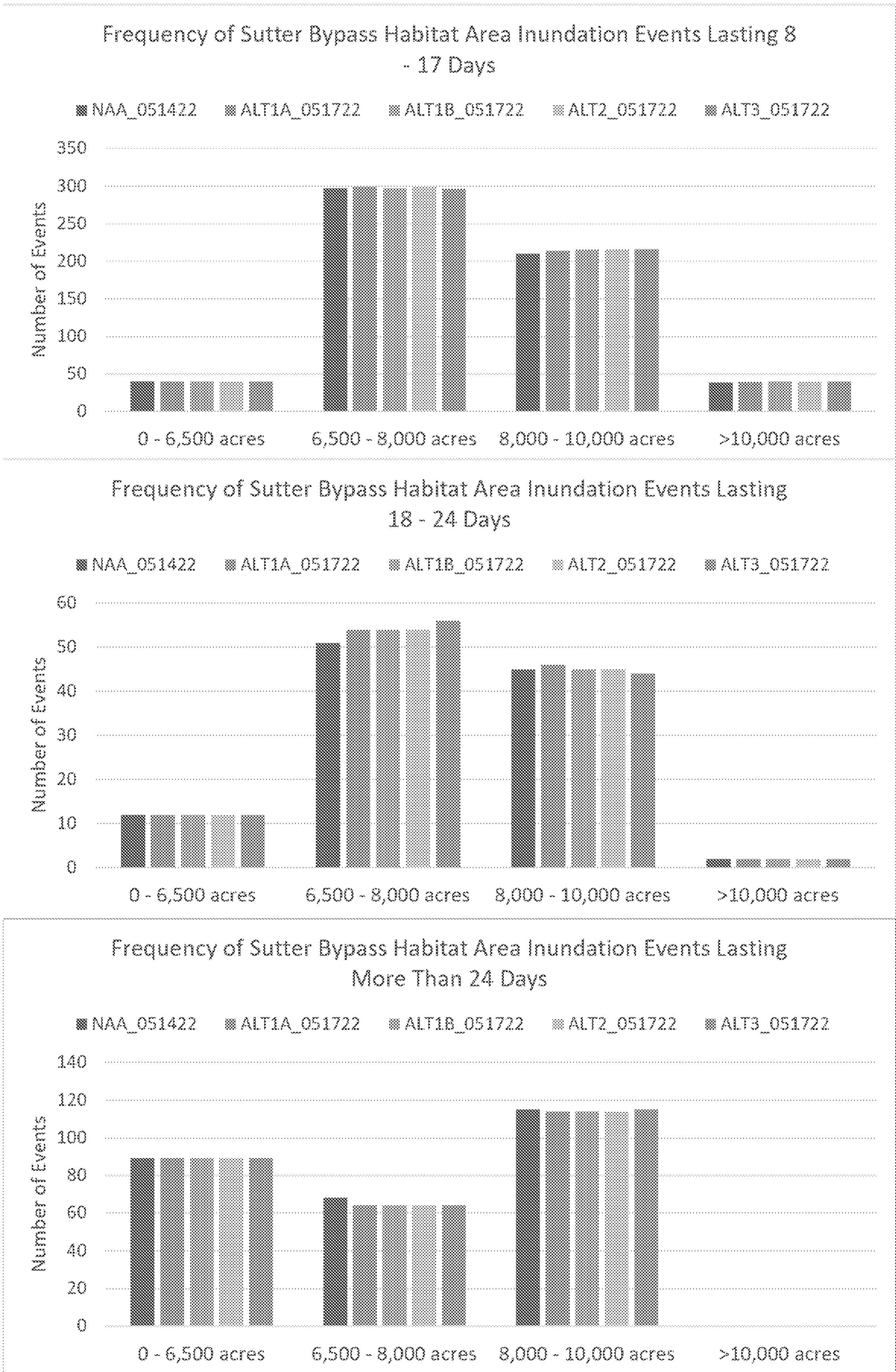


Table 1. Frequency of Sutter Bypass Habitat Area Inundation Events.

	Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days											
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	40	40	0	0%	40	0	0%	40	0	0%	40	0	0%
6,500 - 8,000 acres	297	299	2	1%	297	0	0%	298	1	0%	296	-1	0%
8,000 - 10,000 acres	210	214	4	2%	215	5	2%	215	5	2%	216	6	3%
>10,000 acres	38	39	1	3%	40	2	5%	39	1	3%	40	2	5%
	Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	12	12	0	0%	12	0	0%	12	0	0%	12	0	0%
6,500 - 8,000 acres	51	54	3	6%	54	3	6%	54	3	6%	56	5	10%
8,000 - 10,000 acres	45	46	1	2%	45	0	0%	45	0	0%	44	-1	-2%
>10,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
	Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	89	89	0	0%	89	0	0%	89	0	0%	89	0	0%
6,500 - 8,000 acres	68	64	-4	-6%	64	-4	-6%	64	-4	-6%	64	-4	-6%
8,000 - 10,000 acres	115	114	-1	-1%	114	-1	-1%	114	-1	-1%	115	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

*Based on total number of events in 82 year simulation period.

Table 2. Monthly Summary of Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in October

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	6	6	0	0%	6	0	0%	6	0	0%	6	0	0%
6,500 - 8,000 acres	25	25	0	0%	25	0	0%	25	0	0%	25	0	0%
8,000 - 10,000 acres	7	7	0	0%	7	0	0%	7	0	0%	7	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in November

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	7	7	0	0%	7	0	0%	7	0	0%	7	0	0%
6,500 - 8,000 acres	30	30	0	0%	30	0	0%	30	0	0%	30	0	0%
8,000 - 10,000 acres	25	25	0	0%	25	0	0%	25	0	0%	25	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in December

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	6	6	0	0%	6	0	0%	6	0	0%	6	0	0%
6,500 - 8,000 acres	35	34	-1	-3%	33	-2	-6%	33	-2	-6%	33	-2	-6%
8,000 - 10,000 acres	32	33	1	3%	33	1	3%	33	1	3%	32	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in January

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	6	6	0	0%	6	0	0%	6	0	0%	6	0	0%
6,500 - 8,000 acres	26	27	1	4%	27	1	4%	27	1	4%	26	0	0%
8,000 - 10,000 acres	38	40	2	5%	40	2	5%	40	2	5%	40	2	5%
>10,000 acres	0	0	0	-	1	1	-	0	0	-	1	1	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in February

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
6,500 - 8,000 acres	23	25	2	9%	25	2	9%	25	2	9%	24	1	4%
8,000 - 10,000 acres	25	26	1	4%	27	2	8%	27	2	8%	28	3	12%
>10,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in March

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	13	13	0	0%	12	-1	-8%	13	0	0%	13	0	0%
8,000 - 10,000 acres	17	17	0	0%	17	0	0%	17	0	0%	18	1	6%
>10,000 acres	6	6	0	0%	6	0	0%	6	0	0%	6	0	0%

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in April

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
6,500 - 8,000 acres	17	17	0	0%	17	0	0%	17	0	0%	17	0	0%
8,000 - 10,000 acres	15	15	0	0%	15	0	0%	15	0	0%	15	0	0%
>10,000 acres	16	16	0	0%	16	0	0%	16	0	0%	16	0	0%

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in May

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	18	18	0	0%	18	0	0%	18	0	0%	18	0	0%
8,000 - 10,000 acres	13	13	0	0%	13	0	0%	13	0	0%	13	0	0%
>10,000 acres	13	14	1	8%	14	1	8%	14	1	8%	14	1	8%

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in June

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
6,500 - 8,000 acres	38	38	0	0%	38	0	0%	38	0	0%	38	0	0%
8,000 - 10,000 acres	18	18	0	0%	18	0	0%	18	0	0%	18	0	0%
>10,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in July

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	51	51	0	0%	51	0	0%	51	0	0%	51	0	0%
8,000 - 10,000 acres	13	13	0	0%	13	0	0%	13	0	0%	13	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in August

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	8	8	0	0%	8	0	0%	8	0	0%	8	0	0%
8,000 - 10,000 acres	6	6	0	0%	6	0	0%	6	0	0%	6	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in September

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	10	10	0	0%	10	0	0%	10	0	0%	10	0	0%
6,500 - 8,000 acres	13	13	0	0%	13	0	0%	13	0	0%	13	0	0%
8,000 - 10,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Table 3. Monthly Summary of Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in October													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
6,500 - 8,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
8,000 - 10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in November													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
6,500 - 8,000 acres	6	6	0	0%	6	0	0%	6	0	0%	6	0	0%
8,000 - 10,000 acres	5	5	0	0%	5	0	0%	5	0	0%	5	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in December													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
6,500 - 8,000 acres	3	3	0	0%	3	0	0%	3	0	0%	4	1	33%
8,000 - 10,000 acres	4	5	1	25%	5	1	25%	5	1	25%	5	1	25%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in January													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
6,500 - 8,000 acres	6	7	1	17%	7	1	17%	7	1	17%	7	1	17%
8,000 - 10,000 acres	8	8	0	0%	7	-1	-13%	7	-1	-13%	7	-1	-13%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in February													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	6	7	1	17%	7	1	17%	7	1	17%	8	2	33%
8,000 - 10,000 acres	10	10	0	0%	10	0	0%	10	0	0%	9	-1	-10%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in March													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	5	6	1	20%	6	1	20%	6	1	20%	6	1	20%
8,000 - 10,000 acres	7	7	0	0%	7	0	0%	7	0	0%	7	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in April													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
8,000 - 10,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in May													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%
8,000 - 10,000 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%
>10,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in June													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
8,000 - 10,000 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in July													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%
8,000 - 10,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in August													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	9	9	0	0%	9	0	0%	9	0	0%	9	0	0%
8,000 - 10,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in September													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
6,500 - 8,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
8,000 - 10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Table 4. Monthly Summary of Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days in October

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	8	8	0	0%	8	0	0%	8	0	0%	8	0	0%
6,500 - 8,000 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
8,000 - 10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days in November

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
6,500 - 8,000 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
8,000 - 10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days in December

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	8	8	0	0%	8	0	0%	8	0	0%	8	0	0%
6,500 - 8,000 acres	9	9	0	0%	9	0	0%	9	0	0%	9	0	0%
8,000 - 10,000 acres	5	4	-1	-20%	4	-1	-20%	4	-1	-20%	3	-2	-40%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days in January

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
6,500 - 8,000 acres	8	7	-1	-13%	7	-1	-13%	7	-1	-13%	7	-1	-13%
8,000 - 10,000 acres	6	6	0	0%	6	0	0%	6	0	0%	7	1	17%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days in February

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	14	11	-3	-21%	11	-3	-21%	11	-3	-21%	12	-2	-14%
8,000 - 10,000 acres	8	8	0	0%	8	0	0%	8	0	0%	9	1	13%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days in March

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	7	7	0	0%	7	0	0%	7	0	0%	6	-1	-14%
8,000 - 10,000 acres	17	17	0	0%	17	0	0%	17	0	0%	17	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days in April

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	5	5	0	0%	5	0	0%	5	0	0%	5	0	0%
8,000 - 10,000 acres	19	19	0	0%	19	0	0%	19	0	0%	19	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days in May

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
8,000 - 10,000 acres	35	35	0	0%	35	0	0%	35	0	0%	35	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days in June

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
6,500 - 8,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
8,000 - 10,000 acres	19	19	0	0%	19	0	0%	19	0	0%	19	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days in July

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
6,500 - 8,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
8,000 - 10,000 acres	6	6	0	0%	6	0	0%	6	0	0%	6	0	0%
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

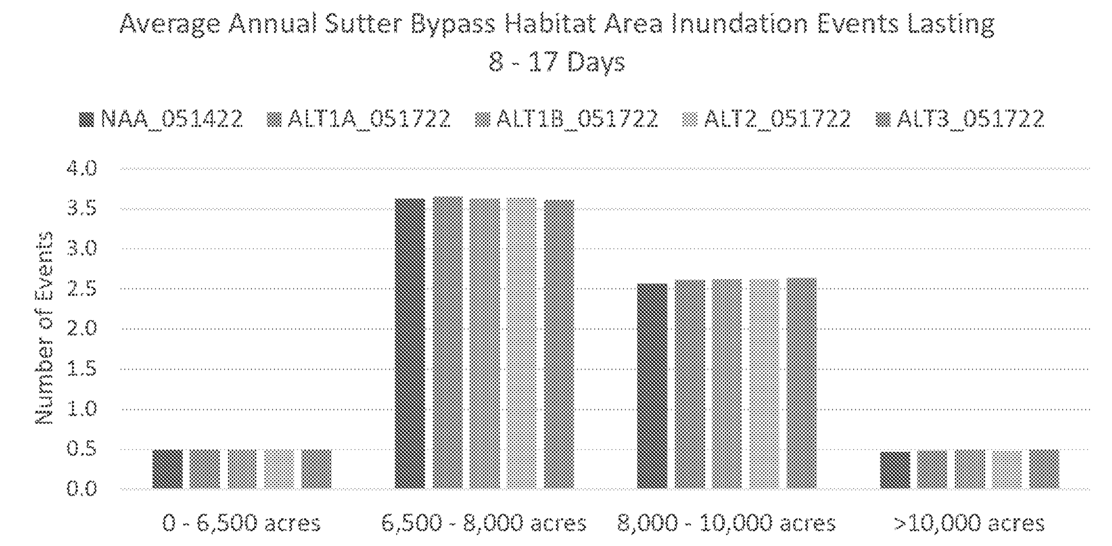
Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days in August

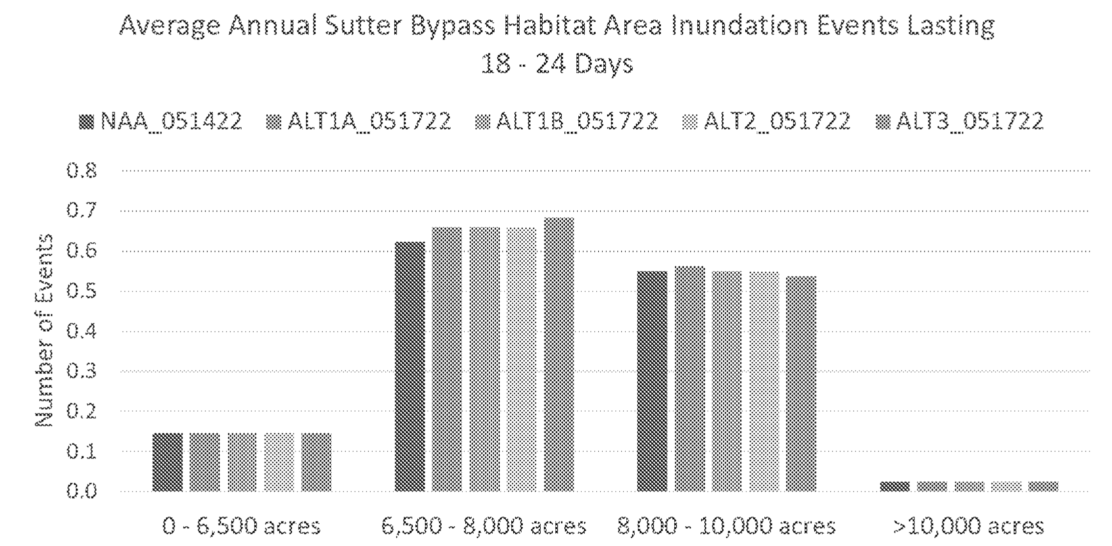
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	24	24	0	0%	24	0	0%	24	0	0%	24	0	0%
6,500 - 8,000 acres	8	8	0	0%	8	0	0%	8	0	0%	8	0	0%
8,000 - 10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days in September

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	39	39	0	0%	39	0	0%	39	0	0%	39	0	0%
6,500 - 8,000 acres	7	7	0	0%	7	0	0%	7	0	0%	7	0	0%
8,000 - 10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>10,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Figure 2. Average Annual Sutter Bypass Habitat Area Inundation Events.





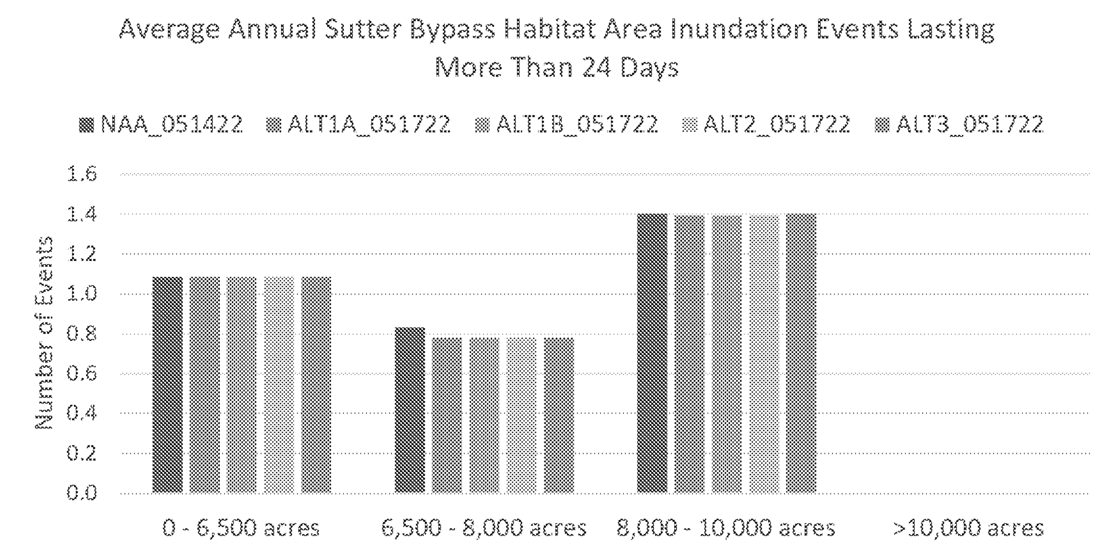


Table 5. Average Annual Sutter Bypass Habitat Area Inundation Events.

Average Annual Sutter Bypass Habitat Area Inundation Events Lasting 8 - 17 Days													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0.49	0.49	0.00	0%	0.49	0.00	0%	0.49	0.00	0%	0.49	0.00	0%
6,500 - 8,000 acres	3.62	3.65	0.03	1%	3.62	0.00	0%	3.63	0.01	0%	3.61	-0.01	0%
8,000 - 10,000 acres	2.56	2.61	0.05	2%	2.62	0.06	2%	2.62	0.06	2%	2.63	0.07	3%
>10,000 acres	0.46	0.48	0.01	3%	0.49	0.02	5%	0.48	0.01	3%	0.49	0.02	5%

Average Annual Sutter Bypass Habitat Area Inundation Events Lasting 18 - 24 Days													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	0.15	0.15	0.00	0%	0.15	0.00	0%	0.15	0.00	0%	0.15	0.00	0%
6,500 - 8,000 acres	0.62	0.66	0.04	6%	0.66	0.04	6%	0.66	0.04	6%	0.68	0.06	10%
8,000 - 10,000 acres	0.55	0.56	0.01	2%	0.55	0.00	0%	0.55	0.00	0%	0.54	-0.01	-2%
>10,000 acres	0.02	0.02	0.00	0%	0.02	0.00	0%	0.02	0.00	0%	0.02	0.00	0%

Average Annual Sutter Bypass Habitat Area Inundation Events Lasting More Than 24 Days													
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 6,500 acres	1.09	1.09	0.00	0%	1.09	0.00	0%	1.09	0.00	0%	1.09	0.00	0%
6,500 - 8,000 acres	0.83	0.78	-0.05	-6%	0.78	-0.05	-6%	0.78	-0.05	-6%	0.78	-0.05	-6%
8,000 - 10,000 acres	1.40	1.39	-0.01	-1%	1.39	-0.01	-1%	1.39	-0.01	-1%	1.40	0.00	0%
>10,000 acres	0.00	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-

*Based on total events in 82 year simulation period.

Table 1. Count of Years that Exceed Fremont Weir Flow Magnitude Thresholds Between 1922 and 2003 for Each Alternative

Table 1a. Count of Years That Exceed Fremont Weir Flow Magnitude Thresholds Between 1922 and 2003, NAA_051422 and ALT1A_051722

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference		NAA 051422	ALT1A 051722	Difference	
> 0 cfs	81	81	0	0.0%	76	76	0	0.0%	74	74	0	0.0%	70	70	0	0.0%	54	55	1	1.9%
> 1,000 cfs	69	67	-2	-2.9%	54	51	-3	-5.6%	47	47	0	0.0%	41	38	-3	-7.3%	36	34	-2	-5.6%
> 2,000 cfs	63	61	-2	-3.2%	50	48	-2	-4.0%	43	42	-1	-2.3%	37	36	-1	-2.7%	30	29	-1	-3.3%
> 3,000 cfs	59	57	-2	-3.4%	47	45	-2	-4.3%	40	37	-3	-7.5%	34	32	-2	-5.9%	24	23	-1	-4.2%
> 4,000 cfs	55	53	-2	-3.6%	45	43	-2	-4.4%	36	34	-2	-5.6%	29	28	-1	-3.4%	22	20	-2	-9.1%
> 6,000 cfs	45	44	-1	-2.2%	34	32	-2	-5.9%	26	25	-1	-3.8%	19	17	-2	-10.5%	10	10	0	0.0%
> 8,000 cfs	44	43	-1	-2.3%	27	27	0	0.0%	24	24	0	0.0%	16	15	-1	-6.3%	7	6	-1	-14.3%
> 10,000 cfs	43	43	0	0.0%	27	26	-1	-3.7%	23	22	-1	-4.3%	14	14	0	0.0%	6	5	-1	-16.7%

Table 1b. Count of Years That Exceed Fremont Weir Flow Magnitude Thresholds Between 1922 and 2003, NAA_051422 and ALT1B_051722

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference		NAA 051422	ALT1B 051722	Difference	
> 0 cfs	81	81	0	0.0%	76	76	0	0.0%	74	74	0	0.0%	70	70	0	0.0%	54	55	1	1.9%
> 1,000 cfs	69	66	-3	-4.3%	54	51	-3	-5.6%	47	47	0	0.0%	41	39	-2	-4.9%	36	34	-2	-5.6%
> 2,000 cfs	63	60	-3	-4.8%	50	48	-2	-4.0%	43	42	-1	-2.3%	37	36	-1	-2.7%	30	29	-1	-3.3%
> 3,000 cfs	59	57	-2	-3.4%	47	45	-2	-4.3%	40	37	-3	-7.5%	34	32	-2	-5.9%	24	23	-1	-4.2%
> 4,000 cfs	55	53	-2	-3.6%	45	43	-2	-4.4%	36	34	-2	-5.6%	29	28	-1	-3.4%	22	19	-3	-13.6%
> 6,000 cfs	45	44	-1	-2.2%	34	32	-2	-5.9%	26	25	-1	-3.8%	19	17	-2	-10.5%	10	10	0	0.0%
> 8,000 cfs	44	43	-1	-2.3%	27	27	0	0.0%	24	24	0	0.0%	16	15	-1	-6.3%	7	6	-1	-14.3%
> 10,000 cfs	43	43	0	0.0%	27	26	-1	-3.7%	23	22	-1	-4.3%	14	14	0	0.0%	6	5	-1	-16.7%

Table 1c. Count of Years That Exceed Fremont Weir Flow Magnitude Thresholds Between 1922 and 2003, NAA_051422 and ALT2_051722

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference		NAA 051422	ALT2 051722	Difference	
> 0 cfs	81	81	0	0.0%	76	76	0	0.0%	74	74	0	0.0%	70	70	0	0.0%	54	55	1	1.9%
> 1,000 cfs	69	67	-2	-2.9%	54	51	-3	-5.6%	47	47	0	0.0%	41	38	-3	-7.3%	36	34	-2	-5.6%
> 2,000 cfs	63	61	-2	-3.2%	50	48	-2	-4.0%	43	42	-1	-2.3%	37	35	-2	-5.4%	30	28	-2	-6.7%
> 3,000 cfs	59	57	-2	-3.4%	47	45	-2	-4.3%	40	37	-3	-7.5%	34	32	-2	-5.9%	24	23	-1	-4.2%
> 4,000 cfs	55	53	-2	-3.6%	45	43	-2	-4.4%	36	34	-2	-5.6%	29	28	-1	-3.4%	22	20	-2	-9.1%
> 6,000 cfs	45	44	-1	-2.2%	34	32	-2	-5.9%	26	25	-1	-3.8%	19	17	-2	-10.5%	10	10	0	0.0%
> 8,000 cfs	44	43	-1	-2.3%	27	27	0	0.0%	24	24	0	0.0%	16	15	-1	-6.3%	7	6	-1	-14.3%
> 10,000 cfs	43	43	0	0.0%	27	26	-1	-3.7%	23	22	-1	-4.3%	14	14	0	0.0%	6	5	-1	-16.7%

Table 1d. Count of Years That Exceed Fremont Weir Flow Magnitude Thresholds Between 1922 and 2003, NAA_051422 and ALT3_051722

Number of years that contain events with consecutive days of spills (max 7 day gap to count as new event)	> 0 days				>10 days				> 20 days				> 30 days				> 45 days			
	NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference		NAA 051422	ALT3 051722	Difference	
> 0 cfs	81	81	0	0.0%	76	76	0	0.0%	74	74	0	0.0%	70	70	0	0.0%	54	55	1	1.9%
> 1,000 cfs	69	67	-2	-2.9%	54	51	-3	-5.6%	47	47	0	0.0%	41	39	-2	-4.9%	36	34	-2	-5.6%
> 2,000 cfs	63	59	-4	-6.3%	50	48	-2	-4.0%	43	42	-1	-2.3%	37	36	-1	-2.7%	30	29	-1	-3.3%
> 3,000 cfs	59	57	-2	-3.4%	47	45	-2	-4.3%	40	37	-3	-7.5%	34	33	-1	-2.9%	24	23	-1	-4.2%
> 4,000 cfs	55	53	-2	-3.6%	45	43	-2	-4.4%	36	33	-3	-8.3%	29	28	-1	-3.4%	22	19	-3	-13.6%
> 6,000 cfs	45	43	-2	-4.4%	34	33	-1	-2.9%	26	25	-1	-3.8%	19	17	-2	-10.5%	10	10	0	0.0%
> 8,000 cfs	44	42	-2	-4.5%	27	27	0	0.0%	24	24	0	0.0%	16	15	-1	-6.3%	7	5	-2	-28.6%
> 10,000 cfs	43	42	-1	-2.3%	27	26	-1	-3.7%	23	21	-2	-8.7%	14	14	0	0.0%	6	5	-1	-16.7%

Table 2. Yolo Bypass habitat inundation duration frequency, HIST, based on estimated daily flows at Woodland, NAA_051422 vs ALT1A_051722

Total Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	181	173	-8	-4%
t>=11 days	75	74	-1	-1%

January Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	28	27	-1	-4%
t>=11 days	16	16	0	0%

February Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	39	41	2	5%
t>=11 days	24	23	-1	-4%

March Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	48	41	-7	-15%
t>=11 days	11	13	2	18%

April Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	26	24	-2	-8%
t>=11 days	8	8	0	0%

May Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	9	8	-1	-11%
t>=11 days	1	1	0	0%

June Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	2	2	0	0%
t>=11 days	0	0	0	0%

July Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	0	0	0	0%
t>=11 days	0	0	0	0%

August Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	0	0	0	0%
t>=11 days	0	0	0	0%

September Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	0	0	0	0%
t>=11 days	0	0	0	0%

October Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	2	2	0	0%
t>=11 days	0	0	0	0%

November Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	7	7	0	0%
t>=11 days	1	1	0	0%

December Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1A_051722	Difference	Percent Diff
t<=10 days	20	21	1	5%
t>=11 days	14	12	-2	-14%

Table 3. Yolo Bypass habitat inundation duration frequency, HIST, based on estimated daily flows at Woodland, NAA_051422 vs ALT1B_051722

Total Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	181	174	-7	-4%
t>=11 days	75	74	-1	-1%

January Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	28	28	0	0%
t>=11 days	16	16	0	0%

February Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	39	42	3	8%
t>=11 days	24	23	-1	-4%

March Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	48	41	-7	-15%
t>=11 days	11	13	2	18%

April Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	26	24	-2	-8%
t>=11 days	8	8	0	0%

May Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	9	8	-1	-11%
t>=11 days	1	1	0	0%

June Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	2	2	0	0%
t>=11 days	0	0	0	0%

July Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	0	0	0	0%
t>=11 days	0	0	0	0%

August Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	0	0	0	0%
t>=11 days	0	0	0	0%

September Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	0	0	0	0%
t>=11 days	0	0	0	0%

October Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	2	2	0	0%
t>=11 days	0	0	0	0%

November Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	7	6	-1	-14%
t>=11 days	1	1	0	0%

December Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT1B_051722	Difference	Percent Diff
t<=10 days	20	21	1	5%
t>=11 days	14	12	-2	-14%

Table 4. Yolo Bypass habitat inundation duration frequency, HIST, based on estimated daily flows at Woodland, NAA_051422 vs ALT2_051722

Total Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	181	173	-8	-4%
t>=11 days	75	74	-1	-1%

January Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	28	27	-1	-4%
t>=11 days	16	16	0	0%

February Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	39	40	1	3%
t>=11 days	24	23	-1	-4%

March Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	48	42	-6	-13%
t>=11 days	11	13	2	18%

April Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	26	24	-2	-8%
t>=11 days	8	8	0	0%

May Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	9	8	-1	-11%
t>=11 days	1	1	0	0%

June Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	2	2	0	0%
t>=11 days	0	0	0	0%

July Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	0	0	0	0%
t>=11 days	0	0	0	0%

August Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	0	0	0	0%
t>=11 days	0	0	0	0%

September Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	0	0	0	0%
t>=11 days	0	0	0	0%

October Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	2	2	0	0%
t>=11 days	0	0	0	0%

November Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	7	7	0	0%
t>=11 days	1	1	0	0%

December Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT2_051722	Difference	Percent Diff
t<=10 days	20	21	1	5%
t>=11 days	14	12	-2	-14%

Table 5. Yolo Bypass habitat inundation duration frequency, HIST, based on estimated daily flows at Woodland, NAA_051422 vs ALT3_051722

Total Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	181	175	-6	-3%
t>=11 days	75	73	-2	-3%

January Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	28	27	-1	-4%
t>=11 days	16	16	0	0%

February Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	39	43	4	10%
t>=11 days	24	22	-2	-8%

March Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	48	41	-7	-15%
t>=11 days	11	13	2	18%

April Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	26	24	-2	-8%
t>=11 days	8	8	0	0%

May Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	9	8	-1	-11%
t>=11 days	1	1	0	0%

June Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	2	2	0	0%
t>=11 days	0	0	0	0%

July Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	0	0	0	0%
t>=11 days	0	0	0	0%

August Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	0	0	0	0%
t>=11 days	0	0	0	0%

September Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	0	0	0	0%
t>=11 days	0	0	0	0%

October Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	2	2	0	0%
t>=11 days	0	0	0	0%

November Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	7	6	-1	-14%
t>=11 days	1	1	0	0%

December Frequency of Exceedance (WY 1922-2003)				
Duration	>20,000 acres			
	NAA_051422	ALT3_051722	Difference	Percent Diff
t<=10 days	20	22	2	10%
t>=11 days	14	12	-2	-14%

Figure 1. Frequency of Yolo Bypass Habitat Area Inundation Events.

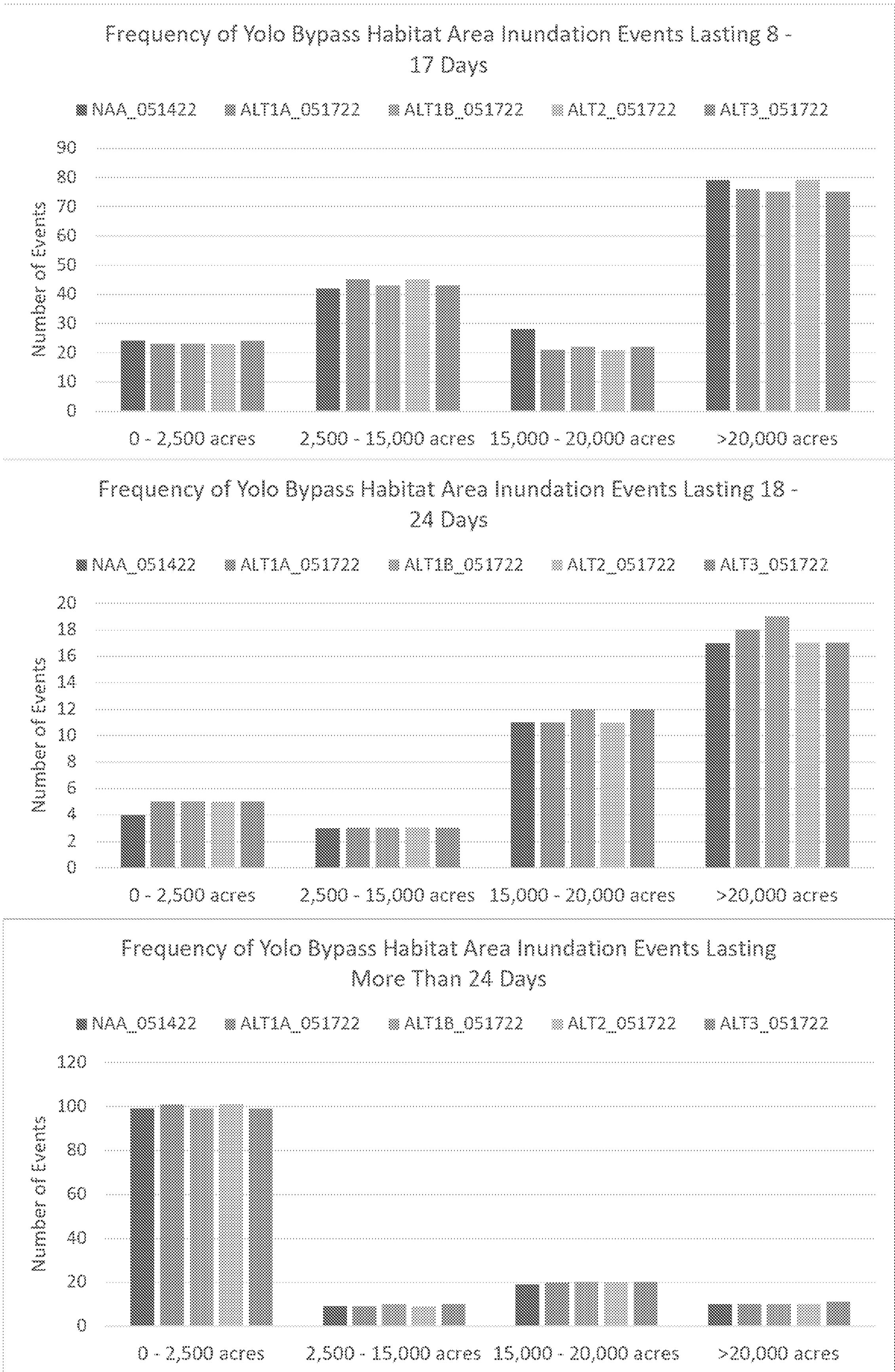


Table 1. Frequency of Yolo Bypass Habitat Area Inundation Events.

	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days															
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	24	23	-1	-4%	23	-1	-4%	23	-1	-4%	24	0	0%
2,500 - 15,000 acres	42	45	3	7%	43	1	2%	45	3	7%	43	1	2%
15,000 - 20,000 acres	28	21	-7	-25%	22	-6	-21%	21	-7	-25%	22	-6	-21%
>20,000 acres	79	76	-3	-4%	75	-4	-5%	79	0	0%	75	-4	-5%
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	4	5	1	25%	5	1	25%	5	1	25%	5	1	25%
2,500 - 15,000 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%
15,000 - 20,000 acres	11	11	0	0%	12	1	9%	11	0	0%	12	1	9%
>20,000 acres	17	18	1	6%	19	2	12%	17	0	0%	17	0	0%
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	99	101	2	2%	99	0	0%	101	2	2%	99	0	0%
2,500 - 15,000 acres	9	9	0	0%	10	1	11%	9	0	0%	10	1	11%
15,000 - 20,000 acres	19	20	1	5%	20	1	5%	20	1	5%	20	1	5%
>20,000 acres	10	10	0	0%	10	0	0%	10	0	0%	11	1	10%

*Based on total number of events in 82 year simulation period.

Table 2. Monthly Summary of Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days

	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in October												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in November												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
2,500 - 15,000 acres	0	1	1	-	1	1	-	1	1	-	2	2	-
15,000 - 20,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
>20,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in December												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
2,500 - 15,000 acres	10	10	0	0%	9	-1	-10%	10	0	0%	10	0	0%
15,000 - 20,000 acres	6	5	-1	-17%	5	-1	-17%	5	-1	-17%	5	-1	-17%
>20,000 acres	9	8	-1	-11%	9	0	0%	8	-1	-11%	8	-1	-11%
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in January												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
2,500 - 15,000 acres	9	9	0	0%	8	-1	-11%	9	0	0%	8	-1	-11%
15,000 - 20,000 acres	6	6	0	0%	6	0	0%	6	0	0%	6	0	0%
>20,000 acres	20	21	1	5%	21	1	5%	21	1	5%	21	1	5%
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in February												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	5	4	-1	-20%	4	-1	-20%	4	-1	-20%	4	-1	-20%
2,500 - 15,000 acres	5	6	1	20%	6	1	20%	6	1	20%	6	1	20%
15,000 - 20,000 acres	7	4	-3	-43%	4	-3	-43%	4	-3	-43%	4	-3	-43%
>20,000 acres	25	22	-3	-12%	21	-4	-16%	24	-1	-4%	21	-4	-16%
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in March												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	5	5	0	0%	5	0	0%	5	0	0%	6	1	20%
2,500 - 15,000 acres	13	12	-1	-8%	12	-1	-8%	12	-1	-8%	10	-3	-23%
15,000 - 20,000 acres	5	3	-2	-40%	4	-1	-20%	3	-2	-40%	4	-1	-20%
>20,000 acres	13	14	1	8%	13	0	0%	15	2	15%	14	1	8%
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in April												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%
2,500 - 15,000 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%
15,000 - 20,000 acres	3	2	-1	-33%	2	-1	-33%	2	-1	-33%	2	-1	-33%
>20,000 acres	10	9	-1	-10%	9	-1	-10%	9	-1	-10%	9	-1	-10%
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in May												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
2,500 - 15,000 acres	0	2	2	-	2	2	-	2	2	-	2	2	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in June												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in July												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in August												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
	Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days in September												
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Table 3. Monthly Summary of Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in October

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in November

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in December

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
>20,000 acres	5	6	1	20%	6	1	20%	6	1	20%	5	0	0%

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in January

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	2	2	0	0%	3	1	50%	2	0	0%	3	1	50%
>20,000 acres	3	2	-1	-33%	2	-1	-33%	2	-1	-33%	2	-1	-33%

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in February

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	1	2	1	100%	2	1	100%	2	1	100%	2	1	100%
2,500 - 15,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
15,000 - 20,000 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%
>20,000 acres	6	5	-1	-17%	6	0	0%	4	-2	-33%	5	-1	-17%

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in March

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
15,000 - 20,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
>20,000 acres	3	4	1	33%	4	1	33%	4	1	33%	4	1	33%

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in April

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%
>20,000 acres	0	1	1	-	1	1	-	1	1	-	1	1	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in May

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in June

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in July

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in August

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days in September

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Table 4. Monthly Summary of Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days in October

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
2,500 - 15,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days in November

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	2	4	2	100%	3	1	50%	4	2	100%	2	0	0%
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days in December

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	5	4	-1	-20%	4	-1	-20%	4	-1	-20%	5	0	0%
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
>20,000 acres	3	2	-1	-33%	2	-1	-33%	2	-1	-33%	3	0	0%

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days in January

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	8	9	1	13%	8	0	0%	9	1	13%	8	0	0%
2,500 - 15,000 acres	1	1	0	0%	2	1	100%	1	0	0%	2	1	100%
15,000 - 20,000 acres	6	6	0	0%	6	0	0%	6	0	0%	6	0	0%
>20,000 acres	4	4	0	0%	4	0	0%	4	0	0%	4	0	0%

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days in February

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	3	3	0	0%	3	0	0%	3	0	0%	3	0	0%
2,500 - 15,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
15,000 - 20,000 acres	6	6	0	0%	6	0	0%	6	0	0%	6	0	0%
>20,000 acres	2	3	1	50%	3	1	50%	3	1	50%	3	1	50%

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days in March

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	8	8	0	0%	8	0	0%	8	0	0%	8	0	0%
2,500 - 15,000 acres	2	3	1	50%	3	1	50%	3	1	50%	3	1	50%
15,000 - 20,000 acres	5	5	0	0%	5	0	0%	5	0	0%	5	0	0%
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days in April

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%
2,500 - 15,000 acres	2	2	0	0%	2	0	0%	2	0	0%	2	0	0%
15,000 - 20,000 acres	1	2	1	100%	2	1	100%	2	1	100%	2	1	100%
>20,000 acres	1	1	0	0%	1	0	0%	1	0	0%	1	0	0%

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days in May

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	2	3	1	50%	2	0	0%	3	1	50%	2	0	0%
2,500 - 15,000 acres	2	1	-1	-50%	1	-1	-50%	1	-1	-50%	1	-1	-50%
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days in June

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	5	6	1	20%	6	1	20%	6	1	20%	6	1	20%
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days in July

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	20	20	0	0%	20	0	0%	20	0	0%	20	0	0%
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

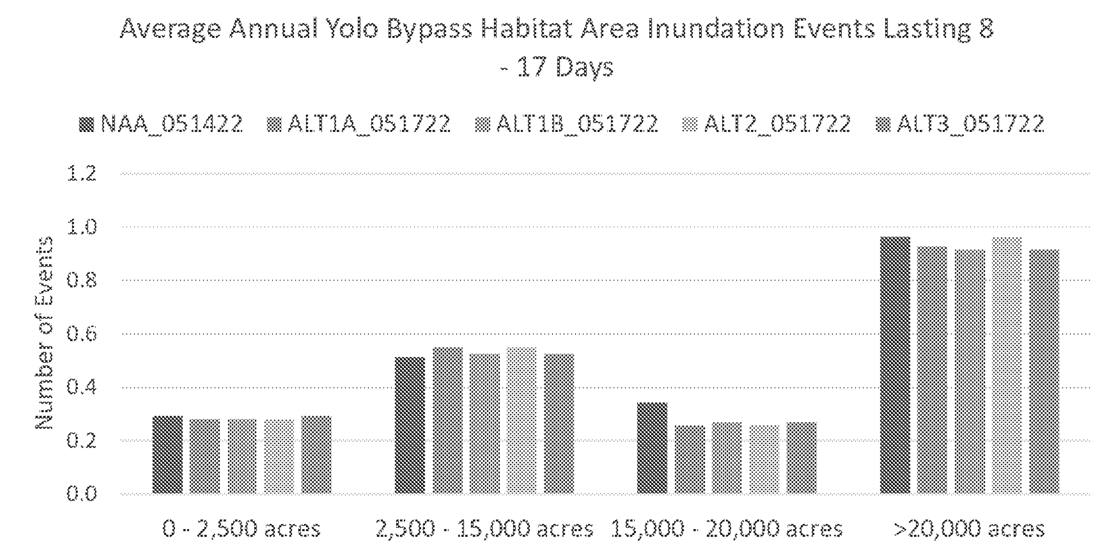
Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days in August

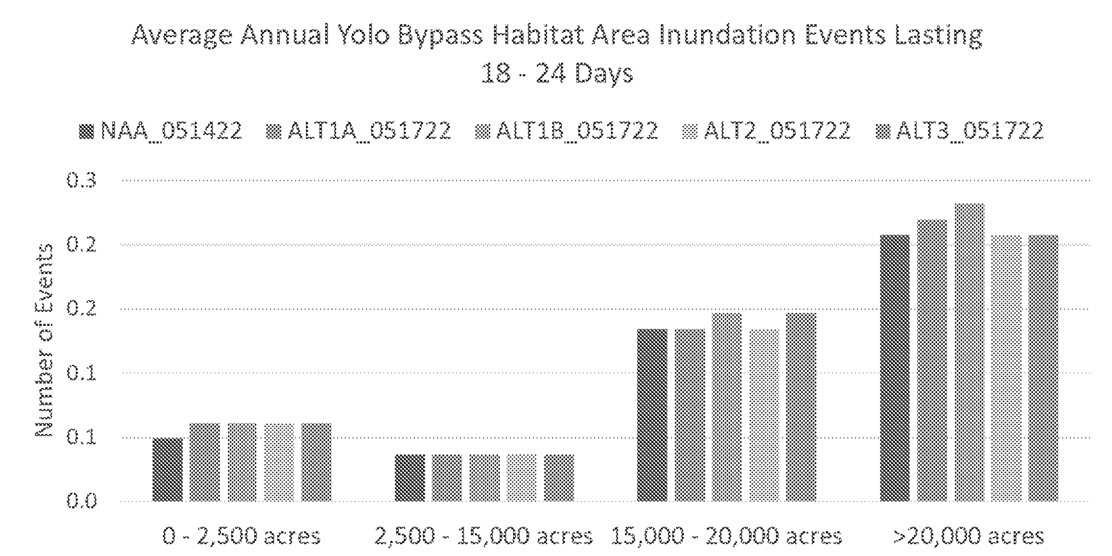
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	26	23	-3	-12%	24	-2	-8%	23	-3	-12%	24	-2	-8%
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Frequency of Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days in September

Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	17	18	1	6%	18	1	6%	18	1	6%	18	1	6%
2,500 - 15,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
15,000 - 20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-
>20,000 acres	0	0	0	-	0	0	-	0	0	-	0	0	-

Figure 2. Average Annual Yolo Bypass Habitat Area Inundation Events.





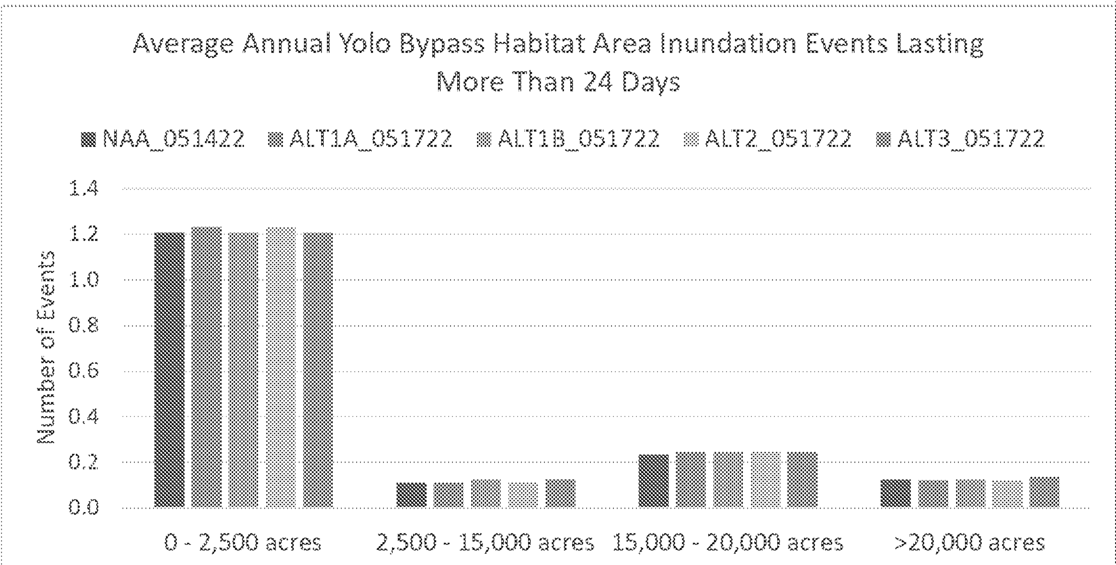


Table 5. Average Annual Yolo Bypass Habitat Area Inundation Events.

	Average Annual Yolo Bypass Habitat Area Inundation Events Lasting 8 - 17 Days											
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0.29	0.28	-0.01	-4%	0.28	-0.01	-4%	0.28	-0.01	-4%	0.29	0.00	0%
2,500 - 15,000 acres	0.51	0.55	0.04	7%	0.52	0.01	2%	0.55	0.04	7%	0.52	0.01	2%
15,000 - 20,000 acres	0.34	0.26	-0.09	-25%	0.27	-0.07	-21%	0.26	-0.09	-25%	0.27	-0.07	-21%
>20,000 acres	0.96	0.93	-0.04	-4%	0.91	-0.05	-5%	0.96	0.00	0%	0.91	-0.05	-5%

	Average Annual Yolo Bypass Habitat Area Inundation Events Lasting 18 - 24 Days											
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	0.05	0.06	0.01	25%	0.06	0.01	25%	0.06	0.01	25%	0.06	0.01	25%
2,500 - 15,000 acres	0.04	0.04	0.00	0%	0.04	0.00	0%	0.04	0.00	0%	0.04	0.00	0%
15,000 - 20,000 acres	0.13	0.13	0.00	0%	0.15	0.01	9%	0.13	0.00	0%	0.15	0.01	9%
>20,000 acres	0.21	0.22	0.01	6%	0.23	0.02	12%	0.21	0.00	0%	0.21	0.00	0%

	Average Annual Yolo Bypass Habitat Area Inundation Events Lasting More Than 24 Days											
Area Range	NAA_051422	ALT1A_051722	ALT1A_051722 minus NAA_051422	Percent Change	ALT1B_051722	ALT1B_051722 minus NAA_051422	Percent Change	ALT2_051722	ALT2_051722 minus NAA_051422	Percent Change	ALT3_051722	ALT3_051722 minus NAA_051422	Percent Change
0 - 2,500 acres	1.21	1.23	0.02	2%	1.21	0.00	0%	1.23	0.02	2%	1.21	0.00	0%
2,500 - 15,000 acres	0.11	0.11	0.00	0%	0.12	0.01	11%	0.11	0.00	0%	0.12	0.01	11%
15,000 - 20,000 acres	0.23	0.24	0.01	5%	0.24	0.01	5%	0.24	0.01	5%	0.24	0.01	5%
>20,000 acres	0.12	0.12	0.00	0%	0.12	0.00	0%	0.12	0.00	0%	0.13	0.01	10%

*Based on total events in 82 year simulation period.

Sites Habitat Area Analysis – Final EIR/EIS 2022

This package includes files related to habitat area analysis of Sites Project alternatives used in the Final EIR/EIS (2022). Results from No Action Alternative (051422), Alternative 1A (051722), Alternative 1B (051722), Alternative 2 (051722), and Alternative 3 (051722) are included.

The habitat area analysis includes the following methods and assumptions:

- Habitat inundation areas are calculated using flow vs habitat inundation area curves. These curves were developed with HEC-RAS modeling that assumed steady state conditions of constant flows lasting 8 days or more.
- Suitable habitat thresholds:
    - Depth: 1 meter
    - Velocity: 1.5 ft/s (not explicitly considered)
- Depth (not velocity) is the controlling threshold in the analysis. However, velocity may be a limiting factor during low flow periods
    - As such, suitable inundated habitat area may be over-estimated during low flow periods
- HEC-RAS simulations do not consider valley tributaries
    - Suitable habitat areas are based on flow at upstream end of each reach
- Backwater effects of tributary inflows and diversions are not considered in suitable inundated habitat area calculations
- Diversions at Red Bluff and Hamilton City are applied at the upstream end of Reach 1 of the Sacramento River

This package is organized in the following manner:

- 1_Habitat_Area_by_Month_and_WYT
    - Includes comparison tables of mean inundation area by month and water year type. The inundation areas were calculated using the 8-day running averages of flow throughout the entire 82-year period, excluding the first 7 days.
        - HabitatAcreageByMonthWYT_AllRegions__FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
- 2_Frequency_and_Duration

- Includes frequency and duration comparison tables for events of varying magnitudes lasting 8-17 days, 18-24 days, and greater than 24 days. The Sutter Bypass and Yolo Bypass include additional files showing inundation events of varying acreages lasting within or greater than 10 days, 20 days, 30 days, and 45 days.
  - InChannel_AllReaches_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
  - InChannel_Reach1_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
  - InChannel_Reach2_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
  - InChannel_Reach3_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
  - Sutter_Bypass_Inundation_Area_Duration-Frequency_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
  - SutterBypass_InundationComparison_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
    - Inundation events of varying acreages lasting within or greater than 10 days, 20 days, 30 days, and 45 days
  - Yolo_Bypass_Inundation_Area_Duration-Frequency_FEIRS2022_NAA_ALT1A_ALT1B_ALT2_ALT3.pdf
  - YoloBypass_InundationComparison_FEIRS2022_HIST_NAA_ALT1A_ALT1B_ALT3.pdf
    - Inundation events of varying acreages lasting within or greater than 10 days, 20 days, 30 days, and 45 days

- 3_Yolo_Bypass_Daily_Flow_and_Habitat_Area_Timeseries
  - Includes daily flow and inundation area (habitat acreage) timeseries for the Yolo Bypass. The inundation areas were calculated using the 8-day running averages of flow throughout the entire 82-year period, excluding the first 7 days.
    - Daily_Flow_and_Habitat_Area_Timeseries_YoloBypass_FEIRS2022_HistClim_NAA_ALT1A_ALT1B_ALT2_ALT3.xlsx

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Technical Memorandum

To: Steve Micko, Jacobs
From: Noble Hendrix, QEDA Consulting
Date: September 2, 2022
Subject: Draft results of OBAN analysis of Sites Alternatives FEIR/S

Executive Summary

This technical memorandum describes results from running the winter-run Oncorhynchus Bayesian Analysis (OBAN) model for a baseline No Action Alternative (NAA) and four alternatives (Alt1A, Alt1B, Alt2, and Alt3) to evaluate the Sites project. The alternatives were compared to the NAA under two configurations: 1) diversions for the Sites project removed from flows at Bend Bridge, 2) diversions for the Sites project incorporated into a flow-survival relationship based on the non-linear survival function developed in Michel et al. (2021).

Results were similar under both configurations of the OBAN model. There was no difference in survival among the NAA and the alternatives in the flow-survival relationship. Thus, the two configurations differed in whether the Sites diversions were removed from Bend Bridge minimum flows (Configuration 1) or Sites diversions were not removed from Bend Bridge flows (Configuration 2). All alternatives had higher escapement abundance relative to the NAA over the 1922-2002 timeframe, but only Alt1B had higher abundances relative to the NAA over the period 1933-2002. The probability of quasi-extinction was higher in all alternatives relative to the NAA except Alt1B, in which the probability was lower than the NAA. Egg to fry survival was also higher in Alt1B relative to the NAA, whereas all other alternatives had lower egg to fry survival compared to the NAA. Egg to fry survival is a function of temperature (mean daily water temperature in the Sacramento River at Bend Bridge) and flow (minimum monthly flow in the Sacramento River at Bend Bridge). Both Alt1B and Alt3 had higher median flow, whereas all alternatives except Alt3 had temperatures lower than the NAA on average. Delta survival was higher under all alternatives relative to the NAA and Alt1B had the highest Delta survival of the alternatives.

OBAN Model Description

The Oncorhynchus Bayesian Analysis (OBAN) model uses statistical approaches to understand how a series of environmental driver variables (e.g., temperature and flow) that are under management control may affect winter-run Chinook salmon population dynamics. The model was developed by first determining which of a suite of parameters (e.g., water temperature, harvest, exports, striped bass abundance, and offshore upwelling) covaried with historical abundance data. The OBAN model incorporates uncertainty by estimating the influence of covariates on population abundance in a Bayesian estimation framework. The set of covariates that provided the best model fit were then retained for the predictive model. The OBAN model can be used to evaluate the effect of project operations on winter-run Chinook. The OBAN model uses values of the covariates under climate or operational alternatives, which are produced primarily from CALSIM and HEC-5Q outputs, to predict patterns in winter-run Chinook salmon population dynamics. Furthermore, uncertainty in the predicted winter-run abundance is then incorporated into model output through Monte Carlo simulations (1,000 simulations per model run). The alternatives are compared to a baseline condition to provide inference on the relative performance of the alternatives to the baseline, which is a more robust approach for evaluating alternatives than absolute prediction.

Specifically, the OBAN model:

- Accounts for mortality during all phases of the Chinook salmon life history, including environmental and anthropogenic factors;
- Evaluates covariates that may explain dynamic vital rates (e.g., thermal mortality reduces alevin survival rates in spawning reaches);
- Estimates model coefficients by fitting predictions of the population dynamics model to observed indices of abundance in a Bayesian framework.

<u>Model Structure</u>

The winter-run Chinook salmon OBAN model is composed of several life history stages:

- Alevin – incubation in the gravel below Keswick Dam
- Fry – rearing above Red Bluff Diversion Dam (RBDD)
- Delta – from RBDD to Chipps Island
- Bay – from Chipps Island to the Golden Gate
- Gulf – Gulf of Farrallones
- Ocean 1 – first year in the ocean, return to spawn as 2 year olds
- Ocean 2 – second year in the ocean, return to spawn as 3 year olds
- Ocean 3 – third and final year in the ocean, return to spawn as 4 year olds
- Escapement – composed of all spawners on the spawning ground

The winter run Chinook OBAN model has been developed from the conceptual life-cycle model of winter run, and uses a Bayesian statistical estimation algorithm to find a statistical "best fit" to empirical trends by matching model predictions to empirically observed juvenile and adult abundances. The model is capable of fitting any number of abundance data sources and estimating any number of coefficient values to find the best statistical prediction.

The transition between life history stages occurs with a Beverton-Holt recruitment function:

$$N_{j+1} = N_j \times \frac{p_j}{1 + \frac{p_j N_j}{K_j}}$$

where N_j is the abundance at stage j, p_j is the productivity in the absence of density dependence for stage j, K_j is the capacity at stage j. The two parameters of the Beverton-Holt transition equation are p_j and K_j, and they can be user defined constants, estimated parameters fixed across all years, or dynamic, i.e., $p_{j,t}$ and $K_{j,t}$ can be modeled as changing in each year t. Note that density dependence can be effectively removed from the formulation by setting K_j to a very large value.

In the case of dynamic productivity ($p_{j,t}$) and capacity ($K_{j,t}$), parameter values, the values of the productivities and capacities in a given year are modeled from a set of time-varying covariates. By using this formulation, the influence of anthropogenic and environmental factors on specific life history stages can be incorporated. Each productivity parameter can be influenced by independent covariates acting simultaneously on the life history stage to drive demographic rates.

The dynamic productivities used a logit transformation, which caused the productivities to remain between 0 and 1. This interval is the sample space for the survival for all stages from alevin to spawner.

$$\text{logit}(p_{j,t}) = \beta_{0,j} + \beta_{1,j}X_{1,t} + \beta_{2,j}X_{2,t} + \cdots + \beta_{5,j}X_{5,t}$$

The dynamic capacities used a natural log transformation, which caused the capacities to remain between 0 and infinity. This interval is the sample space for the abundance for all stages from alevin to spawner.

$$\ln(K_{j,t}) = \beta_{0,j} + \beta_{1,j}X_{1,t} + \beta_{2,j}X_{2,t} + \cdots + \beta_{5,j}X_{5,t}$$

The estimation of $p_{j,t}$ and $K_{j,t}$ involves estimating the β coefficients on the right hand sides of the equations. The $X_{1:5,t}$ are environmental covariates that represent water conditions such as temperature or flow, biotic factors such as predator abundance, food abundance, or anthropogenic factors such as water export levels or harvest rates. The model has the ability to estimate as few or as many of the parameters as desired, and covariates were used in the OBAN model based on their ability to explain historical patterns in winter-run escapement and juvenile abundance at Red Bluff Diversion Dam data.

Covariates

The following covariates were retained in the model and their coefficients estimated:

STEMP: July through September mean daily water temperature (degrees Fahrenheit) in the Sacramento River at Bend Bridge. This covariate affects survival of the alevin life history stage.

FLMIN: August through November minimum monthly flow (cubic feet per second) in the Sacramento River at Bend Bridge (USGS Gauge 11377100 data). This covariate affects survival of the fry life history stage.

EXPT: Total water exports in the south Delta (CVP and SWP) during December through June, derived by taking average daily export rate (cubic feet per second), multiplying by the number of days in the month, and then summing over December-June (IEP Dayflow data). This covariate affects survival in the Delta life history stage.

YOLO: Number of days during December through March with minimum flows of 100 cfs over the Fremont Weir, which is enough for positive flows onto the Yolo Bypass (December of the brood year and January – March of the year following) (Reclamation data). The 100 cfs minimum flow threshold was chosen to distinguish days with an actual inundation event from the rest of the days with year-round 100 cfs flows into the Bypass to maintain positive flows for adult fish passage under the via the preliminary proposal. Although this flow is much lower than the suggested flows needed for juveniles salmonids to gain survival benefits in the Yolo Bypass (~4,000 cfs, T. Sommer pers. comm.), the parameter used to fit the data is number of days of flooding, and not flow rate during flooding. This covariate affects survival in the Delta life history stage.

DCC: Proportion of time that the Delta Cross Channel gates were open between December and March (December of the brood year and January – March of the year following) (US Bureau of Reclamation data). This covariate affects survival in the Delta life history stage.

CURL: a wind stress curl index that is correlated with coastal productivity off California (Chelton 1982) (Pascals per meter) (Pacific Fisheries Environmental Laboratory, Pacific Grove data). Persistent longshore equatorward wind stress during spring and summer forces surface waters offshore via Eckman transport drawing nutrient-rich water to the euphotic zone to replace surface waters pushed offshore (Rykaczewski and Checkley 2008). Once nutrient-rich water reaches the euphotic zone, primary productivity increases. Positive effects of the CURL index on Chinook salmon growth and maturation have been observed (Wells et al. 2007). This covariate affects survival in the Gulf life history stage.

Harvest: Ocean harvest of Ocean 2 and Ocean 3 individuals (Ocean 1 are assumed to be too small to be vulnerable to the fishery) as the proportion of the total Ocean 2 and Ocean 3 individuals available for harvest. The harvest rate index was constructed by using the California Department of Fish and Wildlife ocean and recreational fishing regulations. Until 1987, there was little regulation of the Central Valley Chinook fishery and estimates of the mortality rate on winter run Chinook in the ocean fishery was approximately 0.7 of the mortality rate experienced by fall run Chinook. The harvest rate of fall-run Chinook is calculated annually as the Central Valley Index (CVI) by calculating the proportion of the fall run that were captured in the fishery (harvested/(harvested + escaped)). In 1989, winter-run were listed as threatened and the following year the ocean fishery regulations were shifted to open two weeks later (NMFS 1997). It was assumed that this had an effect on the winter-run harvest mortality and reduced the impact to 0.5 of the CVI. In 1994, winter-run were listed as endangered and, in 1997, a biological opinion was released by NMFS (1997) initiating a delayed opening of the ocean fishery from mid-March to mid-April and eventually to late April in 2001. Using coded wire tagged winter run from 1998 through 2000 cohorts, Grover et al. (2004) estimated ocean harvest rates of 0.22. The effect of the fishery is not the same for Ocean 2 and Ocean 3 stages, however. The rates described above were generated for the Ocean 2 stage. Ocean 2 and Ocean 3 fish are not captured at the same rate. Most winter-run Chinook return to spawn as three-year olds (after the Ocean 2 phase); however, the Ocean 3 stages are more likely to be captured in the commercial fishery due to their larger size. Grover et al. (2004) found that the harvest related mortality of Ocean 3 winter run Chinook was 2.5 to 3.7 times the rate of Ocean 2 winter run. For OBAN, it assumed that the harvest rates experienced by Ocean 3 stage winter run were 2.7 times the harvest rates experienced by Ocean 2 stage. In order to make sure that the harvest rate could not surpass 1, a logistic regression approach was used to incorporate the harvest rates. Harvest also occurs in the Sacramento River, and the best available published rates were used. Between 1967 and 1975, estimates of winter-run harvest in the recreational river fishery varied from 0.04 to 0.14 (Hallock and Fisher 1985). For OBAN, it was assumed that the in-river fishery harvest rates were 0.09 from 1975 to 1982, which was the average of the Hallock and Fisher (1985) estimates. NMFS (1997) published in-river harvest rates from 1983 to 1990 that varied between 0.013 and 0.087. For OBAN, it was assumed that the in-river harvest was constant at 0.05 from 1991 to 2007. The 0.05 river harvest rate was used in combination with the 0.22 ocean harvest rate to equal the average harvest impact rate identified by Grover et al. (2004) for the 1998, 1999, and 2000 cohorts.

Using the OBAN model for Evaluating Sites Project alternatives

In order to simulate winter-run Chinook salmon population dynamics under each of the alternatives, covariate data were required for each alternative. These covariates were produced for each alternative by using hydrological (CalSim) and water quality models (SRWQRM). In addition, DCC position does not differ between model scenarios during the period of winter-run presence in the Delta, as it is assumed to be closed during winter-run presence. All covariates were normalized by subtracting the mean and dividing by the standard deviation of empirical data used to estimate the OBAN model coefficients.

The OBAN model was modified to be able to run for the CalSim2 period of hydrologic outputs (1922 – 2003) by making two modifications to the model. The first was the inclusion of a harvest control rule for calculating harvest rates as a function of spawning abundance. The harvest control rule is consistent with the rule used in the NMFS winter-run life cycle model (WRLCM) and has a maximum harvest rate of 0.2 when the three-year geometric average is greater than 3500 spawners (Hendrix et al. 2014). The second modification was the need to resample from the ocean productivity indices (CURL). The historical 1967 – 2014 CURL values were resampled with replacement in each iteration to provide variability in ocean productivity across the 1000 Monte Carlo simulations for each alternative.

Developing OBAN configurations for Sites diversions

Configuration 1: Sites diversions from Bend Bridge flows

The Sites projects diversions occur below Bend Bridge, however there are only several physical drivers that affect survival in the OBAN model. The first configuration of the OBAN model to evaluate the Sites project modified the Bend Bridge flows to incorporate the diversions to the Sites project. The alternatives used the modified Bend Bridge flows to calculate the egg to fry survival in the OBAN model.

Configuration 2: Sites diversions incorporated into a flow-survival relationship

In the second configuration of the OBAN model, the flow-survival relationship that was developed in Michel et al. (2021) was incorporated into the juvenile survival in the Delta portion of the model (Figure 1). Their selected model uses a step function with three flow thresholds to capture the relationship between juvenile Chinook migration survival in the Sacramento River (from its confluence with Deer Creek to its confluence with the Feather River) and flow at Wilkins Slough gauge. Below a minimum flow threshold of 4,259 cfs, estimated survival is 0.03; between the minimum threshold and the historic mean flow of 10,712 cfs, estimated survival is 0.189; between the historic mean threshold and the high flow threshold of 22,872 cfs, estimated survival is 0.508; and estimated survival above the high flow threshold is 0.353. We modified the Michel et al. (2021) relationship in one important way; we retained the high survival level (0.508) for flows above 22,872 (red line in Figure 1). The objective of retaining this survival rate over those flows was to remove the possibility that survival benefits would be attained by reducing flow below the high threshold in the alternatives.

To obtain an annual survival adjustment factor using this model, we first used monthly averages of modeled flow at Wilkins Slough to calculate monthly estimates of survival. Since the flow model used the historic mean flow threshold as a monthly average flow target, we slightly adjusted this flow threshold in the flow-survival model to 10,690 cfs to remove any ambiguity about which survival estimate to apply to months with approximately 10,712 cfs average flow. These monthly survival estimates were then weighted according to an assumed fraction of the total annual population outmigrating in a given month (Table 1) to obtain an annual survival estimate.

Instead of applying the flow-survival values directly to the OBAN model, we applied a survival anomaly. The anomaly is the difference in survival in the alternative relative to the NAA baseline in the flow-survival relationship. For example, if flows in the NAA were 12,000 cfs at Wilkins but the Alt3A flows in the same month were 9,000 cfs then the survival of the Alt3A was reduced by a value of approximately 0.3 (i.e., survival anomaly of -0.3) (Figure 1) to reflect the lower survival due to decreasing flows at Wilkins through Sites diversions in that month.

Alternatively, if the flows in the NAA were 12,000 cfs and the flows in the same month were 11,000 cfs then the survival anomaly was zero for that month. Finally, months in which flows at Wilkins were higher under the alternative relative to the NAA could provide a positive survival anomaly if the alternative flow surpassed one of the flow thresholds (Figure 1).

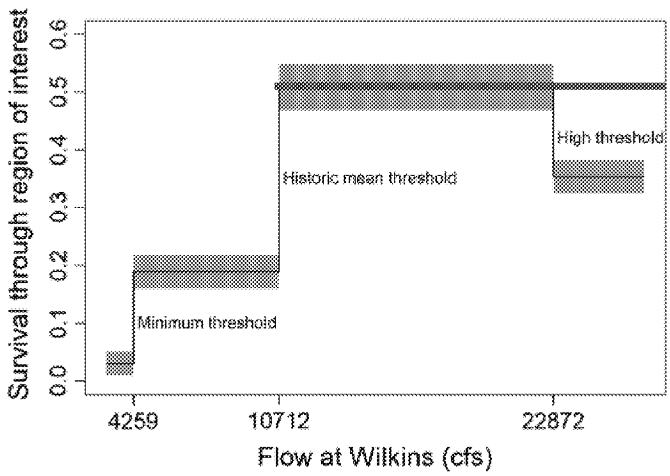

Fig. 6. Thresholds of predicted survival as a function of flow at Wilkins Slough. Predictions are based on the model averaged parameters from the most parsimonious triple threshold models, with mean thresholds at 4259, 10,712, and 22,872 cfs, with 95% confidence intervals (gray fill).

Figure 1. Michel et al. (2021) figure 6 indicating the non-linear relationship between flow at Wilkins Slough and survival with red line showing modification for implementation in the OBAN model.

Table 1. Monthly weights applied to the monthly survival anomalies to reflect Sites diversions.

Month	Weight
January	0.27
February	0.365
March	0.365

In general, the flow at Wilkins was similar between the NAA and alternatives thus the survival anomalies were zero (Figure 2).

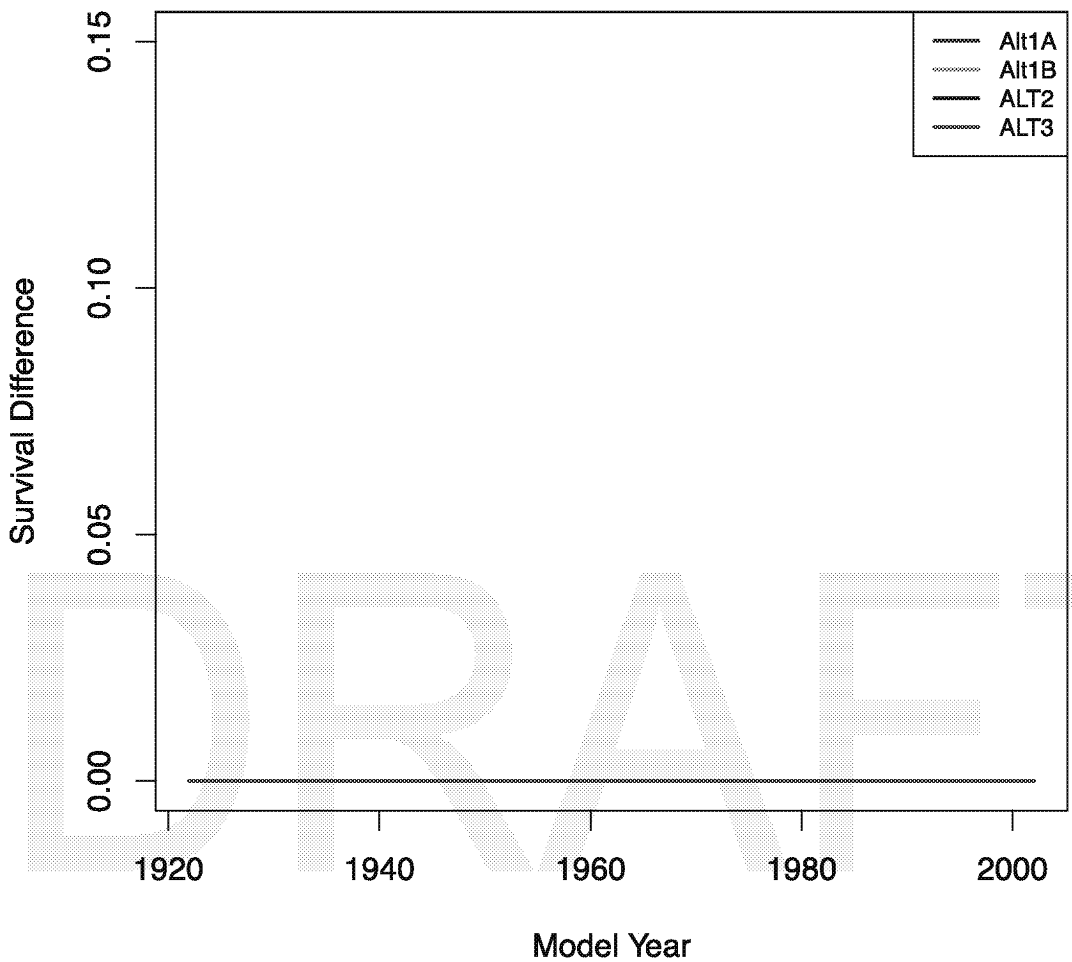

Figure 2. Annual survival differences applied in the Delta life stage to reflect Sites effect on flows at Wilkins Slough.

OBAN Model Results

Configuration 1: Sites diversions from Bend Bridge flows

Median abundance was the highest under Alt 1B relative to the no action alternative (NAA) and to the other alternatives (Figure 3). The greatest differences in spawner abundances between the alternatives and the NAA occurred in the early model years, which may reflect differences in the production during the initialization of the model. Including the first 10 years, Alt3 had the highest median abundance of the alternatives. When the period of evaluation for the abundances was truncated to 1933 – 2002 to allow comparisons between alternatives and the NAA to occur during more representative conditions, median abundance from 1933 to the end of the time series was higher under Alt 1B. Furthermore, over the 1933 – 2002 timeframe the only alternative with higher abundance on average than the NAA was Alt 1B (Figure 3).

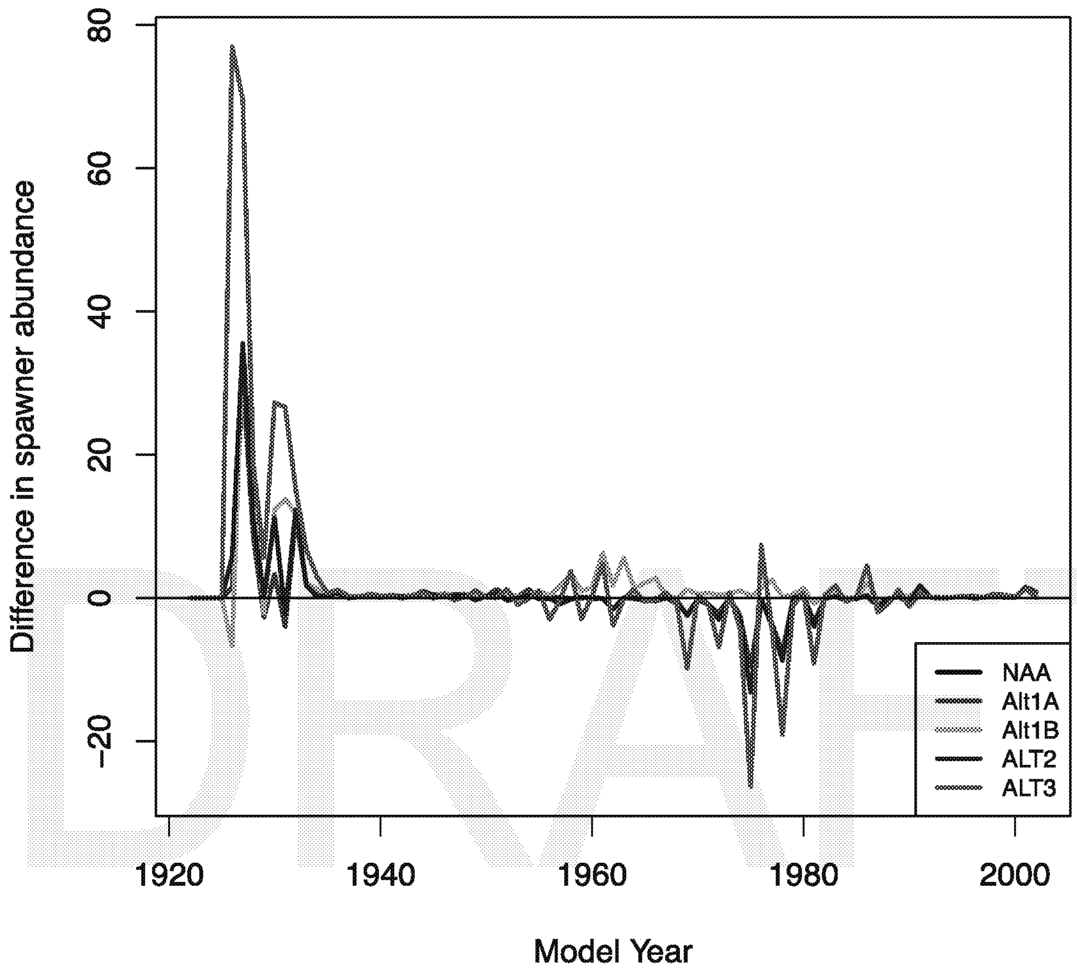

Figure 3. Difference (Alternative – NAA) in median spawner abundance for model years 1922 – 2002. Positive values indicate higher abundances under alternatives relative to the baseline no action alternative (NAA).

For much of the modeled time series, abundances were variable among the alternatives and the NAA except for the 1940's and 1990's 2002 (Figure 3). Uncertainty in the abundances followed these general patterns in which the spawner abundances in the alternatives and the NAA were consistently equivalent (Figure 4). The periods in which there was little difference between the NAA and the alternatives (Figure 3) and low variability in the difference between the NAA and the alternatives (Figure 4) were years of low abundance in both the alternatives and the NAA.

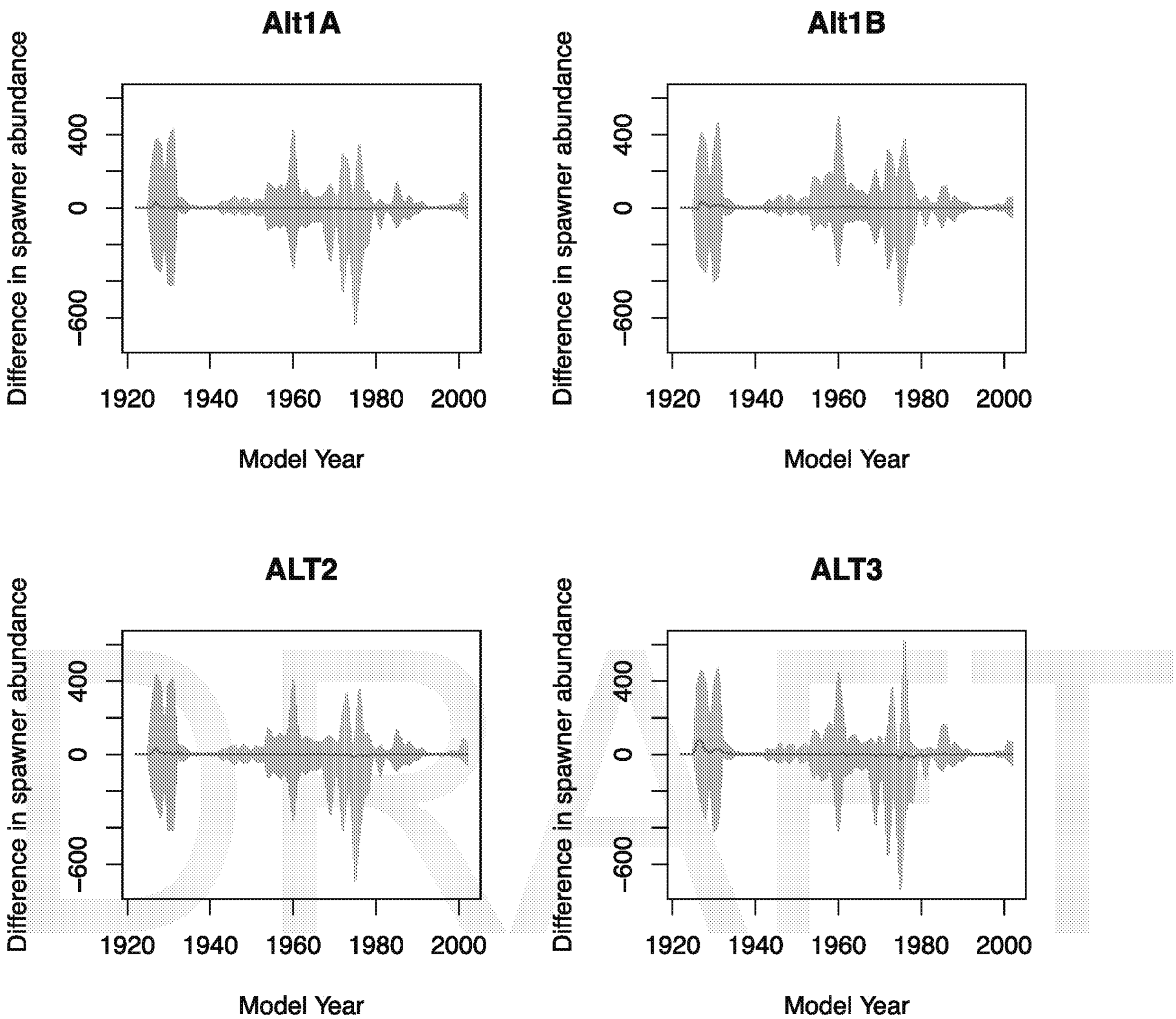

Figure 4. Difference (Alt - NAA) in spawner abundance for model years 1922 – 2002. Positive values indicate higher abundances under alternatives relative to the no action alternative (NAA). Median (red line) and 80% intervals (gray) across 1000 Monte Carlo simulations are presented.

The probability of quasi-extinction (probability that spawner abundance < 100) followed these same general temporal patterns (Figure 5). Periods in which there was little difference between the NAA and the alternatives were periods in which the probability of quasi-extinction was high (Figure 5). Temporal patterns in quasi-extinction were similar among alternatives and the NAA (Figure 5 left). Performance of the alternatives relative to the NAA indicated that Alt1B had lower probabilities of quasi-extinction than the NAA, whereas all other alternatives had higher probabilities (Figure 5, right).

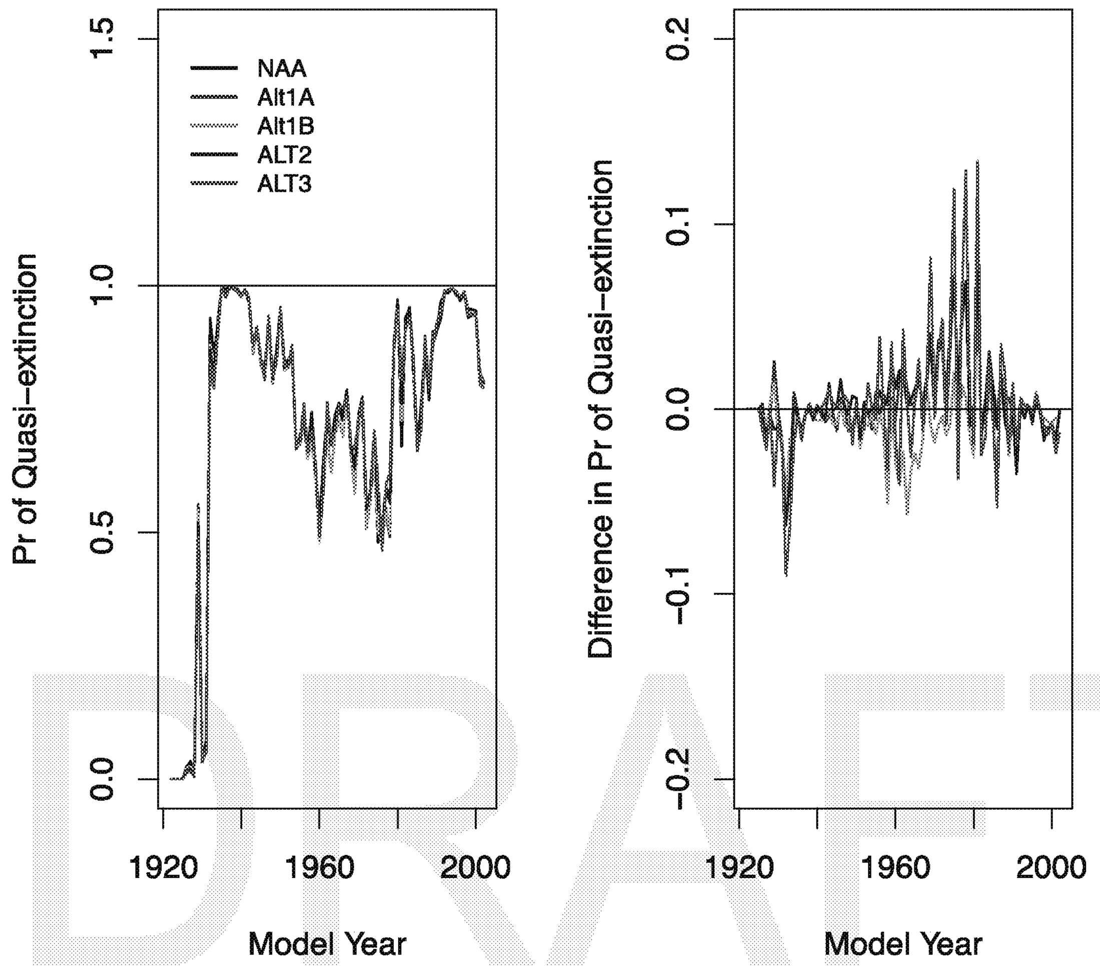

Figure 5. Probability of quasi-extinction (spawner abundance < 100) showing the no action alternative (NAA) (black) and alternatives (left). Difference (Alt – NAA) in the probability of quasi-extinction (right); thus, negative values indicate lower probability of quasi-extinction.

The survival rates in the egg through fry stage provided an indicator of how the Sites project affected the early winter-run life history stages. The differences in survival rates of the alternatives relative to the NAA were calculated to identify the model years in which those differences were occurring. Average egg through fry survival was higher only in Alt 1B relative to the NAA, whereas all other alternatives had lower egg through fry survival than the NAA (Figure 6). Variability in the difference in egg to fry survival (i.e., greater differences above and below the NAA) was the greatest in Alt3 relative to the other alternatives (Figure 6 and 7).

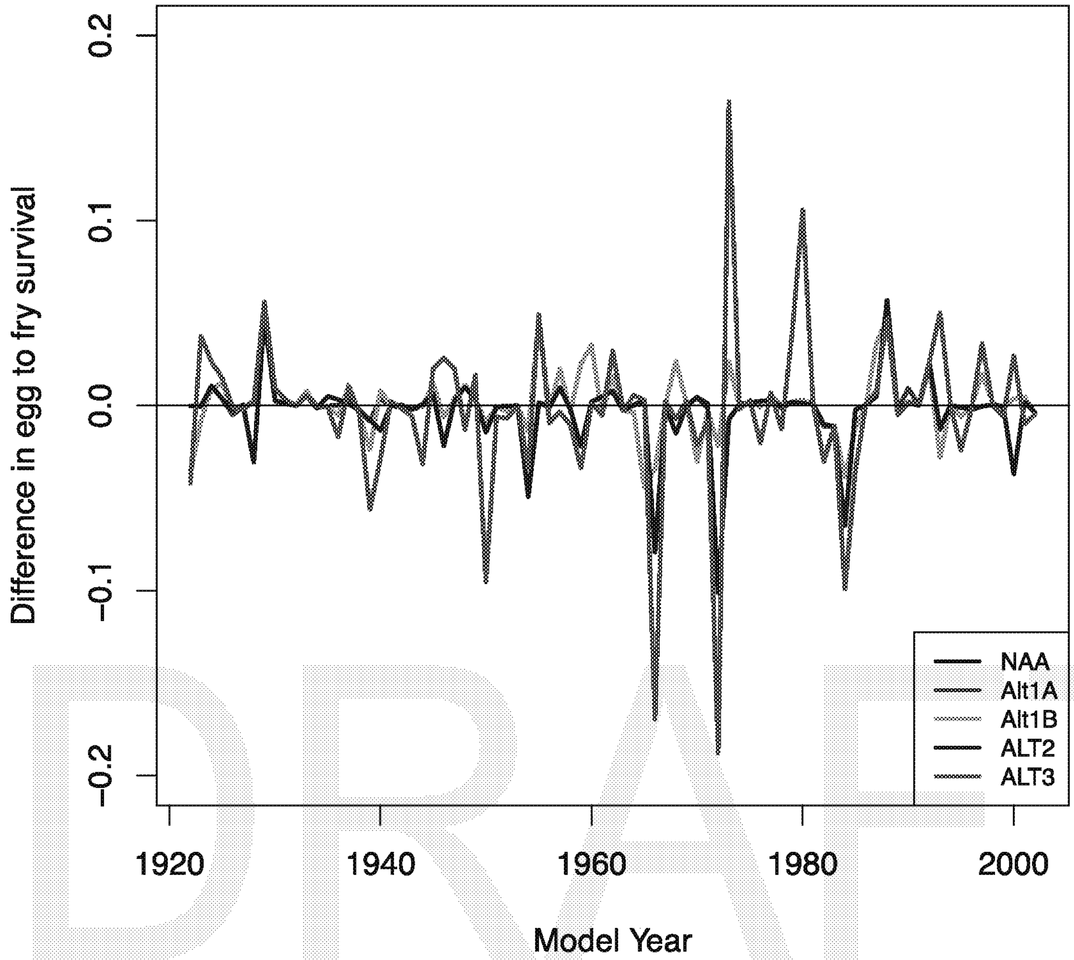

Figure 6. Median difference (Alt – NAA) in survival of the egg through fry stages which includes thermal mortality and Bend Bridge flow effects.

The relative survival of egg through fry in the alternatives varied in their temporal patterns (Figure 6, Figure 7). In most years, the survival of the alternatives and NAA were similar, with a few years having large positive or negative differences, particularly in Alt 3 (Figure 6). The number of years with positive and negative median survival differences provided insight into the different levels of performance of the alternatives. Alt1A had one year with survival differences > 0.05 (i.e., positive effects) and three years with survival differences < -0.05 (i.e., negative effects). For Alt1B there were zero positive and zero negative; Alt2 had one positive and three negative; and Alt3 had four positive and five negative.

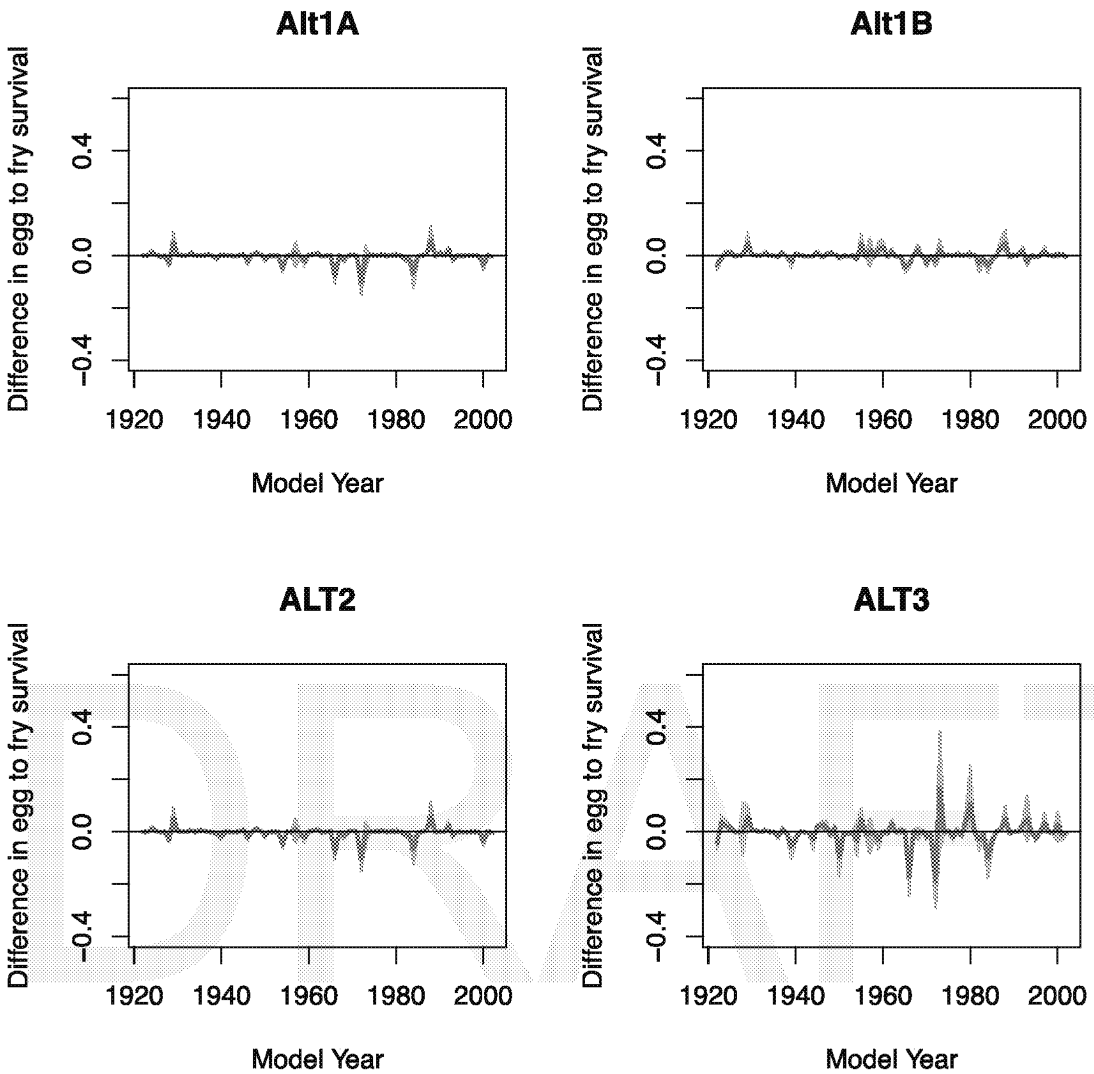

Figure 7. Difference (ALT – NAA) in survival of the egg through fry stages which includes thermal mortality and Bend Bridge flow effects. Median (red line) and 80% intervals (gray) across 1000 Monte Carlo simulations are presented.

In the Delta, survivals under the alternatives were greater than the NAA on average (Figure 8). Over the time series, there was generally little difference between the alternatives and the NAA except for a single positive anomaly under Alt1B and a series of years with positive and negative anomalies under Alt3 (Figure 8). Uncertainty in the estimates followed a similar pattern, but both Alt1B and Alt3 had a single year in which the 90% credible interval was moderately negative, which occurred in model year 1955 in both alternatives (Figure 9).

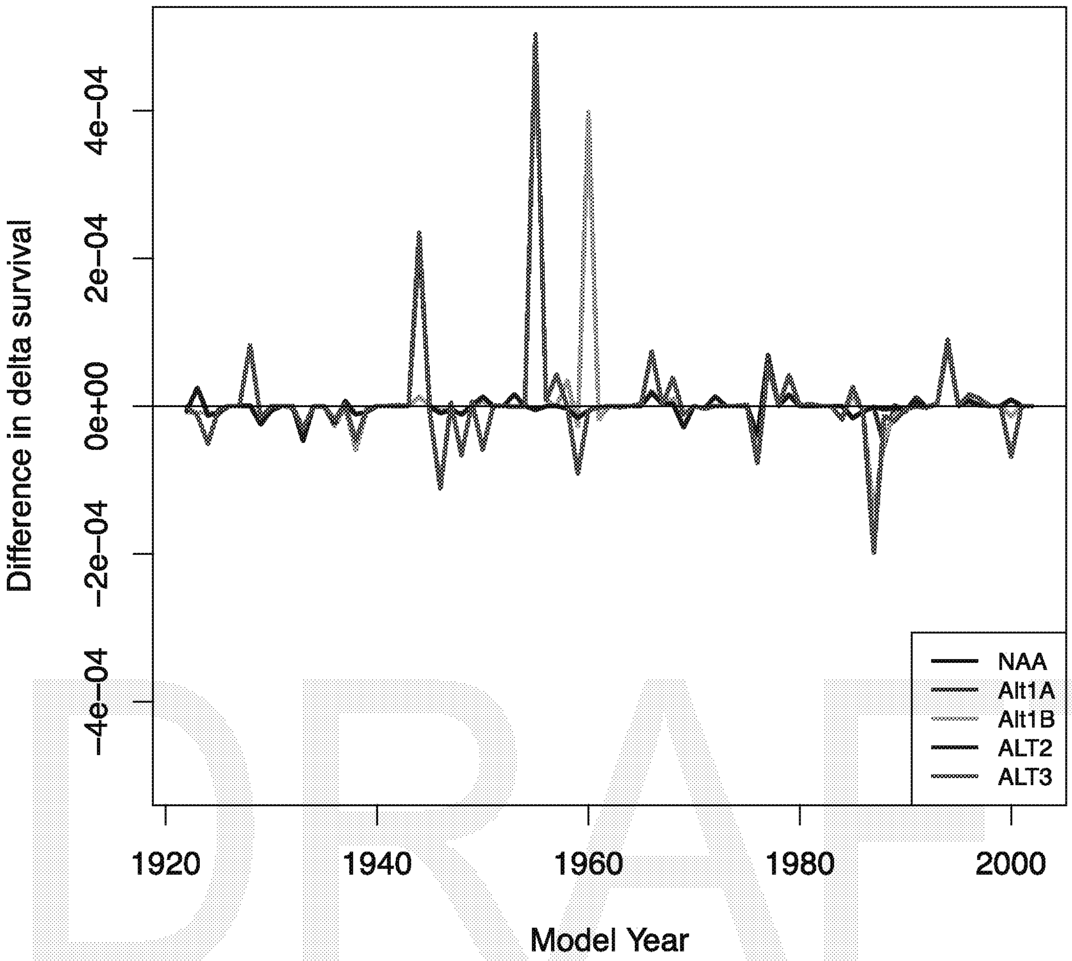

Figure 8. Median difference (Alt – NAA) in survival of the delta stage which includes access to Yolo bypass and export effects.

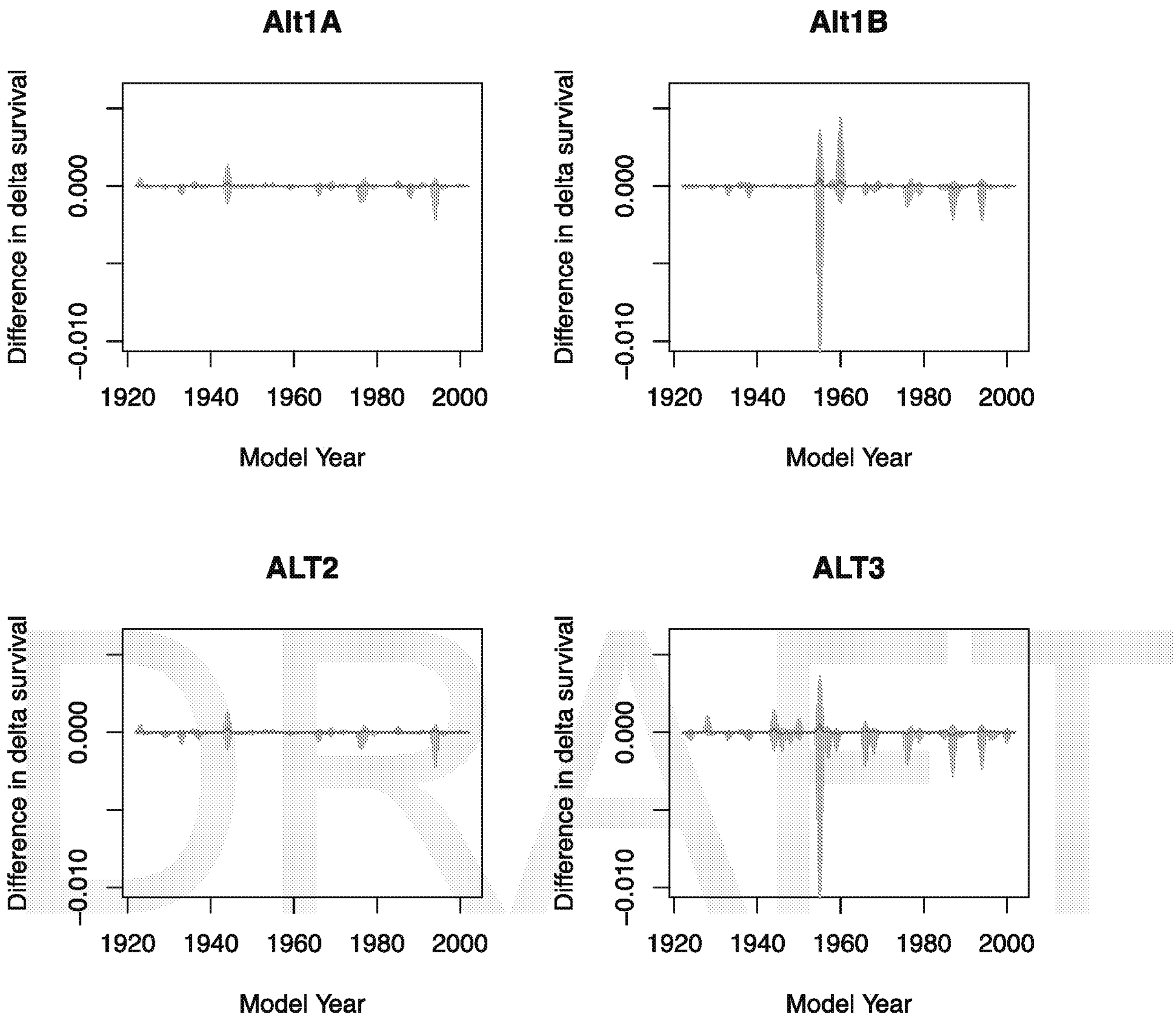

Figure 9. Difference (Alt – NAA) in survival of the delta stage which includes access to Yolo bypass and export effects. Median (red line) and 80% intervals (gray) across 1000 Monte Carlo simulations are presented.

Evaluation of Physical Data Affecting Performance

The two physical drivers that affect the egg through fry survival in the OBAN model are the temperatures at Bend Bridge during egg incubation and the minimum flow at Bend Bridge during fry rearing and outmigration (Figure 10 and 11). Mean temperatures were lower in all alternatives except Alt3 relative to the NAA, with Alt1B providing lowest temperature on average. These differences were driven by a few years, however, and median temperature was less than the NAA only under Alt2.

Differences in minimum flow between the alternatives and the NAA indicated higher minimum flows at Bend Bridge relative to the NAA on average across all alternatives (Figure 11). Median minimum flows were approximately equivalent between the NAA and the alternatives, with Alt1B and Alt3 providing median flows higher than the NAA, whereas Alt1A and Alt2 had median flows less than the NAA (Figure 11).

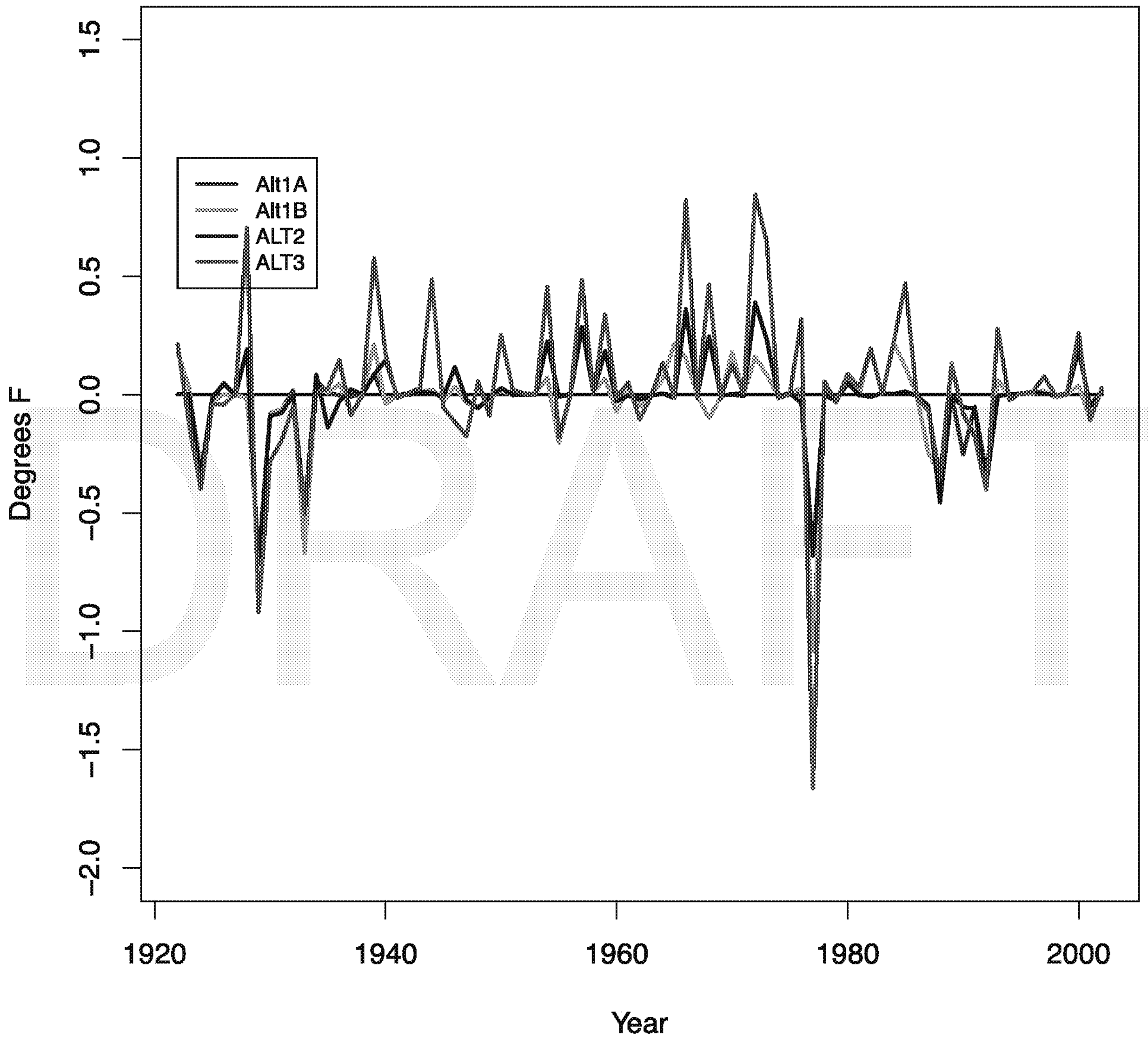

Figure 10. Difference (Alt – NAA) in temperature (degrees F) between the No Action Alternative (NAA) and the alternatives.

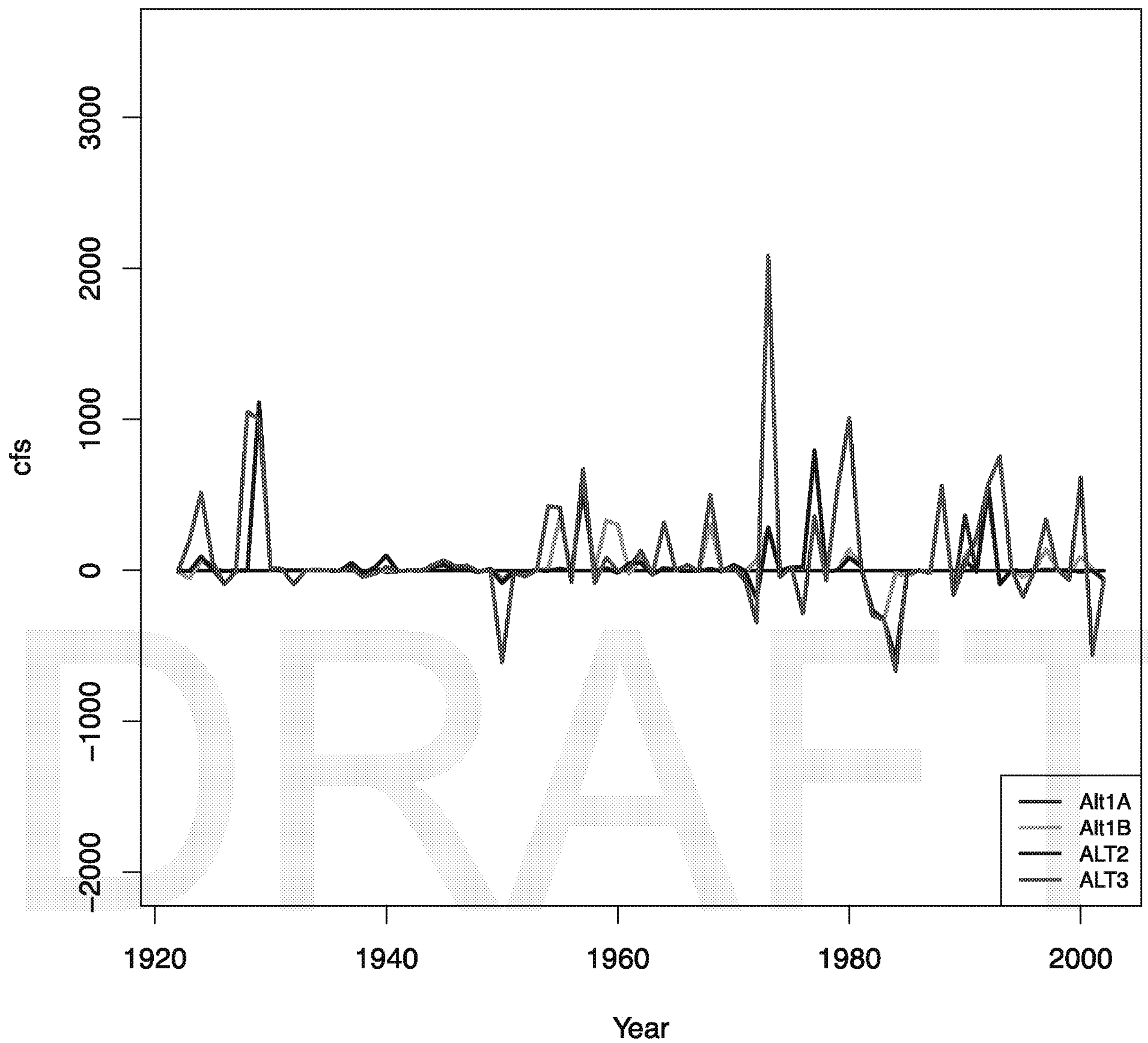

Figure 11. Difference (Alt – NAA) in flow (cubic feet per second, cfs) between the No Action Alternative (NAA) and the alternatives.

