From: Fritz Durst [fritz.durst@gmail.com]
Sent: 11/2/2020 5:43:19 AM
To: Thad Bettner [tbettner@gcid.net]
CC: Jerry Brown [jbrown@sitesproject.org]; Roger Gwinn [rgwinn@tfgnet.com]; Garrett Durst [garrett@naturalresourceresults.com]; Kevin Spesert [kspesert@sitesproject.org]; jsutton@tccanal.com
Subject: Re: Feedback from Reclamation OMB meeting
Attachments: image002.png

Good update. Thank you.

We might also want to include "beneficiary pays" and "partnership" in our dialogue.

On Fri, Oct 30, 2020 at 2:04 PM Thad Bettner <tbettner@gcid.net> wrote:

> Great report and update.
>
> ___________________________________
>
> Thaddeus L Bettner PE, General Manager
> Glenn-Colusa Irrigation District
> PO Box 150
> Willows, CA 95988
> 530.934.8881 (office)
> 530.588.3450 (cell)
>
> SERVING OUR LANDS AND ENVIRONMENT SUSTAINABLY
> GCID
> 100 YEARS OF DEDICATION
> 1920-2020
>
> **From:** Jerry Brown <jbrown@sitesproject.org>
> **Sent:** Friday, October 30, 2020 12:48 PM
> **To:** Roger Gwinn <rgwinn@tfgnet.com>; Garrett Durst <garrett@naturalresourceresults.com>; Kevin Spesert <kspesert@sitesproject.org>; jsutton@tccanal.com; Thad Bettner <tbettner@gcid.net>; fritz.durst@gmail.com
> **Subject:** Feedback from Reclamation OMB meeting
>
> Richard Welsh called this morning to report on the OMB briefing they had yesterday as follows:
>
> 1. Overall, went well. Call lasted 1 hr 10 min. Summary comment "was concerned with \$6-\$7B project, glad to see a smaller project on the table". Next step is they expect written questions from OMB which Reclamation will need to answer. Commissioner emphasized importance of getting everything done to meet WIIN deadline.
>
> 2. OMB attendees: Susan Leetmaa, OMB Examiner, Kelly Colyar (Susan's boss, only attended first ½ hour). Same reviewers for FKC, and BF Sisk so have a some understanding of California water and the plumbing. Susan grew up in small town outside Fresno. Are aware Sites would like to meet with them. Don't do teams, conference call if format only.

3. Reclamation presented a slide deck summarizing the report and the project. Reclamation explained they are looking at a participation closer to the \$200-\$300m range and this participation would be determined further into the process but would fall within the bookends of the feasibility report and not exceed 25% cost share. Reclamation mentioned the rightsized project which is locally preferred and represents a higher B/C ratio than the bookends. The Commissioner communicated there is bipartisan local, state and federal support for the project.

4. Suggested topics to cover in Sites briefing:

a. 1 page fact sheet, don't need a Sites slide deck, Reclamation slide deck covered the project sufficiently for understanding

b. Demonstrate local cost share commitment and a plan for covering these costs

c. Clarify what we changed in value planning and drivers

d. Local interest is in achieving greater permitting and approvals, affordability, and buildability

e. Mention that project is highlighted in the water resilience portfolio

f. Confirm status of discussions with CDFW regarding permitting and how these discussions factored into the value planning process

g. Plans for water rights acquisition

h. Discuss effects of climate change on operations of project

Our next step is already underway with scheduling of Sites briefing with OMB within the next couple of weeks.

From: Kevin Spesert [kspesert@sitesproject.org]
Sent: 11/2/2020 7:26:21 AM
To: Jerry Brown [jbrown@sitesproject.org]; Alicia Forsythe [aforsythe@sitesproject.org]
Subject: Re: Groundwater Commission Presentation

Will do...do you want me to send it to Mary or are you going to send it over to her

From: Jerry Brown <jbrown@sitesproject.org>
Sent: Monday, November 2, 2020 7:22 AM
To: Alicia Forsythe; Kevin Spesert
Subject: Re: Groundwater Commission Presentation

I made this change to the slides.

Kevin can you put this final version on sharepoint wherever it is that you save these. Thanks

From: Alicia Forsythe <aforsythe@sitesproject.org>
Date: Friday, October 30, 2020 at 12:00 PM
To: Jerry Brown <jbrown@sitesproject.org>, Kevin Spesert <kspesert@sitesproject.org>
Subject: RE: Groundwater Commission Presentation

Totally agreed. Just want to be careful that our written statements don't get ahead of our analysis. Maybe the bullet says:

Impacts in the 2017 Draft EIR/EIS were less than significant. No substantial changes anticipated.

I don't see any new or substantially different. But just want to be careful. I am flexible on this so do what you think is best.

Ali

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

From: Jerry Brown <jbrown@sitesproject.org>
Sent: Friday, October 30, 2020 11:53 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Kevin Spesert <kspesert@sitesproject.org>
Subject: Re: Groundwater Commission Presentation

Sure, can do. But my thinking is that since the 2017 Draft was LS, anything we are doing now is the same or less.

From: Alicia Forsythe <aforsythe@sitesproject.org>
Date: Friday, October 30, 2020 at 11:09 AM

To: Kevin Spesert <kspesert@sitesproject.org>, Jerry Brown <jbrown@sitesproject.org>
Subject: RE: Groundwater Commission Presentation

I would say that all other effects are "anticipated to be less than significant". We haven't completed the analysis yet, so not totally sure that they WILL be less than significant.

Ali

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

---

From: Kevin Spesert <kspesert@sitesproject.org>
Sent: Friday, October 30, 2020 9:57 AM
To: Jerry Brown <jbrown@sitesproject.org>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: RE: Groundwater Commission Presentation

Jerry...

Here is the slide deck with the new slides...

I added Stone Corral Creek and Funks Creek to the "possible Local Groundwater Interactions" slide...Let me know if you are good with the additions...and I can send the updated version to Mary

Thanks!

Kevin

From: Jerry Brown <jbrown@sitesproject.org>
Sent: Friday, October 30, 2020 8:26 AM
To: Kevin Spesert <kspesert@sitesproject.org>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: Groundwater Commission Presentation

Here is the slide deck I gave Mary Fahey for the groundwater commission meeting next Tuesday. Please add two new slides after slide 17 as follows:

Slide – Primary Areas for Possible Local Groundwater Interactions

1. Near Reservoir
2. Terminal Regulating Reservoir near GCID Canal
3. Use of Colusa Basin Drain

Slide – Effects Analysis

1. Some areas within the local basin will benefit
2. Broadly, quantity and quality could be improved

3. Limited micro effects still need to be analyzed
4. All other effects are less than significant

Aquatics Negotiations Team Agenda

Affordable Water, Sustainably Managed

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

Meeting Information:

Date:	November 5, 2020	**Location:**	Microsoft Teams
Start Time:	4:00 p.m.	**Finish Time:**	5:00 p.m.
Purpose:	Negotiations team kick-off meeting		

Meeting Participants:

Thad Bettner, GCID	Randall Neudeck, MWD	Jerry Brown, Sites Authority
Heather Dyer, SBVMWD	Bill Vanderwaal, RD 108	Ali Forsythe, Sites Authority
Cindy Kao, Valley Water		

Agenda:

Discussion Topic	Topic Leader	Time Allotted
1. Roles and Responsibilities of the Negotiations Team and Lead Negotiator a. Review of Board adopted negotiations approach and team members. b. Discussion of Lead Negotiator role c. Are there any special circumstances for these negotiations that would warrant altering this approach or are other team members needed?	Ali / Jerry	15 min
2. Aquatics Approach a. Current status of discussion with CDFW, USFWS, NMFS, and Reclamation b. Modeling status and schedule c. Approach for developing diversion criteria	Ali	40 min
3. Review Action Items and Next Steps a. Framing Principles and Parameters	Ali	5 mins

Permit / Agreement	Agency With	Purpose / Key Components Addressed*	Negotiations Timeframe
Biological Assessment	Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service	1. Compliance with Federal ESA requirements for construction, including incidental take of listed species 2. Compliance with related statue such as the Magnuson Stevens Fishery Conservation and Management Act, etc.	9/2020 thru early 2022 Submit BA 6/2021 BO target late 2021 REVISION Submit BA 10/2021 BO target mid 2022
State Incidental Take Permit – Operations	CA Department of Fish and Wildlife	Compliance with State ESA (Section 2081.1 of Fish and Game Code) for operations, including incidental take of listed species	9/2020 thru late 2022 Submit Application 12/2021 ITP target late 2022

From: Laurie Warner Herson [laurie.warner.herson@phenixenv.com]
Sent: 11/2/2020 10:17:14 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]
Subject: draft email for NGOs

Hi Ali,

The following provides draft text for an email to NGOs concerning the upcoming workshop:

Good Morning,

In August 2017, the Sites Project Authority (Authority) and the Bureau of Reclamation (Reclamation) jointly issued a Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Sites Reservoir Project (Project) pursuant to their respective lead agency obligations under the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). In 2020 the Authority decided to prepare a Revised Draft EIR and recirculate to allow the public to review and comment on changes to the project, including new alternatives and associated facilities. Reclamation has agreed to also circulate a Supplemental Draft EIS to comply with NEPA.

The Authority will be conducting a workshop to update non-governmental agencies that commented on the 2017 Sites Reservoir Project Draft EIR/EIS on the current status of the Project. The workshop will provide:

- a project update, including a description of changes to the proposed project facilities and operations due to the Authority's Value Planning process and ongoing coordination with resource agencies;
- an overview of the Authority's decision to recirculate the Revised Draft EIR based on changes to the project;
- the schedule and process for the Revised Draft EIR/Supplemental Draft EIS; and,
- an opportunity for your organization to ask questions in an informal setting.

To better facilitate smaller group participation, the same workshop will be held via on two dates November 17th and 18th, 2020. The workshop will be held as a virtual meeting and not live due to current COVID-19 conditions. The Authority will be sending out invitations for both dates but we ask that your organization accept only one. An agenda will be provided with the invitation.

We look forward to meeting with you. If there are any questions, please contact XXXXX at XXXXXXX.

Thank you,

Alicia Forsythe
Environmental Planning and Permitting Manager

I will continue to coordinate with Marcia on confirming emails so she can send this once you have approved. Also, did you want to send the attachments with this email or the invitations?

Thanks,

Laurie

Laurie Warner Herson
Principal/Owner
Phenix
Environmental Planning

916.201.3935
laurie.warner.herson@phenixenv.com
State of California Small Business (#1796182)
Supplier Clearinghouse Women Business Enterprise (#16000323)

http://phenixenv.com/

Biological – Construction Negotiations Team Agenda

Sites
Affordable Water, Sustainably Managed

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

Meeting Information:

Date:	November 9, 2020	**Location:**	Microsoft Teams
Start Time:	2:00 p.m.	**Finish Time:**	3:00 p.m.
Purpose:	Negotiations team kick-off meeting		

Meeting Participants:

Mike Azevedo, Colusa County	Jeff Sutton, TCCA	Jerry Brown, Sites Authority
Thad Bettner, GCID	Bill Vanderwaal, RD 108	Ali Forsythe, Sites Authority
Heather Dyer, SBVMWD		

Agenda:

Discussion Topic	Topic Leader	Time Allotted
1. Roles and Responsibilities of the Negotiations Team and Lead Negotiator a. Review of Board adopted negotiations approach and team members. b. Discussion of Lead Negotiator role c. Are there any special circumstances for these negotiations that would warrant altering this approach or are other team members needed?	Ali / Jerry	15 min
2. Current Status of Discussions with the Agencies a. Biological Assessment → Reclamation and USFWS (NMFS if Alternative 2) b. 2081 Permit → CDFW • Fully mitigate • Avoidance of fully protected species c. CA Fish and Game Code 5937	Ali	20 mins
3. Biological Construction Permitting Approach a. Biological survey data b. Amended consultations once we have survey data, (close to) final design and target mitigation areas	Ali	20 min

	c. Mitigation stacking – good mitigation opportunities?		
4.	Review Action Items and Next Steps a. Framing Principles and Parameters	Ali	5 mins

Permit / Agreement	Agency With	Purpose / Key Components Addressed*	Negotiations Timeframe
Biological Assessment	Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service	1. Compliance with Federal ESA requirements for construction, including incidental take of listed species 2. Compliance with related statue such as the as the Migratory Bird Treaty Act, etc.	9/2020 thru early 2022 Submit BA 6/2021 BO target late 2021 REVISION Submit BA 10/2021 BO target mid 2022
State Incidental Take Permit – Operations	CA Department of Fish and Wildlife	Compliance with State ESA (Section 2081.1 of Fish and Game Code) for operations, including incidental take of listed species	9/2020 thru late 2022 Submit Application 12/2021 ITP target late 2022

From: Heydinger, Erin [Erin.Heydinger@hdrinc.com]
Sent: 11/3/2020 12:38:05 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]
Subject: FW: [EXTERNAL] Sites CVP Coordination

FYI

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

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From: Heydinger, Erin
Sent: Tuesday, November 3, 2020 12:38 PM
To: 'Sumer, Derya' <dsumer@usbr.gov>
Cc: Davis, Ryan A <rdavis@usbr.gov>; Leaf, Rob/SAC <Rob.Leaf@jacobs.com>; Thayer, Reed/SAC <Reed.Thayer@jacobs.com>; Micko, Steve/SAC <steve.micko@jacobs.com>
Subject: RE: [EXTERNAL] Sites CVP Coordination

Hi Derya,

To clarify – Steve's caveat was to be sure Reclamation recognizes that this model is a work in progress and will be changed before analysis for the EIS, BA, etc. will begin. We are hoping you will review the model's assumptions and will collaborate on potential changes/updates. The list of assumptions provided by Steve are the list of items we are hoping to receive your input on, not that the other assumptions cannot be reviewed. Based on the current status of the model, I don't think it's quite at a point yet where management decisions should be made based on its output; CH still has quite a few changes that need to be incorporated before it's ready for that level of use.

If you'd like to chat about this, I'd be happy to jump on a call to discuss.

Thanks,
Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

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From: Sumer, Derya <dsumer@usbr.gov>
Sent: Tuesday, November 3, 2020 12:01 PM
To: Micko, Steve/SAC <steve.micko@jacobs.com>
Cc: Davis, Ryan A <rdavis@usbr.gov>; Heydinger, Erin <Erin.Heydinger@hdrinc.com>; Leaf, Rob/SAC <Rob.Leaf@jacobs.com>; Thayer, Reed/SAC <Reed.Thayer@jacobs.com>
Subject: RE: [EXTERNAL] Sites CVP Coordination

Steve-

I cannot fulfill your request about not sharing information with my management or not using models in decision making. Operations modeling review has to be done with all the assumptions that go into the model. We cannot separate out parts and pieces. Otherwise, we will be making decisions not knowing the whole picture.
I have not downloaded any of your files and will not be reviewing the models at this time.
Please provide Feasibility Report runs developed under the contract with Reclamation on another link.

Thanks,
Derya

Derya Sumer, PhD, PE
Lead Modeler
US Bureau of Reclamation
Interior Region 10 · California-Great Basin
Email: dsumer@usbr.gov
Mobile: 916-208-7909

From: Micko, Steve/SAC <Steve.Micko@jacobs.com>
Sent: Monday, November 2, 2020 8:35 PM
To: Sumer, Derya <dsumer@usbr.gov>
Cc: Davis, Ryan A <rdavis@usbr.gov>; Heydinger, Erin <erin.heydinger@hdrinc.com>; Leaf, Rob/SAC <Rob.Leaf@jacobs.com>; Thayer, Reed/SAC <Reed.Thayer@jacobs.com>
Subject: [EXTERNAL] Sites CVP Coordination

Hi Derya,

You may access the following information in the "20201102_ALTA2_PEA" sub-directory at this link:

- Documentation of provided material: _Readme_20201102.pdf
- CalSim II studies of:
  - 2020 Sites Feasibility Report:
    - No Action Alternative: NODOS_USBR2020_SitesOFF_WaterFixOFF_CALSIM_MMv3_NAA_4-13-20_QAQC2.7z
    - ALTA1: NODOS_USBR2020_SitesON_WaterFixOFF_CALSIM_MMv3_ALTA1_FF_4-13-20_QAQC2.7z
    - ALTD1: NODOS_USBR2020_SitesON_WaterFixOFF_CALSIM_MMv3_ALTD1_FF_4-13-20_QAQC2.7z
  - 2020 Sites Preliminary Effects Analysis:
    - No Action Alternative: NODOS_SPJPA2020_CALSIM_NAA_091720_rev01.7z
    - Alternative A2 Scen B: NODOS_SPJPA2020_CALSIM_ALTA2_OpFlex91_092220_rev03.7z
    - Alternative A2 PEA: NODOS_SPJPA2020_CALSIM_ALTA2_OpFlex91_092220_rev03_PEA.7z
- Trend reporting spreadsheets:
  - CalSim: NODOS_Trend_Reporting_rev26dpcy_DV6_HistClim_CALSIM__NAA_ALTA2_092220_PEA_FR_NAA_ALTA1_ALTD1.xlsm
    - Model assumptions in "AssumptionMatrix" tab
  - Temperature Models: NODOS_Trend_Reporting_rev03cy_DV2_HistClim_HEC5Q_RecTemp__NAA_091720_ALTA2_092020_PrelimEffects.xlsm
- Feasibility Report Metric PDF:
  - FRmetrics_rev18__ALTA2_CVP91_092220_rev03_ALTA2_CVP91_092220_rev03_vs_PEA.pdf

Provided material are draft and subject to revision. Several model assumptions as well as implementation of actions require technical and management review at the Sites Authority.

The material should only be used for review by technical staff at Reclamation to confirm assumptions inherent to:

- Sacramento River flows (schedule and limits),
- American River flows (schedule and limits),
- Shasta, Trinity, and Folsom storage (schedule and limits),
- Sacramento and American river temperature,
- San Luis Storage,
- Export conveyance priority,
- and salinity costs.

In no way should this material inform management or policy decisions at Reclamation.

Please let me know if you have any questions.

Best,
Steve

Steve Micko, PE | Jacobs | Associate Water Resources Engineer
O:916.286.0358 | M:408.834.6614 | Steve.Micko@jacobs.com
2485 Natomas Park Drive Suite 600 | Sacramento, CA 95833

CDFW Terrestrial- Sites Meeting #2 Agenda

Date: *November 17, 2020*

Location: [HYPERLINK "https://teams.microsoft.com/l/meetup-join/19%3ameeting_YjIyNTFhMGMtNTM4MS00ZGE4LTllYTctZTgwNDhhZjAyODRl%40thread.v2/0?context=%7b%22Tid%22%3a%22cf90b97b-be46-4a00-9700-81ce4ff1b7f6%22%2c%22Oid%22%3a%22e71d783b-a054-4a41-a066-526eebb2c787%22%7d" \t "_blank"]
[HYPERLINK "tel:+1%20213-493-7443,,921135958" \l " " \t "_blank"] United States, Los Angeles (Toll)
Conference ID: 921 135 958#

Time: 2:00 pm – 3:00 pm

Purpose: To resume discussions on CDFW coordination with Sites 2081 and CEQA processes.

Attendees:

Juan Torres, CDFW	Zachary Kearns, CDFW	John Spranza, HDR
Ian Boyd, CDFW	Ali Forsythe, Sites Authority	Monique Briard, ICF
Ian Caine, HDR	Jennifer Haire, ICF	Ellen Berryman, ICF

Agenda:

Action Item	Status
ICF will look into refining bumblebee models.	Ongoing
Ellen will re-distribute the GGS write-up for CDFW to do a final review and make sure they're comfortable with the approach before ICF completes the model write-ups for the remainder of the species. CDFW will provide feedback soon after receiving.	Model distributed, feedback received from CDFW
Monique will look into CEQA issue on timing for resolving one vs two ITPs. That is, does the EIR need to specify one vs two?	In progress
John will confirm if the Revised EIR/Supplemental EIS schedule includes a review period for CDFW prior to public release in July 2021.	In progress
Ellen will set up meeting for three to four weeks from now, to (1) initiate discussions related to the EIR; and (2) discuss models.	Done
Other topics for future meetings include potential flow effects on bank swallow and cuckoo, and the 2081 approach (providing flexibility and one vs two ITPs).	Dates TBD

Discussion Topic	Topic Leader	Time
1. Introductions/Safety/ Admin	John Spranza	5 minutes
2. 2081 vs. CEQA Schedule	Monique Briard	10 minutes
3. Giant garter snake model	Ellen Berryman	15 minutes

4.	CDFW coordination through CEQA process	Monique/John	10 minutes
5.	Topics for future discussion with CDFW	All	15 minutes
6.	Next steps	Ellen Berryman	5 minutes

From: Heydinger, Erin [Erin.Heydinger@hdrinc.com]
Sent: 11/3/2020 4:56:48 PM
To: Jerry Brown [jbrown@sitesproject.org]
CC: Alicia Forsythe [aforsythe@sitesproject.org]
Subject: Trend Reporting Spreadsheet
Attachments: NODOS_Trend_Reporting_rev26dpcy_DV5_HistClim_CALSIM__ALTA2_092220_PrelimEffects.xlsm; NODOS_Trend_Reporting_rev01cy_DV2_HistClim_CALSIM_DSM2_HEC5Q__ALTA2_092220_PrelimEffects.xlsm

Jerry,

Attached is the latest "full" reporting spreadsheet that includes all parameters. Note – there are **a lot** parameters in here, so I also attached the refined version that just has the parameters we reviewed at the agency meeting. The full spreadsheet is the one that's 6 MB (file name "_rev26") and the refined one is only 1 MB (file name "_rev01"). Please let me know if you can't use these and I'll send over the parameters we have available.

Thanks!
Erin

Erin Heydinger, PE, PMP
Asst. Project Manager
Water/Wastewater

HDR
2379 Gateway Oaks Dr, #200
Sacramento, CA 95833
D 916.679.8863 M 651.307.9758

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File Provided Natively

File Provided Natively

From: Jerry Brown [jbrown@sitesproject.org]
Sent: 11/4/2020 8:58:43 AM
To: Heydinger, Erin [erin.heydinger@hdrinc.com]
CC: Alicia Forsythe [aforsythe@sitesproject.org]; Kevin Spesert [kspesert@sitesproject.org]; Marcia Kivett [MKivett@sitesproject.org]
Subject: Re: Trend Reporting Spreadsheet

Here's what I'd like for next weeks bay planning coalition presentation. Graphs of monthly averages for:

1. Diversions to fill
2. Releases
3. Delta Outflow (comparing no project and with project)

Please work with Kevin to get these into slides at the end of the standard overview presentation. Kevin – similar to what we did for the groundwater commission.

thanks

From: "Heydinger, Erin" <Erin.Heydinger@hdrinc.com>
Date: Tuesday, November 3, 2020 at 4:57 PM
To: Jerry Brown <jbrown@sitesproject.org>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: Trend Reporting Spreadsheet

Jerry,

Attached is the latest "full" reporting spreadsheet that includes all parameters. Note – there are **a lot** parameters in here, so I also attached the refined version that just has the parameters we reviewed at the agency meeting. The full spreadsheet is the one that's 6 MB (file name "_rev26") and the refined one is only 1 MB (file name "_rev01"). Please let me know if you can't use these and I'll send over the parameters we have available.

Thanks!
Erin

Erin Heydinger, PE, PMP
Asst. Project Manager
Water/Wastewater

HDR
2379 Gateway Oaks Dr, #200
Sacramento, CA 95833
D 916.679.8863 M 651.307.9758

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From: Briard, Monique [Monique.Briard@icf.com]
Sent: 11/4/2020 12:57:28 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]
Subject: RE: Sites - Project Description Team

Are you also going to be talking about the new Alt 3 with the group today? Thanks, Monique

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Wednesday, November 4, 2020 10:51 AM
To: laurie.warner.herson@phenixenv.com; John Spranza <John.Spranza@hdrinc.com>; Heydinger, Erin <erin.heydinger@hdrinc.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>; Fisher, Linda <Linda.Fisher@hdrinc.com>; Henry.Luu@hdrinc.com; Briard, Monique <Monique.Briard@icf.com>; Lecky, Jim <Jim.Lecky@icf.com>; Williams, Nicole <Nicole.Williams@icf.com>; Rude, Pete/RDD <Pete.Rude@jacobs.com>; Boling, Robert M. <Robert.Boling@hdrinc.com>; Forrest, Michael <michael.forrest@aecom.com>; Jeff.Herrin@aecom.com; Berryman, Ellen <Ellen.Berryman@icf.com>; Unsworth, Ellen <Ellen.Unsworth@icf.com>; Jerry Brown <jbrown@sitesproject.org>; Kevin Spesert <kspesert@sitesproject.org>; conner@cmdwest.com; Smith, Jeff/SAC <Jeff.Smith1@jacobs.com>; Alexander, Jeriann <jalexander@fugro.com>; connermcdonald@gmail.com; Leaf, Rob/SAC <Rob.Leaf@jacobs.com>; Micko, Steve/SAC <Steve.Micko@jacobs.com>; Hendrick, Mike <Mike.Hendrick@icf.com>
Subject: RE: Sites - Project Description Team

Hi all – Attached is our agenda for this afternoon. It is also on SharePoint here:

https://sitesreservoirproject.sharepoint.com/:w:/r/ProjectDescription/Meetings/20201104_Project%20Description%20Team_Meeting-Agenda.docx?d=w652efb82dd5d4689935fa2f553e7984d&csf=1&web=1&e=DhL3Gg

A heads up that we will be asking each service area to provide a quick, 5 minute overview of where you, the key things you are working on, and the key items coming up in the next month or so. Please keep this to 5 mins so everyone has time.

We look forward to the discussion this afternoon!

Ali

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

From: Alicia Forsythe
Sent: Monday, November 2, 2020 1:50 PM
To: laurie.warner.herson@phenixenv.com; john.spranza@hdrinc.com; 'Heydinger, Erin' <Erin.Heydinger@hdrinc.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>; Fisher, Linda <Linda.Fisher@hdrinc.com>; Henry.Luu@hdrinc.com; Monique Briard (Monique.Briard@icf.com) <Monique.Briard@icf.com>; Lecky, Jim <Jim.Lecky@icf.com>; Williams, Nicole <Nicole.Williams@icf.com>; Rude, Pete/RDD <Pete.Rude@jacobs.com>; Boling, Robert M. <Robert.Boling@hdrinc.com>; Forrest, Michael <michael.forrest@aecom.com>; Jeff.Herrin@aecom.com; Berryman, Ellen <Ellen.Berryman@icf.com>; Unsworth, Ellen <Ellen.Unsworth@icf.com>; Jerry Brown <jbrown@sitesproject.org>; 'Kevin Spesert (kspesert@sitesproject.org)' <kspesert@sitesproject.org>; conner@cmdwest.com; Smith, Jeff/SAC <Jeff.Smith1@jacobs.com>; Alexander, Jeriann <jalexander@fugro.com>; connermcdonald@gmail.com; Leaf, Rob/SAC

<Rob.Leaf@jacobs.com>; Micko, Steve/SAC <Steve.Micko@jacobs.com>; Hendrick, Mike <Mike.Hendrick@icf.com>
Subject: RE: Sites - Project Description Team

Hi all – We are getting ready for our team meeting on Wednesday. We will have some open time for your topics, questions, thoughts and ideas. If you have any topics that you'd like to share in advance, please send them to me by COB tomorrow and I will add them to the agenda.

Thanks all!

Ali

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

-----Original Appointment-----
From: Marcia Kivett **On Behalf Of** Alicia Forsythe
Sent: Monday, May 11, 2020 6:41 AM
To: laurie.warner.herson@phenixenv.com; Alicia Forsythe; Ali Forsythe; john.spranza@hdrinc.com; 'Heydinger, Erin'; Arsenijevic, Jelica; Fisher, Linda; Henry.Luu@hdrinc.com; Monique Briard (Monique.Briard@icf.com); Lecky, Jim; Williams, Nicole; robert.tull@jacobs.com; Rude, Pete/RDD; Jim Watson, General Manager; Boling, Robert M.; Forrest, Michael; Jeff.Herrin@aecom.com; Berryman, Ellen; Unsworth, Ellen; Jerry Brown; Kevin Spesert (kspesert@sitesproject.org); conner@cmdwest.com; Smith, Jeff/SAC
Cc: Marcia Kivett; Alexander, Jeriann; connermcdonald@gmail.com; Leaf, Rob/SAC; Micko, Steve/SAC; Hendrick, Mike
Subject: Sites - Project Description Team
When: Wednesday, November 4, 2020 1:00 PM-2:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: +1 213-379-5743 Conference ID: 576 656 37#

This is a recurring, bi-weekly meeting.

Join Microsoft Teams Meeting
+1 213-379-5743 United States, Los Angeles (Toll)
(888) 404-2493 United States (Toll-free)
Conference ID: 576 656 37#
Local numbers | Reset PIN | Learn more about Teams | Meeting options

A Brown and Caldwell Teams meeting has been created for this event.
Help

From: Jerry Brown [jbrown@sitesproject.org]
Sent: 11/4/2020 1:13:29 PM
To: Heydinger, Erin [erin.heydinger@hdrinc.com]
CC: Alicia Forsythe [aforsythe@sitesproject.org]; Kevin Spesert [kspesert@sitesproject.org]; Marcia Kivett [MKivett@sitesproject.org]
Subject: Re: Trend Reporting Spreadsheet

Use whatever we have by Wed next week. thanks

From: "Heydinger, Erin" <Erin.Heydinger@hdrinc.com>
Date: Wednesday, November 4, 2020 at 12:29 PM
To: Jerry Brown <jbrown@sitesproject.org>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>, Kevin Spesert <kspesert@sitesproject.org>, Marcia Kivett <MKivett@sitesproject.org>
Subject: RE: Trend Reporting Spreadsheet

Will do, Jerry.

We will have revised modeling with updated numbers and graphs on Monday or Tuesday next week. When is your meeting with the bay folks? If the timing works, I can hold off until we have the updated results. I expect the changes will be most apparent in our reservoir release numbers.

Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

hdrinc.com/follow-us

From: Jerry Brown <jbrown@sitesproject.org>
Sent: Wednesday, November 4, 2020 8:59 AM
To: Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>; Kevin Spesert <kspesert@sitesproject.org>; Marcia Kivett <MKivett@sitesproject.org>
Subject: Re: Trend Reporting Spreadsheet

Here's what I'd like for next weeks bay planning coalition presentation. Graphs of monthly averages for:

1. Diversions to fill
2. Releases
3. Delta Outflow (comparing no project and with project)

Please work with Kevin to get these into slides at the end of the standard overview presentation. Kevin – similar to what we did for the groundwater commission.

thanks

From: "Heydinger, Erin" <Erin.Heydinger@hdrinc.com>
Date: Tuesday, November 3, 2020 at 4:57 PM
To: Jerry Brown <jbrown@sitesproject.org>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: Trend Reporting Spreadsheet

Jerry,

Attached is the latest "full" reporting spreadsheet that includes all parameters. Note – there are **a lot** parameters in here, so I also attached the refined version that just has the parameters we reviewed at the agency meeting. The full spreadsheet is the one that's 6 MB (file name "_rev26") and the refined one is only 1 MB (file name "_rev01"). Please let me know if you can't use these and I'll send over the parameters we have available.

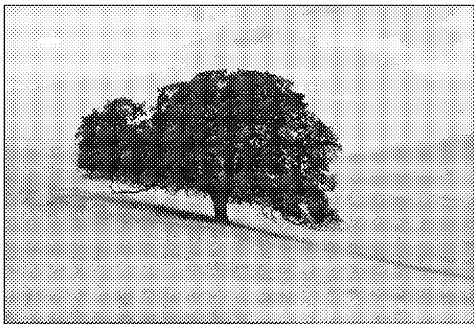
Thanks!
Erin

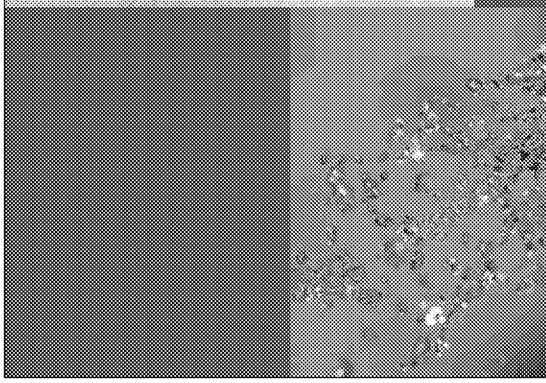
Erin Heydinger, PE, PMP
Asst. Project Manager
Water/Wastewater

HDR
2379 Gateway Oaks Dr, #200
Sacramento, CA 95833
D 916.679.8863 M 651.307.9758

hdrinc.com/follow-us

File Provided Natively





SITES RESERVOIR PROJECT ASSESSMENT OF DELEGATION OF AUTHORITY

November 2020

Darling H_2O
Consulting Inc.

Agenda

I. Role of AB as defined in 2016 and 2018 Bylaws
II. Role of RC as defined in the 2019 Reservoir Project Agreement
III. Role of ED as defined in the 2018 Bylaws
IV. Finding and Recommendation #1: *Modify Bylaws to better define roles for AB, RC and ED*
V. Finding and Recommendation #2: *Approve a detailed Responsibility Matrix to be incorporated in the modified Bylaws*
VI. Finding and Recommendation #3: *Adopt a continuous invoice processing approach*
VII. Next Steps

DELEGATION OF AUTHORITY DOCUMENTS

- Fourth Amended and Restated Joint Exercise of Powers Agreement
  - 3-23-17 Approved
- Reservoir Project Agreement
  - 4-1-19 2019 Reservoir Project Agreement Approved
  - 10-18-19 First Amendment Approved
  - 4-22-20 Second Amendment Approved
- Bylaws
  - 11-21-16 Bylaws for Phase 1 Approved
  - 9-17-18 Bylaws for Phase 2 Approved
- 2019 Organizational Assessment
- 7-22-20 Authority Board's Committees
- 7-22-20 Joint Budget and Finance Committee Chartering Document

ROLE OF THE AUTHORITY BOARD

Authority Board (AB)

Section 4.1 of the 2016 Bylaws defines the role of the Board to include:

- Prop 1 grant compliance
- CEQA lead agency and work with USBR for NEPA lead
- Hold title to water rights
- Dam safety compliance
- Permit applicant
- Review decisions at the Project Agreement level to ensure they are in the best interest of the Sites Reservoir Project
- Acquire property and rights-of-way

ROLE OF THE AUTHORITY BOARD

Authority Board (AB)

Section 10 of the 2018 Bylaws modifies the responsibilities for the AB to include:

- All of the roles defined in Section 4; Plus:
  Negotiation and acceptance of permit conditions
- Commitment to mitigation
- Permit compliance
- Outreach with elected officials, general public, NGO's and tribes
- Determination of Material Changes that affect cost and water supply benefits
- Development of renewable power and pumped storage
- Oversight of employees and consultant contracts
- Establish decision making thresholds by specific topic areas to be addressed by the Reservoir Committee
- Approve the Reservoir Project Agreement and amendments
- Approve a financial plan

ROLE OF THE RESERVOIR COMMITTEE

Reservoir Committee (RC)

Section 3 of the 2019 Reservoir Project Agreement defines the delegated authority to the RC

- Setting policy for the RC
- Recommend actions for the AB to take
- Determine payments (and timing) per participation percentages each fiscal year
- Authorize payments consistent with adopted work plan and budget
- Approve all other actions needed to carry out the project development
- Material actions require both the Reservoir Committee approval and the AB approval

ROLE OF THE EXECUTIVE DIRECTOR

Executive Director (ED)

Section 11.2 of the 2018 Bylaws defines the delegated authority to the General Manager (now Executive Director)

- ❑ Voice of the project on all activities related to advancing the project
- ❑ Represent the project as a leader in the state
- ❑ Maintain costs
- ❑ Seek additional funding partners
- ❑ Delegated spending authorities
    - o Approve Master Service Agreements (MSA) with terms but no scope or cost
    - o Approve MSA Task orders within the budget up to $500k
    - o Execute other professional service agreements within budget and less than $100k
    - o Approve Other expenditures not within budget up to $5k with cost offset from other section in budget
- ❑ Annual performance of key staff positions, consultant contracts and their key personnel

FINDINGS

Finding 1

The Role of the AB was modified in the 2018 Bylaws. Section 4 from the 2016 Bylaws are included plus Section 10 was added. The result has been that all of the RC decisions are being brought to the AB for approval. This leads to extra staff work (and cost) and extra work by the AB to understand non-policy decisions such as technical, environmental, and financial findings. Many of the AB do not sit on the subcommittees that are leading the necessary technical discussions so approving the RC decisions can be stressful. However, keeping informed on the RC decisions is important for the time when the AB needs to certify the environmental documents, adopt mitigation plans and accept all permit terms and conditions.

RECOMMENDATION 1

Direct staff to modify the 2018 Bylaws to clearly lay out the roles of the AB and RC to better reflect that the RC is directing the technical, environmental and financial studies and the AB will be kept informed so that they will be capable of certifying the environmental documents, adopting a mitigation plan and accepting all permit terms and conditions.

FINDINGS

RECOMMENDATION 1 Continued

Proposed 2018 Bylaws modification related to AB roles

Section 4 remains as is:

- Prop 1 grant compliance
- CEQA lead agency and work with USBR for NEPA lead
- Hold title to water rights
- Dam safety compliance
- Permit applicant
- Review decisions at the Project Agreement level to ensure they are in the best interest of the Sites Reservoir Project
- Acquire property and rights-of-way

FINDINGS

RECOMMENDATION 1 Continued

Proposed 2018 Bylaws modification related to AB roles

Transition to RC Role

- Negotiation and acceptance of permit conditions
- Determination of Material Changes that affect cost and water supply benefits
- Development of renewable power and pumped storage
- Establish decision making thresholds by specific topic areas to be addressed by the Reservoir Committee

Part of being CEQA Lead

- Commitment to mitigation
- Permit compliance

Only focus on ED and legal

- Oversight of employees and consultant contracts

No change

- Outreach with elected officials, general public, NGO's and tribes
- Approve the Reservoir Project Agreement and amendments
- Approve a financial plan

FINDINGS

Finding 2

The Role of the ED (and staff) identified in the 2018 Bylaws has evolved. While no significant new spending authority is needed at this time several areas of responsibility have not been made clear. The result is that many administrative items are routinely brought to the Boards for approval. The Bylaws do not define the delegation to the ED in the following areas:

- Budget management
- Grant and Loan applications
- MOUs with agencies and utilities
- CEQA compliance
- Purchasing of materials and supplies
- Insurance claims
- Travel and Training
- Professional Service Contract administration
- Progress Payments
- Land acquisition and easements
- Managing staff
- Access

FINDINGS

RECOMMENDATION 2

Direct staff to create a detailed responsibility matrix that will be approved by both the RC and AB as well as future amendments

Areas of responsibilities should include:

- Budget management
- Grant and Loan applications
- MOUs with agencies and utilities
- CEQA compliance
- Purchasing of materials and supplies
- Insurance claims
- Travel and Training
- Professional Service Contract administration
- Progress Payments
- Land acquisition and easements
- Managing staff
- Access

FINDINGS

Finding 3

The approach to managing payments for contracted services was established in the beginning phase of the project and includes very tight deadlines that allow for subcommittee and Boards approvals on a monthly basis. The impact of this approach is that as the number of contracts increase the stress level of staff is increasing and delays in payments because the Boards only meet once a month will occur more often.

RECOMMENDATION 3

Adopt a commonly used public agency invoicing process that allows for continuous processing of invoices and securing RC approval by warrant register in arrears.

DRAFT Authority Matrix page 1

Sites Project Delegated Authority Levels (Draft for Discussion Purposes)

R = Recommended by, A = Approved, and I = Information Only

	CATEGORY / DOCUMENT	Needs a Policy and Procedure	Legal	Designated Staff	Project Agents	Executive Director	Budget and Finance Committee	Reservoir Committee	Authority Board	Notes
A.	JEPA Agreement, Reservoir Project Agreements, Bylaws									
1	Fourth Amended and Restated Joint Exercise of Powers Agreement		R			R			A	Effective March 21, 2017 (version [illegible])
2	JEPA Amendments		R			R		R	A	AB approves with 75% or greater, each AB member signs
3	JEPA Admission of a new member		R			R		R	A	AB approves with 75% or greater, each AB member signs
4	Amendment 2 to 2019 Reservoir Project Agreement		R			R		A	A	RC/AB approved April 2020. For amendments RC needs 75% or greater weighted approval and all members sign.
5	New members to the RC					R		A	A	RC/AB both approve. RC needs 75% or greater weighted approval and all members sign.
6	Second Amended and Restated Bylaws		R			R		R	A	AB approved [illegible]. Amendments need 75% or greater AB Directors approval and all sign.
7	Administrative Procedures and Amendment Approvals		R			R		A	A	RC/AB approvals. No signatures
8	Approved Administrative Procedure Usage and Administration					A				
B.	Work Plans, Budget, Grants, Loans and MOUs									
1	Phase 2 Amendment 2 Work Plan (work plan from 9/1/20 to 12/31/21)					R	R	A	A	Approved April 22, 2020. RC needs 75% or greater weighted approval and all members sign.
2	Work Plan Budget for 9-1-20 to 12-31-21					R	R	A	A	Approved April 22, 2020. No signatures
3	Budget Transfers	Yes								
	a. Transfers up to $10,000 that are within an approved cost center			R	A		I			Consistent with 8/17/18 Bylaws Section 12.3.2
	b. Transfers up to $50,000 within an approved cost center			R	R	A	I			Consistent with 8/17/18 Bylaws Section 12.3.2
	c. Transfers over $50,000			R	R	R	R	A	A	Consistent with 8/17/18 Bylaws Section 12.3.2
4	Grants									
	a. Application					R		A	A	Consistent with 8/17/18 Bylaws Section 4.[illegible]
	b. Execution and submittal of grant application					A				New
	c. Acceptance and management of grant funds					A		I	I	New
5	Loans									
	a. Application					R		A	A	Consistent with 8/17/18 Bylaws Section 4.[illegible]
	b. Execution and submittal of loan application					A				New
	c. Acceptance and management of loan funds					A		I	I	New
6	MOUs with Federal, State, Local Govts, Native American, Utilities									
	a. MOU Formulation and Approval		R			R		A	A	Recommended addition to 8/17/18 Bylaws Section 4.[illegible]
	b. MOU Execution, management and reporting					A		I	I	New

DRAFT Authority Matrix page 2

	CATEGORY / DOCUMENT	Needs a Policy and Procedure	Legal	Designated Staff	Project Agents	Executive Director	Budget and Finance Committee	Reservoir Committee	Authority Board	Notes
C.	**Environmental Review and Permitting**									
1	CA Environmental Quality Act (CEQA) Authority								A	Sites AB adopted Section 15022(a) State CEQA Guidelines March 28, 2019
a.	Staff determines if a proposed action or project is subject to CEQA									
i.	If no then prepare Exemption(s) and CEQA Determination		R	R		R		R	A	Consistent with 8/17/18 Bylaws Section 4.1
ii.	If yes, prepare an Initial Study and recommend CEQA compliance path		R	R		R		R	A	Consistent with 8/17/18 Bylaws Section 4.1
b.	Board takes lead CEQA agency role									
i.	Makes and Adopts Findings and Determinations		R			R		R	A	Consistent with 8/17/18 Bylaws Section 4.1
ii.	Adopts project and mitigation measures		R			R		R	A	Consistent with 8/17/18 Bylaws Section 4.1
2	Permit Applications (water rights, 404, 401, Biological Assessments, etc.)		R			R		R	A	Board approves, ED signs and administers. Consistent with 8/17/18 Bylaws Section 4.1
3	Local Agency permits, land division & GP Amendments		R			R		R	A	Board approves, ED signs and administers. Consistent with 8/17/18 Bylaws Section 4.1
D.	**Administrative**									
1	Purchases (supplies, materials & equipment)	Yes								
a.	Proposed: $2,000 or less			A	I					New
b.	Proposed: $2,000 up to $10,000			R	A	I				New
c.	Proposed: $10,000 up to $50,000			R	R	A	I			New
d.	Proposed: >$50,000					R	R	A	A	New
2	Administrative Procedures	Yes	R		R	R	R	A	A	New
3	Agenda Item Submittal									
a.	Recommendation to BOD - Action/Info. & Discuss		R		R	R	R	A	A	Current Practice
b.	Recommendation to BOD - Consent		R		R	R	R	A	A	Current Practice
4	Petty Cash Request (less than $50)	Yes			A	I	I			New
5	Sundries/Procurement Card ($500)	Yes			A	I	I			New
6	Response to Public Records Request	Yes	R		R	A		I	I	New
7	Liability Insurance Claim Settlements & Workers Comp Claims	Yes								
a.	< $10,000		R		R	A	I	I	I	New
b.	>$10,001		R			R	R	A	A	New
8	Travel Authorization & Expense Reports (all Agents and Board)	Yes								
a.	Up to $2,000 and within State				A	I				New
b.	Over $2,000 and/or outside State				R	A				New
9	Mileage Reimbursements				A					New
10	Educational (Tuition) Reimbursement	Yes								New
a.	An individual class which is $2,000 or more				R	A				New

DRAFT Authority Matrix page 3

CATEGORY / DOCUMENT	Needs a Policy and Procedure	Legal	Designated Staff	Project Agents	Executive Director	Budget and Finance Committee	Executive Committee	Authority Board	Notes
E. Professional Service Contracts									
1 Decision to use outside consultants	Yes			R	X	I	I		New
2 Request for Qualifications	Yes			A					New
3 Request for Proposals	Yes			A					New
4 Sole Source Professional Services	Yes			R	A	I			New
5 Authority to Negotiate Professional Service Contracts									
a. Approve Master Service Agreements with terms but no scope or cost		R			X				[illegible]
6 Professional Services Agreement									
a. Up to $100,000 within the Project Budget		R	R	A					[illegible]
b. Up to $5,000 NOT WITHIN budget with cost offset		R		R	X				[illegible]
c. Over $100,000 (ED executes and contract manager manages all tasks)		R		R	R	F	A		[illegible]
7 Professional Services Amendment	Yes								
a. Within Contingency and $10,000 or less				A		I			New
b. Within Contingency and more than $10,000				R	X	I			New
c. Exceeds Remaining Contingency				R	R	F	A		New
10 Notice to Proceed									
a. Professional Services				A					[illegible]
11 Progress Payments (Expedited)	Yes								
a. Invoice received. Contract manager approves (or rebuts)			A						[illegible]
b. Department Head approves invoice and submits for immediate payment				A		I			New
c. Checks co-signed by Department Head and Treasurer and mailed									New
e. Boards approve payments via warrant register in arrears				R	R	F	A	A	New
12 Service Completion				A					New
13 Legal Services Agreements									
a. Legal Services with General Counsel					R		R	A	New
b. Legal Services with Subconsultants		R			R		R	A	New
F. Construction Contracts (to be established as project nears construction)									
G. Land Easements and Leases									
1 Easements (accept and/or convey)	Yes								
a. Up to 5 years and less than $10,000 total revenue		R		R	X		I		New
2 Right of Entry/Access Agreements	Yes	R		R	A				New
3 Licenses up to 5 years and less than $10,000 total revenue	Yes	R		R	A		I		New
4 Land Leases	Yes								
a. Up to 5 years and less than $10,000 total revenue		R		R	X		I		New
5 Agricultural Leases	Yes	R		R	A		I		New
6 Grazing Leases of 5 Years or Less	Yes	R		R	A		I		New
7 Land Acquisition/Sale	Yes	R		P	R	R	R	A	Consistent with 2017/18 Bylaws Section [illegible]

DRAFT Authority Matrix page 4

	CATEGORY / DOCUMENT	Needs a Policy and Procedure	Legal	Designated Staff	Project Agents	Executive Director	Budget and Finance Committee	Personnel Committee	Authority Board	Notes
H.	Personnel Issues									
1	Add new position to budget				R	R	R	A	A	Current Practice
2	Reclass Study Request					R	R	A		New
3	Class specification changes					R	R	A		New
4	Position requisition (fill vacancy)				R	A	I			New
5	New Hires									
	a. Executive Director							R	A	[illegible]
	b. Agents					A	I	I	I	Current Practice
6	Leave of Absence Request	Yes			R	A				New
7	Vacation Request									
	a. Vacation Request for ED exceeding one week								A	[illegible]
	b. Vacation Request for agents exceeding one week					A				New
8	Temporary Employee Requisition/Extension			R	A	I				New
9	Student Intern Requisition / Extension			R	A	I				New
I.	Access to District Facilities									
1	Electronic Access Cards	Yes								
	a. Initial Request for Card and Site Access				A					New
	b. Replacement of Lost Card				A					New
2	Mechanical Keys	Yes								
	a. Initial Request for Keys				A					New
	b. Replacement of Lost Keys				A					New

Nest Steps

- November 2020: Seek approval of 3 Recommendations to clarify delegated authority
- December 2020: Seek approval of modified Bylaws to incorporate the 3 Recommendations

File Provided Natively

From: Laurie Warner Herson [laurie.warner.herson@phenixenv.com]
Sent: 11/5/2020 12:14:47 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]
Subject: RE: draft email for NGOs

Flag: Follow up

Hi Ali – just checking in to see if you have had a chance to review this draft email. I have managed to find most of the email addresses for those that signed the comment letters. I have asked Marcia to check the few remaining to see if she happens to have those contacts.

From: Laurie Warner Herson
Sent: Monday, November 2, 2020 10:17 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: draft email for NGOs

Hi Ali,

The following provides draft text for an email to NGOs concerning the upcoming workshop:

Good Morning,

In August 2017, the Sites Project Authority (Authority) and the Bureau of Reclamation (Reclamation) jointly issued a Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Sites Reservoir Project (Project) pursuant to their respective lead agency obligations under the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). In 2020 the Authority decided to prepare a Revised Draft EIR and recirculate to allow the public to review and comment on changes to the project, including new alternatives and associated facilities. Reclamation has agreed to also circulate a Supplemental Draft EIS to comply with NEPA.

The Authority will be conducting a workshop to update non-governmental agencies that commented on the 2017 Sites Reservoir Project Draft EIR/EIS on the current status of the Project. The workshop will provide:

- a project update, including a description of changes to the proposed project facilities and operations due to the Authority's Value Planning process and ongoing coordination with resource agencies;
- an overview of the Authority's decision to recirculate the Revised Draft EIR based on changes to the project;
- the schedule and process for the Revised Draft EIR/Supplemental Draft EIS; and,
- an opportunity for your organization to ask questions in an informal setting.

To better facilitate smaller group participation, the same workshop will be held via on two dates November 17th and 18th, 2020. The workshop will be held as a virtual meeting and not live due to current COVID-19 conditions. The Authority will be sending out invitations for both dates but we ask that your organization accept only one. An agenda will be provided with the invitation.

We look forward to meeting with you. If there are any questions, please contact XXXXX at XXXXXXX.

Thank you,

Alicia Forsythe
Environmental Planning and Permitting Manager

I will continue to coordinate with Marcia on confirming emails so she can send this once you have approved. Also, did you want to send the attachments with this email or the invitations?

Thanks,

Laurie

Laurie Warner Herson
Principal/Owner
Phenix
Environmental Planning

916.201.3935
laurie.warner.herson@phenixenv.com
State of California Small Business (#1796182)
Supplier Clearinghouse Women Business Enterprise (#16000323)

http://phenixenv.com/

From: Thad Bettner [tbettner@gcid.net]
Sent: 11/5/2020 5:07:55 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]; Jerry Brown [jbrown@sitesproject.org]
Subject: SRSP
Attachments: image002.png; SRSP Science Plan September 2020.pdf; Appendix B Activity Table.docx

Ali/Jerry,

Id like to chat with you a bit about the Science Partnership and activities and what we are doing and how this feeds into Sites efforts, monitoring, studies.

Thanks.

Thaddeus L Bettner PE, General Manager
Glenn-Colusa Irrigation District
PO Box 150
Willows, CA 95988
530.934.8881 (office)
530.588.3450 (cell)

Sacramento River Science Partnership Science Plan 2020

Denise J. Reed

September 2020

Table of Contents

List of Figures

List of Abbreviations and Acronyms

2-D	Two-Dimensional
AFSP	Anadromous Fish Screen Program
BY	Brood Year
CS	*Ceratonova Shasta*
CSSP	Coordinated Salmon Science Plan
CVPIA	Central Valley Project Improvement Act
CWP	Cold Water Pool
DTS	Distributed Temperature Sensing
ELAM	Eulerian–Lagrangian–Agent Method
IBM	Individual Based Model
ITP	Incidental Take Permit
JPE	Juvenile Production Estimate
LCM	Life Cycle Model
PBT	Parentage-based tag
PER	Predation Event Recorder
PM	*Parvicapsula Minibicornis*
RBDD	Red Bluff Diversion Dam
RST	Rotary Screw Trap
SDM	Structured Decision Making
SIT	Science Integration Team
TCD	Temperature Control Device
TOPS-WRK	Terrestrial Observation and Prediction System - Weather Research and Forecasting
USBR	US Bureau of Reclamation

Executive Summary

This Plan was developed to support the Sacramento River Science Partnership (Partnership) in their voluntary collaborative research, modeling, monitoring, and synthesis. The geographic scope of interest is the mainstem Sacramento River from Keswick Dam to Verona including the Sutter Bypass. Management actions, processes and effects occurring within the river, including adjacent riparian and floodplain habitats, are considered, recognizing that there are important interactions among management actions and between the mainstem and tributaries. All four species of Chinook Salmon and Steelhead are taken into account, for the most part in general terms due to the direct and indirect ways in which management actions cause change in the system.

Given the complexity of the Sacramento system and the wide array of scientific issues which could be investigated to inform system management, this Plan is focused on several issues identified by the Partnership in their Charter:

- temperature tolerances and other conditions necessary for salmonid egg incubation and early life stages;
- non-temperature sources of mortality; and
- Spring-run Chinook Salmon (Spring-run) emigration survival; and
- quantity, condition, and habitat needs of emerging juvenile fry and smolts.

The Plan is structured around three life stages/geographic areas:

- egg to fry emergence;
- juvenile rearing to outmigration from Keswick Dam to Red Bluff Diversion Dam (RBDD); and
- juvenile rearing to outmigration from RBDD to Sacramento.

This Plan discusses several predictive modeling approaches and how they are used to support management decisions. Recommendations for advancement in this area include supporting the work of the Temperature Modeling Technical Committee and supporting the ongoing development of a Spring-run life cycle model as well as work to increase the use of bioenergetics models to inform planning and design of habitat restoration projects. Further, modeling is expected to be an integral component of several of the Integrated Studies.

Several field surveys and targeted data collection programs are identified. These include:

- temperature profiling, pilot monitoring in Lake Shasta and velocity measurements in the vicinity of the Temperature Control Device;
- surveys of redds in areas or under conditions where they are difficult to observe using current monitoring approaches;
- fish utilization of rearing habitats;
- the effects of floodplain passage on survival; and
- surveys of predators and prey in selected areas of the river under a variety of flow and environmental conditions.

In addition, recommendations include how to enhance existing data or their use in modeling and management decisions, including more specific plans for efficiency tests at the RBDD rotary screw trap, statistical analysis of the relationship between fish passage and environmental conditions, and continued exploration of the use of Parentage Based Tagging methods. An evaluation of how to provide additional information on juvenile fish survival between RBDD and Verona is recommended.

Three Integrated Studies are recommended as opportunities for collaboration and development of mutual understanding within the Partnership and with others. The studies focus on:

1. how river scale management actions translate down toward the scale of the redd;
2. factors influencing fry growth and predation as well as the role of physical stream conditions including those influenced by flow management and habitat restoration management actions; and
3. the benefits and risks of floodplain habitats to juvenile salmon and information to support the refinement of predictive tools for floodplain management actions.

Additional contributions to understanding the effects of management actions can be gained through focused study of a spring flow pulse in dry or below normal years, additional experimental study of active management of agricultural floodplains, and coordinated assessment of habitat use, predation risk, and food availability to better understand survival in the mainstem Sacramento.

This Plan also points to the need to ensure that key data on species of interest are routinely collected to improve monitoring of populations and build long-term data, e.g., assessment of habitat utilization using otoliths (or scales for Steelhead), genetic markers for anadromy in Steelhead, studies related to the effects of pathogens.

Periodic synthesis of available information on key topics to document progress and change in the system is also important. An early need is synthesis of the benefits of habitat restoration actions in the Upper Sacramento. Routine development of summary brood year assessments can also provide an ongoing transparent appraisal of species response to ambient conditions and management actions.

Introduction

Context and Purpose

This Plan was developed to support the Sacramento River Science Partnership (Partnership) in their voluntary collaborative research, modeling, monitoring, and synthesis. It was developed through discussion with Members of the Partnership, staff and contractors of Member organizations, and other experts as well as through review of background documents and scientific reports and papers. The approach to scientific activities – predict, detect, understand – has been used previously to support collaborative science (Reed, 2019). The Plan discusses scientific issues and approaches but purposefully does not address specific study designs.

The purpose of this Plan is to identify scientific activities that will contribute to predicting, detecting, and understanding the effects of management actions, and not to identify management actions that will benefit species. The management actions considered here were identified by the Partnership, and the actions are expected to have a variety of effects, both individually and as they interact. The Sacramento River is managed to meet many economic and societal objectives. This Plan does not address all of these, except as they influence the range of issues being considered and is centered on the effects of some aspects of management on salmonids. Appendix A provides a schematic overview of these action-effect linkages that this Plan seeks to elucidate.

Objectives and Scope

This Plan has two main objectives:

1. Identify a suite of scientific activities which have the potential to inform management actions that seek to improve outcomes for listed salmonids while supporting other uses of the system.
2. Chart a path toward effective use of models, data collection, and synthesis to identify and understand the trade-offs of decisions between different species and water use.

The geographic scope of interest is the mainstem Sacramento River from Keswick Dam to Verona including the Sutter Bypass. Management actions, processes, and effects occurring within the river, including adjacent riparian and floodplain habitats, are considered, recognizing that there are important interactions between the mainstem and tributaries. All four species of Chinook Salmon and Steelhead are taken into account, for the most part in general terms due to the direct and indirect ways in which management actions cause change in the system.

Focus and Approach

Given the complexity of the Sacramento system and the wide array of scientific issues which could be investigated to inform system management, this Plan is focused on several topics identified by the Partnership in their Charter:

- Temperature tolerances and other conditions necessary for salmonid egg incubation and early life stages.
- Non-temperature sources of mortality including, pathogens, predation, lack of suitable spawning habitat, and redd de-watering.
- Conditions necessary for juvenile Spring-run Chinook Salmon (Spring-run) survival.
- Quantity, condition, and habitat needs of emerging juvenile fry and smolts.

Thus, this Plan is structured around three of the life stages identified by Windell et al. (2017): egg to fry emergence, juvenile rearing to outmigration from Keswick Dam to Red Bluff Diversion Dam (RBDD), and juvenile rearing to outmigration from RBDD to Sacramento. These also correspond to the geographic area of interest to the Partnership[1]. However, this Plan does not directly address each of the hypotheses identified by Windell et al. (2017) for each life stage. Rather, this Plan seeks to identify scientific activities which relate the broader scientific issues identified by Windell et al. (2017) to management actions that influence the system. Moreover, the conceptual models articulated by Windell et al. (2017), while providing a useful structure, focus on Winter-run Chinook Salmon (Winter-run). This Plan seeks to provide insight relevant to salmonids more broadly.

For each life stage, relevant management actions are identified, and their potential effects briefly described. Science needs are discussed in terms of three separate but related scientific approaches which are each essential to using processes such as Structured Decision Making (SDM) and other forms of effects analysis:

- The need to ***predict*** the consequences of taking a management action is integral in SDM.
- Surveys and monitoring are used to ***detect*** change in the natural system including those resulting from management actions. Targeted data collection can provide important additional insight into system dynamics beyond those gained from routine monitoring.

BOX 1. INTEGRATED STUDIES

One of the key features of this plan is the collaborative development of Integrated Studies around key topics related to management actions. These topics have been selected to address aspects of the salmonid life cycle which are central to the Partnership's scope and to ultimately inform aspects of salmonid life cycle models used in SDM and other decision-making processes. Currently available life cycle models (LCMs) for salmon (Hendrix et al., 2017; SIT Decisions Support Models) operate on a monthly time step which enables estimation of habitat carrying capacity, for example. The proposed Integrated Studies aim to increase understanding at a finer scale, potentially for use in more detailed decision-support models. Field data, detailed modeling, and experiments can lead to the elucidation of relationships that can inform adjustments in the LCMs.

Three Integrated Studies are described in this Plan that examine:

1. how river-scale management actions translate down to the scale of the redd, and how management actions influence local variations in physical processes and biotic response.
2. factors influencing fry growth and predation, and the role of physical stream conditions including those influenced by flow management.
3. the benefits and risks of floodplain habitats to juvenile salmon.

The information developed is expected to improve action-effects linkages, inform planning and design of habitat restoration management actions, and support the refinement of predictive tools for floodplain management actions. Planning science activities, research logistics, and funding for Integrated Studies in parallel and in collaboration with a wide array of experts and interest groups will ensure alignment and coordinated execution.

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[1] The conceptual model in Windell et al. (2017) extends to Sacramento and includes the Yolo Bypass. The geographic scope of this Plan is more limited.

- Increased scientific ***understanding*** and building an expanded knowledge base on which future actions can be planned and implemented is fundamental to iterative application of SDM and other adaptive management approaches. Increased understanding also underpins refinement of models used in SDM.

Synthesis and evaluation of findings across these three approaches and across life stages in relation to the existing body of knowledge is discussed separately.

This Plan does not include a comprehensive evaluation of existing knowledge, and citations to existing work are selected to illustrate specific points or techniques as context for recommendations. As the focus of this Plan is on building knowledge to inform management actions which change conditions in specific areas, models which consider the whole life cycle of salmonids including the effects of Delta and ocean environments (e.g., Hendrix et al., 2017; Zeug et al., 2012) are not discussed. The way in which such models reflect the effects of management actions can be dependent on assumptions made about the rest of the system.

It is important to note that data collection discussed in this Plan is not intended to replace or alter existing monitoring, especially in cases where it is the basis for regulatory processes. For example, spawning escapement and juvenile abundance monitoring programs serve as the foundation for performance metrics and modeling often used to evaluate management actions. Changes in long term monitoring require careful deliberation but there may be opportunities to improve data and analytic outputs. Thus, targeted data collection to detect the effects of management actions and to explore key cause-effect relationships can provide a foundation for future enhancements in data analysis and/or monitoring program designs. Recommendations for data collection are not directed at a specific agency. Where data collection activities are identified that relate directly to an agency's existing work, e.g., temperature management at Lake Shasta, redd surveys, etc., any additional data collection would be expected to be coordinated with that agency and the additional resource or staffing burden imposed should be acknowledged by the Partnership.

Recommendations for scientific activities provided here have been identified based a limited set of interactions with managers and experts within the scientific community. They are put forth as a solid starting point for the work of the Partnership and are deliberately described only generally so that they can be refined as the details of implementation are developed.

Structure of Report

This Plan describes science activities to promote improved prediction, enhanced detection, and increased understanding around the three life stages, and some needs for system level data collection or synthesis. Within each section, brief discussion of the need for science activities is provided for 'predict', 'detect', and 'understand' followed by specific recommendations for activities and their management relevance. An integrated list of all of the recommended science activities is provided in Appendix B. The final section of the Plan identifies some areas where there is potential for collaboration with other groups on some of the science activities.

Egg to Fry Emergence – Keswick Dam to RBDD

The river channel from Keswick Dam to RBDD varies in width, and much of the current spawning gravel in the area below Keswick Dam has been added as a combination of 'hungry water' and trapping of bedload behind dams leading to coarsening of the bed (Kondolf, 1997; Stillwater Sciences, 2007). The river is a bedrock stream and flows across, and is incised into, older, stable geologic formations.

Actions and Potential Effects

The main management actions that influence the egg to fry emergence life stage include:

- Summer Cold Water Pool Management (Tiers 1- 4) including Temperature Modeling and Shasta Temperature Control Device (TCD) Operation
- Spring Management of Spawning Locations
- Fall and Winter Refill and Redd Maintenance
- Spawning Gravel Injection

Further details on these actions are described in the 2019 National Marine Fisheries Service Biological Opinion on Long-term Operation of the Central Valley Project and the State Water Project[2]. Many of these actions aim to provide suitable conditions for egg survival for Winter-run. Due to the potential for temperature related egg mortality in Winter-run, there is a focus on conservation and management of cold water pool (CWP) in Shasta Lake. Ensuring available CWP for Winter-run may have implications for other salmonids, e.g., if lower flows during fall and winter to refill Shasta Lake result in dewatering of redds for Fall-run Chinook Salmon (Fall-run), or decreased access to rearing habitat. A summary overview of the potential effects of these actions on habitat, physical conditions, and species response is provided in Appendix A.

Predict

Predictive models are essential tools for management of CWP, and the physically based temperature simulations used to assess scenarios are dependent on uncertain predictions of meteorological conditions. The HEC-5Q model is currently used to forecast water temperature conditions in the Sacramento River for seasonal operations planning. There have been several studies in recent years addressing predicting temperatures in the reservoir and downstream in the spawning reaches (e.g., Hallnan, 2017; Hallnan et al., 2020; Pike et al., 2013), although coarse resolution issues (up to 6m layers in the reservoir and 2km reaches in the river) may limit their ability to fully capture temperature gradients. The Temperature Modeling Technical Committee has been ongoing for several years and aims to utilize existing information and models to develop new models to assist operators managing Shasta Lake, as well as other facilities, for water temperature management in downstream Sacramento River reaches. It provides a forum where data, information, and assumptions related to model development can be shared. The Committee has identified the two-dimensional (2-D), laterally averaged CE-QUAL-W2 model which can represent longitudinal and vertical variations in the reservoirs as an appropriate tool for Shasta Lake and Keswick Reservoir (Deas & Sogutlugil, 2020). Also, US Bureau of Reclamation (USBR)

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[2] https://www.fisheries.noaa.gov/resource/document/biological-opinion-reinitiation-consultation-long-term-operation-central-valley

will be initiating a significant temperature modeling development effort in late 2020, including the Upper Sacramento River (R. Field, personal communication).

The influence of river water temperature on eggs is in part dependent on hyporheic flow for which a number of modeling approaches are available (see review by Boano et al., 2014). Bray & Dunne (2017a) have noted the importance of considering the distinct characteristics of river and bar morphology in evaluations of hyporheic flow. In the upper Sacramento, models have rarely been applied to examine gravel bar dynamics (Stillwater Sciences, 2007) which are important to predictions of hyporheic flow. Some detailed modeling of hyporheic conditions is ongoing to explore the relationship between river discharge and interstitial flow as well as the dynamics of interstitial flow at egg scale (E. Danner, personal communication). Few predictive tools are available to predict local (redd-scale) field conditions although the individual based model (IBM) inSALMO (Dudley, 2018, 2019b) simulates conditions resulting in egg mortality from high/low temperature, scour, dewatering, or superimposition at a $20m^2$ scale. The same IBM approach has been used to examine effects of superimposition (Dudley, 2019a). These and other modeling approaches can be used to further enhance understanding of the processes that influence the egg to fry emergence stage in coordination with detailed field investigations, as discussed below.

Predict Recommendations: Egg to Fry Emergence – Keswick Dam to RBDD			
#	**Type**	**Science Activity**	**Management Relevance**
1	Modeling	Support the collaborative model improvement work of the Temperature Modeling Technical Committee.	*Improved prediction* - Extension of the CE-QUAL-W2 modeling of Shasta Lake and Keswick Reservoir to include appropriate river models, creating a linked modeling framework to improve model predictions that assist resource managers.

Detect

An array of existing monitoring programs routinely provides physical and ecological information that informs management of the system in support of the egg to fry emergence life stage. These include carcass and redd surveys (including location and potential for dewatering), temperature measurements in the reservoirs and the river, and discharge monitoring. These ongoing programs deliver key information relied upon in models and other tools and used by agencies in management and operation of the system. However, given the complex interactions of factors that can influence temperature dependent mortality of salmonid eggs, targeted data collection can help improve models and their application and provide insight into the role of causal factors.

For example, Hallnan (2017) used a distributed temperature sensing (DTS) system to obtain high resolution measurements of vertical temperature distribution in the lake to further define cold water pool volumes. Deas & Sogutlugil (2020) note the value of a thermistor string with loggers collecting vertical temperature data at hourly intervals, such as that collected previously in Lake Shasta for modeling. Additional collection of temperature profile data at the Keswick Reservoir log boom, and in the Shasta, McCloud, and Pit River arms of Shasta Lake, is also useful and is being implemented in 2020.

Meteorological and stream inflow data for these tributaries could also be useful to validate or refine some model inputs or dynamics (e.g., TOPS-WRK or National Weather Service data products as discussed in Danner et al. (2012) or wind-driven mixing (Daniels et al., 2018)). USBR has proposed to quantify and assess the quality and statistical nature of the meteorological, river flow, and temperature datasets (simulations and forecasts) currently used to set water-temperature related operating criteria at Shasta Reservoir (R. Field, personal communication).

In addition, vertical temperature gradients may be locally strong within Lake Shasta, especially in mid-to-late summer during drier years, and the resulting density gradients could influence the ways in which water moves through the various gated structures. Further, improved detection of the zone of the reservoir where the vertical temperature gradient changes the fastest is important to ensure that reservoir models are of sufficient resolution to capture this change (Hallnan et al., 2020). Automatic temperature data collection can be challenging due to issues with anchoring and the need for robust communication systems. USBR is working to restore a thermistor string at Shasta Dam and address these challenges. Detailed velocity measurements in the vicinity of the TCD have recently been conducted to characterize the local velocities and vertical (and lateral) extent of withdrawal zones into open TCD gates as well as a high-resolution bathymetric survey of the immediate vicinity of the Shasta Dam forebay (M. Deas, personal communication). A more extensive velocity survey is needed to assess dynamics around TCD gates operating individually and for blending as well as surveys throughout the TCD operating season to assess how the dynamics change as the TCD is operated over time.