Within the physical drivers affecting the Delta survival, variation in the delta survival rates observed under Alt1B and Alt3 were due largely to the reduction in exports in those years (Figure 12).

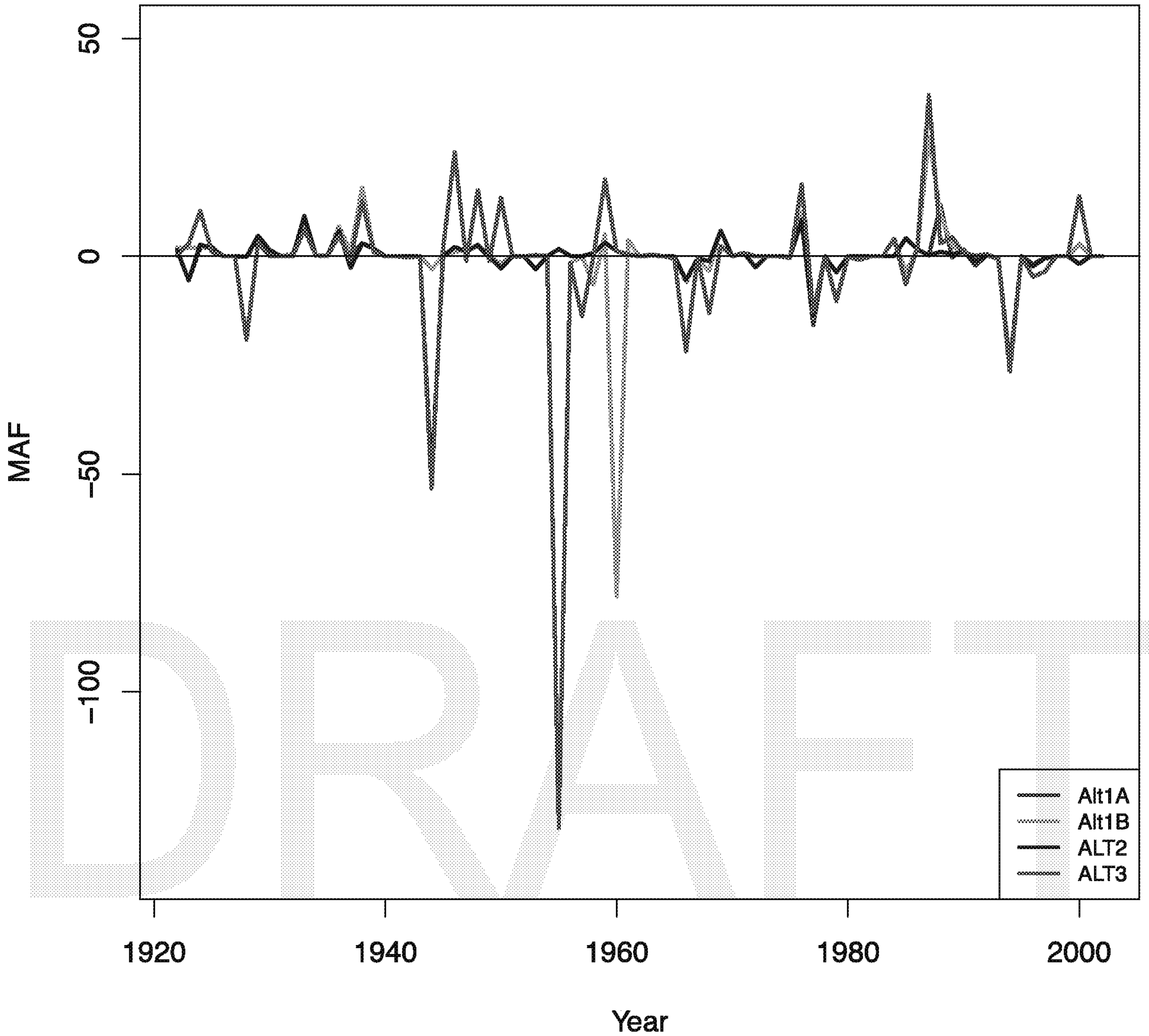

Figure 12. Difference (Alt – NAA) in exports (million acre feet, MAF) between the No Action Alternative (NAA) and the alternatives.

Configuration 2: Sites diversions incorporated into a flow-survival relationship

In general, results were similar for the analysis including the Michel et al. (2021) flow-survival effect (Configuration 2) to the results with Sites diversions affecting Bend Bridge flows (Configuration 1). The Michel et al. (2021) flow-survival relationships were included in the Delta survival portion of the OBAN model, but the Sites diversions did not cause Wilkins flows to shift into a flow range that affected survival (Figure 2). Because the Bend Bridge flows in Configuration 2 do not include Sites diversions, this analysis essentially evaluates the sensitivity of the OBAN results to including Sites diversions in the Bend Bridge flows. Results were essentially equivalent under both configurations.

Median abundance was the highest under Alt3 relative to the other alternatives and the no action alternative (NAA) when evaluated over the full time series (Figure 13). The largest differences in spawner abundances between the alternatives and the NAA were due to the escapement in the early model years, though. When the period of evaluation for the abundances was truncated to 1933 – 2002, median abundance was higher under Alt1B, whereas all other alternatives had average abundances less than the NAA (Figure 13).

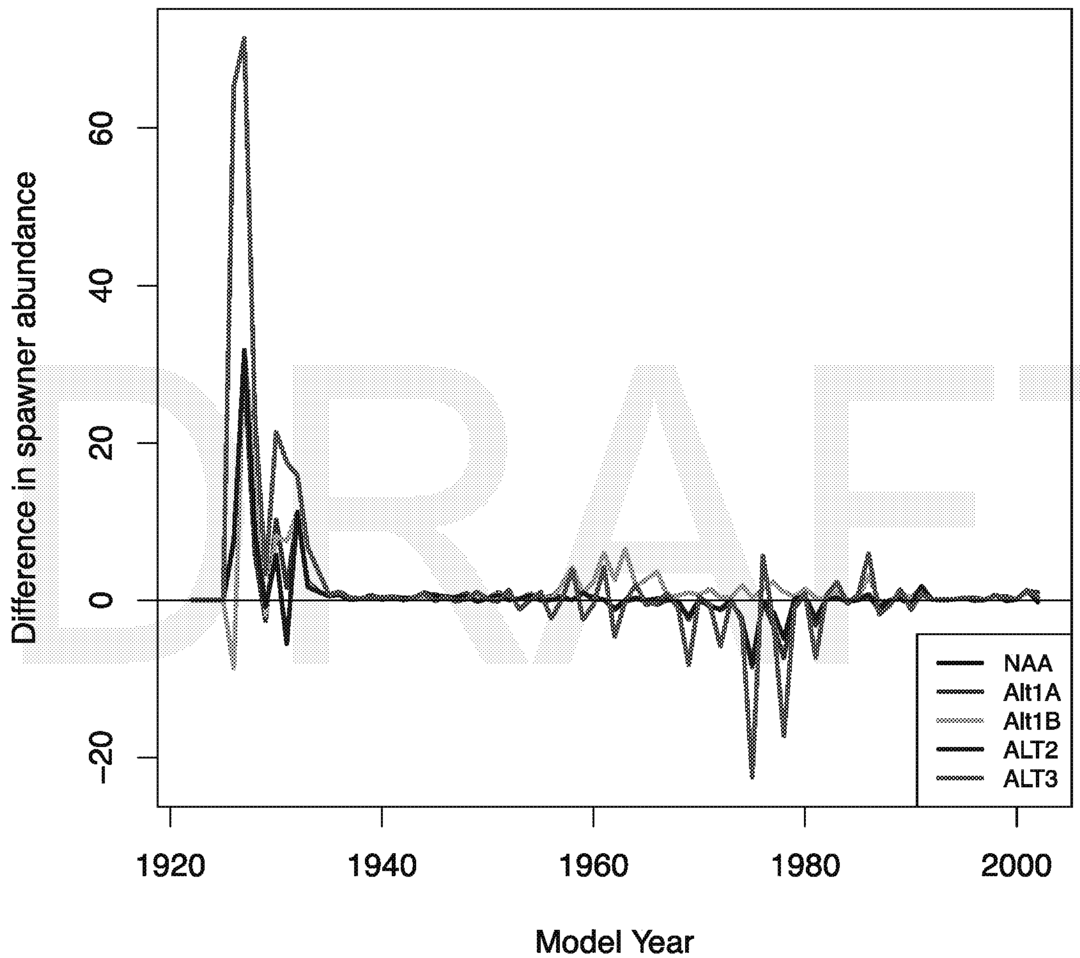

Figure 13. Difference (Alternative – NAA) in median spawner abundance for model years 1922 – 2002. Positive values indicate higher abundances under alternatives relative to the baseline no action alternative (NAA).

Temporal patterns in differences in spawner abundances were similar for the second OBAN configuration as for the first configuration. Namely, for much of the modeled time series, abundances were similar among the alternatives and the NAA. Periods of low variability and low uncertainty across Monte Carlo simulations were years of low abundance in both the alternatives and the NAA (Figure 14).

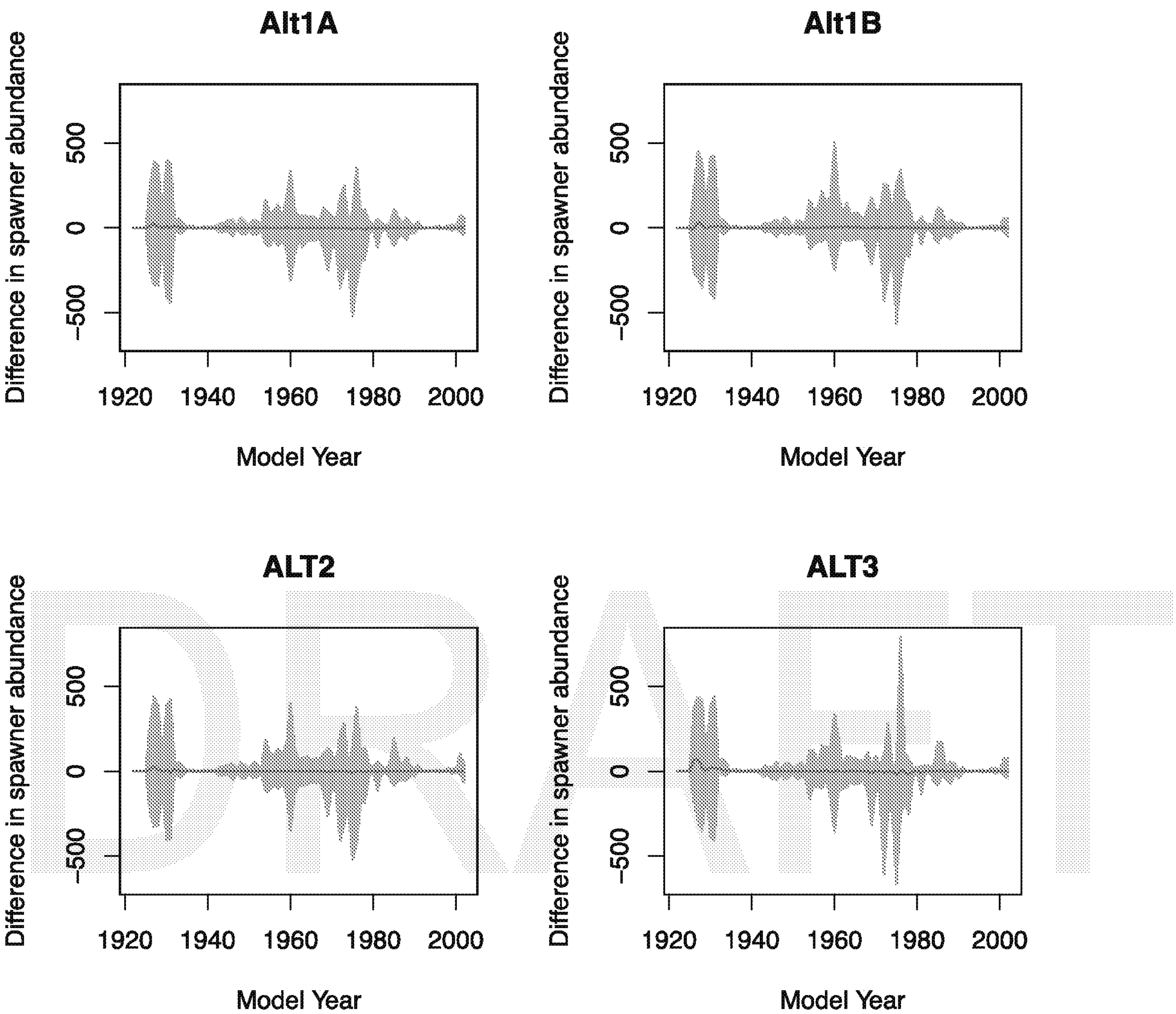

Figure 14. Difference (Alt - NAA) in spawner abundance for model years 1922 – 2002. Positive values indicate higher abundances under alternatives relative to the no action alternative (NAA). Median (red line) and 80% intervals (gray) across 1000 Monte Carlo simulations are presented.

Both the NAA and the alternatives had similar temporal patterns in quasi-extinction (Figure 15) left), but alternatives Alt1B and Alt2 had quasi-extinction probabilities lower than the NAA for the period 1933-2002. This result differs from the results under Configuration 1, in which Alt2 had higher extinction probabilities than the NAA.

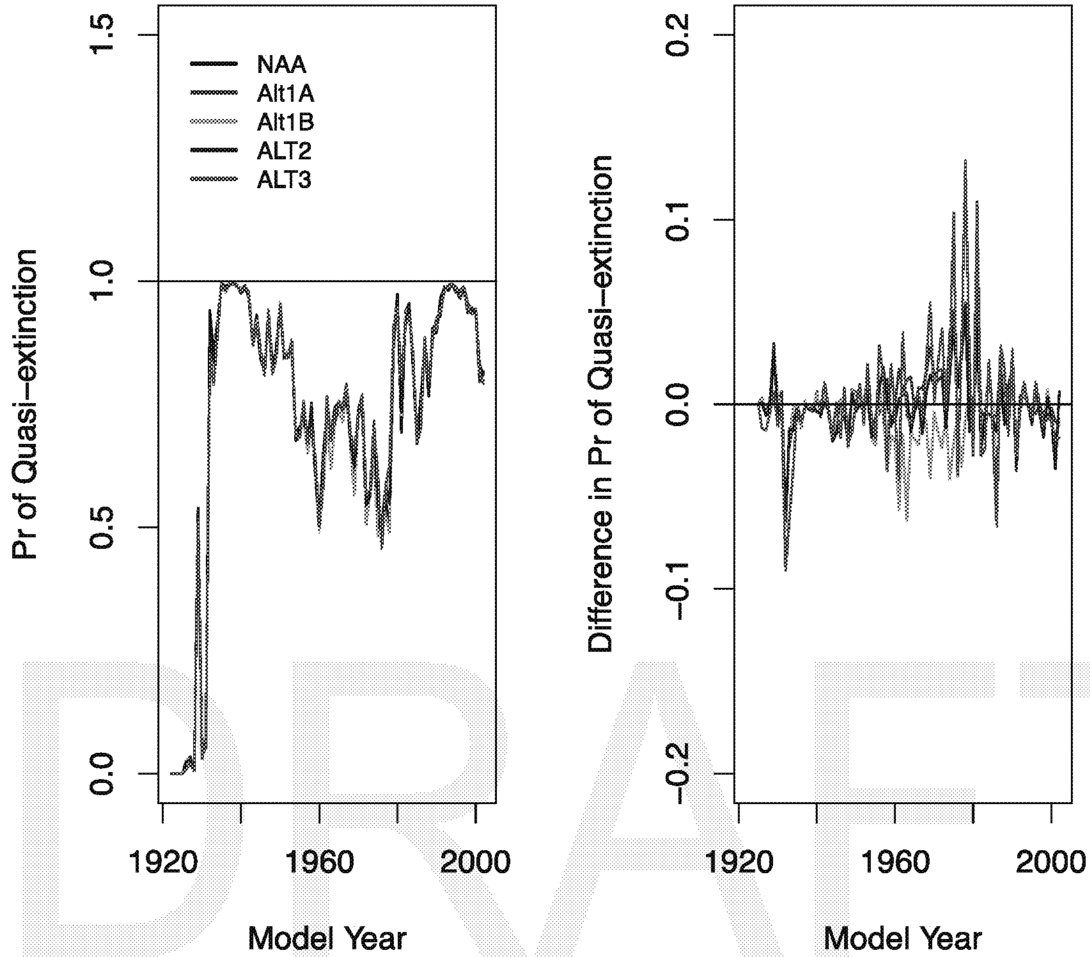

Figure 15. Probability of quasi-extinction (spawner abundance < 100) showing the no action alternative (NAA) (black) and alternatives (left). Difference (Alt – NAA) in the probability of quasi-extinction (right); thus, negative values indicate lower probability of quasi-extinction.

Patterns in the egg to fry survival were similar in the OBAN model runs using the Michel et al. (2021) flow-survival relationships (Figure 16) as in the configuration in which Sites diversions affected Bend Bridge Flows. The only alternative in which egg to fry survival was higher on average than the NAA was Alt1B (Figures 16 and 17).

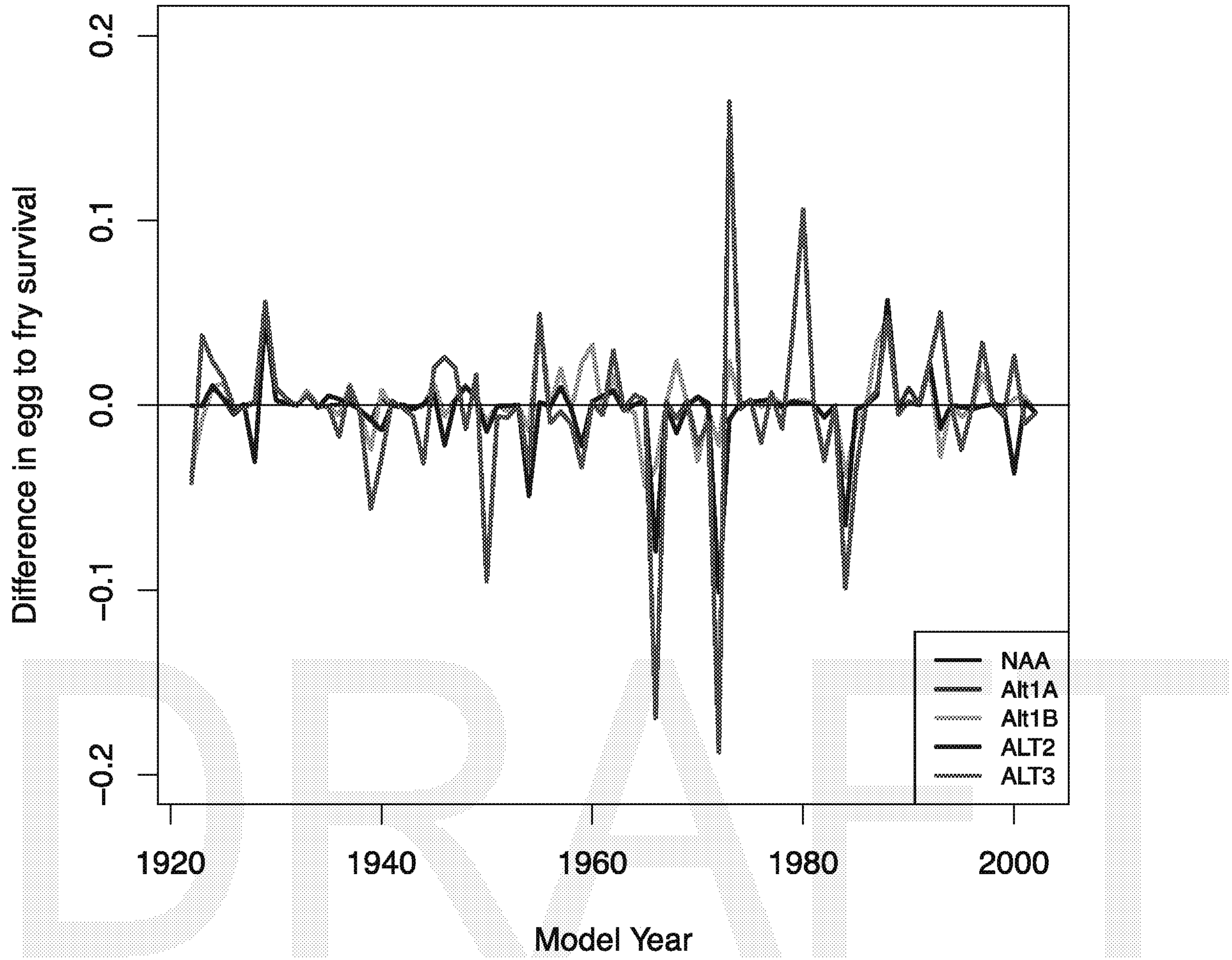

Figure 16. Median difference (Alt – NAA) in survival of the egg through fry stages which includes thermal mortality and Bend Bridge flow effects.

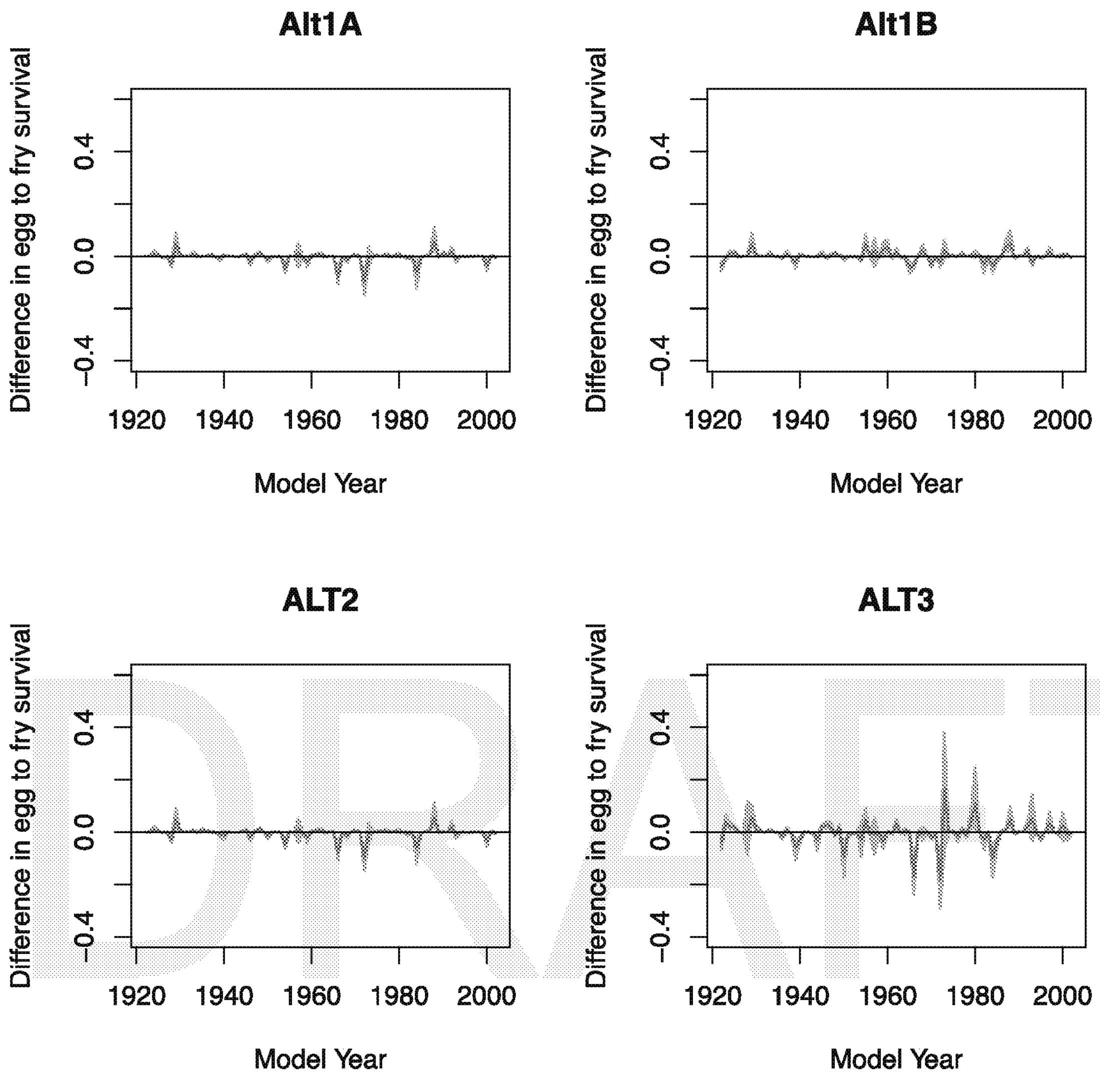

Figure 17. Difference (ALT – NAA) in survival of the egg through fry stages which includes thermal mortality and Bend Bridge flow effects. Median (red line) and 80% intervals (gray) across 1000 Monte Carlo simulations are presented.

Patterns in Delta survival were the same in the two configurations (Figures 18 & 8) due to the flow-survival relationships being equivalent among the NAA and the alternatives (Figure 2).

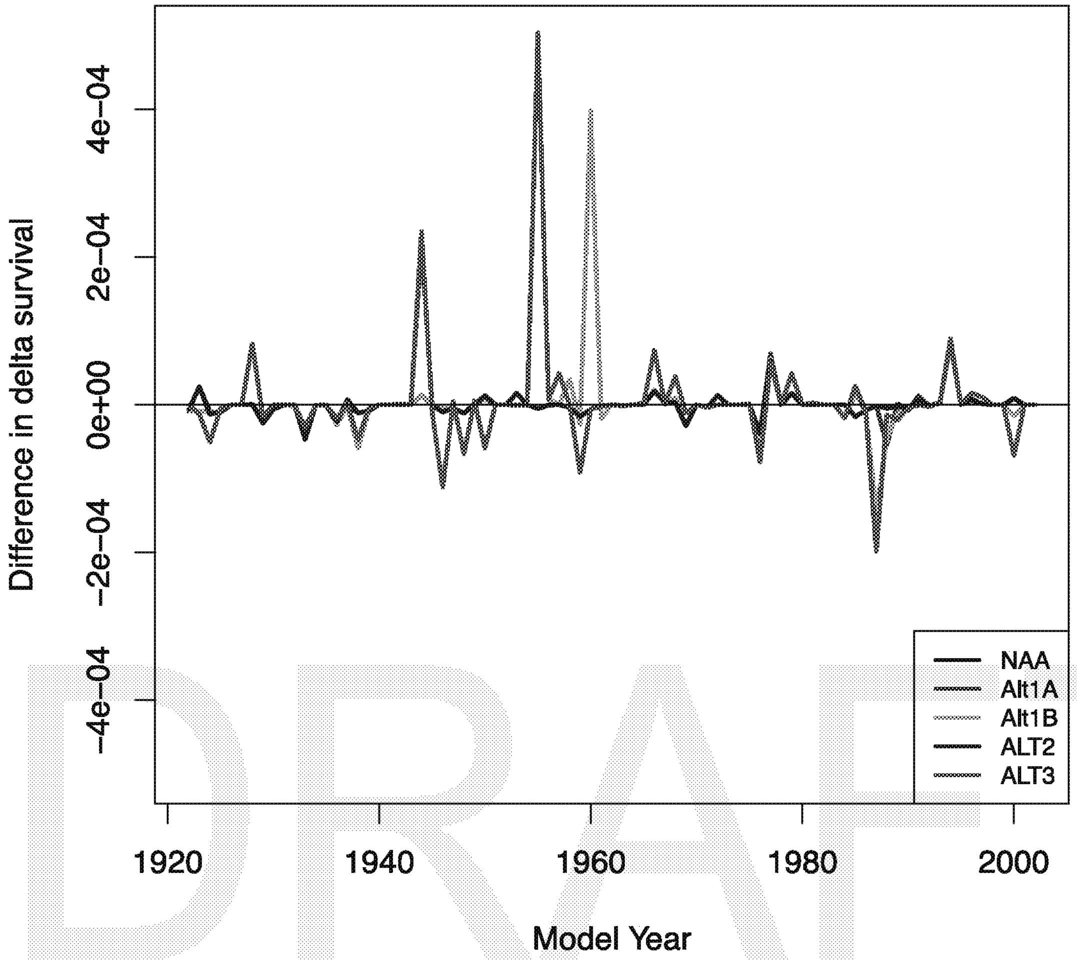

Figure 18. Median difference (Alt – NAA) in survival of the delta stage which includes access to Yolo bypass and export effects.

Evaluation of Physical Data Affecting Performance

The only physical driver that differed between the two configurations was the flow at Bend Bridge. In the first OBAN configuration, Sites diversions were included in the Bend Bridge flows, whereas under the second OBAN configuration, the Bend Bridge flows did not include Sites diversions. Instead, they were included in the flow-survival relationship through Wilkins Slough flows. As a result, we only present the Bend Bridge flows for the evaluation of the physical data under the second configuration.

Differences in minimum flow between the alternatives and the NAA were similar to the first OBAN Configuration. All alternatives had higher flows than the NAA on average, whereas only Alt1B and Alt3 had higher median flows relative to the NAA.

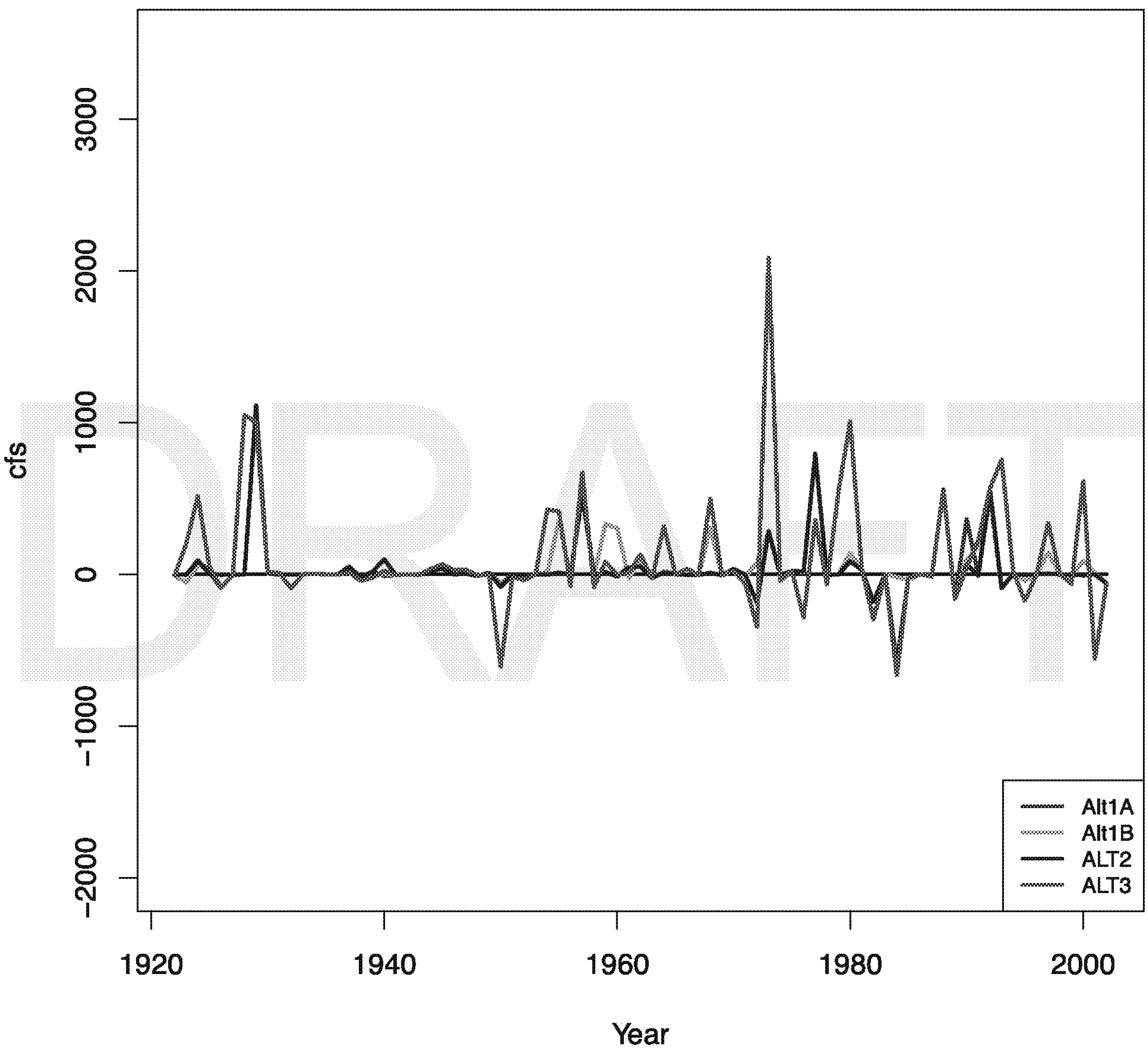

Figure 19. Difference (Alt – NAA) in flow (cubic feet per second, cfs) between the No Action Alternative (NAA) and the alternatives.

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Authority Board Meeting

Agenda Item 3.2: Final EIR/EIS Update

August 24, 2022

Sites

Roles

- Authority Lead Agency under CEQA
  - Takes first CEQA action
  - Members making decision in the context of the Authority's decision (not their own agency's decision)
- Each Reservoir Committee Member is a Responsible Agency under CEQA
  - Takes follow on CEQA action prior to final decision to invest in Project
  - Important that each Member Agency can make this decision based on the Authority's Final EIR/EIS

Speaker: Laurie

Draft - Predecisional Working Document - For Discussion Purposes Only

Final EIR/EIS Development

- RDEIR/SDEIS released November 12, 2021
- Close of public review January 28, 2022
- Ongoing efforts since January:
  - Coordination with Reclamation and legal counsel on approach to Final EIR/EIS, including format, key comments and additional technical analysis
  - Identification of any changes to the Project, both facilities and operations
  - Incorporating revised diversion criteria and revised modeling results
  - Continuing AB 52 consultation and other public outreach
  - Developing master and individual responses to comments

Speaker: Laurie

Draft - Predecisional Working Document - For Discussion Purposes Only

Final EIR/EIS Format

- Volume 1 – Chapters
  - Include all chapters from RDEIR/SDEIS that need to be revised
- Volume 2 – Appendices
  - Include all appendices from RDEIR/SDEIS that need to be revised
- Volume 3 – Responses to Comments on RDEIR/SDEIS
  - Master responses and individual responses to all comments received

Speaker: Laurie

Key Changes To Date

- Changes between RDEIR/SDEIS and Final EIR/EIS to date:
  - Minor changes in facilities due to design refinements
  - Revisions to Diversion Criteria
  - Corrections or clarifications needed in response to comments
- No new or substantial greater impacts identified that would require recirculation

Speaker: Laurie

Draft - Predecisional Working Document - For Discussion Purposes Only

CEQA Decision Process (In Order)

1. Certification of the Final EIR completed in compliance with CEQA and reflects agency's independent judgment
2. Adopt CEQA Findings and Statement of Overriding Considerations
   - Significant Impact – Written findings accompanied by a brief explanation of the rationale
   - Significant and Unavoidable Impacts – Statement of Overriding Considerations
     - Balance, as applicable, the economic, legal, social, technological, or other benefits, including region-wide or statewide environmental benefits, of a proposed project against its unavoidable environmental risks
     - Water Quality, Vegetation and Wildlife, Agriculture, Air Quality, Cultural Resources, Tribal Cultural Resources
   - Adopt Mitigation Monitoring and Reporting Plan
3. Decide whether to approve the Project

Speaker: Ali

Draft - Predecisional Working Document - For Discussion Purposes Only

Next Steps

- Completion of Administrative Final EIR/EIS in October and concurrent review by Reclamation, legal counsel and responsible and cooperating agencies
- Preparation of the complete Final EIR/EIS in early 2023
- Federal review and approval for publication
- Preparation of CEQA Findings, MMRP and Statement of Overriding Considerations
- Authority Board public meeting to decide to adopt CEQA document, make findings and approve project

Speaker: Ali

Questions?

Sites

Meeting: **Sites Reservoir Committee's Coordination Workgroup**

Locations: Maxwell Project Office, 122 Old Highway 99W, Maxwell, CA 95955
See below for alternate meeting locations.

Call in: **1-916-538-7066** Code: **372 979 656#** Click here to join the meeting

Workgroup Chair: Thad Bettner (RC Chair/Glenn-Colusa Irrigation District)
Workgroup Vice-Chair: Valerie Pryor (RC Vice-Chair/Zone 7 Water Agency)
Staff Lead: Jerry Brown, Executive Director

AGENDA

Thursday, September 8, 2022 9:00 – 10:00 am

NO ACTION or DECISION WILL BE TAKEN

ROLL CALL & CALL TO ORDER:

- Introductions
- Period for Public Comment

1. Discussion and Information Items:

1.1 Board Meeting Agenda Planning
  1.1.1 Meeting Schedule for Next Year

1.2 General Coordination Among Committees and Workgroups
  1.2.1 General Counsel/Special Counsel Coordination
  1.2.2 Knowledge Transfer Opportunity

2. Closed Session:

2.1 Potential Litigation – Gov. Code Sec. 54956.9(d)(3)

3. Upcoming Meetings:

Joint Reservoir Committee & Authority Board Meeting
Friday, September 16, 2022 (9:00 am – 12:00 pm)

Coordination Workgroup
Thursday, October 13, 2022 (9:00 – 10:00 am)

Virtual Information will be provided before all meetings at Sitesproject.org.

ADJOURN

PERIOD OF PUBLIC COMMENT: Any person may speak about any subject of concern, provided it is within the jurisdiction of the Reservoir Committee and is not already on today's agenda. The total amount of time allotted for receiving such public communication shall be limited to a total of 10 minutes per issue and each individual or group will be limited to no more than 3 minutes each within the 10 minutes allocated per issue. **Note:** No action shall be taken on comments made under this comment period.

ADA COMPLIANCE: Upon request, agendas will be made available in alternative formats to accommodate persons with disabilities. In addition, any person with a disability who requires a modification or accommodation to participate or attend this meeting may request necessary accommodation. Please make your request to the Board Clerk, specifying your disability, the format in which you would like to receive this Agenda and any other accommodation required no later than 24 hours before the start of the meeting.

Alternate Meeting Locations:

Coachella Valley Water District, 51501 Tyler Street, Coachella, CA 92236

Davis Water District, 6505 Hillgate Road, Arbuckle, CA 95912

Glenn-Colusa Irrigation District, 344 East Laurel Street, Willows, CA 95988

San Bernardino Valley Municipal WD, 380 E. Vanderbilt Way, San Bernardino, CA 92408

Wheeler Ridge-Maricopa Water Storage District, 12109 Hwy 166, Bakersfield, CA 93313

Zone 7 Water Agency, 100 North Canyons Parkway, Livermore, CA 94551

Sites Reservoir Project - 3 Month Look Ahead

Primary	Assigned To	Governing Body
September 2022 (Joint Meeting)		
Consent Items		
Minutes	Sandra Yarbrough	Joint Authority Board & Reservoir Committee
Treasurer's Report	Joe Trapasso	Joint Authority Board & Reservoir Committee
Payment of Claims	Joe Trapasso	Joint Authority Board & Reservoir Committee
HDR task order amendment	Joe Trapasso	Joint Authority Board & Reservoir Committee
Action Items		
Test Pits and Trenching Draft IS/MND - Authority Release for Public Review	aforsythe@sitesproject.org	Joint Authority Board & Reservoir Committee
Approve Consulting Agreement with Mitigation Assistance Service Provider	aforsythe@sitesproject.org, Joe Trapasso	Joint Authority Board & Reservoir Committee
Approve revised conflict of interest code per FPPC	Kevin Spesert	Joint Authority Board & Reservoir Committee
Discussion and Informational Items		
USDA Loan Letter of Conditions Update	Cheyanne Harris, Derek Gardels, JP Robinette	Joint Authority Board & Reservoir Committee
BO and ITP Updates (Construction and Operations)	Ali Forsythe, John Spranza	Joint Authority Board & Reservoir Committee
Status of Consultants Revised Agreements and Closeout of Agreements and Task Orders	Joe Trapasso	Authority Board & Reservoir Committee
Update on Governance Subcommittee discussion	Jerry Brown	Joint Authority Board & Reservoir Committee
MBK - Sole Source	aforsythe@sitesproject.org, Joe Trapasso	Joint Authority Board & Reservoir Committee
Monthly Reporting (Monthly Status Report, Work Plan, Action Items)	All	Joint Authority Board & Reservoir Committee
Closed Session		
Committees/Workgroups		
Payment of Claims	Joe Trapasso	Joint Budget & Finance Committee
HDR task order amendment		
MBK - Sole Source	Joe Trapasso	Joint Budget & Finance Committee
WIFIA Ad Hoc Subcommittee Update	Cheyanne Harris, JP Robinette	Joint Budget & Finance Committee
Updated Guiding Principles	Cheyanne Harris, JP Robinette	Joint WIFIA Ad Hoc Subcommittee
Recommend rating agency	Cheyanne Harris, JP Robinette	Joint WIFIA Ad Hoc Subcommittee
Discuss Master Resolution key points	Cheyanne Harris, JP Robinette	Joint WIFIA Ad Hoc Subcommittee
Discuss Reserve Policy and Debt Management Policy Key Points	Cheyanne Harris, JP Robinette	Joint WIFIA Ad Hoc Subcommittee
Financing tracks update	Cheyanne Harris, JP Robinette	Joint WIFIA Ad Hoc Subcommittee
Local Community Working Group (Pending)	Kevin Spesert	
Governance - 2nd Meeting to review evaluate alternative	Jerry Brown	Joint Governance Committee
No O&E or EPP Work Group Scheduled for this Month		
September 13, 2022 - Plan of Finance Costs Workshop	Cheyanne Harris, Henry Luu, JP Robinette	
Rolling Cost Estimate Approach	Henry Luu, JP Robinette	Joint Authority Board & Reservoir Committee
Value Engineering Opportunities	Henry Luu, JP Robinette	Joint Authority Board & Reservoir Committee
Market Conditions (construction, finance, water)	Cheyanne Harris, JP Robinette	Joint Authority Board & Reservoir Committee
Schedule and Delivery Methods	Cheyanne Harris, Henry Luu, JP Robinette	Joint Authority Board & Reservoir Committee
October 2022		
Consent Items		Authority Board & Reservoir Committee
Minutes	Sandra Yarbrough	Authority Board & Reservoir Committee
Treasurer's Report	Joe Trapasso	Authority Board & Reservoir Committee
Payment of Claims	Joe Trapasso	Authority Board & Reservoir Committee

Primary	Assigned To	Governing Body
Action Items		
Resolution of Appreciation for Senator Nielson	Kevin Spesert	Authority Board & Reservoir Committee
Approve 2023 Authority Board and Reservoir Committee Meeting Calendar	Jerry Brown	Authority Board & Reservoir Committee
PLACE HOLDER - Real Estate Actions	Kevin Spesert	Authority Board & Reservoir Committee
Master Resolution	Cheyanne Harris, JP Robinette	Authority Board & Reservoir Committee
Debt Management Policy	Cheyanne Harris, JP Robinette	Authority Board & Reservoir Committee
Reserves Policy for WIFIA Application	Cheyanne Harris, JP Robinette	Authority Board & Reservoir Committee
Discussion and Informational Items		
Placeholder - Water Rights - Protests Status Update Briefing (May move to November as we will want to have this after the protest period closes)	aforsythe@sitesproject.org	Authority Board & Reservoir Committee
Placeholder: Workplan Status Update - Draft 2023 Expense/Revenue Budget, Cash Flow/Call, Unrestricted Reserve, consultant amendments	Joe Trapasso, Marcus Maltby	Authority Board & Reservoir Committee
Review Project Baseline Schedule	Henry Luu, JP Robinette, Marcus Maltby	Authority Board & Reservoir Committee
Monthly Reporting (Monthly Status Report, Work Plan, Action Items)	All	Authority Board & Reservoir Committee
Closed Session		
Committees/Workgroups		
Governance Meeting	Jerry Brown	Joint Governance Committee
Payment of Claims	Joe Trapasso	Joint Budget & Finance Committee
Amendment 3 Update and Changes - Engineering and Geotech	Henry Luu, JP Robinette, Marcus Maltby	Reservoir Operations & Engineering Workgroup
Review Project Baseline Schedule	Henry Luu, JP Robinette, Marcus Maltby	Reservoir Operations & Engineering Workgroup
Placeholder: WP Status Update - Draft 2023 Expense/Revenue Budget, Cash Flow/Call, Unrestricted Reserve	Joe Trapasso, Marcus Maltby	Joint Budget & Finance Committee
Water Rights - Protests Status Update Briefing (May move to November as we will want to have this after the protest period closes)	Ali Forsythe, John Spranza	Environmental Planning & Permitting Workgroup
Dead Pool Environmental Considerations - Requested by Rob Kunde	Ali Forsythe, John Spranza	Environmental Planning & Permitting Workgroup
BO & ITP Adaptive Management Plan	Ali Forsythe, John Spranza	Environmental Planning & Permitting Workgroup
WIFIA Ad Hoc Subcommittee Update	Cheyanne Harris, JP Robinette	Joint Budget & Finance Committee
Discuss updates to financing tracks	Cheyanne Harris, JP Robinette	Joint WIFIA Ad Hoc Subcommittee
Recommend draft WIFIA reserve policy	Cheyanne Harris, JP Robinette	Joint WIFIA Ad Hoc Subcommittee
Recommend draft debt management policy	Cheyanne Harris, JP Robinette	Joint WIFIA Ad Hoc Subcommittee
Recommend Draft Master Resolution	Cheyanne Harris, JP Robinette	Joint WIFIA Ad Hoc Subcommittee
Review Credit Summary Memo ("front-end" for indicative rating)	Cheyanne Harris, JP Robinette	Joint WIFIA Ad Hoc Subcommittee
Tribal Community Working Group	Kevin Spesert	
Placeholder: Plan of Finance Credit and Reserves Workshop	**Cheyanne Harris, JP Robinette**	Joint Authority Board & Reservoir Committee
November 2022		
Consent Items		Joint Authority Board & Reservoir Committee
Minutes	Sandra Yarbrough	Authority Board & Reservoir Committee
Treasurer's Report	Joe Trapasso	Authority Board & Reservoir Committee
Payment of Claims	Joe Trapasso	Authority Board & Reservoir Committee
3rd 2022 Quarterly Finance Report	Joe Trapasso	Authority Board & Reservoir Committee
Action Items		
Review Authority Board Budget and Authorize Invoices for Board Membership dues - Every Year	Joe Trapasso, JP Robinette	AB
Approve Updated Contracts - Executive Director, Existing Agents		
Placeholder: WP Status Update - Draft 2023 Expense/Revenue Budget, Cash Flow/Call, Unrestricted Reserve, consultant amendments	Joe Trapasso, Marcus Maltby	Joint Authority Board & Reservoir Committee
Approve submittal of materials for an indicative credit rating for the JPA	Cheyanne Harris, JP Robinette	Authority Board & Reservoir Committee
Placeholder: Adopt Guiding Principles and Preliminary Terms (assuming needs to be separate action from approval of indicative credit rating materials)	Cheyanne Harris, JP Robinette	Authority Board & Reservoir Committee
Facility partner MOU/Cooperative Agreement & A3 Budget Adjustments	Cheyanne Harris, JP Robinette	Authority Board & Reservoir Committee

Primary	Assigned To	Governing Body
Discussion and Informational Items		
Discussion of other water management activities across the state relative to Sites.	Jerry Brown	Joint Authority Board & Reservoir Committee
Monthly Reporting (Monthly Status Report, Work Plan, Action Items)	All	Joint Authority Board & Reservoir Committee
Closed Session		
Committees/Workgroups		
No EPP or O&E Work Group This Month		
Governance Meeting	Jerry Brown	Joint Governance Committee
Final changes to indicative rating materials	Cheyanne Harris, JP Robinette	Joint WIFIA Ad Hoc Subcommittee
Placeholder - Recommend the Guiding Principles and Preliminary Terms	Cheyanne Harris, JP Robinette	Joint WIFIA Ad Hoc Subcommittee
Placeholder: WP Status Update - Draft 2023 Expense/Revenue Budget, Cash Flow/Call, Unrestricted Reserve, consultant amendments	Joe Trapasso, Marcus Maltby	Joint Budget & Finance Committee
3rd Quarter 2022 Financial Report	Joe Trapasso	Joint Budget & Finance Committee
Recommend submittal of materials for an indicative credit rating for the JPA	Cheyanne Harris, JP Robinette	Joint Budget & Finance Committee
Local Community Working Group (Bi-Monthly)	Kevin Spesert	
Local Community Working Group (Bi-Monthly)	Kevin Spesert	
Local Community Working Group (Bi-Monthly)	Kevin Spesert	
Local Community Working Group (Bi-Monthly)	Kevin Spesert	
Local Community Working Group (Bi-Monthly)	Kevin Spesert	
Closed Session		
ED Performance Evaluation	Jerry Brown	Authority Board & Reservoir Committee

From: Janis Offermann [janis@horizonh2o.com]
Sent: 9/7/2022 12:40:38 PM
To: Laverne Bill [LBill@yochadehe-nsn.gov]
CC: Eric Hernandez [EHernandez@yochadehe-nsn.gov]; Socorro Reyes-Gutierrez [SReyes-Gutierrez@yochadehe-nsn.gov]; Alicia Forsythe [aforsythe@sitesproject.org]; Kevin Spesert [kspesert@sitesproject.org]; Laurie Warner Herson [laurie.warner.herson@phenixenv.com]; Victoria Delgado [VDelgado@yochadehe-nsn.gov]
Subject: RE: [EXTERNAL] RE: sites geotech 2022-2024 Discovery Plan

Hi, Laverne
We have been focusing a lot on these geotechnical studies lately, but we would also like to keep moving the AB52 consultations for the entire project moving forward. I don't think we have any other meetings scheduled to discuss it. Can we please have Victoria find a few dates to set up a meeting?

Hope you are finding a way to stay cool.
Thanks
janis

From: Laverne Bill <LBill@yochadehe-nsn.gov>
Sent: Wednesday, September 7, 2022 10:52 AM
To: 'Janis Offermann' <janis@horizonh2o.com>
Cc: Eric Hernandez <EHernandez@yochadehe-nsn.gov>; Andrew Cherna Jr <ACherna@yochadehe-nsn.gov>; Socorro Reyes-Gutierrez <SReyes-Gutierrez@yochadehe-nsn.gov>; Alicia Forsythe <aforsythe@sitesproject.org>; Kevin Spesert <kspesert@sitesproject.org>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: [EXTERNAL] RE: sites geotech 2022-2024 Discovery Plan

Good morning, Janis. Thanks for the clarification and we appreciate your email.

Laverne Bill
Director of Cultural Resources

Yocha Dehe Wintun Nation
PO Box 18 | Brooks, CA 95606
p 530.796.3400 | c 530.723.3891
f 530.796.2143
lbill@yochadehe-nsn.gov
www.yochadehe.org

From: Janis Offermann <janis@horizonh2o.com>
Sent: Wednesday, September 7, 2022 10:41 AM
To: Laverne Bill <LBill@yochadehe-nsn.gov>
Cc: Eric Hernandez <EHernandez@yochadehe-nsn.gov>; Andrew Cherna Jr <ACherna@yochadehe-nsn.gov>; Socorro Reyes-Gutierrez <SReyes-Gutierrez@yochadehe-nsn.gov>; Alicia Forsythe <aforsythe@sitesproject.org>; Kevin Spesert <kspesert@sitesproject.org>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: RE: sites geotech 2022-2024 Discovery Plan

[Warning External Sender]

Hi, Laverne
I???m afraid I misspoke in my earlier email.?? The Post Review Discovery Plan, Archaeological Monitoring Plan, and Burial Treatment Plan that I had attached to the email is for the geotechnical studies that are about to begin, not for the trenching and test pits scheduled for later this years.
Apologies for any confusion this may have caused.
Thanks

Janis
??
??
Janis Offermann, MA, RPA
Cultural Resources Practice Lead
Horizon Water and Environment
1801 7th Street, Suite 100
Sacramento, CA 95811
530.220.4918
??
??
??

From: Janis Offermann <janis@horizonh2o.com>
Sent: Tuesday, August 30, 2022 3:48 PM
To: 'Laverne Bill' <lbill@yochadehe-nsn.gov>
Cc: 'Eric Hernandez' <EHernandez@yochadehe-nsn.gov>; 'Andrew Cherna Jr' <ACherna@yochadehe-nsn.gov>; 'Socorro Maldonado' <SMaldonado@yochadehe-nsn.gov>; 'Alicia Forsythe' <aforsythe@sitesproject.org>; 'Kevin Spesert' <kspesert@sitesproject.org>; 'Laurie Warner Herson' <laurie.warner.herson@phenixenv.com>
Subject: sites geotech 2022-2024 Discovery Plan
??
Good afternoon, Laverne
Attached please fine the Post Review Discovery Plan, Archaeological Monitoring Plan, and Burial Treatment Plan prepared to address unanticipated discoveries during the geotechnical trenching and test pits that are scheduled to begin late this year.?? The locations of the geotechnical work discussed in the document are depicted in the shape files that Jelica sent to you on August 2.?? The plan was developed using the protocols you provided, as much as possible. You will note that the Bureau of Reclamation has its own protocols to follow on lands under their jurisdiction.
??
Please review the document and let us know if you have comments or concerns, and please don???t hesitate to give me a call if you have any questions.
??
I???m looking forward to meeting with you on September 15 to discuss the proposed locations of the test pits and trenches, and any concerns you might have.
??
Thanks
Janis
??
Janis Offermann, MA, RPA
Cultural Resources Practice Lead
Horizon Water and Environment
1801 7th Street, Suite 100
Sacramento, CA 95811
530.220.4918

From: Alicia Forsythe [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=A6CDF06A7E904B65BAA21702A82AD329-AFORSYTHE]
Sent: 9/7/2022 3:03:56 PM
To: Jacobson, Allison M [ajacobson@usbr.gov]; Holm, Lisa M [lholm@usbr.gov]
Subject: RE: Sites - Trinity Water Right Term
Attachments: 20220823_Trinity River Language Comparison_Revisions V4_Revised on Call.docx

Hi Allison and Lisa – Here's the tweak that we made on the call. I'll work on updating that first sentence with the revised language and get something over shortly.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

-----Original Appointment-----
From: Jacobson, Allison M <ajacobson@usbr.gov>
Sent: Thursday, August 25, 2022 11:01 AM
To: Jacobson, Allison M; Holm, Lisa M; Alicia Forsythe
Subject: Sites - Trinity Water Right Term
When: Wednesday, September 7, 2022 2:30 PM-3:00 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Microsoft Teams Meeting

Quick discussion with Ali to review development of draft Trinity River water right term (attached).

Microsoft Teams meeting

Join on your computer or mobile app
Click here to join the meeting

Meeting ID: 233 974 795 791
Passcode: tvxwyP
Download Teams | Join on the web

Learn More | Meeting options

Sites Reservoir Project – Trinity River Discussions
August 23, 2022

Humboldt County Proposed Term:

Trinity River water shall not be used to fill Sites Reservoir unless the Trinity River Division of the Central Valley Project is releasing water as a result of storage conditions requiring "Safety of Dams" releases beyond normal operating plans and concurrently when Shasta Reservoir is making flood control releases.

Furthermore, Humboldt County's 1959 water contract with the Bureau of Reclamation, Trinity River Record of Decision (ROD) flows, and releases to implement the Bureau of Reclamation's Long-Term Plan to Protect Adult Salmon in the Lower Klamath River shall not be reduced or negatively impacted in any way as a result of any Sites Reservoir decisions, modeling, operational plans, and water right petitions.

Possible Revised Term Version 4[i]:

The Sites Project shall not divert Trinity River water (water diverted by the Bureau of Reclamation from the Trinity River watershed into the Sacramento River watershed pursuant to its water rights) to storage in Sites Reservoir under this Permit unless the Trinity River water is abandoned in the Sacramento River and all other diversion criteria in this Permit are met.

Furthermore, the Sites Project's diversions to storage under this Permit shall not negatively impact Trinity River obligations of the Bureau of Reclamation, including but not limited to those obligations specified in the 1959 Contract between the United States and Humboldt County, the Trinity River Mainstem Fishery Restoration Record of Decision, and the Long-Term Plan to Protect Adult Salmon in the Lower Klamath River, and related obligations in the Bureau of Reclamation's water right permits 11966, 11967, 11968, 11969, 11970, 11971, 11972, and 11973.

Formatted: Highlight

[i] The Sites Authority Board has not reviewed or approved this possible revised term. Staff has provided this language for discussion purposes only.

From: Alicia Forsythe [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=A6CDF06A7E904B65BAA21702A82AD329-AFORSYTHE]
Sent: 9/8/2022 1:31:53 PM
To: Spranza, John [John.Spranza@hdrinc.com]; David Hubbard [Dhubbard@BrwnCald.com]; mmaltby@brwncald.com
CC: Arsenijevic, Jelica [jelica.arsenijevic@hdrinc.com]
Subject: RE: Mitigation Master Plan - need update please

We are just bringing on a mitigation provider. But I think its still relatively reasonable to complete the activity by Feb 2023. I wouldn't revise this at this time.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Thursday, September 8, 2022 11:37 AM
To: David Hubbard <Dhubbard@BrwnCald.com>; mmaltby@brwncald.com; Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Arsenijevic, Jelica <jelica.arsenijevic@hdrinc.com>
Subject: RE: Mitigation Master Plan - need update please

We selected a contractor to produce the plan but they are not yet under contract. This may result in the completion date being revised as the new team would have some input on the process.

Ali, thought on when we would have this complete by?

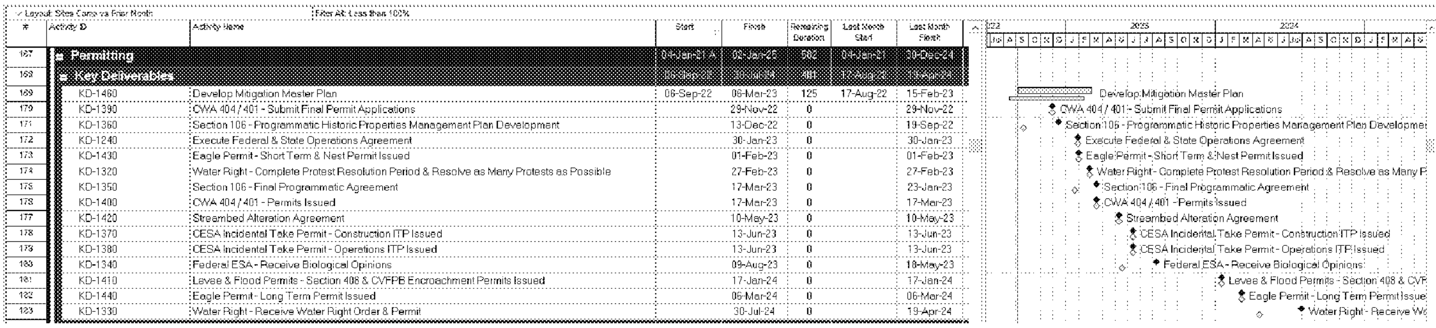
John Spranza

D 916.679.8858 M 818.640.2487

From: David Hubbard <Dhubbard@BrwnCald.com>
Sent: Thursday, September 8, 2022 10:49 AM
To: Marcus Maltby <mmaltby@BrwnCald.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>; Spranza, John <john.spranza@hdrinc.com>; Arsenijevic, Jelica <jelica.arsenijevic@hdrinc.com>
Subject: Mitigation Master Plan - need update please

Mitigation Cost Estimate Update has moved and is driven by ***Develop Mitigation Master Plan.***
I didn't receive any input that this activity started per the plan of 17-Aug, so it's riding the Data Date.

As it's under Permitting, I've cc'd Ali, John and Jelica and am asking any of those to provide an update to the Master Plan. Did we start, date? Can we complete per plan of 15-Feb-23?



✓ Layout: Sites Comp vs Prior Month | Filter All: Less than 100%

#	Activity ID	Activity Name	Start	Finish	Remaining Duration	Last Month Start	Last Month Finish
167	Permitting		04-Jan-21 A	02-Jan-25	582	04-Jan-21	30-Dec-24
168	Key Deliverables		06-Sep-22	30-Jul-24	481	17-Aug-22	19-Apr-24
169	KD-1460	Develop Mitigation Master Plan	06-Sep-22	06-Mar-23	125	17-Aug-22	15-Feb-23
170	KD-1390	CWA 404 / 401 - Submit Final Permit Applications		29-Nov-22	0		29-Nov-22
171	KD-1360	Section 106 - Programmatic Historic Properties Management Plan Development		13-Dec-22	0		19-Sep-22
172	KD-1240	Execute Federal & State Operations Agreement		30-Jan-23	0		30-Jan-23
173	KD-1430	Eagle Permit - Short Term & Nest Permit Issued		01-Feb-23	0		01-Feb-23
174	KD-1320	Water Right - Complete Protest Resolution Period & Resolve as Many Protests as Possible		27-Feb-23	0		27-Feb-23
175	KD-1350	Section 106 - Final Programmatic Agreement		17-Mar-23	0		23-Jan-23
176	KD-1400	CWA 404 / 401 - Permits Issued		17-Mar-23	0		17-Mar-23
177	KD-1420	Streambed Alteration Agreement		10-May-23	0		10-May-23
178	KD-1370	CESA Incidental Take Permit - Construction ITP Issued		13-Jun-23	0		13-Jun-23
179	KD-1380	CESA Incidental Take Permit - Operations ITP Issued		13-Jun-23	0		13-Jun-23
180	KD-1340	Federal ESA - Receive Biological Opinions		09-Aug-23	0		18-May-23
181	KD-1410	Levee & Flood Permits - Section 408 & CVFPB Encroachment Permits Issued		17-Jan-24	0		17-Jan-24
182	KD-1440	Eagle Permit - Long Term Permit Issued		06-Mar-24	0		06-Mar-24
183	KD-1330	Water Right - Receive Water Right Order & Permit		30-Jul-24	0		19-Apr-24

Dave Hubbard
Project Controls
Brown and Caldwell
Cell: 832.840.1789
dhubbard@brwncald.com

Brown AND Caldwell 75

From: Marcus Maltby <mmaltby@BrwnCald.com>
Sent: Thursday, September 8, 2022 10:53 AM
To: David Hubbard <Dhubbard@BrwnCald.com>
Subject: RE: Sites Water Right Permit Schedule Activities

Could you please backcheck my markups showing a comparison to last month? Attached is what I came up with. Graphics I added are not locked in place so be careful moving them around.

I need to come up with why each of these items moved. If you could look into your notes from communications with different leads to start compiling and then I can give you a call later?

Couple questions that we can answer over email or over call….

- What caused the mitigation cost estimate to move right?
- Your comparison screenshot below is missing a yellow bar for WIFIA negotiations. Likely a non-issue but wanted to bring it up just in case.

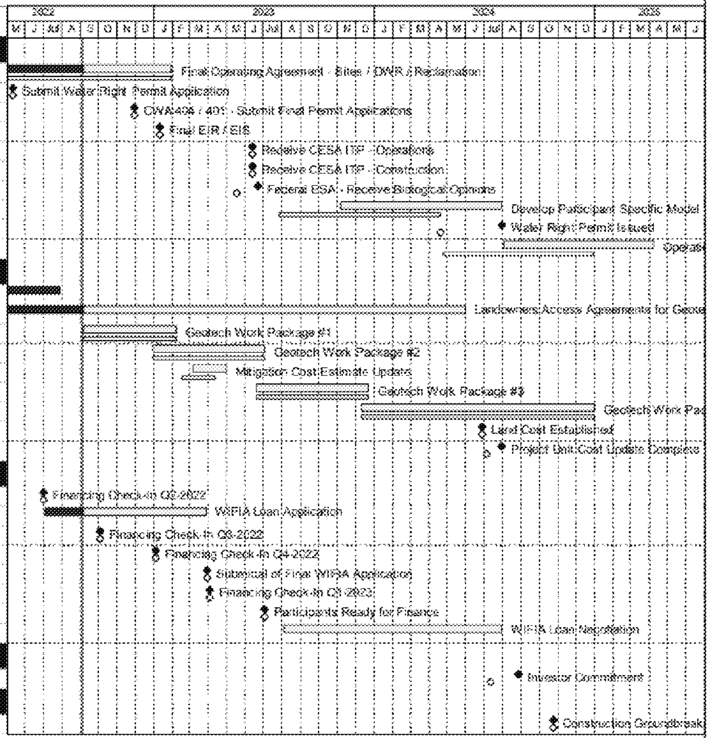
From: David Hubbard <Dhubbard@BrwnCald.com>
Sent: Wednesday, September 7, 2022 1:07 PM
To: Marcus Maltby <mmaltby@BrwnCald.com>
Cc: Cheyanne Harris <CHarris@BrwnCald.com>
Subject: RE: Sites Water Right Permit Schedule Activities

Summary Schedule with Comparison to Prior Month. WRP Issued slipped 70 days/14 weeks.
Participant Specific Model, WIFIA Loan Negotiation, Project Unit Cost Update and Investor Commitment all moved along with it.

Sites Reservoir Project

Work Plan Progress Reporting - Comparison to Prior Month

#	Activity Name	Start	Finish	Last Month Finish	Variance - Last Month Finish
1	**What do we get?**	19-Apr-22 A	08-Apr-26	30-Dec-24	-71
2	Final Operating Agreement - Sites / DWR / Reclamation	19-Apr-22 A	30-Jan-23	30-Jan-23	0
3	Submit Water Right Permit Application		11-May-22 A	11-May-22	0
4	CWA 404 / 401 - Submit Final Permit Applications		29-Nov-22	29-Nov-22	0
5	Final EIR / EIS		09-Jan-23	09-Jan-23	0
6	Receive CESA ITP - Operations		13-Jun-23	13-Jun-23	0
7	Receive CESA ITP - Construction		13-Jun-23	13-Jun-23	0
8	Federal ESA - Receive Biological Opinions		22-Jun-23	18-May-23	-24
9	Develop Participant Specific Model	06-Nov-23	30-Jul-24	19-Apr-24	-70
10	Water Right Permit Issued		30-Jul-24	19-Apr-24	-70
11	Operations Plan, Version 2	02-Aug-24	08-Apr-26	30-Dec-24	-70
12	**What does it cost?**	03-Jan-22 A	31-Dec-24	31-Dec-24	0
13	Geotech EA/IS	03-Jan-22 A	28-Jul-22 A	28-Jul-22	0
14	Landowners Access Agreements for Geotech	22-Mar-22 A	30-May-24	30-May-24	0
15	Geotech Work Package #1	08-Sep-22	06-Feb-23	06-Feb-23	0
16	Geotech Work Package #2	30-Dec-22	03-Jul-23	03-Jul-23	0
17	Mitigation Cost Estimate Update	07-Mar-23	01-May-23	12-Apr-23	-13
18	Geotech Work Package #3	20-Jun-23	22-Dec-23	22-Dec-23	0
19	Geotech Work Package #4 (31-Dec-24)	11-Dec-23	31-Dec-24	31-Dec-24	0
20	Land Cost Established		27-Jun-24	27-Jun-24	0
21	Project Unit Cost Update Complete		30-Jul-24	05-Jul-24	-17
22	**How do we pay?**	01-Jul-22 A	30-Jul-24	19-Apr-24	-70
23	Financing Check-In Q2-2022		01-Jul-22 A	01-Jul-22	0
24	WIFIA Loan Application	05-Jul-22 A	28-Mar-23	28-Mar-23	0
25	Financing Check-In Q3-2022		03-Oct-22	03-Oct-22	0
26	Financing Check-In Q4-2022		03-Jan-23	03-Jan-23	0
27	Submittal of Final WIFIA Application		29-Mar-23	29-Mar-23	0
28	Financing Check-In Q1-2023		03-Apr-23	03-Apr-23	0
29	Participants Ready for Finance		03-Jul-23	03-Jul-23	0
30	WIFIA Loan Negotiation	04-Aug-23	30-Jul-24	19-Apr-24	-70
31	**Investor Commitment**	27-Aug-24	27-Aug-24	12-Jul-24	-32
32	Investor Commitment		27-Aug-24*	12-Jul-24	-32
33	**Construction**	24-Oct-24	24-Oct-24	24-Oct-24	0
34	Construction Groundbreaking	24-Oct-24			0



Dave Hubbard
Project Controls
Brown and Caldwell
Cell: 832.840.1789
dhubbard@brwncald.com

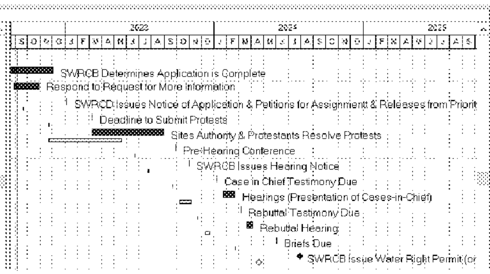
Brown AND Caldwell 75

From: David Hubbard
Sent: Wednesday, September 7, 2022 1:43 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Marcus Maltby <mmaltby@BrwnCald.com>; john.spranza@hdrinc.com; Arsenijevic, Jelica <jelica.arsenijevic@hdrinc.com>
Subject: RE: Sites Water Right Permit Schedule Activities

Marcus – early heads up, the Water Right Permit (WRP) Issuance has moved out another 14 weeks (70 days) from 19-Apr-2024 to 30-Jul-2024. More updates remain, but I'll take a look at the "Summary Schedule" and how it compares to last month as well. Below is a look at the WRP.

Layout: Sites Comp vs Prior Month | Filter: All Less than 100%

#	Activity ID	Activity Name	Start	Finish	Remaining Duration	Last Month Finish	Variance LM Finish
219		**SWRCB Water Right Permit**	12-May-22 A	30-Jul-24	475	19-Apr-24	-70
220	WRP-115a	SWRCB Determines Application is Complete	12-May-22 A	02-Dec-22	60	19-Aug-22	-70
221	WRP-115ac	Respond to Request for More Information	29-Aug-22 A	28-Oct-22	38		
222	WRP-115b	SWRCD Issues Notice of Application & Petitions for Assignmentt & Releases from Priority	04-Jan-23	04-Jan-23	1	20-Sep-22	-70
223	WRP-115c	Deadline to Submit Protests	08-Mar-23	08-Mar-23	1	22-Nov-22	-70
224	WRP-116	Sites Authority & Protestants Resolve Protests	09-Mar-23	29-Aug-23	122	19-May-23	-70
225	WRP-117a	Pre-Hearing Conference	29-Sep-23	29-Sep-23	1	21-Jun-23	-70
226	WRP-117b	SWRCB Issues Hearing Notice	01-Nov-23	01-Nov-23	1	24-Jul-23	-70
227	WRP-117c	Case in Chief Testimony Due	08-Jan-24	08-Jan-24	1	22-Sep-23	-70
228	WRP-117d	Hearings (Presentation of Cases-in-Chief)	24-Jan-24	21-Feb-24	20	06-Nov-23	-70
229	WRP-117e	Rebuttal Testimony Due	07-Mar-24	07-Mar-24	1	22-Nov-23	-70
230	WRP-117f	Rebuttal Hearing	22-Mar-24	04-Apr-24	10	22-Dec-23	-70
231	WRP-117g	Briefs Due	03-Jun-24	03-Jun-24	1	23-Feb-24	-70
232	WRP-120	SWRCB Issue Water Right Permit (original estimate of 28-Dec-23)		30-Jul-24	0	19-Apr-24	-70



Dave Hubbard

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From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Tuesday, September 6, 2022 6:21 PM
To: Marcia Kivett <MKivett@sitesproject.org>; David Hubbard <Dhubbard@BrwnCald.com>
Cc: Marcus Maltby <mmaltby@BrwnCald.com>
Subject: Re: Sites Water Right Permit Schedule Activities

Hi Dave - we need to add a few tasks to the schedule as noted below. We can discuss these on our call tomorrow

New tasks —

Receive State Board request for more information - august 26
Respond to request for more information- 60 days from above
Then continue our current tasks. With extending wrp-115a to 45 days

This will extend out the schedule.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority
| 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

---

From: Marcia Kivett <MKivett@sitesproject.org>
Sent: Tuesday, September 6, 2022 9:15:11 AM
To: David Hubbard <Dhubbard@BrwnCald.com>; Alicia Forsythe <aforsythe@sitesproject.org>
Cc: mmaltby@brwncald.com <mmaltby@brwncald.com>
Subject: Re: Sites Water Right Permit Schedule Activities

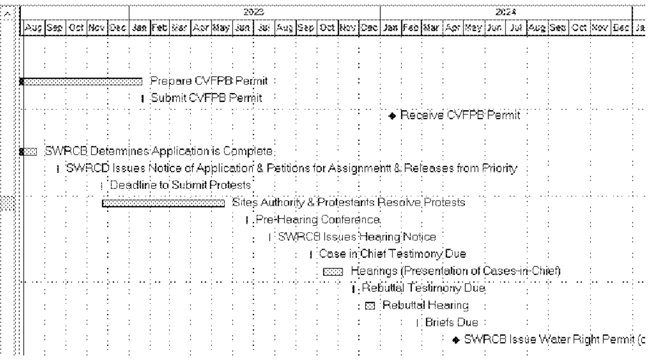
Dave, is this a must for today? Ali have better availability tomorrow.

From: David Hubbard <Dhubbard@BrwnCald.com>
Sent: Tuesday, September 6, 2022 7:11 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Marcia Kivett <MKivett@sitesproject.org>
Cc: Spranza, John <john.spranza@hdrinc.com>; Risse, Danielle <danielle.risse@hdrinc.com>; jelica.arsenijevic <jelica.arsenijevic@hdrinc.com>; mmaltby@brwncald.com <mmaltby@brwncald.com>; JP Robinette <jrobinette@sitesproject.org>
Subject: Sites Water Right Permit Schedule Activities

Marcia – any chance that you can get a half hour MS Teams session today 9/6 for Ali and myself with those copied as optional and certainly welcome to join and participate.
We need to work out the going forward tasks for the Water Right Permit now that SWRCB has asked for additional information, deeming the application incomplete.
Below is a snippet of what we have. I think we probably need to add in an activity for us to provide the additional information and unfortunately probably push the final milestone of permit issued to the right again.

Layout: Sites WBS - Update Filter | Filter All: Less than 100%

#	Activity ID	Activity Name	Remaining Duration	Start	Finish
217		**State Agency Agreements & Permits**	430	04-Jan-21 A	19-Apr-24
218		**Central Valley Flood Protection Board (CVFPB) Levee Encroachment**	369	13-Dec-21 A	17-Jan-24
219	CVFPB-200	Prepare CVFPB Permit	118	13-Dec-21 A	19-Jan-23
220	CVFPB-210	Submit CVFPB Permit	1	20-Jan-23	20-Jan-23
221	CVFPB-220	Receive CVFPB Permit	0		17-Jan-24
222		**SWRCB Water Right Permit**	430	12-May-22 A	19-Apr-24
223	WRP-115a	SWRCB Determines Application is Complete	15	12-May-22 A	19-Aug-22
224	WRP-115b	SWRCD Issues Notice of Application & Petitions for Assignmentt & Releases from Priori	1	20-Sep-22	20-Sep-22
225	WRP-115c	Deadline to Submit Protests	1	22-Nov-22	22-Nov-22
226	WRP-116	Sites Authority & Protestants Resolve Protests	122	23-Nov-22	19-May-23
227	WRP-117a	Pre-Hearing Conference	1	21-Jun-23	21-Jun-23
228	WRP-117b	SWRCB Issues Hearing Notice	1	24-Jul-23	24-Jul-23
229	WRP-117c	Case in Chief Testimony Due	1	22-Sep-23	22-Sep-23
230	WRP-117d	Hearings (Presentation of Cases-in-Chief)	20	10-Oct-23	06-Nov-23
231	WRP-117e	Rebuttal Testimony Due	1	22-Nov-23	22-Nov-23
232	WRP-117f	Rebuttal Hearing	10	11-Dec-23	22-Dec-23
233	WRP-117g	Briefs Due	1	23-Feb-24	23-Feb-24
234	WRP-120	SWRCB Issue Water Right Permit (original estimate of 28-Dec-23)	0		19-Apr-24



Dave Hubbard
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dhubbard@brwncald.com

Brown AND Caldwell 75

Meeting: **Sites Authority Board's Coordination Committee**

Locations: Maxwell Project Office, 122 Old Highway 99W, Maxwell, CA 95955
See below for alternate meeting locations.

Call in: **1-213-379-5743** Code: **703 288 727#** Click here to join the meeting

Committee Chair: Fritz Durst (AB Chair/Reclamation District 108)
Committee Vice-Chair: Jeff Sutton (AB Vice-Chair/Tehama-Colusa Canal Authority)
Staff Lead: Jerry Brown, Executive Director

AGENDA

Monday, September 12, 2022 3:00 – 4:00 pm

NO ACTION or DECISION WILL BE TAKEN

ROLL CALL & CALL TO ORDER:

- Introductions
- Period for Public Comment

1. Discussion and Information Items:

1.1 Board Meeting Agenda Planning

1.1.1 Meeting Schedule for Next Year

1.2 General Coordination among Committees and Workgroups

1.2.1 General Counsel/Special Counsel Coordination

1.2.2 Knowledge Transfer Opportunity

2. Closed Session:

2.1 Potential Litigation – Gov. Code Sec. 54956.9(d)(3)

3. Upcoming Meetings:

Joint Reservoir Committee & Authority Board Meeting
Friday, September 16, 2022 (9:00 am – 12:00 pm)

Coordination Committee
Monday, September 12, 2022 (3:00 – 4:00 pm)

Virtual Information will be provided before all meetings at Sitesproject.org.

ADJOURN

PERIOD OF PUBLIC COMMENT: Any person may speak about any subject of concern, provided it is within the jurisdiction of the Authority Board's Coordination Committee and is not already on today's agenda. The total amount of time allotted for receiving such public communication shall be limited to a total of 10 minutes per issue and each individual or group will be limited to no more than 3 minutes each within the 10 minutes allocated per issue. **Note:** No action shall be taken on comments made under this comment period.

ADA COMPLIANCE: Upon request, agendas will be made available in alternative formats to accommodate persons with disabilities. In addition, any person with a disability who requires a modification or accommodation to participate or attend this meeting may request necessary accommodation. Please make your request to the Board Clerk, specifying your disability, the format in which you would like to receive this Agenda and any other accommodation required no later than 24 hours before the start of the meeting.

Alternate Meeting Locations:

Davis Water District, 6505 Hillgate Road, Arbuckle, CA 95912

Glenn-Colusa Irrigation District, 344 East Laurel Street, Willows, CA 95988

Reclamation District 108, 975 Wilson Bend Road, Grimes, CA 95950

Tehama-Colusa Canal Authority, 5513 Highway 162, Willows, CA 95987

Sites Imported Aggregate Briefing

September 9, 2022

Sites

Agenda

- Project Description
- Dam Filter, Drain and Transition Zones
- Road Base
- Concrete Aggregate
- Summary of Quantities
- Questions

Sites

Project Description

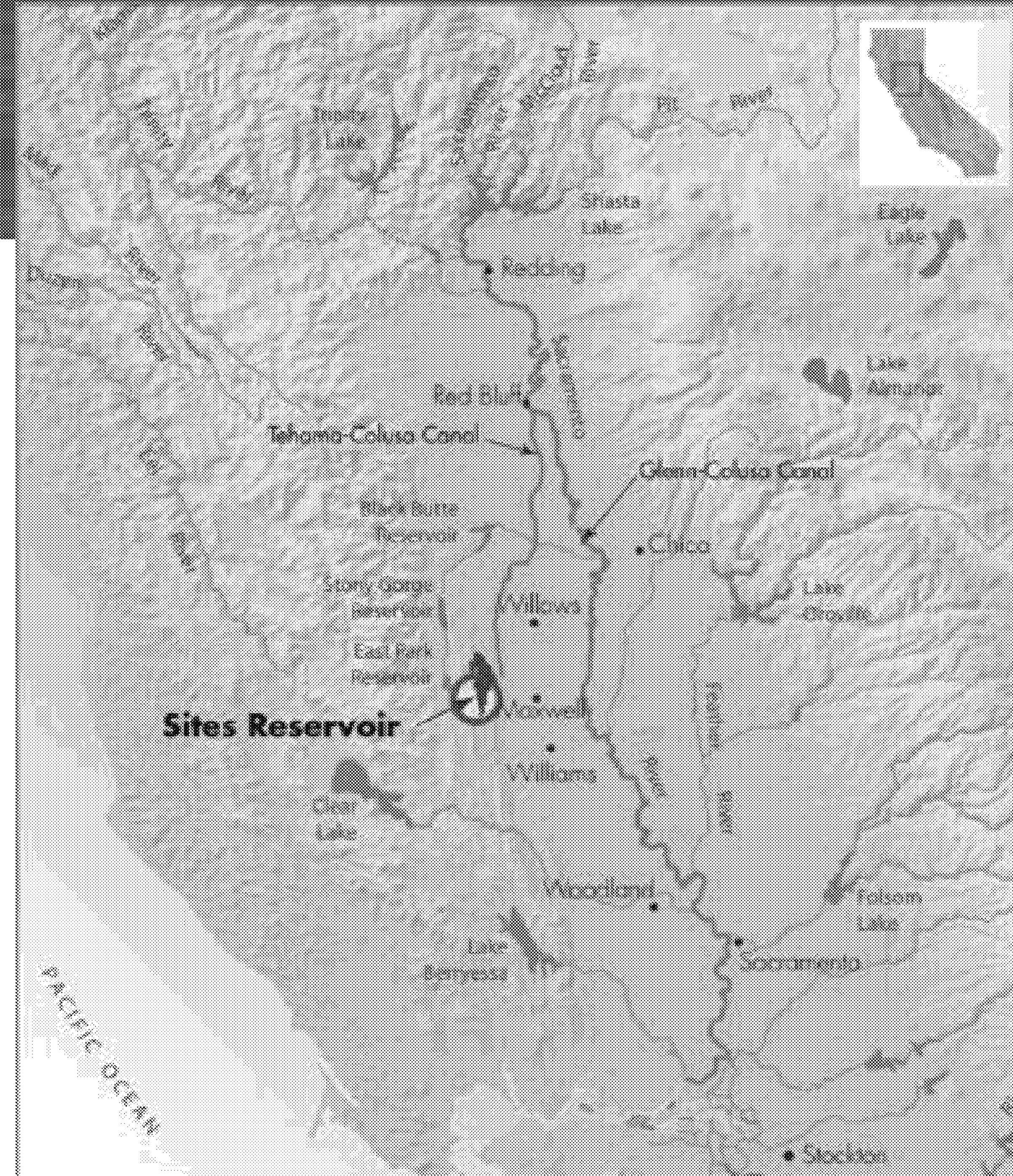
Sites

Project Location

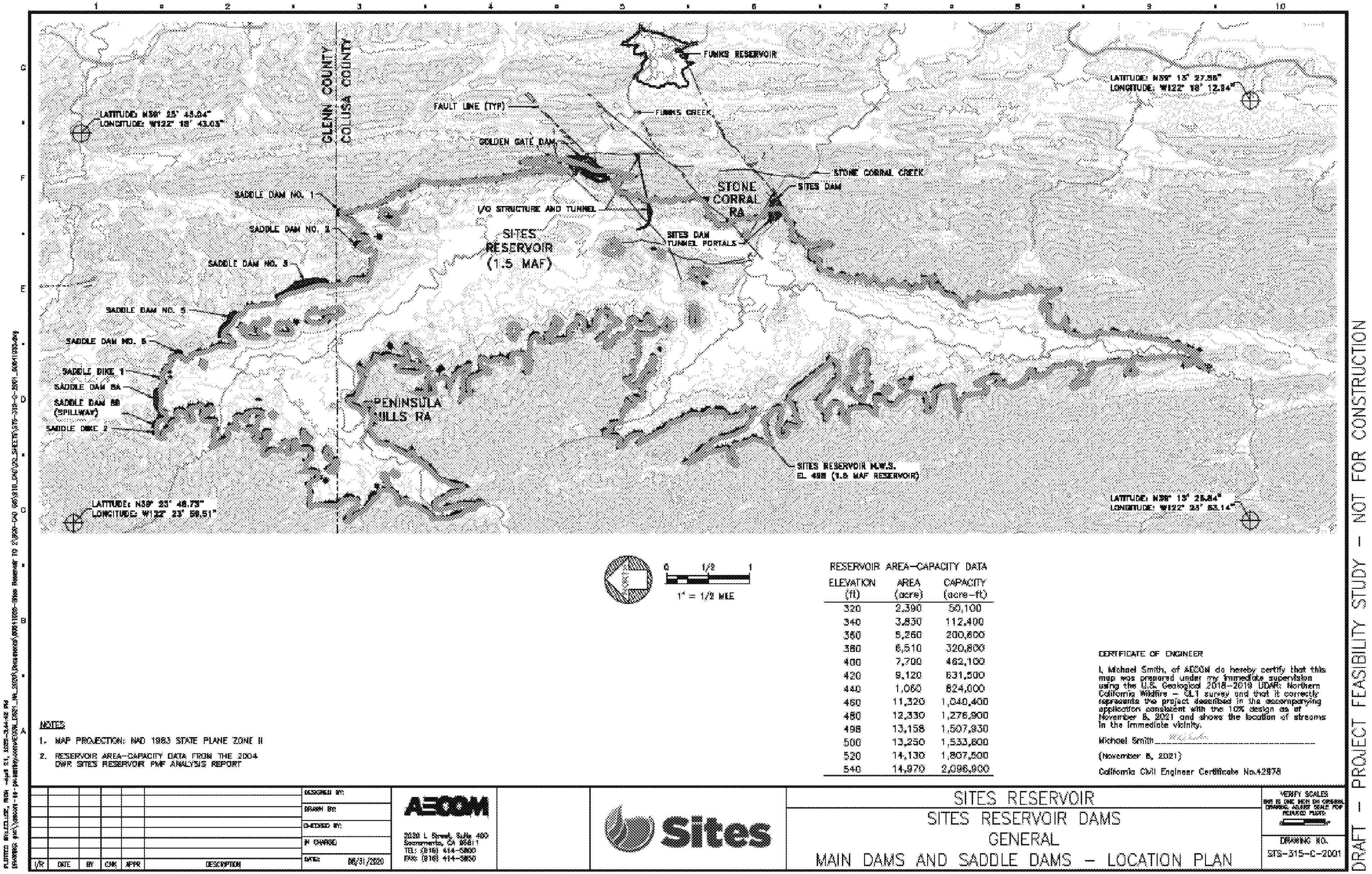
80 miles north of Sacramento

10 miles west of Maxwell

45 miles south of Orland



Sites Reservoir Features

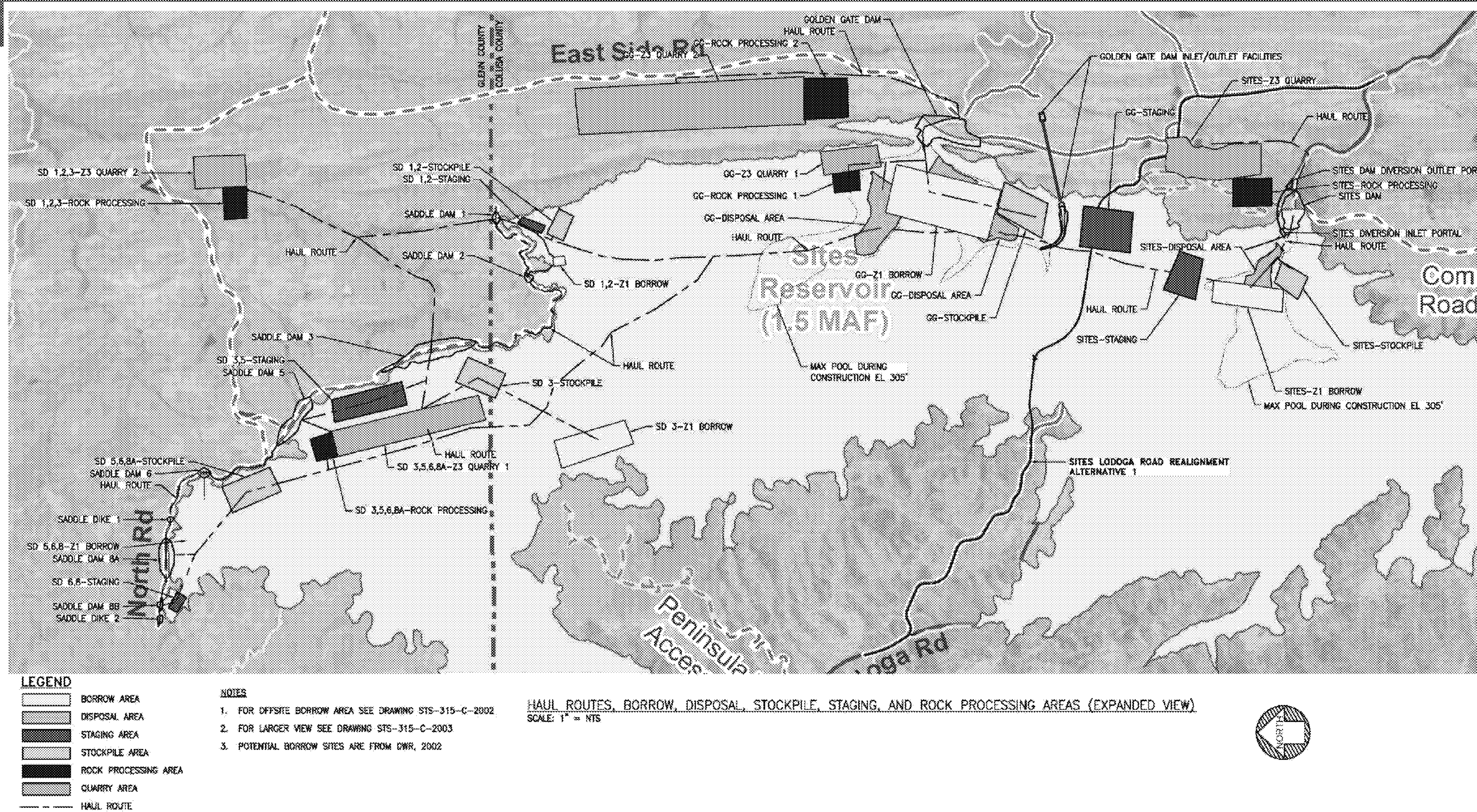


Sites Reservoir Features

Total Storage Capacity	1.5 MAF
Active Storage Capacity	1.4 MAF
Approximate Inundation Area	13,200 acres
Approximate Watershed Area	54,150 acres (84.6 mi^2)
Dam/Saddle Dam/Dike Crest Elevation (Without Camber)	517 feet
Dam Heights (approx. - max. ht. above streambed): Golden Gate Dam Sites Dam 7 Saddle Dams*/2 Saddle Dikes (for freeboard)	 287 feet 267 feet 12 – 107 feet
Maximum Operating Water Elevation	498 feet
Minimum Operating Water Elevation	340 feet
Top of Dead Pool	300 feet
Inlet/Outlet Facilities:	
I/O Tunnel (single), with sloping intake (south of GG Dam)	32 feet ID
Sites Diversion Tunnel (north abutment of Sites Dam)	12 feet ID

* Saddle Dam 8B is the spillway location.

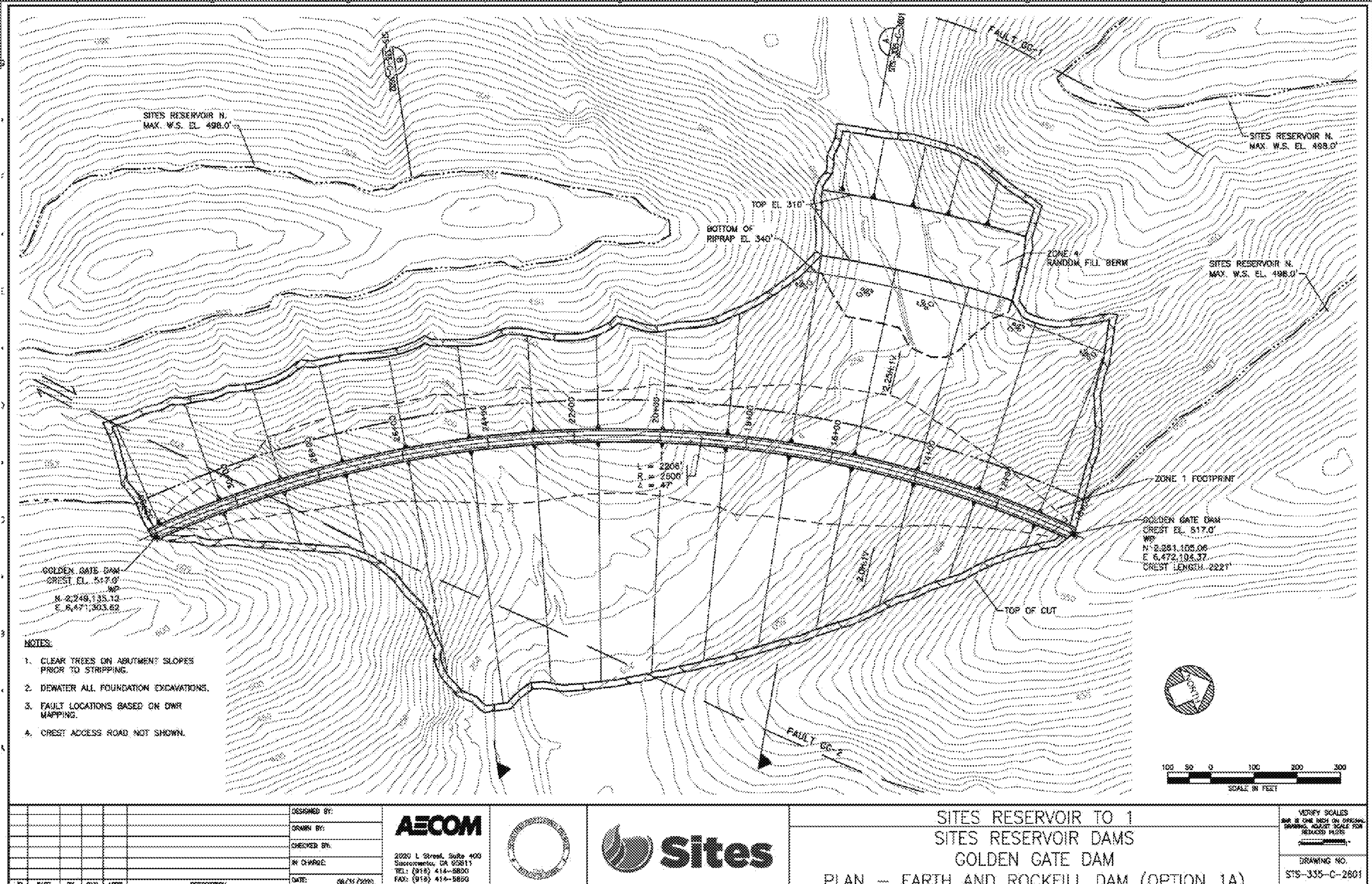
Sites Reservoir Features – Construction



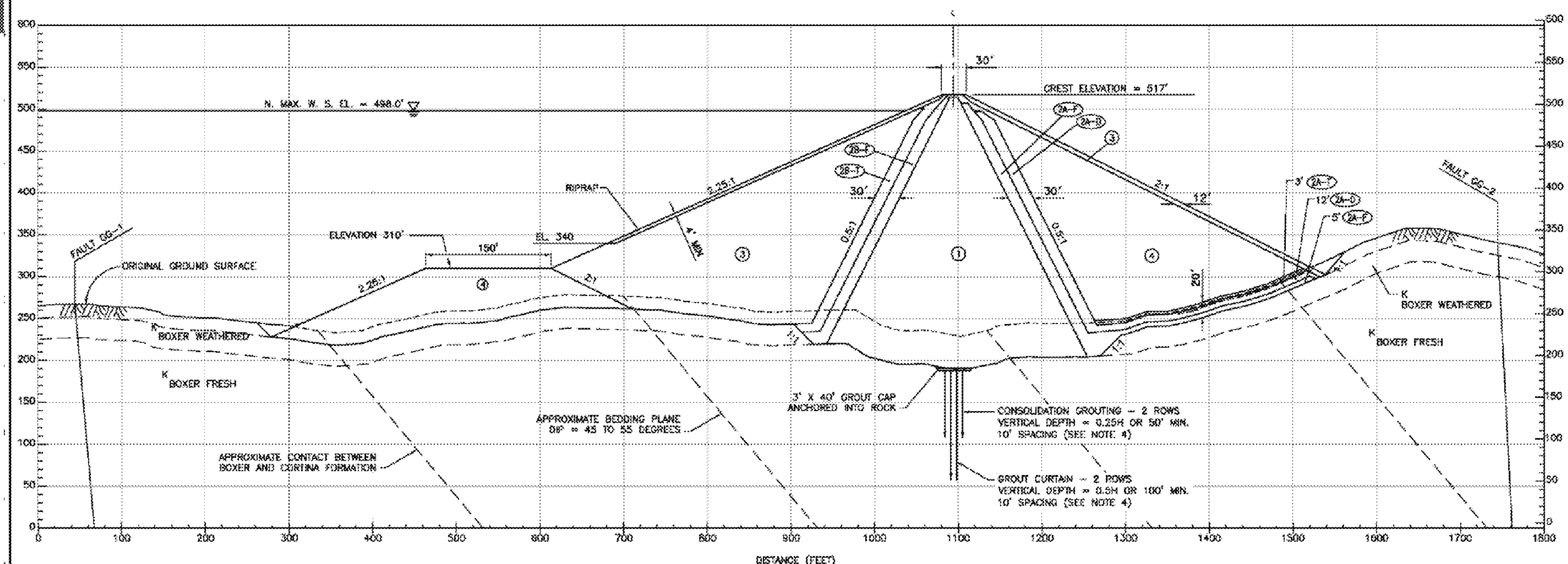
Dam Filter, Drain and Transition Zones

Sites

Golden Gate Dam



Typical Golden Gate and Sites Dam Section



SECTION A | STA 16+40
STS-335-C-2601 | SCALE: 1" = 60'

NOTES:

1. EMBANKMENT SECTION PRESENTED IS PRELIMINARY AND IS BASED UPON FEASIBILITY LEVEL GEOLOGIC EXPLORATION AND MATERIALS INVESTIGATION, TESTING AND EVALUATION PROGRAMS.
2. EMBANKMENT ZONES ARE AS FOLLOWS:
   - ZONE (1) CORE
   - ZONE (2A-) FILTER, DRAIN AND TRANSITION (BLANKET) ZONES
   - ZONE (2B-) FILTER AND TRANSITION ZONES
   - ZONE (3) ROCKFILL
   - ZONE (4) RANDOM
3. H = HEIGHT OF DAM AT ℄
   F = FILTER
   D = DRAIN
   T = TRANSITION
4. FOR CONSOLIDATION AND CURTAIN GROUT PROFILE, SEE DWG STS-343-C-5601.
5. CLEAN AND SLUSH GROUT FOUNDATION SURFACES UNDER CORE ZONE 1 AND FILTER ZONES 2A-F AND 2B-F. STITCH GROUT AT FAULTS AND SHEARS.