In the Sacramento River below Keswick Dam, carcass and redd surveys provide critical information in management that targets the egg to fry emergence life stage. The escapement estimates based on the surveys are used in calculations of egg-to-fry survival (discussed further below). Analysis of detailed surveys of redd distribution can also be used not only to determine whether the extent of spawning gravel is limiting but to refine criteria for predicting or restoring spawning habitat (e.g., Geist et al., 2000). Killam (2019) notes that carcasses are not accessible in some areas of the river due to hazards or deep water and are often bypassed by survey crews. Uncertainty in the adult spawner estimates for brood year (BY) 2017 Winter-run is also noted by Voss & Poytress (2019) due to poor visibility on the carcass survey resulting from high water early in the survey season (when the detection of the first winter-run Chinook salmon spawning is used to determine the onset of CWP management) and prolonged turbidity throughout the survey season. This may be commonly the case during the Late Fall-run spawning period as well. Difficult field survey conditions and ensuing uncertainty are more common for salmonids which spawn during the winter and spring. The proportion of redds found within and downstream of the mark-recapture carcass survey area is used to expand the escapement estimate to account for fish spawning downstream of the carcass survey area. However, aerial redd surveys are focused on location and timing rather than count and do not provide complete counts of redds due to variability in turbidity, water depth, riparian vegetation, weather, wind, and redd superimposition (Bergman et al., 2012; Killam, 2019). Redd dewatering assessment is critical for management actions that specifically target reducing dewatering, and Stompe et al. (2016) noted some of the difficulties encountered including identifying which run made the observed dewatered redds and fluctuating water levels due to storm events.

Supplementing existing programs with periodic targeted boat and snorkel/diver surveys, potentially focused on specific areas or environmental conditions, could be used to evaluate critical assumptions that may bias routine field surveys and thus reduce the effectiveness of management actions reliant on the survey data. While surveys of deeper holes may require specific expertise, the importance of these data for many management decisions means that exploratory data collection is a useful first step. Additional potential enhancements include fitting boats with additional towers/cameras and using boats in conjunction with drones. Such supplemental data may also be useful in understanding how on the ground conditions are reflected in current approaches used to estimate egg-to-fry survival (see discussion below).

Detect Recommendations: Egg to Fry Emergence – Keswick Dam to RBDD			
#	**Type**	**Science Activity**	**Management Relevance**
2	Targeted Data Collection	Pilot monitoring of input stream and local meteorology in the Shasta, McCloud, and Pit River arms of Shasta Lake.	*Increased detection* – Greater resolution of water temperature data above Shasta Dam. *Improved prediction* - Data to validate or refine model inputs and better incorporate the role of meteorological conditions on thermal regime of Shasta Lake and tributary inflows.
3	Targeted Data Collection	Increase vertical resolution for temperature profiling in Lake Shasta especially in mid-to-late summer during drier years.	*Increased detection* - Greater resolution of water temperature and density data within Lake Shasta. *Improved prediction* - Improved characterization of density gradients that could influence the ways in which water moves through the various gated structures.
4	Targeted Data Collection	Conduct velocity surveys to assess dynamics around TCD gates operating individually and for blending, and surveys throughout the TCD operating season to assess how the dynamics change as the TCD is operated over time.	*Increased detection* - Greater resolution of water velocity dynamics around the TCD gates. *Improved prediction* - Improved characterization of local dynamics of withdrawal zones for TCD gates operating individually or for blending, under varying seasonal conditions.
5	Targeted Data Collection	Supplement existing carcass and redd surveys with enhanced boat and in-water surveys, potentially focused on specific areas or environmental conditions.	*Increased detection* – Additional data to support escapement and fecundity estimates. *Improved understanding* - Evaluation of critical assumptions that may bias routine field surveys and thus impact management actions reliant on the survey data.

Understand

The egg-to-fry emergence life stage is critical, and several management actions specifically focus on addressing the potential for temperature mortality and dewatering. Thus, understanding the processes and interactions controlling egg viability and successful hatch is essential. Windell et al. (2017) identify nine hypotheses for this life stage. The work proposed here focuses on a key area where increased understanding can support management actions. It is not proposed as a comprehensive approach to understanding all aspects of process interaction influencing this life stage.

Understanding biotic responses to management actions that target egg-to-fry emergence requires translation of the effects of actions taken at the river or reach scale (e.g., flow releases, gravel augmentation) to the scale of the redd and the egg. Gore et al. (2018) note that eggs within a redd likely experience flow conditions that are spatially variable and temporally dynamic. Many factors are involved which depend on local conditions, limiting the ability to directly transfer knowledge from other systems without local validation. As discussed above, modeling may provide insight into fine scale patterns in environmental conditions around redds, and ongoing flume experiments with artificial redds (E. Danner, personal communication) are exploring how water flows through redds.

Flow around the redds is determined by streambed hydraulic conductivity which exhibits varying magnitude, spatial variability and characteristic vertical patterns, and has been found in some systems to vary by orders of magnitude over the length of a riffle-pool reach (Bray & Dunne, 2017a). Management actions can influence sediment character directly through gravel augmentation and indirectly by altering bedform and bar migration through flow releases. Management actions that alter downriver temperature gradients and water levels influence how the flow and the bed sediment interact at different scales to influence hyporheic flow (Figure 1). This has implications for temperature conditions at the scale of the redd and how it is influenced by water operations.

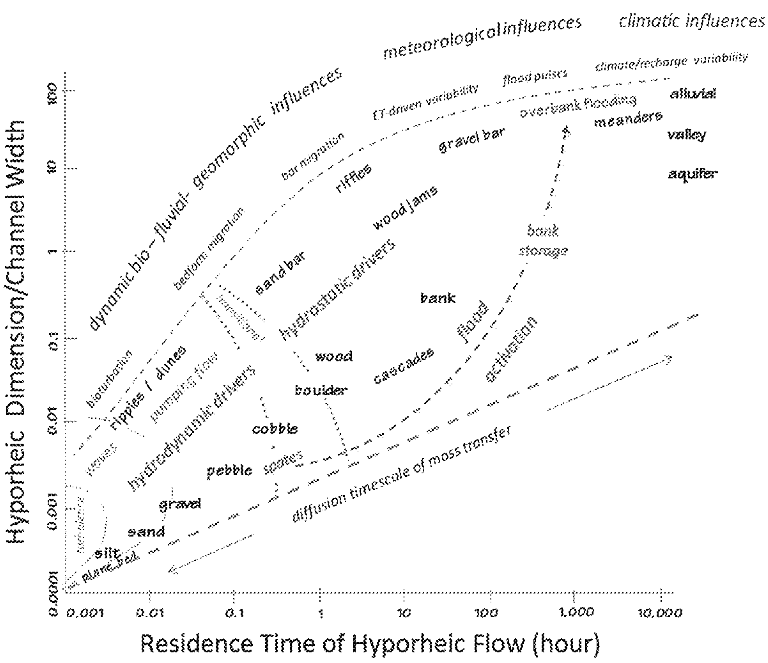

Figure 1. Spatial and temporal scaling of hyporheic flow (Boano et al., 2014)

Egg scale insights can probably best be gained through laboratory experiments. However, understanding how river scale management actions translate down toward the scale of the redd will allow predictive models to better reflect local variations in physical processes, and how the potential biotic response varies with different combinations of management actions.

Integrated Study #1

The issue of how river-scale management actions translate down to the scale of the redd, and this influence temperature-dependent mortality, lends itself well to an integrated study. Leveraging existing field, lab, and modeling approaches to document variations in river and subsurface environmental conditions (including how they vary with season, flow, and instream morphology), and to assess biotic responses (including key determinants of mortality such as flow, temperature, and dissolved oxygen) can provide increased understanding of the mechanisms influencing redd-specific egg-fry survival. The integrated study should be conducted in several reaches along a longitudinal river gradient between Keswick Dam and RBDD. Each reach should comprise gravel bars and pools and could include areas of gravel augmentation. The objective is not necessarily to apply a statistically valid experimental design to field studies but to identify sites which characterize the variety of areas where spawning occurs, and where temperature and depth are managed to reduce temperature-dependent mortality and reduce redd dewatering. Existing redd surveys could provide context for the location, but areas potentially suitable for spawning which may not be adequately encompassed by routine monitoring (e.g., deeper areas), and those where there is potential for redd dewatering, should be included provided there are reliable previous observations of redd occurrence.

The scale of the study will depend on available resources (expertise, equipment, funding) and the ability to leverage ongoing research and monitoring efforts. The planning and design of such studies should be undertaken by a diverse expert workgroup with backgrounds in physical processes and biotic response:

- Field measurements could be used to understand variations in temperature, depth and hyporheic flows that influence conditions ate the scale of redds. For example:
    - Surveys of topography, bathymetry and bed sediment character, and velocity measurements to support spatially distributed predictions of water surface elevation using hydraulic models, e.g., SRH-2D.
    - High-resolution spatiotemporal measurements of near bed water temperature, e.g., using DTS (Bray & Dunne, 2017b). Note DTS may also be used to examine gravel transport.
    - Measurements, using samples or sensors as appropriate, of water quality such as dissolved oxygen and turbidity.
    - Measurements of hydraulic connectivity, e.g., with a backpack permeameter and standpipes.
- Biotic response is difficult to measure directly for wild Winter-run. Alternatively, the field study could initially focus on other runs or use eggs from hatchery-origin fish as surrogates.
    - An option for experimentally examining biotic response would be to deploy incubation boxes or egg tubes across gradients in flow, water depth, or other environmental factors.
    - Redd caps, potentially for Fall-run, could be used to measure emergence of naturally spawned eggs across the flow/depth gradients encompassed by the study.
    - Laboratory experiments with hatchery-spawned eggs (e.g., Del Rio et al., 2019) could be used to assess response to the measured physical conditions, including temporal variation in temperature and dissolved oxygen.

The integrated approach described here focuses on understanding the physical-biological linkage at places where synchronized measurements can be conducted to reduce uncertainty regarding spatial and temporal variability in the factors influencing redd-specific egg to fry survival. For any season (and temperature condition/management regime) measurements on selected parts of the river will not be able to capture details of along-river gradients in temperature and potential for dewatering. These targeted physical and biotic response measurements support improved modeling of instream surface and subsurface physical conditions along critical sections of the river, and testing of models currently used to inform management decisions. Model simulations of near-redd scale conditions can illuminate the interaction of factors such as flow velocity, water temperature, and inundation depth and further understanding of the effects of management actions on instream conditions and egg to fry survival.

Understand Recommendations: Egg to Fry Emergence – Keswick Dam to RBDD			
#	**Type**	**Science Activity**	**Management Relevance**
6	Integrated Study	Collaboratively plan and conduct a multi-year Integrated Study to understand how river-scale management actions translate down to the scale of the redd, e.g., detailed field measurement and model simulations of physical conditions, surveys, and field and laboratory experiments to assess biotic response.	*Improved understanding* - Evaluation of how river-scale management actions, individually and in combination, that alter flow, temperature, DO, and substrate translate down to the scale of the redd and influence redd-specific egg-to-fry survival.

Rearing-Out Migrating Juveniles – Keswick Dam to RBDD

In addition to the spawning gravels, the Sacramento River from Keswick Dam to RBDD includes alluvial features. Downstream of Redding, the river cuts through sedimentary deposits and banks can be vertical and several hundred feet high. In other areas, where the river can move its channel several thousand feet before encountering more resistant deposits, banks are erodible unless armored.

Actions and Potential Effects

Many of the management actions listed for egg to fry emergence that address temperature also influence this life stage. Additional management actions influencing rearing-out migrating juveniles between Keswick and RBDD are:

- Rice Decomposition Smoothing
- Winter Minimum Flow
- Spring Base Flow
- Side Channel Habitat Restoration
- Small Screen Program[3]

Further details on these actions are described in the 2019 National Marine Fisheries Service Biological Opinion on Long-term Operation of the Central Valley Project and the State Water Project[4]. Many of these actions address the quality of, and salmonid access to/from in-channel habitats for rearing. Habitat focused actions seek to improve the conditions supporting growth and survival of juveniles, while those focused on flow in the winter and spring are intended to conserve water in the reservoir for use at other times of year. These uses include deliveries, meeting Delta water quality requirement, and supporting egg-fry emergence. Flow management and seasonal flow reductions have the potential to result in stranding and/or delayed out migration of juveniles which may make them more vulnerable to predation. Low flows can also limit access to habitat. A summary overview of the potential effects of these actions on habitat, physical conditions, and species response is provided in Appendix A.

Predict

Broad predictions of in-channel habitat conditions are often based on habitat area relationships, e.g., DWR (2016). Suitable rearing habitat is often estimated using measured hydrology and modeled hydraulic relationships between flow and inundation area to calculate areas of inundation with appropriate timing, duration, and frequency to support juvenile salmon as in the Estimated Annual Habitat approach (Matella & Jagt, 2014). One-dimensional hydraulic models, such as HEC-RAS, can generate water surface profiles which are used with topography to determine inundation frequency and

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[3] The small screen program directly addresses potential mortality at water intakes and will not be discussed here due to extensive existing work under the CVPIA Anadromous Fish Screen Program (AFSP).

[4] https://www.fisheries.noaa.gov/resource/document/biological-opinion-reinitiation-consultation-long-term-operation-central-valley

duration. Specific frequency criteria can be assessed as well as metrics that reflect a range of frequencies.

More detailed 2-D hydraulics models, such as SRH2D, based on Lidar and supplementary on-site surveys, are used to design habitat projects and can be used to analyze depth and velocity conditions at lower flows (e.g., base flows or minimum flows targeted in management actions). Legleiter et al. (2011) note that uncertainty in topographic information can propagate through flow models to produce highly uncertain evaluations of habitat quality meaning future use of existing models may require updated survey data.

Newly emerged fish transition from shallow, slow-moving water to deeper, faster water as they increase in size (Cramer & Ackerman, 2009). Habitat complexity (e.g., woody debris, overhanging vegetation, and seasonally inundated areas) provides juveniles with hiding, resting, and feeding habitat which increases their ability to grow, develop, and survive emigration. Reflecting such habitat complexity, and the way in which it influences growth and survival is extremely challenging. IBMs, such as inSALMO, can model very complex systems with numerous environmental inputs. They can be spatially and temporally explicit and can include many biological processes and analysis of the parameters that describe those processes (Dudley, 2018). For predicting action-effect linkages, IBMs are particularly useful to explore the mechanisms through which parameters or environmental drivers alter the behavior of the system, not solely the final effect on the system. In addition, models with parameters based on physiology, like inSALMO, can be readily updated as new estimates of those parameters are generated by research studies.

More detailed insight into the response of juveniles to local flow and habitat changes can be gained through the application of models such as the Eulerian–Lagrangian–Agent method (ELAM) which mechanistically simulates three-dimensional movement patterns of individual fish responding to abiotic stimuli (Goodwin et al., 2006). ELAM is being developed for application to understand the effects of structures on fish movement in other parts of the system[5] and could eventually be applied to in-stream rearing habitat complexity (see Integrated Study below).

Managing the system requires assessing many competing needs for water, with support for beneficial rearing habitat being one among many. In the near-term, insight into the effects of flow management and its interaction with in-channel morphology to provide beneficial rearing habitat can best be advanced by building on the types of 2-D analysis conducted for project planning. Bioenergetics models are widely used to simulate changes in growth and consumption in response to environmental conditions and food availability (Deslauriers et al., 2017). Rosenfeld et al. (2016) demonstrated that habitat suitability curves generated using bioenergetics modeling outperformed frequency-based habitat suitability curves (using depth and velocity) as well as those adjusted for growth. Spanjer et al. (2018) used a bioenergetics modeling approach to evaluate how environmental factors influenced juvenile salmon growth across a number of streams. However, Holsman & Danner (2016) explored how

[5] https://www.usbr.gov/research/projects/detail.cfm?id=19105
https://www.usbr.gov/mp/bdo/docs/fy19-special-study.pdf

reliance on mean daily temperatures in bioenergetics models may lead to overestimation of some non-linear physiological rates. Linking bioenergetics modeling with 2-D simulations of in-channel physical processes would allow in-channel restoration projects to be planned and designed to better account for how changes in thermal regime, flow conditions, and food availability affect fish growth and provide information on the potential effects of different flow management decisions on rearing habitat.

Predict Recommendations: Rearing-Out Migrating Juveniles – Keswick Dam to RBDD			
#	**Type**	**Science Activity**	**Management Relevance**
7	Modeling	Identify, refine, and test suitable bioenergetics models for use in conjunction with flow models of in-channel and off-channel habitats.	Improved prediction – Promote models that support planning and evaluation of habitat restoration projects by accounting for how changes in thermal regime, flow conditions, and food availability affect fish growth. Information on the potential effects of different flow management decisions on rearing habitat.

Detect

Existing monitoring programs routinely provide physical and ecological information that informs management of the system for this life stage. Stranding surveys provide information on location, extent, and characteristics of stranding sites including points of connectivity or opportunity for reconnection. In addition, monitoring of new habitat restoration sites includes snorkel surveys based on stream edge habitat (and associated visibility, water elevation, and temperature measurements) that have been supplemented with kayak video surveys in areas where vegetation prohibits snorkel survey. These surveys generally identify fish based on size. Side channel control sites are also surveyed to assess the performance of restored side channels or provide baseline information for restoration. Together, stranding surveys and restoration site surveys provide insight into utilization of in-channel habitats by juveniles. However, they provide only snapshots of fish utilization. The consequences of flow management, i.e., the magnitude of minimum flows or the pace at which flow decreases, for in-stream rearing habitat utilization could be better detected by targeted additional sampling. This sampling should measure similar metrics as existing surveys to enable comparability and improve understanding about magnitude of utilization. Such additional sampling could be conducted in coordination with the stranding surveys, which are initiated immediately following a reduction in flows from Keswick to document fish at known stranding sites prior to their isolation from flow. There may need to be some adjustments in sampling as rescue techniques (seines, electrofishing, and dip nets) are designed to retrieve and relocate fish. This additional sampling to detect utilization would not need to target all fish. Repeated samples in the same locations as flows decline could indicate how flow decreases change rearing habitat utilization prior to potential stranding. Associating the additional sampling/detection with the higher frequency stranding surveys (daily) vs. the weekly assessments of habitat performance (which are also presently limited to specific locations) provides more refined information on habitat use by juveniles and the potential identification of thresholds in environment-use relationships, especially if similar metrics, e.g., density, can be used.

Box 2. The Role of Disease

Two endemic myxozoan parasites of salmonids, *Ceratonova shasta* (CS) and *Parvicapsula minibicornis* (PM), are associated with severe disease in juvenile salmon in other systems. The parasites have been detected in all runs of adult salmon and juvenile Fall-run sampled in March and April in the Sacramento River (Foott, 2016). Foote et al. 2019 note that even trace spore concentrations (< 1 spore / L) produced an average of 16% CS infection demonstrating that CS in the Sacramento River is efficient at transmission.

CS has a complex life cycle, involving an invertebrate polychaete host as well as the vertebrate salmon host. Infected polychaetes release actinospores into the water where they can attach to the salmon's gill tissue, invade into the blood, replicate, and later migrate to the intestinal tract which can result in intestinal problems and anemia. Myxospores released from infected fish after death are ingested by the polychaete and complete the life cycle. PM shares the same polychaete host and it infects the salmon kidney.

Studies using sentinel juvenile hatchery fish exposed to river water and water sampling to detect the presence of spores using eDNA have been conducted for several years (e.g., Voss & Poytress, 2019). BY2016 monitoring showed increasing prevalence of infection downstream, from Anderson to RBDD, which was also reflected in water sample spore concentrations although concentrations were low above Anderson. Water sample and sentinel infection data collected from below Anderson to Tisdale Weir in Fall 2018 suggested the reach above Red Bluff Diversion Dam had the highest infectivity and likely contains a greater concentration of infected polychaetes (Foott et al. 2019). Moreover, actinospores remain infectious for at least 7 days and can move a great distance downstream from the infected polychaetes.

Johnson et al. (2017) call for monitoring of the pathogen load fish and water samples in the Upper Sacramento River to identify zones and periods of high virulence, and the ITP calls for pathology monitoring to provide information on disease in Spring-run. How pathogens affect salmon mortality is yet to be resolved. However, increased awareness and understanding of how this known factor influences survival throughout the life cycle can provide insight into the effectiveness of specific management actions or whether flow management could be adjusted, given other constraints, to reduce the risk of infection. Ongoing research is examining pathogen exposure and immune response in salmon as well as using a disease transmission model to explore disease mortality and interaction with environmental conditions such as water temperature (M. Daniels, personal communication).

Evidence from sentinel fish over a number of years with differing flow conditions suggests that disease and potentially mortality may be more prevalent during conditions such as those experiences in WY2014 (Israel et al., 2015).

Increased understanding of this potential source of impaired health or mortality can be obtained through integrated use of predictive models, field sampling, and experimental studies, i.e., with sentinel fish. In addition to ongoing work, collecting intestinal tract samples from carcasses (Foott et al. 2016) and an examination of how changes in flow conditions could disrupt polychaete habitat (https://www.usbr.gov/mp/cvpia/docs/appendix-b-fisheries-public-charters.pdf) could further enable a broader appreciation of the conditions under which these pathogens influence the effectiveness of management actions.

Sampling of juvenile anadromous fish at RBDD supports year-round production and passage estimates of juvenile Winter-run Chinook salmon and Steelhead (Voss & Poytress, 2019). Winter-run egg to fry survival estimates also rely on data used to estimate the number of viable eggs as well as factors such as fry:smolt survival. Passage estimates based on rotary screw trap (RST) data rely on estimates of efficiency which are conducted under a variety of river discharge levels and trap effort combinations as fish numbers and staffing levels allow. Each year the trap efficiency model is updated with new observations from mark-recapture trials. However, it is unclear how efficiency varies between Chinook salmon and Steelhead smolts, for example, or between fry and smolts, and how it is influenced by factors such as turbidity Johnson et al. (2017) recommended combined use of acoustic tagged fish and coded wire tag fish to estimate gear efficiency for the Chipps Island trawl survey and noted that this analysis may determine the applicability of the approach for use of RSTs on the mainstem Sacramento. The small size of many fish passing RBDD limits the use of acoustic tagging, but the results of studies at Chipps Island should be tracked for insight into additional methods for estimating efficiency at RBDD RTS. Further analysis of existing RBDD juvenile monitoring data to assess relationship between flow and other abiotic variables and passage is discussed below.

Predation of fry is potentially an important determinant of the number of out-migrating juveniles. Detecting the presence of potential predators in the river above RBDD and the type of in-channel habitats with which they are associated can provide important information for planning habitat related projects that seek to improve conditions for juvenile rearing. On the San Joaquin River, boat-based predator surveys, using acoustic techniques, have provided relative predator fish densities and maps of predator associations with river channel characteristics (Cutter et al., 2017). While the small size of juvenile salmon above RBDD may make their detection challenging, surveys of predators and how their distribution changes with varying flows could help interpret response of juvenile passage to flow management as well as supporting planning and implementation of projects that seek to improve in-channel rearing habitats.

Detect Recommendations: Rearing-Out Migrating Juveniles – Keswick Dam to RBDD			
#	**Type**	**Science Activity**	**Management Relevance**
8	Targeted Data Collection	Document the consequences of flow management, i.e., the magnitude of minimum flows or the rate of flow decrease, on utilization of in-stream rearing habitat (potentially expanding on stranding surveys and restoration site surveys) including sampling as flows decline.	*Increased detection* - Refined information on habitat use by juveniles. *Improved understanding* - Potential identification of thresholds in environment-use relationships to improve planning and design of habitat restoration projects.

Detect Recommendations: Rearing-Out Migrating Juveniles – Keswick Dam to RBDD			
#	Type	Science Activity	Management Relevance
9	Targeted Data Collection	Document the relative abundance and distribution of potential predators in the river above RBDD and the types of in-channel habitats with which they are associated with varying flows and environmental conditions.	*Increased detection* - Improved identification of the response of juvenile passage to flow management, i.e., predation as a potential source of non-temperature mortality. *Improved understanding* - Support planning and implementation of projects that seek to improve in-channel rearing habitats.
10	Targeted Data Collection	Assess the role of pathogens and disease through targeted sampling of intestinal tract samples from carcasses, and evaluation of how changes in flow conditions could disrupt polychaete habitat.	*Increased detection* - Increased appreciation of the conditions under which pathogens and disease may influence the effectiveness of management actions.

Understand

This section of the river is the focus of management actions targeting spawning, egg survival, and fry emergence. Metrics of egg to fry survival rely on information collected on spawning grounds and by the RSTs at RBDD where fry and smolt passage reflects all the conditions that occur between spawning and that point in the river. While side channel habitat restoration projects have been conducted and are planned to improve rearing habitat, there is lack of detailed understanding of the way in which abiotic and biotic factors contribute to survival and the direct and indirect effects of management actions. Windell et al. (2017) identify nine hypotheses for rearing-out migrating juveniles in this part of the river including the role of pathogens and disease (Box 2).The work proposed here focuses on several areas where increased understanding can support management actions; these are not proposed as a comprehensive approach to understanding all aspects of process interaction influencing this life stage.

Estimating Egg to Fry Survival

The importance of the egg to fry survival estimate has already been noted. Figure 2 illustrates how data from different sources feed into estimates of eggs and fry. Details of the statistical analysis to derive some of these data, e.g. mark-recapture in the carcass survey, or how to analyze them are not shown and are well described elsewhere (O'Farrell et al., 2018; Voss & Poytress, 2019). Gore et al. (2018) also discuss uncertainties in some of the data and how they are used in modeling.

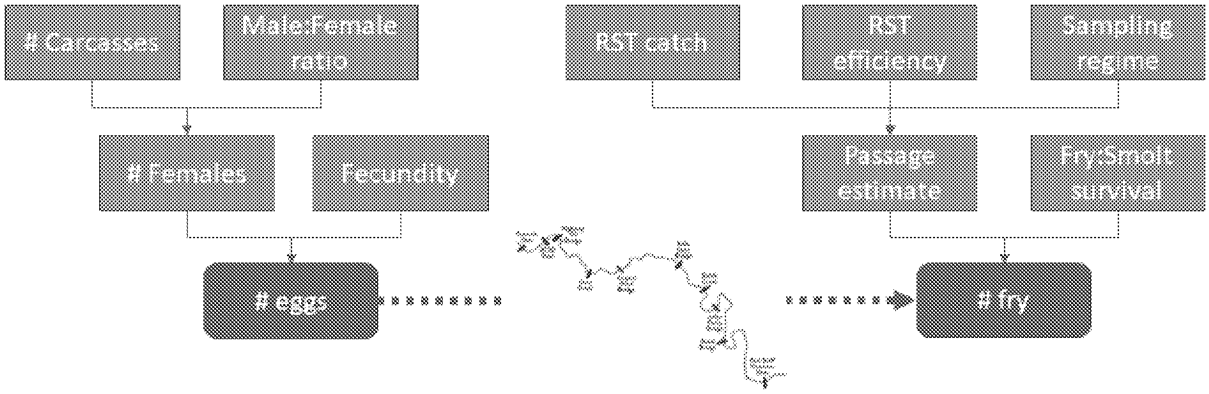

Figure 2. Simplified depiction of the data used to estimate egg to fry survival

Discussions with experts identified two areas where additional analyses could contribute to increased understanding of what the estimated values represent or for potential adjustments to information presently used:

- *Further analysis of existing RBDD juvenile monitoring data* – Analysis could be conducted to assess the relationship between abiotic variables (including flow) and RST catch to validate current approaches to imputing data when conditions prevent RST operation. During periods when fish density is high, elevated river flows, or heavy debris loads, routine trap operations are modified, e.g., subsampling protocols to reduce take and incidental mortality (Voss & Poytress, 2019). Randomized temporal sub-sampling can be applied during storm events, and statistical techniques are used to extrapolate to un-sampled data. If RST operation is discontinued for days or weeks, e.g., due to river conditions, mean daily passage estimates are imputed for missed days based on weekly or monthly interpolated mean daily estimates, respectively. When sampling is not conducted due to high river conditions, imputing in this way may overestimate fish passage or may not account for increased passage stimulated by flow events. However, making such an adjustment requires an understanding of the relationship between fish passage and flow. This cannot be simply assumed as, depending on run timing and the degree to which a run's outmigrants have already passed RBDD, fewer or greater fish could pass during any particular event depending on factors such as the timing and prior storm activity. A detailed analysis of the role of environmental factors in emigration of Pacific lamprey related daily catch at RBDD over a 10 year period to a set of candidate variables including flow, number of days from rain event, turbidity, temperature, precipitation, and moon phase (Goodman et al., 2015). Analyses of this type for juvenile salmonids could be used to refine the current approach to account for missing RST data. Conditions such as high flows and turbidity may be poorly represented in the existing data, and this analysis could also point to the need for additional data to better understand the role of environmental conditions, such as high flow and turbidity, on catch.
- *Parentage-based tag methods* - Genetic analyses are already conducted on sampled fish to support run identification at RBDD. Johnson et al. (2017) note that parentage-based tag (PBT) methods can provide information on the reproductive success of individual spawners which is potentially useful in refining the data uses in Figure 2. Existing work using PBT linked adults

sampled at the Keswick Dam trap and in the carcass survey with juveniles sampled at RBDD for BY2016. Preliminary analysis showed approximately 44% of adults were estimated to have successfully produced recruits to RBDD and hatchery-origin females also produced fewer recruits than expected given their abundance relative to natural-origin females (S. Blankenship, personal communication). However, samples collected in 2016 were collected in late September and based on 18 years of data on run timing, 38% (+/-18%) of the run may have already passed prior to starting genetic collections. Consequently, the preliminary analysis may include a negative bias on the number of fish contributing to juveniles captured at RBDD. Continued exploration of this approach could be useful, as discussed by Johnson et al. (2017), to evaluate how spawn timing, location, and origin (hatchery or wild) influence reproductive success.

Predation

Predation of fry could be an important source of mortality influencing catch at RBDD. Grossman (2016) notes that identifying whether predation is the proximate or the ultimate cause of individual mortality can be problematic, and few surveys of predators or predation studies are available for this section of the River. Developing insight into the potential role of predation requires detection of predator distribution and abundance relative to fry (as described above), and the degree to which predatory fish are consuming fry.

Prey items in the guts of predators can be studied using nonlethal gastric lavage in combination with visual or genetic identification of contents (Stompe et al., 2020). In a detailed study of predation on the Tuolumne River, acoustic tags were inserted into predators caught by hook and line and an array of hydrophones was used to calculate the 2-D position of the fish (FISHBIO, 2013). This allowed habitat use by the predators to be evaluated. In the Tuolumne study, Chinook Salmon were also tagged, and the overlap between predator and prey distributions was assessed. Fry in this section of the river are too small to bear acoustic tags using current technology, but the approach to documenting predator movements in combination with assessments of prey in the predators gut could provide insight into the relative role of predation on fry in response to changing environmental conditions including those associated with management actions.

Recent development of a Predation Event Recorder (PER) provides a way of examining patterns of relative predation across factors such as water depth and may provide information on predator species (Demetras et al., 2016). PERs have been used to assess relative 'predation risk' in the Delta and to support the development of statistical models to estimate predation potential for the South Delta landscape at a 1-day and 1-km resolution (Michel et al., 2020). MicroPERs are a miniaturization of the original PER design and are small enough to be attached to a spinning rod and deployed by casting then allowing them to float through habitats to detect predation in different in-stream conditions (C. Michel, personal communication). However, caution should be used when drawing conclusions from the use of PERs. While PERs can provide relative information, tethering effects may limit understanding of how effective predators are at capturing juvenile salmon (Baker & Waltham, 2020) and local conditions may make the technique more effective in some conditions than others. However, using PERs or MicroPERs in combination with other techniques described above could provide additional insight given the ability to deploy them in shallow water and size limitations on tagging.

A focused study of predation in different environments of the river, under varying flows and seasonal temperature conditions, could substantially increase understanding of the role of predation mortality and when and where it may impact the success of management actions. However, quantifying predation mortality such that it could be used as part of the calculation described in Figure 2 would require substantial additional study. The study described here is a first step and could be designed and implemented independently or as part of an Integrated Study as described below.

Integrated Study #2

Several habitat restoration projects have been implemented, including side channels and placement of root wads to increase habitat complexity, and more are planned. Management actions that alter flows interact with existing and newly restored habitat features and understanding how these interactions can contribute to a coordinated approach to system restoration and management. An Integrated Study could leverage existing field, lab, and modeling approaches and provide information to improve prediction of action-effect linkages relative to juvenile survival and growth. For rearing-out-migrating juveniles above RBDD, a reach of river including a variety of in-channel features should be selected. This could include restored habitat features, features that restoration projects seek to mimic, e.g. reference sites, or a combination of the two. The goal would be to integrate study of several sources of mortality already discussed including disease and predation with additional measurement of food availability and, potentially, growth of fry.

A coordinated field campaign on a selected portion of the river could include:

- Field measurements in combination with modeling to understand variations in environmental conditions (such as temperature, depth, velocity) including those targeted by management actions. For example:
    - Surveys of topography, bathymetry and bed sediment character, and velocity measurements to support spatially distributed predictions of water surface elevation using hydraulic models, e.g., SRH-2D
    - Measurements, using samples or sensors as appropriate, of water quality such as dissolved oxygen and turbidity
- Ecological measurements could include:
    - Surveys of terrestrial and submerged vegetation
    - Water samples and sentinel studies to document prevalence and potential infection rates for *C. shasta* (Box 2)
    - Utilization of different habitats by fry. This could use non-contact methods such as snorkel or kayak video surveys, but for some species, dip nets and seines could provide more specific information including size, overall condition, etc.
    - Documentation of predator abundance movement and gut contents (discussed above)
    - Nets and/or traps to document available food, including drifting insects, and the association of food availability within channel biotic and abiotic conditions
    - Measurement of growth in non-listed species using otoliths

Specific survival estimates for fry are difficult due to their small size although this may be possible with larger fish (O'Farrell et al., 2018). However, insight into factors influencing growth and predation, in tandem with variation on physical stream conditions, could be used to reduce the uncertainty in fine scale models such as ELAM and decision support tools such as inSALMO. Dudley (2018) notes few data were available on the concentration of food and the rate at which drift food regenerates. Such information could also be used in the bioenergetics analyses suggested above for habitat restoration planning and design.

Such an Integrated Study could be planned in several ways depending on the resources available. Being able to link food production areas with downstream availability, could be examined at the habitat/intrahabitat scale, or across longer stretches of river enabling examination of food sources in reservoir releases vs. those produced within channel habitats. Parallel studies of sections of river, e.g., closer to Redding and closer to RBDD, may provide insight on larger within river gradients (as identified in the studies of *C. shasta* – Box 2) and how those gradients vary with seasons and management of flow. If an Integrated Study site incorporated a restored area that is being monitored, the additional data could provide an opportunity to validate ongoing weekly sampling or suggest additional low-effort data collection.

Understand Recommendations: Rearing-Out Migrating Juveniles – Keswick Dam to RBDD			
#	**Type**	**Science Activity**	**Management Relevance**
11	Analysis	Plan, support, and implement a structured approach for efficiency tests at RBDD RST across run/size, flow conditions, etc.	*Increased detection* - Increased confidence in egg-to-fry survival estimates. *Improved understanding* - Evaluation of critical assumptions that may bias routine field surveys and thus impact management actions reliant on the survey data.
12	Analysis	Analyze existing RBDD juvenile monitoring data to assess the relationship between flow and environmental conditions and fish passage.	*Improved understanding* - Validate current approaches to imputing data when conditions prevent RST operation.
13	Analysis	Continue exploration of parentage-based tag methods to provide information on the reproductive success of individual spawners.	*Improved understanding* - Evaluation of how management actions that influence spawn timing, location, and origin (hatchery or wild) affect reproductive success. *Improved prediction* - Potential refinement of egg-to-fry survival estimates.

Understand Recommendations: Rearing-Out Migrating Juveniles – Keswick Dam to RBDD			
#	**Type**	**Science Activity**	**Management Relevance**
14	Focused Study	Plan and conduct a focused study to understand predator distribution and predation in different environments of the river under varying flows and seasonal temperature conditions potentially including gut analysis of predators, predation activity, and tracking predator movements with changing environmental conditions, including those associated with management actions.	*Improved understanding* - Evaluation of when and where predation mortality of salmonids can impact the success of management actions.
15	Integrated Study	Collaboratively plan and conduct a multi-year Integrated Study to understand how managed flows interact with existing and newly restored habitat features to benefit rearing fry, including detailed field measurement and model simulations of physical conditions, and surveys of habitat utilization by fry and potential predators, growth rates (non-listed species), and prevalence and potential infection rates for *C. shasta*.	*Improved understanding* – Assessment of factors influencing fry growth and predation, and the role of physical stream conditions including those influenced by flow management. *Improved prediction* – Incorporate understanding of factors into the planning and design of habitat restoration management actions.

Rearing-Out Migrating Juveniles - RBDD to Verona

This section of the river includes areas of broad meanders with active migration, areas of hardened channel banks, and a long stretch of river downstream of Colusa largely characterized by a narrow deep channel confined by earthen levees and riprap. The Sutter Bypass is flooded via Moulton, Colusa, and Tisdale Weirs at different river stages leading to great variations in habitat availability to rearing salmon depending on river discharge.

Actions and Potential Effects

Management actions influencing rearing-out migrating juveniles between RBDD and Verona include:

- Winter Minimum Flow
- Spring Base Flow
- Rice Decomposition Smoothing
- Spring Pulse Flow
- Side Channel Habitat Restoration
- Riparian Habitat
- Floodplain Habitat
- Managed Floodplains for Food Production
- Small Screen Program[6]

Further details on many of these actions are described in the 2019 National Marine Fisheries Service Biological Opinion on Long-term Operation of the Central Valley Project and the State Water Project[7] and the Central Valley Flood Protection Plan Conservation Strategy[8]. Most of these actions influence flows within the system and habitat condition. In addition, flows in this section of the river can be influenced by Sacramento River diversions, winter flood control releases from dams, and flows from unregulated tributaries. In addition, plans are being considered to add modifications or notches to the flood control weirs that allow flows into the Sutter Bypass. Flows influence the quality of and salmonid access to/from in-channel habitats for rearing, and the spring pulse flow specifically targets out-migration of Spring-run. Habitat focused actions seek to improve the conditions supporting growth and survival of juveniles, and for this section of the river could include in-channel habitats and opportunities in the Sutter Bypass. Managing floodplains for food production is an approach designed to increase food availability in the channel to increase growth of salmonids using managed inundation of adjacent lands. A summary of the potential effects of many of these actions on habitat, physical conditions, and species response is provided in Appendix A.

Predict

In this section of the river many of the actions affect access to, or the quantity and quality of rearing habitats. Some habitat planning tools (e.g., Whipple et al., 2019) have moved beyond quantification of inundated area or the area that meets specific depth/velocity criteria to include floodplain connectivity (e.g., the opportunity for volitional ingress and egress) and thus can be used to consider stranding

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[6] The small screen program directly addresses potential mortality at water intakes and will not be discussed here due to extensive existing work under the AFSP.

[7] https://www.fisheries.noaa.gov/resource/document/biological-opinion-reinitiation-consultation-long-term-operation-central-valley

[8] https://water.ca.gov/Programs/Flood-Management/Flood-Planning-and-Studies/Conservation-Strategy

potential. However, these are largely still based on physical aspects of habitat, despite substantial information of the multiple benefits of floodplains (e.g., Grosholz & Gallo, 2006). As discussed above, linking bioenergetics modeling with 2-D simulations of in-channel and floodplain physical processes would allow habitat restoration and flow management to be planned and designed to better account for how changes in physical conditions including flow, seasonal temperatures, and food availability affect fish growth.

The 2020 Incidental Take Permit for the Long-Term Operation of the State Water Project (ITP) calls for the development of a LCM for Spring-run. While the model is not required under the ITP until 2025, development is already underway. The Spring-run LCM will be a valuable tool for the Partnership to understand the implications of management actions for Spring-run originating in Mill and Deer Creeks as they pass through the mainstem Sacramento. Tracking and contributing to discussions regarding the development of the LCM could allow the Partnership to ensure that the model appropriately reflects the role of management actions that change conditions in the mainstem Sacramento. Further, ensuring that the Spring-run LCM could work in concert with other tools to allow assessment of tradeoffs in hydrology and biological response in relation to the Spring Pulse Flow (such as CWP availability for Winter-run and effects on fall flows for Winter-run, Spring-run, and Fall-run) would enable transparent decision making processes such as SDM to be used for these complex decisions.

Predict Recommendations: Rearing-Out Migrating Juveniles - RBDD to Verona			
#	**Type**	**Science Activity**	**Management Relevance**
16	Modeling	Identify, refine, and test suitable bioenergetics models for use in conjunction with flow models of in-channel and floodplain habitats.	*Improved prediction* - Improved planning and evaluation of habitat restoration and flow management actions by allowing planning and design to better account for how changes in thermal regime, flow conditions, and food availability affect fish growth.
17	Modeling	Foster communication and information sharing to support the ongoing development of the Spring-run LCM. Identify additional data or research needed to appropriately reflect the role of the mainstem Sacramento River conditions and management actions in the model, such that it could eventually be used to assess tradeoffs and support SDM.	*Improved prediction* - Ensure that the Spring-run LCM appropriately reflects the role of management actions that change conditions in the mainstem Sacramento and thus support future management decision making.

Detect

There are relatively few regular and effective sampling locations between RBDD and Verona. RSTs at Glenn-Colusa Irrigation District, Tisdale Weir, and Knight's Landing provide data on fish out-migration timing, but trap efficiencies are either unknown or low. The ITP calls for the collection of genetic samples at Tisdale Weir and Knight's Landing RST to improve run identification and support the proposed Spring-run Juvenile Production Estimate (JPE) and emphasizes the Tisdale Weir RST as an important location to monitor fish that then move through the weir and into the Sutter Bypass. Combined use of acoustic tags and coded wire tagged releases for efficiency studies, discussed above in relation to RBDD, is also included in the ITP. Methods for estimating JPE for Winter-run (O'Farrell et al., 2018) are limited by data availability, especially passage at Sacramento reflecting survival as far as the Delta. A refined JPE does not directly inform action-effect linkages in the mainstem Sacramento River, but the current Winter-run JPE, and potentially the proposed Spring-run JPE, incorporate information that reflects the effectiveness of management actions of interest to the Partnership. Being able to assess the survival of outmigration of juveniles before they reach the Delta could provide an overall assessment of how ambient conditions and management actions in the Sacramento influence outmigration (including passage through Sutter Bypass) as well as supporting JPE estimates, possibly using Method 3 proposed by O'Farrell et al. (2018). Such assessment could be achieved through deployment of a new monitoring location, that would also encompass the effects of other tributaries for some runs depending on the location selected, or more intensive acoustic tagging studies of survival.

In-channel survival has been the topic of several research studies. Michel et al. (2015) calculated percent survival per 10 km of the mainstem Sacramento River in 2007-2011 using acoustic tagging and found lower survival rates upstream of Colusa vs. between Colusa and the Delta for hatchery-origin Late Fall-run juveniles. Using similar methods, Notch et al. (2020) found lower survival between Hamilton City and Colusa in wild Spring-run emerging from Mill Creek in 2013-2017. While these studies do not track the causes of mortality, Notch et al. show that survival increases with movement speed related to flow. Michel et al. (2015) propose that higher survival in the parts of the river confined by levees and armored banks is a result of smolts migrating in the center of the channel, due to lack of rearing conditions, while predators associate with channel margins. Studies like these point to variations in survival along the river which could be the focus of targeted surveys of predators using boat-based surveys (as described previously). Data on how predator abundance and distribution changes through different reaches of the river, and in relation to flow, could help planning and implementation of projects that seek to improve in-channel rearing habitats.

One of the expected benefits of habitat restoration projects is the generation of food for juvenile salmonids and monitoring of restoration sites may include sampling for prey, e.g., Bullock Bend. However, few data are available on existing prey resources to provide context for such monitoring. Targeted data collection campaigns to provide data on patterns of abundance of drift insects and zooplankton (especially in association with habitat features such as side channels, bars, bank slopes, etc.) would provide useful background data for restoration planning projects as well as providing a foundation for future examination of the effects of management actions. Extending data collection to floodplains during periods of inundation, while opportunistic and difficult to plan for, would provide valuable baseline information for projects that seek to increase food resources for salmonids.

A number of studies have documented increased growth of juvenile salmonids that occupy floodplain habitats in the Cosumnes and the Yolo Bypass (e.g., Henery et al., 2010; Jeffres et al., 2008), and there is some evidence that this may be the case for juveniles that migrate through the Sutter Bypass (Cordoleani et al., 2020). Question remain as to whether juvenile salmon experiencing increased growth due to passage through the Sutter Bypass perform any better than juvenile salmon that outmigrate through the main channel. Where habitats are open to juvenile access, comparing the number and size of fish captured across the habitats does not provide unambiguous evidence of differences in growth or survival. For the Yolo Bypass, Sommer et al. (2001) used paired releases of coded-wire-tagged juvenile salmon in Yolo Bypass and the Sacramento River. This approach allowed comparisons of growth among fish of similar origin and provided a relative estimate of migration time and survival. Such studies for the Sutter Bypass could provide direct documentation of the potential benefits of floodplain passage on survival or out-migrating fish, and whether any benefits of increased growth are negated by conditions in the downstream migratory corridor, e.g., poo temperature conditions in the mainstem Sacramento from Verona to the Delta.

Detect Recommendations: Rearing-Out Migrating Juveniles - RBDD to Verona			
#	**Type**	**Science Activity**	**Management Relevance**
18	Analysis	Convene an expert group to evaluate the need for additional juvenile passage monitoring locations on the mainstem Sacramento River in relation to other potential approaches, e.g., additional measurement of survival, modeling.	*Increased detection* - Data to provide an overall assessment of how ambient conditions and management actions in the Sacramento influence outmigration (including passage through Sutter Bypass). *Improved prediction* - Support for refined JPE estimates.
19	Targeted Data Collection	Strategically plan and conduct boat-based surveys of predators to identify how predator abundance and distribution changes through different reaches of the river.	*Increased detection* – Provide greater resolution of river reach-specific predator densities. *Improved understanding* - Support for planning and implementation of projects that seek to improve in-channel rearing habitats
20	Targeted Data Collection	Strategically plan and conduct data collection campaigns to identify patterns of abundance of drift insects and zooplankton in association with habitat features such as side channels, bars, bank slopes, etc. Consider extending data collection to floodplains during periods of inundation.	*Increased detection* - Improved background data for planning restoration projects. Specifically, baseline data for future examination of the effects of management actions that seek to increase food resources for salmonids.
21	Targeted Data Collection	Conduct a series of paired releases of tagged hatchery fish into the Sutter Bypass during flooding and the adjacent Sacramento River, to detect whether passage through the Sutter Bypass increases survival for out-migrating juvenile salmonids	*Increased detection* - Documentation of the potential benefits of floodplain passage on survival of out-migrating fish.

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Understand

The varied nature of this stretch of river means generalizations over large areas are difficult, as shown in the survival studies mentioned above. Windell et al. (2017) identify nine hypotheses for factors influencing survival, out-migration timing, and growth of Winter-run. Scientific activities have already been identified in this Plan to increase understanding of similar processes above RBDD and many could be readily transferable to the river further downstream. Several areas for additional work are provided here including an Integrated Study of floodplain habitats in the Sutter Bypass. Box 3 describes a particular opportunity to increase understanding associated with a management action.

> **Box 3. Management Action Specific Studies: Spring Pulse Flows**
>
> The 2019 Biological Opinion for the Central Valley Project includes management actions that have not previously been routinely applied. Improved understanding of the effects, both intended and unintended, will be valuable to the Partnership as they continue their work through SDM and other collaborative processes. As some management actions are applied differently depending on water storage or other factors, there is an opportunity to learn by studying the response of the system to the actions across a gradient of implementation conditions.
>
> The Biological Opinion includes, as part of Reclamation's proposed action, implementation of a spring pulse flow under certain hydrologic conditions to improve the survival of out-migrating juvenile salmonids, specifically Central Valley Spring-run Chinook salmon. In addition, several Members have participated in the development of an experiment to coincide peak smolt out-migration from Mill and Deer Creek with a short-duration pulse of water through the Sacramento River in order to increase survival rates through the mainstem Sacramento River in the spring. Migrating Fall-run smolts could also benefit from the pulse. Field sampling would include not only tracking the survival of the fish but additional measurements of potentially important factors to outmigration such as turbidity. The greatest response is expected in dry or below-normal water years (such as 2012-2016). However, the Biological Opinion indicates the spring pulse flow would be considered when Shasta Reservoir total storage on May 1 is projected to be sufficient for cold water pool management (i.e., greater than 4 million acre-feet) which may not occur in dry or below normal years, potentially limiting broader understanding of the benefits of spring pulse flows.

Mainstem Habitat Utilization and Benefits

Several studies have identified salmonid utilization of specific habitats. Merz et al. (2016) noted differences in use of Steelhead and juvenile Chinook salmon in the Lower Mokelumne River as well as differential response to temperature. In the Sacramento River, Zajanc et al. (2013) found that Steelhead had a higher probability of holding in habitats where the bank slope was steeper and large woody material density was lower. The presence of submerged vegetation also influenced Steelhead holding time. How and where to invest in habitat restoration or enhancement, and design of projects to provide species benefit, requires more information on specific habitat utilization. The following elements should be included in coordinated field studies at different areas including the broader meandering reaches above Colusa and the leveed reaches above Knight's Landing:

- Measurements of abiotic conditions including flow, water temperature, DO, etc.

- Acoustic tagging of juveniles with specific deployment of receivers to detect holding times in habitat in selected areas, possibly identified based on high and low survival from whole river studies (Michel et al., 2015; Notch et al., 2020). These could be conducted in association with active surveys, e.g., beach seines or electrofishing, across a wider area (in the absence of listed species) to examine within river variation.
- Assessments of predation on salmonids using predator gut content by hook and line sampling. This could be combined with boat-based predator distribution surveys and deployment of MicroPERs to enable the types of analyses conducted by Michel et al. (2020) to estimate patterns of potential predation associated with different habitats. Predation could be linked with the detailed utilization surveys by including the use of predator tag technology (Daniels et al., 2019).
- Surveys of prey availability including drift nets and zooplankton nets (thrown or towed).

This type of coordinated field sampling across diel cycles and seasons can support bioenergetics modeling for planning and design of habitat restoration as well as provide a foundation for more detailed modeling, e.g., using IBMs, and potential refinement of transitions in LCMs.

Actively Managed Agricultural Floodplains

Recent experimental studies of food resources (Corline et al., 2017; Katz et al., 2017) point to the potential benefits of managing the flooding of agricultural fields to provide food and habitat for juvenile salmonids. Managing inundation of field in different ways has been shown to provide valuable habitat for waterbirds during periods of limited habitat availability (Sesser et al., 2018). Given the dramatic reduction in available habitat in the Central Valley for out-migrating juvenile salmonids, as well as the value of habitat for juveniles in the Yolo Bypass during flooding, studies have explored whether agricultural areas within floodways can be more actively managed to enhance this benefit. A multiyear study has been conducted on standard rice and winter wheat fields, adjacent fallow lands, and rice fields with different harvest practices or other experimental modifications to test fish and food web responses within different land management scenarios (Sommer et al., in press). The flooded farm fields produced high levels of biological productivity (Corline et al., 2017) and fish growth was rapid (Katz et al., 2017). However, these studies found that flooded fields are not viable rearing habitat unless wild juvenile salmonids are able to find the fields as well as safely emigrate before drawdown and that avian predator and temperature refugia may be important features of the management design. Volitional access is a key issue with locations in proximity to channels that are viable migration corridors, and where egress at focal points and times does not attract high predator densities, reducing survival. Evaluating the tradeoff between the potential growth advantage against focused predation risk could be explored through modeling although additional information is needed to identify how potential risks can be decreased through design and management. A focused study, in cooperation with landowners and incorporating different experimental management approaches, would provide additional insight on these tradeoffs and the potential net benefit to out-migrating juveniles.

Integrated Study #3

Potential additional floodplain access for out-migrating salmonids may occur through modifications to Tisdale Weir. In 2019, Cordoleani et al. (2020) found four runs of Chinook Salmon were captured during flood events in either the Butte Sink or Sutter Bypass using seines and fyke nets. This indicates the potential importance of these habitats for all four runs of Central Valley Chinook Salmon. The same study found that both managed wetlands and flooded agricultural habitats provided high growth rates during the flood event and that high abundance of zooplankton in the off-channel Butte Sink and Sutter Bypass locations serves as a food resource for the juvenile salmon. Moving from individual studies towards understanding what can be used in an LCM or other decision support tool requires mechanistic understanding of the circumstances under which benefits to juveniles are provided and when other concerns, such as stranding or increased susceptibility to disease as temperatures warm, may dominate. Moreover, relatively frequent flooding of the Sutter Bypass provides an opportunity to understand how variations in floodplain inundation influence the benefits gained (Whipple et al., 2017) which could be used to better plan and design active management of floodplains using structures and managed inundation.

Integrated Study #3 directly targets the improvement of existing habitat assessment tools that might be applied to habitat restoration planning and foundational information for improved consideration of habitats within LCMs. Key elements include:

- Utilize 2-D models and 'suitability' approaches to identify areas of the Sutter Bypass that might be expected to provide high-low quality habitat for juvenile salmon for different flood conditions.
- Focus field sampling during one or more flood events across these gradients in predicted habitat quality to:
    - Document abiotic conditions including water depth, velocity (parameters used in the LCM and some habitat assessment tools), contaminant loading, and temperature
    - Survey fishes and prey (e.g., following methods used in Cordoleani et al., 2020) across areas of high-low quality. Growth of non-listed juveniles can be documented using caged fish (Jeffres et al., 2008) or otolith studies (Limm & Marchetti, 2009)
    - Assess predation potential using PER approaches for nekton and cameras to document potential avian predation
    - If plausible, given the unpredictable nature of Bypass flooding, deploy receivers and use acoustically tagged fish to determine survival in segments of the floodplain characterized by high vs. low quality
- Utilize field data to consider whether gradients in the initial modeled quality assessment captured measured patterns of utilization prey availability, growth, potential predation, and whether abiotic conditions were likely to result in disease (see Box 2).

Laboratory studies or additional bioenergetics modeling could also be used to assess potential for growth across the gradients of conditions found in the field. Initial field campaigns could be more broadly based, with the results being used to design more detailed components in subsequent flood events, e.g., the addition of sentinel studies of potential pathogen effects. Known spatial gradients not related to the abiotic factors should also be considered in field sampling design. For example, Cordoleani et al. (2020) noted lateral banding from west to east within the Sutter Bypass associated with the mixing of different source waters entering the Bypass. This Integrated Study could also be paired with Science Activity #21 (see above) to determine the overall impact of the floodplain passage on survival.

Directly linking field studies with modeling and engaging both field scientists and modeling experts in the design of the study can help ensure that the findings can ultimately be incorporated into models to support SDM and other decision-making processes. This type of integration of field information on growth and survival, with inundation information, into models was used in the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project EIR/EIS to support evaluation of the trade-off between the risk of mortality by rearing for an extended period in Yolo Bypass to gain greater size versus the benefit of greater survival at later life stages associated with extended rearing and growth in the Yolo Bypass (Hinkelman et al., 2017). Using the Integrated Study to explore the role of floodplain structure and complexity providing shelter to rearing juveniles from piscivorous fishes and birds, in the Sutter Bypass, would also support future adaptive management of the system (Tompkins et al., 2017).

Understand Recommendations: Rearing-Out Migrating Juveniles - RBDD to Verona			
#	**Type**	**Science Activity**	**Management Relevance**
22	Focused Study	Support science to understand the effects of the spring pulse flow action including during drier conditions than those identified in the Biological Opinion.	*Improved understanding* - Evaluate the effects of the new management action under varying water year conditions, thus supporting evaluation of tradeoffs among water management benefits and impacts for different runs of salmon.
23	Focused Study	Plan and conduct coordinated field sampling to identify patterns of habitat use within the mainstem Sacramento, including the broader meandering reaches above Colusa and the leveed reaches above Knight's Landing, and assessment of predation potential and prey availability.	*Improved understanding* - Support for bioenergetics modeling for planning and design of habitat restoration and flow management actions. *Improved prediction* - Provision of information to apply/refine decision support tools, e.g., use of IBMs, refinement of transitions in LCMs.
24	Focused Study	Plan and conduct experimental studies of the effects of actively-managed agricultural floodplain utilization on out-migrating salmonids including potential for avian predation, channelized and managed floodplain-mainstem egress on subsequent predation, and tradeoffs between enhanced growth and delays in outmigration associated with extended durations of floodplain access.	*Increased detection* – Focused monitoring of juvenile salmonid utilization of actively-managed agricultural floodplain. *Improved understanding* - Identification of the potential benefits and risks to salmonids of actively managed access to/use of agricultural floodplains.
25	Integrated Study	Collaboratively plan and conduct a multi-year Integrated Study to understand how variations in passive inundation of the Sutter Bypass influences the benefits gained, including model simulations of habitat quality, surveys of habitat utilization and potential for predation and disease, juvenile growth rates, and data to support improved modeling of habitat quality.	*Increased detection* – Focused monitoring of juvenile salmonid utilization of passively inundated floodplains. *Increased understanding* - Evaluation of the benefits and risks of passive access to floodplain habitats to juvenile salmon. *Improved prediction* - Information to support the refinement of predictive tools for supporting floodplain management decisions.

System-Level Assessment

There are several areas where the Partnership could benefit from information which also serves a wider set of interests in relation to Central Valley Chinook Salmon and Steelhead that are not focused on a specific life stage. Some have been discussed previously (Box 2) and others described here include synthesis activities which cross life stages or issues to contribute to shared learning by the Members.

Ongoing Data Needs

Otolith studies have proved useful in identifying the size of individuals during out-migration from tributaries, time- and size-selective mortality along the migratory corridor, and rearing in non-natal habitats (Phillis et al., 2018; Sturrock et al., 2015, 2020). Johnson et al. (2017) pointed to the need for annually collecting otoliths to quantify survival and relative contributions of different rearing strategies. This effort has been piloted as part of the SAIL projects (Johnson et al. 2017) to improve the monitoring program and measure viability metrics. The work is ongoing, and discussions indicate it is proving useful to Members of the Partnership. Sustaining this effort will underpin the work of the Partnership as well as that of others.

The ways in which management actions potentially influence Steelhead is in some part dependent on whether fish are anadromous or resident. The relationship between anadromous and resident Steelhead is poorly understood. Further sampling and analysis of scales described in the California Department of the Fish and Wildlife Steelhead Monitoring Plan could be used to identify whether fish have migrated to the ocean. In addition, recent studies have identified the chromosome Omy5 in a genomic region strongly associated with the prevalence of resident or anadromous life history traits in coastal California Steelhead populations (Pearse et al., 2014), and these have been used to identify life history patterns in other systems (Abadía-Cardoso et al., 2016; Apgar et al., 2017). Further application of these techniques will provide context for Steelhead response to management actions throughout the system.

Brood Year Assessments

The BY2013 assessment for Winter-run (Israel et al., 2015) provides a useful example of how monitoring data and other information can be collaboratively drawn into an evaluative framework to provide a transparent appraisal of species response to ambient conditions and management actions. The BY2013 report was drought focused, and since its compilation, adjustments have been made in some aspects of data collection, e.g., genetic testing to correct for length-at-date criteria and misassignment of winter-run as spring-run. In addition, it was for a single run, and as the report notes, the species of greatest concern may not be a good conservation surrogate for all species.

The focus should be on documenting what happened, with comparison to model predictions if available, and statistical analysis across years if data are adequate. Metrics to be tracked could include: number of spawners; prespawn mortality; number for broodstock; redd distribution including information on dewatering; estimated egg to fry survival (using multiple approaches/models); timing and size distribution of juvenile passage at RBDD, Tisdale, and Knights Landing (and any other available points in the system); timing of movement and size distribution past Chipps Island; and estimated duration of rearing/speed of emigration through parts of the system. Discussion or inference in relation to causality can be included and may require the inclusion of alternative interpretations of cause-effect. Limitations of the data or assumptions in analysis should be clearly documented.

Useful aspects of the BY2013 assessment which should be carried forward with support of the Partnership include:

- A focus on the environmental conditions, management actions, and operational events in relation to species freshwater and estuarine life stages including the specifics of management actions, especially those that vary in character from year to year.
- Comparison of data to the previous 5 years.
- Identification of science needs or monitoring gaps which, if filled, could improve future assessments.

An assessment for BY2019 is presently being undertaken by the Partnership and may utilize different approaches from those proposed here. Key features of such assessments should stay consistent to provide an ongoing way of tracking system change, but new approaches may be beneficial to the Partnership and may override the facets discussed here.

Synthesis

While the findings of individual scientific endeavors provide valuable information, synthesis across studies or management actions can be an effective mechanism for greater insight into system dynamics. Synthesis can integrate not only the findings of work conducted under this Plan but other relevant scientific developments on the Sacramento River and beyond. Conceptual models are often seen as synthesis tools for capturing current knowledge in a structured manner (e.g., Windell et al., 2017), and numerical models can play a similar role if they are routinely updated as knowledge develops. However, reports and papers are one of the most common and accessible synthesis products.

Over a number of years, and in support of SDM, a series of reports could be produced for: key issues such as egg to fry survival or the benefits of floodplain inundation, important locations (e.g., the Sutter Bypass), and individual life stages or transitions (e.g., to collectively assess new developments such as those proposed in this Plan). The brood year assessments discussed above are one example and, given the extensive activity on habitat restoration in the Sacramento and continued investments, a synthesis of the effectiveness if restoration projects on the Upper Sacramento would be of value. Others include benchmark scientific reviews such as those commissioned by the Delta Science Program for the State of Bay Delta Science series, e.g., Perry et al. (2016). Identifying and prioritizing synthesis efforts requires the articulation of management needs and concerns, the availability of appropriate data and information, and the interest of scientists. The Partnership has the ability access or develop all of these and use synthesis to progressively show how shared learning can support the management of system.

Recommendations: System-Level Assessment			
#	**Type**	**Science Activity**	**Management Relevance**
26	Targeted Data Collection	Ensure routine collection of genetic markers for anadromy in Steelhead.	*Increased detection* – Identification and collection of genetic markers for anadromy in Steelhead. *Improved understanding* - Consideration of the effects of management actions on anadromous vs. resident Steelhead.

Recommendations: System-Level Assessment			
#	**Type**	**Science Activity**	**Management Relevance**
27	Targeted Data Collection	Ensure routine collection of otoliths (or scales for Steelhead) for assessment of habitat utilization.	*Increased detection* – Collection of samples/data to support assessment of habitat utilization using otoliths (or scales for Steelhead). *Improved understanding* - Quantification of survival and relative contributions of different rearing strategies.
28	Targeted Data Collection	Ensure routine collection of data needed to assess the effects of pathogens.	*Increased detection* – Collection of samples/data to support assessment of the effects of pathogens. *Improved understanding* - Establish the role of disease influencing salmonid populations.
29	Synthesis	Routinely develop summary brood year assessments.	*Improved understanding* - Ongoing transparent appraisal of species response to ambient conditions and management actions.
30	Synthesis	Develop a synthesis report on the effectiveness of restoration projects in the Upper Sacramento based on monitoring and other available data, including any lessons learned in relation to project evaluation, monitoring or implementation.	*Improved understanding* – Provide accessible information on the field-verified benefits of habitat restoration approaches, to support planning and design of future projects.
31	Synthesis	Identify, prioritize, and conduct additional synthesis efforts.	*Improved understanding* - Periodic evaluation of scientific progress, effects of management actions, and change in the system providing context for management actions and enabling the development of new science questions.

Potential for Collaboration

Existing work by a number of organizations was leveraged in identifying the scientific activities included in this Plan. The array of ongoing science spearheaded by these organizations is impressive and it provides an opportunity for the Partnership to move forward with the science activities recommended here using a collaborative approach. There are common science interests between the Partnership and the Science Integration Team (SIT) for the Central Valley Project Improvement Act, the Collaborative Science and Adaptive Management Program, and the Central Valley Salmon Habitat Partnership, for example. Each of these groups has a different mission from the Partnership but is using science to inform their work. The SIT is planning for restoration and research charters for the next five years, and the Collaborative Adaptive Management Team is developing a Coordinated Salmon Science Plan (CSSP) to be completed in 2020. While the details are still in development several common topics appear to be emerging:

- How habitat improvements benefit rearing and out-migrating juveniles is an area addressed by several of the recommended science activities. The SIT recognizes the need for information on whether juvenile habitat improvements in lower-mid and lower Sacramento River would result in increased survival, and the CSSP is interested in prey availability for juvenile salmonids across different habitats.
- Survival of fishes as they move through the system is an area where acoustic tagging has provided substantial information, and additional science activities are identified in this Plan to make use of this technology and also to detect patterns of predator abundance and whether they consume juvenile salmonids. The CCSP deems science to quantify predation mortality beneficial, and the SIT can benefit from additional survival information for use in its decision support models.

In addition, within areas of the Partnership's interest area, there are opportunities to work together, for instance on spawning and rearing habitat in the Upper River, documenting anadromy in Steelhead (both of interest to the SIT), and active management of agricultural 'floodplain' habitats (of interest to CSSP). Other organizations working in the Central Valley are also interested in additional science information that can help predict, detect, and understand the effects of management actions.

The Partnership is founded on resolving challenges through science and engages managers directly in scientific discussion, helping them to better use new information. Some of the science activities identified in this Plan are relevant beyond the mainstem Sacramento River, and the Partnership may as lead or support the work of others. It is beyond the scope of this Plan to determine those roles, and how collaborative science work should move forward. Rather, providing a list of recommended activities, and the management information to be provided, can serve as a focus for collaboration on specific topics or studies, leveraging skills, resources, and knowledge of many.

Acknowledgements

The development of this report has relied heavily on discussions with a wide range of individuals including Partnership staff and scientists in agencies, universities, and the private sector. They were generous with their time and have contributed ideas and generated thinking as well as pointing to various reports, publications, and work in progress. A number of very useful comments were made on an earlier draft which resulted in refinement and tuning of the recommendations. Any errors in fact or interpretation, however, are the responsibility of the author.

Julie Leimbach and Bruce DiGennaro provided essential background and context throughout the process. Funding was provided by the Sacramento River Settlement Contractors and NOAA Fisheries, (via Anchor QEA). The support of their staff with contracting is appreciated.

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Appendix A. Overview of Action-Effects Linkages

The magnitude of the expected benefits of management actions (green) and potential negative effects (orange) will depend on ambient conditions and the way in which the action is implemented.

Action		Potential Effect														
		Habitat			Physical Conditions			Species Response								
2019 Biological Opinion		Food prod.	Avail. /access	Refuge	Flow	Summ. Temp	DO	Pred-ation	Egg survival	Migration survival	Life hist. diversity	Health	Food access	Fecund.	Growth	Recruit-ment
Seasonal Operation	Winter Minimum Flow															
	Spring Base Flow															
	Summer CWP Tiers 1-3															
Fall and Winter Refill and Redd Maintenance																
Operation of Shasta Dam Raise																
Rice Decomposition Smoothing																
Spring Pulse Flow																
Spring Management of Spawning Locations																
Cold Water Pool Management	Temperature Modeling Platform															
	Shasta TCD Perf. Eval.															
	Battle Creek Restoration and Reintroduction															
	Lower Intakes nr. Wilkins Slough															
Spawning and Rearing Habitat Restoration	Spawning Gravel Injection															
	Side Channel Habitat Restoration															
	Small Screen Program															
	Knights Landing Outfall Gates															
Summer CWP Management: Tiers 3&4	Winter run conservation hatchery															
	Adult rescue															
	Juvenile trap and haul															
Voluntary Agreements (Preliminary)																
Gravel Augmentation																
In Channel Habitat																
Riparian Habitat																
Side Channel Habitat Restoration																
Floodplain Habitat																
Managed floodplain for food production																

Appendix B. Summary Table of Recommended Science Activities

Activity Number	Activity Type	Report Section	Recommended Science Activity	Management Relevance
1	Modeling	Egg to Fry Emergence – Keswick Dam to RBDD	Support the collaborative model improvement work of the Temperature Modeling Technical Committee	*Improved prediction* - Extension of the CE-QUAL-W2 modeling of Shasta Lake and Keswick Reservoir to include appropriate river models, creating a linked modeling framework to improve model predictions that assist resource managers.
2	Targeted Data Collection	Egg to Fry Emergence – Keswick Dam to RBDD	Pilot monitoring of input stream and local meteorology in the Shasta, McCloud, and Pit River arms of Shasta Lake	*Increased detection* – Greater resolution of water temperature data above Shasta Dam. *Improved prediction* - Data to validate or refine model inputs and the better incorporate the role of meteorological conditions on thermal regime of Shasta Lake and tributary inflows.
3	Targeted Data Collection	Egg to Fry Emergence – Keswick Dam to RBDD	Increase vertical resolution for temperature profiling in Lake Shasta especially in mid-to-late summer during drier years	*Increased detection* - Greater resolution of water temperature and density data within Lake Shasta. *Improved prediction*s - Improved characterization of density gradients that could influence the ways in which water moves through the various gated structures.
4	Targeted Data Collection	Egg to Fry Emergence – Keswick Dam to RBDD	Conduct velocity surveys to assess dynamics around TCD gates operating individually and for blending, and surveys throughout the TCD operating season to assess how the dynamics change as the TCD is operated over time.	*Increased detection* - Greater resolution of water velocity dynamics around the TCD gates. *Improved prediction*s - Improved characterization of local dynamics of withdrawal zones for TCD gates operating individually or for blending, under varying seasonal conditions.
5	Targeted Data Collection	Egg to Fry Emergence – Keswick Dam to RBDD	Supplement existing carcass and redd surveys with enhanced boat and in-water surveys, potentially focused on specific areas or environmental conditions	*Increased detection* – Additional data to support escapement and fecundity estimates. *Improved understanding* - Evaluation of critical assumptions that may bias routine field surveys and thus impact management actions reliant on the survey data.

Activity Number	Activity Type	Report Section	Recommended Science Activity	Management Relevance
6	Integrated Study	Egg to Fry Emergence – Keswick Dam to RBDD	Collaboratively plan and conduct a multi-year Integrated Study to understand how river-scale management actions translate down to the scale of the redd, e.g., detailed field measurement and model simulations of physical conditions, surveys, and field and laboratory experiments to assess biotic response.	*Improved understanding* - Evaluation of how river-scale management actions, individually and in combination, that alter flow, temperature, DO, and substrate translate down to the scale of the redd and influence redd-specific egg-to-fry survival.
7	Modeling	Rearing-Out Migrating Juveniles – Keswick Dam to RBDD	Identify, refine, and test suitable bioenergetics models for use in conjunction with flow models of in-channel and off-channel habitats.	*Improved prediction* – Promote models that support planning and evaluation of habitat restoration projects by accounting for how changes in thermal regime, flow conditions, and food availability affect fish growth. Information on the potential effects of different flow management decisions on rearing habitat.
8	Targeted Data Collection	Rearing-Out Migrating Juveniles – Keswick Dam to RBDD	Document the consequences of flow management, i.e., the magnitude of minimum flows or the rate of flow decrease, on utilization of in-stream rearing habitat (potentially expanding on stranding surveys and restoration site surveys) including sampling as flows decline.	*Increased detection* - Refined information on habitat use by juveniles. *Improved understanding* - Potential identification of thresholds in environment-use relationships to improve planning and design of habitat restoration projects.
9	Targeted Data Collection	Rearing-Out Migrating Juveniles – Keswick Dam to RBDD	Document the relative abundance and distribution of potential predators in the river above RBDD and the types of in-channel habitats with which they are associated with varying flows and environmental conditions.	*Increased detection* - Improved identification of the response of juvenile passage to flow management, i.e., predation as a potential source of non-temperature mortality. *Improved understanding* - Support planning and implementation of projects that seek to improve in-channel rearing habitats.
10	Targeted Data Collection	Rearing-Out Migrating Juveniles – Keswick Dam to RBDD	Assess the role of pathogens and disease through targeted sampling of intestinal tract samples from carcasses, and evaluation of how changes in flow conditions could disrupt polychaete habitat.	*Increased detection* - Increased appreciation of the conditions under which pathogens and disease may influence the effectiveness of management actions.

Activity Number	Activity Type	Report Section	Recommended Science Activity	Management Relevance
11	Analysis	Rearing-Out Migrating Juveniles – Keswick Dam to RBDD	Plan, support, and implement a structured approach for efficiency tests at RBDD RST across run/size, flow conditions, etc.	*Increased detection* - Increased confidence in egg-to-fry survival estimates. *Improved understanding* - Evaluation of critical assumptions that may bias routine field surveys and thus impact management actions reliant on the survey data.
12	Analysis	Rearing-Out Migrating Juveniles – Keswick Dam to RBDD	Analyze existing RBDD juvenile monitoring data to assess the relationship between flow and environmental conditions and fish passage.	*Improved understanding* - Validate current approaches to imputing data when conditions prevent RST operation.
13	Analysis	Rearing-Out Migrating Juveniles – Keswick Dam to RBDD	Continue exploration of parentage-based tag methods (PBT) to provide information on the reproductive success of individual spawners.	*Improved understanding* - Evaluation of how management actions that influence spawn timing, location, and origin (hatchery or wild) affect reproductive success. *Improved prediction*s - Potential refinement of egg-to-fry survival estimates.
14	Focused Study	Rearing-Out Migrating Juveniles – Keswick Dam to RBDD	Plan and conduct a focused study to understand predator distribution and predation in different environments of the river under varying flows and seasonal temperature condition potentially including gut analysis of predators, predation activity, and tracking predator movements with changing environmental conditions, including those associated with management actions.	*Improved understanding* - Evaluation of when and where predation mortality of salmonids can impact the success of management actions.

Activity Number	Activity Type	Report Section	Recommended Science Activity	Management Relevance
15	Integrated Study	Rearing-Out Migrating Juveniles – Keswick Dam to RBDD	Collaboratively plan and conduct a multi-year Integrated Study to understand how managed flows interact with existing and newly restored habitat features to benefit rearing fry, including detailed field measurement and model simulations of physical conditions, and surveys of habitat utilization by fry and potential predators, growth rates (non-listed species), and prevalence and potential infection rates for *C. shasta*.	*Improved understanding* – Assessment of factors influencing fry growth and predation, and the role of physical stream conditions including those influenced by flow management. *Improved prediction* – Incorporate understanding of factors into the planning and design of habitat restoration management actions.
16	Modeling	Rearing-Out Migrating Juveniles - RBDD to Verona	Identify, refine, and test suitable bioenergetics models for use in conjunction with flow models of in-channel and floodplain habitats.	*Improved prediction* - Improved planning and evaluation of habitat restoration and flow management actions by allowing planning and design to better account for how changes in thermal regime, flow conditions, and food availability affect fish growth.
17	Modeling	Rearing-Out Migrating Juveniles - RBDD to Verona	Foster communication and information sharing to support the ongoing development of the Spring-run LCM. Identify additional data or research needed to appropriately reflect the role of the mainstem Sacramento River conditions and management actions in the model, such that it could eventually be used to assess tradeoffs and support SDM.	*Improved prediction* - Ensure that the Spring-run LCM appropriately reflects the role of management actions that change conditions in the mainstem Sacramento and thus support future management decision making.
18	Analysis	Rearing-Out Migrating Juveniles - RBDD to Verona	Convene an expert group to evaluate the need for additional juvenile passage monitoring locations on the mainstem Sacramento River in relation to other potential approaches, e.g., additional measurement of survival, modeling.	*Increased detection* - Data to provide an overall assessment of how ambient conditions and management actions in the Sacramento influence outmigration (including passage through Sutter Bypass). *Improved prediction* - Support for refined JPE estimates.

Activity Number	Activity Type	Report Section	Recommended Science Activity	Management Relevance
19	Targeted Data Collection	Rearing-Out Migrating Juveniles - RBDD to Verona	Strategically plan and conduct boat-based surveys of predators to identify how predator abundance and distribution changes through different reaches of the river.	*Increased detection* – Provide greater resolution of river reach-specific predator densities. *Improved understanding* - Support for planning and implementation of projects that seek to improve in-channel rearing habitats
20	Targeted Data Collection	Rearing-Out Migrating Juveniles - RBDD to Verona	Strategically plan and conduct data collection campaigns to identify patterns of abundance of drift insects and zooplankton in association with habitat features such as side channels, bars, bank slopes, etc. Consider extending data collection to floodplains during periods of inundation.	*Increased detection* - Improved background data for planning restoration projects. Specifically, baseline data for future examination of the effects of management actions that seek to increase food resources for salmonids.
21	Targeted Data Collection	Rearing-Out Migrating Juveniles - RBDD to Verona	Conduct a series of paired releases of tagged hatchery fish into the Sutter Bypass during flooding and the adjacent Sacramento River, to detect whether passage through the Sutter Bypass increases survival for outmigrating juvenile salmonids	*Increased detection* - Documentation of the potential benefits of floodplain passage on survival or outmitgrating fish.
22	Focused Study	Rearing-Out Migrating Juveniles - RBDD to Verona	Support science to understand the effects of the spring pulse flow action including during drier conditions than those identified in the Biological Opinion.	*Improved understanding* - Evaluate the effects of the new management action under varying water year conditions, thus supporting evaluation of tradeoffs among water management benefits and impacts for different runs of salmon.
23	Focused Study	Rearing-Out Migrating Juveniles - RBDD to Verona	Plan and conduct coordinated field sampling to identify patterns of habitat use within the mainstem Sacramento, including the broader meandering reaches above Colusa and the leveed reaches above Knight's Landing, and assessment of predation potential and prey availability	*Improved understanding* - Support for bioenergetics modeling for planning and design of habitat restoration and flow management actions. *Improved prediction* - Provision of information to apply/refine decision support tools, e.g., use of IBMs, refinement of transitions in LCMs.

Activity Number	Activity Type	Report Section	Recommended Science Activity	Management Relevance
24	Focused Study	Rearing-Out Migrating Juveniles - RBDD to Verona	Plan and conduct experimental studies of the effects of actively-managed agricultural floodplain utilization on outmigrating salmonids including potential for avian predation, channelized and managed floodplain-mainstem egress on subsequent predation, and tradeoffs between enhanced growth and delays in outmigration associated with extended durations of floodplain access.	*Increased detection* – Focused monitoring of juvenile salmonid utilization of actively-managed agricultural floodplain. Improved understanding - Identification of the potential benefits and risks to salmonids of actively managed access to/use of agricultural floodplains.
25	Integrated Study	Rearing-Out Migrating Juveniles - RBDD to Verona	Collaboratively plan and conduct a multi-year Integrated Study to understand how variations in passive inundation of the Sutter Bypass influences the benefits gained, including model simulations of habitat quality, surveys of habitat utilization and potential for predation and disease, juvenile growth rates, and data to support improved modeling of habitat quality.	*Increased detection* – Focused monitoring of juvenile salmonid utilization of passively inundated floodplains. Increased understanding of the Increased understanding - Evaluation of the benefits and risks of passive access to floodplain habitats to juvenile salmon. *Improved prediction* - Information to support the refinement of predictive tools for supporting floodplain management decisions.
26	Targeted Data Collection	System-Level Assessment	Ensure routine collection of genetic markers for anadromy in Steelhead.	*Increased detection* – Identification and collection of genetic markers for anadromy in Steelhead. *Improved understanding* - Consideration of the effects of management actions on anadromous vs. resident Steelhead.
27	Targeted Data Collection	System-Level Assessment	Ensure routine collection of otoliths (or scales for Steelhead) for assessment of habitat utilization.	*Increased detection* – Collection of samples/data to support assessment of habitat utilization using otoliths (or scales for Steelhead). *Improved understanding* - Quantification of survival and relative contributions of different rearing strategies.
28	Targeted Data Collection	System-Level Assessment	Ensure routine collection of data needed to assess the effects of pathogens.	*Increased detection* – Collection of samples/data to support assessment of the effects of pathogens. *Improved understanding* - Establish the role of disease influencing salmonid populations.

Activity Number	Activity Type	Report Section	Recommended Science Activity	Management Relevance
29	Synthesis	System-Level Assessment	Routinely develop summary brood year assessments	*Improved understanding* - Ongoing transparent appraisal of species response to ambient conditions and management actions.
30	Synthesis	System-Level Assessment	Develop a synthesis report on the effectiveness of restoration projects in the Upper Sacramento based on monitoring and other available data, including any lessons learned in relation to project evaluation, monitoring or implementation.	*Improved understanding* – Provide accessible information on the field-verified benefits of habitat restoration approaches, to support planning and design of future projects.
31	Synthesis	System-Level Assessment	Identify, prioritize, and conduct additional synthesis efforts	*Improved understanding* - Periodic evaluation of scientific progress, effects of management actions, and change in the system providing context for management actions and enabling the development of new science questions.

From: Spranza, John [John.Spranza@hdrinc.com]
Sent: 11/6/2020 8:25:41 AM
To: Boyd, Ian@Wildlife [Ian.Boyd@Wildlife.ca.gov]; Davis-Fadtke, Kristal@Wildlife [Kristal.Davis-Fadtke@wildlife.ca.gov]; Hassrick, Jason (Jason.Hassrick@icf.com) [Jason.Hassrick@icf.com]; Torres, Juan@Wildlife [Juan.Torres@wildlife.ca.gov]; Jim Lecky (jim.Lecky@icf.com) [jim.Lecky@icf.com]; Hendrick, Mike (Mike.Hendrick@icf.com) [Mike.Hendrick@icf.com]; Monique Briard (monique.briard@icf.com) [monique.briard@icf.com]; Alicia Forsythe [aforsythe@sitesproject.org]; andrew.huneycutt@wildlife.ca.gov; Seapy, Briana@Wildlife [Briana.Seapy@Wildlife.ca.gov]; Anwar, Mohammed(Shahid)@Wildlife [Mohammed.Anwar@Wildlife.ca.gov]
Subject: Sites 5737 follow up
Attachments: USGS stream gage data for Stone Corral Creek.xlsx; NODOS fish survery Appendix D.PDF; Richter et al 2011.pdf; Revised EIR_EIS Project Description Summary from 02-03A_rev10052020.pdf

Good Morning,

Attached are the CDFG NODOS report on fish surveys, the Richter et al. paper, and an excel file with daily mean flows and annual peak flows taken from the USGS web site for the Stone Corral Creek gage. A link to the USGS web site for the Stone Corral Creek gauge is below.

https://nwis.waterdata.usgs.gov/ca/nwis/dv/?site_no=11390672&agency_cd=USGS&referred_module=sw

Also included are a project description summary and an excerpt from the draft feasibility study that briefly discusses the facilities for providing water back into each creek. As you can see we are at a conceptual design level for these, and hope to use our meetings to firm up the releases and flow regime. I am looking for some graphics for each dam and will send those when I find them.

Sites Dam Environmental Water Outlet (Sites Dam = Stone Corral, Golden Gate Dam = Funks Creek)
Environmental water releases at Sites Dam to Stone Corral Creek would be made through facilities incorporated into the construction diversion tunnel on the left abutment of the dam. The permanent outlet at Sites Dam would be designed to release creek flows to meet environmental mitigation requirements from regulating agencies. For feasibility design, a maximum release rate of 200 cfs is assumed.

Golden Gate Dam Environmental Water Outlet
Environmental water releases would begin at the Inlet/Outlet (I/O) tunnel manifold and then travels about 2,800 feet north to the Funks Creek discharge point.

Please let me know if you have any questions or would like additional information.

John Spranza, MS, CCN
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SN 90665

North of the Delta
Offstream Storage Investigation

Progress Report

Appendix D: Fish Survey Summary

September 2000

Integrated
Storage
Investigations

CALFED
BAY-DELTA
PROGRAM

DRAFT

North of the Delta
Offstream Storage Investigation

Progress Report

Appendix D: Fish Survey Summary

Report prepared by:
Charles J. Brown
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September 2000

Integrated
Storage
Investigations

CALFED
BAY-DELTA
PROGRAM

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Glen Gorden
Student Assistant

George Low
Student Assistant

April Scholzen
Office Technician

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DRAFT

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Fish Survey Summary

Introduction

In late 1997, the Department of Water Resources began a two-year reconnaissance level study of North of the Delta Offstream Storage authorized by Proposition 204—the Safe, Clean, Reliable Water Supply Act approved by voters in 1996. In early 1999, CALFED consolidated all storage investigations under a comprehensive program called Integrated Storage Investigations. The North of the Delta Offstream Storage Investigation was incorporated into one of seven ISI program elements.

The North of the Delta Offstream Storage Investigation continues engineering, economic, and environmental impact analyses to determine the feasibility of four north of the Delta storage projects. The four potential alternatives are Sites Reservoir, Colusa Project, Thomes-Newville Project, and Red Bank Project (Figure 1). Phase I, currently underway, includes preliminary field surveys of environmental resources and extensive field surveys of cultural resources, geological, seismic and foundation studies, and an engineering feasibility evaluation. Phase II will start when CALFED's Record of Decision and Certification for the Programmatic EIR/EIS is completed and if north of Delta offstream storage is consistent with CALFED's preferred program alternative. Phase II will include completion of necessary fish and wildlife surveys, evaluations of potential mitigation sites, preparation of project-specific environmental documentation, final project feasibility reports, and the acquisition of permits necessary for implementation.

Under Phase I, the Department of Fish and Game conducted studies of fish and wildlife resources in each project area. This appendix summarizes studies of fish in the tributaries that flow through each of the four proposed project areas. The information gathered will be used to describe impacts on fish resources during the planning process. Fishery studies conducted for the Sacramento River will be summarized in a separate report.

Contract with DFG

DFG initiated fish studies in 1997. Studies were conducted to develop data adequate to meet the needs of the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and DFG consultations as required by endangered species legislation. Past studies were also reviewed and evaluated as part of this effort.

Report Organization and Content

Results and discussions of findings in past fishery studies and recently conducted surveys of fishery resources in the four proposed project areas are included in this appendix. The general procedure for commonly used fish surveys are outlined, with specific sampling data and results discussed in respective sections for each proposed project area.

Methodology

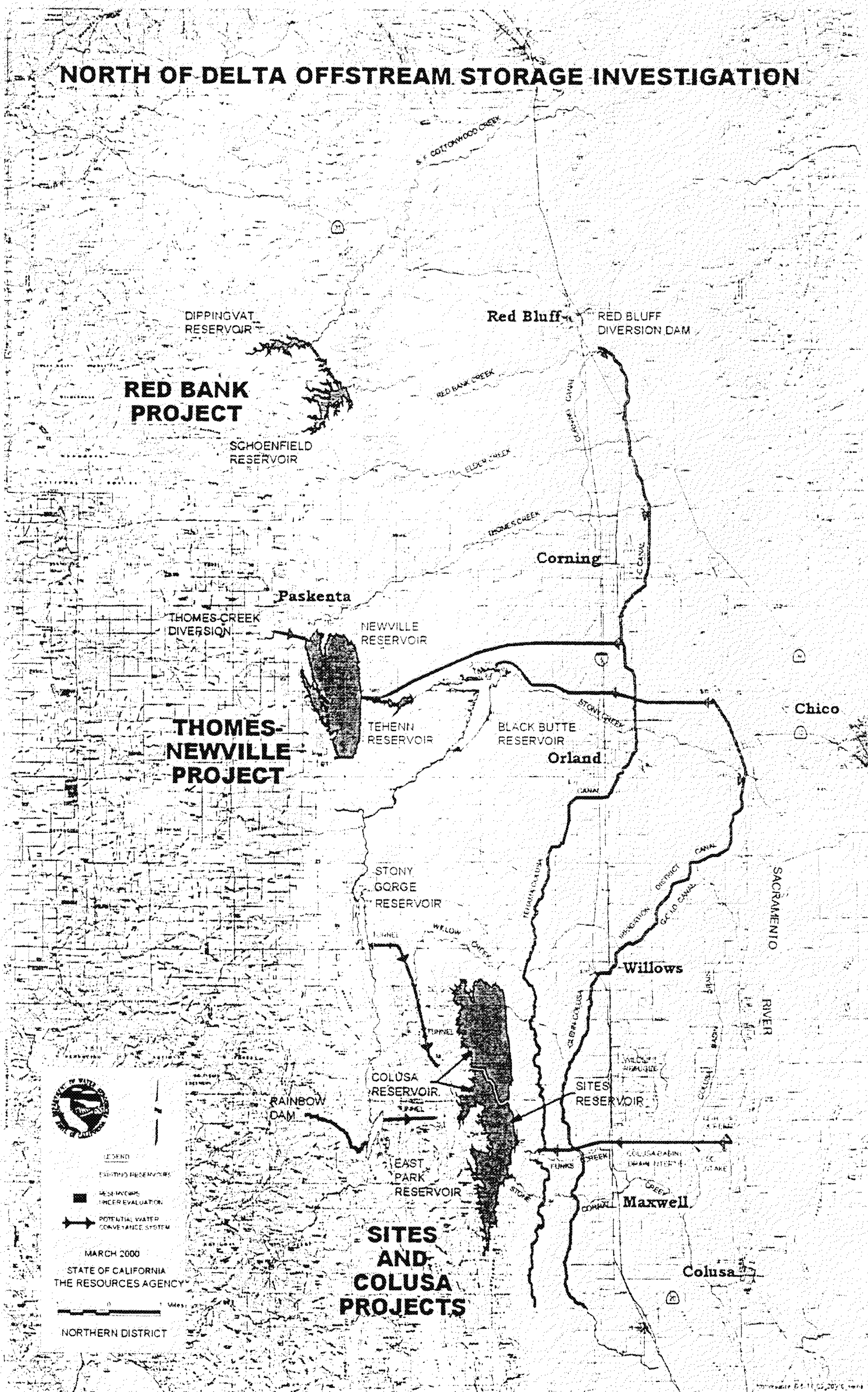
At the proposed project sites, fish surveys were conducted by diving, seining, fyke netting, and/or electrofishing. These methods were used to collect data on occurrence and relative abundance of species of fish. This section discusses general procedures for these methods. Details of surveys and results for each site are discussed in the respective sections.

Diving

Fish were observed in deep pools by divers wearing faceplates. Fish species were identified and numbers of each species observed were recorded. Diving was used as a sampling technique when pools were too big or deep for other sampling methods.

Seining

A seine is used to collect fish for sampling data. Three different seines varying in size were used depending on the size of the pool. The largest seine was 60 feet long, 5 feet high, with a mesh size of one-quarter inch and a 7-foot-by -7-foot pocket. A medium sized seine was 29 feet long, 6 feet high, with a mesh size of one-quarter inch and a pocket size of 7 feet by 5 feet. The third seine, used only for small pools and ponds, was 12 feet long, 4 feet high, with a mesh size of one-quarter inch and a 7-foot-by-5-foot pocket. A seine was brought around from one edge of the pool to the other. To prevent fish from escaping, a barrier net was stretched across the creek upstream and downstream from the pool to be seined. Captured specimens were stored in a bucket of water until they could be examined. Specimens were identified and the first 20 of each species were measured for fork length to the nearest millimeter and then released downstream. The seine was pulled a total of three times at each site. Representative specimens were either preserved or photographed for positive identification.


NORTH OF DELTA OFFSTREAM STORAGE INVESTIGATION
RED BANK PROJECT
DIPPINGVAT RESERVOIR
SCHOENFIELD RESERVOIR
Red Bluff
RED BLUFF DIVERSION DAM
Corning
Paskenta
THOMES-CREEK DIVERSION
NEWVILLE RESERVOIR
TEHENN RESERVOIR
BLACK BUTTE RESERVOIR
Orland
Chico
THOMES-NEWVILLE PROJECT
STONY GORGE RESERVOIR
SACRAMENTO RIVER
Willows
COLUSA RESERVOIR
SITES RESERVOIR
RAINBOW DAM
EAST PARK RESERVOIR
Maxwell
Colusa
SITES AND COLUSA PROJECTS
MARCH 2000
STATE OF CALIFORNIA
THE RESOURCES AGENCY
NORTHERN DISTRICT

Fyke Nets

Fish captured in fyke nets were measured for fork length to the nearest millimeter and weighed by water displacement to the nearest gram. No estimates of abundance were done for fish caught in fyke nets. Therefore, these fish were not included in the relative abundance tables.

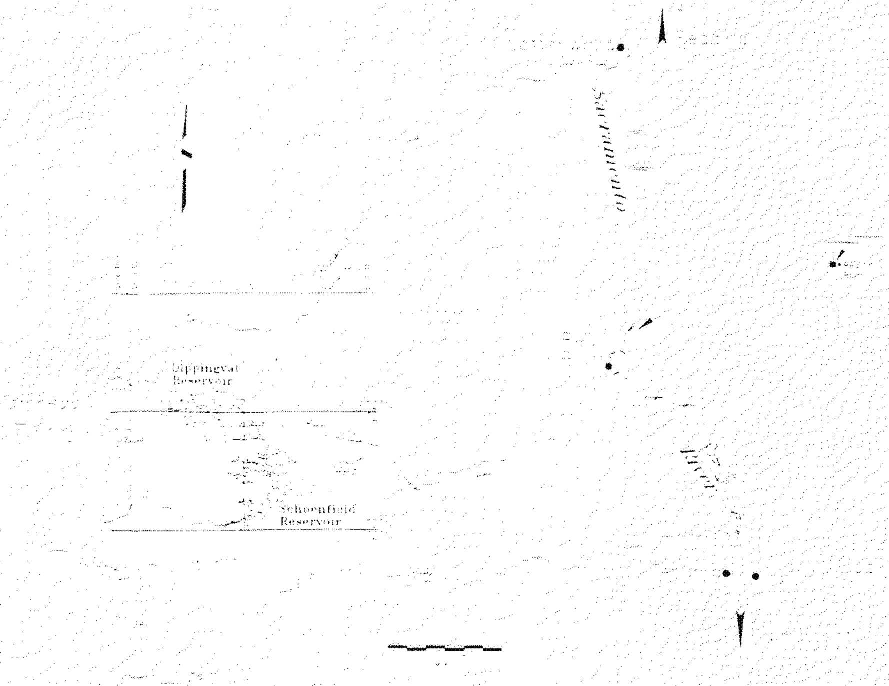
Electrofishing

Electrofishing was done with a Smith-Root Type VII electroshocker. Sections of creek varying from 33 to 138 feet were netted off, upstream and downstream. With a backpack electroshocker, DFG biologists waded into the stream starting from the upstream net and moved downstream. The anode of the electrofisher was inserted into likely fish habitat. The stunned fish were then collected into buckets, measured for fork length to the nearest millimeter for the first 20 of each species, and then a plus count was taken. Fish were weighed using water displacement to the nearest gram. The surface area of each station was calculated in square feet and then converted to square millimeters for fish density analysis. The resulting relative abundance was converted to and reported in fish per square yard.

Red Bank Project Fish Studies

This section describes the results of current and past fish studies conducted on Red Bank, South Fork Cottonwood, and Cottonwood Creeks, the major tributaries of the Red Bank Project area (Figure 2). Past studies date to 1969 and contain the reconnaissance-level fish and wildlife evaluation of Sacramento Valley alternative west side conveyance routes prepared by DFG (Smith and Van Woert 1969). Other studies reviewed include reports prepared by DFG and DWR in 1972, 1975, 1985, and 1987 (Haley and Van Woert 1972, Bill et al. 1975, Brown et al. 1985, Smith 1987).

Figure 2. Cottonwood Creek System and the Red Bank Project



Red Bank Creek Fish Resources

DFG Biologists sampled fish in Red Bank Creek within the footprint of the Schoenfield Reservoir in 1998. Data were collected at 28 stations. In summer 1998, seining was done at 16 stations dispersed on Red Bank Creek and its tributaries, Dry and Grizzly Creeks. Twelve stations were sampled on Red Bank Creek by electrofishing in October and November 1998.

Nongame Fish

Four species of nongame fish were observed (Table 1). The most common species of nongame fish found were California roach (0.588 fish/yd^2) and Sacramento pike minnow (0.158 fish/yd^2) (Table 2).

Resident Game Fish

In 1998, DFG biologists observed four species of resident game fish in Red Bank Creek (Table 3). The most common resident game fish were largemouth bass (0.009 fish/yd^2) and bluegill (0.001 fish/yd^2) (Table 4).

Steelhead

Also in 1998, DFG biologists found juvenile steelhead in the footprint of the proposed Schoenfield Reservoir in Red Bank by electrofishing and estimated density to be 0.002 fish/yd^2. Steelhead were found in two of 28 stations sampled.

Table 1. Nongame Fish Observed in the Red Bank and Cottonwood Creeks

Common Name	Scientific Name	Cottonwood Creek (1976)	Red Bank Creek (1998)
California roach	*Hesperoleucus symmetricus*	X	X
Carp	*Cyprinus carpio*	X	
Golden shiner	*Notemigonus crysoleucas*	X	
Hardhead	*Mylopharodon conocephalus*	X	
Hitch	*Lavinia exilicauda*	X	
Mosquitofish	*Gambusia affinis*	X	
Pacific lamprey	*Lampetra tridentata*	X	X
Prickly sculpin	*Cottus asper*	X	
Sacramento pike minnow	*Ptychocheilus grandis*	X	X
Sacramento sucker	*Catostomus occidentalis*	X	X
Speckled dace	*Rhinichthys osculus*	X	
Threespine stickleback	*Gasterosteus aculeatus*	X	
Tule perch	*Hysterocarpus traski*	X	

Table 2. Relative Abundance of Nongame Fish (Fish/Yd^2) Caught in Lower Cottonwood Creek, 1976, and in Red Bank Creek, 1998

Species	Cottonwood Creek (1976)	Red Bank Creek (1998)
California roach	0.003	0.588
Carp	0.003	
Hardhead	0.022	
Sacramento pike minnow	0.015	0.158
Sacramento sucker	0.006	0.091

Table 3. Game Fish Observed in Cottonwood Creek, 1976, and in Red Bank Creek, 1998

Common Name	Scientific Name	Cottonwood Creek (1976)	Red Bank Creek (1998)
Black bullhead	*Ictalurus melas*	X	
Bluegill	*Lepomis macrochirus*	X	X
Brown bullhead	*Ictalurus nebulosus*	X	
Brown trout	*Salmo trutta*	X	
Chinook salmon	*Onchorhynchus tshawytscha*	X	
Green sunfish	*Lepomis cyanellus*	X	X
Largemouth bass	*Micropterus salmoides*	X	X
Smallmouth bass	*Micropterus dolomieui*	X	
Steelhead	*Onchorhynchys mykiss*	X	X
White catfish	*Ictalurus catus*	X	

Table 4. Relative Abundance of Resident Game Fish (Fish/ Yd^2) Caught in Lower Cottonwood Creek and in Red Bank Creek

Species	Cottonwood Creek (1976)	Red Bank Creek (1998)
Bluegill	0.022	0.001
Brown bullhead	0.006	
Green sunfish	0.015	0.001
Largemouth bass	0.003	0.009
Smallmouth bass	0.003	

Cottonwood Creek Fish Resources

DFG biologists surveyed Cottonwood Creek from the confluence of the north fork to the mouth of Cottonwood Creek in 1976 (Richardson et al. 1978). Observations were made by diving, seining, fyke netting, and electrofishing. Abundance estimates were made for fish caught by electrofishing. Fish caught in fyke nets or observed by divers were not included in the relative abundance tables, because no estimates of abundance were done for these fish.

Nongame Fish

Thirteen species of nongame fish were observed (Table 1). The most common species of resident nongame fish found were hardhead (0.022 fish/yd^2) and Sacramento pike minnows (0.015 fish/yd^2) (Table 2). Some Sacramento pike minnows and Sacramento suckers also migrate to the Sacramento-San Joaquin estuary to rear and return to Cottonwood Creek as adults to spawn (Richardson et al. 1978). Life history information is valuable in planning instream flow studies, HEP evaluations, and determining project impacts.

Resident Game Fish

Ten species of resident game fish were observed in the Cottonwood Creek system in 1976 (Richardson et al. 1978) (Table 3). The most common resident game fish were bluegill (0.022 fish/yd^2) and green sunfish (0.015 fish/yd^2) (Table 4). Green sunfish and bluegill were common in the lower reaches surveyed (Richardson et al. 1978).

Steelhead

DFG biologists found juvenile steelhead in South Fork Cottonwood Creek in the Yolla Bolly Wilderness in the summer of 1976. No estimates of numbers of juvenile steelhead were made. The Yolla Bolly Wilderness is well above the site of the proposed Dippingvat Dam. Adult steelhead were seined from the mouth of Cottonwood Creek in November 1976 (Brown, et al., 1985). DFG estimates that Cottonwood Creek supports an average annual migration of 1,000 steelhead based on the best estimates of biologists who were most familiar with Cottonwood Creek (DFG 1966).

Chinook Salmon

Fall Run. Fall-run chinook salmon ascend Cottonwood Creek and spawn in late October through November (Richardson et al. 1978). They spawn in

Cottonwood Creek from the mouth to the confluence of North Fork Cottonwood Creek. About 53 percent of fall-run chinook salmon spawn from the mouth of Cottonwood Creek to the Interstate-5 highway bridge, 23 percent spawn from the Interstate-5 highway bridge to the confluence of Cottonwood Creek and South Fork Cottonwood Creek, and 24 percent spawn in Cottonwood Creek between the confluence of the south and north forks. Their young begin migrating after they incubate in January (Richardson 1978). They migrate downstream from January through May. DFG estimates that an average of 3,600 fall-run chinook salmon spawn in Cottonwood Creek (Table 5) (Elwell 1962; Fry 1961; Fry and Petrovich 1970; Hoopaugh 1978; Hoopaugh and Knudson 1979; Kano et al. 1996; Kano 1998a, 1998b; Knutson 1980; Mahoney 1962; Menchen 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970; Puckett et al. 1979; Reavis 1983, 1984, 1986).

Table 5. Estimates of Chinook Salmon Spawning in the Cottonwood Creek System, 1952-98 (DFG Spawning Stock Reports)

Year	Fall Run	Spring Run		
		Beegum Gulch	North Fork	South Fork
1952	-	-	-	-
1953	3,000	-	-	-
1954	1,000	-	-	-
1955	800	-	-	-
1956	660	-	-	-
1957	358	-	-	-
1958	600	-	-	-
1959	3,300	-	-	-
1960	350	-	-	-
1961	1,500	-	-	-
1962	6,000	-	-	0
1963	3,500	-	-	-
1964	3,450	-	-	-
1965	900	-	-	-
1966	2,900	-	-	-
1967	600	-	-	-
1968	8,540	-	-	-
1969	4,967	-	-	-
1970	-	-	-	-
1971	-	-	-	-
1972	-	-	-	0
1973	-	0	-	-
1974	-	3	-	-
1975	-	3	-	1
1976	2,427	-	-	-
1977	1,512	-	-	-
1978	1,120	-	-	0
1979	-	-	-	-
1980	-	-	-	-
1981	3,356	-	-	-
1982	700	0	-	-
1983	1,000	-	-	-
1984	500	-	-	-
1985	-	-	-	-
1986	-	-	-	-
1987	-	-	-	-
1988	-	-	-	-
1989	-	0	-	-
1990	-	-	-	-

Table 5. Estimates of Chinook Salmon Spawning in the Cottonwood Creek System, 1952-98 (DFG Spawning Stock Reports) continued

Year	Fall Run	Spring Run		
		Beegum Gulch	North Fork	South Fork
1991	676	-	-	-
1992	1,585	-	-	-
1993	-	1	-	-
1994	-	-	-	-
1995	-	8	-	-
1996	-	6	-	-
1997	-	-	-	-
1998	-	477	-	0

Late Fall-Run. Late fall-run chinook salmon migrate up Cottonwood Creek and spawn in January. DFG Biologists observed them spawning at the mouth of North Fork Cottonwood Creek in January 1976 (Richardson et al. 1978). Their young migrate downstream in May and June as much smaller fry than fall-run at that time of year. Young late fall-run chinook salmon were caught in fyke nets near the mouth of Cottonwood Creek in May and June 1976 (Richardson 1978). DFG estimates that an average of 300 late fall-run chinook salmon migrate up Cottonwood Creek (Smith and Van Woert 1969). DFG biologists surveying Cottonwood Creek in 1977 observed late fall-run chinook salmon spawning, but no estimates of run size were made.

Spring-Run. Spring-run chinook salmon migrate up Cottonwood Creek in April and spend the summer in deep pools in South Fork Cottonwood Creek, Beegum Gulch, and North Fork Cottonwood Creek. Most are found in Beegum Gulch. Young spring-run chinook salmon migrate downstream from January through May. DFG estimates that an average of 500 spring-run chinook salmon migrate up Cottonwood Creek (DFG 1966). DFG biologists surveyed Beegum Gulch in 1998 and found about 500 spring-run chinook salmon. Some young spring-run salmon from the Sacramento River use the lower reach of Cottonwood Creek from Interstate-5 to the mouth for rearing during the summer and fall (Richardson et al. 1978).

Spawning Habitat. DFG biologists took gravel samples in summer 1977 to measure quantity and quality of salmon spawning habitat in Cottonwood Creek. Approximately 392,000 square feet of gravel suitable for chinook salmon spawning was identified in the Cottonwood Creek system (Richardson and Brown 1978). About 40,000 square feet of that total was in south fork. Other investigations have produced estimates ranging from 285,000 square feet (Hansen et al. 1940) to 2,000,000 square feet (Leach and Van Woert 1968) of gravel in the system. A female chinook salmon requires about 100 square feet of gravel for spawning (Leach and Van Woert 1968). Most of the gravel was found in Cottonwood Creek below its confluence with North Fork Cottonwood Creek. Little suitable gravel was found in North Fork Cottonwood Creek.

Instream Flow. An instream flow study was conducted in 1976 and 1977 to measure the amount of chinook salmon spawning and rearing habitat in Cottonwood Creek and South Fork Cottonwood Creek. Optimum spawning flow was about 180 cfs and optimum rearing flow was 200 cfs from the mouth of Cottonwood Creek to the confluence of Cottonwood Creek and South Fork Cottonwood Creek. Optimum spawning flow was about 80 cfs and optimum rearing flow was 100 cfs in the lower seven miles of South Fork (Brown 1979). Natural monthly stream flow averages 295 cfs during fall-run chinook spawning in November near the mouth of Cottonwood Creek (Table 6). Average monthly flows range from 604 to 2,174 cfs when salmon rear from January through May.

Table 6. Average Monthly Stream Flow in Cottonwood Creek at the Cottonwood Gage

Month	Average Monthly Flow (cfs)
January	1,744
February	2,174
March	1,590
April	1,205
May	604
June	283
July	112
August	66
September	66
October	108
November	295
December	955

Thomes-Newville Project Fish Studies

DFG initiated studies of the impacts on fish and wildlife of a Thomes-Newville Project in 1979 as part of DWR's Thomes-Newville Reservoir planning studies. However, the planning studies were halted in 1982. DFG completed a report of its abbreviated studies in 1983 (Brown et al. 1983). In 1998, DFG initiated studies of fish and wildlife resources of a Thomes-Newville Project as part of the North of Delta Offstream Storage Program. A brief survey of spring-run chinook salmon was conducted during the recent investigations. This section discusses recent findings and recapitulates the effort and results of the 1982 study (Brown et al. 1983).

Methodology

Juvenile Salmon

Seining for juvenile chinook salmon in Stony and Thomes Creeks was done over a period of three years, 1980 to 1982. Ten sample stations were selected on Thomes and Stony Creeks. Each station was seined weekly from February to June, with 50-foot delta mesh seines (Brown et al. 1983).

Fyke nets were used to sample for juvenile salmonids during the 1981 and 1982 seasons on Thomes Creek only. Irregular and frequent floodflow releases from Black Butte Reservoir made it impractical to fyke net in Stony Creek. Two fyke nets were used in Thomes Creek. One was placed in the mainstem and another near the confluence to the discharge channel from the Tehama-Colusa Canal. The nets were fished continuously from Monday to Friday and were removed during weekends or during high water. Each net in the mainstem was fished from February through March. Captured fish were measured for fork length to the nearest millimeter and weighed by water displacement to the nearest gram (Brown et al. 1983).

Adult Salmon and Steelhead

Adult chinook salmon carcasses were counted to estimate the number of salmon in Stony and Thomes Creeks. Stony Creek was surveyed for carcasses between the Sacramento River confluence and the North Diversion Dam. Thomes Creek was surveyed between the Sacramento River confluence and Paskenta and in a channel from the discharge point of the Tehama-Colusa Canal to its confluence with Thomes Creek. Counts were taken once per week from November through January in 1980-81 and 1981-82 on Thomes Creek and from December through February in 1981-82 on Stony Creek. Each carcass was tagged by fastening a number 3 hog ring to its mandible. Tick marks were notched into the hog rings with wire cutters to identify the appropriate week of tagging. The sex and fork length of each carcass was noted. The date and location of where each carcass was found was recorded; each carcass was then returned to the same area where it was tagged. On successive surveys, tagged fish that were recovered were cut in half to avoid recounting in subsequent surveys. The 1980-81 spawning escapement estimate for Thomes Creek was calculated with the Schaefer method (Ricker 1975), while the 1981-82 estimates for both Stony and Thomes Creeks were estimated with the Peterson method (Ricker 1975) (Brown et al. 1983).

On June 13, 1979; August 18, 1980; and August 12, 1998, Thomes Creek was surveyed to enumerate adult spring-run chinook salmon and summer-steelhead. The area surveyed was from the gorge to the fjord at Hatch Flat near Paskenta. Each pool was examined by snorkel diving. All fish were identified and their size range and relative abundance estimated. No habitat suitable for spring-run salmon and summer steelhead exists in Stony Creek; therefore, no survey was conducted (Brown et al. 1983). Historical estimates for fall-run chinook salmon for both Stony and Thomes Creeks were compiled from DFG salmon-spawning stock reports.

Resident Fish and Migratory Nongame Fish

A fyke net consisting of 0.03 inch oval mesh netting mounted on a 0.01 inch x 0.02 inch metal tubing frame was placed in the creek near the mouth of Thomes Creek. The purpose of the net was to capture juveniles, larval Sacramento suckers, and Sacramento pike minnows migrating to the Sacramento River. A perforated aluminum box—1.6 feet x 1.6 feet x 3.3 feet—was attached to the cod end of the net to receive captured fish. The net was fished 24 hours per day during weekdays from January to June 1981 (Brown et al. 1983).

To estimate the population of spawning Sacramento suckers and Sacramento pike minnows, adult fish were captured in Thomes Creek and its tributary, Mill Creek. From December 1980 through June 1981, 17 samples were taken at 10-day intervals via electrofishing. A 12-foot Avon rubber raft was retrofitted with a Smith-Root Type VII electroshocker. The battery and electroshocking unit were placed inside an ice chest and secured to the raft's rowing frame. Prove arrays were constructed of 0.08-inch stainless steel cable, attached to the bow of the raft, and fished at a depth of 4.9 feet. (Brown et al. 1983).

Captured fish were weighed to the nearest 0.3 ounce and fork lengths were measured to the nearest millimeter. Each fish was marked with a floy spaghetti tag and released. The tag was inserted under the dorsal fin and tied in a loop. The Jolly-Seber method was used to determine the population estimate for Sacramento suckers while the Schaefer method (Ricker 1975) was used to estimate the population of Sacramento pike minnows (Brown et al. 1983).

Electrofishing was done in streams in the footprint of proposed Newville Reservoir in 1981 and 1982. Seven sections were sampled in streams within the project area. These include North Fork Stony, Salt, and Heifer Camp Creeks. Ten sections in Stony Creek and 15 in Thomes Creek were sampled. Fish were captured by backpack electrofishing. Population number and biomass estimates for each species for the Thomes-Newville data were developed using the two-pass method of Seber and LeCren (1967) (Brown et al. 1983).

Thomes Creek Fish Resources

Juvenile Chinook Salmon

1980 Emigration. Thirteen juvenile chinook salmon were captured by seining during the 1980 sample period (Table 7). These fish were caught in the lowermost stations of Thomes Creek from March 20 to May 24, 1980.

1981 Emigration. Six juvenile chinook salmon were captured by seining during the 1981 sample period (Table 7). One of these fish was from Coleman National Fish Hatchery.

In 1981, 206 juvenile chinook salmon were captured by fyke netting in Thomes Creek, 20 from the mainstem and 186 from the discharge canal (Tables 8 and 9).

Table 7. Juvenile Chinook Salmon Seined from Thomes Creek in 1980 and 1981[1]

Sample Period	Number of Weekly Seinings	Number of Fish	Average Length of Fish (inches)
1980			
March	4	5	2.8
April	5	8	2.8
Total	**9**	**13**	
1981			
March	2	5	4.1
April	1	1	2.3
Total	**3**	**6**	

[1] Brown et al. 1983

Table 8. Fyke Net Catches of Juvenile Chinook Salmon from Mainstem of Thomes Creek in 1981[1]

Sample Period	Hours Fished	Number of Salmon	Average Length of Fish (inches)
February	672	0	0
March	744	9	2.7
April	648	10	3.1
May	336	1	2.7
Total	**2,400**	**20**	

[1] Brown et al. 1983

Table 9. Fyke Net Catches of Juvenile Chinook Salmon from the Tehama-Colusa Canal Discharge Channel in Thomes Creek in 1981 and 1982[1]

Sample Period	Number of Fish	Average Length of Fish (inches)
1981		
January	1	1.4
February	126	1.3
March	59	1.3
Total	**186**	
1982		
January	2	1.4
February	45	1.4
March	337	1.5
Total	**384**	

[1] Brown et al. 1983

The catches from the mainstem occurred over a nine-week period beginnning the first week of March and ending the first week of May. Salmon from these catches ranged in size from 2.7 to 3.1 inches fork length (Table 8). Except for the time when the migration occurred, no real descriptive trends can be derived from these data. These fish, however, appear to be much larger than expected for fall-run fish spawned in Thomes Creek. Some fish may have spawned earlier in the mainstem Sacramento River and moved upstream into Thomes Creek. It is common for juvenile salmonids from the Sacramento River to swim upstream into tributaries (Richard Hallock, DFG, personal communication).

Juveniles captured in the discharge channel spawned there. The presence of live adults, carcasses, and redds in the channel together with the presence of juveniles is strong evidence that successful spawning occurred in the channel.

The migration of juvenile chinook salmon from the discharge channel occurred from late February through the third week of March. At this time the discharge was terminated by the U.S. Bureau of Reclamation and no water flowed to indicate newly hatched fish. These fish were of the fall-run spawn. Although the migration was halted by lack of flow, it could have continued if discharge had been extended. In response to the lack of flow, DFG regional personnel rescued in excess of 3,000 juvenile salmon.

1982 Emigration – No juvenile chinook salmon were captured by seining or fyke netting in the mainstem of Thomes Creek during the 1982 sample period. High flows and other duties limited efforts.

As indicated in Table 9, 384 juvenile chinook salmon were captured by fyke netting in the discharge channel from the Tehama-Colusa Canal. The first fish was captured during the first week of January, but the bulk of the migration did not occur until the third week of February. The migration continued until March 30, 1982, when the discharge was terminated by USBR.

Juvenile Steelhead

Seven juvenile steelhead were captured by seining in Thomes Creek in 1981. Four of these fish were probably from Coleman National Fish Hatchery. They had rounded fins and deformed dorsal fins, which are a characteristic of hatchery-grown fish. Juvenile salmonids from the Sacramento River commonly ascend tributaries (Richard Hallock, DFG, personal communication).

Adult Chinook Salmon

Review of past reports show little information on historic salmon runs in Thomes Creek. Only seven surveys were documented between 1955 and 1979. In 1957, the fall-run escapement estimate was 25, and in 1975 the estimate was 170 fish (Mahoney 1958, Hoopaugh 1978a). Estimates of fall-run salmon for survey years 1959, 1960, 1964, 1965, and 1976 were zero (Mahoney 1960, 1962; Menchen 1965, 1966; Hoopaugh 1978b).

1980-81 Fall-Run Estimate. Fifty-nine chinook salmon carcasses were tagged during 12 surveys of Thomes Creek. Of these 59, 17 fish (29 percent) were males while 42 fish (71 percent) were females. This represented a male-female ratio of 1:2.5. Twenty-three carcasses were recovered in fall 1980. From these data an estimated 155 salmon spawned in Thomes Creek during the sample period.

Live fish were first observed in the creek November 11, 1980, but no carcass was tagged until nine days later. The last carcass was tagged on January 12, 1981. Fifty-seven (97 percent) of the fish tagged were located in the Tehama-Colusa Canal outlet channel. Only two fish (3 percent) were tagged in the mainstem. Observation of six redds and four live fish indicates there was some spawning activity in areas below Henleyville.

1981-82 Fall-Run Estimates. Thirty-eight chinook salmon carcasses were tagged during 10 surveys of Thomes Creek. Of these 38, 16 fish (42 percent) were males while 22 fish (58 percent) were females. This represents a male-female ratio of 1:1.4. All of the fish tagged were located in the Tehama-Colusa Canal outlet channel. Twenty tagged carcasses were recovered. From these data an estimated 167 salmon spawned in Thomes Creek during the sample period. No live fish or redd was seen in the mainstem.

1979-1980 Spring-Run Estimates. No adult anadromous salmonid was seen during the June 1979 or August 1980 spring-run chinook salmon surveys in Thomes Creek. Numerous juvenile steelhead and brown trout were seen in the area of the survey which may indicate that habitat for spring-run chinook salmon or summer steelhead may exist. Although surface water temperatures generally approach 77°F in these areas, cooler water (59-68°F) can be found near the bottom of larger pools that could support salmonids.

1999 Spring-Run Estimates. One adult spring-run chinook salmon was seen during August 1999 diving surveys in Thomes Creek. As in 1980, numerous juvenile steelhead and brown trout were seen in the area of the survey.

1980 Late Fall-Run. The late spawning characteristics of a few chinook salmon indicate that they were of the late fall-run. Those that spawned in late December and January were salmon of this race.

Resident Fish and Migratory Nongame Fish

Twenty-two species of fish were observed in Thomes Creek (Table 10). DFG staff developed population and biomass estimates for 13 of these species (Table 11). Three species were game fish and 10 were nongame fish. Steelhead were the most abundant fish above the gorge, while Sacramento pike minnow, Sacramento suckers, hardhead, California roach, and speckled dace were the more common fish below the gorge.

Most of the nongame fish caught in the reach below the gorge were juveniles, indicating that this reach serves mainly as a spawning and rearing area. Adult Sacramento suckers, Sacramento pike minnow, California roach, and hardhead annually migrate from the Sacramento River into Thomes Creek and its tributaries to spawn. Juveniles that do not migrate immediately after hatching remain to rear until the following rainy season when water flows to the mouth.

Thomes Creek below Paskenta usually dries up except for a few residual pools scattered along the streambed during the late summer, making it impossible for resident adult fish to live throughout the summer months. Some adult game fish such as largemouth and smallmouth bass, bluegill, and green sunfish ascend the creek from the Sacramento River during late spring and early summer to use these pools as spawning areas.

Table 10. Fish Species Found in Thomes Creek in 1982[1]

Common Name	Scientific name
Bluegill	*Lepomis machrochirus*
Brown bullhead	*Ictalurus nebulosus*
California roach	*Lavinia symmetricus*
Carp	*Cyprinus carpio*
Channel catfish	*Ictalurus punctatus*
Golden shiner	*Notemigomus crysoleucus*
Goldfish	*Carassius auratus*
Green sunfish	*Lepomis cyanellus*
Hardhead	*Mylopharodon conocephalus*
Hitch	*Lavinia exilicauda*
Largemouth bass	*Micropterus salmoides*
Mosquitofish	*Gambusia affinis*
Pacific lamprey	*Lampetra tredentata*
Prickly sculpin	*Cottus asper*
Sacramento pike minnow	*Ptychocheilus grandis*
Sacramento sucker	*Catostomus occidentatlis*
Smallmouth bass	*Micropterus dolomeiu*
Speckled dace	*Rhinicthys osculus*
Steelhead	*Onchorynchus mykiss*
Threespine stickleback	*Gasterosteus aculeatus*
Tule perch	*Hysterocarpus traski*
White catfish	*Ictalurus catus*

[1] Brown et al. 1983

Table 11. Average Population Estimates and Biomass Estimates for Fish Caught in Sections of Thomes Creek in 1982[1]

Species	Average Population Estimate	Average Biomass (lb/acre)
Bluegill	3	4.5
California roach	41	10.7
Carp	90	64.2
Goldfish	1	19.2
Green sunfish	14	15.2
Hardhead	47	47.3
Hitch	1	0.4
Largemouth bass	5	8
Prickly sculpin	1	1.8
Sacramento pike minnow	337	89.2
Sacramento sucker	143	16.1
Speckled dace	229	16.1
Tule perch	1	0.2

[1] Brown et al. 1983

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Stony Creek Fish Resources

Juvenile Chinook Salmon

1980 Emigration. During the 1980 sample period, 181 juvenile chinook salmon were caught by seining (Table 12). Salmon were first caught during the second week of February and the last salmon was caught during the first week of May.

1981 Emigration. During the 1981 sample period, 73 juvenile chinook salmon were captured by seining (Table 12). Fish were first captured during the third week of February and the last fish were captured during the second week of April.

1982 Emigration. During the 1982 sample period, only four juvenile chinook salmon were captured by seining (Table 12). Two fish were captured during January and two were captured during the first week of March.

Adult Salmon Studies

1981-82 Fall-Run Estimates. Thirty-six chinook salmon carcasses were tagged during five surveys. Two of these salmon were recovered. From these data DFG estimates that 393 salmon spawned in Stony Creek during the sample period. Of the 36 tagged, 11 fish (31 percent) were males while 25 fish (69 percent) were females. This represents a male-female ratio of 1:2.3.

Most of the spawning activity was located in lower Stony Creek in the reach between the Interstate-5 bridge and the mouth. At least 35 redds and 29 carcasses were counted in this area.

Table 12. Juvenile Chinook Salmon Seined from Stony Creek in 1980, 1981, and 1982[1]

Sample Period	Number of Fish	Average Length of Fish (in)
1980		
February	64	1.7
March	51	1.8
April	60	2.0
May	6	3.0
Total	**181**	
1981		
February	5	1.5
March	64	2.1
April	4	3.0
Total	**73**	
1982		
January	2	3.3
March	2	1.7
Total	**4**	

[1] Brown et al. 1983

Resident Fish Surveys

Six species of fish, two game and four nongame, were captured in streams potentially inundated by the Newville Reservoir (Tables 13 and 14). These streams include North Fork Stony Creek, Salt Creek, and Heifer Camp Creek. Rainbow trout were captured in sections of streams above the inundation line where the water is cool and cover is abundant. California roach, Sacramento pike minnow, Sacramento sucker, carp, and green sunfish were captured in sections of streams below the inundation line. California roach, Sacramento pike minnows, and Sacramento suckers were more abundant species, while carp and green sunfish are relatively uncommon (Brown et al. 1983).

Table 13. Population Estimates for Fish Caught in Selected Sections of Streams within the Newville Reservoir Site in 1983[1]

Species	North Fork Stony Creek	Salt Creek	Heifer Camp Creek
California roach	4	546	120
Carp	1		
Green sunfish	-	13	
Rainbow trout	-	24	8
Sacramento pike minnow	12	24	85
Sacramento sucker	> 2	45	6

[1] Brown et al. 1983

Table 14. Average Biomass Estimates (lb/acre) for Fish Caught in Selected Sections of Streams within the Newville Reservoir Site in 1983[1]

Species	North Fork Stony Creek	Salt Creek	Heifer Camp Creek
California roach	0.9	427.3	72.3
Carp	145.4	-	
Green sunfish	-	33.9	
Rainbow trout	-	74.9	18.7
Sacramento pike minnow	8	339.9	775.1
Sacramento sucker	0.09	88.3	

[1] Brown et al. 1983

The sections of stream within the inundation area are used primarily for spawning and rearing by nongame species (mainly the minnow family), although some green sunfish were observed spawning during the late spring in nonflowing areas of the stream. It is likely that, during high water, adult cyprinids ascend these tributaries from Black Butte Reservoir to spawn (Brown et al. 1983).

Upper Salt Creek supports a population of rainbow trout. Nongame fish were not found in this area nor were migratory cyprinids because they cannot ascend the creek due to a waterfall. This waterfall is not in the inundation area.

However, if Newville Reservoir is built, the waterfall could be flooded, which would allow nongame fish to swim upstream. This may reduce the rainbow trout populations because of competiton with nongame fish (Brown et al. 1983).

Twenty-eight species of fish were observed in Stony Creek (Table 15). DFG developed population and biomass estimates for 21 of these species (Table 16). Eight species were game fish and 13 were nongame fish. Largemouth bass and bluegill were the most abundant gamefish below Black Butte Reservoir; channel catfish and white catfish were the most abundant game fish above the Sacramento River. Sacramento pike minnows and suckers were found in all stations throughout Stony Creek, were the most abundant, and had the highest biomass for all species of fish. Prickly sculpin were found in all sections, but made up a very small portion of the total biomass.

Most nongame fish caught in the reach below Black Butte Reservoir were juveniles, indicating that this reach serves mainly as a spawning and rearing area. Adult Sacramento suckers, Sacramento pike minnow, California roach, and hardhead annually migrate from the Sacramento River into Stony Creek to spawn. Juveniles that do not migrate immediately after hatching remain to rear until the following season when water flows to the mouth. Other game fish such as largemouth bass, smallmouth bass, bluegill, and green sunfish were also observed spawning in backwater areas of Stony Creek. These adult fish may have migrated upstream from the Sacramento River, may have washed downstream from Black Butte Reservoir, or may reside throughout the year in the creek.

Table 15. Fish of the Stony Creek Drainage (Excludes Fish within Newville Reservoir Site)[1]

Common Name	Scientific Name
Black bullhead	*Ictalurus melas*
Black crappie	*Pomoxis melas*
Bluegill	*Lepomis machrochirus*
Brown bullhead	*Ictalurus nebulosus*
California roach	*Lavinia symmetricus*
Carp	*Cyprinus carpio*
Channel catfish	*Ictalurus punctatus*
Golden shiner	*Notemigomus crysoleucus*
Goldfish	*Carassius auratus*
Green sunfish	*Lepomis cyanellus*
Hardhead	*Mylopharodon conocephalus*
Hitch	*Lavinia exilicauda*
Largemouth bass	*Micropterus salmoides*
Mosquitofish	*Gambusia affinis*
Pacific lamprey	*Lampetra tridentata*
Prickly sculpin	*Cottus asper*
Rainbow trout	*Onchorynchus mykiss*
Redear sunfish	*Lepomis microlophus*
Sacramento blackfish	*Orthodon microlepidotus*
Sacramento pike minnow	*Ptychocheilus grandis*
Sacramento sucker	*Catostomus occidentatlis*
Smallmouth bass	*Micropterus dolomeiu*
Speckled dace	*Rhinicthys osculus*
Threadfin shad	*Dorosoma petenense*
Threespine stickleback	*Gasterosteus aculeatus*
Tule perch	*Hysterocarpus traski*
White catfish	*Ictalurus catus*
White crappie	*Pomoxis annularis*

[1] Brown et al. 1983

Table 16. Average Population Estimates and Biomass Estimates for Fish Caught in Selected Sections of Stony Creek in 1982 [1]

Species	Average Population Estimate	Average Biomass (lb/acre)
Black crappie	8	87.4
Bluegill	19	8
California roach	200	54.4
Carp	5	64.2
Channel catfish	57	47.3
Goldfish	8	33.9
Green sunfish	7	2.7
Hardhead	9	24.1
Hitch	32	20.5
Largemouth bass	13	11.6
Mosquitofish	3	0.09
Prickly sculpin	57	11.6
Sacramento pike minnow	146	91
Sacramento sucker	96	256.9
Smallmouth bass	5	16.1
Speckled dace	318	41.9
Threadfin shad	2	0.9
Threespine stickleback	3	0.05
Tule perch	6	5.4
White catfish	30	34.8
White crappie	5	17.8

[1] Brown et al. 1983

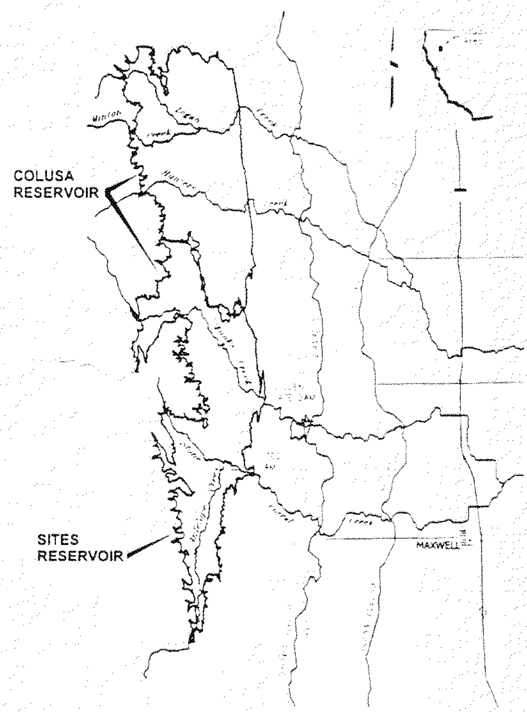
Sites and Colusa Project Fish Studies

Fish studies for the Sites and Colusa Projects included three basic areas of study: fish resources in streams within the proposed reservoirs and in the Colusa Basin Drain, and habitat typing of the dominant streams in the proposed reservoirs.

Sites and Colusa Project Stream Fish Resources

This section summarizes studies of fish in streams that flow through the proposed Sites and Colusa Projects. Studies were conducted in 1998 and 1999. Information gathered in these streams will be used to describe impacts on fish resources during the planning process.

Figure 3. Streams in the Sites-Colusa Project



Methodology

Stone Corral Creek, Funks Creek, Logan Creek, and Hunters Creek and their tributaries originate in oak woodland habitat in western Colusa and Glenn Counties (Figure 3). The creeks flow downstream through annual grassland and cultivated rice fields before flowing into the Colusa Basin Drain. Deeply incised channels characterize these streams with little vegetation on the banks and little cover in streambeds. Streamflow is seasonal with periods of high flow during winter storms, declining flows through spring and early summer, and intermittent flow in late summer. Water quality is poor and high in dissolved minerals. The total dissolved solids in the water are so high that electrofishing as a means of sampling is not possible in the streams.

Pools were seined at specific stations on all creeks surveyed to determine species composition. All sample stations were within the footprint of the Sites-Colusa Project. Thirty-six stations were spread out among Hunter, Minton, Logan, Antelope, and particularly Stone Corral and Funks Creeks. Seven stock ponds in the Sites and Colusa area were also seined for fish.

Twelve species of fish were caught in the Sites and Colusa study area in 1998 and 1999. Five species were game fish and seven species were nongame fish (Table 17). A single spring-run chinook salmon was observed in Antelope Creek, a tributary to Stone Corral Creek in spring 1998. It died a few weeks later and was identified by its carcass.

Table 17. Fish Caught in the Sites Study Area in 1998 and 1999

Common Name	Scientific Name
Bluegill	*Lepomis macrochirus*
California roach	*Hesperoleucus symmetricus*
Chinook salmon	*Oncorhynchus tschawtscha*
Green sunfish	*Lepomis cyanellus*
Hitch	*Lavinia exilicauda*
Largemouth bass	*Micropterus salmoides*
Mosquitofish	*Gambusia affinis*
Redear sunfish	*Lepomis microlophus*
Sacramento blackfish	*Orthodon microlepidotus*
Sacramento pike minnow	*Ptychocheilus grandis*
Sacramento sucker	*Catostomus occidentalis*
Sculpin sp.	*Cottus sp.*

Funks Creek. Fifteen stations were sampled on Funks Creek between July 22, 1998, and January 8, 1999. Stations were evenly spaced between the Golden Gate damsite and the upper limit of flow in Funks Creek. Streamflow was intermittent. Five species of fish were found in Funks Creek, including one type of game fish, largemouth bass (Table 18). The most common fish in Funks Creek was the hitch, with an average density of 3.1 fish/yd^2 (Table 18). Hitch were caught in 11 out of 15 stations seined (Table 18).

Table 18. Species Caught at Each Sample Station and Relative Abundance on Funks Creek

Species	Station Sampled															Fish/yd^2
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hitch			X	X	X	X	X	X	X	X	X	X	X			3.1
Largemouth bass									X			X				0.001
Sacramento pike minnow					X	X			X				X			0.06
Sacramento Sucker					X	X			X	X			X			0.02
Sculpin														X		---

The most diverse sampled sections of Funks Creek were in the lower reaches, stations 5, 6, 9, 10, 12, and 13. The upper reaches of Funks Creek either lacked fish or only one species was found. Hitch densities varied widely throughout the creek, and no one area seemed to maintain a higher population.

Hunters Creek. Three stations on lower Hunters Creek were seined between July 22, 1998, and August 3, 1998. No water was present above these sites. Only two species of fish were found on Hunters Creek, green sunfish and mosquitofish. Both species were found in two of the three stations (Table 19).

Mosquitofish were found in a relative abundance of 3.8 fish/yd^2, but they only occurred in abundance at one station. Green sunfish were found to have an average density of 2.3 fish/yd^2.

Table 19. Relative Abundance of Fish Caught at Hunters Creek

Species	Fish/yd^2
Green sunfish	2.3
Mosquitofish	3.8

Minton Creek. Minton Creek was sampled in two places on August 12, 1998. Samples were taken in lower reaches of the creek because areas of the creek above the sample sites were dry. Hitch were found in only one of those stations, at a density of 0.5 fish/yd^2 .

Stone Corral Creek. Eleven stations were sampled on Stone Corral Creek between July 15, 1998, and January 6, 1999. Stations were located from the damsite to about 1 mile above. Flows were less than 1 cfs. Eight species of fish were found in Stone Corral Creek, including two species of game fish, green sunfish and bluegill (Table 20).

The fish most common fish among the stations was the Sacramento pike minnow followed by the hitch (Table 20). Fish density on Stone Corral was relatively low for all species at all stations. Hitch were the dominant species in terms of density 0.8 fish/yd^2.

Table 20. Species Caught at Each Station and Relative Abundance on Stone Corral Creek

Species	Station Sampled											Fish/yd2
	1	2	3	4	5	6	7	8	9	10	11	
Bluegill				X								0.002
California roach		X		X								0.02
Green sunfish			X					X	X	X	X	0.03
Hitch		X	X					X	X	X	X	0.8
Mosquitofish				X								0.002
Sacramento blackfish											X	0.2
Sacramento pike minnow			X	X	X	X		X	X		X	0.2
Sacramento sucker			X	X		X					X	0.02

Most seining stations on Stone Corral Creek were clustered around the same region. Station 1 was far upstream from the others and yielded no fish. The diversity of species caught was highest at stations 4 and 11.

Antelope Creek. Five seining stations were sampled on Antelope Creek between July 14, 1998, and November 25, 1998. Stations were evenly spaced between the mouth of Antelope Creek and the boundary of Sites Reservoir.

Streamflow was less than 5 cfs. Three species of fish were captured on Antelope Creek: green sunfish, hitch, and Sacramento pike minnow (Table 21). Hitch were the most abundant fish with an average density of 3.8 fish/yd^2. The Sacramento pike minnow and the green sunfish both had a relative abundance of 0.2 fish/yd^2.

Table 21. Species Caught at Each Station and Relative Abundance on Antelope Creek

Species	Station Sampled					Fish/yd2
	1	2	3	4	5	
Green sunfish		X		X	X	0.2
Hitch	X	X	X	X	X	3.8
Sacramento pike minnow				X	X	0.2

Logan Creek. Four stations were sampled on Logan Creek over two days in August 1998. Stations were located in and near the footprint of the proposed Colusa Reservoir. Streamflow was less than 1 cfs. Hitch were caught in stations 1 and 2. The average density of hitch on Logan Creek was 0.4 fish/yd^2.

Ponds. DFG biologist seined seven stock-watering ponds in the study area. The ponds seined do not dry up during the summer. Three game fish were found in the ponds, red-eared sunfish, bluegill, and largemouth bass. Redear sunfish were found in one pond, bluegill were found in abundance in two ponds, and largemouth bass were found in three ponds. No other fish were found in these ponds.

Discussion

Hitch were found in all the creeks in the Sites and Colusa Project area. Hitch were also present in the greatest numbers. Stone Corral Creek had the greatest diversity of fish throughout the year—eight species—including two species of introduced game fish, bluegill and green sunfish. However fish densities were lower, particularly for hitch in Stone Corral than in other creeks. Funks Creek, the next most diverse creek, had only five species of fish, including one introduced game fish, largemouth bass.

Most fish captured during seining were minnows, members of the Cyprinid family. California roach are the only fish present that are adapted to spending summers in the remaining pools of intermittent streams (Moyle 1976). Very few fish found while seining, including game fish, were above 5.9 inches in lengths, suggesting that juvenile fish only rear in these areas. Adult fish typically ascend seasonal creeks in the study area in winter and spawn there in early spring. Most adults migrate downstream after spawning.

No species of concern or threatened or endangered species were found in this study. The species caught during the study are common in California.

Colusa Basin Drain Fish Studies

This section describes the fish resources of the Colusa Basin Drain. Colusa Basin Drain is a natural channel that historically transported water from west side tributaries such as Willow, Funks, Stone Corral, and Freshwater Creeks to the Sacramento River. It also carried overflowing floodwater from the Sacramento River. With the advent of agriculture in the Sacramento Valley, the Colusa Basin Drain was channelized and dredged to carry agricultural runoff in addition to natural flows.

Streamflow in the CBD peaks in winter months when storms swell the small streams that feed the CBD. Flow also reaches high levels in late summer when rice fields are drained into the CBD. Table 22 shows average monthly streamflow in CBD from 1976 to 1997. Daily and instantaneous flows in the CBD may be much higher.

The CBD provides little bank cover for fish; however, some instream cover is provided by large and small woody debris. Its banks are scoured by periodic high flows and roads often run along the dikes that contain the waters of the CBD. The bottom of the CBD is largely mud. Water in the CBD is turbid and warm in the summer, and turbid and cool during the winter. The proposed diversion from the CBD for Sites and Colusa Reservoirs will be east of the town of Maxwell along the CBD.