HOR SCALE: 1"=60'
VERT SCALE: 1"=60'

DESIGNED BY:
DRAWN BY:
CHECKED BY:
IN CHARGE:
DATE: 08/31/2020

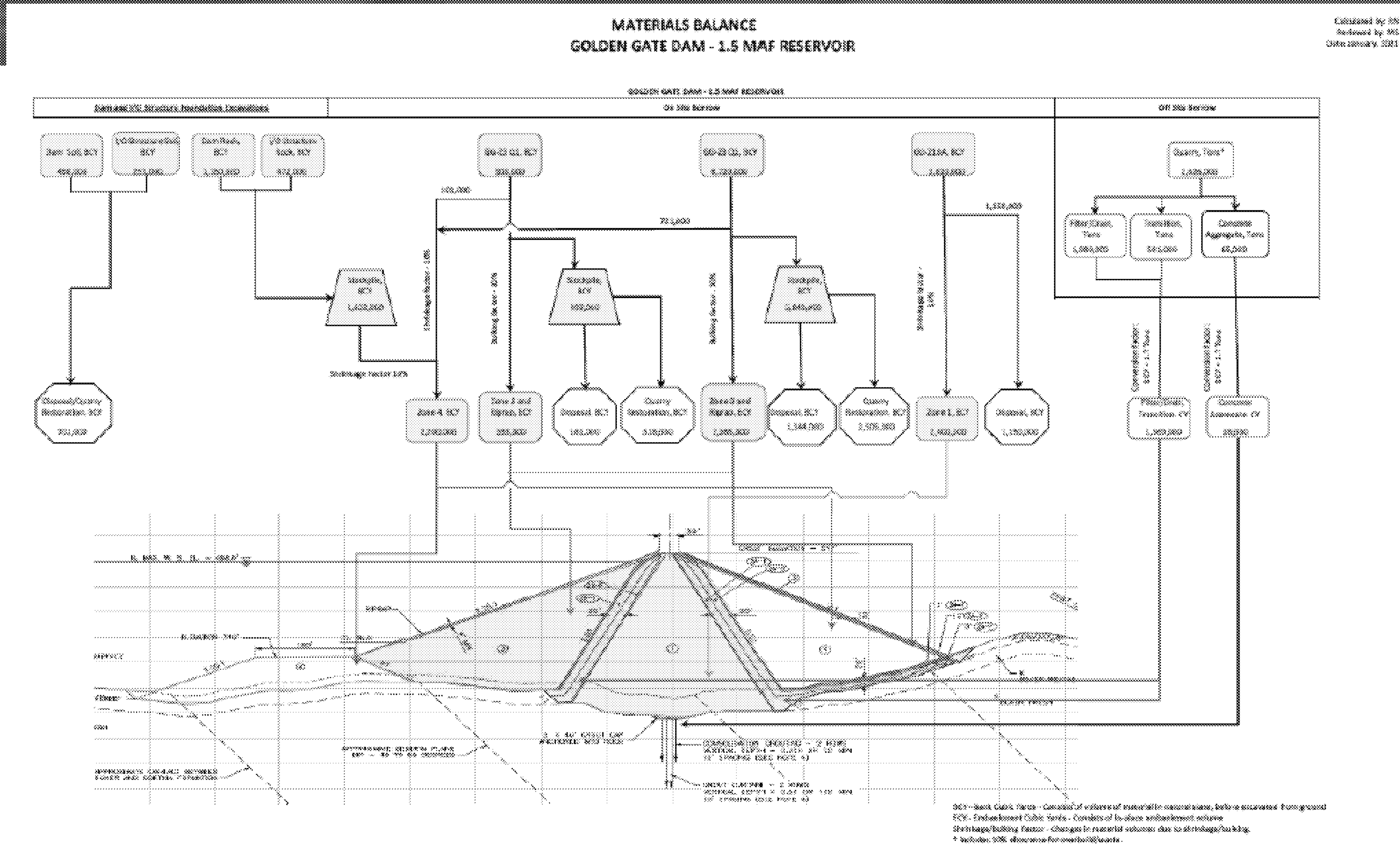
AECOM
2020 L Street, Suite 400
Sacramento, CA 95811
TEL: (916) 414-5800
FAX: (916) 414-5850

Sites

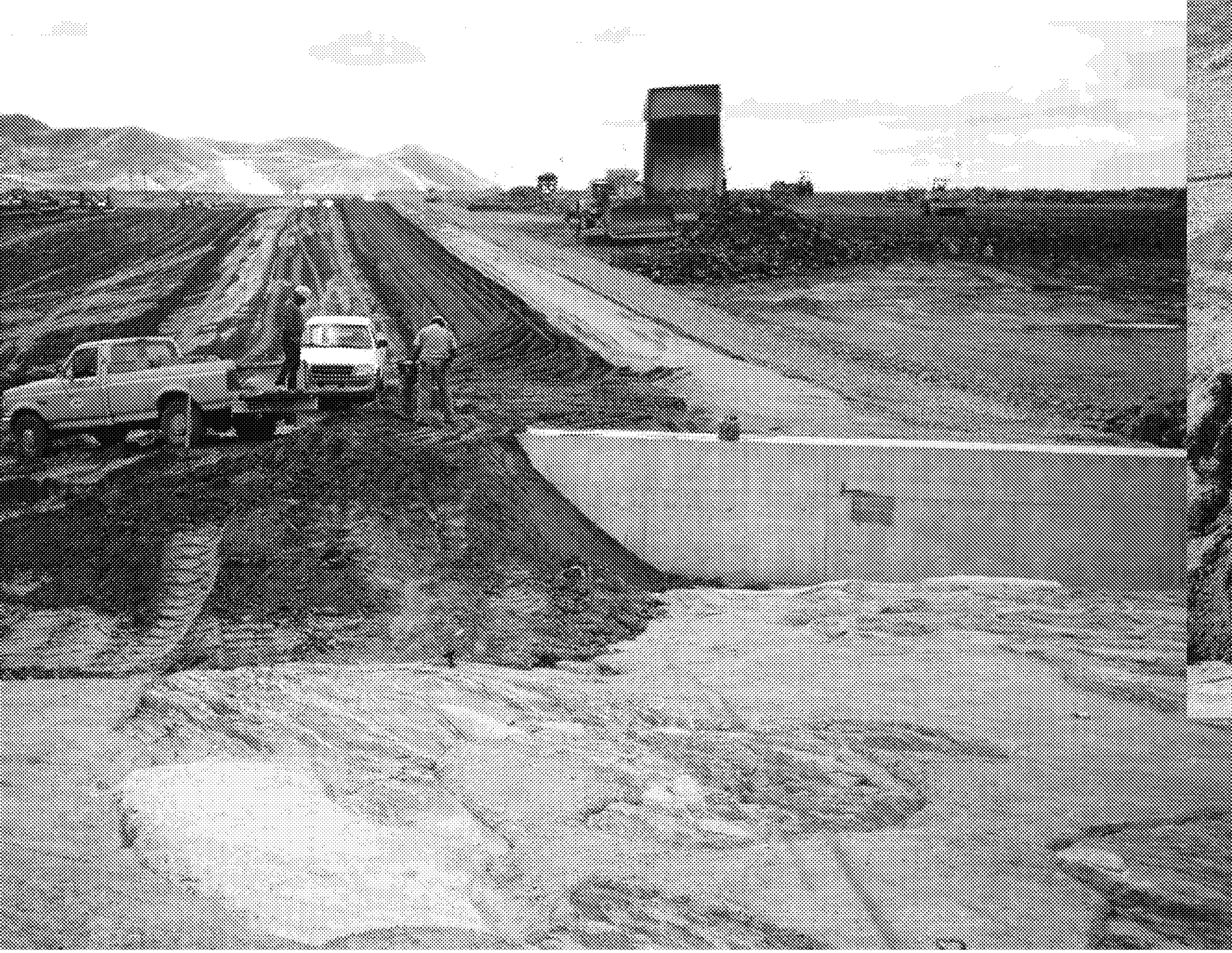
SITES RESERVOIR TO 1
SITES RESERVOIR DAMS
GOLDEN GATE DAM
SECTION A – EARTH AND ROCKFILL DAM (OPTION 1A)

VERIFY SCALES
DRAWING NO.
STS-335-C-3601

Material Balance Golden Gate Dam



Examples of Dam Construction



Examples of Dam Construction

Examples of Dam Construction

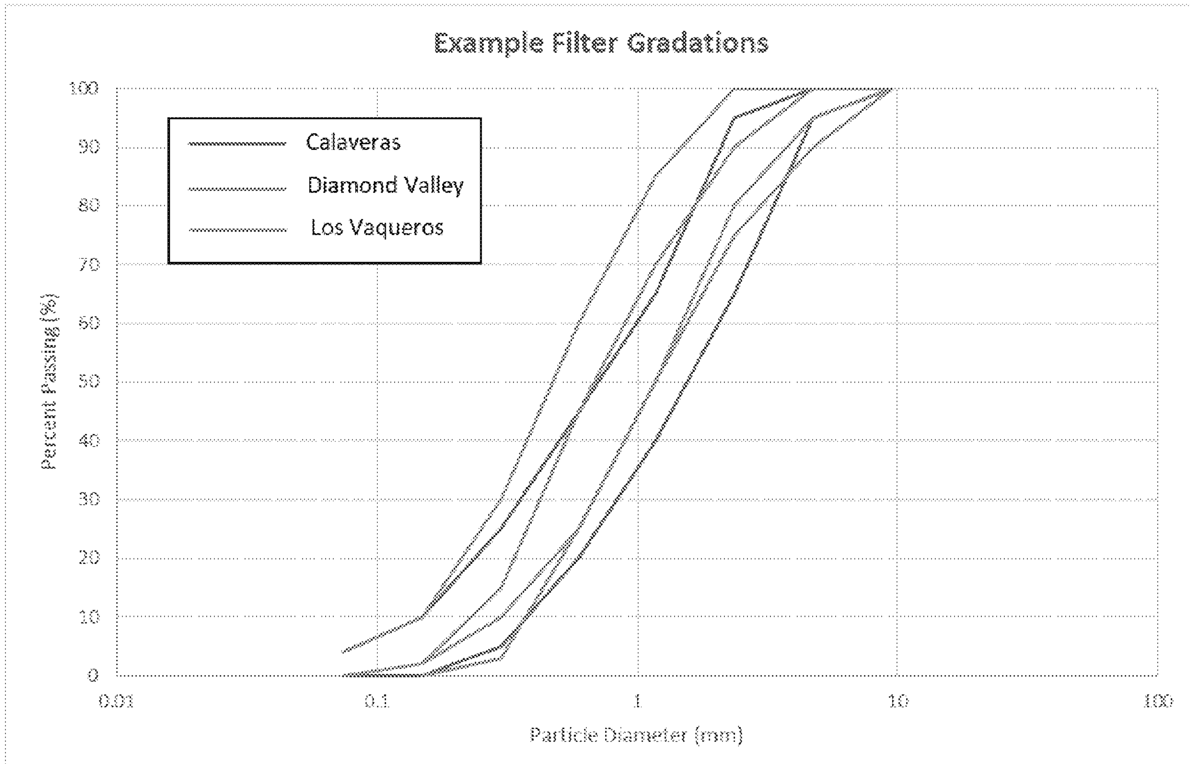
Examples of Dam Construction

Examples of Filter Gradations and Requirements

Generally meet the soundness requirements of ASTM C33 for fine aggregate plus requirements below

Test Type	Acceptability Standard	Criteria
Specific Gravity	ASTM C127	Greater than 2.6
Abrasion Resistance	ASTM C131	10 percent maximum loss by weight at 100 revolutions, and 40 percent loss of weight at 500 revolutions
	ASTM C535	40 percent maximum loss of weight at 1000 revolutions
Sodium Sulfate Soundness	ASTM C88	10 percent maximum weighted average loss by weight, after five cycles
Shape		Particles shall be generally equidimensional
Elongated Particles	CRD-C-119 and CRD-C-120	Not greater than 15 percent by weight
Other		Material shall be free of clay balls, organics, soft particles, and other impurities

Examples of Filter Gradations and Requirements



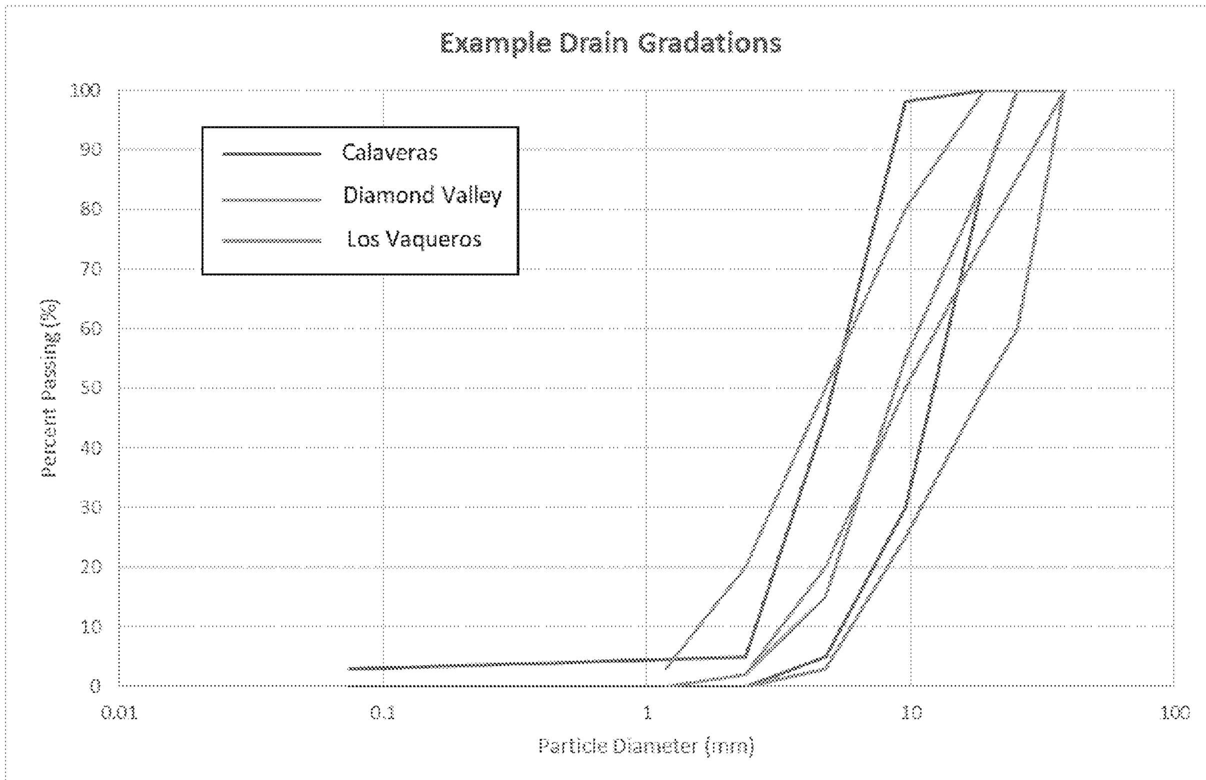
Sieve Size	Calaveras	Diamond Valley	Los Vaqueros
3/8-inch	100	100	100
No. 4	95 – 100	90 – 100	95 – 100
No. 8	65 – 95	75 – 90	80 – 100
No. 16	40 – 65	50 – 70	50 – 85
No. 30	20 – 45	25 – 45	25 – 60
No. 50	5 – 25	3 – 15	10 – 30
No. 100	0 – 10	0 – 2	2 – 10
No. 200	0 – 4	-	0 – 4

Note: No gap or skip grading between any two consecutive sieves

Examples of Drain Gradations and Requirements

Test Type	Acceptability Standard	Criteria
Adsorption	ASTM C127	Greater than 2.6
Specific Gravity	ASTM C127 and C128	Greater than 2.6
Abrasion Resistance	ASTM C131	10 percent maximum loss by weight at 100 revolutions, and 40 percent loss of weight at 500 revolutions
Sodium Sulfate Soundness	ASTM C88	10 percent maximum weighted average loss by weight, after five cycles
Shape		Particles shall be generally equidimensional
Elongated Particles	CRD-C-119 and CRD-C-120	Not greater than 15 percent by weight
Other		Material shall be free of clay balls, organics, soft particles, and other impurities

Examples of Drain Gradations and Requirements

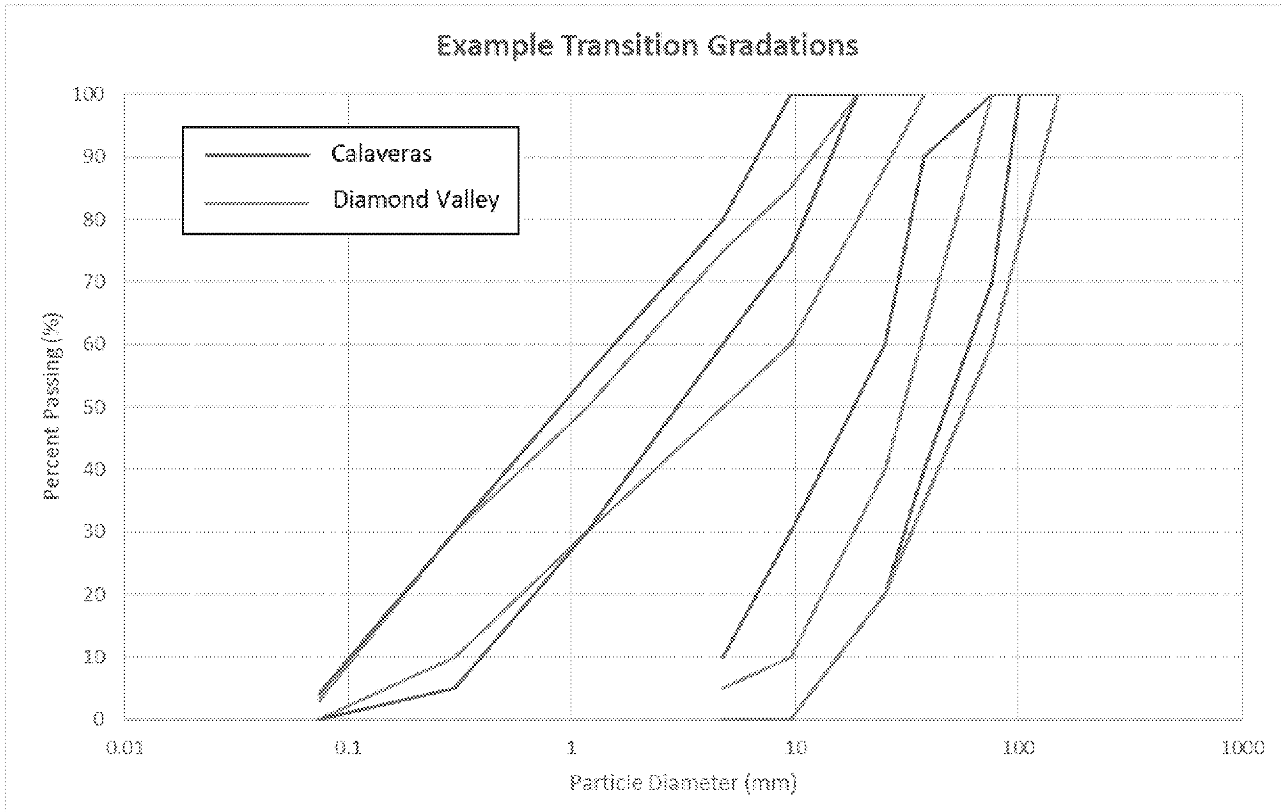


Note: No gap or skip grading between any two consecutive sieves

Sieve Size	Calaveras	Diamond Valley	Los Vaqueros
1.5-inch	-	100	100
1-inch	100	60 – 100	-
3/4-inch	85 – 100	50 – 85	75 – 100
3/8-inch	30 – 98	25 – 55	50 – 80
No. 4	5 – 45	3 – 15	20 – 50
No. 8	0 – 5	0 – 2	2 – 20
No. 16	-	-	0 – 3
No. 200	0 – 3	-	-

Examples of Transition Gradations and Requirements

- Similar soundness requirements to filter and drain



Sieve Size	Calaveras (Upstream)	Calaveras (Downstream)	Diamond Valley (Upstream)	Diamond Valley (Downstream)
6-inch	-	-	-	100
4-inch	-	100	-	-
3-inch	-	70 – 100	-	60 – 100
1.5-inch	-	40 – 90	100	-
1-inch	-	20 – 60	-	20 – 40
¾-inch	100	-	80 – 100	-
3/8-inch	75 – 100	0 – 30	60 – 85	0 – 10
No. 4	60 – 80	0 – 10	50 – 75	0 – 5
No. 16	30 – 55	-	30 – 50	-
No. 50	5 – 30	-	10 – 30	-
No. 200	0 – 4	-	0 – 3	-

Road Base

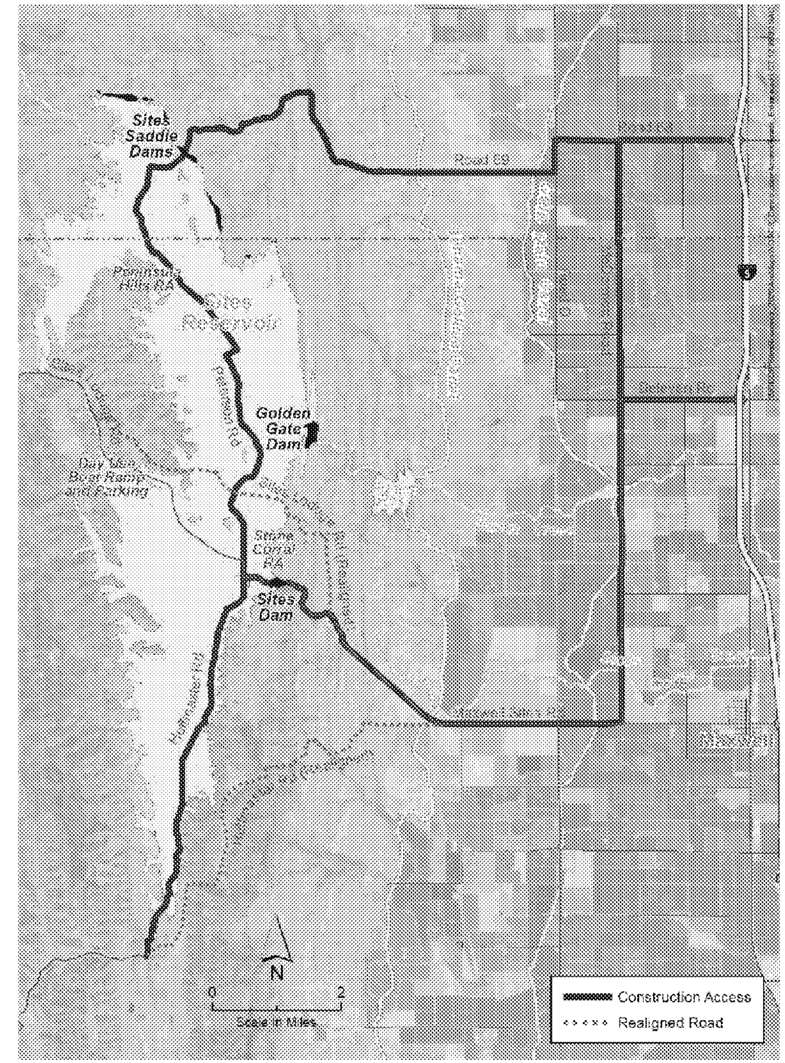
Sites

Road Base

- Caltrans Class 2 Aggregate Base (standard specifications 26-1.02)
  - Consists of clean broken stone, crushed gravel, natural rough-surfaces gravel, sand, and/or processed reclaimed AC, PCC, LCB, or CTB

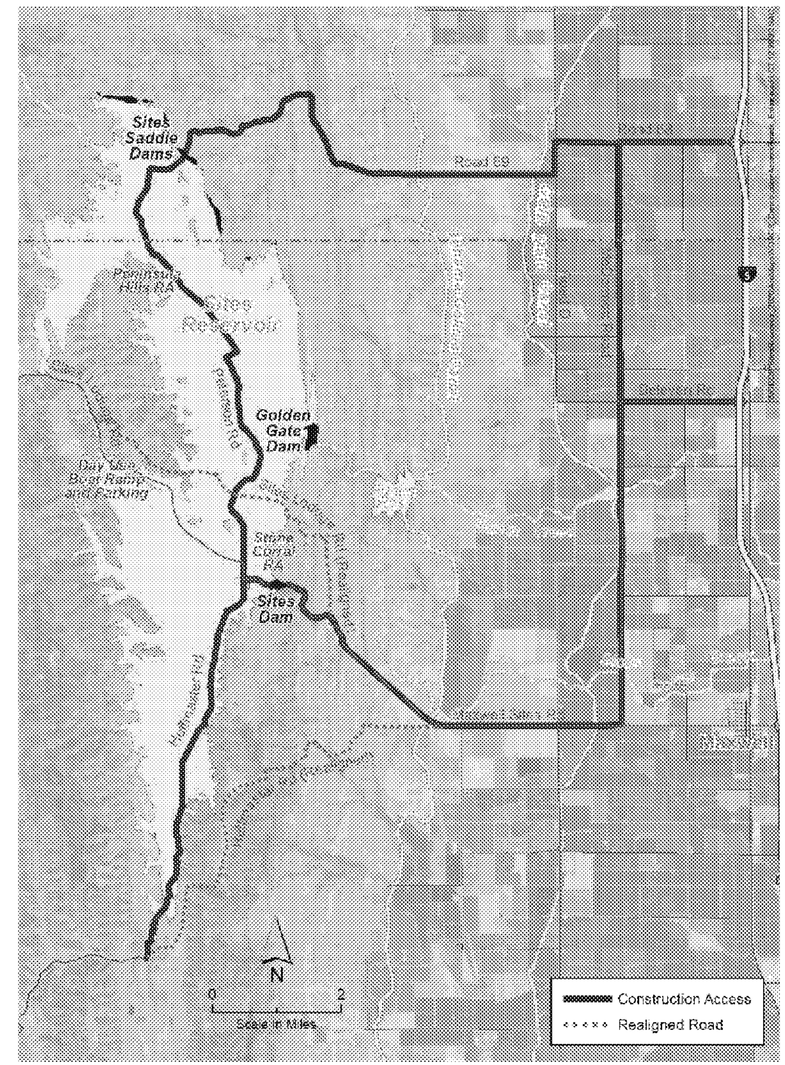
Sieve size	Percentage passing			
	1-1/2 inch maximum		3/4 inch maximum	
	Operating range	Contract compliance	Operating range	Contract compliance
2"	100	100	--	--
1-1/2"	90–100	87–100	--	--
1"	--	--	100	100
3/4"	50–85	45–90	90–100	87–100
No. 4	25–45	20–50	35–60	30–65
No. 30	10–25	6–29	10–30	5–35
No. 200	2–9	0–12	2–9	0–12

Quality characteristic	Requirement	
	Operating range	Contract compliance
Resistance (R-value, min)	--	78
Sand equivalent (min)	25	22
Durability index (min)	--	35



Road Base

- Caltrans Class 4 Aggregate Subbase (standard specifications 25-1.02)
  - Consists of clean broken stone, crushed gravel, natural rough-surfaces gravel, sand, and/or processed reclaimed AC, PCC, LCB, or CTB
  - Gradation and quality requirements to be decided based on project needs, but likely to have a minimum sand equivalent of about 20 and R-value of about 40



Concrete Aggregate

Sites

Concrete Aggregate

- Need to meet quality requirements of ASTM C33, Concrete Aggregates

Location	Approximate Quantities (tons)
Spillway (Saddle Dam 8B)	19,500
Inlet/Outlet Structure	115,900
Sites Diversion Tunnel	10,400
Golden Gate Dam Bypass	35,000
Sites Lodoga Bridge	45,585

Summary of Quantities

Sites

Summary of Quantities

Location	Approximate Quantities (Million Tons)
Zone 2A – Downstream Filter	1.5
Zone 2A – Downstream Drain	1.6
Zone 2A – Downstream Transition	0.3
Zone 2B – Upstream Filter	0.6
Zone 2B – Upstream Transition	0.6
Class 4 Aggregate Subbase	0.3
Class 2 Aggregate Base	0.5
Concrete Aggregate	0.6
Total	**6.0 million tons**

Crude Average Delivery Schedule

- Overall Project Schedule = 800 to 1200 days
- Overall Quantity of Material = 6 million tons
- Average Delivery = 6,000 to 7,500 tons per day

Questions

Sites

Questions

- Do you have the quality of materials needed and their location(s)?
- Do you have the plants to create the materials in spec and their location(s)?
- Do you have the capacity to deliver the quality and quantities of materials in the time needed?

Questions – cont'd.

- Do you have technical specifications/lab certifications such as durability, gradation, petrographic analysis, LA rattler, R-value, available?
- What is the location of quarry and type of material; alluvium, hard rock, soft rock?
- What are the available material remaining/duration of permitted operations?

Questions – cont'd.

- What are the productivity rates for different materials?
- What is the maximum amount of material you can deliver per day?
- What are the approximate at plant costs for different materials?
- Will you be using prevailing labor rates for trucking?

From: Arsenijevic, Jelica [Jelica.Arsenijevic@hdrinc.com]
Sent: 9/12/2022 10:04:16 AM
To: Brian Grubbs [grubbs@montaguederose.com]
CC: Doug Montague [montague@montaguederose.com]; Cheyanne Harris [charris@brwncald.com]; Luu, Henry [henry.luu@hdrinc.com]; Spranza, John [john.spranza@hdrinc.com]; JP Robinette [jrobinette@sitesproject.org]; Angela Bezzone [bezzone@mbkengineers.com]
Subject: RE: Sites: 404(b)(1) cost information

Hi Brian
Are you available Thursday, September 15th …an hour slot between 11 and 2. I'm in the field but can host call.

Jelica Arsenijevic
Environmental Project Manager

HDR
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
D 916-679-8854
M 209-329-6897

Jelica.Arsenijevic@hdrinc.com

hdrinc.com/follow-us

From: Brian Grubbs <grubbs@montaguederose.com>
Sent: Thursday, September 8, 2022 11:38 AM
To: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <John.Spranza@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>; Angela Bezzone <bezzone@mbkengineers.com>
Subject: RE: Sites: 404(b)(1) cost information

Wed, Thur, Fri is wide open next week. In addition to discussing Alt 4, there was a question on the entire table. Should it be "with and without WIINACT" or is that a holdover from when we were showing items as "with and without WIFIA"

Brian Grubbs | Managing Director
Montague DeRose and Associates
916-712-1747

From: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Sent: Wednesday, September 7, 2022 5:10 PM
To: Brian Grubbs <grubbs@montaguederose.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <John.Spranza@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>; Angela Bezzone <bezzone@mbkengineers.com>
Subject: RE: Sites: 404(b)(1) cost information

Hi there Brian

Checking in on the email I sent last week. What is your availability next week to discuss wrapping up the Alternative 4 info needs? I can look at our calendars after we get your availability.

Thanks for all your help

Jelica Arsenijevic
Environmental Project Manager

HDR
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
D 916-679-8854
M 209-329-6897

Jelica.Arsenijevic@hdrinc.com

hdrinc.com/follow-us

From: Arsenijevic, Jelica
Sent: Monday, August 29, 2022 2:44 PM
To: Brian Grubbs <grubbs@montaguederose.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <John.Spranza@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>; Angela Bezzone <bezzone@mbkengineers.com>
Subject: RE: Sites: 404(b)(1) cost information

Hi Brian!
Got your voicemails on Friday. Lets circle back with John and other on next steps. I honestly don't know where we ended up and what we still need to finish this up. Any guidance/input would be appreciated.

Thanks for following up!

Jelica Arsenijevic
Environmental Project Manager

HDR
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Jelica.Arsenijevic@hdrinc.com

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From: Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Sent: Sunday, August 21, 2022 4:39 PM
To: Arsenijevic, Jelica <jelica.arsenijevic@hdrinc.com>; Brian Grubbs <grubbs@montaguederose.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <John.Spranza@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>; Angela Bezzone <bezzone@mbkengineers.com>
Subject: RE: Sites: 404(b)(1) cost information

Hi Brian,

Here is the table with release numbers for the Final EIR/EIS:

Sites Releases Table

Releases (TAF/year)	ALT 1A 051722		ALT 1B 051722		ALT 2 051722		ALT 3 051722	
	Average	Dry and Critical	Average	Dry and Critical	Average	Dry and Critical	Average	Dry and Critical
	1.5 MAF Reservoir Dunnigan Pipeline (outlet to CBD) Historic Climate		1.5 MAF Reservoir Dunnigan Pipeline (outlet to CBD) Historic Climate		1.27 MAF Reservoir Dunnigan Pipeline (outlet to Sac R) Historic Climate		1.5 MAF Reservoir Dunnigan Pipeline (outlet to CBD) Historic Climate	
Releases for Authority PWA Deliveries - North of Delta	24	47	23	44	23	43	21	37
Assumed transfer from North of Delta to South of Delta	7	6	6	8	6	6	5	5
Releases for Authority PWA Deliveries - South of Delta	113	258	103	246	108	240	86	191
Releases for CVP Deliveries - Operational Flexibility	0	0	28	30	0	0	89	91
Releases for Refuge Water Supply	22	38	21	35	23	40	19	33
Releases for Yolo Bypass Habitat Water Supply	41	11	39	10	45	16	37	11
Total Releases	**208**	**361**	**221**	**372**	**205**	**346**	**258**	**369**
Percentage of Total Releases from Sites								
Releases for Authority PWA Deliveries - North of Delta	12%	13%	11%	12%	11%	13%	8%	10%
Assumed transfer from North of Delta to South of Delta	3%	2%	3%	2%	3%	2%	2%	1%
Releases for Authority PWA Deliveries - South of Delta	54%	72%	47%	66%	53%	70%	34%	52%
Releases for CVP Deliveries - Operational Flexibility	0%	0%	12%	8%	0%	0%	35%	25%
Releases for Refuge Water Supply	11%	10%	10%	9%	11%	12%	7%	9%
Releases for Yolo Bypass Habitat Water Supply	20%	3%	18%	3%	22%	5%	15%	3%

Note that 1A is no federal storage, 1B is 7% federal storage, 2 is no federal storage (smaller reservoir) and Alt 3 is 25% federal storage.
The line item “assumed transfer from NOD to SOD” is the amount assumed sold by NOD participants to SOD participants. So you could either count that as NOD or SOD water depending on what you’re trying to evaluate.

I don’t have information about “onsite alternative 4” since that was pre-value planning. I emailed Jelica, John, and Angela about this separately. We’d need to go way back to find that info.

Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

hdrinc.com/follow-us

From: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Sent: Friday, August 19, 2022 12:32 PM
To: Brian Grubbs <grubbs@montaguederose.com>; Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <John.Spranza@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>; Angela Bezzone <bezzone@mbkengineers.com>
Subject: RE: Sites: 404(b)(1) cost information

Thank you both
The main purpose of the table (and overall memo) is to convince the Corps that a 1.3 MAF reservoir is not the least environmentally damaging practicable alternative (LEDPA). WE are trying to provide justification (biological, cultural, cost, feasibility, etc.) that the 1.5 MAF is our LEDPA. Whatever we use, just needs to be consistent, and we note our sources of info.

Jelica Arsenijevic
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Jelica.Arsenijevic@hdrinc.com

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From: Brian Grubbs <grubbs@montaguederose.com>
Sent: Friday, August 19, 2022 10:38 AM
To: Heydinger, Erin <Erin.Heydinger@hdrinc.com>; Arsenijevic, Jelica <jelica.arsenijevic@hdrinc.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <John.Spranza@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>; Angela Bezzone <bezzone@mbkengineers.com>
Subject: RE: Sites: 404(b)(1) cost information

Erin,
What your saying makes sense, but I'll wait for those who are more knowledgeable of the full report being prepared.

That said I think we'll need the water yield breakout by Fed/State/Participants. If you have the participant numbers by NOD/SOD that would be great as well. Can you send that when you're able?

Brian Grubbs | Managing Director
Montague DeRose and Associates
916-712-1747

From: Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Sent: Friday, August 19, 2022 10:27 AM
To: Brian Grubbs <grubbs@montaguederose.com>; Arsenijevic, Jelica <jelica.arsenijevic@hdrinc.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <John.Spranza@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>; Angela Bezzone <bezzone@mbkengineers.com>
Subject: RE: Sites: 404(b)(1) cost information

Just chiming in here.

I agree and am wondering if that row should be with and without WIFIA funding? That is normally what we have shown in that row. I also think we could just assume WIFIA funding at this point and remove that row altogether.

The numbers I provided are TOTAL project releases. I can provide other data as needed.

FYI for Brian and JP – these are the release numbers from the Final EIR/EIS using the historic hydrology (no climate change).

Also cc'ing Angela – she will be able to help you pull in this type of info in the future with my departure on Monday.

Erin

Erin Heydinger PE, PMP
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From: Brian Grubbs <grubbs@montaguederose.com>
Sent: Friday, August 19, 2022 10:06 AM
To: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>

Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <John.Spranza@hdrinc.com>; Heydinger, Erin <Erin.Heydinger@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>
Subject: RE: Sites: 404(b)(1) cost information

Jelica,
1. For the first question, can you verify the WIIN Act Funding percentages desired for each Alternative. I thought Alt 2 was zero WIIN Act funding, but there is a spot for Alt 2 with WIIN Act funding.

2. For Alt 4. This is the 1.8MAF reservoir...I think I can, let me spend some time to make sure the numbers are consistent for the other Alternatives.

A question for you: Are the Estimated Deliveries in your table below Total Deliveries=FED+State+Participants, or just deliveries to Participants? This is important as the cost I've been provided is just for participants.

Brian Grubbs | Managing Director
Montague DeRose and Associates
916-712-1747

From: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Sent: Friday, August 19, 2022 9:12 AM
To: Brian Grubbs <grubbs@montaguederose.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <John.Spranza@hdrinc.com>; Heydinger, Erin <Erin.Heydinger@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>
Subject: RE: Sites: 404(b)(1) cost information

Good morning Brian
Thanks so much for helping ! Much appreciated.

We coordinated with Erin this morning and have the table information updated with estimated deliverables. Using the info provided (from the final EIR/EIS modeling/no historic climate change included), can you provide the estimate cost per acre-foot?

For Onsite Alternative 4 – since we haven't modeled anything since 2019....I'll work with the internal team to get estimated deliveries from the value planning report. Once we get that, are you able to figure out cost by escalating to 2021 dollars?

TABLE 16. ONSITE ALTERNATIVES - ESTIMATED CONSTRUCTION AND REPAYMENT COSTS

Alternative[1]	Onsite Alternative 1	Onsite Alternative 2	Onsite Alternative 3 (Project)	Onsite Alternative 4
Project Parameters				
Reservoir Size	1.5 MAF	1.3 MAF	1.5 MAF	1.8 MAF
Delivery Pipeline Release Capacity (cfs)[2]	1,000	1,000	Same as onsite	1,500

			Alternative 1	
Estimated Deliveries (releases to Funks) (Long-Term Average in TAF)	206-220 (option 1A and 1B) – from final EIR/EIS modeling , no historic climate change included	203 – final EIR/EIS modeling, no historic climate change included.	255 – final EIR/EIS modeling, no historic climate change included.	XX – needs to come from value planning report (ask Trishna for help).
Estimated Cost per Acre-Foot with WIIN Act Funding (2020)	$611	$621	XX	XX
Estimated Cost per Acre-Foot without WIIN Act Funding (2020)	$661	$674	XX	XX
Direct Construction Costs[3]	$4,494,389 (2021 dollars)	$4,423,074 (2021 dollars)	Same as onsite Alternative 1	$3,752,000,000 (2019 dollars)

Jelica Arsenijevic
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From: Brian Grubbs <grubbs@montaguederose.com>
Sent: Thursday, August 18, 2022 1:22 PM
To: JP Robinette <jrobinette@sitesproject.org>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>; Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <john.spranza@hdrinc.com>
Subject: RE: Sites: 404(b)(1) cost information

No problem JP. Revised file. Let me know if additional items need changing.

From: JP Robinette <jrobinette@sitesproject.org>
Sent: Thursday, August 18, 2022 12:28 PM
To: Brian Grubbs <grubbs@montaguederose.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>; Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <john.spranza@hdrinc.com>
Subject: Re: Sites: 404(b)(1) cost information

Brian, sorry for the confusion, that is the right estimate for alt 2, but that cost is only applicable for FM20.

FM19 and FM21 both use the $3,934,200.

Get Outlook for iOS

From: Brian Grubbs <grubbs@montaguederose.com>
Sent: Thursday, August 18, 2022 10:08:13 AM
To: JP Robinette <jrobinette@sitesproject.org>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>; Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <john.spranza@hdrinc.com>
Subject: RE: Sites: 404(b)(1) cost information

JP, and Henry,
I think I found the Alt 2 estimate in my files, $3,874,400,000. Let me know if I should be using a different number. The attached results are for Alt 2.
Brian

Brian Grubbs | Managing Director
Montague DeRose and Associates
916-712-1747

From: Brian Grubbs <grubbs@montaguederose.com>
Sent: Thursday, August 18, 2022 9:11 AM
To: 'Luu, Henry' <henry.luu@hdrinc.com>
Cc: Doug Montague <montague@montaguederose.com>; 'Cheyanne Harris' <charris@brwncald.com>; 'Arsenijevic, Jelica' <Jelica.Arsenijevic@hdrinc.com>; 'Spranza, John' <john.spranza@hdrinc.com>; 'JP Robinette' <jrobinette@sitesproject.org>
Subject: RE: Sites: 404(b)(1) cost information

Henry,
Can you provide the exact estimate. If not I'll just scale the Alt 1 estimate down to $3,870,000,000

Brian Grubbs | Managing Director
Montague DeRose and Associates
916-712-1747

From: JP Robinette <jrobinette@sitesproject.org>
Sent: Wednesday, August 17, 2022 3:20 PM
To: Brian Grubbs <grubbs@montaguederose.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>; Spranza, John <john.spranza@hdrinc.com>
Subject: Re: Sites: 404(b)(1) cost information

Brian, this looks like a good template to use. One thing, we need to use the construction cost from alternative 2, which was developed in the adopted 2021 cost estimate of $3.87B (very small difference, I know).

Location of number:

	POF Case 1	POF Case 6	-(FM 19)-ArmyCorp Alt 1	-(FM 20)-ArmyCorp Alt 2	-(FM 21)-ArmyCorp Alt 3
	(2021$)	(2021$)	(2021$)	(2021$)	(2021$)
	($000s)	($000s)	($000s)	($000s)	($000s)
Annual Debt Service	137,150	106,639	139,008	152,358	105,168
Annual Fixed Costs	12,644	12,644	12,657	15,054	7,446
Annual Variable Costs	2,049	2,049	2,049	2,049	2,049
Total Fixed and Variable Costs	14,693	14,693	14,706	17,103	9,495
Annual Total Costs	151,842	121,332	153,714	169,462	114,663
WSIP$ ($000s)	836,409	836,409	836,409	836,409	836,409
FED%	7.0%	7.0%	7.0%	0.0%	25.0%
Fed$ ($000s)	316,405	316,405	314,607	-	1,123,597
USDA$ ($000s)	439,559	439,559	-	-	-
WIFIA$ ($000s)	-	2,202,251	-	-	-
Participant Cash ($000s)	67,048	67,048	67,048	67,048	67,048
Revenue Bonds ($000s)	2,831,000	664,000	3,271,000	3,585,000	2,472,000
Total	4,490,421	4,525,672	4,489,065	4,488,457	4,499,055
diff from future$ cost	(3,967)	31,283	(5,324)	(5,931)	4,666
% diff from future$ cost	-0.09%	0.70%	-0.12%	-0.13%	0.10%
Total Const Cost ($000s), (2021$)	3,934,200	3,934,200	3,934,200	3,934,200	3,934,200
Total Const Cost ($000s), (future$)	4,494,389	4,494,389	4,494,389	4,494,389	4,494,389

From the presentation in June 2021:

Feasibility Cost Estimate

1. Provides a higher level of accuracy (AACE Class 4)
   a) Considered results from Feasibility Design
   b) Bottom-up approach
2. Provides investors with a higher degree of certainty in project affordability
3. About a 30% cost increase compared to Value Planning estimates (AACE Class 4 vs. Class 5 cost estimates)
   a) Alternative 1: **$3.93 billion** (2021 dollars)
   b) Alternative 2: **$3.87 billion** (2021 dollars)

From: Brian Grubbs <grubbs@montaguederose.com>
Sent: Wednesday, August 17, 2022 2:36 PM
To: JP Robinette <jrobinette@sitesproject.org>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>; Spranza, John <john.spranza@hdrinc.com>
Subject: RE: Sites: 404(b)(1) cost information

JP,

The attached shows the DS cost as well as Total fixed and variable costs. These use the same methodology as the Oct-2021 Plan of Finance tables.

the numbers you're looking for are in F11:H11. I've included the POF Case 1 and 6 along with some other inputs to provide context and for some QA on the inputs I used.

Brian

Brian Grubbs | Managing Director

Montague DeRose and Associates

916-712-1747

From: JP Robinette <jrobinette@sitesproject.org>
Sent: Friday, August 12, 2022 8:54 AM
To: Brian Grubbs <grubbs@montaguederose.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>; Spranza, John <john.spranza@hdrinc.com>
Subject: Fw: Sites: 404(b)(1) cost information

Brian,

We have a need for a stand-alone analysis in support of the Army Corps 404.b.1 memo. I need annual costs for participants for alternative 1, 2, and 3. A few assumptions:

- All financing is bonds at historic rates, don't assume any USDA or WIFIA
- Reclamation levels:
  - Alt 1: 7%
  - Alt 2: 0%
  - Alt 3: 25%

We will then take this annual cost and divide it by the long-term average deliveries that are being run.

Do you have time to do this early next week?

Thanks,
JP

From: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Sent: Thursday, August 11, 2022 5:12 PM
To: JP Robinette <jrobinette@sitesproject.org>
Cc: Smith, Kristin <Kristin.Smith@hdrinc.com>; Spranza, John <john.spranza@hdrinc.com>; Markham, John <John.Markham@icf.com>; Vondergeest, Michael <Michael.Vondergeest@icf.com>
Subject: RE: Sites: 404(b)(1) cost information

JP
As a reminder, tomorrow mornings call is in regards to the cost-related info in the attached draft 404(b)(1) memo tables 2 and 16. On the former, we are requesting confirmation of the existing values (e.g., annual cost/acre foot, annualized deliveries) and populating data for the "XX" placeholders, and on the latter we are requesting data for the "XX"

placeholders in cost screening metrics 3 and 4 and logistics metric 4. As a next step, references and brief technical justification would be needed as support.

Looking forward to the call.
Jelica

Many thanks to ICF for leading tomorrows call!

Jelica Arsenijevic
Environmental Project Manager

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Jelica.Arsenijevic@hdrinc.com

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-----Original Appointment-----
From: Arsenijevic, Jelica
Sent: Thursday, August 4, 2022 10:44 AM
To: Arsenijevic, Jelica; Spranza, John; Markham, John; Vondergeest, Michael; JP Robinette
Cc: Smith, Kristin
Subject: Sites: 404(b)(1) cost information
When: Friday, August 12, 2022 8:00 AM-9:00 AM (UTC-08:00) Pacific Time (US & Canada).
Where: Microsoft Teams Meeting

Meeting to discuss the attached with JP...table 16 from the 404(b)(1) memo. Unfortunately Erin is not available as she is on PTO but we can follow up with her when she returns (if needed).

Microsoft Teams meeting

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Op-Ed Title: Sites Reservoir is a Solution to California's Megadrought

Author: Sites Project Authority

Word Count: 487

When it comes to water, California continues to break records, and not the kind we like to brag about.

According to a study by Nature Climate Change, the West Coast's drought has worsened so much in one year, that it is now the driest in at least 1,200 years and is a worst-case climate change scenario playing out live. In fact, it's being labeled as a "megadrought."

As we close out a brutally dry summer, many water suppliers are leaning more on their stored water supplies.

In many ways, Sites is exactly what a state burdened by droughts needs. Sites would capture and store water from the Sacramento River during big, flashy rain storms—after all other water rights and regulatory requirements are met— and is made available to California's environment, communities, and farms when it's most needed – especially during times of drought.

Here in Southern California, we are utilizing all the tools in our toolbox—recycling, conservation, desalination, groundwater replenishment, and yes, more water storage. Although Sites is located in Glenn and Colusa counties up north, public water agencies throughout California have the opportunity to invest in Sites to secure more water for the customers they serve.

Sites Reservoir is looking to make a big impact on water supply while keeping its environmental footprint small. The project does not dam any major river. Sites is designed to **help** the environment, not cause harm. And a large portion of the water saved in Sites is specifically set aside for fisheries and the environment during dry years. This is a first of its kind and a model for successful future water management.

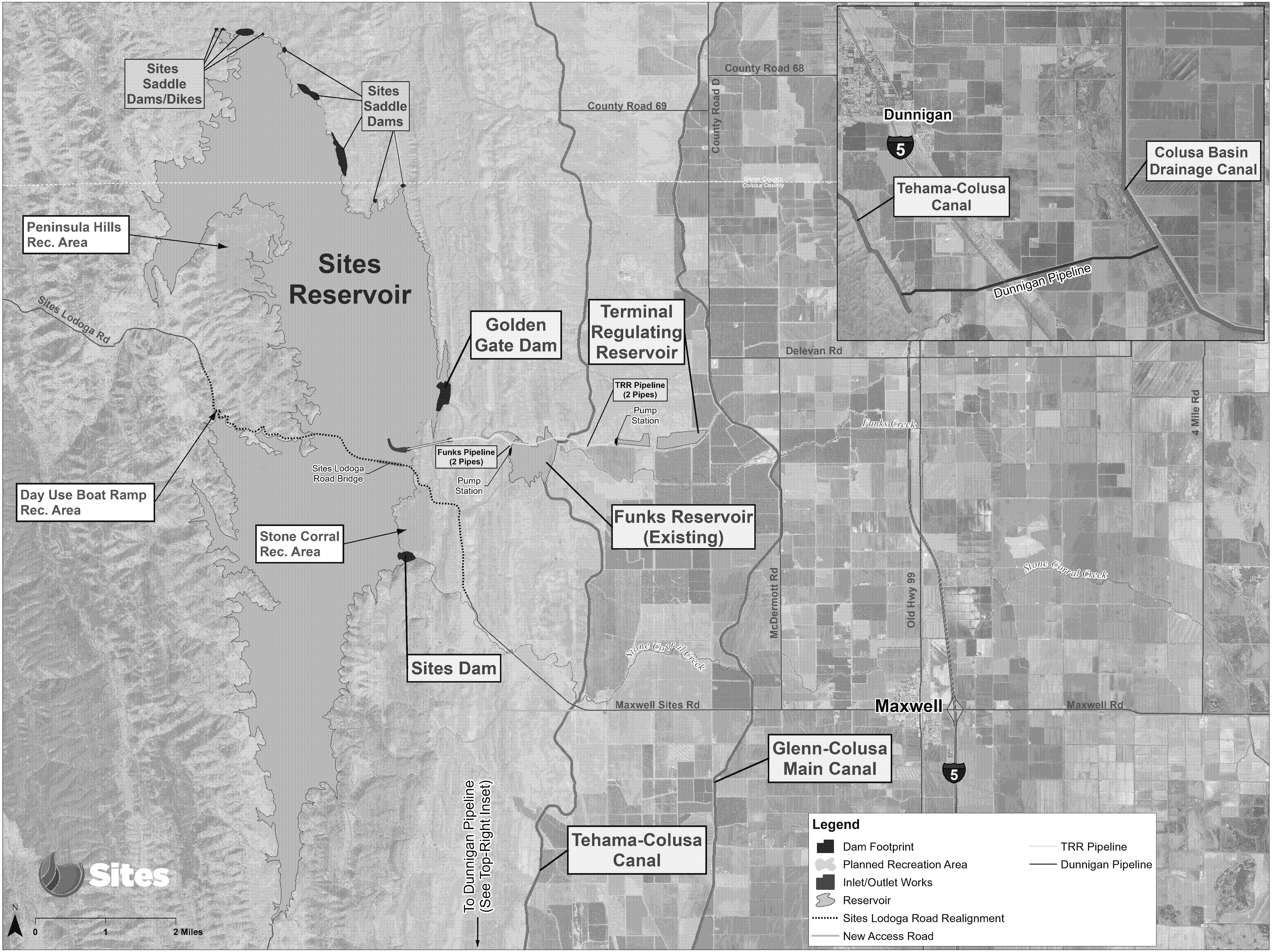
If Sites had been in place prior to 2021, we could have captured and stored much of the excess prior years flood flows for use in what was a very dry year, and California would have had an additional 1 million acre-feet of water available for use during 2021 when it was badly needed. And a good portion of that water would have been held over for use in 2022 which is an equally bad or worse water year.

Sites can best be described as an insurance policy. And if the scientific projections are correct about the impacts of climate change, then having Sites Reservoir will mean we will be able to collect even more water in the reservoir for use during future extended droughts.

The Sites Project Authority is advancing Sites Reservoir because our state needs more water during dry years. And we're proud the project is supported by local water agencies, irrigation districts, and municipalities across California. We're also proud to have the State and Federal government investing in the project.

It's critical that we continue to invest in a broad range of solutions to ensure a resilient water future, and Sites Reservoir would increase water storage, help alleviate symptoms, and address the impacts of a megadrought. It's time to build Sites now.

www.sitesproject.org.



Draft_0019468

From: Jerry Brown [jbrown@sitesproject.org]
Sent: 9/14/2022 9:30:24 AM
To: Spranza, John [john.spranza@hdrinc.com]; Alicia Forsythe [aforsythe@sitesproject.org]
CC: Marcia Kivett [MKivett@sitesproject.org]; Cadei, Michael [Michael.Cadei@hdrinc.com]
Subject: Re: Your invited presentation at CALMS!

Sounds good. Some suggestions to consider as you prepare:

1. Comb through the message platform for other applicable general talking points.
2. Emphasize that we are off stream. Our I/O will lay on the side of the hill and have multiple ports for water in and out to support the health of the lake. 180 miles of conveyance and only 11 miles is new. This reliance on existing infrastructure means we have a good idea what will happen when we move water in/out of Sites.
3. The rightsized project eliminated Delevan, controversial piece, which we expect simplified and eliminated a lot of potential WQ issues of putting water back in the river. 40 miles of mixing with other water before Sites water gets back into the river.
4. Using through delta conveyance to SOD participants. Zero connection or reliance on the Delta Tunnel. Totally independent projects.
5. Wind is big deal in terms of limnology. I don't know if we have a handle on how the Sites will be affected by wind. We were surprised at LVE at how the reservoir "turns over" every year because of how windy it is which turns out to be good for water quality and oxygen levels for fish habitat but not so good for maintaining fish docks and public safety. LV is one of the top fishing spots in the bay area because of it. We can guarantee that Sites will have positives and negatives that we don't yet realize, same as what happened on LV.

Have fun, thanks for doing it, and make sure to report out on the questions you get asked.

Jerry

From: "Spranza, John" <John.Spranza@hdrinc.com>
Date: Wednesday, September 14, 2022 at 8:38 AM
To: Jerry Brown <jbrown@sitesproject.org>, Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Marcia Kivett <MKivett@sitesproject.org>, "Cadei, Michael" <Michael.Cadei@hdrinc.com>
Subject: RE: Your invited presentation at CALMS!

Jerry and Ali,
I confirmed with the conference planning staff that they would like a 25 min presentation that provides a general overview of the Sites Project that highlights some of the key lessons learned and water quality/limnology issues that that would be of interest to the conference attendees.

I was thinking that we could highlight the modeling and assessment for the project releases, how the project becomes more effective under future climate change scenarios, and the role adaptive management will play in the management of the reservoir.

Are you okay with those messages?

John Spranza

D 916.679.8858 M 818.640.2487

From: Jerry Brown <jbrown@sitesproject.org>
Sent: Monday, August 29, 2022 11:46 AM
To: Spranza, John <john.spranza@hdrinc.com>; Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Marcia Kivett <MKivett@sitesproject.org>; Cadei, Michael <Michael.Cadei@hdrinc.com>
Subject: Re: Your invited presentation at CALMS!

Yes, okay. Would like to be apprised of your 3 key messages once you've gotten the chance to think about what you want to say. Thanks

From: "Spranza, John" <John.Spranza@hdrinc.com>
Date: Monday, August 29, 2022 at 10:00 AM
To: Jerry Brown <jbrown@sitesproject.org>, Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Marcia Kivett <MKivett@sitesproject.org>, "Cadei, Michael" <Michael.Cadei@hdrinc.com>
Subject: FW: Your invited presentation at CALMS!

Good Morning,

Looks like this is a go. I thought I was going to be on a panel, but it looks like they have scheduled a 30 minute presentation under the "change and Adaptation" session instead.

Jerry and Ali, please confirm that you are still okay with me presenting under this format.

Thanks,
John

John Spranza

D 916.679.8858 M 818.640.2487

From: Mark Seelos <MSeelos@valleywater.org>
Sent: Thursday, August 25, 2022 4:07 PM
Subject: Your invited presentation at CALMS!

CAUTION: [EXTERNAL] This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hello,

You have been scheduled to give an oral presentation at the California Lake Management Society annual conference in Oakland, CA on October 13, 2022! Thanks again for offering your time to share your work with our community – we look forward to your talk.

A draft agenda is saved here: https://docs.google.com/spreadsheets/d/16um9DX1hTkd6Yav-GxejBgx2dK7NH13qqFtsAf6MlAU/edit?usp=sharing.

Guidelines for Presenters

- You have been assigned a 30 minute time-slot in one of our two afternoon sessions.

- Your 30 minute timeslot will include an introduction to be read by the moderator, your presentation (up to 20 minutes), Q&A, and a transition to the next speaker.
- Help create an engaging presentation for our audience by keeping text to a minimum, using effective graphics, and telling a story. Here's a good article on creating effective presentation slides.

Instructions for Presenters

1. Please **reply to this email** to confirm that you are still able to present in the assigned time slot.
2. If you haven't already, please register for the conference no later than **September 9, 2022**.
3. Email me (mseelos@valleywater.org) a copy of your slide deck and a brief (<100 words) introduction no later than **5pm on Wednesday, October 12.**
4. Bring a thumb drive with your presentation as a backup.

Thanks again, and let me know if you have any questions!

Mark Seelos, Ph.D., CLM
Associate Water Resources Specialist
Environmental Planning Unit
Tel. (408) 630-2075 / Cell. (805) 340-4277

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From: Janis Offermann [janis@horizonh2o.com]
Sent: 9/14/2022 9:38:02 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]
CC: Kevin Spesert [kspesert@sitesproject.org]; Laurie Warner Herson [laurie.warner.herson@phenixenv.com]; Risse, Danielle [Danielle.Risse@hdrinc.com]
Subject: Yesterday's call with Laverne

Hi, Ali
During my chat with Laverne yesterday, we talked about a couple of things other than the sensitivity report for the 2023-24 geotechnical studies.

As I mentioned in my email yesterday, Laverne noted that he needs to turn his attention to Sites, including reading the EIR. He also mentioned that he has been talking with others about a MOU. I took that opportunity to mention that we had read the DCP TCR chapter and wondered if YD was thinking that a similar landscape approach would be appropriate for Sites. He said "not really" and noted that the Sites area is more than a landscape to them. He said, this is where their villages were, this is where their ancestors lived and were buried. I haven't really had time to think about how this would change our approach; and maybe not at all as long as the Authority and YD can establish a close, collaborative relationship (as expressed in a MOU), for managing TCRs, including bio resources, within and adjacent the project footprint.

Laverne used the terms "collaborate" and "partnership" many times throughout the course of the conversation. My take on this is that, given their intimate ties to the area, they truly have a vested interest in the project and they want to be as involved as possible. Of course, this would take commitment and follow-through(in a timely manner) on their part, as well as agreement and a similar commitment by the Authority. Clearly, there is a lot to think about and discuss.

I just wanted to bring this to your attention as food for thought. I am glad we have gotten a heads up that a landscape approach will likely not be the exact approach to take before we got too attached to that idea. Our discussion with Laverne on October 31 should be very interesting.
Let me know if you would like to talk about this more in the near future.
Thanks
janis

Janis Offermann, MA, RPA
Cultural Resources Practice Lead
Horizon Water and Environment
1801 7th Street, Suite 100
Sacramento, CA 95811
530.220.4918

Draft Memorandum

To: John Spranza, Integration Team Permitting Lead

Cc: Nicole Williams ICF CEQA/NEPA Task Lead
Monique Briard, ICF Project Manager

From: Anne Huber, Water Quality Technical Specialist

Date: July 1, 2020

Re: Action Item from 6/15 Water Quality Working Group Meeting

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Purpose

ICF was assigned the task to review potential constituents of concern for Colusa Basin Drain (CBD) and the Yolo Bypass at the Sites Water Quality Working Group Meeting on 6/15/2020. To do this, we reviewed the information contained in the 2017 Public Draft Environmental Impact Report/Environmental Impact Statement (2017 EIR/EIS) as well as the 2014 and 2016 California 303(d)/305(b) Integrated Report (Integrated Report). This memorandum summarizes that information.

Summary

Existing constituents of concern in the Colusa Basin Drain (CBD) and Yolo Bypass are described in Chapter 7 and Appendix 7A of the 2017 EIR/EIS. Excepts are provided in Attachments A and B. The information provided in Attachment B is based on the 2012 version of the Integrated Report. The newer 2014 and 2016 Integrated Report shows the same constituents of concern for Colusa Basin Drain, Knights Landing Ridge Cut, and Tule Canal as the 2012 Integrated Report, except boron in Knights Landing Ridge Cut has been removed from the list and the newer report lists fecal indicator bacteria instead of E. coli. While the Integrated Report lists several constituents of Concern for Tule Canal (boron, salinity, and fecal indicator bacteria), none are listed for Yolo Bypass, although Yolo Bypass is included in the mercury TMDL for the Delta.

The Revised EIR/EIS impact analysis will focus on those constituents or categories of constituents most likely to be affected by the project. Some of these constituents are not included in the Integrated Report but could represent constituents of concern that either were overlooked in the integrated report due to limited data or represent new issues. For the water quality effects associated with the Sites Reservoir discharge, this may include water temperature, salinity, metals, Harmful Algal Blooms, and mercury, as well as potential construction and maintenance-related effects and potential effects associated with passing water through the Yolo Bypass. The 2017 EIR/EIS evaluation of Sites Reservoir discharge focused only on potential salinity effects.

Although the CBD has relatively poor water quality under baseline conditions, the impact analysis will need to show that the releases from Sites Reservoir would not further reduce the water quality in the CBD (i.e., potentially poor baseline conditions would not be further degraded). Similarly, an analysis would be needed for the Tehama-Colusa Canal. The quality of water discharged to the Sacramento River is also of concern. If a substantial amount of water is released to the Yolo Bypass, other water quality concerns may include pesticides and formation of methylmercury, both of which should be addressed in the impact analysis. Nutrients, dissolved oxygen, and organic carbon should also be discussed in association with discharges to the Yolo Bypass.

Section 7.2.4.8 *Colusa Basin Drain*

The CBD is a human-made channel located in Glenn, Colusa, and Yolo counties, and was designed to convey agricultural return flows and storm runoff from the Colusa Basin to the Sacramento River at the Knights Landing Outfall Gates at Sacramento RM 34.15. The Colusa Basin Drain receives inflow from local creeks, including Funks and Stone Corral creeks, and discharge and runoff from the Colusa agricultural basin. Under conditions of low water levels, it drains by gravity into the Sacramento River at Knights Landing; however, when the water levels at Knights Landing are too high for this gravity flow to occur, discharge from the Colusa Basin Drain is routed directly to the Yolo Bypass through the Knights Landing Ridge Cut (USGS, 2002). Beneficial uses designated for the Colusa Basin Drain include agricultural irrigation and stock watering, water contact recreation, and warm- and cold-water habitat, and migration and spawning for aquatic biota (CVRWQCB, 2016). In spite of the many uses of the waterway, the Colusa Basin Drain is listed as impaired for numerous contaminants. Water quality constituents of concern include mercury, dissolved oxygen, pathogens, unknown toxicity, salinity, nutrients, organic carbon, and sulfates.

Mercury

The Colusa Basin Drain was placed on the Section 303(d) list because of mercury contamination that exceeded the USEPA fish tissue residue criterion for methylmercury in fish (SWRCB, 2011o). The Colusa Basin Drain contributed 3.3 percent of total mercury inputs to the Sacramento Basin between 1984 and 2003 (CVRWQCB, 2010). A TMDL for the Colusa Basin Drain is expected to be completed in 2021 (SWRCB, 2011o).

Dissolved Oxygen

The Colusa Basin Drain was placed on the Section 303(d) list because of low dissolved oxygen (SWRCB, 2011a). According to the Final California 2010 Integrated Report (Section 303(d)/305(b) Report) Supporting Information, the sources contributing to the dissolved oxygen impairment are unknown (SWRCB, 2011o).

Pesticides

The Colusa Basin Drain was placed on the Section 303(d) list because of organophosphate pesticide contamination, including by azinphos-methyl (Guthion), diazinon, dichlorodiphenyltrichloroethane, and malathion, and because of organochlorine pesticide contamination, including by dieldrin (SWRCB, 2011o).

Other Constituents of Concern

The Colusa Basin Drain is also listed as contaminated by *E. coli* and unknown toxicity (SWRCB, 2011o). The Knights Landing Ridge Cut and Colusa Basin Drain confluence are listed as contaminated by boron, low dissolved oxygen, and high salinity. A USGS study of Yolo Bypass water quality in 2000 also reported that significant concentrations of ammonium, dissolved organic carbon, and sulfate in the Yolo Bypass were correlated with high concentrations in the Colusa Basin Drain (SWRCB, 2011m; USGS, 2002).

Section 7.2.3.7 *Yolo Bypass*

The Yolo Bypass supports a variety of beneficial uses, including agricultural supply, recreational uses, fish spawning and migration, and aquatic habitat use. The Yolo Bypass is used for agriculture production in times of low flow, and discharges to the Delta contribute to drinking water supplies. The Yolo Bypass also supports seasonal fish and wildlife. Water quality in the Yolo Bypass affects the agriculture, fish, and wildlife in the Yolo Bypass and beneficial uses in the Sacramento River downstream of Rio Vista, the western Delta, and Suisun Bay (CVRWQCB, 2016; Sommer et al., 2001). The primary water quality constituent of concern that could be affected by the Project is mercury.

Mercury

The Yolo Bypass contributes a significant amount of methylmercury and total mercury to the Delta (CVRWQCB, 2010). During high-flow events, water from the Sacramento River that enters the Yolo Bypass through Fremont Weir and the Sacramento Weir inundates the bypass. The Colusa Basin Drain and four westside tributaries also contribute to flows in the bypass. Inundation results in the transport of mercury into the bypass. Inundation is followed by periods during which the water drains toward the Sacramento River. The subsequent periods result in the drying of soils. Much of the mercury remains in the soils in the bypass. As the soil dries, the mercury oxidizes and forms methylated mercury compounds (methylmercury) (USGS, 2002).

Cache Creek, which is one of the four westside tributaries, is a major source of naturally occurring mercury to the Yolo Bypass. The suspended sediment from Cache Creek mine wastes is likely to deposit in the Yolo Bypass, which results in additional sources of methylmercury (CVRWQCB, 2010).

The Cache Creek Settling Basin (CCSB) captures sediment and mercury transported by Cache Creek; however, any sediment that is not captured is transported to the Yolo Bypass (approximately half of the sediment transported by Cache Creek). The California Toxics Rule mercury criterion of 0.050 microgram per liter for drinking water is exceeded in outflow from the CCSB (CVRWQCB, 2010).

The TMDL for methylmercury in the Delta recommends reducing mercury loads entering the CCSB, and regularly excavating the sediment accumulating in the CCSB, in order to increase its effectiveness and prevent its filling and thus cessation of sediment and mercury deposition. Additional reductions in mercury loading to Cache Creek will be achieved through the existing mercury TMDL in the watershed, which includes measures for mine remediation, erosion control in mercury-enriched areas, and the removal of floodplain sediments containing mercury (CVRWQCB, 2010). In addition to efforts targeting mercury loading reductions in Cache Creek, the TMDL includes methylmercury and total mercury load and waste load allocations for agricultural drainage, tributary inputs, and wastewater facilities in the Yolo Bypass to enable reductions in mercury.

Attachment B

Material from Appendix 7A. Information from the 2012 California 303(d)/305(b) Integrated Report

Region	Waterbody	Constituent of Concern	TMDL Status[1]
Sacramento River Basin (cont'd)	Colusa Basin Drain	Diazinon, Malathion, Azinphos-methyl (Guthion), Group A Pesticides, Unknown Toxicity, DDT, Dieldrin, E. coli, Low Dissolved Oxygen, Mercury, Carbofuran	Under Development
	Sutter Bypass	Mercury	Under Development
	Oroville Lake; Feather River, Lower (Lake Oroville Dam and Thermalito Afterbay to Confluence with Sacramento River), Yuba River, Lower[9]	Group A Pesticides, Chlorpyrifos, Unknown Toxicity, Mercury, PCBs	Under Development
	Folsom Lake; Natoma, Lake; American River, Lower (Nimbus Dam to confluence with Sacramento River)[10]	Mercury, Unknown Toxicity, PCBs	Under Development
	Knights Landing Ridge Cut	Boron, Dissolved Oxygen, Salinity	Under Development
	Putah Creek	Boron, Mercury	Under Development
	Cache Creek, Lower (Clear Lake Dam to Cache Creek Settling Basin near Yolo Bypass)	Mercury	Approved: 2007
		Boron, Unknown Toxicity	Under Development
	Yolo Bypass – Tule Canal	Boron, *Escheria coliform*, salinity	Under Development

Appendix 7A: California State Water Resources Control Board Constituents of Concern of Water Bodies in the Study Area

Region	Waterbody	Constituent of Concern	TMDL Status[1]
Sacramento River Basin (cont'd)	Colusa Basin Drain	Diazinon, Malathion, Azinphos-methyl (Guthion), Group A Pesticides, Unknown Toxicity, DDT, Dieldrin, E. coli, Low Dissolved Oxygen, Mercury, Carbofuran	Under Development

SITES RESERVOIR PROJECT
COLUSA BASIN DRAIN
INTAKE EVALUATION

May 2016

Prepared for

Sites Project Authority

Prepared by

AECOM

2870 Gateway Oaks Drive, Suite 150
Sacramento, CA 95833

Contents

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Acronyms and Abbreviations

AF	acre-feet
CBD	Colusa Basin Drain
cfs	cubic feet per second
GCID	Glenn Colusa Irrigation District
mS/cm	milli Siemens per centimeter
RCP	reinforced concrete pipe
TAF	thousand acre-feet
TDS	total dissolved solids
TRR	terminal regulating reservoir

1.0 ABSTRACT

AECOM evaluated the potential for adding a new intake facility at the Colusa Basin Drain (CBD) that could deliver water to either the Terminal Regulating Reservoir proposed for the Glenn Colusa Canal, or to Holthouse/Funks Reservoir. The preliminary benefit cost ratio is approximately 2, suggesting that the benefits are high enough relative to the cost to merit further study. Intake capacities of 250 cubic feet per second (cfs) and 2,000 cfs were considered. Additional study is needed to confirm the quantity and quality of the water available from the CBD and to identify any legal constraints (including water rights) that would limit the ability to pump from the drain.

This technical memorandum includes the following sections:

- Study Objective
- Limitations
- Background
- Hydrology and Water Quality
- Alternatives
- Recommendations

2.0 STUDY OBJECTIVE

The purpose of this initial evaluation of adding an intake facility at the CBD was to determine if the new intake would be physically feasible and economically viable and merit further evaluation. Conceptual cost estimates were developed for two alternative intake capacities of 250 cfs and 2,000 cfs.

3.0 LIMITATIONS

The engineering concepts presented in this memorandum are conceptual level only and are not suitable for financing.

The legal constraints on the availability of water from the CBD have not been determined. Maxwell Irrigation District, the Colusa National Wildlife Refuge, and private landowners are among the water users that divert water from the CBD. The CBD conveys water to the Wallace Weir near the Knights Landing Outfall Gates to the Sacramento River. Water can be diverted through this weir to Knights Landing Ridge Cut into the Yolo Bypass where the water can be used for agricultural purposes. Additional study is needed to understand how pumping would affect downstream users and to define any legal constraints to the amount of water that can be pumped from the CBD.

There will likely be some water quality concerns that will limit when water can be diverted from the CBD. This memorandum provides a preliminary assessment of water quality concerns, but there has been no communication with the Central Valley Regional Water Quality Control Board to determine potential restrictions or monitoring requirements associated with pumping from the CBD.

4.0 BACKGROUND

The CBD serves three purposes:

- It conveys agricultural return flows from Glenn, Colusa, and Yolo Counties to the Sacramento River.
- During the irrigation season, the CBD serves as a water supply canal for lands adjacent to the drain.
- In the winter, the CBD is part of the flood control system conveying water to the Sacramento River and Yolo Bypass. The Colusa Basin includes 32 ephemeral streams (among these are Funks Creek and Stone Corral Creek) that drain toward the CBD.

The CBD has an estimated channel capacity of 20,000 cfs (California Department of Water Resources, 2010).

Some portion of the water in the CBD could be returned to the Glenn Colusa (GC) Canal upstream of Funks Creek for the benefit of downstream water users, or pumped into the planned Sites Reservoir project. From a water source perspective, a new intake on the CBD can likely be operated more often with fewer impacts on aquatic species than a new intake on the Sacramento River. However, the river has more flow and fewer water quality issues that could impact the beneficial use than water diverted from the CBD.

5.0 HYDROLOGY AND WATER QUALITY

This section provides a preliminary evaluation of the availability of water and water quality in the CBD.

5.1 Hydrology

Flow in the CBD varies widely throughout the year (Figure 1). Flows within the drain are predominately agricultural return flows, except during the winter when the CBD conveys storm runoff.

For the purposes of this evaluation, data from the Davis Weir monitoring station were considered most representative of flows in the CBD in the vicinity of the intake location. Figure 2 shows flow data for Davis Weir (the weir is south of the city of Colusa) and was provided by Glenn Colusa Irrigation District (GCID). The proposed intake location is upstream of Stone Corral, Lurline, and Freshwater Creeks, so the contributions from these creeks were not included in the estimated CBD flows.

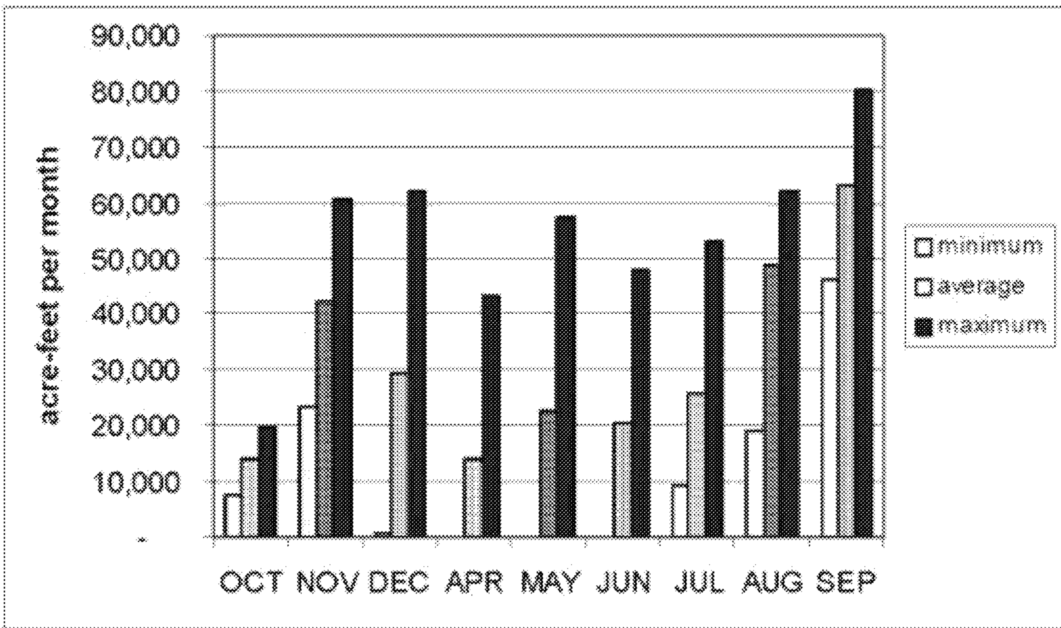


Figure 1. Monthly Volume Discharged from the CBD to the Sacramento River

Water Years 1995 through 2004 (CH2M Hill, 2006)

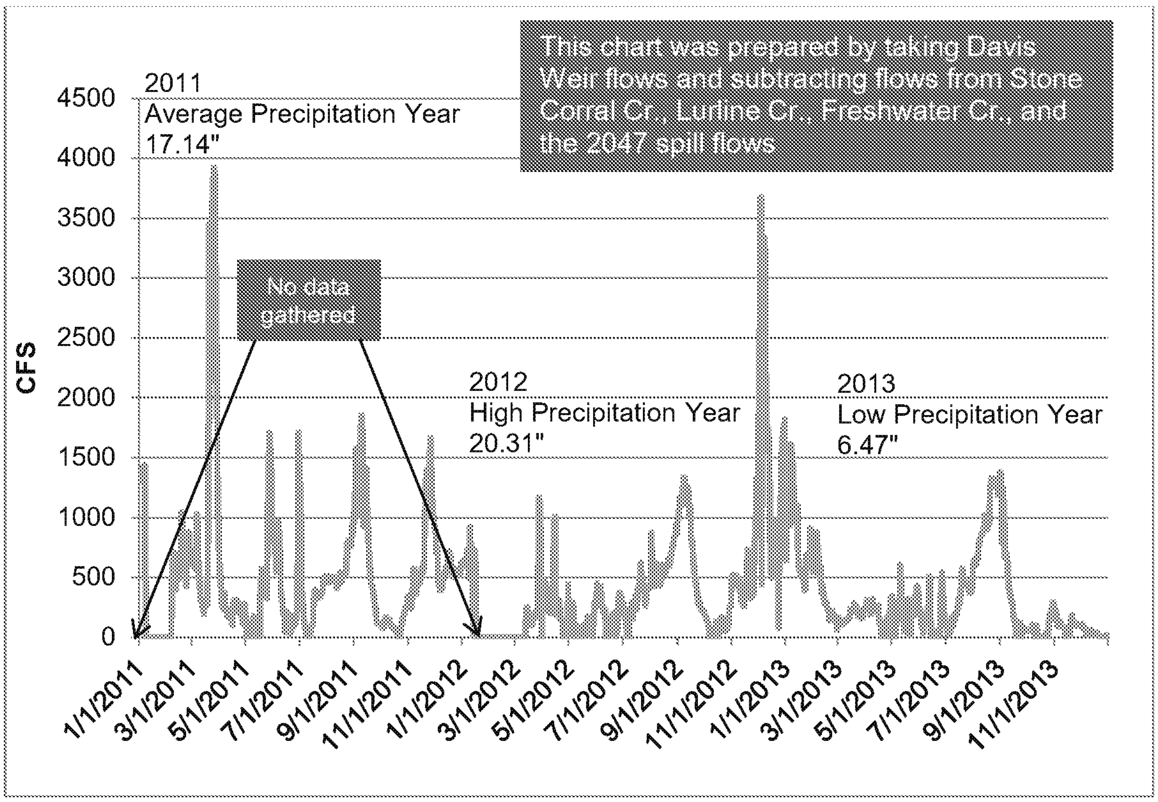


Figure 2. Estimated CBD Flows at the Davis Weir

(Data provided by Glenn-Colusa Irrigation District)

5.2 Water Quality

Water quality parameters that would potentially affect the ability to divert water from the Colusa Basin Drain into either the GC Canal or Sites Reservoir include salinity, pesticides, organic carbon, and nutrients. The concentrations of these parameters in the CBD vary seasonally.

Salinity measurements are generally taken as either total dissolved solids (TDS) or electrical conductivity. Figure 3 shows values of these constituents at the Davis Weir over a three year period.

Data on specific pesticides was not available. Attachment 1(Rice Commission Monitoring Schedule) provides a schedule for pesticide application and other activities developed by the California Rice Commission. Calculated concentrations for dissolved organic carbon are provided in Figure 4. Organic carbon concentrations are of concern to municipal drinking water agencies because they will react with chlorine to form undesirable disinfection byproducts during treatment.

The *Colusa Basin Drain Study Phase I Summary Report* (CH2M Hill, 2006) included a review of nutrient concentrations in the CBD. Figure 5 presents calculated concentrations for total ammonia and organic nitrogen. The prior study by CH2M Hill found that nutrient concentrations (total ammonia, total organic carbon, nitrates, nitrites, and phosphorus) in the CBD are at their highest in the winter months.

Since Sites Reservoir will provide drinking water to downstream users, water quality considerations will be somewhat different than they have been historically for the agricultural supply from the GC and Tehama Colusa Canals. For the purposes of this evaluation, salinity was used as the primary indicator of water quality to assess the timing for diversions. Salinity data was available close to the preferred point of diversion. However, additional evaluation of water quality near the point of diversion will be needed if the CBD intake concept is advanced in the future.

5.3 Availability of Water for Diversion

Table 1 provides an analysis of flow and water quality at the Davis Weir. Assumptions for the initial evaluation of the availability of water for diversion are as follows:

- No more than 50% of the total available flow in the CBD will be diverted
- No diversions occur when CBD flows drop below 250 cfs
- Only divert water when the specific conductivity is ≤ 0.75 milli Siemens per centimeter (mS/cm)
- Only divert water when the total dissolved solids concentration is ≤ 0.75 milligrams per liter

Based on these criteria, an average of approximately 44,800 acre-feet (AF) is available annually on average. It appears that the potential intake would be capable of operating 80 to 120 days per year based on the assumed flow and water quality criteria.

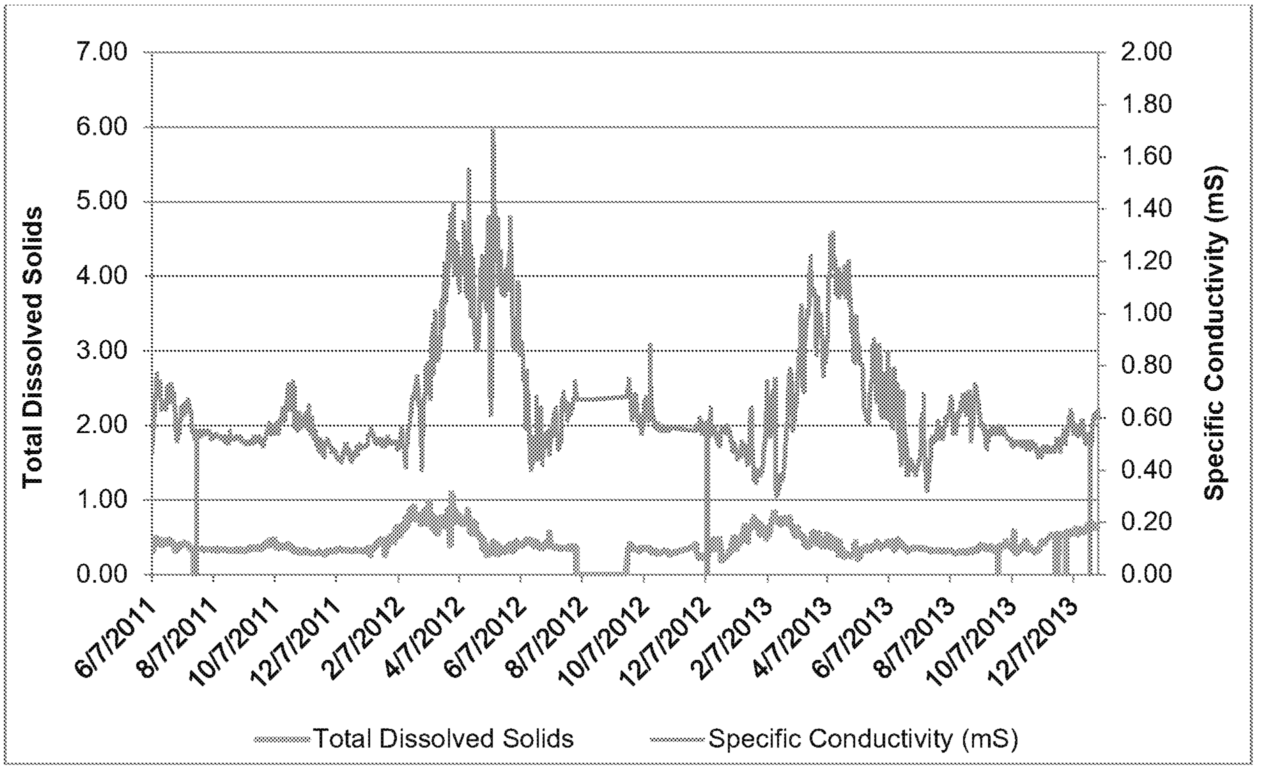


Figure 3. Salinity Measured as Total Dissolved Solids and Specific Conductance at the Davis Weir

(Data provided by Glenn-Colusa Irrigation District)

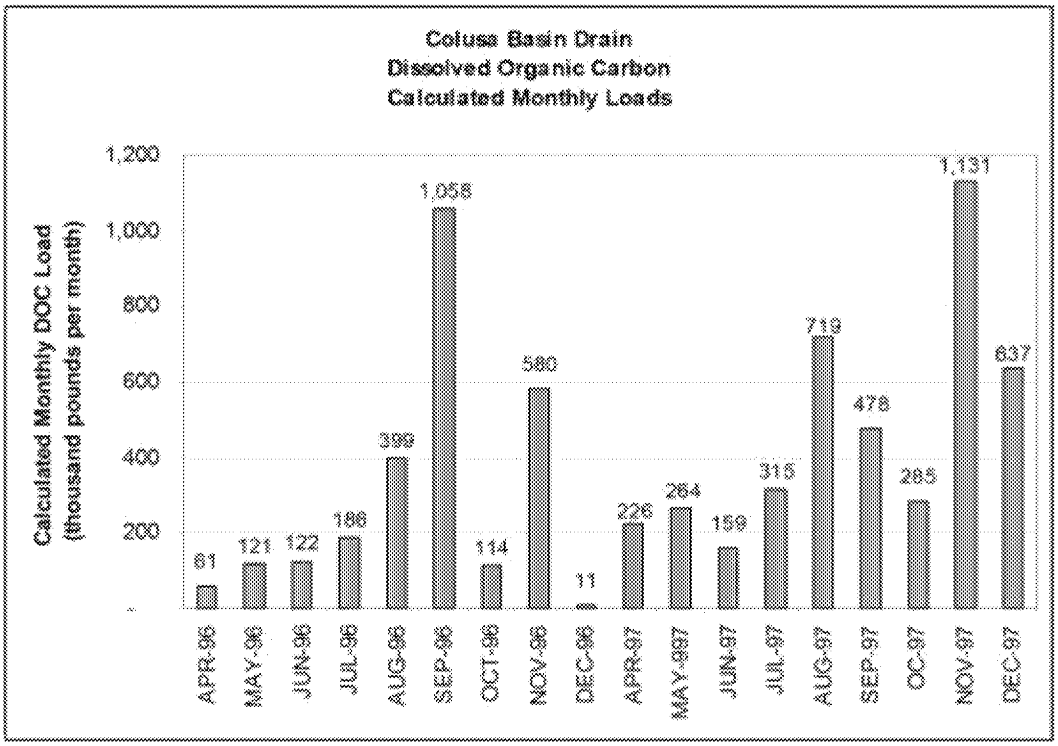


Figure 4. Calculated Dissolved Organic Carbon Loads for the CBD

(CH2M Hill, 2006)

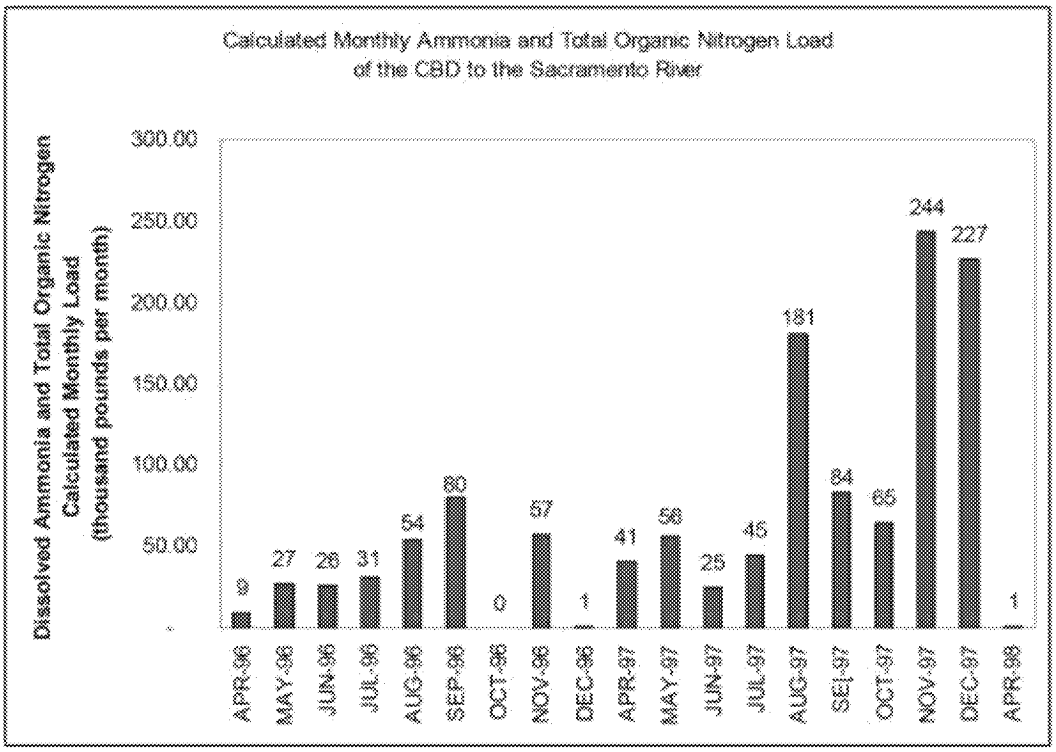


Figure 5. Total Ammonia and Organic Nitrogen Calculated Monthly Loads; Non-Flood Months

(CH2M Hill, 2006)

		Davis Weir Data		Gross Vol (AF)		Vol (AF) w/ SC Limit		Sites (SC-limit; AF)		(CBD Q's > 500cfs/day)		Vol (AF) w/ TDS Limit		(CBD Q's > 500cfs/day)		Combined Vol (AF) w/ TDS & SC		(CBD Q's > 500cfs/day)	
Date	Alternative TRR Diversion Point on the CBD	Specific Conduct. SC < .75 mS	TDS ≥ .75 mg/L	Q (cfs)	Vol (AF)	Q (cfs)	Vol (AF)	Q (cfs)	Vol (AF)	Q (cfs)	Vol (AF)	Q (cfs)	Vol (AF)	Q (cfs)	Vol (AF)	Q (cfs)	Vol (AF)	Q (cfs)	Vol (AF)
(1)	(2)	(3)	(4)	(2a)	(2b)	(3a)	(3b)	(3c)	(3d)	(3e)	(3f)	(4a)	(4b)	(4c)	(4d)	(4a)	(4b)	(4c)	(4d)
2011					390,100 AF/Yr		296,400 AF/Yr		**113,100** AF/Yr		**67,000** AF/Yr		349,600 AF/Yr		63,000 AF/Yr		263,900 AF/Yr		56,100 AF/Yr
2012					301,500 AF/Yr		262,600 AF/Yr		**92,600** AF/Yr		**47,200** AF/Yr		283,500 AF/Yr		48,100 AF/Yr		262,600 AF/Yr		47,200 AF/Yr
2013					230,400 AF/Yr		206,200 AF/Yr		**92,100** AF/Yr		**40,200** AF/Yr		191,500 AF/Yr		30,800 AF/Yr		168,600 AF/Yr		30,800 AF/Yr
AVERAGE					307,400 AF/Yr		255,100 AF/Yr		**99,300** AF/Yr		**51,500** AF/Yr		274,900 AF/Yr		47,400 AF/Yr		231,800 AF/Yr		44,800 AF/Yr

Notes to the averages:

- (2b) Average annual volume flowing past Davis Weir.
- (3b) Total volume past Davis Weir for flows where Specific Conductivity is < 0.75.
- (3d) Volume past Davis Weir for flows where all SC-limited flows up to 250cfs are counted.
- (3f) Volume past Davis Weir for SC-limited Q's and only taking Q's when Q(drain)>500cfs (ensuring flows for other uses always exist in the drain.)
- (4b) Total volume past Davis Weir for flows where TDS capped at 75% of maximum
- (4d) Volume past Davis Weir for TDS-limited Q's and only taking Q's when Q(drain)>500cfs (ensuring flows for other uses always exist in the drain.)
- (4b, combined) Total volume past Davis Weir for flows where TDS capped at 75% of maximum recorded value and SC limits applied.
- (4d, combined) Volume past Davis Weir for TDS- and SC-limited Q's and only taking Q's when Q(drain)>500cfs (ensuring flows for other uses always exist in the drain.)

Table 1. Rationale for Diversion Estimate

Draft_0019487

6.0 ALTERNATIVES

The initial alternative considered was a 250 cfs intake on the CBD. Although a 250 cfs intake is large enough to divert approximately 45,000 AF annually, a larger intake might provide additional flood control benefits. In response to comments from Colusa County, a 2,000 cfs intake alternative was also evaluated considering possible flood control operation.

6.1 250 CFS Intake Alternative

The 250 cfs intake alternative for the CBD would divert water into a new 7-foot diameter pipeline that would convey water to the terminal regulating reservoir (TRR). A new pipeline was considered for two reasons:

- Constructing a separate pipeline would allow releases from the Delevan pipeline to the Sacramento River, even when the CBD diversion is functioning
- The Delevan pipeline is not connected to the TRR and the TRR is the GCID preferred location to receive water from the CBD.

Figure 6 provides a plan view of the intake location and pipeline alignment to the TRR.

Electrical transmission (69 or 120 kvA) to power the new pumping plant would be extended from the Delevan pipeline intake on the Sacramento River. The new intake pumping plant (Figure 7) would include 3 duty pumps and 1 standby pump rated for approximately 83 cfs and 2,000 horsepower each.

The new pipeline would require about 9 miles of 7 foot diameter reinforced concrete pipe (RCP) installed adjacent to the Delevan pipeline to convey water into the TRR. The piping configuration was selected to balance the head loss, velocity, number of pumps, and the cost of the pipe. A new energy dissipation structure would be required at the terminus of the new pipeline to the TRR. Further evaluation would be needed to select the most appropriate number and size of pumps.

The estimated capital cost for the 250 cfs intake is $170M (Attachment 2). The annualized cost is $12M. Estimated annual benefits range from approximately $20M to $30M based on an estimated available annual supply of 40 to 60 thousand acre-feet (TAF). The benefit cost ratio ranges from 1.7 to 2.5.

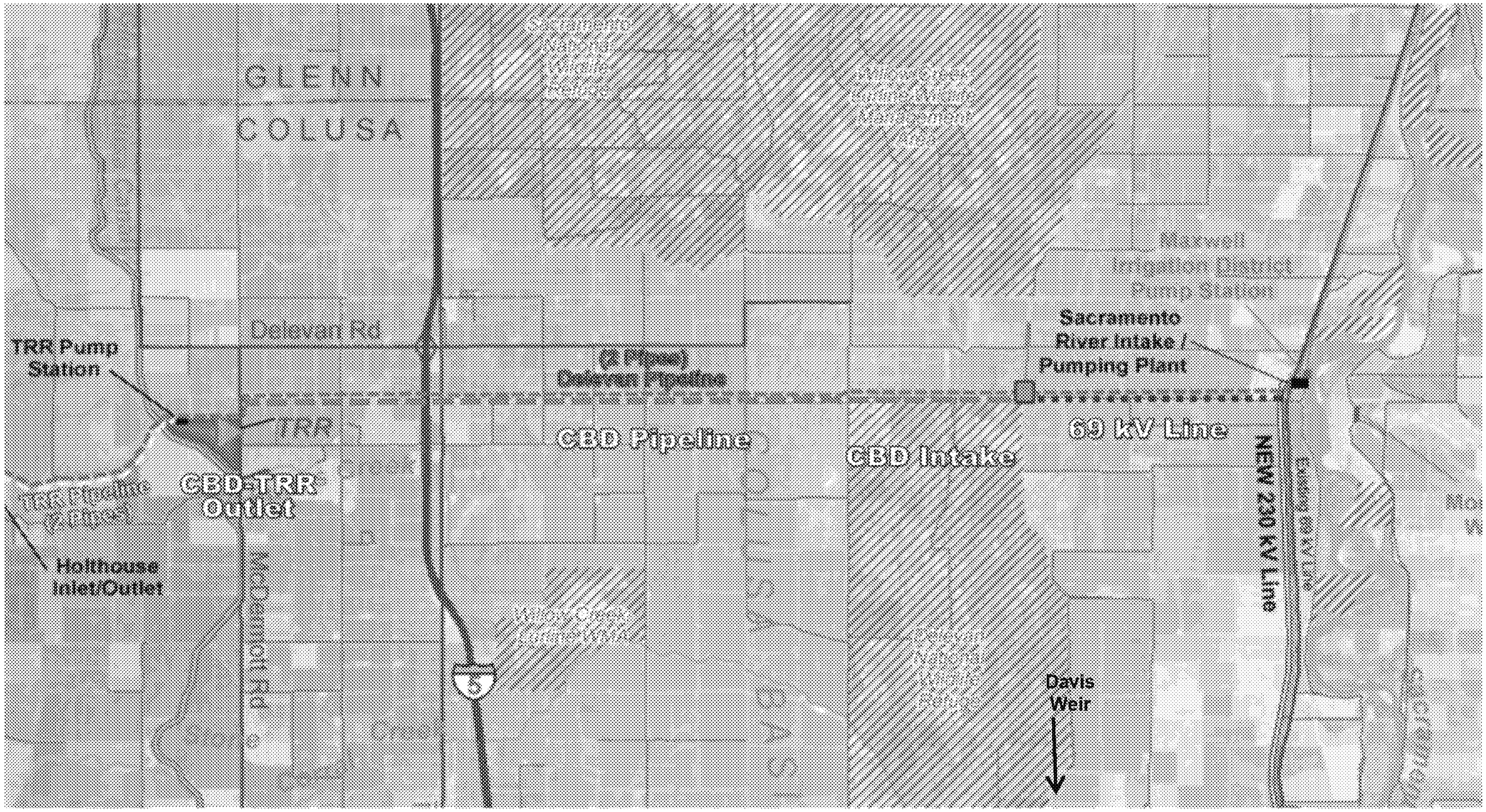


Figure 6. Colusa Basin Drain Intake (250 cfs Alternative)

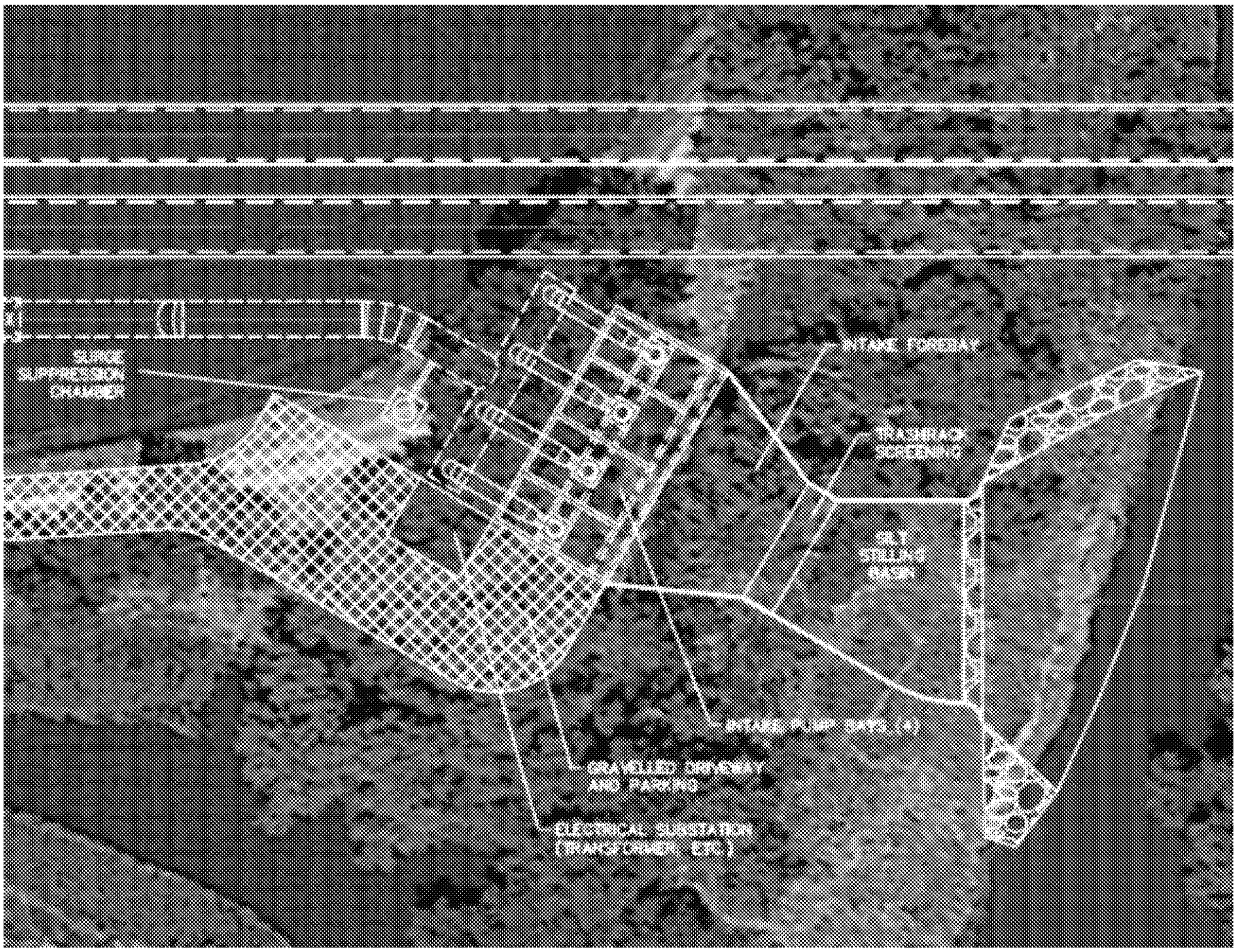


Figure 7. 250 CFS Intake Facility on the CBD

6.2 2,000 CFS Intake Alternatives

A 2,000 cfs intake was also evaluated based on comments from Colusa County. A large intake would provide additional flood control benefit; however, further study is needed to determine exactly how large the intake pumping plant would need to be. The construction of Sites Reservoir includes new dams on Funks Creek and Stone Corral Creek that will reduce the flow in the CBD. A smaller intake might provide an equivalent level of flood protection, but there is not enough information available to determine the most cost effective size at this time. For the purposes of this conceptual study, a 2,000 cfs intake was considered.

There are advantages and disadvantages associated with the larger intake. The larger intake provides additional flood control for the CBD and would divert more water to Sites Reservoir during high flow conditions in the CBD. With a 2,000 cfs intake, it is no longer cost effective to install an independent pipeline (this would require two additional 12-foot diameter pipes). Instead a tee and valve assembly would be provided to support diversion into the Delevan pipelines. This configuration has two disadvantages compared to the smaller system.

- Diverting water into the Delevan pipeline moves the discharge point to Holthouse/Funks Reservoir. Water would have to be released from Holthouse/Funks Reservoir to get water delivered to the TRR. This operation would be constrained to times when the TRR is not pumping water up to Holthouse/Funks Reservoir. Another alternative would be to connect Delevan pipeline to the TRR, but this would result in a larger pumping plant at the TRR (current studies have tried to minimize the size of facilities at the TRR to avoid landowner impacts).
- With the tee and valve assembly, it will no longer be possible to release water to the Sacramento River when the CBD intake is in operation.

Three configurations for the 2,000 cfs intake were considered for costing. Table 2 describes the options and provides the cost.

Table 2. 2,000 cfs Alternatives for CBD Diversions

Case		Cost Increase	Cost Decrease	Net Project Costs
1	• Add 2,000 cfs Colusa Basin Drain Pump Station	$163M	$0	$145M
2	• Add 2,000 cfs Colusa Basin Drain Pump Station • Eliminate Sacramento River Pumping Plant • Eliminate Sacramento River Fish Screens • Eliminate 3 Miles of Delevan Pipeline	$175M	$490M	< $315M >
3	• Add 2,000 cfs Colusa Basin Drain Pump Station • Eliminate Sacramento River Pumping Plant • Eliminate Sacramento River Fish Screens • Add Sacramento River Release Structure • No Delevan Pipeline Changes	$183M	$340M	< $157M >

Case 1 adds a 2,000 cfs pumping plant at the CBD, but retains all of the Delevan pipeline facilities between the CBD and the Sacramento River. This option is slightly less expensive than the 250 cfs intake and will provide increased flood control benefits. The magnitude of the incremental flood control benefits cannot be determined without additional study; however, as noted above it may also be possible to further reduce the size of the intake while still preserving the benefits due to reduced flows into the CBD from Funks and Stone Corral Creek after Sites Dam and Golden Gate Dam are constructed. The estimated annual benefits have greater uncertainty, but are likely in the $20.1M to $30.1M range. The annualized cost is $11M and the benefit cost ratio would be 1.8 to 2.7.

Cases 2 and 3 are integrated with the base alternative, so the benefit cost ratio cannot be evaluated as an “add on” to the project. Case 2 terminates the Delevan pipeline at the CBD and eliminates the intake on the Sacramento River. This results in a potential cost savings of $315M compared to Sites Reservoir Alternative C or D_1 (about 6% of the total cost). If as much water can be diverted from the CBD as from the river, this would increase the benefit cost ratio from about 1.26 to about 1.34 for Sites Reservoir Alternative C.

Case 3 retains the Delevan pipeline for releases to the Sacramento River, but eliminates the new intake. This results in a potential cost savings of $157M (about 3% of the total cost). If as much water can be diverted from the CBD as from the river, this would increase the benefit cost ratio from about 1.26 to about 1.31 for Sites Reservoir Alternative C.

6.3 Alternative Comparison

At this time, the 250 cfs intake and the 2,000 cfs intake appear to be roughly equivalent in terms of the benefit cost ratio with all other facilities remaining the same. There is more uncertainty with the evaluation of the 2,000 cfs intake, as follows:

- The monetary value of the additional flood control benefits is not known (this would tend to increase the benefit cost ratio).
- The reduction in water supply benefits due to not being able to release water when pumping from the CBD is also unknown without further study (this would tend to decrease the benefit cost ratio).

It is likely that the net effect of assessing both of these factors will result in a benefit cost ratio that is still comparable to the 250 cfs intake. As noted previously, the 2,000 cfs intake will deliver water to Holthouse/Funks Reservoir, instead of to the TRR. However, water can be released from Holthouse/Funks to the TRR.

Cases 2 and 3 replace the new intake on the Sacramento River with an intake on the CBD. This modification potentially improves the benefit cost ratio for the project; however, the regulatory constraints for CBD water rights and water quality have not been fully characterized. A more detailed evaluation of flows in the CBD should also be performed to confirm the availability of water in the drain prior to eliminating the intake on the Sacramento River. Assuming diverting water from the CBD in sufficient quantities is feasible, the acceptability to project investors will also need to be considered (i.e., do investors strongly prefer river water to water from the CBD?).

7.0 RECOMMENDATIONS

Adding a new intake to divert water from the CBD looks promising, but will require additional study. Table 3 identifies the uncertainties in the analysis to date and the studies needed to resolve each of the uncertainties.

The 250 cfs and 2,000 cfs (Case 1) intakes offer roughly equivalent benefits for comparable costs. Additional studies needed include:

- An evaluation of irrigation season and winter season water rights on the CBD.
- Further evaluation of the flow and water quality in the CBD in the vicinity of the new intake.

- Evaluation of the change in inundation areas following the construction of Sites and Golden Gate Dams with and without the new intake on the CBD and a determination of the most appropriate intake size.
- Monetization of the flood damage reduction benefits.

Table 3. Uncertainties and Recommended Studies

Uncertainty	Recommended Studies/Evaluations
Constraints from existing water rights on the Colusa Basin Drain	Evaluation of irrigation and winter season water rights
Water quality impacts from CBD diversions	If there is significant reliance on the CBD for diversions into Sites Reservoir, additional water quality modeling is needed to determine the effects on water quality and public benefits
Acceptability of using water from the CBD for agricultural and municipal use	The Sites Project Authority should solicit feedback from current and potential investors to see if using water from the CBD affects the value of the water. The Regional Water Quality Control Board should also be contacted.
How much water is available in the CBD for diversion	Evaluation of stream gauge data and hydrology. Additional stream gauges may be needed.
How significant would losses be if water were released to the CBD (infiltration and diverters) that could reduce public benefits and exports	Evaluation of seepage and stream gauge data to estimate losses/diversions in the CBD
Magnitude of flood damage reduction benefits	Need to determine reduction in flooding solely attributable to the new dams and the incremental reduction from a new intake. The incremental benefits should also be determined.
Appropriate pumping plant size for the CBD diversion	The flood study results can be used to determine the most appropriate size for the CBD intake pumps to most efficiently provide flood benefits
Feasibility level design of CBD facilities	If included in the feasibility study and final Environmental Impact Report/Environmental Impact Statement, additional design is needed for the CBD facilities to bring them to a feasibility level
How CBD facilities would affect overall operations and project deliveries	Add new intake into the CALSIM model for Sites Reservoir
How would a 250 CBD diversion affect the sizing of the TRR and TRR pumping plant?	Further study needed to modify the size and configuration of the TRR facilities

8.0 REFERENCES

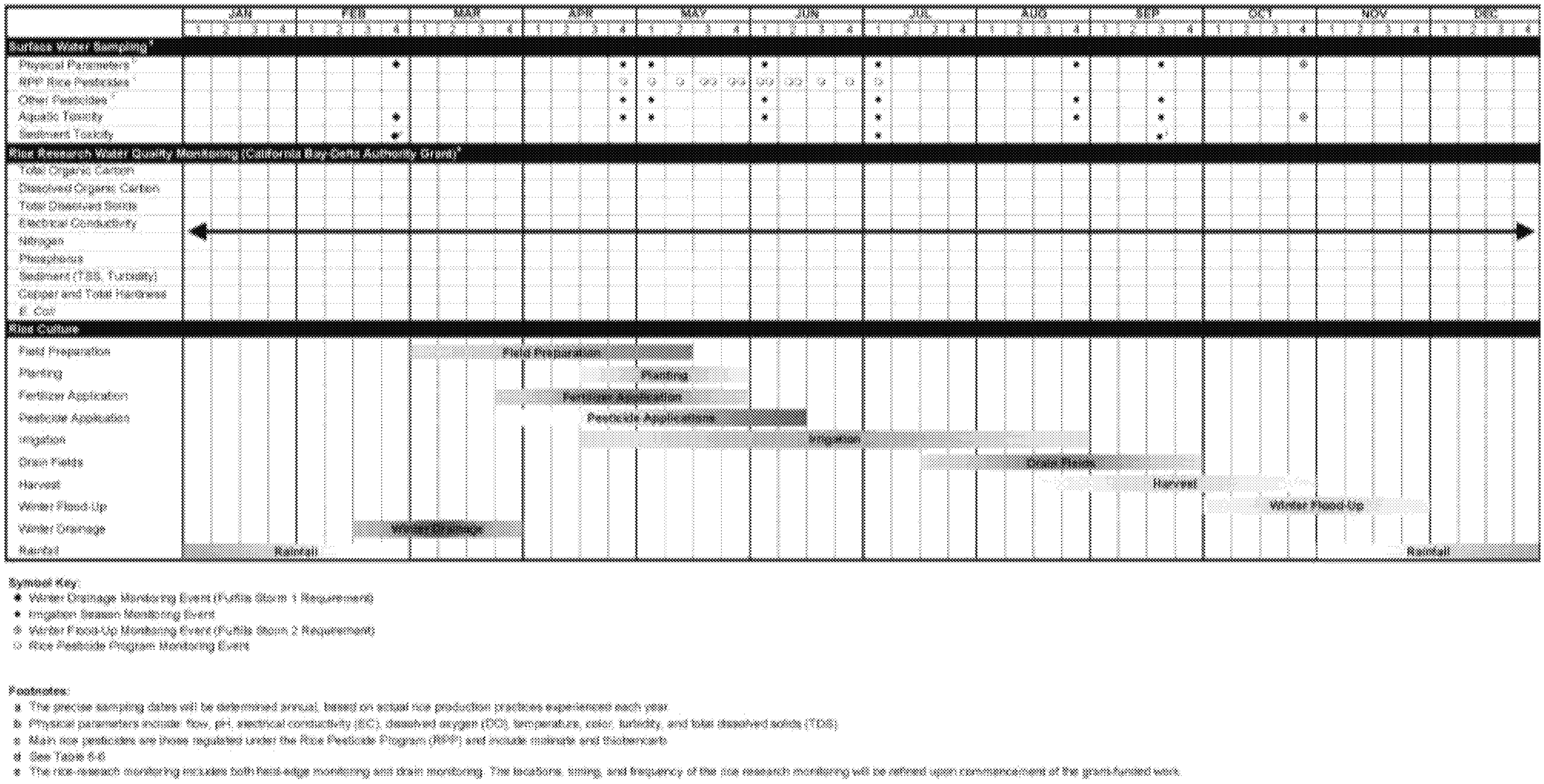
California Department of Water Resources, 2010. *State Plan of Flood Control Descriptive Document.*

CH2M Hill, 2006. *Colusa Basin Drain Study – Phase 1: Characterization of Colusa Basin Drain Water Quality and Flow.*

Glenn Colusa Irrigation District, 2016. *Personal Communication.*

ATTACHMENT 1

Rice Commission Water Quality Monitoring Schedule



California Rice Commission Water Quality Monitoring Schedule for Agricultural Waiver

Source: CH2M Hill, 2006

ATTACHMENT 2

Estimated Capital Cost

ESTIMATE WORKSHEET

SHEET __ OF __

FEATURE:	PROJECT:
NODOS Project Pumping and Generating Plants Colusa Basin Drain Pumping Plant 250 cfs With Separate Discharge Pipeline to TRR Civil — Summary Sheet	NODOS Alternative WOID: ESTIMATE LEVEL: Conceptual REGION: UNIT PRICE LEVEL: Conceptual FILE:

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
100		Land and Rights					$50,000.00
130		Structures and Improvements					$475,922.00
140		Roads and Road Structures (Included with Reservoir Project Roads)					$1,491,500.00
152		Waterways - Buried Penstock Piping and Bifurcations					$87,822,232.77
154		Waterway Protective Structures					$90,052.90
160		Pumps and Prime Movers					$2,720,000.00
165		Turbines and Generators					
170		Accessory Electrical Equipment					$16,400,000.00
		Subtotal					**$109,049,707.67**
		Mobilization	5%	+/-			$5,500,000.00
		Subtotal with Mobilization					**$114,549,707.67**
		Contract Cost Allowances (Sum of):	5%	+/-			(Included)
		Design Contingencies, 10 % (+/-)					
		APS, 0 % (+/-). Type of procurement: Full and open sealed bid competition					
		CONTRACT COST					**$115,000,000.00**
		Construction Contingencies	20%	+/-			$25,000,000.00
		FIELD COST					**$140,000,000.00**
		Non-Contract Costs	20%	+/-			$30,000,000.00
		CONSTRUCTION COST					**$170,000,000.00**
		Escalation to Notice to Proceed (NTP) *(separate calculation not included here)*					
		at		per year for		years	
		CONSTRUCTION COST (with Escalation to NTP)					**$170,000,000.00**

	PRICES	
	BY LJM	**CHECKED** JHB
	DATE PREPARED 04/18/16	**PEER REVIEW / DATE** 04/25/16

ESTIMATE WORKSHEET

SHEET __ OF __

FEATURE: **NODOS Project** **Pumping and Generating Plants** Colusa Basin Drain Pumping Pant 2,000 cfs, Discharge to Delevan Pipeline **Civil** **Summary Sheet**	**PROJECT:** **NODOS Alternative** **WOID:** **ESTIMATE LEVEL:** Conceptual **REGION:** **UNIT PRICE LEVEL:** Conceptual **FILE:**

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
100		Land and Rights					$250,000.00
130		Structures and Improvements					$38,727,270.00
140		Roads and Road Structures					$1,519,760.00
152		Waterways - Buried Penstock Piping and Bifurcations					$8,361,000.00
154		Waterway Protective Structures					$7,300,000.00
160		Pumps and Prime Movers					$21,690,000.00
170		Accessory Electrical Equipment					$14,324,000.00
		Subtotal					**$92,172,030.00**
		Mobilization	5%	+/-			$4,600,000.00
		Subtotal with Mobilization					**$96,772,030.00**
		Contract Cost Allowances (Sum of):	5%	+/-			$3,227,970.00
		Design Contingencies, 10 % (+/-)					
		APS, 0 % (+/-), Type of procurement: Full and open sealed bid competition					
		CONTRACT COST					**$100,000,000.00**
		Construction Contingencies	20%	+/-			$20,000,000.00
		FIELD COST					**$120,000,000.00**
		Non-Contract Costs	20%	+/-			$25,000,000.00
		CONSTRUCTION COST					**$145,000,000.00**
		Escalation to Notice to Proceed (NTP) *(separate calculation not included here)*					
		at		per year for		years	
		CONSTRUCTION COST (with Escalation to NTP)					**$145,000,000.00**

	PRICES	
	BY JHB	**CHECKED** JH
	DATE PREPARED 4/18/16	**PEER REVIEW / DATE** 04/25/16

Dams ($1.6B): 2 Main Dams (267-287 ft); 7 Saddle Dams (27-107 ft); 2 Saddle Dikes (12 ft)

- Water depth of approximately 208 ft at max operating reservoir capacity
- 1,900 ft of 12 ft diameter concrete diversion structure at Sites Dam (permanent)
- 2,100 ft of 48-inch diameter steel pipe encased in 6 ft x 6 ft concrete at Golden Gate Dam (temporary/to be decommissioned after construction)
- 22 miles of access road (12 miles paved; 10 miles graveled)
- Earthfill & Rock dam configuration
    - 5M Ton of dam zoned material; 9M CY of embankment; 10M CY of rock

Inlet/Outlet ($491M): Funks & TRR pipelines (4x12 ft diameter steel pipelines and 32 ft manifold) and Multi-tier concrete structure (230 ft tall); 15 ft diameter sloping intake (285 ft long); 20 ft diameter vertical shaft to tunnel (76 ft tall); 32 ft diameter tunnel (3,100 ft long); mechanical/I&C building

- Up to 21 ports at 7 different levels
- 7 miles of 12 ft diameter pipelines

Conveyance ($636M): TRR (600 acre-ft); TRR & Funks access roads, pumping generating plant, substation, and electrical facilities; Admin & Ops building; Funks Reservoir dredging

- Over 8M CY of excavation
- TRR PGP: 13 x 9,000 hp units; up to 1,800 cfs; 2x500 cfs Francis Turbine for a combined output of 23MW
- Funks PGP: 13 x 8,000 hp units; up to 2,100 cfs; 2x1,000 cfs Francis Turbine for a combined output of 35MW
- 2xSubstation stepdown from 230kV to 13.8kV; over 17 miles of new overhead transmission line
- 2.5 miles of gravel access roads

Dunnigan Pipeline ($97M): 4 miles of 9 ft diameter steel pipeline; concrete inlet and outlet structures; 2x60-inch energy dissipating valve and hood.