Table 22. Average Monthly Streamflow (cfs) in the Colusa Basin Drain at the Highway 20 Crossing

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	237	249	160	185	177	371	312	879	239	434	926	904
1977	169	255	138	312	181	256	90	642	121	121	424	388
1978	116	272	254	3121	2133	1429	365	684	469	711	1056	1028
1979	201	312	113	689	940	407	328	802	424	803	1211	1029
1980	200	563	837	1874	2888	1305	326	1048	603	805	1307	1160
1981	275	328	359	1017	840	433	342	1039	446	1057	1464	1182
1982	284	877	1115	1939	472	383	682	743	908	n.r.	1393	1356
1983	467	778	1225	2331	3028	5304	990	n.r.	n.r.	907	1168	1198
1984	315	1302	3623	1523	493	265	547	1190	851	1310	1580	1041
1985	376	1160	683	285	170	196	409	1048	768	1237	1442	1442
1986	316	663	700	754	4214	1833	449	921	834	1052	1338	1338
1987	318	459	235	249	319	508	495	913	707	907	1175	1175
1988	341	668	462	1365	287	431	666	849	515	586	972	972
1989	345	617	354	342	212	404	438	572	587	800	995	995
1990	303	411	181	346	203	n.r.	n.r.	583	439	533	913	913
1991	247	n.r.	n.r.	153	217	916	423	477	353	371	535	535
1992	159	319	291	261	932	670	256	167	250	149	186	186
1993	116	267	347	2900	3049	762	322	279	290	201	489	489
1994	203	419	466	315	740	331	300	191	147	61	418	418
1995	155	565	549	6612	2020	3823	591	551	364	297	416	416
1996	255	368	749	972	2668	1092	493	771	472	249	660	660
1997	229	643	643	3698	1464	357	321	286	152	368	953	953
AVG	**256**	**547**	**642**	**1420**	**1257**	**1023**	**435**	**697**	**473**	**617**	**956**	**956**

Methodology

Two fyke nets were placed in the CBD, one upstream of the proposed diversion point and one downstream. The first net was put in at the confluence of Willow Creek and the CBD. The second was placed just south of Hwy 20 on the CBD. The fyke nets have a 3 foot-by-5 foot opening, and a 12-foot funnel. Galvanized pipe frames support the net opening. Nets of variable size stretched mesh were used: 1 inch, 0.25 inch, and 0.125 inch. The largest sized mesh was at the front of the funnel, and smallest size mesh was at the back. The narrow end of each net is connected to a wooden live box, 2.5 feet by 1.5 feet by 1.6 feet. Holes in the side and back of the box were covered by screening with a mesh size of 0.19 inch. The fyke nets were held in fishing position by rope bridles attached to ropes secured to metal fencing posts and/or a tree or utility pole on the bank. The nets were installed on January 19, 1999, and checked daily Monday through Friday. The nets were removed from the canal during periods of high water. Captured specimens were identified and measured for fork length to the nearest millimeter for the first 20 of each species, after which species were only tallied. Representatives of each species were either photographed or preserved for future positive identification.

Periodic seining using the medium sized—29-feet long, 6-feet high, one-quarter inch mesh; seine, and hook and line sampling were also used to sample the fish of the Colusa Basin Drain at the upper net location. Two hoop nets and a gill net were also placed at the upper fyke net location February 1, 1999. The hoop nets were installed upstream of the fyke net. The hoop nets were 7 feet long with six hoops 2 feet in diameter set 1 foot apart, with a net mesh size of 1 inch. They had two finger funnels each. These nets were secured to a wooden bridge and placed on either side of the channel. The hoop nets were baited with fish carcasses. The gill net spanned the entire distance of the drain downstream of the fyke net. These nets were removed March 10, 1999. One hoop was replaced at the bridge on March 19, 1999.

Results

A total of 9 game fish and 17 nongame fish were caught in the CBD (Tables 23 and 24). The warmouth (*Lepomis gulosus*) and the largemouth bass (*Micropterus salmoides*), which were caught by U.S. Geological Survey in 1996, were not observed in this recent survey.

Table 23. Resident Game Fish of the Colusa Basin Drain

Common Name	Scientific Name
Black bullhead	*Ictalurus melas*
Black crappie	*Pomoxis nigromaculatus*
Bluegill	*Lepomis macrochirus*
Brown bullhead	*Ictalurus nebulosus*
Channel catfish	*Ictalurus punctatus*
Chinook salmon	*Oncorhynchus tschawtscha*
Green sunfish	*Lepomis cyanellus*
White catfish	*Ictalurus catus*
White crappie	*Pomoxis annularis*

Table 24. Resident Nongame Fish of the Colusa Basin Drain

Common Name	Scientific Name
Big scale logperch	*Percina macrolepida*
California roach	*Hesperoleucus symmetricus*
Carp	*Cyprinus carpio*
Flathead minnow	*Pimephales promelas*
Goldfish	*Carassius auratus*
Hitch	*Lavinia exilicauda*
Inland silversides	*Menidia beryllina*
Mosquitofish	*Gambusia affinis*
Pacific lamprey	*Lampetra tridentata*
Sacramento blackfish	*Orthodon microlepidotus*
Sacramento pike minnow	*Ptycholcheilus grandis*
Sacramento splittail	*Pogonichthys macrolepidotus*
Sacramento sucker	*Catostomus occidentalis*
Sculpin sp.	*Cottus sp.*
Threadfin shad	*Dorosoma pretenense*
Tui chub	*Gila bicolor*
Tule perch	*Hysterocarpus traski*

One late fall-run chinook salmon carcass was found in the upper fyke net. In October 1998, fall-run chinook salmon were observed migrating up the CBD at the Delevan Wildlife Area. DWR biologists saw spring-run chinook salmon in Walker Creek, a tributary to Willow Creek, in spring 1998. Four splittail were caught in the fyke net located just below Highway 20 in July and August, 1999. All four were young-of-the-year splittail. They averaged 1.4 inches, and ranged from 0.9 to 2.0 inches fork length.

The greatest diversity of fish was caught in the upper fyke net, at the confluence of Willow Creek and the CBD. The gill net and the hoop net caught only a few different species of fish (Table 25). Various tadpoles, mostly bullfrog, (*Rana catesbieana)*, were by far the most numerous animal caught by any method, but particularly the fyke nets. Channel catfish were the most frequently caught fish, the majority of which were juveniles. Mostly juvenile fish were caught in the nets. Rarely did fish exceed 5.9 inches, with the exception of the goldfish. Adult channel catfish, up to 17.7 inches, were caught by hook and line. Carp, up to 20 inches, were also caught with hook and line.

Seining was the most efficient form of sampling in the Colusa Basin Drain, with a catch per hour effort ratio of 21.8. The hoop net was the least efficient method of capture, with a catch per hour effort ratio of 0.01 (Table 26).

Table 25. Number of Species Captured at Each Trapping Station

Species	Gill net	Hoop net	Seine	Hook & line	Fyke nets	Total
Big scale logperch			2		3	5
Black bullhead				1	7	8
Black crappie			1		2	3
Bluegill	1	1	10	1	23	36
Brown bullhead				20	18	38
California roach			15		1	16
Carp				69	2	71
Channel catfish	2	1		28	195	226
Chinook salmon					1	1
Flathead minnow					1	1
Goldfish				16	15	31
Green sunfish			8		48	56
Hitch			40	1	52	93
Inland silversides			1		4	5
Mosquitofish			3		6	9
Pacific lamprey					7	7
Sacramento blackfish			96		23	119
Sacramento pike minnow	1				2	3
Sacramento splittail					4	4
Sacramento sucker	1	1	1		3	6
Sculpin sp.			1		1	2
Threadfin shad					6	6
Tui chub						1
Tule perch		1			4	5
White catfish				7	18	25
White crappie					3	3

Table 26. Catch Per Hour Effort for Each Trapping Method

Trapping Method	Total Effort Hours	Catch per Hour Effort
Gill net	336	0.02
Hoop net	576	0.01
Seine	8	21.8
Hook and line	41	3.5
Fyke net	2500	0.25

Discussion

Four Sacramento splittail were caught. This species were federally listed as threatened in March 1999. Numerous fall-run chinook salmon were observed in the CBD and the carcass of one late fall-run chinook salmon was found. Fall-run chinook salmon and late fall-run chinook salmon are federally proposed for listing as threatened. Spring-run chinook salmon were observed in Walker Creek, a tributary to the CBD. They were listed as a State of California Threatened Species in February 1999. They are also proposed for listing as a federally endangered species.

Willow and Freshwater Creeks are tributaries to the CBD. They flow all year in their upper reaches and have deep pools suitable for steelhead juveniles. Steelhead smolts migrate during high stream flows in the winter. The nets set up in the CBD might not have caught them because larger fish and migrating yearling steelhead avoid fixed fyke nets. Willow and Freshwater Creeks should be sampled during summer to detect rearing steelhead fry.

Sites and Colusa Project Habitat Types

This section summarizes studies of habitat types along the streams in the proposed Sites and Colusa Project areas conducted in 1998 and 1999.

Methodology

An initial channel type survey, including an evaluation of the overall channel morphology, was made at the beginning of the study of each creek. Channel type was subsequently determined when the overall character of the channel changed for over 20 bankfull widths.

Channel type surveys began by first noting if the stream is a threaded or single channel. Then the bankfull width was measured at the prominent scour marks and sedimentation on the bank substrate with a 100-foot vinyl tape. Ten depths were taken at the study section to obtain the average bankfull depth. The substrate type was noted (Table 27).

Table 27. Substrate Type and Size Used[1]

Substrate Type	Size in inches
Boulder	> 10
Large Cobble	5-10
Small Cobble	2.5-5
Gravel	0.08-2.5
Sand	<0.08

[1] Flosi et al. 1998

Habitat type evaluation on Funks Creek began at Golden Gate damsite on January 12, 1999, and proceeded upstream to a point just above the mouth of Grapevine Creek on February 25, 1999. After this point, Funks Creek no longer contained water. Habitat typing continued on Grapevine Creek from the confluence with Funks Creek on February 26, 1999, and concluded at the reservoir inundation line on April 28, 1999. Stone Corral Creek habitat typing began on February 10, 1999, and continued until the channel no longer contained water, just past the confluence of Antelope Creek. Habitat typing concluded for Stone Corral and began on Antelope Creek on February 23, 1999. Habitat typing concluded on Antelope Creek on April 22, 1999, at the reservoir inundation line.

Each habitat unit was described as a pool, flat water, or riffle. All data was recorded on a standardized habitat typing data sheet (Flosi et al. 1998). Side channels were evaluated separately only when they demonstrated a different habitat type due to the small nature of the creek bed and intermittent water flow. Once the habitat unit type was identified it was assigned a unit number. For each unit, a mean length (measured as the thalweg length), width, and depth were taken, as well a maximum depth. All measurements were made and recorded in feet and tenths of feet using standard engineering measuring tapes and stadia rods. For pools, the tail-crest depth, type of pool-tail substrate, and the percent the substrate is embedded were also evaluated.

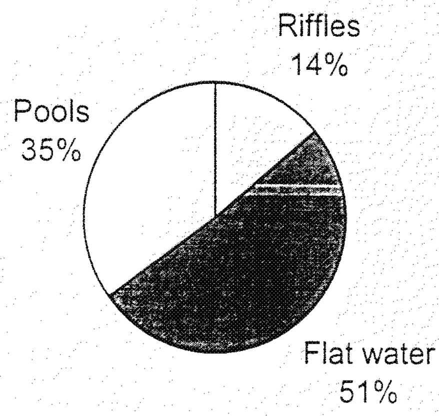
In addition to unit type data, the time surveying began, air and water temperature, date, and surveyors present were all recorded daily. Yellow flags were left at the end of the last habitat unit surveyed each day. The substrate type and percent exposed substrate was recorded. A shelter value for the unit was given based on the quantity and composition of the cover. The total percent cover for the habitat unit was recorded, then broken down into the percentages of the total that each cover element represented.

The bank composition was evaluated and dominant vegetation for right and left banks was recorded. Plant species and bank substrates were entered. The percent of the bank vegetated was evaluated up to bankfull width plus 20 feet. The percent and type, (deciduous or coniferous), of cover by tree canopy at midday was also evaluated. This was done for the entire part of each stream studied.

Results

Funks Creek. Flat water constituted 51 percent of the total creek measured. The average flat water length on Funks Creek was 212 feet. Pools at 35 percent of the total length with an average length of 146 feet, were the second most dominant habitat type. Riffles constituted 14 percent of the creek, with an average unit length of 57 feet (Figure 4).

Figure 4. Relative Occurrence of Habitat Types in Funks Creek



Gravel was the most common substrate (Table 28). Small cobble substrate was the second most common substrate type, occurring at 28 percent of the units surveyed. Silt/clay type substrate was most commonly associated with the gravel substrate, either as the primary or secondary substrate. It also frequently occurred as a layer over bedrock or boulder substrates. Silt/clay was the dominant substrate in the lower reaches of Funks Creek, giving way to gravel as the dominant substrate in the upper reaches of the stream.

Table 28. Summary of Substrates (%) by Habitat Type on Funks Creek

Habitat type	Silt/Clay	Sand	Gravel	Small cobble	Large cobble	Boulder	Bedrock
Riffle	19	0	26	21	10	1	24
Flat water	11	1	33	21	5	8	21
Pool	6	1	41	43	5	2	2
Average	12	1	33	28	7	4	15

The bank composition was overwhelmingly silt/clay. Occasional areas of bedrock bank or cobble bank occurred; where roads passed through or near the creek, boulders dominated the bank. Greater variability of bank composition occurred in the lower reaches of the creek. Most bedrock banks occurred in major blocks where bedrock ridges rose through the valley floor.

Star thistle and grasses dominated both banks. The average percent bank covered by vegetation was 52 percent for the right bank and 53 percent for the left bank. Occasional cottonwoods, willows, oaks, and walnut trees punctuate the bank. Only 18 percent of the habitat units had some degree of canopy. The average canopy cover was 5 percent, or 26 percent when considering only those units that had any canopy cover at all. Trees were concentrated at Golden Gate, where habitat typing began on Funks Creek, and in the upper reaches of the creek.

The average of the total units covered by all cover combined was 27 percent. Aquatic vegetation was the prevalent type of cover, boulders were the most common large cover item. Aquatic vegetation and boulders each comprised an average of 25 percent of the total cover (Table 29). Large woody debris and root masses occurred relatively infrequently. Undercut banks occurred in 17 percent of the habitat units. Pools overall had a large degree and variety of cover, while flat water and riffles had less cover.

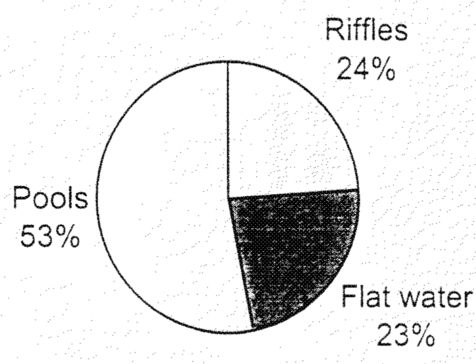
Table 29. Summary of Habitat Cover in Funks Creek

	Percent of each habitat having cover	Percent of Cover Type								
		Undercut banks	Small woody debris	Large woody debris	Root masses	Terrestrial vegetation	Aquatic vegetation	Bubble curtain	Boulders	Bedrock ledges
Riffles	20	-	-	1	-	20	15	30	28	6
Flat water	38	34	1	1	-	1	27	10	25	1
Pools	24	18	3	1	1	1	34	2	21	19
Average	27	17	1	1	-	7	25	14	25	9

Grapevine Creek. Riffles made up 24 percent of the total creek measured (Figure 5). The average riffle length on Grapevine Creek was 72 feet. Flat water made up 23 percent of the total length with an average length of 143 feet, and was the least dominant habitat type. Pools made up just over half, 53 percent, of the total length of Grapevine Creek within the reservoir footprint.

Small cobble was the most common substrate in Grapevine Creek. Gravel was also common, occurring as the substrate in 30 percent of the habitat units. Large cobble was the dominant substrate in 13 percent of the units surveyed. Small cobble substrate was spread throughout the creek system; however, there were no distinct pockets of this or any other substrate.

Figure 5. Relative Occurrence of Habitat Types in Grapevine Creek



Thirty-two percent of the pools on Grapevine Creek were dominated by small cobble substrate. Gravel was dominant in 22 percent of these. Flat water was dominated by gravel and small cobbles (Table 30).

Table 30. Summary of Substrates on Grapevine Creek

	Silt/Clay	Sand	Gravel	Small cobble	Large cobble	Boulder	Bedrock
Riffle	5		32	24	11	1	27
Flat water	12	1	35	41	7	2	2
Pool	6		22	32	21	5	14
Average	8		30	32	13	3	14

Bank composition was overwhelmingly silt/clay. Frequent patches of gravel/cobble banks occurred throughout the creek channel surveyed. Most bedrock banks occurred in major blocks where bedrock ridges rise through the valley floor.

Grasses and star thistle dominated both banks. The average percent bank covered by vegetation was 56 percent for the right bank and 54 percent for the left bank. Occasional oaks, willows, cottonwoods, walnuts, and gray pines punctuate the bank. Thirty-nine percent of the habitat units examined on Grapevine Creek had some degree of canopy—38 percent from deciduous trees and shrubs, and 1 percent from pines. The average canopy cover was 12 percent. Trees were more concentrated at the upstream end where Grapevine Creek starts to climb in elevation toward the edge of the reservoir footprint.

The average of the total unit covered by all cover combined was 29 percent. Aquatic vegetation was the most prevalent type of cover, occurring in 72 percent of the flat water units surveyed. Aquatic vegetation comprised an average 53 percent of the total unit cover (Table 31).

Pools had the largest mean total coverage at 32 percent. Aquatic vegetation comprised 46 percent of the cover in pools. Riffles had a mean total cover 28 percent, 40 percent of which was aquatic vegetation. Terrestrial vegetation, boulders, and bubble curtains also provided cover in riffles—14 percent, 17 percent, and 7 percent, respectively. Flat water averaged 26 percent total coverage, of this 72 percent of the cover was aquatic vegetation.

Aquatic vegetation was the most common large cover item, occurring in 53 percent of the units surveyed. Root masses were another large cover item that occurred with some frequency at 7 percent. Terrestrial vegetation occurred in 9 percent of the habitat units, and bedrock ledges in 4 percent of the units. Riffles and pools contained all of the major types of cover (Table 31).

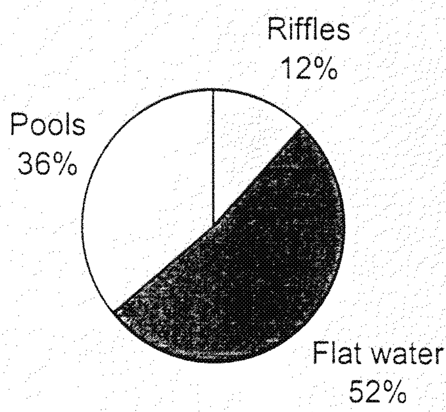
Table 31. Summary of Habitat Cover in Grapevine Creek

	Percent of each habitat having cover	Percent of Cover Type								
		Undercut banks	Small woody debris	Large woody debris	Root masses	Terrestrial vegetation	Aquatic vegetation	Bubble curtain	Boulders	Bedrock ledges
Riffles	28	1	3	3	13	14	40	7	17	2
Flat water	26	5	3	-	4	8	72	4	4	-
Pools	32	7	3	12	4	4	46	4	9	11
Average	29	4	3	5	7	9	53	5	10	4

Stone Corral Creek. Flat water made up the majority of habitat type measured, comprising 52 percent of the total creek. The average flat water length on Stone Corral Creek was 213 feet. Pools, making up 36 percent of the total length and with an average length of 145 feet, were the second most dominant habitat type in terms of total footage. Riffles made up 12 percent of the creek's total length, with an average unit length of 48 feet (Figure 6).

Bedrock was the most common substrate, occurring as the primary substrate in 31 percent of the total units surveyed on Stone Corral Creek. Gravel substrate was the second most common substrate type, occurring in 24 percent of units surveyed. Silt/clay type substrate was commonly associated with bedrock or gravel, occurring as a layer over the other substrates. The lower reach of Stone Corral Creek was heavily dominated by bedrock, giving way to a more gravel base near the confluence with Antelope Creek. Silt/clay substrate is spread consistently throughout the creek system.

Figure 6. Relative Occurrence of Habitat Types in Stone Corral Creek



Thirty-three percent of pools had silt/clay as the dominant substrate (Table 32). Fifty-two percent of flat water had gravel as the dominant substrate. Riffles had 56 percent bedrock dominant and 17 percent silt/clay dominant substrate. The most common occurring pool tail substrate was bedrock.

Table 32. Summary of Substrates on Stone Corral Creek

	Silt/Clay	Sand	Gravel	Small cobble	Large cobble	Boulder	Bedrock
Riffle	17		9	1		17	56
Flat water	20		52		14	14	
Pool	33	5	12	2		12	36
Average	23	2	24	1	5	14	31

The bank composition was overwhelmingly silt/clay. Occasional areas of bedrock bank or cobble bank occurred; where roads passed through or near the creek, boulders dominated the bank. Greater variability of bank composition then occurred in the lower reaches of the creek, where cobbled banks frequently occurred. Most bedrock banks occurred in major blocks where bedrock ridges rise through the valley floor.

Bank vegetation included grasses and star thistle, which dominated both banks. The average percent bank covered by vegetation was 62 percent for the right bank and 63 percent for the left bank. Occasional oaks, willows, cottonwoods, and walnut trees punctuate the bank. Only 11 percent of the habitat units surveyed had some degree of canopy. The average canopy cover was 4 percent, all deciduous trees and shrubs. Trees were more concentrated at the lower end where habitat typing began on Stone Corral Creek.

The average of the total unit covered by all cover types combined was 33 percent. Aquatic vegetation was the most prevalent type of cover, comprising an average of 56 percent of the total unit coverage.

Riffles had a mean total cover of 39 percent, 49 percent of which was aquatic vegetation. An average of 7 percent of the cover in riffles was comprised of boulders. Flat water averaged 34 percent total coverage, of this 61 percent of the cover was aquatic vegetation. Pools had a mean percent total coverage of 26 percent.

Aquatic vegetation was the most common large cover item, occurring in 56 percent of the units surveyed. Boulders and terrestrial vegetation were the next most common cover items at 16 percent and 12 percent, respectively. Undercut banks occurred in 6 percent of the habitat units, and bedrock ledges in 4 percent of the units. No habitat unit types contained all major types of cover (Table 33).

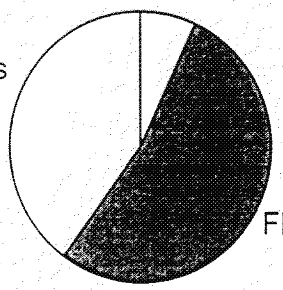
Table 33. Summary of Habitat Cover in Stone Corral Creek

	Percent of each habitat having cover	Percent of Cover Type								
		Undercut banks	Small woody debris	Large woody debris	Root masses	Terrestrial vegetation	Aquatic vegetation	Bubble curtain	Boulders	Bedrock ledges
Riffles	39	-	-	-	-	25	49	18	7	2
Flat water	34	5	5	-	-	6	61	-	21	3
Pools	26	12	-	-	1	4	57	-	19	7
Average	33	6	2	-	-	12	56	6	16	4

Antelope Creek. Flat water made up the majority of the total footage measured, comprising 53 percent of the total creek measured. The average flat water length on Antelope Creek was 135 feet. Riffles made up 7 percent of the creek's total length, with an average unit length of 18 feet. Pools comprised 40 percent of the total length measured with an average length of 103 feet (Figure 7).

Silt/clay was the most common substrate, occurring as the primary substrate in 24 percent of Antelope Creek. Gravel and small cobble were also common substrates at 22 percent each. Silt/clay type substrate was commonly associated with gravel. Small cobble increased in frequency of occurrence in the upper reaches of Antelope Creek. Gravel substrate occurred uniformly throughout Antelope Creek (Table 34).

Figure 7. Relative Occurrence of Habitat Types in Antelope Creek



Silt/clay dominated the majority of pools. Twenty-nine percent of flat water units had silt/clay as the dominant substrate. Gravel and small cobbles at 23 percent and 22 percent respectively (Table 34) dominated riffles.

Table 34. Summary of Substrates on Antelope Creek

	Silt/Clay	Sand	Gravel	Small cobble	Large cobble	Boulder	Bedrock
Riffle	7	2	23	22	7	9	30
Flat water	29	3	25	27	7	2	7
Pool	35	3	18	16	10	14	4
Average	24	3	22	22	8	8	14

Bank composition was largely silt/clay. Occasional areas of bedrock bank or cobble bank occurred; where roads passed through or near the creek, boulders dominated the bank. The diversity of bank substrate increased, particularly gravel and cobble, in the upper reaches of Antelope Creek.

Grasses and star thistle dominated both banks. The average percent bank covered by vegetation was 80 percent for the right bank and 80 percent for the left bank. Oaks, willows, cottonwoods, walnut trees, and gray pines punctuate and occasionally line the bank. Forty-seven percent of the habitat units surveyed had some degree of canopy. The average canopy cover was 20 percent. Trees were more concentrated at the middle to upper reaches.

The average of the total stream habitat covered was 31 percent (Table 35). Aquatic vegetation was the most prevalent type of cover, occurring in 65 percent of the units surveyed. Aquatic vegetation comprised an average of 46 percent of the total unit cover.

Riffles had an average total cover of 34 percent, with 43 percent aquatic vegetation. Flat water averaged 30 percent total coverage—58 percent aquatic vegetation. The primary cover for all units was aquatic vegetation. Some units indicated a higher percentage of cover, but these occur on an infrequent basis in this creek.

Aquatic vegetation and terrestrial vegetation were the most common large cover items, occurring in 46 percent and 17 percent respectively of the units surveyed. Most units surveyed had small amounts of a variety of cover types.

Table 35. Summary of Cover in Antelope Creek

Habitat type	Percent of each habitat having cover	Percent of each habitat type								
		Undercut banks	Small woody debris	Large woody debris	Root masses	Terrestrial vegetation	Aquatic vegetation	Bubble curtain	Boulders	Bedrock ledges
Riffles	34	4	5	4	15	16	43	1	12	-
Flat water	30	4	3	1	8	19	58	1	5	1
Pools	29	18	7	1	7	15	37	1	13	1
Average	31	9	5	2	10	17	46	1	10	1

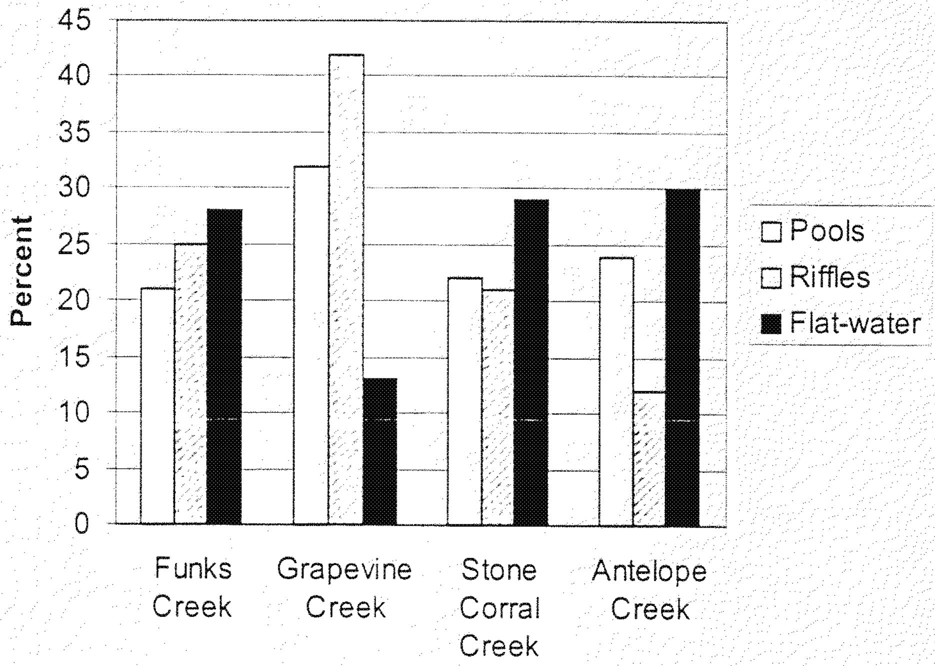
Discussion

Habitat typing was done to quantify physical aquatic habitat to provide information for the NEPA and CEQA process. This quantification will determine habitat lost by inundation and will form the basis for mitigation. Grapevine Creek had more pools and riffles. Grapevine Creek also had the least amount of flat water. Funks Creek and Stone Corral Creek had similar amounts of pools, flat water, and riffles. Antelope Creek was more like Stone Corral and Funks Creeks than Grapevine Creek. Grapevine Creek flows from springs in hills to the west of Sites-Colusa and is steeper than the other creeks. That causes Grapevine Creek to have less flat water than the other creeks (Table 36 and Figure 8).

Table 36. Comparison of Relative Occurrence of Pools, Flat Water, and Riffles in Creeks in the Sites-Colusa Project Area

	Funks	Grapevine	Stone Corral	Antelope
Pools	21	32	22	24
Riffles	25	42	21	12
Flat water	28	13	29	30

Figure 8. Relative Occurrence of Habitat Types in Sites-Colusa



Stone Corral Creek had a high abundance of larger substrates. Grapevine Creek had the lowest percentage of silt. Grapevine Creek also had the most gravel, small cobble, and large cobble substrate. Fine materials are abundant in Stone Corral and Antelope Creeks. The relatively steep nature of Grapevine Creek washes fine materials away and leaves coarser materials behind (Table 37).

Table 37. Summary of Substrates (%) by Habitat Type on Creeks in the Sites-Colusa Study Area

Creek	Habitat type						
	Silt/Clay	Sand	Gravel	Small cobbie	Large cobbie	Boulder	Bedrock
Funks	12	3	32	28	7	3	15
Grapevine	8	1	30	32	13	3	13
Stone Corral	23	2	24	1	5	14	31
Antelope	24	3	22	22	8	8	13

The occurrence of cover types followed the same trends for all four creeks surveyed. Aquatic vegetation was the dominant cover type in each creek. Stone Corral Creek showed a higher percent occurrence of boulders—nearly twice as many as Antelope Creek and nearly five times as many as Funks and Grapevine Creeks.

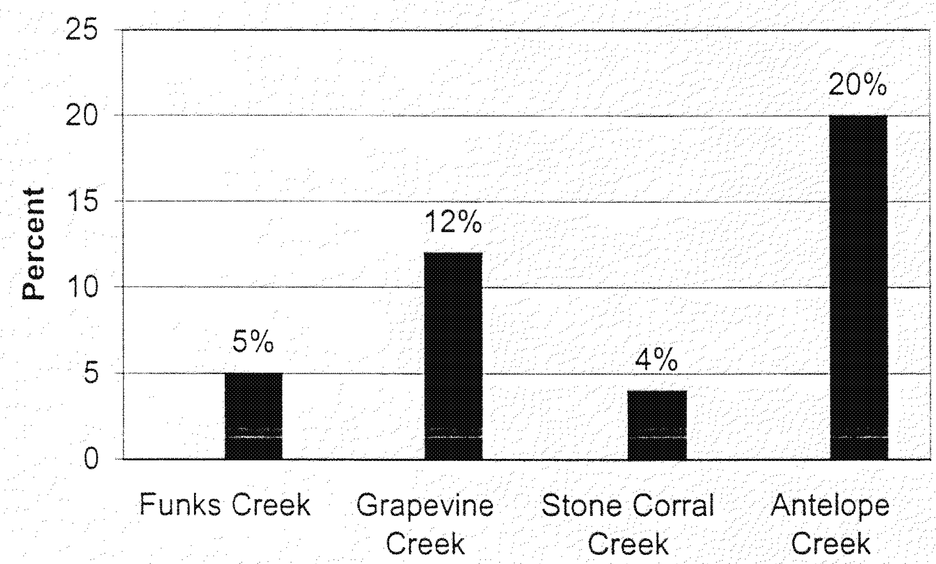
Bubble curtains were more common in Funks Creek. Antelope Creek had more cover provided by root masses than the other creeks (Table 38).

Table 38. Summary of Cover (percent of each habitat type) on Creeks in the Sites-Colusa Study Area

Creek	Percent of each habitat having cover	Percent of Habitat Cover								
		Undercut banks	Small woody debris	Large woody debris	Root masses	Terrestrial vegetation	Aquatic vegetation	Bubble curtain	Boulders	Bedrock ledges
Funks	27	17	1	1	1	7	25	14	25	9
Grapevine	29	4	3	4	7	10	53	6	10	4
Stone Corral	33	6	1	-	1	10	54	6	16	4
Antelope	31	9	5	2	10	17	46	1	9	1

The pools of all four creeks had similar degrees of cover for all habitats, which were spread very closely to 30 percent coverage. Notable spikes in percent unit covered occurred in unit types that have a very low frequency of occurrence. Grapevine and Antelope Creeks show an increase in the occurrence of canopy (Figure 9).

Figure 9. Percent of Canopy Over Creeks Measured at Sites-Colusa Project Area



Creek flows varied widely with lack of rainfall, forcing activity to be suspended on some areas of Funks, Stone Corral, and Antelope Creeks until further rain revived the stream flow. This suggests that streams on the floor of the Antelope Valley are intermittent and only flow during the summers of particularly wet years. Antelope Creek, and particularly Grapevine Creek, could flow year round. The majority of the fish found in this area were juvenile fish that would probably use the creeks only as rearing areas. The high concentration of sediments and aquatic vegetation would also raise the biological oxygen demand in the creeks during the summer months in any remaining deeper pools, making them uninhabitable to most fish, with the exception of the California roach, *Lavinia exilicauda* (Moyle 1976).

Both Grapevine and Antelope Creeks are the continuations of the main creek channels of those systems. Both creeks also show an increase in canopy and larger substrates. When viewed as just two creek systems, Funks-Grapevine and Stone Corral-Antelope both show a trend toward more canopy and larger substrates. The increased canopy and decreased sedimentation in the upper reaches of Antelope Creek and Grapevine Creek may provide sufficient cooling factors for year-long fish inhabitants. Eight-to-10 inch largemouth bass, *Micropterus salmoides*, were seen in the upper reaches of Grapevine Creek, which suggests a year-round flow capable of supporting larger fish. The larger substrate size also provides cover for the minnow fry that occupy the creeks in the spring.

Very little riparian vegetation, such as rushes, essential cover for aquatic amphibians and reptiles, exists on the banks of any of the creeks in the Sites-Colusa Project area, with the exceptions of the upper reaches of Antelope and Grapevine Creeks.

Summary of Fish Studies for Proposed Projects

Thomes Creek has runs of fall-run, late fall-run, and limited numbers of spring-run chinook salmon. Steelhead also spawn in Thomes Creek. Large runs of Sacramento suckers and Sacramento pike minnows migrate up Thomes Creek. Fall-run salmon, Sacramento suckers, and Sacramento pike minnow also migrate up Stony Creek. Cottonwood Creek has larger runs of fall-run, late fall-run, and spring-run chinook salmon. Cottonwood Creek has a run of steelhead, as well as annual migrations of Sacramento suckers and Sacramento pike minnows. Stone Corral Creek and Funks Creek have no established runs of chinook salmon but have small runs of Sacramento suckers and Sacramento pike minnows.

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Special thanks to DWR's Northern District staff,
who drafted many chapters of this progress report and conducted many of the studies that form its core.

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RIVER RESEARCH AND APPLICATIONS
River Res. Applic. (2011)
Published online in Wiley Online Library
(wileyonlinelibrary.com) DOI: 10.1002/rra.1511

SHORT COMMUNICATION

A PRESUMPTIVE STANDARD FOR ENVIRONMENTAL FLOW PROTECTION

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ABSTRACT

The vast majority of the world's rivers are now being tapped for their water supplies, yet only a tiny fraction of these rivers are protected by any sort of environmental flow standard. While important advances have been made in reducing the cost and time required to determine the environmental flow needs of both individual rivers and types of rivers in specific geographies, it is highly unlikely that such approaches will be applied to all, or even most, rivers within the forseeable future. As a result, the vast majority of the planet's rivers remain vulnerable to exploitation without limits. Clearly, there is great need for adoption of a "presumptive standard" that can fill this gap. In this paper we present such a presumptive standard, based on the Sustainability Boundary Approach of Richter (2009) which involves restricting hydrologic alterations to within a percentage-based range around natural or historic flow variability. We also discuss water management implications in applying our standard. Our presumptive standard is intended for application only where detailed scientific assessments of environmental flow needs cannot be undertaken in the near term. Copyright © 2011 John Wiley & Sons, Ltd.

KEY WORDS: environmental flow; sustainability; Sustainable Boundary Approach; river management; corporate water use; water stewardship; water allocation; water scarcity

Received 7 December 2010; Revised 16 January 2011; Accepted 7 February 2011

Available freshwater supplies are being increasingly strained by growing human demands for water, particularly for irrigated agriculture and urban uses. The global population is growing by 80 million people each year, and if consumption patterns evolve as expected, two-thirds of the world's population will live in water-stressed areas by 2025 (WWAP, 2009). Whereas differing patterns of population growth, lifestyle changes and climate change will pose different scenarios on each continent, water managers and planners are challenged to meet growing water needs virtually everywhere.

At the same time, societies around the world are increasingly demanding that water managers also protect the natural freshwater ecosystems that are being tapped for water supplies. The need to protect 'environmental flows'—defined as the quantity, timing and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems (Brisbane Declaration, 2007)—is now being addressed in many governmental water allocation policies, dam development plans and urban water supply plans. The stimuli for protecting environmental flows are varied and many, including the desire to protect biodiversity, ecosystem services (especially fisheries production), water-based tourism or recreation, economic activities such as hydropower generation and other cultural or spiritual values (Postel and Richter, 2003).

However, many good intentions to protect environmental flows have stalled upon encountering confusing and conflicting information about which method for environmental flow assessment is appropriate or 'best' and perceptions that the more credible and sophisticated methods require considerable investment of time, expertise and money to apply. These real and perceived hurdles have too often resulted in doing nothing to protect environmental flows, leaving the vast majority of rivers on the planet vulnerable to over-exploitation (Richter, 2009).

The environmental flow science community has long been attuned and responsive to the need for more cost-efficient and time-efficient approaches to determining environmental flow needs. Beginning in the 1970s with the Tennant (1976) method and continuing with the recent publication of the 'Ecological Limits of Hydrologic Alteration' (ELOHA; Poff *et al.*, 2010), a long series of efforts have been put forth by scientists to streamline and expedite environmental flow assessment while maintaining scientific credibility. However, widespread environmental flow protection across the planet's river networks has yet to be attained.

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Of particular concern and relevance to this paper is the fact that it is proving difficult to implement ELOHA in some jurisdictions even though the approach was explicitly designed to address the issues that have prevented other methods from being applied widely. The four co-authors of this paper have been actively encouraging government entities to apply the ELOHA framework; the difficulties we have experienced in these efforts have provided strong motivation for writing this paper. As we explain later in this paper, we continue to believe that ELOHA provides the best available balance between scientific rigor and cost of application for setting environmental flow standards for many rivers simultaneously. The ELOHA framework is currently being applied in various jurisdictions around the world. However, we are finding that many government entities are unable (or unwilling) to afford the cost of applying ELOHA (generally ranging from $100k to $2M), especially in situations where existing biological data and hydrologic models have poor spatial coverage. Time constraints are an even more frequent hindrance to the implementation of the ELOHA framework, particularly for jurisdictions embroiled in politically challenging situations such as responding to extreme droughts, legislative mandates or lawsuits. We suggest that until ELOHA or some variation can be applied everywhere, a presumptive, risk-based environmental flow standard is needed to provide interim protection for all rivers.

Another strong motivation for putting forth a presumptive standard at this time is the fact that many large water-using corporations are now looking for environmental indicators that can help them screen their operations and supply chains for water-related risks (e.g. SABMiller and WWF-UK, 2009). These corporations are increasingly coming to understand that, when environmental flows are not adequately protected, freshwater ecosystems will be stressed, jeopardizing ecosystem services valued by many people for their livelihoods and well-being. This can lead to conflicts that can ultimately endanger a company's 'social licence to operate' (Orr *et al.*, 2009). Presently, many corporations are using estimates for environmental flow requirements put forth by Smakhtin *et al.* (2004); these estimates range globally from 20% to 50% of the mean annual river flow in each basin. We agree with Arthington *et al.* (2006) that such a low level of protection as suggested by Smakhtin 'would almost certainly cause profound ecological degradation, based on current scientific knowledge'. We hope that the presumptive standard we offer in this paper will replace corporate use of the Smakhtin estimates for water risk screening.

The presumptive standard for environmental flow protection put forth in this paper is intended for use only in situations where the application of ELOHA or site-specific environmental flow determinations (e.g. Richter *et al.*, 2006) cannot be applied in the near future; in other words, it is intended for use as a default placeholder. This presumptive standard is derived from the sustainability boundary approach (SBA) described by Richter (2009), which involves maintaining flows within a certain percentage-based range around natural flows (i.e. flows in the absence of dam regulation or water withdrawals).

Before discussing our proposed presumptive standard in greater detail, we provide a short discussion of the advantages of 'per cent-of-flow' (POF) approaches such as the SBA for expressing environmental flow requirements. We then summarize efforts around the world to apply flow protection standards based on POF expressions. Finally, we propose a specific presumptive standard using risk bands placed around natural flow variability and conclude with management implications in applying this presumptive standard.

APPROACHES FOR SETTING FLOW PROTECTION STANDARDS

A primary challenge in setting flow protection standards is to employ a practical method that limits water withdrawals and dam operations in such a way as to protect essential flow variability. As described by Richter (2009), a large body of scientific literature supports the 'natural flow paradigm' as an important ecological objective to guide river management (Richter *et al.*, 1997; Poff *et al.*, 1997; Bunn and Arthington, 2002; Postel and Richter, 2003; Arthington *et al.*, 2006). Stated simply, the key premises of the natural flow paradigm are that maintaining some semblance of natural flow regimes is essential to sustaining the health of river ecosystems and that health is placed at increasing risk with increasing alteration of natural flows (Richter *et al.*, 2003; Richter, 2009).

Three basic approaches have been employed for setting environmental flow standards across broad geographies such as states or nations: minimum flow thresholds, statistically based standards and POF approaches. The most commonly applied approach to date has been to set a minimum flow level that must be maintained. For example, the most widely used minimum flow standard in the USA is the annual 7Q10, which is defined as the lowest flow for seven consecutive days that occurs every 10 years on average. Whereas the original intent of the annual 7Q10 flow standard was to protect water quality under the federal Clean Water Act of 1972, it has become either explicitly in rule or by default the minimum flow threshold in many states (Gillilan and Brown, 1997; IFC, 2001). The growing recognition that this threshold was not sufficiently protective of aquatic habitats led in the 1980s and 1990s to several states setting higher flow thresholds, such as by setting the minimum level at 30% of the mean annual flow (MAF) or by setting thresholds that vary seasonally, such as at the

DOI: 10.1002/rra

level of 60% of MAF in winter, 30% of MAF in summer and 40% of MAF in spring and fall (Gillilan and Brown, 1997; IFC, 2001).

More recently, statistically based standards have been used to maintain certain characteristics of the flow regime. For example, such a standard may call for protecting a high flow of a specified magnitude, with specified duration, to occur with a specified inter-annual frequency. The application of a statistically based standard in regulating water use generally involves using computerized hydrologic models to simulate the cumulative effects of licenced or proposed water withdrawals and dam operations on the flow regime; hydrologic changes are allowed to accumulate until the statistical standards would be violated by further withdrawals or dam effects.

Flow standards set in the USA, the European Union and elsewhere in the past decade have increasingly been based on a POF approach (see case studies later in this paper). This approach explicitly recognizes the importance of natural flow variability and sets protection standards by using allowable departures from natural conditions, expressed as percentage alteration. The POF approach has several strong advantages over other approaches. For instance, the POF approach is considerably more protective of flow variability than the minimum threshold standards. Minimum-threshold-based standards can allow flow variability to become 'flat-lined' as water allocation pressure increases and reservoir operations are designed only to meet minimum release requirements. Statistically based standards, although usually more protective of flow regimes than minimum thresholds, can be confusing to non-technical stakeholders, and complex statistical targets have proven difficult for water managers to implement (Richter, 2009). By comparison, POF approaches are conceptually simple, can provide a very high degree of protection for natural flow variability and can also be relatively simple to implement (i.e. a dam operator simply releases the prescribed percentage of inflow, or cumulative water withdrawals must not reduce flow by more than the prescribed percentage).

Sustainability boundary approach

Recognizing that human-induced flow alterations can both deplete and unnaturally augment natural flows to the detriment of ecological health, Richter (2009) expanded upon the POF approach by suggesting that bands of allowable alteration called 'sustainability boundaries' could be placed around natural flow conditions as a means of expressing environmental flow needs, as depicted in Figure 1.

To apply the SBA, the natural flow conditions for any point of interest along a river are estimated on a daily basis, representing the flows that would have existed in the absence of reservoir regulation, water withdrawals and return flows (Richter, 2009). Limits of flow alteration, referred to as sustainability boundaries, are then set on the basis of allowable perturbations from the natural condition, expressed as percentage-based deviations from natural flows. Those withdrawing water or operating dams are then required to maintain downstream river flows within sustainability boundaries. Whereas maintaining flows within the targeted range may be infeasible on a real-time basis in many cases, such management can be facilitated by creating computerized hydrologic models to evaluate what the likely perturbation to natural flows would be under existing or proposed scenarios of water withdrawal and dam operations and by licencing such water uses accordingly.

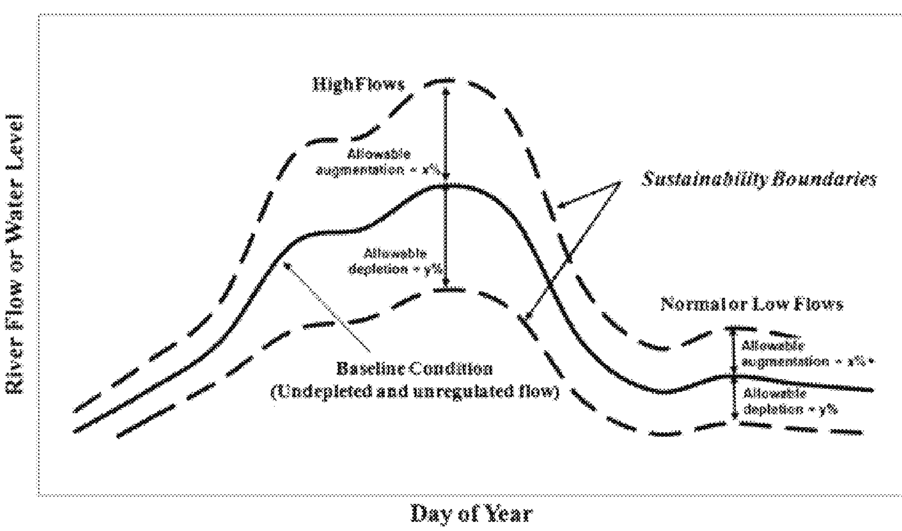

Figure 1. Illustration of the sustainability boundary approach from Richter (2009; reprinted with permission). The sustainability boundaries set limits on the degree to which natural flows can be altered, expressed as a percentage of natural flows.

DOI: 10.1002/rra

The allowable degree of alteration from the natural condition can differ from one point to another along the same river. This determination for any point of interest along a river requires a negotiation or optimization between the following: (i) the desired consumption or dam regulation of water upstream, which might either deplete or unnaturally augment river flows; (ii) the desired uses of water downstream; and (iii) the desired ecological condition and ecosystem services to be maintained. As such, the SBA forces an explicit integration of environmental flow objectives with water withdrawals and dam operations. We recognize and emphasize that this is a socio-political decision-making process as much as it is a scientific one. As suggested by Richter (2009), the application of the SBA in setting river flow management goals requires transparent, inclusive and well-informed stakeholder engagement.

The basic challenge confronting environmental flow proponents is the difficulty of determining how much alteration from natural flows can be tolerated without compromising ecological health and ecosystem services to an undesirable degree. In the absence of such an understanding, water managers and governmental regulators have focused solely on water withdrawals and dam operations, providing only minimum flow protection or neglecting ecosystem considerations altogether. This highly undesirable situation calls for the adoption of a precautionary approach to fill the gap, until more detailed and regionally tailored studies of environmental flow needs can be completed and used to set flow protection standards.

We believe that sufficient scientific evidence and knowledge now exist to propose an SBA-based presumptive standard that can serve as initial guidance for regulating water withdrawals and dam operations in rivers. In designing the presumptive standard recommended later in this paper, we reviewed numerous other efforts to set environmental flow standards that apply across broad regions and many different rivers.

CASE STUDY REVIEW

The following case studies represent environmental flow policies and management guidelines that are being applied in the USA and Europe to limit flow alteration and to achieve relatively high levels of ecological protection, while allowing for carefully managed water development to proceed. Whereas not all of these cases can be characterized as pure POF approaches, we believe that these case studies illustrate useful and progressive water management policies that fulfill the intent of the SBA. They are described here to demonstrate the feasibility of applying standards in a manner consistent with the SBA and to support our recommendations for the presumptive standard described later in this paper.

Example #1—Southwest Florida Water Management District

Under the Florida state law, the state's five water management districts must determine 'minimum flows and levels' (MFLs) for priority water bodies of the state. Methods to determine MFLs differ among the five districts. The Southwest Florida Water Management District (SWFWMD) uses a POF-based approach that includes use of multiple environmental flow assessment methods, including the Instream Flow Incremental Methodology and the Wetted Perimeter approach (see IFC, 2001 for descriptions of these methods), to inform the setting of percentage alteration limits. The intent of the resulting MFLs is to limit water withdrawals such that physical habitat losses do not exceed 15% (Flannery *et al.*, 2002, 2008). The allowable flow reduction, which is referenced to as previous-day flows at a specified river gauge, can vary with season and with magnitude of flow and includes a 'hands-off' low flow threshold, meaning that all withdrawals are curtailed once the flow threshold is reached (see Rules of the Southwest Florida Water Management District, Chapter 40D-8, Water Levels and Rates of Flow, Section 40D-8.041 Minimum Flows at www.swfwmd.state.fl.us).

These MFLs are used in water management planning and incorporated as water withdrawal permit conditions. The percentage of allowable depletion has been set by SWFWMD for five non-tidal rivers in the district, ranging from 8% to 15% during high flows and 10% to 19% during low flows. Allowable depletions tend to be larger for freshwater flows into estuaries. For example, the lower Alafia River can be depleted up to 19% as it enters its estuary, based on limiting fish habitat loss caused by changes in salinity and dissolved oxygen to no more than 15%. No withdrawals are allowed when flows fall below 120 ft^3/s, based on chlorophyll residence time in the estuary, fish, dissolved oxygen and comb jellyfish. The proposed MFL for the Lower Peace River and its estuary limits withdrawals to flows above 130 ft^3/s, with allowable 16% reduction of daily flow up to a flow rate of 625 ft^3/s, 29% flow reductions in fall/winter and 38% flow reductions in summer above 625 ft^3/s (Flannery *et al.*, 2002, 2008).

Example #2—Michigan's Water Withdrawal Assessment Tool Approach

The Great Lakes–St Lawrence River Water Resources Compact and related state law require limits on water withdrawals to prevent 'adverse resource impact', defined as the point when 'a stream's ability to support characteristic fish populations is functionally impaired'. Zorn *et al.* (2008) documented the work of the Michigan Department of Natural Resources to develop a predictive model of how

DOI: 10.1002/rra

fish assemblages in different types of Michigan streams would change in response to decreased summer base flows, using habitat suitability information for over 40 Michigan fish species. The approach involved classification of all river segments in the state based on size and temperature regime and the development of a fish response curve that relates assemblage richness to an index flow (median August streamflow) for each of the 11 river classes. This index flow serves as a surrogate for withdrawals as a POF.

Across the majority of river types in Michigan, 'baseline or existing' ecological conditions are predicted to be maintained with cumulative withdrawals less than 6–15% of the index flow, depending on the stream type (Seelbach *et al.*, 2009). This is roughly equivalent to maintaining excellent ecological condition for many rivers, but some rivers that have historically been degraded would only be maintained in their current condition (Paul Seelbach, personal communication, University of Michigan, Ann Arbor). Adverse resource impacts are predicted to occur on most types of rivers with withdrawals greater than 17–25% of index flow. Rivers classified as 'transitional' between cold and cool rivers are very sensitive to withdrawals and are limited to withdrawals of 2–4% index flows before adverse resource impact is predicted to occur.

The Michigan Water Withdrawal Assessment Tool (WWAT) allows estimation of the likely impact of a water withdrawal on nearby streams and rivers using these threshold values. Use of the WWAT is required of anyone proposing to make a (large) new or increased withdrawal from the waters of the state, including all groundwater and surface water sources, prior to beginning the withdrawal. The WWAT is online at http://www.miwwat.org/.

Unlike Florida's POF approach, which references allowable depletions to a percentage of the previous day's flow, the Michigan approach references its withdrawal limits only to the August median flow. Because August is typically the lowest flow month in Michigan and Michigan flow regimes are fairly predictable, it is unlikely that cumulative withdrawals beyond the adverse resource impact level would frequently exceed the percentage guideline in other months. However, in very dry summers, one would expect the adverse resource impact percentage to be exceeded for a portion of the summer.

Example #3—UK Application of the European Union Water Framework Directive

The European Union (EU) Water Framework Directive, passed in 2000, was designed to protect and restore aquatic ecosystems by setting common ecological objectives across EU member states. The Water Framework Directive requires member states to achieve a 'Good Ecological Status' in all surface waters and groundwaters that are not determined to already be 'heavily modified'(Acreman *et al.*, 2006). It is assumed that meeting the Good Ecological Status requires protecting or restoring ecologically appropriate hydrological regimes, but the Water Framework Directive itself does not define environmental flow standards for any country in the EU (Acreman and Ferguson, 2010).

In the UK, a Technical Advisory Group worked with conservation agencies and academics to begin defining environmental standards for physio-chemical and hydromorphological conditions necessary to meet different levels of ecological status (Acreman *et al.*, 2006). A key part of this work was defining thresholds of allowable water withdrawal as a percentage of natural flow. To achieve this, a literature review was prepared, and numerous expert workshops were convened. Each river in the UK was assigned to one of 10 classes, based on physical watershed characteristics, to facilitate application of withdrawal thresholds (Acreman and Ferguson, 2010).

Withdrawal standards were based on professional knowledge and discussion of the flow needs of various plant and animal communities—primarily macrophytes, macroinvertebrates and fish. Quantitative standards for achieving Good Ecological Status were specified for four groupings of river types, two seasons and four tiers of withdrawal standards based on annual flow characteristics (Table I). The allowable abstraction values in Table I are intended to be restrictions on cumulative withdrawals, applicable to any point on a river of that type.

The withdrawal standards in Table I were derived from an expert consensus workshop approach by using the precautionary principle to deal with considerable uncertainty. Different tolerances to flow alteration were recognized across taxa groups, but a 10% flow alteration was generally seen by experts as likely to have negligible impact for most taxa, stream types and hydrologic conditions (Acreman and Ferguson, 2010). The workgroup also generally agreed upon a Q95 (i.e. fifth percentile) flow as being 'hands-off', meaning that at that flow withdrawal would either stop or be significantly reduced. The recommended allowable withdrawal levels increase with magnitude of flow and in cooler months. Thus, permissible alterations range from 7.5% to 20% in warm months at lower flows (below Q70) and from 20% to 35% during cooler months at higher flows (Acreman *et al.*, 2006).

Example #4—Maine sustainable water use rule

In 2001, the Maine State Legislature passed a law requiring 'water use standards for maintaining instream flows…lake or pond water levels…protective of aquatic life and other uses…based on the natural variation of flows'. The resulting environmental flow and water level protection rule, finalized in 2007, establishes a set of tiered flow protection criteria

DOI: 10.1002/rra

Table I. Standards for UK river types/subtypes for achieving Good Ecological Status, given as per cent allowable abstraction of natural flow (thresholds are for annual flow statistics)

Type or subtype	Season	Flow >Q60	Flow >Q70	Flow >Q95	Flow <Q95
A1	Apr–Oct	30	25	20	15
	Nov–Mar	35	30	25	20
A2 (downstream), B1, B2, C1, D1	Apr–Oct	25	20	15	10
	Nov–Mar	30	25	20	15
A2 (headwaters)	Apr–Oct	20	15	10	7.5
C2, D2	Nov–Mar	25	20	15	10
Salmonid spawning and nursery areas	Jun–Sep	25	20	15	10
	Oct–May	20	15	Flow >Q80	Flow <Q80

From Acreman and Ferguson (2010).

linked to different stream condition classes (Maine DEP, 2010a). The environmental flow standards may be established by one of two methods: a standard allowable alteration of flow or a site-specific flow assessment. The standard allowable alteration is based on the natural flow regime theory (Poff *et al.*, 1997; Richter *et al.*, 1997) and was informed by considerable scientific research on environmental flow requirements for the eastern USA (e.g. Freeman and Marcinek, 2006).

For all streams falling into the state's best-condition class (class AA), 90% of the total natural flow must be maintained when the flow exceeds the spring or early winter 'aquatic base flow' (Maine DEP, 2010b). This aquatic base flow is defined as the median monthly flow of the central month of each season (Maine DEP, 2006). In other seasons, withdrawals of up to 10% of daily flow can only occur when daily flows exceed 1.1 to 1.5 times the seasonal aquatic baseflow. No flow alteration is allowed in any season when flows are below aquatic base flow levels. In addition, all rivers and streams that flow into class AA waters must meet the POF standard.

Although used only for those waters with the highest ecological condition goals, which make up approximately 6% of state waters, the Maine standard provides a good example of use of a hands-off flow level combined with a POF approach.

Summary of case study findings

The case studies summarized here have much in common (Table II). In each case, standards were developed with a general intent to avoid ecological degradation of riverine ecosystems. The specifics of management goals vary from case study to case study, but common among them is the desire to maintain ecological conditions that are good to excellent or to avoid ecological harm. Each of these efforts to set standards has utilized the best available science for their region, and each has engaged large numbers of scientists familiar with flow–ecology science, using expert-based decision-making processes.

We found the recommendations for flow protection emerging from these expert groups to be quite consistent, typically resulting in a range of allowable cumulative

Table II. Summary of per cent-of-flow environmental flow standards from case studies

Location	Ecological goal	Cumulative allowable depletion	Considerations	Decision process
Florida (SWFWMD)	Avoid significant ecological harm (max. 15% habitat loss)	8–19% of daily flow	Seasonally variable extraction limit; 'hands-off' flow	Scientific peer review of site-specific studies
Michigan	Maintain baseline or existing condition	6–15% of August median flow	Single extraction limit for all flow levels	Stakeholders with scientific support
Maine	Protect class AA: 'outstanding natural resources'	10% of daily flow	Single extraction limit for all flow levels above a 'hands-off' flow level	Expert derived
European Union	Maintain good ecological condition	7.5–20% of daily flow	Lower flow; warmer months; 'hands-off' flow	Expert derived
		20–35% of daily flow	Higher flow; cooler months	

DOI: 10.1002/rra

depletion of 6% to 20% of normal to low flows, but with occasional allowance for greater depletion in seasons or flow levels during which aquatic species are thought to be less sensitive (Table II). These results suggest a consensus that modest alteration of water flows can be allowed with minimal to no harm to aquatic ecosystems and species.

A PROPOSED PRESUMPTIVE STANDARD

Our review of the case studies described above suggests that an appropriate presumptive standard for environmental flow protection can be proposed at this time, subject to some important caveats.

We suggest that a high level of ecological protection will be provided when daily flow alterations are no greater than 10%; a high level of protection means that the natural structure and function of the riverine ecosystem will be maintained with minimal changes. A moderate level of protection is provided when flows are altered by 11–20%; a moderate level of protection means that there may be measurable changes in structure and minimal changes in ecosystem functions. Alterations greater than 20% will likely result in moderate to major changes in natural structure and ecosystem functions, with greater risk associated with greater levels of alteration in daily flows. These thresholds are well supported by our case study review, as well as from our experiences in conducting environmental flow assessments for individual rivers (e.g. Richter *et al.*, 2003, 2006; Esselman and Opperman, 2010). This level of protection is also generally consistent with findings from regional analyses such as the 'benchmarking' study in Queensland, Australia, by Brizga *et al.* (2002) and by a national (US) analysis of hydrologic alteration which documented that biological impairment was observed in some sites with hydrologic alteration of 0–25% (the lowest class of alteration assessed) and in an increasing percentage of sites beyond 25% hydrologic alteration (Carlisle *et al.*, 2010).

This presumptive standard can be represented graphically as shown in Figure 2, using the convention of the SBA (Richter, 2009), with risk bands bracketing the daily natural flow conditions. When a single threshold value or standard is needed, such as for corporate risk screening or water supply planning purposes, we suggest that protecting 80% of daily flows will maintain ecological integrity in most rivers. A higher percentage of flow (90%) may be needed to protect rivers with at-risk species and exceptional biodiversity.

Whereas we believe that such a presumptive standard of limiting daily flow alterations to 20% or less is conservative and precautionary, we also caution that it may be insufficient to fully protect ecological values in certain types of rivers, particularly smaller or intermittent streams. Seasonal adjustments of the per cent of allowable depletion may be advisable. Several of our case studies utilized 'hands-off' flow thresholds to limit impacts to the frequency and duration of low-flow events. This may be an additional consideration where fish passage, water quality or other conditions are impaired by low flows. Also, when applying this presumptive standard to rivers affected by hydropower dams, imposing our suggested limits on daily flow averages may be insufficient to protect ecological integrity because of the propensity for peaking power operations to cause river flows to fluctuate considerably within each day. In such cases, our presumptive standard may need to be applied on an hourly, rather than daily, basis. Adjustments to our suggested values

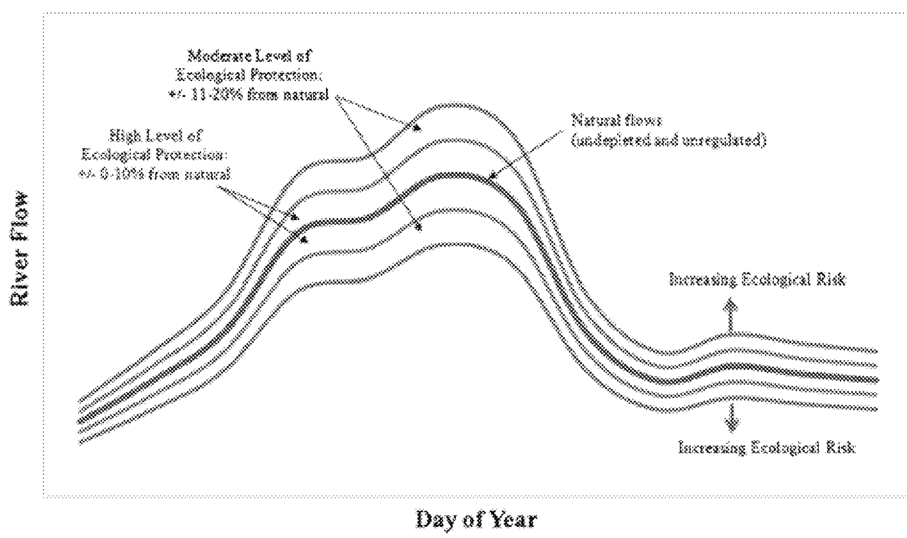

Figure 2. Presumptive standards are suggested for providing moderate to high levels of ecological protection. The greater the departure from natural flow conditions, the greater is the ecological risk to be expected. This figure is available in colour online at wileyonlinelibrary.com/journal/rra.

DOI: 10.1002/rra

should be considered when local or regional ecological knowledge indicates that narrower bands of allowable alteration are needed.

Most importantly, continued investment in detailed, site-specific or regional environmental flow assessment is urgently needed. Such research must continue to inform our understanding of flow–ecology relations and refine our presumptions about the adequacy of protecting different percentages of natural flows.

MANAGEMENT IMPLICATIONS

To properly apply our presumptive standard, water managers and other water stakeholders, such as corporations concerned about the sustainability of water use in particular river basins, will need to be able to do three basic things:

- Develop modelling tool(s) to estimate natural (unregulated and undepleted) flows on a daily basis; this provides the natural or 'baseline' flow data illustrated in Figure 1;
- Use the modelling tool(s) to evaluate whether *proposed* withdrawals, dam operations or other changes—when added to already-existing water uses—would cause the presumptive standard to be violated;
- Monitor daily flows at key locations, such as upstream and downstream of major water withdrawals and return flows, and at points of inflow to reservoirs, as a means for verifying and refining the modelling results and for regulatory enforcement purposes.

The capability to evaluate proposed hydrologic changes (second bullet in the above list) enables water managers to avoid issuing water use permits that would cause hydrologic variations to deviate outside of the sustainability boundaries set by the presumptive standard (±20%). Obviously, if a particular river's flow regime has already been altered more than ±20% during part or all of the time, water managers and stakeholders would need to decide whether to restore flows to a level consistent with the presumptive standard or adopt some other standard.

Application in over-allocated basins

Ongoing efforts to develop sustainable approaches to water management in the Murray-Darling river basin in Australia offer a highly relevant and useful example of re-balancing environmental and economic goals in a previously over-allocated basin. In response to considerable ecological degradation, heavy competition among water users, prolonged drought and climate change projections, the Commonwealth Parliament in 2007 passed a national water act calling for the development of a basin plan that would provide for integrated and sustainable management of water resources (MDBA, 2009). The Basin Plan is required to set enforceable limits on the quantities of surface water and groundwater that can be taken from the basin's water resources. These limits must be set at a level that the Murray-Darling Basin Authority, using the best available scientific knowledge, determines to be environmentally sustainable. This is defined as the level at which water in the basin can be taken from a water source without compromising the key environmental assets, the key ecosystem functions, the productive base or the key environmental outcomes of the water source. Considerable scientific analysis is being undertaken to determine environmental water requirements that will inform the determination of 'sustainable diversion limits'. Recent appropriations of federal funding to enable the buyback of historical entitlements can be used to reduce water usage to levels compatible with these diversion limits (Garrick *et al.*, 2009). The scientific assessment and decision-making being undertaken in the Murray-Darling basin exemplifies a situation in which our presumptive standard would have been violated by past water allocations, yet water managers and stakeholders are now striving to restore a level of ecological health and water use sustainability similar to the goals of our presumptive standard.

Technology requirements

The technology and capacity to manage water in this manner exist in many parts of the world, but we acknowledge that many water management institutions and corporations have not yet developed hydrologic modelling tools with the required level of temporal resolution (i.e. daily) to implement our presumptive standard. Similarly, few countries have been able to install and maintain daily flow monitoring networks with adequate spatial distribution to facilitate data collection and regulation of water uses in the manner we suggest. However, recent and ongoing advances in modelling approaches and technologies, as well as improvements in flow monitoring instrumentation, are driving down the expense of implementing this type of water monitoring and modelling programme. Given growing water scarcity and its economic implications, investment in this level of water management capacity should be given high priority by governments at all levels.

We recognize that many water planners continue to use hydrologic models that operate on a monthly time step. We can offer some guidance and caution. Although it is consistent with our presumptive standard to assume for planning purposes that 20% of the natural monthly mean flow can be allocated for consumptive use, this does not mean that a volume of water equivalent to 20% of the monthly mean can be allocated on a fixed basis without violating our presumptive standard. We illustrate this point

DOI: 10.1002/rra

with a simple hypothetical example. Let us say that the mean monthly flow in July is $100\,m^3/s$. You allocate a sum total of $20\,m^3/s$ (20% of mean) for that month. Our presumptive standard will be violated each day in July that natural daily flows (recorded upstream or modeled) drop below$100\,m^3/s$, which will be the case during the majority of the time for most river types. Therefore, the only way to be assured that our presumptive standard will not be violated given a monthly allocation will be to subsequently model the system at a daily time step to check for compatibility with the standard under the range of flows typically experienced by the river. Once such compatibility is assured, the water authority can confidently grant water use permits based on fixed amounts (i.e. monthly allocations or continuous rates of use) that provide the water user with desirable certainty.

Utility for water planning

Although implementation of our presumptive standard will require considerable investment in adequate technology and expertise as outlined previously in this paper, we want to emphasize that our presumptive standard will also be quite useful for initial water planning purposes that require less technological investment. As discussed in our introduction, many large corporations have become quite concerned about their water-related business risk and are interested in approaches that can help them screen for such risk across many facilities and parts of their supply chains. We suggest that our presumptive standard will be highly appropriate in risk screening, wherein estimates of water availability and use are available for river basins of interest. Our presumptive standard can be used to identify river basins in which water flows appear to have been altered by more than 20%, thereby posing considerable potential risk. In this sense, we are pleased to see the incorporation of a variation of our presumptive standard in the *Water Footprint Assessment Manual* (Hoekstra *et al.*, 2011), which is already being used by many corporations.

Implications for water supply and storage

We recognize that in most hydrologic settings, storage will be required to enable full utilization of up to 20% of the available daily flow for consumptive use. Creating such storage can lead to ecological impacts (such as impediments to fish migrations or blocking sediment transport) that can undo the ecological benefits that our presumptive flow standard is trying to protect. Therefore, we strongly urge water managers and engineers to employ innovative options for water storage—such as off-stream reservoirs or groundwater storage—that do not involve on-stream reservoirs. Alternatively, in systems in which storage reservoirs already exist, enlarging the capacity of those existing facilities will in most cases be far preferable to building new reservoirs.

Some water managers will feel excessively constrained by having to operate within the constraints of the presumptive sustainability boundaries suggested here. However, managing water sustainably necessarily implies living within limits (Richter *et al.*, 2003; Postel and Richter, 2003; Richter, 2009). We suggest that a strong social imperative has emerged that calls for setting those limits at a level that avoids damaging natural systems and the benefits they provide, at least as a default presumption. Where other socio-economic priorities suggest the need for relaxation of the presumptive sustainability boundaries we suggest here, we strongly encourage governments and local communities to invest in thorough assessments of flow–ecology relationships (Richter *et al.*, 2006; Poff *et al.*, 2010), so that decision-making can be informed with scientific assessment of the ecological values that would likely be compromised when lesser degrees of flow protection are adopted.

In our experiences in working with water and dam managers, we have found that a remarkable degree of creativity and innovation emerges when engineers and planners are challenged to meet targeted or forecasted water demands with the least disruption to natural flow patterns. Solving the water equation will require new thinking about how and where to store water, conjunctive use of surface water and groundwater, sizing diversion structures or pumps to enable extraction of more water when more is available during high flows, sizing hydropower turbines such that maximum power can be generated across a fuller range of flows, and other innovations. When such creativity is applied as widespread common practice, human impacts on freshwater ecosystems will most certainly be reduced substantially.

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DOI: 10.1002/rra

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Sites Reservoir Project
Preliminary Project Description
September 2020 (Revised 10/05/2020)

On April 22, 2020, the Sites Project Authority (Authority) directed staff to revise and recirculate a Draft Environmental Impact Report (EIR) consistent with the California Environmental Quality Act (CEQA) to analyze the environmental effects of the facility options identified in the Sites Project Value Planning Report (Value Planning Report), dated April 2020. Since that time, Authority staff and environmental, engineering and modeling consultants have been developing and refining alternatives. In June, staff recommended that the Draft Revised EIR[1]/Supplemental Environmental Impact Statement (EIS)[2] (Revised EIR/Supplemental EIS) evaluate two action alternatives, Alternative 1 and Alternative 2, and provided an initial overview of the two alternatives.