- One 500 ft long, 150-inch steel casing, bore underneath exist I-5
- One 400 ft long, 150-inch steel casing, bore underneath exist Hwy-99 and railroad

Reservoir Clearing & Demo ($33M): Inundation area of approximately 13,200 acres

Recreation ($33M): Peninsula Hill (373 acres), Stone Corral (235 acres), Day-use Boat Ramp (10 acres)

- Kiosk, parking, picnic, camping, trails, and boat lauch

Sites Lodoga Realignment ($367M): 5.5 miles of two-lane paved road realignment

- New 4,050 ft bridge that is approximately 150 ft tall
- 6.2M CY of embankment; 36,000 CY of aggregate base; 23,000 Ton of asphalt; 1.5M CY of rock
- Requires temporary traffic control to maintain access between the towns of Lodoga and Maxwell

Huffmaster Road ($46M): 7.5 miles of residential access gravel road

- 1.5M CY of excavation; 0.5M CY of embankment; 22,000 CY of aggregate base

TCCA ($5M): 2x600 hp, 250 cfs, pump units within existing concrete pumping plant bays

GCID ($7M): 3,000 cfs Headgate structure and up to 17 miles of canal embankment improvements

- 172 ft long, 26 ft wide, 25 ft tall, concrete headgate structure with 8 control gates; 2,000 CY of structural concrete

- 33,000 CY of left bank raise and construction of a gravel access road

Reservoir ($2.0B): 2 Main Dams (267-287 ft); 7 Saddle Dams (27-107 ft); 2 Saddle Dikes (12 ft); 5.5 miles of two-lane paved road realignment (Sites Lodoga Realignment)

- Dams
  - Water depth of approximately 208 ft at max operating reservoir capacity
  - 1,900 ft of 12 ft diameter concrete diversion structure at Sites Dam (permanent)
  - 2,100 ft of 48-inch diameter steel pipe encased in 6 ft x 6 ft concrete at Golden Gate Dam (temporary/to be decommissioned after construction)
  - 22 miles of access road (12 miles paved; 10 miles graveled)
  - Earthfill & Rock dam configuration
    - 5M Ton of dam zoned material; 9M CY of embankment; 10M CY of rock
- Sites Lodoga
  - New 1,633 ft bridge that is approximately 150 ft tall
  - 6.2M CY of embankment; 36,000 CY of aggregate base; 23,000 Ton of asphalt; 1.5M CY of rock
  - Requires temporary traffic control to maintain access between the towns of Lodoga and Maxwell

Maxwell-Sites Pumping and Generating ($1.15B): Inlet/Outlet Works: Funks & TRR pipelines (4x12 ft diameter steel pipelines and 32 ft manifold) and Multi-tier concrete structure (230 ft tall); 15 ft diameter sloping intake (285 ft long); 20 ft diameter vertical shaft to tunnel (76 ft tall); 32 ft diameter tunnel (3,100 ft long); mechanical/I&C building; TRR (600 acre-ft); TRR & Funks access roads, pumping generating plant, substation, and electrical facilities; Admin & Ops building; Funks Reservoir dredging

- Inlet/Outlet
  - Up to 21 ports at 7 different levels
  - 7 miles of 12 ft diameter pipelines
- Funks/TRR
  - Over 8M CY of excavation
  - TRR PGP: 13 x 9,000 hp units; up to 1,800 cfs; 2x500 cfs Francis Turbine for a combined output of 23MW
  - Funks PGP: 13 x 8,000 hp units; up to 2,100 cfs; 2x1,000 cfs Francis Turbine for a combined output of 35MW
  - 2xSubstation stepdown from 230kV to 13.8kV; over 17 miles of new overhead transmission line
  - 2.5 miles of gravel access roads

Reservoir Clearing & Demo ($35M): Inundation area of approximately 13,200 acres

Huffmaster Road ($50M): 7.5 miles of residential access gravel road

- 1.5M CY of excavation; 0.5M CY of embankment; 22,000 CY of aggregate base

Dunnigan Pipeline ($100M): 4 miles of 9 ft diameter steel pipeline; concrete inlet and outlet structures; 2x60-inch energy dissipating valve and hood.

- One 500 ft long, 150-inch steel casing, bore underneath exist I-5
- One 400 ft long, 150-inch steel casing, bore underneath exist Hwy-99 and railroad

TCCA ($5M): 2x600 hp, 250 cfs, pump units within existing concrete pumping plant bays

GCID ($7M): 3,000 cfs Headgate structure and up to 17 miles of canal embankment improvements

- 172 ft long, 26 ft wide, 25 ft tall, concrete headgate structure with 8 control gates; 2,000 CY of structural concrete
- 33,000 CY of left bank raise and construction of a gravel access road

Recreation ($35M): Peninsula Hill (373 acres), Stone Corral (235 acres), Day-use Boat Ramp (10 acres)

- Kiosk, parking, picnic, camping, trails, and boat lauch

Mitigation ($600M): Implement Environmental Mitigation Commitments

From: Laurie Warner Herson [laurie.warner.herson@phenixenv.com]
Sent: 9/15/2022 2:12:53 PM
To: Lassell, Susan [Susan.Lassell@icf.com]; Risse, Danielle [Danielle.Risse@hdrinc.com]; janis@horizonh2o.com; Rogers, Jenifer [Jenifer.Rogers@icf.com]
CC: Alicia Forsythe [aforsythe@sitesproject.org]
Subject: RE: Sites - Discussion of DCP Tribal Cultural Resources Landscape
Attachments: Pages from_Sargent_Ranch_Quarry_DEIR_July_2022 (1).pdf

Hi all – please see attached file for the Cultural and Tribal Cultural Resources section of the Sargent Ranch Quarry Draft EIR. It's just another example of the landscape approach to TCRs. As I understand it, the public comments on the Draft EIR were very TCR focused.

-----Original Appointment-----
From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Thursday, September 8, 2022 8:26 AM
To: Alicia Forsythe; Lassell, Susan; Risse, Danielle; Laurie Warner Herson; janis@horizonh2o.com; Rogers, Jenifer
Subject: Sites - Discussion of DCP Tribal Cultural Resources Landscape
When: Monday, September 12, 2022 1:00 PM-2:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Microsoft Teams Meeting

Microsoft Teams meeting

Join on your computer, mobile app or room device
Click here to join the meeting

Meeting ID: 290 897 638 371
Passcode: 7gPrab
Download Teams | Join on the web

Or call in (audio only)
+1 916-538-7066,,657181252# United States, Sacramento
Phone Conference ID: 657 181 252#
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Learn More | Meeting options

Draft

SARGENT RANCH QUARRY

Environmental Impact Report
SCH # 2016072058

Prepared by
County of Santa Clara
With Technical Assistance by: ESA

July 2022

3.5 Cultural and Tribal Cultural Resources

3.5.1 Introduction

This section evaluates impacts of the Project on known and unknown cultural and tribal cultural resources (, including those of historical, archaeological, paleontological, and ethnographic importance. The discussion within this section is based on several technical reports, including archaeological and historic reports and data sheets prepared by Far Western Anthropological Resources Group, Inc. in January 2017 and December 2017 (Far Western 2017a and 2017b), as well as a confidential ethnographic study prepared by Albion Environmental dated September 2021 and a memo attached to the study, prepared in 2022 (Albion 2021). Locations of archaeological sites and tribal cultural resources as well as information exchanged during the AB 52 consultation contained in these reports are confidential and not available for public review pursuant to CEQA Guidelines section 15120(d). The non-confidential portions of the Far Western reports are provided in Appendix M.

For the purposes of this section, the term "ethnographic study area" includes the Sargent Hills and associated riverine lowlands, as shown in **Figure 3.5-1**. The term "Project site" includes the area being physically impacted by the Project as a result of ground disturbing activities (i.e., mining pits, access roads, conveyor belt footprint, screening berms, stockpile areas, processing plant, etc.). These areas are shown in Figure 2-2 in Chapter 2, *Project Description*.

3.5.2 Regulatory Setting

3.5.2.1 Federal

National Historic Preservation Act

Federal protection is legislated by the National Historic Preservation Act (NHPA) of 1966. These laws maintain processes for determination of the effects on historical properties eligible for listing in the National Register of Historic Places (NRHP). Section 106 of the NHPA and related regulations (36 Code of Federal Regulations Part 800) constitute the primary federal regulatory framework guiding cultural resources investigations and require consideration of effects on properties that are listed or eligible for listing in the NRHP. Impacts to properties listed in the NRHP must be evaluated under CEQA.

The NRHP is the nation's master inventory of historic resources that are considered significant at the national, state, or local level. The minimum criteria (36 Code of Federal Regulations Part 60.4) for determining NRHP eligibility follow:

- The property is at least 50 years old (however, properties under 50 years of age that are of exceptional importance or are contributors to a district can also be included in the NRHP);
- It retains integrity of location, design, setting, materials, workmanship, feeling, and associations; and

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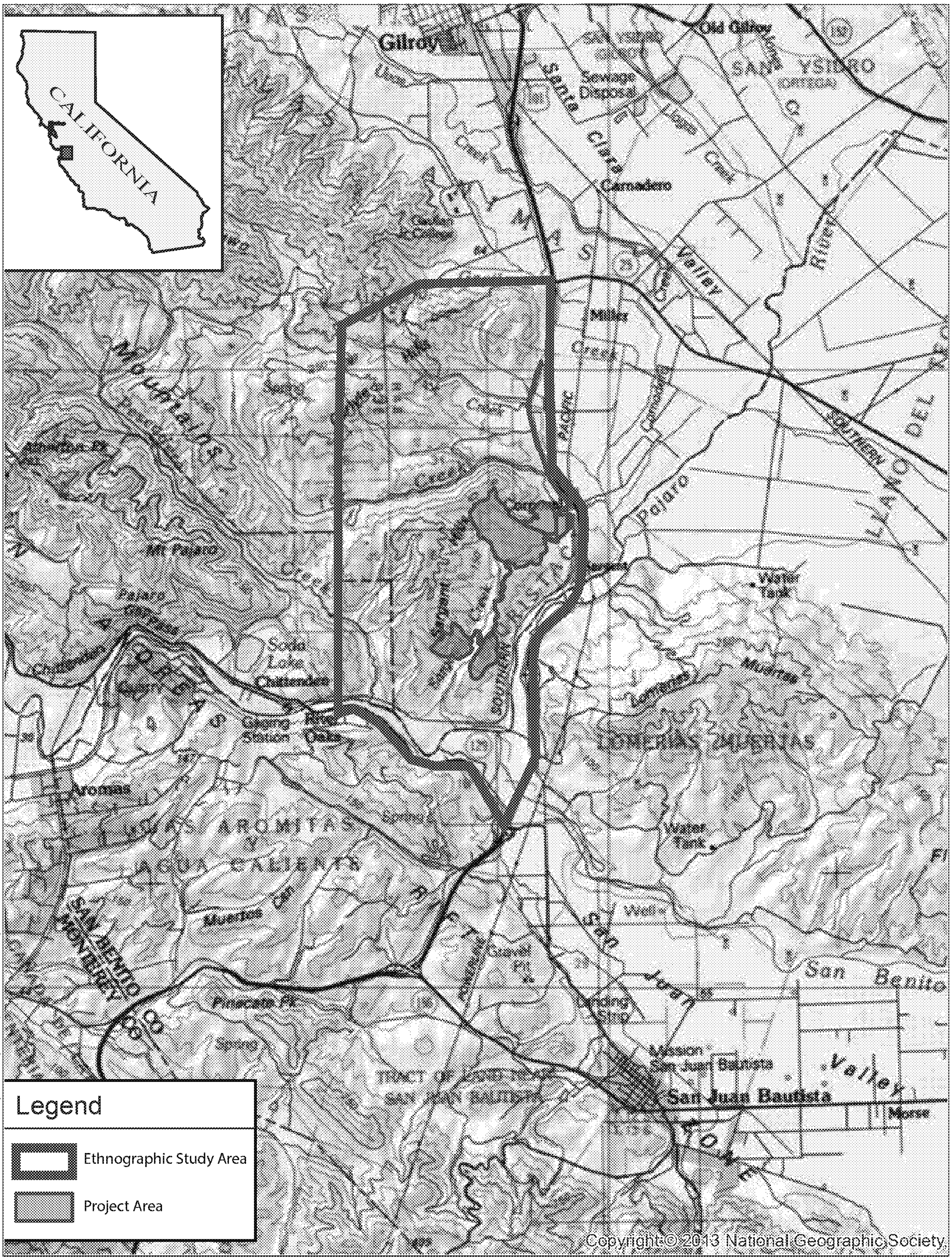

SOURCE: Live Oak Associates, Inc.

SCC Sargent Quarry

Figure 3.5-1
Ethnographic Study Area

ESA

- It possesses at least one of the following characteristics:
  - Association with events that have made a significant contribution to the broad patterns of history.
  - Association with the lives of persons significant in the past.
  - Distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant, distinguishable entity whose components may lack individual distinction.
  - Has yielded, or may yield, information important to prehistory or history.

3.5.2.2 State

California Environmental Quality Act

CEQA has several provisions related to the cultural resources impacts and mitigation measures.

CEQA Guidelines Section 15064.5(a) - Definition of a Historic Resource

CEQA Guidelines Section 15064.5(a) defines a "historic resource" as follows:

(1) A resource listed in, or determined to be eligible by the State Historical Resources Commission, for listing in the California Register of Historical Resources (Pub. Res. Code Section 5024.1, Title 14 CCR, Section 4850 et seq.).

(2) A resource included in a local register of historical resources, as defined in section 5020.1(k) of the Public Resources Code or identified as significant in an historical resource survey meeting the requirements section 5024.1(g) of the Public Resources Code, shall be presumed to be historically or culturally significant. Public agencies must treat any such resource as significant unless the preponderance of evidence demonstrates that it is not historically or culturally significant.

(3) Any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California may be considered to be an historical resource, provided the lead agency's determination is supported by substantial evidence in light of the whole record. Generally, a resource shall be considered by the lead agency to be "historically significant" if the resource meets the criteria for listing on the California Register of Historical Resources (Pub. Res. Code Section 5024.1, Title 14 CCR, Section 4852) including the following:

(A) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

(B) Is associated with the lives of persons important in our past;

(C) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

(D) Has yielded, or may be likely to yield, information important in prehistory or history.

CEQA Guidelines Section 15064.5(b) - Definition of A Substantial Adverse Change in a Historical Resource

CEQA Guidelines Section 15064.5(b) defines a "substantial adverse change" in the significance of a historic resource as follows:

(1) Substantial adverse change in the significance of an historical resource means physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired.

(2) The significance of an historical resource is materially impaired when a project:

(A) Demolishes or materially alters in an adverse manner those physical characteristics of an historical resource that convey its historical significance and that justify its inclusion in, or eligibility for, inclusion in the California Register of Historical Resources; or

(B) Demolishes or materially alters in an adverse manner those physical characteristics that account for its inclusion in a local register of historical resources pursuant to section 5020.1(k) of the Public Resources Code or its identification in an historical resources survey meeting the requirements of section 5024.1(g) of the Public Resources Code, unless the public agency reviewing the effects of the project establishes by a preponderance of evidence that the resource is not historically or culturally significant; or

(C) Demolishes or materially alters in an adverse manner those physical characteristics of a historical resource that convey its historical significance and that justify its eligibility for inclusion in the California Register of Historical Resources as determined by a lead agency for purposes of CEQA.

(3) Generally, a project that follows the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings or the Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings (1995), Weeks and Grimmer, shall be considered as mitigated to a level of less than a significant impact on the historical resource.

CEQA Guidelines Section 15064.5(c) - Effects on Archeological Sites

If a cultural resource in question is an archaeological site, the CEQA Guidelines (Section 15064.5[c][1] require that the lead agency first determine if the site is a historical resource as defined in Section 15064.5(a). If the archaeological site qualifies as a historical resource, potential adverse impacts must be considered in the same manner as a historical resource (CEQA Guidelines Section 15064.5[c][2]). If the archaeological site does not qualify as a historical resource but does qualify as a unique archaeological resource, then the archaeological site is treated in accordance with PRC Section 21083.2 (CEQA Guidelines Section 15064.5[c][3]). In practice, most archaeological sites that meet the definition of a unique archaeological resource also meet the definition of a historical resource.

CEQA (PRC Section 21083.2[g]) defines a unique archaeological resource as an archaeological artifact, object or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it:

- Contains information needed to answer important scientific research questions, and there is public information in that information.

- Has a special and particular quality, such as being the oldest or best example of its type.
- Is directly associated with a scientifically recognized important prehistoric or historic event or person.

CEQA Guidelines Section 15126.4(b) - Mitigation Requirements for Archaeological Historical Resources

CEQA Guidelines Section 15126.4(b) contains the following requirements for mitigating impacts on historical resources that are archeological in nature, including the following:

(3) Public agencies should, whenever feasible, seek to avoid damaging effects on any historical resource of an archaeological nature. The following factors shall be considered and discussed in an EIR for a project involving such an archaeological site:

(A) Preservation in place is the preferred manner of mitigating impacts to archaeological sites. Preservation in place maintains the relationship between artifacts and the archaeological context. Preservation may also avoid conflict with religious or cultural values of groups associated with the site.

(C) When data recovery through excavation is the only feasible mitigation, a data recovery plan, which makes provisions for adequately recovering the scientifically consequential information from and about the historical resource, shall be prepared and adopted prior to any excavation being undertaken. Such studies shall be deposited with the California Historical Resources Regional Information Center. Archeological sites known to contain human remains shall be treated in accordance with the provisions of Section 7050.5 Health and Safety Code. If an artifact must be removed during project excavation or testing, curation may be an appropriate mitigation.

California Register of Historical Resources

The California Register of Historical Resources (CRHR) is administered by the State Office of Historic Preservation and encourages protection of resources of architectural, historical, archeological, and cultural significance. The CRHR identifies historic resources for state and local planning purposes and affords protections under CEQA. Under Public Resources Code Section 5024.1(c), a resource may be eligible for listing in the CRHR if it meets any of the NRHP criteria listed previously.[1]

Historical resources eligible for listing in the CRHR must meet the significance criteria described previously and retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reasons for their significance. A resource that has lost its historic character or appearance may still have sufficient integrity for the CRHR if it maintains the potential to yield significant scientific or historical information or specific data.

The concept of integrity is essential to identifying the important physical characteristics of historical resources and hence; in evaluating adverse changes to them. Integrity is defined as "the authenticity of an historical resource's physical identity evidenced by the survival of characteristics that existed

[1] CEQA Guidelines Section 15064.5(a)(3) and California Office of Historic Preservation Technical Assistance Series #6. March 14, 2006.

during the resource's period of significance." The process of determining integrity is similar for both the CRHR and NRHP and use the same seven variables or aspects to define integrity that are used to evaluate a resource's eligibility for listing. These seven characteristics include 1) location, 2) design, 3) setting, 4) materials, 5) workmanship, 6) feeling, and 7) association.

Discovery of Human Remains

The California Native American Historical, Cultural, and Sacred Sites Act applies to both state and private lands. The act requires that upon discovery of human remains, construction, or excavation activity must cease and the County Coroner be notified. Pursuant to Public Resources Code Section 5097.98 and California Health and Safety Code Section 7050.5, no further disturbance is allowed until the County Coroner has made the necessary findings regarding the origin and disposition of the remains, and subsequent steps have been taken. If the remains are of a Native American, the coroner must notify the Native American Heritage Commission (NAHC). The NAHC then notifies those persons most likely to be related to the Native American remains. The act stipulates the procedures that the descendants may follow for treating or disposing of the remains and associated grave goods.

Section 15064.5(e) of the CEQA Guidelines specifies procedures to be used in the event of an unexpected discovery of Native American human remains. These procedures protect such remains from disturbance, vandalism, and inadvertent destruction, establish procedures to be implemented if Native American skeletal remains are discovered during construction of a project, and establish the NAHC as the authority to resolve disputes regarding disposition of such remains.

Both state law and County of Santa Clara Code (Section B6-189) require that the Santa Clara County Coroner be notified if cultural remains are found on a site. If the County Coroner determines the remains are those of Native Americans, the NAHC and a most likely descendant must also be notified.

Assembly Bill 52 Tribal Cultural Resources

Assembly Bill (AB) 52, effective July 1, 2015, established a new category of resources for consideration by public agencies when approving discretionary projects under CEQA, called tribal cultural resources. Public Resources Code Section 21074 (a), defines tribal cultural resources as either of the following:

(1) Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are also either:

(A) Included or determined to be eligible for inclusion in the CRHR[2]

(B) Included in a local register of historical resources as defined in Public Resources Code Section 5020.1(k)

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2 See Public Resources Code section 5024.1. The State Historical Resources Commission oversees the administration of the CRHR and is a nine-member state review board that is appointed by the Governor, with responsibilities for the identification, registration, and preservation of California's cultural heritage. The CRHR "shall include historical resources determined by the commission, according adopted procedures, to be significant and to meet the criteria in subdivision (c) (Public Resources Code, Section 5024.1 (a)(b)).

(2) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Section 5024.1 (CRHR criteria described above). In applying the criteria, the lead agency shall consider the significance of the resource to a California Native American tribe.

AB 52 requires lead agencies to provide notice of projects to tribes that are traditionally and culturally affiliated with the project's geographic area if they have requested to be notified, in writing, of projects in the geographic area that is traditionally and culturally affiliated with the tribe, and the tribe responds, in writing, within 30 days of receipt of the formal notification of a project and requests consultation (Public Resources Code, Section 21080.3.1.). [3]

As part of the consultation process, the parties may propose mitigation measures, including those capable of avoiding or substantially lessening potential significant impacts to a Tribal Cultural Resource or alternatives that would avoid significant impacts to a Tribal Cultural Resource (Public Resources Code Section 21080.3.2, 21084.3). Section 21080.3.2(b) provides: "The consultation process shall be considered concluded when either of the following occurs: (1) The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource. (2) A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached."

AB 52 Methodology

The identification of tribal cultural resources that might be affected by the proposed Project is based on the County's application of California Public Resources Code section 21074, after consulting with the Amah Mutsun Tribal Band. California Public Resources Code section 21074 defines a Tribal Cultural Resource as noted above in the "Assembly Bill 52 Tribal Cultural Resources."

There are no tribal cultural resources in the Project area that are included in a local register of historic resources; therefore, the evaluation of whether cultural resources meet the definition of tribal cultural resources in Public Resources Code section 21074 is based on the eligibility criteria for listing on the CRHR, which are set forth in Public Resources Code section 5024.1 (c). (Public Resources Code section 21074(a)(2)). Those criteria are whether the resource meets any of the following four criteria for listing on the CRHR:

(1) is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

(2) is associated with the lives of persons important in our past;

(3) embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

3 Consultation has the same meaning under AB 52 as provided in Government Code Section 65352.4: "consultation' means the meaningful and timely process of seeking, discussing, and considering carefully the views of others, in a manner that is cognizant of all parties' cultural values and, where feasible, seeking agreement. Consultation between government agencies and Native American tribes shall be conducted in a way that is mutually respectful of each party's sovereignty. Consultation shall also recognize the tribes' potential needs for confidentiality with respect to places that have traditional cultural significance."

(4) has yielded, or may be likely to yield, information important in prehistory or history. (See also Title 14, Cal. Code Regs. Section 4852 (criteria for listing on the CRHR), and Section 15064.5(a)(3) of the CEQA Guidelines).

The lead agency must also consider the significance of the resource to the Tribe (Public Resources Code section 21074(a)(2)). PRC Section 21080.3.1(a) recognizes that California tribes may have expertise regarding tribal history and practices concerning the tribal cultural resources with which they are traditionally and culturally affiliated.

According to State Office of Historic Preservation Guidelines (California Code of Regulations, Title 14, Chapter 11.5, Section 4850 *et seq*), a "site" is a type of resource that may be eligible for nomination to the CRHR and is defined as follows:

> A site is the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined, or vanished, where the location itself possesses historical, cultural, or archeological value regardless of the value of any existing building, structure, or object. A site need not be marked by physical remains if it is the location of a prehistoric event, and if no buildings, structures, or objects marked it at that time. Examples of such sites are trails, designed landscapes, battlefields, habitation sites, Native American ceremonial areas, petroglyphs, and pictographs (Title 14, Cal. Code Regs. Section 4852(a)(2)).

The integrity of a resource is also an important factor in establishing significance. "Integrity is the authenticity of an historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance. Historical resources eligible for listing in the California Register must meet one of the criteria of significance described in section 4852(b) of this chapter and retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reasons for their significance" (Title 14, Cal. Code Regs. Section 4852(c)). An evaluation of integrity considers the retention of location, setting, design, materials, workmanship, association and feeling. These aspects are judged with reference to the particular criteria under which the resource is proposed for eligibility. Alterations to a resource or historic changes in its use may also have historical, cultural, or architectural significance. A resource that has lost its historic character or appearance may still have sufficient integrity for the CRHR if it maintains the potential to yield significant scientific or historical information or specific data (Title 14, Cal. Code Regs. Section 4852(c)).

With respect to cultural landscapes, Public Resources Code Section 21074(b), provides: "A cultural landscape that meets the criteria of subdivision (a) is a tribal cultural resource to the extent that the landscape is geographically defined in terms of the size and scope of the landscape." California statutes and regulations do not provide specific guidance with respect to "sacred places."

Significance of a Project's Effects on a Tribal Cultural Resource

Pursuant to AB 52, "[a] project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment" (Public Resources Code Section 21084.2). A "substantial adverse change" is defined above. (CEQA Guidelines Section 15064.5(b)(1).)

Consideration of Mitigation Measures and Alternatives under AB 52

Any mitigation measures or alternatives that are agreed upon during the consultation process between the lead agency and the Tribe pursuant to Public Resources Code section 21080.3.2 that are capable of avoiding or substantially lessening the potential significant impacts to a Tribal Cultural Resource must be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, and shall be fully enforceable (Public Resources Code, Section 21082.3). If, however, the mitigation measures recommended by staff of the lead agency as a result of the consultation process are not included in the environmental document, or if there are no agreed upon mitigation measures at the conclusion of the consultation, "and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to subdivision (b) of Section 21084.3" (Public Resources Code, Section 21082.3(e)).

Public Resources Code section 21084.3(a) requires public agencies to avoid damaging effects to any Tribal Cultural Resource, when feasible. Section 21084.3(b) provides that: "If the lead agency determines that a project may cause a substantial adverse change to a tribal cultural resource, and measures are not otherwise identified in the consultation process provided in Section 21080.3.2, the following are examples of mitigation measures that, if feasible, may be considered to avoid or minimize the significant adverse impacts:

(1) Avoidance and preservation of the resources in place, including, but not limited to, planning and construction to avoid the resources and protect the cultural and natural context, or planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.

(2) Treating the resource with culturally appropriate dignity taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:

    (A) Protecting the cultural character and integrity of the resource.

    (B) Protecting the traditional use of the resource.

    (C) Protecting the confidentiality of the resource.

(3) Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.

(4) Protecting the resource.

AB 52 Consultation Summary

AB 52 requires lead agencies to provide notice of projects to tribes that are traditionally and culturally affiliated with the project's geographic area if they have requested to be notified, in writing, of projects in the geographic area that is traditionally and culturally affiliated with the tribe, and the tribe responds, in writing, within 30 days of receipt of the formal notification of a project and requests consultation (Public Resources Code, Section 21080.3.1.).[4]

As part of the consultation process, the parties may propose mitigation measures, including those capable of avoiding or substantially lessening potential significant impacts to a Tribal Cultural Resource or alternatives that would avoid significant impacts to a Tribal Cultural Resource (Public Resources Code Section 21080.3.2, 21084.3). Section 21080.3.2(b) provides: "The consultation process shall be considered concluded when either of the following occurs: (1) The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource. (2) A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached."

For this Project, the County of Santa Clara received a request for consultation under AB 52 from the Amah Mutsun Tribal Band of Costanoan/Ohlone Indians in October 2016. The following table summarizes the consultation activities that occurred between the Tribe and the County of Santa Clara as part of the consultation process (**Table 3.5-1**).

Following conclusion of the consultation in December 2019,[5] the County determined that additional information was needed from the Tribe to complete the environmental analysis. An additional interview was conducted with the Tribe on April 16, 2021. The Tribe provided written responses to the interview questions on May 13, 2021.

3.5.2.3 Local

County of Santa Clara Historic Preservation Ordinance

The Historic Preservation Ordinance, set forth in Division C17 of the County of Santa Clara Ordinance Code, is intended to identify, protect, preserve, and enhance historic resources representing distinctive historical elements (i.e., cultural, social, and economic) of Santa Clara County. The Historic Preservation Ordinance regulates landmark designations, landmark alterations, demolition of historical resources, and provides incentives for historic resource preservation. The County also maintains a list of identified historic resources and landmarks within the County's jurisdiction known as the heritage resource inventory.[6]

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4 Consultation has the same meaning under AB 52 as provided in Government Code Section 65352.4: "consultation' means the meaningful and timely process of seeking, discussing, and considering carefully the views of others, in a manner that is cognizant of all parties' cultural values and, where feasible, seeking agreement. Consultation between government agencies and Native American tribes shall be conducted in a way that is mutually respectful of each party's sovereignty. Consultation shall also recognize the tribes' potential needs for confidentiality with respect to places that have traditional cultural significance."

5 The AB 52 consultation process concluded because, per Public Resources Code Section 21080.3.2, the County concluded after reasonable effort and acting in good faith, that mutual agreement could not be reached as to measures to mitigate or avoid significant effects on tribal cultural resources. The County fully considered the proposed mitigation measures submitted by the Tribe before reaching this conclusion. The Tribe maintained that impacts to tribal cultural resources cannot be fully mitigated.

6 Santa Clara County. Historic Resources Inventory. Accessed January 30, 2018. https://www.sccgov.org/sites/dpd/Programs/HistoricPreservation/Pages/Inventory.aspx.

TABLE 3.5-1
AB 52 CONSULTATION SUMMARY OVERVIEW

Consultation Action	Date
1. County receives Amah Mutsun Tribal Band Resolution No. 03-2016 opposing Sargent Quarry Project on “Unique Ancestral Tribal Lands at Juristac”	10/10/16
2. Letter received from Berkey Williams LLP on behalf of the Tribe requesting formal consultation under AB 52	10/13/16
3. Initial AB 52 consultation meeting to discuss EIR process and reports to be prepared, solicit feedback on potential impacts and mitigation measures	5/17/17
4. County receives comments from the Tribe on the draft archaeological resources report	6/5/17
5. First site visit with County staff, tribal representatives, the Project applicant, archaeologist, and ethnographer Far Western	6/15/17
6. Far Western contacted the NAHC and requested a Sacred Lands Search and Native American Contact List	9/18/17
7. County receives comments from the Tribe on the scope for the ethnographic study	10/5/17
8. Far Western notified parties on the County’s interested parties list for the Project (including the Tribe) of the Project via letter; additional follow up was conducted via email and phone calls on 11/14/17 and 11/20/17	11/7/17
9. County receives letter from Shute, Mihaly &Weinberger, LLP (representing the Tribe) regarding the CEQA review process and potential cultural and biological resources issues	1/19/18
10. Second site visit with County staff, the Tribe, and ethnographer	2/13/18
11. County receives comments from the Tribe on the draft ethnographic study (Ethnohistory and Ethnographic Study of Juristac ("Sargent Ranch Project"))	7/6/18
12. County responds to Tribe’s July 6, 2018 comments on draft ethnographic study	9/13/18
13. Tribe receives administrative draft of EIR Tribal Cultural Resources Section	9/13/18
14. Second AB 52 consultation meeting between the County and the Tribe to discuss the ethnographic study results, Project impacts, potential mitigation measures, alternatives, and the EIR process	9/20/18
15. County receives comments from the Tribe on administrative draft of EIR Tribal Cultural Resources Section, including archaeological resources and tribal cultural resources mitigation measures, and a request for a meeting with the County to discuss the Tribe’s comments and requested mitigation measures	10/5/18
16. County sends revised draft archaeological resources and tribal cultural resources mitigation measures to the Tribe for review	11/20/18
17. Responses to Tribe’s requests for mitigation measures sent by the County	11/27/18
18. Berkey Williams LLP, on behalf of the Tribe, sent the County, via e-mail, the Tribe’s comments on the revised archaeological resources and tribal cultural resources mitigation measures and reiterated the Tribe’s availability for a meeting to discuss the comments and requested mitigation measures.	12/4/18
19. Final AB 52 consultation meeting to discuss the EIR process and final comments on mitigation	10/8/19
20. County sends Tribe the revised administrative draft of EIR Cultural and Tribal Resources Section	10/31/19
21. Tribe responds to revised administrative draft of EIR Cultural and Tribal Resources Section	11/8/19
22. County notifies Tribe in a letter that the AB 52 consultation process has concluded [a]	12/12/19

NOTES:

a. The AB 52 consultation process concluded because, per Public Resources Code Section 21080.3.2, the County concluded after reasonable effort and acting in good faith, that mutual agreement could not be reached as to measures to mitigate or avoid significant effects on tribal cultural resources. The County fully considered the proposed mitigation measures submitted by the Tribe before reaching this conclusion. The Tribe maintained that impacts to tribal cultural resources cannot be fully mitigated.

Santa Clara County General Plan

The County of Santa Clara adopted its General Plan in 1994. The document provides a comprehensive approach to identifying and addressing cultural resources (referred to as heritage resources). The general plan identifies three strategies for protecting heritage resources:

- Strategy #1. Inventory and Evaluate Heritage Resources
- Strategy #2. Prevent, or Minimize, Adverse Impacts on Heritage Resources
- Strategy #3. Restore, Enhance, and Commemorate Resources as Appropriate

The general plan also acknowledges the challenges for preserving heritage resources in urban settings versus rural settings, such as the Project area, and provides similar but different policies for each setting. Section RC of the Santa Clara County General Plan (County of Santa Clara 2015) addresses cultural and tribal resources that may be considered "heritage resources." There are two general policies that guide implementation of the strategies in rural settings:

> ***Policy R-RC 81**:* Heritage resources within rural unincorporated areas shall be preserved, restored wherever possible, and commemorated as appropriate for their scientific, cultural, historic, and place values.
>
> ***Policy R-RC 82**:* The following strategies should provide overall direction to efforts to preserve heritage resources:
>
> - Inventory and evaluate heritage resources.
> - Prevent, or minimize, adverse impacts on heritage resources.
> - Restore, enhance, and commemorate resources as appropriate.

Other resource policies that pertain to this Project include the following:

> ***Policy R-RC 85**:* No heritage resource shall knowingly be allowed to be destroyed or lost through a discretionary action (zoning, subdivision site approval, grading permit, building permit, etc.) of the County of Santa Clara unless: a. the site or resource has been reviewed by experts and the County Historic Heritage Commission and has been found to be of insignificant value; or b. there is an overriding public benefit from the project and compensating mitigation to offset the loss is made part of the project.
>
> ***Policy R-RC 86**:* Projects in areas found to have heritage resources shall be conditioned and designed to avoid loss or degradation of the resources. Where conflict with the resource is unavoidable, mitigation measures that offset the impact may be imposed.
>
> ***Policy R-RC 88**:* For projects receiving environmental assessment, expert opinions and field reconnaissance may be required if needed at the applicant's expense to determine the presence, extent, and condition of suspected heritage resources and the likely impact of the project upon the resources.
>
> ***Policy R-RC 92**:* The participation of concerned citizens and professionals dealing with heritage resources in the identification of sites and the review and conditioning of projects by its boards and commissions shall be encouraged by the County.

3.5.3 Environmental Setting

3.5.3.1 Ethnographic Context

As discussed in the ethnographic study by Albion (2021), the Ohlone, also known as the Costanoans, occupied a large part of the San Francisco Bay Area (and beyond) at the time of European contact in the late eighteenth century. This area of occupation extended from the San Francisco Peninsula south to the northern part of Big Sur and included parts of the East Bay north and east to the Sacramento–San Joaquin River Delta, and the Santa Clara Valley down to San Juan Bautista. This larger Ohlone territory was further divided into a number of subdivisions based on language dialects. Ohlone territory during the European contact period was occupied by numerous tribal groupings and villages; however, historical sources do not explicitly delineate tribal boundaries. For most parts of west-central California, approximate tribal locations can be determined indirectly, based on marriage patterns and baptism records.

The *Uñijaimas*, the *Ausaimas*, and the *Motsun* were the three major Ohlone tribelets occupying the ethnographic study area in the vicinity of the Pajaro River at its confluence with the San Benito River. Tribelet is the basic unit of Ohlone political organization. The Amah Mutsun Tribal Band (Tribe) today connects its roots to these three Ohlone tribelets.

The *Uñijaima* people were associated with the villages of *Carneadero*, *Saisin*, *Tebletac*, *Thirthiri*, and *Tipisastac* (north of the Project area). The *Ausaimas* occupied the eastern side of the southern Santa Clara Valley, in the vicinity of Pacheco Creek, and their major villages included *Poytoquix*, *Jupagtac*, *Upunixmum*, *Ssuric-numa*, and *Tipumin*. The *Motsun* occupied the area south of the *Uñijaimas*. The southern boundary of the *Uñijaimas* was likely located at the Pajaro River, and *Motsun* territory was located south of the Pajaro River. It is possible that *Juristac* (or *Jurestaca*) was a *Motsun* village north of the Pajaro River.

Subsistence and Religion

Ohlone people built permanent villages and seasonal campsites throughout their ancestral territory. They would travel across this territory to hunt and gather seasonally available resources such as oak, salmon, berries, deer, rabbit, and important basketry and medicinal plants. Ohlone people traded raw materials and finished crafts with other villages and Tribal cultures outside of their ancestral area, in addition to meeting their own needs.

The Ohlone are a deeply spiritual people who continue to practice ceremonial traditions that pre-date missionization. Many of these traditions pertain to the Project area and have been documented in a confidential ethnographic study prepared as part of the environmental review for the Project. This study documents Ohlone religion, and cosmology, provided through consultation with Ohlone Tribal elders and cultural experts and supplemented with data collected by early ethnographers and within the historical record. Central to the ceremonial values of the Sargent Ranch region is the ancestral figure of *Kuksui*, who made his home in these hills and came in spirit to nearby Ohlone villages.

Mission Period

In the late 1700s, Spanish exploratory expeditions passed through southern Santa Clara Valley. The expeditions encountered a number of Native villages in the vicinity of Tar Creek and the Pajaro River (i.e., the general location of Sargent Ranch). Spanish accounts from the time indicate that the southern Santa Clara Valley was an area of extensive indigenous habitation. The three major Ohlone tribelets occupying the ethnographic study area (*Uñijaimas*, the *Ausaimas*, and the *Motsun*) were forced into the missions at San Juan Bautista, Mission San Carlos Borromeo, Santa Clara de Asís, and Santa Cruz.

Mission San Juan Bautista was founded in 1797 along the route that would become the El Camino Real, in an area the Native peoples called *Popeloutchom.*[7] Native Americans living at Mission San Carlos Borromeo (in Carmel) were taken to Mission San Juan Bautista and new converts came from villages and tribes in the surrounding area. Despite acts of Native American resistance, the mission continued to take Native Americans for baptism. Between 1797 and 1807, a large portion of the surrounding region's Native population was forced into the mission and placed under the control of the mission padres. In 1800, 275 *Mutsun* were taken to the mission, enslaved, and baptized.

Following significant deaths from disease due to unsanitary and inhumane conditions at the mission in the early 1800s, indigenous people from the Central Valley and Sierra Miwoks were brought into the mission to manage the expanding ranchlands and herd animals. Outstations, where livestock could be raised away from the Mission itself, were established. These outstations were located on lands formerly occupied by Native peoples and villages. The mission put these lands into "trust," until such time that reorganization of indigenous life consistent with Spanish ways had been achieved (i.e., until the Native peoples had become Hispanicized). Mission San Juan Bautista owned and operated seven outstations, including *Natividad, Aromas, La Brea, San Felipe, Pagsines, Santa Ana*, and *San Matias*.

La Brea was located on land centered on the Sargent Hills in the vicinity of Sargent Ranch extending from Carnadero in the north to the Pajaro River/San Benito River confluence in the south. It is likely that *La Brea* (*brea* is Spanish for tar) derived its name from Tar Creek. While most of *La Brea* was grazing land, the mission outstation also contained an adobe, corrals, and kitchen. *La Brea* was also an important place for the Mission Indians, families permanently occupied the outstation during those years as a center for managing herds of livestock in the vicinity. Archaeological investigations did not, however, uncover significant evidence of this outstation. The outstation may have been located at SCL-577/H, where a few artifacts were found indicative of the mission outstation. Additional investigations focused on the historic-era component would be needed to determine the connection between the site and the mission outstation.

Post-Mission Period (Secularization)

The mission padres managed *La Brea* until 1834, when church properties were confiscated by civil authorities and Native Americans were emancipated from Mission San Juan Bautista. Two brothers, Antonio and Faustino German, acquired the title to Sargent Ranch (and surrounding

[7] The term *Popeloutchom* is generally considered by the Tribe to be a Native region rather than a village name.

lands) during secularization in 1835, having already lived there for a number of years, and constructed adobe houses on the site. During the land transfer, the name changed from *Rancho La Brea* to *Rancho Juristac*.

Native people were living in the area of *Rancho Juristac* immediately after post-secularization, including ancestors of today's Amah Mutsun Tribal Band members (including Ascensión Solórsano's family). Ascensión Solórsano is the cultural bearer of the Tribe and she lived on a now-demolished house on Sargent Ranch. Ascensión Solórsano's teachings and practices carry special significance for the Tribe.

The Tribe recovered knowledge of their ancestral ways of life from the more than 75,000 pages of notes of the Tribe's oral history (as told to John P. Harrington, an early ethnographer during the 1920s and 1930s), most of which came from Ascensión Solórsano. The Tribe recognizes these notes as an essential body of knowledge of their traditions and honors them as scriptural texts. There were several post-mission villages, or rancherias, where emancipated Native peoples found refuge upon the collapse of the mission system. The German brothers apparently wanted the Native peoples living at *Rancho Juristac* evicted but were halted from doing this by civil authorities and a compromise was agreed to where the Native peoples would be allowed to occupy the area at the confluence of Pescadero Creek and the Pajaro River.

In 1856, Faustino German sold a portion of the property to the Sargent brothers, but several Native peoples continued to live on the land through 1856 and beyond after the property was sold. The Project area and portions of greater Sargent Ranch continued to be used for ranching throughout the late 1800s and early 1900s. When James Sargent died in 1900, he passed on his estate to his children; however, according to records, most of the Native peoples had left or were evicted by 1936.

Recent History

By the time anthropologists began their studies of the California Indians in the early twentieth century, many of the tribes' pre-contact cultural traditions had been forgotten. During the Mission Period, Franciscan fathers discouraged or banned Ohlone customs, rites, and rituals.

Further, as a result of disease and birth rate declines, the Ohlone population fell from approximately 10,000 in 1770 to less than 2,000 in 1832. Limited knowledge of their language, lifestyle, and material culture was preserved by the few surviving Ohlone and was supplemented by eighteenth century Spanish letters, diaries, and archival information drawn from the ethnographic record left by pioneer ethnographer J. Peabody Harrington. From this information and archaeological investigations of the area, ethnographers have been able to piece together information related to traditional Ohlone culture at the time of European contact.

3.5.3.2 Archaeological Resources Context

As discussed in the Cultural Resources Sensitivity Assessment for the Sargent Ranch Project by Far Western (2017a), the Santa Clara Valley landscape has changed significantly during the last 15,000 years. Floodplains and alluvial fans of the Santa Clara Valley experienced repeated cycles of deposition, erosion, and stability, processes that have strongly influenced the condition of the local archaeological record. The potential for surface prehistoric archaeological sites to be located within the Project area was assessed.

The potential for unidentified surface prehistoric archaeological sites to be located within the Project area was assessed using a weighted model recently created for the San Francisco Bay-Delta Region that includes all Santa Clara County (Far Western, 2017a). This model considers three environmental factors—surface slope, determined using a digital elevation model; distance to a historic-era stream; and distance to a stream confluence. Results identify areas of greater or lesser sensitivity for prehistoric surface sites.

Areas assessed as having the highest potential (high or highest sensitivity) for prehistoric and historic-era surface archaeological sites were surveyed. A pedestrian transect survey of the site was completed between October 23 and 26, 2017. The survey team focused on areas with the highest surface site potential, while excluding the extremely steep slopes categorized as having the low and lowest potential for archaeological surface sites. In-field assessments of topography and archaeological potential were also made. Revisions to the site sensitivity maps, based on on-the-ground observations, were completed.

Archaeological sensitivity maps indicate that the potential for prehistoric surface sites is lowest to low in the majority of the Project mining areas, with the high to highest potential at the processing plant and a portion of the permanent overburden stockpile area, Phase 1 and Phase 2 mining areas, and along much of the existing roadways (including Old Monterey Road).

The potential for buried prehistoric sites in the Project area was also assessed and is lowest to low in approximately 90 percent of the Project area. The majority of the high potential area is adjacent to Tar Creek at the processing plant and permanent overburden stockpile area, with a small amount of highest potential area located along Old Monterey Road near Tick Creek.

Because of its long history as a major transportation corridor extending back to the 1770s, the Project area is also sensitive for historic-era archaeological sites. Areas with the greatest potential for historic-era archaeological resources include areas related to El Camino Real, La Brea Mission, Antonio and Faustino German Adobe, the stagecoach road, and Carnadero School (described further below).

3.5.3.3 Historic Context

The Project area is located within the Highway 101 corridor between San Juan Bautista and Gilroy which has been a primary artery of travel and commerce since the initial settlement of the northern Alta California frontier by Spain in the late eighteenth century. As discussed in the Far Western cultural resources sensitivity assessment (2017a), the route became a primary corridor of travel (part of El Camino Real) between the Bay Area and Monterey, and later to the mission established in 1797 at San Juan Bautista. In the early years of the nineteenth century, the mission fathers at San Juan Bautista established outlying ranchos in the valleys and foothills along this traveled way. Established in 1803, San Juan Bautista mission's La Brea Rancho was located north of the Pajaro River in the vicinity of Carnadero (the butchering place) where Tic Creek emerged from the Santa Cruz Mountains and drained into Carnadero Creek.

Later, a stagecoach stop between San Jose and Monterey along El Camino Real was founded in the Project vicinity. The stage road departed from El Camino Real in the vicinity of Tar Creek and climbed uphill southwesterly, paralleling Sargent Creek to the Pajaro River to Monterey Bay. The stage road remained active until the 1880s. Since the 1870s, the Highway 101 corridor has also supported railroad traffic with a station strategically located near the convergence of the Old Monterey Road and the Pajaro River crossing. Historic-era buildings (depot, express office, post office, hotel, saloon, open-air dance floor, gas station, etc.) were once associated with the station and town of Sargent but are now gone.

The Sargent brothers emerged as the principal owners of property along the El Camino Real corridor (later known as State U.S. 101) in southern Santa Clara County at the start of the century. The 10,000-acre Sargent Ranch extended from the former Juristac Rancho westerly into the Sargent Hills and the Pescadero Creek watershed. The ranch was originally headquartered at the Faustino German adobe site in the vicinity of where Tar Creek crossed El Camino Real, at a place later named Corporal. Haciendas were later established along El Camino Real where Tic Creek and Tar Creek emerge from the foothills along Old Monterey Road at Sargent Ranch.

3.5.3.4 Known Archaeological and Historic Resources

Table 3.5-2 summarizes the known archaeological and historic resources in the Project area and their eligibility for the NRHP and CRHR registers (Far Western Anthropological Research Group, Inc. 2017b). One of these resources is eligible for the NRHP and CRHR registers: Prehistoric midden with known human burials within the Antonio German Adobe and Farm Complex: CA-SCL-577/H. Although the prehistoric component of CA-SCL-578/H was found to be ineligible for NRHP and CRHR, the exact location and significance of buried historic-era resources associated with CA-SCL-578/H are unknown and have not been evaluated.

Antonio German Adobe and Farm Complex: CA-SCL-577/H

The Antonio German adobe and farm complex was located immediately adjacent to Old Monterey Road (in the vicinity of the Project entrance from U.S. 101) between two small drainages converging at Tic Creek. In the 1830s, it was occupied primarily by Antonio, his wife and children, and several farm laborers. Census data from 1833 to 1852 suggest that there must have been multiple dwellings constructed at the site. The site consists of two components dating to the prehistoric and historic periods.

The prehistoric component is comprised of a moderately large, intact midden deposit that extends to a depth of 2.3 feet, as well as flaked stone tools and flaking debris, ground stone tools, and vertebrate faunal remains. Human burials are also present. The deposit dates predominately to the Early (4500–2500 BP[8]) and Middle (2500–850 BP). The prehistoric component at SCL-577/H was found eligible for the NRHP. It is therefore also eligible for the CRHR.

8 BP (Before Present)

TABLE 3.5-2
SUMMARY OF ARCHAEOLOGICAL AND BUILT ENVIRONMENT RESOURCES

Resource	Resource Description	Register Eligibility
Antonio German Adobe and Farm Complex: CA-SCL-577/H	Prehistoric midden with known human burials	NRHP and CRHR eligible
	Buried historic-era artifacts from Spanish and Mexican occupation, and the Mission and Rancho Periods	Insufficient data to evaluate the historic-era component
Faustino German Adobe and Ranch Complex: CA-SCL-578/H (includes the Sargent Ranch Complex)	Highly disturbed prehistoric flaked stone deposit with pockets of midden	Ineligible for NRHP and CRHR
	Historic-era artifacts related to the Spanish and Mexican occupation	Unevaluated
	Four historic-era structures (residence, barn, shed, corral)	Ineligible for NRHP and CRHR
Bloomfield Horse Ranch: P-43-000855	Five historic-era structures buildings (two residences, two sheds, stables)	Ineligible for NRHP, CRHR eligibility unevaluated
Carnadero School: 101-2H/P-43-002462	Site of demolished Carnadero school building; low probability of archaeological deposits	Unevaluated (avoided by Project)
Old Monterey Road/Old State Route 2: P-43-003850	Historic-era (concrete and asphalt) road alignment, continually used and maintained	Ineligible for NRHP and CRHR
Tick Creek and Tick Creek Culverts: P-43-000872 and P-43-000873	Box culverts along Old Monterey Road	Unevaluated (avoided by Project)
Road Alignment: Th-03	Paved and striped asphalt road	Ineligible for NRHP and CRHR

NOTES:
* Trinomial identification numbers have been simplified for the purposes of this report and summary table.

Abundant nineteenth-century artifacts were recovered during testing of the prehistoric component in 1993, including ceramic sherds indicative of Spanish and Mexican sites, and floor and roof tiles characteristic of Mission- and Rancho-Period sites. The current site boundary does not indicate the extent of the historic-era component. The State Historic Preservation Officer determined that not enough data was produced from the 1990 excavations to allow for evaluation of the historic-era component. It is possible that additional historic-era archaeological resources are present in the vicinity. Because the people who were associated with this site have been identified, and that population base appears to have been relatively stable, it enhances the site's potential to yield important information.

Faustino German Adobe and Ranch Complex: CA-SCL-578/H

The Faustino German Adobe and Ranch Complex was located immediately adjacent to the Old Monterey Road near Tar Creek. Faustino and his wife lived in a small, two to three room single-story adobe, but employed many ranch hands of Hispanic descent and Native Americans who resided at the adobe or in nearby dwellings. Census data from 1852 suggest that there were as many as two dozen people residing on Faustino's ranch. Numerous buildings (associated with the Sargent Ranch headquarters) have been erected and demolished at the site of the Faustino German adobe. Over the long period of occupation by multiple generations of Sargent family members, railroad and highway construction has impinged on the Sargent Ranch complex and resulted in buildings being torn down or relocated and roads being realigned. The site consists of two components dating to the prehistoric and historic periods.

The prehistoric component of SCL-578/H is a highly disturbed deposit consisting of flaked stone and a few pockets of midden located beneath and just west of U.S. 101. SCL-578/H was previously evaluated and found ineligible for the NRHP with State Historic Preservation Officer concurrence; therefore, it can also be considered ineligible for the CRHR.

In depth analysis was not conducted on the historic-era artifacts recovered during evaluation of the prehistoric component. Historic-era artifacts observed include ceramics, glass, and nails. It is possible that the historic-era assemblage recovered is not reflective of all activities at the site. Significant remains of the Faustino German adobe—architectural remains and artifact deposits—could be present on the property. Archaeological resources related to the Spanish and Mexican Periods of California history are rare and can make significant contributions to our understanding of this important and poorly documented time period. Historic-era artifact deposits from this site have never been analyzed and therefore do not provide additional evidence as to the site's early occupation. It is also possible that additional historic-era artifact deposits are located in the vicinity outside of the Project area boundary.

Sargent Ranch Complex: CA-SCL-578/H

Four historic-era structures (a residence and shed, barn, and corral) composing the Sargent Ranch Complex are adjacent to the Old Monterey Highway/access road and Tar Creek, north of the proposed processing plant. These structures were constructed between 1914 and 1939 and are described below.

The residence is an approximately 930-square-foot bungalow with a side-gable roof sheathed with composition shingles and exposed angle brackets. The building has a rectangular footprint with an enclosed partial-width porch extension and board-and-batten wood siding, as shown in the photo to the right. Immediately west of (behind) the house is an approximately 1,300-square-foot wood frame storage shed, which has a rectangular footprint, a side-gable roof with corrugated-metal sheathing, and an open north-facing façade (see **Figure 3.5-2**).

At the west end of the complex is an approximately 3,000-square-foot, wood-frame transverse barn, which has a square footprint, concrete foundation, and steeply pitched gable roof with extended peaks above the hay doors (see **Figure 3.5-3**). The barn has corrugated metal siding and roofing, except for north-side vertical wood board siding, as shown in the photo below. Several of the doors appear to have fallen off the structure, as shown below.

West of these structures is the three-acre cattle corral, containing a network of metal pipe fencing and gates and wood structures, as shown in the photo below (see **Figure 3.5-4**). Near the center of the enclosure is a wood-frame shade structure, which appears to have a gable roof sheathed with corrugated metal.

None of these structures meets the criteria for listing in the NRHP or the CRHR because they do not have sufficient historical significance. Nor are the structures located on the County's heritage resource inventory.

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Figure 3.5-2
Residence Associated with CA-SCL-578/H

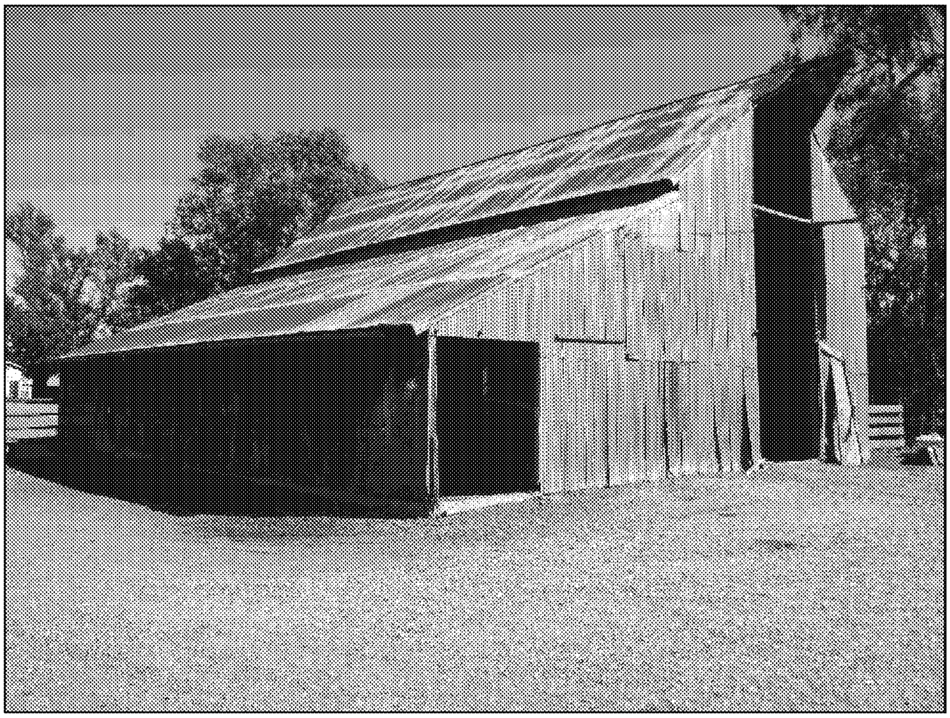

Figure 3.5-3
Barn Associated with CA-SCL-578/H

Figure 3.5-4
Corral Associated with CA-SCL-578/H

Bloomfield Horse Ranch: P-43-000855

Historic-era site P-43-000855 is the Bloomfield Horse Ranch, located at 3201 Monterey Road adjacent to the Project entrance from U.S. 101, though outside of the defined Project area. The property complex comprises five buildings—two single-family residences built in the 1920s to the 1930s, equipment shed built around 1955, horse stables built around 1920 and 1950, and a stock shed built in the 1940s. The property has been deemed ineligible for the NRHP but has not been assessed for eligibility for the CRHR or for local significance.

Carnadero School: 101-2H/ P-43-002462

Historic-era site P-43-002462 is the location of the now-demolished Carnadero school building, which operated on the west side of Old Monterey Road (which would be improved as part of the Project) just north of Tick Creek, from around 1870 to 1920. The Carnadero school served children who lived at the south end of the Santa Clara Valley. The location of the school (along the Project access road) has not been previously examined or tested for archaeological deposits, but the site would be avoided by the proposed Project.

Old Monterey Road/Old State Route 2: P-43-003850

Old Monterey Road was originally developed as a county wagon road in 1858 and later converted to State Route 2 in 1914. This section of Old Monterey Road/Old State Route 2 is located in the vicinity of the original El Camino Real alignment first travelled by foot, horseback, and ox carts during the era of Spanish colonial settlement in the late eighteenth century. It also provided ready access to the Spanish- and Mexican-era missions and ranchos. Among those who frequented the route were the mayordomo and herdsmen who cared for San Juan Bautista mission sheep and cattle and operated a waystation for travelers at the mission's La Brea Rancho (Far Western, 2017b).

In 1853, the County of Santa Clara Board of Supervisors commissioned construction of an improved county road between Gilroy and San Juan Bautista that roughly followed the El Camino Real alignment. The road, which came to be known as the Monterey-San Juan Road, and later Old Monterey Road, was completed in 1858. In the early twentieth century, the State of California Highway Commission adopted the route as State Route 2, and in 1914 completed a project to widen the road to 15 feet and to pave it with concrete. Later, between 1924 and 1926, the concrete was overlain with asphalt and slightly widened. In the Project area, the road was replaced as a main access route by the current alignment of U.S. 101 in 1949. Old Monterey Road/Old State Route 2 has since functioned as an access road for Sargent Ranch and adjacent properties (Far Western, 2017b).

As discussed in the Far Western Supplemental Cultural Resources Survey Report (2017b), the roadway in the Project area was deemed ineligible for listing on the NRHP and CRHR, and did also not appear to be a historical resource defined by CEQA because it lacked integrity to its period of construction.

Tick Creek Culvert: P-43-000872 and Tick Creek Branch Culvert: P-43-000873

Both of these historic-era resources are appurtenant features of Old Monterey Road. The Tick Creek Culvert (shown below in **Figure 3.5-5**) is a double-box, board-formed concrete culvert with sacked concrete wingwalls and timber post railings along the roadway.

Figure 3.5-5
Tick Creek Branch Culvert

The Tick Creek Branch Culvert is a single-box, reinforced, board-formed concrete culvert with sacked concrete wingwalls, and downstream concrete rip-rap fortification. Timber post railings are located along the margins of the roadway above the culvert.

Both culverts were constructed in 1914 as part of the California Highway Commission's project to widen and pave to a two-lane automobile road. The sacked concrete wingwalls appear to be a later addition. These resources have not previously been evaluated for listing on the NRHP or CRHR but would be avoided by the proposed Project.

Abandoned Road Alignment: Th-03

This abandoned road alignment (shown below in **Figure 3.5-6)** is located to the east of U.S. 101 where wetland mitigation area is proposed. TH-03 travels east about 0.25 mile until it meets and follows the western bank of the Pajaro River for about 0.50 mile before extending in a meandering, northwesterly route for about another 0.50 mile, where it terminates at the intersection with an unnamed rural access road near Tar Creek. Th-03 is paved with asphalt with a solid yellow lane and is heavily overgrown. The segment is approximately 0.3 mile in length, with a fence line along the alignment in several places. This rural access road does not meet the criteria for listing in the NRHP or CRHR because it does not have sufficient historical significance.

Figure 3.5-6
Abandoned Road Alignment: Th-03

3.5.3.5 Tribal Cultural Resources

Tribal Cultural Resources (TCRs) Within the Project Area

The following information is based on the results of the confidential ethnographic and ethnohistoric study for the Sargent Ranch Project, completed by Albion Environmental, Inc. (Albion) and Environmental Science Associates (Albion, 2021), on behalf of the County of Santa

Clara. Through archival research, interviews, and consultation with the Tribe, four tribal cultural resources within the Project area were identified: 1) Juristac Tribal Cultural Landscape (JTCL) 2) Betevel Bluff, 3) SCL-577/H, and 4) SCL-578/H. **Table 3.5-3** summarizes the general location, integrity, and California Register of Historical Resources (CRHR) eligibility of each of the four tribal cultural resources within the Project site (Albion 2021).

Sargenta Village (CA-SCL-578/H)

As stated in Table 3.5-3, the JTCL encompasses the Project site and surrounding areas, including the village site of Sargenta, located in the vicinity of Sargent Station. As part of the JTCL, the Project site could contain resources, such as plants used for healing or ceremonies, used by inhabitants of a village within the JTCL, even where the village site itself is outside of the Project boundaries.

Historical records are complicated for Sargent Station. There were two railroad stations in or near the current Project area:

> **Sargent Station:** The Sargent residence appears on historic maps of the region as early as 1866, near the location of CA-SCL-578/H (Healy, 1866). The rail station was reportedly placed at the mouth of Tar Creek, approximately three miles east of the tar pits, established in 1869, at about the same location as the residence depicted on the 1866 map.
>
> **Betebel Station:** This station was built no later than 1880, at the location of CA-SCL-92/H, at the confluence of the Pajaro and San Benito rivers. A 1940 California Division of Highways As-Built Map depicts a rail station here, as well as a house and stone cabins, on the Sargent property (Caltrans 1940). It is specifically referred to as the Sargent Railroad Siding on archaeological records (Milliken et al. 1993; Nelson 1999; Shurkin et al. 1974), though it appears that this attribution is in error. The station is clearly depicted as "Betabel" on the 1915 USGS map of the area. The discrepancy may be a result of the depiction on the Caltrans As-Built—the map is clearly labeled "Sargent" but this may be only in reference to the property held there and not the name of the station or residence/cabins, which do not appear to have been separately named on the map.

Both station locations are along the Pajaro River riparian corridor, which facilitated the collection of medicinal plants, and both had Native American artifacts present when first recorded. The Sargenta Village community was known to be at the mouth of Tar Creek as late as 1882. The first village site, located near Sargent Station, was impacted by US 101 in 1936, which resulted in the destruction of the of the Sargent adobe and residential complex. The second site, Betabel Station, is shown on Caltrans as-built plans from 1940, as being completing destroyed.

For the reasons stated in Table 3.5-3, the original Sargenta site (CA-SCL-578/H) was determined to be eligible as an individual Tribal Cultural Resource under Criterion 1. The portion of the site within the Project footprint consists of a light artifact scatter; the main part of the village likely lay outside of the Project footprint. The existing archaeological data and historical literature suggest that the physical archaeological footprint of the second Sargenta village site (CA-SCL-92/H) does not extend into the Project site.

TABLE 3.5-3
SUMMARY OF GENERAL LOCATION, INTEGRITY, AND CALIFORNIA REGISTER OF HISTORICAL RESOURCES (CRHR) ELIGIBILITY OF EACH OF THE FOUR TRIBAL CULTURAL RESOURCES

	CRHR Criteria			
Tribal Cultural Resource	1. *Associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States.*	2. *Associated with the lives of persons important to local, California, or national history.*	3. *Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master, or possesses high artistic values.*	4. *Has yielded, or has the potential to yield, information important to the prehistory or history of the local area, California, or the nation.*
Juristac Tribal Cultural Landscape (JTCL). Place where the Tribe's spiritual traditions blended seamlessly with the habitation of the village sites, the numerous natural resources nearby, and the sacred areas of the springs, waterways, and hills. Encompasses the Sargent Hills and parts of the adjacent waterways, including Sargent Creek, Tar Creek, and Tick Creek, and includes numerous archaeological sites, resource collection areas, and landscape features.	**Eligible.** Value under Criterion 1 for its association with several important events, including creation of the Maksahjah (Sargent Hills), Big Head Dance, Noyola confronts the Mutsun evil spirit, the Healing of Barbara Solórsano, and Mutsun ceremonies.	**Eligible.** Associated with numerous individuals that are important to Mutsun and the AMTB culture, including Ascensión Solórsano, Kuksui, Kaknú, Noyola, other deities directly associated with the landscape, and shamans and doctors.	**Eligible.** Associated directly with shamanic and doctoring traditions of the Mutsun and the AMTB people, particularly the Spring of Eternal Water and the Juristac village location. Doctoring, healing, and leading ceremonies are master crafts in the AMTB culture.	**Eligible.** One of the purposes of the JTCL in the AMTB culture is to educate. It is the place where Ascensión Solórsano learned the craft of healing from Mutsun elders, and this experience led to her recording much of the history and culture of the AMTB with early-twentieth-century ethnographers. This knowledge forms the core of much of the AMTB identity.
	Integrity. Intact for location, setting, association, and feeling.	**Integrity.** Intact for location, setting, association, and feeling.	**Integrity.** Intact for location, setting, association, and feeling.	**Integrity.** Intact for location, setting, association, and feeling.
Betevel Bluff. A hill overlooking the confluence of the San Benito and Pajaro Rivers, in southern Santa Clara County. Evaluated in conjunction with the Juristac Tribal Cultural Landscape. Contributing element to that landscape, but has sufficient importance to the AMTB to be considered as an individual tribal cultural resource under AB 52.	**Eligible.** Associated with the Big Head Dance, an important healing ceremony held by the Mutsun at the Juristac village site that was near the confluence of the San Benito and Pajaro Rivers. During this ceremony, the creator deity Kuksui would descend the slope flying in a zigzag pattern on his way to the roundhouse. Also a place where Tribal people would go for renewal ceremonies and where shamans and doctors practiced their craft, at poles installed on the hillside.	**Eligible.** Associated with both Kuksui and the powerful headmen who lived and performed ceremonies at Juristac. The names of the headmen have been lost over time, but this does not detract from the importance of this place under Criterion 2	**Ineligible.** Betevel Bluff is associated with shamanic practices and the craft of shamanism of pre-contact Ohlone, and post-contact Mutsun and the AMTB. However, material evidence of that master craft, such as roundhouse remains, sacred springs, shamanic poles or other regalia features described in the oral histories and ethnographic accounts, are lacking from the Project Area.	**Eligible.** Betevel Bluff remains a prominent landscape feature wherein Tribal elders could take Tribal youth to teach them their culture and ceremonial history. Betevel Bluff has the potential to be used for teaching Tribal members about many of the historic themes identified for this resource: Indigenous Resistance and Survival, JTCL as Provider, JTCL as Home, and JTCL as a Place of Power.
	Integrity. Intact for location, setting, association, and feeling.	**Integrity.** Intact for location, setting, association, and feeling.	**Not applicable.**	**Integrity.** Intact for location, setting, association, and feeling.

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**TABLE 3.5-3 (CONTINUED)
SUMMARY OF LOCATION, INTEGRITY, AND CALIFORNIA REGISTER OF HISTORICAL RESOURCES (CRHR) ELIGIBILITY OF EACH OF THE FOUR TRIBAL CULTURAL RESOURCES**

	CRHR Criteria			
Tribal Cultural Resource	1. *Associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States.*	2. *Associated with the lives of persons important to local, California, or national history.*	3. *Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master, or possesses high artistic values.*	4. *Has yielded, or has the potential to yield, information important to the prehistory or history of the local area, California, or the nation.*
SCL-577/H. Multi-component, indigenous (precolonial) and historic-era archaeological site located at the northern end of the Project Area.	**Eligible.** Associated with pre-contact habitation of this area by Ohlone people. The presence of at least six burials here indicates the performance of burial ceremonies, important events in Ohlone traditions that consecrate the ground in which the burials are interred, creating a sacred place.	**Ineligible.** Historical research for and oral history of the Project did not identify any individuals associated with this location that would suggest CA-SCL-577/H has values under Criterion 2.	**Ineligible.** The site lacks a robust archaeological deposit or oral history accounts that could illustrate the materials, methods, and finished products needed to support an association with a master craft or craftsperson.	**Eligible.** CA-SCL-577/H contains the evidence, and example, of numerous past traditions, from tool production to ornamentation. The site has been found to have the potential for teaching archaeologists; this data potential also exists for Tribal people.
	Integrity. Intact for location, setting, association, and feeling.	**Not applicable.**	**Not applicable.**	**Integrity.** Intact for location, setting, association, and feeling.
CA-SCL-578/H. This multi-component archaeological site, which is located in the vicinity of the southern end of Old Monterey Road, is a contributing element to the JTCL, but has sufficient importance to the AMTB to be considered as an individual tribal cultural resource under AB 52.	**Eligible.** The historic component of CA-SCL-578/H is associated with the survival of post-contact Ohlone people. Refuge sites and places where Ohlone culture was preserved and passed forward by mission survivors are significant to the Ohlone, even if the site's current conditions cannot convey those values to non-Tribal people. Post-mission indigenous survival is an important event to the AMTB, and the places where post-contact Ohlone people sought safety and refuge have values under Criterion 1 for this association.	**Ineligible.** This historical research and oral history of the Project did not identify any individuals associated with this location that would suggest that CA-SCL-578/H has values under Criterion 2.	**Ineligible.** The site lacks a robust archaeological deposit or oral history accounts that could point to the types of activities that took place here. As such, the location lacks the context necessary to tie it to important crafts, arts, ceremonies, or traditions of Mutsun people and the AMTB.	**Eligible.** Although little of the site remains, this location is still important as a location where Tribal people can come to reflect on Ohlone survival during the Mission Period and the connection of this place to the larger JTCL.
	Integrity. Intact for location, setting, association, and feeling.	**Not applicable.**	**Not applicable.**	**Integrity.** Intact for location, setting, association, and feeling.

NOTE: The table is a summary of information from Chapter 5 of Ethnohistoric and Ethnographic Study of Sargent Ranch, Santa Clara County, California (Albion 2021).

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Juristac Tribal Cultural Landscape

The Juristac Tribal Cultural Landscape (JTCL) was, and continues to be, the most sacred landscape of the Mutsun people and the AMTB with immense spiritual and cultural value. The JTCL spans approximately 33 square miles from Gilroy in the north to Watsonville in the south. The entirety of the landscape as defined by the boundaries given to the AMTB is a Tribal Cultural Resource, which includes all hills and natural features on the Project site. The AMTB recognizes the JTCL's importance as a home to spiritual deities, tribal ceremonies, doctoring, a refuge, and a source of important plants, animals and fish. AMTB villages in the JTCL maintained the sacredness of the landscape.

The Juristac Tribal Cultural Landscape is considered a TCR. The character-defining features of the JTCL include nature features like springs, creeks, and rivers, and landscape features associated with tribal history, culture, and spirituality. Viewsheds comprising line of sight to Pacheco and Mariposa Peaks, native habitats, archaeological sites, trails, and ceremonial areas are also character-defining features of the JTCL. Specific character-defining features to the JTCL which overlap, adjoin or encompass the Project area include:

- Maksahjah, the Sargent Hills themselves, which are considered sacred
- Sargent Creek riparian and wildlife corridor
- Tar Spring Creek riparian corridor
- Trees of life—large live oak trees held sacred in Mutsun traditions
- Ancestral trails, especially those associated with the travel of important tribal figures, including deities and spirits
- Ceremonial areas associated with renewal, healing, resource collection, or harvesting
- Landscape features associated with Tribal history, culture, or spirituality

3.5.4 Impact Evaluation

3.5.4.1 Significance Criteria

The project would result in a significant impact on a cultural or tribal cultural resource if it would:

a) Cause a substantial adverse change in the significance of a historical resource pursuant to Section 15064.5;

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5;

c) Disturb any human remains, including those interred outside of formal cemeteries; or

d) Cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:

1. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or

2. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.

3.5.4.2 Project Impacts

Impact 3.5-1: The Project would cause a substantial adverse change in the significance of known historical or archaeological resources. (Less than Significant with Mitigation Incorporated)

Significance criteria (a) and (b) are applicable to this impact discussion. One of the identified resources listed in Table 3.5-1 is eligible for the NRHP and CRHR registers: Prehistoric midden with known human burials within the Antonio German Adobe and Farm Complex: CA-SCL-577/H. Although the prehistoric component of CA-SCL-578/H was found to be ineligible for NRHP and CRHR, the exact location and significance of buried historic-era resources associated with CA-SCL-578/H are unknown and could not be evaluated. Both resources are assumed to be CEQA-defined "historical resources" for purposes of this impact analysis.

Construction

The mining pits, processing plant, rail spur, and conveyor belt are not located close enough to CA-SCL-577/H and CA-SCL-578/H to affect these known resources during construction. Use of Old Monterey Road by trucks during construction could cause enough deterioration in the road surface to disturb burial sites and archaeological deposits that are part of CA-SCL-577/H. A free-span bridge is proposed over Tar Creek to provide truck access to the processing plant from Old Monterey Road. Construction of this bridge could result in disturbance of buried historic-era artifacts that are associated with CA-SCL-578/H. Use of Old Monterey Road by construction traffic, as well as installation of the free-span bridge over Tar Creek could disturb CA-SCL-577/H and CA-SCL-578/H, causing a substantial adverse change in the significance of known historical or archaeological resources. Therefore, the construction impact on known historical or archaeological resources would be **significant**.

Operation

The mining pits, processing plant, and conveyor belt are not located close enough to CA-SCL-577/H and CA-SCL-578/H to affect these known resources during Project operations. Operation of the rail spur would not cause ground disturbance. Use of the Tar Creek bridge during operations would not disturb buried historic-era artifacts that are associated with CA-SCL-578/H. However daily use of Old Monterey Road by haul trucks as well as any improvements or maintenance of the road during operations could cause enough deterioration in the road surface to disturb burial sites and archaeological deposits within CA-SCL-577/H. In addition, use of the access road between Tar Creek and the processing plant by trucks during operations could disturb of buried historic-era artifacts that are associated with CA-SCL-578/H.

Use of Old Monterey Road and the access road between Tar Creek and the processing plant by operational traffic could disturb CA-SCL-577/H, causing a substantial adverse change in the significance of known historical or archaeological resources. Therefore, the impact of Project operations on known historical or archaeological resources would be **significant**.

Reclamation

The locations of the mining pits, processing plant, and conveyor belt are not located close enough to CA-SCL-577/H and CA-SCL-578/H to affect these known resources during reclamation. As the rail spur would not be removed, there would be no ground disturbance associated with this Project component during reclamation. Use of the Tar Creek bridge during final reclamation of the Project site would not disturb buried historic-era artifacts that are associated with CA-SCL-578/H. However, daily use of Old Monterey Road by haul trucks as well as any improvements or maintenance of the road during operations could cause enough deterioration in the road surface to disturb burial sites and archaeological deposits within CA-SCL-577/H. In addition, use of the access road between Tar Creek and the processing plant by trucks during reclamation could resources result in disturbance of buried historic-era artifacts that are associated with CA-SCL-578/H.

Use of Old Monterey Road by traffic associated with final reclamation of the Project site could disturb CA-SCL-577/H, causing a substantial adverse change in the significance of known historical or archaeological resources. Therefore, the impact of reclamation on known historical or archaeological resources would be **significant**.

Mitigation Measure 3.5-1:

a. ***Resource Avoidance/Protection.*** Roads used by the Project, such as the existing access roads that cross identified resources (CA-SCL-577/H and CA-SCL-578/H), shall be capped through use of durable materials to ensure that wear and tear by vehicles of the road surface does not disturb the road bed and damage archaeological deposits, or burials located underneath. No ground disturbance below the existing grade shall occur. In addition, fencing shall be used to prevent vehicles from leaving the access roads where they are adjacent to identified resource sites. The Applicant shall submit archaeological and historic resource protection plans to the County Department of Planning and Development for review and approval prior to any Project construction.

b. ***Archaeological Testing Program for Known and Unrecorded Resources.*** For areas where ground disturbance would occur, the Applicant shall retain a qualified archaeological consultant to prepare an Archaeological Testing Program (ATP) that covers each of the three Project phases: construction, mining, and reclamation. The ATP shall identify the type of archaeological resources that could potentially be disturbed by the proposed Project, the testing method to be used, and the locations recommended for testing based on sensitivity mapping for areas identified as having high to highest sensitivity, as well as and the location of known resources. The purpose of the ATP will be to determine whether archaeological materials are present and evaluate whether the materials constitute an historical resource. The ATP shall focus on areas that are of high to highest sensitivity, as well as those that are in the vicinity of CA-SCL-578/H, and would apply during all phases of the Project. Disturbance shall not occur in areas where newly-discovered significant cultural resources are identified; newly-discovered significant cultural resources shall be avoided if feasible, with data recovery only if avoidance is not feasible, consistent with CEQA Guidelines § 15126.4(b).

The Applicant shall submit the draft ATP to the County Department of Planning and Development and to a designated representative of the Amah Mutsun Tribal Band for review. The County and Tribal representative shall have 45 days to review and comment on the draft ATP. The qualified archaeological consultant shall then update the draft ATP to incorporate relevant comments and resubmit a final ATP to the County and Tribal representative. Testing shall not begin until the County Department of Planning and Development has approved the final ATP.

Testing shall be conducted by the archaeological consultant and observed by a monitor designated by the Amah Mutsun Tribal Band in accordance with the approved Archaeological Monitoring Program (AMP), as described further in Mitigation Measure 3.4-1c.

At the completion of activities associated with the ATP, the archaeological consultant shall submit a written report of findings to the County of Santa Clara Department of Planning and Development and Tribal representative for review. If, based on the ATP, the archaeological consultant finds that potentially eligible archaeological resources are present, the archaeological consultant shall consult (as part of one in-person meeting or conference call) with the County Department of Planning Development and the Tribal representative to determine if additional measures are warranted during testing. Additional measures that may be undertaken include specialized archaeological testing methods and/or an archaeological data recovery program.

c. ***Archaeological Monitoring Program for Known and Unrecorded Resources.*** Following completion of the ATP, the Applicant shall prepare and the County Department of Planning and Development shall implement an Archaeological Monitoring Program (AMP) in consultation with the archaeological consultant and the Tribal representative. The AMP shall include the following:

- Prior to any ground-disturbing activities related to the development of the Project throughout the Project life, including access roads, the free-span bridge over Tar Creek, mining areas, and processing facilities, the following shall occur:

  i. The County, in consultation with the archaeological consultant and Tribal representative, shall determine what Project activities shall be monitored.

  ii. All ground-disturbing activities (outside of the low sensitivity areas of Phases 1 and 2), such as demolition, excavation, grading, utilities installation, etc., shall require archaeological and Native American monitoring because of the risk these activities pose to potential buried archaeological resources and to their depositional context.

- The Native American monitor shall be designated/approved by the Amah Mutsun Tribal Band to monitor ground-disturbing activities at the Project proponent's expense. The terms of Native American monitoring shall be determined prior to the onset of monitoring activities, including requirements for prior notice of areas to be disturbed and provisions if a designated monitor is unavailable,. The Native American monitor shall be notified at least 30 days prior to onset of construction, and at least 14 days in advance of when and where new ground disturbance will occur. The Native American monitor shall be present at all times that the archaeological monitor is present, unless the Native American monitor determines that his/her presence is not required at a particular location. If the Native American monitor does not arrive or is not present as scheduled, Project work may continue in the monitor's absence.

- The archaeological monitor and Native American monitor shall advise Project contractors to be alert for evidence of archaeological resources, how to identify archaeological resources, and of appropriate protocol in the event of discovery of an archaeological resource.
- The archaeological monitor and Native American monitor shall be present on the Project area according to a schedule agreed upon by the archaeological consultant and County (generally during ground-disturbing activities) until the County has, in consultation with the Project archaeological consultant and Tribal representative, determined that Project construction activities in the particular disturbance area could have no effects on significant archaeological deposits.
- The archaeological monitor shall record and be authorized to collect soil samples and material of archaeological or historical interest as warranted for analysis.
- If an intact archaeological deposit is encountered, ground-disturbing activities in the vicinity of the deposit shall cease. The archaeological monitor shall temporarily redirect ground-disturbing activities until the deposit is evaluated. The archaeological consultant shall immediately notify the County Department of Planning and Development of the encountered archaeological deposit. The archaeological consultant shall make a reasonable effort to assess the identity, integrity, and significance of the encountered archaeological deposit, and present the findings of this assessment in a report submitted to the County and Tribal representative. Should archaeological resources with ties to Native Americans be discovered, the archaeological monitor shall immediately notify the County Coordinator of Indian Affairs.

The draft AMP shall be submitted to the County Department of Planning and Development and to a designated representative of the Amah Mutsun Tribal Band for review. The County and Tribal representative shall have two weeks to review and comment on the draft AMP. The qualified archaeological consultant shall then update the draft AMP to incorporate relevant comments and resubmit a final AMP to the County and Tribal representative. Testing shall not begin until the County has approved the final AMP.

d. ***Archaeological Data Recovery Program for Known and Unrecorded Resources.*** If an eligible archaeological resource is determined to be present as part of the ATP or AMP, then the Applicant shall implement an archaeological data recovery plan (ADRP) to be prepared by the Applicant. The archaeological consultant, County Department of Planning and Development staff, and Amah Mutsun Tribal Band representative shall consult (as part of one conference call or in-person meeting) on the scope of the ADRP prior to preparation of a draft ADRP.

The ADRP shall be consistent with the requirements of CEQA Guidelines Section 15126.4(b)(3). It shall identify how the proposed data recovery program will preserve the relevant information the archaeological resource contains, identify what scientific/historical research questions are applicable to the resource, what data classes the resource possesses, and how the data classes would address applicable research questions. Destructive data recovery methods shall not be applied to portions of the archaeological resources if nondestructive methods are practical. The scope of the ADRP shall also include the following elements:

- Descriptions of proposed field strategies, procedures, and operations;
- Additional measures that should be undertaken if Native American resources are unearthed;
- Description of selected cataloguing system and artifact analysis procedures;
- Description of and rationale for field and post-field discard and deaccession policies;
- Consideration of an off-site public interpretive program during the course of the ADRP;
- Recommended security measures to protect the archaeological resource from vandalism, looting, and non-intentionally damaging activities;
- Description of proposed final report format and distribution of results; and
- Description of the procedures and recommendations for the curation of any recovered data having potential research value, identification of appropriate curation facilities, and a summary of the accession policies of the curation facilities.

The draft ADRP shall be submitted to a designated representative of the Amah Mutsun Tribal Band and to the County Department of Planning and Development for review. The Tribal representative and County shall have two weeks to review and comment on the draft ADRP. The qualified archaeological consultant shall then update the draft ADRP to incorporate relevant comments and resubmit a final ADRP to the County and Tribal representative. Data recovery shall not begin until the County has approved the final ADRP.

e. ***Final Archaeological Resources Report for Known and Unrecorded Resources.*** The Applicant shall retain the services of the archaeological consultant, who shall submit a Draft Final Archaeological Resources Report (FARR) to the County Department of Planning and Development describing the historical significance of discovered archaeological resources and describing the archaeological and historical research methods employed in the archaeological testing/monitoring/data recovery programs undertaken. Information that may put at risk (such as resource locations) any archaeological resource shall be provided in a separate removable insert within the final report. Once approved by the County, copies of the FARR (including any formal site recordation forms and/or documentation for nomination to the National Register of Historic Places and California Register of Historic Resources) shall be distributed to the California Archaeological Site Survey Northwest Information Center, County of Santa Clara Department of Planning and Development, and Tribal representative.

Significance after Mitigation: Less than significant

Implementation of Mitigation Measure 3.5-1 would reduce or eliminate ground-disturbing activities in areas of known historical or archaeological resources and require protection of resources that would not be subject to grading. In the event grading in and around these resources cannot be avoided, this mitigation measure would provide for monitoring and stop work procedures to prevent further disturbance in the event of discovery during Project activities as well as identification of the proper procedures for preserving the relevant information the archaeological resource it contains.

Impact 3.5-2: Implementation of the proposed Project could damage unrecorded subsurface prehistoric and historic archaeological resources. (Less than Significant Impact with Mitigation Incorporated)

As discussed in Section 3.5.3.2, the potential for unidentified surface prehistoric archaeological sites to be located within the Project area was assessed using a weighted model recently created for the San Francisco Bay-Delta Region that includes all Santa Clara County (Far Western, 2017). This model takes into account three environmental factors—surface slope, determined using a digital elevation model; distance to a historic-era stream; and distance to a stream confluence. Results identify areas of greater or lesser sensitivity for prehistoric surface sites, which are discussed below with respect to the Project components.

Construction

The processing plant area and areas where access roads are located are rated as having high potential for prehistoric surface sites as well as unidentified historic-area resources. The processing plant and adjacent new rail spur would be graded, potentially disturbing buried, undiscovered resources. Installation of the Tar Creek Bridge could disturb unrecorded subsurface resources. Truck traffic on the access road could also disturb such resources beneath the road bed if there's enough deterioration in its surface. The mining pits would not be excavated during the construction phase. However, portions of the conveyor belt near the Phase 3 and 4 mining area would require minor grading and excavation to establish the access/maintenance road underneath the conveyor belt and to install the supports. These construction activities could disturb buried, undiscovered resources.

Construction of the processing plant, rail spur, and conveyor belt as well as use of access roads by trucks could damage undiscovered subsurface archaeological resources in areas of high sensitivity. Therefore, the construction impact on unrecorded subsurface prehistoric and historic archaeological resources would be **significant.**

Operation

The access roads are located in areas rated as having high potential for prehistoric surface sites as well as unidentified historic-area resources. Operational truck traffic on the access road could disturb such resources beneath the road bed if there's enough deterioration in its surface. The Phase 1 and 2 mining areas are rated as having low potential for prehistoric surface sites and unidentified historic-area resources. However, the location of the permanent overburden stockpile, between the processing plant and the Phase 1 and Phase 2 mining areas, is rated as having a high sensitivity. Placement of this material would not involve excavation at this location. However, ground disturbance might occur during preparation of the site during operations. The Phase 3 and 4 mining areas are also rated as having high sensitivity. Disturbance of undiscovered resources could occur during excavation of these pits.

Because of the archaeological sensitivity of these areas, excavation of the Phase 3 and 4 mining pits, development of the permanent overburden pile, and truck traffic on access roads during operations have the potential to damage unrecorded subsurface prehistoric and historic archaeological resources. Therefore, the construction impact on unrecorded subsurface prehistoric and historic archaeological resources would be **significant.**

Reclamation

The access roads are located in areas rated as having high potential for prehistoric surface sites as well as unidentified historic-area resources. Truck traffic on the access road during final reclamation of the proposed quarry site could disturb such resources beneath the road bed if there's enough deterioration in its surface. The Phase 1 and 2 mining areas are rated as having low potential for prehistoric surface sites and unidentified historic-area resources. Therefore, reclamation of these mining pits would not likely disturb these resources. The Phase 3 and 4 mining areas are rated as having high sensitivity. Disturbance of undiscovered resources could occur during reclamation of these pits as well as removal of the conveyor belt. Reclamation of the processing plant could also disturb undiscovered resources based on its high sensitivity.

Because of the archaeological sensitivity of these areas, reclamation activities associated with the Phase 3 and 4 mining pits, the conveyor belt, and processing plant as well as truck traffic on access roads during final reclamation have the potential to damage unrecorded subsurface prehistoric and historic archaeological resources. Therefore, the construction impact on unrecorded subsurface prehistoric and historic archaeological resources would be **significant.**

Mitigation Measure 3. 5-2: Implement Mitigation Measure 3.5-1.

Significance after Mitigation: Less than significant

Implementation of Mitigation Measure 3.5-1 would reduce impacts to unrecorded subsurface prehistoric and historic archaeological resources during construction, operations, and reclamation by reducing or eliminating ground-disturbing activities in areas of high sensitivity and requiring protection of resources that would not be subject to grading. In the event that grading in and around these resources cannot be avoided, this mitigation measure would provide for monitoring and stop work procedures to prevent further disturbance in the event of discovery during Project activities as well as identification of the proper procedures for preserving the relevant information the archaeological resource to contains.

Impact 3.5-3: The Project could disturb human remains, including those interred outside of dedicated cemeteries. (Less than Significant with Mitigation Incorporated)

Archaeological resources may contain human burials. Portions of the Project area are located within mapped areas of high to highest sensitivity for prehistoric archaeological surface sites and historic-era resources. Human burials are also known to be present at CA-SCL-577/H.

Construction

A portion of Monterey Road passes through CA-SCL-577/H, which is known to contain human burials. Heavy truck traffic during construction could cause enough deterioration in the surface of this road to disturb buried human remains. Construction of the bridge over Tar Creek near CA-SCL-578/H, heavy use of nearby access roads, and grading for the processing plant and rail spur could also potentially disturb unrecorded burials due to these areas being rated as having high sensitivity for prehistoric archaeological surface sites and historic-era resources. The mining pits would not be excavated during the construction phases. However, during construction of the conveyor belt, the upper portion of which is located in a sensitive area, undiscovered human remains would be disturbed. The impact of disturbance of human remains during construction would be **significant.**

Operation

A portion of Monterey Road passes through CA-SCL-577/H, which is known to contain human burials. Heavy truck traffic during Project operations could cause enough deterioration in the surface of this road to disturb buried human remains. Heavy use of access roads in the vicinity of CA-SCL-578/H and the processing plant could similarly disturb human remains. Phases 3 and 4 are located in areas of high sensitivity for prehistoric archaeological surface sites and historic-era resources and would be excavated during this phase. However, the likelihood of human remains being located in these upland areas is relatively low. Nevertheless, the impact of disturbance of human remains during operations would be **significant.**

Reclamation

A portion of Monterey Road passes through CA-SCL-577/H, which is known to contain human burials. Heavy truck traffic during final reclamation of the Project site could cause enough deterioration in the surface of this road to disturb buried human remains. Heavy use of access roads in the vicinity of CA-SCL-578/H and the processing plant could similarly disturb human remains. The Phase 3 and 4 mining pits would undergo final reclamation during this phase, although encountering human remains in these areas is unlikely. Nevertheless, the impact of disturbance of human remains during operations would be **significant.**

> **Mitigation Measure 5.3-3a:** Implement Mitigation Measure 3.5-1.
>
> **Mitigation Measure 3.5-3b:** In the event that human remains are discovered during ground-disturbing activities and/or grading at the site, the Applicant shall stop all activity within a 50-foot radius of the find. The County Coroner shall be notified immediately and shall make a determination as to whether the remains are of Native American origin or whether an investigation into the cause of death is necessary (as required by Health and

Safety Code Section 7050.5, Public Resources Code Section 5097.98, Title 14 California Code of Regulations Section 15064.5(e), and County Ordinance Number B6-18). If the remains are determined to be Native American, the Coroner shall notify the NAHC within 24 hours of this determination. Once the NAHC identifies the most likely descendants, the descendants shall make recommendations regarding proper burial (including the treatment of grave goods). No further disturbance of the site shall be made except as authorized by the County Coordinator of Indian Affairs and NAHC in accordance with the provisions of state law and the County Ordinance.

Significance after Mitigation: Less than significant

Implementation of Mitigation Measure 3.5-1 would reduce impacts to human remains during construction, operation, and reclamation by reducing or eliminating ground-disturbing activities in known burial areas, such as CA-SCL-577/H, or in sensitive areas where unrecorded human remains may be present or capping these areas to prevent further disturbance. In the event that human remains are discovered, Mitigation Measure 3.5-3b would stop ground-disturbing activities to prevent further damage and require consultation with descendants on proper burial in the event they are determined to be of native American origin.

Impact 3.5-4: The Project would cause a substantial adverse change in the significance of tribal cultural resources. (Significant and Unavoidable)

Three specific TCRs discussed above are located within the footprint of the proposed Project: Betevel Bluff, the SCL-577/H archaeological site, and the CA-SCL-578/H. These resources are also contributing elements of the JTCL. The effects of the Project on these three TCRs are discussed below. The JTCL is the fourth TCR and encompasses, but is not limited to, the other three. Impacts to the JTCL are analyzed in Impact 3.5-5.

Betevel Bluff

This tribal cultural resource is a hill overlooking the confluence of the San Benito and Pajaro Rivers, in southern Santa Clara County. It is eligible under CRHR criteria 1, 2, and 4 because of its association with AMTB ceremonies, with both Kuksui and the powerful headmen who lived and performed the ceremonies, and because of its potential to be used for teaching Tribal members about many of the historic themes identified for this resource: Indigenous Resistance and Survival, and JTCL as Provider, Home, and Place of Power.

Construction

A portion of Betevel Bluff overlaps with Phase 4 mining area. However, excavation of this pit would not occur during construction. The processing plant, rail spur, access road, and roadway improvements are not located near Betevel Bluff. However, the conveyor belt is located near Betevel Bluff. The conveyor belt would begin at the base of Phase 3 and Phase 4 mining pits, which overlap with the Betevel Bluff TCR. Grading and vehicle trips associated with the installation of the conveyor belt at the base of the Betabel Bluff TCR could have substantial adverse effects on this resource. Therefore, the impact of construction on Betevel Bluff would be **significant**.

Operation

The processing plant, rail spur, access road, roadway improvements, are not located near Betevel Bluff, and operation of these Project components would not affect this tribal cultural resource. However, a portion of Betevel Bluff overlaps with the Phase 4 mining area, and operation of the conveyor belt would be adjacent to Betevel Bluff. The excavation of the pit would start at the top of the hill, and remove the upper 200 feet of the hill, which is the likely extent of the aggregate resources in this phase. Sand and gravel would be excavated from west to east using mobile equipment (e.g., scrapers, bulldozers, excavators, and front-end loaders). During mining Phase 4, quarry pit slopes would be maintained with slopes of 2:1 and 10-foot-wide benches every 40 vertical feet. Currently, Betevel Bluff is considered intact for location, setting, association, and feeling (spiritual and cultural significance to the Tribe, as described in Table 3.5-3) but would be significantly altered by this mining phase. Therefore, impacts of Project operations on Betevel Bluff would be **significant**.

Reclamation

The processing plant, rail spur, access road, roadway improvements, are not located near Betevel Bluff. However, the conveyor belt is in proximity to Betevel Bluff. Removal of these components during final reclamation would not affect this resource. Reclamation for Phase 4 would include using remaining stockpiles to fill, compact, and re-soil the pit and process water basin, contour and grade unnecessary internal roads, rip, disk, and re-soil the quarry floor, and re-soil the reclamation slopes and benches. After the area has been graded, topsoil would be placed over the area and reseeded with native and naturalized plant species. Although these activities would lessen the visible scarring of the landscape caused by mining, reclamation of this pit would not completely restore this part of the Betevel Bluff to its original physical form, which would adversely affect its spiritual and cultural significance to the Tribe. Therefore, this impact would be **significant**.

Summary

Construction of the conveyor belt for Phases 3 and 4 and mining of the Phase 4 quarry would significantly alter the physical form of a portion of Betevel Bluff, and reclamation would not completely restore it to the point that its spiritual and cultural significance to the Tribe would not be adversely affected. Therefore, Project operations and reclamation would cause a substantial adverse change in the significance of tribal cultural resource, Betevel Bluff, and this impact would be **significant**.

SCL-577/H

This is a multi-component, indigenous (precolonial) and historic-era archaeological site located at the northern end of the Project Area. It is eligible under CRHR Criterion 1 because it is associated with pre-contact habitation of this area by Ohlone people. contains the evidence, and example, of numerous past traditions, from tool production to ornamentation. It is eligible under CRHR

Criterion 4 because it contains the evidence, and example, of numerous past traditions, from tool production to ornamentation.

Construction

The mining pits, Tar Creek bridge, processing plant, rail spur, and conveyor belt are not located near SCL-577/H. Construction of these components would not affect this resource. The northern portion of Old Monterey Road crosses SCL-577/H. Truck traffic associated with construction would use this road to reach the processing plant and other construction sites. These heavy vehicles could degrade the road, causing damage to burial sites and archaeological deposits, adversely affecting this tribal cultural resource. Therefore, the construction impact on this tribal cultural resource would be **significant**.

Operation

The mining pits, Tar Creek bridge, processing plant, rail spur, and conveyor belt are not located near SCL-577/H. Use of these components during quarry operations would not affect this resource. The northern portion of Old Monterey Road crosses SCL-577/H. Truck traffic during operation of the proposed quarry would use this road to access the processing plant and other sites. These heavy vehicles could degrade the road, causing damage to burial sites and archaeological deposits, adversely affecting this tribal cultural resource. In addition, any improvements or maintenance of the road that occur during operations could also affect this resource. Therefore, this impact of Project operations would be **significant**.

Reclamation

The mining pits, Tar Creek bridge, processing plant, rail spur, and conveyor belt are not located near SCL-577/H. Apart from truck traffic, which is discussed above, removal of these components during final reclamation would not affect this tribal cultural resource. The northern portion of Old Monterey Road crosses SCL-577/H. Truck traffic during operation of the proposed quarry would use this road to reach the processing plant and other sites. These heavy vehicles could degrade the road, causing damage to burial sites and archaeological deposits, adversely affecting this tribal cultural resource. In addition, any improvements or maintenance of the road that occur during final reclamation could also affect this resource. Therefore, the impact of reclamation on this tribal cultural resource would be **significant**.

Summary

Trucks using Old Monterey Road to reach other parts of the Project area during construction, operations, and reclamation, could degrade the road, causing damage to burial sites and archaeological deposits, adversely affecting this tribal cultural resource. Therefore, the proposed Project would cause a substantial adverse change in the significance of a tribal cultural resource, Betevel Bluff, and this impact would be **significant**.

CA-SCL-578/H

This multi-component archaeological site, located in the northeast corner of the Project area, is a contributing element to the JTCL, but it has sufficient importance to the AMTB to be considered as an individual tribal cultural resource under AB 52. CA-SCL-578/H is eligible under Criterion 1 because it is associated with the survival of post-contact Ohlone people. It is eligible under Criterion 4 because it is still important as a location where Tribal people can come to reflect on Ohlone survival during the Mission Period and the connection of this place to the larger JTCL.

Construction

The proposed mining pits, processing plant, rail spur, and conveyor belt are not located near CA-SCL-578/H, so construction of these components would not affect this resource. A free-span bridge is proposed over Tar Creek to provide truck access to the processing plant from Old Monterey Road. Construction of this bridge could result in disturbance of buried historic-era artifacts that are associated with CA-SCL-578/H. In addition, the access road between the bridge and the processing plant is located in the vicinity of CA-SCL-578/H. Truck traffic during construction could degrade the road, causing damage to burial sites and archaeological deposits, adversely affecting this tribal cultural resource. Therefore, the impact of construction on this tribal cultural resource would be **significant**.

Operation

The proposed mining pits, processing plant, rail spur, and conveyor belt are not located near CA-SCL-578/H. Therefore, use of these components during quarry operations would not affect this resource. Use of the Tar Creek bridge during operations would not cause ground disturbance in the vicinity of CA-SCL-578/H. However, truck traffic on the road between the bridge the processing plant could degrade the road to the point of causing damage to burial sites and archaeological deposits that may be buried in the road bed, adversely affecting this tribal cultural resource. Therefore, the impact of Project operations on this tribal cultural resource would be **significant**.

Reclamation

The mining pits, processing plant, rail spur, and conveyor belt are not located near SCL-578/H. Apart from truck traffic, which is discussed above, removal of these components during final reclamation would not affect this tribal cultural resource. Use of the Tar Creek bridge during final reclamation would not cause ground disturbance in the vicinity of CA-SCL-578/H. However, truck traffic on the road between the bridge the processing plant could degrade the road to the point of causing damage to burial sites and archaeological deposits that may be buried in the road bed, adversely affecting this tribal cultural resource. Therefore, the impact of reclamation on this tribal cultural resource would be **significant**.

Summary

Trucks using Old Monterey Road to reach other parts of the Project area during construction, operations, and reclamation, could degrade the road, causing damage to burial sites and archaeological deposits, adversely affecting this tribal cultural resource. In addition, any improvements or maintenance of the road that occur during operations could also affect this resource. Therefore, the proposed Project would cause a substantial adverse change in the significance of a tribal cultural resource, CA-SCL-578/H, and this impact would be **significant.**

Mitigation Measure 3.5-4a: Implement Mitigation Measures 3.5-1 and 3.5-3b.

Mitigation Measure 3.5-4b: To partially offset and compensate for impacts to the three specific TCRs, and to compensate for the loss and disturbance of those portions of the physical landscape of the JTCL that are within the Project site, the property owner/applicant shall record a conservation easement in accordance with Civil Code section 815 et seq. The conservation easement shall be conveyed by the property owner/applicant to any entity identified in Civil Code section 815.3, and verified by the County prior to any ground disturbance. The conservation easement shall include a minimum two acres for every one acre disturbed by the Project (total disturbed acreage of the Project is 403.3 acres), and shall include the Project site itself upon completion of reclamation. In addition, the conservation easement shall include an area outside the Project site of comparable size to the acreage disturbed by the Project. The boundaries of the offsite easement shall be determined by the County in consultation with the Amah Mutsun Tribal Band, and shall include areas and/or resources that are of particular important in their contribution to the JTCL, such as identified tribal cultural resources, riparian areas and /or specific oak trees.

The conservation easement shall prohibit all uses and development that are not already legally occurring prior to Project approval, except for environmental restoration activities, including biological resource compensatory mitigation measures identified in this EIR and restoration of the JTCL, which may be allowed with the appropriate governmental approval and permits. Consistent with Public Resources Code section 21084.3(b)(3), this mitigation measure will ensure the land within the conservation easement is substantially preserved and/or restored in its current natural state, thereby preventing development or disturbance from new uses that could adversely affect the JTCL.

Significance after Mitigation: Significant and Unavoidable

Implementation of Mitigation Measure 3.5-1 would reduce or eliminate ground-disturbing activities in areas of known historical or archaeological resources (SCL-577/H and CA-SCL-578/H), which are also tribal cultural resources, reducing the impact to these resources to less-than-significant levels. In the event that human remains are discovered, Mitigation Measure 3.5-3b would stop ground-disturbing activities in known burial areas, such as CA-SCL-577/H, to prevent further damage and to consult with descendants on proper burial in the event they are determined to be of native American origin. With respect to Betevel Bluff, there is no available alteration to Phase 4 that would avoid or eliminate the substantial adverse change to this TCR that would be caused by excavation and reclamation of this mining pit. Implementation of Mitigation Measure 3.5-4b would partially offset and compensate for impacts to the three TCRs by ensuring that SCL-577/H and 578/H are protected from future disturbance or development. However, because Betevel Bluff would be irreversibly altered, the impact would remain significant even with mitigation.

Impact 3.5-5: The Project would cause a substantial adverse change in the significance of the Juristac Tribal Cultural Landscape (Significant and Unavoidable).

As discussed in Section 3.5.3.5 above, the JTCL is a large landscape that includes the Sargent Hills and the entirety of the proposed Project site. The County has determined this resource is a TCR pursuant to PRC § 21084.2. The landscape is eligible under all four of the California Register of Historical Resources for multiple historic themes (Albion 2021).The JTCL is considered by the Tribe to be sacred terrain where the Tribe's spiritual traditions blended seamlessly with the habitation of the village sites, the numerous natural resources nearby, and the sacred areas of the springs, waterways, and hills. It encompasses the entirety of the proposed Project site, the Sargent Hills, parts of the adjacent waterways, including Sargent Creek, Tar Creek, and Tick Creek. The TCRs discussed under Impact 3.5-4—Betevel Bluff, SCL-577/H, and CA-SCL-578/H—are contributing elements to the JTCL as well as other elements that have not been identified.

Construction

Construction impacts would adversely affect the JTCL and contributing elements of the JTCL. The processing plant, rail spur, and the conveyor belt are located in the JTCL, and installation of the conveyor belt would be near an identified contributing element of the JTCL, the Betevel Bluff. Character defining features of the JTCL 7such as springs, creeks, rivers, topography, vegetation, native habitats, and cultural resources could be impacted during construction of the processing plant, rail spur, and conveyor belt.. The JTCL, which includes the entirety of the proposed Project footprint, may include such resources. Therefore, construction impacts would adversely affect the JTCL.

Construction-related impacts to SCL-577/H and CA-SCL-578/H would occur through truck usage of Old Monterey Road and installation of the free-span bridge over Tar Creek. Construction- related impacts associated with installation of the conveyor belt would adversely affect the Betevel Bluff TCR. Betevel Bluff overlaps with Phase 4 mining area. However, excavation of this pit would not occur during construction. There would not be construction related impacts to the CA-SCL-92/H site because that is located outside of the proposed Project footprint. The impact of Project construction on the JTCL, and contributing elements of the JTCL would be **significant** because there would be a substantial adverse change in the significance of a tribal cultural resource.

Operation

Project operations would result in a substantial adverse change to the JTCL. All four mining phases would irrevocably damage and irreversibly alter character defining features of the JTCL. This impact includes, but is not limited to, alterations to the natural features and habitats of the JTCL that involved the removal and recontouring of landscapes that are held sacred by the AMTB. These physical changes would significantly diminish the emotional and spiritual associations held by the AMTB to this cultural landscape through the alteration of the sacred and spiritual qualities that qualify the JTCL as a TCR.

The processing plant and rail spur are not located near the identified contributing elements of the JTCL, and therefore operation of these components would not affect these resources. As discussed under Impact 3.5-4, operations-related impacts to SCL-577/H and CA-SCL-578/H would occur through truck usage of Old Monterey Road and the section of road between the Tar Creek bridge and the processing plant. However, the Project would not directly affect the CA-SCL-92/H site because it is located outside of the proposed Project footprint. The Betevel Bluff TCR would be substantially altered through excavation of a pit in the Phase 4 mining area, and operation of the conveyor belt near the Betevel Bluff TCR. Operating the conveyor belt would change the visual character of the Betevel Bluff TCR. As a result, the impact of Project operations on the JTCL, and on contributing elements of the JTCL, would be **significant** because there would be a substantial adverse change in the significance of a tribal cultural resources.

Reclamation

Reclamation activities would not restore the JTCL to a condition that reflects its cultural significance. While reclamation activities would restore some of the features of the landscape, it would not restore the site to its pre-Project condition. Further, reclamation activities include the use of heavy truck traffic that would continue to alter the appearance and use of the landscape. There would be a substantial adverse change to the JTCL caused by Project construction, operation, and reclamation, resulting in permanent and irreversible alterations to the physical landscape of the JTCL. These alterations would significantly diminish the emotional and spiritual associations held by the Tribe to this cultural landscape through the destruction of the sacred and spiritual qualities that qualify the JTCL as a TCR.

The processing plant and rail spur are not located near the identified contributing elements of the JTCL. Reclamation of these components would not affect these resources. As discussed under Impact 3.5-4, during reclamation, impacts to SCL-577/H and CA-SCL-578/H would occur through truck usage of Old Monterey Road and the section of road between the Tar Creek bridge and the processing plant. However, the conveyor belt is located near the Betevel Bluff. Betevel Bluff overlaps with the Phase 4 mining area. Reclamation for Phase 4 would include using remaining stockpiles to fill, compact, and re-soil the pit and process water basin, contour and grade unnecessary internal roads, rip, disk, and re-soil the quarry floor, and re-soil the reclamation slopes and benches. Nevertheless, reclamation of this pit would not completely restore this part of the Betevel Bluff to its original physical form, which would adversely affect its spiritual and cultural significance to the Tribe.

As a result, the impact of Project reclamation on the JTCL, these contributing elements of the JTCL, and other contributing elements to the JTCL would be **significant** because there would be a substantial adverse change in the significance of a tribal cultural resource.

Summary

The Project would cause a substantial adverse change to the JTCL. Construction and operation of the processing plant, rail spur, bridge installations, and conveyor belt would alter character defining features of the JTCL such as springs, creeks, rivers, native habitats, and cultural resources. Reclamation of the project would involve heavy truck traffic in the JTCL that would further alter the appearance of the landscape, and reclamation of the Phase 4 pit would not completely restore this part of the Betevel Bluff to its original physical form. As a result, the Project's impact on the

JTCL, and on contributing elements of the JTCL, would be significant because there would be a substantial adverse change in the significance of a tribal cultural resource.

Mitigation Measure 3.5-5a: Implement Mitigation Measures 3.5-1, 3.5-3b, and 3.5-4b.

Mitigation Measure 3.5-5b: Prior to commencement of any vegetation removal or ground disturbance, the Project Applicant shall prepare and submit, to the satisfaction of the Director of Planning, or Director's designee, evidence that the following actions have been satisfied:

i. After seeking consultation with the Amah Mutsun Tribal Band (AMTB), refine the plant list provided in Appendix F of *Gathering Voices Past and Present (2021)* to identify those plants that contribute to the significance of the JTCL as a Tribal Cultural Resource, and that could be present within the Project site.

ii. Prepare a survey of the Project site to identify the plant species identified in the plant list.

iii. Determine the extent of Project impacts based on the number of individuals impacted and the acreage of habitat occupied by each plant species on the plant list. The survey shall be conducted by a qualified plant biologist.

iv. Plant Species:

(a) For species on the plant list that are also federal or state-listed special-status plant species, implement Mitigation Measure 3.4-1, which requires compensatory mitigation for the loss of special-status plants.

(b) For species on the plant list that are not federal or state-listed special-status, compensatory mitigation shall be provided by preservation and management of another, existing on-site population if feasible, or if not an off-site population within the JTCL boundary. Habitat occupied by the affected species shall be preserved and managed in perpetuity at a minimum 1:1 mitigation ratio (at least one plant preserved for each plant affected, and also at least one occupied acre preserved for each occupied acre affected for the affected plant species).

v. In addition to 1:1 preservation as described in 3.5-5b.iv, the restoration area shall be enhanced by transplanting individual plants or seeds from the Project site as appropriate.

vi. Plant species in the preservation areas shall be monitored using specific, objective final criteria and performance criteria, monitoring methods, data analysis, reporting requirements, and monitoring schedule. At a minimum, performance criteria shall include demonstration that any plant population fluctuations over the monitoring period do not indicate a downward trajectory in terms of reduction in numbers and/or occupied area for the preserved mitigation population that can be attributed to management (i.e., that are not the result of local weather patterns, as determined by monitoring of a nearby reference population, or other factors unrelated to management).

Significance after Mitigation: Significant and Unavoidable

As discussed under Impact 3.5-4, implementation of Mitigation Measures 3.5-1 and 3.5-3b would reduce the impacts of the Project during construction, operation, and reclamation on the tribal cultural resources of SCL-577/H and CA-SCL-578/H through a combination of avoidance, stop-work and resource preservation procedures. Mitigation

Measure 3.5-5b would reduce impacts to plant species that contribute to the significance of the JTCL as a TCR. The mitigation measure would reduce the impact through surveys, preparing a comprehensive list in consultation with the AMTB, compensating for the loss of listed and non-listed species, and restoring impacted areas. With respect to Betevel Bluff, there is no available alteration to Phase 4 that would avoid or eliminate the substantial adverse change to this TCR, a contributing element of the JTCL, that would be caused by excavation and reclamation of this mining pit.[9]

With respect to the JTCL as a whole, the installation of equipment, grading, mining, and reclaiming the site would substantially change the JTCL post-mitigation through altering character defining features of the JTCL such as topography, springs, creeks, rivers, native habitats, and other natural and cultural resources. Mitigation Measure 3.4-4b would partially offset and compensate for the impacts on the JTCL by placing a portion of the JTCL, in a conservation easement. The Project site itself would be included in the conservation easement after reclamation is complete, which would protect SCL-577/H and CA-SCL-578/H from future disturbance, as well as any features within the Project site that would be restored through reclamation (e.g., vegetation, creek crossings). Because the Project site would be substantially altered even after reclamation, placing it in a conservation easement would only partially offset the impact of the Project on the JTCL. Therefore, additional acreage, equivalent to the size of the area disturbed by the Project, would also be placed in a conservation easement. The lands within this easement would be protected from further development or disturbance, except for activities that currently occur there and possible environmental restoration activities, such as biological habitat and/or other plant restoration. However, because the Project site would be irreversibly altered, the impact would remain significant. There is no feasible mitigation that would avoid or further reduce the substantial adverse changes to the JTCL.

3.5.4.3 Cumulative Analysis

The geographic area for evaluation of cumulative impacts on cultural and tribal cultural resources is the Project area and vicinity. The only project identified in Section 3.1 located within the vicinity of the Project site is the U.S. 101 Widening Project, which would be located adjacent to the east and south of the Project site.

Impact 3.5-6: The Project could contribute to cumulative adverse changes in known historical or archaeological resources. (Less Than Significant with Mitigation Incorporated)

The 2013 EIR for the U.S. 101 widening project identified SCL-577/H as a known archaeological site, which is eligible for the national and California registers, that could be adversely affected by subsurface excavation such as utility work, foundation/bridge pier trenches and driving as well as surface related construction, such as staging. However, the EIR determined that this impact would be less than significant through implementation of mitigation of an Archaeological Treatment

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9 Alternative 2: Phases 1 and 2 Only (Section 4.5.2 of Alternatives Analysis) would reduce the impact to the JTCL by eliminating Phase 4 mining. However, even under this alternative, the impact to JTCL would be Significant and Unavoidable because project construction, operation, and reclamation would result in substantial adverse changes to character defining elements such as landforms, natural features, and cultural resources that comprise the JTCL.

Plan and construction monitoring. Therefore, the cumulative impact with respect to adverse changes in known historical or archaeological resources would be **less than significant**.

Project Contribution

As discussed in Impact 3.5-1, the proposed Sargent Quarry Project could also cause damage to SCL-577/H through the use of Old Monterey Road by heavy trucks, which could cause deterioration of the road surface. However, this impact could be mitigated to a less-than-significant level. Therefore, post-mitigation the Project's cumulative contribution would not be considerable, and the cumulative impact on known historic or archaeological resources would be less-than-cumulatively considerable and **less than significant**.

Mitigation Measure 3.5-6: Implement Mitigation Measure 3.5-1.

Significance After Mitigation: Less than Significant

Impact 3.5-7: The Project could contribute to cumulative adverse changes in unrecorded subsurface prehistoric and historic archaeological resources. (Less than Significant with Mitigation Incorporated)

The 2013 EIR for the U.S. 101 widening project did not evaluate impacts on unrecorded subsurface prehistoric and historic archaeological resources as a separate impact. But given that ground-disturbing activities of that highway construction project would occur in the vicinity of areas that are known to have high potential for prehistoric surface sites as well as unidentified historic-area resources, the cumulative impact with respect to adverse changes in unrecorded subsurface prehistoric and historic archaeological resources would be **significant**.

Project Contribution

The proposed Sargent Quarry Project would also cause impacts on unrecorded resources through construction, operations, and reclamation, and these impacts would be cumulatively considerable pre-mitigation. However, as discussed in Impact 3.5-2, this impact would be mitigated to a less-than-significant level. Mitigation Measure 3.5-1 would require avoiding areas of known archaeological resources, testing for areas of recorded and unknown resources with a monitor from the tribe, archaeological monitoring developed in consultation with the AMTB, and a data recovery program for known and unknown resources. Lastly, Mitigation Measure 3.5-1 would require drafting a final archaeological report for known and unknown resources Therefore, post-mitigation the Project's cumulative contribution would not be considerable, and the cumulative impact on unrecorded subsurface prehistoric and historic archaeological resources would be **less than significant**.

Mitigation Measure 3.5-7: Implement Mitigation Measure 3.5-1.

Significance After Mitigation: Less than Significant

Impact 3.5-8: The Project could contribute to cumulative disturbance of human remains, including those interred outside of dedicated cemeteries. (Less than Significant with Mitigation Incorporated)

The 2013 EIR for the U.S. 101 widening project did not evaluate impacts on human remains. However, SCL-577/H, which could be adversely affect by construction activities, is known to contain human burials. Therefore, the cumulative impact with respect to disturbance of human remains would be **significant**.

Project Contribution

As discussed in Impact 3.5-3, the proposed Sargent Quarry Project could also disturb human remains within SCL-577/H through the use of Old Monterey Road by heavy trucks, which could cause deterioration of the road surface, and this impact would be cumulatively considerable pre-mitigation. However, this impact would be mitigated to a less-than-significant level. Implementation of Mitigation Measure 3.5-3 would reduce impacts to human remains during construction, operation, and reclamation by reducing or eliminating ground-disturbing activities in known burial areas, such as CA-SCL-577/H, or in sensitive areas where unrecorded human remains may be present or capping these areas to prevent further disturbance. Therefore, post-mitigation the Project's cumulative contribution would not be considerable, and the cumulative impact on known historic or archaeological resources would be **less than significant**.

Mitigation Measure 3.5-8: Implement Mitigation Measures 3.5-1 and 3.5-3b.

Significance After Mitigation: Less than Significant

Impact 3.5-9: The Project could contribute to cumulative adverse changes in the significance of tribal cultural resources. (Significant and Unavoidable)

The 2013 EIR for the U.S. 101 widening project did not evaluate impacts on tribal cultural resources, but that does not indicate an absence of impacts to such resources as a result of the project. As discussed under Impact 3.5-6, that EIR did find that project construction activities could adversely affect SCL-577/H, which is a tribal cultural resource and a contributing element of the JTCL. The EIR concluded the impact of construction on SCL-577/H would be less than significant through implementation of mitigation that included an Archaeological Treatment Plan and construction monitoring. The 2013 EIR for the U.S. 101 widening project did not identify SCL-578/H as a site that would be affected by project construction. In addition, the U.S. 101 widening project is not located in the vicinity of Betevel Bluff.

However, regarding cumulative impacts on the JTCL, the full extent of the JTCL is not known; the U.S. 101 widening project could add to the Project's impacts on altering character- defining features of the JTCL such as topography, springs, creeks, rivers, native habitats, and other natural and cultural resources; and there may be other contributing elements that have not yet been identified that could be adversely affected. Therefore, the cumulative impact with respect to adverse changes in the significance of tribal cultural resources would be **significant**.

Project Contribution

The proposed Sargent Quarry Project could also cause damage to SCL-577/H through the use of Old Monterey Road by heavy trucks, which could cause deterioration of the road surface and these impacts would be cumulatively considerable pre-mitigation. However, this impact would be mitigated to a less-than-significant level through capping the road to protect resources that may be damaged by heavy truck traffic and by installing fencing to prevent vehicles from leaving the road. Therefore, post-mitigation the Project's contribution to a cumulative impact on this tribal resource would not be cumulatively considerable. In addition, because the U.S. 101 widening project would not affect SCL-578/H or Betevel Bluff, there would be no cumulative effect on these resources.

However, as noted above, the full extent of the JTCL is not known; the U.S. 101 widening project could add to the Project's impacts on altering character- defining features of the JTCL such as topography, springs, creeks, rivers, native habitats, and other natural and cultural resources; and there may be other contributing elements that have not yet been identified. Therefore, pre-mitigation the Project's cumulative contribution to impacts on TCRs would be considerable. Mitigation Measures 3.5-1, 3.5-3b, 3.5-4b, and 3.5-5b would reduce Project impacts to the affected TCRs, but would not fully offset the alterations to the TCRs in the Project site and the JTCL. Therefore, post-mitigation the Project's cumulative contribution would be considerable, and the cumulative impact on would be **significant**.

Mitigation: Implement Mitigation Measures 3.5-1, 3.5-3b, 3.5-4b and 3.5-5b.

Significance After Mitigation: Significant and Unavoidable

3.5.5 References

Albion, 2021. Gathering Voices of the Past and Present, An Ethnohistoric and Ethnographic Study of Sargent Ranch, Santa Clara County, California, September; and TCR Memo Update for Sargent Ranch, January 28, 2022 (Confidential)

Far Western Anthropological Research Group, Inc. 2017a. Cultural Resources Sensitivity Assessment for the Sargent Ranch Project. (Confidential)

Far Western Anthropological Research Group, Inc. 2017b. Supplemental Cultural Resources Survey Report for the Sargent Ranch Quarry Project, Santa Clara County, California. (Confidential)

Santa Clara Valley Transportation Agency. 2013. Final Environmental Impact Report, U.S. 101 Improvement Project between Monterey Street and State Route 129.

From: Micko, Steve [Steve.Micko@jacobs.com]
Sent: 9/20/2022 12:21:40 PM
To: Wesley Walker [walker@mbkengineers.com]
CC: Alicia Forsythe [aforsythe@sitesproject.org]; Leaf, Rob [Rob.Leaf@jacobs.com]
Subject: RE: Sites Project - Quick Question on 2070 WSIP Hydrology

Hi Wes,

We have not conducted modeling for the two extreme scenarios (WSIP 2070 WMW and WSIP 2070 DEW).

Hope this helps,
Steve

From: Wesley Walker <walker@mbkengineers.com>
Sent: Tuesday, September 20, 2022 12:06 PM
To: Micko, Steve <Steve.Micko@jacobs.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: [EXTERNAL] RE: Sites Project - Quick Question on 2070 WSIP Hydrology

Hi Steve,

Per your email to Ali below, have you completed any modeling for Sites under the two extreme scenarios? Even if you have, I'm not sure that we would actually use them as part of the water availability analysis. However, we would like to know whether or not they are available as we strategize on our response back to the SWRCB's request.

Thanks!
Wes

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Tuesday, September 13, 2022 1:57 PM
To: Angela Bezzone <bezzone@mbkengineers.com>; Spranza, John <john.spranza@hdrinc.com>; Wesley Walker <walker@mbkengineers.com>
Subject: FW: Sites Project - Quick Question on 2070 WSIP Hydrology

See below. Thought I would send on as this will likely help in our write-up.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Micko, Steve <Steve.Micko@jacobs.com>
Sent: Tuesday, September 13, 2022 1:09 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Leaf, Rob <Rob.Leaf@jacobs.com>
Subject: RE: Sites Project - Quick Question on 2070 WSIP Hydrology

Hi Ali,

WSIP 2070 hydrology is documented in Appendix A of the WSIP Technical Reference Document (TRD), attached.

In addition to WSIP 2070 hydrology, the CWC developed two sensitivities at the 2070 time horizon: 2070 Wet Moderate Warming (WMW), and 2070 Dry Extreme Warming (DEW).
These hydrologic data sets are briefly described in the "wsip_extreme_climate_conditions_description.pdf" (attached).
Please note that WSIP 2070 WMW and WSIP 2070 DEW were "intended for optional use by applicants for the uncertainty analysis related to extreme climate conditions."

We are using the WSIP 2070 hydrology documented in the WSIP TRD.
Per guidance from the Commission, the extreme climates (WSIP 2070 WMW and WSIP 2070 DEW) are intended for uncertainty analyses.

Hope this helps.

Best,
Steve

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Tuesday, September 13, 2022 12:51 PM
To: Micko, Steve <Steve.Micko@jacobs.com>
Subject: [EXTERNAL] Sites Project - Quick Question on 2070 WSIP Hydrology

Steve – We are meeting with the State Board on Thursday. On our agenda, they added the text below in red.

Climate Change – Section 1.2, Water Supply – Pulling the 2035 CT that was in appendix to the main body and adding a 2070 CWC WSIP Scenario (Please specify which 2070 CWC WSIP Scenario(s) and how it relates to the expected life of the Project). This should satisfy the request for climate change scenarios.

Is there a write-up of the 2070 WSIP hydrology that you can send? I am not sure what they are getting at in their comment. But Wes Walker mentioned that there may have been a few different WSIP 2070 scenarios???

Anything you have would be super helpful.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

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REQUEST FOR SURVEY

REQUEST DATE: August 26, 2021		
PROJECT NAME: Sites Reservoir – Roads and Bridges		
AGENCY: Sites Authority	ROUTE: All Roads per TM	POST MILE: NA
Agency Project No. TBD	Fed. Project No. N/A	AECOM Project No. TBD

TO: Alex Remar

FROM: Howard Michael

DUE DATE: August 26, 2021

SURVEY REQUEST PURPOSE: For 30% design of the roadways and bridges as listed in the Technical Memo.

WORK LIMITS: As defined in the Technical Memo.

SURVEY PRODUCTS:

1. Basemap plot.
2. AutoCAD Civil 3D file of basemap – 2016 or later.
3. DTM (surface) with 0.5-foot contours in the valley and 1-foot in the hills/mountains.
4. Land Net and Boundary Survey

BASEMAP CONTENT:

1. Benchmark
2. Legend
3. Scale
4. Symbols
5. Plannemetrics with individual layers for the following
   a. Right of way lines
   b. Property lines
   c. Easement lines
   d. Utility alignments (see details below)
   e. Fences
   f. Roadway elements (see details below)
   g. Bridge elements (see details below)
   h. Topographic flow lines and break lines
   i. Annotation of features, signs, facilities, etc.
   j. APN, and owner
6. Survey points in separate layers – separated into layer by point type

ROADWAY ELEMENTS:

1. Crown/Grade breaks
2. Metal beam guardrails
3. Utility lids
4. Dike/Curb and flow lines
5. Edge of payments
6. Concrete aprons
7. Top/Toe of cuts/fills
8. Top/Toe of canal banks
9. Driveway limits/configuration within right of way
10. Signs
11. Mailboxes
12. Intersection limits and 100 feet back on adjoining roadway
13. Drainage inlets
    a. Inlet invert
    b. Pipe-in inverts
    c. Pipe-out inverts
    d. Grate elevation
    e. Grate flow line
    f. Pipe sizes and alignment
14. Drainage culverts
    a. Headwall limits, heights, thickness
    b. Inlet invert
    c. Outfall invert
    d. Size and alignment

SITE FEATURES:

1. Trees larger than 6" in BHD (TBD during supplemental surveying)
2. Tree drip lines larger than 6" in BHD (TBD during supplemental surveying)
3. Limits of brush (TBD during supplemental surveying)
4. Water wells (TBD during supplemental surveying)
5. Septic systems (TBD during supplemental surveying)
6. Survey monuments
7. Drainage swales, ditches, etc

UTILITY FACILITIES:

1. Sewer manholes (if exists)
    a. Manhole invert
    b. Pipe-in inverts
    c. Pipe-out inverts
    d. Lid elevation
    e. Pipe sizes and alignment
    f. Cleanouts (locate even if on private property)
2. Curb markings (if exists)
3. Landscape facilities (BFP, valves, boxes, controller boxes, etc.) (if exists)

4. Water valve boxes, meter boxes, fire hydrants, backflow preventers, ARV boxes/containers, markers, etc. (locate even if on private property) (if exists)
5. Gas valve boxes/meter boxes, vents (if exists)
6. Vaults – corners and access hatches (if exists)
7. Paddle markers
8. Poles and guy wire anchors
9. Utility control cabinets
10. Streetlights (if exists)
11. Service drops
12. Utility paint markings, (i.e. U.S.A. markings)

SUPPLEMENTAL SURVEYS: (to be performed in later phase)

1. Pothole locations
2. Densification/conform areas (as requested during design)

COMMENTS BY SURVEYOR:

Vertical Datum

- ☐ Assumed
- ☐ NGVD29
- ☒ NAVD88

Horizontal Datum

- ☐ Local
- ☐ NAD27
- ☐ Epoch
- ☒ NAD83

Stone Corral Creek and Funks Creek Aquatic Study Plan

September 20, 2022

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Acronyms and Abbreviations

ADCP	acoustic Doppler current profiler
ASCI	Algae Stream Condition Index
CDFW	California Department of Fish and Wildlife
AFDM	ash-free dry mass
CFGC	California Fish and Game Code
CSCI	California Stream Condition Index
CPUE	catch per unit effort
CVRWQCB	Central Valley Regional Water Quality Control Board
Chico ABL	Chico Aquatic Bioassessment Laboratory
Cfs	cubic feet per second
°F	degrees Fahrenheit
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
GIS	geographic information system
GCID	Glenn-Colusa Irrigation District's
GPS	global positioning system
LiDAR	light detection and ranging
MPSL-MLML	Marine Pollution Studies Laboratory at Moss Landing Marine Laboratories
PHAB	parameters, and physical habitat
QA/QC	quality assurance/quality control
Authority	Sites Project Authority
Project	Sites Reservoir Project
SWRCB	State Water Resources Control Board
Aquatic Study Plan	Stone Corral Creek and Funks Creeks Aquatic Study Plan
SQL	Structured Query Language
SWAMP	Surface Water Ambient Monitoring Program
TC Canal	Tehama-Colusa Canal
TCCA	Tehama-Colusa Canal Authority
TAF	thousand acre-feet
USGS	U.S. Geological Survey

1.0 Introduction and Purpose

1.1 Introduction

This Stone Corral Creek and Funks Creeks Aquatic Study Plan (Aquatic Study Plan) has been prepared for the Sites Project Authority (Authority) to guide fisheries technical studies to be conducted prior to and during operation of the Sites Reservoir Project (Project), as well as ongoing monitoring during Project operations. The Project is a proposed offstream storage project located on the west side of the Sacramento Valley in Glenn and Colusa Counties, approximately 10 miles west of the community of Maxwell in Glenn and Colusa Counties. It is designed to store unappropriated water from winter and spring storm events in the northern Sacramento River watershed. The Project would impound a maximum of 1.5 million acre-feet of water in a reservoir. The reservoir would be created by building Sites Dam on Stone Corral Creek, Golden Gate Dam on Funks Creek, and a series of saddle dams on the northeastern rims of Antelope Valley. While a portion of naturally occurring seasonal flows in Stone Corral and Funks Creeks would be retained in the reservoir, the primary source of water for the reservoir would be diversions from the Sacramento River. These diversions would be up to 4,200 cubic feet per second (cfs) via two existing facilities: the Red Bluff fish screen and pumping plant (operated by the Tehama-Colusa Canal Authority [TCCA]) and the Glenn-Colusa Irrigation District's (GCID) fish screen and pumping plant near Hamilton City.

1.2 Purpose of Aquatics Study Plan

As part of the Project alternatives development, the Authority has committed in the Project's Final Environmental Impact Report (EIR) and Environmental Impact Statement (EIS), as well as in the Project's application to appropriate water, to conduct technical studies. Together, these studies would document the two creeks' existing hydrology, assess flow levels needed to maintain fluvial geomorphic processes, and update information on aquatic species presence and habitat use in the reaches downstream of the dams to the streams confluence with each other to establish aquatic baseline information that would be used to manage environmental releases from the Project into the creeks. As part of this Aquatic Study Plan, these studies would be initiated once access permission to the creeks through private property is obtained. The studies would also be used to inform final design for the proposed Sites Dam and Golden Gate Dam release facilities and operational requirements. The Aquatic Study Plan includes fish monitoring, a Surface Water Ambient Monitoring Program (SWAMP) bioassessment study, a hydrogeomorphic study, and a temperature study. Specific details for the field studies would be designed and conducted in collaboration with the California Department of Fish and Wildlife (CDFW) and State Water Resources Control Board (SWRCB).

The objectives of these studies are as follows.

- Determine existing fish assemblages in these creeks, including fish species presence and habitat use.
- Characterize habitats available (e.g., spawning, rearing, foraging, and sheltering habitats) at varying flow levels, including the presence or absence of pools that persist through summer, which may require some supplemental flow.
- Characterize flows, including assessing the baseflow during summer and conducting a fluvial geomorphologic study to characterize habitat conditions, substrate compositions, and flow levels necessary for protection of aquatic habitat and sediment mobilization.

- Conduct a SWAMP technical study (i.e., a stream bioassessment) that focuses on relationships between physical habitat, water quality, and benthic macroinvertebrates.
- Implement hydrological studies to define flow temperature relationships.

The Authority would use information from the results of implementation of this Aquatic Study Plan, including field studies described below, to prepare a Reservoir Operations Plan for Stone Corral Creek and Funks Creek. The Reservoir Operations Plan would identify the approach for flow releases, including release schedule and volumes, and an adaptive management plan to maintain fish in good condition consistent with California Fish and Game Code (CFGC) Section 5937 in the creek reaches of interest. These reaches are below the locations of Sites and Golden Gate Dams and upstream of the confluence of Stone Corral Creek and Funks Creek. The information would be integrated to focus on aquatic species of concern in the lower portions of the two creeks with an emphasis on maintaining existing community structure and habitat conditions. It is expected that flow releases from Sites Reservoir into these creeks would mimic the seasonal pattern of their natural discharge, but that releases would be lower during Sacramento River Index Dry and Critically Dry Water Years and higher during Above Normal Water Years.

This Aquatics Study Plan summarizes the methods and reporting strategies for the reaches downstream of the proposed impoundments on Stone Corral Creek and Funks Creek. Using information obtained from these field studies, along with currently available information, the Authority would develop a schedule of releases for Stone Corral Creek and Funks Creek to be incorporated into the Reservoir Operations Plan. Flow releases into these creeks would be made to maintain flood control benefits of the Project and would not overtop streambanks or flood downstream areas. The release schedule would also account for meeting demands of senior water right holders on Funks and Stone Corral creeks that are downstream from the proposed dams. Appendix 2D, *Best Management Practices, Management Plans, and Technical Studies* of the *Sites Reservoir Project Revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement* (Sites Project Authority and Bureau of Reclamation 2021) describes the purpose, objectives, content, and timing of the field studies identified above.

Furthermore, the Authority has proposed to adapt this study program into an operations monitoring program with a duration of 5 to 10 years to document and adaptively manage the timing and magnitude of flow releases to maintain fish below the dams and the habitats upon which they depend. Performance standards would be developed in conjunction with the Authority and the relevant permitting agencies (CDFW, SWRCB and the Central Valley Regional Water Quality Control Board [CVRWQCB]) prior to the start of operations monitoring.

2.0 Environmental Setting

2.1 Environmental Setting of Stone Corral and Funks Creeks

Stone Corral Creek and Funks Creek are both small watersheds originating below the snowline on the eastern foothills of the California Coast Range at elevations of 700 to 850 feet. Consequently, they do not receive cold snowmelt water. Rather, they respond rapidly to significant rainfall events and flow intermittently, mostly during winter and early spring. From their origins, they flow through low foothills, across Antelope Valley (the proposed site of Sites Reservoir), through a series of shallow canyons and eventually spill onto the Sacramento Valley floor (Figure 1). For much of their course on the valley floor, they are confined to narrow channels between berms along the edge of agricultural fields and road prisms. While the stream channels of these creeks are not actively managed, their straight alignment and angular turns around agricultural fields and along roads indicate that they were modified from their natural historic channels. In the upper parts of the watersheds just above the dam locations, these streams are largely devoid of riparian cover resulting from livestock use (Bureau of Reclamation and California Department of Water Resources 2008:3-20). In the lower reaches where the streams run through and around agricultural fields, shaded riparian habitat is sparse and consists mostly of low shrubs, grasses, and occasional oaks (*Quercus* sp.) and cottonwood (*Populus* sp.) trees.

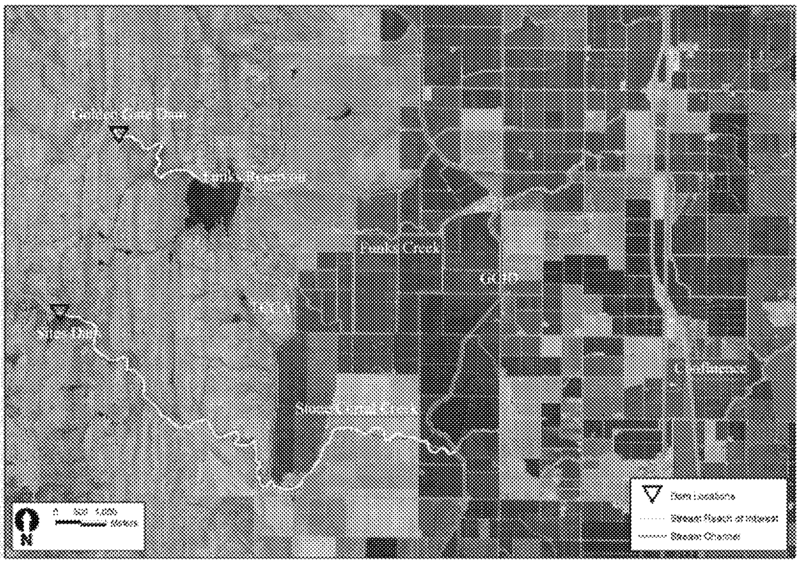


Figure 1. Stone Corral and Funks Creek Reaches of Interest and Downstream Reaches

2.1.1 Stone Corral Creek

Stone Corral Creek has a drainage area of 38 square miles at the proposed Sites Dam. From the proposed location of the Sites Dam, Stone Corral Creek meanders through a shallow canyon onto the valley floor, where it flows through an incised channel across grazing lands. At 4.6 miles from the Sites Dam location, Stone Corral Creek crosses over a siphon in the Tehama-Colusa Canal (TC Canal) and begins to travel through agricultural lands. About 3 miles below the TC Canal siphon, Stone Corral Creek crosses the GCID Main Canal. Although most of the water in the canal passes under Stone Corral Creek in a siphon, GCID releases water from the canal into Stone Corral Creek for delivery to agricultural fields downstream. About 5.5 miles below the GCID Main Canal, Funks Creek flows into Stone Corral Creek, and then Stone Corral Creek flows an additional 5 miles to the Colusa Basin Drain.

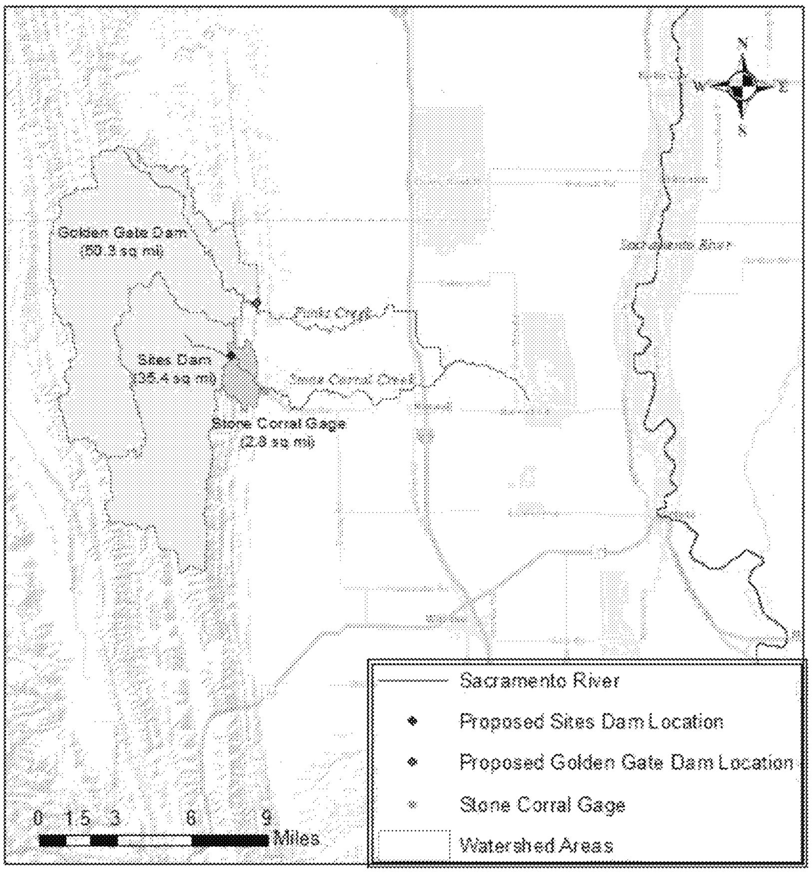
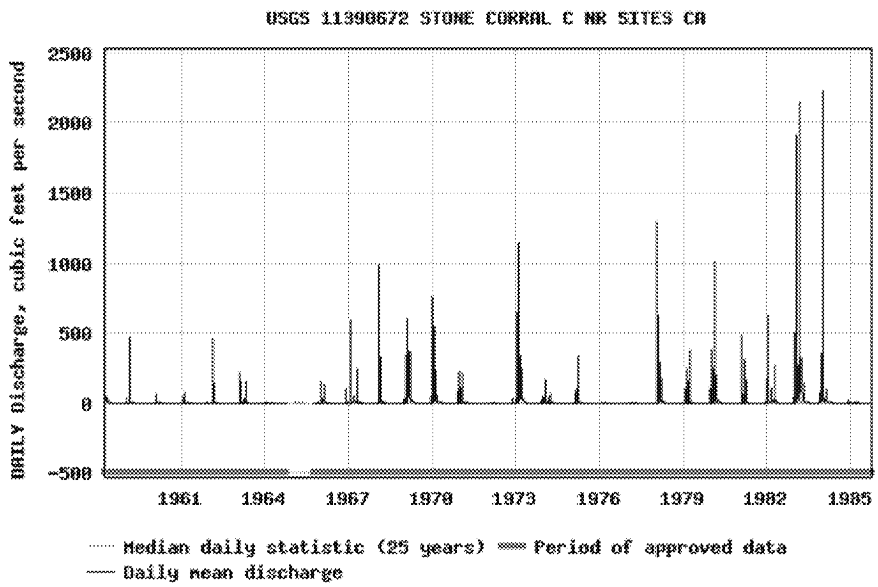


Figure 2. Stone Corral Creek and Funks Creek Watersheds Upstream of Proposed Sites Dam and Golden Gate Dam Locations and Stone Corral Creek Gage Location

The U.S. Geological Survey (USGS) collected 27 years of discharge measurements at USGS Gage No. 11390672, in Stone Corral Creek near the community of Sites, California, from 1958 through 1985 (Figure 2). The data demonstrate a high variability of flow over the period of record, and there were 3 years of zero flow: 1972, 1976, and 1977 (Figure 3). Yates (1989) estimated the recurrence interval of a winter without flow at 12 to 14 years. The maximum annual discharge during the period of record was 39.9 thousand acre-feet (TAF) in 1983. Based on the USGS period of record, mean annual daily discharge for the period of record was calculated as 9.02 cfs (SD of 67.5, median is 0) and annual average discharge through the creek was 6.5 TAF per year.



Source: U.S. Geological Survey stream gage 11390672

Figure 3. Mean Daily Flow in Stone Corral Creek near Sites (cfs)

Because the historical gage record for Stone Corral Creek is limited and Funks Creek is not gaged, historical stream gage data from Elder Creek was used to produce a longer-term estimate of streamflow on Stone Corral and Funks Creeks. The Elder Creek gage was chosen because it was the nearest gage on the valley floor with a long record of data available. It was assumed that Elder Creek has relatively similar precipitation and runoff patterns to Stone Corral and Funks Creeks. The streamflow of Elder Creek, located in Tehama County, has been measured since 1948 (USGS Gage No. 11379500). The gage site is approximately 49 miles northwest of the proposed Sites Reservoir, and has a drainage area upstream of the gage of 92.4 square miles (Attachment 1- MBK Engineers 2022). The overlapping period of gage records for Stone Corral Creek and Elder Creek (1958–1985) was used to determine a logarithmic correlation between the two gages for each month of the year. The developed streamflow timeseries was then further adjusted to account for the difference in watershed areas upstream of the old USGS Stone Corral Creek gage and the proposed location of Sites Dam. Table 1 provides the results of this analysis, which shows the average monthly flow volume by water year type (MBK Engineers

2022). The average monthly flow volumes are calculated using the gage record for October 1958 through August 1985 with logarithmic monthly correlations for September 1985 through September 2021. Results are summarized by Sacramento Valley Water Year Type: wet, above normal, below normal, dry, and critical.

Table 1. Stone Corral Creek at Proposed Sites Dam Average Monthly Flow Volume (ac-ft) by Water Year Type (1958–2021)

Month	Wet	Above Normal	Below Normal	Dry	Critical	Average of All Years
Oct	0	0	0	0	0	0
Nov	42	11	2	5	0	17
Dec	872	242	29	47	54	336
Jan	3,365	2,825	711	345	171	1,663
Feb	4,487	4,667	1,283	135	307	2,317
Mar	2,135	1,522	407	264	179	1,039
Apr	901	319	114	25	35	375
May	136	119	15	7	9	65
Jun	20	8	2	1	1	8
Jul	1	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
WY Total	11,959	9,713	2,562	828	757	5,827

2.1.2 Funks Creek

Funks Creek, a tributary to Stone Corral Creek, has a drainage area of 50.3 square miles upstream of the proposed Golden Gate Dam. From the proposed location of Golden Gate Dam, Funks Creek meanders through a series of low ridges and grazing lands for about 1.8 miles to Funks Reservoir. Funks Reservoir is a re-regulating reservoir on the TC Canal and is created by a low dam on Funks Creek. Funks Dam is operated by TCCA to manage water levels within the TC Canal. However, the Funks Dam gates are opened during large storm events to pass flood waters through Funks Reservoir and down Funks Creek to avoid compromising the TC Canal and its operations. There are no requirements to maintain flows in Funks Creek below Funks Reservoir, but seepage through the dam gates maintains perennial flow in Funks Creek.

Below Funks Dam, Funks Creek travels 3.9 miles through agricultural fields in a combination of natural and straightened channels to where it crosses the GCID Main Canal. While the GCID Main Canal passes under Funks Creek in a siphon, GCID releases water from the canal to Funks Creek. Similar to Stone Corral Creek, GCID uses the downstream portions of Funks Creek as part of its conveyance system to deliver water to agricultural fields. Approximately 2 miles northeast of Maxwell and 1 mile east of Interstate 5, Funks Creek flows into Stone Corral Creek.

There is no flow record for Funks Creek, but given the comparable size, geology, and topography of the two watersheds and their proximity to each other, Funks Creek seasonal flow patterns and flow magnitudes are likely similar to Stone Corral Creek.

The same correlation approach used to estimate streamflow in Stone Corral creek cannot be followed to estimate streamflow in Funks Creek because there are no streamflow data available for Funks Creek. Therefore, flow in Funks Creek was estimated by prorating monthly Stone Corral Creek streamflow data by the ratio of Funks and Stone Corral Creek's watershed areas upstream of the proposed dam locations (MBK Engineers 2022). Table 2 provides the results of this analysis and identifies the average monthly flow volume by water year type.

Table 2. Funks Creek Average Monthly Flow Volume (ac-ft) by Water Year Type (1958–2021)

Month	Wet	Above Normal	Below Normal	Dry	Critical	3-Year Average
Oct	0	0	0	0	0	0
Nov	60	16	3	7	1	24
Dec	1,239	343	41	66	77	485
Jan	4,778	4,011	1,010	489	243	2,362
Feb	6,372	6,628	1,822	192	436	3,290
Mar	3,031	2,161	578	375	255	1,475
Apr	1,280	453	162	36	49	553
May	193	169	21	9	13	93
Jun	28	11	2	1	2	12
Jul	2	0	0	0	0	1
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
WY Total	16,984	13,793	3,638	1,176	1,075	8,275

Physical Characteristics

The only drainages that exit Antelope Valley are Stone Corral Creek and Funks Creek. Each creek continues through the steeper, foothill environments and then transitions to the Sacramento Valley floor, where each is generally shallow and highly altered, primarily for water conveyance and agricultural purposes. Straight channels and angular turns associated with agricultural fields and roads indicate that natural channels have been at least partially modified. Along their reaches on the valley floor, these creeks are mostly confined to narrow channels between berms adjacent to agricultural fields and road prisms.

Stone Corral Creek and Funks Creek are largely devoid of riparian habitat in their upper reaches (foothill environments) due to heavy livestock use. In the lower reaches where the creeks run through and around agricultural fields, riparian habitat is variable and consists mostly of low shrubs, grasses, and occasional oak and cottonwood trees; however, some segments of Stone Corral Creek possess dense stands of mature riparian vegetation.

Although the reaches of interest have been modified by livestock grazing, channelization, irrigation conveyance systems and minor diversions, they are still expected to have available aquatic habitat (i.e., benthic macroinvertebrate [BMI]). They also both experience much of their natural hydrograph (albeit altered due to local conveyance) and fluvial geomorphic processes and provide water and sediment that ultimately flows into the Colusa Basin Drain during rain events. Some of the larger flow events may be important for water (and sediment) contributions to the Colusa National Wildlife Refuge.

3.0 Fish Monitoring

3.1 Study Design

Assessment of the goal to maintain fish in good condition consistent with CFGC Section 5937 would be made using a Before-After-Control-Impact experimental study design, using the reach below Funks Reservoir as a control. Sampling would be conducted to assess fish community and habitat present in the study area for up to 5 years prior to operation of the Project. Following completion of the pre-operation survey, fish communities and aquatic habitats in the study area would be monitored in a similar fashion for a 5-to-10-year period after the Project is operational. Fish community and habitat data that showed statistically significant negative departures from baseline data would trigger reassessment of downstream flow management under a proposed adaptive management plan.

3.1.1 Pre-operation Baseline Monitoring

Pre-operation baseline monitoring would be conducted within the study area to identify, quantify, and map habitats (Chapter 4, *SWAMP Bioassessment Study Designs and Methodology*), document aquatic species distribution and population characteristics (e.g., relative abundance, diversity), and identify triggers (e.g., decrease in relative abundance) for adaptive management actions. This monitoring establishes a baseline condition from which success criteria are measured and includes initial reconnaissance and pre-operation sampling.

The pre-operation surveys would first involve a reconnaissance survey to observe and record variables that may affect sampling efforts and establish monitoring stations. Data collection would include information about the site, habitat, and fauna that are observed during site visits. Aquatic habitat and fish species sampling would be conducted once the reconnaissance is complete and sampling stations have been established. Data would be collected via standardized electronic or paper forms by experienced biologists during assessments and sampling. Data collected as part of pre-operation efforts would be summarized into yearly reports and a final pre-operation baseline report to the Authority at the end of the pre-operation survey period. Surveys would provide the information required to characterize baseline conditions of the fisheries resources, as well as threats and stressors to fish species and habitat in the pre-operation conditions.

3.1.2 Operations Monitoring

Operations monitoring would occur periodically at appropriate intervals specified herein, or as required by other plans and programs, or as established by the Authority. Operations sampling would document fish abundance, condition, and distribution and compare the results with data collected on habitat area, location, and changes in habitat characteristics over time. Data from the fish study would be used in documenting compliance with CFGC Section 5937 with data from the SWAMP assessments providing additional details on overall stream status.

Operations sampling methods would be identical to the pre-operation sampling, including returning to established stations and tracking fish abundance, diversity, and distribution through time. Threats and stressors identified in the pre-operation survey would be assessed during operations surveys to differentiate changes in habitat or fish communities not related to the operation of the Project. Data collected as part of the operations sampling effort would be compared against the baseline data, as well as previous years' data and summarized into interim and final reports to the Authority.

3.1.3 Integration with Aquatic Habitat Survey Methods

Aquatic habitat survey methods for sampling are described below. Note that the field observations and results from other studies (i.e., the stream bioassessment study and hydrogeomorphic study) would aid in the assessment of aquatic habitat and are referenced where applicable.

An initial reconnaissance survey would provide information on existing habitat and inform the selection of sampling stations within the Stone Corral Creek and Funks Creek drainages. Stations would initially be set at fixed distances apart to accommodate between 10 and 15 sampling stations within each drainage. Stations would be mapped prior to going into the field and then field-verified during the reconnaissance survey. Some leeway would be given to adjust locations to prioritize reaches containing optimal fish habitat. Stations that fell within dry or sub-optimal aquatic habitat for fish survival would be de-prioritized or curtailed.

As part of the pre-operation sampling for fish community and aquatic habitat, the following data would be collected and/or integrated into the fish study:

- **Fish community** – Surveys would characterize local fish communities using methods described below. As feasible and appropriate, methods would be consistent with those used in previous and ongoing fish community survey efforts (e.g., methods accepted as standard practice for sampling aquatic systems; Meador et al. 1993). (Fish Study)

- **Substrate composition** – Surveys would document stream bed substrate particle size using Wolman pebble counts (Wolman 1954; Kondolf and Li 1992), gravelometer, substrate facies mapping, or similar methods. (Hydrogeomorphic Study)

- **Riparian vegetation cover** – Surveys would measure the relative amount (e.g., percent cover) of riparian vegetation cover over aquatic habitat to document conditions. Riparian vegetation cover would be monitored using the California Rapid Assessment Method (Brown 2013), or similar method. (Hydrogeomorphic Study)

- Benthic macroinvertebrate presence – A SWAMP bioassessment that focuses on the relationships between physical habitat, water quality, benthic macroinvertebrates, and algal communities would be conducted on the reaches downstream of the proposed impoundments on Funks Creek and Stone Corral Creek. The bioassessment study would be conducted using the methods described in the SWRCB's SWAMP protocols (Ode et al. 2016a, 2016b). (SWAMP Bioassessment Study)

- **Water quality** – Monitoring for general water quality parameters (e.g., temperature, turbidity, pH, conductivity, salinity, dissolved oxygen) would be conducted to assess surface water quality. Water quality monitoring would be conducted using methods described in the State Water Board's SWAMP protocols (Ode et al. 2016a, 2016b). (SWAMP Bioassessment Study and Fish Study)

- **Water temperature:** – Water temperature profiles for Stone Corral Creek and Funks Creek would be developed. These water temperature profiles would be used to inform decisions about which tiers of the inlet/outlet (I/O) tower to use when conducting releases into downstream water bodies. The goal would be to mimic existing temperature profiles to benefit native fish in Funks Creek, which are accustomed to the warm temperatures present in this creek under existing conditions (Temperature Study).

3.1.4 Fish Sampling Methods

Beach Seining

Seining is a low cost, low impact method for capturing aquatic organisms. Circumstances that may affect efficacy include the amount or type of benthic structure, presence/absence of aquatic vegetation, water clarity, flow rate, and water depth. Seining is most effective in smooth bottom habitats free of aquatic debris or vegetation, with elevated turbidity, and are shallow enough for biologists to wade in. When benthic structure is complex, water clarity is high, and habitats contain extremely deep, shallow, or rapidly moving water that may exclude biologists from deploying nets, efficacy is dramatically decreased.

Seines with a "bag" to minimize aquatic organism handling stress are preferred. Seines with a bag are also preferred where obstructions make access to the water (or deployment/retrieval of the seine) difficult (U.S. Fish and Wildlife Service 2012). Blocking nets typically improve efficacy by reducing opportunities for target species to move out of the area being seined. Where the area to be isolated for sampling includes culverts, deep pools, undercut banks, or other cover attractive to fish (e.g., thick overhanging vegetation, root wads, logjams) it may be appropriate to isolate a portion or portions of the study area in phases, rather than attempting to herd fish from the entirety of the work area in a single downstream pass.

The size of the seines used for sampling would depend on the size of the habitat being sampled. Larger seines may be up to 30 feet long, 6 feet high, with a mesh size of 0.25 inch and a pocket size of 5 feet by 5 feet. Smaller seines used for small pools and ponds may be 12 feet long, 4 feet high, with a mesh size of 3/16 inch and a pocket that is 5 feet by 5 feet. Seines would be used or deployed in conjunction with block nets to prevent fish from moving out of the area prior to being sampled. Captured specimens would be held in floating net pens or large aerated containers, based on site conditions, prior to being processed. Specimens would be identified to species and the first 20 of each species would be measured for fork length to the nearest millimeter before being released at the capture site. Additional specimens would be tallied and released. Representative specimens would be photographed for positive identification.

Electrofishing with Block Nets

The effects of electrofishing are typically short-term and limited to fish in the area immediately surrounding the electrical field. However, electrofishing has limited use in deeper water and in low and high conductivity water (Beauchamp 1995). Additionally, not all species are easily targeted by electrofishing (e.g., benthic species may be under-represented) (Beauchamp 1995), and capture may be biased towards larger fish.

Previous work in Stone Corral and Funks Creeks indicates that total dissolved solids are high enough to prevent the use of electrofishing as a means of sampling (California Department of Fish and Game and California Department of Water Resources 2000). During reconnaissance surveys, basic water quality measurements would be taken to confirm this observation. If total dissolved solids values are above levels known to interfere with electrofishing, the method would be curtailed in favor of seining. If employed, electrofishing would be done with a Smith-Root type backpack electrofisher. Sections of creeks would be isolated using blocking nets before biologists wade into them, starting from the upstream net and moving downstream. Captured specimens would be held in buckets, floating net pens, or large aerated containers prior to being identified and measured as above for seine sampling. Effort would be calculated using shock time. If fish exhibit signs of stress, including symptoms of tetany or bruising, electrofisher settings would be adjusted accordingly to reduce impacts.

Visual Surveys

Any visual observations by biologists during reconnaissance and sampling of stream fauna would be systematically recorded based on pre-determined reach locations. This would include documenting amphibians and reptiles that may be observed incidentally during fish sampling efforts.

General Water Quality

Water quality data would be measured at every station using a YSI Pro DSS unit (or similar collection device), following Chapter 3 of the 2016 version of the SWAMP *Standard Operating Procedures for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat* (SWAMP 2016 SOP) (Ode et al. 2016a) and recorded on standard SWAMP data forms. Water quality data obtained would include temperature, specific conductivity, salinity, dissolved oxygen, turbidity, and pH.

3.1.5 Fish Response

Abundance

All sampling efforts would be quantified using catch per unit effort (CPUE). Catch metrics would be computed based on the CPUE for a specific sampling method. Tracking CPUE by sites would be organized into charts or tables that accurately portray the CPUE for a given site and control effort. When a negative response in the CPUE of a target fish community for a given method is observed across sites or across sampling periods, investigators would assess whether the decline exceeded the threshold for triggering reassessment of flows under the proposed Adaptive Management Plan. If declines were observed to exceed thresholds, the Authority would be notified.

The CPUE would be computed for each sample method and assessed once multiple data sets are available for comparison. Numbers of individuals, weight, and area sampled would be recorded. A decline in CPUE, in comparison to baseline values and accounting for threats and stressors, would reflect a potential adaptive management trigger.

Condition

Condition factor (K) would be calculated for all fish specimens for which length and weight have been recorded. The condition factor of fish reflects environmental and biological circumstances and fluctuations in feeding conditions and physiological factors (Le Cren 1951). The condition factor also indicates changes in food reserves and can be used as an indicator of the general condition of aquatic organisms. Therefore, information on condition factor can be used to assess biological health of monitored organisms because the measure provides information about the specific condition under which organisms are developing (Araneda et al. 2008).

A decline in condition factor, in comparison to baseline values and accounting for threats and stressors, would reflect a potential adaptive management trigger.

Distribution

Fish presence would be recorded and tracked through the study area. Fish distribution would be determined through reconnaissance and pre-operation surveys, known distributions, and incidental observations made during other sampling efforts. Records may be kept as count data and volumetric data but would ultimately be provided as presence or absence of fish species within sampling reaches.

3.2 Timing and Frequency

The schedule and effort for the pre-operation and operation portions of the proposed study are detailed below. The pre-operation surveys would be five consecutive annual visits staged at any point prior to start of operation and within the seasonal restrictions indicated below. Monitoring efforts would be one-per-year visits each year following initiation of operation up to a 5- or 10-year timeline as determined by the Authority.

Pre-Project implementation:

- Desktop scoping effort: lay out sampling reaches using geographic information system (GIS) data overlaid on aerial imagery, organize data sheets, and coordinate with water quality and SWAMP efforts. Spring 2022
- Initial reconnaissance: 2 days with 2-person crew; ideal timing would be when water levels are most restricted, which is typically in autumn.
- Pre-operation effort 1: 14 days with 4-person crew. 2023
- Pre-operation effort 2: 14 days with 4-person crew. 2024
- Pre-operation effort 3: 14 days with 4-person crew. 2025
- Pre-operation effort 4: 14 days with 4-person crew. 2026
- Pre-operation effort 5: 14 days with 4-person crew. 2027

Post-Project implementation:

- Operation effort 1: 14 days with 4-person crew. 2028
- Operation effort 2: 14 days with 4-person crew. 2029
- Operation effort 3: 14 days with 4-person crew. 2030
- Operation effort 4: 14 days with 4-person crew. 2031
- Operation effort 5: 14 days with 4-person crew. 2032
- Additional efforts up to 10 years after initial operation would be determined by the Authority.

Permitting Requirements

A CDFW Scientific Collecting Permit (Specific Use) or Memorandum of Understanding permit would be required to complete the study design as proposed. BMI samples would be the only sacrificed species.

4.0 SWAMP Bioassessment Study Designs and Methods

4.1 Purpose of Bioassessment Monitoring Program

Stream bioassessment monitoring is a method of evaluating and monitoring the environmental health and integrity of freshwater wadeable streams by using BMI, water quality parameters, and physical habitat (PHAB) conditions indicators of stream condition. Bioassessments are especially useful in tracking the aquatic conditions before and after a project is implemented to determine the project effects on aquatic communities. A SWAMP bioassessment that focuses on the relationships between physical habitat, water quality, BMI, and algal communities would be conducted on the reaches downstream of the proposed impoundments on Stone Corral Creek and Funks Creek.

This information, along with the other required studies (i.e., Fish Assemblage Study and Hydrogeomorphic Study), would help to inform the type of flow releases that should be made to the creeks under various operating conditions.

4.2 Overview of Proposed Methods

The bioassessment effort would be conducted using the methods described in the SWAMP 2016 SOP (Ode et al. 2016a, 2016b), or any updated version thereof. The reach-wide benthos method, which requires collection from each of 11 designated major transects across the sampling reach regardless of stream habitat type (e.g., riffle, run, pool), would be employed.

The ultimate number of individual sites, herein referred to as sampling reaches, on each creek would be based on access and safety; however, it is anticipated that five sampling reaches would be located on Funks Creek and that six sampling reaches would be located on Stone Corral Creek (Figure 4). Since there is no stringent guidance on establishing the number of bioassessment sampling reaches for a project such as this (Rehn pers. comm.), the number of sampling reaches was chosen to both best capture and quantify the two different elevational gradients within the study area (i.e., foothill and valley floor environments), and to have adequate spacing/distance between the sampling reaches (approximately 500 meters apart on Funks Creek above Funks Reservoir and approximately 2 kilometers apart elsewhere).Field and laboratory methods would be fully described in an associated Quality Assurance Project Plan.

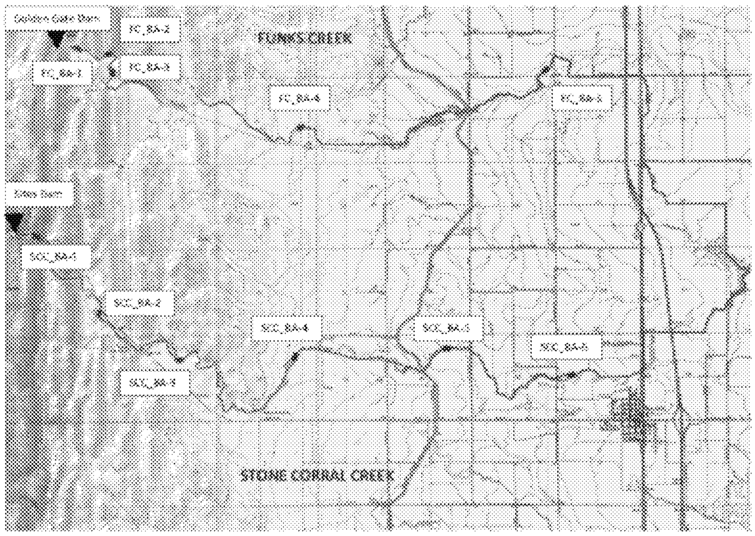


Figure 4. Potential Bioassessment Sampling Reaches, Stone Corral and Funks Creeks

4.3 Field Methods

This section summarizes the methods that would be used to collect all bioassessment data. All surveys would be performed by a qualified team of a biologist or biologists and a geomorphologist with expertise in benthic macroinvertebrate and algae collection, water quality monitoring, and physical habitat data collection.

4.3.1 Sampling Reach Delineation

As described in Chapter 2 of the SWAMP 2016 SOP, the average wetted width of each sampling reach would be used to determine the sampling reach length (Ode et al. 2016a). The SWAMP 2016 SOP specifies standard sampling reach lengths that are based on wetted width (150 meters for sampling reaches with average wetted widths less than or equal to 10 meters, and 250 meters for sampling reaches with average wetted widths greater than 10 meters).

After the sampling reach length is determined, it would be laid out using marked surveyor's flags for transect identification and transects would be labeled according to the SWAMP 2016 SOP (main transects A–K and inter-transects AB, BC, etc.) for a total of 11 main transects and 10 inter-transects.

4.3.2 Basic Data Collection

Basic information collected at each sampling site would include project name, sampling reach name, time and date of survey, stream/watershed name, global positioning system (GPS) coordinates, and the names of the survey crew members. GPS coordinates would be recorded with an appropriate collection device (e.g., hand-held GPS receiver or iPad). Data collected at the sampling reaches would include water quality and stream discharge measurements, physical habitat information, and BMI and algae sample collections. The most recent version of the SWAMP *Stream Habitat Characterization Form Full Version* field forms would be used to enter data in the field.

4.3.3 Water Quality and Discharge Measurements

Water quality data would be measured using a YSI Pro DSS unit (or similar collection device), following Chapter 3 of the SWAMP 2016 SOP (Ode et al. 2016a) and recorded on standard SWAMP data forms. Water quality data obtained would include temperature, specific conductivity, salinity, dissolved oxygen, alkalinity, turbidity, and pH.

To determine alkalinity (which is a standard YSI is not capable of doing), a water sample would be collected at each sampling reach. The sample would be taken at approximately 10 to 15 centimeters below the water surface. Using gloves, collectors would fill the water sample bottles to the brim to ensure that air bubbles would not get trapped in the sample bottle. The bottle would then be placed on ice in a cooler until all field data collections were completed. In the evening following each day's sample collection, the water samples would be removed from the coolers and allowed to warm to room temperature. Alkalinity would then be determined by the double endpoint titration method using a Hach Digital Titrator.

Stream discharge would be measured using a Marsh-McBirney Flo-Mate Model 2000 flow meter and following the Velocity Area Method (Module O in Chapter 8 of the SWAMP 2016 SOP (Ode et al. 2016a, 2016b). Every effort would be made to select a stream transect with a relatively uniform cross section and laminar flow, and at least 20 equally spaced data points would be used to estimate streamflow.

4.3.4 Physical Habitat Assessment and Photo-Documentation

As required by the SWAMP 2016 SOP, PHAB information would be collected at the sampling reaches at each transect and inter-transect location. At the 11 main transects, the full measurements listed in Chapter 6 of the SWAMP 2016 SOP would be taken (Ode et al. 2016a, 2016b). At the 10 inter-transects, fewer measurements would be taken per the SWAMP *Stream Habitat Characterization Form Full Version* field forms.

Digital photo documentation for each sampling reach would consist of upstream and downstream views at transects A, F, and K (i.e., the downstream, middle, and upstream portions of the sampling reach). Incidental observations such as recent rainfall, fire effects, flooding, and other disturbances would also be recorded.

At each sampling reach, reach-wide PHAB conditions relative to three Rapid Bioassessment Protocol (RBP) habitat parameters would be evaluated based on visual observations. These observations would include epifaunal substrate/cover, sediment deposition, and channel alteration. Each of these parameters would be scored using the following numeric value and ranked using the following 20-point scale, per the SWAMP 2016 SOP.

- 1–5 rank as poor
- 6–10 rank as marginal
- 11–15 rank as suboptimal
- 16–20 rank as optimal

4.3.5 Benthic Macroinvertebrate Sample Collection

BMI collection would be conducted according to the SWAMP 2016 SOP, using the reach-wide benthos method, which requires collection from each of the 11 major transects across the sampling reach regardless of stream habitat type (e.g., riffle, run, and pool). The BMI samples would be collected 1 meter downstream of each major transect by sampling a 1-foot-square area using a D-frame net. The sampling would begin at transect A (the downstream end) and continue upstream to transect K, with the sample location alternating from left (25% of width), to center (50% of width), to right (75% of width) on each subsequent transect.

All collections from the 11 major transects would be composited into a single sample and transferred into a 1-liter, wide-mouth plastic jar and preserved with 95% ethanol, following the SWAMP 2016 SOP. Samples would be labeled with collection site, time, and collector's name; and a chain-of-custody form would be filled out to accompany the samples on their way to the laboratory for identification. Replicate samples would be collected according to the SWAMP 2016 SOP at one sampling reach for quality assurance/quality control (QA/QC) purposes.

4.3.6 Algae Sample Collection

Algae would be collected in the same manner as the BMI samples, except that the algae would be collected 25 centimeters above the location where the BMI sample would be located. Algae samples would be collected using the sampling tools identified in the SWAMP 2016 SOP, which vary according to the substrate being sampled. A rubber delimiter would be used for large gravel and cobble; a PVC delimiter would be used for fines and gravels; and a syringe scrubber would be used for bedrock and large boulders (if present).

Similar to the BMI sampling, each algae sample collected at the 11 major transects would be composited into a single sample for processing. The processing of the algae would follow the SWAMP 2016 SOP, which would involve removal of algae from the substrates collected and processing the sample for the four algae analyses: quantitative soft-bodied algae, quantitative diatoms, ash-free dry mass (AFDM), and chlorophyll a. A soft-bodied algae qualitative sample would also be collected from each sampling reach by collecting a composite of all types of soft-bodied algae observed within the sampling reach into a single sample. This sample would aid in the identification of soft-bodied algae in the quantitative sample and would be used in the calculation of some of the algae metrics. Replicate algae samples would be collected at the same sampling reaches where replicate BMI samples would be collected.

4.4 Laboratory Processing

This section summarizes the methods that would be used to process all bioassessment data.

4.4.1 Water Quality

Water samples would be collected at each sampling reach to determine total nitrogen and total phosphorus, constituents necessary for helping to determine algal results. Samples would be sent to a local water quality processing laboratory in northern California. The water quality analyses would be consistent with SWAMP protocols for water chemistry. Total nitrogen would be analyzed according to U.S. Environmental Protection Agency Method 351.2, and total phosphorous would be analyzed according to Standard Methods 4500-P B and 4500-P E.

4.4.2 Benthic Macroinvertebrate Sample Processing

BMI sample taxa identification would be conducted by an outside laboratory (most likely by the Chico Aquatic Bioassessment Laboratory [Chico ABL] in Chico, California). BMI samples would be picked, sorted, and identified completely or until a 600 count (SAFIT Level 2) is reached. Chico ABL follows QA/QC procedures developed under the SWAMP program.

4.4.3 Algae Sample Processing

Five types of algae would be collected and processed: qualitative grab, soft-bodied algae, diatoms, AFDM, and chlorophyll a. The qualitative grab, soft algae, and diatom samples would be sent to the CDFW Group at the Marine Pollution Studies Laboratory at Moss Landing Marine Laboratories (MPSL-MLML). MPSL-MLML would report the data to Marco Sigala at Moss Landing in SWAMP template formats. Mr. Sigala would calculate the Algae Stream Condition Index (ASCI) from the data. The samples of AFDM and chlorophyll a would also be sent to MPSL-MLML, who would report the data in California Environmental Data Exchange Network template formats. PSL-MLML follows the QA/QC procedures developed under the SWAMP.

4.5 Data Analysis

PHAB information would be entered using the SWAMP Version 2.5 bioassessment data entry forms (Marine Pollution Studies Laboratory 2022) and then loaded into the Microsoft Structured Query Language (SQL) Server database of the MPSL-MLML. BMI and algae taxonomy data, as well as water chemistry data would be loaded from Microsoft Excel templates into the same Microsoft SQL Server database. The data entry forms and templates would be obtained from the MPSL-MLML Data Center website. All data would be verified and checked for completeness after input into the database.

4.5.1 Physical Habitat Information

PHAB data would be entered by the MPSL-MLML using the SWAMP Bioassessment Field Form Microsoft Access database, and then loaded into the MPSL-MLML's Microsoft SQL Server database. After loading, additional error and completeness checks would be run following SWAMP business rules. The data would be sent to the California Environmental Data Exchange Network, where it would be available to the public for viewing and download.

PHAB metrics would be calculated using the SWAMP Bioassessment Reporting Module. The SWAMP protocol contains a subset of parameters measured within the U.S. Environmental Protection Agency's Environmental Monitoring and Assessment Program for freshwater wadeable streams; therefore, many of their metrics described in Kaufmann et al. (1999) form the basis of the SWAMP Bioassessment Reporting Module output.

SWAMP has developed a PHAB Index similar to the California Stream Condition Index (CSCI) (Section 4.5.3, *Benthic Macroinvertebrates*) for BMI data. The PHAB Index (called the *IPI*) combines eight GIS-calculated metrics with 12 PHAB metrics to produce one IPI value (Rehn et al. 2018). For the purposes of statewide assessments, the IPI has thresholds of physical condition: greater than or equal to 0.94 indicates likely intact condition; 0.93 to 0.84 indicates possibly altered condition; 0.83 to 0.71 indicates likely altered condition; and less than or equal to 0.70 indicates very likely altered condition.

In addition, the results would be compared to key stressor thresholds that best highlight the conditions at the sampling reaches identified in *Ecological Condition Assessment of California's Perennial Wadeable*

Streams: Highlights from the Surface Water Ambient Monitoring Program's Perennial Stream Assessment (PSA) (2000–2007) (Ode et al. 2011). These select stressor thresholds are not regulatory limits set by SWRCB; rather, they are biology-based stressor thresholds developed by researchers as an objective means to set meaningful, regionally appropriate water quality standards. Two statewide and regional physical habitat biological stressor thresholds, the Percent Fines and Sand and Mean Embeddedness thresholds, are examples of biological stressor thresholds that would be appropriate to analyze for this Project.

4.5.2 Water Quality

Similar to the PHAB analysis described above, water quality results would be compared to key stressor thresholds that best highlight the conditions at the sampling reaches identified in *Ecological Condition Assessment of California's Perennial Wadeable Streams: Highlights from the Surface Water Ambient Monitoring Program's Perennial Stream Assessment (PSA) (2000–2007)* (Ode et al. 2011).

4.5.3 Benthic Macroinvertebrates

MPSL-MLML would be contracted to assist in the analysis of the BMI data. MPSL-MLML would use the BMI taxonomic data obtained from Chico ABL to calculate CSCI scores for each sampling reach. The CSCI is a statewide biological scoring tool that translates complex data about individual BMIs found living in a stream into an overall measure of stream health (Rehn et al. 2015).

CSCI scores and output would be calculated using R scripts defined in Mazor et al. (2017). CSCI score categories would be applied as defined in Rehn et al. (2015).

- Less than or equal to 0.62: very likely altered
- 0.63–0.79: likely altered
- 0.80–0.91: possibly altered
- Greater than or equal to 0.92: likely intact

MPSL-MLML would also calculate several BMI metrics from the taxonomic data for each sampling reach. These individual metrics would be reviewed to discuss the individual results for each sampling reach and event. Representative metrics may include measures of taxa richness, composition, tolerance, functional feeding groups, and habit measures. These other metrics may be more insightful for determining the biological integrity of the BMI communities than the CSCI scores alone (at least in the valley floor sampling reaches), as valley floor reference sites (the sites used in the CSCI calculations) are relatively limited in abundance (Rehn pers. Comm.).

4.5.4 Algae

Diatoms and Soft Algae

MPSL-MLML would be contracted to calculate the statewide diatom, soft algae, and hybrid ASCI and associated metrics. These predictive biological indices replace past regional indices with a statewide index allowing for improved comparisons across diverse landscapes in a consistent and comparable manner. While ASCI can be calculated for soft algae and diatoms separately, the hybrid ASCI produces stronger species distribution models for more accurate and integrative assessments of biological condition.

Chlorophyll a and Ash-Free Dry Mass

Ode et al. (2011) in their analysis of the results from the statewide Perennial Stream Assessment between 2000 and 2007, have included stressor thresholds for chlorophyll a and AFDM. These thresholds are more protective than levels proposed by previous authors, which were 100 milligrams per square meter for chlorophyll a and 50 grams per square meter for AFDM (Barbour et al. 1999, Welch et al. 1988, Dodds et al. 1998, Sosiak 2002, Dodds and Welch 2000, U.S. Environmental Protection Agency 2000, Biggs 2000). The thresholds proposed by Ode et al. (2011) are not regulatory limits or requirements but rather recommendations. The chlorophyll a and AFDM stressor thresholds (statewide and regional) would be evaluated for each sampling reach by MPSL-MLML.

4.6 Timing and Frequency

The bioassessment surveys would be conducted during the appropriate index period for Central Valley streams (June through August), which is typically 4 to 6 weeks following the last winter storm event. Depending on stream conditions, however, bioassessment surveys may need to be performed prior to the appropriate index period to ensure adequate flow for benthic and algal sampling is present. Baseline (pre-operation monitoring) would occur in the spring for 5 years prior to project operation. Follow-up (baseline) surveys would be conducted on an annual basis during the same period for up to 10 years after operation activities are initiated. The Authority and the relevant permitting agencies (CDFW, SWRCB and the CVRWQCB) would be consulted if the frequency of monitoring would be shortened after 5 years.

4.6.1 Permitting Requirements

A CDFW Scientific Collecting Permit (Specific Use) or Memorandum Of Understanding permit would be required to complete the study design as proposed. BMI samples would be the only sacrificed species.

4.7 Additional Water Quality Measurements

In addition to the standard water quality measurements included in the SWAMP bioassessment as described above, samples would be collected for additional laboratory measurements. The objectives for taking these additional measurements would be to compare pre-Project and Project values, determine any effect of operational adjustments on sampled water quality constituents, and compare measurement values to key stressor thresholds. These additional measurements include:

- A suite of total and dissolved metals and metalloids. The suite includes aluminum, arsenic, cadmium, chromium (total), chromium, copper, iron, lead, manganese, mercury, methylmercury, nickel, selenium, silver, and zinc.
- Cyanobacteria and cyanotoxins. The cyanobacteria water samples would be collected for the purpose of laboratory analysis for cyanobacteria presence and density and the presence of cyanotoxins (specifically microcystins, anatoxin-a, and cylindrospermopsin).
- Methymercury in fish tissue. Level I trophic level fish would likely be more abundant than higher trophic level fish, so the measurements of methylmercury concentrations in fish tissue would focus on these fish. Higher trophic level fish would be sampled intermittently as available. To assess methylmercury in fish tissue, sampling would be conducted using the SWAMP protocol for California rivers and streams (California Water Boards 2011 or most current).

When these additional water quality samples and fish are collected, the following basic survey information and data described above would be collected: project name, sampling reach name, time and date of survey, stream/watershed name, and the names of the survey crew members. Incidental observations such as recent rainfall, fire effects, flooding, and other disturbances would also be recorded. Basic data collected at the sampling sites would include stream discharge measurements, temperature, specific conductivity, dissolved oxygen, turbidity, pH, and water samples for total nitrogen and total phosphorus laboratory measurements. In addition, water samples would be collected for laboratory measurements of dissolved organic carbon and hardness as these parameters influence water quality standards for aquatic life protection for some metals.

These measurements would be taken twice a year, once during a high flow period and once during a low flow period, at the upstream and downstream bioassessment sampling locations on each creek. Sampling would occur during the same years as the rest of the bioassessment studies.

5.0 Hydrogeomorphic Study

5.1 Purpose of Study

The overall purpose of the Hydrogeomorphic Study would be to characterize historical and present-day streamflows, including baseflow during the spring and summer months, on Funks and Stone Corral Creeks; the relevant geomorphic characteristics of each creek (herein called *geomorphic indicators*); and flow levels necessary for channel maintenance of geomorphic processes required to maintain the channels in their current condition.

A Hydrogeomorphic Study with quantitative and qualitative monitoring data to fully characterize the existing hydrologic regime of Funks and Stone Corral Creeks, as well as the overall type and abundance of sediment available for aquatic organisms, would be developed. To inform the appropriate streamflows for the creeks under inquiry, a geomorphic assessment of the reaches of interest (i.e., the stream reaches below the dams) would constitute the first step in the analysis. The channel segments upstream of the dams would also be rapidly assessed to provide a greater understanding of the local watershed geomorphic characteristics. The focus of the geomorphic assessment would be to determine the dominant geomorphic processes, document the surrounding landforms and channel bed topography, and to determine how the observed morphology of each creek is influenced by the hydrologic regime and the surrounding land uses. Likewise, collection of geomorphic information would aid in the determination of overall channel stability for each creek, which has important implications for the proposed releases.

The Hydrogeomorphic Study to examine the hydrologic regime of Funks and Stone Corral Creeks would include a desktop modeling exercise, as well as installation of stilling wells, staff gages, and real-time water surface level collection devices. The goal of the Hydrogeomorphic Study would be to evaluate the physical and hydrologic condition of the reaches of interest within both Stone Corral Creek and Funks Creek. This information, along with the other required studies as discussed in previous chapters (i.e., Fish Assemblage Study and SWAMP bioassessment study), would help to inform the type of flow releases that should be made to the creeks under various Project operating conditions.

After completion of the baseline studies, consideration would be given to when and how flows would be released and whether a portion of these flows are needed to maintain fluvial geomorphic processes (based on the findings from the geomorphic assessment).

5.2 Study Design

The (baseline) Hydrogeomorphic Study components are discussed below. *Field site locations* are applicable to the geomorphic component of the Hydrogeomorphic Study; *hydrologic monitoring locations* represent the potential locations where stilling wells, staff gages, and real-time water surface level collection devices would be installed (i.e., the hydrologic component of the Hydrogeomorphic Study). The ultimate number of field site locations on each creek would be based on access and safety; however, it is anticipated that five sites would be located on Funks Creek and that six would be located on Stone Corral Creek. The locations for the geomorphic component of the Hydrogeomorphic Study would presumably be the same as the bioassessment sampling reaches as part of the SWAMP bioassessment study as described in Chapter 4 (Figure 4).

The ultimate number of hydrologic monitoring locations on each creek would primarily be based on access, due to the need for monitoring during and after precipitation events. It is anticipated that two sites would be located on each creek: one in the foothills and one on the valley floor as shown on Figure 5.

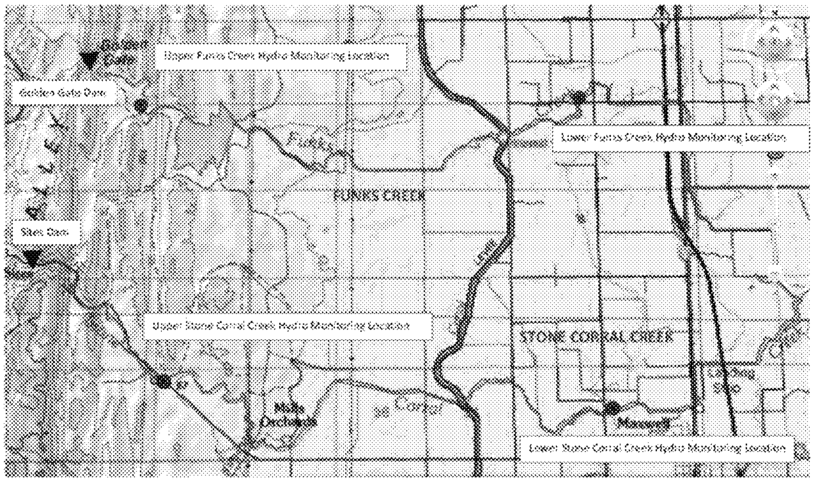


Figure 5. Potential Hydrologic Monitoring Locations, Stone Corral and Funks Creeks

5.2.1 Geomorphic Conditions

Data collected during the geomorphic component of the Hydrogeomorphic Study (geomorphic assessment) would include a host of geomorphic attributes, or indicators, as described below. Topographic data (longitudinal profile and cross sections) needed for the hydrologic model (further described below) would also be collected during the geomorphic assessment. The geomorphic assessment would be conducted by a geomorphologist with expertise in channel and floodplain dynamics, channel stability analyses, and topographic surveying techniques.

The geomorphic assessment would include evaluation of the following indicators.

- Channel classification
- Local watershed inputs
- Hydrologic and flow patterns
- Riparian vegetation condition
- Bankfull width and depth and wetted width
- Bank instability and bank characteristics
- Channel bed substrate composition and embeddedness
- Channel complexity
- Degree of channel incision
- Stage of channel evolution

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- Cross section and longitudinal profile surveys

These indicators would be assessed for each field site location (Figure 4). In addition, at least three permanent cross sections would be established within each field site location and within each hydrologic monitoring location (Figure 5) for collection of quantitative channel morphology information and required modeling input. Evaluation methods for these indicators are described below.

Channel Classification

River segments can be grouped into three generalized classifications based on their position in the watershed and the relative balance of transport capacity to sediment supply (Montgomery and Buffington 1998). Headwater source areas are typically transport-limited (often due to limited channel runoff) but do offer sediment storage that is intermittently initiated under large flow events, debris flows, or other gravitational events. Transport segments are composed of morphologically resilient, supply-limited reaches (e.g., bedrock, cascade, and step-pool) that rapidly convey increased sediment inputs. Response segments consist of lower-gradient, more transport-limited depositional reaches (e.g., plane-bed, pool-riffle) where channel adjustments occur in response to changes in sediment supply delivered from upstream.

Based on field observations and the stream classification methodology of Montgomery and Buffington (1998), each field site location would be classified accordingly. The classification would aid in the determination of the sediment regime and bedform morphology, which would help characterize the stream habitat and function of each field site location on the reaches of interest.

Local Watershed Inputs

Any major inputs of sediment and runoff into the field site locations (e.g., landslides or other mass wasting features, recent burn scars) would be summarized. The objective would be to identify any land use changes that could alter the balance of sediment supply and runoff that could lead to future instability (e.g., channel aggradation of degradation) within the reaches of interest. This would aid in the determination of channel stability and the potential for available habitat to be disrupted or altered in the vicinity of the field site locations.

Hydrologic and Flow Patterns

The hydrologic pattern would be determined throughout the length of the field site locations and would include identification of whether streamflow is perennial, intermittent, or ephemeral. Perennial streams are those which flow year-round; intermittent streams are those which flow for only certain times of the year and receive water from both surface water and groundwater; and ephemeral streams are those which have their channels above the water table year-round and only receive water from surface runoff. This geomorphic indicator would rely on the field-based hydrologic component of the overall Hydrogeomorphic Study, as describe below.

Riparian Vegetation Condition

Riparian vegetation is an important indicator for overall stream habitat and function as it serves to stabilize streambanks and allows for canopy cover to create suitable water temperatures for aquatic species. Riparian condition refers to a description of the general health of the riparian area, focusing on the amount and type of vegetative cover.

Within each field site location, riparian condition would be described as low (0–25 % vegetative cover), moderate (25–50 % vegetative cover), high (50–75 % vegetative cover), or very high (75–100 %

vegetative cover). The size and approximate age of any riparian vegetation growing in the channel bed would be documented because this is evidence of channel adjustment and possible re-stabilization from a prior disturbance.

Bankfull Width and Depth and Wetted Width

Bankfull width and depth measurements would be recorded to assess the hydraulic capacity of the channel in the field site locations. Specifically, a geomorphic or effective bankfull surface would be identified in the field. The geomorphic bankfull or effective surface is the surface that gets inundated by the discharge that performs the most geomorphic work on a system, typically a flow that occurs every 1.5–2 years (Knighton 1999). This discharge, known as the geomorphic bankfull discharge, is defined as that water discharged when stream water just begins to overflow into the active floodplain. The geomorphic bankfull or effective surface would be identified based on the methodology of Harrelson et al. (1994) and Hauer and Lamberti (1996). Once this surface is recognized, width and depth measurements would be recorded.

Like bankfull width and depth measurements, wetted width and depth measurements would be recorded. Specifically, the wetted surface would be determined identified in the field and width and depth measurements would be recorded.

Bankfull and wetted width and depth data collection would help to determine the size of the channel, which would help in assessing overall available habitat conditions in the field site locations and reaches of interest.

In addition, the "active channel" width would be identified, which typically represents a typical low to moderate flow regime and is usually bounded by the width of the in-channel vegetation.

Bank Instability and Bank Characteristics

The term *bank instability* refers to streambanks that are either actively retreating or have the potential to retreat soon. In brief, weakening processes are any bank or near-bank processes that act to erode or prepare streambanks for further erosion (Lawler 1992). The purpose of assessing this indicator would be to identify fluvial erosion (erosion associated with flowing water) and bank failure (erosion associated with gravitational forces and weakening processes). Fluvial erosion is closely related to boundary shear stress, which can be loosely approximated by unit stream power variations, and bank failure is collapse of all or part of the streambank in situ (Lawler 1995).

Bank stability would be defined as the natural streambank that has stable groundcover. Stable ground cover includes rooted trees, shrubs, herbaceous plants, and naturally occurring rocky substrates. Bank composition and bank height/angle would also be determined. The results, in conjunction with the other indicators, can be used to detect where the channel may be downcutting as suggested by over-steepened banks, and can also be used to describe the potential for the channel to potentially laterally migrate and increase the risk of bank instability.

Bank stability analyses would aid in determination of the sediment regime and bedform morphology, which would help characterize the stream habitat and function of the field site locations, as well as the determination of channel stability and the potential for available habitat to be disrupted or altered in the field site locations.

Channel Bed Substrate Composition and Embeddedness

Substrate composition and embeddedness refer to the size of the substrate materials on the channel bed, and the degree to which these materials are embedded. These conditions indicate how frequently the channel substrate is mobilized. Substrate composition and embeddedness would be measured using the methods described by Bunte and Abt (2001). Substrate composition would identify the available substrate (overall type and abundance) for aquatic species in the vicinity of each field site location and would allow for determination as to whether the Reservoir Operations Plan would require gravel augmentation in the reaches of interest.

Channel Complexity

The presence or absence of gravel bar development and evidence of scour and/or deposition would be determined throughout the length of each field site location. Pool and riffle habitats containing in-channel structures (e.g., instream woody material) that create complexity and habitat niches for aquatic organisms would also be documented. Basic channel or habitat units (e.g., pool, riffle, and flatwater) would be delineated according to standard habitat mapping descriptions in each field site location. A rough proportion of unit types would be calculated.

Channel or habitat units would be defined as follows.

- **Pool:** Slow water, length, and width at least one-half the bankfull channel width, and a 10-inch minimum residual pool depth. Subcategories define the general type of pool and include scour (lateral, channel, channel confluence, plunge), dam, and backwater, as defined by Overton et al. (1997).
- **Riffle:** Swiftly flowing, turbulent water, some partially exposed substrate, substrate cobble, and/or boulder dominated (McCain et al. 1990).
- **Flatwater:** Wide, uniform channel bottom, low to moderate water velocity, and little surface agitation. Encompasses any areas that do not qualify as pool or riffle (McCain et al. 1990).

If appropriate (i.e., if the habitat diversity merits such a method), the field site locations would be habitat typed to provide a more detailed stream habitat inventory. Stream habitats would be delineated into one of the six Level-III habitat classification types (per Flosi et al. 2010) based on morphological characteristics. These include overall channel gradient, water velocity and depth, substrate, and, where applicable, the channel features (e.g., boulder, bedrock, woody material, converging flow) causing the formation of the habitat unit through scour and sediment deposition (Flosi et al. 2010). Channel/habitat type determination would allow for identification of available habitat types for aquatic species.

Degree of Channel Incision

The degree to which the channel is incised would be recorded as negligible, low, moderate, high, or very high. The degree of incision would be qualitatively analyzed using the following criteria.

- **Identification of any Quaternary landforms on the floodplain (e.g., terraces, low floodplain, fan, etc.).** Terraces typically have steep streambanks and the channel may not necessarily be incised. Steep, unstable streambanks adjacent to a low floodplain surfaces, however, typically indicate incision.
- **Identification of bedforms downstream of the site where and if the channel is less incised.** Bed and streambank material from incised channels would typically be deposited downstream in somewhat uncharacteristically large deposits on the channel bed (downstream aggradation).

- **Recognition of base level changes downstream.** Dams and other barriers can create upstream changes in channel bed elevation (i.e., headward migration of incision).
- **Visual survey of channel bed at the field site location.** Channel or habitat sequences, such as pool-riffle sequences, are rare in incised channels, and those that do exist do so for only limited time intervals. Additionally, the increased depth of flow associated with incision, coupled with an increased flashy regime, results in bed armoring and a decreased frequency of bed mobilization.
- **Determination of the health of the riparian and floodplain plant species.** Plants that are found in similar, un-incised reaches are usually not present in incised reaches. No vegetation at all is an indicator of no hydrologic interaction between the floodplain and the channel and therefore incision.
- **Identification of recent evidence of overbank deposition of fine sediment, plant debris, or other organic matter.** A channel that floods its streambanks frequently would typically have splay (i.e., sand) deposits and vegetation with a smoothed, flooded appearance in the downstream direction. Natural levee development is also an indication of frequent flooding.

Stage of Channel Evolution

A stream evolution model (Cluer and Thorne 2013) would be applied to the entirety of the reaches of interest on Funks and Stone Corral Creeks to provide a template for understanding geomorphic responses and processes within the immediate watershed. The stream evolution model of Cluer and Thorne (2013) revisits and updates two well-established channel evolution models (Schumm et al. 1984, Simon and Hupp 1987) in light of recent research and the authors' practical experiences.

In addition, a channel stability analysis would be conducted at each field site location. The chosen methodology would be dictated by site conditions but could include the methods as presented in the modified Pfankuch procedure (Pfankuch 1975) as described by Rosgen (2001), Simon and Down (1995), Bledsoe et al. (2010), or other applicable method. The stream evolution model and the channel stability analyses would aid in the determination of how on Funks and Stone Corral Creeks may evolve (e.g., deepen/widen) or remain in a state of equilibrium in the future, thus, having implications for the available habitat within the channels.

Cross Section and Longitudinal Profile Surveys

As mentioned above, at least three permanent cross sections would be established within each field site location (Figure 4) and within each hydrologic monitoring location (Figure 5) for collection of quantitative channel morphology information and required modeling input. Permanent cross sections would be established perpendicular to the primary channel following the methodology of Harrelson et al. (1994). Each transect would be surveyed using ground-based surveying equipment to capture and track channel morphology. Elevations along the cross sections would be collected at intervals close enough to capture slope breaks and distinct morphological features within the floodplain (if present), and along the channel sides and bottom.

The location of each cross section would be permanently marked in the field using 4-feet-tall metal t-posts or wooden lathes (to easily find the general transect location) and with rebar driven vertically into the ground surface, capped with an appropriate cover (to establish known permanent elevations [permanent monuments or benchmarks] on each side of the transect). The permanent benchmarks for each transect would be placed in a stable location above the active channel on the left and right (as viewed facing downstream) banks or terraces of the channel. Transect endpoints (i.e., the permanent monuments) would be documented using a GPS receiver. Representative photographs would be taken at each cross section.

In addition to the cross sections, a longitudinal profile would be surveyed throughout the length of the channel within a field site location. The spacing between channel bed data points would vary depending on the complexity of the channel bed characteristics. Digital photographs would be taken in the upstream and downstream directions at various locations throughout the longitudinal profile. The location(s) of each cross section would be surveyed on the longitudinal profile for graphical plotting purposes.

Channel Geometry Metrics

As mentioned previously, bankfull width and depth measurements would be recorded to assess the hydraulic capacity of the channels. This would be completed at the cross sections measured in the field. In addition to bankfull, wetted, and active channel width and depth measurements, the bankfull and entire channel width-to-depth ratio would be calculated for each cross section, and sinuosity and gradient of the longitudinal profile would be determined.

5.2.2 Hydrologic Conditions

The hydrologic component of the Hydrogeomorphic Study would consist of both desktop (modeling and historical conditions review) and field-based efforts (generation of stage-discharge relationships), both of which are summarized below. The desktop effort would provide detailed information on various (modeled) flows of interest (i.e., the 2-year, 5-year, 10-year, 50-year, and 100-year flow events), while the field-based efforts would validate/calibrate the modeling results via collection of real-time streamflow data, especially for smaller streamflow events (the flows that are expected to occur most of the time on each creek).

Summary of Modeling Approach

A HEC-HMS rainfall-runoff-routing watershed hydrology model would be created to generate hydrographs for both Stone Corral Creek and Funks Creek. Inputs into the hydrology model would include watershed land use, percent impervious inputs, soil types, precipitation and evapotranspiration, drainage network characteristics, and topography (which would be generated from available light detection and ranging [LiDAR] technology).

The topographic surveys as described above would also serve to augment the existing LiDAR data with on-the-ground data to better capture topography in areas requiring additional detail (such as densely vegetated areas). The topographic surveys would be tied into the State Plane Coordinate System and would be sufficient to generate contours at a 1-foot interval. The data collected via the topographic surveys would also be required for generation of stage discharge relationships, as described below.

It should be noted that HEC-HMS rainfall-runoff-routing watershed hydrology model constitutes the first (somewhat exploratory) step in the hydrologic analysis. Releases into Funks Creek would be made through the transition manifold at the base of Golden Gate Dam and a new pipeline that terminates at Funks Creek below the dam. These facilities would carry up to 100 cfs with a release range of 0 to 100 cfs into Funks Creek. Releases into Stone Corral Creek would be made through the permanent outlet at Sites Dam. This outlet would have a release range of 0 to 100 cfs, with an emergency release capacity of up to 2,500 cfs. The modeling effort would be the first step in verifying that this proposed range described in the EIR is adequate to address the purpose of CFGC Section 5937 given the modeled hydrology.

Summary of Field-Based Analysis

The primary objective of the field investigation would be to provide an accurate description of the existing watershed hydrology and variations in streamflow and water surface elevations (i.e., stage) on both Stone Corral Creek and Funks Creek. Periodic streamflow measurements (depth and velocity measurements) would be taken to develop stage-discharge relationships (rating curves) to translate the continuous water depth measurements measured with continuous stage recorders (i.e., HOBO water level loggers [Onset Computer Corporation]) into continuous estimates of flow. These measurements would occur at the hydrologic monitoring locations as shown on Figure 5.

To determine continuous estimates for streamflow, the stage recorders, which measure water temperature and pressure, and vertical stilling wells would be installed in relatively deep portions of the creeks at the locations as shown on Figure 5. The HOBO water level loggers would be set to monitor water depth every 15 or 30 minutes. Additional HOBO water level loggers would also be installed to monitor barometric pressure every 15 or 30 minutes for the purpose of calibrating the depth (water pressure) measurements, which are also affected by barometric pressure. These additional data loggers would be secured to upland surfaces (e.g., trees). Streamflow measurements would be collected to develop equations to convert the continuous stage recorder data into estimated streamflows (discharge). During variable discharge conditions, streamflows would be estimated using a Marsh-McBirney Flo-Mate Model 2000 flow meter and top-setting rod following the procedures described in Module O in Chapter 8 of the SWAMP 2016 SOP (Ode et al. 2016a, 2016b).

Daily precipitation data from obtained from the California Data Exchange Center or the PRISM Climate Group would be used to characterize the rainfall patterns during the study period. Rainfall patterns would be displayed concurrently with the measured streamflow data.

If necessary, acoustic Doppler current profiler (ADCP) technology could be used to capture high flow events. ADCP equipment is particularly useful for collecting accurate and precise water depth and 2-D/3-D velocity data, especially at high flows when other standard surveying techniques as described above are impractical or unsafe. ADCP technology also offers the advantage of detecting bed elevation change resulting from high flow events that would be useful for evaluating sediment mobility in the reaches of interest. The applicability of ADCP would be investigated during the first season of hydrologic monitoring (once biologists ascertain the field conditions at the field site locations).

5.3 Timing, Frequency, and Operation Monitoring

5.3.1 Pre-Operation Monitoring

The baseline geomorphic component of the Hydrogeomorphic Study would first be conducted during the winter/spring of 2023. It is anticipated that all relevant geomorphic indicators could be collected during one field trip. Additional baseline geomorphic data collection during subsequent years would be necessary if precipitation patterns are highly variable during the pre-operation period.

The desktop hydrologic component of the Hydrogeomorphic Study would occur during 2023. The field-based hydrologic component of the Hydrogeomorphic Study would occur at the locations as shown on Figure 5 until the dams are constructed.

5.3.2 Operations Monitoring

Follow-up geomorphic and hydrologic surveys would be conducted on an annual basis for up to 10 years after operations begin. The Authority would consult with the relevant permitting agencies (CDFW, SWRCB and the CVRWQCB) if the frequency of monitoring would be shortened after 5 years. Additional information on each component of is provided below.

Geomorphic Stability Monitoring Plan

Operations geomorphic monitoring would generally be like the pre-operation efforts, including returning to established field site locations and collecting information on geomorphic indicators by performing a geomorphic assessment as described above. Data collected as part of the operations geomorphic monitoring effort would be compared against the baseline data and summarized into interim and final reports to the Authority.

The focus of the operations geomorphic monitoring effort, however, would be geomorphic stability monitoring. As such, the primary survey components of the Geomorphic Stability Monitoring Plan would include cross section and longitudinal profile surveys, channel bed substrate composition determination, and channel stability evaluations. All methods for these efforts would be identical to those described above. The objectives of these monitoring elements and their relevance to geomorphic stability are summarized below.

Cross Section and Longitudinal Profile Surveys

The objectives of collecting data at the cross sections would be to collect primarily lateral stability information to determine the rate of lateral migration through bank erosion and overall cross-sectional area change. The rate, magnitude, and direction of lateral change and area change would be determined over time using repeat longitudinal profile surveys.

The objective of collecting data at the longitudinal profiles would be to collect primarily vertical stability information to determine rates of aggradation or degradation (whether the stream is downcutting [degrading], filling [aggrading], or remaining static). The rate, magnitude, and direction of vertical change would be determined over time using repeat longitudinal profile surveys.

Channel Bed Substrate Composition and Embeddedness

The objectives of collecting channel bed substrate composition and embeddedness information would be to observe potential shifts in bed material size-frequency distribution, which can be determined over time. Collected grain size information would aid in interpretation in specific geomorphic changes if they occur (such as any changes identified via the cross-sectional and longitudinal profile analyses above).

Channel Stability Evaluations

The chosen methodology for channel stability evaluations would be dictated by site conditions but could include the methods as presented in the modified Pfankuch procedure (Pfankuch 1975) as described by Rosgen (2001), Simon and Down (1995), Bledsoe et al. (2011), or other applicable method. Together with the stream evolution model (Cluer and Thorne 2013), the channel stability analyses would aid in the determination of how on Funks and Stone Corral Creeks may continue to evolve (e.g., deepen/widen) or remain in a state of equilibrium in the future, thus having implications for the available habitat within the channels.

Hydrologic Monitoring Plan

Operations hydrologic monitoring would be like the pre-operation field-based efforts, including returning to established hydrologic monitoring locations, monitoring stage and stream discharge over time. Data collected as part of the operation hydrologic monitoring effort would be compared against the baseline data and summarized into interim and final reports to the Authority.

The level of effort of the operations Hydrologic Monitoring Plan, however, would be considerably less than for the pre-operation effort because, depending on the streamflow and precipitation patterns during the pre-operation time-period, there would presumably already be numerous years of pre-operation hydrologic monitoring data at the hydrologic monitoring locations (in other words, a robust data set with multiple discharge measurements and associated stages would be available). The operation hydrologic monitoring effort would therefore primarily consist of measuring streamflow values that were not obtained during the pre-operation monitoring effort (presumably higher flow events) and conducting routine field maintenance activities such as periodic downloads of the HOBO water level loggers and upkeep of field equipment.

5.4 Applicable Methods for Maintaining Streamflows

After baseline hydrogeomorphic conditions are obtained and evaluated in context with the studies from other disciplines (i.e., Fish Assemblage Study and SWAMP bioassessment study), various approaches for estimation of minimum streamflows to maintain ecosystem and geomorphic function would be reviewed, such as "the functional flow" approach suggested by Yarnell et al. (2015), the Instream Flow Incremental Methodology (National Biological Service, U.S. Department of the Interior 1995), the CDFW Instream Flow Program,[1] the California Environmental Flows Framework,[2] and the Richter et al. (2011) approach. These methods would be investigated for their applicability to determine appropriate streamflows on Funks and Stone Corral Creeks to maintain fish in good condition. Coordination with the permitting agencies would be required before a chosen method is selected.

[1] https://wildlife.ca.gov/Conservation/Watersheds/Instream-Flow

[2] https://ceff.ucdavis.edu/

6.0 Temperature Study Design and Methods

6.1 Overview of Proposed Methods

A temperature study would be conducted to characterize temperatures under existing conditions and determine flow and storage effects on temperature in Stone Corral and Funks Creeks under operating conditions. The study would involve evaluating temperatures in the creeks before and after initiation of Project operation and would be conducted in combination with the Hydrogeomorphic Study (Appendix 2D, Section 2D.4.2 in the *Sites Reservoir Project Revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement* (Sites Project Authority and Bureau of Reclamation 2021) and Sites Reservoir storage data.

The study would assess the following.

- The temperatures that support the aquatic community under existing conditions.
- Reservoir discharge needed to establish suitable temperatures in Stone Corral Creek downstream of Sites Dam after operation.
- Reservoir discharge needed to establish temperatures suitable for native fish in Funks Creek downstream of Golden Gate Dam after operation begin.

6.2 Study Design

Once access to Stone Corral Creek is obtained, a temperature probe would be installed in Stone Corral Creek at the location of Sites Dam release, and four additional probes would be installed downstream by approximately 0.5 mile, 1 mile, 2.4 miles (near where Stone Corral Creek goes under Maxwell Sites Road), and 4.4 miles (near where TC Canal goes under Stone Corral Creek).

Once access to Funks Creek is obtained, a temperature probe would be installed in Funks Creek at the location of the I/O tower release to Funks Creek, and two additional probes would be installed downstream by approximately 0.5 mile and 1 mile (far enough upstream of Funks Reservoir to be unaffected by it). In addition, probes would be installed at the TC Canal inlet to Funks Reservoir, at the TC Canal outlet from Funks Reservoir, and at the Funks Creek outlet from Funks Reservoir.

As described in the draft Reservoir Management Plan included in Appendix 2D of the RDEIR/SDEIS, once operation has commenced, water temperature profiles would be measured near Golden Gate Dam once every 2 weeks at 5-feet depth intervals to inform decisions about which ports of the I/O tower to use during March through October. The temperature probes in the creeks would continuously record hourly temperatures. These temperatures would be used along with specific fish requirements to develop target temperature ranges for operation conditions.

Temperatures recorded after Sites Reservoir is operational would be used in conjunction with flow and storage data to determine flow and storage effects on creek temperatures. If creek temperatures cannot be accurately estimated with flow, storage, meteorology, and the reservoir temperature profiles, water temperature modeling could be performed for both Sites Reservoir and Funks and Stone Corral Creeks. If modeling is necessary, models would be calibrated with the measured flow, storage, and temperature data.

Water released into Stone Corral Creek would originate from the lower half of Sites Reservoir and would likely be cooler than equilibrium values during months when the reservoir is stratified. The biggest differential between release temperatures and equilibrium values would occur when the reservoir is full and ambient air temperature conditions are high. If it is determined that flow should be maintained in Stone Corral Creek at times when releases would be relatively cool compared to temperatures under existing conditions, lower flows would allow the water to warm farther upstream than higher flows.

Water released to Funks Creek would originate from the I/O tower and, when the reservoir is stratified, would be warmer than the water released to Stone Corral Creek. The temperatures would be warmer because the withdrawals would come from higher in the reservoir and, as described in the Reservoir Management Plan, the I/O tower port openings would be chosen to provide 65 degrees Fahrenheit (°F) or higher water temperatures during the rice growing season (May to September).

6.3 Timing and Frequency

Water temperature measurements would occur before and during operation. Measurements during the initial fill period would be useful for evaluating water temperature under low-storage conditions. Reservoir profile measurements and measurements at the Stone Corral Creek and Funks Creek releases may need to continue in the long term.

Measurements downstream of the release locations could be discontinued if the following conditions are met.

- Sites Reservoir has made releases for at least 2 years when the reservoir was at least 75% full.
- Temperature effects are found to have little effect on native fish (e.g., if only short sections of the creeks below the dams experience temperature effects) or if flow and storage effects on creek temperatures are understood well enough that average daily creek temperatures can be estimated within 3°F based on meteorological conditions, flow, reservoir storage, and reservoir temperature profiles.

7.0 Reporting and Permit Requirements

7.1 Annual Reporting Requirements

Reporting requirements would be met through the preparation and submittal of annual and final reports as part of the Stone Corral and Funks Creeks Aquatics Study Plan that would be implemented as a part of the Authority's commitments and responsibilities to maintain fish in good condition consistent with CFGC Section 5937.

The first five annual reports would summarize the first 5 years of baseline conditions. All future (operation) reporting efforts would compare the conditions at that time to those collected during the baseline conditions.

- **Annual and Final Reports:** The following information would be addressed in comprehensive annual reports with multiple chapters covering fish, bioassessment, hydrogeomorphic, and temperature study results.

  Fish Study Results: The annual report would include descriptions and locations of fish communities in Stone Corral and Funks creeks, summarizing monitoring results in the study area. The report would document monitoring results and link results to objectives. The report would identify new or ongoing management issues, threats and stressors, and provide recommendations for future monitoring and management.

  Bioassessment Results: The annual reports would include BMI, algae, water quality, and PHAB output and results and a summary of each of these indicators. The most recent version of the SWAMP *Stream Habitat Characterization Form, Full Version* field forms would be provided in appendix format, along with representative photography of the sampling reaches.

  Hydrogeomorphic Results: The annual reports would include a summary of the monitoring methods; a summary and analysis of the hydrogeomorphic monitoring results, including an evaluation of site conditions in the context of the performance standards; a discussion of the monitoring results; a discussion of any modifications made to the monitoring methods; a discussion of the previous year's monitoring efforts; and photographs taken from the cross sections and longitudinal profiles.

  Temperature Results: The annual reports would include a summary of temperatures that support the aquatic community under existing conditions, and a recommendation of reservoir discharge needed to establish suitable temperatures in Stone Corral Creek downstream of Sites Dam and Funks Creek downstream of Golden Gate Dam after operation has commenced.

- **Monitoring Program Evaluation:** The annual reports would evaluate the Aquatic Study Plan to ensure that data (1) are collected efficiently, (2) address information needs, and (3) adequately assess resource responses to management actions. Changes in monitoring methods, protocols, or frequency would be summarized in the annual reports.

- **Objective Criteria Evaluation:** Annual reports during operations would evaluate whether management actions are meeting project objectives or performance standards (described below). Where the cause of fish and BMI community declines is understood, corrective actions would be recommended based on monitoring data or other scientifically defensible sources of information. An assessment would be made as to causal factors of observed declines, including the potential role of external stressors outside the parameters of Project effects.

- **Adaptive Management Thresholds:** The link between the technical and decision-making steps requires regular interaction and exchange of information between technical staff and decision-makers. This would be accomplished by bi-annual meetings (approximately every 6 months) involving the Authority and the permitting agencies where both regulatory and technical expertise can be integrated into revising goals and objectives, adjusting management and/or monitoring activities, or allocating funding. Meetings should be timed such that any new information discussed assists with the planning of upcoming seasonal work.

7.2 Performance Standards

Performance standards for the Aquatic Study Plan would be based on quantitative metrics. These performance standards would be designed specifically as a means of monitoring the progress and performance of the physical and biological conditions of the study reaches.

Fish community performance standards would include measures of community diversity and percent area occupied for both available and total reach distance within the study areas. BMI performance standards would likely include three main indicators—PHAB IPI scores, BMI CSCI scores, and algae ASCI scores. Geomorphic performance standards would focus on channel stability evaluations such as:(1) evidence of significant and detrimental morphologic changes at any of the cross sections; (2) evidence of channel headcutting; (3) significant loss of gravels via dam impoundment; and (4) significant decrease in the channel stability score during the duration of monitoring activities.

Performance standards would be developed in conjunction with the Authority and the relevant permitting agencies (CDFW and the CVRWQCB) prior to the start of operation monitoring.

7.3 Creek Operations Plan

The Authority would use information from the results of implementation of this Aquatic Study Plan, including field studies described below, to prepare the Funks Creek and Stone Corral Creek Operations Plan. The Funks Creek and Stone Corral Creek Operations Plan would describe the approach to address CFGC Section 5937 requirements, if any, resulting from impoundments to storage of flows from Stone Corral Creek and Funks Creek, while also ensuring that the Project's flood protection benefits are realized. Further, the Creek Operations Plan would include, but would not be limited to, the approach for reservoir releases into Funks Creek and Stone Corral Creek, including release schedules and volumes. As stated in the Authority's application to appropriate water, the Creek Operations Plan would be developed in consultation with CDFW, USFWS, and Colusa County, and approved by the Deputy Director for Water Rights.

8.0 References

Commented [CJ1]: Red = no citation found in text for this reference.
Yellow = citation listed in text, but no matching reference listed in this section.

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8.2 Personal Communications

Rehn, Andrew. Biologist, California Department of Fish and Wildlife. April 6, 2022—Phone conversation with Jeff Peters of ICF and Marco Sigala at Moss Landing Marine Laboratories regarding a suitable number of bioassessment sampling reaches on Funks Creek and Stone Corral Creek for the Sites Reservoir Project.

From: Spranza, John [John.Spranza@hdrinc.com]
Sent: 9/21/2022 12:05:42 PM
To: steve.micko@jacobs.com; Leaf, Rob/SAC (Rob.Leaf@jacobs.com) [rob.leaf@jacobs.com]
CC: Alicia Forsythe [aforsythe@sitesproject.org]; Angela Bezzone [bezzone@mbkengineers.com]
Subject: Freeport bypass flows

Hi Rob and Steve,
At one time we have the following bypass criteria for Freeport, do you know its origin and what it was designed to protect?
Thanks.
John

Diversions for filling Sites Reservoir would only be allowed when a Sacramento River flow of 15,000 cfs is present at Freeport in January, 13,000 cfs in December and February through June, and 11,000 cfs in all other months. This flow threshold was designed to protect and maintain existing downstream water uses and water quality in the Delta.

John Spranza, MS, CCN
Senior Ecologist / Regulatory Specialist

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From: Leaf, Rob [Rob.Leaf@jacobs.com]
Sent: 9/21/2022 12:59:34 PM
To: Spranza, John [john.spranza@hdrinc.com]
CC: Alicia Forsythe [aforsythe@sitesproject.org]; Angela Bezzone [bezzone@mbkengineers.com]; steve.micko@jacobs.com
Subject: RE: Freeport bypass flows
Attachments: SPJPA_Sites_ExcessDeltaOutflowDiversionCriterion_rev03_20211116.docx

John,

The purpose of this criteria was to manage potential impacts of NODOS diversions on the operations of the CVP and SWP to meet D1641 standards, specifically Spring X2.
It was developed early on (circa 2006) when the proposed project was much larger in storage and intake capacity and also had an objective to improve WQ in the Delta.
Potential impacts on salinity from the diversions into Sites was a significant concern to both the operation of the CVP/SWP as well as the WQ benefit of NODOS.

For our most recent work (since 2018) this rule has been replaced by the Excess Conditions diversion criteria.
The focus of the Excess Conditions diversion criteria is to avoid potential impacts on CVP/SWP D1641 operations.
Please see the attached writeup. This version is the Nov 2021 draft.

Rob

From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Wednesday, September 21, 2022 12:06 PM
To: Micko, Steve <Steve.Micko@jacobs.com>; Leaf, Rob <Rob.Leaf@jacobs.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>; Angela Bezzone <bezzone@mbkengineers.com>
Subject: [EXTERNAL] Freeport bypass flows

Hi Rob and Steve,
At one time we have the following bypass criteria for Freeport, do you know its origin and what it was designed to protect?
Thanks.
John

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Sites Reservoir

Sites

Our Strength is in Our Broad Statewide Participation

Sacramento Valley

City of American Canyon
Colusa County
Colusa County Water Agency
Cortina Water District
Davis Water District
Dunnigan Water District
Glenn County
Glenn-Colusa Irrigation District
LaGrande Water District
Placer County Water Agency
Reclamation District 108
City of Roseville
Sacramento County Water Agency
City of Sacramento
Tehama-Colusa Canal Authority
Westside Water District
Western Canal Water District

Bay Area

Santa Clara Valley Water District
Zone 7 Water Agency

San Joaquin Valley

Wheeler Ridge-Maricopa Water Storage District
Rosedale-Rio Bravo Water Storage District

Southern California

Antelope Valley – East Kern Water Agency
Coachella Valley Water District
Desert Water Agency
Irvine Ranch Water District
Metropolitan Water District
San Bernardino Valley Municipal Water District
San Gorgonio Pass Water Agency
Santa Clarita Valley Water Agency

Waiting List-

Cal-Am Sacramento
City of Napa
Delta View WUA
Glenn County
La Cumbre MWC
Madera County
Pacific Resources MWC
Palmdale Water District
Santa Clara Valley WD
Westlands WD
Wheeler Ridge Maricopa WSD
Woodland Davis CWA

Sites

Affordable, Permittable, Buildable

Sites underwent a rigorous value planning effort that resulted in a "right-sized" project. The Sites Reservoir of today:

- Has a smaller footprint than the previous iteration
- Meets the water supply needs of current participants
- Comes at a lower cost
- Supports State's environmental goals
- Creates flexibility for participants
- Performs under most challenging climate change scenarios

The right-sized project cuts roughly $2 billion from the original proposal.

Sites is now more affordable, permittable, and buildable.

Sites

Provides Climate Change Resiliency

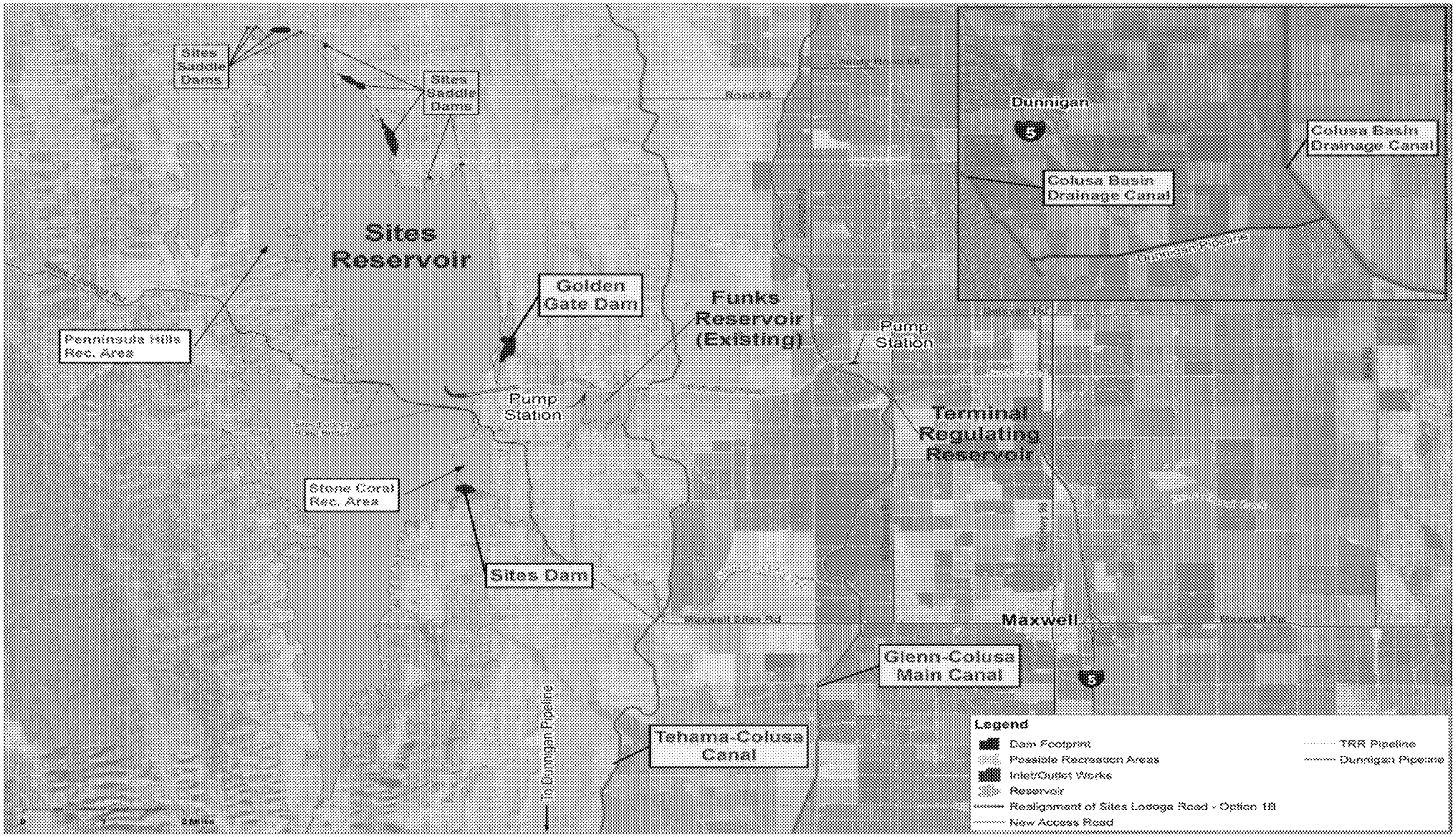
How does Sites Reservoir address these challenges?