This preliminary project description summarizes the alternatives presented in the preliminary Revised EIR/Supplemental EIS Chapter 2, Alternatives Description, which was completed on August 31, 2020. That preliminary draft Chapter 2 reflects preliminary design efforts, including the preparation of technical memos and preliminary drawings, and coordination between the service providers and staff. Modeling and engineering efforts are ongoing, and additional information related to operations and construction means and methods will likely supplement the preliminary Draft Chapter 2 in the coming weeks.

1.0 Overview of Alternatives

The following table compares facilities and operational considerations under Alternatives 1 and 2. This table is an updated version of a table provided at the June 24 Authority Board meeting (Agenda Item 3.3 Attachment B) and identifies existing as well as new facilities that will be constructed to implement each alternative.

Table 1. Revised Alternatives Summary Table

Facilities/Operations	Alternative 1	Alternative 2
Diversion/Reservoir Infrastructure Details		
Reservoir Size	1.5 million acre feet (MAF)	1.3 MAF
Dams [Scaled to the size of the reservoir]	2 main dams, Golden Gate Dam and Sites Dam 7 saddle dams 2 saddle dikes	2 main dams, Golden Gate and and Sites Dam 6 saddle dams 2 saddle dikes
Spillway	One spillway on Saddle Dam 8b	Similar to Alternative 1
Funks Reservoir and Funks Pumping Generating Plant	Funks Reservoir excavated to original capacity; same footprint as existing Funks Reservoir. New Funks Pump Generating Plant (PGP). New Funks pipeline alignment with 2 pipelines.	Similar to Alternative 1

[1] The Revised EIR/Supplemental EIS will also address the No Project/No Action Alternative.
[2] A Supplemental EIS will be prepared to comply with the National Environmental Policy Act (NEPA).

Table 1. Revised Alternatives Summary Table

Facilities/Operations	Alternative 1	Alternative 2
Terminal Regulating Reservoir (TRR); TRR Pumping Generating Plant; TRR Pipeline	New TRR facilities (TRR and TRR PGP) adjacent to the Glenn Colusa Irrigation District (GCID) Main Canal. New TRR pipeline alignment with 2 pipelines.	Same as Alternative 1
Hydropower	Power generation incidental upon release.	Same as Alternative 1
Diversion(s)	Diversion from Sacramento River into existing Tehama-Colusa Canal at Red Bluff and the existing GCID Main Canal at Hamilton City. Adding 2 pumps in existing bays at the plant at the Red Bluff Pumping Plant.	Same as Alternative 1
Emergency Release Flow	Releases into Funks Creek via Inlet/Outlet Works. Releases into Stone Corral Creek via Sites Dam permanent discharge outlet. Emergency outflow pipeline and structures in Saddle Dams 3, 5 and 8b to release north to Hunters Creek Watershed. Release from spillway on Saddle Dam 8b.	Similar to Alternative 1
Flood Control	Flood damage reduction benefit for local watersheds from reservoir storage.	Same as Alternative 1
Reservoir Management	Reservoir Management Plan and Reservoir Operations Plan.	Same as Alternative 1
Electrical Facilities	Transmission Lines, substations, switchyards; interconnection with Western Area Power Administration or Pacific Gas and Electric.	Same as Alternative 1
Recreation		
Multiple Facilities Consistent with WSIP Application	Two primary areas with infrastructure (with phased construction): 1. Peninsula Hills Area 2. Stone Corral Creek, including boat ramp facilities A second day-use boat ramp w/parking located on the west side of the reservoir and south of the bridge.	Same as Alternative 1
Transportation/Circulation		
Provide Route to West Side of Reservoir	Bridge crossing the reservoir as a result of the relocation of existing Sites Lodoga Road. Relocation of Huffmaster Road with gravel road to residents at the south end of the reservoir terminating at the south end of the reservoir.	No bridge. Relocation of Sites Lodoga Road to include the relocated portion of Huffmaster Road, paved instead of gravel, to residents at south end of the reservoir and continues as a paved roadway to Lodoga.
Mulitple Maintenance and Local Access Roads	Approximately 46 miles of new paved and unpaved roads would provide construction and maintenance	Similar to Alternative 1

Table 1. Revised Alternatives Summary Table

Facilities/Operations	Alternative 1	Alternative 2
	access to the proposed facilities, as well as provide public access to the proposed recreation areas. Approximate number of roads related to the reservoir: 5 local/construction roads 2 construction/maintenance roads 7 local roads 4 maintenance roads Approximate number of access roads related to conveyance facilities: 1 to the TRR 1 to Funks complex Multiple within pipeline easements	
Operations		
Operational Criteria	Option based on Value Planning Report, Table 3.1 Scenario B, anticipated to be modified by future modeling efforts.	Same as Alternative 1
Reclamation Involvement	Two Options: 1. Funding Partner 2. Operational Exchanges a. Within Year Exchanges b. Real-time Exchanges	Same as Alternative 1
State Water Project (SWP) Involvement	Operational Exchanges with Oroville and storage in SWP facilities South-of-Delta.	Same as Alternative 1
Bypass Releases into Funks Creek and Stone Corral Creek	Develop specific bypass criteria to protect downstream water right holders and ecological function.	Same as Alternative 1
Conveyance Dunnigan Release	Release 1,000 cubic feet per second (cfs) into new pipeline to Colusa Basin Drain to meet member participant demands and Proposition 1 needs.	Release into new pipeline to Sacramento River to meet member participant demands. Partial release into the Colusa Basin Drain to fulfill the Proposition 1 needs.

2.0 Facilities

The project will utilize both existing and proposed new facilities, all of which will be located within northern California in Glenn, Colusa, Tehama and Yolo Counties (see Figures 1 and 2 at the end of this document). As summarized in the Table 1 above, most facilities are the same or similar under Alternatives 1 and 2 although features may differ in scale or location due to the size of the reservoir. Facilities that have substantial differences between alternatives, such as the proposed dams, Dunnigan Pipeline and the Sites Lodoga Road realignment/relocation, are described in more detail below.

2.1 Existing Facilities

The project will utilize certain existing water supply infrastructure, including:

- Existing Bureau of Reclamation infrastructure operated by the Tehama-Colusa Canal Authority (TCCA):

  - Red Bluff Pumping Plant
  - Tehama-Colusa Canal
  - Funks Reservoir located approximately 65 miles south of the Red Bluff Pumping Plant
- Existing GCID Hamilton City Diversion and the GCID Main Canal
- Colusa Basin Drain (CBD)

Both action alternatives would require pumping capacity that exceeds the existing total installed capacity of 2,000 cfs of the Red Bluff Pumping Plant to convey flow to Funks Reservoir and ultimately Sites Reservoir. Both action alternatives would require installation of two additional 250-cfs vertical axial-flow pumps into existing concrete pump bays at the pumping plant.

Both action alternatives would also require a new 3,000-cfs GCID Main Canal headgate structure about 0.25 mile downstream of Hamilton City Pump Station. The existing headgate structure would be inadequate for proposed winter operation during high river flows. To streamline maintenance during the winter shutdown period (i.e., reduce it from the current shutdown window of 6 weeks to 2 weeks), smaller improvements would be required to integrate Sites Reservoir into the GCID system.

Use of the existing Funks Reservoir would require excavation of sediment to return it to its original capacity. The bottom of Funks Reservoir would be reshaped to allow large, unimpeded flows to and from the new Funks PGP.

Proposed access during construction will avoid the town of Maxwell, utilizing Glenn County Roads 68 and 69, and Colusa County McDermott, Maxwell Sites and Sites Lodoga Roads. Several of these existing roads would require improvement to support construction activities. Other local roads would need to be relocated or developed to accommodate access due to the construction of reservoir facilities. These include portions of Sites Lodoga Road, Huffmaster Road, and Communication Road.

2.2 Proposed Conveyance Facilities

Implementation of either Alternative 1 or 2 would require various facilities to control the conveyance of water between Sites Reservoir and the Tehama-Colusa Canal and GCID Main Canal. These facilities would include regulating reservoirs, pipelines, PGPs, electrical substations, and administration and maintenance buildings.

The two regulating reservoirs would be the existing Funks Reservoir and the new Terminal Regulating Reservoir (TRR). Both regulating reservoirs would have two 12-foot-diameter pipelines extending to and from Sites Reservoir just below Golden Gate Dam. At each regulating reservoir, the pipelines would be connected to a pumping generating plant that pumps water from the regulating reservoir to Sites Reservoir, as well as turbines that would generate power when flows were released from Sites Reservoir. There would also be energy dissipation equipment adjacent to each PGP (e.g., fixed cone valve[s]) to throttle the flow of water into each regulating reservoir when the turbines are not being used.

A transition manifold would be constructed at the base of Golden Gate Dam to connect pipelines from Sites Reservoir to Funks Reservoir and the TRR pipelines. In addition, a point of interconnection to a high-voltage electric transmission line would be required to power the facilities at the proposed TRR and Funks electrical substations.

Water released from Sites Reservoir would be conveyed south of Sites Reservoir using the existing Tehama-Colusa Canal and a new Dunnigan pipeline. T. Under Alternative 1, the water would subsequently be conveyed to the CBD and released through the proposed CBD Outlet Structure, eventually reaching the Sacramento River at Knights Landing or flow to the Yolo Bypass/Cache Slough complex through the Knights Landing Ridge Cut. Under Alternative 2 water would flow south to the end of the Tehama-Colusa Canal but would be diverted into an extended Dunnigan Pipeline, with release directly to the Sacramento River with some flows released to the CBD to (a) flow into the Yolo Bypass/Cache Slough complex through the Knights Landing Ridge Cut for environmental benefits under Proposition 1, and (b) flow into the Sacramento River for delivery to participants.

2.3 Proposed Reservoir Facilities

Under either alternative, water would be impounded by the Golden Gate Dam on Funks Creek and the Sites Dam on Stone Corral Creek; a series of saddle dams along the eastern and northern rims of reservoir would close off topographic saddles in the surrounding ridges to form Sites Reservoir. Two saddle dikes are also needed at topographic saddle low points along the northern end of the reservoir. These components of the reservoir would be scaled according to the alternative.

Under Alternative 1, the proposed 1.5-MAF reservoir would have a Normal Maximum Water Surface (NMWS) elevation of 498 feet. Under Alternative 2, the proposed 1.3-MAF reservoir would have an NMWS elevation of 482 feet. Nominal crest would be at elevation 517 feet for all dams for 1.5-MAF capacity, and at elevation 500 feet for 1.3-MAF capacity. Table 2 presents a summary of dam heights required to impound Sites Reservoir for the 1.5-MAF capacity and 1.3-MAF capacity.

Table 2. Dam Heights for 1.5-MAF and 1.3-MAF Sites Reservoir Alternatives

Dam/Dike	1.5-MAF Reservoir Maximum Height Above Streambed (feet)	1.3-MAF Reservoir Maximum Height Above Streambed (feet)
Golden Gate Dam	287	270
Sites Dam	267	250
Saddle Dam 1	27	No Saddle Dam
Saddle Dam 2	57	40
Saddle Dam 3	107	90
Saddle Dam 5	77	60
Saddle Dam 6	47	No Saddle Dam
Saddle Dam 8A	82	65
Saddle Dam 8B	37	5
Saddle Dike 1	12	10 (near Saddle Dam 1)
Saddle Dike 2	12	10 (near Saddle Dam 6)
Saddle Dam 10 [a]	Not required for 1.5-MAF Reservoir	30

[a] For the1.3-MAF Reservoir, Golden Gate Dam would be reconfigured and Saddle Dam 10 added to close off a topographic saddle in the ridge that is closed in the 1.5-MAF Golden Gate Dam configuration.

The engineering team is continuing to evaluate different options for dam fill that would be utilized under either Alternative 1 or Alternative 2. One option is an earth- and rockfill dam and another option is an earthfill dam. The proposed inlet/outlet works for an earthfill dam would be located to the south of Golden Gate Dam and would be used both to fill the reservoir through conveyance facilities located to the East and to make releases from Sites Reservoir. The inlet/outlet works include:

1. A multi-level intake tower including a low-level intake.
2. Two 23 foot inside diameter inlet/outlet tunnels through the ridge on the right (north) abutment of Golden Gate Dam.

2.4 Proposed Recreational Facilities

As specified in the Sites Water Storage Investment Program application, either alternative would include two primary recreation areas and a day-use boat ramp which are to be phased in over a period of time. Located on the northwest shore of the proposed Sites Reservoir, to the north of the existing Sites Lodoga Road, the Peninsula Hills Recreation Area would include approximately:

- 200 campsites (car and recreational vehicle)
- one group camp area
- 10 picnic sites (with parking at each site)
- hiking trails
- electricity
- potable water
- one kiosk
- 19 vault toilets

Located on the eastern shore of the Sites Reservoir, north of the existing Maxwell Sites Road and proposed Sites Dam, the Stone Corral Creek Recreational Area would include:

- 50 campsites (car and recreational vehicle)
- electricity

- 10 picnic sites (with parking at each site)
- six-lane boat launch site
- hiking trails
- potable water
- one kiosk
- 10 vault toilets

Each alternative would also include a Day-Use Boat Ramp/Parking Recreation Area, located on the western side of the reservoir where the existing Sites Lodoga Road intersects with the proposed inundation area for the reservoir. This second boat launch provides for emergency water access on both sides of the reservoir. Facilities would include:

- one kiosk
- one vault toilet
- potable water
- parking area

2.5 Proposed Roads and South Bridge

In addition to modifying existing roads for construction access, the project will require up to 46 miles of new paved and unpaved roads to provide construction and maintenance access to the proposed facilities, as well as public access to the proposed recreation areas. Sites Lodoga Road provides access to and from the town of Maxwell, which is adjacent to Interstate 5. Sites Lodoga Road becomes Maxwell Sites Road east of the rural community of Sites that is within the inundation area. The reservoir would eliminate east-west access to Interstate 5 (east of the reservoir) from the rural communities of Stonyford and Lodoga (west of the reservoir) because it would inundate the current route of Sites Lodoga Road. The current Sites Lodoga Road is an east-west, two-lane rural collector road and provides an emergency and evacuation route to and from these rural communities. Because construction of the Sites Dam would eliminate access on the Sites Lodoga Road, this collector road would need to be relocated/realigned prior to project construction.

Under Alternative 1, the realigned Sites Lodoga Road would include the construction of a bridge across the reservoir. Various bridge types and options have been evaluated. One option for a bridge is a full-length bridge that would offer navigational passage along the entire width of the reservoir. Another option for a bridge is a causeway with partial fill, which would limit the navigational passage within the reaches of the shorter bridges; however, the approach to implementing fill prism in the reservoir would significantly reduce construction cost. Alternative 1 would also include the realignment of a portion of the existing Huffmaster Road to provide access to properties otherwise inaccessible due to reservoir construction.

Under Alternative 2, the realignment of Sites Lodoga Road would result in a road that ultimately extends from Maxwell to the community of Lodoga around the southern end and western side of the proposed Sites Reservoir. This road, referred to as the Maxwell Lodoga Road, would include the same realigned portion the existing Huffmaster Road. However, the realigned Sites Lodoga Road, including that portion of Huffmaster Road would be paved in its entirety.

2.6 Project Buffer

The proposed project buffer would consist of the total amount of land that would be acquired beyond the facility footprints for each alternative. The preliminary approach to the buffer is outlined below.

- The buffer would include 100 feet around all buildings and most ground facilities (e.g., substations, any aboveground pipelines) along with 100 feet around the Sites Reservoir Complex and recreation areas.
- The buffer may be less than 100 feet if the facility is near a property boundary and the proposed uses do not conflict with the adjacent land uses.
- No project buffers are anticipated for underground or buried facilities (i.e., Dunnigan Pipeline), overhead power lines, or roads (both public and project maintenance access roads).
- The Authority would evaluate the need for the buffer (and if implemented, an appropriate width) on a case-by-case basis in coordination with adjacent landowners. The buffer would likely be acquired in fee title by the Authority; however, acquisition of buffer areas in an easement may be feasible under certain circumstances.
- The lands within the buffer would generally remain undeveloped. Limited features may be installed to reduce future maintenance activities and fire hazards. These features may include limited fencing, regrading to construct fire breaks or fire trails, or similar actions.
- The lands within the buffer would be maintained by the Authority. Maintenance activities that are proposed to be undertaken within the project buffer include vegetation maintenance and periodic fire break maintenance. Such activities may include grazing, periodic tilling or disking, and performing limited controlled/prescribed burns. Where appropriate, the buffer may be managed as wildlife habitat. Fence maintenance would occur within the buffer.

3.0 Operations

The operation of the project under each alternative will be defined in upcoming months as the modeling and development of diversion criteria are further advanced. The member participants of the Authority have a collective demand of approximately 240,000 acre-feet per year on average, of which 192,892 acre-feet is needed by participating public water agencies[3]. Reclamation is also a participant through funding and/or operational exchanges with Shasta Lake. The State would also be involved through operational exchanges with Oroville Reservoir and storage in State Water Project facilities south-of-Delta.

Sites Reservoir would be filled by diverting unregulated/unappropriated flow in the Sacramento River. This water originates during winter storm events, which increase flows in the tributaries to the Sacramento River below Keswick Dam and avoiding any effects on the Trinity River. Water would be available for diversion after senior water rights are met, in-river aquatic species protection requirements are met, and delta water quality

[3] April 2020 Sites Project Value Planning Alternatives Appraisal Report.

requirements have been met. Diversions would occur at the fish screened Red Bluff Pumping Plant and the fish screened GCID Hamilton City location when applicable regulatory requirements are met and existing pumping and conveyance capacity is available to convey water through the canals to the reservoir. TRR and Funks Reservoir, PGPs, and pipelines connect directly to the inlet/outlet works and would be operated in parallel to pump water into and out of Sites Reservoir. Water would enter (and be released from) the reservoir through the inlet/outlet works.

Reservoir releases include releases to meet participant demands and to deliver water for a range of environmental benefits that will be finalized during project development and permitting.

- Sites Reservoir would be operated in cooperation with Central Valley Project (CVP) and SWP operations to coordinate with releases made with the CVP and SWP from Shasta Lake, Lake Oroville, and Folsom Lake. Sites Reservoir releases could supplement and/or allow reduced releases from other reservoirs while maintaining minimum instream flow objectives, Sacramento River temperature requirements, and Delta salinity control requirements assigned to CVP and SWP.
- Releases would be made mostly in dry and critical water years. Water users north of the Delta would mostly receive deliveries from the TCCA canal and GCID canal. Participants in the State Water Project service area would receive water through the North Bay Aqueduct and the California Aqueduct.
- Using the CBD for conveyance of Sites Reservoir water would include coordination with the local landowners regarding the project operation and timing of the additional flows.

Releases would also be made to Funks and Stone Corral Creeks for downstream water right holders and to maintain ecological function in the sections of these creeks affected by the project. A proposed Reservoir Operations Plan would describe the management of water operations, including releases to Funks and Stone Corral Creeks.

Operation of either alternative would require power to run facilities and pump water. The identification of a power source and the location of transmission facilities is pending coordination with Western Area Power Administration and/or Pacific Gas and Electric. Each of the alternatives would also generate incidental power when water is released from Sites Reservoir at the Funks PGP and TRR PGP. The capacity of the project power generation facilities is anticipated to be below the threshold such that no license would be required from the Federal Energy Regulatory Commission and the facilities would satisfy the criteria for a "Qualifying Conduit Hydropower Facility" under the Hydropower Regulatory Efficiency Act of 2013, as amended by America's Water Infrastructure Act of 2018.

4.0 Maintenance and Management

Under either alternative, maintenance activities for the project facilities would include debris removal, dredging, vegetation control, rodent control, erosion control and protection, routine inspections (dams, tunnels, pipelines, PGPs, inlet/outlet works, fencing, signs, and gates), painting, cleaning, repairs, and other routine tasks to maintain facilities in accordance with design standards after construction and commissioning. Routine visual inspection of the facilities would be conducted to monitor performance and prevent mechanical and structural failures of project elements. Maintenance activities associated with proposed river intakes could include cleaning, removal of sediment, debris, and biofouling materials. These maintenance actions could require dewatering; suction dredging or mechanical excavation around intake structures; or the use of underwater diving crews, boom trucks, rubber-wheel cranes, and raft- or barge-mounted equipment. Proposed maintenance activities could occur on a daily, annually, periodically (as needed), and long-term basis.

The Authority would also develop and implement a Reservoir Management Plan to define the land uses of project lands controlled by the Authority, fish stocking and vector control practices, and the resources associated with project lands. The Reservoir Management Plan (or Plans) would include the following types of information:

- **Fisheries Management.** This would target species composition for Sites Reservoir, including stocking strategies, habitat enhancement measures, and monitoring efforts.
- **Land Use Management and Recreation.** This would outline how decisions regarding future amenities would be made and what land use considerations would be factored into Authority operations and activities.
- **Easement Management:** Right-of-ways and/or permanent easements would be required for long-term operation and maintenance of all the large-diameter pipelines. This would outline management and maintenance activities for easement areas.
- **Emergency Management.** This would establish protocol on how the Authority would be involved in controlling and resolving emergency situations, including those arising as a result of recreationists (e.g., injury).
- **Vector Management.** This would establish protocols and practices for communicating and coordinating with vector control authorities in determining how vector control would be managed at the project facilities.
- **Sediment Management and Removal.** This would consolidate information on the frequency and locations of dredging, testing of sediment before disposal, disposal locations, and procedures to follow if sediment contaminant levels exceed regulatory standards for constituents of concern (e.g., pesticides).

5.0 Best Management Practices

A number of Best Management Practices and environmental commitments are proposed to be included in Project design, construction and operation/maintenance. The following proposed list of Best Management Practices and environmental commitments would be considered part of the Project.

- Conform with Applicable Design Standards and Building Codes
- Perform Geotechnical Evaluations and Prepare Geotechnical Data Reports
- Utility and Infrastructure Verification and/or Relocation

- Natural Gas Well Decommissioning
- Water Wells Decommissioning
- Road Abandonment
- Environmental Site Assessment(s)
- Salvage, Stockpile, and Replace Topsoil and Prepare a Topsoil Storage and Handling Plan
- Stormwater Pollution Prevention Plan(s) and Best Management Practices (storm water and non-storm water)
- Stormwater Pollution Prevention Plan for Operation and Maintenance
- Spill Prevention and Hazardous Materials Management / Accidental Spill Prevention, Containment, and Countermeasure Plans and Response Measures
- Minimize Soil Disturbance
- Comply with Requirements of RWQCB Order 5-00-175
- Groundwater/ Dewatering Water Supply
- Construction Equipment, Truck, and Traffic Management Plan
- Visual/Aesthetic Design, Construction, and Operation Practices
- Fire Safety and Suppression / Fire Prevention and Control Plan
- Worker Health and Safety Plan
- Blasting Standard Requirements
- Mosquito and Vector Control During Construction
- Construction Noise Management
- Operation and Maintenance Noise Management
- Construction Emergency Action Plan
- Emergency Action Plan for Reservoir Operations
- Electrical Power Guidelines and EMF Field Management Plan
- Construction Equipment Exhaust Reduction Plan
- Fugitive Dust Control Plans
- Construction Best Management Practices to Reduce Greenhouse Gas Emissions
- Hazardous Materials Management Plans
- Construction Site Security
- Notification of Maintenance Activities in Waterways
- Worker Environmental Awareness Program
- Fish Rescue and Salvage Plans for Funks Reservoir, Stone Corral Creek, and Funks Creek for Alternative 1; for Sacramento River for Alternative 2 if coffer dam required during construction
- Construction Best Management Practices and Monitoring for Fish, Wildlife, and Plant Species Habitats, and Natural Communities
- Control of Invasive Plant Species during Construction and Operation

6.0 Pre-Construction Activities

In addition to items/activities addressed in the above list of proposed BMPs and ECs, there are other activities that would be required prior to the initiation of construction of the different physical components of either Alternative 1 or Alternative 2. These activities include: finalizing criteria and standards used for final design, including emergency management/release requirements; preparing a Dam Monitoring Program; conducting additional geotechnical and related field investigations to support design;

relocation of two private cemeteries (Sites Cemetery and a Rancheria Cemetery); and the development and implementation of a Resident Relocation Program.

7.0 Timing of Environmental Review and Feasibility Report

The current schedule contemplates release of the Revised EIR/Supplemental EIS in July 2021. This is roughly the same timing for the engineering team's finalization of the Feasibility Report for the California Water Commission. As such, preparation of the Revised EIR/Supplemental EIS and Feasibility Report are proceeding simultaneously. To accommodate the project schedule and the simultaneous preparation of the Revised EIR/Supplemental EIS and Feasibility Report, the following project components will be utilized for the analysis:

- Sites Lodoga Road and Bridge – Under Alternative 1, the Revised EIR/Supplemental EIS will include the option of the shorter bridge with fill prisms, including the cast-in-place prestressed concrete box girder bridge type. This option was identified as a lowest cost bridge alternative in the Value Planning Report while meeting the functional requirements for efficient traffic flow.
- Dam Fill Materials – Under Alternative 1 and 2, the Revised EIR/Supplemental EIS will include the option of using earth and rockfill. This option is anticipated to be preferred by the Division of Safety of Dams and will assist in meeting the schedule and affordability goals; it also provides maximum coverage for potential environmental effects as the rockfill involves blasting associated with rock quarrying.
- Terminal Regulating Reservoir (TRR) – Under Alternative 1 and 2, it is anticipated that the Revised EIR/Supplemental EIS will include the current TRR location. Other locations currently are under review due to the extent and costs associated with ground preparation needed for construction at the current site.
- GCID and Colusa Basin Drain Facility Improvements – Under Alternative 1 and 2, the Revised EIR/Supplemental EIS will describe the types of improvements needed to convey water through existing facilities and reduce GCID's current maintenance winter shutdown period from 6 weeks to 2 weeks, pending agreement between GCID and the Authority on any specific improvements that may be warranted due to implementation of the project. Improvements may also be needed to the Colusa Basin Drain to convey Sites water.
- Emergency Releases – In the rare and unanticipated condition that the Sites Reservoir has to conduct emergency releases, these releases are currently planned to be made into Funks Creek via the Inlet/Outlet Works, into Stone Corral Creek via Sites Dam permanent discharge outlet, and into the Hunters Creek watershed via Saddle Dam 3, 5, and 8b. Emergency release locations and the extent of potential impacts will be evaluated in further detail as part of the on-going feasibility study.
- Dunnigan Release – Under Alternative 1, the Revised EIR/Supplemental EIS will evaluate a release to the CBD based on a preliminary hydraulic analysis. Alternatives 2 will carry forward an extension of the Dunnigan pipeline to the Sacramento River.

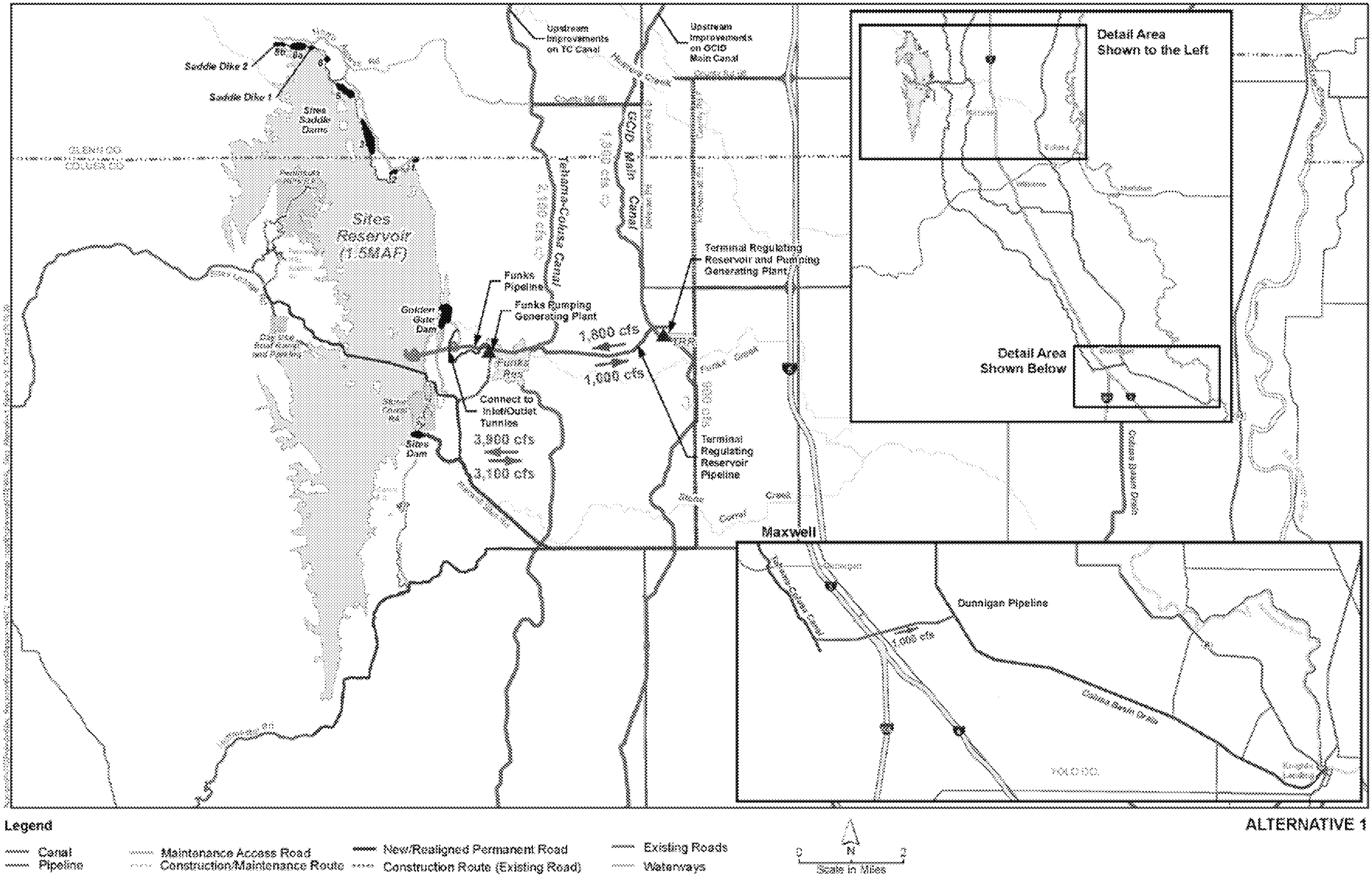
- Hydropower Generation – Under Alternative 1 and 2, the Revised EIR/Supplemental EIS will evaluate incidental in-line conduit hydropower generation below the threshold for a Federal Energy Regulatory Commission license.
- Temporary Water Supply for Construction – Under Alternative 1 and 2, the Revised EIR/Supplemental EIS will evaluate options for obtaining temporary water supply for construction, such as obtaining water on site via existing groundwater or surface water facilities and/or utilizing existing or drilling new wells, including any necessary treatment depending on the water quality.

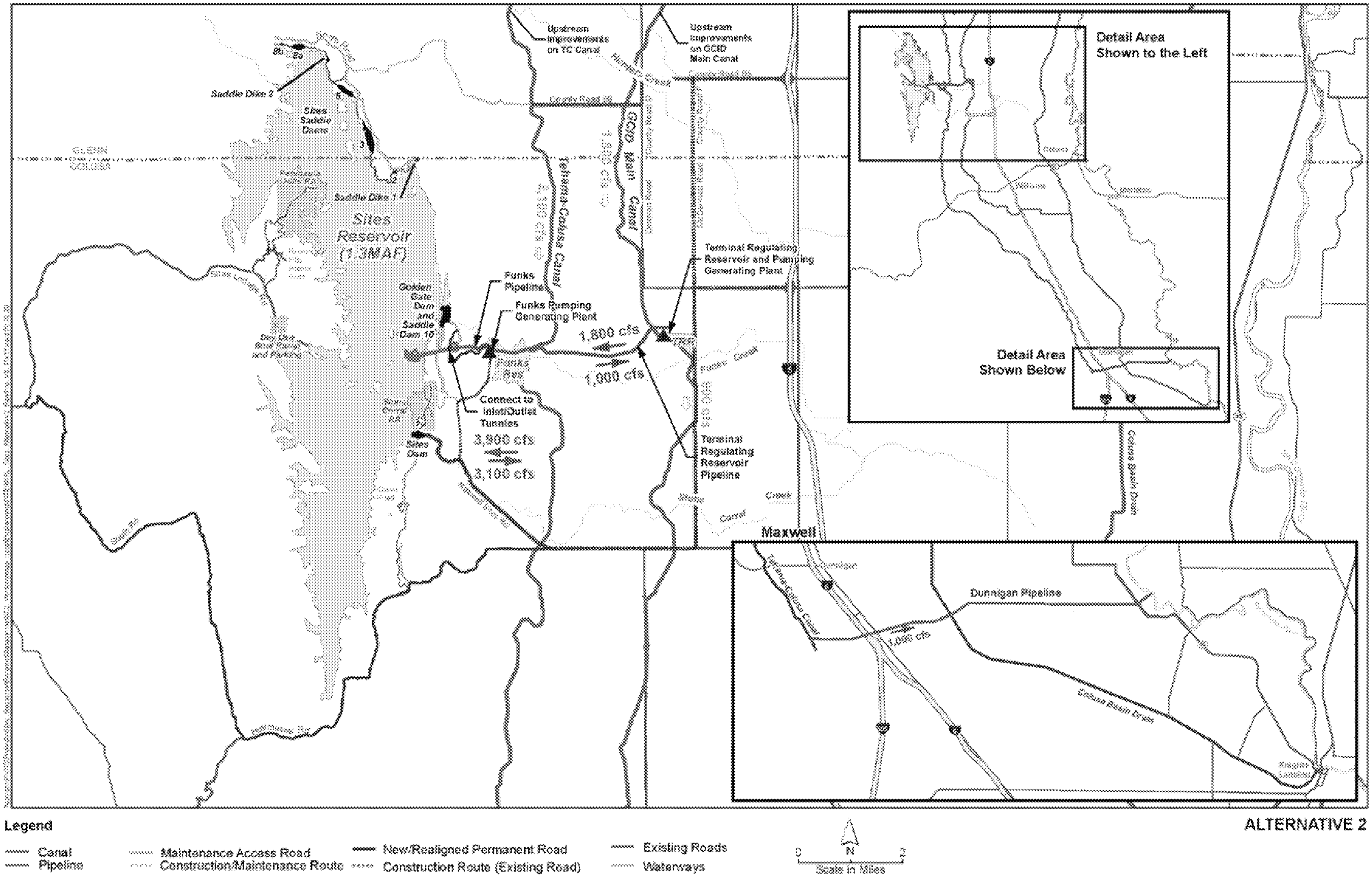
The engineering team will continue to consider and analyze options for various facility components, consistent with CEQA and NEPA requirements, in order to optimize design considerations and reduce costs.

It should also be noted that in the upcoming weeks, there will be further definition of project operations through modeling, clarification of water rights, and consultation with resource agencies. This information and any resulting changes to the alternatives described in the preliminary draft will be incorporated into the complete Chapter 2, Alternatives Description, to be completed by December 2020.

8.0 Identification of the Preferred Alternative for the Revised EIR/Supplemental EIS Analysis

The CEQA Guidelines require that an EIR analyze a reasonable range of alternatives to the project which would feasibly attain most of the basic objectives of the project and avoid or substantially lessen the significant effects of the project. An EIR also needs to identify a proposed project, i.e., a preferred alternative. At this time, Authority staff is recommending the designation of Alternative 1 as the Authority's proposed project based on it meeting the objectives identified in the Value Planning Report and being most closely aligned with Alternative VP-7, and its ability to meet the revised draft CEQA project objectives. The Revised EIR/Supplemental EIS will also evaluate Alternative 2 and the No Project/No Action Alternative.


Sites Reservoir (1.5MAF)
Saddle Dike 2
Saddle Dike 1
Sites Saddle Dams
Golden Gate Dam
Sites Dam
Funks Pipeline
Funks Pumping Generating Plant
Connect to Inlet/Outlet Tunnles
3,900 cfs
3,100 cfs
1,800 cfs
1,000 cfs
Upstream Improvements on TC Canal
Upstream Improvements on GCID Main Canal
GCID Main Canal
Tehama-Colusa Canal
Terminal Regulating Reservoir and Pumping Generating Plant
Terminal Regulating Reservoir Pipeline
Maxwell
Detail Area Shown to the Left
Detail Area Shown Below
Dunnigan Pipeline
Legend
Canal
Pipeline
Maintenance Access Road
Construction/Maintenance Route
New/Realigned Permanent Road
Construction Route (Existing Road)
Existing Roads
Waterways
Scale in Miles
ALTERNATIVE 1


Upstream Improvements on TC Canal
Upstream Improvements on GCID Main Canal
Detail Area Shown to the Left
Saddle Dike 2
Sites Saddle Dams
GLENN
COLUSA
Saddle Dike 1
Sites Reservoir (1.3MAF)
GCID Main Canal
Tehama-Colusa Canal
Funks Pipeline
Funks Pumping Generating Plant
Golden Gate Dam and Saddle Dam 10
Terminal Regulating Reservoir and Pumping Generating Plant
1,800 cfs
1,000 cfs
Funks Res
Connect to Inlet/Outlet Tunnels
3,900 cfs
3,100 cfs
Sites Dam
Terminal Regulating Reservoir Pipeline
Maxwell
Detail Area Shown Below
Dunnigan Pipeline
Colusa Basin Drain
Legend
Canal
Pipeline
Maintenance Access Road
Construction/Maintenance Route
New/Realigned Permanent Road
Construction Route (Existing Road)
Existing Roads
Waterways
N
Scale in Miles
ALTERNATIVE 2

From: Briard, Monique [Monique.Briard@icf.com]
Sent: 11/6/2020 9:25:51 AM
To: John Spranza [John.Spranza@hdrinc.com]; Lecky, Jim [Jim.Lecky@icf.com]; Alicia Forsythe [aforsythe@sitesproject.org]
Subject: RE: Sites 5737 follow up

Thanks, John, for keeping us updated. Juan's leadership and collaborative style is already setting us up on a successful path on so many fronts for this project.

Happy Friday!
Monique

From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Friday, November 6, 2020 8:36 AM
To: Lecky, Jim <Jim.Lecky@icf.com>; Briard, Monique <Monique.Briard@icf.com>; aforsythe (aforsythe@sitesproject.org) <aforsythe@sitesproject.org>
Subject: FW: Sites 5737 follow up

Looks like 10 days and we will get something back.

John Spranza

D 916.679.8858 M 818.640.2487

From: Torres, Juan@Wildlife [mailto:Juan.Torres@wildlife.ca.gov]
Sent: Friday, November 6, 2020 8:33 AM
To: Spranza, John <John.Spranza@hdrinc.com>
Subject: RE: Sites 5737 follow up

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.

Thank you John it was a good meeting and you provided us with really good info. I think we should have some comments and/or suggestion by the end of next week or beginning of the following now that we have help from HQ and we identified some of the key players. I forwarded your email to Robert Sherrick and Zach Kearns since they are part of the team.

Have a good weekend.

Juan

From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Friday, November 6, 2020 8:26 AM
To: Boyd, Ian@Wildlife <Ian.Boyd@Wildlife.ca.gov>; Davis-Fadtke, Kristal@Wildlife <Kristal.Davis-Fadtke@wildlife.ca.gov>; Hassrick, Jason (Jason.Hassrick@icf.com) <Jason.Hassrick@icf.com>; Torres, Juan@Wildlife <Juan.Torres@wildlife.ca.gov>; Jim Lecky (jim.Lecky@icf.com) <jim.Lecky@icf.com>; Hendrick, Mike (Mike.Hendrick@icf.com) <Mike.Hendrick@icf.com>; Monique Briard (monique.briard@icf.com) <monique.briard@icf.com>; aforsythe (aforsythe@sitesproject.org) <aforsythe@sitesproject.org>; Huneycutt, Andrew@Wildlife <Andrew.Huneycutt@Wildlife.ca.gov>; Seapy, Briana@Wildlife <Briana.Seapy@Wildlife.ca.gov>;

Anwar, Mohammed(Shahid)@Wildlife <Mohammed.Anwar@Wildlife.ca.gov>
Subject: Sites 5737 follow up

Warning: This email originated from outside of CDFW and should be treated with extra caution.

Good Morning,

Attached are the CDFG NODOS report on fish surveys, the Richter et al. paper, and an excel file with daily mean flows and annual peak flows taken from the USGS web site for the Stone Corral Creek gage. A link to the USGS web site for the Stone Corral Creek gauge is below.

https://nwis.waterdata.usgs.gov/ca/nwis/dv/?site_no=11390672&agency_cd=USGS&referred_module=sw

Also included are a project description summary and an excerpt from the draft feasibility study that briefly discusses the facilities for providing water back into each creek. As you can see we are at a conceptual design level for these, and hope to use our meetings to firm up the releases and flow regime. I am looking for some graphics for each dam and will send those when I find them.

Sites Dam Environmental Water Outlet (Sites Dam = Stone Corral, Golden Gate Dam = Funks Creek)
Environmental water releases at Sites Dam to Stone Corral Creek would be made through facilities incorporated into the construction diversion tunnel on the left abutment of the dam. The permanent outlet at Sites Dam would be designed to release creek flows to meet environmental mitigation requirements from regulating agencies. For feasibility design, a maximum release rate of 200 cfs is assumed.

Golden Gate Dam Environmental Water Outlet
Environmental water releases would begin at the Inlet/Outlet (I/O) tunnel manifold and then travels about 2,800 feet north to the Funks Creek discharge point.

Please let me know if you have any questions or would like additional information.

John Spranza, MS, CCN
Senior Ecologist / Regulatory Specialist

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john.spranza@hdrinc.com

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hdrinc.com/follow-us

From: Herrin, Jeff [jeff.herrin@aecom.com]
Sent: 11/6/2020 11:09:40 AM
To: Heydinger, Erin [erin.heydinger@hdrinc.com]; Alicia Forsythe [aforsythe@sitesproject.org]; Spranza, John [John.Spranza@hdrinc.com]; Jerry Brown [jbrown@sitesproject.org]; Luu, Henry [Henry.Luu@hdrinc.com]; Leaf, Rob/SAC [Rob.Leaf@jacobs.com]; Joe Trapasso [jtrapasso@sitesproject.org]
CC: Carlson, Nik [nik.carlson@aecom.com]; Boling, Robert M. [Robert.Boling@hdrinc.com]
Subject: Slides and Updated Table: Sites WSIP/Prop 1 Benefits
Attachments: Benefits Discussion_110620.pptx; Benefit Considerations R1.docx

Sites Reservoir
Benefits Status

Sites

WSIP Benefits Determination Process

Public review process including public comment on the proposed benefits

- **February 1** –Authority receives comments.
- **February 23** – The Authority appeal is due at 5 PM.
- **April 20** – The Commission response to appeals.
- **May 1-3** – The Public Benefit Ratio finalized in a Commission meeting.
- **May 25** – Component scores posted for all scoring categories.
- **June 27-29** – Component scores finalized in Commission meeting.
- **July 24-27** – The maximum eligibility determination will be finalized in a Commission meeting.

The process for modifying a benefit is not specified

Sites

Public Benefit Determinations

	Applicant Original Estimates	Staff Adjustments	Applicant Appeal	Staff Estimates after Appeal	Draft Capital Cost Allocation	May Staff Estimates	Final Capital Cost Allocation
Ecosystem Benefits					$691.5		$766.4
Andramous Fish	$1,637.1	$0.0	$1,616.4	$0.0		$0.0	
Refuge Water Supply	$675.4	$420.8	$448.1	$432.3		$432.9	
Oroville Coldwater Pool	$595.3	$0.0	$597.4	$0.0		$0.0	
Yolo Bypass Flows	$268.5	$0.0	$259.2	$259.2		$333.5	
Water Quality Benefits							
Flood Benefits	$138.3	$44.6	$44.6	$44.6	$44.6	$44.6	$44.6
Emergency Response Benefits							
Recreation Benefits	$191.6	$197.2	$197.2	$197.2	$197.2	$197.2	$197.2
Total Public Benefits	$3,506.2	$662.6	$3,162.9	$933.3		$1,008.3	

Sites

Anadromous Fish Benefits

- Initial analysis with SALMOD (not a lifecycle model)
- Subsequent analysis with OBAN (not reviewed)

"The quantification of net benefits provided in the appeal analysis does not account for the cumulative reduction in survival in sections of the river upstream and downstream of the Delevan intake. Therefore, this flow survival analysis does not evaluate the benefits to one life stage and the impacts to other life stages. Thus, the Department is unable to make a determination regarding the claimed net benefit to all runs of Chinook salmon."

CDFW, April 9, 2018

Sites

Oroville Benefits

- No lifecycle model to establish benefits
- Note warmer conditions in the Feather River – may lose anadromous fish due to climate change

Sites

Flood Benefits

- Benefit reduced based on depth of flooding (5 ft versus 2 feet)
- Possible loss of events with shorter return periods in DWR calculation with FRAM (e.g., 20-year events)
- Key parameters
  - Flood inundation map
  - Crop mix
  - Affected structures

Sites

Water for Wildlife Refuges

Table D-5. Comparing Water Transfer Unit Values from Transfer Price Regressions to SWAP Unit Values

Year Type	Unit Value Estimates (in 2015 $/AF)									
	Sacramento Valley			San Joaquin						
		Comparable from SWAP			Comparable from SWAP					
	Table D-3 2030 unit value	2030 (CU)	2045 and later, with SGMA (CU)	Table D-3 2030 unit value	Delta Export 2030 (AW)	East San Joaq 2030 (CU)	Friant 2030 (CU)	2045 and later, with SGMA: Delta Export (AW)	2045 and later, with SGMA: East San Joaq (CU)	2045 and later, with SGMA: Friant (CU)
Wet	$185			$228						
Above Normal	$244	$138	$143	$286	$225	$133	$251	$519	$388	$321
Below Normal	$280			$322						
Dry	$301	$248	$256	$343	$226	$201	$278	$674	$466	$512
Critical	$351	$338	$347	$393	$326	$375	$324	$1,056	$728	$1,105

Notes
- AW indicates SWAP estimates per acre-foot of applied water
- CU indicates SWAP estimates per acre-foot of consumptive use

Year Type

Location

SGMA

WSIP Technical Reference, Appendix D, CWC, 2016

Sites

Sites Reservoir Benefits Considerations

One of the items we need to address in the feasibility report is updating our benefits to correspond to the right-sized project. The talking points below reflect the pros and cons and uncertainties associated with the various benefit categories.

Benefit	Considerations
Participant Benefits	
Authority Water Supply	Updated deliveries will be part of Jacob's modeling effort
CVP Water Supply	Discussions are ongoing. We need to decide whether to include any discussion/ reference to potential CVP/Reclamation water in the WSIP Feasibility Report
SWP Water Supply	I'm aware of prior discussions, but as far as I know we do NOT plan to include anything in the WSIP Feasibility Report
WSIP Benefits	
Refuge Supply[a]	The conveyance of refuge supply benefits is expensive and requires the use of facilities outside the direct control of the Authority. Agreements for use of SWP and CVP facilities to deliver water would be required. Delivery of water to refuges south of the Delta is more expensive, but also supported by the environmental community. • It may be advantageous to reduce the refuge supply and increase some other benefit • It may be advantageous to place refuge water in a blended account that may be used by the Authority to meet refuge commitments and pay for O&M • The optimal allocation of water to NOD and SOD refuges needs to be determined
Delta Habitat (Smelt)[a]	Final valuation increased by the CWC – unlikely to go higher unless we divert more water.
Anadromous Fish[a]	It is rumored that recent lifecycle models for the right-sized project may show no net benefit to anadromous fish. These benefits are dependent on the amount of water storage increase in Shasta. • Is there a way to provide data to demonstrate a net benefit to anadromous fish? • Do we need to modify operations to achieve this benefit?
Delta Water Quality	Was not monetized or selected as a benefit in the WSIP application. Introduces a new party (SWRCB) to negotiations. Likely challenging as we do not provide a net increase in Delta outflow; however, we may provide an increase in critical years. Agency may argue that this is required for mitigation regardless and, therefore, ineligible.
Emergency Water Supply	Not currently included in the project or WSIP application. LVE is providing a dedicated source of water (a maximum of 160,000 AF for non-drought emergencies and a maximum of 42,000 AF during drought emergencies). This water would likely need to be reserved in Sites Reservoir, thereby decreasing the releases for other purposes.
Flood	Currently valued at $45M. The County believes it should be higher. Might be a difficult negotiation, but it might be possible to increase. The original request was based on $134M in benefits.
Recreation	Currently valued at $197M. No foreseeable justification for increasing further.

[a] – WSIP requires that ecosystem benefits be greater than 50% of the total benefits.

From: Micko, Steve/SAC [Steve.Micko@jacobs.com]
Sent: 11/6/2020 4:40:20 PM
To: Davis-Fadtke, Kristal@Wildlife [Kristal.Davis-Fadtke@wildlife.ca.gov]; Evan Sawyer - NOAA Federal [evan.sawyer@noaa.gov]
CC: Alicia Forsythe [aforsythe@sitesproject.org]; Spranza, John [john.spranza@hdrinc.com]; Heydinger, Erin [erin.heydinger@hdrinc.com]; Leaf, Rob/SAC [Rob.Leaf@jacobs.com]
Subject: Sites: Preliminary CalSim II study

Hi Kristal and Evan,

You may access the preliminary CalSim II study, presented on October 26th, in the "20201106_ALTA2_PEA" folder at the link below:
_ToCDFW_NMFS

Please let me know if I should share this link with a specific person on your staff.

Also, please note that this model is in development. Several revisions are expected.
These revisions include, but are not limited to, the following:

- Baseline model assumptions
    - 2020 SWP ITP actions to be incorporated
- CVP operations
    - Sites exchange with Shasta reservoir to be incorporated
    - Sites coordination with CVP operations is subject to change
- SWP operations
    - Sites coordination with SWP operations is subject to change
- South Delta Pumping
    - South Delta pumping in December to match baseline conditions

We plan to complete a revised model next week, and will share it shortly thereafter.

Please let me know if you have any questions.

Best,
Steve

Steve Micko, PE | Jacobs | Associate Water Resources Engineer
O:916.286.0358 | M:408.834.6614 | Steve.Micko@jacobs.com
2485 Natomas Park Drive Suite 600 | Sacramento, CA 95833

Work Group Chartering Document

Status: **Ad Hoc**

- Leaders:

Chair	Vice Chair
Thad Bettner, GCID	Heather Dyer (SBVMWD)

- Members (9):

Mike Azevedo (Colusa Co.)	Randall Neudeck (MWD)
Robert Cheng (CVWD)	Bill Vanderwaal (DWD)
Jeff Davis (SGPWA)	
Rob Kunde (WR-M WSD)	
Eric Leitterman (Valley Water)	

- Expertise: PCWA/Roseville for Lower American River

  Staff from participating agencies who have specific expertise that is relevant to the matter being addressed by this work group.

- Staff Support:
  1. Environmental Planning and Permitting Manager.
  2. Legal counsel on an as needed basis.
  3. Other specialty advisors or experts, including consultant team members on an as needed basis.

- Re-Adoption of Charter: June 17, 2020

- Expires: End of the Phase 2 Reservoir Project Agreement

Related Documents:

- Attachment A: Work Group Chartering Process, General Requirements

Purpose: To advise the Reservoir Committee on all environmental planning and permitting aspects of the development and implementation of pre-construction, construction, and mitigation actions for the Sites Reservoir Project.

Meeting Frequency: When either the Leader determines or the Reservoir Committee Chairperson requests that a potential issue exists to warrant convening the work group to develop a recommended resolution or response for the Reservoir Committee to then consider and act upon.

Work Group's Roles and Responsibilities:

- The primary focus of this work group is to review and provide input to:

  1. The Authority's adoption of CEQA Guidelines, revisions to those Guidelines, if any, and proposed environmental policies.

  2. The Authority's development, completion, and implementation of all environmental planning and permitting aspects of pre-construction, construction, environmental commitments, and mitigation actions for the Sites Reservoir Project.

     NOTE: The review of operations or construction permits and approvals has been assigned to the Reservoir Operations and Engineering Work Group (e.g., Dam Safety, Traffic).

From: Heydinger, Erin [Erin.Heydinger@hdrinc.com]
Sent: 11/9/2020 3:29:41 PM
To: Micko, Steve/SAC [Steve.Micko@jacobs.com]; Alicia Forsythe [aforsythe@sitesproject.org]
CC: Leaf, Rob/SAC [Rob.Leaf@jacobs.com]; Thayer, Reed/SAC [Reed.Thayer@jacobs.com]
Subject: RE: Sites: 2nd Iteration CalSim Model

Hi Steve,

Thanks for taking the time to chat with me today about model timing. I just sent out some meeting invites for Thursday to review results and prep for the WG meeting. Please send the updated trend reporting spreadsheet by the end of the day Wednesday if at all possible so we can review it before we meet.

Jerry is working on pulling together a few figures for a meeting and would like to use data on the following parameters:
1. Diversions to fill
2. Releases
3. Delta Outflow (comparing no project and with project)

If you could send me the trend charts for each of these as soon as we have them, I will help get them into Jerry's presentation. He was hoping to have it finalized by Wednesday, so if you have this data before the full trend reporting spreadsheet is done, please send it over.

Thanks,
Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

hdrinc.com/follow-us

From: Micko, Steve/SAC <Steve.Micko@jacobs.com>
Sent: Monday, November 9, 2020 10:57 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Cc: Leaf, Rob/SAC <Rob.Leaf@jacobs.com>; Thayer, Reed/SAC <Reed.Thayer@jacobs.com>
Subject: Sites: 2nd Iteration CalSim Model

Hi Ali and Erin,

We encountered an unexpected bug in the 2nd iteration Sites CalSim II model.
Rob and Reed are prioritizing de-bugging the model.
The 2nd iteration CalSim II model should be ready in a couple days.

Let me know if you would like to discuss.

Apologies for the delay,
Steve

Steve Micko, PE | Jacobs | Associate Water Resources Engineer
O:916.286.0358 | M:408.834.6614 | Steve.Micko@jacobs.com
2485 Natomas Park Drive Suite 600 | Sacramento, CA 95833

File Provided Natively

From: Micko, Steve/SAC [Steve.Micko@jacobs.com]
Sent: 11/10/2020 1:02:22 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]; Heydinger, Erin [erin.heydinger@hdrinc.com]
CC: Leaf, Rob/SAC [Rob.Leaf@jacobs.com]
Subject: FW: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Hi Ali and Erin,

I think we need to ask Chuching to run questions through you two, or cc you both.
Let me know how you would like to proceed.

Answers to his questions are quick:
1. I believe "Conveyance System" refers to "Delta Conveyance Project". If so, no.
2. 2030
3. Not yet. We plan to conduct a climate change sensitivity analysis under 2035 CT climate conditions, from the 2020 SWP LTO FEIR.

Best,
Steve

From: Leaf, Rob/SAC <Rob.Leaf@jacobs.com>
Sent: Tuesday, November 10, 2020 11:12 AM
To: Micko, Steve/SAC <Steve.Micko@jacobs.com>
Subject: Fwd: [EXTERNAL] Quick Clarification Questions for Sites Modeling

FYI. We need to coordinate response with Erin.

Sent from my iPhone

Begin forwarded message:

From: "Wang,Chuching" <cwang@mwdh2o.com>
Date: November 10, 2020 at 11:04:16 AM PST
To: "Tull, Robert/SAC" <Robert.Tull@jacobs.com>, "Leaf, Rob/SAC" <Rob.Leaf@jacobs.com>
Subject: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Rob & Rob,
I am going to have a MWD internal Sites briefing discussion on modeling status soon.

I understand that you are working on the baselines and various scenarios. I just need to get a brief response from you to clarify some of my questions.
1. Though in the long run, you will consider Sites with and without a Conveyance System. But at this moment, you have not included a conveyance system in your modeling analysis. Is it correct?
2. For the CALSIM analysis, what is the long term planning horizon? 2040? 2050? Or others?
3. For your current modeling efforts, have you considered climate changes?

Other than question 2, the other two are "yes/no" questions. Thank you for your quick response.

Chuching Wang, Ph.D., P.E.
Senior Engineer
Bay Delta Initiatives

Office of The General Manager
Metropolitan Water District of Southern California
(213)217-6188, (310)500-8658 cell

From: Heydinger, Erin [Erin.Heydinger@hdrinc.com]
Sent: 11/10/2020 1:07:57 PM
To: Micko, Steve/SAC [Steve.Micko@jacobs.com]; Alicia Forsythe [aforsythe@sitesproject.org]
CC: Leaf, Rob/SAC [Rob.Leaf@jacobs.com]
Subject: RE: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Hi Steve,

Thanks, Steve. Yes, please go ahead and respond to Chuching, cc myself and Ali, and ask him to cc us in the future.

Quick question – what does he mean when he says "long term planning horizon"? Is that asking how demands are estimated for CVP/SWP (i.e. using 2030 demands)?

You may also want to include that we will be doing some additional climate change analysis for the CWC Feasibility Study (2030 and 2070).

Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

hdrinc.com/follow-us

From: Micko, Steve/SAC <Steve.Micko@jacobs.com>
Sent: Tuesday, November 10, 2020 1:02 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Cc: Leaf, Rob/SAC <Rob.Leaf@jacobs.com>
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Office of The General Manager
Metropolitan Water District of Southern California
(213)217-6188, (310)500-8658 cell

From: Spranza, John [John.Spranza@hdrinc.com]
Sent: 11/11/2020 8:07:37 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]; Fisher, Linda [Linda.Fisher@hdrinc.com]
CC: Laurie Warner Herson (laurie.warner.herson@phenixenv.com) [laurie.warner.herson@phenixenv.com]; Arsenijevic, Jelica [Jelica.Arsenijevic@hdrinc.com]
Subject: RE: Sites - Ad Hoc Environmental Planning and Permitting Work Group Meeting - Draft Agenda

I'll work in this after my 8:30 call

John Spranza

D 916.679.8858 M 818.640.2487

From: Alicia Forsythe [mailto:aforsythe@sitesproject.org]
Sent: Wednesday, November 11, 2020 7:37 AM
To: Fisher, Linda <Linda.Fisher@hdrinc.com>
Cc: Spranza, John <John.Spranza@hdrinc.com>; Laurie Warner Herson (laurie.warner.herson@phenixenv.com) <laurie.warner.herson@phenixenv.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Subject: RE: Sites - Ad Hoc Environmental Planning and Permitting Work Group Meeting - Draft Agenda

Thanks Linda.

John – I am thinking we can use the action plan for schedule for the permitting side of things.

Laurie – I will forward you the draft action plan. I am thinking we create an analogous schedule graphic and tracking table (see towards the end) for the EIR/EIS efforts. Not a whole action plan – just these two components so we can quickly update on schedule and progress each month.

Ali

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

---

From: Fisher, Linda <Linda.Fisher@hdrinc.com>
Sent: Tuesday, November 10, 2020 12:47 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Spranza, John <John.Spranza@hdrinc.com>; Laurie Warner Herson (laurie.warner.herson@phenixenv.com) <laurie.warner.herson@phenixenv.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Subject: RE: Sites - Ad Hoc Environmental Planning and Permitting Work Group Meeting - Draft Agenda

Hi Ali,

Based on Thad's comment on the Ad Hoc agenda should we add a summary slide for planning and a summary slide for permitting to the presentation deck? Should we also show a snippet of the schedule – maybe the next two months? Or should we include a milestone list?

Thanks, Linda

Linda Fisher, M.S.
D 916.817.4962 M 530.400.3212

hdrinc.com/follow-us

From: Thad Bettner [mailto:tbettner@gcid.net]
Sent: Friday, November 6, 2020 12:46 PM
To: Fisher, Linda <Linda.Fisher@hdrinc.com>; Heather Dyer <heatherd@sbvmwd.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: RE: Sites - Ad Hoc Environmental Planning and Permitting Work Group Meeting - Draft Agenda

Thank you. I would recommend a high level summary of schedule of the various activities under workgroups direction. I don't know if that's part of #2 discuss along with the strategic plan or not, but kicking off each meeting with a schedule update would be good.

Keep casting the vision.

Thanks.

Thaddeus L Bettner PE, General Manager
Glenn-Colusa Irrigation District
PO Box 150
Willows, CA 95988
530.934.8881 (office)
530.588.3450 (cell)

From: Fisher, Linda <Linda.Fisher@hdrinc.com>
Sent: Friday, November 6, 2020 11:13 AM
To: Heather Dyer <heatherd@sbvmwd.com>; Thad Bettner <tbettner@gcid.net>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: Sites - Ad Hoc Environmental Planning and Permitting Work Group Meeting - Draft Agenda

Hi Heather and Thad,

Attached please find the Draft Agenda for next Ad Hoc Environmental Planning and Permitting Work Group Meeting on Nov. 16th. Please let us know if you have any questions, suggestions, or additional topics that you would like to include.

Thank you, Linda

Linda Fisher, M.S.
Environmental Project Manager

HDR
2365 Iron Point Road, Suite 300
Folsom, California 95630
D 916.817.4962 M 530.400.3212
linda.fisher@hdrinc.com

hdrinc.com/follow-us

From: Laurie Warner Herson [laurie.warner.herson@phenixenv.com]
Sent: 11/11/2020 8:07:58 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]
CC: Fisher, Linda [Linda.Fisher@hdrinc.com]; john.spranza@hdrinc.com; Arsenijevic, Jelica [Jelica.Arsenijevic@hdrinc.com]
Subject: Re: Sites - Ad Hoc Environmental Planning and Permitting Work Group Meeting - Draft Agenda

Sounds good, thank you!

On Nov 11, 2020, at 7:36 AM, Alicia Forsythe <aforsythe@sitesproject.org> wrote:

Thanks Linda.

John – I am thinking we can use the action plan for schedule for the permitting side of things.

Laurie – I will forward you the draft action plan. I am thinking we create an analogous schedule graphic and tracking table (see towards the end) for the EIR/EIS efforts. Not a whole action plan – just these two components so we can quickly update on schedule and progress each month.

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

From: Fisher, Linda <Linda.Fisher@hdrinc.com>
Sent: Tuesday, November 10, 2020 12:47 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Spranza, John <John.Spranza@hdrinc.com>; Laurie Warner Herson (laurie.warner.herson@phenixenv.com) <laurie.warner.herson@phenixenv.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
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Thanks, Linda

Linda Fisher, M.S.
D 916.817.4962 M 530.400.3212

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Sent: Friday, November 6, 2020 12:46 PM
To: Fisher, Linda <Linda.Fisher@hdrinc.com>; Heather Dyer <heatherd@sbvmwd.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: RE: Sites - Ad Hoc Environmental Planning and Permitting Work Group Meeting - Draft Agenda

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.

Thank you. I would recommend a high level summary of schedule of the various activities under workgroups direction. I don't know if that's part of #2 discuss along with the strategic plan or not, but kicking off each meeting with a schedule update would be good.

Keep casting the vision.

Thanks.

____

Thaddeus L Bettner PE, General Manager
Glenn-Colusa Irrigation District
PO Box 150
Willows, CA 95988
530.934.8881 (office)
530.588.3450 (cell)
<image001.png>

From: Fisher, Linda <Linda.Fisher@hdrinc.com>
Sent: Friday, November 6, 2020 11:13 AM
To: Heather Dyer <heatherd@sbvmwd.com>; Thad Bettner <tbettner@gcid.net>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: Sites - Ad Hoc Environmental Planning and Permitting Work Group Meeting - Draft Agenda

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Thank you, Linda

Linda Fisher, M.S.
Environmental Project Manager

HDR
2365 Iron Point Road, Suite 300
Folsom, California 95630
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linda.fisher@hdrinc.com

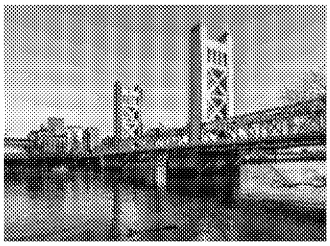
hdrinc.com/follow-us

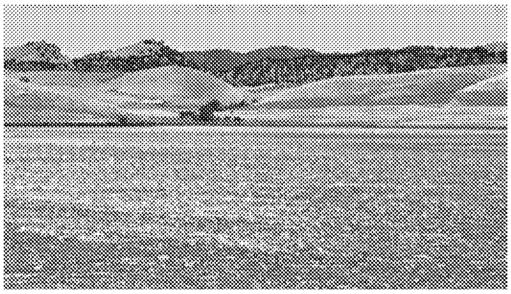
Sites Reservoir

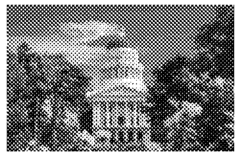
Sites

21st Century Solution to California's Water Reliability Challenges

Sites Reservoir is a generational opportunity to construct a multi-benefit water storage project that helps **restore flexibility, reliability, and resiliency** to our statewide water supply



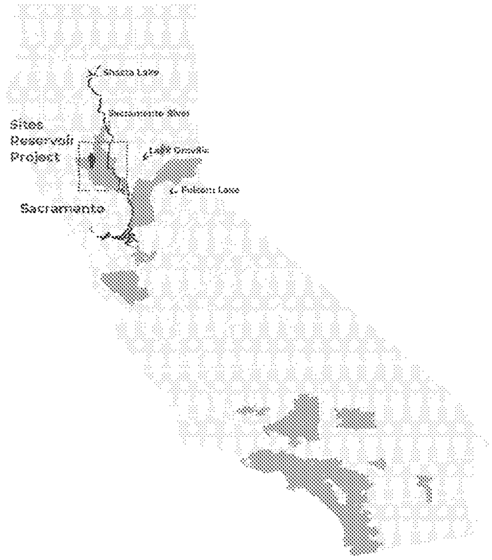




Sites

Our Strength is in Our Broad Statewide Participation

Diverse statewide representation of public agencies advancing Sites Reservoir



Participants include **counties, cities, water and irrigation districts**

Urban and **Rural**

Sacramento Valley

San Joaquin Valley

Bay Area

Southern California

Sites

Our Strength is in Our Broad Statewide Participation

Sacramento Valley

Carter Mutual Water Company
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

Southern California

Antelope Valley - East Kern Water Agency
Coachella Valley Water District
Desert Water Agency
Metropolitan Water District
San Bernardino Valley Municipal Water District
San Gorgonio Pass Water Agency
Santa Clarita Valley Water Agency

Sites

Rightsized to Meet Our Current and Future Water Supply Needs

Sites Reservoir has been designed and optimized to meet our water supply needs for today and in the future

The Sites Project Authority conducted a **rigorous Value Planning effort** to review the project's proposed operations and facilities **to develop a project that is "right sized" for our investors and participants** while still providing water supply reliability and enhancing the environment

Rightsizing the reservoir was **responsive to input** from **state and federal agencies, NGOs, elected officials, landowners and local communities**

The **feedback we received** through a robust outreach effort was **critical** to developing a reservoir that is the **right size for both people and the environment**

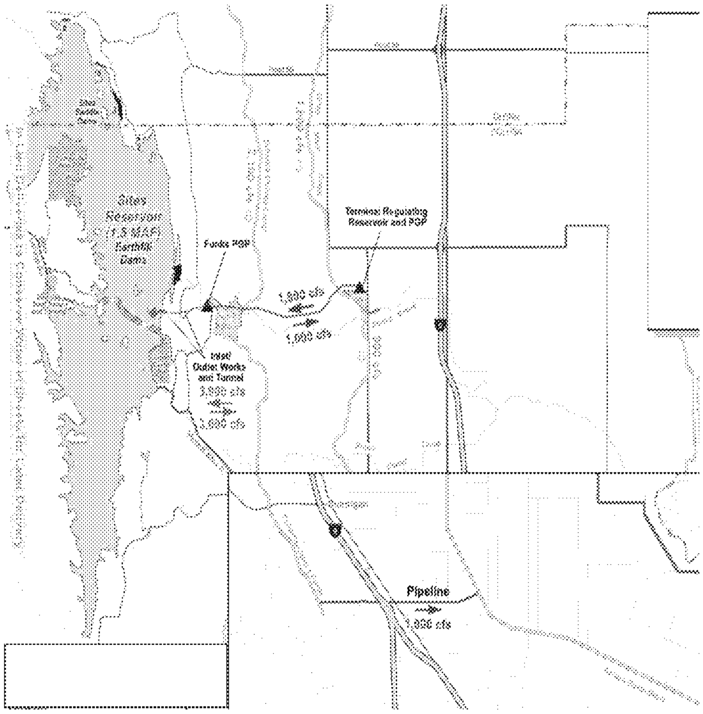
Sites

Rightsized to Meet Our Current and Future Water Supply Needs

1.5 million acre-feet

Utilizes the existing **Glenn-Colusa Irrigation District** and **Tehama-Colusa Canal Authority** canals to convey water to Sites Reservoir from the Sacramento River

Delivers water back to the Sacramento River through the **Tehama-Colusa Canal** and through the **Colusa Basin Drain** for participant deliveries and for the environment



Rightsized to Meet Our Current and Future Water Supply Needs

Member	Reservoir Participation(AFY)
Public Water Agencies	
North of Delta	52,142
South of Delta	140,750
Subtotal Public Water Agencies	192,892
State of CA	~ 40,000
Total Requirement	~230,000

Participant Demand

Participant water subscriptions allocated in the **current participation agreement**

Allocation of State of California water subscription is based on the **Proposition 1 water investment**

- Water for Delta Smelt
- Water for Refuges

Release Capacity from Sites

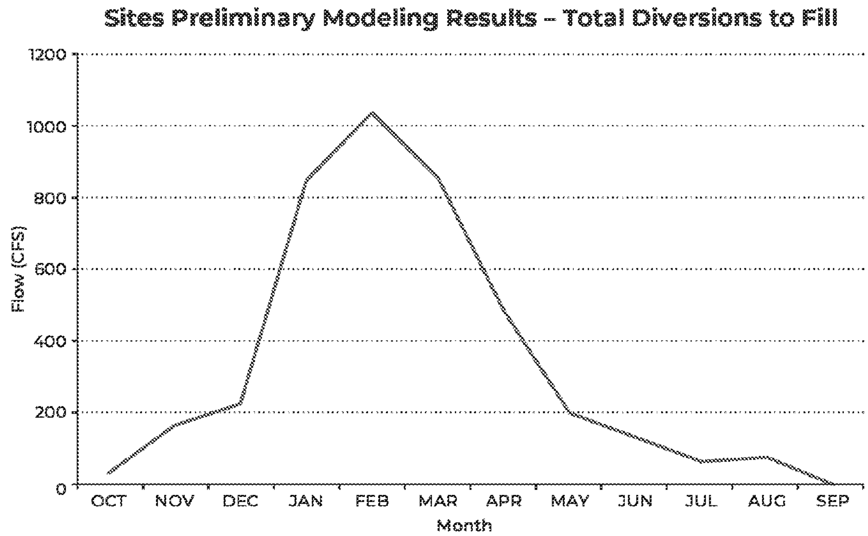
The "rightsized" project can deliver water to meet the demands of our participants and California's investment of water for the environment

Long term average ~240,000 AFY

Year Type	1,000 cfs Release Capacity (AFY) to the Colusa Basin Drain
Wet	90 - 120
Above Normal	260 - 290
Below Normal	245 - 275
Dry	355 - 385
Critically Dry	210 - 240

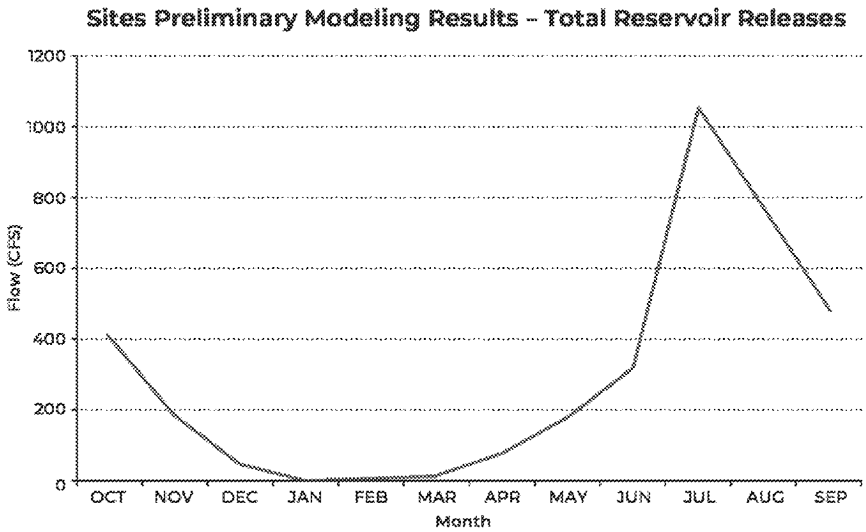
Sites

Timing of Sites Diversions (storing storm flows for use during drier times)



Sites

Timing of Sites Releases (increased water available for all uses in driest times)



Sites

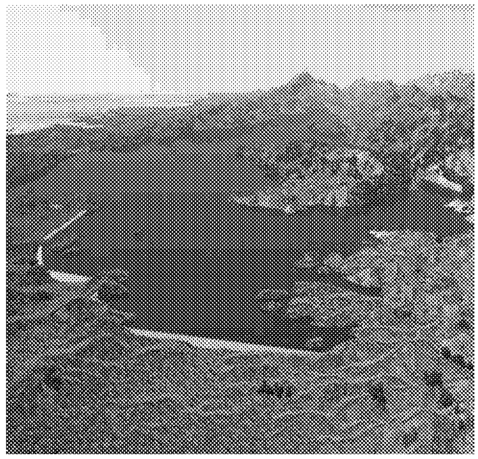
Rightsized to Meet Our Current and Future Water Supply Needs

The Value Planning process has **resulted** in a project that has a **smaller footprint** and **operated in a different manner** then originally designed

Due to these changes the Authority will **revise and recirculate its Draft EIR**

Work with **landowners, tribes, stakeholders, NGOs, and local communities** to develop a **collaborative environmental review process**

It is essential that we **build a project now that makes sense for all our participants** – local, state, and federal



Sites

Rightsized to Meet Our Current and Future Water Supply Needs

Reservoir Size (MAF)	1.5
Project Cost (2019$, billions)	$2.4 - $2.7
Contingency Cost (2019$, billions)	$0.6
Total Project Cost (2019$, billions)	$3.0 - $3.3
Annualized AFY release	240,000
Range of Annual Costs During Repayment Without WIFIA Loans (2020$, $/AF)	$650 - $710
Range of Annual Costs During Repayment With WIFIA Loans (2020$, $/AF)	$600 - $660

The rightsized project is **roughly $2 Billion less** then the 2017 preferred alternative

Cost savings primarily from the **removal** of the **Delevan Diversion** facility on the Sacramento River and the **Delevan Pipeline**

Lowered the Annual Cost during repayment ($/AF)

Significant savings to participants with finance through a **WIFIA** government backed loan

Sites

Provides Statewide Benefits for Generations to Come

Sites Reservoir provides many multi-layered benefits

Off-stream Storage

Does not create a barrier to native fish migration

Federal and State Agencies Manage Environmental Water

Adaptable to current and future conditions and priorities

Local Leadership and Cooperation

Aligns with Sacramento Valley's values and fosters regional and statewide collaboration

Cooperative Operation

Increases effectiveness and efficiency of existing water storage infrastructure

Adaptable to Climate Change

Contributes to system reliability and performance with climate change

Dry Year Water Supply

Reliable dry year water supply for California communities, farms and businesses

Recreational Opportunities

Provides northern Sacramento Valley with additional opportunities for recreation

Environmental Support

Provides environmental water in drier periods for native fish, and habitat for native species and birds

Sites

Provides Statewide Benefits for Generations to Come

Sites Reservoir provides water dedicated to environmental use

A significant portion of the **Sites Reservoir Project's annual water supplies will be dedicated to environment uses:**

- **Preserve cold-water** pool in **Lake Shasta** later into the 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**
- Provide **water dedicated** to help improve conditions for the **Delta Smelt**

Water dedicated for the environment provided by Sites Reservoir will be **managed by state resources agency managers** who will decide how, and when, this water would be used – creating a water asset for the state that **does not currently exist**

Sites

Possibilities of Environmental Water Uses

Member	Reservoir Participation(AFY)
Public Water Agencies	
North of Delta	52,142
South of Delta	140,750
Subtotal Public Water Agencies	192,892
State of CA	~ 40,000
Total Requirement	~230,000

Sites **creates a resource that can be managed for the benefit of the species.**

Water for the environment is **managed by state resource agencies.**

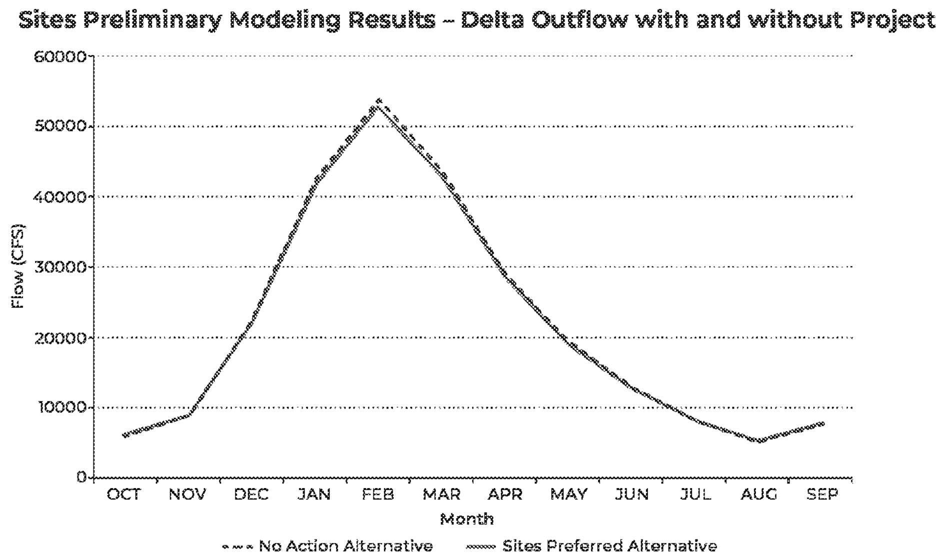
Potential Beneficiary
Level 4 refuge water
Enhanced Delta Ecosystem
Improve Survival of Anadromous Fish

There is **flexibility** to manage these benefits each year.

The range of possibilities will be covered in the recirculated Draft EIR.

Sites

Uncaptured Flow put to highest and best use



Sites

Anticipated flows through the Delta from proposed Voluntary Agreements

Increased Flows above Baseline

(TAF)	C	D	BN	AN	W
San Joaquin Basin	63	215	249	182	50
Sacramento Basin	37	276	256	281	45
Water Purchase Programs	125	109	195	237	205
Exporters	0	100	0	0	0
Subtotal New Outflow Above Baseline (Year 1)	225	700	700	700	300
New Water Projects & Programs (Before Year 8)	45	202	212	115	45
Total New Outflow Above Baseline (Year 1-8)	270	902	912	815	345
Exporters (Spring baseline maintenance)	0	200	300	300	0
Total New and Re-operated Outflows	270	1,102	1,212	1,115	345
State Team's Adequacy Target	260-350	740-1,000	840-1,100	840-1,200	300*-350

*Only applies to a subset of wet years

Sites

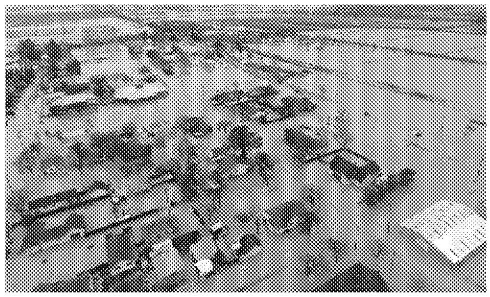
Provides Statewide Benefits for Generations to Come

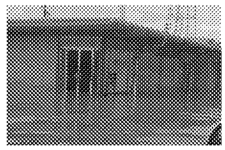
Sites Reservoir provides regional flood protection benefits

Provides significant **regional flood protection benefits** for the Sacramento Valley

Will capture and store **flood flows** that would normally impact the community of **Maxwell** - protecting homes, business and farms

Will help to **limit "down stream" flooding issues** by capturing storm flows that sometimes overwhelm the regions flood control facilities





Sites

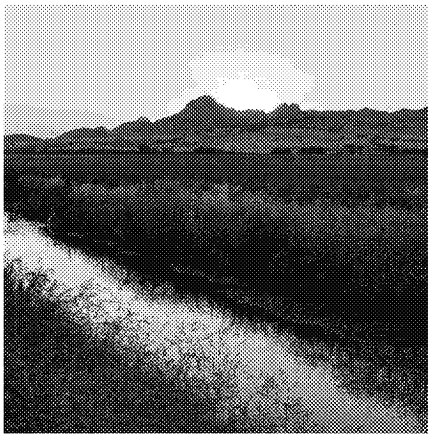
Provides Statewide Benefits for Generations to Come

Sites Reservoir will benefit the local and regional economy

Create hundreds of construction-related jobs during each year of the construction period, and **long-term jobs related to operations**

Creates **new recreation opportunities** in the Sacramento Valley which adds to the **region's economy**

Adding **resiliency** to the water supply will **strengthen the statewide economy** and **business** that rely on a reliable source of water for their operations – particularly agriculture



Sites

We are On-Track to Deliver This Vital Project for the People of California

Key Milestones Through 2021

Meet **eligibility requirements under Prop 1 (WSIP)** in order to access the remainder of the $816 Million in funding

Recirculate Draft EIR for public comment, proactively engage stakeholders, develop responses to comments to support environmental feasibility determination

Complete Feasibility Report

Secure environmental permit certainty and **draft permit applications**

Update and **refine cost estimate** and **affordability analysis**

Develop Plan of Finance

Improve definition of **SWP/CVP** exchange, including **Operations Plan**

Enhance landowner, stakeholder & NGO engagement

Develop Operating Agreement Term Sheets with: DWR, USBR, TCCA, GCID, CBD Authority

Sites


Questions
Sites

Assumed Diversion and Operations Criteria

Location	Criteria
Wilkins Slough Bypass Flow	8,000 cfs April/May 5,000 cfs all other times
Fremont Weir Notch	Prioritize the Fremont Weir Notch, Yolo Bypass preferred alternative, flow over weir within 5%
Flows into the Sutter Bypass System	No restriction due to flow over Moulton, Colusa, and Tisdale Weirs
Freeport Bypass Flow	Modeled WaterFix Criteria (applied on a daily basis) Post-Pulse Protection (applied on a moving 7-day average) Post-Pulse (3 levels) = January–March Level 2 starts January 1 Level 1 is initiated by the pulse trigger
Net Delta Outflow Index (NDOI) Prior to Project Diversions	44,500 cfs between March 1 and May 31

Sites

Assumed Release Criteria

Most releases occur in dry years for water supply and environmental benefits

Priority of releases assume the following:

- Provide water to project participants north and south of the delta
- Provide water to Cache Slough area via Yolo bypass
- Provide water for incremental Level 4 refuge deliveries
- Support Reclamation goals through exchanges

Deliveries to SWP contractors supplement Table A (start @ 85% allocation and more aggressive releases starting @ 65%)

Sites

Sent: 11/11/2020 4:07:17 PM
To: Jerry Brown [jbrown@sitesproject.org]
Subject: FW: Sites 2030 Cash Flow
Attachments: Sites Summary Schedule October 2020.pdf

Jerry – I just left you a long voicemail on this. Attached is the post 2021 schedule. I have some comments on this and a few changes are being made now

----

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

From: Westcot, Cathy <Cathy.Westcot@hdrinc.com>
Sent: Tuesday, November 10, 2020 9:13 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>; JP Robinette <jrobinette@brwncald.com>
Subject: RE: Sites 2030 Cash Flow

Ali,

Here is the latest schedule. Let me know if you need anything else.

Cathy Westcot, PMP
Project Controls

HDR
2379 Gateway Oaks Dr #200
Sacramento, CA 95833
M 916-213-3076
cathy.westcot@hdrinc.com

hdrinc.com/follow-us

From: Alicia Forsythe [mailto:aforsythe@sitesproject.org]
Sent: Tuesday, November 10, 2020 9:04 AM
To: Westcot, Cathy <Cathy.Westcot@hdrinc.com>; JP Robinette <jrobinette@brwncald.com>
Subject: RE: Sites 2030 Cash Flow

Thanks Cathy. I totally lost this in my email and am just looking at this now.

Do we have the post 2021 schedule to go with this? I ask as the ROW work just looks so late. Its just not clear to me how we could begin construction without having ROW start like 2 years earlier. I feel like ROW should start right after the Final EIR/EIS.

Ali

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

From: Westcot, Cathy <Cathy.Westcot@hdrinc.com>
Sent: Friday, November 6, 2020 11:00 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>; JP Robinette <jrobinette@brwncald.com>
Subject: Sites 2030 Cash Flow

Ali,

Attached is the draft that JP and I have prepared for your final review. Once you provide comments JP will get his graphic person to make it into a presentation level graphic.

Thanks,

Cathy Westcot, PMP
Project Controls

HDR
2379 Gateway Oaks Dr #200
Sacramento, CA 95833
M 916-213-3076
cathy.westcot@hdrinc.com

hdrinc.com/follow-us

SITES PROJECT | **Date: 03-Nov-20**

Activity ID	Activity Name	Remaining Duration	Start	Finish
SITES PROJECT		2357	02-Jan-20 A	13-Nov-29
MILESTONES		2357	13-Apr-20 A	13-Nov-29
MS-005-VP	Approve Preferred Project	0		13-Apr-20 A
MS-020-CS	WIIN Construction Start Date	0		02-Nov-20*
MS-007-PD	Preliminary Project Description Complete	0		28-Dec-20
MS-001-LF	Local Funding (Go/No-go #1)	0		07-Jan-21
MS-002-LF	Local Funding (Go/No-go #2)	0		08-Feb-21
MS-011-DE	Release Revised Draft EIR/ Supplemental Draft EIS for Public I	0		02-Aug-21
MS-003-LF	Local Funding (Go/No-go #3)	0		03-Dec-21
MS-250-FE	Final EIR/EIS	0		13-May-22
MS-450-RD	ROD Signed	0		16-Sep-22
MS-500-CS	Construction Starts	0		27-Aug-24
MS-510-CC	Construction Complete	0		11-Dec-28
MS-600-PB	Public Benefits	0		13-Nov-29
VALUE PLANNING		0	02-Jan-20 A	13-Apr-20 A
	Value Planning Analysis	0	02-Jan-20 A	03-Mar-20 A
	Value Planning Report	0	14-Feb-20 A	13-Apr-20 A
	Preferred Project	0	13-Apr-20 A	13-Apr-20 A
PROJECT DESCRIPTION		108	11-Feb-20 A	31-Mar-21
	Determine Needs	0	11-Feb-20 A	28-Apr-20 A
	Components	108	01-Apr-20 A	31-Mar-21
	Develop Project Description	29	29-Apr-20 A	15-Dec-20
	Preliminary Project Description Complete	0	28-Dec-20	28-Dec-20
OPERATIONS MODELING		2133	02-Jan-20 A	03-Jan-29
	Value Planning Operations	0	02-Jan-20 A	20-Aug-20 A
	Refine Operational Parameters	0	10-Feb-20 A	12-Jun-20 A
	Full Operations Analysis	85	12-Jun-20 A	26-Feb-21
	EIR/EIS AND BA/ITP Documentation	129	04-Jan-21	08-Jul-21
	Operations Plan, Ver 1	224	02-Jan-20 A	23-Nov-21
	Operational Agreements	474	04-Jan-21	28-Nov-22
	Bridging Analysis for CWC/WSIP Benefits	94	14-Jan-21	28-May-21
	Final Sites-Reclamation Operating Agreement	328	03-Aug-21	28-Nov-22
	Final Sites-DWR Operating Agreement	328	03-Aug-21	28-Nov-22
	Final TCCA Facility Use Agreement	328	03-Aug-21	28-Nov-22
	Final GCID Facility Use Agreement	328	03-Aug-21	28-Nov-22
	Final CBDA Facility Use Agreement	328	03-Aug-21	28-Nov-22
	Operations Plan, Version 2	370	03-Aug-21	02-Jan-23
	Annual Operating Plan Process and Procedures	519	19-Oct-21	13-Oct-23
	Develop Organizational Operating Roles and Responsibilities	519	19-Oct-21	13-Oct-23
	Provide Operations Input on Response to Comments and Final EIR/EIS	20	21-Mar-22	15-Apr-22
	Member Portal/Accounting System	0	03-Jan-29	03-Jan-29
	Operations Support	717	12-Nov-21	13-Aug-24
	Task Management - Work Group-Res Comm-Authority Support	285	28-Aug-20 A	03-Dec-21
EIR/EIS		1060	11-Feb-20 A	22-Nov-24
	Work Plan & Outline	0	11-Feb-20 A	22-Sep-20 A

Critical Remaining Work
Milestone
Summary

SITES MASTER SUMMARY SCHEDULE

Activity ID	Activity Name	Remaining Duration	Start	Finish
	Project Description Chapter	65	22-Sep-20 A	29-Jan-21
	Revised Draft EIR/Supplemental Draft EIS	186	01-Sep-20 A	02-Aug-21
	Public Review	43	03-Aug-21	30-Sep-21
	Begin Preparation of the Admin Revised Final EIR/Supplemental Final EIS	27	17-Sep-21	26-Oct-21
	Environmental Feasibility Report For CWC	52	17-Sep-21	03-Dec-21
	Revised Final EIR/Supplemental Final EIS	149	19-Oct-21	13-May-22
	NOD, Findings of Fact, Statement of Overriding Considerations, Mitigation Monitoring	32	25-Apr-22	07-Jun-22
	Authority Certifies EIR and Approves Project and File NOD	1	07-Jun-22	08-Jun-22
	ROD	90	16-May-22	16-Sep-22
	Additional NEPA/CEQA Review, if needed	570	19-Sep-22	22-Nov-24
	Task Management - Work Group-Res Comm-Authority Support	288	01-Sep-20 A	30-Dec-21
	PERMITTING	270	14-Apr-20 A	06-Dec-21
	CWC Feasibility Report	270	30-Oct-20 A	06-Dec-21
	Geotechnical Field Monitoring	243	01-Dec-20	18-Nov-21
	Task Management - Work Group-Res Comm-Authority Support	270	14-Apr-20 A	03-Dec-21
	FEDERAL PERMITS	1048	14-Apr-20 A	06-Nov-24
	Phase 1 Environmental Site Assessments	763	06-Dec-21	06-Nov-24
	U.S. Army Corps of Engineers CWA 404, Rivers and Harbors Act Section 10	591	05-May-20 A	06-Feb-23
	U.S. Army Corps of Engineers Rivers and Harbors Act Section 14, Section 408	591	02-Nov-20	06-Feb-23
	U.S. EPA and U.S. Army Corps of Engineers LEDPA Review	591	02-Nov-20	06-Feb-23
	Advisory Council on Historic Preservation NHPA Section 106	284	01-Sep-20 A	02-Dec-21
	USFWS and NMFS ESA Section 7	365	14-Apr-20 A	27-Mar-22
	USFWS Bald Eagle Protection Act	610	01-Sep-20 A	17-Apr-23
	U.S. Coast Guard Navigability Determination	239	06-Dec-21	17-Nov-22
	USBR Warren Act	356	16-Apr-21	16-Sep-22
	USBR - Land Agreement	485	02-Nov-20	13-Oct-22
	STATE PERMITS AND AGREEMENTS	2272	01-Sep-20 A	17-Jul-29
	Caltrans Encroachment & Transportation	733	06-Dec-21	04-Nov-24
	State Lands Commission/State Lands Lease, if needed	242	06-Dec-21	22-Nov-22
	Central Valley Flood Protection Board Levee Encroachment	520	01-Sep-20 A	06-Feb-23
	SWRCB Water Rights Permit	643	01-Sep-20 A	19-Apr-23
	SWRCB NPDES and CWA Section 402 (Multiple permits based on construction packa	1234	24-Jul-23	13-Apr-28
	SWRCB Waste Discharge Requirements (Multiple permits based on constr. package	1234	24-Jul-23	13-Apr-28
	RWQCB CWA Section 401 Water Quality Certification	1003	18-Nov-21	22-Sep-25
	DWR DSOD (Multiple permits based on construction packages and/or ROW access)	221	29-Apr-24	03-Mar-25
	Cal OSHA Permits (Multiple permits based on construction packages and/or ROW ac	1541	22-Aug-23	17-Jul-29
	CDFW Streambed Alteration	547	01-Sep-20 A	06-Dec-22
	CDFW Section 2081	381	01-Sep-20 A	18-Apr-22
	NAHC/Local Tribes AB 52 Consultation	355	01-Sep-20 A	08-Apr-22
	SMARA	126	19-Oct-21	22-Apr-22
	LOCAL AGENCY PERMITS AND APPROVALS	685	02-Nov-20	16-Jun-23
	Colusa County	400	06-Dec-21	16-Jun-23
	Glenn County	400	02-Nov-20	13-May-22
	Yolo County	400	02-Nov-20	13-May-22
	MITIGATION	2357	28-Aug-20 A	13-Nov-29
	FEASIBILITY LEVEL GEOTECH	270	25-Mar-20 A	03-Dec-21

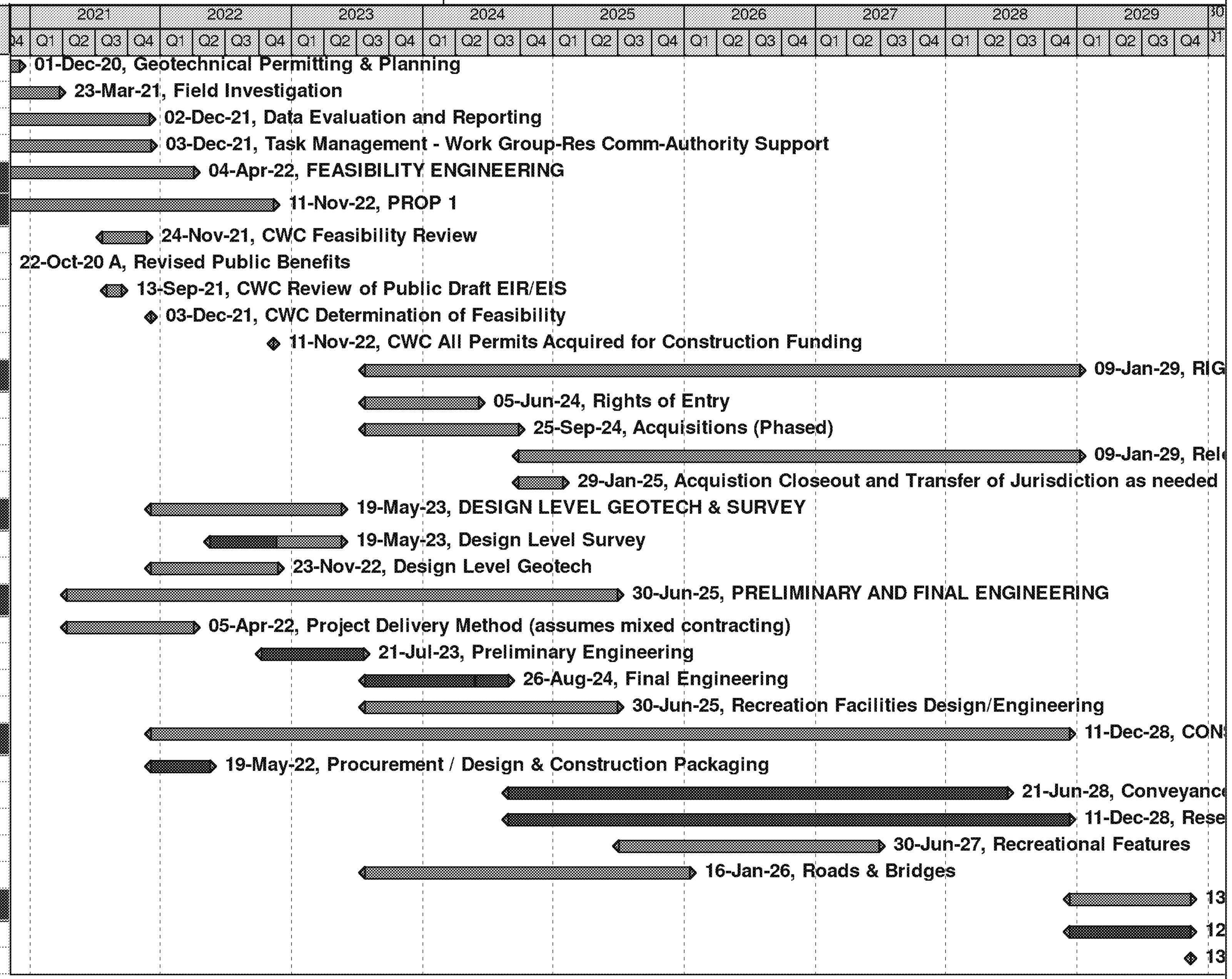
Critical Remaining Work

Milestone

Summary

SITES MASTER SUMMARY SCHEDULE

Activity ID	Activity Name	Remaining Duration	Start	Finish
	Geotechnical Permitting & Planning	19	25-Mar-20 A	01-Dec-20
	Field Investigation	95	30-Oct-20 A	23-Mar-21
	Data Evaluation and Reporting	269	30-Oct-20 A	02-Dec-21
	Task Management - Work Group-Res Comm-Authority Support	270	28-Aug-20 A	03-Dec-21
	FEASIBILITY ENGINEERING	371	02-Jan-20 A	04-Apr-22
	PROP 1	340	22-Oct-20 A	11-Nov-22
	CWC Feasibility Review	85	23-Jul-21	24-Nov-21
	Revised Public Benefits	0	22-Oct-20 A	22-Oct-20 A
	CWC Review of Public Draft EIR/EIS	30	03-Aug-21	13-Sep-21
	CWC Determination of Feasibility	0	03-Dec-21	03-Dec-21
	CWC All Permits Acquired for Construction Funding	0	11-Nov-22	11-Nov-22
	RIGHT OF WAY (ROW)	1427	24-Jul-23	09-Jan-29
	Rights of Entry	218	24-Jul-23	05-Jun-24
	Acquisitions (Phased)	298	24-Jul-23	25-Sep-24
	Relocation Assistance, as needed	1119	26-Sep-24	09-Jan-29
	Acquistion Closeout and Transfer of Jurisdiction as needed	90	26-Sep-24	29-Jan-25
	DESIGN LEVEL GEOTECH & SURVEY	380	06-Dec-21	19-May-23
	Design Level Survey	261	20-May-22	19-May-23
	Design Level Geotech	253	06-Dec-21	23-Nov-22
	PRELIMINARY AND FINAL ENGINEERING	1097	16-Apr-21	30-Jun-25
	Project Delivery Method (assumes mixed contracting)	253	16-Apr-21	05-Apr-22
	Preliminary Engineering	205	10-Oct-22	21-Jul-23
	Final Engineering	286	24-Jul-23	26-Aug-24
	Recreation Facilities Design/Engineering	506	24-Jul-23	30-Jun-25
	CONSTRUCTION	1831	06-Dec-21	11-Dec-28
	Procurement / Design & Construction Packaging	119	06-Dec-21	19-May-22
	Conveyance Features	997	27-Aug-24	21-Jun-28
	Reservoir Features	1120	27-Aug-24	11-Dec-28
	Recreational Features	520	03-Jul-25	30-Jun-27
	Roads & Bridges	650	24-Jul-23	16-Jan-26
	OPERATIONS	241	12-Dec-28	13-Nov-29
	Early Operations (Commissioning)	240	12-Dec-28	12-Nov-29
	Full Operations Begins	0	13-Nov-29	13-Nov-29



Critical Remaining Work
Milestone
Summary

SITES MASTER SUMMARY SCHEDULE

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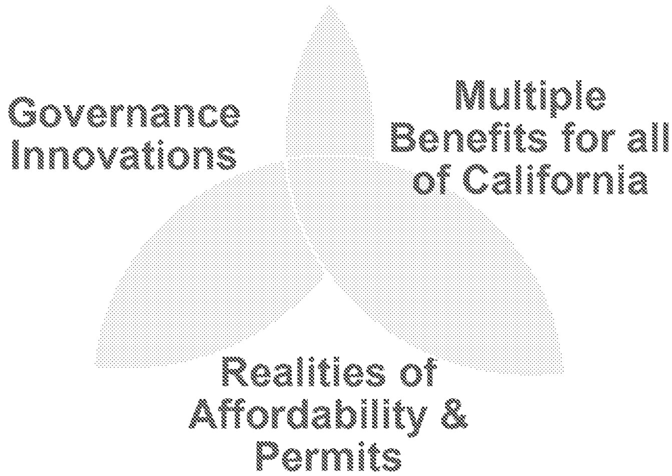
Sites Reservoir

Sites

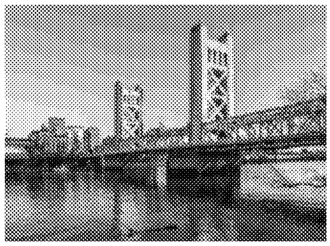
Key Presentation Take-Aways for BPC

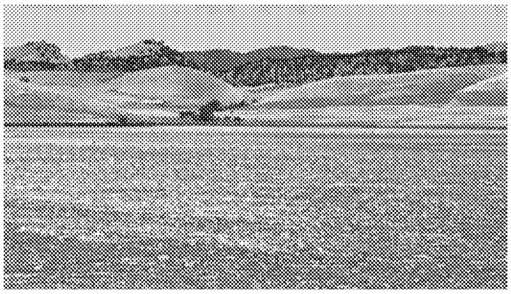


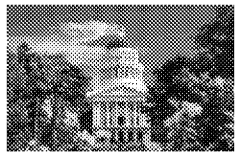
Sites

21st Century Solution to California's Water Reliability Challenges

Sites Reservoir is a generational opportunity to construct a multi-benefit water storage project that helps **restore flexibility, reliability, and resiliency** to our statewide water supply

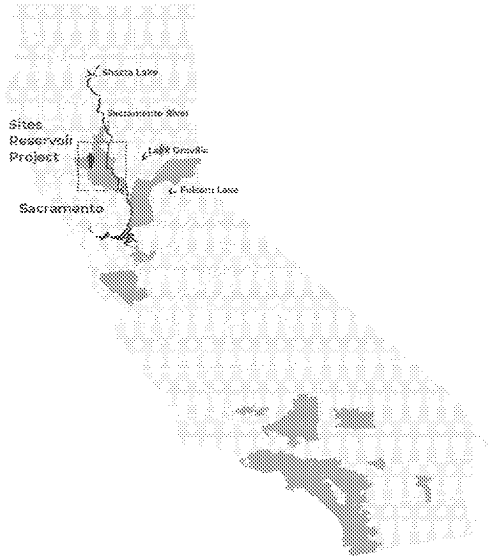




Sites

Our Strength is in Our Broad Statewide Participation

Diverse statewide representation of public agencies advancing Sites Reservoir



Participants include **counties, cities, water and irrigation districts**

Urban and **Rural**

Sacramento Valley

San Joaquin Valley

Bay Area

Southern California

Sites

Our Strength is in Our Broad Statewide Participation

Sacramento Valley

Carter Mutual Water Company
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

Southern California

Antelope Valley – East Kern Water Agency
Coachella Valley Water District
Desert Water Agency
Metropolitan Water District
San Bernardino Valley Municipal Water District
San Gorgonio Pass Water Agency
Santa Clarita Valley Water Agency

Sites

Rightsized to Meet Our Current and Future Water Supply Needs

Sites Reservoir has been designed and optimized to meet our water supply needs for today and in the future

The Sites Project Authority conducted a **rigorous Value Planning effort** to review the project's proposed operations and facilities **to develop a project that is "right sized" for our investors and participants** while still providing water supply reliability and enhancing the environment

Rightsizing the reservoir was **responsive to input** from **state and federal agencies, NGOs, elected officials, landowners and local communities**

The **feedback we received** through a robust outreach effort was **critical** to developing a reservoir that is the **right size for both people and the environment**

Sites

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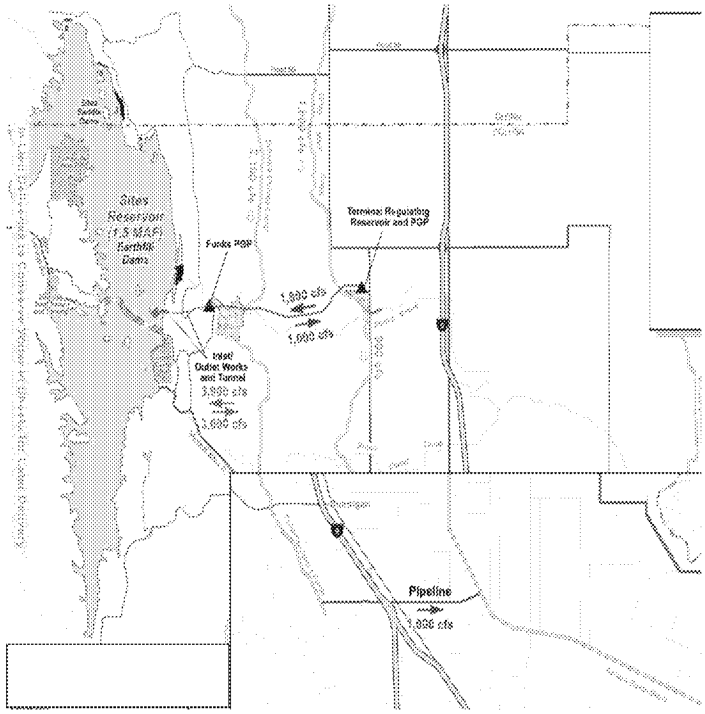
Rightsized to Meet Our Current and Future Water Supply Needs

1.5 million acre-feet

Utilizes the existing **Glenn-Colusa Irrigation District** and **Tehama-Colusa Canal Authority** canals to convey water to Sites Reservoir from the Sacramento River

Delivers water back to the Sacramento River through the **Tehama-Colusa Canal** and through the **Colusa Basin Drain** for participant deliveries and for the environment



Rightsized to Meet Our Current and Future Water Supply Needs

Member	Reservoir Participation(AFY)
Public Water Agencies	
North of Delta	52,142
South of Delta	140,750
Subtotal Public Water Agencies	192,892
State of CA	~ 40,000
Total Requirement	~230,000

Participant Demand

Participant water subscriptions allocated in the **current participation agreement**

Allocation of State of California water subscription is based on the **Proposition 1 water investment**

- Water for Delta Smelt
- Water for Refuges

Release Capacity from Sites

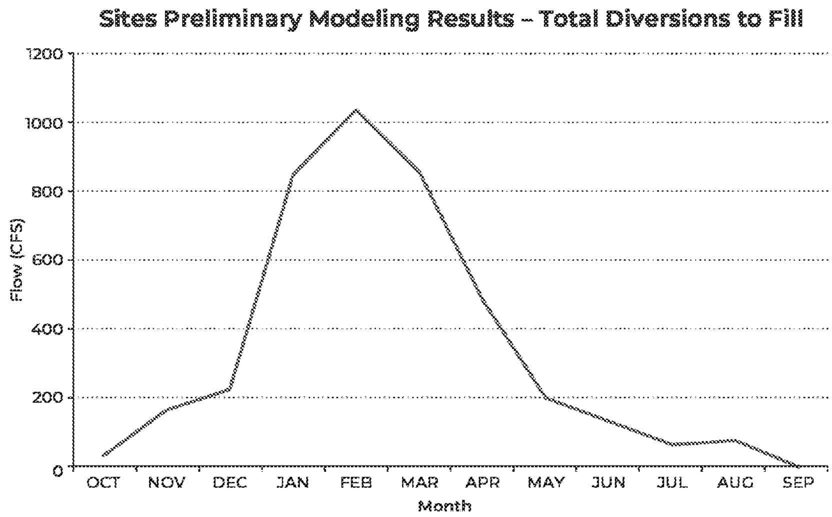
The "rightsized" project can deliver water to meet the demands of our participants and California's investment of water for the environment

Long term average ~240,000 AFY

Year Type	1,000 cfs Release Capacity (AFY) to the Colusa Basin Drain
Wet	90 - 120
Above Normal	260 - 290
Below Normal	245 - 275
Dry	355 - 385
Critically Dry	210 - 240

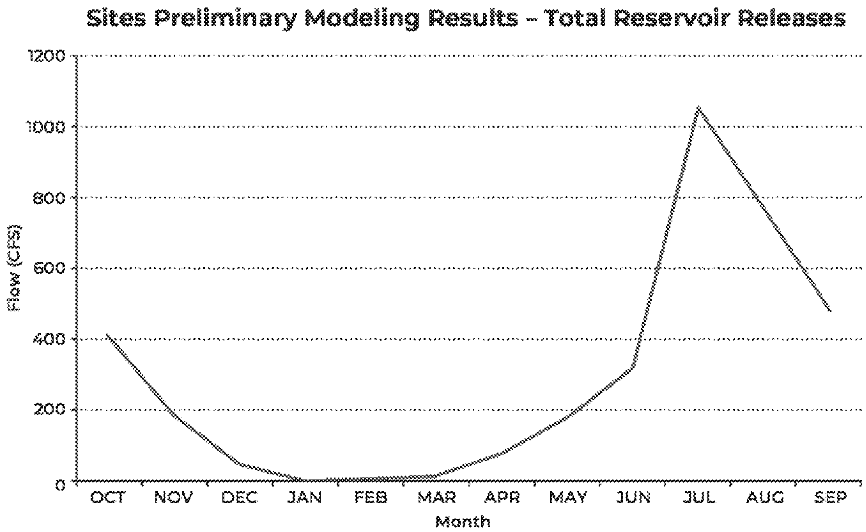
Sites

Timing of Sites Diversions (storing storm flows for use during drier times)



Sites

Timing of Sites Releases (increased water available for all uses in driest times)



Sites

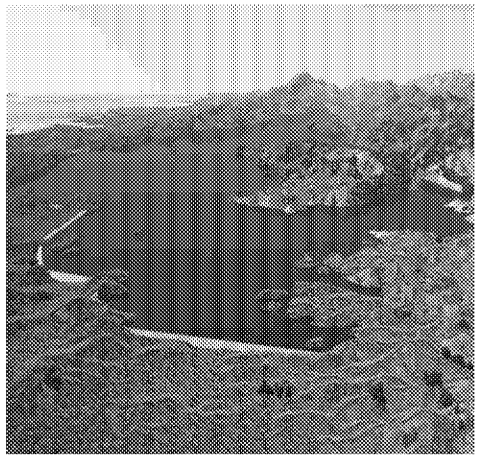
Rightsized to Meet Our Current and Future Water Supply Needs

The Value Planning process has **resulted** in a project that has a **smaller footprint** and **operated in a different manner** then originally designed

Due to these changes the Authority will **revise and recirculate its Draft EIR**

Work with **landowners, tribes, stakeholders, NGOs, and local communities** to develop a **collaborative environmental review process**

It is essential that we **build a project now that makes sense for all our participants** – local, state, and federal



Sites

Rightsized to Meet Our Current and Future Water Supply Needs

Reservoir Size (MAF)	1.5
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The rightsized project is **roughly $2 Billion less** then the 2017 preferred alternative

Cost savings primarily from the **removal** of the **Delevan Diversion** facility on the Sacramento River and the **Delevan Pipeline**

Lowered the Annual Cost during repayment ($/AF)

Significant savings to participants with finance through a **WIFIA** government backed loan

Sites

Provides Statewide Benefits for Generations to Come

Sites Reservoir provides many multi-layered benefits

Off-stream Storage
Does not create a barrier to native fish migration

Federal and State Agencies Manage Environmental Water
Adaptable to current and future conditions and priorities

Local Leadership and Cooperation
Aligns with Sacramento Valley's values and fosters regional and statewide collaboration

Cooperative Operation
Increases effectiveness and efficiency of existing water storage infrastructure

Adaptable to Climate Change
Contributes to system reliability and performance with climate change

Dry Year Water Supply
Reliable dry year water supply for California communities, farms and businesses

Recreational Opportunities
Provides northern Sacramento Valley with additional opportunities for recreation

Environmental Support
Provides environmental water in drier periods for native fish, and habitat for native species and birds

Sites

Provides Statewide Benefits for Generations to Come

Sites Reservoir provides water dedicated to environmental use

A significant portion of the **Sites Reservoir Project's annual water supplies will be dedicated to environment uses:**

- **Preserve cold-water** pool in **Lake Shasta** later into the 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**
- Provide **water dedicated** to help improve conditions for the **Delta Smelt**

Water dedicated for the environment provided by Sites Reservoir will be **managed by state resources agency managers** who will decide how, and when, this water would be used – creating a water asset for the state that **does not currently exist**

Sites

Possibilities of Environmental Water Uses

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Sites **creates a resource that can be managed for the benefit of the species.**

Water for the environment is **managed by state resource agencies.**

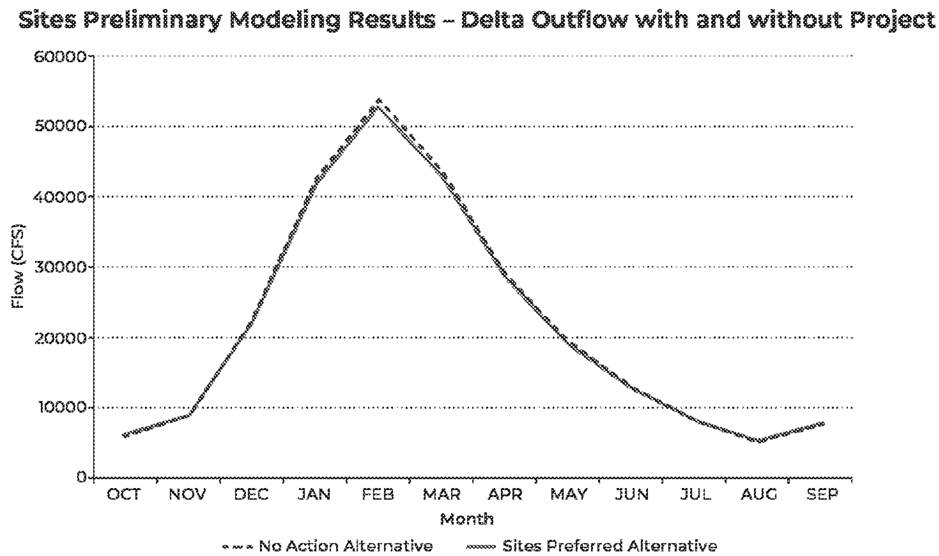
Potential Beneficiary
Level 4 refuge water
Enhanced Delta Ecosystem
Improve Survival of Anadromous Fish

There is **flexibility** to manage these benefits each year.

The range of possibilities will be covered in the recirculated Draft EIR.

Sites

Uncaptured Flow put to highest and best use



Sites

Anticipated flows through the Delta from proposed Voluntary Settlements

Increased Flows above Baseline

(TAF)	C	D	BN	AN	W
San Joaquin Basin	63	215	249	182	50
Sacramento Basin	37	276	256	281	45
Water Purchase Programs	125	109	195	237	205
Exporters	0	100	0	0	0
Subtotal [illegible] Above Baseline (Year 1)	225	700	700	[illegible]	300
New Water Projects & Programs (Before Year 8)	45	202	212	115	45
[illegible] Outflow Above Baseline (Year 1-8)	270	902	[illegible]	[illegible]	345
Exporters (Spring baseline maintenance)	0	200	300	300	0
Total New and Re-operated Outflows	270	1,102	1,212	1,115	345
State Team's Adequacy Target	260-350	740-1,000	840-1,100	840-1,200	300*-350

*Only applies to a subset of wet years

1

Sites

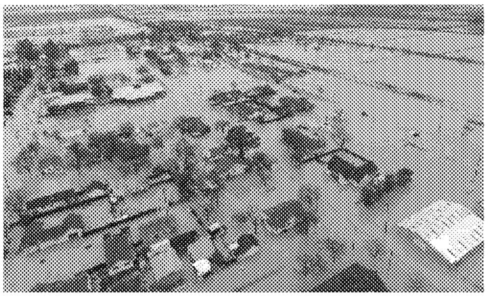
Provides Statewide Benefits for Generations to Come

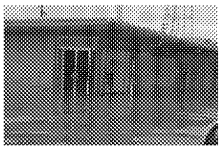
Sites Reservoir provides regional flood protection benefits

Provides significant **regional flood protection benefits** for the Sacramento Valley

Will capture and store **flood flows** that would normally impact the community of **Maxwell** - protecting homes, business and farms

Will help to **limit "down stream" flooding issues** by capturing storm flows that sometimes overwhelm the regions flood control facilities





Sites

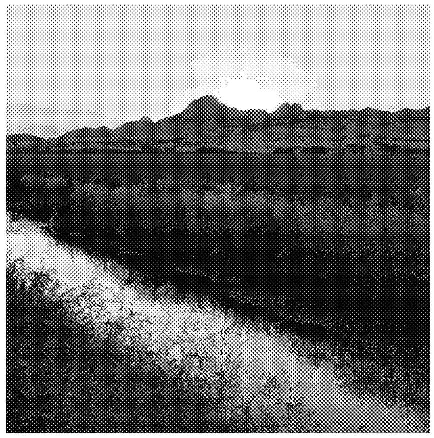
Provides Statewide Benefits for Generations to Come

Sites Reservoir will benefit the local and regional economy

Create hundreds of construction-related jobs during each year of the construction period, and **long-term jobs related to operations**

Creates **new recreation opportunities** in the Sacramento Valley which adds to the **region's economy**

Adding **resiliency** to the water supply will **strengthen the statewide economy** and **business** that rely on a reliable source of water for their operations – particularly agriculture



Sites

We are On-Track to Deliver This Vital Project for the People of California

Key Milestones Through 2021

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Enhance landowner, stakeholder & NGO engagement

Develop Operating Agreement Term Sheets with: DWR, USBR, TCCA, GCID, CBD Authority

Sites

Summary Of Take-Aways for BPC

Governance & Innovation

Beneficiary Pays
Fed/State/Local Participation
Local Oversight
Benefit Contracts

Multiple Benefits for all of California

New Water Supply (Ag & Urban)
Ecosystem Priority Flexibility
Added Flood Control/Public Safety
New Recreation
JOBS!

Realities of Affordability & Permits

Competitive unit cost of water
Protective conditions for species
Net benefits for the environment
Use of existing facilities
Integrated Operations

Sites

Questions

Sites

Assumed Diversion and Operations Criteria

Location	Criteria
Wilkins Slough Bypass Flow	8,000 cfs April/May 5,000 cfs all other times
Fremont Weir Notch	Prioritize the Fremont Weir Notch, Yolo Bypass preferred alternative, flow over weir within 5%
Flows into the Sutter Bypass System	No restriction due to flow over Moulton, Colusa, and Tisdale Weirs
Freeport Bypass Flow	Modeled WaterFix Criteria (applied on a daily basis) Post-Pulse Protection (applied on a moving 7-day average) Post-Pulse (3 levels) = January–March Level 2 starts January 1 Level 1 is initiated by the pulse trigger
Net Delta Outflow Index (NDOI) Prior to Project Diversions	44,500 cfs between March 1 and May 31

Sites

Assumed Release Criteria

Most releases occur in dry years for water supply and environmental benefits

Priority of releases assume the following:

- Provide water to project participants north and south of the delta
- Provide water to Cache Slough area via Yolo bypass
- Provide water for incremental Level 4 refuge deliveries
- Support Reclamation goals through exchanges

Deliveries to SWP contractors supplement Table A (start @ 85% allocation and more aggressive releases starting @ 65%)

Sites

From: Micko, Steve/SAC [Steve.Micko@jacobs.com]
Sent: 11/12/2020 10:03:26 AM
To: Heydinger, Erin [erin.heydinger@hdrinc.com]; Alicia Forsythe [aforsythe@sitesproject.org]
CC: Leaf, Rob/SAC [Rob.Leaf@jacobs.com]
Subject: RE: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Hi Erin,

To your question, yes.
Long-term planning horizon refers to level of development (LOD) and land use.
LOD and land use plug-in to calculations for demands in the model.

I will include WSIP 2030 and 2070 in my response.

Best,
Steve

From: Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Sent: Tuesday, November 10, 2020 1:08 PM
To: Micko, Steve/SAC <Steve.Micko@jacobs.com>; Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Leaf, Rob/SAC <Rob.Leaf@jacobs.com>
Subject: RE: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Hi Steve,

Thanks, Steve. Yes, please go ahead and respond to Chuching, cc myself and Ali, and ask him to cc us in the future.

Quick question – what does he mean when he says "long term planning horizon"? Is that asking how demands are estimated for CVP/SWP (i.e. using 2030 demands)?

You may also want to include that we will be doing some additional climate change analysis for the CWC Feasibility Study (2030 and 2070).

Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

hdrinc.com/follow-us

From: Micko, Steve/SAC <Steve.Micko@jacobs.com>
Sent: Tuesday, November 10, 2020 1:02 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Cc: Leaf, Rob/SAC <Rob.Leaf@jacobs.com>
Subject: FW: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Hi Ali and Erin,

I think we need to ask Chuching to run questions through you two, or cc you both.
Let me know how you would like to proceed.

Answers to his questions are quick:
1. I believe "Conveyance System" refers to "Delta Conveyance Project". If so, no.
2. 2030
3. Not yet. We plan to conduct a climate change sensitivity analysis under 2035 CT climate conditions, from the 2020 SWP LTO FEIR.

Best,
Steve

From: Leaf, Rob/SAC <Rob.Leaf@jacobs.com>
Sent: Tuesday, November 10, 2020 11:12 AM
To: Micko, Steve/SAC <Steve.Micko@jacobs.com>
Subject: Fwd: [EXTERNAL] Quick Clarification Questions for Sites Modeling

FYI. We need to coordinate response with Erin.

Sent from my iPhone

Begin forwarded message:

From: "Wang,Chuching" <cwang@mwdh2o.com>
Date: November 10, 2020 at 11:04:16 AM PST
To: "Tull, Robert/SAC" <Robert.Tull@jacobs.com>, "Leaf, Rob/SAC" <Rob.Leaf@jacobs.com>
Subject: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Rob & Rob,
I am going to have a MWD internal Sites briefing discussion on modeling status soon.

I understand that you are working on the baselines and various scenarios. I just need to get a brief response from you to clarify some of my questions.
1. Though in the long run, you will consider Sites with and without a Conveyance System. But at this moment, you have not included a conveyance system in your modeling analysis. Is it correct?
2. For the CALSIM analysis, what is the long term planning horizon? 2040? 2050? Or others?
3. For your current modeling efforts, have you considered climate changes?

Other than question 2, the other two are "yes/no" questions. Thank you for your quick response.

Chuching Wang, Ph.D., P.E.
Senior Engineer
Bay Delta Initiatives
Office of The General Manager
Metropolitan Water District of Southern California
(213)217-6188, (310)500-8658 cell

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From: Wang,Chuching [cwang@mwdh2o.com]
Sent: 11/12/2020 10:17:24 AM
To: steve.micko@jacobs.com
CC: Alicia Forsythe [aforsythe@sitesproject.org]; Heydinger, Erin [erin.heydinger@hdrinc.com]; Leaf, Rob/SAC [Rob.Leaf@jacobs.com]
Subject: RE: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Steve,

Thank you for the response.

1. Yes. I meant Delta Conveyance Project.
2. This may not impact the analysis. But, isn't 2030 for long term too short?

Chuching

Chuching Wang, Ph.D., P.E.
Senior Engineer
Bay Delta Initiatives
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From: Micko, Steve/SAC <Steve.Micko@jacobs.com>
Sent: Thursday, November 12, 2020 10:08 AM
To: Wang,Chuching cwang@mwdh2o.com

Cc: Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <erin.heydinger@hdrinc.com>; Leaf, Rob/SAC <Rob.Leaf@jacobs.com>
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Going forward, can you please cc Ali Forsythe and Erin Heydinger on questions related to Sites?

Please let me know if you have any questions.

Best,
Steve

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Sent: Tuesday, November 10, 2020 11:12 AM
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From: Jerry Brown [jbrown@sitesproject.org]
Sent: 11/12/2020 6:37:22 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]; Heydinger, Erin [erin.heydinger@hdrinc.com]
Subject: Re: Sites Update
Attachments: Sites_Overview PPT reclamation.pptx

From: Alicia Forsythe <aforsythe@sitesproject.org>
Date: Thursday, November 12, 2020 at 6:33 PM
To: "Heydinger, Erin" <erin.heydinger@hdrinc.com>, Jerry Brown <jbrown@sitesproject.org>
Subject: FW: Sites Update

FYI. See below. I worked with Chandra at CH2 many moons ago.

Erin, can you take a stab at a few slides? I will let you know when I hear back on deadline.

Ali

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

---

From: Alicia Forsythe
Sent: Thursday, November 12, 2020 6:32 PM
To: 'Chandra Chilmakuri' <cchilmakuri@swc.org>
Subject: RE: Sites Update

Sure thing. When do you need them by?

I hope you are doing well also!

Ali

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

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From: Chandra Chilmakuri <cchilmakuri@swc.org>
Sent: Thursday, November 12, 2020 4:56 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: Sites Update

Hi Ali,
Hope you are doing well in these crazy times!
I have an internal presentation at SWC where I am providing a quick overview of various ongoing water supply projects. Could you provide couple of slides that you may readily that summarizes the project as it is currently defined and potential water supply implications to SWP participants? Hope this doesn't require you to do any additional work.
Please let me know if you have any questions.
Thank you!

Chandra Sekhar Chilmakuri, Ph.D., P.E.
Assistant General Manager for Water Policy
State Water Contractors
1121 L Street, Suite 1050 | Sacramento, CA 95814
P: 916.562.2583 | M: 916.335.3017 | **cchilmakuri@swc.org**

Sites Reservoir

Sites

Our Strength is in Our Broad Statewide Participation

Sacramento Valley
Carter Mutual Water Company
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

Southern California
Antelope Valley - East Kern Water Agency
Coachella Valley Water District
Desert Water Agency
Metropolitan Water District
San Bernardino Valley Municipal Water District
San Gorgonio Pass Water Agency
Santa Clarita Valley Water Agency

Sites

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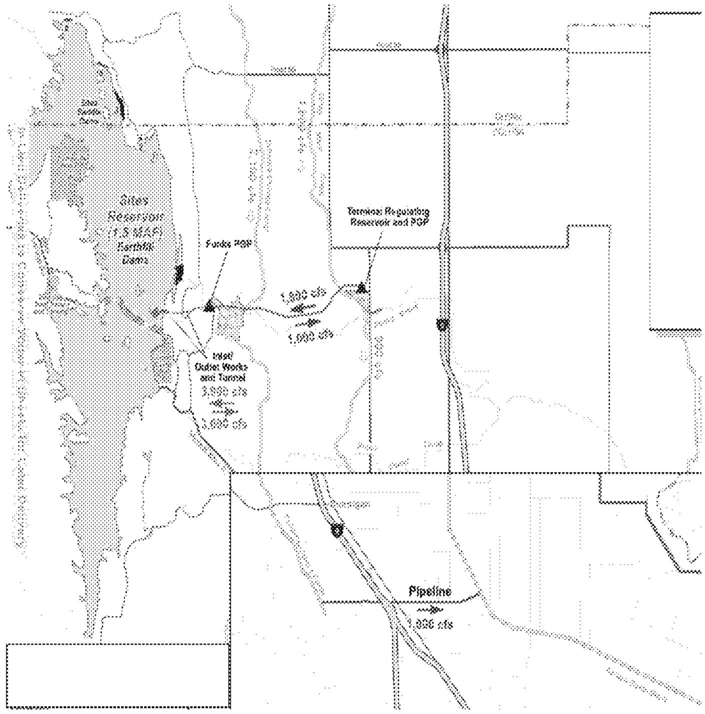

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Enhance landowner, stakeholder & NGO engagement

Develop Operating Agreement Term Sheets with: DWR, USBR, TCCA, GCID, CBD Authority

Sites

Draft_0005087

Questions

Sites

From: Joe Trapasso [jtrapasso@sitesproject.org]
Sent: 11/13/2020 7:07:12 AM
To: Jerry Brown [jbrown@sitesproject.org]; Alicia Forsythe [aforsythe@sitesproject.org]; Kevin Spesert [kspesert@sitesproject.org]
Subject: RE: Poliing Evidence of Climate Concerns

Yes, it puts a large explanation point behind Sites and climate change!

From: Jerry Brown <jbrown@sitesproject.org>
Sent: Thursday, November 12, 2020 6:29 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Joe Trapasso <jtrapasso@sitesproject.org>; Kevin Spesert <kspesert@sitesproject.org>
Subject: Poliing Evidence of Climate Concerns

California final Presidential results were 65/35 Biden and for areas served by our project results were closer to 75/25 Biden. This is why we need to emphasize the climate change benefits of the project.

"Nationwide, 58 percent of Americans said they were either 'very concerned' or 'somewhat concerned' about their communities being harmed by climate change ... with 39 percent saying they were 'not too concerned' or 'not concerned at all,'" the *Times* reported. "But that poll also found a stark partisan split: 90 percent of voters who favored Joseph R. Biden Jr. ... expressed concern about climate change, while just 23 percent of voters who backed President Trump, the Republican incumbent, did so."

Climate change has been traced to issues that directly affect drinking water and wastewater utilities, including the promotion of toxic algae growth in source water, coastal flooding, and water scarcity. By tying concern around these issues to political preferences, the polling suggests that voters think President-elect Biden will have a different approach to these issues than his predecessor.

From: Wang,Chuching [cwang@mwdh2o.com]
Sent: 11/13/2020 11:32:59 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]; steve.micko@jacobs.com
CC: Heydinger, Erin [erin.heydinger@hdrinc.com]; Leaf, Rob/SAC [Rob.Leaf@jacobs.com]; Neudeck,Randall D [rneudeck@mwdh2o.com]
Subject: RE: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Hi, Ali,

In the past, you have a model output summary spreadsheet, including mass balance chart.
For example: SitesIncomeStatement_rev18_110218_mergemod_1,000cfs_Release_Capacity_v1.

Do you have the similar spreadsheet for your new analysis?
Can we get the spreadsheet and DSS output files before the next model review discussion?

Chuching

Chuching Wang, Ph.D., P.E.
Senior Engineer
Bay Delta Initiatives
Office of The General Manager
Metropolitan Water District of Southern California
(213)217-6188, (310)500-8658 cell

From: Wang,Chuching
Sent: Friday, November 13, 2020 9:03 AM
To: 'Alicia Forsythe' <aforsythe@sitesproject.org>; steve.micko@jacobs.com
Cc: Heydinger, Erin <erin.heydinger@hdrinc.com>; Leaf, Rob/SAC <Rob.Leaf@jacobs.com>
Subject: RE: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Thank you for the info.

Chuching

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Friday, November 13, 2020 9:01 AM
To: steve.micko@jacobs.com; Wang,Chuching <cwang@mwdh2o.com>
Cc: Heydinger, Erin <erin.heydinger@hdrinc.com>; Leaf, Rob/SAC <Rob.Leaf@jacobs.com>
Subject: RE: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Hi all – Yes, we should be cautious to change 2030 to something longer. We need to balance the baseline requirements of CEQA in the analysis. CEQA requires a baseline at the time of the NOP or a projected future baseline, with justification/support. There is a lot of support for going with 2030 from a CEQA and consistency perspective – especially considering this is what Reclamation used it its NEPA doc for ROC on LTO. We'd have to carefully consider going out further than 2030 as our baseline.

We will have the 2035 CT along with 2070 analysis for the CWC efforts that will go out further.

Ali

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

---

From: Micko, Steve/SAC <Steve.Micko@jacobs.com>
Sent: Thursday, November 12, 2020 10:36 AM
To: Wang,Chuching <cwang@mwdh2o.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <erin.heydinger@hdrinc.com>; Leaf, Rob/SAC <Rob.Leaf@jacobs.com>
Subject: RE: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Hi Chuching,

You raise a good point.
I am cautious to change that though.
2030 is consistent with the baseline model provided by Reclamation.
It's unlikely they would support or agree with a change to the planning horizon.

Rob, please add/edit as you see fit.

Best,
Steve

From: Wang,Chuching <cwang@mwdh2o.com>
Sent: Thursday, November 12, 2020 10:17 AM
To: Micko, Steve/SAC <Steve.Micko@jacobs.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <erin.heydinger@hdrinc.com>; Leaf, Rob/SAC <Rob.Leaf@jacobs.com>
Subject: RE: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Steve,
Thank you for the response.

1. Yes. I meant Delta Conveyance Project.
2. This may not impact the analysis. But, isn't 2030 for long term too short?

Chuching

Chuching Wang, Ph.D., P.E.
Senior Engineer
Bay Delta Initiatives
Office of The General Manager
Metropolitan Water District of Southern California
(213)217-6188, (310)500-8658 cell

From: Micko, Steve/SAC <Steve.Micko@jacobs.com>
Sent: Thursday, November 12, 2020 10:08 AM
To: Wang,Chuching cwang@mwdh2o.com

Cc: Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <erin.heydinger@hdrinc.com>; Leaf, Rob/SAC <Rob.Leaf@jacobs.com>
Subject: RE: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Good morning Chuching,

Answers to your questions are below:
1. I believe "Conveyance System" refers to "Delta Conveyance Project". If so, no.
2. 2030
3. Not yet. We plan to conduct a climate change sensitivity analysis under 2035 CT climate conditions, from the 2020 SWP LTO FEIR. We will also conduct climate change analyses with WSIP 2030 and 2070 climates for the CWC Feasibility Study.

Going forward, can you please cc Ali Forsythe and Erin Heydinger on questions related to Sites?

Please let me know if you have any questions.

Best,
Steve

From: Leaf, Rob/SAC <Rob.Leaf@jacobs.com>
Sent: Tuesday, November 10, 2020 11:12 AM
To: Micko, Steve/SAC <Steve.Micko@jacobs.com>
Subject: Fwd: [EXTERNAL] Quick Clarification Questions for Sites Modeling

FYI

Sent from my iPhone

Begin forwarded message:

From: "Wang,Chuching" <cwang@mwdh2o.com>
Date: November 10, 2020 at 11:04:16 AM PST
To: "Tull, Robert/SAC" <Robert.Tull@jacobs.com>, "Leaf, Rob/SAC" <Rob.Leaf@jacobs.com>
Subject: [EXTERNAL] Quick Clarification Questions for Sites Modeling

Rob & Rob,
I am going to have a MWD internal Sites briefing discussion on modeling status soon.

I understand that you are working on the baselines and various scenarios. I just need to get a brief response from you to clarify some of my questions.
1. Though in the long run, you will consider Sites with and without a Conveyance System. But at this moment, you have not included a conveyance system in your modeling analysis. Is it correct?
2. For the CALSIM analysis, what is the long term planning horizon? 2040? 2050? Or others?
3. For your current modeling efforts, have you considered climate changes?

Other than question 2, the other two are "yes/no" questions. Thank you for your quick response.

Chuching Wang, Ph.D., P.E.
Senior Engineer
Bay Delta Initiatives
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(213)217-6188, (310)500-8658 cell

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From: Eric Leitterman [ELeitterman@valleywater.org]
Sent: 11/13/2020 12:30:47 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]
Subject: Follow-up Questions - Sites Ops and Engr WG

Flag: Follow up

Hi Ali,

I had a couple of questions that I held back in the interest of time during the call this morning that I was hoping you might be able to help me with.

- Will iteration 2 modeling include a temperature analysis downstream of the CBD? I know that at least one of my directors is concerned about a critique from some NGO's that the project will release warm water that could lead to increased algae blooms in the Delta.
- Can JP provide an update on efforts to work with the CWC to understand the Prop 1 75% financing requirement for eligibility? Will a financing plan with the cash calls described in the presentation be acceptable?

ERIC LEITTERMAN
ASSISTANT ENGINEER II - CIVIL
Imported Water Unit
Water Supply Division
Tel. (408) 630-2669 / Cell. (408) 784-4966
eleitterman@valleywater.org

Valley Water

SANTA CLARA VALLEY WATER DISTRICT
5750 Almaden Expressway, San Jose CA 95118
www.valleywater.org

Clean Water · Healthy Environment · Flood Protection

From: Adrian Covert [acovert@bayareacouncil.org]
Sent: 11/13/2020 5:05:30 PM
To: Jerry Brown [jbrown@sitesproject.org]
CC: Anna Sciaruto [asciaruto@bayareacouncil.org]
Subject: Re: hydropower?

Definitely worth looking into. Look into it we shall!

From: Jerry Brown <jbrown@sitesproject.org>
Date: Tuesday, November 10, 2020 at 3:36 PM
To: Adrian Covert <acovert@bayareacouncil.org>
Cc: Anna Sciaruto <asciaruto@bayareacouncil.org>
Subject: Re: hydropower?

Hi Adrian - I recall we took a run at this about a decade ago and hit a brick wall called pge and state wanted rooftop solar. Maybe things have changed since then. On surface would be good but devil is in the details. Could be beneficial to sites but I don't see anything legislatively to determine what we do for power. Keep me posted. I'd like to help however I can.

Sent from my iPhone

On Nov 10, 2020, at 2:00 PM, Adrian Covert <acovert@bayareacouncil.org> wrote:

Thanks for the quick response Jerry! Very interesting to know about Sites. I don't have an supplier ready (sorry!). Would there be any benefit to the Sites project if its hydropower counted as renewable under the RPS? I'm not as well versed in energy policy, but I'm think a strong case could be made to expand the qualifying hydro power under the RPS to include large off-stream hydro as a way to expand GHG-free energy and improve reliability given increase of heat waves at minimal environmental cost (maybe LVE could benefit as well?). Related, we've also been thinking about ways to incentivize generation of biomass energy to stimulate demand for vegetation removal. Copying my colleague Anna who's been looking into this.

Adrian

From: Jerry Brown <jbrown@sitesproject.org>
Date: Tuesday, November 10, 2020 at 1:24 PM
To: Adrian Covert <acovert@bayareacouncil.org>
Subject: Re: hydropower?

Yes! Through in line conduit hydro which means we capture the energy of the water falling out of the reservoir when we're making releases to meet demands in July-Nov and we'll push that energy onto the grid for others to consume.

Our energy needs generally fall between Dec-Apr during our filling operations. We would very much like to find a renewable resource for this supply. I'm having discussions with a developer that is trying to create a 80MW solar/battery plant within 5 miles of the reservoir.

If you have other ideas for suppliers, let me know.

From: Adrian Covert <acovert@bayareacouncil.org>
Date: Tuesday, November 10, 2020 at 1:14 PM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: hydropower?
ee
Hi Jerry - I hope you're doing well! Quick question – Will sites generate hydropower?

From: Spranza, John [John.Spranza@hdrinc.com]
Sent: 11/16/2020 7:23:06 AM
To: Alicia Forsythe [ali@forsythe-group.com]
CC: Heydinger, Erin [Erin.Heydinger@hdrinc.com]; Laurie Warner Herson [laurie.warner.herson@phenixenv.com]
Subject: FW: [EXTERNAL] Sites Hydropower FERC Response

Morning,
FERC's staff agrees that we would be 2 PGPs which, if approved by the commission, would put the project around 70 MW. Wayne and Jacobs would have the actual number, but "around 70-75 MW" was what Wayne and I were discussing.