- Captures excess flows from Sacramento River – rain instead of snowmelt
- Off-river storage increases environmental benefits by not damming major river system
- Adds 1.5 million acre-feet of water into the statewide system, easing pressure on other sources during droughts
- Supplies water for people, farms and environment during the longer dry spells California experiences
- Allows other reservoirs, like Shasta, Oroville and Folsom to conserve more cold water during dry periods in order to benefit fisheries

Project performance is expected to improve by approximately 5%-10% under anticipated climate change conditions

Sites

Affordable, Permittable, Buildable



Provides a Resilient, New Supply of Dry Year Water

SITES PROJECT NEW WATER SUPPLY

Year Type	Water Supply (thousand acre-feet)*
Wet	80-120
Above Normal	130-390
Below Normal	170-330
Dry	375-440
Critically Dry	265-315
Long-Term Average	208-280

*Ranges depict differences in selected project alternative and hydrology

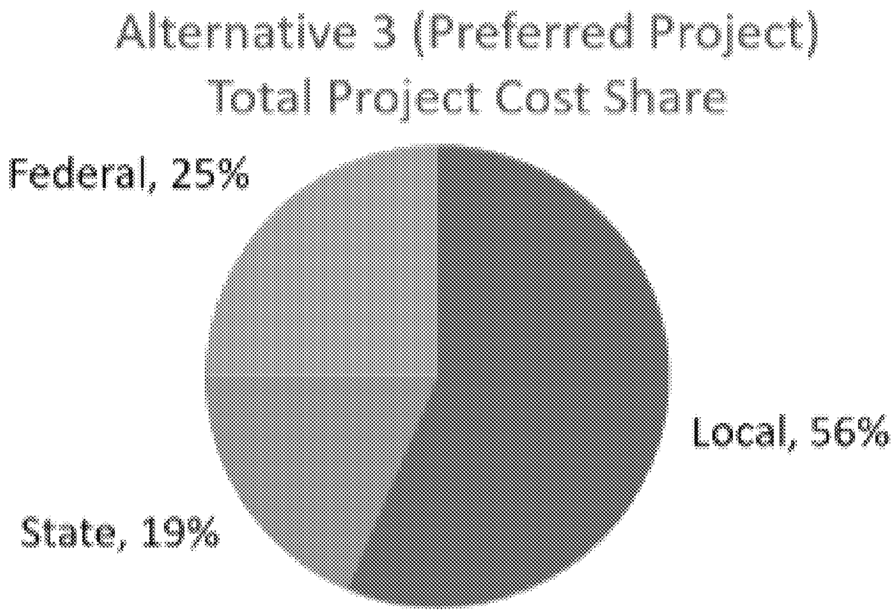
One thousand acre-feet of water supply can serve about 2,000-3,000 households for one year, or 200-500 acres of productive California agriculture.

Sites

EIR Project Alternatives

Facilities / Operations	Alternative 1	Alternative 2	Alternative 3
Reservoir Size	1.5 MAF	1.3 MAF	1.5 MAF
Hydropower	Incidental upon release	Same as Alt 1	Same as Alt 1
Diversion Locations	Red Bluff Pumping Plant and Hamilton City	Same as Alt 1	Same as Alt 1
Conveyance Release / Dunnigan Release	1,000 cubic feet per second (cfs) into new Dunnigan Pipeline to Colusa Basin Drain	1,000 cfs into new Dunnigan Pipeline to Sacramento River. Partial release into the Colusa Basin Drain	Same as Alt 1
Reclamation Involvement	1. Funding Partner 2. Operational Exchanges a. Within Year Exchanges b. Real-time Exchanges	Operational Exchanges a. Within Year Exchanges b. Real-time Exchanges	Same as Alt 1, but up to ***25%*** storage allocation
DWR Involvement	Operational Exchanges with Oroville and use of SWP facilities South-of-Delta	Same as Alt 1	Same as Alt 1
Route to West Side of Reservoir	Bridge across reservoir	Paved road around southern end of reservoir	Same as Alt 1

Sites is a Local Led Project with Federal and State Investment



Sites

Draft_0019612

State Investment Provides Badly Needed Environmental Benefits

Sites Reservoir provides water dedicated to environmental use

Between 20%-40% of the **Sites Reservoir Project's annual water supplies will be dedicated to environment uses**:

Preserve cold-water pool for later use during dry years in summer months to support **salmon development, spawning and rearing**

Provide a **reliable supply of refuge water** to improve **Pacific Flyway** habitat for **migratory birds** and other **native species**

Improve **water flows in the Delta** to help improve conditions for the **Delta Smelt**

Water and Storage Space dedicated for the environment - Sites Reservoir creates a water asset for the state that **does not currently exist.**

Sites

Environmental & Regulatory Considerations

- **Water Rights Protections** – Withdrawing from the River only during excess conditions, when **all senior water rights and Delta flows/water quality conditions are met**
- **Multi Barrier Intake Protections** – Limited withdrawal periods, diverting while certain **bypass flow conditions exist**, River pulse protections, all diversions through **state-of-the-art fish screens**
- **Water Quality and Delta Flows Protected – Returning additional water** to the River/Delta during dry periods of dry years, water quality continuously monitored
- **Future Water Availability Analyzed – Evaluated 3 scenarios** under differing scenarios; all find sufficient water being available in all year types
- **Terrestrial Effects Fully Mitigated** – Project relying heavily on **existing infrastructure, limiting construction impacts**, opportunities for environmental enhancements with mitigation

Sites

The project is mostly a large earthwork project because of the heavy dependence on existing pumping and conveyance features

Serving California's environment, families, and farms takes:

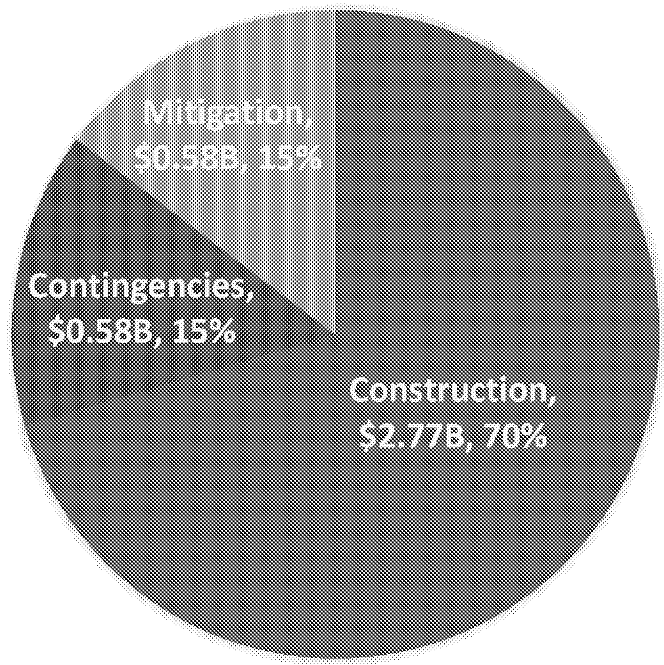
1.5 million acre-ft of storage

2 new large dams and several smaller saddle dams

11 miles of big pipes (9-12ft)

20 million cubic yards of fill

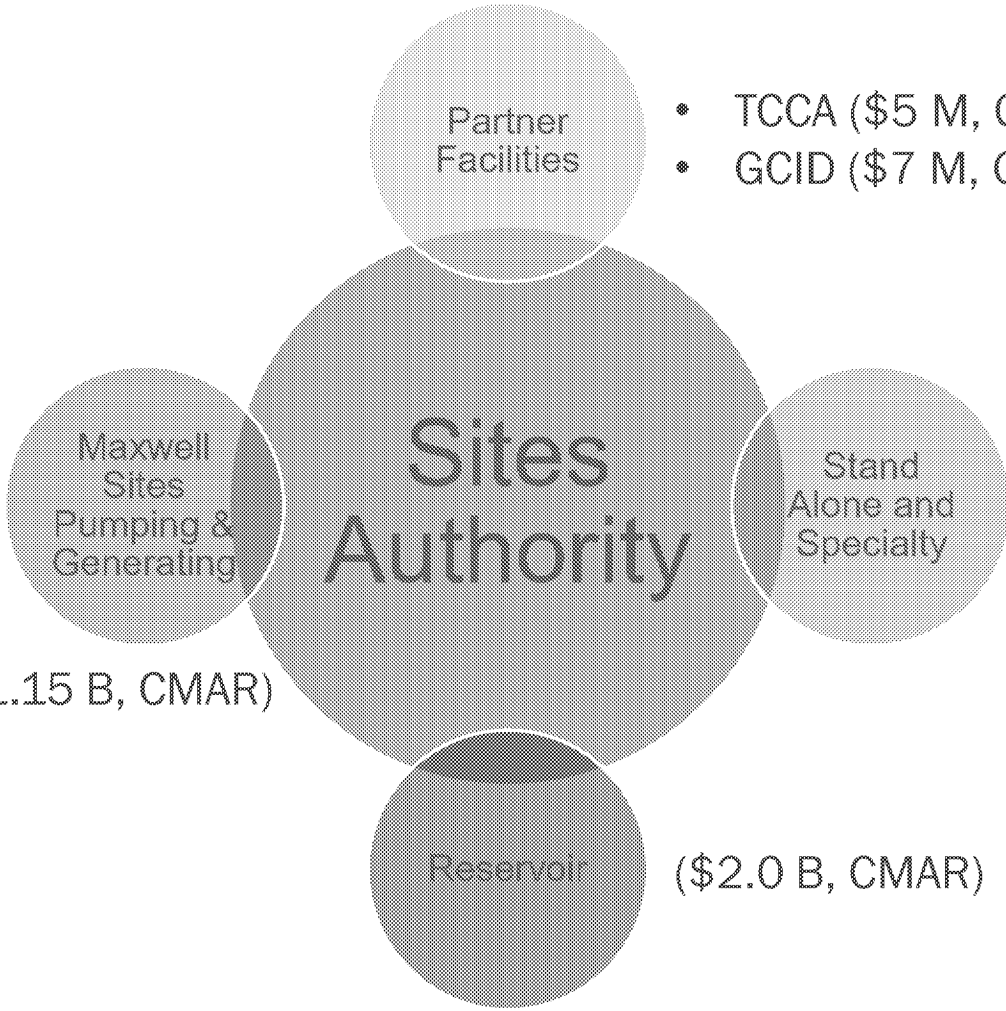
ESTIMATED PROJECT COSTS
($3.9B, 2021$)



Estimated construction costs are based on the class 4 cost estimate for alternative 1 approved by the Reservoir Committee and Authority Board in June 2021

Sites

Summary of the Authority's Current Contracting Strategy adopted July 2022 (costs in 2021$)



- TCCA ($5 M, Owner Agreements)
- GCID ($7 M, Owner Agreements)

- Dunnigan Pipeline ($100 M, DBB)
- Huffmaster Road ($50 M, DBB)
- Reservoir Clearing ($35 M, DBB)
- Mitigation ($600 M, various)
- Recreation ($35 M, DBB or DBO)

($1.15 B, CMAR)

($2.0 B, CMAR)

Sites

Project Costs and Affordability

Reservoir Size (MAF)	Alternative 3 (1.5MAF)
Total Project Cost (2021$, billions)	$3.93
Annualized AF/year release (AFY)	250,000
Range of Annual Costs During Repayment With WIFIA Loans (2021$, $/AF)	~$760

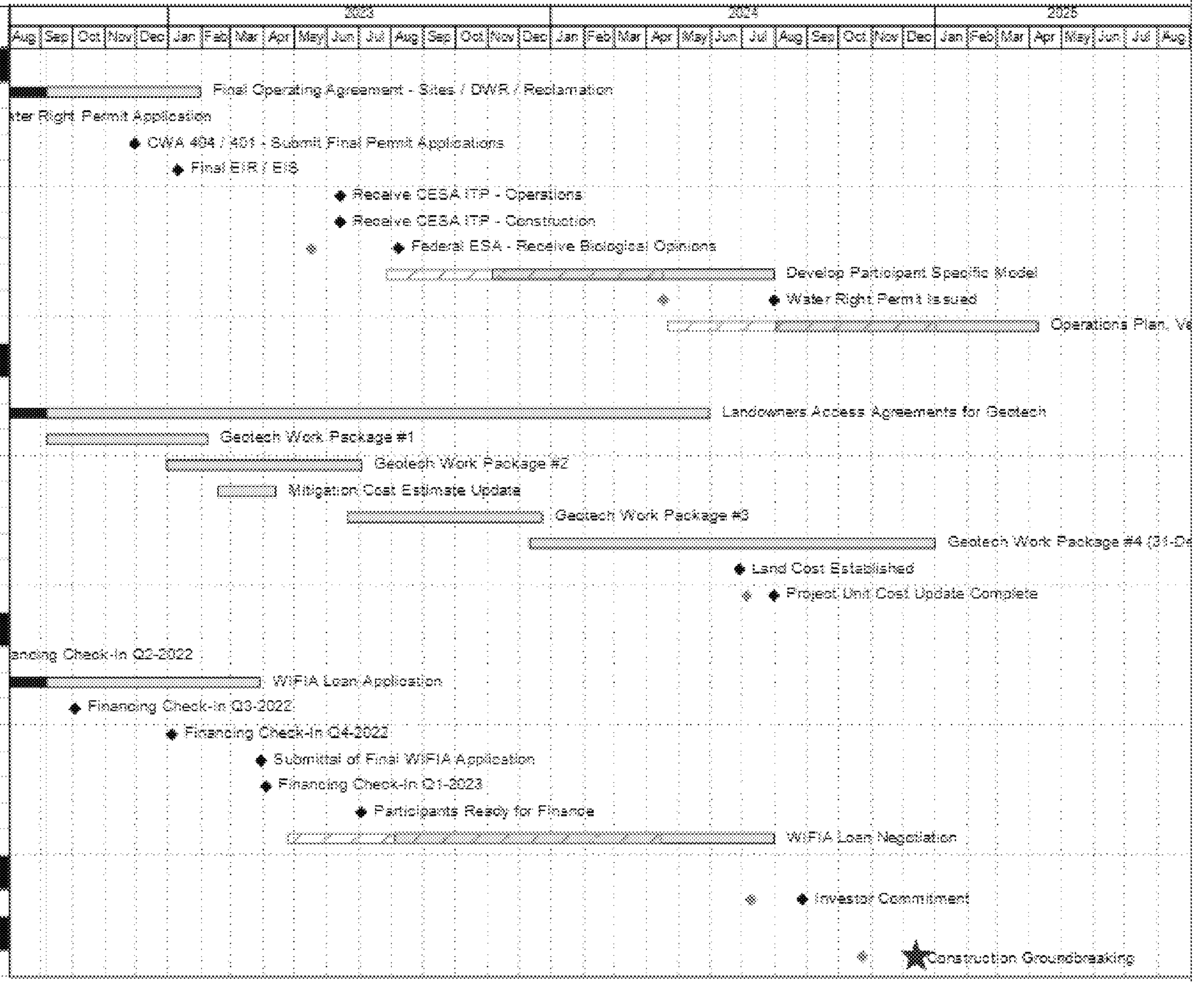
F.O.B Origin

Sites

Looking Ahead

Sites Reservoir Project Schedule

#	Activity Name	Start	Finish
1	**What do we get?**	19-Apr-22 A	08-Apr-25
2	Final Operating Agreement - Sites / DWR / Reclamation	19-Apr-22 A	30-Jan-23
3	Submit Water Right Permit Application		11-May-22 A
4	CWA 404 / 401 - Submit Final Permit Applications		29-Nov-22
5	Final EIR / EIS		09-Jan-23
6	Receive CESA ITP - Operations		13-Jun-23
7	Receive CESA ITP - Construction		13-Jun-23
8	Federal ESA - Receive Biological Opinions		07-Aug-23
9	Develop Participant Specific Model	06-Nov-23	30-Jul-24
10	Water Right Permit Issued		30-Jul-24
11	Operations Plan, Version 2	02-Aug-24	08-Apr-25
12	**What does it cost?**	03-Jan-22 A	31-Dec-24
13	Geotech EA/IS	03-Jan-22 A	28-Jul-22 A
14	Landowners Access Agreements for Geotech	22-Mar-22 A	30-May-24
15	Geotech Work Package #1	06-Sep-22	06-Feb-23
16	Geotech Work Package #2	30-Dec-22	03-Jul-23
17	Mitigation Cost Estimate Update	16-Feb-23	12-Apr-23
18	Geotech Work Package #3	20-Jun-23	22-Dec-23
19	Geotech Work Package #4 (31-Dec-24)	11-Dec-23	31-Dec-24
20	Land Cost Established		27-Jun-24
21	Project Unit Cost Update Complete		30-Jul-24
22	**How do we pay?**	01-Jul-22 A	30-Jul-24
23	Financing Check-In Q2-2022		01-Jul-22 A
24	WIFIA Loan Application	05-Jul-22 A	28-Mar-23
25	Financing Check-In Q3-2022		03-Oct-22
26	Financing Check-In Q4-2022		03-Jan-23
27	Submittal of Final WIFIA Application		28-Mar-23
28	Financing Check-In Q1-2023		03-Apr-23
29	Participants Ready for Finance		03-Jul-23
30	WIFIA Loan Negotiation	04-Aug-23	30-Jul-24
31	**Investor Commitment**	27-Aug-24	27-Aug-24
32	Investor Commitment		27-Aug-24*
33	**Construction**	11-Dec-24	11-Dec-24
34	Construction Groundbreaking	11-Dec-24	



Key:
Work Completed
Work Remaining
Change from Previous Month

Data Date: 05-Sep-22 / Print Date: 12-Sep-22

Creating an Affordable, Permittable & Buildable Project

Goals for 2022 - 2024

- Secure Final Prop 1 Funding award with CWC
- Execute Final Operations Agreement
- Secure WIIN and BIL Federal Funding
- Complete WIFIA/USDA Loan Agreements
- Execute Benefits and Obligations Contracts
- Complete Final EIR/EIS
- Obtain Critical Environmental Permits (BO, ITP, 404)
- Receive Water Right Order and Permit
- Obtain Local Agency Agreements and Permits
- Execute Benefits Contracts with DWR and CDFW

Sites

Creating an Affordable, Permittable & Buildable Project

Goals for 2022 - 2024

- Develop Mitigation Acquisition Master Plan
- Initiate Application for DSOD Permit to Construct
- Advance Engineering Design to achieve Level 3 cost estimate
- Determine Procurement and Delivery Strategy
- Determine Overall Project Schedule
- Develop and Implement Land Acquisition Master Plan
- Conduct Geotech Investigations and Evaluations
- Perform Geotech Evaluation of all "Willing Seller" Properties
- Determine Organization Structure and Governance

Sites

INFO@SITESPROJECT.ORG

SITESPROJECT.ORG

Sites

From: Alicia Forsythe [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=A6CDF06A7E904B65BAA21702A82AD329-AFORSYTHE]
Sent: 9/22/2022 4:35:51 PM
To: Angela Bezzone [bezzone@mbkengineers.com]; Spranza, John [john.spranza@hdrinc.com]
CC: Wesley Walker [walker@mbkengineers.com]
Subject: RE: sacwam

Thanks Angela. I wonder if we include this detail in our response letter to the State Board with an explanation of why we cant use SAC WAM. This may help us, State Board, and NGOs understand why we cant use this. I think NRDC will continue to push on using it. And its not that we don't want it use it. Its that the runs provided are baseline runs. Not implementation runs. So there is no way TO use it right now. I am not sure if NRDC completely understand that.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

---

From: Angela Bezzone <bezzone@mbkengineers.com>
Sent: Thursday, September 22, 2022 11:14 AM
To: Spranza, John <john.spranza@hdrinc.com>; Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Wesley Walker <walker@mbkengineers.com>
Subject: RE: sacwam

Hello! Just want to close the loop on this to make sure we have a common understanding of the available SacWAM runs. As noted below, all available runs are baseline scenarios.

2016 – beta/model development version with baseline of existing conditions
2017 – baseline of existing conditions, baseline of unimpaired flow

- The existing flows and the UIF were developed for the Scientific Basis Report to, "...characterize the hydrology of the Bay-Delta watershed..." They calculated the UIF by essentially turning off all the reservoir operations, diversions, and limiting the GW pumping for their existing conditions run so they could then compare existing to UIF conditions. In other words, this is an UIF scenario, but it is to establish a baseline – not a scenario showing %UIF implementation or results.

2019 – baseline of existing conditions, further refined

Please let me or Wes know if you have any questions.

Thanks,
Angela

From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Tuesday, September 20, 2022 2:22 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Angela Bezzone <bezzone@mbkengineers.com>; Wesley Walker <walker@mbkengineers.com>
Subject: sacwam

Here is the link
https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/sacwam/sacwam_download.html

We chose to not use it because it was not representative of the UIF that Board staff had requested.

John Spranza, MS, CCN
Senior Ecologist / Regulatory Specialist

HDR
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
D 916.679.8858 M 818.640.2487
john.spranza@hdrinc.com

hdrinc.com/follow-us
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From: Alicia Forsythe [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=A6CDF06A7E904B65BAA21702A82AD329-AFORSYTHE]
Sent: 9/23/2022 8:38:45 AM
To: Cadei, Michael [Michael.Cadei@hdrinc.com]
CC: Luu, Henry [henry.luu@hdrinc.com]; Spranza, John [john.spranza@hdrinc.com]; Leu, Joanna [Joanna.Leu@hdrinc.com]; Patel, Trishna [Trishna.Patel@hdrinc.com]; Edwards, Dawn [Dawn.Edwards@hdrinc.com]
Subject: RE: Flood Management Plan Scope Questions

Hi all – I just sent this email to Mike in response to his email that was attached, but thought I would send it to this group also.

-

Yes, you are authorized to have access to these folders. Sorry I lost track of this email. I actually changed the title of one of the earlier folders, so they are now:

DWR Flood and Recreation

I could see a number of folks needing access to these folders to work on the Flood and Recreation Plans. I am not sure that I want to give them all access as our contract negotiations are in this folder also.

Could you work with Randy or others to set up a new "page" for Management Plans? This would be the same level header as the Project Description page. We can then move all of the Management Plan work into one folder – as we will be embarking on these two, but also a few more (Lands, Reservoir) in 2023. It would be nice to have these all in one place so folks can compare them as we draft them all over the next year. And in a spot that its confidential as the plans themselves are not confidential. It's the contract negotiations that are.

Ali

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From: Cadei, Michael <Michael.Cadei@hdrinc.com>
Sent: Friday, September 23, 2022 7:17 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <john.spranza@hdrinc.com>; Leu, Joanna <Joanna.Leu@hdrinc.com>; Patel, Trishna <Trishna.Patel@hdrinc.com>; Edwards, Dawn <Dawn.Edwards@hdrinc.com>
Subject: RE: Flood Management Plan Scope Questions
Importance: High

Hello Ali

Saw this email go by and I wanted to also add Joanna Leu to the conversation. She will be leading the effort to prepare the Flood Management Plan for HDR.

You might recall that I sent you an email about this when things were pretty hectic (which is most of the time, I suppose.) See attached.

Thanks Ali.

Michael Cadei, PE, DBIA
(CA, NV, OR, FL, VA, NC)
D 916.817.4927 M 916.295.0450

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From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Thursday, September 22, 2022 4:49 PM
To: Spranza, John <john.spranza@hdrinc.com>
Cc: Luu, Henry <henry.luu@hdrinc.com>; Cadei, Michael <Michael.Cadei@hdrinc.com>
Subject: RE: Flood Management Plan Scope Questions

Thanks John. We should schedule a call on this next week with folks. It's a totally different flood plan. It will be used to fulfill the Adaptive Management Plan requirement in the Prop 1 benefits contracts. I've attached the early draft AMP template from CDFW. This is tricky for how to apply to flood as the flood benefits are inherent to the Reservoir.

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Trishna and Erin also did a draft outline for the plan that is here:
Flood Management Plan

We might need to move this folder somewhere else as its in a confidential file right now that may have limited access.

We should talk through this on a call as this is not typical. 😊

Cheyanne and Trishna should attend also as they have been part of the discussions with DWR on this too.

Ali

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From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Thursday, September 22, 2022 10:42 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Luu, Henry <henry.luu@hdrinc.com>; Cadei, Michael <Michael.Cadei@hdrinc.com>
Subject: Flood Management Plan Scope Questions

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- Definition of events that trigger emergency action

I can jump on a call to discuss this if you would like.
Thanks,
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Sent: 9/23/2022 8:51:11 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]
CC: Luu, Henry [henry.luu@hdrinc.com]; Spranza, John [john.spranza@hdrinc.com]; Leu, Joanna [Joanna.Leu@hdrinc.com]; Patel, Trishna [Trishna.Patel@hdrinc.com]; Edwards, Dawn [Dawn.Edwards@hdrinc.com]; Olden, Randy [randall.olden@hdrinc.com]
Subject: RE: Flood Management Plan Scope Questions - New Folders for Sites Management Plans

Importance: High

Thanks for the response Ali

We (Randy) will start working on setting up a new page for "Management Plans".

Michael Cadei, PE, DBIA
(CA, NV, OR, FL, VA, NC)
D 916.817.4927 M 916.295.0450

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Sent: Friday, September 23, 2022 8:39 AM
To: Cadei, Michael <Michael.Cadei@hdrinc.com>
Cc: Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <john.spranza@hdrinc.com>; Leu, Joanna <Joanna.Leu@hdrinc.com>; Patel, Trishna <Trishna.Patel@hdrinc.com>; Edwards, Dawn <Dawn.Edwards@hdrinc.com>
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John Spranza, MS, CCN
Senior Ecologist / Regulatory Specialist

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2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
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john.spranza@hdrinc.com

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Cumulative Flow Effect Analysis for the Water Storage Investment Program Projects (DRAFT)

Results Summary

August 4, 2022

Prepared for:

California Department of Water Resources

Prepared by:

Stantec Consulting Services Inc.
3301 C St Suite 1900
Sacramento, CA 95816

CUMULATIVE FLOW EFFECT ANALYSIS FOR THE WATER STORAGE INVESTMENT PROGRAM PROJECTS (DRAFT)

Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date
0	DRAFT	AW, SH, TF	12/11/2021	YS	12/11/2021		
1	DRAFT	AW, SH, TF	12/17/2021	YS	12/19/2021	DO, CS, AM	04/12/2022
2	DRAFT	AW, SH, TF	06/22/2022	YS	6/26/2022	DO, AM	07/18/2022
3	DRAFT	AW, SH, TF	07/21/2022	YS	08/04/2022		

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CUMULATIVE FLOW EFFECT ANALYSIS FOR THE WATER STORAGE INVESTMENT PROGRAM PROJECTS (DRAFT)

1.0 BACKGROUND

In 2017, eight water storage projects were funded by the State of California under the planning efforts related to the Water Storage Investment Program (WSIP). One project, the Temperance Flat Reservoir, was withdrawn. The seven remaining projects consist of four surface water diversion projects and three groundwater (GW) storage banks (Figure 1). Three surface water diversion projects are located north of the Sacramento-San Joaquin Delta (Delta) or in the Delta: Sites Reservoir Project (Sites), Harvest Water Program (Harvest) (formerly known as the South County Ag Program), and the Los Vaqueros Reservoir Expansion Project (LVE). One surface water diversion project, the Pacheco Reservoir Expansion Project (PREP), is located south of the Delta. The three GW banks are located south of the Delta: Chino Basin Program (Chino Basin), Kern Fan Groundwater Storage Project (Kern Fan), and Willow Springs Water Bank Conjunctive Use Project (Willow Springs). Because PREP has no direct impact on the Delta watershed analyzed in this study, it was excluded from the analysis.

The six WSIP projects analyzed in this study operate independently of each other with different timelines for implementation, and it is possible some will not be implemented. Each project has developed an independent set of modeling tools and analysis used to support the original WSIP application and subsequent permitting and feasibility assessments. The primary focus of this study is to integrate the six independent models and quantitatively analyze the cumulative flow effects and potential interactions between all six WSIP projects, and to assess the resulting Central Valley Project (CVP) and State Water Project (SWP) operations in the Sacramento River, Feather River, and Delta.

Three surface water diversion projects north of the Delta or in the Delta – Sites, Harvest, and LVE – potentially contribute to operational changes and relative water availability in the Delta, primarily through changes to flows in the Feather River, Sacramento River, and Cosumnes River, and subsequent changes to Delta inflows, Delta surplus flows, and exports from the Harvey O. Banks Pumping Plant (Banks) and the C.W. Bill Jones Pumping Plant (Jones). Three south-of-Delta GW bank projects include Chino Basin, Kern Fan, and Willow Springs; each include a GW storage component that could potentially contribute to operational changes and relative water availability in the Delta through changes to Delta inflows, Delta surplus flows, and Banks exports, and through a coordinated pulse flow released from Lake Oroville.

The California Department of Water Resources (DWR) is proposing to release pulse flows into the Feather River from Lake Oroville using water exchanged with the three south-of-Delta GW banks. The periodic release of pulse flows from Lake Oroville are intended to facilitate fish migration and survival, and the estimated release frequency is once every 3 to 4 years. The pulse flow volumes are estimated to range up to 100 thousand acre-feet (TAF) released over a period of several days to several weeks and would typically be released during the months of March through May in dry and below-normal years (as described later, the pulse flow for this analysis is applied exclusively in the month of April in Below Normal years and Dry years as defined by the Sacramento Valley Index). DWR will be applying to the State

Water Resources Control Board (SWRCB) for a California Water Code 1707 instream flow dedication for these pulse flows to prevent further diversion and to contribute to the Delta outflows.

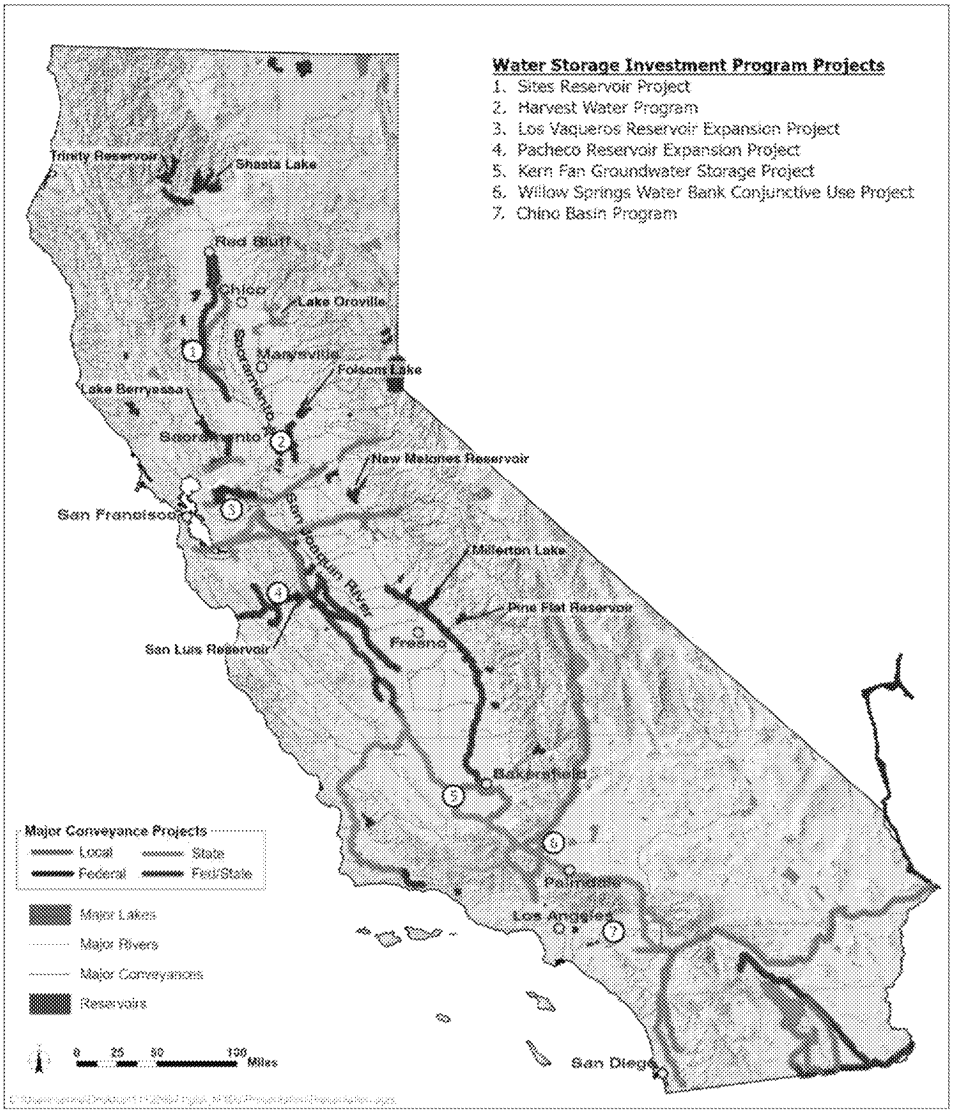

Figure 1. Map of seven Water Storage Investment Program projects analyzed.

The volume of water released for the pulse flows would become available through an exchange facilitated by the applicable WSIP GW project with participating SWP contractors (Partner Contractors). There would not be a direct transfer of additional water supplies into Lake Oroville; instead, an exchange of water supplies would occur, where new water banked in GW facilities would be distributed to Partner Contractors in lieu of receiving SWP deliveries directly from the SWP. New water supplied to the GW banks would come from sources of water not currently utilized or previously allocated (e.g., Delta surplus or local recycled water). The additional water distributed from each GW bank would allow for reduced direct SWP deliveries to Partner Contractors. These reductions would, by operational exchanges in the SWP, create the pulse flow volumes released from Lake Oroville.

Implementation of the three south-of-Delta GW bank WSIP projects and the three north-of-Delta or in Delta surface water storage projects may affect operations of the SWP, including operations of south Delta pumping facilities and San Luis Reservoir, and water availability in the system during and immediately following the release of pulse flows. As needed, San Luis Reservoir would be operated to facilitate exchanges needed to compensate for pulse flow releases from Lake Oroville. However, San Luis Reservoir would be replenished, and water supplies made whole via exchange with the GW banks used by the pulse flow projects. (As described later in the document, the hedging and payback for San Luis Reservoir are not included in the analysis.)

Stantec was retained by DWR to provide support services for the cumulative flow analysis, including cumulative implementation of three south-of-Delta GW bank WSIP projects and three north-of-Delta or in Delta surface water diversion WSIP projects onto a baseline existing conditions model, development of coordinated pulse flow operations, and analysis of changes to hydrologic conditions, including flows in the Sacramento River and Feather River, Delta inflow and surplus conditions, SWP diversions from the Delta, and diversions from the Sacramento River, Delta, or San Luis Reservoir by SWP contractors that could result from implementation of the six WSIP projects. The assumptions developed in this analysis are preliminary and subject to ongoing review.

2.0 PROCEDURAL SUMMARY

A post-processing tool was developed to model and evaluate the cumulative implementation and pulse flow effects of six WSIP Projects: Sites, Harvest, LVE, Kern Fan, Willow Springs, and Chino Basin. A summary of the tool development and analysis procedure is provided below, and more details are available in Appendix A.

2.1 MAIN ASSUMPTIONS

An existing conditions WSIP baseline CalSim II model (WSIP Baseline[1]) was developed by DWR in 2021 and served as the basis of CVP and SWP system operations. The WSIP Baseline included historical hydrology, 2019 Biological Opinions (BiOps) for the long-term CVP and SWP operations, and the 2020 Incidental Take Permit (ITP) for the SWP operations, among other regulatory conditions. The general approach to the cumulative effects analysis includes adding to or subtracting from flow values in the WSIP Baseline based on the operations of each individual WSIP project, subject to regulatory and operational constraints of the WSIP Baseline.

To modify the WSIP Baseline, a post-processing tool was developed to incrementally augment specific CalSim II variables based on simplified operations of the six WSIP Projects. Three surface water diversion projects north of the Delta or in the Delta were implemented incrementally from north to south: Sites, Harvest, then LVE. Then the coordinated operations of all three south-of-Delta GW banks were implemented: Kern Fan, Willow Springs, and Chino Basin. This coordinated operation assumes Kern Fan and Willow Springs have equal access to exportable Delta surplus for filling operations (Chino Basin fills with local supply), and that stored GW across all banks is exchanged for water in Lake Oroville, enabling (1) the GW banks to deliver previously stored GW supplies to Partner Contractors in lieu of SWP supply from the SWP and (2) a pulse flow to be released from Lake Oroville using exchanged water.

This report focuses on current conditions as depicted in the WSIP Baseline CalSim II model and near-term modeling used by WSIP projects. Future conditions such as 2070 scenarios and future climate change impacts were not evaluated in this report.

The simplified operations and facility assumptions for each WSIP project were obtained from existing documentation (Table 1), either WSIP application documents and modeling, or other updated documents and modeling (e.g., related EIRs) provided to DWR for the analysis. Modifications to the WSIP Baseline to reflect WSIP project operations in the post-processor were made in three ways:

- *For Sites and LVE:* An alternative CalSim II model and baseline CalSim II model were available for each project. The difference between the alternative model variable and the baseline model variable was added to the WSIP Baseline variable.
- *For Harvest:* WSIP application documentation was used to identify a variable of interest (e.g., changes in Sacramento River flows) and a corresponding calculation node in CalSim II. A net change in the variable between a baseline condition and alternative condition was calculated, and the net change was then added to the corresponding CalSim II node in the WSIP Baseline.

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[1]An existing conditions CalSim II baseline model and four future conditions CalSim II baseline models were developed in 2017 by DWR and Reclamation for use in WSIP applications. In September 2021, DWR updated these baseline models to account for current regulations governing Delta operations and to include all other CalSim II model updates as of September 2021, including updates from DWR's 2019 Delivery Capability Report.

- *For Chino Basin, Kern Fan, and Willow Springs:* Spreadsheet models for each project were available that simulated GW bank operations using variables from a baseline CalSim II model. Each spreadsheet model was modified to read CalSim II variables from the WSIP Baseline, and the spreadsheet model parameters were modified to incorporate operational changes expected from the cumulative implementation of WSIP projects (e.g., coordinated pulse flows in the same month released from all GW banks). Any resulting net changes to a CalSim II variable (e.g., increases in Feather River flows due to a pulse flow release) were added to the WSIP Baseline variable.

Table 1. Basis of WSIP project modeling included in the post-processing analysis

Scenario/Project	Existing Conditions Model (date developed)	Project Alternative Model
WSIP Baseline	2021 WSIP Baseline CalSim II model (09/30/2021, prepared by DWR)	N/A
Sites	2022 Baseline CalSim II model (5/14//2022) File Name: CALSIM_MMv5_NOACTION_051422	Sites Alt 3 (modified from Existing Conditions Baseline) File Name: CALSIM_MMv5_ALT3_051722
Harvest	2017 WSIP 2030 Baseline CalSim II model (2017. Note this CalSim II model run was not used in the post-processor, only the results from the Harvest Project Alternative Model)	Regional San Program, Year 20 equilibrium conditions (modified from Existing Conditions Baseline) Reference: From 2017 WSIP Application Info, Regional San_CALSIM_HEC5Q_ModelingTM_A.1ProjectConditions_SecBCMR.pdf
LVE	2017 LVE Baseline CalSim II model (05/02/2017) File Name: CALSIM_LVE275_EC_050217/LVE275_DSEIR_EC_160TAF	LVE Alt 1B (modified from Existing Conditions Baseline) File Name: CALSIM_LVE275_EC_050217/LVE275_DSEIR_EC_Alt1B
Willow Springs	N/A	Custom spreadsheet model (based on Conjunctive Operations Concept for the Willow Springs Water Bank memo dated 04/06/2022)
Kern Fan	N/A	Spreadsheet model (based on WSIP 2030 operation, "Model_KernFan_02_09_2018.xlsm")
Chino Basin	N/A	Spreadsheet model (based on WSIP 2030 operation, Chino Basin Program Water Supply Investment Program Water Exchange Operations Model, "CBP WSIP Operations Analysis Tool v 20211001.xlsx")

2.2 SURFACE WATER DIVERSIONS, RELEASES, AND DELTA ASSUMPTIONS (MOD1)

Operations for the three surface water diversion projects north of the Delta or in the Delta are incorporated cumulatively from north to south – Sites, Harvest, then LVE – and are referred to collectively as modification 1 (MOD1). The analysis uses the WSIP Baseline and applies the incremental difference between the individual WSIP project CalSim II baseline and alternative models (Alternative CalSim II models), or the difference between a project alternative and a baseline quantified using other modeling tools, to the WSIP Baseline. The WSIP Baseline includes updates to the regulatory and operational assumptions that have the potential to change the timing and availability of surplus flows compared to previous CalSim II models that may have been used to model existing conditions for the surface water diversion projects. The changes in flows from each surface water diversion project were evaluated in the post-processing tool and constrained by Delta conditions in the WSIP Baseline. This is because it is important to analyze the changes from the WSIP projects in the context of Delta surplus and balanced as exists under the current regulatory conditions in the WSIP Baseline.

If the results of Alternative CalSim II models, when incrementally added to the WSIP Baseline, show that pumping at Banks is increased beyond regulatory capacity in the WSIP Baseline, this analysis identifies that increment as "infeasible" meaning that the WSIP project yield is overestimated. The assumption is that operational agreements with DWR would not allow significant impacts to Banks pumping. Likewise, if the results of Alternative CalSim II models, when incrementally added to the WSIP Baseline, show that Delta surplus is reduced beyond what is currently available based on regulatory conditions in the WSIP Baseline, which would require a corresponding reduction in Banks exports to maintain balance in the Delta, this analysis identifies that increment as "infeasible" meaning that the WSIP project yield is overestimated.

The major assumptions for implementing each project are described below:

- **Sites**: Operations are modeled as a change in flow at four locations: Feather River (CalSim II node C203 and C223), Delta inflow from the Sacramento River at Hood, Yolo bypass flow into the Delta, and Banks exports.

  a. The net difference between Delta inflow (Sacramento River flows at Hood plus Yolo bypass flow) and Banks exports between the Sites Alternative CalSim II model and the Sites baseline CalSim II model is added to (if positive) or subtracted from (if negative) the WSIP Baseline Delta surplus. If the Sites adjustments results in reductions to Delta surplus that were greater than available Delta surplus in the WSIP Baseline, these adjustments are tracked as infeasible (i.e., reduction in Sites yield). Any increase in Delta inflow due to releases from Sites (either through the Sacramento River or through Yolo Bypass) are protected through to Delta outflow and are not made available for export by other WSIP surface water diversion or GW projects.

  b. The difference in Banks exports between the Sites Alternative CalSim II model and the Sites baseline CalSim II model is added to (if positive) or subtracted from (if negative) Banks exports. If the Sites adjustments result in increases or reductions to Banks exports that are greater than available permit/regulatory capacity in the WSIP Baseline or less than the health and safety minimum (300 cubic feet per second (cfs)), these adjustments are tracked as infeasible.

- **Harvest**: Operations are modeled as a change in Delta inflow, which reflects the combined net change in flow of the Sacramento River at Hood and the Cosumnes River.

  a. The net difference between decreased releases and increased surface water return flow to the Sacramento River at Hood from Harvest is calculated using a monthly pattern of flow applied to an annual flow volume defined in the WSIP application, assuming the project has reached equilibrium after 20 years of operation. The net difference is added to the WSIP Baseline Sacramento River flow at Hood. Note that in earlier years of operations there would be less return flows to the Sacramento River or to the Delta in general through the Consumnes River so impacts are greater in the first part of the 20 years of operation.

  b. The increase in streamflow to the Cosumnes River is calculated using a monthly pattern of flow applied to an annual flow volume defined in the WSIP application, assuming the project has reached equilibrium after 20 years of operation. The net difference is added to the WSIP Baseline Consumnes River flow.

  c. The net change in Delta inflow (Delta inflow from the Sacramento River plus Consumnes River) is added to (if positive) or subtracted from (if negative) the Sites modified Delta surplus. If Delta inflow is reduced and the Delta is in a balanced condition, Banks exports are reduced to maintain a balanced Delta condition.

- **LVE**: Operations are modeled as a change in Delta surplus and Banks exports.

  a. The net difference in Delta surplus between the LVE Alternative CalSim II model and the LVE baseline CalSim II model is added to (if positive) or subtracted from (if negative) the Sites/Harvest modified Delta surplus. If the LVE adjustments result in reductions to Delta surplus that were greater than Sites/Harvest modified available Delta surplus, these adjustments are tracked as infeasible (i.e., reduction in LVE yield).

  b. The difference in Banks exports between the LVE Alternative CalSim II model and the LVE baseline CalSim II model is added to (if positive) or subtracted from (if negative) the Sites/Harvest modified Banks exports. If the LVE adjustments result in increases or reductions to Banks exports that are greater than available permit/regulatory capacity or less than the health and safety minimum, these adjustments are tracked as infeasible.

Based on Sites and LVE Alternative CalSim II modeling, implementation of these two surface water diversion projects causes some minimal changes in storage in the major CVP and SWP reservoirs (Oroville, Shasta, Trinity, Folsom, San Luis Reservoirs) and SWP and CVP allocations, so these changes are ignored for purposes of this post-processing analysis because the focus of the analysis is on changes to Delta inflows and exports and tracking additional upstream reservoir storage changes could be too complicated for its worth.

The controlling regulations in the Delta are a critical component of the analysis that is referenced for each project. For each month in the WSIP Baseline, Delta conditions are classified as surplus (i.e., with no controlling Delta regulations), Surplus with export restrictions (i.e., when the Delta is in surplus but Delta regulations are limiting exports), or Balanced. For these last two classifications, Delta control is identified as EI ratio cap export control, OMR control, D-1641 April-May export cap control, D-1641 outflow control, D-1641 salinity control, or SWP ITP export cut to enforce the spring outflow requirement in April and May. The post-processor does not recalculate or change Delta control in any month based on the represented operations of the WSIP projects. The WSIP Baseline control is assumed to remain in control throughout all post-processor modifications, with exceptions noted below.

In any given month, implementation of a surface water diversion project may result in changes in Delta inflow, which then are used to cumulatively adjust Delta surplus. Adjustments to Delta surplus can be categorized as increased Delta surplus, reduced but still positive Delta surplus, a reduction in Delta surplus to balanced conditions (i.e., reduction of all Delta surplus), or an infeasible reduction in Delta surplus beyond what is available in the WSIP Baseline or subsequent incremental adjustments. If Delta surplus increases, the increase is tracked separately but not made available for cumulative WSIP projects. If Delta surplus is reduced but still positive, the reduced volume of Delta surplus is available for cumulative WSIP projects. If Delta surplus is reduced to 0 (balanced conditions), no Delta surplus is available for cumulative WSIP projects. If Delta surplus is reduced below 0, the additional reductions below 0 are tracked as infeasible, and Delta surplus remains at 0 for WSIP cumulative projects. Adjustments to Delta surplus are tracked as 'infeasible' if they present conflicts with SWP operations, i.e., if they require Banks export cuts. Reductions in surplus and the required SWP export cuts that would be necessary (but are not tracked cumulatively) are made based on rules listed in Table 2.

Table 2. Delta condition classification and corresponding post-processor treatment when Delta inflow is reduced

Controlling Regulation	Surplus with restrictions	Balanced[1]
EI ratio cap export control	Split reduction between SWP exports and Delta outflow by appropriate proportion to maintain EI ratio control. Track volume of required Delta outflow reductions[1].	Split reduction between SWP exports and Delta outflow by appropriate proportion to maintain EI ratio control. Track volume of required Delta outflow reductions.
OMR control	Reduce surplus 1:1 to Delta inflow reduction until all surplus is eliminated, then refer to Balanced condition	Reduce SWP exports at a 1:1 ratio to Delta inflow reduction
D-1641 April-May export cap control	Reduce surplus 1:1 to Delta inflow reduction until all surplus is eliminated, then refer to Balanced condition	Reduce SWP exports at a 1:1 ratio to Delta inflow reduction
D-1641 outflow control	Not applicable	Reduce SWP exports at a 1:1 ratio to Delta inflow reduction
D-1641 salinity control	Not applicable	Split reduction between exports and Delta outflow based on carriage water requirements. Track volume of required Delta outflow reductions.
SWP ITP export cut (April-May spring outflow)	Reduce surplus 1:1 to Delta inflow reduction until all surplus is eliminated, then refer to Balanced condition	Not applicable unless all surplus has been reduced, then reduce SWP exports at a 1:1 ratio to Delta inflow reduction

[1] For Sites and LVE, these export cuts are tracked as 'infeasible' with the WSIP Baseline and are not cumulatively implemented.

The above modeling assumptions were developed to reduce available Delta surplus without impacting the SWP operations within the WSIP Baseline (i.e., Table A deliveries and Article 21 deliveries in the WSIP Baseline are preserved). Sites and LVE operations that assume modifications of Delta surplus during balanced conditions, when no Delta surplus is available, are incompatible with SWP operations in the WISP Baseline and are tracked separately without cumulatively impacting the analysis. At this time, the analysis is focused exclusively on the SWP system, and no CVP system effects were analyzed. Modeling results from the Sites and LVE environmental documents can be referenced for specific CVP system effects.

Carriage water requirements from the WSIP Baseline are generally maintained in the surface water diversion portion of the MOD1 analysis, with the following clarifications:

- When D-1641 salinity control is in place and Delta inflow is reduced, the ratio of required export reduction to Delta inflow reduction may be less than 1:1 since a portion of inflow is going to carriage water. This is only applicable to the Harvest adjustment, which can reduce Delta inflows during Delta balanced conditions.

- Sites and LVE reductions to Delta surplus are only allowed cumulatively when the Delta is in a surplus condition. In these conditions, reductions to Delta surplus do not require a cut to Banks exports. Since D-1641 salinity control is never controlling during surplus conditions, there are no carriage water requirements to account for during Sites and LVE Delta surplus reductions.

- Sites increases to Delta inflow, generally in July through November, support additional Banks exports. These inflows are greater than Banks exports due to carriage water requirements and Sites environmental flows through the Yolo Bypass. The post-processor does not calculate these carriage water requirements. For simplicity, increases in Delta inflow minus Banks export increases are added to Delta surplus. However, these increases are not made available to be exported by subsequent WSIP projects in this analysis. This assumption is consistent with the Sites project description, which states Sites releases would allow increases in Delta outflow during drier months due to the Yolo Bypass habitat flows and increases in carriage water.

2.3 GROUNDWATER PROJECT OPERATIONS ASSUMPTIONS (MOD2)

The three GW banks located south of the Delta are represented in the post-processor using a water balance that consists of fill, release, and loss. Fill operations are either independent of CalSim II variables (Chino Basin) or rely on Delta surplus flow or modifications to San Luis Reservoir (Kern Fan, Willow Springs) that cumulatively impact the CalSim II variables described in MOD1. Release operations are based on the pulse flow assumptions described below and result in additional cumulative changes to the CalSim II variables described in MOD1. The collective modification of WSIP Baseline and MOD1 variables by GW projects is referred to as modification 2 (MOD2).

The main components of each GW banks operations are as follows:

- **Chino Basin:** Fill occurs with a constant supply of treated water using a time series consistent with the WSIP application. Releases for pulse flows are based on the assumptions described below. To be consistent with the WSIP application, the target volume for each pulse flow is 50 TAF (resulting in only 40 TAF of GW bank storage reduction for each pulse due to an assumed 20% carriage water savings), total storage available in the GW bank is 150 TAF, total borrowing capacity (i.e., deliveries debited against other Chino Basin groundwater) is 100 TAF, and initial storage is set to 75 TAF as described in application project operations documents. Chino Basin pulse flow operations are decoupled from releases to Partner Contractors (in this case, Metropolitan Water District of Southern California, or MWD). In years when a pulse flow is made in the model, MWD does not necessarily take delivery of supplies from Chino Basin in lieu of SWP export reductions from Banks. MWD would reduce SWP deliveries in that year and call on Chino Basin in non-pulse flow years for delivery of stored supplies when SWP Table A allocations dropped below a user defined threshold value (42% in the spreadsheet model). This threshold value was determined by trial and error in the model to maintain reasonable GW storage over time in terms of debit or surplus deliveries.

- **Kern Fan:** Fill occurs based on the availability of current month Delta surplus flow available as Article 21 supplies from MOD1 (i.e., Delta surplus flow in excess of Article 21 supplies delivered in the WSIP Baseline, when SWP San Luis Reservoir is full). Delivery of Article 21 supplies to Kern Fan is limited by Banks permit/regulatory export capacity from MOD1 (i.e., preserving Article 21 deliveries from the WSIP Baseline and considering any additional export cuts or increases from surface water diversion projects) and the California Aqueduct conveyance constraint at the Kern Fan turn-out, which was set at a constant 400 cfs (23.8 TAF per month). This fill is split between an environmental account for pulse flows, storage for Irvine Ranch Water District (IRWD), and storage for Rosedale Rio-Bravo Water Storage District (RR). Releases for pulse flows are based on the assumptions described below. Total storage available in the environmental account for pulse flows is 25 TAF, but the target volume for each pulse flow is 18 TAF (resulting in only 14 TAF of GW bank storage reduction for each pulse due to an assumed 23% carriage water savings), and initial storage was set at 0 TAF, consistent with the WSIP application. Total storage in the GW bank across all accounts is 100 TAF.

- **Willow Springs:** Fill occurs using opportunistically captured Delta surplus flow, which is stored in San Luis Reservoir in Pre-Evacuated Public Benefit Space that was created by moving water from San Luis Reservoir to the Water Bank earlier in the year. A simplified spreadsheet model of the Willow Springs operation, based on the April 6, 2022 Technical Memo from Willow Springs, determines the operation. Storage space in San Luis Reservoir made available by pre-evacuation can be filled by additional exports of Delta surplus from MOD1 (as limited by permit/regulatory export capacity), thereby generating additional yield. This additional yield is then moved into the GW bank into an Ecological Benefit Storage account, which is used to compensate for pulse flow releases. The deficit in San Luis Reservoir due to pre-evacuation is always made up by the end of the water year, either by the Antelope Valley-East Kern Water Agency (AVEK) taking its Table A allocation from the GW bank instead of San Luis Reservoir, or by returning pre-evacuated water to the California Aqueduct. Water stored in the GW bank is subject to a 10% leave-behind, removed from the Ecological Benefit Storage account, in two cases. First, when additional yield is moved into the Ecological Benefit Storage account, and second, when pre-evacuated water is returned to the California Aqueduct. Consistent with recent modeling updates, the target volume for each pulse flow is 28.6 TAF per year. Initial storage was set at 0 TAF to be consistent with the Kern Fan assumptions. Total storage capacity of the GW bank is 560 TAF, with inflow and outflow capacity of 200 cfs.
- **Fill priority:** For the purposes of modeling and treating two Article 21-dependent groundwater banks equally, half of the MOD1 Delta surplus flow available in a given month will be made available for additional San Luis fill facilitated by the Willow Springs operation, and the other half will be made available to Kern Fan. Note that these deliveries would be in addition to the Article 21 deliveries simulated in the WSIP Baseline, which are preserved through MOD1 and MOD2.

Supplies in each GW bank are indirectly exchanged for storage in Oroville to enable a spring pulse flow release from Oroville in April of Below Normal and Dry water year types, as defined by the Sacramento Valley Index. Capacity would be combined from multiple GW banks to deliver a pulse flow with a magnitude up to 100 TAF in a given year (the combined storage volume for pulse flow exchange water of all GW banks is up to 97 TAF for this analysis), but magnitude of allowable pulse flow would be constrained by several factors:

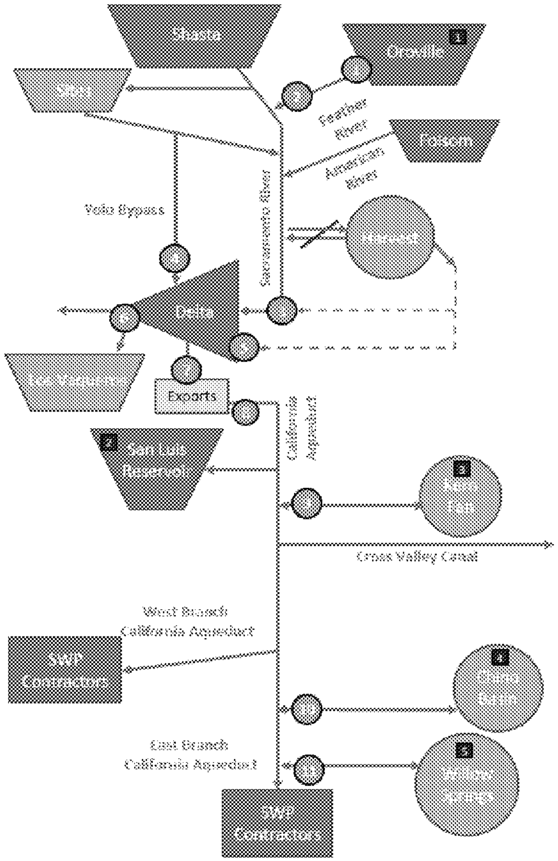
- The volume each GW bank had in their pulse flow storage account in April
- GW bank specific pulse flow triggers as described in project assumptions or implemented in spreadsheet models:
  - Chino Basin will only make a pulse flow for either 3 consecutive or 4 out of 10 years, and only if Lake Oroville storage and San Luis Reservoir storage are within minimum and maximum threshold values.
  - Kern Fan will only make a pulse flow if final SWP Table A allocations are greater than 20% and only if sufficient storage has accumulated in the account to deliver the full pulse flow requested (i.e., Kern Fan will not make partial delivery).
  - Willow Springs does not have an SWP Table A allocation threshold or minimum storage level for making a pulse flow.
- The total volume of Feather River flow reductions in July through September that would still ensure Feather River minimum flow requirements are met. This is based on the concept that DWR would forecast summer releases and Feather River minimum flow requirements before a pulse flow is approved, and would only deliver a pulse flow volume in the spring that could be compensated with reduced releases in summer months that still meet or exceed Feather River minimum flow requirements. The total flow release reductions would allow Lake Oroville storage to recover by the end of the water year to the anticipated storage without the pulse flow operation.
- The magnitude of additional Banks export reductions that could occur due to decreases in Delta inflow while still maintaining exports above the minimum health and safety threshold of 300 cfs.

Feather River releases or Banks export reductions could be reduced across several months or could be reduced in some months and not others, depending on the constraints above. There would be no priority to modify flows or exports evenly across months. In general, Delta outflow would be increased during the pulse flow release months and would remain relatively unchanged during pulse flow compensation reduction months, when Delta inflows would be reduced but Banks exports would be reduced an equivalent amount, resulting in relatively unchanged Delta outflows. In real-time operations, the effects of these operations on antecedent salinity conditions could result in changes in carriage water requirements and Delta operations, but these effects are beyond the scope of this analysis.

To simplify the analysis, no carriage water savings are calculated during the pulse flow compensation summer months, when Banks exports are reduced, and the GW banks are delivering SWP supplies to Partner Contractors in lieu of Banks exports.

2.4 SCHEMATIC

The main variables developed in the post-processing tool are outlined in the schematic shown in Figure 2.



NODES/STORAGE FROM CALSIM FOR WSIP BASELINE, MOD1, AND MOD2

Flow Variable	CalSim II Node
1 Feather River Flow below Thermalito	C203
2 Feather River Flow at mouth	C223
3 Sacramento River Flow at Hood	C400
4 Flow through Yolo Bypass	C157
5 Mokelumne River inflow to Delta	C504
6 Delta outflow surplus	C407_SWP + C407_CVP
7 Banks Exports	D419
8 Article 21 Delivered SOD	DEL_SWP_PIN (minus NOD deliveries)
9 Deliveries to Kern Fan	N/A
10 Deliveries to Chino Basin	N/A
11 Deliveries to Willow Springs	N/A

Storage Variable	
1 Oroville Storage	S6
2 SWP San Luis Reservoir	S12
3 Kern Fan	N/A
4 Chino Basin	N/A
5 Willow Springs	N/A

Figure 2. Schematic of variables adjusted in the cumulative flow analysis.

3.0 PRELIMINARY RESULTS

The preliminary results from the analysis are described in terms of surface water diversion project adjustments (MOD1) to the WSIP Baseline, groundwater project adjustments (MOD2) to MOD1 and the WSIP Baseline, and summary results of modeled pulse flow delivery and pulse flow compensation reductions.

3.1 SURFACE WATER DIVERSION PROJECT ADJUSTMENTS (MOD1)

3.1.1 Delta Surplus

The long-term monthly average cumulative effects of the three surface water diversion WSIP projects on Delta surplus is shown in Figure 3 and Table 3. Each MOD1 adjustment to Delta surplus is only tracked when the WSIP Baseline shows a Delta surplus condition based on controlling regulations. If the Delta is in a balanced condition, the adjustments are not cumulatively added. In general, diversions to Sites in winter months (January through March) result in reduced Delta inflow, and subsequently, reduced Delta surplus. In summer months, Sites releases to the Sacramento River and Yolo bypass increase Delta inflow but correlating increases in Delta exports generally results in relatively small increases to Delta surplus. These increases in Delta surplus are not available for export by other WSIP projects. Harvest adjustments to Delta inflow generally results in minor reductions to Delta surplus. LVE use of Delta surplus occurs in wet winter months (January through March). Mean annual reductions in Delta surplus throughout the simulation period are 317 TAF, or 3% of the total 10,473 TAF of mean annual Delta surplus. As noted in Section 2, carriage water costs are not subtracted from the Sites increases in Delta inflow in summer months that support additional Banks exports, and thus summer increases in Delta surplus due to Sites operations may be slightly overstated. The long-term monthly average cumulative effects of the three surface water diversion WSIP projects on Delta surplus by water year type is shown in Figure 4 and in Tables 4 through 8.

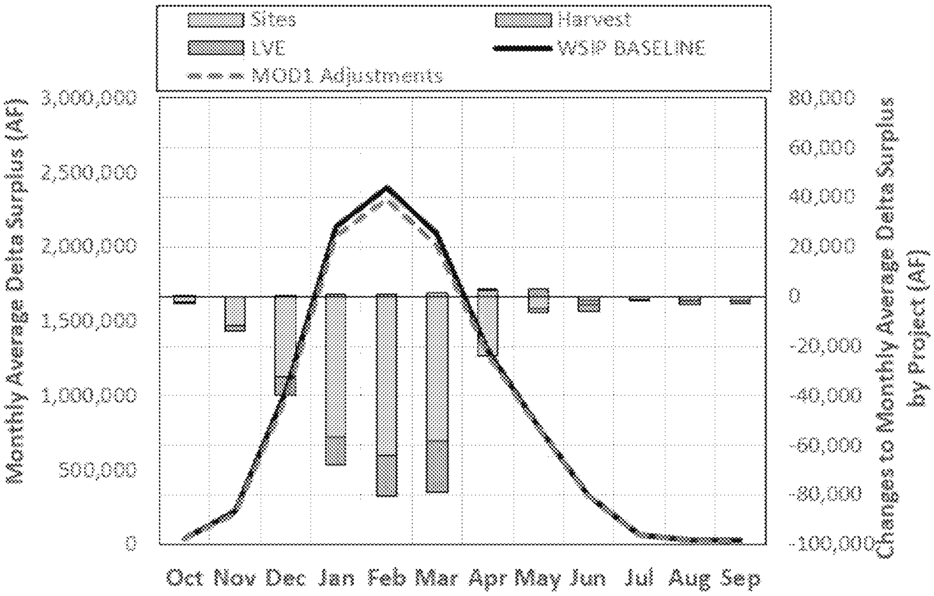


Figure 3. Monthly Average Delta Surplus for WSIP Baseline and MOD1 Adjustments and Changes to Monthly Average Delta Surplus by Project (in acre-feet))

Table 3. Monthly Average Delta Surplus and Changes to Monthly Average Delta Surplus, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	38	224	1,031	2,140	2,401	2,088	1,307	787	332	64	34	28	10,473
MOD1 Adjustment	36	210	991	2,073	2,322	2,010	1,285	784	326	63	31	25	10,157
MOD1 Adjustment minus WSIP Baseline	-2	-14	-40	-66	-79	-77	-21	-3	-6	-1	-3	-3	-317
MOD1 Adjustment by Sites	-2	-12	-32	-57	-64	-58	-24	-5	-2	0	0	-2	-258
MOD1 Adjustment by Harvest	0	0	0	1	1	2	2	-1	-1	-1	-2	0	1
MOD1 Adjustment by LVE	0	-2	-8	-11	-16	-21	0	3	-3	0	-1	-1	-60

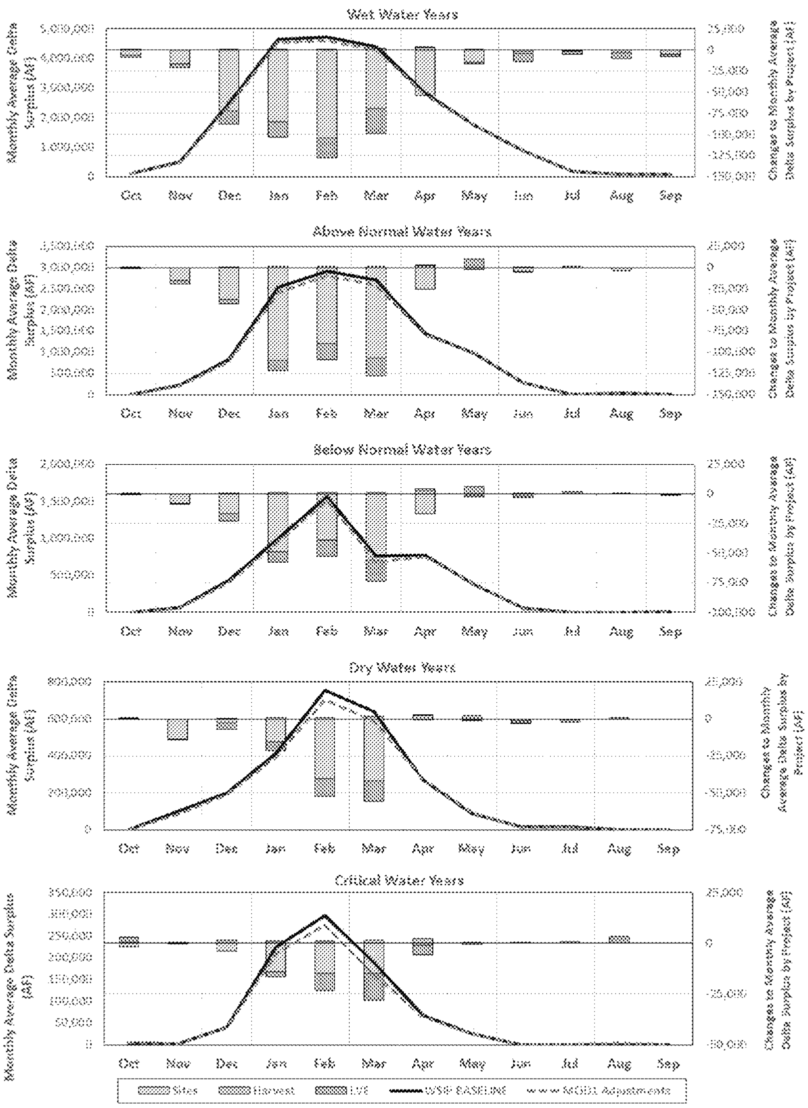


Figure 4. Monthly Average Changes to Delta Surplus for WSIP Baseline and MOD1 Adjustments, and by Individual Project (in acre-feet), by Water Year Type

Table 4. Monthly Average Delta Surplus and Changes to Monthly Average Delta Surplus, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Wet Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	118	498	2,479	4,649	4,719	4,392	2,827	1,751	881	193	87	80	22,676
MOD1 Adjustment	110	477	2,392	4,547	4,593	4,295	2,775	1,736	867	188	77	72	22,130
MOD1 Adjustment minus WSIP Baseline	-8	-21	-88	-102	-127	-97	-51	-16	-14	-5	-10	-8	-546
MOD1 Adjustment by Sites	-6	-16	-72	-85	-104	-69	-54	-15	-2	-1	0	-5	-428
MOD1 Adjustment by Harvest	0	0	0	1	1	2	2	-1	-2	-1	-4	0	-3
MOD1 Adjustment by LVE	-2	-4	-16	-18	-24	-30	0	1	-10	-3	-6	-3	-115

Table 5. Monthly Average Delta Surplus and Changes to Monthly Average Delta Surplus, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Above Normal Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	1	223	831	2,531	2,922	2,715	1,433	979	275	0	42	0	11,950
MOD1 Adjustment	1	204	789	2,410	2,814	2,589	1,411	986	270	1	38	0	11,512
MOD1 Adjustment minus WSIP Baseline	0	-19	-43	-121	-108	-126	-22	8	-5	1	-4	0	-438
MOD1 Adjustment by Sites	0	-15	-37	-110	-90	-107	-25	-1	-4	0	0	0	-390
MOD1 Adjustment by Harvest	0	0	0	1	1	2	2	-1	-1	0	-4	0	0
MOD1 Adjustment by LVE	0	-4	-5	-12	-19	-21	1	10	1	1	0	0	-49

Table 6. Monthly Average Delta Surplus and Changes to Monthly Average Delta Surplus, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Below Normal Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	0	69	430	1,005	1,569	758	770	380	54	0	0	13	5,049
MOD1 Adjustment	0	60	408	949	1,518	686	758	384	52	2	0	12	4,828
MOD1 Adjustment minus WSIP Baseline	0	-9	-22	-56	-51	-72	-12	4	-2	2	0	-1	-220
MOD1 Adjustment by Sites	0	-8	-17	-49	-39	-56	-17	-1	-2	0	0	0	-188
MOD1 Adjustment by Harvest	0	0	0	1	1	2	2	-1	-1	0	0	-1	4
MOD1 Adjustment by LVE	0	-1	-6	-9	-13	-18	2	6	1	2	0	0	-36

Table 7. Monthly Average Delta Surplus and Changes to Monthly Average Delta Surplus, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Dry Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	0	99	200	413	755	641	271	89	14	15	0	0	2,497
MOD1 Adjustment	0	85	193	393	704	587	273	90	11	13	1	0	2,350
MOD1 Adjustment minus WSIP Baseline	0	-14	-7	-21	-51	-54	3	1	-3	-2	1	0	-148
MOD1 Adjustment by Sites	0	-13	-3	-16	-41	-42	0	0	-1	0	0	0	-117
MOD1 Adjustment by Harvest	0	0	0	1	1	2	2	-1	-1	-2	0	0	3
MOD1 Adjustment by LVE	0	0	-5	-6	-12	-14	1	2	-1	0	1	0	-34

Table 8. Monthly Average Delta Surplus and Changes to Monthly Average Delta Surplus, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Critical Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	3	2	41	225	297	189	67	25	0	0	0	0	850
MOD1 Adjustment	5	2	39	209	274	162	64	25	0	1	3	0	785
MOD1 Adjustment minus WSIP Baseline	1	0	-2	-15	-22	-26	-3	0	0	1	3	0	-64
MOD1 Adjustment by Sites	-2	0	-4	-14	-15	-15	-1	0	0	0	0	0	-50
MOD1 Adjustment by Harvest	0	0	0	1	1	2	2	0	0	0	0	0	6
MOD1 Adjustment by LVE	3	0	2	-3	-9	-13	-4	0	0	1	3	0	-21

3.1.2 Banks Exports

The long-term monthly average cumulative effects of the three surface water diversion projects on Banks exports is shown in Figure 5 and Table 9. Sites results in increased Banks exports of transfers in summer months, concurrent with Sites releases that increase Delta inflow. Reductions in Banks exports in winter months from Sites are due to random model variation, a result of inconsistent application of the Delta Cross Channel Reasonable and Prudent Alternative (RPA) export restriction in a few months in the Sites Baseline and Alternative CalSim II models. In other words, they are modeling artifacts.

Implementation of both Harvest and LVE results in decreases in Banks exports throughout the year, with greater export cuts in the summer months. Adjustments from Harvest are due to required cuts to exports when Delta inflows are reduced, and the Delta is not in a surplus condition. Adjustments from LVE are likely due to random model variation occurring in the LVE Alternative CalSim II model relative to the LVE CalSim II baseline model. Different from the above Sites scenario, the exact reason for these minor changes have not been identified; however, it is certain that they are not caused by any intentional operation in the LVE Alternative. For the cumulative analysis, these export decreases are still included in the calculations here for reasons of completeness as their relative magnitude is minor (well below a 1% annual average change in exports), creating limited effects on the results of this cumulative analysis. The long-term monthly average cumulative effects of the three surface water diversion projects on Banks exports by water year type are shown in Figure 6 and in Tables 10 through 14.

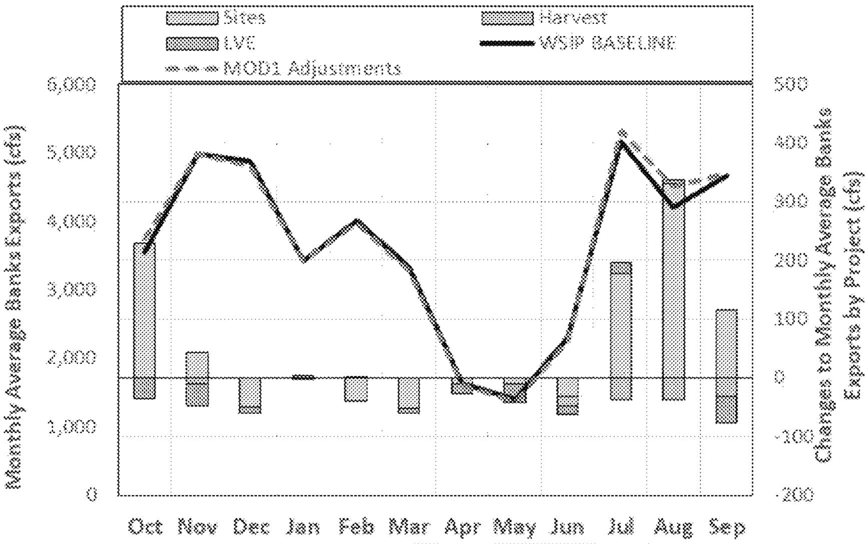


Figure 5. Monthly Average Banks Exports for WSIP Baseline and MOD1 Adjustments and Changes to Monthly Average Banks Exports by Project (in cubic feet per second)

Table 9. Monthly Average Banks Exports and Changes to Monthly Average Banks Exports, WSIP Baseline and MOD1 Adjustments (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,555	4,986	4,879	3,433	4,009	3,345	1,642	1,406	2,317	5,171	4,206	4,671	3,635
MOD 1 Adjustment	3,750	4,981	4,818	3,435	3,970	3,286	1,614	1,364	2,256	5,330	4,505	4,710	3,668
MOD 1 Adjustment minus WSIP Baseline	194	-5	-61	2	-39	-59	-27	-42	-61	159	299	39	33
MOD 1 Adjustment by Sites	229	43	-50	4	-39	-51	-11	-10	-31	179	332	115	59
MOD 1 Adjustment by Harvest	0	-10	0	0	0	0	0	-2	-16	-37	-38	-30	-11
MOD 1 Adjustment by LVE	-35	-37	-10	-2	0	-8	-16	-31	-15	17	5	-46	-15

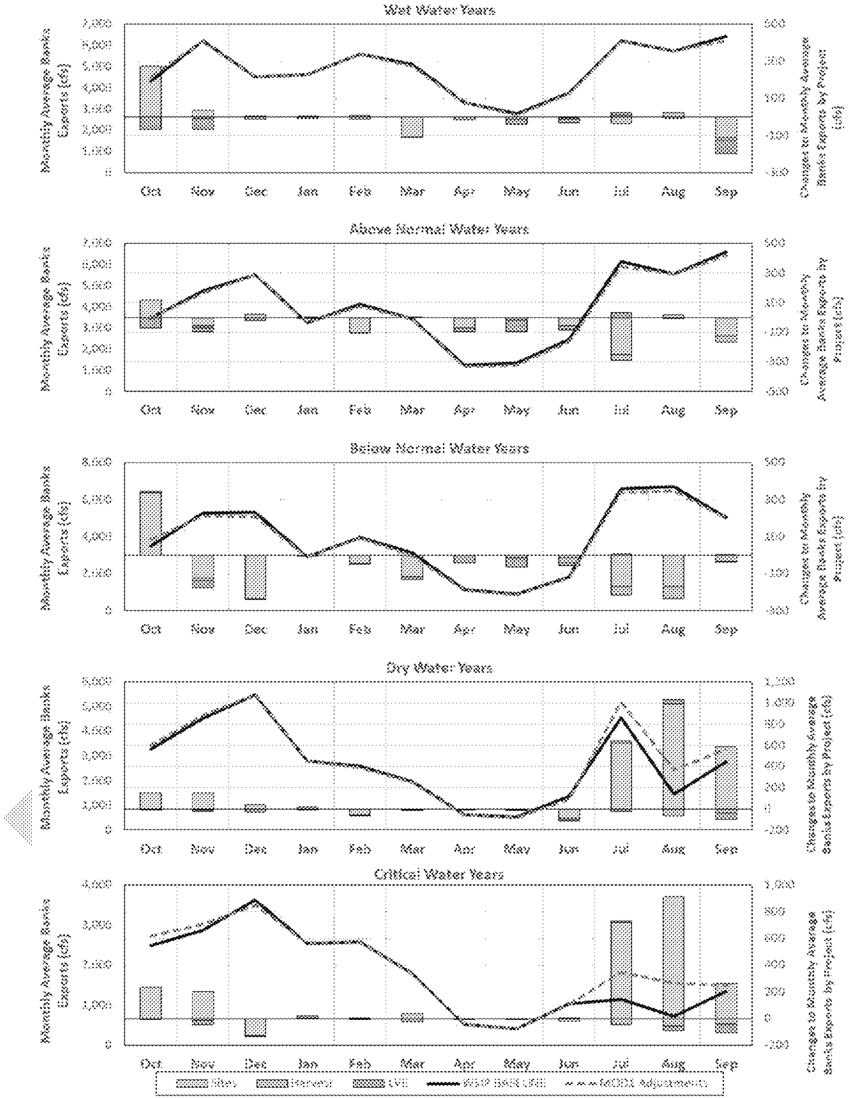


Figure 6. Monthly Average Banks Exports for WSIP Baseline and MOD1 Adjustments, and by Individual Project (in cubic feet per second), by Water Year Type

Table 10. Monthly Average Banks Exports and Changes to Monthly Average Banks Exports, WSIP Baseline and MOD1 Adjustments (in cubic feet per second), Wet Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	4,309	6,239	4,515	4,638	5,609	5,124	3,311	2,773	3,756	6,220	5,740	6,420	4,888
MOD 1 Adjustment	4,517	6,206	4,506	4,630	5,605	5,016	3,294	2,734	3,724	6,212	5,755	6,224	4,869
MOD 1 Adjustment minus WSIP Baseline	208	-33	-9	-8	-4	-107	-17	-39	-33	-8	15	-196	-19
MOD 1 Adjustment by Sites	276	34	-11	1	-13	-107	-1	-12	-5	10	22	-109	7
MOD 1 Adjustment by Harvest	0	-7	0	0	0	0	0	0	-5	-33	-8	-15	-6
MOD 1 Adjustment by LVE	-68	-60	1	-8	9	0	-15	-27	-23	15	0	-72	-21

Table 11. Monthly Average Banks Exports and Changes to Monthly Average Banks Exports, WSIP Baseline and MOD1 Adjustments (in cubic feet per second), Above Normal Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,453	4,744	5,505	3,259	4,123	3,418	1,258	1,335	2,447	6,149	5,554	6,604	3,987
MOD 1 Adjustment	3,496	4,649	5,507	3,258	4,022	3,419	1,161	1,238	2,362	5,891	5,566	6,438	3,917
MOD 1 Adjustment minus WSIP Baseline	44	-95	2	-1	-101	1	-97	-97	-85	-259	12	-166	-70
MOD 1 Adjustment by Sites	116	-59	23	0	-101	1	-73	-19	-56	-251	18	-127	-44
MOD 1 Adjustment by Harvest	0	-12	0	0	0	0	0	0	-22	-40	-6	-39	-10
MOD 1 Adjustment by LVE	-72	-24	-21	-1	0	0	-24	-78	-7	32	0	0	-16

Table 12. Monthly Average Banks Exports and Changes to Monthly Average Banks Exports, WSIP Baseline and MOD1 Adjustments (in cubic feet per second), Below Normal Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,504	5,279	5,322	2,942	3,976	3,114	1,149	922	1,833	6,607	6,717	5,052	3,868
MOD 1 Adjustment	3,847	5,104	5,086	2,935	3,926	2,982	1,110	856	1,776	6,399	6,481	5,017	3,793
MOD 1 Adjustment minus WSIP Baseline	344	-175	-236	-6	-50	-132	-39	-66	-57	-208	-236	-35	-75
MOD 1 Adjustment by Sites	338	-125	-234	0	-43	-115	-1	-13	-13	-170	-169	1	-45
MOD 1 Adjustment by Harvest	0	-12	0	0	0	0	0	-1	-26	-44	-66	-31	-15
MOD 1 Adjustment by LVE	6	-38	-2	-6	-7	-17	-38	-51	-17	7	0	-5	-14

Table 13. Monthly Average Banks Exports and Changes to Monthly Average Banks Exports, WSIP Baseline and MOD1 Adjustments (in cubic feet per second), Dry Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,282	4,523	5,475	2,786	2,597	1,950	614	524	1,377	4,568	1,460	2,777	2,661
MOD 1 Adjustment	3,420	4,647	5,484	2,797	2,532	1,929	611	506	1,259	5,183	2,427	3,269	2,839
MOD 1 Adjustment minus WSIP Baseline	138	124	9	11	-65	-21	-3	-18	-117	616	967	493	178
MOD 1 Adjustment by Sites	149	147	37	16	-61	-11	0	-1	-88	621	989	591	199
MOD 1 Adjustment by Harvest	0	-11	0	0	0	0	0	-7	-14	-26	-67	-40	-14
MOD 1 Adjustment by LVE	-11	-13	-28	-5	-4	-10	-3	-10	-15	20	45	-58	-8

Table 14. Monthly Average Banks Exports and Changes to Monthly Average Banks Exports, WSIP Baseline and MOD1 Adjustments (in cubic feet per second), Critical Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	2,495	2,864	3,633	2,542	2,582	1,781	525	407	1,043	1,146	722	1,348	1,757
MOD 1 Adjustment	2,722	3,017	3,496	2,561	2,583	1,793	521	403	1,023	1,829	1,544	1,504	1,916
MOD 1 Adjustment minus WSIP Baseline	227	153	-137	19	1	12	-3	-4	-20	683	822	156	159
MOD 1 Adjustment by Sites	235	201	-127	1	2	34	0	-4	1	720	914	264	187
MOD 1 Adjustment by Harvest	0	-13	0	0	0	0	0	0	-22	-49	-59	-38	-15
MOD 1 Adjustment by LVE	-8	-35	-10	18	-1	-22	-3	0	0	13	-33	-69	-13

As noted in the assumption discussion, the simulated Article 21 deliveries from the WSIP Baseline are preserved since none of the projects' impacts to Delta surplus that would require cuts to Banks exports are implemented in the model or tracked cumulatively.

Delta surplus reductions made in the Sites and LVE Alternative CalSim II models relative to their project baseline did not always occur when Delta surplus was available in the WSIP Baseline. In this case, the assumed Delta surplus reduction from each project was tracked as 'infeasible', i.e., a reduction in their project yield in this analysis relative to the project analysis, and these values were tracked separately but not implemented cumulatively in the model. This assumption ensured Banks exports were not negatively affected by LVE and Sites operations. However, export reductions due to Harvest operations were implemented cumulatively in the model to remain consistent with the Harvest wastewater change petition approved by the State Water Resources Control Board, and for simplicity these reductions were applied only to Banks. As shown in Table 15, throughout the 82-year simulation period, approximately 20,425 TAF (249 TAF per year) in Sites reductions to Delta surplus occurred when surplus was available, while 846 TAF (10 TAF per year) occurred when there was no Delta surplus (i.e., Sites reduced Delta inflow and the Delta was in a balanced condition). For purposes of this analysis, Sites yield is reduced by 4% due to differences with the WSIP Baseline. For LVE, 5,914 TAF (72 TAF per year) in LVE reductions to Delta surplus occurred when surplus was available, while 662 TAF (7.6 TAF per year) occurred when there was no Delta surplus (i.e., LVE reduced Delta surplus and the Delta was in a balanced condition). For purposes of this analysis, LVE yield is reduced by 10% due to differences with the WSIP Baseline.

Table 15. Monthly average Delta condition and feasibility of Delta surplus reductions

	WSIP Baseline	**Delta surplus available and cumulatively reduced by project**		**Delta surplus not available to be reduced[1]**	
		Sites Adjustments			
Type of Delta Control	**# of months**	**# of months**	**Total Volume (AF)**	**# of months**	**Total Volume (AF)**
EI ratio cap export control	59	0	0	8	179,932
OMR control	273	171	13,455,687	14	130,776
D-1641 Outflow control	259	0	0	42	392,828
D-1641 Salinity control	111	0	0	20	136,695
D-1641 April-May export cap control	11	7	1,093,762	0	0
SWP ITP control	109	39	280,994	1	3,222
Surplus	162	68	5,594,867	2	3,373
TOTAL	**984**	**285**	**20,425,310**	**87**	**846,826**
		LVE Adjustments			
Type of Delta Control	**# of months**	**# of months**	**Total Volume (AF)**	**# of months**	**Total Volume (AF)**
EI ratio cap export control	59	0	0	26	219,316
OMR control	273	208	3,720,157	3	37,249
D-1641 Outflow control	259	0	0	26	147,803
D-1641 Salinity control	111	0	0	39	210,700
D-1641 April-May export cap control	11	6	21,723	0	0
SWP ITP control	148	45	204,201	1	664
Surplus	123	86	1,968,165	2	6,939
TOTAL	**984**	**345**	**5,914,246**	**97**	**622,672**

[1] For this analysis, Delta surplus not available to be reduced reflects a balanced Delta condition in the WSIP Baseline. The Sites or LVE reduction in Delta surplus during these conditions is considered an 'infeasible' operation that would have required cuts to Banks exports to implement. This column thus reflects a reduction to the project yield due to conflicts with the WSIP Baseline – these surplus reductions were not implemented in the model.

3.1.3 Delta Inflow from Sacramento River

The long-term monthly average cumulative effects of the three surface water diversion projects on Delta Inflow from Sacramento River is shown in Figure 7 and Table 16. Mean annual reductions in Delta Inflow from Sacramento River throughout the simulation period are 46 TAF, or 0.3% of the total 15,478 TAF of mean annual Delta Inflow from Sacramento River. The long-term monthly average cumulative effects of the three surface water diversion WSIP projects on Delta Inflow from the Sacramento River by water year type are shown in Figure 8 and in Tables 17 through 21.

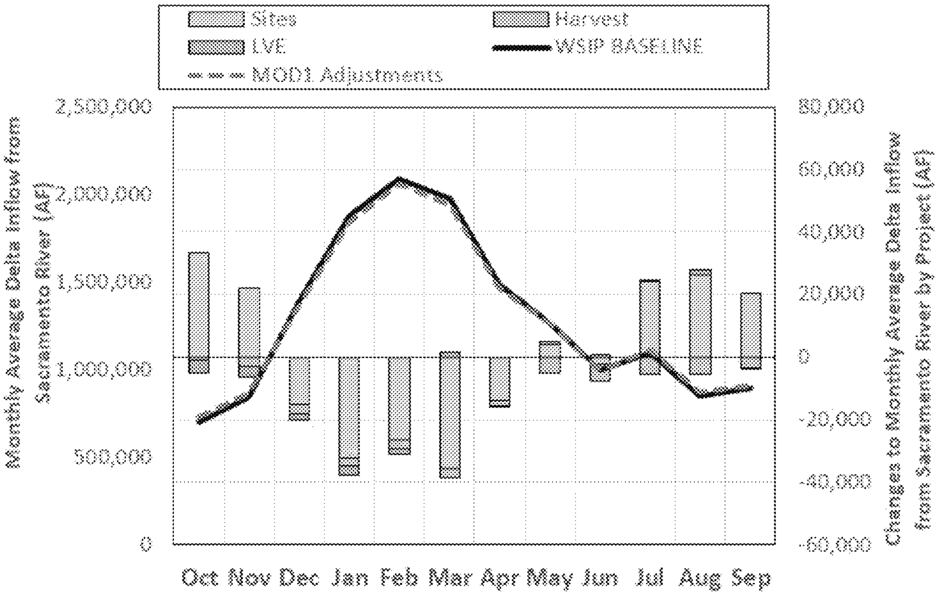


Figure 7. Monthly Average Delta Inflow from Sacramento River for WSIP Baseline and MOD1 Adjustments and Changes to Monthly Average Delta Inflow from Sacramento River by Project (in acre-feet)

Table 16. Monthly Average Delta Inflow from Sacramento River and Changes to Monthly Average Delta Inflow from Sacramento River, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	699	846	1,397	1,880	2,089	1,975	1,482	1,266	1,002	1,094	851	896	15,478
MOD 1 Adjustment	728	861	1,377	1,842	2,058	1,938	1,466	1,266	996	1,113	874	913	15,432
MOD 1 Adjustment minus WSIP Baseline	28	16	-20	-38	-31	-37	-15	0	-7	19	23	16	-46
MOD 1 Adjustment by Sites	33	22	-15	-32	-26	-36	-14	4	-2	24	26	20	5
MOD 1 Adjustment by Harvest	-1	-3	-3	-3	-3	-3	-2	-5	-5	-5	-5	-3	-41
MOD 1 Adjustment by LVE	-4	-4	-2	-3	-2	2	0	1	1	0	2	-1	-9

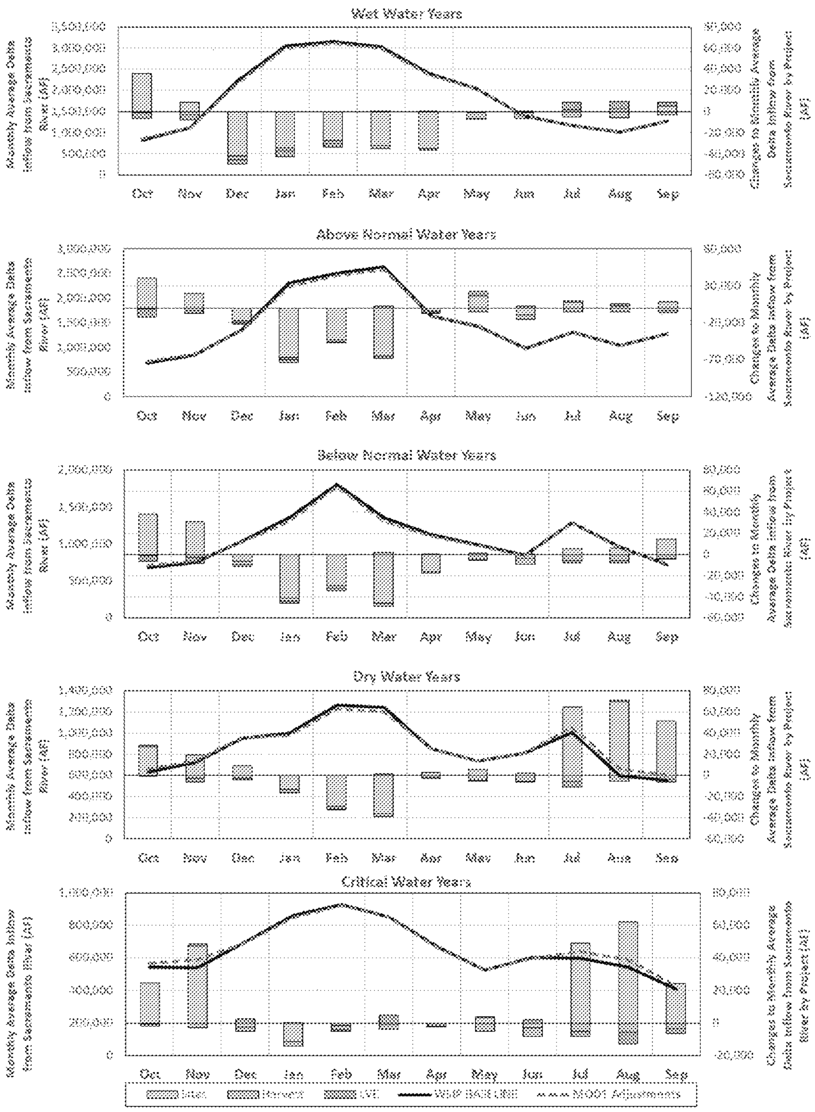


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Figure 8. Monthly Average Delta Inflow from Sacramento River for WSIP Baseline and MOD1 Adjustments, and by Project (in acre-feet), by Water Year Type

Table 17. Monthly Average Delta Inflow from Sacramento River and Changes to Monthly Average Delta Inflow from Sacramento River, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Wet Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	836	1,117	2,238	3,045	3,153	3,028	2,405	2,047	1,409	1,179	1,021	1,274	22,751
MOD 1 Adjustment	865	1,119	2,189	3,002	3,120	2,993	2,369	2,040	1,403	1,182	1,025	1,279	22,586
MOD 1 Adjustment minus WSIP Baseline	29	1	-49	-43	-33	-35	-36	-6	-6	3	4	6	-164
MOD 1 Adjustment by Sites	36	9	-42	-34	-27	-32	-35	-1	-1	2	2	5	-118
MOD 1 Adjustment by Harvest	-1	-3	-3	-3	-3	-3	-2	-5	-5	-5	-5	-3	-41
MOD 1 Adjustment by LVE	-6	-5	-4	-6	-3	0	0	0	1	6	7	4	-6

Table 18. Monthly Average Delta Inflow from Sacramento River and Changes to Monthly Average Delta Inflow from Sacramento River, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Above Normal Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	687	856	1,357	2,311	2,508	2,643	1,639	1,432	981	1,311	1,047	1,274	18,046
MOD 1 Adjustment	716	868	1,335	2,237	2,461	2,578	1,633	1,449	969	1,316	1,047	1,277	17,887
MOD 1 Adjustment minus WSIP Baseline	29	12	-22	-74	-47	-65	-6	18	-12	5	0	2	-159
MOD 1 Adjustment by Sites	41	19	-17	-67	-43	-65	-4	17	-10	8	3	8	-110
MOD 1 Adjustment by Harvest	-1	-3	-3	-3	-3	-3	-2	-5	-5	-5	-5	-3	-41
MOD 1 Adjustment by LVE	-11	-4	-2	-4	-2	3	0	6	3	2	3	-3	-8

Table 19. Monthly Average Delta Inflow from Sacramento River and Changes to Monthly Average Delta Inflow from Sacramento River, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Below Normal Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	680	753	1,037	1,358	1,810	1,353	1,130	988	847	1,290	957	725	12,928
MOD 1 Adjustment	712	775	1,026	1,311	1,776	1,306	1,113	985	839	1,287	955	735	12,822
MOD 1 Adjustment minus WSIP Baseline	32	22	-11	-46	-34	-47	-16	-4	-8	-3	-2	10	-106
MOD 1 Adjustment by Sites	38	31	-6	-41	-30	-46	-16	1	-4	5	6	15	-46
MOD 1 Adjustment by Harvest	-1	-3	-3	-3	-3	-3	-2	-5	-5	-5	-5	-3	-41
MOD 1 Adjustment by LVE	-5	-6	-2	-3	-2	2	1	0	1	-2	-2	-1	-20

Table 20. Monthly Average Delta Inflow from Sacramento River and Changes to Monthly Average Delta Inflow from Sacramento River, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Dry Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	629	721	955	998	1,264	1,243	858	738	815	1,005	597	558	10,380
MOD 1 Adjustment	657	734	959	982	1,231	1,205	858	738	812	1,059	663	604	10,501
MOD 1 Adjustment minus WSIP Baseline	28	13	5	-16	-32	-38	0	0	-4	54	66	45	121
MOD 1 Adjustment by Sites	27	19	9	-13	-29	-36	3	5	2	64	70	52	173
MOD 1 Adjustment by Harvest	-1	-3	-3	-3	-3	-3	-2	-5	-5	-5	-5	-3	-41
MOD 1 Adjustment by LVE	2	-3	-2	0	0	1	-1	0	-1	-5	2	-3	-11

Table 21. Monthly Average Delta Inflow from Sacramento River and Changes to Monthly Average Delta Inflow from Sacramento River, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Critical Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	544	542	696	859	927	851	670	528	605	598	542	409	7,770
MOD 1 Adjustment	567	588	693	846	922	852	668	526	599	639	591	427	7,917
MOD 1 Adjustment minus WSIP Baseline	23	46	-3	-14	-5	1	-2	-1	-6	41	49	18	146
MOD 1 Adjustment by Sites	25	47	-2	-11	-2	-1	0	3	-3	49	62	24	191
MOD 1 Adjustment by Harvest	-1	-3	-3	-3	-3	-3	-2	-5	-5	-5	-5	-3	-41
MOD 1 Adjustment by LVE	-1	2	2	0	-1	5	0	1	2	-3	-8	-3	-4

3.1.4 Delta Inflow from Yolo Bypass

The Sites project provides environmental flows into the Yolo Bypass as part of its provision of public benefits. These are shown below as summer increases in flow in the Yolo Bypass. Sites also diverts water to storage in excess conditions that can reduce spills from the Sacramento River into the Yolo Bypass. That is shown as a decrease in Delta inflow from Yolo Bypass below. The long-term monthly average cumulative effects of the three surface water diversion projects on Delta Inflow from Yolo Bypass is shown in Figure 9 and Table 22. Mean annual reductions in Delta Inflow from Yolo Bypass throughout the simulation period are 55 TAF, or 2.3% of the total 2,428 TAF of mean annual Delta Inflow from Yolo Bypass. The long-term monthly average cumulative effects of the three surface water diversion WSIP projects on Delta Inflow from the Yolo Bypass by water year type are shown in Figure 10 and in Tables 23 through 27.

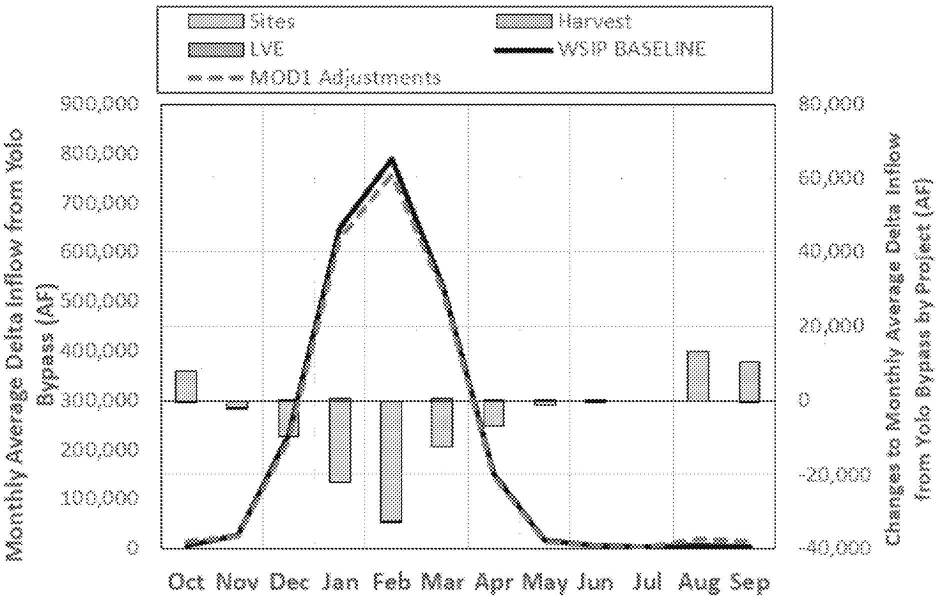


Figure 9. Monthly Average Delta Inflow from Yolo Bypass for WSIP Baseline and MOD1 Adjustments, by Project (in acre-feet)

Table 22. Monthly Average Delta Inflow from Yolo Bypass and Changes to Monthly Average Delta Inflow from Yolo Bypass, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	7	28	231	649	790	534	152	17	7	3	6	4	2,428
MOD 1 Adjustment	15	26	221	627	758	521	145	15	7	3	19	15	2,373
MOD 1 Adjustment minus WSIP Baseline	8	-2	-10	-22	-33	-12	-7	-1	0	0	13	10	-55
MOD 1 Adjustment by Sites	8	-2	-10	-22	-33	-13	-7	-1	0	0	13	10	-56
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	0	0	0	0	0	0	0	0	0	0	0	0	1

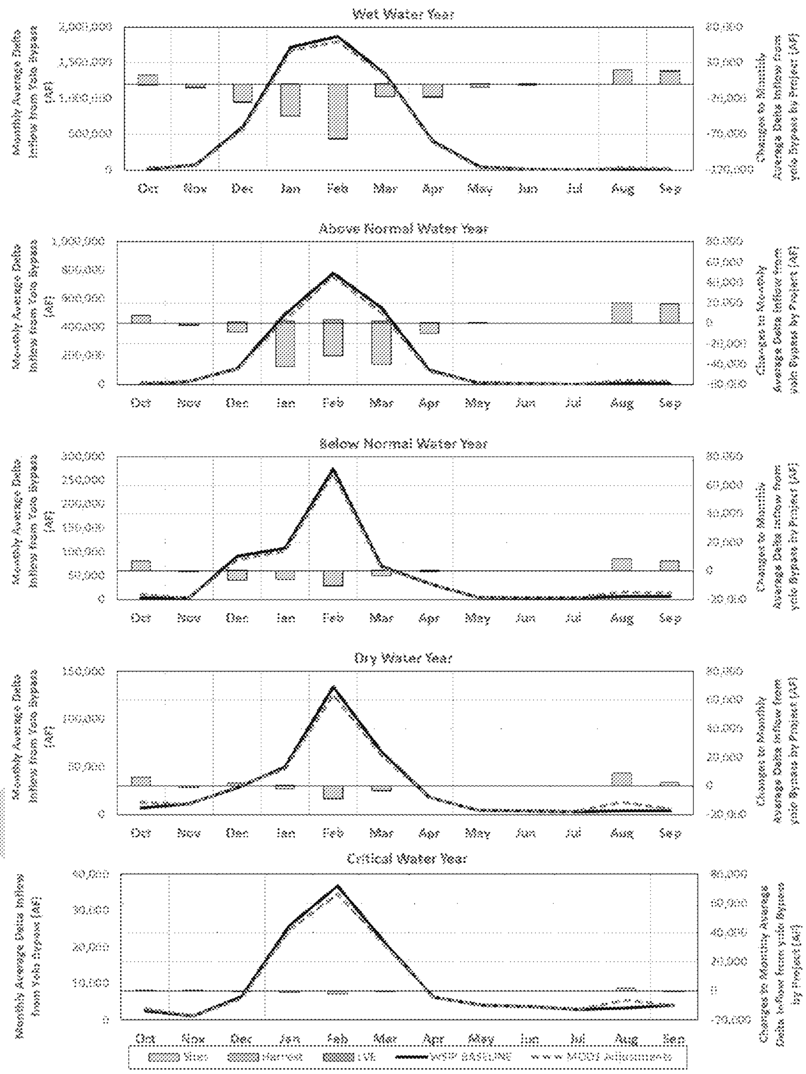


Figure 10. Monthly Average Delta Inflow from Yolo Bypass for WSIP Baseline and MOD1 Adjustments, and by Individual Project (in acre-feet), by Water Year Type

Table 23. Monthly Average Delta Inflow from Yolo Bypass and Changes to Monthly Average Delta Inflow from Yolo Bypass, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Wet Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	15	68	604	1,714	1,873	1,341	400	39	14	3	9	4	6,084
MOD 1 Adjustment	27	64	579	1,669	1,796	1,324	383	35	14	3	29	23	5,946
MOD 1 Adjustment minus WSIP Baseline	13	-4	-24	-44	-77	-17	-17	-4	0	0	20	18	-137
MOD 1 Adjustment by Sites	13	-4	-24	-45	-75	-17	-17	-4	0	0	20	18	-136
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	0	0	0	0	-2	0	0	0	0	0	0	0	-2

Table 24. Monthly Average Delta Inflow from Yolo Bypass and Changes to Monthly Average Delta Inflow from Yolo Bypass, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Above Normal Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	2	20	114	493	782	539	101	12	4	3	6	4	2,081
MOD 1 Adjustment	10	19	107	453	753	501	91	12	4	3	26	23	2,002
MOD 1 Adjustment minus WSIP Baseline	8	-2	-7	-40	-29	-38	-10	0	0	0	20	19	-79
MOD 1 Adjustment by Sites	8	-2	-8	-43	-32	-40	-10	0	0	0	20	19	-88
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	0	0	1	2	3	2	0	0	0	0	0	0	9

Table 25. Monthly Average Delta Inflow from Yolo Bypass and Changes to Monthly Average Delta Inflow from Yolo Bypass, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Below Normal Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	3	3	91	108	276	71	33	4	4	3	7	6	608
MOD 1 Adjustment	10	3	84	101	265	67	33	4	4	3	16	13	604
MOD 1 Adjustment minus WSIP Baseline	7	0	-7	-6	-10	-3	0	0	0	0	9	7	-4
MOD 1 Adjustment by Sites	7	0	-7	-6	-10	-3	0	0	0	0	9	7	-4
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 26. Monthly Average Delta Inflow from Yolo Bypass and Changes to Monthly Average Delta Inflow from Yolo Bypass, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Dry Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	7	11	28	50	134	66	18	5	4	3	4	4	334
MOD 1 Adjustment	13	11	30	48	126	62	18	5	4	3	13	7	339
MOD 1 Adjustment minus WSIP Baseline	6	-1	2	-2	-9	-3	0	0	0	0	9	3	5
MOD 1 Adjustment by Sites	6	-1	2	-2	-9	-3	0	0	0	0	9	3	5
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 27. Monthly Average Delta Inflow from Yolo Bypass and Changes to Monthly Average Delta Inflow from Yolo Bypass, WSIP Baseline and MOD1 Adjustments (in thousand acre-feet), Critical Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	3	1	7	26	37	21	6	4	4	3	3	4	119
MOD 1 Adjustment	3	1	6	25	35	20	6	4	4	3	6	4	117
MOD 1 Adjustment minus WSIP Baseline	1	0	-1	-1	-2	-1	0	0	0	0	2	0	-2
MOD 1 Adjustment by Sites	1	0	-1	-1	-2	-1	0	0	0	0	2	0	-2
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	0	0	0	0	0	0	0	0	0	0	0	0	0

3.1.5 Feather River Flow

The Sites operations includes an exchange with the SWP at Oroville for delivery management. In June of drier years, Sites releases additional water from storge to meet part of the outflow requirements of the SWP/CVP. In August and later, Oroville releases are commensurately increased and exported during the transfer window. The long-term monthly average cumulative effects of the three surface water diversion on Feather River flow (CalSim II node C203, flow below Thermalito) are shown in Figure 11 and Table 28. Mean annual decrease in Feather River flow throughout the simulation period are less than 1 cfs, or less than 0.1% of the 3,984 cfs of mean annual Feather River flow. The long-term monthly average cumulative effects of the three surface water diversion WSIP projects on Feather River flow (C203) by water year type are shown in Figure 12 and in Tables 29 through 33.