John Spranza

D 916.679.8858 M 818.640.2487

-----Original Message-----
From: Luu, Henry
Sent: Sunday, November 15, 2020 11:56 AM
To: Rude, Pete/RDD <Pete.Rude@jacobs.com>; dyok <dyok@prodigy.net>
Cc: Spranza, John <John.Spranza@hdrinc.com>
Subject: RE: [EXTERNAL] Sites Hydropower FERC Response

Great news!

Wayne - thank you for being diligent with this item, very much appreciated.

Henry H. Luu, PE
D 916.679.8857 M 916.754.7566
hdrinc.com/follow-us

-----Original Message-----
From: Rude, Pete/RDD [mailto:Pete.Rude@jacobs.com]
Sent: Friday, November 13, 2020 4:27 PM
To: Luu, Henry <Henry.Luu@hdrinc.com>; Spranza, John <John.Spranza@hdrinc.com>
Cc: dyok <dyok@prodigy.net>
Subject: FW: [EXTERNAL] Sites Hydropower FERC Response

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.

HI Henry and John - please see good news below from Wayne Dyok. We can proceed with assuming that both PGP's will each be under the 40 MW hydro power FERC exemption. If you have detailed questions please contact Wayne.

Sorry in the late notice as I was on vacation and am now getting all caught up on e-mail traffic.

Peter H. Rude, PE (CA, HI, CO) /Jacobs/ Civil Engineer & Principal Project Manager
1-530-229-3396 (office)/ 1-530-917-4164 (mobile)/ 2525 Airpark Drive, Redding, CA 96001
pete.rude@jacobs.com /
https://nam12.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.jacobs.com%2F&data=04%7C01%7CHenry.Luu%40hdrinc.com%7C4e90b98ba5cb475f02b908d88834004e%7C3667e201cbdc48b39b425d2d3f16e2a9%7C0%7C0%7C637409104214737783%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=9eCImKQdFUAn8nEzQLz72XS0v%2F%2FF%2Fga127D0eybiThk%3D&reserved=0

-----Original Message-----
From: Wayne Dyok <dyok@prodigy.net>
Sent: Monday, November 09, 2020 4:49 PM
To: Rude, Pete/RDD <Pete.Rude@jacobs.com>; Smith, Jeff/SAC <Jeff.Smith1@jacobs.com>; Isaman, Cameron/SEA <Cameron.Isaman@jacobs.com>
Subject: [EXTERNAL] Sites Hydropower FERC Response

Hi Pete and Jeff.

Today I had a conference call with FERC (Kelley Houff and Chris Chaney) on whether Sites would qualify as one or two independent projects. Staff provided their opinion which is non binding on the Commission. The good news is that staff agrees with our assessment that Sites would qualify as two independent projects.

I also confirmed that the form I transmitted to you is the proper form to submit when we are ready to transmit. In essence we will request an exemption from licensing and exemption. I know this is confusing but that is the terminology (exemption from exemption).

FERC also suggested that we consider providing a draft to staff before formally filing. I think this is an excellent idea. FERC can provide guidance on how we might best explaIn the independence.

I have not notified HDR or Sites about FERC's response as this would be best transmitted by Jacobs.

Regards,
Wayne

Sent from my iPhone

____

From: Laurie Warner Herson [laurie.warner.herson@phenixenv.com]
Sent: 11/16/2020 7:25:44 AM
To: Spranza, John [John.Spranza@hdrinc.com]; Alicia Forsythe [ali@forsythe-group.com]
CC: Heydinger, Erin [Erin.Heydinger@hdrinc.com]
Subject: RE: [EXTERNAL] Sites Hydropower FERC Response

That's consistent with what Pete had told us. So, that's great, can I pass this on to Nicole for the PD?

-----Original Message-----
From: Spranza, John [mailto:John.Spranza@hdrinc.com]
Sent: Monday, November 16, 2020 7:23 AM
To: Alicia Forsythe <ali@forsythe-group.com>
Cc: Heydinger, Erin <Erin.Heydinger@hdrinc.com>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: FW: [EXTERNAL] Sites Hydropower FERC Response

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FERC's staff agrees that we would be 2 PGPs which, if approved by the commission, would put the project around 70 MW. Wayne and Jacobs would have the actual number, but "around 70-75 MW" was what Wayne and I were discussing.

John Spranza

D 916.679.8858 M 818.640.2487

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From: Luu, Henry
Sent: Sunday, November 15, 2020 11:56 AM
To: Rude, Pete/RDD <https://urldefense.proofpoint.com/v2/url?u=http-3A__Pete.Rude-40jacobs.com&d=DwIGaQ&c=euGZstcaTDllvimEN8b7jXrwqOf-v5A_CdpgnVfiiMM&r=5lDi_dRX9hZUr3uaaaVnGL7X3t7keCUI33rc_MkofTH8fiDFwXqWpRnG7poqY5i5&m=nlmbo9xuSA5bJF40p25Y4Th68J7N9qRzTQ1eaumz6uQ&s=fmaZlbTws40xVFnh5mIh1PgA6djtYqDBeDU45wd8IsU&e=>; dyok <dyok@prodigy.net>
Cc: Spranza, John <John.Spranza@hdrinc.com>
Subject: RE: [EXTERNAL] Sites Hydropower FERC Response

Great news!

Wayne - thank you for being diligent with this item, very much appreciated.

Henry H. Luu, PE
D 916.679.8857 M 916.754.7566
https://urldefense.proofpoint.com/v2/url?u=http-3A__hdrinc.com_follow-2Dus&d=DwIGaQ&c=euGZstcaTDllvimEN8b7jXrwqOf-v5A_CdpgnVfiiMM&r=5lDi_dRX9hZUr3uaaaVnGL7X3t7keCUI33rc_MkofTH8fiDFwXqWpRnG7poqY5i5&m=nlmbo9xuSA5bJF40p25Y4Th68J7N9qRzTQ1eaumz6uQ&s=yMlD72MxdcLRj552y5NvOjViK3gyWTl98qaCSZOHuYU&e=

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Cc: dyok <dyok@prodigy.net>
Subject: FW: [EXTERNAL] Sites Hydropower FERC Response

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pete.rude@jacobs.com / https://urldefense.proofpoint.com/v2/url?u=https-

3A__nam12.safelinks.protection.outlook.com_-3Furl-3Dhttp-253A-252F-252Fwww.jacobs.com-252F-26amp-3Bdata-3D04-257C01-257CHenry.Luu-2540hdrinc.com-257C4e90b98ba5cb475f02b908d88834004e-257C3667e201cbdc48b39b425d2d3f16e2a9-257C0-257C0-257C637409104214737783-257CUnknown-257CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0-253D-257C1000-26amp-3Bsdata-3D9eCImKQdFUAn8nEzQLz72XS0v-252F-252FF-252Fga127D0eybiThk-253D-26amp-3Breserved-3D0&d=DwIGaQ&c=euGZstcaTDllvimEN8b7jXrwqOf-v5A_CdpgnVfiiMM&r=5lDi_dRX9hZUr3uaaaVnGL7X3t7keCUI33rc_MkofTH8fiDFwXqWpRnG7poqY5i5&m=nlmbo9xuSA5bJF40p25Y4Th68J7N9qRzTQ1eaumz6uQ&s=7C9fXnObFG5h4pWv7PMizGDNNahZ2FwQQHtJcFeBARQ&e=

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Sent: Monday, November 09, 2020 4:49 PM
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Subject: [EXTERNAL] Sites Hydropower FERC Response

Hi Pete and Jeff.

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FERC also suggested that we consider providing a draft to staff before formally filing. I think this is an excellent idea. FERC can provide guidance on how we might best explaIn the independence.

I have not notified HDR or Sites about FERC’s response as this would be best transmitted by Jacobs.

Regards,
Wayne

Sent from my iPhone

____

From: Arsenijevic, Jelica [Jelica.Arsenijevic@hdrinc.com]
Sent: 11/16/2020 11:54:40 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]
Subject: Emailing: GeotechUpdate.docx
Attachments: GeotechUpdate.docx

Flag: Follow up

Her is update.
Your message is ready to be sent with the following file or link attachments:

GeotechUpdate.docx

Note: To protect against computer viruses, e-mail programs may prevent sending or receiving certain types of file attachments. Check your e-mail security settings to determine how attachments are handled.

Good morning

As promised, below is an update for the upcoming 2020-2021 geotechnical investigations.

The collective team (environmental, Reclamation, real estate, and engineering) have been hard at work with obtaining necessary approvals, permits and authorizations for the upcoming effort.

CEQA/NEPA

Our CEQA Notice of Exemption has been filed with Yolo and Colusa counties on November 4th.

Reclamation is in the process of reviewing and approving the NEPA Categorial Exclusion for signature. The NEPA CE will be signed in the next week.

USFWS/SHPO Consultations

We've prepared a supplemental biological assessment. In record time, less than a month, we received an amended biological opinion (BO) from USFWS. We received the amended BO on October 15th, 2 weeks ahead of our target date (October 31st)

We also prepared an amended cultural sensitivity report to support consultation with SHPO. Concurrence on a finding of no effect was received from SHPO on November 5th.

Encroachment Permits/Landowner Access Agreements

Encroachment permits are either in hand or will be approved in the next couple of weeks. We will have all permits in hand by the time we get going on the work on December 4th.

The landowner access agreement process has gone well. We received permission from one of the private property owners last week. Two more agreements are underway and should be signed early this week. All coordination related to these agreements has involved the Land Management Committee every step of the way.

Due to the engagement activities with the landowners, the landowners have made specific requests. These requests came in after we received our amended BO and SHPO concurrence. The requests triggered a need for us to reconsult with SHPO and USFWS. These changes are minor in nature and included a change in an entrance/exit point to a property and moving a bore location so that it doesn't interfere with the landowner's daily operations on that parcel. The change in entrance/exit point and moving the bore hole were identified as being outside of areas that we consulted on – outside of the action area and area of potential effect.

We are honoring the landowner requests and hence we are reinitiating consultation.

USFWS re-consultation should be a quick process via email communication. SHPO re-consultation will take the full 30 days. Though we are reconsulting, we don't expect any schedule implications. We will still begin on December 4th in areas that are unaffected by these changes.

Pre-construction Surveys

And finally, some extra good news on this Monday. We had our official kickoff to the 2020-2021 effort this past Friday, November 13th. We completed the first half of preconstruction surveys on Friday, and our 2nd survey is scheduled this Wednesday.

From: Laurie Warner Herson [laurie.warner.herson@phenixenv.com]
Sent: 11/16/2020 4:17:59 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]
Subject: FW: Sites Reservoir: Draft Memo re GHG MMs Attached

Hi Ali,

I will add GHG as a topic on our agenda for Friday. Meanwhile, Nicole's July memo (see my email below) is here: https://sitesreservoirproject.sharepoint.com/:f:/r/EnvPlanning/Deliverables%20Completed/GHG%20Memo?csf=1&web=1&e=kzqOEy

Laurie

From: Laurie Warner Herson
Sent: Monday, July 27, 2020 8:52 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: RE: Sites Reservoir: Draft Memo re GHG MMs Attached

Hi Ali,

I did not mark up or edit the GHG memo that ICF provided. Instead, here is a list of key points:

- The 2017 Draft EIR/EIS took into consideration BMPs and other AQ mitigation but did not include any specific GHG-related mitigation measures, concluding that all alternatives would result in significant and unavoidable GHG effects.
  - Based on the 2017 EIR/EIS analysis, "there was no variation in mitigation between the hydropower-generating alternatives (i.e., Alternatives A and D) and the alternative that did not generate hydropower (i.e., Alternative C1), the hydropower generation did not demonstrably help reduce effects related to GHGs."
  - The 2017 Draft EIR/EIS "qualitatively discusses the potential benefits associated with hydropower generation, but does not quantify the expected reduction in GHG emissions associated with optimizing operations to both generate hydropower and use renewable resources when pumping" so hydropower benefits of the project were not identified.
- For the revised Draft EIR/EIS analysis, BMPs and AQ mitigation "would be partially or wholly retained, because these commitments will demonstrate that construction-related GHG impacts are being minimized to the extent feasible" while additional mitigation measures "may also be proposed to provide further substantiation of the Authority's commitment to minimizing GHG emissions."
  - The purchase of offset mitigation credits could be one form of additional mitigation but ICF points out that "offsetting the total net emissions increase associated with the proposed action alternatives may be exceedingly cost intensive."
  - The revised EIR/EIS analysis will also evaluate the project's anticipated total 40 MW of power generation and the corresponding benefits with respect to emissions and the State's renewable energy goals.
- Even so, with implementation of Alternatives 1 and 2 GHG emissions are likely to be substantial and, given the magnitude of the expected construction and operational GHG emissions, ICF recommends that "all feasible GHG mitigation measures be incorporated into the Revised EIR/EIS."

We have a resource-specific meeting to address AQ/GHG/climate change in the Amendment 2 scope of work and should be able to schedule the meeting in mid-September. The Authority will need to consider whether the purchase of offset credits is feasible mitigation prior to the meeting. We will also need to update measures (BMPs and AQ mitigation) relied on in the previous analysis.

If you would like to discuss the GHG memo with ICF, I can add this to our next biweekly EIR/EIS meeting agenda.

Thanks,

Laurie

From: Williams, Nicole [mailto:Nicole.Williams@icf.com]
Sent: Friday, July 10, 2020 3:47 PM
To: Laurie Warner Herson <laurie.warner.herson@phenixenv.com>; Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Briard, Monique <Monique.Briard@icf.com>
Subject: Sites Reservoir: Draft Memo re GHG MMs Attached

Hello Ali and Laurie – please see attached per the request of the last PD team meeting on 7/1 to prepare a memo discussing GHG mitigation measures. Let me know if you have any questions or if there is additional information you require.

Cheers, Nicole

NICOLE L. WILLIAMS | Senior Environmental Planner | (o) 916.231.9614 | (m) 530.867.0470 | nicole.williams@icf.com | icf.com

ICF | 980 9th Street Suite 1200 Sacramento CA 95814 |

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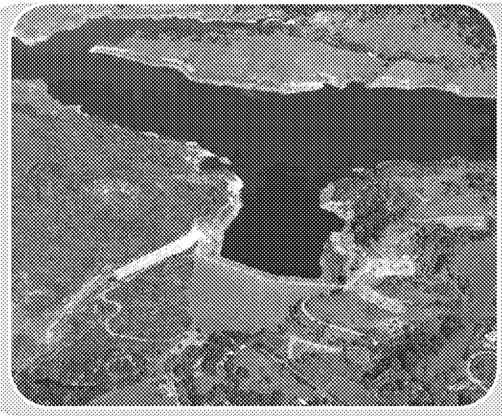
ICF50 YEARS 1969 - 2019

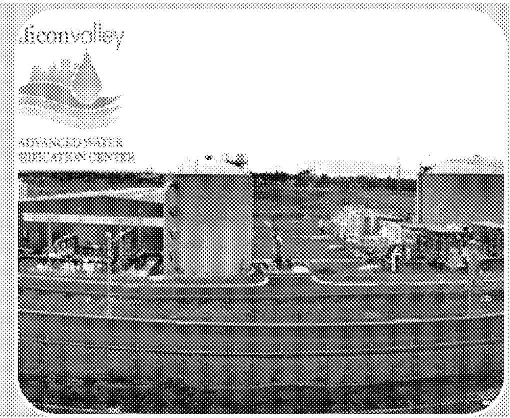
Los Vaqueros Reservoir, Sites Reservoir, and Delta Conveyance Project MAP Evaluation

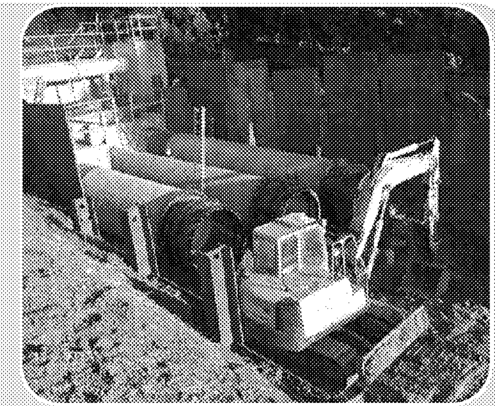
Presented by: **Vincent Gin**, Deputy Operating Officer
Samantha Greene, Ph.D., Senior Water Resources Specialist
Cindy Kao, Ph.D., P.E., Imported Water Unit Manager

Board of Directors Meeting
November 17, 2020

Water Supply Master Plan 2040







Secure

- Capital Improvement Program Projects
- Delta Conveyance Project

Expand

- Water Conservation
- Stormwater Capture
- Potable Reuse

Optimize

- Pacheco Reservoir Expansion
- Transfer-Bethany Pipeline
- South County Recharge

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Valley Water

Master Plan Back-up Projects

- Bay Area Regional Desalination
- Countywide Water Reuse Master Plan (in excess of 24 MGD reuse project)
- Groundwater Banking
- Lexington Pipeline
- Local Land Fallowing
- Los Vaqueros Reservoir
- Montevina Water Treatment Plant
- Refinery Recycled Water Exchange
- Sites Reservoir
- San Pedro Ponds Recharge Improvement
- South County Water Treatment Plant
- Shallow Groundwater Reuse

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Looking Ahead

- Current Board Action
  - Los Vaqueros Expansion (LVE)
  - Sites Reservoir (Sites)
  - Delta Conveyance Project (DCP)

- Upcoming Updates

Pacheco Reservoir Expansion	Early	2021
Annual MAP	Summer	2021
Purified Water Project	Fall	2021
LVE, Sites, DCP	Throughout	2021

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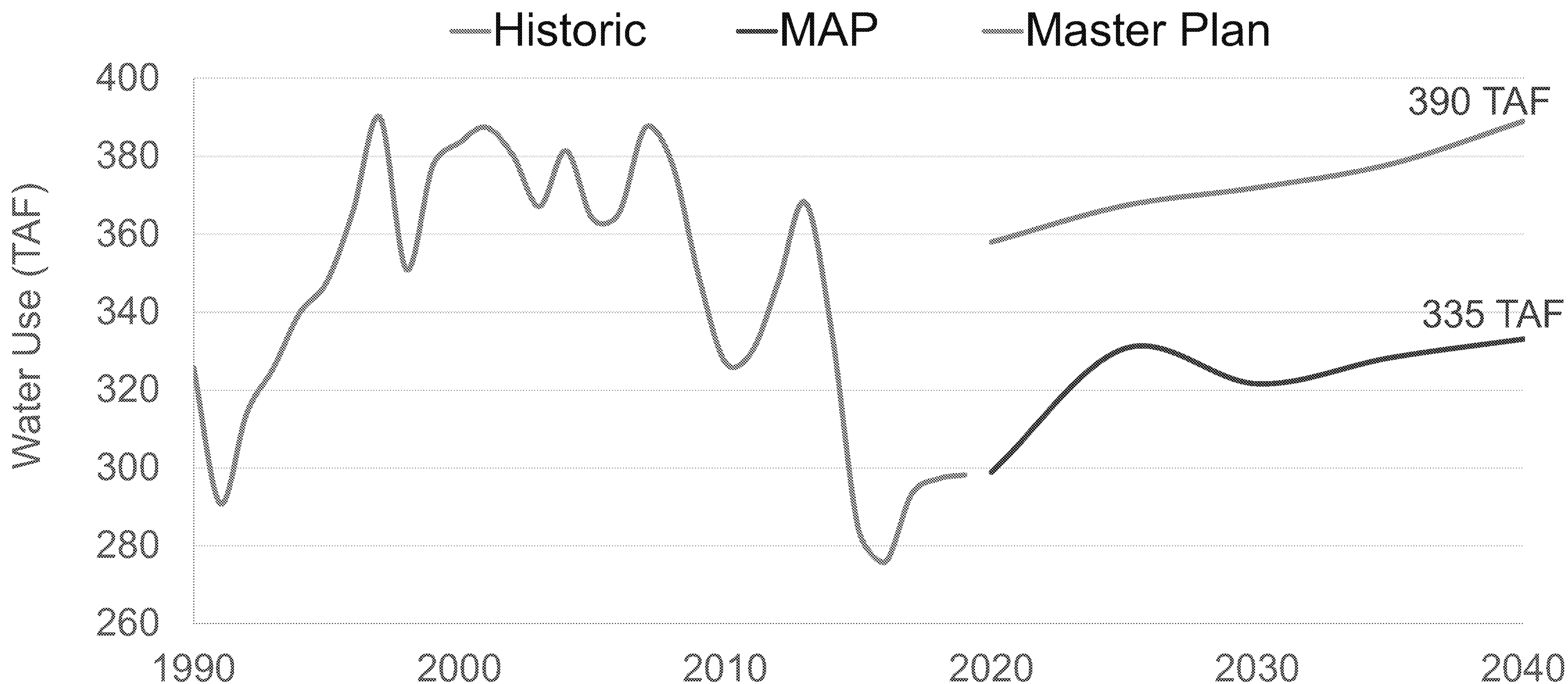
New Map Demand Projection



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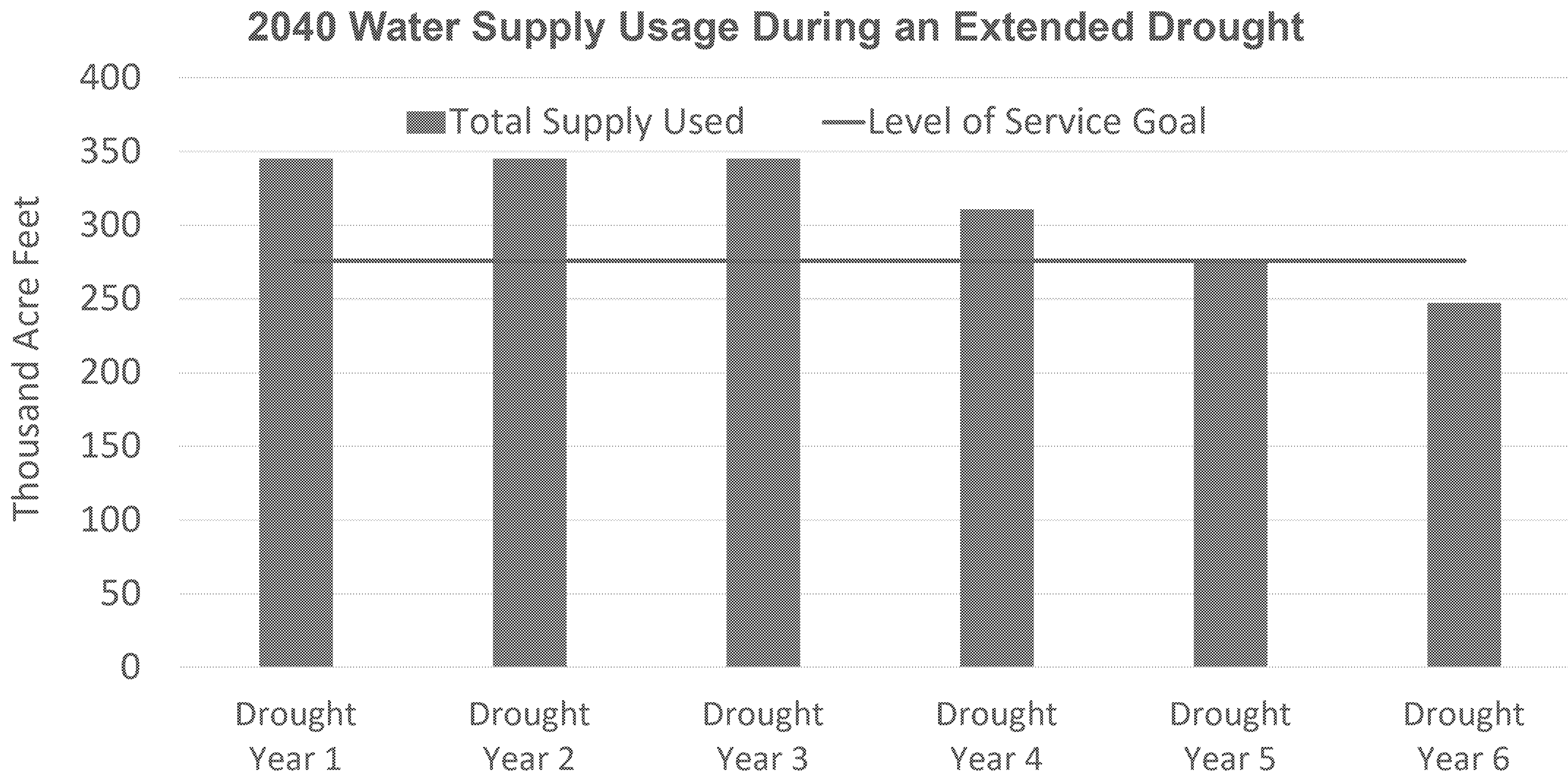
Baseline Investments with New 2040 Demands



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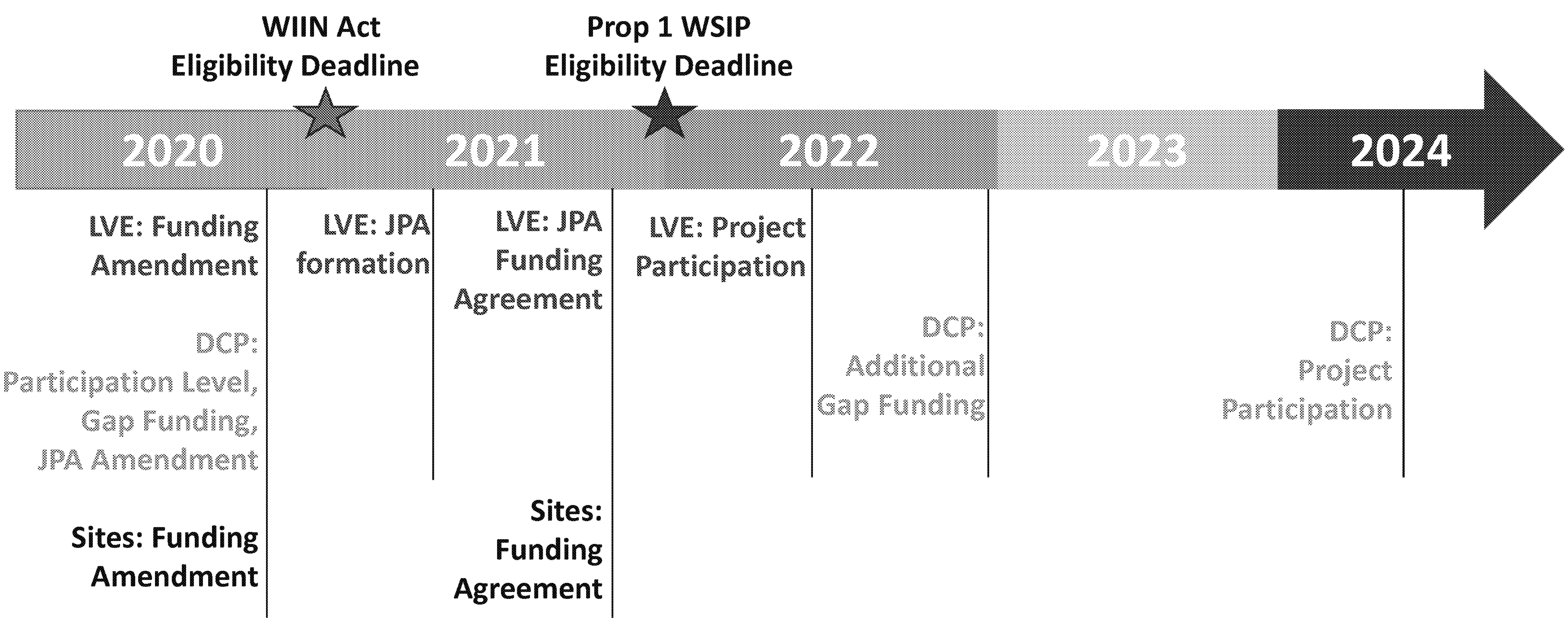
Major Decision Points



Los Vaqueros Expansión (LVE) Delta Conveyance Project (DCP) Sites Reservoir Project (Sites)

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Decisions for Three Projects

A. Los Vaqueros Expansion & Transfer-Bethany Pipeline

- Cost share agreement not to exceed approximately $1.0 Million

B. Sites Reservoir Project

- Minimal participation level, $50,000 funding authorization

C. Delta Conveyance Project

- Provisional participation percentage of 2.73% with authorization up to 3.23%
- Gap funding agreement for up to about $4.0 million for 2021 / 2022, optional up to about $7.0 million for 2023 / 2024 with future Board approval
- Amendments to the Delta Conveyance Design and Construction Authority JPA

Update on Los Vaqueros Expansion

Samantha Greene, Ph.D., Senior Water Resources Specialist

Board of Directors Meeting, November 17, 2020

Recommendation

- Approve Amendment 2 to the 2019 Multi-Party Agreement for contract extension through December 2021 and a cost-share not to exceed approximately $1.0 Million.

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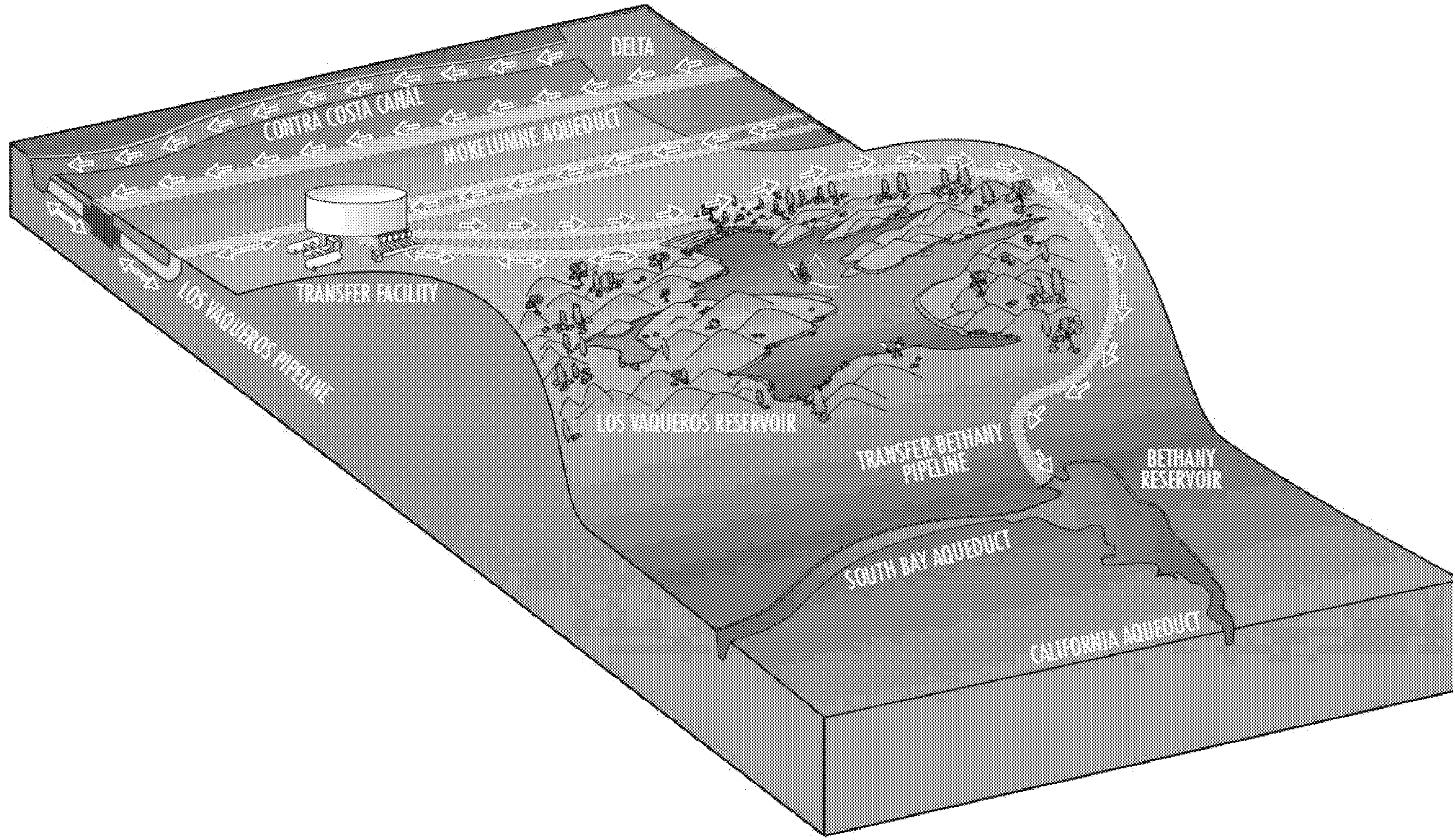
Project Location and Description

- 275 thousand acre-foot reservoir
  - 115 thousand acre-feet of new storage
  - New storage available to partners
- Upgraded and new conveyance facilities



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Project Costs and Benefits

Storage:

- Diversify Semitropic Bank
- Provide emergency supply

Transfer Bethany Pipeline:

- Provide operational flexibility
- Support potential regional projects
- Access to new Delta water supplies during wet periods (Delta surplus)

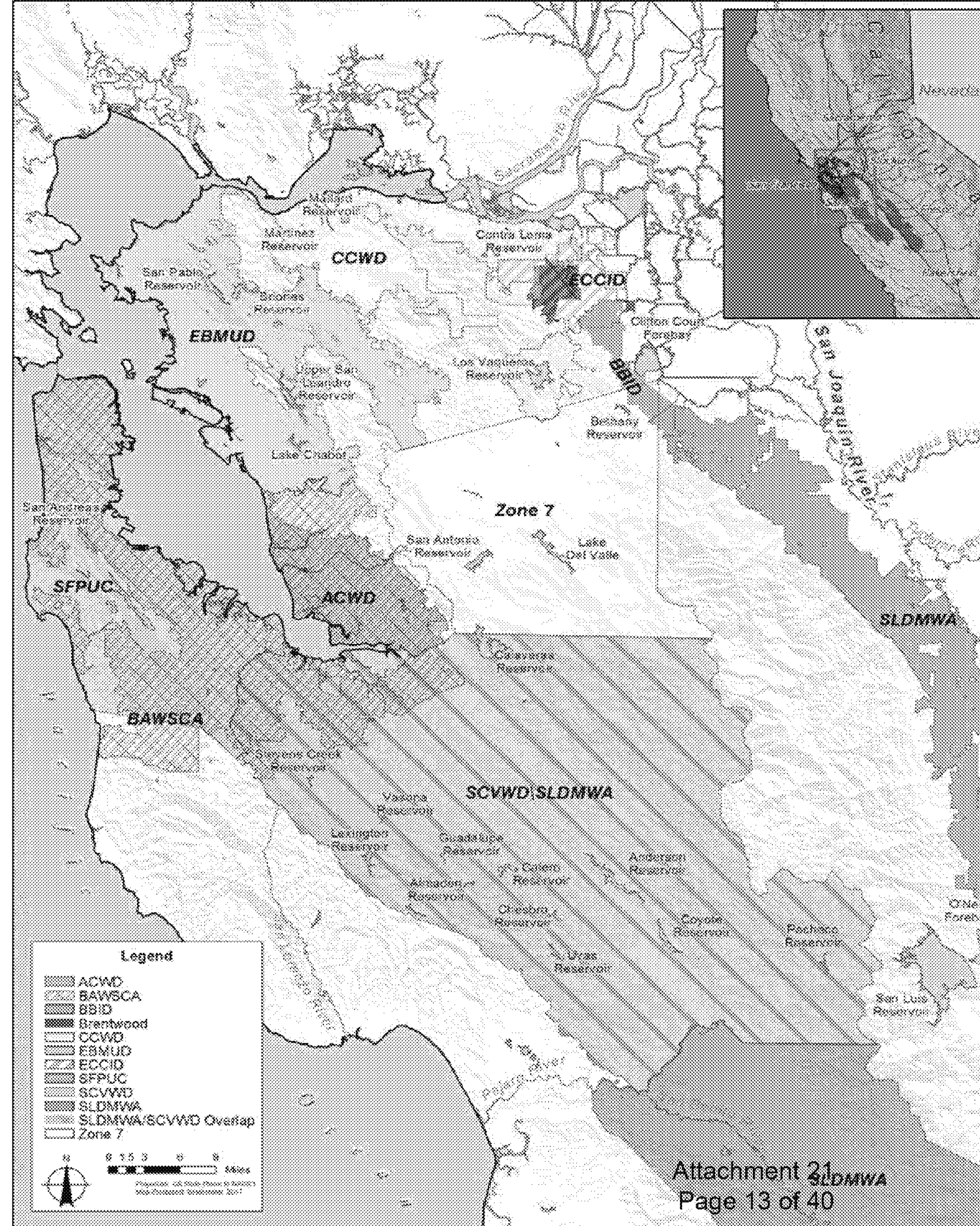
STORAGE AND CONVEYANCE	Dedicated Storage (30 TAF)	Pooled Storage (up to 20 TAF)	Transfer Bethany Pipeline Only
PV Life Cycle Cost to Valley Water (2019$)	$200 Million	$50 Million	$50-250 Million[1]
Average Storage Volume (TAF/yr)	13	3	-
PV life cycle unit cost ($/AF)	$1,000	$1,300	$700

[1]Range represents participation of between 1-7% in the Transfer Bethany Pipeline

LVE Local Agency Partners (LAPs)

1. Contra Costa Water District
2. Alameda County Water District
3. East Bay Municipal Utility District
4. Grassland Water District (Refuge)
5. Santa Clara Valley Water District
6. San Francisco Public Utilities Commission
   - Bay Area Water Supply and Conservation Agency
7. Zone 7 Water Agency
8. San Luis & Delta-Mendota Water Authority
   - Byron Bethany Irrigation
   - Del Puerto Water District
   - Westlands Water District
   - Panoche Water District

Valley Water



Attachment 21
Page 13 of 40

Recommendation: Continue Participation

- Extends project agreement and funding through December 2021
- Provides time to evaluate effectiveness for supporting Valley Water needs
- Can withdraw at any time
- No commitment to the JPA is included in Amendment 2

Update on Sites Reservoir Project: Second Amendment to 2019 Reservoir Project Agreement for Continued Participation

Cindy Kao, Ph.D., P.E., Imported Water Manager

Board of Directors Meeting, November 17, 2020

Valley Water

Recommendations

A. Receive and discuss updated information.

B. Authorize execution of Second Amendment to 2019 Reservoir Project Agreement at a 0.2% participation level - $50,000 cost

C. Direct staff to continue engagement.

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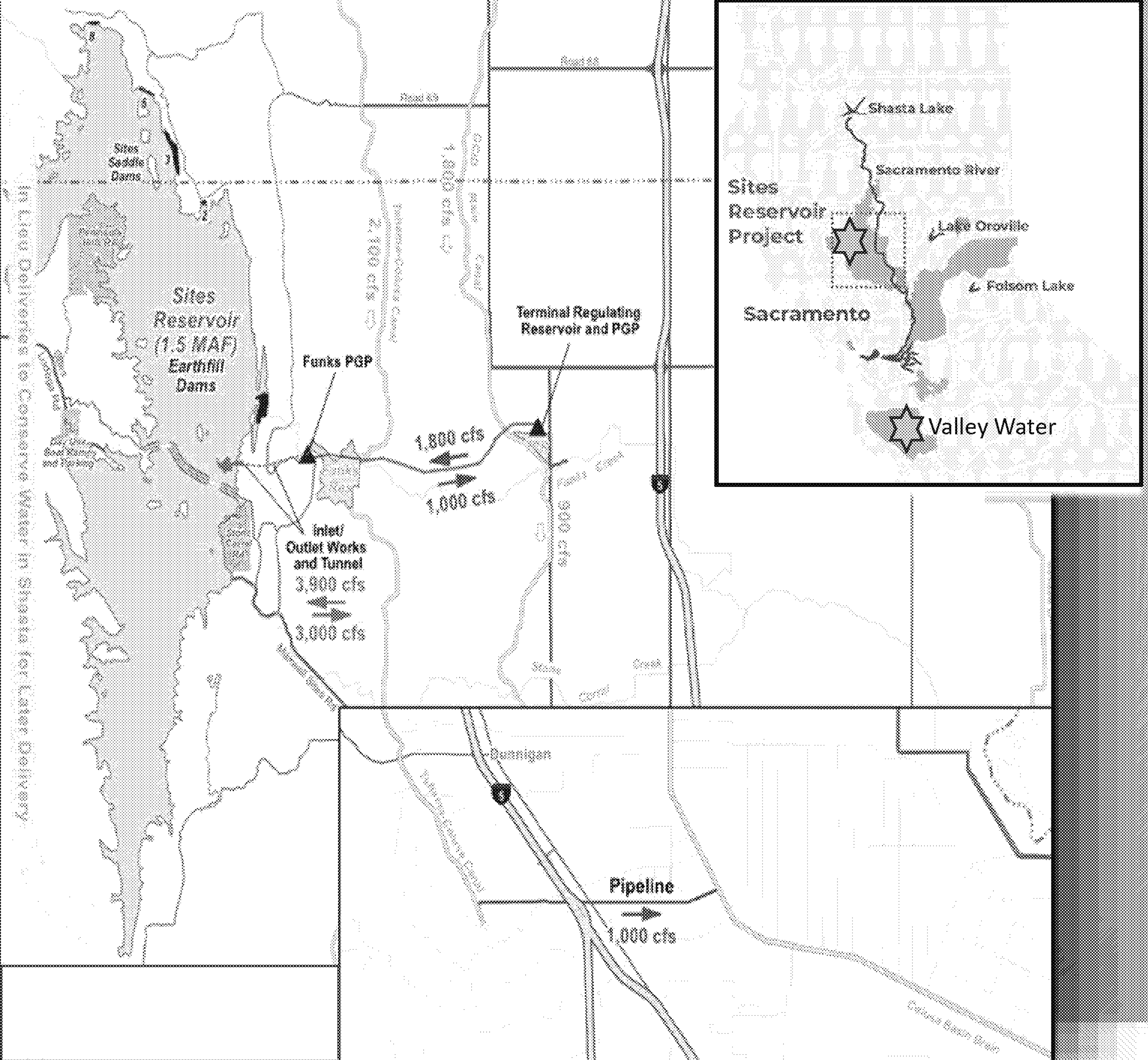

Sites Reservoir Project

Location: Colusa and Glenn Counties, California

- Size: 1.5 million acre-foot
- Preliminary Estimated Average Annual Yield: 240,000 acre-foot (AF)
- Preliminary Estimated Dry/Critical (Drier) Annual Yield: 330,000 AF
- Total Project Cost (2019 Dollars): [$3 - $3.3] Billion

Potential Benefits to Valley Water

Direct benefits:

- Long term (beyond 2040) water supply reliability
  - New water supplies
  - New storage capacity

Indirect benefits:

- Improved CVP reliability
- Access to new transfer supplies
- Potential to facilitate groundwater banking withdrawals through exchanges

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Valley Water

Major Project Risk and Challenges

Water Supply:	Permitting & Construction:	Cost:
• Transportation across Delta • Projected yield and storage capacities • Coordinated operations with State and Federal facilities	• Secure water rights • CEQA/NEPA approvals • Environmental opposition • Geotechnical uncertainties	• Secure adequate participation • Proposition 1 funding compliance • Construction cost increases

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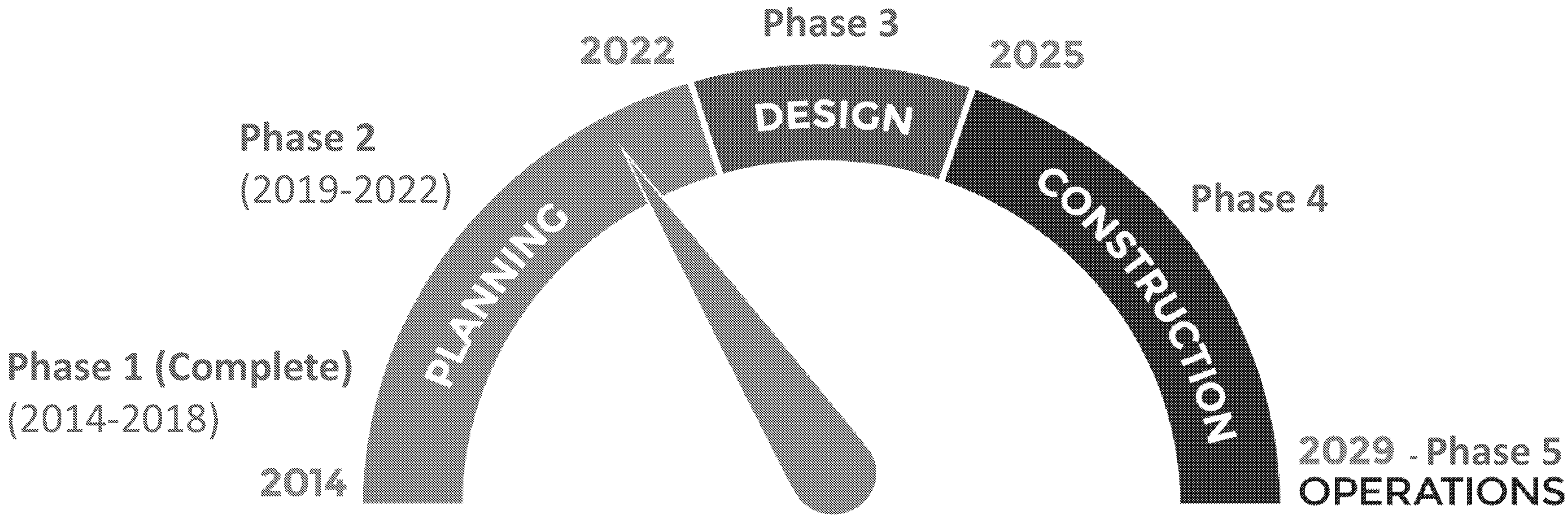
Path Forward: Project Phasing

Phase 2: Planning - EIR/EIS completion, feasibility studies, predesign, critical permits, and water rights. (In Progress)



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Preliminary Amendment 2 Participation

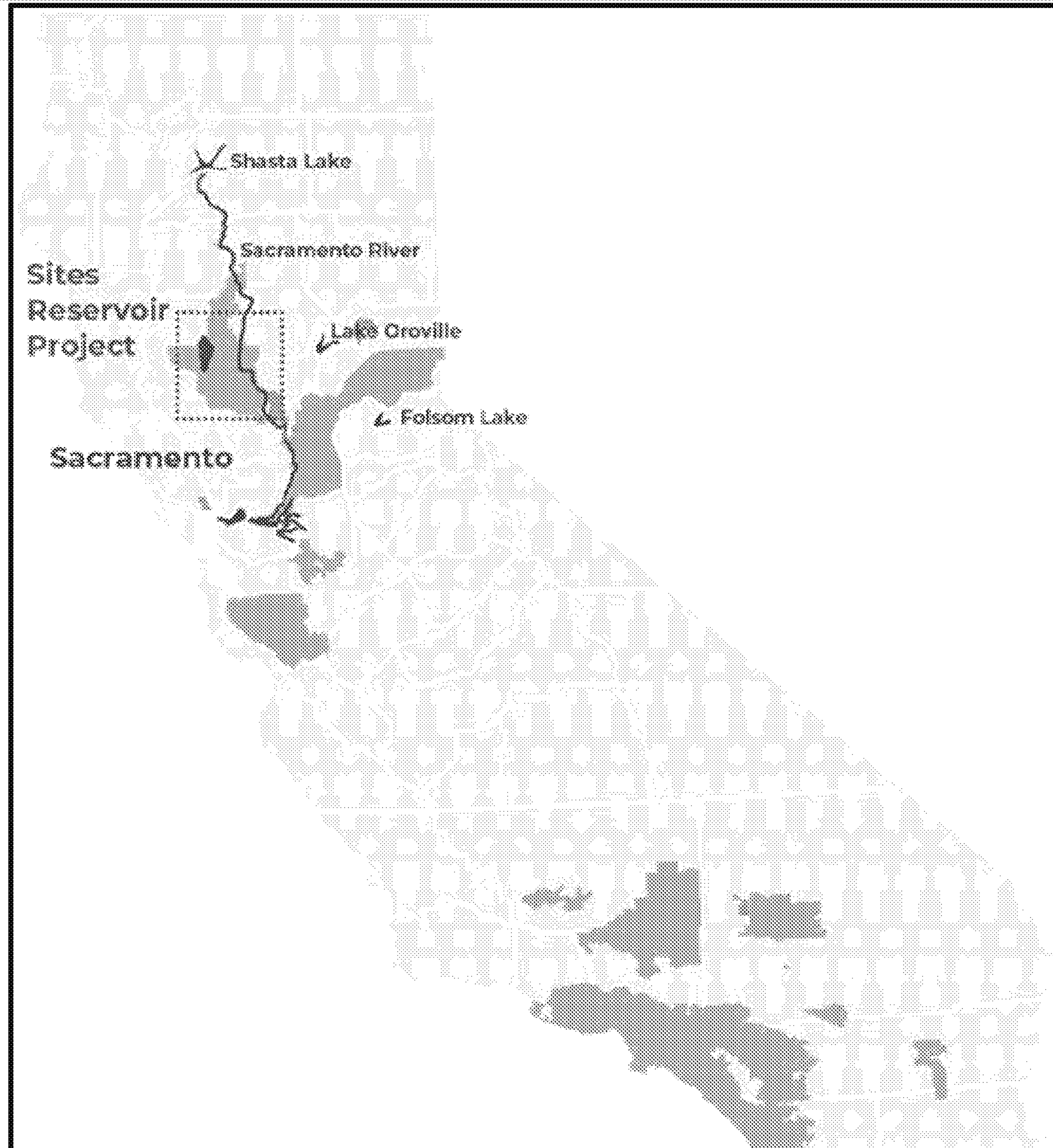
All existing participants, except Valley Water, have approved continued participation

South of Delta: (approx. 75% funding)

- 9 SWP contractors
- 1 SWP and CVP contractor (Valley Water, Pending)
- Requested Yield(s): 500 AF to 50,000 AF

North of Delta: (approx. 25% funding)

- 10 CVP contractors
- 1 SWP contractor
- Requested Yield(s): 300 AF to 10,000 AF



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Valley Water Participation Options

- ***Option 1 – Reduce but maintain significant benefits***
  - Reduce requested yield from 16,000 AF to 7,800 AF
  - 3.2% participation, $780,000 commitment
- ***Option 2 – Reduce participation by half***
  - Reduce requested yield 16,000 AF to 4,000 AF
  - 1.6% participation, $400,000 commitment
- ***Option 3 (RECOMMENDED) – Reduce to a minimal participation level***
  - Reduce requested yield to 500 AF, insignificant benefits
  - 0.2% participation, $50,000 commitment
  - Maintains participation in Sites Reservoir Project Committee
- ***Option 4 – Withdraw from the project***
  - Withdraw completely from project and Sites Project Reservoir Committee.

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Valley Water

Valley Water Participation Options (Cont.)

Option	Level of Participation		Estimated Benefits (Storage and Yield)			Cost		
	Total Project (%)	Request (AF)	Average Delivered Yield (AF)	Average Drier Year Delivered Yield (AF)	Storage Share (AF)	Total Capital Cost, 2019 Dollars ($ Million)	Total Capital Cost Fully Inflated ($ Million)	Funding Commitment ($ Million)
Feb. 2019	3.2	16,000	11,100	21,500	55,000	192	242	0.96
1	3.2	7,800	4,700 to 6,100	6,500 to 8,200	45,000	97	125	0.78
2	1.6	4,000	2,400 to 3,100	3,300 to 4,200	23,000	50	64	0.40
3	0.2	500	300 to 400	400 to 500	2,800	6	8	0.05
4	0.0	0	0	0	0	0	0	0

- Possibility for reimbursement of funding commitment if reduce participation or withdraw later

Next Steps

- Early 2021: WIIN Act feasibility determination, draft EIR released
- April 1, 2021: 2nd funding payment
- Fall 2021: Consideration of new funding agreement
- Jan 1, 2022: WSIP funding validation

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Update on Delta Conveyance Project

Cindy Kao, Ph.D., P.E., Imported Water Manager

Board of Directors Meeting, November 17, 2020

Recommendations

A. Provisional participation of 2.73% with authorization up to 3.23% total;

B. Funding agreement for up to about $4.0 million for 2021 and 2022 planning and design costs, with an option for up to about $7.0 million, upon future Board approval, for 2023 and 2024; and

C. Amendment to the Delta Conveyance Design and Construction Authority Joint Powers Agreement

Outline

A. Agreement in Principle
B. Provisional Participation Level
C. Gap Funding Agreement
D. Design & Construction Authority Amendments
E. Preliminary Cost Estimate
F. Preliminary Water Supply Benefits

Guiding Principles

1. Santa Clara County needs are primary
2. All parties pay fair share
3. Addresses stakeholder & community input
4. Water supply is affordable
5. Equity and costs are important
6. Flexibility to acquire supplemental water
7. Keep negotiating for Santa Clara County
8. Public engagement is paramount to success

Valley Water Board Resolution 19-69, adopted September 24, 2019

Agreement in Principle

- Basis for future SWP Contract Amendment
- Allocates costs and benefits
- Option to opt-out of costs & benefits
- Option to assume additional costs & benefits
- Project Table A and Article 21 supplies
- Conveyance capacity for non-Project water, transfers, exchanges
- Protection from sea level rise and levee failure events
- Carriage water savings

Provisional Participation Levels

SWP Contractors (29 SWP)	SWP Contractors (29) 100 % of Total	Valley Water Share 2.40 % of Total
North of Delta Exemption (24 SWP)	NOD SWP Contractors (5) 2.79 % of Total	Valley Water Share 2.47% of Total
South of Delta Participants (18 SWP)	SOD Non-Participating SWP Contractors (6) 3.67 % of Total	Valley Water Share 2.73 % of Total

Gap Funding Agreement

Environmental review, planning and design

Total = $340.7 million

Option to fund 2 years or all 4 years

Potential Valley Water share:

	Two Years of Funding	Four Years of Funding
2.5%	$3.1M	$8.5M
2.73%	$3.4M	$9.3M
3.0%	$3.7M	$10.2M
3.23%	$4.0M	$11.0M
4.0%	$5.0M	$13.6M
5.0%	$6.2M	$17.0M
6.0%	$7.5M	$20.4M

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Proposed Amendments to DCA

Current	Proposed
5 Directors (only 4 filled)	7 Directors
Simple majority of Board for all decisions except,	Simple majority of Board for all decisions
80% of Directors needed to: 1. Endorse legislation 2. Terminate membership 3. Article XII Budget and Expense	Reconsideration option for Article XII Budget and Expense and certain contracts: • Construction Contracts >$10 M • Service Contracts >$1M
No Reconsideration Option	Reconsideration requires 70 % Contracted Proportionate Share vote to disapprove motion
Approval of all Members needed to amend Agreement	Approval of two-thirds of Members needed to amend Agreement

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Delta Conveyance Alternatives

All Alternatives

Intakes and North Tunnels

East Alternative

Eastern Tunnel Corridor

Central Alternative

Central Tunnel Corridor

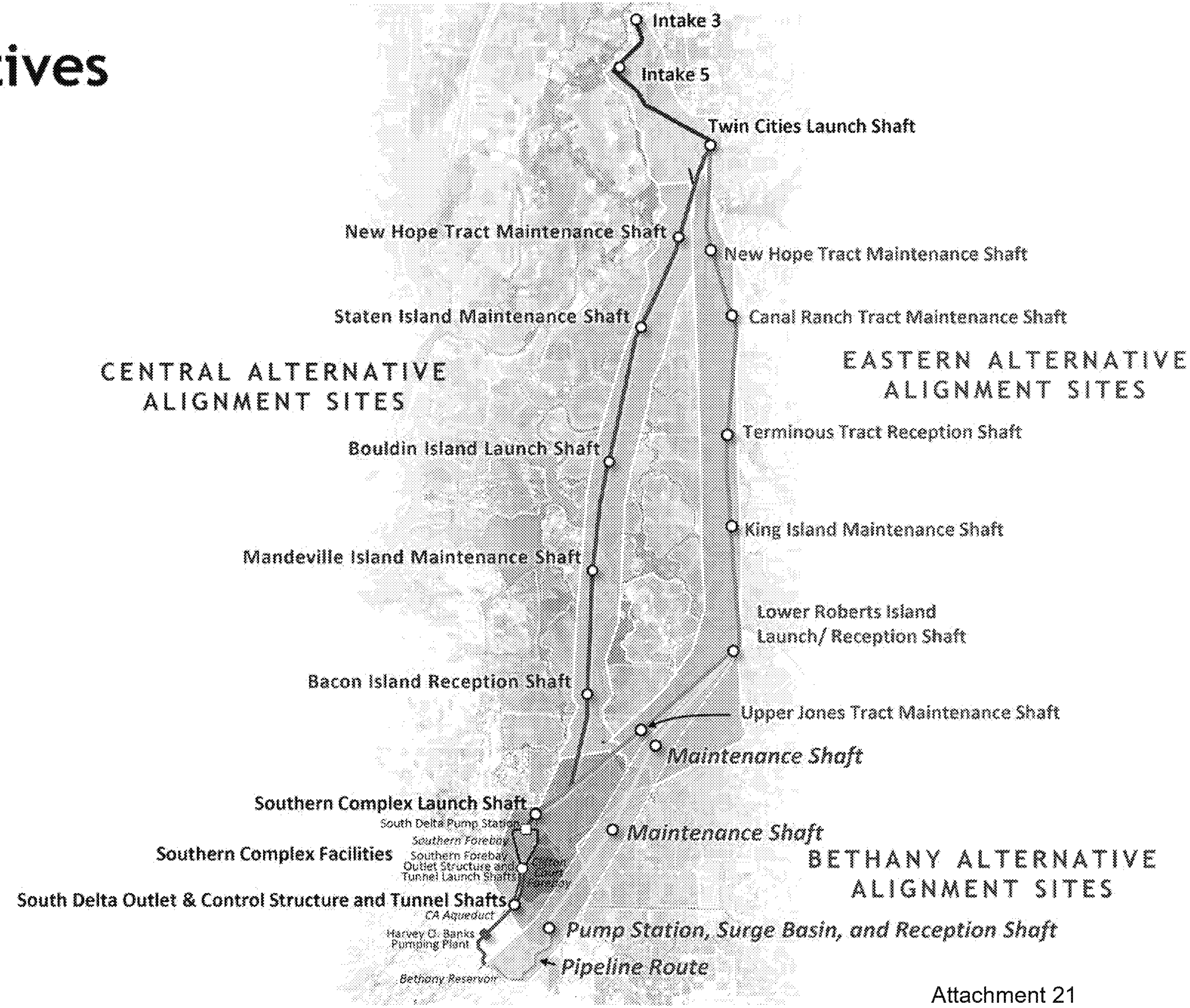
East & Central Alternatives

Pump Station, Southern Forebay & South Delta Conveyance

Bethany Alternative

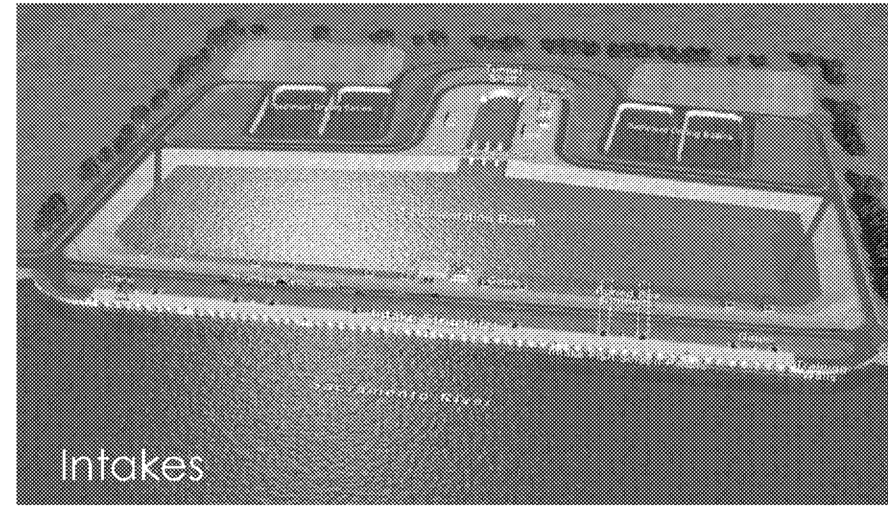
Eastern Tunnel Corridor

Bethany Corridor, Pump Station, Surge Relief Basin and Pipelines



DCP Preliminary Cost Summary

	Costs (2020 dollars)
CONSTRUCTION	$ 8.77 billion
CONTINGENCY (38%)	$ 3.33 billion
SOFT COSTS	$ 3.40 billion
ENVIRONMENTAL MITIGATION	$ 0.40 billion
TOTAL	$15.90 billion



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Valley Water's Potential Share of Total Capital Costs

Participation Level	Share of Capital Costs[1]
2.5%	$398 million
2.73%	$434 million
3.0%	$477 million
3.23%	$514 million
4.0%	$636 million
5.0%	$795 million
6.0%	$954 million

[1] Total Project costs are in undiscounted 2020 dollars and do not include financing costs.

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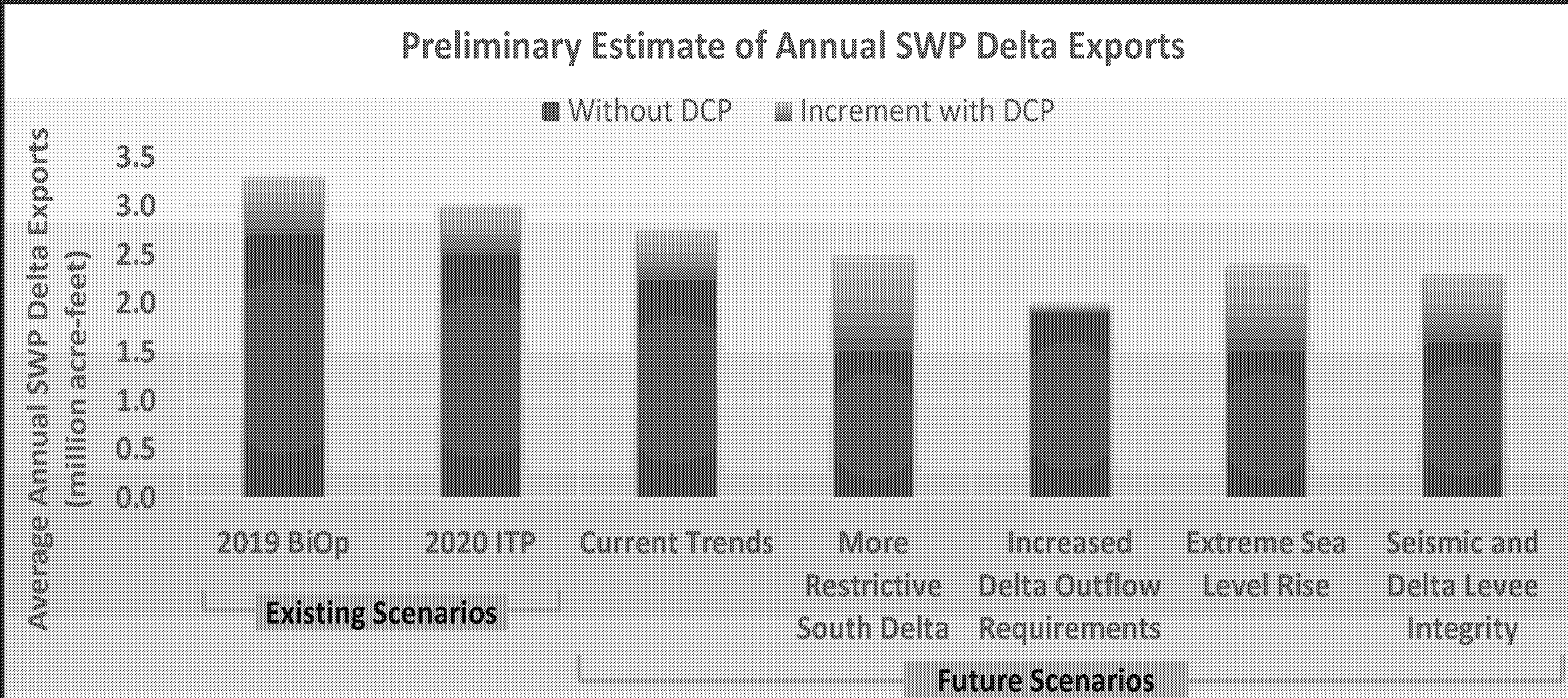
Potential Water Supply Benefits

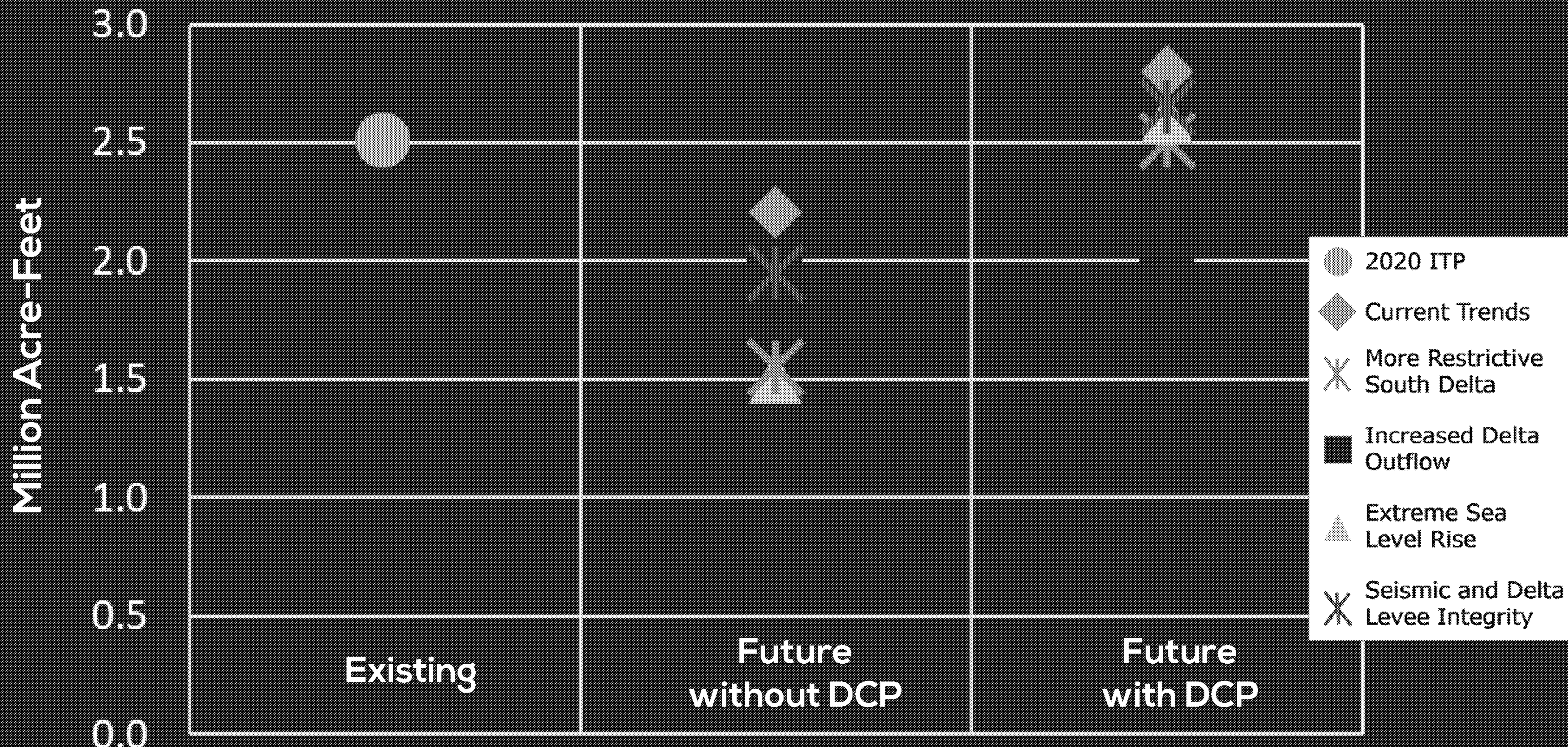
- Climate Change
- Sea Level Rise
- Levee Stability
- Stormwater Capture
- Operational Flexibility
- Water Transfer Capacity
- Carriage Water Savings
- Flow Patterns
- Water Quality

Preliminary SWP Benefits - Estimated Annual Exports



Source: State Water Contractors

Preliminary SWP Benefits - Estimated Annual Exports



Source: State Water Contractors

Delta Conveyance Project Schedule

VW Decision Points

- Potential Additional Gap Funding
- Potential Decision on Project Participation

2021 | 2022 | 2023 | 2024

Project Milestones

- Public Draft EIR/EIS

- Final EIR/EIS
- ROD/NOD
- CESA/ESA Permits

- Water Rights
- Delta Plan Consistency
- Other Environmental Permits

Valley Water

Schedule subject to change

Decisions for Three Projects

A. Los Vaqueros Expansion & Transfer-Bethany Pipeline
   - Cost share agreement not to exceed approximately $1.0 Million

B. Sites Reservoir Project
   - Minimal participation level, $50,000 funding authorization

C. Delta Conveyance Project
   - Provisional participation percentage of 2.73% with authorization up to 3.23%
   - Gap funding agreement for up to about $4.0 million for 2021 / 2022, optional up to about $7.0 million for 2023 / 2024 with future Board approval
   - Amendments to the Delta Conveyance Design and Construction Authority JPA

From: Briard, Monique [Monique.Briard@icf.com]
Sent: 11/17/2020 3:03:54 PM
To: Spranza, John [john.spranza@hdrinc.com]; Lecky, Jim [Jim.Lecky@icf.com]; Alicia Forsythe [aforsythe@sitesproject.org]
Subject: RE: Sites 5737 follow up

Juan shared during our terrestrial call today that they are still gathering comments and input for us and is hoping to have it ready to send by the end of the week.

From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Friday, November 6, 2020 8:36 AM
To: Lecky, Jim <Jim.Lecky@icf.com>; Briard, Monique <Monique.Briard@icf.com>; aforsythe (aforsythe@sitesproject.org) <aforsythe@sitesproject.org>
Subject: FW: Sites 5737 follow up

Looks like 10 days and we will get something back.