Commented [HE1]: Note this would likely occur outside of just June

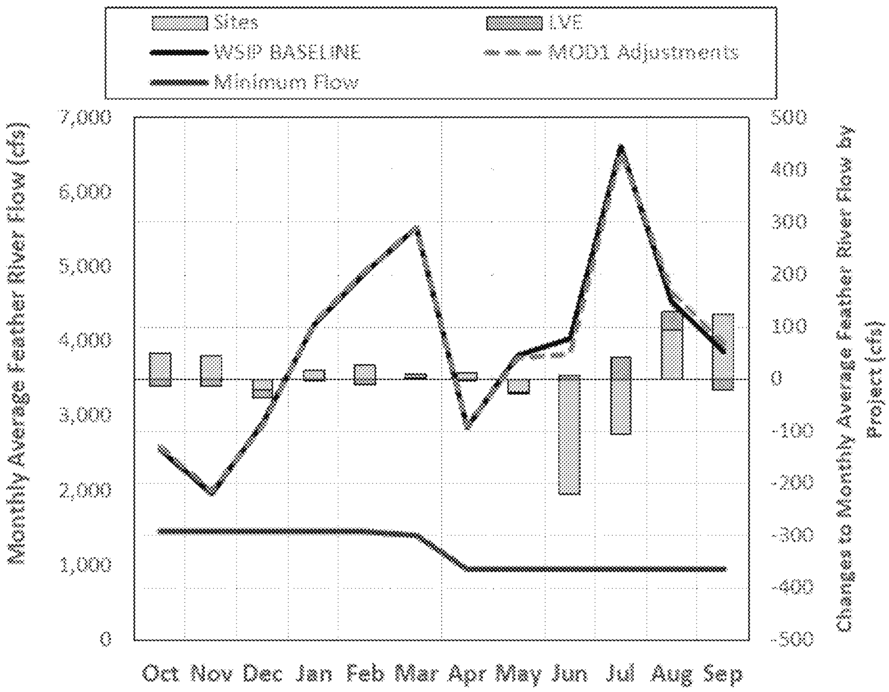


Figure 11. Monthly Average Feather River Flow (C203) for WSIP Baseline and MOD1 Adjustments and Changes to Monthly Average Feather River Flow by Project (in acre-feet)

Table 28. Monthly Average Feather River Flow (C203), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in cfs)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	May	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	2,549	1,961	2,907	4,219	4,915	5,521	2,858	3,810	4,043	6,613	4,537	3,875	3,984
MOD 1 Adjustment	2,584	1,992	2,870	4,230	4,930	5,530	2,867	3,784	3,826	6,550	4,665	3,977	3,984
MOD 1 Adjustment minus WSIP Baseline	35	31	-37	11	15	9	9	-26	-217	-63	128	101	0
MOD 1 Adjustment by Sites	49	45	-22	16	26	1	11	-25	-222	-105	95	123	-1
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	-14	-13	-15	-4	-12	8	-2	0	5	42	33	-22	0
Minimum Flow Requirement	1,461	1,461	1,461	1,461	1,461	1,401	945	945	945	945	945	945	1,198

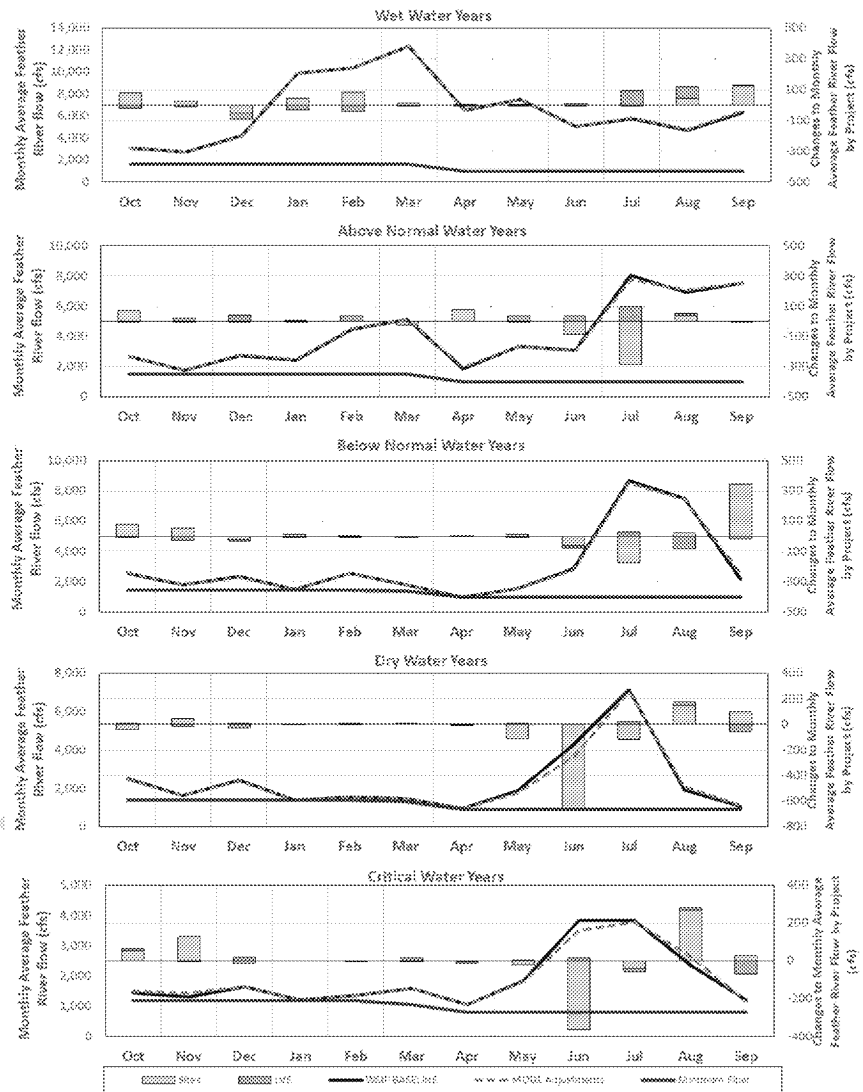


Figure 12. Monthly Average Feather River Flow (C203) for WSIP Baseline and MOD1 Adjustments, and by Individual Project, by Water Year Type (in cubic feet per second)

Table 29. Monthly Average Feather River Flow (C203), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Wet Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,042	2,693	4,195	9,862	10,347	12,325	6,486	7,521	5,052	5,752	4,661	6,297	6,519
MOD 1 Adjustment	3,100	2,700	4,103	9,870	10,385	12,341	6,489	7,523	5,058	5,843	4,781	6,426	6,552
MOD 1 Adjustment minus WSIP Baseline	59	8	-92	9	39	15	3	1	6	91	120	128	32
MOD 1 Adjustment by Sites	80	22	-54	43	83	15	3	3	-3	-3	42	124	30
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	-21	-14	-38	-34	-44	0	0	-1	9	94	78	5	3
Minimum Flow Requirement	1,612	1,612	1,612	1,612	1,612	1,583	1,000	1,000	1,000	1,000	1,000	1,000	1,303

Table 30. Monthly Average Feather River Flow (C203), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Above Normal Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	2,682	1,746	2,742	2,444	4,489	5,126	1,871	3,335	3,062	8,034	6,947	7,540	4,168
MOD 1 Adjustment	2,694	1,745	2,756	2,487	4,500	5,132	1,950	3,334	3,012	7,783	7,082	7,549	4,169
MOD 1 Adjustment minus WSIP Baseline	12	-1	14	44	11	6	79	-1	-49	-251	135	9	1
MOD 1 Adjustment by Sites	70	0	-4	0	3	-27	79	-1	-87	-286	36	-6	-19
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	-57	-1	19	44	8	33	0	0	38	35	99	14	19
Minimum Flow Requirement	1,525	1,525	1,525	1,525	1,525	1,483	1,000	1,000	1,000	1,000	1,000	1,000	1,259

Table 31. Monthly Average Feather River Flow (C203), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Below Normal Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	2,543	1,778	2,347	1,480	2,579	1,798	982	1,520	2,853	8,674	7,494	2,168	3,018
MOD 1 Adjustment	2,615	1,805	2,313	1,492	2,579	1,798	982	1,531	2,775	8,529	7,435	2,495	3,029
MOD 1 Adjustment minus WSIP Baseline	72	27	-34	12	0	0	0	10	-78	-146	-59	327	11
MOD 1 Adjustment by Sites	81	53	-23	12	0	0	0	11	-62	-176	25	344	22
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	-9	-26	-11	0	0	0	0	-1	-16	30	-85	-17	-11
Minimum Flow Requirement	1,457	1,457	1,457	1,457	1,457	1,396	982	982	982	982	982	982	1,215

Table 32. Monthly Average Feather River Flow (C203), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Dry Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	2,500	1,617	2,431	1,397	1,534	1,479	938	1,855	4,297	7,148	1,904	1,047	2,346
MOD 1 Adjustment	2,466	1,645	2,411	1,397	1,537	1,486	930	1,743	3,625	7,049	2,082	1,090	2,288
MOD 1 Adjustment minus WSIP Baseline	-34	28	-20	0	3	7	-8	-113	-672	-100	178	43	-57
MOD 1 Adjustment by Sites	-37	45	11	0	-1	5	-6	-113	-659	-119	149	99	-52
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	2	-17	-31	0	4	2	-2	0	-13	19	29	-56	-5
Minimum Flow Requirement	1,394	1,394	1,394	1,394	1,394	1,319	903	903	903	903	903	903	1,142

Table 33. Monthly Average Feather River Flow (C203), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Critical Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	1,429	1,317	1,648	1,196	1,370	1,581	1,056	1,846	3,846	3,847	2,360	1,197	1,891
MOD 1 Adjustment	1,496	1,442	1,652	1,196	1,370	1,591	1,044	1,824	3,500	3,790	2,641	1,156	1,892
MOD 1 Adjustment minus WSIP Baseline	67	125	3	0	0	10	-12	-22	-346	-57	281	-41	1
MOD 1 Adjustment by Sites	53	129	-15	0	0	-6	-3	-22	-363	-43	268	29	2
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	14	-5	18	0	0	16	-9	0	17	-15	13	-70	-2
Minimum Flow Requirement	1,175	1,175	1,175	1,175	1,175	1,050	792	792	792	792	792	792	973

The long-term monthly average cumulative effects of the three surface water diversion projects on Feather River flow (CalSim II node C223, flow at the junction with the Sacramento River) is shown in Figure 13 and Table 34. Mean annual decrease in Feather River flow throughout the simulation period are 1 cfs, or less than 0.1% of the total 7,418 cfs of mean annual Feather River flow. The long-term monthly average cumulative effects of the three surface water diversion WSIP projects on Feather River flow (C223) by water year type are shown in Figure 14 and in Tables 35 through 39.

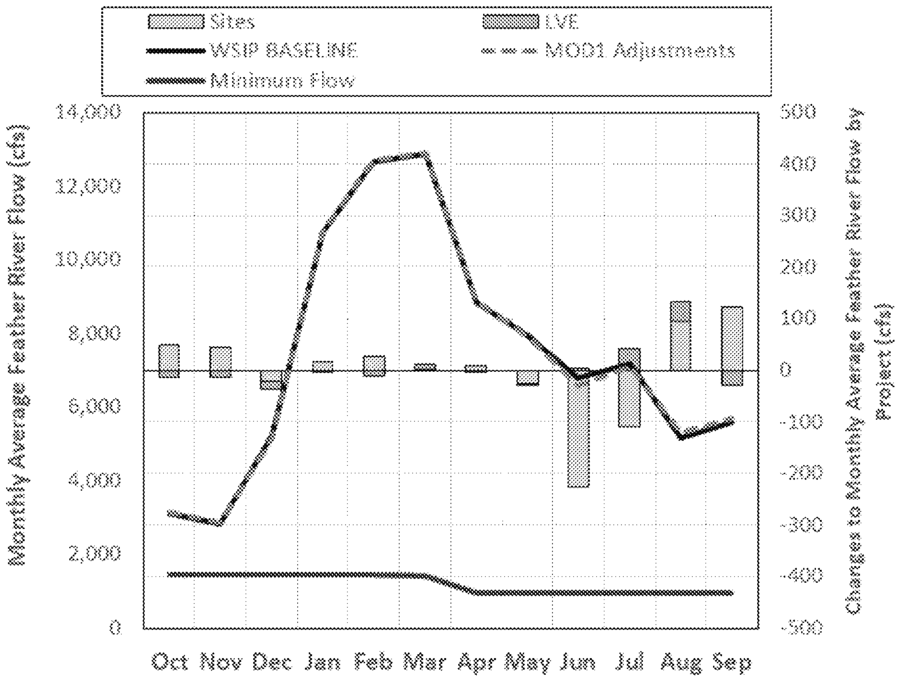


Figure 13. Monthly Average Feather River Flow (C223) for WSIP Baseline and MOD1 Adjustments and Changes to Monthly Average Feather River Flow by Project (in acre-feet)

Table 34. Monthly Average Feather River Flow (C223), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline and MOD1 Adjustments (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,101	2,819	5,219	10,767	12,671	12,886	8,852	7,956	6,798	7,180	5,178	5,592	7,418
MOD 1 Adjustment	3,135	2,850	5,182	10,781	12,688	12,897	8,861	7,929	6,577	7,112	5,311	5,688	7,417
MOD 1 Adjustment minus WSIP Baseline	34	31	-37	13	17	12	9	-27	-222	-68	133	95	-1
MOD 1 Adjustment by Sites	48	45	-21	17	28	3	10	-27	-227	-109	96	123	-1
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	-14	-13	-15	-4	-11	9	-1	0	5	41	37	-28	0
Minimum Flow Requirement	1,461	1,459	1,461	1,461	1,461	1,401	945	945	945	945	945	945	1,198

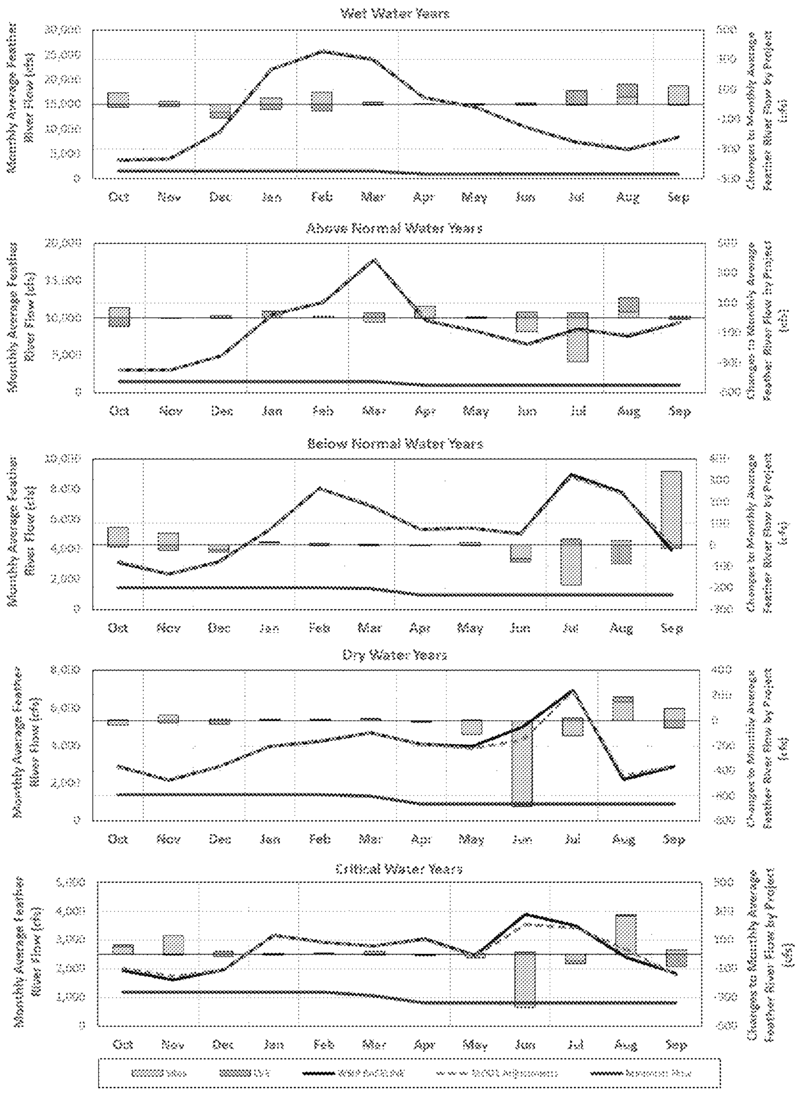


Figure 14. Monthly Average Feather River Flow (C223) for WSIP Baseline and MOD1 Adjustments, and by Individual Project, by Water Year Type (in cubic feet per second)

Table 35. Monthly Average Feather River Flow (C223), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline and MOD1 Adjustments, Wet Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,798	3,993	9,571	22,085	25,734	24,148	16,345	14,467	10,476	7,416	5,988	8,326	12,695
MOD 1 Adjustment	3,856	4,000	9,479	22,095	25,772	24,163	16,346	14,467	10,481	7,506	6,123	8,446	12,728
MOD 1 Adjustment minus WSIP Baseline	59	8	-92	10	39	15	1	0	5	89	135	121	32
MOD 1 Adjustment by Sites	80	22	-54	43	83	15	0	0	-3	-4	46	127	30
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	-21	-14	-38	-34	-44	0	1	0	9	93	89	-6	3
Minimum Flow Requirement	1,612	1,605	1,612	1,612	1,612	1,583	1,000	1,000	1,000	1,000	1,000	1,000	1,303

Table 36. Monthly Average Feather River Flow (C223), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline and MOD1 Adjustments, Above Normal Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,012	3,027	4,943	10,443	12,148	17,846	9,694	8,293	6,462	8,582	7,600	9,418	8,456
MOD 1 Adjustment	3,024	3,026	4,957	10,487	12,159	17,853	9,774	8,292	6,413	8,326	7,737	9,424	8,456
MOD 1 Adjustment minus WSIP Baseline	12	-1	14	44	11	7	80	-1	-50	-256	137	7	0
MOD 1 Adjustment by Sites	69	0	-4	0	3	-26	80	-1	-89	-291	39	-6	-19
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	-57	-1	18	43	8	33	0	0	39	35	99	13	19
Minimum Flow Requirement	1,525	1,525	1,525	1,525	1,525	1,483	1,000	1,000	1,000	1,000	1,000	1,000	1,259

Table 37. Monthly Average Feather River Flow (C223), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline and MOD1 Adjustments, Below Normal Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,132	2,350	3,150	5,271	8,049	6,927	5,314	5,400	5,047	8,972	7,797	3,924	5,444
MOD 1 Adjustment	3,203	2,377	3,117	5,286	8,055	6,930	5,314	5,410	4,968	8,815	7,735	4,251	5,455
MOD 1 Adjustment minus WSIP Baseline	72	27	-34	15	6	4	0	10	-80	-157	-63	327	11
MOD 1 Adjustment by Sites	81	53	-22	12	0	0	0	11	-64	-186	22	343	21
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	-9	-26	-11	3	6	4	0	-1	-16	29	-85	-16	-10
Minimum Flow Requirement	1,457	1,457	1,457	1,457	1,457	1,396	982	982	982	982	982	982	1,215

Table 38. Monthly Average Feather River Flow (C223), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline and MOD1 Adjustments, Dry Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	2,899	2,162	2,895	3,977	4,252	4,684	4,099	3,972	5,014	6,969	2,221	2,894	3,837
MOD 1 Adjustment	2,863	2,191	2,875	3,980	4,258	4,693	4,092	3,860	4,329	6,867	2,408	2,933	3,779
MOD 1 Adjustment minus WSIP Baseline	-35	29	-20	2	6	10	-8	-112	-685	-102	186	39	-57
MOD 1 Adjustment by Sites	-38	46	11	2	2	8	-6	-112	-671	-121	149	98	-53
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	3	-17	-30	0	4	2	-2	0	-13	19	37	-59	-5
Minimum Flow Requirement	1,394	1,394	1,394	1,394	1,394	1,319	903	903	903	903	903	903	1,142

Table 39. Monthly Average Feather River Flow (C223), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline and MOD1 Adjustments, Critical Water Years (in cfs)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	1,946	1,597	1,964	3,167	2,911	2,779	3,032	2,467	3,887	3,491	2,378	1,838	2,621
MOD 1 Adjustment	2,011	1,721	1,967	3,173	2,918	2,800	3,020	2,440	3,532	3,425	2,654	1,782	2,620
MOD 1 Adjustment minus WSIP Baseline	65	124	3	5	7	21	-12	-27	-355	-66	275	-56	-1
MOD 1 Adjustment by Sites	52	129	-15	7	5	-1	-3	-27	-372	-45	268	28	2
MOD 1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD 1 Adjustment by LVE	13	-5	18	-1	2	22	-9	1	17	-21	7	-83	-3
Minimum Flow Requirement	1,175	1,175	1,175	1,175	1,175	1,050	792	792	792	792	792	792	973

3.2 GROUNDWATER PROJECT ADJUSTMENTS (MOD2)

Using MOD1 adjusted values, the groundwater projects were used to cumulatively adjust Delta surplus and Banks exports based on their proposed fill operations. A reduction was also made to Banks exports in summer months to compensate for reduced releases from Oroville that resulted in unbalanced Delta conditions (except in limited cases when Delta surplus was available in summer months).

3.2.1 Delta Surplus

The long-term monthly average cumulative effects of the three GW WSIP project Delta surplus decreases, and pulse flow release are shown in Figure 15 and Table 40. Mean annual reductions in Delta surplus throughout the simulation period are 309 TAF, or 3% of the total 10,473 TAF of mean annual Delta surplus. Note that MOD1 and MOD2 lines are almost equal because of the smaller magnitude of the impact of Kern Fan and Willow Springs diversions of surplus flows and the relatively infrequent diversions of surplus flows. The mean annual pulse flow release throughout the simulation period is 18.7 TAF in April. The long-term monthly average cumulative effects of the three GW WSIP projects on Delta surplus and pulse flow release by water year type are shown in Figure 16 and in Tables 41 through 45.

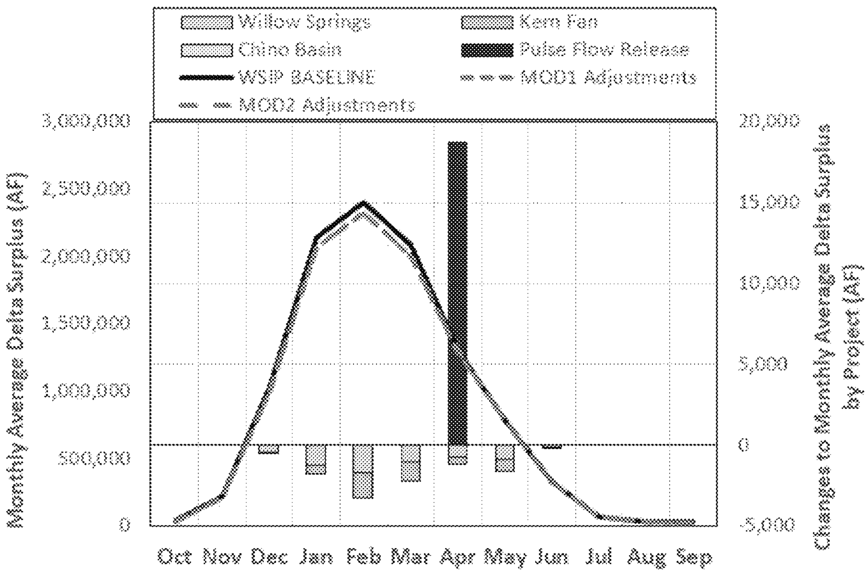


Figure 15. Monthly Average Delta Surplus for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Changes to Monthly Average Delta Surplus by Project, and Pulse Flow Release from Lake Oroville (in acre-feet)

How to interpret Tables that include both MOD1 and MOD2 adjustments: In Table 40 below, the first 6 lines are the same as in Table 3 that only analyze MOD1 projects. The third data line (MOD1 Adjustment minus WSIP Baseline) is the impact of the MOD1 projects that are subtracted from the WSIP Baseline. Similarly, the CALSIM II model calculates impacts from the MOD2 projects shown in data lines 8-11. These impacts are added to the MOD1 Adjustment and gives you the MOD2 Adjustment (data line 7) that represents the total impact of all WSIP projects analyzed at this location. The monthly change from all analyzed projects is shown in the last data line.

Table 40. Monthly Average Delta Surplus, Changes to Monthly Average Delta Surplus and Pulse Flow Release from Lake Oroville for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in thousand acre-feet)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	38	224	1,031	2,140	2,401	2,088	1,307	787	332	64	34	28	10,473
MOD1 Adjustment	36	210	991	2,073	2,322	2,010	1,285	784	326	63	31	25	10,157
MOD1 Adjustment minus WSIP Baseline	-2	-14	-40	-66	-79	-77	-21	-3	-6	-1	-3	-3	-317
MOD1 Adjustment by Sites	-2	-12	-32	-57	-64	-58	-24	-5	-2	0	0	-2	-258
MOD1 Adjustment by Harvest	0	0	0	1	1	2	2	-1	-1	-1	-2	0	1
MOD1 Adjustment by LVE	0	-2	-8	-11	-16	-21	0	3	-3	0	-1	-1	-60
MOD2 Adjustment	36	210	991	2,072	2,318	2,008	1,303	782	326	63	31	25	10,165
MOD2 Adjustment by Willow Springs	0	0	0	-1	-2	-1	-1	-1	0	0	0	0	-6
MOD2 Adjustment by Kern Fan	0	0	0	-1	-2	-1	0	-1	0	0	0	0	-5
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	19	0	0	0	0	0	19
Total Change (MOD2 Adjustment minus WSIP Baseline)	-2	-14	-40	-68	-83	-80	-4	-5	-6	-1	-3	-3	-309

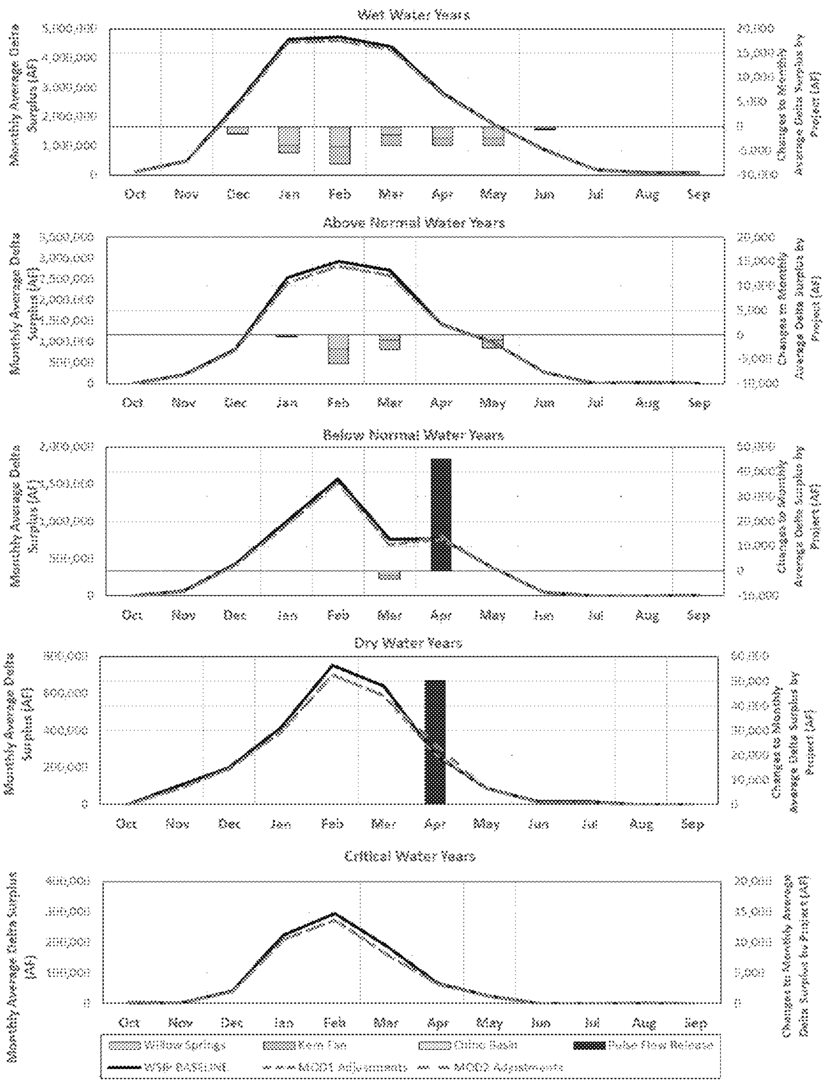


Figure 16. Monthly Average Delta Surplus for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, by MOD2 Project, and Pulse Flow Release from Lake Oroville, by Water Year Type (in acre-feet)

Table 41. Monthly Average Delta Surplus, Changes to Monthly Average Delta Surplus and Pulse Flow Release from Lake Oroville for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in thousand acre-feet), Wet Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	118	498	2,479	4,649	4,719	4,392	2,827	1,751	881	193	87	80	22,676
MOD1 Adjustment	110	477	2,392	4,547	4,593	4,295	2,775	1,736	867	188	77	72	22,130
MOD1 Adjustment minus WSIP Baseline	-8	-21	-88	-102	-127	-97	-51	-16	-14	-5	-10	-8	-546
MOD1 Adjustment by Sites	-6	-16	-72	-85	-104	-69	-54	-15	-2	-1	0	-5	-428
MOD1 Adjustment by Harvest	0	0	0	1	1	2	2	-1	-2	-1	-4	0	-3
MOD1 Adjustment by LVE	-2	-4	-16	-18	-24	-30	0	1	-10	-3	-6	-3	-115
MOD2 Adjustment	110	477	2,390	4,542	4,585	4,291	2,772	1,732	867	188	77	72	22,103
MOD2 Adjustment by Willow Springs	0	0	-1	-4	-4	-2	-2	-2	0	0	0	0	-16
MOD2 Adjustment by Kern Fan	0	0	0	-2	-3	-2	-2	-2	0	0	0	0	-10
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	-8	-21	-89	-108	-135	-101	-55	-19	-14	-5	-10	-8	-572

Table 42. Monthly Average Delta Surplus, Changes to Monthly Average Delta Surplus and Pulse Flow Release from Lake Oroville for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in thousand acre-feet), Above Normal Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	1	223	831	2,531	2,922	2,715	1,433	979	275	0	42	0	11,950
MOD1 Adjustment	1	204	789	2,410	2,814	2,589	1,411	986	270	1	38	0	11,512
MOD1 Adjustment minus WSIP Baseline	0	-19	-43	-121	-108	-126	-22	8	-5	1	-4	0	-438
MOD1 Adjustment by Sites	0	-15	-37	-110	-90	-107	-25	-1	-4	0	0	0	-390
MOD1 Adjustment by Harvest	0	0	0	1	1	2	2	-1	-1	0	-4	0	0
MOD1 Adjustment by LVE	0	-4	-5	-12	-19	-21	1	10	1	1	0	0	-49
MOD2 Adjustment	1	204	789	2,410	2,808	2,586	1,411	984	270	1	38	0	11,500
MOD2 Adjustment by Willow Springs	0	0	0	0	-3	-1	0	-1	0	0	0	0	-5
MOD2 Adjustment by Kern Fan	0	0	0	0	-3	-2	0	-2	0	0	0	0	-7
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	0	-19	-43	-121	-113	-129	-22	5	-5	1	-4	0	-450

Table 43. Monthly Average Delta Surplus, Changes to Monthly Average Delta Surplus and Pulse Flow Release from Lake Oroville for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in thousand acre-feet), Below Normal Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	0	69	430	1,005	1,569	758	770	380	54	0	0	13	5,049
MOD1 Adjustment	0	60	408	949	1,518	686	758	384	52	2	0	12	4,828
MOD1 Adjustment minus WSIP Baseline	0	-9	-22	-56	-51	-72	-12	4	-2	2	0	-1	-220
MOD1 Adjustment by Sites	0	-8	-17	-49	-39	-56	-17	-1	-2	0	0	0	-188
MOD1 Adjustment by Harvest	0	0	0	1	1	2	2	-1	-1	0	0	-1	4
MOD1 Adjustment by LVE	0	-1	-6	-9	-13	-18	2	6	1	2	0	0	-36
MOD2 Adjustment	0	60	408	949	1,518	683	803	384	52	2	0	12	4,870
MOD2 Adjustment by Willow Springs	0	0	0	0	0	-2	0	0	0	0	0	0	-2
MOD2 Adjustment by Kern Fan	0	0	0	0	0	-2	0	0	0	0	0	0	-2
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	45	0	0	0	0	0	45
Total Change (MOD2 Adjustment minus WSIP Baseline)	0	-9	-22	-56	-51	-76	33	4	-2	2	0	-1	-179

Table 44. Monthly Average Delta Surplus, Changes to Monthly Average Delta Surplus and Pulse Flow Release from Lake Oroville for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in thousand acre-feet), Dry Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	0	99	200	413	755	641	271	89	14	15	0	0	2,497
MOD1 Adjustment	0	85	193	393	704	587	273	90	11	13	1	0	2,350
MOD1 Adjustment minus WSIP Baseline	0	-14	-7	-21	-51	-54	3	1	-3	-2	1	0	-148
MOD1 Adjustment by Sites	0	-13	-3	-16	-41	-42	0	0	-1	0	0	0	-117
MOD1 Adjustment by Harvest	0	0	0	1	1	2	2	-1	-1	-2	0	0	3
MOD1 Adjustment by LVE	0	0	-5	-6	-12	-14	1	2	-1	0	1	0	-34
MOD2 Adjustment	0	85	193	393	704	587	324	90	11	13	1	0	2,400
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	50	0	0	0	0	0	50
Total Change (MOD2 Adjustment minus WSIP Baseline)	0	-14	-7	-21	-51	-54	53	1	-3	-2	1	0	-97

Table 45. Monthly Average Delta Surplus, Changes to Monthly Average Delta Surplus and Pulse Flow Release from Lake Oroville for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in thousand acre-feet), Critical Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	3	2	41	225	297	189	67	25	0	0	0	0	850
MOD1 Adjustment	5	2	39	209	274	162	64	25	0	1	3	0	785
MOD1 Adjustment minus WSIP Baseline	1	0	-2	-15	-22	-26	-3	0	0	1	3	0	-64
MOD1 Adjustment by Sites	-2	0	-4	-14	-15	-15	-1	0	0	0	0	0	-50
MOD1 Adjustment by Harvest	0	0	0	1	1	2	2	0	0	0	0	0	6
MOD1 Adjustment by LVE	3	0	2	-3	-9	-13	-4	0	0	1	3	0	-21
MOD2 Adjustment	5	2	39	209	274	162	64	25	0	1	3	0	785
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	1	0	-2	-15	-22	-26	-3	0	0	1	3	0	-64

3.2.2 Banks Exports

The long-term monthly average cumulative effects of the three GW WSIP project export increases and pulse compensation export reductions are shown in Figure 17 and Table 46. Both Willow Springs and Kern Fan result in additional exports in December through May for filling operations. Chino Basin is filled with local treated water, resulting in no changes in Delta exports. The mean monthly increase in Banks exports due to MOD2 projects fill operations is 15 cfs (10.8 TAF). As a result of the pulse flow compensation, Banks exports are reduced in July through September. The total mean annual pulse flow compensation reduction in Banks exports is 18.0 TAF (reductions of 183 cfs, 88 cfs, and 23 cfs in July, August, and September, respectively), which is the same volume as the mean annual delivered pulse flow. The pulse flow compensation reduction from Banks is greater than the total mean annual increase in exports due to GW fill operations. The pulse flow compensation reduction accounts for the entire volume of the pulse flow, provided by Willow Springs, Kern Fan, and Chino Basin, but the increase in exports only go to Willow Springs and Kern Fan (Chino Basin fills with local supply). The mean annual volume of water exported to two GW banks is less than the required flow reduction needed to compensate for a pulse flow provided by three GW banks. The long term monthly average cumulative effects of the three GW projects on Banks exports and pulse flow compensation by water year type are shown in Figure 18 and in Tables 47 through 51.

The net change in exports is negative in March through July, November, and December (Table 46). In summer months, increased exports from Sites implementation were greater than export cuts for the pulse flow compensation, resulting in a net positive increase in Banks exports relative to the WSIP Baseline. Note that as previously mentioned, carriage water saving was not accounted for in the export reductions for pulse flow compensation, and thus the values likely overstate the export reductions that would occur, since a portion of the Delta inflow reductions due to Oroville release reductions would have gone towards carriage water.

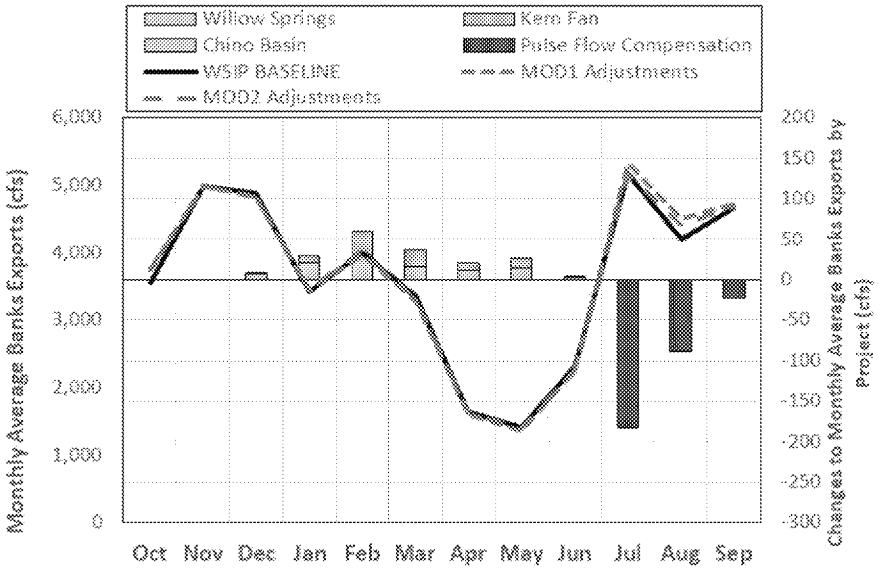


Figure 17. Monthly Average Banks Exports for WSIP Baseline and MOD2 Adjustments, Changes to Monthly Average Banks Exports by Project, and Pulse Flow Compensation (in cubic feet per second)

Table 46. Monthly Average Banks Exports, Changes to Monthly Average Banks Exports and Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,555	4,986	4,879	3,433	4,009	3,345	1,642	1,406	2,317	5,171	4,206	4,671	3,635
MOD1 Adjustment	3,750	4,981	4,818	3,435	3,970	3,286	1,614	1,364	2,256	5,330	4,505	4,710	3,668
MOD1 Adjustment minus WSIP Baseline	194	-5	-61	2	-39	-59	-27	-42	-61	159	299	39	33
MOD1 Adjustment by Sites	229	43	-50	4	-39	-51	-11	-10	-31	179	332	115	59
MOD1 Adjustment by Harvest	0	-10	0	0	0	0	0	-2	-16	-37	-38	-30	-11
MOD1 Adjustment by LVE	-35	-37	-10	-2	0	-8	-16	-31	-15	17	5	-46	-15
MOD2 Adjustment	3,750	4,981	4,826	3,464	4,029	3,323	1,635	1,391	2,258	5,147	4,416	4,687	3,659
MOD2 Adjustment by Willow Springs	0	0	7	20	31	16	12	14	2	0	0	0	9
MOD2 Adjustment by Kern Fan	0	0	0	8	28	20	8	12	0	0	0	0	6
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	-183	-88	-23	-25
Total Change (MOD2 Adjustment minus WSIP Baseline)	194	-5	-54	31	20	-23	-7	-16	-59	-23	210	15	24

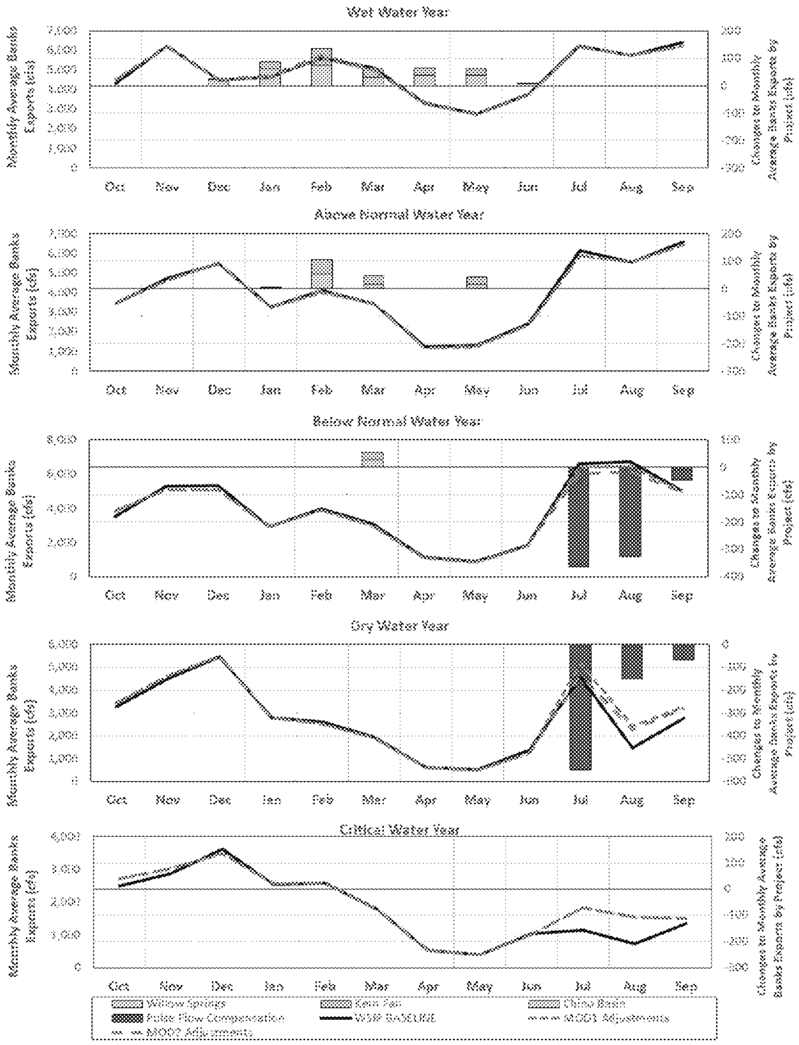


Figure 18. Monthly Average Banks Exports for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Changes to Monthly Average Delta Surplus by Project and Pulse Flow Compensation, by Water Year Type (in cubic feet per second)

Table 47. Monthly Average Banks Exports, Changes to Monthly Average Banks Exports and Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in cubic feet per second), Wet Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	4,309	6,239	4,515	4,638	5,609	5,124	3,311	2,773	3,756	6,220	5,740	6,420	4,888
MOD1 Adjustment	4,517	6,206	4,506	4,630	5,605	5,016	3,294	2,734	3,724	6,212	5,755	6,224	4,869
MOD1 Adjustment minus WSIP Baseline	208	-33	-9	-8	-4	-107	-17	-39	-33	-8	15	-196	-19
MOD1 Adjustment by Sites	276	34	-11	1	-13	-107	-1	-12	-5	10	22	-109	7
MOD1 Adjustment by Harvest	0	-7	0	0	0	0	0	0	-5	-33	-8	-15	-6
MOD1 Adjustment by LVE	-68	-60	1	-8	9	0	-15	-27	-23	15	0	-72	-21
MOD2 Adjustment	4,517	6,206	4,529	4,718	5,742	5,080	3,359	2,797	3,731	6,212	5,755	6,224	4,906
MOD2 Adjustment by Willow Springs	0	0	23	63	74	29	39	38	8	0	0	0	23
MOD2 Adjustment by Kern Fan	0	0	0	25	63	34	26	25	0	0	0	0	14
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	208	-33	13	80	133	-44	48	24	-25	-8	15	-196	18

Table 48. Monthly Average Banks Exports, Changes to Monthly Average Banks Exports and Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in cubic feet per second), Above Normal Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,453	4,744	5,505	3,259	4,123	3,418	1,258	1,335	2,447	6,149	5,554	6,604	3,987
MOD1 Adjustment	3,496	4,649	5,507	3,258	4,022	3,419	1,161	1,238	2,362	5,891	5,566	6,438	3,917
MOD1 Adjustment minus WSIP Baseline	44	-95	2	-1	-101	1	-97	-97	-85	-259	12	-166	-70
MOD1 Adjustment by Sites	116	-59	23	0	-101	1	-73	-19	-56	-251	18	-127	-44
MOD1 Adjustment by Harvest	0	-12	0	0	0	0	0	0	-22	-40	-6	-39	-10
MOD1 Adjustment by LVE	-72	-24	-21	-1	0	0	-24	-78	-7	32	0	0	-16
MOD2 Adjustment	3,496	4,649	5,507	3,265	4,128	3,468	1,161	1,281	2,362	5,891	5,566	6,438	3,934
MOD2 Adjustment by Willow Springs	0	0	0	3	53	17	0	17	0	0	0	0	7
MOD2 Adjustment by Kern Fan	0	0	0	3	53	32	0	27	0	0	0	0	10
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	44	-95	2	6	4	50	-97	-53	-85	-259	12	-166	-53

Table 49. Monthly Average Banks Exports, Changes to Monthly Average Banks Exports and Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in cubic feet per second), Below Normal Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,504	5,279	5,322	2,942	3,976	3,114	1,149	922	1,833	6,607	6,717	5,052	3,868
MOD1 Adjustment	3,847	5,104	5,086	2,935	3,926	2,982	1,110	856	1,776	6,399	6,481	5,017	3,793
MOD1 Adjustment minus WSIP Baseline	344	-175	-236	-6	-50	-132	-39	-66	-57	-208	-236	-35	-75
MOD1 Adjustment by Sites	338	-125	-234	0	-43	-115	-1	-13	-13	-170	-169	1	-45
MOD1 Adjustment by Harvest	0	-12	0	0	0	0	0	-1	-26	-44	-66	-31	-15
MOD1 Adjustment by LVE	6	-38	-2	-6	-7	-17	-38	-51	-17	7	0	-5	-14
MOD2 Adjustment	3,847	5,104	5,086	2,935	3,926	3,037	1,110	856	1,776	6,036	6,156	4,970	3,737
MOD2 Adjustment by Willow Springs	0	0	0	0	0	27	0	0	0	0	0	0	2
MOD2 Adjustment by Kern Fan	0	0	0	0	0	28	0	0	0	0	0	0	2
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	-363	-325	-47	-61
Total Change (MOD2 Adjustment minus WSIP Baseline)	344	-175	-236	-6	-50	-77	-39	-66	-57	-571	-561	-82	-131

Table 50. Monthly Average Banks Exports, Changes to Monthly Average Banks Exports and Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in cubic feet per second), Dry Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,282	4,523	5,475	2,786	2,597	1,950	614	524	1,377	4,568	1,460	2,777	2,661
MOD1 Adjustment	3,420	4,647	5,484	2,797	2,532	1,929	611	506	1,259	5,183	2,427	3,269	2,839
MOD1 Adjustment minus WSIP Baseline	138	124	9	11	-65	-21	-3	-18	-117	616	967	493	178
MOD1 Adjustment by Sites	149	147	37	16	-61	-11	0	-1	-88	621	989	591	199
MOD1 Adjustment by Harvest	0	-11	0	0	0	0	0	-7	-14	-26	-67	-40	-14
MOD1 Adjustment by LVE	-11	-13	-28	-5	-4	-10	-3	-10	-15	20	45	-58	-8
MOD2 Adjustment	3,420	4,647	5,484	2,797	2,532	1,929	611	506	1,259	4,634	2,277	3,200	2,775
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	-549	-149	-70	-64
Total Change (MOD2 Adjustment minus WSIP Baseline)	138	124	9	11	-65	-21	-3	-18	-117	66	817	423	114

Table 51. Monthly Average Banks Exports, Changes to Monthly Average Banks Exports and Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in cubic feet per second), Critical Water Year Type

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	2,495	2,864	3,633	2,542	2,582	1,781	525	407	1,043	1,146	722	1,348	1,757
MOD1 Adjustment	2,722	3,017	3,496	2,561	2,583	1,793	521	403	1,023	1,829	1,544	1,504	1,916
MOD1 Adjustment minus WSIP Baseline	227	153	-137	19	1	12	-3	-4	-20	683	822	156	159
MOD1 Adjustment by Sites	235	201	-127	1	2	34	0	-4	1	720	914	264	187
MOD1 Adjustment by Harvest	0	-13	0	0	0	0	0	0	-22	-49	-59	-38	-15
MOD1 Adjustment by LVE	-8	-35	-10	18	-1	-22	-3	0	0	13	-33	-69	-13
MOD2 Adjustment	2,722	3,017	3,496	2,561	2,583	1,793	521	403	1,023	1,829	1,544	1,504	1,916
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	227	153	-137	19	1	12	-3	-4	-20	683	822	156	159

3.2.3 Delta Inflow from Sacramento River

The long-term monthly average cumulative effects of the three GW WSIP projects on Delta Inflow from Sacramento River is shown in Figure 19 and Table 52. Mean annual reductions in Delta Inflow from Sacramento River throughout the simulation period are 45 TAF, or 0.3% of the total 15,478 TAF of mean annual Delta Inflow from Sacramento River. Mean pulse flow release of 18.7 TAF occurs in April and the mean pulse flow compensation of 18.0 TAF occurs from July to September. The long-term monthly average cumulative effects of the three GW projects on Delta Inflow from the Sacramento River by water year type are shown in Figure 20 and in Tables 53 through 57.

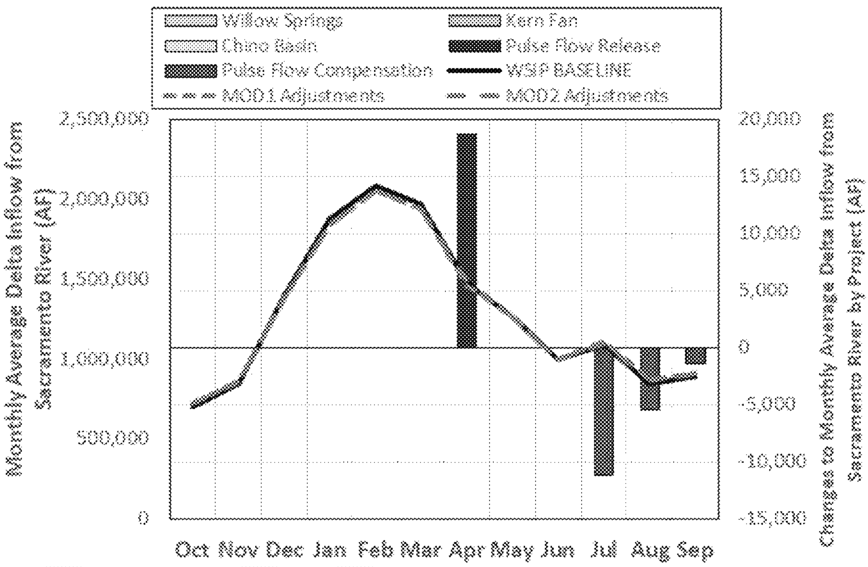


Figure 19. Monthly Average Delta Inflow from Sacramento River for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Changes to Monthly Average Delta Inflow from Sacramento River by Project, Pulse Flow Release from Lake Oroville, and Pulse Flow Compensation (in acre-feet)

Table 52. Monthly Average Delta Inflow from Sacramento River, Changes to Monthly Average Delta Inflow from Sacramento River, Pulse Flow Release from Lake Oroville, and Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in thousand acre-feet)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	699	846	1,397	1,880	2,089	1,975	1,482	1,266	1,002	1,094	851	896	15,478
MOD1 Adjustment	728	861	1,377	1,842	2,058	1,938	1,466	1,266	996	1,113	874	913	15,432
MOD1 Adjustment minus WSIP Baseline	28	16	-20	-38	-31	-37	-15	0	-7	19	23	16	-46
MOD1 Adjustment by Sites	33	22	-15	-32	-26	-36	-14	4	-2	24	26	20	5
MOD1 Adjustment by Harvest	-1	-3	-3	-3	-3	-3	-2	-5	-5	-5	-5	-3	-41
MOD1 Adjustment by LVE	-4	-4	-2	-3	-2	2	0	1	1	0	2	-1	-9
MOD2 Adjustment	728	861	1,377	1,842	2,058	1,938	1,485	1,266	996	1,102	868	912	15,433
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	19	0	0	0	0	0	18.7
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	-11	-5	-1	-18.0
Total Change (MOD2 Adjustment minus WSIP Baseline)	28	16	-20	-38	-31	-37	3	0	-7	8	17	15	-45

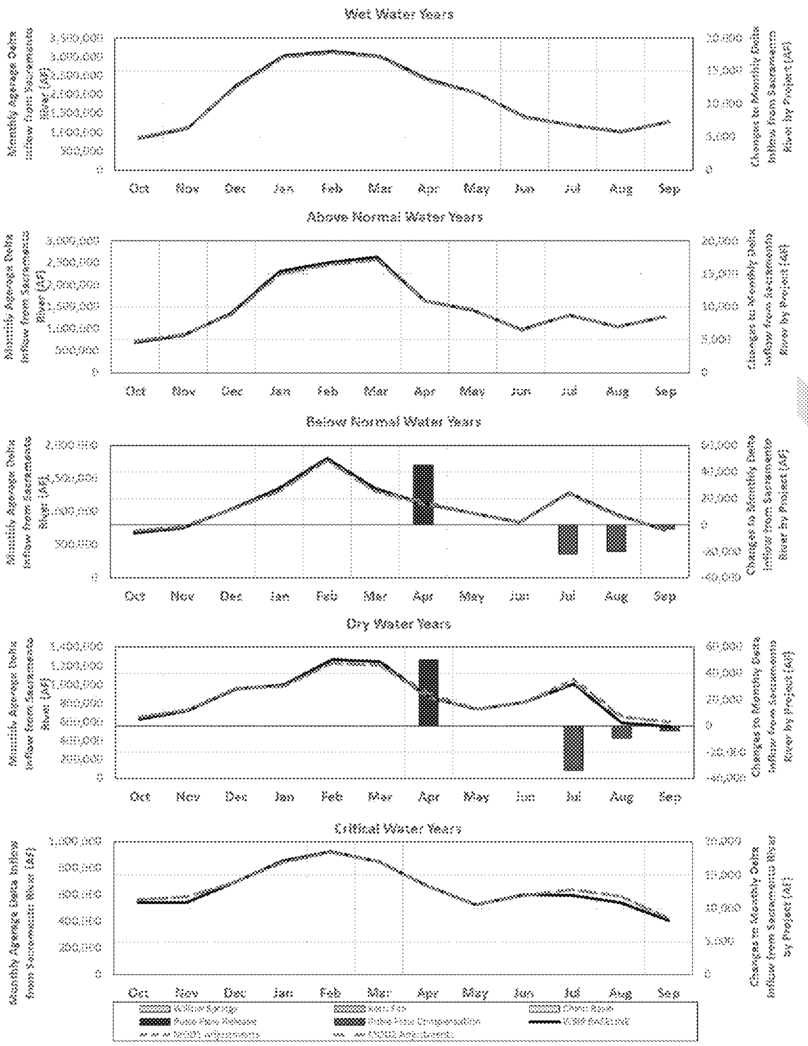


Figure 20. Monthly Average Delta Inflow from Sacramento River for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Changes to Monthly Average Delta Inflow from Sacramento River by Project, Pulse Flow Release from Lake Oroville, and Pulse Flow Compensation, by Water Year Type (in acre-feet)

Table 53. Monthly Average Delta Inflow from Sacramento River, Changes to Monthly Average Delta Inflow from Sacramento River, Pulse Flow Release from Lake Oroville, and Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in thousand acre-feet), Wet Water Years

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	836	1,117	2,238	3,045	3,153	3,028	2,405	2,047	1,409	1,179	1,021	1,274	22,751
MOD1 Adjustment	865	1,119	2,189	3,002	3,120	2,993	2,369	2,040	1,403	1,182	1,025	1,279	22,586
MOD1 Adjustment minus WSIP Baseline	29	1	-49	-43	-33	-35	-36	-6	-6	3	4	6	-164
MOD1 Adjustment by Sites	36	9	-42	-34	-27	-32	-35	-1	-1	2	2	5	-118
MOD1 Adjustment by Harvest	-1	-3	-3	-3	-3	-3	-2	-5	-5	-5	-5	-3	-41
MOD1 Adjustment by LVE	-6	-5	-4	-6	-3	0	0	0	1	6	7	4	-6
MOD2 Adjustment	865	1,119	2,189	3,002	3,120	2,993	2,369	2,040	1,403	1,182	1,025	1,279	22,586
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	29	1	-49	-43	-33	-35	-36	-6	-6	3	4	6	-164

Table 54. Monthly Average Delta Inflow from Sacramento River, Changes to Monthly Average Delta Inflow from Sacramento River, Pulse Flow Release from Lake Oroville, and Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in thousand acre-feet), Above Normal Water Years

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	687	856	1,357	2,311	2,508	2,643	1,639	1,432	981	1,311	1,047	1,274	18,046
MOD1 Adjustment	716	868	1,335	2,237	2,461	2,578	1,633	1,449	969	1,316	1,047	1,277	17,887
MOD1 Adjustment minus WSIP Baseline	29	12	-22	-74	-47	-65	-6	18	-12	5	0	2	-159
MOD1 Adjustment by Sites	41	19	-17	-67	-43	-65	-4	17	-10	8	3	8	-110
MOD1 Adjustment by Harvest	-1	-3	-3	-3	-3	-3	-2	-5	-5	-5	-5	-3	-41
MOD1 Adjustment by LVE	-11	-4	-2	-4	-2	3	0	6	3	2	3	-3	-8
MOD2 Adjustment	716	868	1,335	2,237	2,461	2,578	1,633	1,449	969	1,316	1,047	1,277	17,887
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	29	12	-22	-74	-47	-65	-6	18	-12	5	0	2	-159

Table 55. Monthly Average Delta Inflow from Sacramento River, Changes to Monthly Average Delta Inflow from Sacramento River, Pulse Flow Release from Lake Oroville, and Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in thousand acre-feet), Below Normal Water Years

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	680	753	1,037	1,358	1,810	1,353	1,130	988	847	1,290	957	725	12,928
MOD1 Adjustment	712	775	1,026	1,311	1,776	1,306	1,113	985	839	1,287	955	735	12,822
MOD1 Adjustment minus WSIP Baseline	32	22	-11	-46	-34	-47	-16	-4	-8	-3	-2	10	-106
MOD1 Adjustment by Sites	38	31	-6	-41	-30	-46	-16	1	-4	5	6	15	-46
MOD1 Adjustment by Harvest	-1	-3	-3	-3	-3	-3	-2	-5	-5	-5	-5	-3	-41
MOD1 Adjustment by LVE	-5	-6	-2	-3	-2	2	1	0	1	-2	-2	-1	-20
MOD2 Adjustment	712	775	1,026	12,822	0	0	0	0	0	0	0	0	15,336
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	45	0	0	0	0	0	45.1
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	-22	-20	-3	-45.1
Total Change (MOD2 Adjustment minus WSIP Baseline)	32	22	-11	-46	-34	-47	29	-4	-8	-25	-22	7	-106

Table 56. Monthly Average Delta Inflow from Sacramento River, Changes to Monthly Average Delta Inflow from Sacramento River, Pulse Flow Release from Lake Oroville, and Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in thousand acre-feet), Dry Water Years

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	629	721	955	998	1,264	1,243	858	738	815	1,005	597	558	10,380
MOD1 Adjustment	657	734	959	982	1,231	1,205	858	738	812	1,059	663	604	10,501
MOD1 Adjustment minus WSIP Baseline	28	13	5	-16	-32	-38	0	0	-4	54	66	45	121
MOD1 Adjustment by Sites	27	19	9	-13	-29	-36	3	5	2	64	70	52	173
MOD1 Adjustment by Harvest	-1	-3	-3	-3	-3	-3	-2	-5	-5	-5	-5	-3	-41
MOD1 Adjustment by LVE	2	-3	-2	0	0	1	-1	0	-1	-5	2	-3	-11
MOD2 Adjustment	657	734	959	982	1,231	1,205	908	738	812	1,025	654	599	10,504
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	50	0	0	0	0	0	50.3
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	-34	-9	-4	-47.1
Total Change (MOD2 Adjustment minus WSIP Baseline)	28	13	5	-16	-32	-38	50	0	-4	20	57	41	124

Table 57. Monthly Average Delta Inflow from Sacramento River, Changes to Monthly Average Delta Inflow from Sacramento River, Pulse Flow Release from Lake Oroville, and Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in thousand acre-feet), Critical Water Years

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
WSIP Baseline	544	542	696	859	927	851	670	528	605	598	542	409	7,770
MOD1 Adjustment	567	588	693	846	922	852	668	526	599	639	591	427	7,917
MOD1 Adjustment minus WSIP Baseline	23	46	-3	-14	-5	1	-2	-1	-6	41	49	18	146
MOD1 Adjustment by Sites	25	47	-2	-11	-2	-1	0	3	-3	49	62	24	191
MOD1 Adjustment by Harvest	-1	-3	-3	-3	-3	-3	-2	-5	-5	-5	-5	-3	-41
MOD1 Adjustment by LVE	-1	2	2	0	-1	5	0	1	2	-3	-8	-3	-4
MOD2 Adjustment	567	588	693	846	922	852	668	526	599	639	591	427	7,917
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	23	46	-3	-14	-5	1	-2	-1	-6	41	49	18	146

3.2.4 Feather River Flow

The long-term monthly average cumulative effects of three GW WSIP projects on Feather River flow (C203 -Thermalito node) is shown in Figure 21 and Table 58. The mean monthly increase in Feather River flow throughout the simulation period is 1 cfs, or less than 0.1% of the total 3,984cfs of mean monthly Feather River flow. The mean pulse flow release of 315 cfs occurs in April and the mean pulse flow compensation of 295 cfs occurs from July to September. The long-term monthly average cumulative effects of the three GW WSIP projects on Feather River flow (C203) by water year type are shown in Figure 22 and in Tables 59 through 63.

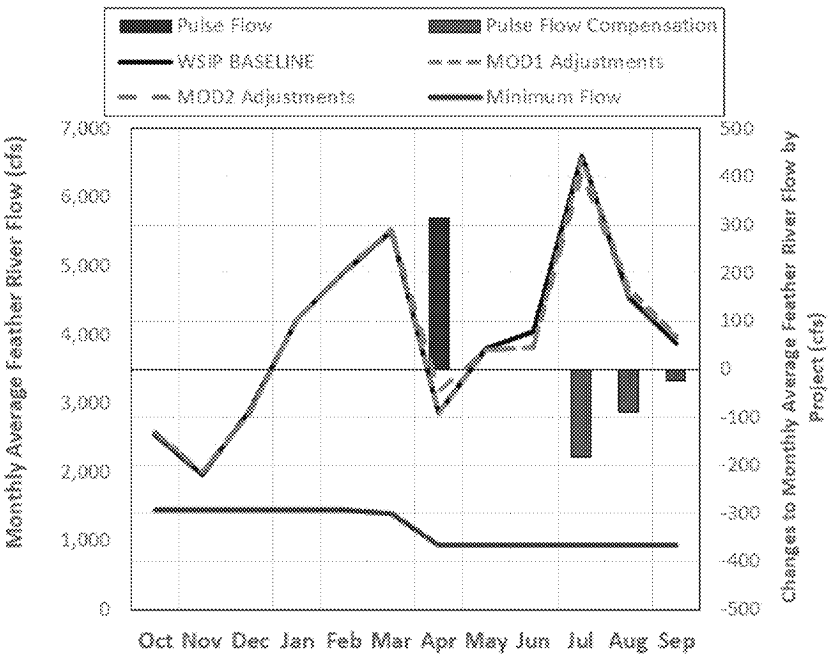


Figure 21. Monthly Average Feather River Flow (C203) for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Changes to Monthly Average Feather River Flow by Project, Pulse Flow Release from Lake Oroville, Pulse Flow Compensation, and Minimum Flow Requirement (in cubic feet per second)

Table 58. Monthly Average Feather River Flow (C203), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	2,549	1,961	2,907	4,219	4,915	5,521	2,858	3,810	4,043	6,613	4,537	3,875	3,984
MOD1 Adjustment	2,584	1,992	2,870	4,230	4,930	5,530	2,867	3,784	3,826	6,550	4,665	3,977	3,984
MOD1 Adjustment minus WSIP Baseline	35	31	-37	11	15	9	9	-26	-217	-63	128	101	0
MOD1 Adjustment by Sites	49	45	-22	16	26	1	11	-25	-222	-105	95	123	-1
MOD1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD1 Adjustment by LVE	-14	-13	-15	-4	-12	8	-2	0	5	42	33	-22	0
MOD2 Adjustment	2,584	1,992	2,870	4,230	4,930	5,530	3,183	3,784	3,826	6,367	4,577	3,953	3,985
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	315	0	0	0	0	0	26
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	-183	-88	-23	-25
Total Change (MOD2 Adjustment minus WSIP Baseline)	35	31	-37	11	15	9	324	-26	-217	-246	39	78	1
Minimum Flow Requirement	1,461	1,461	1,461	1,461	1,461	1,401	945	945	945	945	945	945	1,198

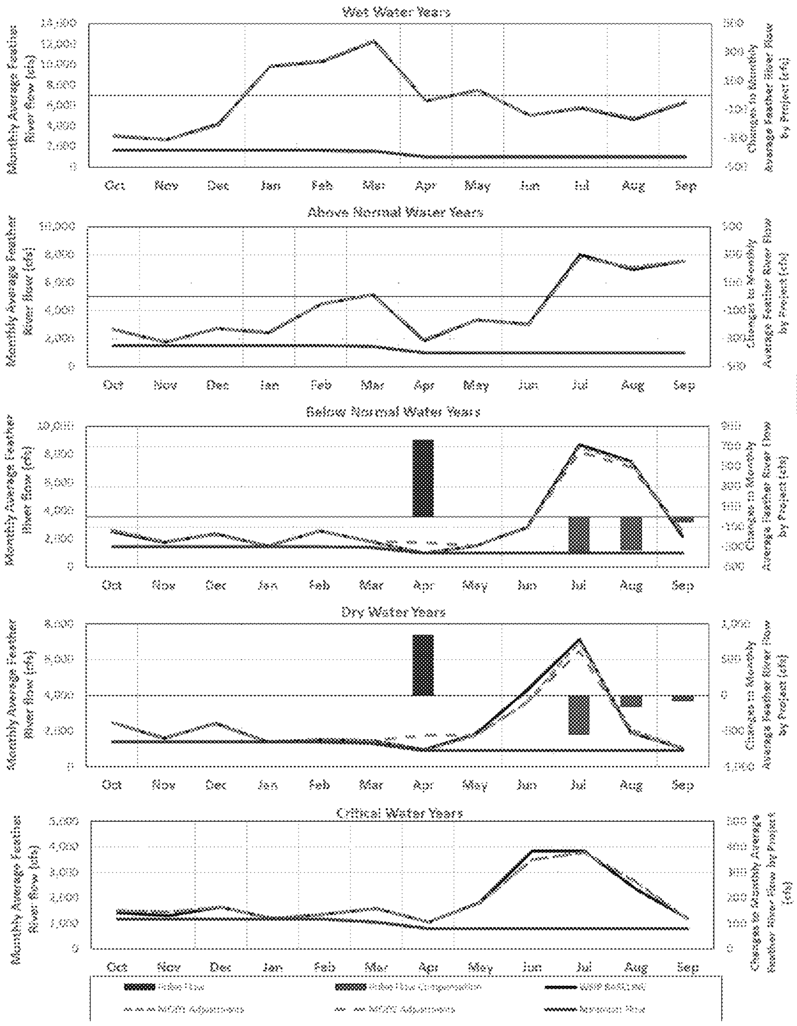


Figure 22. Monthly Average Feather River Flow (C203) for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Changes to Monthly Average Feather River Flow by Project, Pulse Flow Release from Lake Oroville, and Pulse Flow Compensation, by Water Year Type (in cubic feet per second)

Table 59. Monthly Average Feather River Flow (C203), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Wet Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,042	2,693	4,195	9,862	10,347	12,325	6,486	7,521	5,052	5,752	4,661	6,297	6,519
MOD1 Adjustment	3,100	2,700	4,103	9,870	10,385	12,341	6,489	7,523	5,058	5,843	4,781	6,426	6,552
MOD1 Adjustment minus WSIP Baseline	59	8	-92	9	39	15	3	1	6	91	120	128	32
MOD1 Adjustment by Sites	80	22	-54	43	83	15	3	3	-3	-3	42	124	30
MOD1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD1 Adjustment by LVE	-21	-14	-38	-34	-44	0	0	-1	9	94	78	5	3
MOD2 Adjustment	3,100	2,700	4,103	9,870	10,385	12,341	6,489	7,523	5,058	5,843	4,781	6,426	6,552
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	59	8	-92	9	39	15	3	1	6	91	120	128	32
Minimum Flow Requirement	1,612	1,612	1,612	1,612	1,612	1,583	1,000	1,000	1,000	1,000	1,000	1,000	1,303

Table 60. Monthly Average Feather River Flow (C203), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Above Normal Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	2,682	1,746	2,742	2,444	4,489	5,126	1,871	3,335	3,062	8,034	6,947	7,540	4,168
MOD1 Adjustment	2,694	1,745	2,756	2,487	4,500	5,132	1,950	3,334	3,012	7,783	7,082	7,549	4,169
MOD1 Adjustment minus WSIP Baseline	12	-1	14	44	11	6	79	-1	-49	-251	135	9	1
MOD1 Adjustment by Sites	70	0	-4	0	3	-27	79	-1	-87	-286	36	-6	-19
MOD1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD1 Adjustment by LVE	-57	-1	19	44	8	33	0	0	38	35	99	14	19
MOD2 Adjustment	2,694	1,745	2,756	2,487	4,500	5,132	1,950	3,334	3,012	7,783	7,082	7,549	4,169
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	12	-1	14	44	11	6	79	-1	-49	-251	135	9	1
Minimum Flow Requirement	1,525	1,525	1,525	1,525	1,525	1,483	1,000	1,000	1,000	1,000	1,000	1,000	1,259

Table 61. Monthly Average Feather River Flow (C203), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Below Normal Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	2,543	1,778	2,347	1,480	2,579	1,798	982	1,520	2,853	8,674	7,494	2,168	3,018
MOD1 Adjustment	2,615	1,805	2,313	1,492	2,579	1,798	982	1,531	2,775	8,529	7,435	2,495	3,029
MOD1 Adjustment minus WSIP Baseline	72	27	-34	12	0	0	0	10	-78	-146	-59	327	11
MOD1 Adjustment by Sites	81	53	-23	12	0	0	0	11	-62	-176	25	344	22
MOD1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD1 Adjustment by LVE	-9	-26	-11	0	0	0	0	-1	-16	30	-85	-17	-11
MOD2 Adjustment	2,615	1,805	2,313	1,492	2,579	1,798	1,742	1,531	2,775	8,165	7,109	2,448	3,031
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	760	0	0	0	0	0	63
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	-364	-326	-47	-61
Total Change (MOD2 Adjustment minus WSIP Baseline)	72	27	-34	12	0	0	760	10	-78	-509	-385	280	13
Minimum Flow Requirement	1,457	1,457	1,457	1,457	1,457	1,396	982	982	982	982	982	982	1,215

Table 62. Monthly Average Feather River Flow (C203), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Dry Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	2,500	1,617	2,431	1,397	1,534	1,479	938	1,855	4,297	7,148	1,904	1,047	2,346
MOD1 Adjustment	2,466	1,645	2,411	1,397	1,537	1,486	930	1,743	3,625	7,049	2,082	1,090	2,288
MOD1 Adjustment minus WSIP Baseline	-34	28	-20	0	3	7	-8	-113	-672	-100	178	43	-57
MOD1 Adjustment by Sites	-37	45	11	0	-1	5	-6	-113	-659	-119	149	99	-52
MOD1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD1 Adjustment by LVE	2	-17	-31	0	4	2	-2	0	-13	19	29	-56	-5
MOD2 Adjustment	2,466	1,645	2,411	1,397	1,537	1,486	1,776	1,743	3,625	6,498	1,933	1,020	2,295
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	846	0	0	0	0	0	71
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	-550	-150	-70	-64
Total Change (MOD2 Adjustment minus WSIP Baseline)	-34	28	-20	0	3	7	838	-113	-672	-650	28	-27	-51
Minimum Flow Requirement	1,394	1,394	1,394	1,394	1,394	1,319	903	903	903	903	903	903	1,142

Table 63. Monthly Average Feather River Flow (C203), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Critical Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	1,429	1,317	1,648	1,196	1,370	1,581	1,056	1,846	3,846	3,847	2,360	1,197	1,891
MOD1 Adjustment	1,496	1,442	1,652	1,196	1,370	1,591	1,044	1,824	3,500	3,790	2,641	1,156	1,892
MOD1 Adjustment minus WSIP Baseline	67	125	3	0	0	10	-12	-22	-346	-57	281	-41	1
MOD1 Adjustment by Sites	53	129	-15	0	0	-6	-3	-22	-363	-43	268	29	2
MOD1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD1 Adjustment by LVE	14	-5	18	0	0	16	-9	0	17	-15	13	-70	-2
MOD2 Adjustment	1,496	1,442	1,652	1,196	1,370	1,591	1,044	1,824	3,500	3,790	2,641	1,156	1,892
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	67	125	3	0	0	10	-12	-22	-346	-57	281	-41	1
Minimum Flow Requirement	1,175	1,175	1,175	1,175	1,175	1,050	792	792	792	792	792	792	973

The long-term monthly average cumulative effects of three GW WSIP projects on Feather River flow (C223 – at junction with Sacramento River) is shown in Figure 23 and Table 64. The mean monthly increase in Feather River flow throughout the simulation period is 1 cfs, or less than 0.1% of the total 7,418 cfs of mean monthly Feather River flow. The mean pulse flow release of 315 cfs occurs in April and the mean pulse flow compensation of 295 cfs occurs from July to September. The long-term monthly average cumulative effects of the three GW WSIP projects on Feather River flow (C223) by water year type are shown in Figure 24 and in Tables 65 through 69.

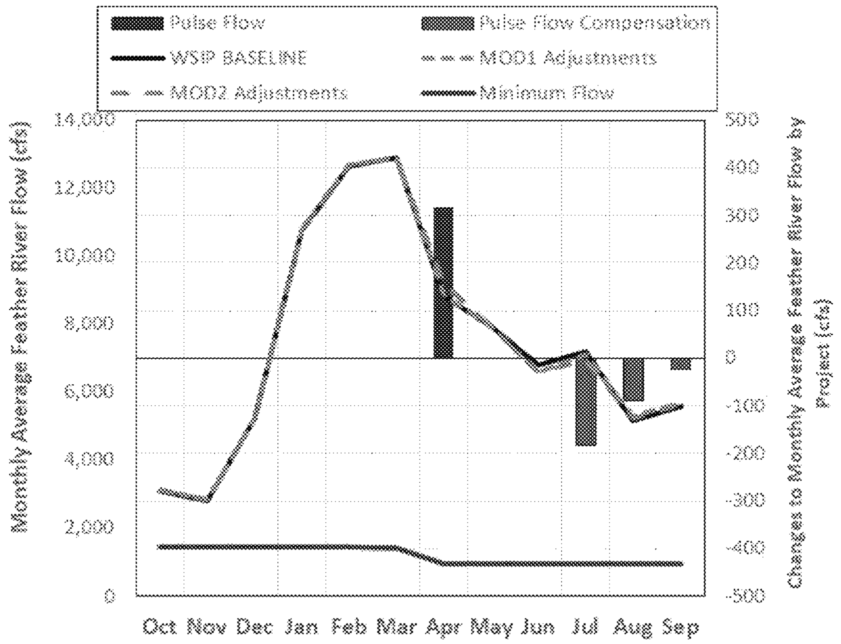


Figure 23. Monthly Average Feather River Flow (C223) for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Changes to Monthly Average Feather River Flow by Project, Pulse Flow Release from Lake Oroville, Pulse Flow Compensation, and Minimum Flow Requirement (in cubic feet per second)

Table 64. Monthly Average Feather River Flow (C223), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,101	2,819	5,219	10,767	12,671	12,886	8,852	7,956	6,798	7,180	5,178	5,592	7,418
MOD1 Adjustment	3,135	2,850	5,182	10,781	12,688	12,897	8,861	7,929	6,577	7,112	5,311	5,688	7,417
MOD1 Adjustment minus WSIP Baseline	34	31	-37	13	17	12	9	-27	-222	-68	133	95	-1
MOD1 Adjustment by Sites	48	45	-21	17	28	3	10	-27	-227	-109	96	123	-1
MOD1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD1 Adjustment by LVE	-14	-13	-15	-4	-11	9	-1	0	5	41	37	-28	0
MOD2 Adjustment	3,135	2,850	5,182	10,781	12,688	12,897	9,176	7,929	6,577	6,929	5,222	5,664	7,419
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	315	0	0	0	0	0	26
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	-183	-88	-23	-25
Total Change (MOD2 Adjustment minus WSIP Baseline)	34	31	-37	13	17	12	324	-27	-222	-251	45	72	1
Minimum Flow Requirement	1,461	1,459	1,461	1,461	1,461	1,401	945	945	945	945	945	945	1,198

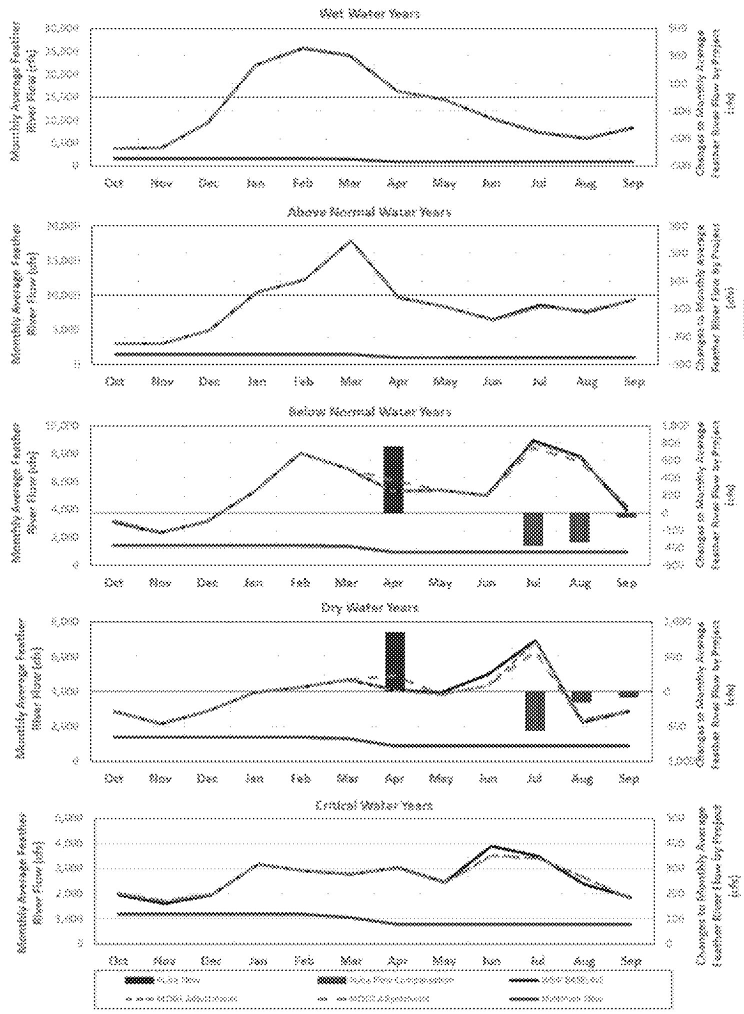


Figure 24. Monthly Average Feather River Flow (C203) for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Changes to Monthly Average Feather River Flow by Project, Pulse Flow Release from Lake Oroville, Pulse Flow Compensation, and Minimum Flow Requirement, by Water Year Type (in cubic feet per second)

Table 65. Monthly Average Feather River Flow (C223), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Wet Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,798	3,993	9,571	22,085	25,734	24,148	16,345	14,467	10,476	7,416	5,988	8,326	12,695
MOD1 Adjustment	3,856	4,000	9,479	22,095	25,772	24,163	16,346	14,467	10,481	7,506	6,123	8,446	12,728
MOD1 Adjustment minus WSIP Baseline	59	8	-92	10	39	15	1	0	5	89	135	121	32
MOD1 Adjustment by Sites	80	22	-54	43	83	15	0	0	-3	-4	46	127	30
MOD1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD1 Adjustment by LVE	-21	-14	-38	-34	-44	0	1	0	9	93	89	-6	3
MOD2 Adjustment	3,856	4,000	9,479	22,095	25,772	24,163	16,346	14,467	10,481	7,506	6,123	8,446	12,728
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	59	8	-92	10	39	15	1	0	5	89	135	121	32
Minimum Flow Requirement	1,612	1,605	1,612	1,612	1,612	1,583	1,000	1,000	1,000	1,000	1,000	1,000	1,303

Table 66. Monthly Average Feather River Flow (C223), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Above Normal Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,012	3,027	4,943	10,443	12,148	17,846	9,694	8,293	6,462	8,582	7,600	9,418	8,456
MOD1 Adjustment	3,024	3,026	4,957	10,487	12,159	17,853	9,774	8,292	6,413	8,326	7,737	9,424	8,456
MOD1 Adjustment minus WSIP Baseline	12	-1	14	44	11	7	80	-1	-50	-256	137	7	0
MOD1 Adjustment by Sites	69	0	-4	0	3	-26	80	-1	-89	-291	39	-6	-19
MOD1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD1 Adjustment by LVE	-57	-1	18	43	8	33	0	0	39	35	99	13	19
MOD2 Adjustment	3,024	3,026	4,957	10,487	12,159	17,853	9,774	8,292	6,413	8,326	7,737	9,424	8,456
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	12	-1	14	44	11	7	80	-1	-50	-256	137	7	0
Minimum Flow Requirement	1,525	1,525	1,525	1,525	1,525	1,483	1,000	1,000	1,000	1,000	1,000	1,000	1,259

Table 67. Monthly Average Feather River Flow (C223), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Below Normal Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	3,132	2,350	3,150	5,271	8,049	6,927	5,314	5,400	5,047	8,972	7,797	3,924	5,444
MOD1 Adjustment	3,203	2,377	3,117	5,286	8,055	6,930	5,314	5,410	4,968	8,815	7,735	4,251	5,455
MOD1 Adjustment minus WSIP Baseline	72	27	-34	15	6	4	0	10	-80	-157	-63	327	11
MOD1 Adjustment by Sites	81	53	-22	12	0	0	0	11	-64	-186	22	343	21
MOD1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD1 Adjustment by LVE	-9	-26	-11	3	6	4	0	-1	-16	29	-85	-16	-10
MOD2 Adjustment	3,203	2,377	3,117	5,286	8,055	6,930	6,073	5,410	4,968	8,451	7,409	4,204	5,457
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	760	0	0	0	0	0	63
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	-364	-326	-47	-61
Total Change (MOD2 Adjustment minus WSIP Baseline)	72	27	-34	15	6	4	759	10	-80	-521	-388	280	12
Minimum Flow Requirement	1,457	1,457	1,457	1,457	1,457	1,396	982	982	982	982	982	982	1,215

Table 68. Monthly Average Feather River Flow (C223), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Dry Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	2,899	2,162	2,895	3,977	4,252	4,684	4,099	3,972	5,014	6,969	2,221	2,894	3,837
MOD1 Adjustment	2,863	2,191	2,875	3,980	4,258	4,693	4,092	3,860	4,329	6,867	2,408	2,933	3,779
MOD1 Adjustment minus WSIP Baseline	-35	29	-20	2	6	10	-8	-112	-685	-102	186	39	-57
MOD1 Adjustment by Sites	-38	46	11	2	2	8	-6	-112	-671	-121	149	98	-53
MOD1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD1 Adjustment by LVE	3	-17	-30	0	4	2	-2	0	-13	19	37	-59	-5
MOD2 Adjustment	2,863	2,191	2,875	3,980	4,258	4,693	4,938	3,860	4,329	6,317	2,258	2,863	3,785
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	846	0	0	0	0	0	71
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	-550	-150	-70	-64
Total Change (MOD2 Adjustment minus WSIP Baseline)	-35	29	-20	2	6	10	839	-112	-685	-652	36	-31	-51
Minimum Flow Requirement	1,394	1,394	1,394	1,394	1,394	1,319	903	903	903	903	903	903	1,142

Table 69. Monthly Average Feather River Flow (C223), Changes to Monthly Average Feather River Flow, Pulse Flow Release, Pulse Flow Compensation for WSIP Baseline, MOD1 Adjustments and MOD2 Adjustments, Critical Water Years (in cubic feet per second)

Scenario/Project	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
WSIP Baseline	1,946	1,597	1,964	3,167	2,911	2,779	3,032	2,467	3,887	3,491	2,378	1,838	2,621
MOD1 Adjustment	2,011	1,721	1,967	3,173	2,918	2,800	3,020	2,440	3,532	3,425	2,654	1,782	2,620
MOD1 Adjustment minus WSIP Baseline	65	124	3	5	7	21	-12	-27	-355	-66	275	-56	-1
MOD1 Adjustment by Sites	52	129	-15	7	5	-1	-3	-27	-372	-45	268	28	2
MOD1 Adjustment by Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD1 Adjustment by LVE	13	-5	18	-1	2	22	-9	1	17	-21	7	-83	-3
MOD2 Adjustment	2,011	1,721	1,967	3,173	2,918	2,800	3,020	2,440	3,532	3,425	2,654	1,782	2,620
MOD2 Adjustment by Willow Springs	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Kern Fan	0	0	0	0	0	0	0	0	0	0	0	0	0
MOD2 Adjustment by Chino Basin	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Release from Lake Oroville	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulse Flow Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Change (MOD2 Adjustment minus WSIP Baseline)	65	124	3	5	7	21	-12	-27	-355	-66	275	-56	-1
Minimum Flow Requirement	1,175	1,175	1,175	1,175	1,175	1,050	792	792	792	792	792	792	973

3.2.5 Groundwater Bank Storage

Annual and cumulative fill of the pulse flow account for each project is shown in the top of Figure 25 for the 82-year simulation period, and the annual fill of all accounts of Willow Springs and Kern Fan are shown in the bottom of Figure 25 along with MOD2 exportable Delta surplus as Article 21 (minimum of Delta surplus and regulatory/physical capacity at Banks).

Chino Basin fills with approximately 12 TAF per year of treated water. Willow Springs and Kern Fan only fill when Delta surplus is available, SWP San Luis Reservoir is full, and there is excess permitted or regulatory capacity at Banks. This occurs only in four years prior to 1969, and in each instance, Willow Springs exports more Delta surplus for two primary reasons: (1) Willow Springs has significantly more storage capacity in the environmental account than Kern Fan and (2) Kern Fan exports are allocated to other storage accounts. Total exported Delta surplus is generally split by each of these projects, except when Kern Fan has reached full capacity in all accounts and Willow Springs still has available capacity (e.g., bottom of Figure 25 in 1970 and 1984).

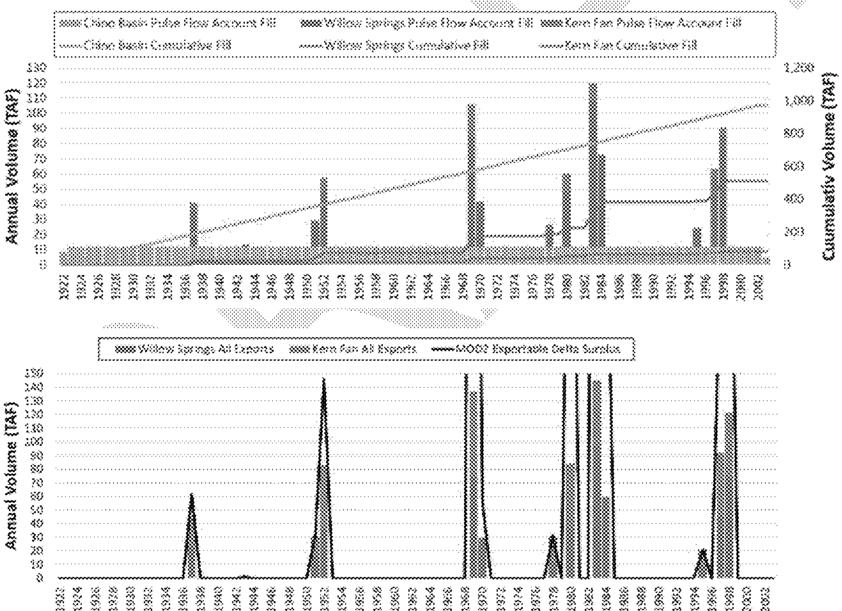


Figure 25. Top: Annual and Cumulative Fill of Each Groundwater Project Pulse Flow Account (in thousand acre-feet). Bottom: Annual Fill of Willow Springs and Kern Fan All Accounts and Exportable Delta Surplus.

Figures 26 through 28 show the total monthly storage in each GW bank for the 82-year simulation period. As shown in Figure 26, unlike the other two GW banks, Chino Basin does not maintain an explicit account for allowing pulse flows. Instead, consistent with their local agreement, total storage fluctuates between a maximum amount, which reflects the total capacity of the GW bank, and a negative minimum amount, which reflects borrowing from other Chino Basin groundwater. Storage increases continuously due to recharge from treated water and is reduced only when deliveries are made to Inland Empire Utility Agency (IEUA) or MWD. In a pulse flow year, MWD would reduce their SWP exports from Banks from April through December. As previously mentioned, because the pulse flow is decoupled from the compensation deliveries to IEUA and MWD, the reductions in total storage are independent from the pulse flow years (e.g., 1935 to 1937). The bottom portion of the figure shows the virtual storage account of Lake Oroville and the San Luis Reservoir storage account. In a pulse flow year, the Lake Oroville virtual account is debited 40 TAF in April when a pulse flow is made, and then credited 40 TAF in July when Lake Oroville releases and Banks exports are reduced. The San Luis Reservoir storage account accumulates supplies starting in April when MWD reduces their SWP deliveries. This account is reduced to a negative value in July to offset the Banks export reductions, then the account accumulates supplies through the remainder of the calendar year to return the account to 0.

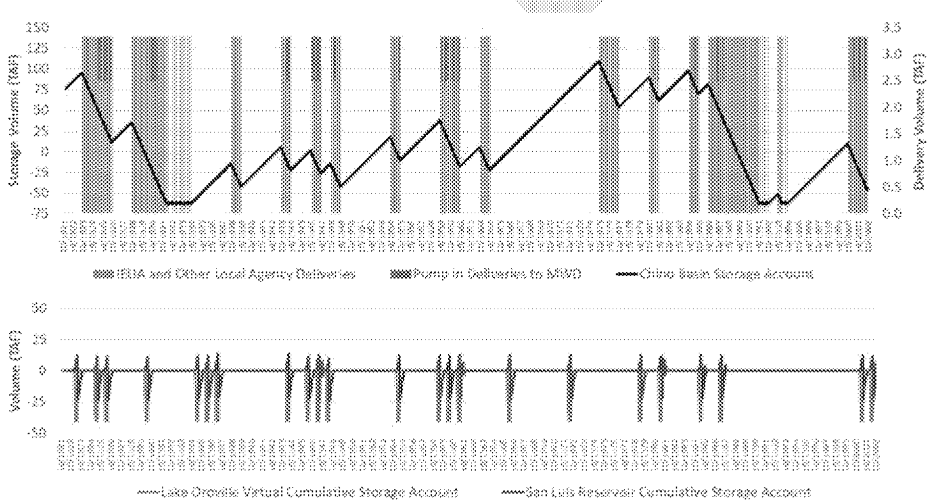


Figure 26. Top: Monthly Storage in and Deliveries from Chino Basin (in thousand acre-feet). Bottom: Storage Accounts to Track Pulse Flow and Compensation (in thousand acre-feet)

Shown in Figure 27, there are three storage accounts in Willow Springs: Pre-evacuation, Ecological Benefit Storage, and Table A. The Pre-evacuation storage account receives water that is moved from San Luis Reservoir in order to open up space for opportunistic pumping of Delta surplus, and that account is always reduced back to zero by the end of the water year. The Ecological Benefit Storage account holds any additional yield generated by opportunistic pumping of Delta surplus, which could be first stored in San Luis Reservoir and then transferred to this account. The Ecological Benefit Storage account can go slightly negative at times due to the leave-behind requirements, but this deficit must be paid off before water from that account can be used for pulse flow compensation. The Table A account holds a portion of AVEK's Table A allocated water that is in excess of their consumptive use demand, developing a backup supply for years when their Table A allocation is insufficient for their consumptive use demand. The Table A account does not have any effect on the pulse flow operation. It is managed in this simulation to store a reasonable volume of supplies for drought years but to not fill up the GW bank, a condition that could limit the operation of the Ecological Benefit Storage account and associated pulse flow operations.

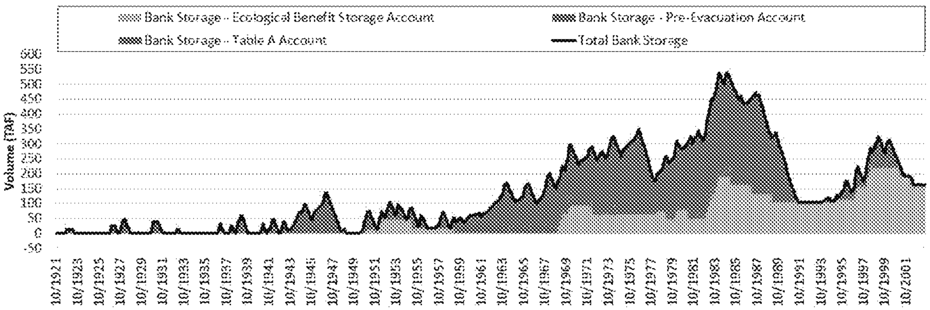


Figure 27. Monthly Storage for Willow Springs (in thousand acre-feet)

As shown in Figure 28, Kern Fan is composed of three accounts: environmental, IRWD, and RR. Available Article 21 supply is split between the three accounts, with 25% going to the environment account when storage capacity is available and 38% going to both the IRWD and RR accounts. The available storage in the environmental account is used to determine the pulse flow release. Even though there are some pulse flow years when Kern Fan has water stored in the environmental account, the original Kern Fan spreadsheet model does not allow partial delivery, so no water is contributed to the pulse flow operations.

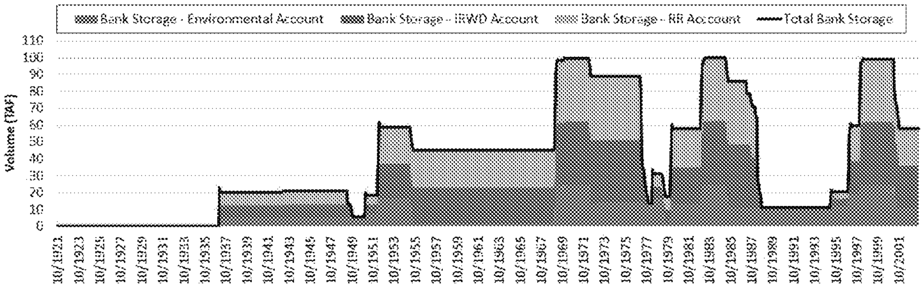


Figure 28. Monthly Storage for Kern Fan (in thousand acre-feet)

3.3 PULSE FLOW DELIVERY

For the cumulative analysis, a pulse flow was requested in April of Below Normal and Dry water year types, as defined by the Sacramento Valley Index, consistent with the water year types used by each groundwater bank in their WSIP application materials. The maximum requested pulse flow was 100 TAF; as previously mentioned, the combined storage volume for pulse flow exchange water of all GW banks is 97 TAF. The actual pulse flow request would be determined in real time subject to requests from CDFW.

The feasible pulse flow volume available to be delivered in MOD2 is based on the minimum of two values. The first value is the total volume of Lake Oroville flow release reductions, from July through September, that could be made while maintaining both the minimum flow threshold in the Feather River and the minimum Banks health and safety export (295 cfs). The second value is the total storage available for pulse flows in all GW banks in April. This value was assumed physically available to compensate Partner Contractors through the end of the year for any pulse flow made in April. The minimum of these two values was calculated and delivered as a pulse flow in April. An equivalent volume of pulse flow compensation reduction was made from July through September to ensure Lake Oroville storage levels in September matched those in the WSIP Baseline. Storage levels in SWP San Luis Reservoir were not analyzed, since compensatory releases from GW banks are always the same as the reductions in releases for exports from Lake Oroville. SWP San Luis Reservoir can be assumed to always have equivalent storage at the end of the year under the conditions when pulse flows are not implemented.

An annual time series of the pulse flow request, allowable pulse flow volume based on minimum flow or export constraints, and pulse flow delivery based on total GW storage available for pulse flows is shown in Figure 29. The pulse flow request is consistently set at 100 TAF, and the minimum flow and export adjustments do not require any reduction in the pulse flow request (i.e., there is enough volume in July through September above the Feather River minimum flow requirement and above the Banks health and safety minimum export limit to reduce Oroville releases, and in effect Delta inflows, by the full pulse request volume). Total pulse flow deliveries averaged 45.1 TAF in Below Normal years and 50.3 TAF in Dry years, less than the pulse flow request, due to the lack of available GW storage during drought periods and certain limitations within each GW spreadsheet model as to when pulse flows could be delivered.

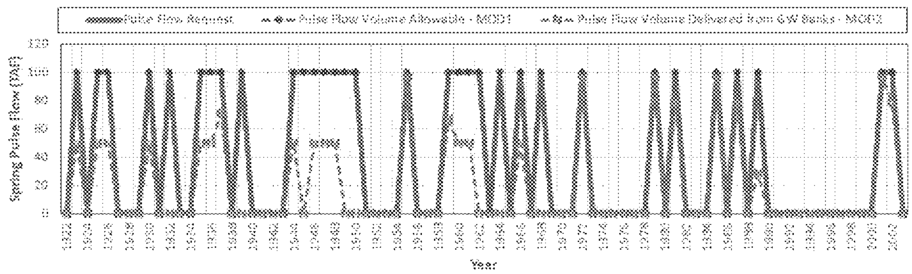


Figure 29. Annual Pulse Flow Time Series (in thousand acre-feet)

An annual time series of the pulse flow delivered by project is shown in Figure 30, and the pulse flow delivery by project is shown in Table 70. Chino Basin is most consistent in delivering a pulse flow when requested, as it remains relatively full due to the continuous fill operation from non-Delta sources. There are several instances when Chino Basin does not release a pulse flow due to constraints on consecutive years of pulse flow delivery (no more than 3 consecutive or 4 out of 10 years). Willow Springs is limited in providing pulse flows prior to 1972, due to the lack of exportable surplus that can be used to generate additional yield, which in turn limits storage in the GW bank that can be used to compensate for pulse flows. Kern Fan does not provide a pulse flow consistently until 1955, 33 years into the simulation after sufficient water has accumulated in the environmental storage account. Even though Kern Fan partially fills prior to 1955, the post-processor does not allow a pulse flow to be made until 18 TAF is held in storage, consistent with project operations.

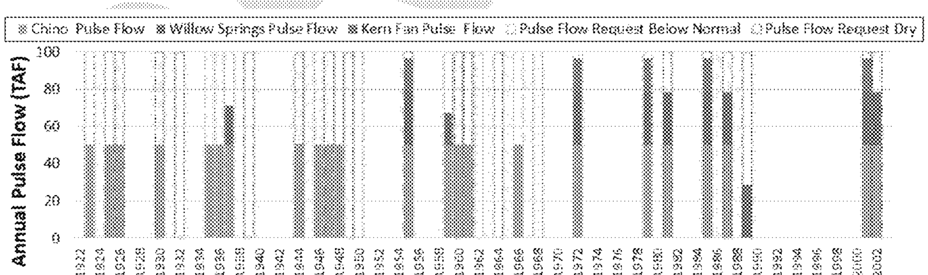


Figure 30. Annual Pulse Requested in Below Normal (dashed yellow line) and Dry (dashed red line) Years and Delivered by Each Groundwater Project (in thousand acre-feet)

Table 70. Average Pulse Flow Request and Delivery by Project by Water Year Type (in thousand acre-feet)

Water Year Type	Pulse flow request (TAF)	Chino Basin pulse flow delivered (TAF)	Kern Fan pulse flow delivered (TAF)	Willow Springs pulse flow delivered (TAF)	Total pulse flow delivered (TAF)
W	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0
BN	100.0	35.7	2.6	6.8	45.1
D	100.0	36.1	3.0	11.2	50.3
C	0.0	0.0	0.0	0.0	0.0
Average	**39.0**	**14.0**	**1.1**	**3.6**	**18.7**

The results of the analysis suggest the following two factors contribute to the pulse flow delivery:

1. **CalSim II hydrology and the assumption on initial storage.** Willow Springs and Kern Fan are set to an initial storage of 0 TAF, so no compensation for pulse flows can be provided until sufficient storage is accumulated. The availability of Delta surplus is highly dependent on CalSim II hydrology. Starting each groundwater bank at 0 TAF initial storage may artificially suppress the groundwater bank availability for a pulse flow since CalSim II hydrology starts relatively dry for first few decades. Chino Basin is set to an initial storage of 75 TAF to be consistent with the project proposed operation. A value of 0 TAF was not used in the cumulative analysis because Chino Basin can leverage the basin agreement to allow borrowing from other groundwater accounts.

   The effect of initial storage used in the analysis was analyzed as a sensitivity. Starting Willow Springs with 50 TAF of initial storage and Kern Fan with 25 TAF of initial storage increases the annual pulse flow delivered from 18.7 TAF per year to 19.2 TAF per year and changes the number of pulses provided by Kern Fan (5 to 7) and Willow Springs (13 to 14). From a viewpoint of providing pulse flows, the initial storage seems to have limited effects. Other alternative approaches to reduce the effects of initial storage may be explored in the future if warranted; however, it is likely that the sequence of hydrology is more constraining than the assumed initial storage conditions for each groundwater banks.

2. **The assumption on allowing partial delivery.** There is no available Delta surplus that can be exported for Kern Fan or Willow Springs in the WSIP Baseline until 1936, 14 years into the simulation. Both Kern Fan and Willow Springs export surplus for fill at this time. Willow Springs can deliver a partial pulse flow in subsequent years with this volume, but the Kern Fan model only allows delivery of the full pulse volume, so it does not deliver a pulse flow until it fills more. The next time exportable surplus becomes available is 14 years later in 1951. At this point, Kern Fan begins accumulating sufficient storage to begin providing a pulse flow when requested. Kern Fan total storage for pulse flows is 25 TAF, and the reduction in storage due to a delivered pulse

flow is 14 TAF, so after one pulse flow is made the storage account must be refilled at least partially before making a subsequent release. This limits the ability of Kern Fan to deliver a pulse flow compared to the other two GW banks. Both Willow Springs and Chino Basin contain total storage for pulse flows greater than twice the pulse flow volume delivered, allowing them to deliver more frequent pulses without requiring a total refill.

4.0 PRELIMINARY SUMMARY OF FINDINGS

A post-processing tool was developed to analyze the cumulative effects of Sites, Harvest, LVE, Chino Basin, Kern Fan, and Willow Springs WSIP projects on Delta surplus and exports in a baseline CalSim II model. The tool integrated changes in Delta flows and exports from these projects, and assessed the ability of the three GW banks to make a coordinated pulse flow release from Lake Oroville. This section organizes and summarizes the preliminary findings.

4.1 ABILITY TO SUPPORT PULSE FLOW OPERATIONS

Out of 32 possible pulse flow delivery years (i.e., 32 total Below Normal and Dry years in the 82-year simulation period), a full 97 TAF pulse flow is delivered in 5 years, a partial pulse flow averaging 53 TAF is delivered in 20 years, and no pulse flow is delivered in 7 years. Two primary reasons limit the delivery of a pulse flow. First, for Willow Springs and Kern Fan, each GW bank fills using Delta surplus water that is subject to Delta operational constraints and only available in a limited number of years. These GW banks often do not have enough water accumulated in storage to deliver a full pulse flow. Kern Fan is particularly constrained since it cannot store more volume than what it delivers as a pulse flow in a single year. Willow Springs can fill to a much greater amount than the pulse flow volume, which enables a more reliable pulse flow delivery, especially later in the simulation period. Second, Chino Basin is not subject to Delta operations, but pulse releases are limited in frequency to 3 consecutive or 4 out of 10 years. There are several instances when the frequency of Below Normal and Dry years exceeds this limit, and Chino Basin does not release a pulse (e.g., 1942 to 1952). The cumulative implementation of all WSIP projects suggests pulse flows cannot be delivered during certain conditions, including relatively dry multi-decadal dry periods (e.g., 1920 – 1950) and dry decades following a wet period (e.g., 1960 – 1970).

Another limitation on pulse flow deliveries is hydrologic sequencing in the CalSim II model. The existing conditions CalSim II hydrology begins with a relatively dry period and ends with a much wetter period. This hydrologic sequence results in a multi-decadal period before the GW banks can accumulate water supply and deliver a pulse flow. However, each GW bank ends the simulation period with stored water supplies available for a pulse flow following the relatively wet 1990s. For example. Willow Springs finishes the simulation with 162 TAF of unused water in the Ecological Benefit Storage account (see Figure 27). This is sufficient water to provide for 5-7 more pulses in addition to the 13 that Willow Springs already provides. If the simulation had started with a wet period and ended with a dry period these additional pulses would be included in the results of this analysis. A different hydrologic sequencing of dry and wet years could be assessed by randomly starting the models and post-processors in different years. It is likely, however, that there would still be years the pulse flow would not be provided. It is reasonable to say that the deficiency in providing needed pulse flows on schedule is still likely to happen, even with the Monte Carlo approach to alleviate the limitations from a set hydrologic sequence.

Preliminary findings suggest Kern Fan may be the most sensitive to the cumulative implementation of the six WSIP projects relative to when the projects were simulated independently. Kern Fan and Willow Springs compete for available Delta surplus flows when SWP San Luis Reservoir is full. Willow Springs generates new water supplies by allowing for additional exports that are stored in space opened up in San Luis Reservoir through pre-evacuation, while Kern Fan is filled with additional Article 21 deliveries beyond those in MOD1. Since San Luis Reservoir filling is prioritized ahead of additional Article 21 deliveries, and the availability of Delta surplus and export capacity when San Luis Reservoir is full can be limited, Kern Fan is more constrained by the cumulative implementation of projects than Willow Springs. In addition, from a system-wide standpoint, Sites and LVE are reducing Delta surplus, and Harvest to a lesser extent, which could also reduce supplies for Willow Springs and Kern Fan.

The results from the cumulative analysis also suggest that the CVP, SWP, and Delta are tightly operated in the WSIP Baseline. There are limited opportunities when surplus is available, especially early in the 82-year simulation period that is historically dry. There are also limited opportunities when export capacity is available south of the Delta to take advantage of the available surplus. Kern Fan and Willow Springs are more reliably filled later in the 82-year simulation period, and are more consistent in providing a pulse flow when requested after 1969. Their ability to meet the pulse flow request is constrained by the availability of accumulated supplies. In the case of Chino Basin, it is not constrained by tight Delta operation but by certain release rules. For example, Chino Basin proposed operations only make a pulse release for either 3 consecutive or 4 out of 10 years, and only if Lake Oroville storage and San Luis Reservoir storage are within minimum and maximum threshold values.

4.2 EFFECTS OF CALSIM II BASELINE MODEL

It is also prudent to point out the effects of using the updated WSIP Baseline CalSim II model runs for the cumulative analysis. In reviewing the WSIP Baseline CalSim II model runs, it was noted that exportable Delta surplus is much less than in the 2030 WSIP CalSim II model runs that most of these projects used in development of their operations and for their WSIP applications. This is especially apparent in the period prior to 1969. There is more exportable surplus in the prior model runs even though SWP San Luis Reservoir is full more frequently in the more recent models, which should increase the frequency of opportunities for additional export. This reduction in exportable surplus could impose significant constraints on the abilities of Willow Springs and Kern Fan to accumulate groundwater banking assets for pulse flow implementation, as demonstrated in the previously discussed results.

Stantec has investigated the reasons for the observed difference between these model runs and concluded with three contributing factors. First, Article 21 demands have increased in the WSIP Baseline compared to the 2017 WSIP models, reducing the remaining physical and regulatory capacity available for exporting additional Delta surplus. Second, the Old and Middle River flow standards are more restrictive in March in the WSIP Baseline, imposing additional restriction for additional exports. And third, for Willow Springs only, the CalSim II runs used in the original WSIP application for that project assumed a Delta operation that included the use of Jones Pumping Plant for SWP exports when Banks capacity is not available based on the Joint Point of Diversion under the CVP/SWP water rights. This assumption is not typically used in CalSim II applications for project evaluations and is also not used in the cumulative effect analysis presented here.

The sensitivity of the additional yield generated by Kern Fan and Willow Springs to Article 21 demand assumptions in the WSIP Baseline could be further investigated. The higher Article 21 demands and deliveries in the WSIP Baseline are contributing to lower additional yield in the current analysis compared to the 2017 modeling and hence lower pulse flow deliveries. This increase in Article 21 demands was due to an update to CalSim II demands conducted by DWR for the 2019 Delivery Capability Report. Based on documentation in CalSim II input files, the current annual Article 21 demand for each SWP contractor is based on the maximum of annual Article 21 deliveries during 2005-2018 and annual Article 21 requests in 2011, 2017, and 2019, then increased by 20% to represent future increases in demand. An evaluation could be conducted of the sensitivity of the pulse flow benefits by these two GW banks to Article 21 demand assumptions, and of the appropriateness of the current Article 21 demand assumptions for this analysis.

4.3 KNOWN LIMITATIONS

This section highlights known limitations that were encountered while developing the post-processing tool and analyzing the results.

Because the post-processing tool sequentially implements the operations of individual projects independently based on existing models with differing baselines, certain processes and interactions cannot be simulated or analyzed. This is a known limitation and deficiency of this approach. For example, use of San Luis Reservoir to hedge or backstop a pulse flow is not implemented or tracked cumulatively. We also made a decision to implement a project hierarchy that resulted in implementation of the effects of Sites and LVE before any GW bank. It is possible one WSIP project may reduce the performance of another, but we made no attempt to resolve these disputes.

It is possible the implementation of all projects cumulatively into a CalSim II model would reduce some limitations of the post-processor approach. However, this would be a significant undertaking that would require consideration of the observations from this study before implementation. Any CalSim II model would still be dependent on the limited number of months and years when supply is available to divert for surface storage and to fill GW banks. There would likely still be situations when a pulse flow could not be provided unless DWR negotiated with member agencies to modify SWP Table A allocations for pulse flow compensation. To that effect, the post-processor provides a reasonable depiction of the general trends expected with cumulative implementation of WSIP projects, and there is no reason to believe a modified CalSim II model would produce significantly different results.

The post-processing tool combined information and results from many sources. The tool integrates results from different CalSim II baselines – the updated WSIP Baseline developed in 2021, the baseline used for the original WSIP applications, and 2022 models used for the Sites project. Some conflicts have been identified in certain periods (i.e., LVE exporting Delta surplus in the LVE Alternative CalSim II model when it is not available in the WSIP Baseline) and may be likely caused by incompatibilities between the two baselines. These conflicts could be reduced if all WSIP projects would redo their CalSim II modeling used the updated WSIP Baseline. However, this is subject to further directives from DWR or the California Water Commission and is outside of the current scope.

The post-processor incorporated the same assumptions as the GW bank spreadsheet models that were developed and optimized using a future conditions baseline (2030 conditions) instead of an existing baseline (WSIP Baseline). The difference in baselines likely results in different yields for each project. For example, Chino Basin is the only GW bank that allows borrowing, or negative storage, at an amount that was determined based on optimizing the model for future conditions. The post-processor results show Chino Basin borrows capacity more frequently and for longer durations than in the original model, which results in greater deliveries to IEUA and MWD. These assumptions and the specific model thresholds determined based on future conditions should assessed with the project proponents to ensure the original assumptions are still valid.

The carriage water consideration was included in MOD1, but it was not explicitly considered in MOD2 when evaluating Banks export reductions in summer months due to pulse flow compensation reductions for Oroville releases. Our results likely overstate the export reductions required since some of the Delta inflow reductions would reduce carriage water instead. This is an area that can be refined in the future.

From the viewpoint of operations, it is critical to recognize that the WSIP projects are at different levels of approval for implementation. Some (e.g., LVE) have completed a federal feasibility study including environmental review, and some are still working on necessary environmental review. The permit acquisition process and schedule of these WSIP projects may differ further. Therefore, the preliminary results should be reviewed in consideration that not all assumed operations for each WSIP were approved by DWR or other appropriate entities. While the assumptions were consistent with the project proposal based on best available information, Stantec has not had direct communications with project proponents for questions and clarifications. Therefore, the CVP and SWP allocations and use of Article 21 for these projects may be subject to change, including the additional assumptions Stantec incorporated into the post-processing tool for prioritizing (or more specifically, deprioritizing) certain operations. However, it is also important to note that the equal sharing principal currently imposed in the post processing tool for Kern Fan and Willow Springs only has a minor effect on the overall ability for the three GW banks to provide the Oroville pulse flow.

APPENDIX

Appendix A POST-PROCESSOR DETAILS

The following sections provide detailed descriptions of the assumptions laid out in the procedural summary. The analysis assumes the following:

- A post-processing tool has been developed to model and evaluate the cumulative implementation of six WSIP Projects: Sites, LVE, Harvest, Kern Fan, Willow Springs, and Chino Basin.
- The WSIP CalSim II existing conditions model provided by DWR serves as the baseline for the analysis. This is referred to as the WSIP Baseline.
- The first modification to the WSIP Baseline is to implement the cumulative operations of the three WSIP surface water diversion projects (Sites, Harvest, and Los Vaqueros). This first modified baseline is referred to as MOD1.
- MOD1 is then modified to implement the coordinated operations of the coordinated pulse flows from the three WSIP groundwater bank projects (Chino Basin, Kern Fan, and Willow Springs). This second modified baseline is referred to as MOD2.
- With the MOD1 and MOD2, changes are tracked and quantified for the following major variables:
  - Flows in the Feather River
  - Flows in the Sacramento River
  - Delta inflow from the Sacramento River
  - Delta inflow from Yolo Bypass
  - Delta surplus
  - SWP Delta exports from Banks
  - GW bank account balances

A.1 SURFACE WATER DIVERSIONS, RELEASES, AND DELTA ASSUMPTIONS

The following sections provide detailed descriptions of the assumptions for the three WSIP surface water diversion projects (Sites, Harvest, and LVE) and Delta operations. The analysis assumes the following:

A.1.1 Main Assumptions

Projects are implemented from upstream to downstream based on how they impact Delta inflows, Delta surplus, and Delta exports. The simplified operations of the three WSIP surface water diversion projects are layered onto the WSIP Baseline in the following order:

1. Sites
2. Harvest
3. LVE

This modified baseline is referred to as MOD1. Each operation is layered onto the WSIP Baseline in series, i.e., first, changes from Sites operation are made, second, changes from Harvest operation are made, and third, changes from the LVE operation are applied.

- MOD1A – Sites operations applied
- MOD1B – Harvest operations added after Sites operations applied
- MOD1C – LVE operations added after Sites and Harvest operations applied

It is assumed that the Sites and LVE operations under the WSIP Baseline CalSim II existing condition model meet salinity operations standards,

Under the WSIP Baseline, Sites and LVE operations meet salinity operation standards. It is assumed that adding the three WSIP surface water diversion projects together onto the WSIP Baseline will not violate salinity standards as long as the post-processor recalculates surplus and exports to maintain Delta balance (see Delta Operations section for more detail). This assumption was made because salinity standards are too complex to model in the post-processor and a simplifying assumption is needed. As long as the Delta remains in balance, it is assumed Delta interior hydrodynamics are not modified significantly and Delta salinity standards are maintained.

A.1.2 Sites

The actual operational rules of Sites are not relevant to the analysis, only the effects of Sites operations on the Delta and SWP/CVP systems. The effects of Sites Reservoir operation are simulated by applying the change between the Sites Alternative 3 and the Sites No Action Alternative (NAA), referred to as the Sites Difference (Sites_D), to the WSIP Baseline at several CalSim II nodes. These changes are referred to as MOD1A. There are minimal changes between Sites Alt 3 and the NAA for major storage reservoirs and SWP and CVP allocations, so these are ignored. The focus of the analysis is on changes to Delta inflows, exports, and control.

Delta Inflow

Sites Reservoir operations primarily impacts flows in the Sacramento River (via diversions and releases) and Yolo Bypass (via releases). Delta inflow are modified by calculating the Sites_D at two locations: the Sacramento River at Hood (C400) and the Yolo Bypass at (C157). The Sites_D at these two locations are summed to produce a total change in Delta inflow.

Export Changes

The Sites_D of Banks exports (D419) in each month is added to the WSIP Baseline Banks exports to create a new variable, D419_MOD1A. This calculation is checked against Banks permit capacity (BANKSALLOWOUT), regulatory capacity, and health and safety minimums:

- Permit capacity
  - If D419_MOD1A is less than BANKSALLOWOUT, no additional action is taken.

  - If D419_MOD1A is greater than BANKSALLOWOUT, the additional exports above the export capacity for the month are tracked as 'infeasible', and no additional modifications are made.
- Regulatory capacity as defined as the minimum of flows available under the EI ratio export cap, Apr-May D-1641 export cap, D-1641 outflow control, D-1641 salinity control, OMR, and the SWP ITP export cut (April-May spring outflow).
  - If increases in exports are within regulatory capacity, no additional action is taken.
  - If increases in exports are not within regulatory capacity, exports are set to the regulatory capacity limit, and the additional exports above the limit are tracked as 'infeasible'.
- Health and safety minimum:
  - Any reductions in exports that reduce Banks monthly exports below 300 cfs are tracked as 'infeasible'.

There are only minor changes in Jones exports for Sites_D but large increases in summer exports at Banks. Additional Banks exports are tracked and implemented in MOD1A to further constrain export and conveyance capacity for the next project applied in the cumulative analysis.

Delta Surplus Modifications and Delta Control

Changes to WSIP Baseline Delta surplus are calculated as the net change in Sites Delta inflow and Sites Banks exports (i.e., changes in Sites Delta inflows minus changes in Sites Banks exports). This net change is added to (if positive) or subtracted from (if negative) the WSIP Baseline Delta surplus flows (C407_SWP + C407_CVP), creating a new Delta surplus variable C407_MOD1A. The following actions are taken:

- If the net change is positive, no additional action is taken. WSIP Baseline Delta surplus flows have been increased, the Delta is in balance conditions, and C407_MOD1A is available to be exported for the next project.
- If the net change is negative:
  - If the resulting Delta surplus C407_MOD1A is still positive, WSIP Baseline Delta surplus flows have been decreased, and the reduced value is carried forward to cumulative projects.
  - If the resulting Delta surplus C407_MOD1A is negative, C407_MOD1A is set to 0 and no surplus flow is available for the next project. The negative amount is tracked as 'infeasible', i.e., a reduction in Sites yield due to conflicts with the WSIP Baseline.

Additional Assumptions

There will be no assumed changes to the following in the WSIP Baseline based on the comparison between Sites Alternative 3 and Sites NAA. These variables were not changed significantly in the Sites alternative relative to the Sites baseline, and thus their inclusion in the post-processing tool is not warranted.

- Shasta storage (minor changes < 3% in all WY types)
- Oroville storage (minor changes < 1% in all WY types)
- Folsom storage (minor changes < 1% in all WY types)
- San Luis Reservoir CVP or SWP storage (minor changes < 4% in all WY types)

- SWP Table A allocations (minor changes < 2% in all WY types)
- CVP M&I and SOD M&I allocations (minor changes < 2% in all WY types)
- CVP Ag and Ag SOD allocations (minor changes < 4% in all WY types)
- Jones exports (minor changes < 1% in all WY types)
- Cross Valley Canal deliveries (minor changes < 2 cfs in all WY types))

A.1.3 Harvest

The effects of Harvest operation are simulated by applying a monthly reduction in flow in the Sacramento River at Hood (C400) and a monthly increase in flow in the Mokelumne River inflow to the Delta (C504). Conditions from the WSIP application will be used, reflecting 2030 conditions with climate change after twenty years of operations when groundwater return flows contribute to increases in surface water flows. These changes are referred to as MOD1B. Reductions in return flow to the Sacramento River of 50,000 AF per year was approved in the water rights Wastewater Petition WW0092. The WSIP application described additional return flows.

Sacramento River Flow Changes

The net difference between monthly waste-water discharge reductions into the Sacramento River and monthly increases in return flows to the Sacramento River is calculated and applied as a time series to reduce Delta inflows at the Sacramento River at Hood (C400):

- Annual discharge reductions into the Sacramento River are calculated as 42,850 AF per year. This value, reported in the WSIP application and consistent with the water rights Wastewater Petition WW0092, reflects a discharge reduction of 50,000 AF into the Sacramento River and a diversion reduction of 7,150 AF (due to future offsetting groundwater extractions). Monthly values are calculated based on the monthly discharge reduction percentages reported in the WSIP application (Table 2a in the application).
- Annual increases in Sacramento River are calculated as 1,744 AF per year, which is 5% of the total return flow increases in the Consumnes and Sacramento Rivers. Monthly values are calculated based on the monthly increase in streamflow percentages reported in the WSIP application (Table 5a in the application).
- The net change in annual flow at C400 is -41,106 AF (-42,850 AF + 1,744 AF), applied based on monthly percentages as a decrease in Delta surplus flow (C407_MOD1A).

Mokelumne River Flow Changes

The increase in monthly return flows into the Consumnes River is calculated and applied as a time series to increase Delta inflows at the Mokelumne River at Hood (C504), which increases flow available as Delta surplus:

- Annual increases in Mokelumne River are calculated as 33,133 AF per year, which is 95% of the total return flow increases in the Consumnes and Sacramento Rivers. Monthly values are calculated based on the monthly increase in streamflow percentages reported in the WSIP application (Table 5a in the application).

- The net change in annual flow at C504 is 33,133 AF, applied based on monthly percentages as an increase in Delta surplus flow (C407_MOD1A)

Delta Surplus Modifications and Delta Controls

Harvest operations will change Delta inflows, which will change Delta surplus. Increases in Delta surplus would not influence any operations and needs no further action. Decreases in Delta surplus may require reductions in exports, especially if the reduction is greater than the surplus available.

Modifications to C407_MOD1A Delta surplus are calculated as the net change in Sacramento River flow and Mokelumne River flow. This change is added to (if positive) or subtracted from (if negative) the C407_MOD1A Delta surplus flows, creating a new Delta surplus variable C407_MOD1B.

Based on the net change to C407_MOD1A, Banks exports (D419_MOD1A) would be modified to a value of based on the following:

- If the net change is positive, no additional action is taken. C407_MOD1A Delta surplus flows have been increased, the Delta is in balance, and C407_MOD1B is available to be exported for the next project.
- If the net change is negative:
  - If the resulting Delta surplus C407_MOD1B is still positive, C407_MOD1A Delta surplus flows have been decreased, the Delta may no longer be in a balanced condition, and action would be needed to decrease exports depending on the controlling regulation in the Delta for that given month:
    - If the WSIP Baseline Delta condition is Surplus, no additional action is taken.
    - If the WSIP Baseline Delta is Surplus with restrictions or Balanced (see Delta Operations section), exports would need to be reduced to maintain Delta balance. The volume of export reductions are calculated as described in the Delta Operations section. A new export value is calculated as D419_MOD1B.
  - If the resulting Delta surplus C407_MOD1B is negative, C407_MOD1A Delta surplus flows have been decreased and the Delta is no longer in balance. The volume of export reductions would be calculated as described in the Delta Operations section depending on the WSIP Baseline Delta condition in that given month. The new export value will be calculated as D419_MOD1B.

A.1.4 Los Vaqueros Expansion

The actual operational rules of LVE are not relevant to the analysis, only the effects of LVE operations on the Delta and SWP/CVP systems. There are minimal changes between LVE Alt 1B and the LVEEC for major storage reservoirs and SWP and CVP allocations, so these are ignored. The focus of the analysis is on changes to Delta surplus and exports. The effects of LVE Reservoir operation are simulated by applying the change between the LVE Alternative 1B and the LVE Existing Conditions (LVEEC), referred to as the LVE Difference (LVE_D), to MOD1B at several CalSim II nodes. These changes are referred to as MOD1C.

Delta Surplus Modifications and Delta Control

The effect of LVE operations is primarily a reduction in Delta surplus flows. These reductions need to be checked against the cumulative surplus flows (those modified by Sites and Harvest).

The differences in Delta surplus flow (C407) in LVE_D are summed and added to (if sum is positive) or subtracted from (if sum is negative) Delta surplus flow (C407_MOD1B), creating a new Delta surplus variable C407_MOD1C.

- If the net change is positive, no additional action is taken. C407_MOD1B surplus flows have been increased, the Delta is in balance, and C407_MOD1C is available to be exported for the next project.
- If the net change is negative:
  - If the resulting Delta surplus C407_MOD1C is still positive, C407_MOD1B Delta surplus flows have been decreased, and the reduced value is carried forward to cumulative projects.
  - If the resulting Delta surplus C407_MOD1C is negative, C407_MOD1B is set to 0 and no surplus flow is available for the next project. The negative amount is tracked as 'infeasible', i.e., a reduction in LVE yield due to conflicts with the WSIP Baseline, Sites, and Harvest implementation.

Export Changes

The LVE_D of LVE exports (D419) in each month is added to D419_MOD1B Banks exports to create a new variable, D419_MOD1C. This calculation is checked against Banks permit capacity (BANKSALLOWOUT), regulatory capacity, and health and safety minimums:

- Permit capacity
  - If D419_MOD1C is less than BANKSALLOWOUT, no additional action is taken.
  - If D419_MOD1C is greater than BANKSALLOWOUT, the additional exports above the export capacity for the month are tracked as 'infeasible', and no additional modifications are made.
- Regulatory capacity as defined as the minimum of flows available under the EI ratio export cap, Apr-May D-1641 export cap, D-1641 outflow control, D-1641 salinity control, OMR, and the SWP ITP export cut (April-May spring outflow), as reduced by Sites and Harvest.
  - If increases in exports are within regulatory capacity, no additional action is taken.
  - If increases in exports are not within regulatory capacity, exports are set to the regulatory capacity limit, and the additional exports above the limit are tracked as 'infeasible'.
- Health and safety minimum:
  - Any reductions in exports that reduce Banks monthly exports below 300 cfs are tracked as 'infeasible'.

Additional Assumptions

There will be no changes to the following based on the comparison of the LVE Alternative 1B to the LVEEC. These variables were not changed significantly in the LVE alternative relative to the LVE baseline, and thus their inclusion in the post-processing tool is not warranted.

- Shasta storage (minor changes < 2% in all WY types)
- Folsom storage (minor changes < 1% in all WY types)
- Delta inflow (minor changes < 0.5% in all WY types)
- San Luis Reservoir CVP or SWP storage (minor changes < 3% in all WY types)
- SWP Table A allocations (minor changes < 1% in all WY types)
- CVP M&I and SOD M&I allocations (minor changes < 1% in all WY types)
- CVP Ag allocations (minor changes < 1% in all WY types)
- Jones and Banks exports (minor changes < 1.5% in all WY types)

A.1.5 Delta Operations

The post-processor is not simulating Delta interior hydrodynamics or Delta control, so rules are needed to determine how to treat Delta surplus under the cumulative analysis based on the controlling regulation.

WSIP Baseline Delta Classification

In each month, a lookup of the WSIP Baseline variables classifies the Delta into one of the following conditions:

- Balanced
  - Delta surplus (C407 or MOD version) = 0 and a controlling regulation is identified
- Surplus with restrictions
  - Delta surplus (C407 or MOD version) >0 and a controlling regulation is identified
- Surplus (with no controlling regulations)
  - Delta surplus (C407 or MOD version) >0 with no controlling regulation

The lookup determined which of the following regulations is controlling Delta operations in the given month, if applicable, based on the CalSim II variable condition listed in parenthesis:

- EI ratio cap export control (EIEXPCTRL = C409)
- OMR control (C408_LBOUND = C408 = C409)
- D-1641 outflow control (C407_SWP + C407_CVP + C407_ANN = 0)
- D-1641 salinity control (C407_ANN > 0)
- D-1641 Apr-May export control (AprMayExpCtrl = ExportactualTD)
- SWP ITP export cut control (April-May spring outflow) (SWPITP_ExpCut_SJRIE_> 0)
- Surplus (none of the above equations are valid)

Delta control does not change based on modifications to inflows, exports, or surplus flows. The WSIP Baseline control is assumed to remain in control throughout all post-processor modifications. The only exception is if Delta surplus flow is reduced to 0 in any given month, it is assumed the Delta is under D-1641 outflow control.

Delta Control, Delta Surplus, and Export Reduction

When Delta surplus flows are reduced, the following actions occur based on the WSIP Baseline Delta classification for that month, and whether the modeled reduction in Delta surplus flows is greater than the Delta surplus flow available.

The table below summarizes the adjustments to surplus or SWP exports based on changes to Delta inflow. For all cases when SWP exports are reduced, export reductions are tracked monthly without cumulative effects, are not carried SOD, and do not have an impact on post-processed storage or allocations.

Controlling Regulation	Surplus with restrictions	Balanced[1]
EI ratio cap export control	Split reduction between SWP exports and Delta outflow by appropriate proportion to maintain EI ratio control. Track volume of required Delta outflow reductions.[1]	Split reduction between SWP exports and Delta outflow by appropriate proportion to maintain EI ratio control. Track volume of required Delta outflow reductions.
OMR control	Reduce surplus 1:1 to Delta inflow reduction until all surplus is eliminated, then refer to Balanced condition	Reduce SWP exports at a 1:1 ratio to Delta inflow reduction
D-1641 April-May export cap control	Reduce surplus 1:1 to Delta inflow reduction until all surplus is eliminated, then refer to Balanced condition	Reduce SWP exports at a 1:1 ratio to Delta inflow reduction
D-1641 outflow control	Not applicable	Reduce SWP exports at a 1:1 ratio to Delta inflow reduction
D-1641 salinity control	Not applicable	Split reduction between exports and Delta outflow based on carriage water requirements. Track volume of required Delta outflow reductions.
SWP ITP export cut (April-May spring outflow)	Reduce surplus 1:1 to Delta inflow reduction until all surplus is eliminated, then refer to Balanced condition	Not applicable unless all surplus has been reduced, then reduce SWP exports at a 1:1 ratio to Delta inflow reduction

[1] For Sites and LVE, these export cuts are tracked as 'infeasible' with the WSIP Baseline and are not cumulatively implemented.

Additional Assumptions

The following assumptions are inherent to the implications to Delta operations and control described above:

- No assessment is made of changes to Delta interior hydrodynamics
- Salinity changes associated with changes in inflows and exports are not accounted for

- No changes to OMR flows or assessment of when OMR may control based on changed Delta conditions

A.2 GROUNDWATER PROJECT COORDINATION

A.2.1 Main Assumptions

The simplified operations of each WSIP groundwater bank are layered onto MOD1 using the spreadsheet model provided by each project as part of the WSIP application (or an updated model as requested by DWR). Each spreadsheet model generally contains a water balance of inflows, outflows (for pulse exchange only) including losses, and change in GW storage (only the environmental storage account for pulse flows), with other changes to MOD1 as discussed below. The changes from GW banks layered onto MOD1 are referred to as MOD2.

A.2.2 Groundwater Bank Storage

The GW storage capacity of each GW bank available for storing environmental pulse flow volumes is the amount stated in the WSIP application

- Chino Basin: 50 TAF (50 TAF is released when called on for a pulse flow)
- Kern Fan: 25 TAF (18 TAF is released when called on for a pulse flow)
- Willow Springs: 28.6 TAF (annual pulse flows can be released up to 28.6 TAF)

Each GW bank has specific pulse flow volumes that are assumed released out of Oroville and specific volumes of water that are released to Partner Contractors to compensate for reduced exports from Banks. A smaller volume is used for compensation since carriage water was not needed to deliver water from Oroville to Banks. The assumed pulse flow and compensation flow are:

- Chino Basin: 50 TAF pulse flow release from Oroville, 40 TAF compensation flow (20% carriage water savings)
- Kern Fan: 18 TAF pulse flow release from Oroville, 14 TAF compensation flow (23% carriage water savings)
- Willow Springs: 28.6 TAF pulse flow release from Oroville, 28.6 TAF compensation flow (0% carriage water savings)

A.2.3 Groundwater Bank Filling

Each GW bank operates as a separate entity with independent filling operations. For the purposes of modeling, delivery of Delta surplus flow (C407_MOD1C) is split between Willow Springs and Kern Fan so as not to prioritize one GW bank over the other.

Chino Basin

Chino Basin is filled using a constant source of treated water using a time series and magnitude of water consistent with what was used in the WSIP application.

Kern Fan

Kern Fan is filled using unallocated SWP Article 21 supplies, consistent with the WSIP application. For modeling purposes, it is assumed additional exports could only occur when Delta surplus flow is available (C407_MOD1C > 0) and the Delta is in Surplus conditions (if the Delta is Surplus with restrictions or Balanced, there is no mechanism to increase Delta inflow and maintain Delta balance if exports are increased). A volume of water is assumed delivered to Kern Fan that is the minimum of the following in the given month:

- Delta surplus flows (C407_MOD1C)
- Banks export capacity (D419_MOD1C)
- Available storage capacity in Kern Fan
- Largest available conveyance capacity available in the California Aqueduct at key locations upstream of the Project:
  - C805 (capacity = 10,000 cfs)
  - C846 (capacity = 8100 cfs)
  - C865 (capacity = 4,480 cfs)
- Article 21 supplies based on contractor amount
- WSIP application identified conveyance capacity of 23.8 TAF per month (400 cfs).

Willow Springs

Fill occurs using opportunistically captured Delta surplus flow, which is stored in San Luis Reservoir in Pre-Evacuated Public Benefit Space that was created by moving water from San Luis Reservoir to the Water Bank earlier in the year. A simplified spreadsheet model of the Willow Springs operation, based on the April 6, 2022, Technical Memo from Willow Springs, determines the operation. Storage space in San Luis Reservoir made available by pre-evacuation can be filled by additional exports of Delta surplus from MOD1 (as limited by permit/regulatory export capacity), thereby generating additional yield. This additional yield is then moved into the GW bank into an Ecological Benefit Storage account, which is used to compensate for pulse flow releases. The deficit in San Luis Reservoir due to pre-evacuation is always made up by the end of the water year, either by Antelope Valley-East Kern Water Agency (AVEK) taking its Table A allocation from, as the GW bank instead of San Luis Reservoir, or by returning pre-evacuated water to the California Aqueduct. Water stored in the GW bank is subject to a 10% leave-behind, removed from the Ecological Benefit Storage account, in two cases. First, when additional yield is moved into the Ecological Benefit Storage account, and second, when pre-evacuated water is returned to the California Aqueduct. .

A.2.4 Groundwater Bank Coordinated Pulse Flow Exchange with Oroville

Each GW bank is coordinated to exchange banked GW for storage in Oroville to enable a spring pulse flow release from Oroville and subsequent summer reduction in Oroville releases to the Feather River.

For modeling purposes, the following assumptions on pulse flow magnitude, source, triggers, and timing are proposed. If desired, a time series of years when pulse flows are requested could also be developed as a trigger :

- Pulse flow magnitude and source (i.e., GW bank priority)
  - Capacity is combined from multiple GW banks to deliver a pulse flow with magnitude up to 97 TAF in a given year.
    - Capacity contributed by each GW bank is limited by how much each GW bank had in storage available to be used in that year for a pulse flow.
    - The entire capacity available in each GW bank is used for the pulse, except for Kern Fan, which does not allow a partial pulse flow.
- Pulse flow trigger and timing
  - To occur in April of below normal and dry water year types
  - To occur only if GW banks have water in storage available for use as a pulse flow (e.g., Willow Springs could not provide pulse using water in storage that was delivered in a year when pre-evacuation occurred)
  - Additional pulse flow constraints vary by project:
    - Chino Basin will only make a pulse flow for either 3 consecutive or 4 out of 10 years, and only if Lake Oroville storage and San Luis Reservoir storage are within minimum and maximum threshold values.
    - Kern Fan will only make a pulse flow if final SWP Table A allocations are greater than 20% and only if sufficient storage has accumulated in the account to deliver the full pulse flow requested (i.e., Kern Fan will not make partial delivery).
    - Willow Springs does not have an SWP Table A allocation threshold or minimum storage level for making a pulse flow.
- To occur only if magnitude and timing of Feather River flow reductions in July through September could occur:
  - Reductions to releases from Lake Oroville would be made in July - Sep of same year of pulse flow to ensure storage at Sep EOM is equal to WSIP Baseline storage conditions
  - Reduced Oroville releases would result in reduced flow in the Feather and Sacramento Rivers. The magnitude of possible reductions, and thus the magnitude of the pulse flow, would be constrained by:
    - Meeting the monthly minimum flow in the Feather River (C203_MIF or C223_MIF, whichever is more restrictive)
    - Reductions to Delta inflow resulting in reductions to Feather River flows must not cause Delta to be taken out of a balanced condition. The same rules developed for Sites and LVE Delta surplus modifications and Delta control are assessed to determine if the Delta was in surplus and inflow reductions could have occurred with no additional action, or if the Delta was controlled and reductions in exports would need to be assumed equivalent to reductions in inflows.
  - Feather River releases could be reduced across several months or could be reduced in some months and not others, depending on the constraints above. There is no priority to reduce flows evenly across months.

DRAFT

DRAFT WSIP CUMULATIVE FLOW ANALYSIS-NARRATIVE

(DWR – August 2022)

1. Introduction

The Water Storage Investment Program (WSIP) is a $2.7 billion program for investments in water storage projects in California, approved by the voters through Proposition 1 in 2014 and administered by the California Water Commission (CWC). Seven projects have been selected for funding consideration based on a rigorous review process. In addition to water storage benefits, the CWC selected projects that demonstrate an ability to provide public benefits related to flood control, ecosystem improvement, water quality improvement, recreation, and/or emergency response. The selected WSIP projects range from expanding existing reservoirs to boosting groundwater storage to building modern surface storage facilities. Once operational, the seven WSIP projects listed below would increase California's water storage capacity by 4.3 million acre-feet over the current (2021) baseline. The projects are listed below and are described in Section 2.

- Chino Basin Program (Chino Basin)
- Kern Fan Groundwater Storage Project (Kern Fan)
- Willow Springs Water Bank Conjunctive Use Project (WSWB)
- Los Vaqueros Reservoir Expansion Project (LVE)
- Sites Reservoir Project (Sites)
- Pacheco Reservoir Expansion Project (Pacheco)
- Harvest Water Program (Harvest Water)

The purpose of the cumulative flow analysis is to describe changes to the flows in the Feather River, Sacramento River, and Delta areas if the WSIP projects were in operation. There has been no similar analysis done by any of the individual WSIP projects. The projects have evolved, and some are still evolving, since the CWC application stage. This analysis puts the cumulative flow changes associated with the projects in the context of overall flows in the waterways on a monthly and water-year-type basis.

The quantitative analysis is based on a CalSim II post processing study done by Stantec – "Cumulative Flow Effect Analysis of Water Storage Investment Program Projects" – Draft July 2022 (Stantec Report). The Stantec Report did not include the Pacheco project as that project has minimal impacts of the waterways studied in this flow analysis[1].

This paper helps interpret modeling results from the Stantec Report and includes WSIP project information from publicly available information. It summarizes anticipated changes in flows due to these projects including amounts, monthly variations, and year types. It also considers the magnitude of these changes compared to baseline flows and hydrologic conditions (i.e., excess, or balanced conditions) to provide context for the anticipated changes.

[1] Draft EIR Pacheco Reservoir Expansion Project November 2021 Tables 3.12.33 and 3.12.34

This analysis is intended to assess potential cumulative hydraulic impacts to waterways and Delta exports and therefore does not attempt to assess potential cumulative impacts to aquatic or biological resources- as these impacts occur on a daily/ short-term time step as compared to a monthly, annual, long-term timestep as evaluated here. This memorandum does not address the environmental impacts of the WSIP projects pursuant to the California Environmental Quality Act (CEQA). Each WSIP project has either completed or is in the process of completing its own environmental documentation for CEQA compliance, including a discussion of cumulative effects as required by CEQA.

2. Background

This section provides background information on the State Water Project (SWP) and the seven WSIP projects.

The California Department of Water Resources (DWR) holds contracts with 29 public agencies for water supplies from the SWP. Key SWP facilities are Lake Oroville, the Harvey O. Banks Pumping Plant, and San Luis Reservoir. These facilities are operated and connected by a network of canals, aqueducts, and other facilities to deliver on average approximately 2.6 million acre-feet of contracted water supplies annually (Reclamation, 2019).

The U.S. Department of the Interior Bureau of Reclamation (Reclamation) also delivers water through the Delta at its Central Valley Project (CVP) pumping plant in the south Delta, Jones Pumping Plant, and either delivers it directly or stores water in San Luis Reservoir for later delivery to its contractors south of the Delta. DWR and Reclamation coordinate their operations on a daily basis. Some factors that DWR and Reclamation consider when coordinating their joint operations include required in-Delta flows, Delta outflow, water quality, fish species protections, schedules for the joint use facilities (e.g., San Luis Reservoir), pumping/wheeling arrangements,[2] and facility capacity limitations.

During balanced water conditions, DWR and Reclamation share a responsibility to meet in-basin uses and maintain a daily water accounting of the SWP and CVP obligations in conformance with the Coordinated Operation Agreement between the two projects. Balanced water conditions are defined as periods when it is mutually agreed that releases from upstream reservoirs plus unregulated flows approximately equal the water supply needed to meet Sacramento Valley in-basin uses plus exports. Excess water conditions are periods when it is mutually agreed that releases from upstream reservoirs plus unregulated flows exceed Sacramento Valley in-basin uses plus exports. The duration of balanced water conditions varies from year to year. While balanced conditions may never occur in some very wet years, some very dry years may have long continuous periods of balanced conditions, and still other years may have several periods of balanced conditions interspersed with excess water conditions. During excess water conditions, sufficient water is available to meet all beneficial uses, and the CVP and SWP are not required to supplement the supply with water from reservoir storage. As specified in the Coordinated Operation Agreement, DWR and Reclamation have the responsibility during excess water conditions to store and export as much water as possible within physical, legal, and contractual limits (Reclamation, 2019). If there is additional water supply beyond the capacity of the SWP and CVP to store or deliver in excess conditions, that water can be made available to individual CVP and SWP contractors.

Article 21 water is one of several types of SWP water supply made available to the SWP contractors under the long-term water supply contracts between DWR and the SWP contractors. Unlike Table A water, which is the maximum allocated annual supply made available for scheduled delivery throughout the year, Article 21 water is made available only when certain conditions exist (which occur predominately in wet years). As with all SWP water, Article 21 water is supplied under existing SWP

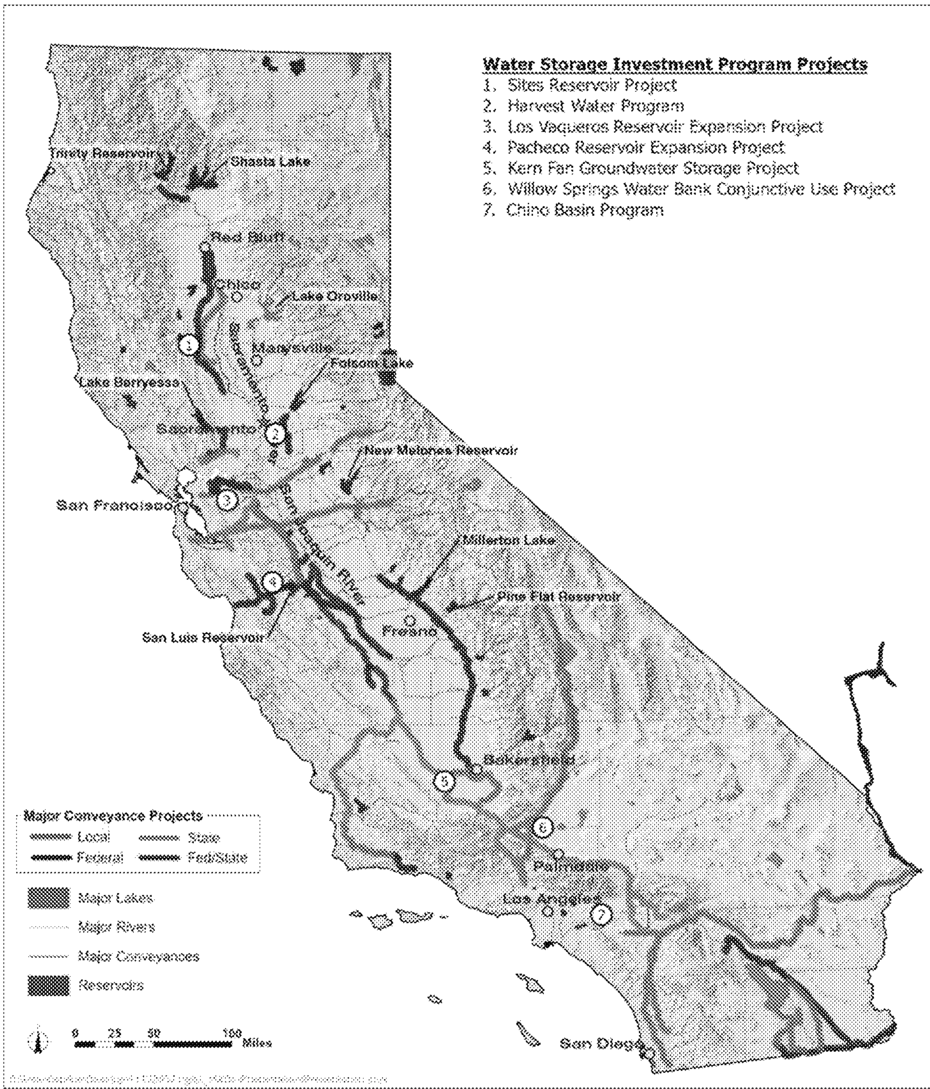
[2] Wheeling means using the water supply facilities by someone other than the owner or operator to transport water for a fee.

water rights permits and is pumped from the Delta under the same environmental, regulatory, and operational constraints that apply to all SWP supplies.

Article 21 water is typically offered to contractors on a weekly basis when all of the following conditions exist: (1) the SWP share of San Luis Reservoir is physically full, or projected to be physically full within approximately 1 week at permitted pumping rates; (2) other SWP reservoirs south of the Delta are at their storage targets or the conveyance capacity to fill these reservoirs is maximized; (3) the Delta is in excess condition; (4) current Table A demand is being fully met; and (5) Banks Pumping Plant has export capacity beyond that which is needed to meet current Table A and other SWP operational demands. The increment of available unused Banks Pumping Plant capacity is offered as the Article 21 delivery capacity (Reclamation, 2008).

The seven WSIP projects are described below. The location of each of the projects and how operations can affect hydrologic conditions are also described below. For the five WSIP projects that involve the SWP (Chino Basin, Kern Fan, WSWB, Sites and LVE), DWR has not yet approved operations of the projects, so the operations described below are subject to change.

The flow numbers in this paper come from several sources. Each WSIP project used flow models at various stages of project development (i.e., application, feasibility study and CEQA). The Stantec Report uses a 2021 version of CalSim II that the WSIP projects generally did not use. This can create some differences in flow data such as baseline flows in waterways. This can affect calculations such as the percentage of flow in a waterway impacted by a WSIP project. Data sources are footnoted to show where data came from.



Pulse Flow Projects

The following are operations common to the three Pulse Flow Projects (Chino Basin, Kern Fan and WSWB),

In dry and below normal years, stored water would be used to provide pulse flows to enhance spring instream flows in the Feather River below Lake Oroville. The amount of a pulse flow in a given year will be determined by California Department of Fish and Wildlife (CDFW) requests and DWR approval of a pulse flow. The modeling uses assumed maximum amounts of water stored for each project. A water exchange process is required to replace water used for pulse flows with stored groundwater. This will require agreements with SWP Partner Contractors to forego SWP Table A deliveries equivalent to the pulse flow amount in exchange for receiving an equivalent amount of water from the groundwater bank. South-of-Delta exports needed to meet SWP Partner Contractor Table A demands would be reduced by the amount of water released for pulse flows. A credit for a reduction of Delta carriage water requirements is being considered. Also required are agreements with DWR and CDFW to re-operate Lake Oroville and manage the water to provide the pulse flows

Chino Basin Program

Chino Basin would construct a new advanced water treatment facility and distribution facilities in western San Bernardino County that would store up to 15 thousand acre-feet (TAF) per year of treated wastewater in the Chino Basin (groundwater bank). Chino Basin would be operated to dedicate blocks of water, assumed to be in increments of 50 TAF,[3] for Oroville pulse flows. The Partner Contractor will be the Metropolitan Water District of Southern California. After the initial 25 years of operation and fulfilling ecosystem public benefits, pulse flows would cease, and Chino Basin would be operated for local water supply benefits.

Kern Fan Groundwater Storage Project

Kern Fan would develop a regional groundwater bank in Kern County, west of Bakersfield, that would store up to 100 TAF per year of Article 21 water and other available water supplies, including Federal Section 215 water. Kern Fan would be operated so that in wet years, the project would store these water supplies in the water bank. Twenty-five percent of the stored water, up to 25 TAF would be stored in an "ecosystem account" and would be dedicated for Oroville pulse flows in blocks of water assumed to be 18 TAF[4] each. The remaining water would be stored by the project participants for water supply reliability purposes. The Partner Contractors are anticipated to be Kern County Water Agency and Dudley Ridge Water District. After the initial 50 years of operation and fulfilling ecosystem public benefits, pulse flows would cease, Kern Fan would be operated for local water supply benefits.

Willow Springs Water Bank Conjunctive Use Project

WSWB would enhance the existing Willow Springs Water Bank located in southern Kern County, northwest of the City of Lancaster, in the adjudicated Antelope Valley Groundwater Basin. WSWB is a conjunctive use and reservoir reoperation project that would leverage 560 TAF of existing groundwater storage facilities at the Willow Springs Water Bank and High Desert Water Bank and operate conjunctively with the SWP.

WSWB will pre-position SWP water to WSWB between November and April in years when there is not a low volume concern in San Luis Reservoir. This SWP water would be "owned" by DWR and used in any SWP allocation calculation. Article 21 water would not be utilized. Pre-positioning SWP water in the groundwater bank reduces the amount of water stored in San Luis Reservoir, thus increasing available storage capacity in the reservoir to be filled at a later date. "New" water is created when the pre-positioning allows SWP facilities to capture water that would otherwise not be pumped at Banks Pumping Plant due to storage capacity limitations. Pumping would occur when the SWP has water rights to divert and storage space or direct delivery capability in excess or balanced conditions. This operation could impact the availability of Article 21 by delaying conditions when Article 21 would be

[3] Pulse flows are modeled as 50 TAF but may vary in amounts per CDFW requests.
[4] Pulse flows are modeled as 18 TAF but may vary in amounts per CDFW requests.

available. DWR is expected to mitigate this impact by allowing SWP contractors to take Article 21 before San Luis Reservoir fills to mimic conditions without WSWB.

WSWB would be operated to dedicate blocks of water assumed to be 28 TAF[5] for Oroville pulse flows. The Partner Contractor is anticipated to be Antelope Valley East Kern Water Agency. After the initial 50 years of operation and fulfilling ecosystem public benefits, pulse flows would cease, and WSWB would be operated for local water supply benefits.

Los Vaqueros Reservoir Expansion Project

LVE is a surface storage project located in southeastern Contra Costa County that would enlarge the capacity of an existing off-stream reservoir by 115 TAF (from 160 TAF to 275 TAF). This project would also upgrade existing conveyance facilities, construct new conveyance, and re-operate existing facilities to develop water supplies for ecosystem public benefits and increased water supply reliability for project participants. LVE would divert water from the Delta at Rock Slough, Old River, and Middle River intakes that are operated by Contra Costa Water District, divert water from the Sacramento River at the Freeport Intake, and deliver water to project participants within Contra Costa Water District's service area, the Bay Area, the Delta, neighboring regions, and south-of-Delta wildlife refuges.

Diversions for LVE can be used for direct deliveries and for diversion to storage. Diversions would occur during excess and balanced conditions. During balanced conditions, total diversions at the Delta and Freeport intakes would increase by a long-term average of 58 TAF per year.[6] These diversions represent a reduction of about 0.5 percent or less of Delta outflow during dry and critical dry years[7],. During excess conditions total diversions at the Delta and Freeport intakes would increase by a long-term average of 69 TAF per year.[8] These diversions represent less than 0.3 percent reduction of Delta outflow during wet and above normal years.[9]

Commented [D1]: CCWD to check these numbers to conform to page 11 and Table 1.

The maximum diversion rates at the intakes are 250 cubic feet per second (cfs) for the Old River Intake, 250 cfs for the Middle River Intake (320 cfs for the Old River and Middle River Intakes combined), 350 cfs for the Rock Slough Intake, and 155 cfs (of project supplies) at the Freeport Intake. Diversion to storage from all sources requires the use of the Transfer Pump Station, which has a pumping capacity of 200 cfs, so the rate of diversion to storage is limited to 200 cfs. Direct deliveries up to 300 cfs can be made to the California Aqueduct through the proposed Transfer-Bethany Pipeline.

Sites Reservoir Project

Sites is a new surface storage reservoir located in Colusa County in the Sacramento Valley west of the town of Maxwell. Sites would be an off-stream 1.5 million acre-feet (MAF) reservoir that would impound Funks Creek and Stone Coral Creek and provide storage capacity for Sacramento River diversions. This project also includes conveyance through the use of the existing Tehama Colusa (T-C) Canal and Glenn-Colusa Irrigation District Canal (GCID) diversion and conveyance facilities. Operation of the proposed reservoir would be in cooperation with the operations of existing CVP and SWP system facilities. Sites would release water to the GCID Canal and the T-C Canal. A new Dunnigan Pipeline will allow water in the T-C Canal to flow into the Colusa Basin Drain and ultimately

[5] Pulse flows are modeled as 28 TAF but may vary in amounts per CDFW requests.
[6] This value represents the difference between Alternative 1B with transfers and the no project/no action alternative under existing conditions (see Reclamation 2020, revised Table 4.2-6 in Appendix B-1, Updated Modeling Analysis).
[7] Long-term Delta outflow is estimated at 16.3 million acre-feet per year (MAF/yr), with an average of 28.7 MAF/yr in wet years, 17.7 MAF/yr in above normal years, 9.5 MAF/yr in below normal years, 9.5 MAF/yr in dry years, and 5.3 MAF/yr in critical dry years (Reclamation 2019, Appendix D – Modeling, Table 41-1, Current Operations).
[8] This value represents the difference between Alternative 1B and the no project/no action alternative under existing conditions (see Reclamation, 2020; Revised Table 4.2-8 in Appendix B-1, Updated Modeling Analysis).
[9] See footnote 6.

back into the Sacramento River. Using these facilities, Sites water would be delivered to participants within neighboring areas, to SWP and CVP contractors, to the Yolo Bypass and to north- and south-of-Delta wildlife refuges. The project also includes exchanges with upstream reservoirs to preserve cold water releases for fishery benefits.

Diversions would range from an average of 61 to 406 TAF per year, depending on water year type, availability of Sacramento River water, and diversion and conveyance facility capacities.[10] Diversions would occur only under excess conditions. The maximum Sacramento River diversion rate is 3,900 cfs plus losses. Sacramento River flows would be diverted at the Red Bluff Pumping Plant (up to 2,100 cfs) and the Hamilton City Pump Station (up to 1,800 cfs). Modeling for the environmental documents show that the Sites Project diversions during wet years from January through March when excess conditions are expected shows a 3 to 4 percent reduction in flows in the Sacramento River downstream of Red Bluff Diversion Dam.

Excess condition diversions could occur anytime between September 1 to June 145, the timeframe that the Sacramento River is not fully appropriated; however, most diversions would occur from December through March during wet and above normal water years. Diversions are expected to decrease Sacramento River inflow to the Delta by approximately 2 percent (and less during wet water years), assuming an average diversion rate for above normal years of 406 TAF.[11]

Average annual releases from the Sites Project would range from 70 to 427 TAF per year, depending on water year type, with a long-term average annual release to Sacramento River or Yolo Bypass of 140 TAF (over all year types).[12] Water would be conveyed via existing waterways. The Dunnigan Pipeline diverts water released into the Tehama-Colusa Canal from Sites into the Colusa Basin Drain that eventually flows into the Sacramento River or the Yolo Bypass. Maximum releases to the Sacramento River would be 1,000 cfs. Releases would occur during balanced conditions.

Delta exports range from 13-203 TAF per year for Sites participants south of the Delta and for environmental water delivers to south of Delta refuges.

The table below summarizes the estimated Sites average diversions and releases by water year type.

Water Year Type (Sacramento Valley 40-30-30 Index)	Diversions to Storage (TAF)	Releases from Reservoir (TAF)	Releases through Dunnigan Pipeline to Sacramento River or Yolo Bypass (TAF)	Delta Exports for Sites Participants and Refuges (TAF)
Wet	390361	8681	7072	131+1
Above Normal	406488	154324	78102	340+2
Below Normal	213285	224285	440132	5337+18
Dry	134177	427440	254247	179182+28
Critically Dry	6142	348263	187*160	203*139+14

Commented [HE2]: Max diversions = 4,200 cfs from river. 3,900 into Sites (difference is potential canal losses).

Commented [HE3]: I believe these may be based on old modeling and not the model provided to Stantec in May 2022

Commented [MS4R3]: Erin's right – I updated to reflect Alt 3 from May 2022

[10] Sites Project Authority, 2021; Section 2.5.2.
[11] Long-term Sacramento River flow at Freeport is estimated at 15.5 MAF/yr, with an average of 22.4 MAF/yr in wet years, 18.2 MAF/yr in above normal years, 12.2 MAF/yr in below normal years, 11.5 MAF/yr in dry years, and 7.6 MAF/yr in critical dry years (Reclamation 2019, Appendix D – Modeling, Table 29-1, Current Operations).
[12] Sites Project Authority, 2020; Table 5-2 and 5-3 and Table B1-1.

Average Annual	257277	232256	140137	876812
*Values for exports can be higher than values for releases due to exchanges with the CVP				

Commented [HE5]: This should not be the case unless looking at a monthly timestep

Commented [MS6R5]: Agreed

Sites operations also includes exchanges with State and Federal facilities. Exchanges with upstream reservoirs could occur to preserve cold water in the upstream reservoirs for fishery benefits, with most of the exchanges occurring in dry and critical water year types.[13] These releases from Sites for exchanges would typically occur in spring and early summer with the exchanges listed below occurring in late summer and fall. The following exchanges would likely occur during balanced conditions, but do not represent the only timeline that they would be considered.

- Shasta Lake exchanges would result in Sites releasing water in the spring in exchange for Shasta Lake releases in August and September.
- Lake Oroville exchanges would result in Sites releasing water in June and July in exchange for Lake Oroville releases in August through November.
- Folsom Lake exchanges would result in Sites releasing water in the spring and early summer in exchange for Folsom Lake releases in late summer and fall.
- Real-time exchanges with local participants would result in deliveries from Sites to CVP partner contractors in lieu of direct diversions from the Sacramento River.

Pacheco Reservoir Expansion Project

Pacheco is a surface storage project located in southeast Santa Clara County that would enlarge an existing reservoir by 136 TAF (from 6 TAF to 142 TAF). The project would construct new conveyance infrastructure to the CVP San Felipe Division in Santa Clara County and deliver water supply to up to eight south-of-Delta wildlife refuges in Merced County. Pacheco benefits include increased delivery of water to south-of-Delta wildlife refuges, improved local habitat for threatened South-Central California Coast Steelhead, and emergency water storage. The primary water sources to fill the expanded reservoir would be natural inflows from the North and East Forks of Pacheco Creek and imported water from San Luis Reservoir. Supplemental flows to the expanded reservoir would arrive from Valley Water's and the San Benito County Water District's share of contracted CVP pumped water from San Luis Reservoir as well as water from excess condition diversions, when available.

San Luis Reservoir stored water is expected to decrease due to transfers to Pacheco Reservoir. This would increase the amount of available San Luis Reservoir storage that can be used by the SWP and CVP. South-of-Delta diversions could increase in both excess and balanced conditions. Valley Water has simulated SWP exports from Banks Pumping Plant by water year type[14]. This analysis shows a percent change in Banks exports ranging from -0.5% to +0.2%. Simulated SWP south of Delta allocations by water year type shows a range of -1% to +1% change.[15] Operation of Pacheco could impact the availability of Article 21 by delaying conditions when Article 21 would be available. DWR is expected to mitigate this impact by allowing SWP contractors to take Article 21 before San Luis spills to mimic conditions without Pacheco.

Pacheco was not modeled in the Stantec Report because it has minimal effects on the waterways included in that analysis.

[13] Sites Project Authority, 2020; Section 5.2.
[14] Draft EIR Pacheco Reservoir Expansion Project November 2021 Table 3.12.33
[15] Draft EIR Pacheco Reservoir Expansion Project November 2021 Table 3.12.34

Harvest Water Program

Harvest Water is a conjunctive use project in Sacramento County, Harvest Water would store and manage groundwater via in lieu recharge during the irrigation season and passive recharge by applying recycled water to sandhill crane habitat in the winter while improving stream flow, enhancing groundwater dependent riparian habitats, sustaining prime agricultural lands, and improving regional water supply reliability. Sources of water would be up to 50 TAF per year of tertiary-treated recycled water produced by Sacramento Regional County Sanitation District (Regional San) and diverted from discharge into the Sacramento River. Water produced from Harvest Water would be used to irrigate up to 16,000 acres of agriculture and habitat lands in Sacramento County near the lower Cosumnes River and Stone Lakes National Wildlife Refuge.

Up to 50 TAF per year of recycled water would be applied to lands in lieu of groundwater pumped from the South American Subbasin portion of the Sacramento Valley groundwater basin. An estimated 32.5 TAF per year of recycled water would be used for irrigation during the growing season (April through October). In a dry year, irrigation demands could be as much as 37.5 TAF per year. An additional 8.75 to 17.5 TAF per year of recycled water would be applied to lands during the non-growing season for wildlife enhancement. The recycled water for wildlife enhancement does not reduce groundwater pumping but does provide passive recharge of groundwater. In the future, an additional 5.5 TAF per year could also be used for wildlife enhancement purposes (to be confirmed). Return flows from irrigation are assumed to be minimal. In theory, reuse of up to 50 TAF per year of recycled water could potentially result in a reduction of up to 50 TAF per year in wastewater outflow to the Sacramento River. The flow rate of the reduction will vary over the year based on annual pattern of wastewater generation. In any event, this represents a relatively small change in Sacramento River flow – less than a 0.7 % decrease in Sacramento River inflow to the Delta.[16] The amount of water that is sent to the project area rather than to the Sacramento River (i.e., the flow rate of the reduction) is not based upon wastewater supply at the recycled water treatment plant. Rather, the flow rate of the reduction depends upon demand for recycled water by users in the project area (i.e., agricultural and habitat lands). Therefore, reductions in Sacramento River flow may be greater during periods of high demand (e.g., in drier years and in summertime when farmers need more recycled water) than the calculated average (0.7%).

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However, after 20 years, as documented in reference 2 (Modeling TM) and reference 6 (Implementation Water Rights TM) in the Harvest Water list of references, the net outflow to the Sacramento River and the downstream Delta environment, is projected to be reduced by approximately 25 TAF per year (50% of the 50 TAF per year remains in the groundwater basin and 50% returns to the Delta). This is from the result of projections of the groundwater basin filling. This represents an even smaller change in Sacramento River flow – less than a 0.4 percent decrease in Sacramento River inflow to the Delta. By the end of the 84-year modeling period, 80% of the flow eventually returns to the Delta. To mitigate this potential affect during the first 20 years, Regional San has agreed through its Wastewater Petition for Change (Order No. 0092) negotiation process to cut back recycled water deliveries in Shasta Critical and in Critically Dry years by 50% (of the 32.5-37.5 TAF per year) and 25% respectively. These cutbacks sunset only after the 50% threshold described above is reached as demonstrated by the latest calibrated groundwater-surface water model maintained by Regional San.

3. Analysis

This section describes the individual effects of each of the WSIP projects, considers how they interact, and addresses cumulative changes to Delta, Feather River, and Sacramento River flows, and other

[16] See Footnote 11.

parts of the SWP system. Table 1 provides a summary of expected changes from each of the WSIP projects. The following is a summary of Hydrology Changes for Individual WSIP Projects.

Chino Basin Program

- Project Additional Groundwater Storage: 15 TAF/year
- Feather River pulse flows: up to 50 TAF in selected years
- Reduced Delta Exports: up to 50 TAF in pulse flow years,
- Additional Delta Outflow: up to 50 TAF in pulse flow years

Kern Fan Groundwater Storage Project

- Project Additional Groundwater Storage: up to 100 TAF/year, with up to 25 TAF stored in an "ecosystem account" dedicated for ecosystem benefits.
- Feather River pulse flows: up to 18 TAF in selected years
- Delta Exports, Excess Conditions: up to 100 TAF/year when Article 21 water is available under excess conditions
- Reduced Delta Exports: up to 18 TAF in pulse flow years
- Additional Delta Outflow: up to 18 TAF in pulse flow years

Willow Springs Water Bank Conjunctive Use Project

- Project Additional Groundwater Storage: 34 TAF/yr w/ 2030 hydrology and 39.2 TAF/yr under 2070 hydrology[17]
- Feather River pulse flows: up to 28 TAF in selected years
- Delta Exports: Pre-positioning of SWP Water to WSWB allows for additional Delta exports averaging about 8.4 TAF/year.
- Reduced Delta Exports: up to 28 TAF in pulse flow years
- Additional Delta Outflow: up to 28 TAF in pulse flow years.

Los Vaqueros Reservoir Expansion Project

- Additional Surface Water Storage: 115 TAF (reservoir increase)
- Sacramento River Diversions: up to 155 cfs at Freeport (long-term average up to 6 TAF/year[18])
- Delta Exports increase, Balanced Conditions: up to 500 cfs[19] (long term average 42 TAF/year)
- Delta Exports increase, Excess Conditions: up to 50 cfs (long term average 48 TAF/year)

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Sites Reservoir Project

- Additional Surface Water Storage: 1,500 TAF (reservoir capacity)

[17] WSWB 2019 and Table 1 of AVWS 2017
[18] Freeport diversions would occur during balanced and excess conditions. The long-term average Freeport diversions increased by 1 TAF/yr during balanced conditions, and by 6 TAF/yr during excess conditions.
[19] This represents the combination of diversion to storage (up to 200 cfs) and direct diversions made to the California Aqueduct (up to 300 cfs).

- Sacramento River Diversions: up to 3,900 cfs (average of 60 to 406 TAF/year) depending on year type during excess conditions
- Sacramento River Releases: up to 1,000 cfs (70 to 254 TAF/year) during balanced conditions. This includes possible releases for exchanges with upstream reservoirs. Additional releases are delivered to local Sites participants or north-of-Delta refuges.
- Increased Delta Exports, Balanced Conditions: average of 203 TAF/year in critically dry years from deliveries pumped at Banks and Jones Pumping Plants

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Commented [HE11]: When including exchanges, releases could be higher than 1,000 cfs

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Commented [AF13R11]: Releases from the reservoir to the Sacramento River would be up to 1,000 cfs. But exchanges would allow for greater movement of Sites water as some would be released from Shasta or Oroville and not limited to the 1,000 cfs capacity of the Dunnigan pipeline

Pacheco Reservoir Expansion Project

- Additional Surface Water Storage: 136 TAF (reservoir increase)
- Delta Exports: Modeling shows changes in CVP and SWP exports to be minimal, within uncertainty ranges of models. San Luis Reservoir will have increased capacity due to the Pacheco project that will allow some additional SWP and CVP export from the Delta. These exports could occur in balanced or excess conditions.

Harvest Water Program

- Sacramento River discharge reductions: During first 20 years up to 50 TAF/year in both balanced and excess conditions. However, during Shasta Critical and in Critically Dry years, treated wastewater deliveries are reduced 50% and 25%, respectively. described in Section 2 above under balanced and excess conditions, thus reducing net decreases of flows into the Sacramento River.
- Project Additional Groundwater Storage: up to 50 TAF/year in lieu use except in “cutback years” as described in the point above.
- After the first 20 years, lower discharge reductions.

3.1 Cumulative Flows

This section summarizes the analysis done in the Stantec Report. See the Stantec Report for scope, limitations and assumptions made. The Stantec Report used a CalSim II post-processing technique to “layer” operations of each project to show cumulative changes. Pacheco was not included in the Stantec Report because it has a minimal effect on the waterways included in this analysis.

The Stantec Report modeling analyzes flows at the following locations:

-Delta Surplus flows

-Banks Pumping Plant

-Delta Inflow from Sacramento River

-Delta Inflow from the Yolo Bypass

-Feather River (at Thermalito outfall)

-Feather River (at Sacramento River junction)

-Groundwater Bank Storage

CalSim II simulates water project operations over an 82-year hydrologic period (1921-2002). For each location a long-term monthly average is shown that includes applicable WSIP projects. Not all WSIP projects impact all locations. This set of data is followed by the same data by water year type: wet, above normal, below normal, dry and critical. Data is shown as plotted and in tabular form. The Stantec Report analyzes Sites, LVE and Harvest Water (Upstream Projects), then separately analyzes impacts from Kern Fan, Chino and WSWB (Groundwater Projects). The data from both analyses can be used to show combined effects.

The following is a summary of the Stantec Report analysis organized by location.

Delta Surplus (This is a measure of flows when the Delta is in excess conditions – it can also be considered a measure of Delta outflow when excess conditions exist)

Upstream Projects: The largest changes in Delta surplus are from Sites and LVE. These projects divert relatively large amounts of water under excess conditions. In balanced conditions, changes to Delta surplus flows are assumed to be unchanged by WSIP projects because of operational constraints to limit impacts to existing water users. The exception is Harvest Water that is allowed by its water rights to reduce wastewater discharges to the Sacramento River under some balanced conditions.

Mean annual reductions in Delta surplus under excess conditions throughout the simulation period are 317 TAF, or 3% of the total 10,473 TAF of mean annual Delta surplus under excess conditions[20]. These reductions mainly occur in the months of January-March. Year type analysis shows that the largest reductions occur in wet and above normal years. In these types of years average monthly reductions in Delta surplus range from 97 TAF to 127 TAF[21]. This represents about 2-5% of Delta surplus in these years[22]. In drier years there are still some smaller opportunities to divert under excess conditions.

Groundwater Projects: Kern Fan and WSWB also impact Delta surplus by using surplus flows to create Exchange Water. This use of surplus flows by these projects are an order of magnitude smaller than the Upstream Projects mostly due to conveyance constraints. Mean annual reductions in Delta surplus (excluding pulse flows) under excess conditions throughout the simulation period are 11 TAF of the total 10,473 TAF of mean annual Delta surplus under excess conditions - less than 0.1%.[23] This occurs in Wet and Above Normal years.

A spring pulse flow in Below Normal and Dry years adds to Delta outflow, but has little impact on Delta surplus, because in Below Normal and Dry years there are small amounts of Delta surplus in April when the pulse flows are simulated in the modeling. The model results in the tables shows an average 45-50 TAF pulse flow over a month because the 100 TAF pulse flow is modeled over a two-week period.

Banks Pumping Plant (Banks)

Upstream Projects: Sites results in increases in pumping at Banks, mostly in Dry and Critical years in July-September from deliveries of stored water to SWP participants south of the Delta. Since these are deliveries of stored water, there is no impact on other water users. Carriage water assessments are applied to deliveries during this period. Year type analysis show that these deliveries mostly occur in Dry and Critical years. Monthly average delivery rates are 967 cfs or less[24]. During July-September

[20] Stantec Report Table 3
[21] Stantec Report Tables 4 and 5
[22] ibid
[23] Stantec Report Table 40
[24] Stantec Report Tables 13 and 14 and Figure 6

of Dry and Critical years, these monthly average additional deliveries are modeled to be 12%-114% of WSIP Baseline pumping[25].

Groundwater Projects: Kern Fan and WSWB increase Banks pumping during excess conditions when pumping capacity exists by a monthly average of up to 137 cfs in January-May of Wet and Above Normal years.[26] Banks pumping is reduced by a monthly average of 47 to 549 cfs by all three Groundwater Projects to replenish Lake Oroville pulse flows by exchange during July-September in a pulse flow year.[27] In July and August of pulse flow years this is a monthly average reduction of 5% to 12% of WSIP Baseline pumping[28].

Combined Effect: The reduction in Banks pumping by the Groundwater Projects pulse flow exchange occurs in July-September in dryer years when a pulse flow is made. This could be the same time period and year type where Sites is delivering stored water to participants south of the Delta. However, a pulse flow will likely not occur in a critical year, but Sites deliveries are likely in critical years. These actions are of the same order of magnitude and may offset each other to some degree in dryer water years.[29]

Delta Inflow from Sacramento River

Upstream Projects: Sacramento River inflows to the Delta are mostly reduced by Sites diversions under excess conditions in wetter years[30]. There is a corresponding increase in inflow during the July-November transfer window in drier years when water is released from storage from Sites for delivery to participants south of the Delta. There is a small decrease in inflow from reduction of wastewater discharges from Harvest Water.

Year type analyses shows that in wetter years there are more reductions in inflow in the winter as would be expected with Sites diverting under excess conditions. The average monthly percent reduction for Upstream Projects in December-March of Wet and Above Normal years is 1%-3% with a maximum monthly average reduction of 74 TAF[31]. In Dry and Critical years Sites delivers~~ies~~ mostly in the July through October time frame. Combined effects of Upstream Projects on Sacramento River inflow result in an increase of 0.4%-11%, as much as 66 TAF per month[32].

Groundwater Projects: A spring pulse flow in Below Normal and Dry years adds to Delta inflow. The analysis shows an average 45-50 TAF pulse flow over a month because the 100 TAF pulse flow is modeled to occur over a two-week period[33]. Delta inflow from the Sacramento River is decreased during the summer months where Lake Oroville releases are decreased to replenish Lake Oroville pulse flows. Delta inflow is reduced by a monthly average of 3 TAF to 34 TAF during July-September of Below Normal and Dry years with the largest decrease being 3% of the WSIP Baseline[34].

Combined Effect: Oroville pulse flows are expected to occur in dry and below normal years while diversions to Upstream Projects that reduce Delta inflow from Upstream Projects will occur in wetter years under excess conditions. The reduction in Delta inflow from decreased Lake Oroville releases to replenish Lake Oroville pulse flows can occur the same months and year types as increases in stored water deliveries from Sites. These changes in flows can be of the same order of magnitude so there can be an offsetting effect. Tables 54 thorough 56 in the Stantec Report shows this relationship.

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[25] Stantec Report Tables 13 and 14.
[26] Stantec Report Tables 47 and 48
[27] Stantec Report Tables 49 and 50
[28] ibid
[29] Stantec Report Table 50
[30] Stantec Report Figure 8
[31] Stantec Report Tables 17 and 18
[32] Stantec Report Tables 20 and 21
[33] Stantec Report Figure 20 and Tables 55 and 56
[34] Stantec Report Tables 55 and 56.

Delta Inflow from Yolo Bypass

This flow is measured where the Yolo Bypass feeds into the Sacramento River near Rio Vista. Only Sites impacts Yolo Bypass flows in any significant way. Since Sites diverts under excess conditions, there will be times when these diversions delay Sacramento River overflows into the Yolo Bypass and return flow back into the Sacramento River. In the summer months Sites is conveying stored water through the Yolo Bypass for environmental purposes. Other WSIP projects have no significant impact on the Yolo Bypass.

Year type analysis shows that the reductions in Yolo Bypass flows are mostly in wet and above normal years. Modeling shows a monthly average reduction in December through April of 7 TAF to 77 TAF in Wet and Above Normal years[35]. This is in approximately a 1% to 10% reduction in Yolo Bypass monthly flows[36]. Additions to the Yolo Bypass from Sites come in all years from August through October (minimal flow in critical years). These additions are a monthly average of 20 TAF or less[37].

Feather River below Thermalito Junction

Upstream Projects: This location is in the Feather River at the junction of the discharge of the Thermalito Afterbay. The low flow channel of the Feather River is upstream of this point. Apart from the pulse flow operations, the only project that has significant impacts to the Feather River is Sites. As part of a cold water management process to benefit salmon, Sites would exchange water with the SWP by providing Sacramento River flows in June and July to meet some of SWP flow obligations and in return have the SWP release the same amount of water mostly in August and September. Year type analysis shows that these exchanges occur mostly in in Dry and Critical years. The highest average monthly flow reduction in June and July of dry and critical years is 659 cfs and reduced flows are well above minimum flow standards in the Feather River.[38] These reductions can reduce average monthly Feather River flows 1% to 16% in these months.[39]

Groundwater Projects: The spring pulse flows in Below Normal and Dry years add to Feather River flows. Assuming a 100 TAF pulse flow, the modeled flow was a pulse of 3,000 cfs over a 10-day period with a ramp down of 500 cfs per day. The analysis shows an average 700-800 cfs pulse flow over a month because the 3,000 cfs pulse flow is assumed to occur over a 10-day period (with an 8-day ramp down)[40]. Monthly baseline average monthly flows in this part of the Feather River during April in Below Normal and Dry years are in the range of 900-1000 cfs[41]. In a pulse flow year, Lake Oroville releases are reduced in July through September to replenish Lake Oroville. The volume of the reduction match to pulse flow amounts. The modeled reduction in Feather River flows range from a monthly average of 47 cfs to 550 cfs or from 2% to 8% of Feather River flows at this location[42].

Combined Effect: The cold water exchange between Sites and Lake Oroville occurs in June through September with the SWP releasing extra water into the Feather River mostly in August and September. August and September are some of the same months that the Groundwater Projects cause Lake Oroville to release less water to replenish storage from the spring pulse flow. These flows are the same order of magnitude and can partially offset each other in some years if Sites is in operation.

Feather River at Sacramento River Junction

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35 Stantec Report Figure 10 and Tables 23 and 24
36 Stantec Report Tables 23 and 24
37 Stantec Report Figure 10 and Tables 23 through-27
38 Stantec Report Figure 12
39 Stantec Report Tables 31 and 32
40 Stantec Report Figure 22
41 Stantec Report Tables 61 and 62
42 Stantec Report Table 61 and 62

Flow patterns in the Feather River at the Junction of the Sacramento River approximately mirror those at the Thermalito Junction[43]. Baseline flows are higher in the Feather River at this point, due to inflows in the Feather River between Thermalito and the Sacramento River. Flow changes from the WSIP projects are the same, but the impacts are less due to the higher baseline flows.

Groundwater Banking Operations

The Stantec Report also analyzes how the three groundwater banks would provide Exchange Water for pulse flows. Each project, in their application for Prop 1 funding and subsequent updates, made assumptions about the rate of input of water supplies into their groundwater banks and under what conditions they would provide Exchange Water for pulse flows. These arrangements are expected to be specified in Contracts for Administration of Public Benefit with CDFW. It is the responsibility of the WSIP projects to meet environmental obligations in these contracts. The Stantec Report models how all three projects could contribute to pulse flows based on assumptions made by each project and historical hydrology included in CalSim II. This narrative report will not summarize this part of the Stantec Report. The Stantec Report generally shows that it is possible to meet the pulse flow obligations, but much depends on hydrology, particularly for Kern Fan and WSWB who depend on excess conditions water diversions to develop Exchange Water.

The Stantec Report treats Article 21 availability different than what is contemplated in current draft operating agreements with DWR that are under development for Kern Fan and WSWB. The draft operating agreements assume that Article 21 water will come from Article 21 allocations of their Partner Contractors. The Stantec Report assumes that Article 21 water supplies for these projects are in addition to the Article 21 deliveries simulated in the WSIP Baseline. This may not make too much of a difference because Kern Fan and WSWB may increase allocated Article 21 demand above current levels.

The analysis does not include calculations for carriage water savings (also called Efficiency Credits) from delivery of water supplies from groundwater banks to Partner Contractors to replace Table A diverted from the Delta.

This section summarizes cumulative flows in the context of diversions, releases and exports.

Sacramento River Diversions

LVE (through use of the Freeport diversion) and Sites would increase Sacramento River diversions and Harvest Water would reduce inflow into the Sacramento River.

Sites is by far the largest Sacramento River diversion at 3,900 cfs, which would occur only during excess conditions. LVE Freeport diversion has a capacity of 155 cfs and may divert under excess conditions for LVE. Since the Harvest Water reduces Sacramento River inflows by 50 TAF per year on a continuous basis, that amount averages to a reduction of 69 cfs per day (or less as described in Section 2.2 above according to negotiated cutback in the first 20 years of operations).

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The LVE Freeport diversion could also divert in balanced conditions such as for diverting SWP Table A supplies into LVE. This type of relatively small diversion would be scheduled and coordinated through the LVE operating agreements with the SWP and CVP to eliminate any adverse consequences and will be diverted in conformance with all permits and regulations. Any Harvest Water reductions in

[43] Stantec Report Figure 23

balanced conditions are not substantial (less than 0.7 percent or less during Shasta Critical and Critically Dry cutback years).[44]

Summary: The largest diversion, Sites, occurs in excess conditions and is a relatively small percentage of Sacramento River flows during wet time periods. The LVE Freeport diversion is expected to be utilized less frequently than the LVE Delta diversion locations and is a relatively small diversion rate. Harvest Water reductions in discharges are relatively small given the volume of Sacramento River flows.

Sacramento River Releases

Sites would release flows back to the Sacramento River during balanced conditions. The releases from Sites to the Sacramento River are estimated to be a maximum of 1,000 cfs. The releases will be to local waterways eventually leading to the Sacramento River and the Delta. The releases would be scheduled and coordinated through the Sites operating agreements with the SWP and CVP to avoid any substantial adverse consequences and will be diverted in conformance with all permits and regulations.

Pulse flows from Lake Oroville into the Feather River will travel down the Sacramento River and through the Delta. The pulse flows will be protected from diversion through a SWRCB instream flow dedication (Water Code 1707). These flows are expected to occur, when requested by CDFW and approved by DWR, in the spring of Dry and Below Normal years. These flows could overlap with some other WSIP project operations but the pulse flows are considered environmentally beneficial “extra” flows.

Summary: Releases in balanced conditions are coordinated with the SWP and CVP, so any WSIP operations should not impact other water users.

Delta Exports in Balanced Conditions

The Groundwater Projects do not increase Delta exports in balanced conditions. The Groundwater Projects reduce demand for Delta pumping for individual SWP Partner Contractors who receive their Table A deliveries by exchange with water recovered from the Groundwater Projects instead of the Delta or San Luis Reservoir. This reduced demand results in less pumping at Banks Pumping Plant in the summer of pulse flow years. Note that the reduced diversions could result in the SWP using that unused pumping capacity at Banks Pumping Plant for additional exports, but Delta conditions during that period are unlikely to provide opportunities for additional exports.

Sites releases water from storage during balanced conditions for delivery to project participants and for exchanges with upstream SWP and CVP reservoirs. Most of the deliveries to project participants will be provided at SWP and CVP export facilities. LVE will also divert water from the Delta during balanced conditions. An example would be export of SWP Table A water for SWP South Bay Aqueduct contractors.

Pacheco results in increased available capacity in San Luis Reservoir that would allow a small amount of additional SWP and CVP export from the Delta in both balanced and excess conditions.

Combined Delta exports in balanced conditions for Sites and LVE are approximately 245 TAF per year.[45] For this analysis additional Delta exports resulting from the Pacheco project are not included. Note that these exports would occur under the same environmental, regulatory, and operational constraints that apply to all SWP supplies.

[44] Average annual flow in the Sacramento River at Freeport is 10,400 to 30,900 cfs depending on year type (Reclamation 2019, Appendix D – Modeling, Table 29-1); a reduction of 69 cfs per day would decrease annual flow by no more than 0.7 percent.
[45] Assumed 203 TAF from the Sites Project and 42 TAF from the LVE Project.

For the Groundwater Projects there are carriage water "credits" under discussion where the projects could be credited with water savings from not having to move Table A water through the Delta (because water equivalent to Table A is provided by groundwater banks). The potential savings is because when water is moved through the Delta for export, a fraction of that export is used as Delta outflow to maintain Delta water quality standards. The carriage water savings matter is being discussed with SWP and CVP operators, but no final decision has been made. CalSim II modeling accounts for carriage water with changes in Delta exports. The carriage water credits would affect water accounting for the Groundwater Projects' obligations for Exchange Water.

Summary: Delta exports in balanced conditions are coordinated with the SWP and CVP, so any WSIP operations should not impact other water users.

Delta Exports in Excess Conditions

Kern Fan, WSWB, and the LVE would increase Delta exports during excess conditions. Pacheco results in increased available capacity in San Luis Reservoir that will allow some additional SWP and CVP exports from the Delta in both balanced and excess conditions. The exports during excess conditions would cause a small reduction in Delta outflow. Combined flows are expected to be a relatively small percentage of Delta outflow during excess conditions.These exports would occur under the same environmental, regulatory, and operational constraints that apply to all SWP supplies.

Summary: Delta diversions during excess conditions are a relatively small percentage of Delta outflow.

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Regional San, 2020. Harvest Water Program EcoPlan and Wintertime Application Project, South Sacramento County Agriculture and Habitat Lands Recycled Water Program Environmental Impact Report Addendum. Prepared by Ascent Environmental. December 7, 2020

Regional San, 2021. Harvest Water Program Groundwater Accounting Project, South Sacramento County Agriculture and Habitat Lands Recycled Water Program Environmental Impact Report Addendum. Prepared by Ascent Environmental. March 1, 2021.

Regional San, 2021. Petition for Change Mitigation Implementation Plan Summary, Draft Technical Memorandum. June 17, 2020 (Updated May 7, 2021)

Table 1. Resulting Changes from the WSIP Projects

Location or Type	Chino Basin Program	Kern Fan Project	WSWB Project	LVE Project	Sites Project	Pacheco Project	Harvest Water Program
Additional Surface Reservoir Storage	--	--	--	115 TAF	1,500 TAF	136 TAF	--
Additional Groundwater Storage	15 TAF/yr	up to 100 TAF/yr (up to 25 TAF/yr for ecosystem use)	34 TAF/yr	--	--	--	up to 50 TAF/yr in lieu use
Feather River Pulse Flows volumes	Up to 50 TAF	Up to 18 TAF	Up to 28 TAF	--	--	--	--
Sacramento River Diversions or Reductions	--	--	--	up to 155 cfs (7 TAF/yr average) in diversions @ Freeport	up to 3,900 cfs (60-406 TAF/yr average) diversions in excess conditions	--	up to 50 TAF/yr in reduced wastewater discharge (with reduced reductions in critically dry years and in later project operations)
Sacramento River Releases	--	--	--	--	up to 1,000 cfs (70-254 TAF/yr average) in balanced conditions. Plus local and environmental releases	--	--
Delta Exports, Balanced Conditions	Reduced export in pulse flow years of up to 50 TAF	Reduced export in pulse flow years up to 18 TAF	Reduced exports in pulse flow years up to 28 TAF. Average 8.4 TAF/yr increase in Delta exports in balanced and excess conditions	Increased exports up to 500 cfs (42 TAF/yr average)	Increased exports -avg of 203 TAF/yr in critical years from deliveries	some additional exports due to increased capacity available in San Luis Reservoir	--
Delta Export Increases, Excess Conditions	--	up to 100 TAF/yr	Average 8.4 TAF/yr increase in Delta exports in balanced and excess conditions	Up to 50 cfs (48 TAF/yr average)	--	some additional due to increased capacity available	--

Commented [D14]: CCWD to check this number

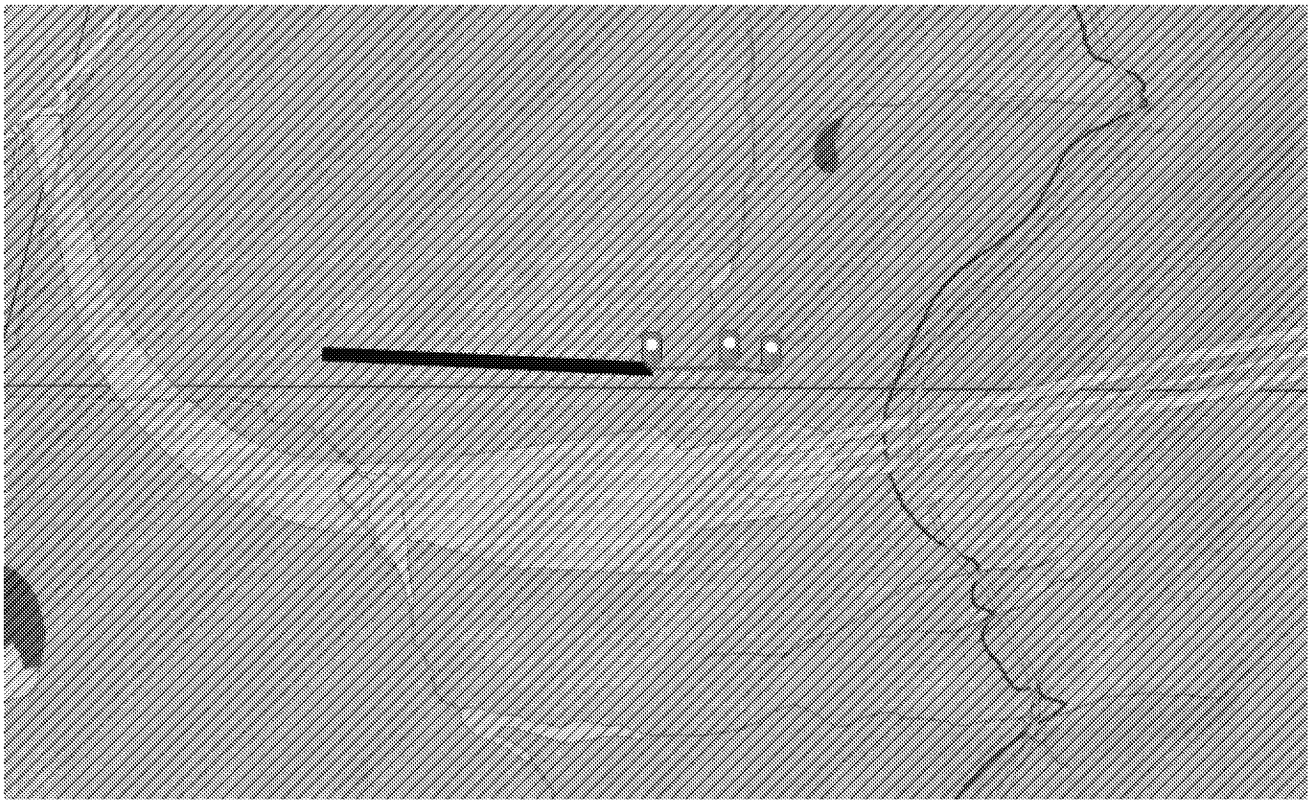
Location or Type	Chino Basin Program	Kern Fan Project	WSWB Project	LVE Project	Sites Project	Pacheco Project	Harvest Water Program
						in San Luis Reservoir	

).

From: Luu, Henry [Henry.Luu@hdrinc.com]
Sent: 9/23/2022 10:42:36 AM
To: Arsenijevic, Jelica [jelica.arsenijevic@hdrinc.com]
CC: Edwards, Dawn [Dawn.Edwards@hdrinc.com]; Risse, Danielle [danielle.risse@hdrinc.com]; Kalaskar, Tanya [Tanya.Kalaskar@hdrinc.com]; Tannourji, Danielle [Danielle.Tannourji@icf.com]; Havelaar, Christiaan [christiaan.havelaar@icf.com]; Conner McDonald [conner@cmdwest.com]; Kevin Spesert [kspesert@sitesproject.org]; Alexander, Jeriann [jalexander@fugro.com]
Subject: RE: Review Submittal: Sites Reservoir Draft GIWP and Reference Documents

Jelica,

As part of the Fugro's team update to the exploration program GIS data we will show the length extended approximately 250-ft east as you've indicated in the snippet. Please note that this length is intended to show the maximum extent/limit of the fault trench activity – it is likely that the actual length and physical impacts of this activity will be shorter within the indicated limits.



Henry H. Luu, PE
D 916.679.8857 M 916.754.7566

hdrinc.com/follow-us

From: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Sent: Wednesday, September 21, 2022 8:28 AM
To: Luu, Henry <henry.luu@hdrinc.com>
Cc: Edwards, Dawn <Dawn.Edwards@hdrinc.com>; Risse, Danielle <danielle.risse@hdrinc.com>; Kalaskar, Tanya <Tanya.Kalaskar@hdrinc.com>; Tannourji, Danielle <Danielle.Tannourji@icf.com>; Havelaar, Christiaan <christiaan.havelaar@icf.com>; Conner McDonald <conner@cmdwest.com>; Kevin Spesert <kspesert@sitesproject.org>
Subject: RE: Review Submittal: Sites Reservoir Draft GIWP and Reference Documents

Please provide a proposed footprint of this location and bio/cultural/real-estate can take a look at shift . Again, we need to avoid known resources and get buy off from Kevin/Conner as they are currently coordinating with land owners.

Jelica Arsenijevic
Environmental Project Manager

HDR
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From: Luu, Henry <Henry.Luu@hdrinc.com>
Sent: Monday, September 19, 2022 8:21 PM
To: Arsenijevic, Jelica <jelica.arsenijevic@hdrinc.com>
Cc: Edwards, Dawn <Dawn.Edwards@hdrinc.com>; Risse, Danielle <danielle.risse@hdrinc.com>; Kalaskar, Tanya <Tanya.Kalaskar@hdrinc.com>; Tannourji, Danielle <Danielle.Tannourji@icf.com>; Havelaar, Christiaan <christiaan.havelaar@icf.com>; Conner McDonald <conner@cmdwest.com>; Kevin Spesert <kspesert@sitesproject.org>
Subject: RE: Review Submittal: Sites Reservoir Draft GIWP and Reference Documents

Hi Jelica,

The engineering team proposes using lidar information that is currently being processed in addition to field reconnaissance to positively identify the fault location for investigation. If this data indicates the fault is likely further east of the currently identified location then the team proposes to shift the work eastward to intercept the fault while maintaining the same trench length (not lengthening/extending). I'm happy to chat if you think further discussions are required.

Thanks,

Henry H. Luu, PE
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From: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Sent: Sunday, September 18, 2022 3:53 PM
To: Luu, Henry <henry.luu@hdrinc.com>
Cc: Edwards, Dawn <Dawn.Edwards@hdrinc.com>; Risse, Danielle <danielle.risse@hdrinc.com>; Kalaskar, Tanya <Tanya.Kalaskar@hdrinc.com>; Tannourji, Danielle <Danielle.Tannourji@icf.com>; Havelaar, Christiaan <christiaan.havelaar@icf.com>; Conner McDonald <conner@cmdwest.com>; Kevin Spesert <kspesert@sitesproject.org>
Subject: RE: Review Submittal: Sites Reservoir Draft GIWP and Reference Documents

Hi Henry
Following up on the email below. Should we further discuss

As discussed last week, Kevin/Conner should know too (now cc'd)

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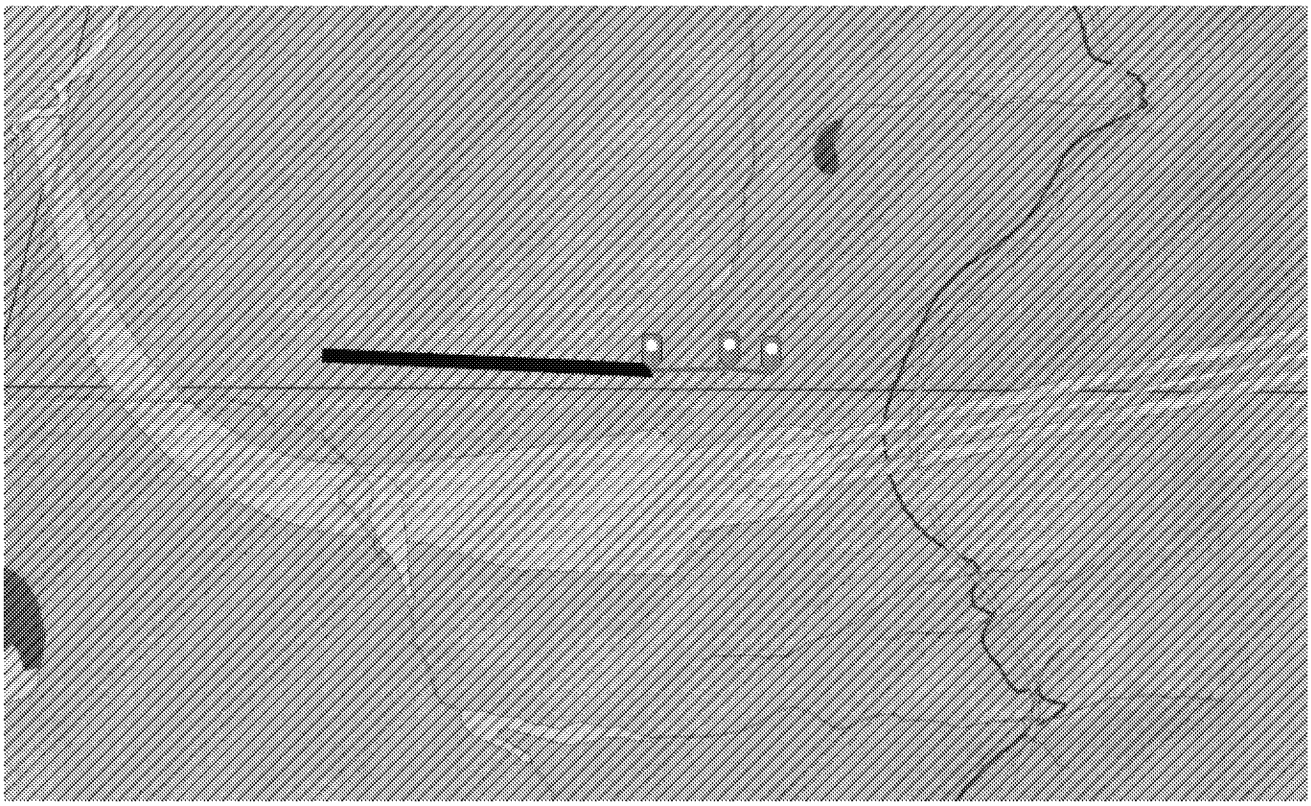
From: Arsenijevic, Jelica
Sent: Monday, August 22, 2022 11:31 AM
To: Luu, Henry <henry.luu@hdrinc.com>
Cc: Edwards, Dawn <Dawn.Edwards@hdrinc.com>; Risse, Danielle <danielle.risse@hdrinc.com>; Kalaskar, Tanya <Tanya.Kalaskar@hdrinc.com>; Tannourji, Danielle <Danielle.Tannourji@icf.com>; Havelaar, Christiaan <christiaan.havelaar@icf.com>
Subject: RE: Review Submittal: Sites Reservoir Draft GIWP and Reference Documents

Hi Henry
Extending fault trench IO-T-001 250 feet further east to evaluate presence/absence of faulting in the foundation of the upstream valve structure seems like a reasonable approach; however, there will be conditions.

Per snippet, we are outside of known cultural sensitive areas and aerially interpreted sensitive habitat. Field conditions during pre-investigation surveys will dictate if we can fully extend the trench 250 feet east. There may be a scenario, depending on field conditions, that we hopscotch over resources. We need be compliant with the mitigation measures being put forward in the CEQA document (being public released at end of September) for these activities …full avoidance of sensitive resources.

I'm cc'ing Dawn and other key team members of the team to keep them in the loop. Dawn, and others, if you need more info, please feel free to contact me and we can talk through it.



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From: Luu, Henry <Henry.Luu@hdrinc.com>
Sent: Monday, August 22, 2022 8:46 AM
To: Arsenijevic, Jelica <jelica.arsenijevic@hdrinc.com>
Subject: FW: Review Submittal: Sites Reservoir Draft GIWP and Reference Documents

Jelica, can you help verify if there are impacts related to extending the fault trenching length per attached comment no. 6?

Thanks,

Henry H. Luu, PE
D 916.679.8857 M 916.754.7566

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From: Ermakovich, Mikhail@DWR <Mikhail.Ermakovich@water.ca.gov>
Sent: Thursday, August 18, 2022 11:28 AM
To: Luu, Henry <Henry.Luu@hdrinc.com>
Cc: JP Robinette <jrobinette@sitesproject.org>; Smith, Michael (orange) <michael.g.smith@aecom.com>; Wisniewski, Jeffrey <jeffrey.wisniewski@aecom.com>; Rude, Pete/RDD <Pete.Rude@jacobs.com>; Alexander, Jeriann <jalexander@fugro.com>; Krivanec, Christopher <Christopher.Krivanec@hdrinc.com>; Lam, Wallace@DWR <Wallace.Lam@water.ca.gov>
Subject: RE: Review Submittal: Sites Reservoir Draft GIWP and Reference Documents

Henry,

DSOD reviewed Geotechnical Investigation Work Plan (GIWP) dated June 15, 2022, and the draft Field Investigation Schedule for the proposed Sites Reservoir. The comment list is attached. The list includes general comments on GIWP and several comments specific to the explorations included in the Work Package 1. We will issue comments on Work Package 2, 3 and 4 explorations later, as our review progresses.

Best regards,

Mikhail Ermakovich, P.E.
Senior Engineer, Water Resources
Division of Safety of Dams
Department of Water Resources

Phone: (916) 565-7832

From: Luu, Henry <Henry.Luu@hdrinc.com>
Sent: Friday, June 17, 2022 3:46 PM
To: Ermakovich, Mikhail@DWR <Mikhail.Ermakovich@water.ca.gov>
Cc: JP Robinette <jrobinette@sitesproject.org>; Smith, Michael (orange) <michael.g.smith@aecom.com>; Wisniewski, Jeffrey <jeffrey.wisniewski@aecom.com>; Rude, Pete/RDD <Pete.Rude@jacobs.com>; Alexander, Jeriann <jalexander@fugro.com>; Krivanec, Christopher <Christopher.Krivanec@hdrinc.com>
Subject: Review Submittal: Sites Reservoir Draft GIWP and Reference Documents

Hello Mikhail,

The Sites Project is requesting DSOD review of the Project's Draft Geotechnical Investigation Work Plan (20220617_Draft GIWP Submittal) to ensure we have identified and planned for geotechnical investigation activities in alignment with DSOD's expectations. You should have received a separate email from me with a OneDrive link that contains the following documents:

- 20220617_Sites Reservoir_Draft GIWP.pdf – Draft Geotechnical Investigation Work Plan
- 20220617_Sites Reservoir_Draft Field Investigation Schedule.pdf – Preliminary schedule of field investigation activities intended to provide an overview of prioritization starting this year through 2024.
- References – data that may be useful for reference
  - DSOD Jurisdictional Facility_Funks and TRR Pipeline Drawings.pdf
  - DSOD Jurisdictional Facility_Reservoir Dams and IO Drawings.pdf
  - Geologic Feasibility Report, Sites Reservoir Project.pdf
  - Geologic Feasibility Report, Sites Reservoir Project - Appendix A.pdf
  - Geologic Feasibility Report, Sites Reservoir Project - Appendix B.pdf
  - Geologic Feasibility Report, Sites Reservoir Project - Appendix C.pdf
  - Sites Reservoir Engineering Feasibility Study_Dams_DWR (2003).pdf
  - Sites Reservoir Feasibility Study, Fault_Seismicity Report (WLA).pdf
  - Sites Reservoir Feasibility Study, Materials Investigation, Testing, and Evaluation.pdf
  - TRR GDR.pdf
  - TRR Pipeline Area Historic Logs.pdf

Please let us know if there are any questions or clarifications we can assist with while you and your team are reviewing this data. I recommend we plan our next meeting for the latter half of August 2022 to check-in and follow-up on next steps. If you are amendable with this recommendation then I will work towards identifying a few date/times for your team's consideration.

Thank you,
Henry H. Luu, PE
D 916.679.8857 M 916.754.7566

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From: Arsenijevic, Jelica [Jelica.Arsenijevic@hdrinc.com]
Sent: 9/26/2022 12:34:25 PM
To: Brian Grubbs [grubbs@montaguederose.com]
CC: Doug Montague [montague@montaguederose.com]; Cheyanne Harris [charris@brwncald.com]; Luu, Henry [henry.luu@hdrinc.com]; JP Robinette [jrobinette@sitesproject.org]; Angela Bezzone [bezzone@mbkengineers.com]; Spranza, John [john.spranza@hdrinc.com]; steve.micko@jacobs.com
Subject: RE: Sites: 404(b)(1) Circle Back

Hi Brian
Feel free to arrange the table so that it makes sense. Footnote will/can be included that input assumed no USDA loan was provided for all cases.

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Environmental Project Manager

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From: Brian Grubbs <grubbs@montaguederose.com>
Sent: Thursday, September 22, 2022 3:00 PM
To: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>; Angela Bezzone <bezzone@mbkengineers.com>; Spranza, John <John.Spranza@hdrinc.com>
Subject: RE: Sites: 404(b)(1) Circle Back

Jelica,
I understand. So the values would be as this table here. Note that the Direct Construction Costs are in thousands, resulting in a $/AF as below.

I hadn't seen the $/AF depicted in this way, but if that's what's needed for this analysis, it allows comparison between the 4 alternatives. Maybe rearrange the rows so they are in the order of the calculation…Direct Costs, then Estimated Deliveries, then $/AF.
Also, is a note needed indicating that it was assumed no USDA loan was provided for all cases?

TABLE 16. ONSITE ALTERNATIVES - ESTIMATED CONSTRUCTION AND REPAYMENT COSTS				
Alternative[1]	Onsite Alternative 1	Onsite Alternative 2	Onsite Alternative 3 (Project)	Onsite Alternative 4
Project Parameters				

Reservoir Size	1.5 MAF	1.3 MAF	1.5 MAF	1.8 MAF
Delivery Pipeline Release Capacity (cfs)[2]	1,000	1,000	1,000	1,500
Federal Participation Percentage)	7%	0%	25%	25%
Estimated Deliveries (releases to Funks) (Long-Term Average in TAF)	Option 1A: 206 Option 1B: 220 Source: (option 1A and 1B) – from final EIR/EIS modeling , no historic climate change included JA/JS: USE OPTION 1b (220), MAKE FOOTNOTE	203 SOURCE: final EIR/EIS modeling, no historic climate change included.	255 Source: final EIR/EIS modeling, no historic climate change included.	542 Source: USING ATTACHED TM
Estimated Cost per Acre-Foot (2021$) (Direct Construction Cost / AF Release)	Option 1A: 19,098 Option 1B: 17,883	19,086	15,428	10,226
Direct Construction Costs(2021$, $000s)[3]	$3,934,200	$3,874,400	Same as onsite Alternative 1	$5,542,700

Brian Grubbs | Managing Director
Montague DeRose and Associates
916-712-1747

From: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Sent: Thursday, September 22, 2022 2:20 PM
To: Brian Grubbs <grubbs@montaguederose.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>; Angela Bezzone <bezzone@mbkengineers.com>; Spranza, John <John.Spranza@hdrinc.com>
Subject: RE: Sites: 404(b)(1) Circle Back

Hi Brian
John, Angela, and I exchanged a few emails.

In summary/simplistic approach - take the direct constructions cost and divide it by what we have shown for Estimated Deliveries

For Onsite Alternative 1:
Estimated Cost per AF for Option 1B = $3,934,200 ÷ 220,000 AF = $19.67/AF

Does this make sense? Let us know

Thanks again for your help

Jelica Arsenijevic

Environmental Project Manager

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M 209-329-6897

Jelica.Arsenijevic@hdrinc.com

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From: Brian Grubbs <grubbs@montaguederose.com>
Sent: Wednesday, September 21, 2022 3:48 PM
To: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>; Angela Bezzone <bezzone@mbkengineers.com>; Spranza, John <John.Spranza@hdrinc.com>
Subject: RE: Sites: 404(b)(1) Circle Back

Jelica,
For the "Estimated Cost per Acre-Foot (2021$)", Is this the PWA Cost /AF Yield? If so we need to have the Estimated Deliveries to the PWAs, which I think the line in the table for deliveries is total deliveries (PWA + State + Fed).

Brian Grubbs | Managing Director
Montague DeRose and Associates
916-712-1747

From: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Sent: Wednesday, September 21, 2022 12:49 PM
To: Brian Grubbs <grubbs@montaguederose.com>
Cc: Doug Montague <montague@montaguederose.com>; Cheyanne Harris <charris@brwncald.com>; Luu, Henry <henry.luu@hdrinc.com>; JP Robinette <jrobinette@sitesproject.org>; Angela Bezzone <bezzone@mbkengineers.com>; Spranza, John <John.Spranza@hdrinc.com>
Subject: RE: Sites: 404(b)(1) Circle Back
Importance: High

Hi Brian
Thanks so much for carving out time last week – John and I found it very informative. Below is the revised table that includes financial information you provided to JP on August 18, 2022, information discussed during last week's call, and input from Erin before she left.

As you can see in the table notations, Erin provided information related to estimate deliveries (using information from the Final EIR/EIS modeling recently done). John and I made a note to use Alternative 1 Option 1B delivery as the basis for "estimated cost per acre foot"

Please review , confirm, and provide information as needed, in particular for Onsite Alternative 4. Information for Alternative 4 should be consistent with the cost assumptions you used for Alt 1, 2, and 3 (from your excel sheet provided on 8/18):

- WSIP$– $836,408
- Federal 25%
- Construction cost using 2021 costs (escalating 2019 cost)

Please let us know if you have any questions.

TABLE 16. ONSITE ALTERNATIVES - ESTIMATED CONSTRUCTION AND REPAYMENT COSTS

Alternative[1]	**Onsite Alternative 1**	**Onsite Alternative 2**	**Onsite Alternative 3 (Project)**	**Onsite Alternative 4**
Project Parameters				
Reservoir Size	1.5 MAF	1.3 MAF	1.5 MAF	1.8 MAF
Delivery Pipeline Release Capacity (cfs)[2]	1,000	1,000	1,000	1,500
Federal Participation Percentage)	7 %	0%	25%	25%
Estimated Deliveries (releases to Funks) (Long-Term Average in TAF)	Option 1A: 206 Option 1B: 220 Source: (option 1A and 1B) – from final EIR/EIS modeling , no historic climate change included JA/JS: USE OPTION 1b (220), MAKE FOOTNOTE	203 SOURCE: final EIR/EIS modeling, no historic climate change included.	255 Source: final EIR/EIS modeling, no historic climate change included.	542 Source: USING ATTACHED TM
Estimated Cost per Acre-Foot (2021 $) Source: Erin suggested Final EIS model	$XX	$XX	XX	XX
Direct Construction Costs(2021 dollars)[3] Source: Brian's 8/18/2022 Email to JP	$3,934,200	$3,874,400	Same as onsite Alternative 1	$5,335,000,000 (2019) NEED TO ESCALATE TO 2021

Sources: Authority 2020c; Reclamation 2020; AECOM 2021; Jacobs 2021.

[1] Onsite Alternative 1 in this memorandum is based on value planning process Alternative VP 7, and onsite Alternative 2 is based on
Alternative VP 6 (Authority and Reclamation 2021).

[2] The Dunnigan pipeline is the delivery pipeline for onsite Alternatives 1, 2, and 3 and the Delevan pipeline is the delivery pipeline for onsite Alternative 4.

[3] Direct construction costs include the following project components: Develop Sites Reservoir, including Sites Lodoga Road, clearing and demolition; Other roads (Project and Recreation); South Road to residents (onsite Alternative 2); Sites Lodoga Road bridge (onsite Alternatives 1 and 3); North construction access road; construct Sites Dam and Golden Gate Dam; Construct saddle dams; Construct TRR facilities; Construct Holthouse reservoir facilities (onsite Alternative 4); Funks Reservoir dredging/structures (onsite Alternatives 1, 2 and 3); Construct I/O structure and tunnels for Reservoir; Construct TRR pumping/generating plant; Construct Funks pumping/generating plant;; Construct TRR pipeline & Funks pipeline; Construct Dunnigan pipeline (onsite Alternatives 1, 2 and 3); Construct Delevan pipeline (onsite Alternative 4); Transmission lines, substations, switchyards.

cfs = cubic feet per second; TAF = thousand acre-feet; WIFIA = Water Infrastructure Finance and Innovation Act; VP = Value Planning; N/A = Not applicable.

Note: For all cases there is no WIFIA funding and all cases WSIP is $836,000,000

Jelica Arsenijevic

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-----Original Appointment-----
From: Arsenijevic, Jelica
Sent: Monday, September 12, 2022 11:04 AM
To: Arsenijevic, Jelica; Brian Grubbs; Spranza, John
Cc: Doug Montague; Cheyanne Harris; Luu, Henry; JP Robinette; Angela Bezzone
Subject: Sites: 404(b)(1) Circle Back
When: Thursday, September 15, 2022 1:00 PM-2:00 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Microsoft Teams Meeting

John and I plan on chatting with Brian to see what are the remaining steps. Others that are cc'd are optional…it may be good to get some of you on the phone, but John and I can circle back with team following conversation with Brian.

Microsoft Teams meeting

Join on your computer, mobile app or room device
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Passcode: tremJZ
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(833) 255-2803,,769036514#   United States (Toll-free)
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Learn More | Meeting options

Sites

County of Glenn
Department of Public Works
Attention: Don Rust, Director
Sent via email

September 28, 2022

Re: Summary of August 10, 2022, Meeting with Sites Project Authority and Request for Additional Information

Dear Mr Rust,

Sites Project Authority (Authority) appreciated the opportunity to meet with you and your associates in the Public Works and Environmental Health office on August 10, 2022, regarding permitting for field investigation work that is planned to support the preliminary design of the Sites Reservoir Project within Glenn County over the next 2.5 years. Those in attendance are identified on the attached agenda. The agenda and notes were shared with the county ahead of the meeting.

Presented below are the meeting high points which require additional discussion with Glenn County regarding their permitting procedures/policies so that we can move forward with permit application submittals.

The County required that we provide a letter summarizing the meeting and which identifies items which require a more formal approval process by the County Administrative Officer (CAO).

This letter is the one which was requested.

The Authority representatives indicated that they would provide a tabulated list of permits being requested for ROW areas to facilitate the County determination of fees to be paid.

The County indicated this would be appreciated as there are other fees in addition to the permit application fees which would need to be collected before the permit application is approved. The Authority representatives indicated that once the permit packages are ready to be submitted a tabulation including both environmental health and encroachment permits would be provided.

Sites

The Environmental Health Permit requires a signature by the owner of the parcel where work is planned.

Don Rust indicated that the CAO needs to be requested to provide authorization for someone at the County to be a signatory for permits for work in the ROW .

For individual property owners Authority representatives requested consideration that this requirement be waved as long as the Authority can ensure that the owner has given permission to allow the work to be completed and that the Authority will ensure permit compliance.

The Environmental Health permitting process requires boring abandonment and piezometer completion under state requirements which state that holes which extend below water should be backfilled with grout placed using termite methods.

Authority representatives discussed the issue behind using any type of bentonite slurry which results in high pH waste cuttings and water which require management as a hazardous waste. Recognizing the concern, Colusa County has modified this requirement for parcels that are not contaminated and are allowing the use of bentonite chips mixed with water prior to gravity feed into a hole as a sealing method; no tremie placement is required. The Authority representatives requested waving this requirement for the work planned so that there is consistency in means and methods between work areas.

An encroachment permit may be required for the Pre Investigation Surveys.

The Pre-Investigation Surveys are considered pedestrian surveys; no investigation work is performed, only viewing and observing of the work areas ahead of planned investigation to identified areas to be avoided due to safety or environmental resource sensitive area concerns. County staff spent some time discussing this amongst themselves as there are a number of entities which do not even notify the County that they will be in the ROW. The Authority representatives requested that the County wave any requirement for an encroachment permit for the Pre-Investigation Surveys.

The County PW department will be conducting a baseline survey of the roads where investigation work is planned.

The County indicated that an assessment is to define zones of implied or verified ROW to clarify notification and ROW use requirements as this distinction is important. It is possible that some of the ROW areas are easements with implied uses for passage of vehicles, and would not allow a different type of use such as drilling a boring without the property owner holding the easement to approve the proposed work. They would also define the width of the ROW on the three identified roads where investigations will be completed. They may also note ROW conditions during their survey. The Authority representatives requested a copy of the findings of the County assessment.

The County does not have a nearby yard/lot for storage of the investigation cuttings and wastewater waste drums which may be generated while completing the ROW work.

The state requirement is that the waste materials are stored in approved containers which are kept within the project area (ROW) until testing is completed and they can be removed by a licensed waste hauler. For compliance with the state law, the Authority requests that the County provide space at their Waste Management facility in Orland to allow temporary storage of the drums.

We appreciate the opportunity to continue to discuss and come to an agreement on these high points so the Authority may move forward with submitting permit applications for the work planned in the County.

Sincerely,

Kevin Spesert
External Affairs Manager
Sites Project Authority

Attachment : Meeting Agenda for August 10, 2022

P.O. Box 517
Maxwell, CA 95955
530.438.2309

Sites

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From: Alicia Forsythe [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=A6CDF06A7E904B65BAA21702A82AD329-AFORSYTHE]
Sent: 9/28/2022 9:48:18 PM
To: Spranza, John [john.spranza@hdrinc.com]
Subject: FW: Sites Project - Without Exchanges Trend Reporting Spreadsheet

John, can you get a call set up with the ICF team, Steve and Rob, Angela and I in about a week or so to review these? Would love for the ICF team to have looked through them a bit by then and come with questions/thoughts/concerns.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Alicia Forsythe
Sent: Wednesday, September 28, 2022 9:47 PM
To: Angela Bezzone <bezzone@mbkengineers.com>; 'Davis-Fadtke, Kristal@Wildlife' <Kristal.Davis-Fadtke@wildlife.ca.gov>; Uttley, Paige@Wildlife <Paige.Uttley@wildlife.ca.gov>; Spranza, John <john.spranza@hdrinc.com>; Williams, Jonathan@Wildlife <Jonathan.Williams@wildlife.ca.gov>; steve.micko@jacobs.com; Rob Leaf <Rob.Leaf@jacobs.com>; Hendrick, Mike <Mike.Hendrick@icf.com>; Wilder, Rick <Rick.Wilder@icf.com>
Subject: Sites Project - Without Exchanges Trend Reporting Spreadsheet

Hello all – Earlier this month, we had a call to discuss the possibility of what the Project may look like if exchanges with Shasta Lake and Lake Oroville were not implemented in any given year. We have completed a CALSIM II sensitivity analysis of this and the results are attached in the trend reporting spreadsheet.

The attached trend reporting spreadsheet contains the following modeled results:

- NAA 041122 2035CT – No Action Alternative, 2035 CT climate change hydrology
- ALT 3A 041122 2035CT – Alternative 3A (including current diversion criteria which includes 10,700 cfs Oct-June at Wilkins Slough), 2035 CT climate change hydrology
- ALT 3A 041122 2035CT without Shasta, nor Oroville Exchanges sensitivity analysis – Same Alternative 3A as above but without exchanges with both the CVP and SWP

It is important to note that the Authority has not changed its project description – the Project continues to include exchanges. Exchanges are voluntary and any party can choose to not conduct an exchange in a given year. We completed the attached CALSIM II sensitivity analysis to have a more informed dialogue around environmental changes that may occur in the event that exchanges are not implemented in any given year or in a series of years. As its difficult to "turn off" exchanges in only some years, the attached CALSIM II analysis was completed without exchanges in all years. This represents more of a bookend, because as noted above, exchange are part of the Project and would likely only not be implemented on a more year-by-year basis (for example, if there was too much risk that exchanged water would spill as flood water from Shasta, the Authority may elect to not participate in a given year).

Also important to note is that the modeling was completed with Alternative 3A, which includes up to 25% Reclamation investment in Sites (modeling assumed 25%). Thus, there continues to be interaction of Sites and the CVP operations due to Reclamation's investment.

We haven't yet summarized these runs. They are hot off the press. We thought we would get these out for review so folks can begin to look at the information.

Kristal, Paige and Jon – I'll let you all distribute to your staff as you see appropriate.

I'll reach back out shortly and we can get a call scheduled in 2 to 3 weeks to review the results and talk about next steps.

Thanks all!

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Spranza, John [John.Spranza@hdrinc.com]
Sent: 9/30/2022 3:14:21 PM
To: Glen Spain [fish1ifr@aol.com]; Alicia Forsythe [aforsythe@sitesproject.org]
Subject: RE: Sites Project - Catch up on Fisheries Topics

Hi Glenn,
Thanks for sending these along, much appreciated. Sorry for the slow response, it's been a crazy week.

I did review the modeling we used for the project and the analysis in the RDEIR/SDEIS uses 53.5°F as an index value for analysis of Chinook salmon spawning and egg incubation. We also use the Martin and Anderson models, which use the 53.5°F value. We also added an analysis to the Final EIR/EIS that looks more into this temperature index value for salmonid temperature-dependent egg mortalities related to summer cold-water pool management.
If you have any questions let me know. Have a great weekend.
John

John Spranza

D 916.679.8858 M 818.640.2487

From: Glen Spain <fish1ifr@aol.com>
Sent: Friday, September 23, 2022 12:02 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Spranza, John <john.spranza@hdrinc.com>
Subject: Re: Sites Project - Catch up on Fisheries Topics

Alicia, John ----

THANKS for your time and consideration in our meeting today! I found it very helpful in better understanding the Sites Project generally. I hope it was helpful to you in better understanding commercial salmon fishing industry concerns related to the Central Valley water systems as well.

Please feel free to send me any additional information that you think may be of interest to us about the likely or modeled fish impacts of Sites and to ask any questions of us on our concerns about the salmonid impacts as this proceeds.

Attached are two documents I referred to in our call:

(a) The Pacific Fishery Management Council's Sept. 12, 2022, letter to the various agencies involved with water management in the Central Valley for salmonids, noting the obsolete (and too high) current temperature dependent mortality (TDM) threshold of 56.0 F. still assumed for salmonid eggs, and the great need to re-evaluate those standards, which are more than 30 years old, in light of new science.

(b) A UC Davis 2014 peer-reviewed study I referred to concluding that California's current water rights system has over-allocated its limited water supply by as much a *5 times the total water flows annually available*. For more details about that study you might contact the authors. This massive California over-appropriations problem is the "elephant in the room" that nobody wants to deal with, apparently. Its implications for ever getting California's water system onto a sustainable basis are staggering. But its a major reason we believe that, to achieve any reasonable balance between actual California water supply and total demand, that we can never get there by simply "storing more water" without also greatly reducing demand (e.g., better conservation, more efficient watering patterns and water transport systems, changes from water intensive to water thrifty crops, and fallowing marginal lands in favor of other non-ag uses (such as solar or wind power production)).

==
Glen H. Spain, J.D., NW Regional Director/General Legal Counsel
Pacific Coast Federation of Fishermen's Associations (PCFFA)
and the Institute for Fisheries Resources (IFR)
PO Box 11170, Eugene OR 97440-3370
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In a message dated 9/23/2022 6:29:34 AM Pacific Standard Time, aforsythe@sitesproject.org writes:

meeting