John Spranza

D 916.679.8858 M 818.640.2487

From: Torres, Juan@Wildlife [mailto:Juan.Torres@wildlife.ca.gov]
Sent: Friday, November 6, 2020 8:33 AM
To: Spranza, John <John.Spranza@hdrinc.com>
Subject: RE: Sites 5737 follow up

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.

Thank you John it was a good meeting and you provided us with really good info. I think we should have some comments and/or suggestion by the end of next week or beginning of the following now that we have help from HQ and we identified some of the key players. I forwarded your email to Robert Sherrick and Zach Kearns since they are part of the team.

Have a good weekend.

Juan

From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Friday, November 6, 2020 8:26 AM
To: Boyd, Ian@Wildlife <Ian.Boyd@Wildlife.ca.gov>; Davis-Fadtke, Kristal@Wildlife <Kristal.Davis-Fadtke@wildlife.ca.gov>; Hassrick, Jason (Jason.Hassrick@icf.com) <Jason.Hassrick@icf.com>; Torres, Juan@Wildlife <Juan.Torres@wildlife.ca.gov>; Jim Lecky (jim.Lecky@icf.com) <jim.Lecky@icf.com>; Hendrick, Mike (Mike.Hendrick@icf.com) <Mike.Hendrick@icf.com>; Monique Briard (monique.briard@icf.com) <monique.briard@icf.com>; aforsythe (aforsythe@sitesproject.org) <aforsythe@sitesproject.org>; Huneycutt, Andrew@Wildlife <Andrew.Huneycutt@Wildlife.ca.gov>; Seapy, Briana@Wildlife <Briana.Seapy@Wildlife.ca.gov>; Anwar, Mohammed(Shahid)@Wildlife <Mohammed.Anwar@Wildlife.ca.gov>
Subject: Sites 5737 follow up

Warning: This email originated from outside of CDFW and should be treated with extra caution.

Good Morning,

Attached are the CDFG NODOS report on fish surveys, the Richter et al. paper, and an excel file with daily mean flows and annual peak flows taken from the USGS web site for the Stone Corral Creek gage. A link to the USGS web site for the Stone Corral Creek gauge is below.

https://nwis.waterdata.usgs.gov/ca/nwis/dv/?site_no=11390672&agency_cd=USGS&referred_module=sw

Also included are a project description summary and an excerpt from the draft feasibility study that briefly discusses the facilities for providing water back into each creek. As you can see we are at a conceptual design level for these, and hope to use our meetings to firm up the releases and flow regime. I am looking for some graphics for each dam and will send those when I find them.

Sites Dam Environmental Water Outlet (Sites Dam = Stone Corral, Golden Gate Dam = Funks Creek)
Environmental water releases at Sites Dam to Stone Corral Creek would be made through facilities incorporated into the construction diversion tunnel on the left abutment of the dam. The permanent outlet at Sites Dam would be designed to release creek flows to meet environmental mitigation requirements from regulating agencies. For feasibility design, a maximum release rate of 200 cfs is assumed.

Golden Gate Dam Environmental Water Outlet
Environmental water releases would begin at the Inlet/Outlet (I/O) tunnel manifold and then travels about 2,800 feet north to the Funks Creek discharge point.

Please let me know if you have any questions or would like additional information.

John Spranza, MS, CCN
Senior Ecologist / Regulatory Specialist

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Sacramento, CA 95833
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QEDA Consulting LLC
4007 Densmore Ave N
Seattle, WA 98103
206.300.5595
noblehendrix@gmail.com

QEDα

Technical Memorandum

To: Steve Micko, Jacobs
From: Noble Hendrix, QEDA Consulting
Date: October 26, 2020
Subject: Draft results of OBAN analysis of Sites Alternative ALTA2_092220_PEA and NAA_091720

This technical memorandum describes preliminary results from running the OBAN model for a baseline alternative (NAA_091720) and a Sites proposed action (ALTA2_092220_PEA).

Model Details:

The OBAN model was modified to be able to run for the full CalSim period of hydrologic outputs. Two modifications were made to the OBAN 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. The second modification was the need to resample from the ocean productivity indices in each Monte Carlo iteration of the model. The historical 1967 – 2014 ocean productivity indices were resampled in each iteration with replacement to provide variability in ocean productivity across Monte Carlo simulations.

Model Results:

The ALTA2 tended to have slightly higher abundances relative to the NAA, with notable increases in the median difference in spawners in model years 1927, 1928, and 1962 (Figure 1). Variability in the difference in abundance was substantial across Monte Carlo simulations (gray area in Figure 1) although some periods indicated higher probability of increased abundance under ALTA2 compared to NAA (e.g., 1980 – 2002).

The probability of quasi-extinction was (probability that spawner abundance < 100) showed similar temporal patterns across the 1922 to 2002 time series (Figure 2 left). Still, the probability of quasi-extinction was consistently lower for ALTA2 compared to the NAA (Figure 2 right).

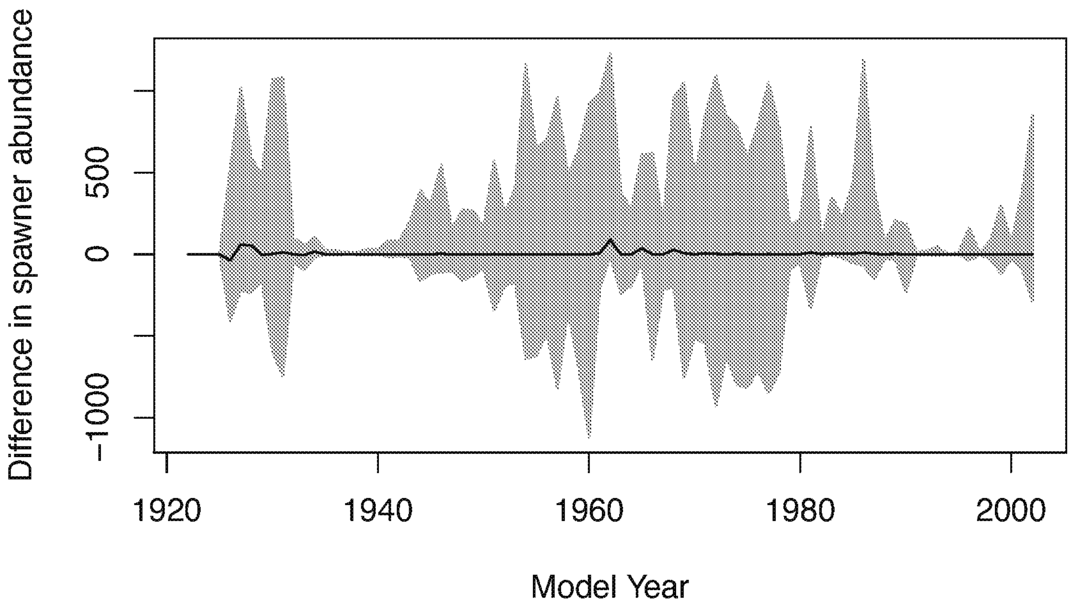

Figure 1. Difference (ALTA2 – NAA) in spawner abundance for model years 1922 – 2002. Positive values indicate higher abundances under ALTA2 relative to NAA. Median (line) and 80% intervals (gray) across 1000 Monte Carlo simulations are presented.

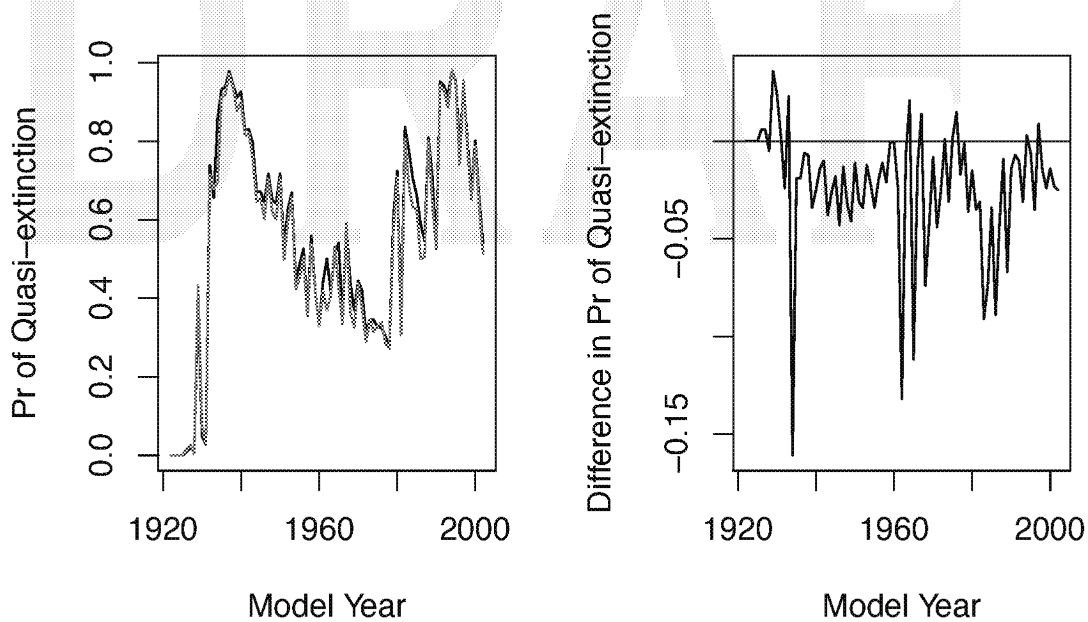

Figure 2. Probability of quasi-extinction (spawner abundance < 100) (left) showing the NAA (black) and ALTA2 (red). (Right) difference (ALTA2 – NAA) in the probability of quasi-extinction.

We also evaluated the difference in survival rates in the egg through fry stages and in the delta stage to understand where the two alternatives may differ and in what model years those differences may be occurring. The survival differences in the egg through fry stage indicated periods of substantial improvement in survival under ALTA2, in particular model years 1959, 1966, and 1978 in which median differences in survival were greater than 0.10 (Figure 3). In contrast, there was little difference in the delta survival estimates from the OBAN model between alternatives (Figure 4).

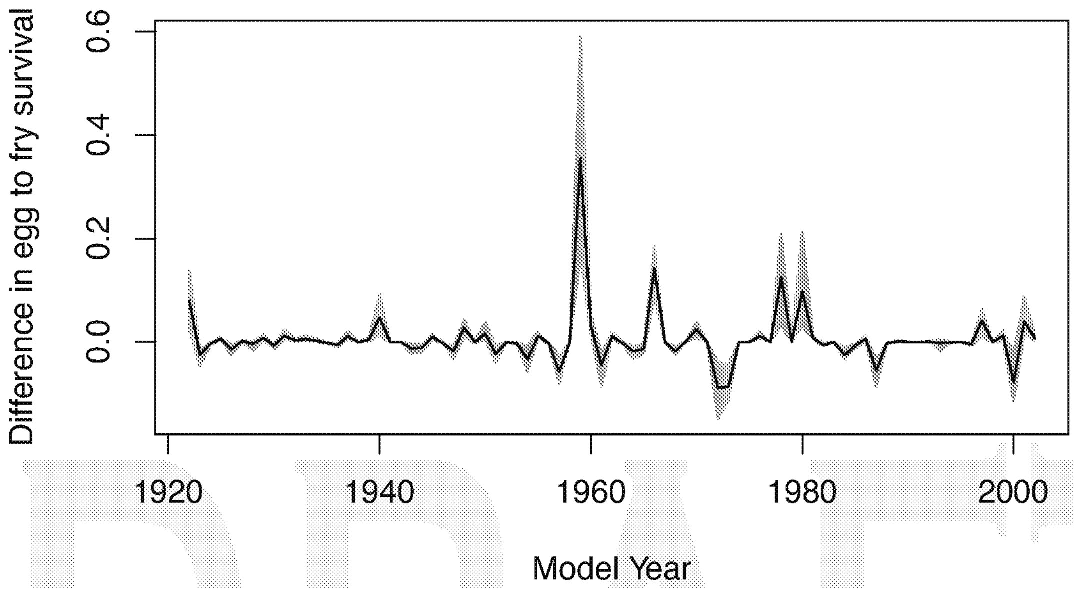

Figure 3. Difference (ALTA2 – NAA) in survival of the egg through fry stages which includes thermal mortality and Bend Bridge flow effects. Median (line) and 80% intervals (gray) across 1000 Monte Carlo simulations are presented.

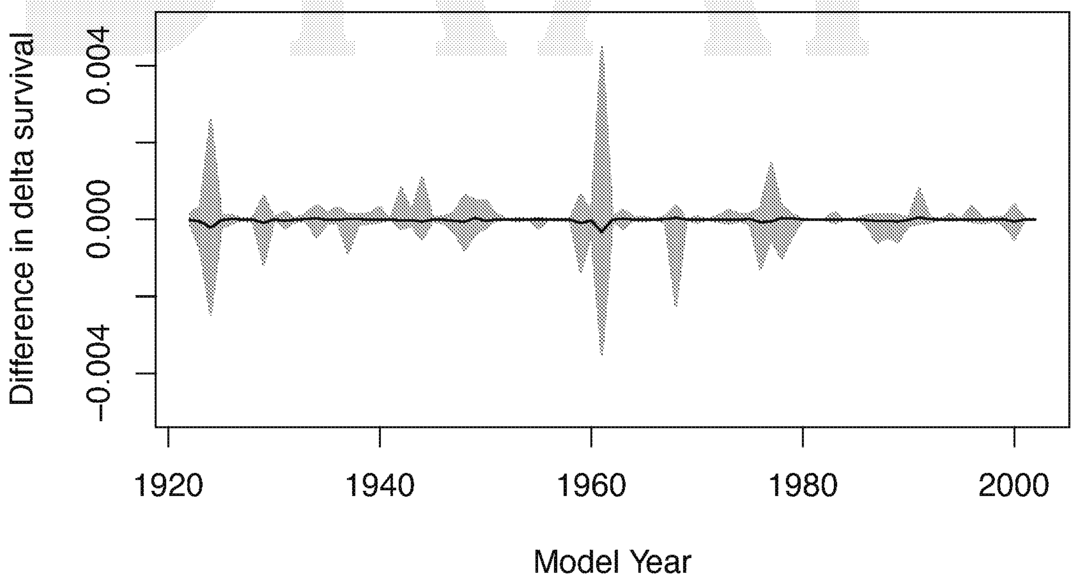

Figure 4. Figure 3. Difference (ALTA2 – NAA) in survival of the delta stage which includes access to Yolo bypass and export effects. Median (line) and 80% intervals (gray) across 1000 Monte Carlo simulations are presented.

From: Micko, Steve/SAC [Steve.Micko@jacobs.com]
Sent: 11/18/2020 12:21:14 AM
To: Spranza, John [john.spranza@hdrinc.com]; Heydinger, Erin [erin.heydinger@hdrinc.com]; Lecky, Jim [jim.lecky@icf.com]
CC: Alicia Forsythe [aforsythe@sitesproject.org]; Leaf, Rob/SAC [Rob.Leaf@jacobs.com]
Subject: Sites: Aquatics Meeting Follow-Up
Attachments: NODOS_Trend_Reporting_rev26bdpcy_DV5_HistClim_CALSIM__ALTA2_092220_PrelimEffects.xlsm

Hi all,

A CalSim II trend reporting spreadsheet, with reduced output parameters, is attached.
I also posted the NAA 091720 CalSim II model to the OneDrive link that is shared with CDFW/NMFS technical staff.

Please let me know if you would like me to transmit these materials.

Best,
Steve

Steve Micko, PE | Jacobs | Associate Water Resources Engineer
O:916.286.0358 | M:408.834.6614 | Steve.Micko@jacobs.com
2485 Natomas Park Drive Suite 600 | Sacramento, CA 95833

File Provided Natively

From: Thayer, Reed/SAC [Reed.Thayer@jacobs.com]
Sent: 11/18/2020 5:05:02 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]; Heydinger, Erin [erin.heydinger@hdrinc.com]
CC: Leaf, Rob/SAC [Rob.Leaf@jacobs.com]; steve.micko@jacobs.com
Subject: Sites Alternative 1 - Iteration 2
Attachments:NODOS_Trend_Reporting_rev29dpcy_DV5_HistClim_CALSIM_NAA_ALTA2_092220_rev03_PEA_111820_ALT1_rev01.xlsm

Ali and Erin,
We have completed "Iteration 2" of Alternative 1. The model is labeled "ALTA1_OpFlex91_111820_rev01_PEA". It is very similar to the model that we discussed this morning. A trend report, NODOS_Trend_Reporting_rev29dpcy_DV5_HistClim_CALSIM_NAA_ALTA2_092220_rev03_PEA_111820_ALT1_rev01.xlsm, is attached which includes this alternative and Alt A2 rev03 PEA and their associated No Action Alternatives:

Alt A2 rev03 PEA
No Action: NAA 091720
Alternative: ALTA2 rev03 PEA

Alt 1 rev01 PEA
No Action: NAA 111820
Alternative: ALT1 rev01 PEA

May we send this to the ICF aquatics team? Is there anyone else we should send this to?

Thank you,

Reed Thayer, PE | Jacobs | Water Resources Engineer
O: 916.286.0228 | M: 831.233.2141 | reed.thayer@jacobs.com
2485 Natomas Park Dr, Ste 600 | Sacramento, CA 95833 | USA

File Provided Natively

From: Heydinger, Erin [Erin.Heydinger@hdrinc.com]
Sent: 11/18/2020 6:29:18 PM
To: Thayer, Reed/SAC [Reed.Thayer@jacobs.com]; Alicia Forsythe [aforsythe@sitesproject.org]
CC: Leaf, Rob/SAC [Rob.Leaf@jacobs.com]; steve.micko@jacobs.com
Subject: RE: Sites Alternative 1 - Iteration 2

Yes, I'm fine sending this to the aquatics team. I think that's all for now. I do think the engineering team will be interested to see your Dunnigan capacity tables updates (or possibly just the exceedance charts would be fine).

Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

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From: Thayer, Reed/SAC <Reed.Thayer@jacobs.com>
Sent: Wednesday, November 18, 2020 5:05 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Cc: Leaf, Rob/SAC <Rob.Leaf@jacobs.com>; Micko, Steve/SAC <Steve.Micko@jacobs.com>
Subject: Sites Alternative 1 - Iteration 2

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No Action: NAA 091720
Alternative: ALTA2 rev03 PEA

Alt 1 rev01 PEA
No Action: NAA 111820
Alternative: ALT1 rev01 PEA

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Thank you,

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O: 916.286.0228 | M: 831.233.2141 | reed.thayer@jacobs.com
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CDFW Terrestrial- Sites Meeting #2 Notes

Date: *November 17, 2020*

Location: Join Microsoft Teams Meeting
+1 213-493-7443 United States, Los Angeles (Toll)
Conference ID: 921 135 958#

Time: 2:00 pm – 3:00 pm

Purpose: To resume discussions on CDFW coordination with Sites 2081 and CEQA processes.

Attendees:

Juan Torres, CDFW	Zachary Kearns, CDFW	John Spranza, HDR
Ian Boyd, CDFW	Ali Forsythe, Sites Authority	Monique Briard, ICF
Ian Caine, HDR	Jennifer Haire, ICF	Ellen Berryman, ICF

Agenda:

Action Item	Status
ICF will look into refining bumblebee models.	Ongoing
Ellen will re-distribute the GGS write-up for CDFW to do a final review and make sure they're comfortable with the approach before ICF completes the model write-ups for the remainder of the species. CDFW will provide feedback soon after receiving.	Done. Model distributed, feedback received from CDFW
Monique will look into CEQA issue on timing for resolving one vs two ITPs. That is, does the EIR need to specify one vs two?	Done. Monique said they don't need to specify one vs two for the EIR.
John will confirm if the Revised EIR/Supplemental EIS schedule includes a review period for CDFW prior to public release in July 2021.	In progress
Ellen will set up meeting to (1) initiate discussions related to the EIR; and (2) discuss models.	Done
Other topics for future meetings include potential flow effects on bank swallow and cuckoo, and the 2081 approach (providing flexibility and one vs two ITPs).	Dates TBD (CEQA issues higher priority)

Discussion Topic	Topic Leader	Notes
1. Introductions/Safety/ Admin	John Spranza	
2. Giant garter snake	Ellen/John Howe	John Howe showed aerial imagery indicating there's no rice west of the GCID Canal where the impact is present. Juan said CDFW concurs with the habitat cut-off being at GCID Canal *in that specific area.* There is rice west of GCID Canal, but that's well south of anticipated project impact.

3. 2081 vs. CEQA Schedule	Monique Briard	Admin Draft EIR in April. Draft 2081 by end of 2021. Juan asked about whether there would two ITPS or not. Monique said that probably one but perhaps two. Juan said they'd prefer one ITP rather than two. Or two ITPs around the same time. CDFW asked about SAA – Monique said that will be pursued in 2022 with next funding period with Sites. John said probably multiple agreements.
4. CDFW coordination through CEQA process	Monique/John	John showed permitting timelines graphic. Admin Draft in April goes to work group and after that CDFW can share compoeenents of that. So many commenters that they'll be selective on chapters they send CDFW. He doesn't have list but things aquatics, terrestrial, botany, water quality would go out to CDFW. Not for detailed wordsmithing – just for substantive issues where there may need to be substantial revision or different analytical approach. Juan suggested CDFW look at TOC and let them know what they're interested in reviewing. **ACTION:** Monique will provide TOC to CDFW to they'll let them know what they'd like to review. John Spranza. They have to write while they're doing initial analysis for the ITP. Whatever is put into the EIR draft analysis will likely be more conservative than what goes into the ITP. ITP will be less impactful. Juan –Understood and fine. Just need to make sure CEQA doc explains how impacts will be refined over time.
5. Topics for future discussion with CDFW	All	Jennifer suggests prioritizing modeling for listed species. Terrestrial species CEQA analysis needs to be completed in January, so models need to move forward quickly. Juan says they have limited availability, large workload. Juan agreed species to be covered in the ITP should be prioritized. Ian said habitat maps not as important as model descriptions. Ian willing to help review, and thinks it should move relatively quickly since the format/approach was already developed with GGS. Ian, Zach, and Juan are all going to be available during the holiday season – not going on vacation. **ACTION:** ICF will put together schedule for completion of model descriptions, for CDFW review. **ACTION:** ICF send species list to CDFW along with schedule. **ACTION:** ICF set up next meeting that allows enough time for CDFW to review first batch of models beforehand. **Action:** Jennifer and Ellen will coordinate with John Spranza and Monique to determine how the process should be integrated with Work Group.
6. Next steps	Ellen Berryman	See action items above.

From: Thayer, Reed/SAC [Reed.Thayer@jacobs.com]
Sent: 11/19/2020 12:14:44 PM
To: Spranza, John [john.spranza@hdrinc.com]; Hendrick, Mike [mike.hendrick@icf.com]; Lecky, Jim [jim.lecky@icf.com]; Hassrick, Jason [jason.hassrick@icf.com]; Chris Fitzer [CFitzer@esassoc.com]; Wilder, Rick [rick.wilder@icf.com]; Greenwood, Marin [Marin.Greenwood@icf.com]
CC: Alicia Forsythe [aforsythe@sitesproject.org]; Heydinger, Erin [erin.heydinger@hdrinc.com]; steve.micko@jacobs.com; Leaf, Rob/SAC [Rob.Leaf@jacobs.com]; Noble Hendrix [noblehendrix@gmail.com]; Steve Zeug [stevez@fishsciences.net]
Subject: Sites Project Alternative 1 - Trend Reporting
Attachments:NODOS_Trend_Reporting_rev29dpcy_DV5_HistClim_CALSIM_NAA_ALTA2_092220_rev03_PEA_ALT1_111820_rev01_PEA.xlsm

Sites Aquatics Team,

We have completed "Iteration 2" of Alternative 1. The CalSim II study is labeled "ALT1_OpFlex91_111820_rev01_PEA".

A trend report, NODOS_Trend_Reporting_rev29dpcy_DV5_HistClim_CALSIM_NAA_ALTA2_092220_rev03_PEA_ALT1_111820_rev01_PEA.xlsm, is attached which includes this alternative and Alt A2 rev03 PEA and their associated No Action Alternatives:

Alt A2 rev03 PEA
No Action: NAA 091720
Alternative: ALTA2 rev03 PEA

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No Action: NAA 111820
Alternative: ALT1 rev01 PEA

Please contact us with any questions.

Reed Thayer, PE | Jacobs | Water Resources Engineer
O: 916.286.0228 | M: 831.233.2141 | reed.thayer@jacobs.com
2485 Natomas Park Dr, Ste 600 | Sacramento, CA 95833 | USA

File Provided Natively

From: Heydinger, Erin [Erin.Heydinger@hdrinc.com]
Sent: 11/20/2020 7:55:50 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]
Subject: RE: Follow-up Questions - Sites Ops and Engr WG

I agree. We do have temperature analysis that we showed for iteration 1, but it's at Clear Creek, not below the CBD. I think we would need to have our CBD temperature analysis done before we could estimate temperature impacts south of the CBD, which wouldn't be done until final modeling is complete (or sometime during an iterative run for the final modeling).

As we've talked about before, the water will most likely be at ambient temperature at the terminus of the CBD. So, I suppose we would be assessing whether increased CBD flows (likely at their current temperature) would have an impact on the River.

I can give Steve a call to ask about this to be sure I'm not off on any assumptions I've noted.

Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

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From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Friday, November 20, 2020 6:33 AM
To: Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Subject: FW: Follow-up Questions - Sites Ops and Engr WG

Erin – What do you think on Eric's question below. I don't think we will have temperature analysis for the second iteration, but we will have temperature analysis at some point. Do you have a sense of when CH2 would be providing this?

Ali

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

From: Eric Leitterman <ELeitterman@valleywater.org>
Sent: Friday, November 13, 2020 12:31 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: Follow-up Questions - Sites Ops and Engr WG

Hi Ali,

I had a couple of questions that I held back in the interest of time during the call this morning that I was hoping you might be able to help me with.

- Will iteration 2 modeling include a temperature analysis downstream of the CBD? I know that at least one of my directors is concerned about a critique from some NGO's that the project will release warm water that could lead to increased algae blooms in the Delta.
- Can JP provide an update on efforts to work with the CWC to understand the Prop 1 75% financing requirement for eligibility? Will a financing plan with the cash calls described in the presentation be acceptable?

ERIC LEITTERMAN
ASSISTANT ENGINEER II - CIVIL
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Water Supply Division
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eleitterman@valleywater.org

Valley Water

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From: JP Robinette [JRobinette@BrwnCald.com]
Sent: 11/20/2020 7:59:11 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]
CC: Heydinger, Erin [erin.heydinger@hdrinc.com]
Subject: RE: Follow-up Questions - Sites Ops and Engr WG

I will, but I need to check with Jerry so it may be a slight delay. He has had a talk with the CWC on this and I want to be sure I relay it correctly.

JP Robinette, PE*
Brown and Caldwell
JRobinette@brwncald.com
T 916.853.5312 | **C** 801.819.4306
*Professional Registration in Specific States

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Friday, November 20, 2020 6:31 AM
To: Eric Leitterman <ELeitterman@valleywater.org>; Heydinger, Erin <Erin.Heydinger@hdrinc.com>; JP Robinette <JRobinette@BrwnCald.com>
Subject: RE: Follow-up Questions - Sites Ops and Engr WG

Hi Eric – My apologies. This got buried in my email and I just realized that I had not follow up on this.

I've included Erin and JP on this email. Erin and I will circle back on your first bullet. JP, can you respond on Eric's second bullet?

Ali

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From: JP Robinette [JRobinette@BrwnCald.com]
Sent: 11/20/2020 9:08:46 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]; Eric Leitterman [ELeitterman@valleywater.org]; Heydinger, Erin [erin.heydinger@hdrinc.com]
Subject: RE: Follow-up Questions - Sites Ops and Engr WG

Eric, to your second bullet point:

In preliminary discussions with CWC staff, the concepts outlined in the project financing action plan including self-defining the cost share commitment were discussed. CWC staff generally agreed with Sites' self-defined approach to demonstrating 75% local cost share commitment which includes an approved plan of finance, an approved water storage and supply services contract term sheet, and an executed successor participation agreement funding the next phase of work. Also, it should be mentioned that it's the DWR Director that makes the call on the 75% local cost share commitment being sufficient. We anticipate that any specific requirements the CWC or DWR might raise in the coming months in this regard could be incorporated into the details of these documents.

JP Robinette, PE*
Brown and Caldwell
JRobinette@brwncald.com
T 916.853.5312 | **C** 801.819.4306
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From: Heydinger, Erin [Erin.Heydinger@hdrinc.com]
Sent: 11/20/2020 1:03:13 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]
Subject: RE: Follow-up Questions - Sites Ops and Engr WG

I just had a chance to chat with Steve, and he agreed that temperature modeling below the CBD won't be done until January. I think we can let Eric know that it is something we have been thinking about and have our eye on as the results become available.

I also checked in with him on a meeting with MBK and he agreed that mid-December would probably be a good time for a kickoff. Maybe we shoot for late the week of the 14th or early the week of the 21st? Let me know if that sounds good to you and I can send out a Doodle poll.

Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

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From: Heydinger, Erin
Sent: Friday, November 20, 2020 7:56 AM
To: 'Alicia Forsythe' <aforsythe@sitesproject.org>
Subject: RE: Follow-up Questions - Sites Ops and Engr WG

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From: Thayer, Reed/SAC[Reed.Thayer@jacobs.com]
Sent: Fri 11/20/2020 3:52:58 PM (UTC-08:00)
To: Spranza, John[john.spranza@hdrinc.com]; Hendrick, Mike[mike.hendrick@icf.com]; Lecky, Jim[jim.lecky@icf.com]; Hassrick, Jason[jason.hassrick@icf.com]; Chris Fitzer[CFitzer@esassoc.com]; Wilder, Rick[rick.wilder@icf.com]; Greenwood, Marin[Marin.Greenwood@icf.com]
Cc: Alicia Forsythe[aforsythe@sitesproject.org]; Heydinger, Erin[erin.heydinger@hdrinc.com]; steve.micko@jacobs.com[steve.micko@jacobs.com]; Leaf, Rob/SAC[Rob.Leaf@jacobs.com]; Noble Hendrix[noblehendrix@gmail.com]; Steve Zeug[stevez@fishsciences.net]
Subject: RE: Sites Project Alternative 1 - Trend Reporting
Attachment: NODOS_Trend_Reporting_rev29dpcy_DV5_HistClim_CALSIM_NAA_PEA_ALT1_111820_rev01_PEA_ALT1_rev01_PEA_WS10700aprmay_ALT1_rev01_PEA_WS10700febmay.xlsm

Sites Aquatics Team,

We have performed additional sensitivity analysis on Alt 1 rev01 PEA:

- Alt 1 rev01 PEA with the Wilkins Slough bypass flow increased to 10,700 cfs in April and May
- Alt 1 rev01 PEA with the Wilkins Slough bypass flow increased to 10,700 cfs in February through May

A trend reporting spreadsheet, "NODOS_Trend_Reporting_rev29dpcy_DV5_HistClim_CALSIM_NAA_PEA_ALT1_111820_rev01_PEA_ALT1_rev01_PEA_WS10700aprmay_ALT1_rev01_PEA_WS10700febmay.xlsm" is attached. It includes:

- NAA 111820
- Alt 1 111820 rev01 PEA
- Alt 1 111820 rev01 PEA with the Wilkins Slough bypass flow increased to 10,700 cfs in April and May
- Alt 1 111820 rev01 PEA with the Wilkins Slough bypass flow increased to 10,700 cfs in February through May

Please contact me with any questions.

Reed Thayer, PE | Jacobs | Water Resources Engineer
O: 916.286.0228 | M: 831.233.2141 | reed.thayer@jacobs.com
2485 Natomas Park Dr, Ste 600 | Sacramento, CA 95833 | USA

From: Thayer, Reed/SAC
Sent: Thursday, November 19, 2020 12:15 PM
To: Spranza, John <john.spranza@hdrinc.com>; Hendrick, Mike <mike.hendrick@icf.com>; Lecky, Jim <jim.lecky@icf.com>; Hassrick, Jason <jason.hassrick@icf.com>; Chris Fitzer <CFitzer@esassoc.com>; Wilder, Rick <rick.wilder@icf.com>; Greenwood, Marin <Marin.Greenwood@icf.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <erin.heydinger@hdrinc.com>; Micko, Steve/SAC <Steve.Micko@jacobs.com>; Leaf, Rob/SAC <Rob.Leaf@jacobs.com>; Noble Hendrix <noblehendrix@gmail.com>; Steve Zeug <stevez@fishsciences.net>
Subject: Sites Project Alternative 1 - Trend Reporting

Sites Aquatics Team,

We have completed "Iteration 2" of Alternative 1. The CalSim II study is labeled "ALT1_OpFlex91_111820_rev01_PEA".

A trend report, NODOS_Trend_Reporting_rev29dpcy_DV5_HistClim_CALSIM_NAA_ALTA2_092220_rev03_PEA_ALT1_111820_rev01_PEA.xlsm, is attached which includes this alternative and Alt A2 rev03 PEA and their associated No Action Alternatives:

Alt A2 rev03 PEA
No Action: NAA 091720
Alternative: ALTA2 rev03 PEA

Alt 1 rev01 PEA
No Action: NAA 111820
Alternative: ALT1 rev01 PEA

Please contact us with any questions.

Reed Thayer, PE | Jacobs | Water Resources Engineer
O: 916.286.0228 | M: 831.233.2141 | reed.thayer@jacobs.com
2485 Natomas Park Dr, Ste 600 | Sacramento, CA 95833 | USA

File Provided Natively

Sites/DWR Meeting
Sites Yield as Project versus Non-Project Water
during week of Nov 30 - Dec 4, 2020

DRAFT AGENDA

Invitees: Kunde, CWang, BTincher, AFlores
Heydinger, Leaf, Forsythe, Micko
Cooke, Leahigh, White, AMiller *(others as DWR determines)*

Purpose: We (Sites) understand (a) DWR has done some analysis regarding Sites Project yield for Sites SWP Participants, and (b) the analysis shows Sites yield to be 30% higher if Sites water is managed as SWP Project Water versus Non-Project Water.

Sites Questions: We have the following questions for DWR:

1. Is our understanding correct? If not, educate us.
2. How does DWR view operational differences between delivery of Sites water as Project versus Non-Project water?
3. What analysis has been done?
4. Using what modeling tools?
5. Using what assumptions?
   a. Water year types
   b. Months
6. Using what degree of integration between Sites and the SWP?
   a. Oroville releases and storage
   b. Within year exchanges - Use of Sites direct deliveries to meet spring (summer?, fall?) SWP water quality obligations resulting in a payback obligation matching the Sites participants demand patterns for that year
   c. Carryover
   d. San Luis Reservoir Storage
   e. Salinity costs and Carriage losses

DWR Questions: TBD

From: Heydinger, Erin [Erin.Heydinger@hdrinc.com]
Sent: 11/23/2020 4:04:56 PM
To: Eric Leitterman [ELeitterman@valleywater.org]
CC: Alicia Forsythe [aforsythe@sitesproject.org]; JP Robinette [jrobinette@brwncald.com]
Subject: RE: Follow-up Questions - Sites Ops and Engr WG

Hi Eric,

Iteration 2 will only include temperature modeling downstream at Clear Creek, but the ultimate analysis (scheduled for completion in January) will include reservoir, CBD, and downstream Sacramento River temperature modeling. The topic of warmer temperatures and algae blooms is on our radar and we will be sure it is addressed based on the results in January. We think it's likely that the reservoir water would reach ambient temperatures of the CBD by the time it reaches the River, but the model will provide a more definite assessment.

Please don't hesitate to reach out with any further questions.

Thanks,

Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

hdrinc.com/follow-us

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Friday, November 20, 2020 6:31 AM
To: Eric Leitterman <ELeitterman@valleywater.org>; Heydinger, Erin <Erin.Heydinger@hdrinc.com>; JP Robinette <jrobinette@brwncald.com>
Subject: RE: Follow-up Questions - Sites Ops and Engr WG

Hi Eric – My apologies. This got buried in my email and I just realized that I had not follow up on this.

I've included Erin and JP on this email. Erin and I will circle back on your first bullet. JP, can you respond on Eric's second bullet?

Ali

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

From: Eric Leitterman <ELeitterman@valleywater.org>
Sent: Friday, November 13, 2020 12:31 PM

To: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: Follow-up Questions - Sites Ops and Engr WG

Hi Ali,

I had a couple of questions that I held back in the interest of time during the call this morning that I was hoping you might be able to help me with.

- Will iteration 2 modeling include a temperature analysis downstream of the CBD? I know that at least one of my directors is concerned about a critique from some NGO's that the project will release warm water that could lead to increased algae blooms in the Delta.
- Can JP provide an update on efforts to work with the CWC to understand the Prop 1 75% financing requirement for eligibility? Will a financing plan with the cash calls described in the presentation be acceptable?

ERIC LEITTERMAN
ASSISTANT ENGINEER II - CIVIL
Imported Water Unit
Water Supply Division
Tel. (408) 630-2669 / Cell. (408) 784-4966
eleitterman@valleywater.org

Valley Water

SANTA CLARA VALLEY WATER DISTRICT
5750 Almaden Expressway, San Jose CA 95118
www.valleywater.org

Clean Water · Healthy Environment · Flood Protection

From: Jerry Brown [jbrown@sitesproject.org]
Sent: 11/25/2020 7:18:20 AM
To: Marcia Kivett [MKivett@sitesproject.org]
Subject: Re: Cal Chamber Water Committee Meeting
Attachments: Sites_Overview PPT CalChamber Dec 20.pptx

From: Marcia Kivett <MKivett@sitesproject.org>
Date: Wednesday, November 25, 2020 at 6:09 AM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: Cal Chamber Water Committee Meeting

Attaching the agenda and zoom information.

I've also pasted the link below for your convenience. Since I will probably help with the screen share (limited experience), I hope you can forward the presentation as soon as it is available so I know everything is working at our end. Please let me know if you need any other information. I appreciate your assistance and we look forward to meeting you and Mr. Brown on Thursday, December 3. Thanks again and Happy Thanksgiving.

Join Zoom Meeting
https://calchamber.zoom.us/j/99604330813

Meeting ID: 996 0433 0813
One tap mobile
+16699006833,,99604330813# US (San Jose)
+13462487799,,99604330813# US (Houston)

Update. They will send the link later this month.

Hi Marcia,
We are doing well here in Sacramento. Hope you are as well. I am confirming that our meeting on 12/3 will be via Zoom. Our meeting begins a 3 pm, but we would like Mr. Brown to join us at 3:15 pm as we will have some housekeeping items to take care of with the committee. Mr. Brown can join anytime prior to 3:15 but he will be in the "virtual waiting room" until it's time. I will send the link to you later this month with a copy of the agenda. As far as presentation, we can certainly handle the screen share as long as we have a copy of the presentation by Monday, 11/30 (or Tuesday). The committee is looking forward to being updated on the status of the Sites Reservoir and where the Chamber members could be helpful. Presentations are usually 20 minutes with another 10 minutes for questions. This will be a very informal meeting with about 15 Zoom participants.

We appreciate his participation. We look forward to meeting him by Zoom. If you have any questions, please do not hesitate to contact me. I look forward to further communications. Thanks again.

Martha Maltz
Administrative Assistant, Policy

CalChamber.
HR Expert & Business Advocate™

California Chamber of Commerce
1215 K Street, 14th Floor
Sacramento, CA 95814

T 916 930 1291
F 916 325 1272

From: Marcia Kivett <MKivett@sitesproject.org>
Sent: Tuesday, November 10, 2020 9:37 AM
To: Maltz, Martha <martha.maltz@calchamber.com>
Subject: RE: Mr. Jerry Brown, Speaker at CalChamber Water Committee meeting on Thursday, December 3 in San Francisco or possibly a virtual meeting

Good Morning Martha,

I hope all is well on your end. May I assume this meeting will be virtual? What is the date you will need Jerry's presentation by? Lastly, will you share the screen during the presentation or would you like Jerry to manage that?

Marcia Kivett
Sites Project Admin
Phone: 561.843.9740
Email: mkivett@sitesproject.org
Web: www.SitesProject.org
P.O. Box 517
122 Old Hwy 99W
Maxwell, CA 95955

From: Maltz, Martha <martha.maltz@calchamber.com>
Sent: Wednesday, October 28, 2020 2:38 PM
To: Marcia Kivett <MKivett@sitesproject.org>
Subject: RE: Mr. Jerry Brown, Speaker at CalChamber Water Committee meeting on Thursday, December 3 in San Francisco or possibly a virtual meeting

Hi Marcia,
Wanted to let you know that the CalChamber Water Committee meeting on Thursday, December 3 will be a virtual meeting. We will be sending more information including the Zoom link/number next month. Thanks again for your assistance.

Martha Maltz
Administrative Assistant, Policy

CalChamber.
HR Expert & Business Advocate™

California Chamber of Commerce
1215 K Street, 14th Floor
Sacramento, CA 95814

T 916 930 1291
F 916 325 1272

From: Marcia Kivett <MKivett@sitesproject.org>
Sent: Tuesday, September 22, 2020 2:27 PM
To: Maltz, Martha <martha.maltz@calchamber.com>
Subject: RE: Mr. Jerry Brown, Speaker at CalChamber Water Committee meeting on Thursday, December 3 in San Francisco or possibly a virtual meeting

Thank you so much Martha for the information. I will put a placeholder on his calendar. Have a great day.

Marcia Kivett
Sites Project Admin
Phone: 561.843.9740
Email: mkivett@sitesproject.org
Web: www.SitesProject.org
P.O. Box 517
122 Old Hwy 99W
Maxwell, CA 95955

From: Maltz, Martha <martha.maltz@calchamber.com>
Sent: Tuesday, September 22, 2020 2:19 PM
To: Marcia Kivett <MKivett@sitesproject.org>
Subject: Mr. Jerry Brown, Speaker at CalChamber Water Committee meeting on Thursday, December 3 in San Francisco or possibly a virtual meeting

Hi Marcia,

I am reaching out to you to coordinate the speaking engagement for Mr. Jerry Brown. We, at CalChamber, are pleased to hear that Mr. Brown has agreed to speak about the Sites Reservoir Project at the next CalChamber Water Committee meeting on Thursday, December 3 in San Francisco. Our meetings run from 3 pm to 5 pm with our **speaker joining us about 3:15 pm**. Presentations are generally 20 minutes with another 10 minutes for questions. It is an informal setting with 10-12 members in attendance. At this time we are not certain whether we will have a face-to-face or Zoom meeting on 12/3. As soon as it is confirmed, I will let you know. Please let me know if you have any questions. I look forward to communicating with you regarding this meeting. Thank you.

Meeting location *(tentative)*
The Fairmont
Thursday, December 3, 2020
950 Mason Street
San Francisco, CA
3 pm to 5 pm

Martha Maltz
Administrative Assistant, Policy

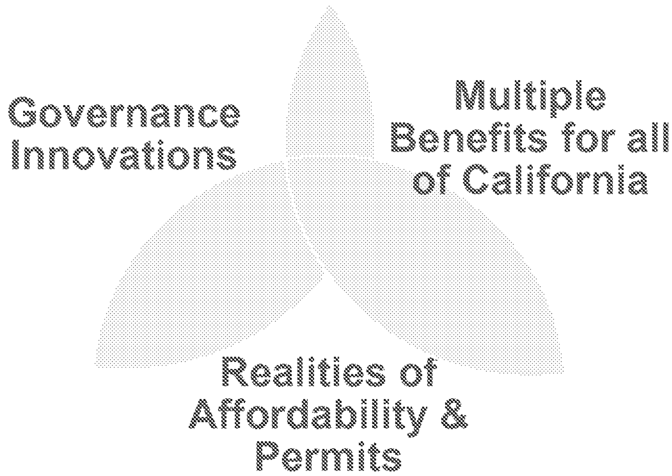
CalChamber.
HR Expert & Business Advocate™

California Chamber of Commerce
1215 K Street, 14th Floor
Sacramento, CA 95814

T 916 930 1291
F 916 325 1272


Sites Reservoir
Sites

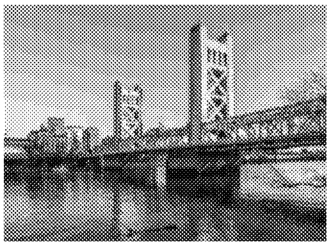
Key Presentation Take-Aways for Cal Chamber

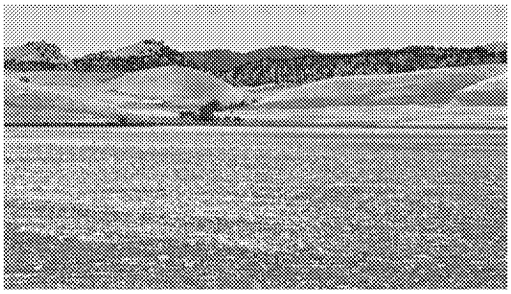


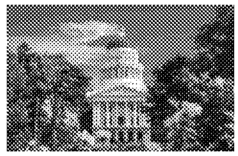
Sites

21st Century Solution to California's Water Reliability Challenges

Sites Reservoir is a generational opportunity to construct a multi-benefit water storage project that helps **restore flexibility, reliability, and resiliency** to our statewide water supply



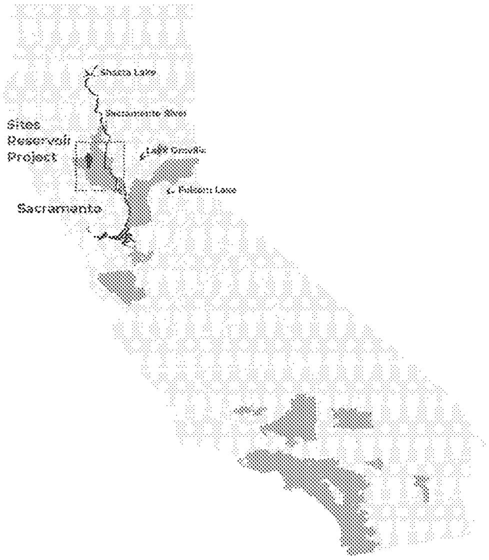




Sites

Our Strength is in Our Broad Statewide Participation

Diverse statewide representation of public agencies advancing Sites Reservoir



Participants include **counties, cities, water and irrigation districts**

Urban and **Rural**

Sacramento Valley

San Joaquin Valley

Bay Area

Southern California

Sites

Our Strength is in Our Broad Statewide Participation

Sacramento Valley

Carter Mutual Water Company
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
Metropolitan Water District
San Bernardino Valley Municipal Water District
San Gorgonio Pass Water Agency
Santa Clarita Valley Water Agency

Sites

Rightsized to Meet Our Current and Future Water Supply Needs

Sites Reservoir has been designed and optimized to meet our water supply needs for today and in the future

The Sites Project Authority conducted a **rigorous Value Planning effort** to review the project's proposed operations and facilities **to develop a project that is "right sized" for our investors and participants** while still providing water supply reliability and enhancing the environment

Rightsizing the reservoir was **responsive to input** from **state and federal agencies, NGOs, elected officials, landowners and local communities**

The **feedback we received** through a robust outreach effort was **critical** to developing a reservoir that is the **right size for both people and the environment**

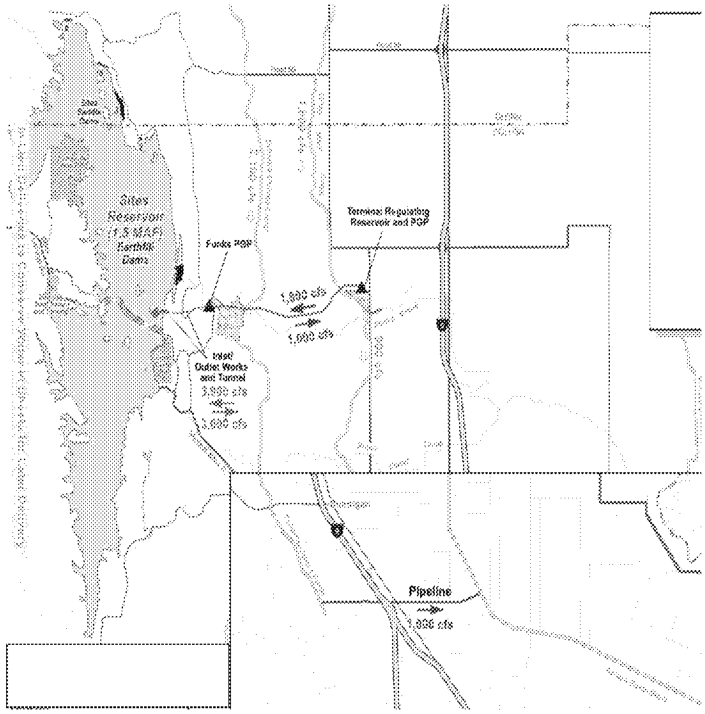
Sites

Rightsized to Meet Our Current and Future Water Supply Needs

1.5 million acre-feet

Utilizes the existing **Glenn-Colusa Irrigation District** and **Tehama-Colusa Canal Authority** canals to convey water to Sites Reservoir from the Sacramento River

Delivers water back to the Sacramento River through the **Tehama-Colusa Canal** and through the **Colusa Basin Drain** for participant deliveries and for the environment



Rightsized to Meet Our Current and Future Water Supply Needs

Member	Reservoir Participation(AFY)
Public Water Agencies	
North of Delta	52,142
South of Delta	140,750
Subtotal Public Water Agencies	192,892
State of CA	~ 40,000
Total Requirement	~230,000

Participant Demand

Participant water subscriptions allocated in the **current participation agreement**

Allocation of State of California water subscription is based on the **Proposition 1 water investment**

- Water for Delta Smelt
- Water for Refuges

Release Capacity from Sites

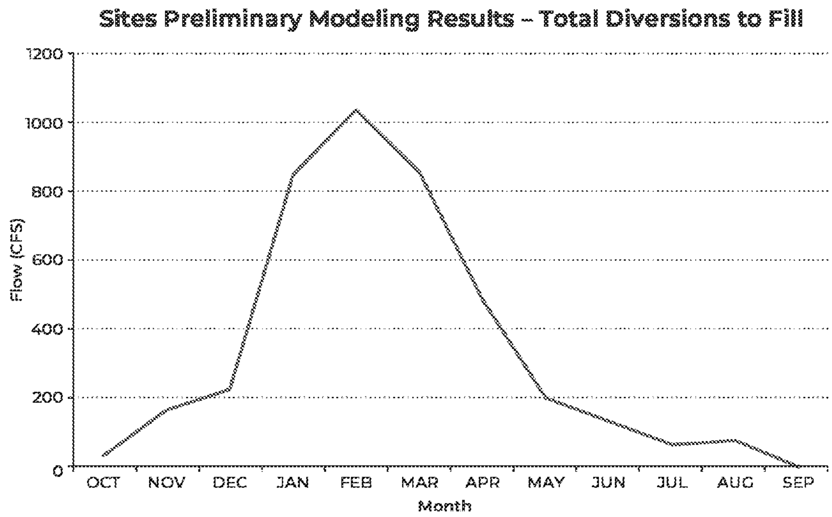
The "rightsized" project can deliver water to meet the demands of our participants and California's investment of water for the environment

Long term average ~240,000 AFY

Year Type	1,000 cfs Release Capacity (AFY) to the Colusa Basin Drain
Wet	90 - 120
Above Normal	260 - 290
Below Normal	245 - 275
Dry	355 - 385
Critically Dry	210 - 240

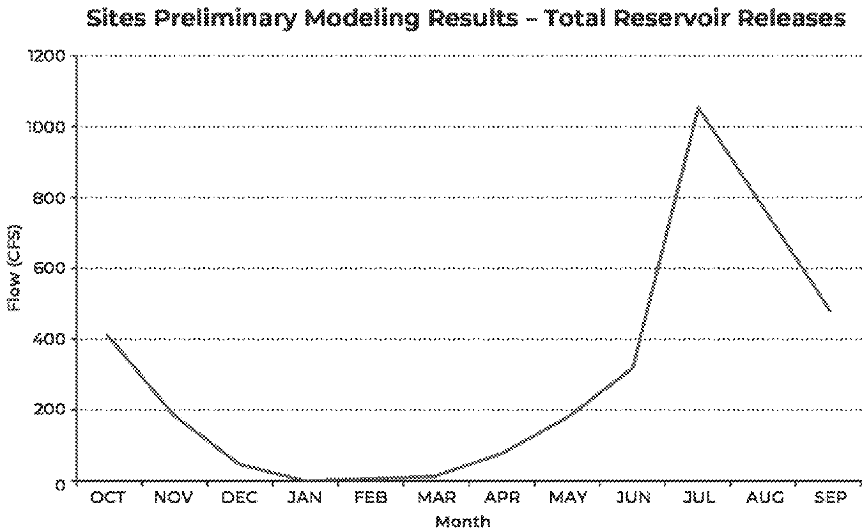
Sites

Timing of Sites Diversions (storing storm flows for use during drier times)



Sites

Timing of Sites Releases (increased water available for all uses in driest times)



Sites

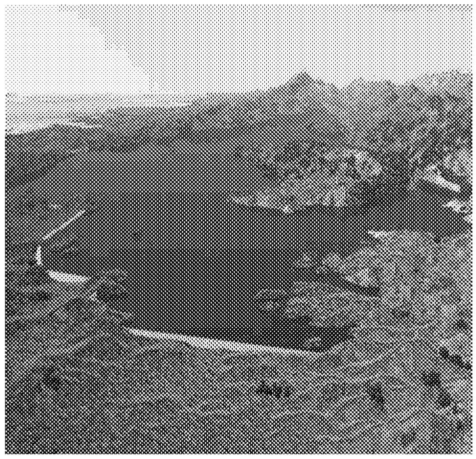
Rightsized to Meet Our Current and Future Water Supply Needs

The Value Planning process has **resulted** in a project that has a **smaller footprint** and **operated in a different manner** then originally designed

Due to these changes the Authority will **revise and recirculate its Draft EIR**

Work with **landowners, tribes, stakeholders, NGOs, and local communities** to develop a **collaborative environmental review process**

It is essential that we **build a project now that makes sense for all our participants** – local, state, and federal



Sites

Rightsized to Meet Our Current and Future Water Supply Needs

Reservoir Size (MAF)	1.5
Project Cost (2019$, billions)	$2.4 - $2.7
Contingency Cost (2019$, billions)	$0.6
Total Project Cost (2019$, billions)	$3.0 - $3.3
Annualized AFY release	240,000
Range of Annual Costs During Repayment Without WIFIA Loans (2020$, $/AF)	$650 - $710
Range of Annual Costs During Repayment With WIFIA Loans (2020$, $/AF)	$600 - $660

The rightsized project is **roughly $2 Billion less** then the 2017 preferred alternative

Cost savings primarily from the **removal** of the **Delevan Diversion** facility on the Sacramento River and the **Delevan Pipeline**

Lowered the Annual Cost during repayment ($/AF)

Significant savings to participants with finance through a **WIFIA** government backed loan

Sites

Provides Statewide Benefits for Generations to Come

Sites Reservoir provides many multi-layered benefits

Off-stream Storage

Does not create a barrier to native fish migration

Federal and State Agencies Manage Environmental Water

Adaptable to current and future conditions and priorities

Local Leadership and Cooperation

Aligns with Sacramento Valley's values and fosters regional and statewide collaboration

Cooperative Operation

Increases effectiveness and efficiency of existing water storage infrastructure

Adaptable to Climate Change

Contributes to system reliability and performance with climate change

Dry Year Water Supply

Reliable dry year water supply for California communities, farms and businesses

Recreational Opportunities

Provides northern Sacramento Valley with additional opportunities for recreation

Environmental Support

Provides environmental water in drier periods for native fish, and habitat for native species and birds

Sites

Provides Statewide Benefits for Generations to Come

Sites Reservoir provides water dedicated to environmental use

A significant portion of the **Sites Reservoir Project's annual water supplies will be dedicated to environment uses:**

- **Preserve cold-water** pool in **Lake Shasta** later into the 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**
- Provide **water dedicated** to help improve conditions for the **Delta Smelt**

Water dedicated for the environment provided by Sites Reservoir will be **managed by state resources agency managers** who will decide how, and when, this water would be used – creating a water asset for the state that **does not currently exist**

Sites

Possibilities of Environmental Water Uses

Member	Reservoir Participation(AFY)
Public Water Agencies	
North of Delta	52,142
South of Delta	140,750
Subtotal Public Water Agencies	192,892
State of CA	~ 40,000
Total Requirement	~230,000

Sites **creates a resource that can be managed for the benefit of the species.**

Water for the environment is **managed by state resource agencies.**

Potential Beneficiary
Level 4 refuge water
Enhanced Delta Ecosystem
Improve Survival of Anadromous Fish

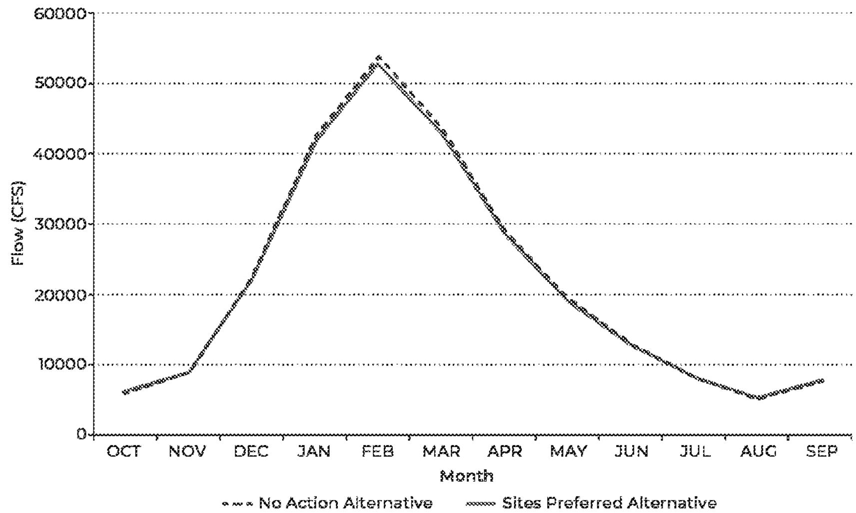
There is **flexibility** to manage these benefits each year.

The range of possibilities will be covered in the recirculated Draft EIR.

Sites

Uncaptured Flow put to highest and best use

Sites Preliminary Modeling Results – Delta Outflow with and without Project



Sites

Anticipated flows through the Delta from proposed Voluntary Settlements

Increased Flows above Baseline

(TAF)	C	D	BN	AN	W
San Joaquin Basin	63	215	249	182	50
Sacramento Basin	37	276	256	281	45
Water Purchase Programs	125	109	195	237	205
Exporters	0	100	0	0	0
Subtotal [illegible] Above Baseline (Year 1)	225	700	700	[illegible]	300
New Water Projects & Programs (Before Year 8)	45	202	212	115	45
Total [illegible] Outflow Above Baseline (Year 1-8)	270	902	[illegible]	[illegible]	345
Exporters (Spring baseline maintenance)	0	200	300	300	0
Total New and Re-operated Outflows	270	1,102	1,212	1,115	345
State Team's Adequacy Target	260-350	740-1,000	840-1,100	840-1,200	300*-350

*Only applies to a subset of wet years

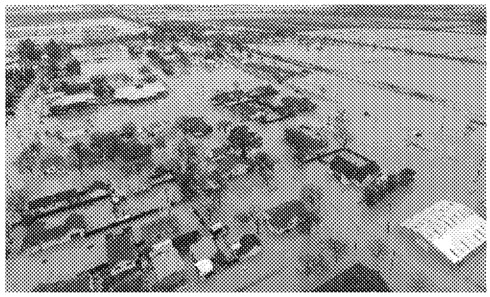
Provides Statewide Benefits for Generations to Come

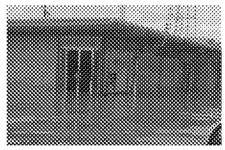
Sites Reservoir provides regional flood protection benefits

Provides significant **regional flood protection benefits** for the Sacramento Valley

Will capture and store **flood flows** that would normally impact the community of **Maxwell** - protecting homes, business and farms

Will help to **limit “down stream” flooding issues** by capturing storm flows that sometimes overwhelm the regions flood control facilities





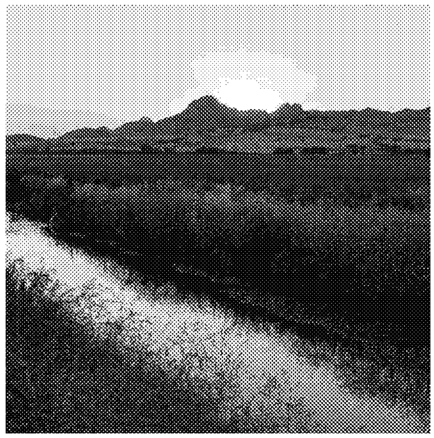
Provides Statewide Benefits for Generations to Come

Sites Reservoir will benefit the local and regional economy

Create hundreds of construction-related jobs during each year of the construction period, and **long-term jobs related to operations**

Creates **new recreation opportunities** in the Sacramento Valley which adds to the **region's economy**

Adding **resiliency** to the water supply will **strengthen the statewide economy** and **business** that rely on a reliable source of water for their operations – particularly agriculture



Sites

We are On-Track to Deliver This Vital Project for the People of California

Key Milestones Through 2021

Meet **eligibility requirements under Prop 1 (WSIP)** in order to access the remainder of the $816 Million in funding

Recirculate Draft EIR for public comment, proactively engage stakeholders, develop responses to comments to support environmental feasibility determination

Complete Feasibility Report

Secure environmental permit certainty and **draft permit applications**

Update and **refine cost estimate** and **affordability analysis**

Develop Plan of Finance

Improve definition of **SWP/CVP** exchange, including **Operations Plan**

Enhance landowner, stakeholder & NGO engagement

Develop Operating Agreement Term Sheets with: DWR, USBR, TCCA, GCID, CBD Authority

Sites

Summary Of Take-Aways for Cal Chamber

Governance & Innovation

Beneficiary Pays
Fed/State/Local Participation
Local Oversight
Benefit Contracts

Multiple Benefits for all of California

New Water Supply (Ag & Urban)
Ecosystem Priority and Flexibility
Added Flood Control/Public Safety
New Recreation
JOBS!

Realities of Affordability & Permits

Competitive unit cost of water
Protective conditions for species
Net benefits for the environment
Use of existing facilities
Integrated Operations

Sites

Questions

Sites

From: Spranza, John [John.Spranza@hdrinc.com]
Sent: 11/30/2020 10:37:55 AM
To: Melissa Denena [mdenena@res.us]; Alicia Forsythe [aforsythe@sitesproject.org]
CC: Frankie Savoy [frankie@res.us]
Subject: RE: [EXTERNAL] RE: Compensatory Mitigation - Sites Reservoir

Hi Melissa,
Ali and I have been slammed recently and I apologize for not having gotten back to you sooner. I had some time over the weekend to review your document and appreciate the general overview you sent.

At our last meeting I brought up a few items that were of particular concern for the project and am wondering if you had a chance to think about them, and what a general approach would be to overcome them? If I remember correctly they were:

1) Mitigating for the magnitude of impacts across terrestrial and aquatic habitats that will need mitigation. For example, approximately 9,000+ acers of grassland habitat, 300+ acers of oak woodland, 300+ acers of wetlands and effects to salmonids in the Sacramento River and delta associated with reduction in flows in the River.
2) The lack of sufficient mitigation banks to cover all of our impacts and competition with other regional projects for mitigation lands.
3) The complications associated with wide-spread effects of the project across the Sacramento Valley and Delta.
4) The inability to gain access to much of the project area until sometime after 2022, but the need to have mitigation identified in the EIR/EIS and permit applications in 2022.
5) The phased approach that will be associated with construction and construction-related effects (2-6 years post 2022).

I'd be interested to hear some approaches to addressing those items that would be specific to our project area.

Thanks.
John

John Spranza

D 916.679.8858 M 818.640.2487

From: Melissa Denena [mailto:mdenena@res.us]
Sent: Thursday, November 19, 2020 1:00 PM
To: Spranza, John <John.Spranza@hdrinc.com>; Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Frankie Savoy <frankie@res.us>
Subject: Re: [EXTERNAL] RE: Compensatory Mitigation - Sites Reservoir

Hi John and Ali,

I hope you are both doing well! Would you have time to circle back regarding the Sites Reservoir compensatory mitigation? We'd be happy to discuss some of your options further.

Looking forward to hearing from you!

Sincerely,

Melissa Denena
Client Solutions Manager
RES | res.us
Mobile: 408.981.1151

From: "Spranza, John" <John.Spranza@hdrinc.com>
Date: Friday, October 23, 2020 at 5:58 PM
To: Melissa Denena <mdenena@res.us>, Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Frankie Savoy <frankie@res.us>
Subject: [EXTERNAL] RE: Compensatory Mitigation - Sites Reservoir

Thank you Melissa, I look forward to reading this. I will likely be able to get to it sometime next week.
Have a great weekend.

John Spranza
D 916.679.8858 M 818.640.2487

From: Melissa Denena [mailto:mdenena@res.us]
Sent: Friday, October 23, 2020 3:12 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Spranza, John <John.Spranza@hdrinc.com>
Cc: Frankie Savoy <frankie@res.us>
Subject: Compensatory Mitigation - Sites Reservoir

Hi Ali and John,

I hope you have both been doing well since we spoke in September. As discussed, attached is a document outlining how RES feels we could add value to the existing Sites Reservoir team during the Work Plan stage of the Project. We'd be happy to discuss this further at your convenience and look forward to hearing from you!

Sincerely,

Melissa Denena
Client Solutions Manager
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From: jsutton@tccanal.com [jsutton@tccanal.com]
Sent: 11/30/2020 1:21:19 PM
To: Jerry Brown [jbrown@sitesproject.org]; Marcia Kivett [MKivett@sitesproject.org]; 'Fritz Durst' [fdurst@rd108.org]; Jamie@tnpfarms.com; GEvans@countyofcolusa.org; logan@canalfarms.com
CC: 'Ann Nordyke' [boardclerk@countyofcolusa.com]
Subject: RE: November's Authority Board Coordination Committee

That is what I thought, but couldn't recall for sure. Thanks for the confirmation Jerry.

Jeffrey P. Sutton
General Manager
Tehama-Colusa Canal Authority
5513 State Highway 162
PO Box 1025
Willows, CA 95988
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Mobile (530) 301-1030
jsutton@tccanal.com

From: Jerry Brown <jbrown@sitesproject.org>
Sent: Monday, November 30, 2020 10:59 AM
To: Marcia Kivett <MKivett@sitesproject.org>; Fritz Durst <fdurst@rd108.org>; Jeff Sutton <jsutton@tccanal.com>; Jamie@tnpfarms.com; GEvans@countyofcolusa.org; logan@canalfarms.com
Cc: Ann Nordyke (boardclerk@countyofcolusa.com) <boardclerk@countyofcolusa.com>
Subject: Re: November's Authority Board Coordination Committee

FYI - we are carrying a 1.3MAF option as Alternative 2 in the revised EIR/EIS. Recall this was a question raised at this morning's meeting while discussing the early modeling results and the question of affordability.

From: Marcia Kivett <MKivett@sitesproject.org>
Date: Wednesday, November 25, 2020 at 9:27 AM
To: Fritz Durst <fdurst@rd108.org>, Jeff Sutton <jsutton@tccanal.com>, Jamie@tnpfarms.com <Jamie@tnpfarms.com>, GEvans@countyofcolusa.org <GEvans@countyofcolusa.org>, logan@canalfarms.com <logan@canalfarms.com>, Jerry Brown <jbrown@sitesproject.org>
Cc: Ann Nordyke (boardclerk@countyofcolusa.com) <boardclerk@countyofcolusa.com>
Subject: November's Authority Board Coordination Committee

Good Morning,

Please see the attached agenda and supporting documents for Monday's 8:00 am meeting.

Marcia Kivett
Sites Project Admin
Phone: 561.843.9740
Email: mkivett@sitesproject.org
Web: www.SitesProject.org
P.O. Box 517
122 Old Hwy 99W
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Brown AND Caldwell

A Brown and Caldwell Teams meeting has been created for this event.

Help

____

From: Laurie Warner Herson [laurie.warner.herson@phenixenv.com]
Sent: 11/30/2020 2:28:59 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]; Williams, Nicole [Nicole.Williams@icf.com]; Briard, Monique [Monique.Briard@icf.com]; Linda Fisher (linda.fisher@hdrinc.com) [linda.fisher@hdrinc.com]
Subject: Approach to Alternative 3 and GCID RR Siphon
Attachments: 20201201_EIR-EIS Biweekly Mtg Follow Up-Draft AGN.docx

Good afternoon –

Please see the attached agenda for our meeting tomorrow. This meeting is a follow-up to the discussions we started during the biweekly EIR/EIS coordination meeting held on 11/20/2020. Specifically, we need to discuss the addition of Alternative 3 to the EIR/EIS, including the development of a description of the alternative, the mechanics of adding it to the document, and impacts to schedule and budget. It would be helpful if Nicole and Monique can be ready to discuss the general level of effort that would be required at tomorrow's meeting. More specifics regarding costs and schedule will be needed at a later date.

We also need to discuss to what level we should analyze potential repair and/or replacement of the GCID RR Siphon as part of the current RDEIR/SDEIR.

The agenda is also on SharePoint:
https://sitesreservoirproject.sharepoint.com/:w:/r/EnvPlanning/Meetings/Biweekly%20EIR_EIS%20meetings/20201201_EIR-EIS%20Biweekly%20Mtg%20Follow%20Up-Draft%20AGN.docx?d=w3677364f97e54bba8a9e9cf2e7fa3e0b&csf=1&web=1&e=YaQPhj

Thank you,

Laurie

Laurie Warner Herson
Principal/Owner

Phenix
Environmental Planning

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